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***Lithics in prehistory, from archaeological finds to
museum objects: Theories, perspectives, and strategies
in the valorisation of a 'semi-invisible' heritage***

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ABSTRACT

This research examines Palaeolithic lithic artefacts in museum settings and their potential in promoting the significance of human origins and prehistory to wider publics. It begins from the premise that, despite growing public interest in the human past, prehistory remains marginal within contemporary cultural discourse. In this context, it is argued that lithic artefacts, as the earliest and most persistent traces of human activity, offer a potent medium through which to revitalise public engagement with human prehistory. However, their appreciation in museum contexts is often limited by the fact that the technological, contextual, and cultural dimensions that make them significant are not readily accessible to public audiences, rendering them, in effect, *semi-invisible* as heritage. The central claim is that a technologically grounded understanding of lithic artefacts—rooted in the ways archaeological research reconstructs past human action—provides a coherent basis for interpreting Palaeolithic collections and supports more effective strategies for their valorisation and public communication.

To establish a clear rationale for a lithics-focused project, the dissertation articulates the fundamental role of lithic artefacts in prehistoric archaeology and its practices. The research then focuses on the Italian context, where distinctive institutional structures, legislative frameworks governing *beni culturali*, and varied disciplinary traditions shape particular conditions for lithic musealisation. The dissertation demonstrates, through investigation across Italian museum contexts combining lithic technological analysis, museographic examination, and institutional inquiry, that lithic semi-invisibility is neither accidental nor superficial. Rather, it emerges from structural conditions operating at the intersection of historical trajectories, archaeological knowledge production, museum communication practice, and heritage valorisation frameworks. The research identifies mechanisms of museum mediation of lithic technological knowledge—mechanisms that collectively produce lithic semi-invisibility: 1) the material nature and ontological complexity of the stone tool; 2) the strengths and limits of museum display; 3) knowledge transformation processes; and 4) the systematic reframing of archaeological knowledge into museal forms. These mechanisms reveal how museum conditions mediate technological dimensions and shape the public encounter with lithic technology.

In response, the thesis proposes a valorisation strategy grounded in knowledge domains designed to make lithic technological knowledge legible within the realities of museum practice. This approach situates lithic semi-invisibility within the broader marginality of prehistory and argues that addressing it requires interpretive reframing that foregrounds the technological, cognitive, and cultural dimensions of stone tools within museum contexts. The research contributes to discussions on human origins and early prehistory within contemporary heritage discourse, advocating that museum and public dimensions be treated as integral to archaeological knowledge production.

Keywords: lithics, Palaeolithic heritage, technology, museology, valorisation

La litica nella preistoria, da reperti archeologici a oggetti museali: Teorie, prospettive e strategie nella valorizzazione di un patrimonio *semi-invisibile*

Questa ricerca esamina i manufatti litici paleolitici in contesti museali e il loro potenziale nel promuovere presso il pubblico più ampio il significato delle origini umane e della preistoria. Muove dal presupposto che, nonostante il crescente interesse verso il passato umano, la preistoria rimanga marginale nel discorso culturale contemporaneo. In questo quadro, si sostiene che la litica, quale insieme delle tracce più antiche e persistenti dell'attività umana, costituisca un mezzo efficace per rivitalizzare il coinvolgimento del pubblico nei confronti della preistoria. Tuttavia, la sua comprensione in ambito museale è spesso limitata dal fatto che le dimensioni tecnologiche, contestuali e culturali che ne determinano il significato non risultano immediatamente accessibili ai visitatori, rendendola, di fatto, *semi-invisibile* come patrimonio. L'argomentazione centrale è che una comprensione tecnologicamente fondata dell'industria litica, radicata nei modi in cui la ricerca archeologica ricostruisce l'azione umana nel passato, offra una base coerente per l'interpretazione delle collezioni paleolitiche e per strategie più efficaci di valorizzazione e comunicazione pubblica.

Per definire una chiara motivazione di un progetto incentrato sulla litica, la tesi articola il ruolo fondamentale dell'industria litica nell'archeologia preistorica e nelle sue pratiche. L'indagine si concentra poi sul contesto italiano, in cui specifiche strutture istituzionali, quadri normativi relativi ai beni culturali e tradizioni disciplinari diversificate determinano condizioni particolari per la musealizzazione della litica. Attraverso un'analisi condotta in diversi musei italiani, che integra analisi tecnologica dell'industria litica, esame museografico e indagine istituzionale, la tesi dimostra che la semi-invisibilità della litica non è né accidentale né superficiale. Essa emerge invece da condizioni strutturali situate all'intersezione tra traiettorie storiche, produzione di conoscenza archeologica, pratiche comunicative museali e quadri di valorizzazione del patrimonio. La ricerca identifica i meccanismi di mediazione museale della conoscenza tecnologica litica — meccanismi che producono collettivamente la semi-invisibilità della litica: 1) la natura materiale e la complessità ontologica dello strumento in pietra; 2) i punti di forza e i limiti dell'esposizione museale; 3) i processi di trasformazione della conoscenza; e 4) la sistematica riformulazione della conoscenza archeologica in forme museali. Tali meccanismi mostrano come le condizioni museali medino le dimensioni tecnologiche e modellino l'incontro del pubblico con la tecnologia litica.

In risposta a queste dinamiche, la tesi propone una strategia di valorizzazione fondata su domini di conoscenza concepiti per rendere la conoscenza tecnologica litica più leggibile all'interno delle realtà operative dei musei. Questo approccio colloca la semi-invisibilità della litica nel più ampio quadro della marginalità della preistoria e sostiene che affrontarla richieda una riformulazione interpretativa capace di mettere in primo piano le dimensioni tecnologiche, cognitive e culturali dell'industria litica nei contesti museali. La ricerca contribuisce alle discussioni sulle origini umane e sulla preistoria antica nell'ambito del discorso patrimoniale contemporaneo, sostenendo che le dimensioni museali e pubbliche debbano essere considerate parte integrante della produzione di conoscenza archeologica.

Parole chiave: industria litica, patrimonio paleolitico, tecnologia, museologia, valorizzazione

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1.

INTRODUCTION

1.1. Premise

This research examines Palaeolithic lithic artefacts in museum settings and their potential in promoting the significance of human origins and prehistory to wider publics. The investigation is grounded in three underlying views: 1) that despite increasing public interest in the human past, the subject remains marginal in contemporary cultural discourse; 2) that in this context, stone artefacts, which are among the earliest and most persistent traces of human activity, offer a potent medium through which to revitalise engagement with human prehistory; and 3) that the museum constitutes the most effective institutional setting for undertaking such an endeavour.

On marginality

Despite a rapidly expanding body of archaeological data and increasing media coverage of discoveries, documentaries, and popular science books, human prehistory remains relatively marginal in mainstream cultural discourse, and by extension, reductive in the collective consciousness. In this context, *mainstream* refers to the dominantly visible narratives and institutional frameworks through which the past is represented and valued, while *marginality* denotes the limited cultural (symbolic value and relevance in collective imagination), educational (curricular and pedagogical presence), and epistemic (authority and legitimacy) weight accorded to prehistory relative to later historical epochs. The scale of prehistoric time, spanning millions of years, renders these periods, especially the Palaeolithic, a subject of great fascination and curiosity, but also of particular susceptibility to abstraction and disconnection from contemporary concerns.

Drawing on anthropological theory and foundational work on the construction of difference, it can be argued that the cognitive disconnect produced by temporal distance, may be amplified, if not structured, through a mechanism of *othering* (see [Fabian, 1983](#)). Within this framework, the Palaeolithic subject is constructed as the *Other*, and chronologically distant human experiences are positioned as fundamentally alien to modern life and excluded from narratives of historical agency and importance. Furthermore, if this phenomenon were to be contemplated through larger frameworks that examine how societies construct meaning and value hierarchies, or why some ways of being, knowing, or living are deemed “better,” “more advanced,” or “more important” (e.g., on evolutionary hierarchies, [Morgan, 1877](#); [Tylor, 1871](#); on the structural construction of meaning, [Boas, 1911](#); [Lévi-Strauss, 1964](#); on the

institutional production of value and power dynamics, [Bourdieu, 1979](#); [Foucault, 1966](#); [Graeber, 2001](#); [Said, 1978](#)), it can be acknowledged that such assessments are not inherent but socially and historically produced.

[Lévi-Strauss's \(1964\)](#) binaries as tools for structuring meaning are echoed in common double-concepts like *primitive/modern*, *simple/complex*, and *savage/civilised*. In structuralist thought, these binaries are recognised as relational rather than absolute, and therefore may be hierarchical but also neutral, or may function as strict opposites but also as continua. Notwithstanding, some notions carry explicit value assignment, little nuance, and are treated as dichotomies (often false). Deeper cultural biases rooted in nineteenth-century unilinear evolutionary theory and modernist assumptions about progress ([Morgan, 1877](#); [Tylor, 1871](#)) that also permeated museum collection displays (e.g., Pitt-Rivers Museum, see [Tyler, 1901](#)), might explain the tendency to assign greater attention and prestige to historical periods characterised as “complex” and “civilised,” compared with prehistoric periods often characterised as “primitive,” “simple” and “savage.” Without disregarding critiques that challenge(d) the universality of evolutionist claims ([Boas, 1911](#); [Firmin, 1885](#); [Hubert & Mauss, 1902](#)), these frameworks continue to influence contemporary perceptions of what constitutes significant human achievement through inherited classificatory systems and simplified evolutionary narratives in education and popular media. For example, *The March of Progress* (originally *The Road to Homo [s]apiens*; **Figure 1.1**), is arguably the most widely circulated visual representation of human evolution, and has persisted despite strong critiques of its oversimplified and reductive portrayal of human development (e.g., [Dawson, 2024](#); [Gould, 1989](#)). Whether the public that encounters it is aware of its scientific obsolescence and the active efforts to counter the related misconceptions—online, in schools, and in museums—is unclear. Regardless, the image remains iconic and continues to be reproduced prolifically¹ (e.g., **Figure 1.2**).

In practice, the treatment of prehistory within educational, academic, and professional structures can be considered institutional expressions of such marginality. Limited coverage of human prehistory in primary and secondary school curricula (e.g., [Helms, 2020](#); [Serafini, 2019](#); [Tarantini, 2009](#)), the rarity of dedicated university degree programmes, reduced allocation of research funding, and the scarcity of permanent academic posts ([Vitali, 2021](#))

¹ [Arquié \(2014\)](#), who compiled more than 30 variations of *The March of Progress*, calls it a *contemporary meme*. On the impact of visual representations of the past to perceptions on human origins, see [Conkey \(2010\)](#), [Moser \(1998\)](#), [Moser & Gamble \(1997\)](#).

and specialised research units in prehistoric archaeology² are particularly revealing of conditions that not only contribute to public unfamiliarity with the deep past, but that reinforce perceptions that prehistory is not as significant as other types of knowledge. Professionally, the lack of career opportunities and the general precarity of employment for archaeologists, which may be especially pronounced in highly specialised subfields, are among the most critical consequences of this disadvantaged position (see [Brami et al., 2022](#); [Hardy, 2014, 2015](#); [Speakman, et al., 2017](#)). It would be speculative to assert direct causality between the systems in place and marginalisation. However, it would be reasonable to suggest that these structures both reflect and perpetuate the prevailing cultural attitudes that position human prehistory as a marginal concern—creating a cyclical process in which institutional neglect sustains public disengagement, which in turn justifies continued institutional neglect.

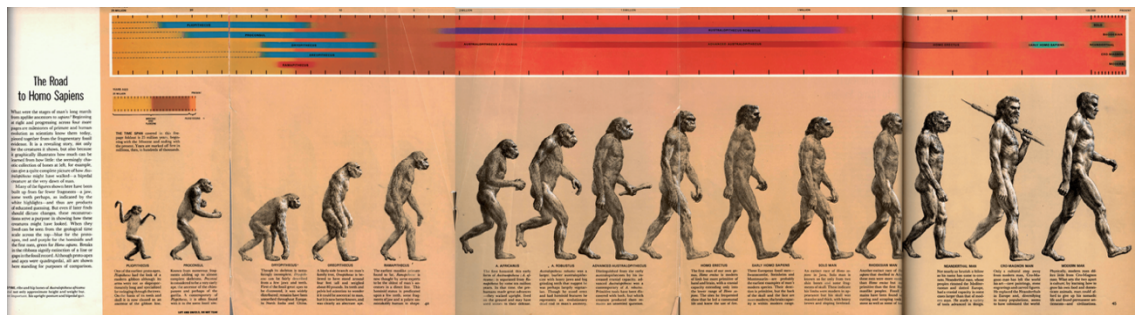


Figure 1.1. R. Zallinger's scientific illustration of human evolution published in the *Early Man* (1965) with the original title *The Road to Homo sapiens*, more popularly known as *The March of Progress*. Source: [Blake \(2018\)](#).

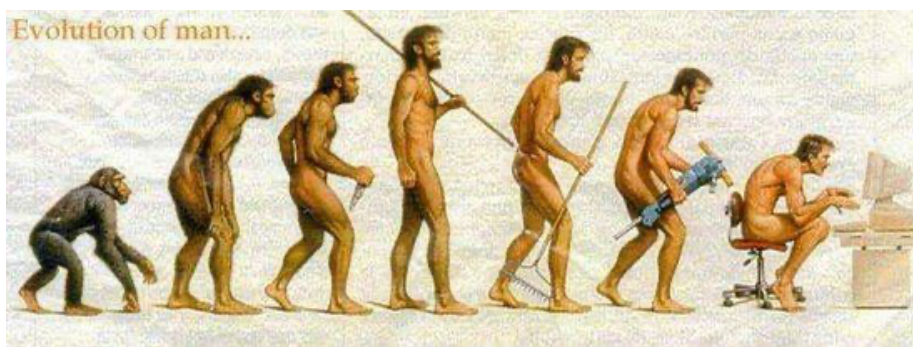


Figure 1.2. “The march towards technological regression.” Source: [Arquié \(2014\)](#).

In cultural policy and heritage recognition, this marginality is reflected in the underrepresentation of prehistoric sites in the World Heritage List. In 2008, the UNESCO formally acknowledged the scant visibility of archaeological sites and properties related to

² For a historical perspective on this in Italy, see [Guidi \(2010\)](#).

human origins within the implementation of the World Heritage Convention, despite their global distribution and critical relevance in understanding millions of years of the human lineage (Sanz, 2011). In line with the continuous commitment to expand the definition of heritage beyond built monuments to include more complex and multidimensional cultural phenomena, this recognition was matched with a positive momentum and immediately set off a series of international meetings and calls for research on cultural representations linked to prehistoric archaeology—a process that eventually led to the development and adoption of the thematic World Heritage and Prehistory programme, *Human Evolution: Adaptations, Dispersals and Social Developments* (HEADS) (Sanz, 2011). The programme effectively conveys the notion of a marginalised position of prehistoric heritage,³ especially early prehistory, in cultural promotion: the sites in question do not feature visually striking and easily identifiable monuments and structures, but rather buried sediment deposits containing fossilised bones, stone artefacts, and sometimes other organic remains, whose significance may not be immediately apparent to a non-specialised public (Sanz, 2011; Sémah, 2015a; see also Peretto et al., 2015; Sémah, 2015b). Although tangible, sites being less conspicuous and more abstract in nature means that they often fail to capture public imagination in the same way that, for example, ancient ruins from classical archaeology or even ancient dwellings from protohistoric sites do. Sémah (2015b) also uses *invisible heritage* to refer to sites linked to human evolution (e.g., karst caves, fissures, alluvial terrace complexes, sedimentary basins with occupation soils, and sedimentary records that reflect the evolution of palaeoclimates and palaeoenvironments of the Quaternary) that are only valuable for a content that is not immediately visible.

This condition of limited visibility extends from prehistoric archaeological sites to their material culture. There is little to dispute in the assertion that the link between prehistoric sites and artefacts must remain in some way physical even though their separation is inevitable, as objects and samples need to be retrieved and moved, 1) to the laboratory so that the authenticity and therefore scientific value may be revealed through analysis, and 2) to the museum to allow all audiences to perceive their heritage value (Sémah, 2015b). Manifesting this link in the museum space proves to be challenging, and the implications on prehistoric heritage appreciation are crucial. In museum settings, artefacts are typically exhibited in glass enclosures, protected from light, humidity, temperature, and direct contact

³ Prehistoric heritage represents a complex category encompassing material traces of Palaeolithic human activity, the scientific knowledge derived from their study, and their contemporary cultural significance (see also Carman, 2002; Smith, 2006).

(Merriman, 2016; Rivière & Visser, 1960), but potentially perceived as isolated and void of their original and archaeological contexts. Certain categories of artefacts, like stone tools, although physically present and accessible, possess a significance that is rarely self-evident, as their meaning is grounded in the stratigraphic, technological and contextual relationships that define them. While scientific analysis reveals their value as sources of knowledge about the past, it is effective communication that transforms this knowledge into meaningful heritage for the public. Without effective interpretive frameworks that render their meanings intelligible, such artefacts remain, in effect, *semi-invisible* as heritage.

Why stone tools?

Lithics⁴ are an excellent expression of this dynamic. Stone artefacts occupy a prominent place in archaeological research, not because they offer a complete picture of the past, but because their materiality grants them exceptional longevity in the archaeological record. They endure where organic materials often vanish, making them the most consistently available evidence of past human activity. In museums, stone tools often *define*, and at times even dominate, prehistoric collections. However, the way these objects are typically presented to the public does not necessarily encourage consideration of their scientific and heritage significance. Some remain displayed in arrangements styled like *cabinets of curiosities*, reminiscent of the antiquarian, aristocratic beginnings of archaeology and early museums; more generally, lithics are often reduced to mere “stones in glass cases.” From behind the glass, raw material, morphology, and function based on typology may be readily visible, but rather *semi-invisible* is the heritage they embody—the technological, cultural, and cognitive implications, which are conceptual and may require a more refined scientific perspective to be fully understood and appreciated.

The ability to make and use tools is considered one of the most fundamental characteristics that define and distinguish humans from other animals, encapsulated in the catchphrase, “Man, the toolmaker” (e.g., Oakley, 1961). While it has been established that toolmaking is not a trait strictly unique to humans (Goodall, 1964; Proffitt et al., 2016), such recognition remains meaningful given the important role of *technology* in human evolution (Ambrose, 2001; Hussain & Soressi, 2021; Hussain & Will, 2021). The cognitive conceptualisation of stone knapping through the use of the conchoidal fracture technique provides a basis that

⁴ *Lithics* refers to the corpus of stone artefacts recovered in archaeological contexts, not limited to finished tools or implements but encompassing the broader spectrum of stone materials involved in tool production and use, i.e., assemblage; may also include manuports, stone anvils, byproducts (sometimes referred to as debris).

differentiates this human ability from that of the nut-cracking of chimpanzees or the simple splitting technique of bonobos (Pelegrin, 2005; Pelegrin & Roche, 2017). Understanding human groups through their techniques (Mauss, 1935, 1947) is fundamental to conceptualising technology, or the science of human activities (Leroi-Gourhan, 1943; also Haudricourt 1964, see Inizan et al., 1995/1999; Soressi & Geneste, 2011). The prevalence of lithic artefacts in the archaeological record across space and through time has made them a foundational resource for studying changes in technique and tracing the emergence and evolution of technology, cognition, behaviour, and lifeways of prehistoric human groups, closely entangled with biological evolution and environmental pressures (e.g., Ambrose, 2001; Hussain & Soressi, 2021; Hussain & Will, 2021; Muller et al., 2017; Stout, 2011). Lithic technology encompasses both material and immaterial dimensions of the past: beyond physical traces of activity, they embody intangible aspects, such as knowledge systems, social and cultural practices, and symbolic meanings (Davidson, 2016; Ingold, 1988; Kuhn, 2020; Leroi-Gourhan, 1964; Pelegrin, 1990; Schlanger, 2005). The earliest stone tools, thus, may be interpreted to constitute the basis of technology and cultural expression, testament to the ingenuity⁵ of the human lineage. No other type of archaeological artefact is able to provide humans with such deep context that can be traced, with continuity and progression, from at least 3.3 million years ago.

The tendency to privilege lithic artefacts and potentially overlook other components of the material record has been a well-noted concern in archaeological interpretation and practice (Dobres, 2000; see also Anghelnu et al., 2020). And rightly so. This research recognises the heuristic importance of lithics and maintains critical awareness of the limitations imposed by too-narrow views. While lithics, like other types of remains in the archaeological record (human, faunal, floral, etc.), are examined through distinct analytical methodologies, they must not be treated in isolation but rather as part of a whole, in which meaning arises intra- and inter-relationally across assemblages and environments (see Schiffer, 1972). The foundational rationale for focusing on lithics is not to reduce prehistory to stone tools, but to draw on their multidimensional character, and to employ them as a material and epistemological anchor through which to investigate the historical emergence, scientific structuring, and museological mediation of prehistoric archaeology.

⁵ Dennell (2015) recognises conchoidal stone flakes, the Acheulean handaxe, and other prehistoric stone technologies as ‘represent[ing] a masterpiece of human creative genius’ in line with a proposal on using the World Heritage List criteria for demonstrating the Outstanding Universal Value (OUV) of prehistoric sites in Eurasia.

Why the museum?

The museum is an interesting place because they exemplify humans' intrinsic relationship with objects, and the act of collecting. Early this year a collection of essays came out of a 2022 seminar on the psychology of collecting, organised by the Leiden University group "Museums, Collections, and Society" entitled *The urge to collect: Motives, obsessions and tensions* (O'Farrell & ter Keurs, 2024). The book talks about the deep psychological and social roots of the phenomenon of collecting across historical and cultural contexts, how it is an illustration of the strong emotional connections between people and objects, and how it serves as both a personal obsession and a societal construct, often linked to themes of identity, power, and nostalgia. Today, there is a museum for anything and everything, and they can be oddly specific. For example, there is a cup noodles museum sampling the best ramen bowls in Ikeda (Japan), a museum of bad art in Somerville (USA), a museum dedicated to kittens in Amsterdam (Netherlands), and a museum of broken relationships in Zagreb (Croatia), curating "a collection of items left over after love affairs have disintegrated" (Miller, 2023).

Museums occupy a central role in the mediation of prehistory. Among the various forms of public archaeology and heritage engagement (i.e., popular media platforms), museums possess distinctive institutional authority. While such authority is contingent on the museum's functioning, visibility, and reputation, museums generally operate within frameworks of peer review, curatorial scholarship, and adherence to professional standards that lend credibility to their interpretive claims (Hooper-Greenhill, 1992; Macdonald, 2006). The physical presence of authentic artefacts further reinforces this authority, as visitors encounter primary evidence, and in turn create a perceived *direct* connection to the archaeological discovery and what it represents. Museums serve diverse audiences and can therefore address the varied entry points through which different publics might engage with prehistoric material culture (Merriman, 1989).

Humans are deeply material beings; our history, identity, and memory are often tied to the tangible (Hodder, 1994, 2012; Ingold, 2000; Malafouris, 2013). Objects are more than just tools or possessions, they are vessels of meaning, markers of identity, and links between the past and the present. In this context, museums, as institutions dedicated to the preservation, interpretation, and display of objects, are a manifestation of this profound relationship (Dudley, 2010; Pearce, 1993). By facilitating the public communication of archaeology, conferring heritage authority, and shaping public consciousness (Macdonald, 2006; Smith,

2004; Stevenson, 2022), museums become critical sites for examining how the marginality of prehistory operates in practice, and eventually for developing strategies to address it.

For all the objects it may house or purposes it may serve, the museum is uniquely positioned at the intersection of art, science, history, and society; “the main institutional connection between archaeology as a profession and discipline, and wider society” (Shanks & Tilley, 1992, p. 68). It is of major interest for this dissertation because it is where opportunities are created for the public to engage directly with archaeological materials, including lithic artefacts. For non-specialists, if not the museum, where else can the complexities of human prehistory be communicated through direct engagement with objects and the narratives they embody?

1.2. Research statement and objectives

Lithic artefacts are central to understanding human origins, yet their appreciation in museum contexts is often limited by the fact that the technological, contextual, and cultural dimensions that render them significant are not readily accessible to public audiences, resulting in their status as *semi-invisible* heritage. This research examines how the significance of Palaeolithic lithic artefacts can be more effectively communicated in museum settings by analysing the factors that contribute to their *semi-invisibility* and by exploring interpretive possibilities informed by archaeological and anthropological approaches to technology. Through an integrated study of objects, displays, and institutional practices, the project identifies the conditions that shape current representations of lithics and assesses how insights from lithic technology might be translated into museum interpretation. The central claim is that a technologically grounded understanding of lithic artefacts—rooted in the ways archaeological research reconstructs past human action—provides a coherent basis for interpreting Palaeolithic collections and supports more effective strategies for their valorisation⁶ and public communication.

⁶ The use of the term *valorisation* in this work is intended as the English equivalent of the Italian “*valorizzazione*,” a broad term encompassing various functions of heritage management (physical improvement, access, promotion, interpretation, and socio-economic integration). As many other authors have already noted (e.g., Alfano et al., 2023; Casini, 2024; Rech, 2022), while the terms *enhancement* and occasionally, *promotion*, are more common translations, *valorisation* aligns more closely with the Italian use of the concept.

The assertions made in this thesis regarding lithic artefacts rest on the recognition that these objects constitute a critical component of prehistoric archaeological evidence, and as an extension, of prehistoric collections in the museum. Across much of the Palaeolithic, which accounts for roughly 3.3 million years of human (pre)history, stone artefacts comprise the vast majority of the surviving material record. Without them, the early human past would be largely inaccessible. The scientific pursuit centred on these artefacts has driven major methodological developments in prehistoric research and continues to shape archaeological theory and practice. Their multidimensional character provides direct links between people, landscapes, and materials across time and space, making lithics a primary source of knowledge on early human evolution and behaviour. In Italy, as in contexts globally, lithic artefacts as prehistoric archaeological remains are classified as cultural assets (*beni culturali*), and therefore cultural heritage (*patrimonio culturale*), under national legislation.⁷ This statutory designation underscores their status as culturally significant objects and the responsibility to protect, conserve, and valorise them. Revisiting and reinvesting in museum lithic collections through critical approaches is therefore not only an academic imperative but also a cultural and legal one, reflecting the mandated significance of such artefacts as constituting irreplaceable records of humans' earliest ancestors.

The research, therefore, seeks to engage with two central questions: *why* do lithics, despite their foundational importance to prehistory, both as primary evidence base and as the principal if not defining component of prehistoric collections in museums, appear to have limited success in engaging public audiences; and *how* might this dissonance be addressed? To respond to these questions, the research is developed around a series of objectives.

The first objective is to establish a clear rationale for a lithics-focused project by demonstrating the fundamental role of lithic artefacts in prehistoric archaeology and its practices. With this as foundation, the research narrows its focus to the Italian context, identifying and examining the historical, disciplinary, legislative, institutional, and heritage conditions that define it. The third objective is to investigate lithic artefacts in Italian museum settings through field research and applying a three-domain analysis encompassing: 1) the lithic domain, which considers the technological features embodied in the objects; 2) the museographic domain, which examines how exhibition strategies and display practices

⁷ Italian Cultural Heritage and Landscape Code. *Decreto legislativo 22 gennaio 2004, n. 42*, in materia di *Codice dei beni culturali e del paesaggio*. Published in: *Gazzetta Ufficiale* n. 45 del 24 febbraio 2004, Supplemento Ordinario n. 28. Effective 1 May 2004.

influence their perception by visitors; and 3) the institutional domain, which analyses how disciplinary and organisational conditions shape curatorial possibilities. Drawing on these data and relevant theoretical frameworks, the research synthesises the findings to identify trends, patterns, and perspectives. Finally, the work seeks to explore alternative approaches to museum lithics and to conceptualise a valorisation proposal that is defined by its theoretical, methodological, and practical dimensions.

Summary of research objectives:

1. Articulate the historical, scientific, and museological foundations that make lithic artefacts central to prehistoric archaeology.
2. Define and examine the Italian context in archaeological, institutional, and heritage terms.
3. Conduct an integrated object, museographic, and institutional analyses of museum lithics to understand their state, interpretation, and the surrounding logics.
4. Synthesise empirical findings through relevant theoretical frameworks to identify patterns and insights.
5. Conceptualise new approaches and propose a valorisation strategy.

The concluding proposal, as is the research itself, is grounded in an interdisciplinary orientation that integrates conceptualisations from archaeology, anthropology, museology, and heritage studies. The work challenges the traditional dichotomy between fundamental and applied sciences by treating theoretical investigation and practical valorisation as mutually constitutive processes in advancing prehistoric archaeology in both its scholarly and social dimensions. The expected outcomes are intended to inform academic inquiry and institutional practice while contributing to more general discussions on the role of early prehistory within contemporary public discourse. In doing so, the research constitutes a critique of entrenched academic separations between research and public engagement and argues that museum and public dimensions of archaeological work should be recognised as integral to the research process and inherently relevant to knowledge production.

This research aims to contribute to the scholarly and professional communities from which it has drawn insight and inspiration. It addresses prehistorians and archaeologists, especially those in these disciplines who seek to break down barriers between specialised knowledge and society. It offers museum curators and exhibition managers a framework for enhancing the interpretation, display, and valorisation of lithic artefacts. It also speaks to scientific

mediators and public archaeology practitioners, whether operating within or outside museum contexts, whose roles are in the translation of archaeological knowledge into public-facing initiatives. Cultural policymakers and heritage authorities may draw on the findings to set cultural priorities, inform decisions, policies, and programmes. Finally, while the general public and museum audiences are not direct readers of this work, it is intended that its findings ultimately reach them in some form, whether through future adaptations, or simply by enriching the ways we think about prehistoric heritage.

1.3. Conceptual and theoretical framework

Two related conceptual dimensions concerning lithics, museums, and prehistoric heritage constitute this study (**Figure 1.3**). The first establishes the research problem by defining and theorising the marginality of prehistory as a cultural, disciplinary, and museological condition, and by demonstrating how lithics are positioned within this marginality through their semi-invisibility as heritage in museum interpretation. From this foundation emerges the second dimension, representing the thesis' main analytical advance: defining the characteristics and significance of lithics and arguing that, through new theoretical lenses, analytical models, and interpretive methods oriented towards their valorisation in museums, a strategy of counter-marginality can be realised.

The research integrates concepts on prehistoric technology, material culture, and heritage from archaeology, anthropology, museology, and heritage studies to approach Palaeolithic stone tools in the museum. This lithics-centred approach positions stone artefacts as the primary subject of investigation, with theoretical lenses serving to interpret and illuminate their dynamic identities, epistemic roles, and cultural significance. Critical to this positioning is [Hussain & Soressi's \(2021\)](#) characterisation of lithic studies as *basic science*—capable of contributing to human evolution narratives while articulating significance within interdisciplinary research contexts. Lithic artefacts are considered multivalent objects that carry multiple forms of meanings and significance, continually contextualised and re-contextualised as they move across disciplinary and institutional domains: first, to rationalise a lithics focus (i.e., in terms of historical, scientific, and museal significance), and second to emphasise the trajectory through which they are transformed, from archaeological finds to museum objects.

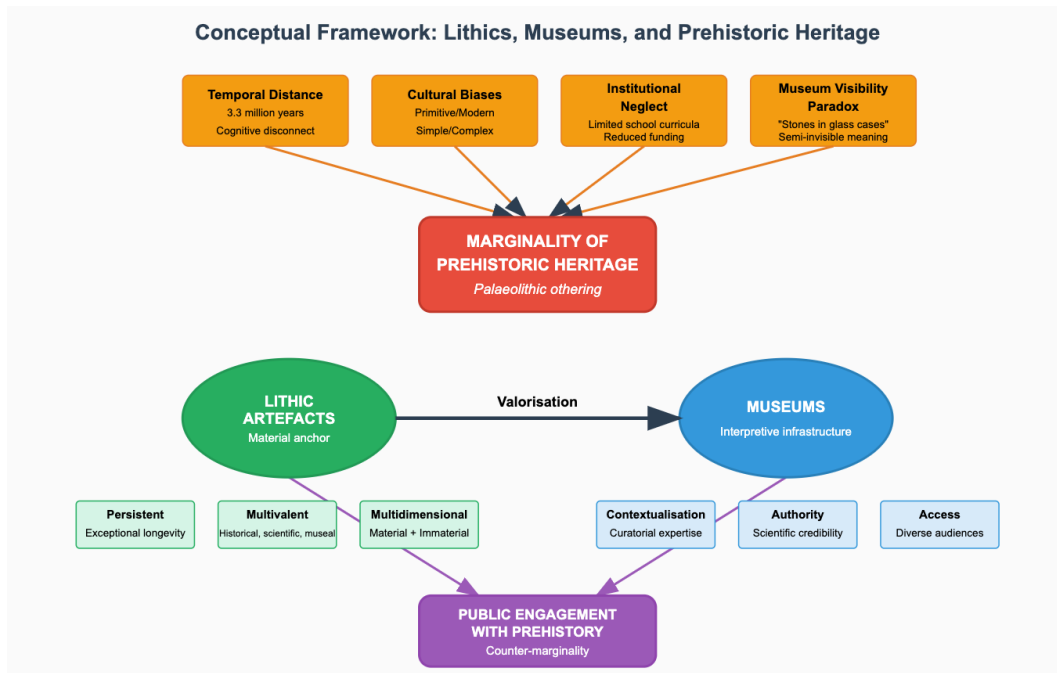


Figure 1.3. Conceptual framework: Lithics, Museums, and Prehistoric Heritage

The focus on technology arises from the recognition that it constitutes a fundamental domain of archaeological knowledge about prehistoric tools that moreover offers particular potential for transforming public engagement with stone artefacts in museum settings. Since early conceptualisations by Mauss (1935, 1947) on techniques and technical systems, anthropological and archaeological scholarship has developed increasingly nuanced conceptualisations of technology (Bruun & Wahlberg, 2022; Coupaye, 2022). Among others: *technical tendencies* and integrated systems of gesture, tool, and cognition (Leroi-Gourhan, 1943, 1964); technology as a total technical fact (Cresswell, 2003; Schlanger, 1991) or as a total social phenomenon (Pfaffenberger, 1988); technology as involving all and any interaction of matter, energy, objects, gestures, and knowledge (Lemonnier, 1986, 1992); technology as the application of rational understanding to extend human control over the natural environment (Ingold, 2000). Anthropological perspectives particularly emphasise an understanding of technology beyond artefacts and their material existence, origin, creation, and use, to include human bodies, skills, traditions, processes, and socio-technical systems (Bruun & Wahlberg, 2022). Drawing on conceptualisations on the social and cultural embeddedness and the sequential and structural dimensions of technical activities (Mauss, 1935), this research employs a *chaîne opératoire* framework (Leroi-Gourhan, 1964, 1993) to analyse Palaeolithic lithic artefacts as materialised traces of technical processes (Lemonnier, 1992; Pigeot, 2011; Mauss & Schlanger, 2006; Schlanger, 2005). It has already been argued that the *chaîne opératoire* as a descriptive and interpretative tool helps make

visible, among others, the relational complexity, temporal logic, and material-social heterogeneity embedded in technical processes through systematic documentation of observed practice (Coupaye, 2015; 2022). This approach enables the identification of technological dimensions expressed by museum lithics and supports a systematic assessment of whether display practices render these dimensions perceptible or obscure the procedural intelligence that lithic specimens materialise.

The study simultaneously considers meaning, materiality, and mediation in museum contexts. Exhibitions, within which lithic objects are situated, are treated as communicative environments structured by spatial, visual, and discursive conventions, while museums are approached as cultural and epistemic agents embedded within broader policy, disciplinary, and heritage regimes (Bennett, 1995; Harrison et al., 2016; Macdonald, 2006). The research approach is informed by developments in *new museology* (Vergo, 1989a), structured by three key insights: 1) the situated and contextual rather than inherent nature of museum objects and their meanings (Saumarez Smith, 1989; Vergo, 1989b); 2) the recognition that matters like education, politics, commercialism, entertainment, and visitor demographics are integral rather than peripheral concerns to understanding museums (e.g., Greenhalgh, 1989); and 3) attention to how museums and exhibitions may be perceived and interpreted differently by diverse audiences (Merriman, 1989).

Museum archaeology increasingly embraces reflexive approaches that recognise museums as active sites where knowledge is produced, mediated, and contested (Delley & Schlanger, 2022; Stevenson, 2022). Museums thus participate in an ongoing project of interpretation and repeated contextualisation that extends beyond simply disseminating archaeological discoveries. The integration of lithic objects in museum spaces constitutes a form of mediation bringing together past and present, object and audience, technology and society. This research adopts such a critical framework and examines how cultural, institutional, and epistemological assumptions shape both the production and communication of archaeological knowledge (Förster, 2014). It interrogates how disciplinary and museological practices construct, interpret, and prioritise particular narratives and material cultures, revealing the social and ideological forces underpinning the mediation of prehistoric evidence. Within this orientation, valorisation is conceived not merely as the institutional assignment of worth but as a reflective process that fosters nuanced and plural constructions of heritage value—one attentive to diverse epistemologies, material agencies, and interpretive possibilities. This provides conceptual grounding for analysing the *semi-*

invisibility of lithics within heritage narratives and for developing strategies that enhance their interpretive presence and epistemic significance in communicating prehistoric knowledge.

1.4. Scope and limitations

This research investigates the status and representation of lithic artefacts within prehistoric museum⁸ settings, with a particular focus on Italy. It examines how lithic objects are collected, interpreted, categorised, and displayed within institutional settings, and how these practices shape both the epistemological status of the artefacts and their reception by diverse publics. The empirical investigation centres on the Italian situation: on the regulatory frameworks, practices, and realities in Italy, and the overarching frameworks to which Italy is subject, such as those established by the European Union or by the International Council of Museums (ICOM). This work does not attempt to provide a comprehensive survey of Italian museums but instead focuses on selected institutions as representative case studies. The study also draws on insights gained during periods of research mobility, conference participation, and museum visits abroad, particularly in France, to highlight contrasts and parallels and to examine Italian specificities and their alignment with, or divergence from, the wider Western European landscape.⁹ It does not, however, intend to be exhaustive.

To maintain analytical coherence, while this work refers broadly to *prehistoric* lithic collections, -archaeology, and -heritage, it focuses primarily on Palaeolithic contexts. In Europe, the Palaeolithic is conventionally divided into the Early, Middle, and Upper Palaeolithic. The Mesolithic and Neolithic and later periods are beyond the scope of this research. The Palaeolithic offers particular relevance because stone tools dominate the archaeological record of this period and remain conceptually central to reconstructions of early human life. This focus also underscores the place of human origins and evolution in contemporary conceptualisations of heritage.

⁸ Includes any museum institution that houses and displays Palaeolithic collections, regardless of whether prehistory constitutes its primary focus; this may encompass national museums, regional archaeological museums, site museums, and university collections that interpret and present stone tool assemblages to public audiences.

⁹ This coverage acknowledges both the geographical focus of the research and the corresponding archaeological and museological traditions examined. Such regional delimitation reflects shared historical developments in prehistoric archaeology, comparable heritage legislation frameworks, and similar institutional structures, while recognising that other global realities offer different conditions and approaches to prehistoric heritage presentation.

Notwithstanding its strong focus on lithic collections, this study acknowledges that no single class of artefact can, or should, be isolated from its context. It does not seek to disregard other materials and technologies present in the archaeological and museum record but rather foregrounds lithics as a primary lens through which to investigate more encompassing questions about the material and semiotic framing of archaeological objects in the museum.

The research employs a technologically informed analysis of museum lithics, drawing on specialist knowledge to investigate museum communication practices while remaining attentive to institutional constraints and possibilities. Data collection consisted primarily of systematically recording lithic collections comprising exhibition content, object-focused observations, documentation of curatorial strategies, and semi-structured interviews with museum professionals. Archives were not consulted, an exclusion that reflects a deliberate prioritisation of material display and curatorial mediation over documentary history, though institutional histories or collection formation processes were considered as contextual factors through interviews and published institutional literature. Visitor engagement is addressed primarily through institutional perspectives; while public interpretation is considered, no systematic visitor studies were undertaken. These limitations are acknowledged as part of the research design and serve to delimit the scope rather than diminish the relevance of the findings. They also define the parameters within which the proposed methodological reconfiguration is to be understood and potentially applied.

This research is grounded primarily within the Italian framework. Accordingly, much of the literature cited reflects orientations, traditions, and practices pertinent, though not exclusive, to this localisation. This focus enables in-depth engagement with historical, disciplinary, and institutional specificities that have shaped the dynamics of prehistory, museums, and heritage management in Italy. However, this does not preclude a wider applicability: the study may serve as a comparative reference or be adapted to other contexts, provided that its core analytical framework remains situated within the relevant archaeological and museological discourses.

The research progresses through empirical analysis documenting current museum practice and identifying mechanisms of undervalorisation, concluding with a theoretically grounded valorisation proposal that emerges from and responds to empirical findings. The proposal offers conceptual frameworks, methodological strategies, and practical recommendations,

but does not implement interventions, test visitor responses, or measure communication effectiveness. These activities constitute important directions for future research. The valorisation proposal should therefore be understood as establishing theoretically informed foundations for enhanced practice rather than as a prescriptive blueprint. Implementation would require contextualisation within specific museum missions, resources, collections, and constituencies, with strategies adapted to institutional circumstances rather than uniformly applied. The research thus makes two distinct but complementary contributions: a rigorous empirical analysis of existing conditions and a theoretically grounded set of conceptual alternatives for reimagining possibilities.

1.5. Thesis structure

The dissertation develops as a cumulative argument from broad theoretical framing through empirically grounded analysis toward critical discussion and concluding with a proposal. With **Chapter 1** introducing the premise, research problem, objectives, frameworks, and scope, the thesis unfolds across seven further chapters.

Chapter 2 establishes the rationale for focusing the research on lithics (*Why lithics?*) by examining the co-evolution of three interdependent and continuously shifting domains: prehistoric archaeology as a discipline, lithic studies as a scientific field, and the museum as an institution. This chapter anchors the conceptual references used throughout the thesis.

Chapter 3 narrows the focus to the Italian context and defines the primary terrain of the investigation by outlining the landscape of prehistoric archaeology, museum, and cultural heritage management in Italy. It should be read both as a situational grounding and as an entry point into the empirical dimension of the work, establishing the research within localised traditions and institutions, and setting up the necessary baseline for qualifying the strategic parameters of the methodology.

Chapter 4 presents the research design, materials, and methods. It details the selection criteria for case study museums, the data collection procedures, and the tripartite methodology used to examine how lithic collections are situated within different museum settings: lithic objects analysis, museographic analysis, and institutional dynamics analysis.

It also explains the integration of theoretical perspectives used to support a context-sensitive interpretation and synthesis of data.

Chapter 5 presents the results of the multi-level analyses: the technological knowledge embedded—visible and semi-invisible—in lithic objects as displayed; the exhibition strategies and narratives conveyed through material and spatial configurations, as well as the wider communicative ecosystem shaped by educational and interpretive tools; and institutional dynamics affecting display choices and principal decisions within the museum.

Chapter 6 offers a critical reading and discussion of these findings, problematising the implications of conceptual and practical challenges of lithic musealisation and the more general implications on how lithics (and by extension, prehistory), are understood and valued by the public.

Chapter 7 presents an attempt to *respond* to the concepts from Chapter 6, recognising the opportunities and addressing the limitations of the current systems, by proposing a valorisation strategy to approach museum lithics. The chapter outlines the theoretical, methodological, and practical dimensions of this approach and considers the role of museum networks and underutilised tools in its implementation.

Finally, **Chapter 8** concludes the thesis by synthesising insights and outlining future research trajectories. It reflects on the broader significance of the research for prehistory, museum archaeology, and heritage studies, and establishes foundations for further development and application of the proposed strategy.

2.

WHY LITHICS? MATERIAL PERSISTENCE,
DISCIPLINARY FOUNDATIONS, AND THE CO-
EVOLUTION OF PREHISTORIC ARCHAEOLOGY,
LITHIC STUDIES, AND THE MUSEUM INSTITUTION

2.1. An object of history: Lithics in the establishment of deep human antiquity, of prehistory as a discipline, and of prehistory within the museum

The constitution of prehistory as a disciplinary and institutional field in the 19th century was inextricably linked to the interpretive reconfiguration of stone tools, whose perceived anthropic origin and temporal depth enabled the consideration of alternative claims about the remote human past and the questioning of existing paradigms. As historic objects, lithics precipitated the recognition of the high antiquity of humankind, prompting the formation and institutionalisation of prehistory as a discipline; through their public display at the 1867 Universal Exposition in Paris, they legitimised both the antiquity claim and the emergent field, among other functions ([Delley & Schlanger, 2022](#); [Kaeser, 2014](#); [Quiblier, 2014](#)).

2.1.1. From thunderstones to stone tools, post-diluvian to ante-diluvian, and antiquarianism to archaeology

The earliest emergence of stone tools as objects of scholarly interest may be traced to their initial treatment as *curiosities* by antiquarians. Stone artefacts being found across Europe were collected and classified, together with crystals, petrified plants and animals, and other distinctively shaped stone objects, as marvels of natural history with aesthetic and/or exotic value ([Trigger, 1989](#)). At the time, a medieval, folkloristic interpretation was also prevalent, and what are casually called “stone tools” today were believed to have celestial or supernatural origins, i.e., as thunderstones or elf-bolts/arrows ([Daniel, 1962](#); [Schnapp, 2002](#); [Trigger, 1989](#)). As early as the 16th century, enlightened minds such as geologist Georgius Agricola, anatomist Ulysses Aldrovandi, and naturalist Michele Mercati already had questions about the real nature and origins of these objects and have expressed opinions about their human origins ([Clarke, 1978](#); [Schnapp, 2002](#); [Segre, 2001](#); [Trigger, 1989](#)). However, the attribution of such stones to human agency and to deep antiquity was a realisation that would prove neither immediate nor free from contention for many centuries that followed.

When Western European colonial explorations began in the 16th century, scholars became aware of Indigenous populations in the Americas and the Pacific who relied on stone tools and lacked metallurgical traditions ([Trigger, 1989](#)). These tools were brought back to Europe

and circulated, first as curiosities, and later serving as ethnographic specimens (Grayson, 1983). This awareness prompted a (re)consideration of the interpretations of similar objects that were being found in Europe at the time: one that affirmed a human origin for stone tools and gave rise to the idea that people who had made and used stone tools, before or without learning metalworking, had once inhabited Europe (Daniel, 1962; Trigger, 1989). Supporting accounts emerged through ethnographic analogies between the Indigenous, so-called “modern primitive peoples,” and *prehistoric*¹⁰ Europeans (Grayson, 1983; Trigger, 1989). Vatican Botanical Garden superintendent Mercati, in his work, *Metallototeca Vaticana* (written 1574, published posthumous 1717), identified thunderstones from the Vatican collections as flint weapons knapped by people who lacked knowledge of metallurgy, based on comparisons with the stones that arrived from Asia and America (Clarke, 1978; Daniel, 1962; Schnapp, 2002).

Notwithstanding similar works and concordant claims coming from several scholars¹¹ across Europe, uncertainty persisted throughout the 17th and until the 18th century. Antiquarians like Ole Worm, despite access to comparable ethnographic examples, did not abandon the belief in the celestial origin of polished stone axes (Klindt-Jensen, 1975; Trigger, 1989). In his own museum in Denmark (opened to the public in 1680, five years after the Ashmolean was established at Oxford), human-made objects and natural curiosities were assembled in collections that would become the basis for the *Kunstammer* or Royal Collection. Trigger (1989) forwards two implications of this “slowness”: first, the absence of a cohesive scholarly network in Europe at the time, through which sustained intellectual exchange could have taken place; and second, that “*the artefactual nature of stone tools was not self-evident*” (p. 94).

By the end of the 18th century, that stone tools were deliberately manufactured by humans who lived in Europe in a relatively “remote” past, was generally acknowledged. However, due to the dominant theological worldviews at the time, the idea of very high antiquity faced

¹⁰ Though the idea of *prehistoric* would not exist until the 1830s and the term would not acquire its modern meaning until the 1850s. For the complex etymology and earliest usage of *prehistoric* and related terms, see Chippindale (1988); Clermont & Smith (1990); Rowley-Conwy (2006).

¹¹ E.g., Pietro Martire d’Anghiera (1600) and Ulisse Aldrovandi (1648; *Museum Metallicum*) in Italy; Isaac de La Peyrère (1655), Antoine de Jussieu (1723) and Bernard de Montfaucon (1729–1733) in France; William Dugdale (1656), Robert Plot (1686), Edward Lhwyd (1699), Charles Lyttelton (1766) and Samuel Johnson (1775) in England; Robert Sibbald (1684) in Scotland; Kilian Stobaeus (1738) in Sweden; Erik Pontoppidan (1763) in Denmark (Clarke, 1978; Daniel, 1962; Klindt-Jensen, 1975; Laming-Emperaire, 1964; Trigger, 1989).

considerable resistance. It remained difficult for people to comprehend such claims and consolidate them with the creation of the Earth in 4004 BC and the cataclysmic Flood (Daniel, 1962; Trigger, 1989). The ideas of Mercati, for example, were explained through adhering to such biblical chronologies and positing degenerationist models, arguing that metallurgy, though known early in human history (as suggested by Genesis), was only later forgotten by populations who settled in regions without access to iron ore after the biblical Flood (Daniel, 1962; Schnapp, 2002). Similar narratives suggested that knowledge was not accumulated over time but lost through dispersion and environmental constraints following cataclysmic events, consistent with Georges Cuvier's (1812) catastrophism (Kaeser, 2002; Laming-Emperaire, 1964).

The gradual epistemological transformation which gathered momentum in the Enlightenment increasingly challenged such theological views. Philosophers and scientists such as Francis Bacon, Galileo Galilei, and Isaac Newton promoted scientific reasoning, empirical observation, and natural law as means to investigate the world (Clarke, 1978; Daniel, 1962; Schnapp, 2002; Trigger, 1989). In this emerging framework, technologically "simple" societies came to be seen not as degenerate but as survivals of an earlier human condition, a shift that laid the foundation for an evolutionary perspective on cultural and technological development (Delley & Schlanger, 2022; Kaeser, 2002).

A rupture with scriptural time came in the early 19th century through stratigraphic discoveries. The establishment of the principle of uniformitarianism in the work of Charles Lyell, *Principles of Geology* (1830-33) was crucial in providing the deep time necessary for human antiquity and biological evolution (Clarke, 1978; Daniel, 1962; Schnapp, 2002; Trigger, 1989). It was in this intellectual climate that Jacques Boucher de Perthes, a French antiquarian, played a pivotal role. He examined the stream terraces around Abbeville in the Somme River Valley where quarries have been excavated and meticulously collected flint handaxes that were stratigraphically associated with remains of extinct megafauna (Daniel, 1962; Grayson, 1983; Groenen, 1994; Kaeser, 2002; Sackett, 2014). Casimir Picard, a naturalist who believed that "a scientific antiquarian must first gain a detailed knowledge of the intrinsic makeup of artefacts themselves before becoming overly concerned about their possible culture-historical significance" worked out the basics of what we now call *lithic technology* for the Abbeville handaxes, and highlighted the importance of the distinctive morphology which made their identification possible (Sackett, 2014). Picard had died before the publication of Boucher de Perthes' works on the Somme Valley, *Antiquités Celtiques et*

Antédiluviennes (1847), which was met with scepticism, partly due to the lack of scientific rigour in Boucher’s presentations¹² (**Figure 2.1**), his focus on “figured stones,” his regard to handaxes as symbolic items rather than utilitarian implements, and his self-promotion (Kaesler, 2002; Sackett, 2014; Schnapp, 2002). In 1854, Marcel-Jérôme Rigollot published well-illustrated accounts of hundreds of handaxes and chipped stone tools found in the same strata as remains of Pleistocene animals from the quarries at Amiens, especially at Saint-Acheul (**Figure 2.2**).

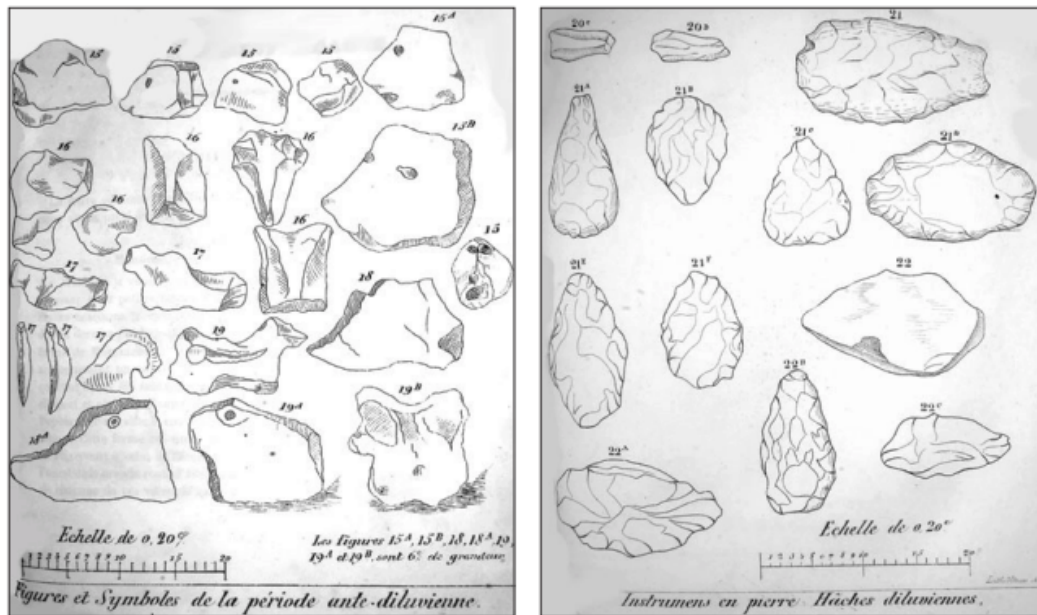


Figure 2.1. Boucher de Perthes’ own illustrations of figured stones (L) and handaxes and tools (R) as published in *Antiquités Celtiques et Antédiluviennes* (1847). Source: Sackett (2014).

The findings of Boucher de Perthes, Picard, and Rigollot became established in 1859, when a visit by British scientists, including geologist Joseph Prestwich and antiquarian John Evans, provided corroboration of the *in situ* association of human artefacts with extinct animal remains at the Somme Valley sites—the consensus that finally overcame the institutional resistance of the French Academy of Sciences¹³ (Pope & Roberts, 2009; Sackett, 2014). Prestwich then published the results of his work in the Proceedings of the Royal Society of London, entitled *On the Occurrence of Flint-Implements, Associated with the Remains of Extinct Mammalia, in Undisturbed Beds of a Late Geological Period* (1860)

¹² Sackett (2014) points out that Boucher’s early lack of expertise in stone tool morphology made him susceptible to purchasing not only authentic specimens but also forged handaxes.

¹³ The consensus emerged when the findings were endorsed within the Parisian scientific establishment, which had long remained sceptical of claims advanced from outside its institutional centre (Sackett, 2014; see also Grayson, 1983).

(**Figure 2.3**). This breakthrough in the Somme Valley, alongside careful excavations at Brixham Cave where flint tools associated with extinct animals were recovered (Falconer et al., 1858; Pengelly, 1859; Prestwich, 1873), contributed to the growing acceptance of deep human antiquity and challenged prevailing chronologies of human origins (Daniel, 1962; Gruber, 1965; Pope & Roberts, 2009).

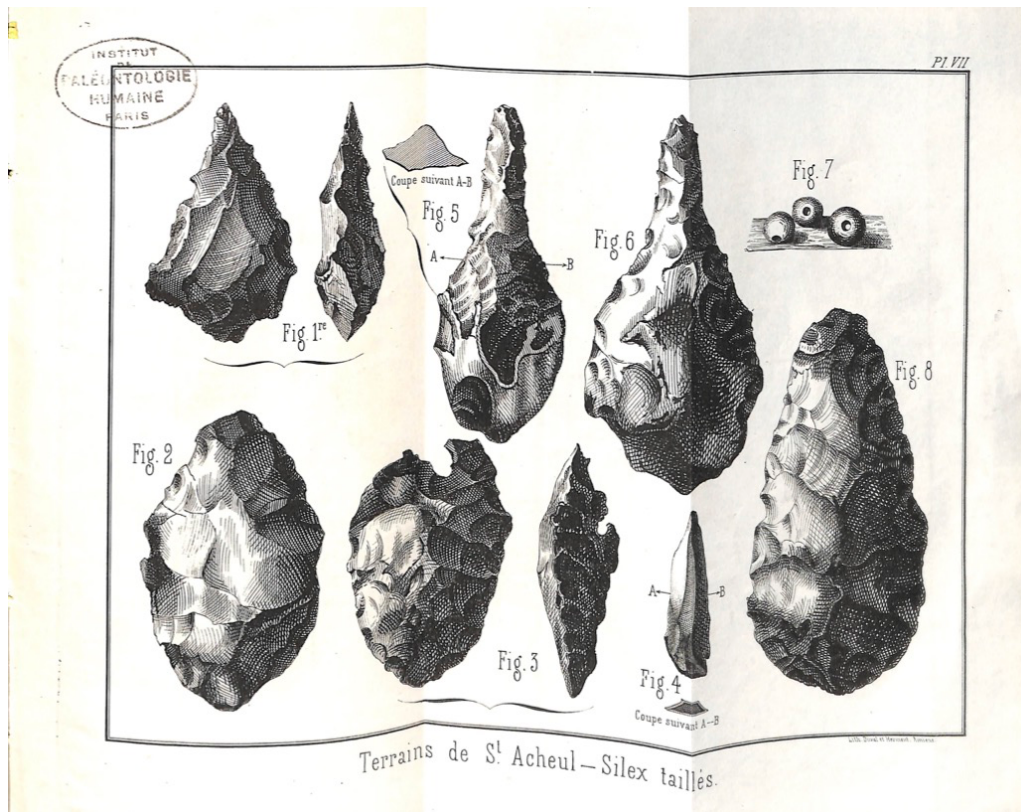


Figure 2.2. Rigollot's illustrations of knapped flints from Saint-Acheul, published in *Mémoire sur des instruments en silex trouvés à St-Acheul, près d'Amiens, et considérés sous les rapports géologique et archéologique*. Source: Rigollot (1854), courtesy of IPH Paris.

In the same year, Charles Darwin published *On the Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life* (1859). The conceptual transition of the interest in lithics, from mythical interpretations to a recognition as prehistoric tools, constituted a fundamental shift in the comprehension of human antiquity, from chronologies constrained by biblical, creationist worldviews to the acceptance of deep geological time and evolutionist ideas (Clarke, 1978; Daniel, 1962; Schnapp, 2002). It took almost sixty years for John Frere's publication in the Society of Antiquaries of London's *Archeologia* (1800) of the Hoxne handaxes—flint weapons he described as “bifacially chipped, pointed stone tools” from Suffolk—to be recognised (Daniel, 1962; Trigger, 1989). In 1863, Lyell's *Geological Evidences of the Antiquity of Man* was published, where he addressed both human antiquity and the origin of species (Grayson, 1983).

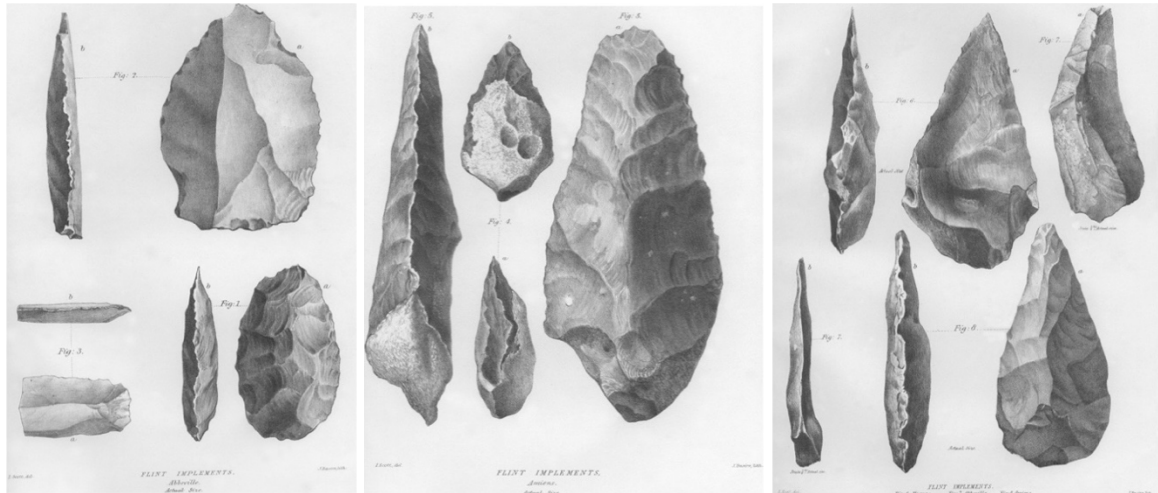


Figure 2.3. Excerpts from the publication that “validated” deep human antiquity showing illustrations of flint implements from Abbeville (Fig. 1–3 from Boucher de Perthes’ collection; Fig. 7 collected by Prestwich), Saint-Acheul at Amiens (Fig. 4,5,8 found by Prestwich), and Hoxne (Fig. 6 from the collection of Amyott).
Source: [Prestwich \(1860\)](#).

This pragmatic shift required a new classificatory structure for human antiquity. The concept of a *three-age system* (Stone, Bronze, Iron) was not new, having roots in classical thought already cited by Mercati in his work, and being proposed by French scholars like Mahudel and Goguet in the 18th century based on Mercati’s work ([Schnapp, 2002](#)). The decisive leap in systematising prehistory, however, came from the museums. Christian Jürgensen Thomsen, appointed to catalogue the Danish Royal Commission for the Preservation and Collection of Antiquities, formulated and applied the three-age system (Stone, Bronze, Iron) at the Royal Museum of Nordic Antiquities in Copenhagen in 1817, some decades before the resolution of the human antiquity problem ([Daniel, 1962](#); [Kaeser, 2006](#); [Klindt-Jensen, 1975](#); [Rodden, 1981](#); [Schnapp, 2002](#); [Trigger, 1989](#)). Thomsen’s ingenuity was in classifying artefacts not by geography or presumed historical association, but by their material and technological development. He utilised “closed finds,” or groups of artefacts found together in undisturbed contexts like graves or hoards, to determine which types of objects consistently co-occurred and which did not, thereby building a relative chronology ([Thomsen, 1836](#)). This methodological innovation allowed the assignment of objects to distinct periods and the demonstration of their chronological succession, profoundly shaping the framework of archaeology ([Daniel, 1943, 1962](#); [Rodden, 1981](#); [Schnapp, 2002](#)). The public display of his system in the museum effectively transformed it into a “language of objects,” creating a universal way through which the earliest periods can be understood, and bypassing older literary or mythological accounts ([Delley & Schlanger, 2022](#)). His model was soon corroborated through excavation and stratigraphic validation by Jens Jacob

Asmussen Worsaae, who also formalised the division of the Stone Age into what later will be termed *Palaeolithic* and *Neolithic* by Sir John Lubbock (*Prehistoric Times*, 1865), and later applied across Europe, quickly spreading through translations and correspondences (Clarke, 1978; Daniel, 1962; Klindt-Jensen, 1975; Trigger, 1989). The importance of the three-age system is also in that it granted prehistoric objects an “entrance” to a global vision of the history of humanity, thus it being called as *the first paradigm of archaeology* (Kristiansen, 2014; Rodden, 1981; see also Daniel, 1943).

Three elements were crucial to the emergence of a systematic prehistoric archaeology: the recognition of stone tools as human-fabricated and associated to extinct fauna; the adoption of a fluvialist geological framework; and the acceptance of the tripartite division of human prehistory into the three ages (Daniel, 1962).

2.1.2. Emergence of international networks and academic structures in the institutionalisation of prehistory

The acceptance of deep human antiquity fostered the view that the study of human societies from their origins constituted a distinct and coherent field of research (Groenen, 1994). Such impetus instigated the disciplinary status of prehistory and led to the demand for dedicated institutions. The transformation of prehistoric archaeology from antiquarian collecting to systematic scientific discipline occurred through the gradual establishment of formal academic structures and international scholarly networks during the mid-to-late 19th century (Daniel, 1962; Kaeser, 2002; Trigger, 1989).

The first specifically prehistoric institution was a journal, *Matériaux pour l'histoire positive et philosophique de l'homme* (1864), launched in France by trained geologist Gabriel de Mortillet, which achieved considerable international success and was soon followed by similar journals in Germany (*Archiv für Anthropologie*, 1866) and Italy (*Bullettino di Paletnologia Italiana*, 1875) (Kaeser, 2002). While early antiquarian interests were often localised or national in scope, the coalescence of prehistory into a recognised science was shaped by a broader, more interconnected intellectual landscape. Crucially, the first dedicated prehistoric association was international: the *Congrès international d'anthropologie et d'archéologie préhistoriques* (CIAAP), which was proposed by de Mortillet and geologist-archaeologist Édouard Desor at a meeting of the *Società Italiana di Scienze Naturali*, in 1865 chaired by geologist Giovanni Capellini (Guidi, 2008, 2010;

Kaeser, 2002, 2009; Vai, 2002). While the French Academy had continuously demonstrated scepticism, first towards the evidence of deep human antiquity, which delayed the recognition of Boucher de Perthes' work (Laming-Emperaire, 1964; Sackett, 2014; Van Riper, 1993), and later to the disciplinary legitimacy of prehistoric studies (Kaeser, 2002; Müller-Scheessel, 2001), the Italian counterparts demonstrated greater receptivity. The Congress was strategically established in La Spezia in Italy and its first session held in Neuchâtel, Switzerland (1866) to ensure its independence from French imperial scientific institutions. The nature of the Congress was a reflection of the intellectual milieu from which it emerged: multilingual, well-networked, politically engaged, and cosmopolitan (Kaeser, 2002, 2009; Guidi, 2010; Vai, 2002).

The CIAAP was highly successful for several decades, attracting leading scholars and a wide range of participants, including natural scientists, from across Europe.¹⁴ Its influence was instrumental in developing shared rules and methods for the emerging scientific community. Moreover, its international character was a deliberate attempt to remove proponents of the antiquarian tradition¹⁵ from prehistoric research, in favour of the evolutionist approach, which concerned itself more with the process of human evolution and on cultures as products of the interaction between society and environment (Kaeser, 2002). Such is also the notion of prehistory, coming from the influence of natural scientists, as a *natural history of mankind* (Kaeser, 2006, 2009). Establishing universal methodological principles for prehistoric research, i.e., emphasising the importance of typology, stratigraphic excavations, and technological studies, proved essential to the eventual emancipation of archaeology from the antiquarian discipline (Schnapp, 2002; cf. Kaeser, 2002). Like the Italian Natural Sciences Society, within which the CIAAP was founded, other scholarly societies such as the *Société d'Anthropologie de Paris* and the Anthropological Institute of Great Britain and Ireland, although not dedicated to prehistory, provided venues for organising research activities and maintaining correspondence networks among prehistorians (Van Riper, 1993). Not long after, these collaborations led to joint international research initiatives, enabling comparative studies of prehistoric contexts across broader geographical scales (Trigger, 1989).

¹⁴ In 1931, the Congrès international des sciences préhistoriques et protohistoriques (CISPP) was created as a direct successor to CIAAP, which in 1956 was renamed the Union internationale des sciences préhistoriques et protohistoriques (UISPP)—the organisation and name we recognise today. The UISPP remains to be one of the most important and most active world organisations in the discipline.

¹⁵ Kaeser (2002) defines the antiquarian programme as one that is concerned “mainly in illustrating the life, manners, customs, and beliefs of ancient peoples, using biblical texts, mythology, linguistics, and philology, and defining the diachronic permanence and essentialist features of individual cultures, peoples, and ‘nations.’”

The success of this international institutionalisation¹⁶ directly facilitated the later establishment of national prehistoric societies and the eventual creation of dedicated academic chairs and departments in European universities (Guidi, 2008, 2010; Kaeser, 2002). In the second half of the 19th century, prehistory came into existence as a conscious and separate aspect of the study of the human past, primarily within Western Europe and Scandinavian academic contexts, reflecting both the historical development of university systems and the concentration of early archaeological discoveries in these regions (Klindt-Jensen, 1975; Van Riper, 1993). The intellectual foundation of prehistoric archaeology as a discipline is referred to as a collective revolution, predominated by French (encyclopaedic, collection-based), Danish (chrono-typological based on museum collections), and Italian (stratigraphic, geo-archaeological)-developed methodologies (Vai, 2014). Moreover, an increasing awareness of the value of archaeological heritage led to the constitution of numerous public bodies tasked with the excavation and conservation of sites, which was a development that played a key role in the gradual emergence of professionalisation (Kaeser, 2002). Within museums, prehistory slowly asserted its identity and separated itself from broader fields of ethnology, national antiquities, and natural history.

2.1.3. The “industry” in *lithic industries* and prehistory on display at the 1867 Universal Exposition in Paris

The original purpose of the *Exposition universelle* was to present a comparative display of industrial production and showcase national prowess in science, technology, manufacture, and the decorative arts (Delley & Schlanger, 2022). It emerged from a tradition inaugurated in 1851 with the Great Exhibition in London, which soon after was followed by the World Fair in Paris in 1855 (De Tholozany, 2011). This was in part a reflection of Napoléon III’s view of the Exposition as an opportunity to position France at the intellectual and cultural centre of a modern, interconnected world (McMillan, 2003). By the time of the 1867 Exposition, the aims had expanded and intensified to reflect the broader imperial, economic, and ideological ambitions of the time, turning into an event to celebrate a totalising vision of human progress and modernity. The exhibition grounds at the Champ-de-Mars, designed with a monumental elliptical palace and a radial layout, were intended not only to house material displays but to symbolise a world rationally ordered and unified by scientific and industrial advancement (Benedict, 1983; Quiblier, 2014). The 1867 Fair was decisive in that

¹⁶ Although for the international *extent* of the Congress’ influence, see also Sommer (2006).

it extended the logic of such industrial fairs into new domains, as part of a comprehensive attempt to frame a universal narrative of human development (material, intellectual, and moral) within which the emerging science of prehistory found institutional and ideological expression (Dias, 1994; Greenhalgh, 1989; Sackett, 2014).

A particularly crucial component of this world's fair was the *Musée de l'histoire du travail*, which traced the history of tools and production prior to 1800 (thus, the “retrospective museum”; **Figure 2.4** and **Figure 2.5**), uniquely including the “earliest times” and “epochs prior to the use of metals” (Delley & Schlanger, 2022; Hurel, 2014; Kaeser, 2006). What would become the very first, methodical, public, and international display of prehistory¹⁷ was the first gallery at the Museum of the History of Labour. Countries like Great Britain, Switzerland, and Russia also displayed prehistoric objects, but the dominating and “most impressive” display was (of course) that of France's (Müller-Scheessel, 2001), the first section of which was described to present, more accurately, “The first epoch: Gaul before the use of metals. Bone and stone tools, with the bones of animals now extinct from the soil of France, but found with these tools and able to indicate the period to which they belong” (Commission Impériale, 1867 in French; Ducuing, 1867 in Italian).

Lartet and de Mortillet, from their own collections (**Figure 2.6**) and from those of their colleagues at the CIAAP,¹⁸ organised the display with the aim to create a narrative of “anticipatory continuity” (Delley & Schlanger, 2022, p. 32), linking prehistoric “Acheulean” and “Mousterian” stone tool *industries* (de Mortillet, 1867) to the contemporary industrial achievements celebrated elsewhere in the Exposition. The purpose was not simply to *show* French prehistoric objects, but to emphasise their chronological contextualisation as the earliest stage of human labour and therefore as artefacts of cultural-historical value, while prehistoric objects from other nations were presented as pieces of art (Müller-Scheessel, 2001; also Ducuing, 1867). The stone tool *industries*¹⁹ mirrored the national-based framework of the Exposition and effectively normalised the concept of industry as the foundational and triumphant characteristic of Western civilisation, which could be traced

¹⁷ For an extensive discussion on the prehistoric exhibit at the 1867 Exposition, see Quiblier (2014), and on prehistoric exhibits in general at French Universal Expositions, Müller-Scheessel (2001).

¹⁸ Many of the CIAAP members were involved in the organisation of the Museum of the History of Labour. The second session of the congress, led by Lartet and de Mortillet, was held in Paris during the Universal Exposition (Quiblier, 2014).

¹⁹ The term *industry* gained traction, entered common usage, and was eventually developed to have definitions and configurations more appropriate to stone tool research (de Mortillet, 1869, 1883; see also Clarke, 1978).

back to crude stone implements, especially those found in France (Clarke, 1978; Delley & Schlanger, 2022; Kaeser, 2015).



Figure 2.4. An engraving of the *Musée rétrospectif*. Source: *Grand album de l'Exposition Universelle 1867* (Commission Impériale, 1868, p. 51), courtesy of the Digital Archives, Heidelberg University Library.



Figure 2.5. An engraving of *Museo Retrospettivo - Galleria del Lavoro* [this is a cropped version of the original]. Source: *L'esposizione Universale del 1867 illustrata...* (Ducuing, 1867, p. 596), courtesy of the Digital Archives, Heidelberg University Library.

As far as prehistory is concerned, the 1867 Paris Exposition represented a convergence of several important developments: it 1) marked the first time flint tools were displayed to the public; 2) conclusively demonstrated human origins far earlier than previously thought; 3) asserted the scientific legitimacy of prehistoric archaeology (although not without criticism, see Müller-Scheessel, 2001); and 4) placed not only the emerging science but also prehistoric objects in the service of the French imperial soft power, projecting France's global influence through culture, science, and modernity, at the same time framed as a project of universal education (de Mortillet, 1867; Hurel, 2014; Mitchell, 1989; Quiblier, 2014). Stone tools were no longer just curiosities or objects of antiquarian interest, their display at the Exposition that served to illustrate them as the *origins* of industry aligned the nascent field of prehistoric archaeology with broader social development frameworks (Trigger, 1989). In the Universal Expositions that followed (i.e., 1878 onwards), prehistoric materials were displayed juxtaposed with ethnographic objects from contemporary non-European peoples ("modern savages") within the framework of a steady, unilinear, progress of humanity (de Mortillet, 1867). The organisation of these anthropological-archaeological exhibits (more accurately "*archéologie préhistorique et ethnographique*"; Müller-Scheessel, 2001) would eventually take a troublesome²⁰ course of its own (see Chevalier, 2020; Stocking Jr., 1985).



Figure 2.6. Abbéville handaxe from the Lartet collection, signed by Boucher de Perthes and was displayed at the 1867 *Musée de l'histoire du travail*. Source: Wikimedia commons, courtesy of MHN Toulouse.

²⁰ The political and ideological stakes of the *Expositions Universelles* were significant. In official rhetoric, it was a peaceful competition between nations, a stage for cooperation and exchange. In practice, it also reinforced hierarchies of race, civilisation, and temporal development. The anthropology and ethnography sections, in particular, naturalised the colonial gaze (see Mitchell, 1989). Non-European societies were depicted through their material cultures as vestiges of an earlier human condition. Their presence, real or represented, within the exhibition was instrumental to the legitimisation of European colonialism, which could now be narrated not only as economic or military domination, but as the inevitable outcome of a civilisational arc.

The *Musée de l'histoire du travail* marked the entry of prehistory into public discourse, and of archaeology into the domain of mass culture and state-sponsored knowledge. The Exposition crystallised the 19th-century belief that the past could be made visible, ordered, and morally instructive through objects.

The formal institutionalisation of prehistoric archaeology, and its “official” entry into the public domain, was also closely linked to the establishment of the national museum at Saint-Germain-en-Laye. Reflecting the growing scientific interest in human antiquity, highlights of Boucher de Perthes’ archaeological collection were requested and placed on permanent display at the *Musée des Antiquités Nationales* (MAN) (**Figure 2.7**), inaugurated in 1867, at the same time as the opening of the Universal Exposition in Paris (Delley & Schlanger, 2022; Gascons, 2022; Kaeser, 2002; Sackett, 2014; Schwab, 2023). The museum was originally intended in 1862 by the imperial decree of Emperor Napoléon III to be dedicated only to Gallic and Gallo-Roman civilisations, but with the inclusion of prehistoric collections donated by Boucher de Perthes and Lartet (**Figure 2.8**), and with the intentionality and influence of Desor, de Mortillet, and the CIAAP, the Gallo-Roman Museum was transformed into the Museum of National Antiquities and became the first state institution in France specifically dedicated to prehistoric and early historic material culture (Kaeser, 2006; Schwab, 2023). In 2005, the museum took the name Museum of National Archaeology, with the term *archaeology* as a reflection of the museum’s moving away from being a conservatory of antiquities to the living scientific practice that is its ambition (Louboutin, 2017). In 2009, the museum and the National Estate were integrated into the same establishment so that until today its official name is the *Musée d’Archéologie nationale et Domaine national de Saint-Germain-en-Laye*.

The dynamic and international intellectual climate of the time was also reflected in the intensified widespread donations and exchange of archaeological artefacts—a practice that has since become integrated into standard collection protocols and remains visible in the museum today (Skeates, 2000). Boucher de Perthes and Lartet donated their collections from Abbeville and the Vézère Valley, respectively, to different French museums, but the English archaeologist Henry Christy who also worked at the Dordogne with Lartet, donated his to the British Museum in London (Schwab, 2023). Private collections in Italy acquired English and French handaxes, as well as Swiss artefacts from lake dwellings, and Italian prehistoric materials were housed at the MAN and the British Museum (Guidi, 2008).

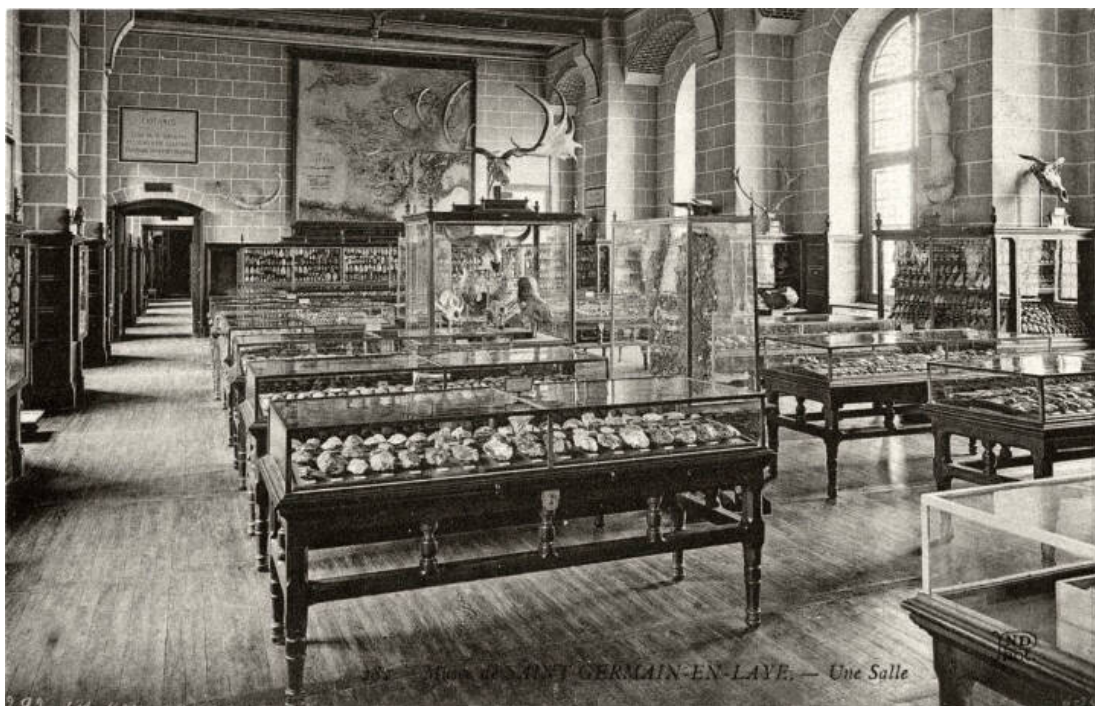


Figure 2.7. Salle I – salle de la Préhistoire at the Musée d'Archéologie nationale, taken in 1867. Source: [Multon \(2017\)](#), courtesy of MAN-Archives.



Figure 2.8. Salle I – salle de la Préhistoire at the Musée d'Archéologie nationale, view showing the busts of Édouard Lartet (1801-1871) and Jacques Boucher de Perthes (1788-1868), taken c. 1880s. Source: [Schwab \(2023\)](#), courtesy of Photothèque du musée d'Archéologie nationale.

2.2. An object of science: Lithics in the production and construction of archaeological knowledge.

Methods, theories, and practices in stone tool research

While stone tools played a foundational role in the 19th-century emergence of prehistoric archaeology, marked by their early inclusion in museum collections and their display at the 1867 Universal Exposition in Paris, it was together with the advancement of scientific methodologies, that they began to serve as major sources of knowledge about the Palaeolithic ([Groenen, 1994](#)). The continued presence of lithics at the core of archaeological interpretation underscores their status as both material and conceptual instruments through which the human past is rendered intelligible.

Scientific knowledge about the Palaeolithic is both produced through empirical methods and constructed within theoretical frameworks. As Kuhn ([1962](#)) argued, observation itself is shaped by paradigms, making interpretation inseparable from data. Lithic studies, thus, is instrumental in both the production of archaeological knowledge through scientific practices and the construction of interpretive narratives about early human life. Because of the essential subjectivity of archaeology, it is necessary to be familiar with a historical background to understand current interpretations of archaeological data ([Odell, 2001](#)). The importance of this reflexivity is underlined in the consideration that the knowledge produced and the knowledge constructed do not remain confined to academic discourse but are transferred into the public realm, through schools, museums, and popular media. The opportunity is also taken to make a disclaimer that while many terms, concepts, methods, and classifications are shared in the discipline around the world, the following discussion is best understood as regionally specific to Western Europe rather than universally applicable.

2.2.1. Some notes on lithic nomenclature

The term *lithic* is etymologically derived from the ancient Greek word λίθος (lithos), meaning “stone.” Understandably it is a term generally more associated to geology (e.g., lithosphere, lithology), and while today its use is almost conventional in the systematic study of prehistoric stone tools, its adoption into archaeological discourse has been sporadic and slow until the 1970s ([Rapp, 2014](#)). Initially employed as an adjective (e.g., lithic industries, lithic technology), the term gradually assumed nominal status in Anglophone scholarship,

where it was pluralised as *lithics* to denote the corpus of stone artefacts recovered in archaeological contexts. This nominalisation reflected a growing recognition of the analytical specificity required to address the technological, typological, and functional variability of stone tools across temporal and cultural contexts (Andrefsky, 2005). By the mid-20th century, particularly in the wake of processual archaeology (Hodder, 1999) and its emphasis on scientific methodologies, lithics had become entrenched as a specialised subfield within prehistoric archaeology. The term came to encompass not only finished tools, but the broader spectrum of materials involved in their production. In contemporary archaeological discourse, *lithics* functions as both a technical term and a disciplinary shorthand which signifies not only the material category of stone artefacts but also the analytical domain through which to study human behaviour through their production and use of stone tools.

The French and Italian traditions maintained stronger ties to *industrie lithique* and *industria litica*, respectively. *Industry* here does not denote mechanised or large-scale production as in contemporary usage, although subtly it does in an original sense, due to its historical legacy from the 1867 Paris Universal Exposition (de Mortillet, 1867) from where it was eventually adopted by French prehistorians. In the modern sense and analytically, it carries several implications: systematic production (i.e., that tools were systematically produced using recognisable techniques, often involving sequences of operations), technological coherence, cultural attribution, comparability and classification (Bordes, 1953; Clarke, 1978; Inizan et al., 1995/1999; Leroi-Gourhan, 1943; Pelegrin, 1990; Tixier et al., 1980). Each lithic industry is meant to define a consistent set of technological characteristics—specific knapping techniques, tool types, raw material preferences, and reduction strategies. These traits are then taken to indicate “shared knowledge” and “learned practices” within a group or across groups. For this reason, in the literature, *industries* are interchangeably used with *traditions* and *cultures*. These semantics would prove relevant in shaping narratives and the eventual understanding of prehistory.

2.2.2. Knowledge production: Development of stone tool research

For lithics, the epistemic trajectories include the shift from typological to technological to functional and symbolic interpretations, changes in the scientific status of lithic studies, and the incorporation of new analytical tools in the methodology. It is important to note that the

European focus in the early development of prehistoric archaeology established enduring patterns in how lithic technologies were conceptualised and studied. The emphasis on typological classification and cultural-historical interpretation reflected the intellectual traditions of European scholarship, creating analytical frameworks that may or may not have influenced subsequent research in other geographical contexts (Grayson, 1983).

Ideas and questions in traditional stone tool research have been around since the late 19th century (e.g., from the earliest to more recent: Rau, 1869; Evans, 1872; Spurrell, 1892; Holmes, 1894; also Vayson de Praderme, 1920; Curwin, 1930, 1935; Crawford, 1935 as cited in Andrefsky, 2005). Clearly presented methodologies then began with the typological approach in the 1950s with the works of Bordes (1950, 1953, 1961) and others (e.g., Laplace 1966; Sonnevile-Bordes & Perrot, 1954; Tixier, 1963), quantitatively and qualitatively illustrating variability in Palaeolithic assemblages corresponding to different stone tool traditions (Bar-Yosef & van Peer, 2009; Soressi & Geneste, 2011). Typological analysis is among the earliest and most widely applied methods in lithic studies, developed to classify stone tools into types based on shared characteristics, categorising artefacts into groups based on morphology and assumed function, often to create chronological or cultural sequences (Andrefsky, 2005). Though limited by its emphasis on form rather than function, typology remains a fundamental approach, especially when comparing large artefact assemblages.

Taking off from earlier conceptualisations on technique and human activities (Mauss, 1935; 1947) and developing through the 1970s, the discipline saw the advancement of the technological approach, going beyond (or complementarily with) typologically classifying stone artefacts to deeply understanding the methods and techniques involved in the process of making them, placed within the cultural and social contexts in which they were made (e.g., Andrefsky, 2005; Boëda, 1988, 1994, 1995; Inizan et al., 1995/1999; Tixier et al., 1980). This approach examines the production process of stone tools, from raw material selection to the sequence of reduction techniques and provides insight into the skill level, efficiency, and cultural choices embedded in tool-making practices. A core concept within this approach is the *chaîne opératoire*, a conceptual framework that reconstructs the operational sequence²¹ of stone tool production, use, and disposal, and which has been

²¹ Although the terms *operational chain* or *operational sequence* is used as its direct translations, the French term *chaîne opératoire* is commonly retained in English-language archaeological literature to reflect the concept's specific theoretical development within the French structuralist tradition, particularly as formulated by Leroi-Gourhan (1964), et al. (cf. Tostevin, 2011).

especially influential in understanding past societies by framing technological practices as situated processes with embedded cognitive, social, and cultural dimensions (Leroi-Gourhan, 1964; see also Pelegrin, 1990; Schlanger, 2005).

Raw-material analysis (e.g., Demars, 1982; Geneste, 1985; Morala, 1980; Rigaud, 1982) and use-wear analysis (e.g., Hayden & Kamminga, 1973; Odell, 1975; Kantman, 1971; Semenov, 1964; Tringham et al., 1974) were also developed as new approaches around the same time (Soressi & Geneste, 2011). Raw material sourcing, or provenance studies, involves identifying the geological sources of lithic materials. By matching artefact materials to their geological origins, researchers can make inferences about trade networks, resource procurement strategies, and economy. Techniques such as petrographic analysis and geochemical characterisation provide data on the exchange and mobility patterns within prehistoric societies (Glascock, 2002). Together with lithic studies, geoarchaeology also focuses on understanding how natural processes such as erosion, sedimentation, and climate changes influence the deposition, preservation, and spatial distribution of stone tools, an approach that can provide insights into past landscapes, resource availability, and human-environment interactions (Odell, 2001).

The analysis of traces on prehistoric artefacts, especially on tools, is a key method in archaeological research because of its potential to inform on human activity, as well as site type, function, and formation processes through findings that cannot be achieved without the use of the microscope. Also known as traceology, this approach concerns all kinds of physical traces on the surface of an artefact, regardless of origin: anthropic traces, both active (e.g., use-wear, traces of production) and passive (non-utilitarian wear), as well as natural traces (e.g., post-depositional alterations) (Grace, 1996; Longo & Skakun, 2008; Marreiros et al., 2020; Pawlik, 2001; Semenov, 1964). Applying basic physical principles of interacting surfaces in relative motion, it is able to observe and study, both qualitatively and quantitatively, the resulting traces through optical and imaging techniques, as well as identify the nature of the worked/processed materials and potentially the kind of activities conducted through the study of traces and residues adhering on the stone tool surfaces (Fuentes et al., 2019). Use-wear analysis focuses on identifying traces of wear on tools to determine their function. Microscopic examination can reveal specific patterns that suggest how tools were used, whether for cutting, scraping, or grinding (Keeley, 1980). Although challenged by issues of replicability and interpretative ambiguity, use-wear analysis has advanced with the

development of high-power microscopy, which allows for greater precision in distinguishing wear types (Odell, 2001).

The discipline that aims to identify the processes affecting the appearance and context of lithic artefacts subsequent to their cultural use lives (that is, after permanent discard) is termed *knapped stone taphonomy* (Eren et al., 2011). This involves the reconstruction of the different geomorphological conditions that affected the site to which the lithic industry belongs (e.g., Burroni et al., 2002; Mazzucco et al., 2013; McPherron et al., 2014), made possible by the analysis of observable traces on the surface and edges of lithic artefacts, known as post-depositional alterations (PdAs). Despite being developed in the context of use-wear studies, this has over time transformed into its own field, no longer only concerned with discriminating natural from anthropic traces for use-wear research purposes (Eren et al., 2011; McPherron et al., 2014) but now interests itself, for example, in understanding environmental conditions and site formation processes to assess the integrity and coherence of archaeological sites and contexts (Berruti & Arzarello, 2020; Palconit et al., 2025).

In experimental archaeology, lithic tools may be recreated through traditional manufacturing techniques (i.e., flint knapping) to understand how tools were transformed from raw material blocks. This hands-on approach helps verify hypotheses about tool-making processes, efficiency, as well as use-wear, bridging the gap between theoretical knowledge and practical understanding (Crabtree, 1972; Johnson, 1978). Ethnoarchaeology involves studying contemporary or recent traditional societies that still use stone tools to draw parallels with prehistoric practices (e.g., Beyries, 1999; do Nascimento Coutinho et al., 2025; McCall, 2012; Pétrequin & Pétrequin, 1993). Observing how these tools are manufactured, used, and discarded in modern or historic communities can help archaeologists interpret ancient lithic assemblages.

Recent advancements in analytical techniques have seen the expansion of morphometric methods in lithic analysis, particularly 2D and 3D geometric morphometrics, which offer quantitative frameworks for assessing shape variability and reduction processes (Bustos-Pérez et al., 2024; Cardillo, 2010). These approaches complement traditional typology by allowing statistical comparison of tool outlines, cross-sections, and surface models, enhancing reproducibility and objectivity in classification (Archer et al., 2015; Matzig et al., 2023). Morphometrics has proven especially useful for detecting subtle intra- and inter-assemblage differences, tracking standardisation, and identifying technological traditions.

The application of 3D surface scanning and landmark-based shape analysis supports studies of reduction intensity, blank selection, and retouch standardisation, while also providing digital data that can be integrated into open-access repositories ([Fitzpatrick et al., 2021](#)). As these techniques become more widely adopted, they contribute to a broader effort to quantify variability, refine cultural taxonomies, and improve cross-site comparability in lithic research.

These methodological and theoretical shifts have shaped how lithics are used to reconstruct prehistoric human life, their specific contributions to knowledge about the Palaeolithic, and their role in constructing narratives of human origins, both within academia and for the public.

2.2.3. Knowledge construction: Understanding early humans and the Palaeolithic

Within the interpretive framework of Palaeolithic archaeology, lithics are active agents in shaping reconstructions of early lifeways. Archaeological assemblages are interpreted to reflect subsistence strategies, social learning, group organisation, and landscape use ([Kuhn, 2020](#); [Stout et al., 2008](#); [Wynn & Coolidge, 2011](#)). Some of the most significant contributions of archaeology to understanding early humans and the Palaeolithic have basis on the study of stone tools: the formalisation of lithic *industries* or *cultures* has anchored our understanding of palaeoanthropological chronologies, i.e., the Palaeolithic phases and their associated human groups, albeit not without contention. Even with advances in genetic and palaeoproteomic techniques, lithics remain the most pervasive and enduring artefactual record of human evolution ([Barton & Clark, 2021](#); [Hussain & Soressi, 2021](#); [Kuhn, 2020](#); [Shea, 2016](#)).

Man, the toolmaker

The maxim “man the toolmaker,” like *Homo faber*, encapsulates a central insight into what it means to be *human* (see also [Gascons, 2022](#)). The subtitle of [Kenneth Oakley’s \(1961\)](#) book of the same name provides us an elaboration, “An up-to-date and authoritative account of the early history of man’s distinguishing trait—his ability to use tools.” Of course, this notion has been heavily undermined since [Jane Goodall \(1964\)](#) published her work documenting that chimpanzees also made and used tools. Subsequent research has moreover

expanded these observations across multiple species, revealing that birds, dolphins, and other mammals also exhibit tool-related behaviours (Seed & Byrne, 2010).

The quest for human uniqueness, i.e., the need to define our species and identify what sets us apart from animals, emerged from certain intellectual conditions. During the Enlightenment of the 18th century, European thinkers positioned *reason* as humanity's primary distinguishing characteristic. René Descartes's (1637) dualism created a template for seeking singular capacities that separated humans from animals, which he considered mechanical entities lacking consciousness. The development of Carl Linnaeus' (1758) taxonomic system intensified this challenge by placing humans within the animal kingdom as *Homo sapiens*, creating tension between scientific classification and traditional concepts of human uniqueness. If humans were to be classified alongside other animals, what empirical criteria could justify their continued claim to special status? The Industrial Revolution made technology increasingly visible as a transformative force, while Romantic thinkers emphasised aesthetic sensibility and creative expression as defining traits (Herder, 1772). Charles Darwin (1859) eliminated purely biological criteria for human uniqueness by demonstrating evolutionary continuity with other animals, a development that created the need for behavioural and cognitive distinctions compatible with evolutionary theory. Darwin (1871) himself proposed several possibilities, including moral sense, aesthetic appreciation, and again, technological capacity. Language capacity emerged as a major candidate through Wilhelm von Humboldt's (1836) and Max Müller's (1862) work documenting the complexity and universality of human linguistic systems. The discovery of Palaeolithic art at Altamira and Lascaux added aesthetic expression as another potential distinction, with scholars arguing that non-utilitarian artistic creation represented a fundamental difference from animal behaviour (Cartailhac, 1902). Religious and symbolic behaviour gained attention through the apparent universality of ritual practices, with researchers arguing that humans alone possessed capacity for transcendent experience and symbolic thought (Müller, 1862). Early anthropological theorists incorporated multiple characteristics into their frameworks: Edward Tylor's (1871) definition of culture encompassed language, belief systems, artistic expression, and technological knowledge as components of broader human cultural capacity, while Franz Boas (1911), maintaining that no single trait captured human uniqueness, emphasised cultural transmission, symbolic behaviour, and linguistic diversity.

The attribution of stone tools to *Homo habilis* in the early Pleistocene reinforced the “man, the toolmaker” identity, marking the beginning of the genus *Homo* in the

palaeoanthropological record (Leakey et al., 1964). This identification of early hominins through lithic artefacts has epistemological and ontological consequences. The presence of knapped stone tools has long served as the minimal criterion for recognising intentionality, planning, and symbolic potential in the archaeological record (Inizan et al., 1995/1999; Leroi-Gourhan, 1964). While it is recognised that some non-human animals use tools, systematic lithic production, particularly involving core reduction sequences, standardised flake removal, and curated toolkits, remains unique to hominins (Ambrose, 2001). The notion that humans are distinguished not only by their anatomy or language but by their technical capacity—*technicity*—is central to philosophical anthropology (Leroi-Gourhan, 1964; Simondon, 1958). The maxim *man the toolmaker*, therefore, retains its cultural and conceptual force: the human condition remains deeply intertwined with technology, creativity, and the capacity to manipulate the environment (e.g., Bruun & Wahlberg, 2022; Hussain & Soressi, 2021; Hussain & Will, 2021). From this perspective, lithic technology is not merely one aspect of human behaviour; it is constitutive of human-ness. This narrative is not without ideological weight.

Palaeolithic chronologies, technologies, and cultures

The well-known periodisation of Palaeolithic stone tool industries in Europe originated from early attempts to categorise prehistoric tools into distinct technological and chronological phases. Terminological chronology follows the history of archaeological discovery. Classifications are primarily credited to 19th- and early 20th-century European archaeologists and anthropologists, including John Lubbock, G. de Mortillet, É. Lartet, H. Christy, Henri Breuil, and later scholars who refined these categories based on stratigraphic evidence and evolving scientific methods (Daniel, 1962; Trigger, 1989). These divisions are founded on typological distinctions, stratigraphy, and comparative analysis of lithic assemblages from different archaeological contexts. Although some of these classifications and terminologies were later adopted and modified in many places, these terms are best understood as applicable only within the disciplinary understanding for the regional context of Western Europe.

John Lubbock (1865) first popularised the terms *Palaeolithic* and *Neolithic* based on the presence or absence of polished stone tools. Gabriel de Mortillet (1869, 1873, 1883) further refined classifications within the Palaeolithic by identifying distinct industries, like *Acheulean* (originally *Chellean*), *Mousterian*, *Solutrean*, based on specific lithic technologies and typologies observed at key European sites (Table 2.1). He argued that the

typological and technological signatures of stone tools are often more stable than organic remains and can therefore be used as *type fossils*, indexing cultural entities across space and time. His classification provided a foundation that subsequent researchers have expanded, with additional categories reflecting new discoveries and more nuanced understandings of hominin behaviour (Monnier, 2006).

Table 2.1. De Mortillet's 1873 classification of the Palaeolithic. From Monnier (2006, p. 712).

Ancient Divisions	Industrial Divisions	Epochs Based on Industry	Principal Sites	Geology and Meteorology	Fauna
Polished stone or Neolithic	Polished stone	Robenhausian: polished stone axes and barbed flint arrowheads	Robenhausen, Meilen, Mooseedorf, Wangen (lacustrine occupations), Grand Pressigny (workshop), Chastay (camp or oppidum)	Current climate	Domesticated animals; human races very mixed, brachycephalic and dolichocephalic, analogous to moderns
Flaked stone, Archeolithic or Paleolithic	Flaked stone with bone tools	Magdalenian: barbed bone arrowheads and flint blades	La Madeleine, Les Eyzies, Laugerie-Basse, Bruniquel, Massat, Montrejeau, Arcy, Schussenried	Postglacial	Reindeer, aurochs, and bears very abundant; also mammoths, hyenas, large felids
	Flaked stone only	Solutrean: bifacially worked laurel-leaf flint points	Solutr�, Laugerie-Haute, Badegols, Saint-Martin d'Excideuil	Cold and dry climate	Brachycephalic and mesocephalic man, close to the modern race (La Laisse, Cro-Magnon Laugerie-Basse, Solutr�)
		Mousterian: unifacially worked flint points and scrapers	Moustiers, Chez Pourr�, La Martini�re, L'Ermitage, La M�re Grand, Buoux, N�ron, Grenelle, Levallois, Clichy, Le Pecq, Montguillan	Glacial; cold and humid climate	Cave bears, rhinoceros: inferior, dolicocephalic man (Engis, Oimo)
		Acheulean: large almond-shaped stone tools	Saint-Acheul, Abbeville, Thenne, Sotteville les Rouen, Vaudricourt, San Isidro (Madrid), Tilly, La Ganterie, Sausse and Ceillone Valleys	Preglacial temperate climate	Hippopotamus, <i>Elephas antiquus</i> ; man the most inferior type (Neanderthal, Egusheim, La Naulette, Denize)

The entry of African sites into the global archaeological consciousness fundamentally disrupted European-based origins and chronologies. Louis and Mary Leakey's work in Olduvai, following a visit to Berlin and eventual collaboration with German geologist Hans Rack, led to a discovery that proved earlier than the Acheulean and promoted the African origin of humans—the *Oldowan* lithic industry (Leakey, 1965). Each major discovery has forced revision of existing chronological frameworks. The adaptation of European nomenclature meant that eventually *Acheulean* assemblages were found in Africa (Kleindienst, 1961).

The classic Clarkian (1969) sequencing of the past into modes, i.e., Mode 1–5 lithic industries (Table 2.2; Figure 2.9), represented an attempt to create universal categories that could accommodate discoveries from any geographic region. By focusing on technological

attributes rather than geographic origins, Clark’s framework offered a solution to the growing complexity of regional nomenclatures and became an example of a fundamental set of categories which provides structure to how we handle and represent the human past, and continues to guide empirical investigations, interpretations, theories, and meta-narratives of hominin evolution (Kuhn, 2020). In a similar vein, Oldowan, Acheulean, and Mousterian, are routinely deployed by archaeologists and non-archaeologists alike to frame and organise the past, more often together with the African periodisation of the Early, Middle, and Late Stone Ages (Figure 2.10; Figure 2.11). These terms are deeply entangled not only with different epistemological assumptions but also with varying sets of observations and inferred patterns of lithic variability and “cultures” of human groups (cf. Corbey & Roebroeks, 2001).

Table 2.2. The technological Modes according to Clark (1969). From Shea (2013, p. 152).

Mode	Characteristics	Time period	Representative industries from Western Europe
1	Pebble cores and flake tools	Lower Palcolithic (early)	Chellean Tayacian Clactonian
2	Large bifacial cutting tools made from flakes and cores	Lower Palcolithic (later)	Abbevillian Acheulian
3	Flake tools struck from prepared cores	Middle Palcolithic	Levalloisian Mousterian
4	Punch-struck prismatic blades retouched into various specialized forms	Upper Palcolithic	Aurignacian Gravettian Solutrean
5	Retouched microliths and other retouched components of composite tools	Later Upper Palcolithic and Mesolithic	Magdalenian Azilian Maglemosian Sauveterrian Tardenoisian

The attribution of lithic assemblages to the technological Modes originally presented by Clark (1969), a system based on general technological characteristics of stone tool industries designed to “free lithic assemblages from chronological and geographical constraints,” has dominated the conceptualisation of lithic production in the context of human evolution and dispersals in varying degrees but more or less on a global scale. Later, these categories were adapted to match techno-cultural entities (especially for Africa and Eurasia; Carbonell et al., 1999), until it became standard procedure to identify sites based on their lithic repertoires (Gallotti & Peretto, 2015). The 2015 discovery of *Lomekwian* tools at 3.3 million years (Harmand et al., 2015) in Lake Turkana, Kenya has created fundamental problems for Clark’s Mode system. The *Lomekwian* assemblage exhibits characteristics that do not fit neatly into Mode 1 categories, despite being 700,000 years older than classic Oldowan industries. This discovery suggests that either Mode 1 technology was more diverse than

originally conceived, a “Mode 0” category is needed for pre-Oldowan technologies, or that the Mode system fails to capture the complexity of early technological development.

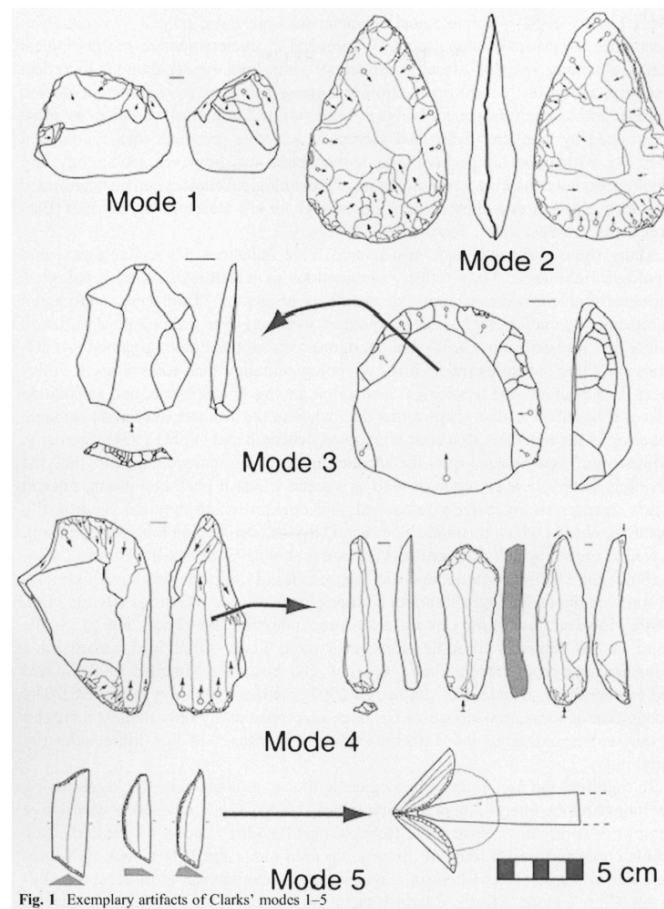


Figure 2.9. The technological Modes according to [Clark \(1969\)](#). From [Shea \(2013, p. 153\)](#).

Critiques and counter-concepts to the Clarkian Modes would continue to come out through the decades that follow as the discovery of more and more archaeological sites present us with lithic assemblages that simply cannot fit into straightforward categories and implicit associations. Alternative frameworks have also been proposed, such as that of [Shea \(2013\)](#). [Bar-Yosef \(2005\)](#) highlights the fact that a clear demarcation does not necessarily exist between the Modes, considering their supposed distinctive traits, and that instead, there is a demonstration of continuity. For example, in an Acheulean site that is supposed to show Mode 2 technology, evidence for the use of Mode 1 persists, and in sites that have identified Mode 3 assemblages, handaxes persist; indeed, classification into Modes seems to limit the great complexity of technical behaviours (e.g., [Aureli et al., 2016](#)). This periodisation has been further refined through modern archaeological methods, such as stratigraphic dating, paleoenvironmental reconstructions, and advanced technological analysis like microwear and residue studies. These tools have helped archaeologists better understand the regional

variations and overlaps between industries, which were once thought to be strictly sequential.

Importantly, these interpretive frameworks are not neutral. The sequencing of Modes ([Clark, 1969](#)) and typological taxonomies are theory-laden constructs that have historically shaped (and at times constrained) our understanding of technological variability and cultural complexity ([Barton & Clark, 2021](#); [Lycett & Gowlett, 2008](#); [Runnels, 1985](#)). Contemporary critiques argue that rigid classificatory schemas may obscure hybrid forms, parallel traditions, and regional heterogeneity (e.g., [Aureli et al., 2016](#); [Shea, 2013](#)) and may oversimplify the complex patterns of technological innovation and regional adaptation evident in the archaeological record ([Lycett & Gowlett, 2008](#)).



Figure 2.10. “The evolution of flaked stone tool technologies, from left to right, an Oldowan chopper or core, Acheulean handaxe, Mousterian point, bifacial Middle Stone Age point, Upper Palaeolithic blade.”
From [Erlandson & Braje \(2013, p. 5\)](#).

Today, index fossils and Modes are no longer explicitly and exclusively used to date assemblages because they are known to overlap widely, but they continue to be used as key components in the periodisation of the Palaeolithic and contextualising archaeological sites in Europe and Africa, and to a limited extent, in Asia. The tendency to construct universal chronological frameworks for the Palaeolithic, while not necessarily ill-intended and at times useful for comparative dialogue among international scholars, has repeatedly proven problematic. Such frameworks often result in inaccuracies and shifting interpretations, especially when applied beyond the contexts from which they emerge. Attempts to impose typological entities from the European Palaeolithic record (which is also already greatly diversified within) beyond this specific context tend to overlook and reduce distinct local trajectories to “imperfect” analogues of European models. The direct transfer of the traditional European *Lower, Middle, and Upper* categories into the Chinese Palaeolithic, for example, has been critically reassessed as inappropriate for capturing regional traditions

(Gao & Norton, 2002). Discontinuities in the archaeological record across regions such as Southeast Arabia further undermine assumptions of neat cultural successions defined in Europe (Bretzke et al., 2020). More broadly, the Movius Line controversy (Lycett & Bae, 2010), positing a supposed east-west “technological boundary” between “Acheulean handaxe-rich” regions in Africa & western Eurasia and “Acheulean handaxe-poor” eastern & southeast Asia, has been a long-standing debate. Nevertheless, these issues have become a major source of scholarly debate, and current discussions increasingly acknowledge that such difficulties stem not only from empirical challenges but also from a long disciplinary history shaped by Eurocentric research emphases and colonial frameworks. Recent work has sought to move beyond direct transplants of European chronologies, instead exploring regionally grounded chronological schemes that remain compatible with global comparative studies while respecting local variability.

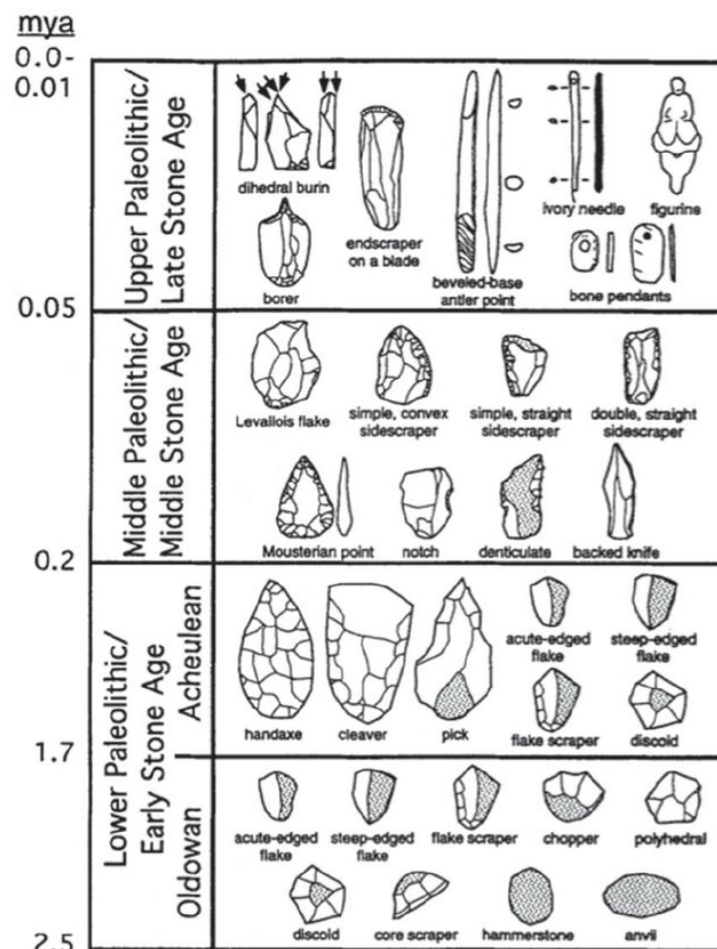


Figure 2.11. A representation of the “increasing complexity” of technology during the Pleistocene, before the discovery of the Lomekwian. From Neco & Richerson (2015, p. 116).

Implications on human origins and evolution

The establishment of a general idea of human evolution is then made possible, combining the archaeological record with a structuring of assemblages into *techno-complexes*, *industries*, or *cultures*, rendering Palaeolithic chronologies explicitly legible (e.g., [Erlandson & Braje, 2013](#); [Neco & Richerson, 2015](#)). It should go without saying that any attempt to provide even just an overview of the current understanding of human evolution is inevitably simplified, as evolution is a fundamentally complex phenomenon: it is not a linear or goal-directed process but rather driven by multiple mechanisms; the units and levels of evolutionary change vary; contingency plays a central but immeasurable role; and because cultural and disciplinary biases shape how its understanding is constructed ([Gould, 1980](#); [Gould & Eldredge, 1977](#)). Moreover, any overview can only ever represent a conventionally understood narrative at a given time and remains always provisional—continuously supported, contested, and revised in response to ongoing and increasingly prolific research.

Prehistoric archaeology is constrained by the very same complexities when attempting to offer evolutionary overviews, magnified by the fragmentary and indirect nature of the archaeological record. Stone tools are often used as material markers of evolutionary stages—cognitive, technological, or social. Tool types and reduction sequences offer insight into motor planning, skill acquisition, and cognitive evolution ([Muller et al., 2017](#); [Nonaka et al., 2010](#); [Pigeot, 2011](#); [Schlanger, 1994](#); [Shott, 2011](#); [Stout, 2002, 2011](#)). Technological standardisation and cumulative innovation are particularly salient: the emergence of bifacial symmetry, platform preparation, or hafting practices signal shifts in technical reasoning and possibly social teaching. Concepts such as *cumulative culture* ([Davidson, 2016](#); [Shipton, 2024](#)) and *technical traditions* (e.g., [Garriga, 2011](#); [Lemonnier, 1992](#)) are increasingly invoked to theorise how lithics express cultural transmission beyond biological inheritance. In short, lithic industries are commonly made to represent evolutionary trajectories. However, these models are, by necessity, simplified and linearised reconstructions of a process that was more accurately mosaic, regional, and variable than such sequences suggest.

Although the applicability of the terms “Lower,” “Middle,” and “Upper Palaeolithic” outside Europe has been widely debated, these designations are retained here for heuristic and comparative purposes. As discussed earlier in this chapter, these terms originated within a European research tradition and do not map uniformly onto the archaeological records of Africa or Asia. Nevertheless, they continue to function as broadly recognised chronological

and technological shorthand within the literature, particularly in synthetic discussions that span multiple regions. Their use in this subsection is therefore not intended to imply strict cultural equivalence or synchronicity across regions, but rather to provide a common framework that facilitates comparison and situates regional developments within a shared, if imperfect, classificatory vocabulary. Where relevant, this terminology is accompanied by explicit chronological references to mitigate potential ambiguities. Building on this, the discussion begins with the earliest documented lithic industries in Africa, which provide the necessary point of departure for understanding the emergence of stone tool technologies. The focus then progressively shifts toward Europe, reflecting both the structure of the archaeological record and the central geographical emphasis of this thesis (Western Europe and Italy).

The beginning of the use of modified stones, marking the Lower Palaeolithic, was a major technological breakthrough in the human evolutionary history, although research is still under way to address the question of what triggered early hominids to begin modifying stones 3.3 million years with the Lomekwian industry ([Harmand et al., 2015](#)) or 2.6 million years ago with the Oldowan industry ([Semaw et al., 1997](#); [Semaw, 2006](#)). In the 1970s, Isaac's influential work on Oldowan tools and his food-sharing hypothesis suggested that these tools reflect the early development of social structures and shared resources ([Isaac, 1978](#)). The Oldowan, which for the longest time was considered as the earliest lithic industry associated to *Homo habilis*, was named after Olduvai Gorge in Tanzania by Louis Leakey in the 1930s. [Leakey's \(1951\)](#) excavations provided critical evidence for *simple* flake and core tools associated with early hominins. This industry is primarily characterised by unrefined flakes, choppers, and cores, which are believed to have been used for processing animal and plant materials. About ten years ago, the *in situ* discovery of large, heavy-duty cores and flakes at the site of Lomekwi 3 in northern Kenya compelled not only pushing back the earliest evidence of stone tools a couple hundred thousand years but also expanding the hominin taxa to which lithic manipulation is associated, as the Lomekwian is attributable to a pre-Homo context, potentially *Kenyanthropus platyops* or *Australopithecus afarensis* ([Harmand et al., 2015](#)). The findings suggest that stone toolmaking began as an opportunistic, situational activity rather than a fully formed technological tradition, motivating a gradual recognition that technological capacity did not originate suddenly with the genus *Homo*.

The Acheulean industry emerging in Africa around 1.7 million years ago has been found across Africa, Europe, and Asia, indicating widespread adoption and the ability to maintain consistent manufacturing techniques over vast regions (Lycett & Gowlett, 2008). This industry is often associated with *Homo erectus* and *Homo heidelbergensis*, and is characterised by large, bifacial handaxes and cleavers, reflecting complex manufacturing process and likely a broader range of tool functions. This industry was named by de Mortillet (1883) after findings at Saint-Acheul in France, where handaxes were considered to display a refinement in tool production that contrasted with the “simpler” Oldowan tools (Clark, 1969). Subsequent discoveries in other places in Africa and across Europe and Asia have revealed regional and chronological variations within the Acheulean, illustrating the adaptability of associated hominin groups to diverse environments. Works investigating the regional diversity of Acheulean tools illustrate how environmental and resource availability influenced tool design and manufacturing techniques (García-Medrano et al., 2023; Lycett & Gowlett, 2008). Additionally, controlled experiments (e.g., Stout et al., 2008) have provided insights into the neurological processes underlying Acheulean tool production, implying that this industry represents a significant advance in early humans’ ability to plan, shape, and adapt tools to diverse ecological contexts, suggesting complex cognitive processes and enhanced motor control (Pelegriñ & Roche, 2017).

The Middle Palaeolithic in Europe is predominantly associated with *Homo neandertalensis* and early *Homo sapiens*. Technologically, this period is characterised by flake-based technologies, such as Levallois, discoid, quina, and laminar knapping methods, which reflects cognitive advances in planning and predetermination (to varying degrees) of tool forms (Boëda, 1995; Inizan et al., 1995/1999; Tixier et al., 1980). These tools also sometimes correlate with the emergence of complex behaviours, including hafting, regional variability, and increased use of fire and shelters (Mithen, 1996; Roebroeks & Villa, 2011). In certain parts of Western Europe, there persists a common, quite loose association between the Middle Palaeolithic, the Mousterian industry, and Neanderthals. This industry was named after the site of Le Moustier in France, first defined by French archaeologist Henri Breuil, focusing on scraper forms and points that suggested new methods of hafting and tool maintenance (Bordes, 1961). In general, the Middle Palaeolithic shows wide variability of human groups, artefacts, and behaviours across Europe and Asia, also considering the wide range of environments in question (Bar-Yosef & van Peer, 2009). Findings at the Denisova Cave suggest coexistence and interaction between Denisovans, Neanderthals, and modern humans (Zavala, et al., 2021).

The Upper Palaeolithic is associated exclusively with anatomically modern humans. In Europe, it introduced several distinct industries of well-developed blade-based technologies, composite tools, specialised tools, artefacts of diverse raw materials, and symbolic behaviours associated to art and burial practices (Barton & Clarke, 2021; Kuhn, 2020). The Aurignacian industry is typified by blades, bone tools, and personal ornaments, marking a technological and cognitive shift (Hoffecker, 2009). Subsequent industries (e.g., Gravettian, Solutrean, Magdalenian) show increased regionalisation, specialisation in hunting tools, and elaboration of symbolic artefacts. Upper Palaeolithic industries in Asia and elsewhere are heterogeneous. Northern and central Asian sites (e.g., Siberia, Mongolia) sometimes display blade technologies resembling those found in Europe, while southern regions exhibit continuity with earlier flake-based traditions, possibly indicating parallel cultural trajectories (Kuhn, 2020; Liu et al., 2015). Research on Upper Palaeolithic cultures is expanding significantly, with publications exploring the emergence of art, ornamentation, and complex hunting strategies as reflections of symbolic thinking and social cohesion among *Homo sapiens* (d'Errico et al., 2003). These techno-cultural changes are closely tied to demographic expansions, social networks, and climatic fluctuations. The dispersal of *Homo sapiens* and the eventual disappearance of archaic populations are hypothesised to align with shifts in technological systems, suggesting that tool innovation, social learning, and ecological flexibility were central to modern human success (Mellars, 2006; Mithen, 1996; Shea, 2016), although these claims need further investigation.

This notwithstanding, it is recognised that while the use of stone tools to help outline evolutionary processes is not misguided, it is fundamentally constrained (the constraint being primarily evidential rather than conceptual). Stone tools provide a material record of technological choices, but the archaeological visibility of lithic technology creates systematic biases in what can be inferred about hominin behaviour. While systematic analysis of reduction sequences, raw material selection, and technological organisation permits evidence-based interpretations of past behaviour, these interpretations remain several inferential steps removed from the evolutionary processes they are used to model. Evolutionary models are heuristics and not total explanations. The inferential leap from artefact morphology to evolutionary causation is substantial, and the models employed are necessarily underdetermined by the lithic evidence alone. The chronological progression from Oldowan to Acheulean and so on does not automatically constitute an evolutionary trajectory in any directional or progressive sense; these are taxonomic categories imposed

on continuous variation in technological behaviour. The risk lies in reading evolutionary inevitability into what may represent contingent responses to specific ecological or social contexts, or simple drift in small populations. Responsible acknowledgement of limits demands specification of precisely which aspects of evolutionary process can and cannot be addressed through lithic evidence, along with rigorous accounting of the auxiliary assumptions required to bridge from stone tools to broader evolutionary claims.

2.3. An object of musealisation: Lithics on display, the museum institution, and mediating prehistory

In the emergence of lithics within the historical and scientific foundations of prehistoric archaeology, the museum played a parallel and formative institutional role, most notably in developing connections to a broader public. While not initially distinct in its orientation, it was within the museum that an understanding of a *public* that extends beyond academic, professional, and elite audiences, was most fully and lastingly articulated.

2.3.1. The museum: Definition/s and disciplinary configurations

The great museum phenomenon is that in its evolution it developed such a *universality* to it that it can be defined in almost infinite ways, depending on the element/s in focus or the disciplinary lens through which it is examined:

How does one define a museum? By a conceptual approach (museum, heritage, institution, society, ethics, museal), by theoretical and practical considerations (museology, museography), by its functions (object, collection, musealisation), through its players (professionals, public), or by the activities which ensue from it (preservation, research, communication, education, exhibition, mediation, management, architecture)?

(Desvallées & Mairesse, 2010, p. 20)

Museums may be defined as cultural, social, and philosophical institutions, constructing, reflecting, and mediating narratives of identity, heritage, and meaning. From an anthropological perspective, museums are considered as repositories and interpreters of material culture, offering insights into societies' histories and identities while critically addressing issues of colonialism, representation, and power dynamics, to name a few (Bennett, 1995; Stocking Jr., 1985). Museums may also be defined for being essential institutions dedicated to the preservation, conservation, and interpretation of cultural and historical materials, ensuring their accessibility for future generations. In archaeology, museums serve as curators of artefacts, safeguarding the physical remnants of human history, providing insights into past behaviours, cultures, and technologies through interpretive displays, thus playing a vital role in public archaeology (Skeates, 2000). Shanks & Tilley (1992, p. 68) recognises the museum as “the main institutional connection between archaeology as a profession and discipline, and wider society.” Heritage studies further

emphasise the safeguarding of both tangible and intangible heritage, contributing to the construction of collective memory and identity and ensuring the preservation of diverse cultural expressions and ensure their continuity for future generations (Smith, 2006).

Sociologically, museums are seen as social institutions that both mirror and influence societal values, norms, and power structures, shaping public discourse and social identities while navigating their potential as spaces of inclusion or exclusion (e.g., Bennett, 1995; Fyfe & Jones, 2016; Litvin, 2022; Mangione, 2017). Philosophically, museums serve as sites for contemplation, dialogue, meaning making, and transforming knowledge, inviting visitors to engage with objects, ideas, and narratives that may inspire reflection and critical thought (e.g., Förster, 2014; Harrison et al., 2016; Hein, 2006). Museums also serve as vital spaces for the celebration and exploration of art and creative expression, fostering aesthetic appreciation and intellectual engagement. From the perspective of art history, museums act as repositories and exhibitors of artworks, preserving and showcasing the evolution of artistic traditions while engaging with the canon of art history to disseminate cultural and artistic knowledge (Macdonald, 2006). In education, research, and the dissemination of knowledge, museums may be defined as dynamic spaces for learning and narrative construction. As informal learning environments, museums foster curiosity and knowledge by offering diverse audiences pedagogical experiences through interactive exhibits and programs, highlighting their role in lifelong learning (Falk & Dierking, 2000; Mastrandrea & Maricchiolo, 2016).

Museums may also be defined as dynamic physical and economic entities that significantly influence urban, economic, and cultural landscapes. From a cultural economics perspective, museums are key contributors to cultural capital, tourism, and local economic development, fostering sustainability within cultural industries through their collections, programming, and role as tourist destinations (Throsby, 2001). Architecturally, museums are carefully designed spaces that balance functionality and symbolism, acting as cultural landmarks that shape visitor experiences and contribute to the identity of both the museum and the urban environment (MacLeod, 2005). These perspectives highlight its role as economic drivers and architectural icons, and their impact on shaping cities.

It would not be a legitimate chapter on *what is a museum* if the International Council of Museums (ICOM, 2022) definition is not cited here—notably recently updated, following an assembly in Praga in August of 2022:

“A museum is a not-for-profit, permanent institution in the service of society that researches, collects, conserves, interprets and exhibits tangible and intangible heritage. Open to the public, accessible and inclusive, museums foster diversity and sustainability. They operate and communicate ethically, professionally and with the participation of communities, offering varied experiences for education, enjoyment, reflection and knowledge sharing.”

The ICOM is perhaps the most legitimate and authoritative body in the museum sector, with a network spanning 119 national and 32 international committees. It sets widely accepted standards for museum practice, and its definition of a museum serves as a global benchmark, shaping public understanding and institutional policies, and influencing funding bodies and stakeholders. This latest version of a museum definition underlines inclusivity, sustainability, accessibility, and the museum's role in fostering critical dialogue, rendering even more specific the previous one from 2007.

The origins of the museum can be traced to diverse ancient practices of collecting and organising objects, typically held by elites. The Mouseion in Alexandria, founded in the 3rd century BCE, is often cited as one of the earliest large, dedicated institutions for scholarship, learning, and research (Alexander et al., 2017). During the Renaissance, wealthy patrons, scholars and royalty in Europe began to amass *cabinets of curiosities* or *Kunstammer* and *cabinets of wonders* or *Wunderkammer*, which are private, showcased collections, reflecting ideals of humanism and burgeoning scientific inquiry, emerging contemporaneously with the age of discovery and exploration (Alexander et al., 2017; Bennett, 1995; Stocking Jr., 1985). The *Wunderkammer* was not a “museum” in the modern sense of the word, but both a microcosm of the universe and a reflection of its owner’s wealth, status, and intellectual pursuits (Findlen, 1989). Its purpose was to evoke wonder and spark inquiry. Typical contents included natural specimens, antiquities, scientific instruments, and artefacts from distant lands.

The Enlightenment of the 17th and 18th centuries brought a shift from private collections to public institutions, driven by ideals of reason, progress, and education (Bennett, 1995; Findlen, 1989). The era’s emphasis on knowledge sharing and education led to the establishment of some of the first modern museums. The Ashmolean Museum, opened in 1683 at the University of Oxford, is sometimes considered the first true public museum, but access was highly restricted primarily to scholars and gentlemen who could pay admission and was not “public” in any meaningful democratic sense; the British Museum, established

in 1753, marked a significant step toward public access, opening its doors to all “studious and curious persons” regardless of social class (Alexander et al., 2017). The Capitoline Museums (1734) have the strongest claim as the first true public museum in the modern sense as publicly owned and with regular public access, following Pope Clement XII’s orders to transfer the collection to the Roman people (Poulot, 2018). The Louvre in Paris, initially a royal palace, was transformed into a public museum after the French Revolution in 1793, symbolising the democratisation of knowledge and culture (McClellan, 1994).

The 19th century, shaped by forces of economic development, i.e., the Industrial Revolution, and nationalism that transformed Europe, saw a rapid expansion of museums across Europe and North America (Silberman, 1982). Urbanisation and the growth of the middle class increased public demand for cultural and educational experiences, and museums became symbols of national identity and cultural heritage, often tied to colonial expansion and the acquisition of artefacts from around the world following trends of imperial domination. Collections reflected the imperial ambitions of European nations, such as the archaeological artefacts brought to the British Museum, the Louvre, and the Berlin Neues Museum, from regions like the Middle East, Africa, and Asia (Thomas, 2010). It is also during this period that museums began to specialise, with institutions dedicated to art, natural history, science, ethnography, and archaeology emerging (Findlen, 1989). Museums became central to public education and scholarly research: the Museo Egizio in Turin was founded in 1824, the Smithsonian Institute in 1846, the Victoria and Albert Museum was opened in 1852, and the Natural History Museum in London in 1881.

In the 20th century, museums expanded globally, and museum philosophy significantly shifted to prioritise accessibility, education, and community engagement. Modernist ideals, influenced by European art movements, led to the establishment of institutions like the Guggenheim in Venice (1951) and the Centre Pompidou in Paris (1977), blending innovative architecture with avant-garde curatorial practices (Macdonald, 2006; Newhouse, 1998). Following the devastation of two World Wars, museums became sites of cultural preservation and reconciliation (Marstine, 2011). Efforts were made to involve diverse audiences, breaking down barriers of class, race, and geography.

Today, museums are increasingly seen as spaces of dialogue, addressing social, political, and environmental issues. European museums continue to grapple with their colonial past and ethical responsibilities: institutions like the British Museum and the Musée du Quai Branly

face calls for the repatriation of artefacts, challenging the historical structures of acquisition and display (Thomas, 2010). Questions about decolonisation and repatriation are reshaping the narratives presented in museums. Moreover, many institutions are embracing participatory models, encouraging visitors to contribute to the museum experience (Pecci & Mangiapane, 2010; Simon, 2010). Technological advancements have also transformed the way museums operate. Virtual and augmented reality, as well as online exhibitions, have expanded the reach of museums beyond their physical walls.

Museology, museum studies, and museum archaeology

Museology, defined as the study of museums and their role in society by the ICOM International Committee for Museology (ICOFOM, 1977) has evolved significantly over the past centuries, transitioning from practical guidelines for museum organisation to an academic field concerned with the theory, philosophy, and social implications of museums (Brulon Soares, 2019). Discussions are in place for the recognition of *museology* as the “science of museums,” and in the Anglo-American world the term *museum studies* is favoured as an embodiment of this reluctance (Desvallées & Mairesse, 2010).

The historical development of museology is closely tied to the expansion of museums in Europe during the 19th century, where the focus was primarily on *museography*—the technical and descriptive aspects of museum work. Early writings on museology were largely concerned with the classification, display, and arrangement of objects within collections. The distinction between museology and museography, which began to emerge in the 20th century especially through the work of key figures such as Georges Henri Rivière, has been established as follows: museology is the critical and theoretical examination of the museal field, whereas the practical aspect, thus, the set of techniques associated with museum practices, is museography (Brulon Soares, 2019; Desvallées & Mairesse, 2010). This conceptual division would influence museum training and professional roles globally, establishing a framework in which museology was seen as the theoretical backbone to the practical work carried out by curators and other museum professionals. The 1980s marked a significant shift in museology, as the field moved beyond normative and prescriptive models to embrace a more reflexive, critical stance. Reflexive museology involved an ongoing critique of museum practices and an awareness of their social, cultural, and political implications stance (e.g., Sofka, 1978, 1995). This perspective challenged the idea of a universal, objective approach to museology, advocating instead for an understanding that varied across different regions and contexts. In the 1990s, museum studies underwent a

notable paradigm shift from what has been termed the *old museology*, primarily concerned with technical and methodological aspects, towards a *new museology* that critically re-evaluated the foundational purposes of museums (Mairesse & Desvallées, 2007; Vergo, 1989a; see also Krstović, 2020).

This reconceptualisation has repositioned museums from being primarily collection-focused institutions to entities increasingly oriented around visitor engagement. The assumption that museums inherently exist to collect, preserve, interpret, educate, and conduct research has thus been called into question. These functions are now understood as historically contingent and shaped by broader social contexts (Stevenson, 2022).

Within archaeology, museums and collections are considered to have long occupied a peripheral position in disciplinary discourse. While they were central during the formative stages of archaeological practice—serving as repositories, taxonomic laboratories, and spaces of disciplinary legitimation—today they are often relegated to the margins of archaeological operations (Stevenson, 2022). With the notable exception of museums that were established also as research centres and teaching institutions (e.g., the Muséum national d'Histoire naturelle in Paris, the Musée de Préhistoire de Tautavel, the Museo del Paleolitico di Isernia) in contemporary frameworks, the museum tends to appear only at the terminus of the archaeological project, primarily as a platform for dissemination, public engagement, or ethical accountability, rather than as a legitimate site of archaeological knowledge production in its own right. While this trend is increasingly imprecise, with many museums, particularly those affiliated with universities or functioning as also research and teaching institutions (e.g., the Muséum national d'Histoire naturelle in Paris, the Musée de Préhistoire de Tautavel, the Museo del Paleolitico di Isernia, and several Italian university museum networks), actively participating in research and knowledge production, the characterisation of museums as primarily sites for dissemination and public engagement remains a useful generalisation and point of reflection.

The characterisation of museum archaeology as the discipline of archaeology as it affects museums (Skeates, 2017), which implicitly frames the relationship as unidirectional, or archaeology influencing museums but not vice versa, reinforces the perception that museums primarily receive, preserve, and exhibit the products of fieldwork, rather than actively shaping archaeological knowledge. However, as it has been increasingly established, the relationship between museums and archaeological practice, as well as between archaeology

and its publics, is far from linear or hierarchical. Rather, it is reciprocal, contested, and mediated through shifting institutional, social, and epistemological frameworks (Delley & Schlanger, 2022; Stevenson, 2022).

2.3.2. The museum and the mediation of prehistory

Institutional logics refer to the underlying belief systems, values, practices, and organising principles that guide behaviour and meaning-making within institutions (Thornton et al., 2012). Prehistoric material culture circulates through archaeology and museum systems, each with its own epistemic framework. On one hand, archaeological knowledge production is research-oriented, context-driven, analytical, and often specialised. Museum knowledge production, on the other, is public-oriented, narrative-driven, and presents materials for legibility (Findlen, 1989; Förster, 2014; Graf, 2016). Understanding the mediation of prehistoric artefacts therefore requires analysing how the institutional logics of both archaeology and the museum shape their representation, interpretation, and public reception.

Whatever the contingencies of their specific histories, the three-dimensional objects thrown in the way of museum observers from out of the past are not placed there by historical accident. Their placement in museums, their problematic character, and indeed, their “otherness,” are the outcome of large-scale historical processes. In the case of some “anthropological” objects—e.g., a palaeolithic stone ax—these processes may be the very long-term ones of geological, climatic, and human evolutionary change. But the historical processes that led to the collection of archaeological objects in museums are much more recent: they have to do on the one hand with the forces of economic development and nationalism that transformed Europe in the nineteenth century, and on the other with those of imperial domination.

(Silberman, 1982).

In museum contexts, logics that shape how objects are selected, interpreted, and displayed, reflect tensions between education, preservation, entertainment, science, and heritage. As a critical practice, museum work operates at the intersection of internal dynamics, shaped by the agencies and priorities of museum professionals, and external pressures such as political agendas and economic constraints (Mairesse & Desvallées, 2007; Stevenson, 2022). These intersecting forces structure how museums engage with archaeological material and influence their position within broader archaeological practices. Far from being limited to the dissemination of discoveries, museum work forms an integral part of the ongoing process of interpretation and recontextualisation. Whether artefacts are on display, in storage, or mobilised through other forms of use, museums actively shape the questions asked and the

narratives constructed around archaeological assemblages (Delley & Schlanger, 2022; Stevenson, 2022). This demands a reflexive and historically informed approach, one that acknowledges the complex conditions and agencies underpinning museum-archaeological assemblages and commits to a responsive, community-engaged mode of knowledge production, interpretation, and access (Delley & Schlanger, 2022; Sofka, 1995; Stevenson, 2022).

Prehistoric lithics, as highly context-dependent and technically specialised artefacts, are thus reframed within the museum to produce legible narratives of human prehistory. This process of mediation is governed by institutional priorities that balance scientific authority, pedagogical clarity, and visitor engagement (Mayo, 2013). Museums function as sites of translation, where the epistemic content of lithics is transformed into narratives, experiences, and pedagogical frameworks accessible to diverse audiences. Through these logics, the museum mediates prehistoric lithics as carriers of temporal, technological, and social knowledge, producing public understanding of prehistory in ways that reflect both curatorial expertise and societal values. These curatorial strategies render lithics semiotic objects: they communicate meaning not only through their original materiality but through their spatial arrangement, didactic labels, and associated multimedia (Alberti, 2005).

2.3.3. The museum, a space in service of public archaeology

Museums have increasingly positioned themselves as active agents in the mediation of archaeological knowledge, aligning closely with the principles of public archaeology (Christophilopoulou et al., 2020). Museums dedicated to prehistory occupy a distinct position within this broader ecosystem. Unlike classical or historical collections, prehistoric assemblages lack textual sources and rely entirely on the interpretation of material traces—stone tools, faunal remains, features, and stratigraphy. This dependence on materiality has amplified the museum’s role in shaping prehistoric narratives and rendering them publicly legible (Schnapp, 2011). Within this framework, museums do not merely exhibit the prehistoric past; they actively construct it.

Public archaeology in the museum context entails more than accessibility or didactic clarity; it involves making the processes of archaeological interpretation, collection, and display visible and contestable (Christophilopoulou et al., 2020). By incorporating experimental archaeology, immersive reconstructions, and multisensory installations, they invite the

public to engage not only with objects but with the interpretive labour that underlies prehistoric knowledge production ([Gascons, 2022](#); [Hurcombe, 2008](#)). Such strategies render visible the contingencies and ambiguities inherent in working with materials and deep time. Furthermore, temporality plays a central role. Unlike excavation sites, which are bound to specific locations and seasons, museums can provide continuity in the public dissemination and reinterpretation of archaeological material. These activities reframe archaeology as a living practice with contemporary resonance instead of a merely retrospective gaze.

Architecture and internal spatiality are likewise mobilised to articulate the prehistoric. Cave reconstructions, artificial stratigraphies, and long chronological galleries construct not only a narrative of time but also an affective experience of temporal scale and ancestral remoteness; for example, the Centre International d'Art Parietal in Montignac, France ([ArchDaily, 2017](#)). These design choices serve a didactic function but also open the possibility for existential reflection ([Förster, 2014](#); [Hein, 2006](#)), wherein the public confronts the deep history of the human species. Site museums, established in the immediate proximity of an archaeological site, precisely serve as a facility where original artefacts are housed and displayed, but also sometimes make accessible musealised ancient occupation floors (e.g., Museo Nazionale del Paleolitico in Isernia) or prehistoric cave sites (e.g., many museums in Les Eyzies-de-Tayac in France). Exhibition design is reconfigured to encourage dialogic interaction with such, as well as with open storage systems, multimedia stations, and visible conservation labs that demystify expert practice and invite critical inquiry ([Sémah, 2015a](#); [Shelton, 2013](#)).

Museums also serve public archaeology by offering both a physical and intellectual space for the negotiation of heritage. They do so not only through their collections and displays, but by interrogating their own authority, making room for multiple voices, and embedding archaeological practice within broader civic and ethical conversations ([Marstine, 2011](#); [Sabloff, 2008](#); [Smith, 2006](#); [Smith & Waterton, 2009](#)). Moreover, these institutions often engage in public archaeology as a form of ethical self-scrutiny. Postcolonial critiques and repatriation debates have pushed European museums to reassess their archaeological collections, especially those acquired during imperial or fascist regimes ([Curtis, 2006](#)). Many prehistoric collections in Western Europe derive from 19th- and early 20th-century excavations, often conducted under nationalist, colonial, or extractivist frameworks ([Chevalier, 2024](#); [Thomas, 2010](#)). Public archaeology, in this context, must also engage with the historical conditions under which these objects entered the museum. Recent initiatives

have begun to foreground these legacies by questioning practices of collection, modes of representation, and the erasure of Indigenous or non-state cosmologies in earlier interpretive models ([Hamilakis, 1996](#); [Hurel, 2015](#)). In this sense, the museum becomes not only a site of education but of institutional accountability. Efforts such as the Humboldt Forum's public consultation processes or the British Museum's contested dialogues around its holdings illustrate the potential and limitations of museums as platforms for critical heritage engagement ([Shelton, 2013](#)). Rather than functioning solely as custodians of material heritage, they have come to operate as civic institutions that frame archaeological discourse as socially embedded and politically relevant ([Hamilakis, 1996](#); [Harrison et al., 2016](#)). Within this evolving paradigm, museums offer a platform not only for display but also for active public participation.

3.

*ANTE USUM FERRI & DURISSIMUS SILICIBUS**:

THE ITALIAN FOCUS

* Before the use of iron and with very hard flints. From [Mercati](#)'s *Metalloteka* (1717), Chapter XVI "Ceraunia Vulgaris, et Sicilex": "Qui historiam callent, **ante usum ferri & durissimis silicibus** tundendo suisse defectandos ad bella hostium arbitrantur. Nam antiquissimis hominum segmenta silicum pro cultellis fuere." ("Those who are versed in history think that **before the use of iron and** by hammering **with very hard flints**, [armies] were equipped for wars against enemies. For the most ancient of men, segments of flint served as little knives." Translation supplied by AI.)

3.1. Italian prehistoric archaeology: Richness of finds, early institutions, dialectical methodologies

In the decades following the decisive recognition of the high antiquity of humankind in 1859 in Europe, Italy played a leading role in the institutionalisation of prehistoric studies. The emergence of the discipline in the newly unified state was both early and rapid. Significant prehistoric discoveries across Italian territory provided the material foundation for scholarly work and the unification created administrative conditions that fostered scientific development. Moreover, prehistory, particularly in its evolutionary framing, aligned with the liberal, anti-clerical ideologies and secular ambitions of the new state, making it politically expedient (Falcucci, 2022; Kaeser, 2014; Tarantini, 2014). However, such a promising beginning did not guarantee straightforward development. The subsequent trajectory of Italian prehistoric archaeology was marked by tensions and reorientations: ongoing engagement with international scholarship coexisted with periods of isolation, incessant methodological debates between naturalistic and archaeological (read: geological, palaeontological *versus* antiquarian, historical) approaches that fragmented the disciplinary community, and shifting political and social contexts (nationalist, colonialist, imperialist, sensu Trigger, 1984) profoundly shaped institutional structures and research priorities.

3.1.1. Foundations: All roads lead to Italy, at least according to Desor and Gozzadini

As with the discoveries that had inspired questions about deep human antiquity elsewhere in Europe, the first report that marked early prehistoric research in Italy concerned stone tools. This would remain to be true even if Mercati's premature (1574) interpretations of thunderstones as ancient weapons were considered (Figure 3.1). Almost three centuries and a number of paradigm shifts later, Giuseppe Scarabelli published *Intorno alle armi antiche di pietra dura che sono state raccolte nell'Imolese*²² (1850; Figure 3.2), the first scientific publication on prehistoric lithic industries in Italy (Tarantini, 2023), theoretically integrated with three analogous articles that contain the palaeontological and stratigraphic premises of the archaeological work (Scarabelli, 1846a, 1846b, 1849 as cited in Vai, 2014). Scarabelli's

²² "About the ancient weapons of hard stone collected in the Imolese area." An English translation of this article, along with other Scarabelli articles relevant to the origin of prehistoric archaeology, has been published by G.B. Vai (2019) and made available online at <https://giuseppescarabelli.it/opere-di-scarabelli/>

seminal work initiated the beginning of what would become an extensive programme of archaeological fieldwork and inquiry in the peninsula. In 1853, Giovanni Gozzadini discovered the remains of the Iron Age culture of Villanova, and then in 1862 the Etruscan settlement of Marzabotto ([Cova, 2010](#)). In 1860, the Alpine lake-dwellings or *palafitte* at Mercurago were studied by Bartolomeo Gastaldi with Pellegrino Strobel and Luigi Pigorini, and in 1863 the *palafitte* at Lake Varese by Antonio Stoppani and pile-platform settlements or *terramare* by Gaetano Chierici ([Guidi, 2008, 2010](#)).

Italy rapidly established its presence in the emerging field of prehistoric studies, ascribed to a connection with its contemporary political situation ([Tarantini, 2014](#)), but also to the impact of the “very substance of Italian prehistory,” i.e., the wealth of written and archaeological sources on the ancient history of the Italian Peninsula, which made it an ideal location for the essential epistemological transition between prehistory and history ([Kaeser, 2014](#), p. 51). The establishment of high human antiquity following the handaxe discoveries at Abbeville and elsewhere ([Daniel, 1962; Trigger, 1989](#)), which pushed back human origins to what was the then-vague *prehistoric* times, had revealed a large chronological gap between human palaeontology and classical history. Key Italian archaeological findings such as the *terramare* and *palafitte* sites of the Po Valley, the Villanovan tombs of Emilia-Romagna, and the Celtic burials of Marzabotto dated to the Neolithic, Bronze Age, Villanovan, and La Tène period help bridge this gap ([Kaeser, 2014](#)). Desor, having originally envisioned this through Swedish peat bog finds in 1846, became convinced that Italy was “the ideal location to establish the link between the history of the earth and that of humanity,” and that prehistoric research must be principally conducted in this region ([Cocchi, 1865](#) and [Desor, 1863](#) as cited in [Kaeser, 2014](#)).

In Liguria, prehistoric collections began forming in the mid-19th century, driven by research in cave sites in the Western Riviera, particularly at the Balzi Rossi near Ventimiglia and the Finalese area ([De Pascale & Negrino, 2017](#)). Researchers were mainly from naturalist backgrounds (e.g., Stanislas Bonfils, Emile Rivière, Arturo Issel, Nicolò Morelli) and the clergy (e.g., Filippo Ighina, Giovanni Battista Amerano). In Rome, Latium and wider Central Italy, explorations and research by Luigi Ceselli and Gustav Bleicher, among others, have yielded results pertinent to vertebrate palaeontology and Palaeolithic archaeology (stratigraphy, fossil vertebrates, and lithic industries) ([Segre, 2001](#)).



Figure 3.1. Excerpts from *Metallotheca*, showing thunderstones (*ceraunia*) that Mercati argued to be ancient flint weapons and tools manufactured by people with no access to iron. Source: Mercati (1717).

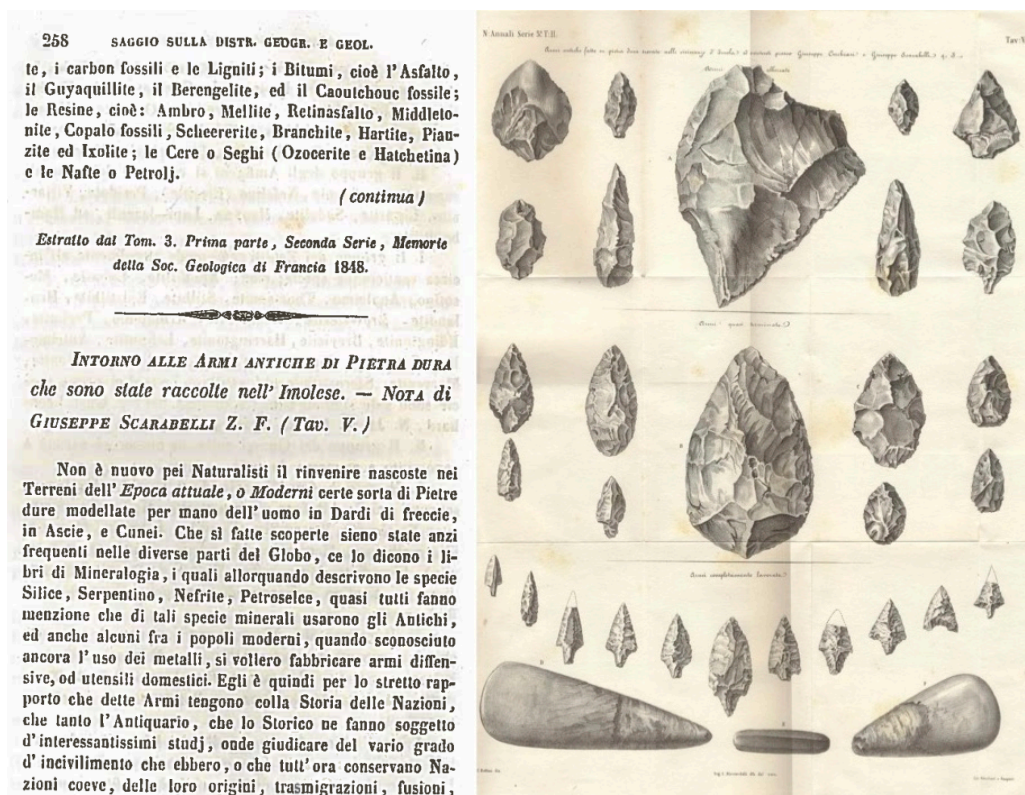


Figure 3.2. Excerpts from Scarabelli's note on Palaeolithic tools from Imola. Source: Scarabelli (1850) and Vai (2019).

The first lecture of Giuseppe Ponzi, who held the first chair of geology at the University of Rome *La Sapienza*, was on human prehistory and the Pleistocene of Latium. University of

Naples anthropology professor Giustiniano Nicolucci, Michele Stefano De Rossi, and Francesco Anca all contributed to Pleistocene research in the region (Segre, 2001). Anca was conducting excavations in Sicily at the same time, where prehistoric research also began early, stemming largely from natural history and geology circles within the Bourbon Reign (Cultraro, 2020; Di Patti, 2007). In his excavations, such as those at Grotta Perciata (1859) and Grotta San Teodoro in Messina (1860 and onwards), Anca analysed the layers and distinguished the upper, anthropogenic strata containing stone tools and paleofauna from the lower geological deposits containing the bones of large extinct mammals, such as elephants, hippopotami, and hyenas. Anca's detailed stratigraphic sections, including petrographic analysis, mirrored the rigorous work done by Scarabelli in Imola (Cultraro, 2020).

It is essential to note that Italians were already engaged in important international scholarly meetings even before their critical role in the foundation of the *Congrès paléoethnologique international*, later renamed to *Congrès international d'anthropologie et d'archéologie préhistoriques* (CIAAP).²³ Following the materialisation of the union in La Spezia in 1865, at a meeting of the *Società Italiana di Scienze Naturali* dedicated to prehistory, the Congress propelled certain developments for the emerging discipline: in France, it contributed substantially to the 1867 Universal Exposition in Paris and to the establishment of the National Museum of Antiquities in Saint-Germain-en-Laye (Quiblier, 2014); in Italy, *paletnologia* was born (Guidi, 2008). After the first congress in Neuchâtel, CIAAP sessions were held in Paris (1867), Norwich and London (1868), and Copenhagen (1869). The fifth, which was held in Bologna (1871), was considered a major moment for Italian prehistory. In his opening speech at the Congress, Gozzadini brought up discourse similar to that of Desor, defining the Italian peninsula as the country most suited to researching “the link between historical times and earlier ages” (Gozzadini, 1873 as cited in Kaeser, 2014). The congresses following Bologna saw a steady increase in the participation of Italian delegates, which also facilitated the dissemination of significant archaeological findings to the international community, and reinforced Italian influence. When the term “Eneolithic” was coined by Italian scholars to refer to the transitional period between the Stone and Bronze Ages, it entered broader European usage (Guidi, 2008).

²³ Since 1846, Gozzadini had been fostering in Bologna a milieu that brought together figures such as E. Chantre, Sir Arthur Evans, O. Montelius, G. de Mortillet, and H. Schliemann, while Italian pioneers forged links abroad: B. Gastaldi trained in E. Lartet's Paris laboratory, and Giovanni Capellini, during travels between 1858 and 1860, met Lartet, C. Lyell, and H. Falconer (Guidi, 2008; Vai, 2002; Vitali, 1989).

In 1875, Chierici, Pigorini, and Strobel founded the *Bullettino di Paletnologia Italiana*, the first journal dedicated to the prehistory of a single nation (Tarantini, 2014), and whose greater importance was in that it allowed prehistorians to disseminate their work without being judged by historians or naturalists (Kaesler, 2014). Scholars from across Europe contributed articles (Guidi, 2008). Also in 1875, the *Museo Nazionale Preistorico ed Etnografico* was instituted in Rome, and shortly after, in 1877, the first university chair for *paletnologia*²⁴ in Italy, at University of Rome *La Sapienza*. Both posts were assigned to Luigi Pigorini (Guidi, 2008, 2010; Tarantini, 2014).

3.1.2. From *paletnologia* to *preistoria*, between disciplinary emancipation and international integration

Prehistory brought together practitioners from antiquarian, archaeological, and naturalist backgrounds. At its inception in Italy, however, the discipline was largely subsumed under the natural sciences, progressing together with the earth sciences. Many early prehistorians were trained in geology and palaeontology, and *paletnologia* itself emerged within naturalist circles—the *Società Italiana di Scienze Naturali* meeting where the CIAAP was founded, was led by Giovanni Capellini, who had the first chair of geology at the University of Bologna in 1860, and who also led the organisation of the 1871 CIAAP session in Bologna²⁵ (Vai, 2002; Vitali, 1989). The nature of archaeological data, i.e., lithic artefacts and fossils deposited in stratigraphic sequences, essentially made it a *natural* concern of geological study (Tarantini, 2014). Geologists Gastaldi and Stoppani argued that periods of the human past only documented by fossil remains naturally fell within geological research, and that therefore within the field of prehistoric studies there exists a conceptual division between a more recent period amenable to “historical and archaeological” approaches, and an older period to “history of pre-historic times” (more accurately “*storia dei tempi anti-storici*” per Stoppani, 1866) requiring geo-paleontological interpretation (Tarantini, 2014, 2021).

Nevertheless, strong efforts to define *paletnologia* as a distinct discipline for human prehistory were sustained, especially by Pigorini. Inspired by Scandinavian and German models, he placed emphasis on material culture and comparative ethnography and contended

²⁴ Notably, more than a decade before the first chair of archaeology, 1889.

²⁵ Although not without opposition. Capellini encountered resistance from the “true palethnologists” Strobel, Gastaldi, and Pigorini, who considered him of no authority in prehistoric archaeology despite his geological contributions (Vitali, 1989).

that geology and archaeology introduced methods and habits that are not applicable to human prehistory (Guidi, 2008; Tarantini, 2021). Pigorini, who became a dominant figure of this early period and who would influence Italian prehistory both intellectually and institutionally for nearly half a century, exercised a centralising authority that reinforced the autonomy of the discipline but also constrained its internal diversity, and eventually led to ruptures. In 1877, Strobel, in an act of protest, published an article in the *Bullettino di Paletnologia Italiana* challenging Pigorini (implicitly) to clearly define the boundary between geology and prehistory. Moreover, the foundation of the National Prehistoric-Ethnographic Museum (Rome, 1877), separate from the National Museum of Anthropology and Ethnography (Florence, 1871), marked *paletnologia*'s conscious departure from anthropology as institutionalised by Paolo Mantegazza through the *Società Italiana di Antropologia e Etnologia*,²⁶ which advocated for prehistory to be part of anthropology as “the natural history of man” (Tarantini, 2004, 2021). Between the two national museums, Pigorini and Mantegazza also had disputes over control of ethnographic collections.

If the earliest beginnings of prehistoric studies were crucially international in character, during the late 19th century in Italy, the discipline was increasingly mobilised in support of nationalist narratives. Pigorini's theories²⁷ that attributed Italic civilisations to Nordic origins reflected the new state's geopolitical alignment with Central Europe as sanctioned by the Triple Alliance with Austria-Hungary and Germany (Guidi, 2010). The long controversy of the “strange flints” of Breonio, the prehistoric flint tools from northern Italy that in 1885 were alleged (mainly by the French)—and much later, in the 1930s, were proven (by Italians)—to be forgeries, was a scientific dispute that turned into a defence of “the honour of Italian palethnologists” and a claim of national sovereignty, as criticism was framed as French interference in Italian affairs (Tarantini, 2024). Furthermore, contradicting G. de Mortillet's universal sequence, Pigorini published the paper *Sulla mancanza nell'Italia delle antichità dell'età della pietra, periodo delle renne* (1886) denying the existence of an Upper Palaeolithic in Italy (Guidi, 2008; Tarantini, 2021). In 1904, when Grotta Romanelli (Puglia) containing lithic industries attributed to the Upper Palaeolithic was dated to the last interglaciation through the analysis of palaeontological remains, Pigorini rejected the use of faunal data in archaeological interpretation. Again, in 1911, Florentine naturalists, especially

²⁶ Notwithstanding, prehistorian scholars actively participated in the Italian Society for Anthropology and Ethnology, and its journal, the *Archivio per l'Antropologia e la Etnologia*, was important in disseminating prehistoric research.

²⁷ Also known as *teoria pigoriniana*, see Guidi (1988). Arguing for a north-to-south movement of “civilised” cultures in the Italian peninsula also reinforced the idea of north Italian supremacy (Skeates, 2000).

Aldobrandino Mochi and Gian Alberto Blanc, revived the debate and reinforced the importance of palaeoclimatic data in prehistoric research, but were again met with the same dismissive response (Tarantini, 2021). Pigorini's vehement rejection of faunal data and denial of the Italian Palaeolithic, despite international consensus, contributed to a rigidity that would ultimately prove detrimental to *paletnologia* at large.

Italian prehistory experienced a marked decline in the early 20th century. What some scholars characterise as overly rapid disciplinarisation meant that many natural scientists eventually returned to their original domains. Moreover, the loss of interdisciplinary dialogue, attributed to Pigorini's authoritarian approach, dogmatism, and problematic stances, isolated Italians from the international community (Guidi, 2010; Tarantini, 2021). The polemic between Pigorini and the Florentine Palaeolithic scholars led to the foundation of the *Comitato per le Ricerche di Paleontologia Umana* (CRPU) in Florence in 1913 (Guidi, 2010; Tarantini, 2021), an initiative that sought to re-anchor prehistoric archaeological research in the natural sciences and aimed to study the Palaeolithic through an interdisciplinary collaboration between palethnologists, geologists, palaeontologists, and physical anthropologists, drawing inspiration from the *Institut de Paléontologie Humaine* in Paris (1910) and the *Comisión de Investigaciones Paleontológicas y Prehistóricas* in Madrid (1912) (see Díaz-Andreu, 2014). By 1927, the CRPU had evolved into the *Istituto Italiano di Paleontologia Umana* (IIPU), and from 1936 became established in different cities across Italy. It made major historical contributions to the field, including the discovery of the Neanderthal skulls at Saccopastore and Circeo (Lazio), and the foundation of the new discipline of human palaeontology, with the first chair at the University of Pisa in 1939 entrusted to Paolo Graziosi (Guidi, 2010; Tarantini, 2004, 2021). Other local prehistoric societies and centres were subsequently founded (e.g., Lenzi & Nenzioni, 2014). Within the new discipline, a new (but not unfamiliar) division arose between a more natural sciences-oriented approach to the study of the Palaeolithic and a primarily materials-based (archaeological) approach to the study of the later periods of prehistory; eventually, prehistory and protohistory (Tarantini, 2021).

The political ideology of the Fascist period, rooted in a national-racist framework that emphasised historical and spiritual factors of the Italian "race" and sought to legitimise the regime's imperialistic aspirations led to greater support for Classical archaeology (Guidi, 2008; Tarantini, 2004). While it received substantial funding and academic chairs, prehistoric studies suffered stasis and regression. Intellectual currents like Benedetto Croce's

idealism also criticised the positivist methods of *paletnologia*, contributing to its sidelining (Cova, 2010; Pacciarelli et al., 2014). The *Bullettino di Paletnologia Italiana* underwent “fascistization,” with its editorial committee largely comprising Classical archaeologists and its research program redirected towards Italy’s Mediterranean connections²⁸ (Tarantini, 2004). Notably, foreign scholars wrote many of the synthesis works on Italian prehistory during the interwar period, underscoring internal struggles and a relative decline in Italian efforts. Despite these challenges, the period saw important field initiatives, including works at the Arene Candide cave in Liguria starting in 1941, seminal not only for the scientific accuracy of its stratigraphic excavations, but for having been a collaboration between a Classics-trained archaeologist (Luigi Bernabò Brea) and one with a naturalist background (Luigi Cardini) (Guidi, 2010; Nomi et al., 2021).

The post-war period saw a push for renewed studies and intensified efforts to reintegrate Italian prehistory into the international scholarly community, though internal division persisted. Several scholars emerged and prehistory chairs were established at different Italian universities, e.g., in Cagliari, Ferrara, Firenze, Pisa, and Siena (Guidi, 2010). In 1945, Paolo Graziosi founded the *Rivista di Scienze Preistoriche*, intended as an interdisciplinary journal covering all periods from the Palaeolithic to the Iron Age. This active work in rebranding and broadening the field toward prehistoric sciences, further reinforced through the establishment of the *Museo Fiorentino di Preistoria*, aimed to reconnect Italian scholarship with international studies after years of isolation (Tarantini, 2004). The tension within the IIPU was ultimately settled through institutional bifurcation in 1954: the IIPU headquarters was moved from Florence to Rome, and the Florence section became the *Istituto Italiano di Preistoria e Protostoria* (IIPP) (Guidi, 2010; Tarantini, 2004, 2021). The Italian Institute of Human Palaeontology (IsIPU)²⁹ maintained its focus on human palaeontology within a naturalistic framework, emphasising the study of prehistoric humans in relation to Quaternary environments, evolution and ecology. The creation of the IIPP by Graziosi, Massimo Pallottino, and Giacomo Devoto aimed to overcome fragmentation not only

²⁸ As opposed to Pigorini’s theory of Nordic origins that linked Italic civilisations to Indo-European peoples from the north, the Mediterraneist and autochthonist theories promoted by scholars like Giuseppe Sergi and Ugo Rellini asserted that the origins of Roman civilization were indigenous to the Italian soil, supporting Fascist rhetoric (Pacciarelli et al., 2014).

²⁹ The IsIPU continues today with a naturalistic and interdisciplinary approach to human history, with a focus on prehistoric sites in southern Lazio and abroad. It publishes the scientific journal *Quaternaria Nova*, as well as monographs in the *Memorie dell’Istituto Italiano di Paleontologia Umana* (<https://www.isipu.it/chi-siamo/>).

through promoting multidisciplinary collaboration but also integration across all periods of prehistory and protohistory³⁰ (Tarantini, 2004).

3.1.3. Stability, continuity, innovations

New ideas and methods entered Italian prehistoric studies from the 1960s and onwards with the eventual spread of processualist approaches from Anglo-American traditions, although notably more in Central and Northeast Italy than elsewhere (Guidi, 2010). Also in the 1970s, professionalisation³¹ started as archaeologists secured positions within state antiquities offices, and archaeological activity increased with amateur practitioners, research conducted by university personae, and even infrastructure development works, which resulted in the identification of numerous significant prehistoric sites across the national territory. Along with the changing government and national politics, localism dominated Italian prehistory: different approaches were observable in Northern Italy and Tuscany, Rome and Central Italy, north-eastern Italy, and southern Italy and in the islands, otherwise referred to as an “archaeological pluriverse” (Tosi, 1985–86 as cited in Guidi, 2010; see also Malone, 2003).

Guidi (2012) describes the present state of Italian prehistoric archaeology, among other things, as prolific with fieldwork (e.g., Falezza & Iacono, 2024 and references therein), publications, congresses, and local museums, but suffering an imbalance in terms of funding and resources, overpowered by the politically prevalent Classical archaeology. Early prehistory continues to operate within the overlap between the natural sciences and archaeology—and considering current practice—broader humanities. With contemporary advances in science concerning interdisciplinarity and transdisciplinarity (Mittelstrass, 2018), interestingly despite the continuing trend toward specialisation in higher education, however, it would be reasonable to say that prehistoric archaeology no longer suffers an existential crisis but rather enjoys a renewed intellectual vitality through expanded theoretical, methodological, and conceptual horizon, and collaboration that fosters new solutions to existing problems and opens new avenues for innovative inquiry in understanding early human prehistory and engaging with contemporary society.

³⁰ Today, the identity that the IIPP presumes remains faithful to the original, that of “a legal entity that brings together the institutions and scholars [...] committed to the protection, study, and promotion of prehistoric and protohistoric remains *and the scientific disciplines* [emphasis added] that contribute to improving our understanding of humanity's most remote past” (<https://www.iipp.it/chi-siamo/>).

³¹ For a history on the archaeology profession in Italy, see Cella & Pintucci (2014).

3.2. Italian prehistory in the context of museum traditions and collection histories

Crucial to the institutionalisation of prehistoric archaeology, aside from unions, journals, and university chairs, was establishing a position within museums. The creation of regional prehistoric collections and museums across multiple Italian cities in the 1860s (Cova, 2010; Tarantini, 2009), along with the founding of the Roman-Germanic Central Museum in Mainz (1852) and the National Museum of Antiquities in Saint-Germain-en-Laye (1867), was considered pioneering on an international scale (Kaesler, 2014). As with the evolution of the discipline itself, museums emulated shifting scientific paradigms and curatorial practices, inevitably intertwined with national and regional cultural, social, and political contexts (Díaz-Andreu, 2007; Lombardo & Peretto, 2019).

The historical development of museums in Italy presents considerable complexity that extends beyond the parameters of this research. Contemporary museum holdings comprise diverse materials—archaeological finds from multiple periods, ethnographic objects from global contexts, epigraphic collections, decorative arts, statues—that derive from heterogeneous acquisition pathways: expeditionary retrieval, colonial appropriation, private and institutional donations, systematic excavation, wartime salvage operations, and inter-institutional transfers at national and international scales. Within this broader landscape, the formation, institutionalisation, and dynamics of prehistoric collections merit closer attention. While this is not meant to be an exhaustive review of museum and collection histories in all of Italy, it serves to provide a general idea on the principal mechanisms through which prehistoric materials entered Italian museum collections, the institutional frameworks that shaped their classification and display, and the epistemological shifts that have influenced their interpretation from the nineteenth century to the present.

3.2.1. The nineteenth-century museum and the classificatory dilemma of prehistory

The trend in 19th century positivist Europe was the fragmentation of universal museums into discipline-specific institutions. This was a change driven by several factors: 1) the scientification of knowledge (Foucault, 1970), i.e., academic disciplines establishing methodological boundaries and institutional structures, superseding earlier antiquarian

approaches in arranging collections; 2) post-Darwin evolutionary frameworks inspiring museums to adopt developmental narratives that required specialised expertise; 3) Western imperial expansion and colonial acquisitions generating vast material collections; and 4) museums positioning themselves as pedagogical instruments for public education within discrete knowledge domains (Bennett, 1995; Stocking Jr., 1985; Tarantini, 2014; Whitehead, 2009). In Italy, the dynamics in the musealisation of prehistoric artefacts were a representation of the emergence, development, and dilemmas of prehistoric archaeology as a new scientific discipline. Prehistory lacked independence, and prehistoric collections were absorbed into existing structures: either in geology/natural history museums or in local archaeological museums (Tarantini, 2014).



Figure 3.3. Prehistoric artefacts in university geological museums. On the left: Geological Museum ‘Giovanni Capellini’ (Bologna), flint tools among palaeontological remains and reconstructions within the antediluvian display. Photo © T. Falconit, 2022. On the right: Geological Museum ‘Gaetano Giorgio Gemmellaro’ (Palermo), flint tools from S. Teodoro cave excavations, F. Anca collection (1860; see also Di Patti, 2007). Photo source: [Terradamare](#), © V. Russo.

Prehistoric objects went into geological or natural history museums because geologists viewed archaeological materials as another type of fossil evidence, since the oldest human remains and tools could only be studied using stratigraphic and palaeontological methods in the absence of written sources. Geologists such as Gastaldi and Iginio Cocchi did not only support a *geological* jurisdiction of prehistoric artefacts, they also emphasised the importance of documenting through labels precise locality and depositional conditions (in short, stratigraphic context) for archaeological objects in the museum, similar to the museographic treatment applied to geological specimens, and moving away from *Wunderkammer* approaches to traditional antiquities (Tarantini, 2014). Prehistory practitioners were also university professors, and many collectors were clerical tutors and

assembled private collections for didactic and pedagogical purposes in religious colleges (Cultraro, 2020; Sarti, 2010; Tarantini, 2014). Consequently, prehistoric materials flowed into university museums or *cabinets* of geology (e.g., **Figure 3.3**), palaeontology, or natural sciences, as in cities like Imola, Bologna, Milan, Florence, Genoa, Pisa, Naples, and Palermo.

3.2.2. The rise of civic museums and Italian prehistory on display at the 1871 International Congress in Bologna

If not in paleontological, geological, or natural history museums, prehistoric materials were placed in local archaeological museums as the earliest chapter of the territory's history. This was not about prehistory as a scientific discipline but about civic identity and creating complete local historical narratives from earliest times to the present. The local museum model reveals important political dynamics of post-unification Italy (Cova, 2010; Tarantini, 2014). Provincial cities feared being culturally marginalised by centralisation under the newly unified state, and creating museums was a way of asserting the regions as having an ancient, distinctive identity. The concept that “national history should be composed of diverse local histories” represents a federalist/regionalist vision opposing Roman-centred, top-down state-building (Cova, 2010; Tarantini, 2014, 2021). By including prehistory in these local museums, regions were essentially claiming autonomous, primordial identities.

Cova (2010) notes that civic museums emerged particularly in northern Italy due to the intensity of archaeological activity in the area, which drove the need for a proper place to house the materials coming from the excavations, and the significant co-involvement with the development of prehistoric archaeology. The *Gabinetto di Antichità Patrie* (Reggio Emilia, 1862) founded by Gaetano Chierici, which evolved into the *Museo di Storia Patria* (1870) and finally to *Museo 'Gaetano Chierici' di Paletnologia* (1886), is considered one of the most important collections in Italy (Desittere, 1985 as cited in Guidi, 2010). Now part of the Civic Museums of Reggio Emilia, it features a core palethnology collection containing “archaeolithic” (Palaeolithic) and Iron Age artefacts and tombs from excavations conducted in the province (**Figure 3.4**), extra-provincial materials illustrating the archaeology of other Italian regions and European sites, as well as archaeological and ethnographic materials from other continents (see Falcucci, 2022) for comparative approaches. Chierici's vision for the museum emphasised a full (i.e., *complete* local history, from prehistory to the Middle Ages)

and systematic representation (i.e., geographical, chronological, and typological groupings) (Cova, 2010).



Figure 3.4. Museo ‘Gaetano Chierici’ di Paletnologia (Reggio Emilia), showing artefacts from the “Archaeolithic Age” and prehistoric tombs. Source: [Musei Civici Reggio Emilia](#), photo © C. Vannini.

The materials yielded from the *terramare* fieldwork³² conducted by Strobel and Pigorini in the Emilian countryside were placed in what is now the National Archaeological Museum of Parma, where Pigorini started his career in 1860, and where he became the director in 1867, organising the prehistoric collections based on the three-age system and using ethnographic comparisons (Falcucci, 2022; Tarantini, 2014). Some materials from Liguria, such as a significant palethnological and archaeological collection Capellini acquired through purchases and exchanges when he conducted early work in the Grotta dei Colombi, as well as artefacts from the Cenisola necropolis investigated by Chierici, are dispersed among museums in Reggio Emilia, La Spezia, and Parma (Da Pascale & Negrino, 2017). In the region of Marche, multiple civic museums were established post-unification to house local prehistoric antiquities. The first official prehistoric collection was in the *Gabinetto Paleoetnografico ed Archeologico delle Marche* (later Ancona Museum), established by Carisio Ciavarini in 1868 and comprised lithic artefacts from the provinces of Ancona,

³² *Terramare* materials refer to the archaeological artefacts associated with *terramare* sites, including but not limited to: ceramics and pottery (storage jars, cooking vessels, decorated ware), metal artefacts (tools, weapons, ornaments); organic and wooden remains (structural elements, tools, agricultural implements, domestic items including loom weights and spindles); domestic implements (textile and household tools).

Ascoli Piceno, Macerata and Pesaro so substantial and interesting that it was deemed worthy of being exhibited at the Vienna World Exhibition in 1872 (Pignocchi, 2014).

In 1871, when Italy hosted the fifth international session of the CIAAP in Bologna led by Gozzadini and Capellini, the latter aimed, through the Congress, to demonstrate to the foreigners the progress made by Italian prehistoric research in just ten years, not only through the scientific communication but also through the display of archaeological materials and excursions to excavation sites (Vitali, 1989, 2021). In what would become, officially, the first Italian exhibition of prehistoric anthropology and archaeology (Vai, 2002), the most significant prehistoric and palaeontological materials, from over fifty sites in the national territory, converged and were put on display in Bologna (CIAAP, 1873). The Congress was held under the patronage of the House of Savoy, and Prince Umberto himself participated in the events (CIAAP, 1873); notwithstanding the ideological debates that occurred throughout the conference, there was strong signalling that secular scientific thought can now exist, free from clerical censorship, in the new state (Vitali, 2021). If the 1867 display in Paris served the legitimisation of prehistory in France as well as French imperialist interests, the 1871 display in Bologna served the legitimisation of prehistory in Italy as well as the bigger visions of nation-building and colonial expansion in the newly unified Italian state.

Coinciding with the event, the Civic Archaeological Museums of Bologna and Modena were also established. Bologna's collections included materials from the site of Villanova and excavations at the Etruscan necropolis of Certosa. Edoardo Brizio, the first director, ensured that local findings were separated from those of unknown provenance. The museum, reinaugurated in 1881, chronologically displayed Villanovan, Etruscan, and Celtic materials from the region, with walls decorated by frescoes reproducing Etruscan tomb paintings (Cova, 2010). Modena's *Museo Civico Archeologico Etnologico* was established and directed for over two decades by Carlo Boni, whose conception of civic museums reflected post-unification Italian museological practice, i.e., such institutions as instruments for developing local and national cultural identity (Cova, 2010). Boni advocated that museums should be centres for cultural and economic advancement alongside historical preservation and serve the community actively rather than function solely as repositories. Together with local *terramare* materials, the museum incorporated an industrial collection. Contemporary manufactured goods were exhibited to draw comparisons between prehistoric craftsmanship and 19th-century production, with the objective of stimulating local industrial development (Cova, 2010). Archaeological materials were organised chronologically and geographically,

then subdivided typologically, with comparative material from other Italian and European regions included in displays. Like other civic museums, it arranged artefacts typologically, chronologically, and geographically, and later incorporated an ethnographic collection for comparative purposes (Cova, 2010; Falcucci, 2022).

In any case, prehistoric materials entering the museum as either a subfield of geology/natural history, or as the earliest phase of local/regional history, reflected prehistoric archaeology's lack of disciplinary autonomy. *Paletnologia* as a field of study with its own intellectual coherence was what Pigorini aimed to establish through the National Museum in Rome.

3.2.3. The National Museum of Prehistory and Ethnography in the new capital

The establishment of the *Regio Museo Nazionale Preistorico-Etnografico* in 1875 was conceived due to Pigorini's efforts to create a scientific and institutional structure for Italian palethnology and to provide a unified scientific approach to the discipline (La Rocca & Mangani, 2014). With the support of then-Minister of Public Instruction Ruggiero Bonghi, the museum was part of a larger strategic vision to create a museum complex in the new capital, intended to include a Prehistoric-Ethnographic Museum, an Italic Museum, and a Lapidary Museum, dedicated to illustrating the history of Italian populations from prehistoric times, specifically highlighting the less monumental aspects of Roman civilisation (Tarantini, 2014). The museum's creation served a clear scientific and political goal: to be the repository of all Italian prehistoric materials and universal ethnographic materials, thereby constructing a national master narrative on Italian origins and history (La Rocca & Mangani, 2014). Civic values were strong in Italy post-unification, and this instance was but another recognition of the role of the museum, especially of the *national* museum, in contributing to a nation's consciousness, identity, and historic heritage preservation.

The museum, of course, reflected the ideologies of the time, but mostly Pigorini's. His museographic approach was directly influenced by Scandinavian models, particularly the National Museum in Copenhagen (La Rocca & Mangani, 2014). Pigorini insisted on the organic integration of prehistory and ethnography (Figure 3.5). In the prehistory section, Italian and foreign prehistoric materials were arranged chronologically, then by provenance. Each Italian region and foreign nation received dedicated display space, even those without

current discoveries, anticipating future finds (Lerario, 2012). In the ethnography section, ancient and exotic Italian objects were displayed alongside material culture from contemporary non-European populations, “the living savages” (more accurately “*i selvaggi viventi*” per Pigorini, 1876), especially from Africa, for comparison (Falcucci, 2022). Such views, i.e., that the “modern primitives” represented “living fossils” that could illuminate European prehistory by offering an “image of the past” were neither new (Lubbock, 1865) nor isolated (e.g., Pitt-Rivers Museum; Tyler, 1901) and were part of the Western colonialist, imperialist ideologies prevalent at the time (Falcucci, 2022; Lerario, 2012; see also Chevalier, 2024; Hurel, 2015). The comparative displays positioned regional Italian diversity within a “unity in diversity” evolutionary framework, reconciling strong municipal and regional identities with nascent national consciousness (Lerario, 2012) with colonial aspirations (Falcucci, 2022). Pigorini’s position as chair of *paletnologia* at the *La Sapienza* from 1877 allowed him to connect the museum directly to university teaching.



Figure 3.5. Museo Nazionale Preistorico ed Etnografico (Rome), in its first location at the Collegio Romano, showing the first installation (1875). Source: Wikimedia Commons, courtesy of Museo delle Civiltà.

The collections were assembled through multiple channels between 1875 and 1911. Pigorini leveraged governmental requisition powers to request materials from provincial inspectors throughout Italy “on behalf of patriotic spirit and the positive value of science” (Lerario, 2012, p. 60). Despite perceiving Sicilian research as sometimes isolated and abstract, Pigorini recognised Sicily’s early commitment to *paletnologia* and reached out to Sicilian

scholars, asking for information and donations for his centralised museum, acknowledging the island's surprising number of collections on human antiquity (Cultraro, 2020). The collections, archaeological and ethnographic, grew from diverse sources: transfers from existing institutions (the Kircherianum objects, university geology and zoology cabinets, archaeological museums in Parma, Naples, Modena), contributions from the Italian Geographic Society and Arsenal of Venice, private donations from collectors and explorers (including from the Italian colonies), and acquisitions from 17th and 18th-century Catholic missions previously held in other places (Lerario, 2012). By the end of Pigorini's directorship, the museum contained 54 sections with over 170,000 objects, plus a specialised library and Pigorini's personal library. However, this bureaucratic centralisation, combined with severe economic crises, led to a fading of fervour in local research. The shift in administration of antiquities to the centralised *Direzione Centrale di Antichità* in Rome after 1875 contributed to a decline in local cultural enterprise. The Museo Civico of Ripatransone (1877) notably acquired archaeological artefacts and ethnographic material from the National Museum in Rome in exchange for archaeological artefacts, illustrating early institutional exchange practices (Pignocchi, 2014).

In 1895, Capellini donated his collection of about 7000 various artefacts from different parts of Italy and Europe to the Bologna Civic Museum, which has since made up the Hall of Prehistoric Comparisons (*Sala dei confronti preistorici*) (Figure 3.6; Cova, 2010). In the University Geological Museum, Vitali (1989) notes, Capellini “had preserved only a few lithic artefacts, the most ancient remains of human industry... exhibited to show the link that unites geological sciences with ethnology and prehistoric archaeology” (p. 297). Capellini's decision to donate this collection was reportedly due to the scarcity of space at the Geological Museum for geological and palaeontological materials, but also, notably, to the increasingly tenuous link of prehistoric studies to the geological sciences (Vitali, 1989).

The museographic traditions developed in the late 1800s along with the important turns in Italy's political state continued into the 20th century. Prehistoric materials continued to come out from excavations in Italy and abroad and continued to flow into the new museums, for example, in Milan and Turin (Falcucci, 2022). Many Ligurian prehistoric materials were eventually acquired by state or academic institutions in Genoa or Turin, often after private collectors decided to sell them to prevent dispersion (De Pascale & Negrino, 2017). In Ancona, Ciavarini criticised the lack of a strong regional administrative structure which meant that important local finds were often dispersed or channelled away to central, “more

important” museums, particularly by Pigorini and later Rellini, reflecting the ongoing centralising policy (Pignocchi, 2014). Ciavarini wanted for the museum in Ancona to become a state museum but had been unsuccessful for 30 years, until 1906 when it became the *Museo Nazionale delle Marche* (Pignocchi, 2014).



Figure 3.6. *Museo Civico Archeologico* (Bologna), showing the Hall of Prehistoric Comparisons. Source: [Biblioteca Salaborsa](#) (2021).

3.2.4. Stasis, renewals, new discoveries, movement of collections

During the Fascist regime, ethnographic objects from colonies continued to be displayed, but the comparative function was often eclipsed by the need to portray colonised subjects as *primitive* to justify subjugation. While prehistoric studies were reduced and landed at an (almost) stasis,³³ the propagandistic use of research and museum display increased in favour of Roman archaeology, to support imperial rhetoric (Falcucci, 2022; Guidi, 2010; Kaeser, 2014; Pacciarelli et al., 2014 Tarantini, 2014). After Pigorini's death in 1925, the National Museum in Rome was named in his honour.

The period after the war brought renewed resources and a re-evaluation of the role of museums, coupled with a commitment to applying modern scientific rigour to research. Curators began confronting the widening gap between historical interpretations and modern research. A key development in the civic museums of Emilia-Romagna (Reggio Emilia, Modena, Bologna, also Imola) was the conscious decision to resist modernising trends and instead preserve and restore the original 19th-century layouts, displays, and classification systems as “artefacts” of the past (Cova, 2010, 2014). This approach recognised the historical collections as invaluable resources for understanding the history of *paletnologia*, museology, and the political/cultural climate of the 19th century. In the Chierici Museum, objects added later were removed, and the comparative ethnographic material was reintroduced. New, separate sections were created (e.g., *Museo di Preistoria e Protostoria*) to present modern research. Moreover, the rigorous scientific approaches developed pre-war by Florentine scholars, including the establishment of the Florentine Museum of Prehistory became the model for subsequent studies in the 1940s and beyond, revitalising research and opening a new era for museum development. The eventual establishment of the dedicated Museum of Prehistory ‘Luigi Donini’ in San Lazzaro di Savena (BO) in the 1970s is manifest to this (although the history of its collections extends back to Scarabelli and Capellini's works in the 1860s; Lenzi & Nenzioni, 2014), coinciding with the founding of several core collections that eventually formed local museums, following the increase of archaeological activity across Italy. The National Museum in Rome, despite a massive collection, suffered from a negative image and reduced accessibility after being moved to the EUR district (designed during the Fascist regime) in the 1970s (Lerario, 2012). The contemporary narrative of the museum attempts to bridge the gap between the original collections and the

³³ While the Fascist era is often regarded as a “pause” in the development of prehistoric archaeology, research and collecting activities in various localities did not entirely cease. Documentation (as cited throughout the chapter) indicates that several significant post-war developments had their origins in initiatives undertaken between the 1920s and the 1940s.

present by separating the prehistoric and ethnographic sections, moving away from the old evolutionary comparative paradigm to treat both as distinct disciplines.

The intellectual and international milieu within which prehistoric archaeology emerged and eventually developed as a discipline in Europe facilitated not only the movement of scholars and exchange of ideas but also of archaeological artefacts ([Guidi, 2008](#)). Private collections, donations, and institutional transfer throughout the centuries would explain the presence of foreign (particularly French, English, and Swiss) prehistoric artefacts in older Italian museums, and the presence of Italian artefacts in foreign museums such as the French National Archaeological Museum (MAN) and the British Museum, among others.

3.3. Italian prehistoric archaeology in the cultural heritage domain: Systems and operations

Archaeological sites and artefacts are recognised as cultural heritage in Italy, entering a framework of legal, administrative, and operational structures that govern their valorisation. Examined here are such frameworks, beginning with legal foundations, followed by institutional architecture, international obligations, and operational dynamics, situating prehistoric archaeology within the broader system of cultural heritage management.

3.3.1. Heritage legislation

The Italian heritage management system operates through a comprehensive legal framework that has evolved and is continuously evolving through continuous legislative refinement over two millennia. Acidini (2024), in tracing the history of cultural heritage protection in Italy, emphasises the weight of the etymological foundation and early definitions of the Italian term *tutela* as a concept that embodies the defence/protection/safeguarding of a right or a material or moral good, that is a fragile subject, by responsible figures. This reflects the Italian understanding of cultural heritage as requiring active guardianship and legal intervention for collective benefit, a principle that has remained consistent despite political and social transformations.

Legal foundations

The principles underlying Italian heritage legislation can be traced to Roman imperial law, specifically the *Digesto Giustiniano* (533 A.D.), which established that private objects placed in public spaces fell under the legal status of *res populi Romani*, creating a precedent for public interest taking precedence over individual property rights (Acidini, 2024). This foundational concept of *publica utilitas* established the legal principle that would prove durable, influencing heritage protection concepts through subsequent centuries and providing the theoretical foundation for contemporary state authority over cultural property regardless of private ownership claims. Medieval and Renaissance developments built upon this Roman foundation while adapting to changing political circumstances and emerging humanistic values. Medieval municipal governments demonstrated commitment to heritage

protection and established the principle of perpetual protection for cultural monuments,³⁴ reflecting both practical urban planning concerns and spiritual beliefs about the permanence of cultural achievements. Renaissance developments included Raphael's 1519 Letter to Leo X, written with Baldassar Castiglione, which implored papal protection for Rome's ancient remains and led to Raphael's appointment as the first heritage supervisor, making him "the forebearer of today's *soprintendenti*" (Acidini, 2024). This appointment created the institutional precedent for professional heritage oversight that would evolve into the contemporary *Soprintendenze* system, establishing the principle that heritage protection required specialised expertise and dedicated administrative structures rather than ad hoc interventions.

The development of systematic export controls and heritage documentation between the 17th and early 19th centuries established the fundamental principles that continue to govern Italian heritage law. Export restrictions, beginning with Florence's 1602 prohibitions and culminating in Rome's 1733 Albani Edict, created the principle of territorial connection between heritage objects and their places of origin alongside state pre-emption rights (Acidini, 2024). Eighteenth-century Enlightenment approaches transformed heritage protection from reactive prohibition to proactive stewardship through systematic cataloguing and comprehensive documentation, while the Medici's *Patto di famiglia* (1737) articulated the tripartite justification for heritage protection: aesthetic enhancement, public education, and economic benefit through tourism. The Napoleonic crisis (1797–1815) accelerated institutional innovation, resulting in Pius VII's 1802 Chirograph and the 1820 Pacca Edict, which established the conceptual and procedural foundations for all subsequent Italian heritage legislation, including cataloguing requirements, state protection duties for private works, export regulation, and professional supervisory appointments that created administrative mechanisms adaptable to changing political circumstances (Acidini, 2024).

The newly unified Italian state (1861) inherited a patchwork of cultural heritage protection systems developed under different pre-unification governments (Bondini, 2019). The Papal States had maintained extensive antiquities collections and export controls, the Kingdom of Two Sicilies had developed systematic archaeological oversight, and northern duchies had established their own approaches to cultural property protection (Ranaldi, 2012). This

³⁴ An exemplification is the Roman Senate's 1162 decree imposing the death penalty for damaging Trajan's Column, declaring it should "remain as it is, for all eternity, intact and unaltered until the end of the world" (Acidini, 2024).

fragmentation created immediate challenges for establishing coherent national policies while respecting established local practices and property rights. The Liberal state's approach to heritage protection reflected broader tensions between centralisation and regional autonomy, between state authority and private property rights, and between national cultural interests and international art market pressures (Sciullo, 2017). These tensions would persist throughout subsequent legislative developments and continue to influence contemporary heritage management.

Prehistoric archaeology as heritage

Without disregarding the proposed bills by the Ministry in-charge post-unification,³⁵ over 40 years passed before the first comprehensive national heritage legislation emerged: the *Law of June 20, 1909, No. 364*, also known as the *Rosadi-Rava Antiquities and Fine Arts Law* or simply *Rosadi-Rava* or *Rosadi Law*, expanded heritage definitions to encompass “*le cose immobili e mobili che abbiano interesse storico, archeologico, paletnologico o artistico*” (movable and immovable property endowed with historical, archaeological, *palethnological* [emphasis added] and artistic interest) (Acidini, 2024; Ranaldi, 2012). Prehistoric sites and objects officially enter the category of cultural heritage subject to protection at this time. The legislation was progressive for considering items that *tutela* did not previously cover, and for introducing the concept of state ownership and interest in cultural objects. It created the legal foundation for state intervention in private property rights when protection was at stake, though enforcement mechanisms remained limited by Liberal-era respect for property rights and limited administrative capacity (Sciullo, 2017). The *Rosadi Law* also established early administrative structures for heritage oversight, including the reorganisation of the Directorate-General of Antiquities and Fine Arts and the creation of the institutional foundations for what would eventually become the *Soprintendenze* system. However, jurisdictional boundaries remained unclear, and coordination between different levels of government proved problematic throughout the Liberal period (Sciullo, 2017; Ranaldi, 2012).

The year 1939 was pivotal for Italian heritage legislation as under Minister Giuseppe Bottai more defined laws for the protection of cultural property (*Law of 1 June 1939, No. 1089*) and landscape (*Law of 29 June 1939, No. 1497*) were enacted (Acidini, 2024). The *Bottai*

³⁵ At the time, the *Ministero della Pubblica Istruzione* (Ministry of Public Education) was the state department in charge of cultural heritage protection.

Laws expanded state authority through broadening the categories of cultural property subject to protection (i.e., to include “everything that had relevance to the nation’s history”), strengthening state powers of intervention and requisition, enhancing export controls and international movement restrictions, and creating systematic administrative procedures for heritage management ([Acidini, 2024](#); [Ranaldi, 2012](#)). The legislation established more coherent institutional structures, including the *Soprintendenze* system in recognisable form, specialist roles within heritage administration, systematic cataloguing and documentation requirements, and integration of heritage protection with broader territorial planning ([Barbati, 2017](#)). For archaeological materials, the Bottai Law established principles of automatic state ownership that remain fundamental to contemporary Italian heritage law. All archaeological discoveries, regardless of the ownership status of the discovery location, became state property upon discovery, with compensation mechanisms for landowners but no recognition of private ownership rights over archaeological materials themselves. Comprehensive landscape protection, moreover, recognised the interconnection between cultural monuments and their environmental contexts and created legal frameworks for protecting the territorial contexts within which archaeological sites were embedded. This law also established planning integration requirements, environmental impact assessment procedures for development projects, and coordination mechanisms between heritage protection and territorial development. The ideological dimensions of Fascist heritage legislation reflected broader political objectives of centralised state control and nationalist cultural narratives ([Bondini, 2019](#); [Sciullo, 2017](#)). Heritage protection became integrated with propaganda efforts emphasising Italian cultural superiority and historical continuity with the Roman Empire, creating lasting tensions between scholarly objectivity and political instrumentalisation that would influence post-war heritage policy development.

The Italian Constitution of 1948, Article 9 established cultural heritage protection as a fundamental state obligation: “The Republic promotes the development of culture and scientific and technical research. It protects the landscape and the historical and artistic heritage of the Nation” ([Costituzione della Repubblica Italiana, 1947](#)). This constitutional provision created the ultimate legal authority for heritage protection measures, transcending political cycles and establishing heritage protection as a permanent state responsibility. Despite regime change, the substantive framework of the Bottai Laws remained largely intact through the immediate post-war period. This continuity reflected both the technical quality of the 1939 legislation and the practical difficulties of comprehensive legal reform during reconstruction ([Barbati, 2017](#)). However, significant administrative reforms were

required to integrate heritage protection within democratic governance structures. The re-establishment of the *Soprintendenze* system involved substantial personnel changes and procedural reforms. The integration of heritage management within the Ministry of Education reflected the educational and cultural priorities of the new republic, though this placement later caused difficulties as heritage management became increasingly complex and specialised (Barbati, 2017). Post-war archaeological activity expanded dramatically with infrastructure reconstruction and economic development and consequently created new challenges. The expansion of rescue archaeology fundamentally altered the scale and character of archaeological discovery, with implications for museum collection formation and management that persist in contemporary practice (Guidi, 2010).

Italy's European Union membership (1957) and subsequent treaty developments created new legal frameworks also affecting heritage protection. The European Court of Justice decisions, particularly in cases involving cultural property export restrictions and art market regulation, influenced Italian heritage legislation development and enforcement practices. Integration with European cultural programmes and funding mechanisms also created new opportunities for heritage development. International conventions ratified during this period included the UNESCO World Heritage Convention (1972), ratified by Italy in 1977, the European Convention on the Protection of Archaeological Heritage (1992), the Hague Convention for the Protection of Cultural Property (1954), and various bilateral agreements for cultural property protection and restitution.

The implementation of regional governments in the 1970s created new tensions between central state authority over heritage and emerging regional autonomy. Regional governments gained significant powers over territorial planning, tourism, and cultural initiatives, which required clearer divisions of competence, and stronger procedures that catered both to better integration and local participation in decision-making (Barbati, 2017). These reforms proved significant for archaeological heritage, as regional governments often became major stakeholders in museum development and archaeological research funding.

Separate ministerial recognition came in 1974 with the establishment of the *Ministro per i beni culturali e ambientali* (Ministry for Cultural Assets and Environments) (Acidini, 2024). This served as a demonstration of the growing recognition of heritage management as requiring specialised institutional structures distinct from broader educational administration, which paralleled European trends toward recognising cultural policy as a

governmental responsibility that needed specialised expertise and dedicated resources. The ministerial oversight of cultural heritage has undergone several changes and reversions in name and structural reforms,³⁶ reflecting the rise and collapse of regimes and evolving national priorities (**Table 3.1**). Today it is called the *Ministero della Cultura* (MiC).

The Cultural Heritage and Landscape Code

The culmination of centuries of legal evolution is represented by Legislative Decree 22 January 2004, No. 42, *Codice dei beni culturali e del paesaggio* (Cultural Heritage and Landscape Code), which consolidates and systematises previously fragmented legislation, and builds upon foundational laws from the Liberal period (Law 364/1909 or the Rosadi Law) through the Fascist era (Law 1089/1939 & Law 1497/1939 or the Bottai Laws). Fundamentally, the Code: defines *patrimonio culturale* (cultural heritage) as comprising *beni culturali* (cultural goods/assets) and *beni paesaggistici* (landscape assets); establishes state responsibility for their identification, protection, conservation, and valorisation; and creates a comprehensive legal framework for public access and enjoyment ([Barbati, 2017](#); [Bondini, 2019](#); [Celani, 2024](#)).

The Code explicitly cements prehistoric archaeology's place within cultural heritage. Article 10 directly includes “*le cose che interessano la paleontologia, la preistoria e le primitive civiltà*” (things that concern palaeontology, prehistory, and past civilisations³⁷) in what constitutes *beni culturali* (cultural assets). Furthermore, among institutes and places of culture detailed in Article 101 are museums and archaeological areas, the latter defined as “*un sito caratterizzato dalla presenza di resti di natura fossile o di manufatti o strutture preistorici o di età antica*” (a site characterised by the presence of fossil remains or of prehistoric or ancient artefacts or structures). The Code mandates that the State, regions, and other public territorial bodies ensure the valorisation of the cultural goods present in these institutions. Valorisation involves promoting knowledge of cultural heritage and ensuring the best conditions for public use and enjoyment, including for people with disabilities, to foster cultural development.

³⁶ Archaeological superintendencies maintained operational continuity throughout these transitions. The 1974 separation represented the most significant structural change, removing cultural heritage from educational ministry oversight for the first time since unification.

³⁷ The translation “past civilisations” for *primitive civiltà* (taken verbatim in the Code) is a deliberate choice to preserve temporal meaning (i.e., from the distant past) while avoiding the negative or hierarchical connotations associated with “primitive” in contemporary English and Italian usage.

Table 3.1. Ministerial oversight of cultural heritage in Italy since 1861

Period	Ministry Name
1861–1922 Liberal period	<i>Ministero della Pubblica Istruzione</i> Ministry of Public Education
1922–1943 Fascist period	<i>Ministero dell'Educazione Nazionale</i> Ministry of National Education
1943–1974 Post-Fascist-First Republic	<i>Ministero della Pubblica Istruzione</i> Ministry of Public Education
1974–1998 (specialisation)	<i>Ministero per i beni culturali e ambientali</i> Ministry for Cultural Heritage and Environments
1998–2013 Second Republic (expansion)	<i>Ministero per i beni e le attività culturali</i> Ministry for Cultural Heritage and Activities
2013–2018 (tourism integration)	<i>Ministero dei beni e delle attività culturali e del turismo</i> Ministry of Cultural Heritage and Activities and Tourism
2018–2019 (tourism separation)	<i>Ministero per i beni e le attività culturali</i> Ministry for Cultural Heritage and Activities
2019–2021 (tourism reintegration)	<i>Ministero dei beni e delle attività culturali e del turismo</i> Ministry of Cultural Heritage and Activities and Tourism
Since 2021 (streamlined designation)	<i>Ministero della cultura</i> Ministry of Culture

3.3.2. Organisational architecture

The Cultural Heritage and Landscape Code establishes a comprehensive administrative framework, including the *Ministero della Cultura* for central coordination and policy development, the *Direzione Generale per i Beni Culturali* for operational oversight, *Soprintendenze* for territorial implementation, and specialist *Istituti Centrali* for technical support. Procedural frameworks include standardised procedures for heritage identification and protection, systematic documentation requirements through *Istituto Centrale per il Catalogo e la Documentazione* (ICCD) protocols, integrated planning procedures coordinating heritage and territorial development, and enforcement mechanisms including administrative and criminal sanctions.

The *Ministero della cultura* (MiC) holds the ultimate authority over cultural heritage in Italy. It is the department responsible for the protection, conservation, and enhancement of artistic, cultural, and landscape heritage, as well as culture and entertainment ([Ministero della cultura, 2023](#)). Its organisational structure is complex, with repeated modifications,

including central offices and peripheral bodies. These include the General Secretariat, which ensures coordination and unity of administrative action, elaborates directives, and coordinates the Ministry's offices. There are also eleven General Directorates. Through its *Direzione generale archeologia, belle arti e paesaggio* and *Direzione generale musei*, the Ministry determines strategic priorities, allocates funding, and monitors the implementation of national policy. It also oversees major institutional reforms, such as the creation of institutes with special autonomy, including state museums and archaeological parks of national importance, and digital heritage initiatives.

The *Soprintendenze* are peripheral bodies of the MiC with territorial responsibilities for the protection and enhancement of cultural and landscape heritage. The *Soprintendenze archeologia, belle arti e paesaggio* (SABAP) has 43 offices across 15 ordinary regions and 2 autonomous regions (Friuli-Venezia Giulia and Sardegna), while the remaining 3 autonomous regions (Sicily, Trentino-Alto Adige, and Valle d'Aosta) manage their cultural heritage independently. These operate alongside other specialised cultural heritage protection bodies, including special superintendencies (e.g., the *Soprintendenza speciale per Roma*), the *Soprintendenza nazionale per il patrimonio culturale subacqueo*, and the *soprintendenze archivistiche e bibliografiche* which has 17 offices overseeing all 20 Italian regions, as archival heritage falls under the Ministry's competence even in autonomous regions.

Historically, the SABAP were established as specialist offices focusing on archaeology (*Soprintendenze archeologiche*), but their competencies were expanded and merged with those for architecture and landscape conservation during the 2014–2017 reforms led by Minister Dario Franceschini. This territorial integration represented the most radical administrative change of the entire reform period, consolidating three distinct disciplinary traditions into unified territorial offices. Simultaneously, the *Direzione Generale Archeologia, Belle Arti e Paesaggio* (DG-ABAP) was established to coordinate these unified superintendencies, replacing the previous separate directorates for archaeological, architectural, and landscape heritage. The Franceschini Reform (D.P.C.M. 171/2014) and the reorganisation of the then-MiBACT also mandated the establishment of autonomous museums with special status and the creation of 17 *Poli museali regionali* to manage numerous state museums without autonomy that were distributed throughout the national territory and previously under the competence of other offices (Barbati, 2017; Bondini, 2019; Ministero della cultura, 2016).

The brief tenure of Minister Alberto Bonisoli (June 2018–September 2019) introduced what was widely characterised as a “counter-reform” that sought to reverse core elements of the Franceschini reorganisation through increased centralisation and the reduction of institutional autonomy ([Finestre sull'Arte, 2019](#)). Bonisoli's approach included controversial mergers and incorporation of autonomous museums into larger institutions, the creation of interregional museum networks (the *Poli museali regionali* were replaced by the *Direzioni territoriali delle reti museali*), and the establishment of powerful centralised directorates. However, this counter-reform period proved institutionally destabilising. The attempt to merge prestigious museums generated widespread professional and political opposition, while the fragmentation of export functions from superintendencies created bureaucratic complications that undermined protection effectiveness ([Finestre sull'Arte, 2019](#)). When Franceschini resumed the ministry in September 2019, he methodically reversed Bonisoli's changes, dismantled his reforms, and codified this restoration process (D.P.C.M. 169/2019). The unified SABAP structure was strengthened and stabilised and the *Direzioni territoriali delle reti museali* were replaced by *Direzioni regionali musei* in February 2020, creating the current system of 17 regional museum directorates and the separate Rome directorate ([Ministero della cultura, 2020](#)).

As part of a broader reorganisation of government ministries under the Draghi government in 2021, tourism competencies were transferred to a newly created, separate Ministry of Tourism; the Ministry of Cultural Heritage and Activities and Tourism (MiBACT) then became simply the Ministry of Culture (MiC) (Decree Law 22/2021). The renaming was accompanied by significant organisational restructuring implemented through different regulatory measures (**Figure 3.7**). The implementation of the National Recovery and Resilience Plan (PNRR) has necessitated the creation of two extraordinary general management-level offices operating until 31 December 2026: the Mission Unit to coordinate interventions and projects under the Ministry's responsibility, and the Special Superintendency to perform functions of cultural and landscape heritage protection in cases where heritage is affected by any PNRR intervention ([Ministero della cultura, 2021](#)).

Following Franceschini, Minister Gennaro Sangiuliano's most significant administrative innovation was the introduction of a departmental structure to replace directorates-general, implemented through Decree Law 105/2023, Article 10. The departmental structure is meant to address persistent criticisms about coordination challenges within the ministry's complex

organisation. Rather than multiple autonomous directorates-general, the new system created four thematic departments with enhanced hierarchical coordination. However, Santiapichi's tenure ended abruptly in September 2024 due to personal scandal, leaving the long-term impact of the departmental structure uncertain. The following appointment of Alessandro Giuli as Culture Minister occurs within a now-stabilised institutional framework. The current administration inherits a system that has been tested through multiple political transitions and refined through practical application.

3.3.3. International standards and obligations

While Italian cultural heritage management is primarily grounded in national structures, these legislative frameworks also interact with international conventions and guidelines. The most influential comprise four primary frameworks that establish global standards for heritage protection and valorisation:

- The 1972 UNESCO World Heritage Convention represents the foundational international mechanism for heritage recognition, establishing criteria for Outstanding Universal Value and systematic site protection (UNESCO, 1972). Italy ratified this convention in 1977, becoming one of the earliest adopters and subsequently achieving the highest number of World Heritage inscriptions globally.³⁸
- The 1970 UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property addresses cultural property trafficking through international cooperation mechanisms and export controls (UNESCO, 1970). Italy ratified this convention in 1978. The convention's bilateral agreement emphasis and repatriation procedures aligned with existing domestic export licensing systems developed through earlier national legislation.
- The 1992 European Convention on the Protection of the Archaeological Heritage (Malta Convention) represents the most significant European intervention in archaeological practice, requiring archaeological impact assessment, developer funding, and public access provision (Council of Europe, 1992). Italy's delayed ratification in 2015, despite earlier implementation of many provisions through

³⁸ Currently, 61 Italian properties are inscribed on the UNESCO World Heritage List, plus 30 on the tentative list (<https://whc.unesco.org/en/statesparties/it>).

national legislation, may reflect institutional considerations about sovereignty and administrative oversight rather than opposition to convention principles.

- The 2005 Council of Europe Framework Convention on the Value of Cultural Heritage for Society (Faro Convention) introduces community-oriented approaches emphasising heritage communities and participatory management ([Council of Europe, 2005](#)). Italy signed this convention in 2013 but has not ratified it.

The inclusion of international frameworks in a discussion of Italian cultural heritage management is relevant in articulating the practical impact of two consequent obligations: first, to comply with legally binding international commitments, and second, to participate in an evolving global discourse on heritage protection, conservation, and valorisation.

National structures do not operate in isolation and adherence to international standards is about alignment. Beyond legal compliance, international frameworks function as a repository of technical guidance and ethical standards. UNESCO and Council of Europe instruments articulate principles of authenticity, integrity, and sustainability, prescribing methodologies for best practices, which provides Italian institutions with a set of benchmarks against which to assess their own. Having systems in place to ensure that recognised professional standards are met, in turn, reinforces legitimacy and public accountability. By demonstrating alignment with globally recognised norms, institutions enhance their credibility in the eyes of stakeholders, including local communities, tourists, scholars, and policymakers. In practical terms, compliance with international frameworks opens avenues for collaboration and sharing of resources with other nations, as well as access to funding opportunities from international bodies.

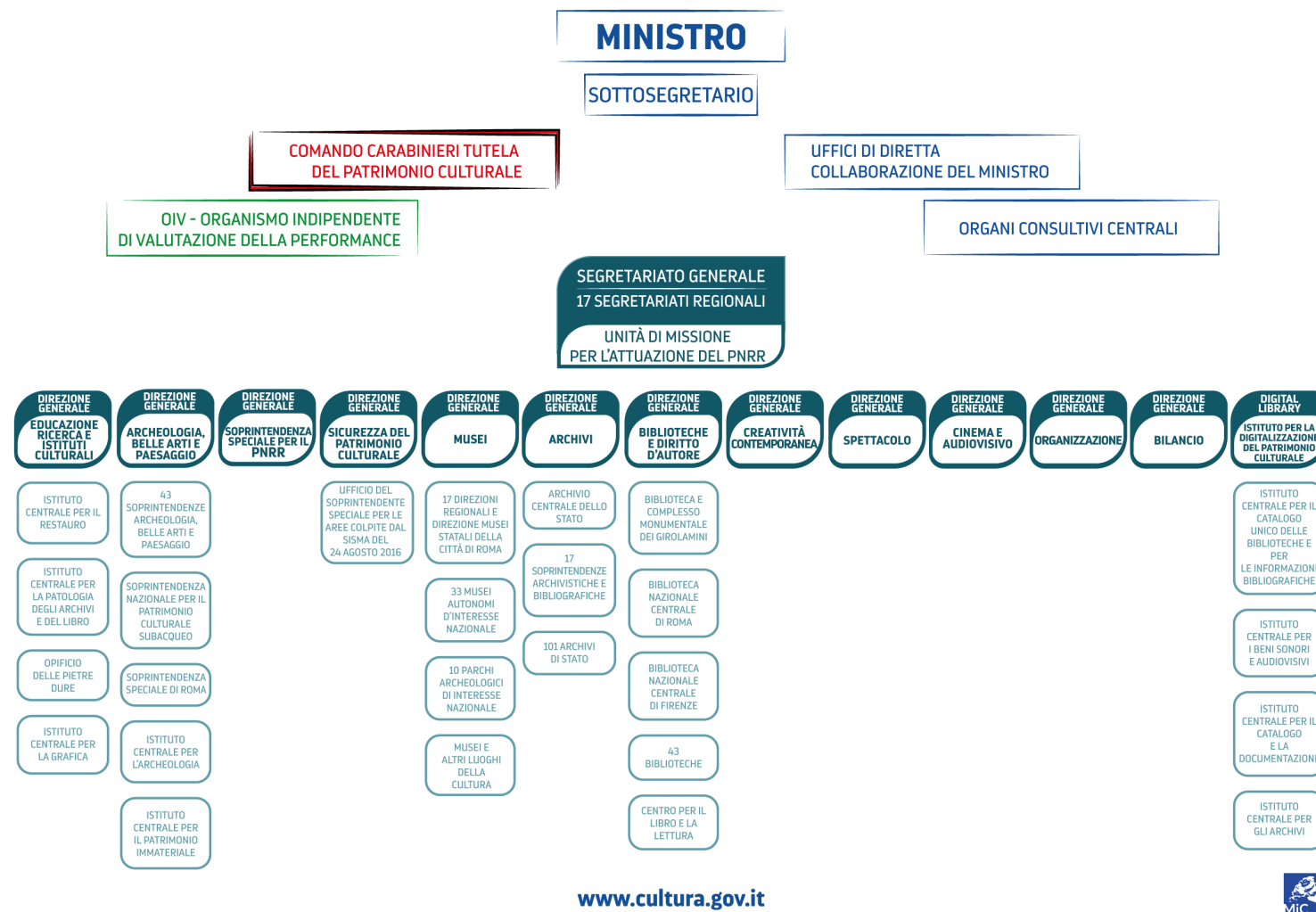


Figure 3.7. Organisational structure of the Ministry of Culture as established by D.L. 22/2021 “*Disposizioni urgenti in materia di riordino delle attribuzioni dei Ministeri.*” Source: *Ministero della cultura* (2021).

3.3.4. Current investments in cultural heritage valorisation and Cultura 4.0

Contemporary digital governance frameworks represent the most recent evolution in Italian heritage management, also as reflected in the legislative tradition. *Italia Domani*, Italy's national recovery and resilience plan (PNRR), represents the country's most ambitious investment in cultural heritage since the establishment of the Ministry of Culture in 1974. Developed under the Next Generation EU programme, a total cultural investment of over €8 billion is allocated to culture and tourism in Italy for the period 2021–2026 ([Italia Domani, 2025](#)). The Ministry of Culture's PNRR is part of Mission 1, Component 3, also known as *Tourism and Culture 4.0*. It includes investments for digital platforms and strategies, accessibility improvements, and environmental sustainability. The measures are based on a multilevel governance model and envisage strong cooperation between public stakeholders, in line with the Faro Convention and the European Framework for Action on Cultural Heritage ([PNRR Cultura, 2025](#)). This cross-sectoral endeavour encompasses museums, archives, libraries, archaeological sites, and heritage landscapes, positioning digitalisation and accessibility as central strategic pillars.

Cultura 4.0 represents the digitalisation component of the PNRR's cultural heritage agenda. Investment 1.1, dedicated to digital strategies and platforms for cultural patrimony, commits €500 million across 12 distinct sub-programmes overseen by the *Istituto Centrale per la Digitalizzazione del Patrimonio Culturale – Digital Library* through the framework set in the national digitalisation plan (*Piano Nazionale di Digitalizzazione* or PND). The PND functions as the conceptual and operational architecture underpinning Cultura 4.0 initiatives, defining standards, methodologies, and strategic priorities that translate policy objectives into institutional practice. The *Direzione Generale Musei* serves as the implementing structure for investments that directly impact museum institutions.

The programme addresses deficiencies in digital infrastructure while enhancing capabilities of museums, archives, libraries, and other cultural institutions that own, protect, manage, and enhance cultural heritage, by: 1) stimulating market development for cultural services among small-to-medium enterprises and innovative start-ups; 2) enabling knowledge transfer from research contexts into practical heritage applications; 3) exploiting databases and digital collections for educational, entertainment, and scholarly purposes; and 4) guaranteeing sustained accessibility of digital archives ([PNRR Cultura, 2025](#)). Specific

commissioning processes include investing on procurement for digitising storage collections, encompassing in excess of 600,000 artefacts (archaeological materials, artworks, graphic works) distributed across more than 70 museum and archaeological locations, with pronounced emphasis on southern regions (constituting 40% of allocated resources). Projections indicate generation of approximately 2,000,000 digital assets accompanied by metadata facilitating discoverability within a national digital repository, aligned with European performance indicators requiring 65 million accessible digital resources by late 2025. The model of interoperability is shared at national level and is transversal between international organisations within the digital ecosystem ([PNRR Cultura, 2025](#)). Within the international context (ICOM, ICA, IFLA), it operates toward integration between often divergent descriptive models, addressing heterogeneous artefacts, various media and assets (historical-artistic, archaeological, architectural and landscape), and documentary typologies. International collaboration includes UNESCO World programme participation, ICOM ethical standards integration, climate change adaptation strategies for heritage protection, and digital humanities and virtual heritage initiatives.

SIGEC, CLIO, and the cataloguing infrastructure

The production of millions of digital assets through PNRR procurement procedures, however, requires robust cataloguing infrastructure to transform raw image files into discoverable cultural knowledge. The *Sistema Informativo Generale del Catalogo* (SIGEC), created by the *Istituto Centrale per il Catalogo e la Documentazione* (ICCD) under the Ministry of Culture, is a comprehensive, multi-level distributed information system for cataloguing cultural heritage initially conceived as a centralised database, then evolved into a territorially distributed information network ([Calosso et al., 2008](#)). SIGECweb is the online platform that manages the entire cataloguing workflow, from production and dissemination of cataloguing standards to assignment of unique catalogue codes, to cataloguing of heritage (archaeological, architectural and landscape, demo-ethno-anthropological, photographic, musical, naturalistic, numismatic, scientific and technological, historical and artistic), to publication of catalogue records for fruition on the general catalogue of cultural heritage website ([Ministero della cultura, 2018](#)). SIGECweb is transitioning to a new cataloguing platform: CLIO-SCN, Cataloguing, Localisation, Identification, and Organisation (of cultural heritage knowledge) - *Sistema Catalogazione Nazionale* ([Archeomatica, 2025](#)). Significantly, a training course titled “Towards the new National Catalogue System: tools and methods” focuses on this transition, aimed at MiC staff who conduct cataloguing activities. This training initiative forms part of actions defined by the Ministry of Culture

within the PNRR.³⁹ The new cataloguing system CLIO-SCN is scheduled for release in autumn 2025.

The *Sistema Museale Nazionale* and public-facing digital infrastructure

While SIGECweb structures the backend cataloguing processes that render digital collections semantically coherent and searchable, the *Sistema Museale Nazionale* (SMN) and its associated *Musei Italiani* platform constitute the public-facing infrastructure through which users access these valorised resources.

The National Museum System functions as the organisational and governance framework for museum valorisation initiatives. Established by Ministerial Decree 21 February 2018 (DM 113/2018), the National Museum System aims to create governance of heritage based on sustainability, innovation, and participation, and founded on networking principles to strengthen collaboration among state museums and cultural sites, as well as regional, municipal, diocesan, private, university, and military structures. Multi-level coordination and intersectoral cooperation offer quantitative and qualitative advantages for visitors and favour Italy's competitiveness in the international tourism landscape ([Ministero della cultura, 2012](#)). The system, coordinated by the *Direzione Generale Musei*, aims to network nearly 5,000 Italian museums and cultural sites—both public (state and non-state) and private—to improve the system of fruition, accessibility, and sustainable management of cultural heritage. Museums can adhere voluntarily through an accreditation process, based on recognition of quality and propensity for continuous and progressive improvement through application of uniform quality standards.

PNRR funding directly enabled development of the public interface. Presented on 3 July 2024, *Musei Italiani* is the official app of the *Sistema Museale Nazionale*, connected to the platform museiitaliani.it (**Figure 3.8**), which enables users to obtain information, explore, and securely purchase entry tickets for state cultural sites throughout the national territory ([Ministero della cultura, 2024a](#)). The app represents one of the first concrete results of the PNRR, demonstrating how infrastructure investments translate into tangible public services. It will soon enter a new phase, welcoming non-state cultural sites beyond MiC-managed museums, fully realising the SMN's objectives. New functionalities are being implemented,

³⁹ The *Dicolab. Cultura al digitale* initiative delivers complimentary, accredited training for heritage professionals and institutions, addressing competency deficits in digital domains across museums, archives, and libraries ([Ministero della cultura, 2024b](#)).

including recommended itineraries and audio/video guides for visitors. This planned expansion beyond state institutions toward comprehensive network coverage reflects the SMN's foundational principle: valorisation through collaboration rather than hierarchy, leveraging digital infrastructure to reduce disparities between well-resourced major institutions and under-resourced smaller sites.



Figure 3.8. Home page of the Italian National Museum System. Source: [Musei Italiani](https://www.museiitaliani.it).

The PNRR represents more than financial investment; it embodies a strategic vision for transforming how Italy's cultural heritage functions within society. For prehistoric archaeology and lithic studies, these investments create unprecedented opportunities to address long-standing challenges in museum interpretation and public engagement. The transformative potential of such undertakings encompasses fundamental questions about the role of prehistoric archaeology within contemporary cultural discourse. However, realising this potential requires intricate understanding of both archaeological knowledge and museum practice, combined with a commitment to developing interpretive frameworks that serve both scholarly and public interests.

3.4. Italy, in prehistory museums: A contemporary overview

That Italy boasts a vast museum landscape is an understatement. Already that the oldest continuously operating public museum (the Capitoline Museums, Rome, 1471) is found in this country, and that being a “widespread museum” is an Italian peculiarity (Poulot, 2018), the sheer volume and diversity of material culture now housed within Italian museums defies straightforward categorisation (!).

3.4.1. Cultural structures, the national numbers

According to recent statistics (Istat, 2022), the number of museums and similar cultural institutions⁴⁰ in the country in 2021 was 4,292, among which 3,338 are museums (**Figure 3.9**).

Distribution of Italian Cultural Structures (Total: 4,292)

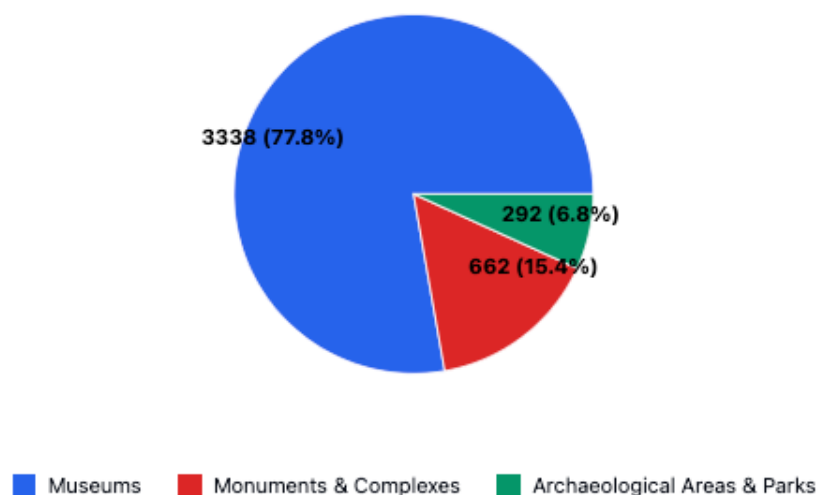


Figure 3.9. Distribution of cultural institutions per type. Data source: Istat (2022), refers to 2021 census.

⁴⁰ This Istat survey excludes structures that organise exclusively temporary exhibitions and those without organised access arrangements. For the full report, see Istat.it (press release, reference period 2021, published 2 December 2022; <https://www.istat.it/wp-content/uploads/2022/12/accessibilita-luoghi-cultura-dic2022.pdf>).

Distribution of Museums and Similar Institutions in Italy by Region (Total: 4,292)

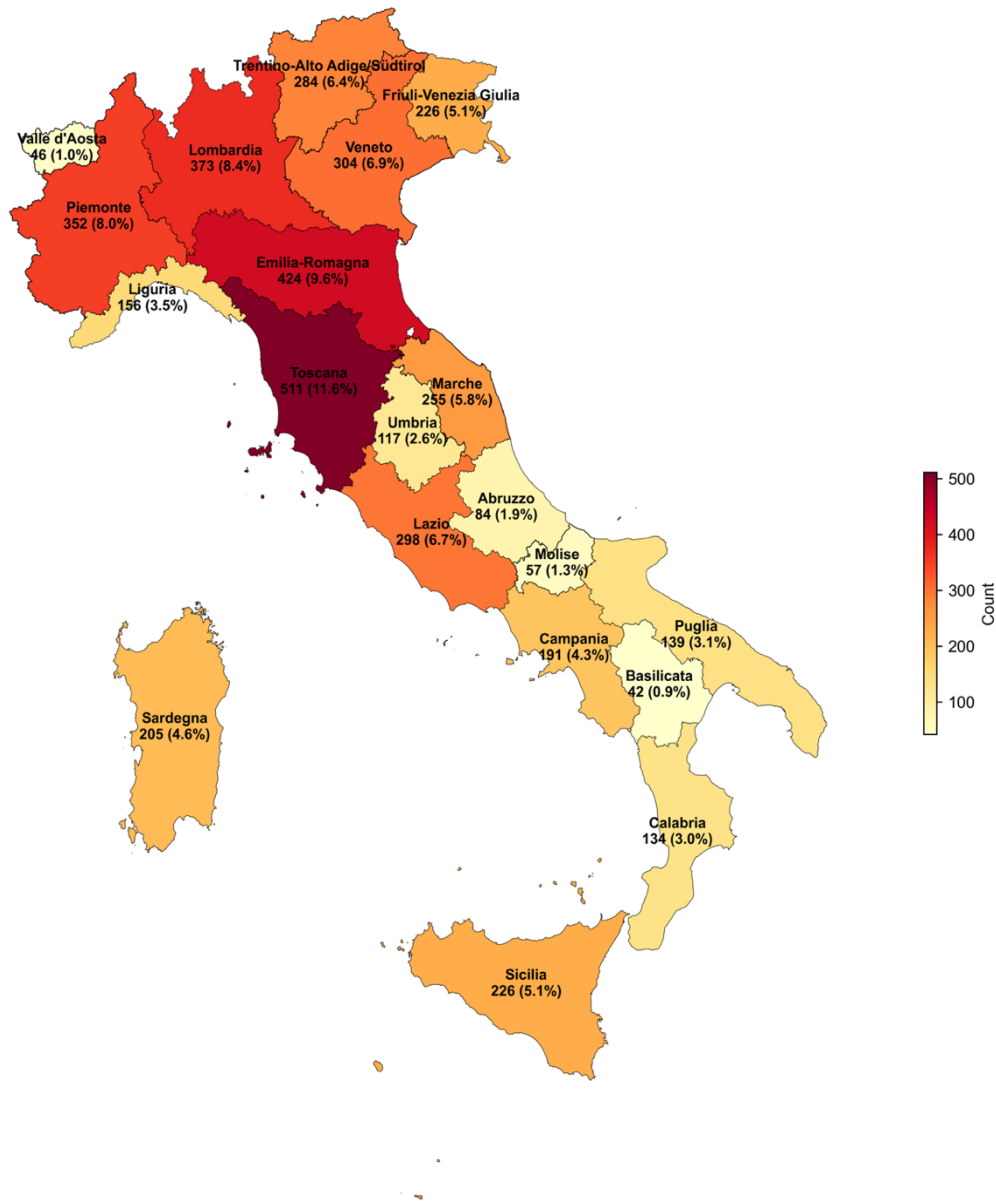


Figure 3.10. Geographic distribution of museums, monuments/complexes, and archaeological areas/parks in Italy; count per region. Data source: [Istat \(2022\)](#), refers to 2021 census.

The geographic distribution reveals northern concentration, with 45.3% of cultural institutions located in northern regions, followed by central regions (28.6%) and southern regions including islands (26.1%) (**Figure 3.10**). Toscana leads in absolute terms with 511 structures, followed by Emilia-Romagna (424) and Lombardia (373). Notwithstanding, data indicates that smaller regions often demonstrate higher institution density per capita, while larger, more populous regions may have substantial absolute numbers but lower relative

density.⁴¹ The major Italian cities with the greatest concentration of historical-cultural, architectural, and archaeological heritage, in the North are Milan, Turin, Genoa, Venice, Trieste, and Bologna; in the Centre are Florence, Siena, and Rome; and in the South are Naples and Palermo. Nevertheless, museum institutions (and libraries) are not exclusively found in major metropolitan areas but are also present in small centres (with populations up to 5,000 inhabitants) and medium-sized Italian municipalities (with populations ranging from 5,000 to 30,000 inhabitants).

3.4.2. Museums, in focus

Among the 3,338 museums, the public sector manages 2,183 (65.4%), of which 1,512 (~70%) are under local authorities; of the remaining 1,155 (34.6%) private museums, 358 (31%) are ecclesiastical/association-run. In terms of collection type, Istat data show that no single museum type dominates the Italian cultural landscape, with the largest category (art museums at 23.2%) representing less than a quarter of all institutions (**Figure 3.11**). Archaeological museums (prehistoric and ancient civilisations) constitute a notable 16.1%, a proportion that reflects the country's rich ancient heritage, though not overwhelmingly considering its general archaeological significance. Unfortunately, there is limited breakdown available for the 2021 census; however, based on the detailed 2017 data ([Istat, 2019](#)), the unlisted category most likely encompasses traditional disciplinary museums including natural history and science museums (6.6% in 2017), and history museums (8.1% in 2017).

Not considering the “Others” category, there is relatively even distribution across the rest, which may be taken to reflect the diversity of the institutional landscape, but may also be about methodological considerations.⁴² Mixed-discipline institutions are common in the Italian museum sector, regardless of administrative type but especially local civic museums that focus more on territorial rather than disciplinary significance. Military museums, technology and industrial museums, and religious museums that operate separately from general art collections may fall under either the unlisted category or the thematic

⁴¹ For example, Valle d'Aosta records the highest density at 3.9 institutions per 10,000 inhabitants despite having only 46 structures in total; Lazio, containing the capital and 298 cultural institutions, achieves merely 0.5 structures per 10,000 residents.

⁴² Istat follows the guidelines of the European Group on Museum Statistics (EGMUS) and ICOM definitions, with a classification based on public fruition relevance (what visitors primarily experience) and institutional characterisation (what most defines the museum) ([Istat, 2019; 2022](#)).

classification, though the precise distribution between these categories remains unclear from the available data.

Distribution of Italian Museums by Collection Type (Total: 3,338)

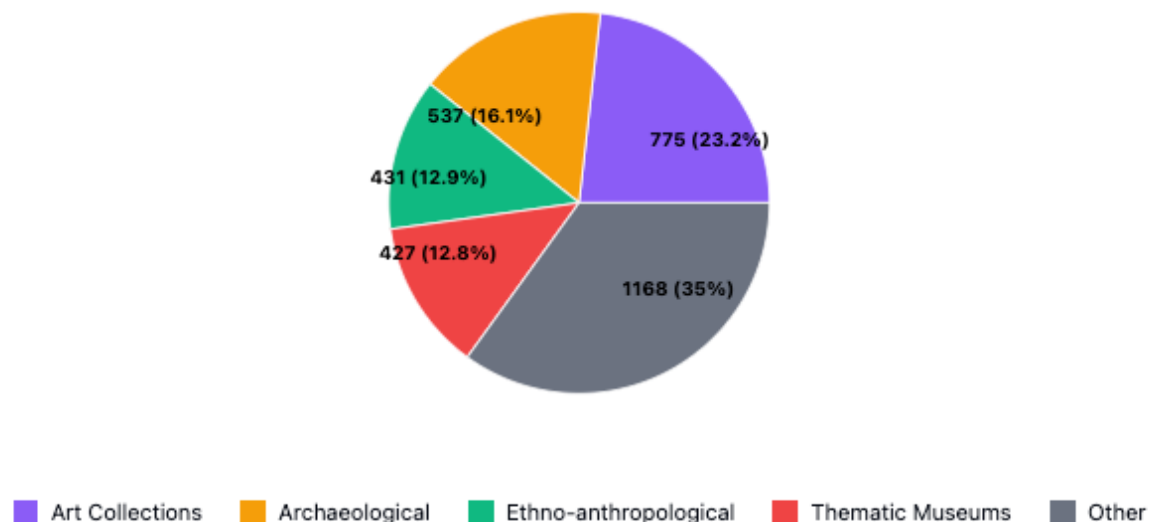


Figure 3.11. Distribution of museums per collection type. Data source: [Istat \(2022\)](#), refers to 2021 census.

3.4.3. Palaeolithic collections, in focus

Many institutions housing significant Palaeolithic collections have already been discussed in relation to the historical development of Italian prehistoric archaeology and museum traditions. The formation of collections and museum institutions such as in the civic museums in Emilia-Romagna and the Marche, the National Prehistoric-Ethnographic Museum in Rome, and the Florentine Museum of Prehistory, among others, exemplifies the intertwining of disciplinary history, collection practices, and institutional frameworks that have shaped the contemporary museum landscape. These historically prominent institutions represent nexuses where early excavation campaigns, classificatory innovations, and museological developments converged, establishing both material repositories and interpretive paradigms that continue to influence how Palaeolithic archaeology is presented in Italy.

However, the broader distribution of Palaeolithic material across Italian museums extends well beyond these well-documented cases, creating a complex and fragmented panorama that resists straightforward mapping. Exact information on the precise collections held by

institutions is not provided by statistical data. Museums housing Palaeolithic lithic collections may be identified based on explicit institutional mandates and disciplinary logic, i.e., museums with “prehistoric” or “archaeological” in their official names or mission statements. From a historical perspective, however, it has been established that other types of disciplinary museums, such as geology museums, natural history museums, anthropology museums, and natural science university museums constitute Palaeolithic materials as well (*Ch. 3.2 above*). Moreover, a museum’s disciplinary classification provides no guarantee of actual holdings, as scope varies considerably. *Archaeological museums* may maintain chronologically comprehensive collections but may also focus exclusively on protohistoric or Classical periods, and *prehistoric museums* may sometimes not represent the Palaeolithic and focus exclusively on later periods, depending on the presence of finds in the territory being presented. Similarly, stone tool collections may be found in *historic museums* or in *local heritage museums* where materials of territorial significance are collected and conserved regardless of disciplinary boundaries. Other than verification through visit, published documentation such as catalogues, academic literature citations, and official excavation records may be consulted, as well as museum websites and databases.

The actual presence and extent of Palaeolithic holdings thus depend on multiple factors including institutional history, regional archaeological discoveries, collection development policies, and curatorial expertise; definitive assessment would require direct institutional consultation or comprehensive collection surveys outside the realm of national cultural statistics. For the current purposes, to understand that Palaeolithic materials in Italian museums exist across several configurational types is sufficient. The following characterisation synthesises documented practices and operational frameworks (legislation and institutional mandates) typical of each museum type, drawing on published institutional histories, museum documentation, and archaeological literature referencing collection contexts, most of which have already been discussed throughout this chapter. Where primary sources are limited, the synthesis incorporates insights from direct institutional engagement and professional knowledge of Italian museum practice developed through this research.

State museums

State museums represent the most formally structured component of the Italian museum system. They operate under direct oversight of the Ministry of Culture either autonomously or through the Directorate-General of Museums and follow standardised operational protocols under the Cultural Heritage and Landscape Code. These institutions are staffed by

civil servants, including archaeologists, conservators, and administrative personnel appointed through national competitive examinations (*concorsi pubblici*) (Cella & Pintucci, 2014). Funding derives from central government allocations, supplemented by ticketing revenue and occasional project-based grants. Palaeolithic collections within state museums generally originated through several mechanisms: systematic excavation campaigns conducted by state archaeological services (*Soprintendenze*), legal deposition following chance discoveries reported under cultural heritage protection laws (Celani, 2024), transfers from earlier state collections (including material from suppressed or reorganised institutions), and acquisitions from private collectors or estates purchased with public funds (Falcucci, 2022; Guidi, 2008; Lerario, 2012; Tarantini, 2014). Infrastructure varies considerably: major institutions such as the *Museo delle Civiltà* in Rome maintain dedicated prehistoric sections with climate-controlled storage, conservation laboratories, and research facilities, while smaller state museums may house prehistoric material within broader archaeological holdings with more limited specialist infrastructure. Curatorial capacity similarly ranges from dedicated prehistoric specialists to generalist archaeologists managing chronologically diverse collections.

Civic (municipal) museums

Beyond major national and regional institutions, Italy's museum landscape includes numerous smaller, locally focused museums that often house significant Palaeolithic collections, despite their modest scale, serving as repositories for regionally specific prehistoric sequences. Civic museums that combine disciplines to represent territorial significance frequently maintain Palaeolithic collections (Cova, 2010, 2014; Falcucci, 2022; Pignocchi, 2014).

Civic museums (*musei civici*) operate under municipal governance, with administrative and financial structures determined by local government. Staffing models vary significantly: larger urban museums may employ specialised archaeologists and conservators on permanent municipal contracts, while smaller provincial or rural institutions often rely on part-time directors, external consultants, or volunteers from local archaeological associations. Funding depends primarily on municipal budgets—inherently variable and vulnerable to local political and economic fluctuations—supplemented by regional cultural funding programmes and occasionally by local foundations or cultural associations. Collections typically form through local excavation projects (often collaborative ventures between municipalities, universities, and *Soprintendenze*), donations from local residents or

collectors, material from rescue excavations during urban development, and transfers from pre-existing communal collections, local learned societies, or educational institutions. The civic museum model reflects strong territorial identity—collections are generally restricted to material from the municipal territory or immediate surroundings, creating geographically bounded assemblages. Infrastructure ranges from purpose-built modern facilities with professional conservation and storage capacity to historic buildings adapted for museum use with limited environmental control or security. Many smaller civic museums operate with restricted opening hours due to staffing limitations, and collection accessibility for research purposes depends heavily on the presence or absence of trained curatorial personnel.

University museums and collections

University prehistoric collections exist primarily within academic departments—most commonly Earth Sciences, Biological and Geological Sciences, Cultural Heritage, or Archaeology departments—rather than as public-facing museums. These are managed by academic staff, research fellows, or doctoral students, with responsibilities often integrated into broader teaching and research duties rather than constituting dedicated curatorial positions. Funding derives from university operating budgets, research grants, and occasionally from specific endowments or donations. Collections form almost exclusively through academic excavation projects conducted by faculty and research teams, with material retained as reference collections, teaching resources, and ongoing research datasets (Benetti & Santacroce, 2019). Occasionally, historic collections assembled by earlier scholars are incorporated when chairs or departments are succeeded or reorganised. The history of Italian palaeontological and prehistoric research demonstrates the foundational role university collections played in disciplinary development (e.g., Di Patti, 2007; Sarti, 2010; Segre, 2001; Tarantini, 2014; Vai, 2002). Infrastructure is typically research-oriented: collections are housed in departmental storage facilities, laboratories, or dedicated repository spaces, with cataloguing systems designed for scholarly use rather than public interpretation. Environmental controls and conservation infrastructure vary widely depending on institutional resources and departmental priorities. Public accessibility is generally limited—these are working research collections rather than display-oriented institutions—though some universities maintain small exhibition spaces or have developed public-facing museum sections from historic collections. Documentation standards tend to be high where collections are actively used in research, but orphaned or legacy collections from defunct projects may lack systematic cataloguing.

Private and foundation museums

A smaller number of Palaeolithic collections are held by private institutions or foundations, operating outside public administrative structures. These include museums established by private collectors or their estates, foundations created to preserve and display specific collections, and institutions run by cultural or scientific associations. Governance structures vary: some operate as registered charitable foundations with boards of trustees, others as private enterprises, and some as associative organisations ([Barbati, 2017](#)). Staffing ranges from professional museum staff employed by well-resourced foundations to volunteer-run institutions dependent on enthusiast labour. Funding sources are diverse and often precarious: endowments from founding estates, private donations, membership fees from supporting associations, limited public grants for cultural activities, and earned income from admissions or educational programmes. Collections typically originate from the founding collector's assemblage—whether amateur discoveries, personal excavations (often predating modern regulatory frameworks), or acquisitions from earlier collectors ([Acidini, 2024](#); [Ranaldi, 2012](#)). Subsequent growth may occur through donations from other private collectors, occasional small-scale excavations if the institution has developed research capacity, or transfers from individuals or families unable to maintain private collections. Infrastructure quality is highly variable and directly dependent on financial resources: well-endowed foundations may maintain professional-standard facilities, while smaller private museums may operate in inadequate spaces with minimal conservation infrastructure. Legal status affects collection stability—privately owned collections may be sold or dispersed, while foundation-held material generally has greater protection, particularly if subject to cultural heritage constraints (*vincoli*) under current protective legislation ([Celani, 2024](#)).

Site/specialised museums

Site museums and/or specialised prehistoric institutions represent a distinct configurational type, established around specific archaeological contexts or thematic foci. These may operate under state, regional, municipal, or mixed governance models, but share a concentrated curatorial scope. Staffing typically includes site directors or curators, supported by conservation, education, and administrative personnel, though smaller site museums may have minimal permanent staff supplemented by seasonal workers during tourist periods. Funding derives from the governing authority (state, region, municipality) and is frequently supplemented by admission revenue, particularly at high-visibility sites. Collections are inherently circumscribed by institutional mandate: material derives almost exclusively from the associated site or closely related contexts within a defined territory. Acquisitions occur

through ongoing excavation and monitoring at the site, surface surveys in the surrounding area, and occasionally through recovery of previously excavated material held elsewhere that is repatriated or loaned to the site museum. Infrastructure is often purpose-built or adapted to integrate with the archaeological site itself, creating spatial relationships between in situ contexts and displayed collections. Storage and conservation facilities may be on-site or located separately, depending on space and resource availability. These institutions face particular challenges regarding collection growth—holdings are determined by archaeological potential of the site rather than active collecting policies—and sustainability, as smaller site museums may struggle with seasonal visitor fluctuations and limited catchment areas for local engagement.

4.

MATERIALS AND METHODS

4.1. Case study museums and *museum lithics*

This research examines lithic objects on display in museums. The term *museum lithics* designates neither lithics studied as archaeological materials nor museums examined as institutions generally, but rather the specific configuration where archaeological objects, curatorial practices, and institutional contexts intersect to produce particular forms of representation. Museum lithics thus constitute integrated analytical objects requiring examination of material composition (what objects are present and observable), representational frameworks (how collections are organised and interpreted), and institutional contexts (what contexts shape representational choices). Analysing museum lithics as situated objects where specialist knowledge meets public representation, and institutional practices mediate between archaeological understanding and visitor encounter, creating particular possibilities for public engagement with technological dimensions of material culture.

The research design centres on case study museums selected based on collection holdings and researcher access, visited between November 2023 and June 2024. Museum selection employed purposive sampling aimed at capturing maximum institutional diversity rather than achieving statistical representativeness. This approach aligns with established case study research principles (Flyvbjerg, 2006) and prioritises understanding processes and relationships over quantitative generalisation. While general museum numbers and archaeological museum counts are documented, no systematic survey appears to exist regarding the distribution, size, or research accessibility of Palaeolithic lithic collections across different institutional types. Moreover, the diversity of institutional contexts housing prehistoric materials underscores the complexity of defining *museums of prehistory* in the Italian context. Lithic collections are distributed across institutions with markedly different primary mandates and organisational structures. This institutional variety necessitates approaches that acknowledge the specific characteristics and priorities of individual museums rather than forcibly imposing uniform analytical frameworks.

The ten case study museums demonstrate considerable institutional diversity across multiple dimensions (Table 4.1). Geographically, they distribute across northern (Lombardia, Piemonte, Veneto, Emilia-Romagna), central (Lazio, Toscana), and southern (Molise, Puglia) Italy, representing eight of the twenty regions (Figure 4.1). This distribution reflects

mainly researcher access and practical constraints. Notwithstanding comprehensive geographic coverage remaining beyond current research scope, the selected institutions are sufficient for examining how material presence, museographic apparatus, and institutional contexts interact to shape lithic representation.

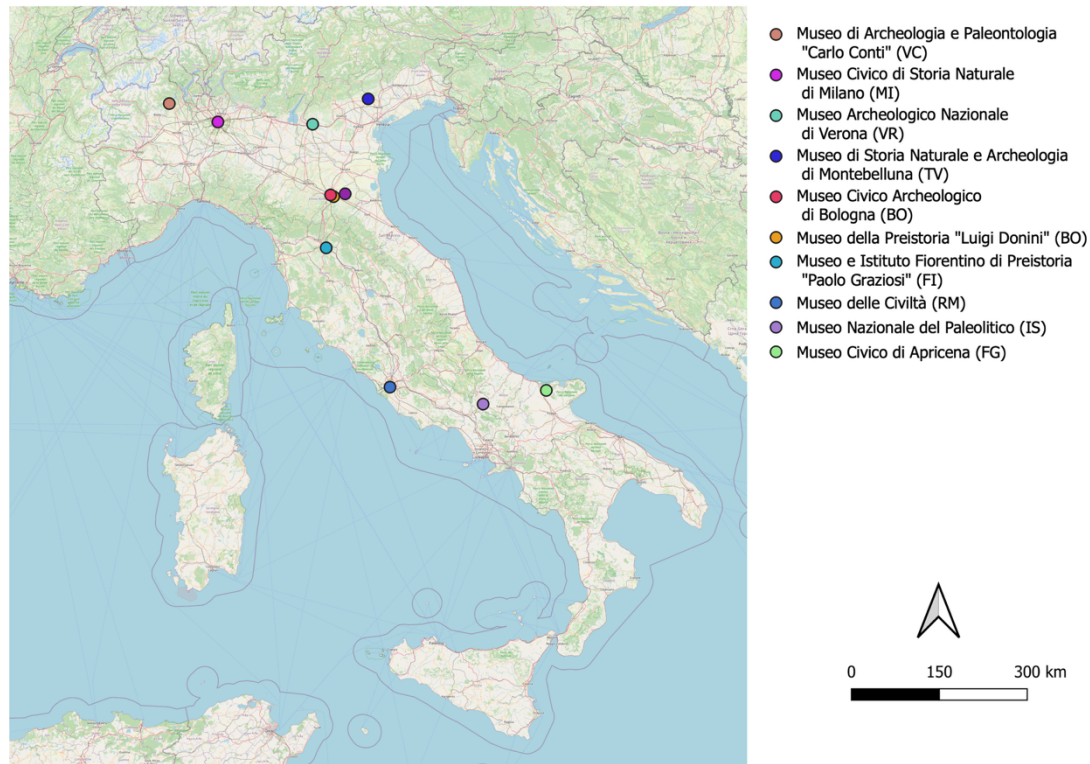


Figure 4.1. Case study museums, locations and geographic distribution.

Administratively, the institutions span state museums, university collections, private foundations, and municipal museums. State museums operate through two distinct models: autonomous and regionally managed. The Museo delle Civiltà was granted autonomous status by the same 2016 reform that created the museum complex by merging previously separate national museums and collections; this study focuses specifically on the Pigorini collections. Museums under regional directorates (Museo del Paleolitico, MAN Verona) follow standard state management through regional administrative structures but maintain the same state ownership and professional oversight. University and private foundation-affiliated museums, represented here only by the Graziosi Museum in Florence, operate through independent governance with institutional partnerships, enabling specialised scientific focus through multi-stakeholder oversight that brings together universities, municipalities, and archaeological authorities. It integrates research and teaching functions with student access and scholarly use, leveraging academic institutional resources for

collection development and maintenance. Municipal museums demonstrate the greatest administrative variety, from major civic institutions with substantial collections (Bologna, Milano) to smaller territorial museums emphasising community heritage (Donini, Montebelluna, Carlo Conti, Apricena), all sharing local government ownership and management with varying degrees of professional staffing and resources. These administrative structures reflect different institutional priorities and resource allocation methods, with state museums focusing on national archaeological significance, private foundations enabling collaborative scientific work, municipal institutions preserving territorial heritage with community-based models maximising local engagement within municipal frameworks, but not exclusively. This variety reflects the complex landscape of Italian museum governance and enables examination of how different organisational frameworks shape curatorial approaches and resource allocation.

Museum collections are organised around different subject areas and disciplinary approaches, spanning natural history, dedicated archaeological museums, and hybrid approaches combining multiple collection types. This distribution reflects how lithic materials circulate through different knowledge systems and interpretative traditions. Natural history museums maintain comprehensive collections spanning multiple scientific disciplines from mineralogy to vertebrate zoology, typically organised by taxonomic or geological classification systems. Archaeological museums focus on human material culture from specific chronological periods in their respective geographic regions and sometimes beyond. The MAN Verona covers the Veronese territory from the Palaeolithic to the Iron Age, the Donini Museum covers the Bologna hills/gypsum area from the Palaeolithic through Roman times, and the Civic Museum of Bologna covers Bologna and its territory from prehistoric through Roman times but also features an important Egyptian civilisation collection. Several institutions demonstrate hybrid approaches. Montebelluna and Carlo Conti combine natural history with archaeological collections, reflecting territorial approaches where local heritage encompasses both environmental and cultural history. The Pigorini Museum, apart from its prehistoric exhibit, maintains extensive ethnographic collections from Africa, Asia, and the Americas. The rich prehistoric collections of the Graziosi Museum also feature archaeological artefacts from international excavations. Site museums like those of Isernia and Carlo Conti are in close proximity to the archaeological sites presented in their collections. Isernia, specialised in the Palaeolithic, concentrates on the site of Isernia La Pineta, which is musealised and accessible through the museum, but it also features other archaeological sites in Molise, reflecting its regional administrative

scope. Carlo Conti, beyond the archaeological cave sites in its territory, promote natural karstic landscapes through other speleological activities. These collection profiles demonstrate considerable institutional diversity and reflect coverage and/or focus that considers collecting opportunities rather than predetermined disciplinary boundaries.

Foundation dates range from 1838 to 2022, representing nearly two centuries of Italian museum development and enabling observation of how institutional age and historical context influence current curatorial practice. Pre-1900 establishments (Milano Natural History 1838, Pigorini 1876, Bologna Civic Museum 1881) emerged during Italy's post-unification period when scientific institutions were consolidating national identity through cultural heritage, often building on earlier scholarly collections or filling gaps in emerging university and civic infrastructure. Twentieth century foundations (Graziosi 1946, Donini 1971, Montebelluna 1984, Isernia 1999/2001) reflect different motivations: Graziosi arose during post-war scientific reconstruction, while Donini, Montebelluna, and Isernia represent later 20th-century civic initiatives to preserve local heritage, often tied to significant archaeological discoveries or regional identity projects. The more recent establishments (Carlo Conti 2007, Apricena 2010, MAN Verona 2022) coincide not with archaeological discoveries being recent but with new opportunities to create formal institutions, or broader heritage tourism development agendas, often enabled by specific funding grants or infrastructure projects. The Carlo Conti Museum has been originally proposed in 1931, and MAN Verona's establishment has been anticipated since 1982.

Table 4.1. Museums selected for case study: institutional profiles and collection characteristics

	Museum Name	Location	Administrative type	Collection type	Foundation year
1	Museo delle Civiltà (former Museo “Luigi Pigorini”)	Rome (RM)	State (Autonomous)	Ethnography/Archaeology	1876/2016
2	Museo Archeologico Nazionale di Verona	Verona (VR)	State (Regional Directorate)	Archaeology (Prehistoric-Roman)	2022
3	Museo Civico di Storia Naturale di Milano	Milan (MI)	Municipal	Natural History	1838
4	Museo Civico Archeologico di Bologna	Bologna (BO)	Municipal	Archaeology	1881
5	Museo Nazionale del Paleolitico	Isernia (IS)	State (Regional Directorate)	Archaeology (esp. Palaeolithic)	1999/2001
6	Museo e Istituto Fiorentino di Preistoria “Paolo Graziosi”	Florence (FI)	Private Foundation (multi-institutional)	Archaeology (esp. Prehistoric)	1946/1975
7	Museo Civico di Storia Naturale e Archeologia di Montebelluna	Montebelluna (TV)	Municipal	Natural History/Archaeology	1984
8	Museo della Preistoria “Luigi Donini”	San Lazzaro di Savena (BO)	Municipal	Geology/Archaeology (esp. Prehistoric)	1970/2003
9	Museo di Archeologia e Paleontologia “Carlo Conti”	Borgosesia (VC)	Municipal	Archaeology/Palaeontology	2007
10	Museo Civico di Apricena	Apricena (FG)	Municipal	Archaeology/Local industrial heritage	2010

Significant limitations merit acknowledgement. The sample presented here, while capturing substantial institutional diversity, cannot represent all contexts within which Italian museum lithics operate. Notable geographic gaps include southern peninsular and insular regions, particular institutional types remain underrepresented, and certain museum scales or governance structures may not appear. These limitations preclude claims of statistical representativeness or comprehensive coverage. The research instead pursues analytical depth enabling identification of processes, relationships, and patterns transferable to broader museum contexts through theoretical understanding. Moreover, temporal constraints inherent to doctoral research limited both the number of institutions studied and the depth of institutional engagement possible. Extended ethnographic investigation within single museums, comprehensive staff interviews, or longitudinal observation of curatorial processes would enhance institutional understanding but exceeded available research time and resources. The resulting analysis necessarily represents particular moments in ongoing institutional processes rather than comprehensive developmental trajectories.

Despite these limitations, the methodological approach enables substantive engagement with the research objectives. The selected museums collectively demonstrate the range of contexts within which Italian Palaeolithic lithics achieve museum representation, from major national institutions defining authoritative archaeological narratives to small community museums serving territorial heritage preservation. The systematic documentation protocols allow comparable data across institutional contexts, while the integrated analytical framework enables examination of how material, museographic, and institutional dimensions interact.

4.2. Methodology: An interdisciplinary approach

In investigating museum lithic collections and exploring their potential for valorisation, the methodology draws on three complementary disciplines: prehistoric archaeology, anthropology of technology, and museology. The research object itself, lithic artefacts within museum contexts, exists at the intersection of past human behaviour, technological practice, and contemporary institutional interpretation. **Prehistoric archaeology** provides the analytical framework for understanding lithic artefacts in their systemic, prehistoric context. Through archaeological lithic analysis, it allows the reconstruction of past human behaviours and lifeways. **Anthropology of technology** offers a lens to examine the social, cognitive, and cultural aspects embedded in stone tool technology itself, highlighting the human dimensions of material culture. **Museology** situates the artefacts within their contemporary institutional context. It provides concepts and methods for understanding curatorial and public engagement contexts, addressing how collections are preserved, interpreted, and valorised. This perspective is crucial for understanding how lithic artefacts are currently framed, what interpretive challenges they present, and how their communicative potential might be enhanced. These approaches enable a holistic methodology that moves from understanding lithic artefacts as products of prehistoric human behaviour, to interpreting their technological and cultural significance, to evaluating and reimagining their role within museum practice. This integrated framework is therefore not only appropriate but necessary for addressing the research objective of revitalising public engagement with human origins through lithic collections.

The choice to focus on technology emerges from disciplinary considerations and the specific aims of this research. First, lithic technology constitutes a foundational domain of prehistoric archaeological inquiry (Bordes, 1961; Inizan et al., 1995/1999; Kuhn, 2020; Leroi-Gourhan, 1943, 1964; Pelegriin, 1990; Tixier et al., 1980). It therefore provides a robust body of specialist knowledge that can be mobilised for public communication. Second, a technological perspective offers a coherent analytical framework through which lithic representation can be examined across various museum institutions. Although museums organise lithic collections through diverse systems (chronological, typological, functional, aesthetic, cultural-historical, or site-based), technological information underpins all these interpretive modes. Using technology as a lens thus enables systematic comparison of how such information is selected, emphasised, or obscured in different display contexts. Third,

technological understanding holds particular potential for public valorisation by foregrounding lithics as material traces of human intelligence, skill, decision-making, and social organisation (Cresswell, 1976, 2003; Lemonnier, 1992; Mauss, 1935, 1947; Pfaffenberger, 1988)—ideations that can transform perception from “broken stones” and “old rocks” to evidence of human ingenuity and prehistoric heritage.

4.2.1. Lithic technology: From archaeological to museum contexts

This research develops an analytical approach to museum lithics, grounded in the concept of chaîne opératoire as a comprehensive framework for understanding lithic technology in museum contexts. In everyday usage, “technology” typically denotes material objects such as tools, machines, and devices; applied technical knowledge in fields like engineering and design; or, increasingly, modern digital innovations and computing systems. It has already been established that this common-sense understanding is fundamentally object-centric and often presentist, equating technology with particularly contemporary things (Bruun & Wahlberg, 2022). Archaeological perspectives on technology have evolved substantially across paradigmatic shifts in the discipline. Early archaeological engagement with lithic technology, particularly before the 1970s, centred on typological-descriptive approaches that conceptualised technology principally as tool types defined through morphological attributes (Bordes, 1961; Tixier, 1963). The analytical focus rested on classification, establishing chronological sequences, and attributing artefacts to cultural groups through comparative typology across assemblages and regions. Within this framework, tools were understood fundamentally as finished objects serving as classificatory units to organise material culture spatially and temporally. Culture-historical frameworks extended this typological thinking into broader interpretive schemes, treating industries, traditions, and technocomplexes as signatures of distinct peoples or archaeological cultures, with lithic assemblages serving primarily as ethnic or cultural identifiers (Childe, 1956; Clark, 1969). The processualist revolution of the 1970s and 1980s transformed lithic studies significantly. Functional-adaptive frameworks (Binford, 1973, 1979) reconceptualised technology as adaptive strategies responding to environmental and economic pressures. Analytical attention shifted toward tool function, subsistence optimisation, and ecological adaptation, with methodological innovations including systematic use-wear analysis (Keeley, 1980; Semenov, 1964) and experimental archaeology (Crabtree, 1972). Tools were reframed ontologically as functional solutions to adaptive problems, with technological variability

explained primarily through environmental constraints and subsistence needs. Concurrently, behavioural archaeology (Schiffer, 1976) approached technology as material correlates of human behaviour, emphasising formation processes, use-life sequences, and technological organisation through methods focusing on reduction intensity, curation studies, and raw material economy (Andrefsky, 1994). This framework positioned tools as records of behavioural choices and material management strategies, with assemblage variability reflecting adaptive decision-making within specific ecological and social contexts. More recent approaches since the 1990s have emphasised social dimensions of technology. Frameworks have emerged situating technology as socially constituted practice embedded in power relations, identity construction, and agency, with analytical foci including technological choices as social statements, gendered divisions of labour, and symbolic dimensions of material culture (Dobres, 2000; Dobres & Hoffman, 1994). Evolutionary approaches have framed technology through cultural transmission theory, treating technical traits as replicators subject to selection pressures, with research emphasising innovation rates, transmission fidelity, and cumulative cultural evolution (Lycett, 2015; Tostevin, 2012).

Archaeological frameworks for understanding lithic technology have developed primarily for analysing prehistoric material remains, directing analytical attention toward artefacts themselves, their attributes, assemblage contexts, and technological signatures. This analytical focus on past objects and behaviours has generated methods presupposing technical expertise: for example, specialised terminology (e.g., Inizan et al., 1995/1999; Pelegrin, 1990), experimental replication protocols (e.g., Dibble & Whittaker, 1981), and statistical approaches to attribute variation (e.g., Andrefsky, 2005; Shott, 1994; Tostevin, 2011). The primary epistemological aim centres on producing new knowledge about past technologies for specialist consumption through peer-reviewed publication, advancing disciplinary understanding and testing hypotheses about past behaviour. This research-oriented focus creates opportunity to extend archaeological knowledge into a complementary domain: understanding how specialist comprehension of technology appears in museum contexts. The analytical frameworks archaeologists employ to comprehend past technical practices provide reference points for examining contemporary representational practices. Questions that fall outside traditional archaeological analytical scope—how knowledge travels from excavation to exhibition, what transformations occur through institutional mediation, which frameworks museums employ to organise and interpret collections, what constraints shape curatorial choices, whether non-specialist audiences encounter technological insights that archaeologists consider fundamental—become central

concerns when archaeological expertise redirects toward museum analysis. The present study applies archaeological understanding developed for one purpose (i.e., comprehending past technologies through material analysis) to a different but complementary purpose (i.e., understanding contemporary representation of that knowledge through museum displays). This analytical engagement requires maintaining fidelity to archaeological understanding of technology while developing tools for understanding museum mediation of that knowledge. The chaîne opératoire concept provides the theoretical bridge enabling this focus, serving both as archaeological method for comprehending technology and as reference framework for understanding whether and how museums enable public encounter with technological dimensions that specialists recognise as fundamental.

The concept of chaîne opératoire emerged from French prehistoric archaeology and ethnology during the mid-twentieth century, representing a fundamental reconceptualisation of how technology should be understood and analysed (Pigeot, 2011; Soressi & Geneste, 2011). Rather than focusing on finished tool forms as classificatory endpoints, the approach directs analytical attention toward the total process of technical action—from raw material acquisition through production, use, maintenance, and eventual discard (Inizan et al., 1995/1999). The foundational theoretical articulation positioned chaîne opératoire within broader theories of human evolution, understood as consisting centrally of co-evolution among brain, hand, and technical gesture, with tools representing exteriorisation of biological functions or material extensions of human capacities (Leroi-Gourhan, 1964, 1993). It emerged as methodological apparatus for analysing how technical actions organise sequentially, how gestures embed within these sequences, and how material transformations materialise human intelligence and social organisation. Several foundational principles were established: first, that technology must be understood processually rather than as static objects; second, that technical actions possess structure, rhythm, and syntax; third, that operational sequences vary culturally, representing learned and transmitted technical traditions rather than universal or instinctive behaviours; fourth, that analysing sequential organisation reveals embedded cognitive and social dimensions of technical practice (Leroi-Gourhan, 1964, 1993; Pigeot, 1991, 2011).

Broader conceptualisations of chaîne opératoire through anthropological perspectives on technology and applying ethnographic engagement demonstrated that technical choices invariably involve social dimensions transcending narrow functional optimisation (Lemonnier, 1986, 1992). Technologies were shown to express cultural values, cosmological

principles, and social relations, with technical variability reflecting meaningful cultural choices rather than merely environmental constraints or random individual variations. Diverse case studies assembled in *technological choices* demonstrated that operational sequences, far from representing economically determined solutions to material problems, constitute arenas where social logic materialises through technical action (Lemonnier, 1992). Understanding why particular techniques are selected over alternatives requires analysing economic factors such as raw material availability, time investment, and mobility constraints, alongside social factors including gendered divisions of labour, access to knowledge, and specialist versus generalist production, as well as cultural factors encompassing aesthetic preferences, traditional practices, and symbolic associations (Lemonnier, 1992).

Cognitive dimensions of chaîne opératoire analysis emerged through attention to “mindful technology”—the practical intelligence and situated reasoning structuring technical action (Cresswell, 2003; Schlanger, 2001). Particular emphasis was placed on distinguishing *savoir-faire* (embodied know-how, practical competence) from *savoir* (propositional knowledge, explicit principles), noting that much technical knowledge resists verbalisation yet demonstrates sophisticated understanding of materials, tools, gestures, and sequences. In this reading, chaîne opératoire analysis becomes a method for accessing cognition-in-practice, revealing how technical intelligence operates through embodied engagement with material transformations (Schlanger, 1994, 2006).

Systematic applications of chaîne opératoire specifically to prehistoric lithic analysis established methodological protocols for reconstructing reduction sequences, identifying diagnostic technical gestures from material traces, and analysing decision-making processes materialised in stone tool production (Bar Yosef & van Peer, 2009; Inizan et al., 1995/1999; Pelegrin, 1990, 2005; Pelegrin et al., 1988). Experimental work demonstrated how specific technical gestures—hard versus soft hammer percussion, direct versus indirect percussion, pressure flaking—leave distinctive material signatures enabling reconstruction of operational sequences from archaeological assemblages. This body of work demonstrated chaîne opératoire’s analytical power for Palaeolithic archaeology while establishing it as standard framework within lithic studies internationally (Boëda, 1995; Geneste, 1985; Soressi & Geneste, 2011).

4.2.2. Operationalising the technological framework for museum lithics

The significance and methodological power of *chaîne opératoire* derive from its comprehensive engagement with technology as a complex socio-technical phenomenon. As articulated in key theoretical statements by [Lemonnier \(1992\)](#), the framework provides “a way of breaking down and analysing the complexity of any action on matter” (p. 1). It reveals “the entire technical process from procurement of the raw material to discard of the tool” while simultaneously accessing “the social choices that are embodied in techniques” (p. 5). In this study, *chaîne opératoire* is employed not to reconstruct past technical practices, but as an analytical lens for examining lithic collections in museum contexts. Traditional archaeological *chaîne opératoire* analysis examines excavated assemblages from prehistoric sites. Its objective is to reconstruct past operational sequences and generate new archaeological knowledge. In contrast, a museum-focused application examines how lithic collections represent technological knowledge, and whether this representation allows non-specialist audiences to engage with past technical practices. The research objects comprise museum lithics as representational phenomena. Their meaning emerges from curatorial choices (which objects to include or exclude), spatial arrangements (what visitors see and how), interpretative frameworks, textual mediation (through labels and panels), visual strategies, and the broader institutional context shaping all these dimensions. Collections encountered are curated and selected rather than complete assemblages, observed through displays in fixed positions rather than through handling, and their institutional interpretation is analysed as constitutive of how museum lithics signify rather than as secondary context.

To enable systematic analysis, this framework is articulated through seven interconnected dimensions that synthesise its theoretical commitments: material engagement, sequential organisation and embodied practice, technical choices and contexts, social dimensions, variability and diversity, economic and adaptive embedding, and temporal dynamics. These dimensions provide a structured understanding of what technology *is* as a complex socio-technical phenomenon and, at the same time, enable systematic examination of how museum lithics convey these aspects to viewers. While *chaîne opératoire*’s defining conceptual innovation lies in reconceptualising technology as a sequential process rather than a finished product, the dimensions are presented in an order reflecting practical analytical requirements. Materials constitute what is empirically encountered first (both archaeologically and within the museum), enabling assessment of what sequential

understanding those materials permit or obscure. The dimensions remain profoundly interconnected, i.e., material properties shape possible sequences, sequences materialise through embodied practice, choices reflect material constraints, and so forth. The ordering serves organisational clarity rather than implying independence or strict causality.

Dimension 1: Material engagement

Material engagement and lithic properties constitute the foundational constraint shaping technological practice. Stone participates actively in technical processes (Dobres, 2000); lithic properties fundamentally determine available techniques: fine-grained, homogeneous flint enables thin, controlled flaking and formal tool production, while coarse-grained, heterogeneous quartzite resists fine flaking, necessitating thicker, more robust forms. Material contexts matter profoundly. Stone properties, including grain size, homogeneity, fracture quality, and thermal responsiveness constrain or enable particular techniques, with competent technical practice requiring responsive engagement with lithic variability encountered during procurement and reduction (Andrefsky, 1994). Successful knapping requires practical understanding of how stone fractures, comprehending relationships amongst platform angle, striking force, percussion material (hard hammer versus soft hammer), and resultant flake morphology. This understanding develops through embodied experience, materialising in consistent technical competence (Pelegriin, 1990, 2005). Knappers respond flexibly to material variability within nodules, unexpected flaws encountered during reduction sequences, or suboptimal stone quality requiring adjustment of operational choices mid-sequence. Such adaptive responses indicate material engagement that enable sequence continuation despite obstacles (Bamforth & Bleed, 1997). Thermal treatment or intentional heating to improve flaking quality by making stone more homogeneous, fracturing more predictably, and removing moisture represents particularly advanced material knowledge, demonstrating understanding that material properties can be manipulated through controlled transformation, essentially adding preparatory stages to operational sequences that enhance subsequent reduction possibilities (Brown et al., 2009; Domanski & Webb, 1992).

Dimension 2: Sequential organisation and embodied practice

The integration of sequential and embodied dimensions captures chaîne opératoire's fundamental insight about technology consisting of *making* processes. Technical action possesses internal organisation and syntax. Identifying specific operations involved in transforming raw materials into finished products and subsequently through use and discard

reveals that sequences possess hierarchical dependencies: certain operations must precede others, creating logical constraints on action ordering (Pelegrin, 1990). Sequences can be linear, where operations follow fixed order with limited variation, or arborescent, where multiple pathways and branching decision points exist depending on material properties, intended products, or situational contingencies (Boëda, 1995; Geneste, 1985). The distinction matters analytically because linear sequences indicate highly standardised, culturally transmitted operative schemes, while arborescent sequences suggest flexible, responsive technical practice adapting to circumstances. *Making* possesses temporal rhythms: intensive focused episodes versus intermittent casual production, rapid expedient knapping versus prolonged careful reduction. These reflect not only technical requirements (some operations demand sustained attention while others permit interruption) but also social contexts, activity schedules, and embodied experiences of making (Dobres, 2000). Sequential documentation represents the starting point, but the framework's analytical power emerges from examining what sequential organisation reveals about choices, contexts, social relations, and material engagements structuring technical practice.

Sequential operations do not execute themselves abstractly but materialise through embodied competence developed through sustained practice. Effective knapping requires precise, practised gestural sequences: controlled percussion at appropriate angle and force, coordinated core-hand-hammer positioning, rhythmic alternation for flaking (Nonaka et al., 2010; Pelegrin, 1990; Stout, 2002). These motor patterns become incorporated through repeated practice, eventually performing smoothly without conscious deliberation. Technical gestures leave distinctive material signatures. For example, hard hammer percussion produces thick flakes with pronounced bulbs and cortical platforms, soft hammer percussion enables thinner flakes with diffuse bulbs and prepared platforms, pressure flaking generates highly regular removals with characteristic terminations (Pelegrin, 1990, 2005). Reading these signatures enables reconstruction of gestural sequences from archaeological assemblages. Competent knappers develop perceptual sensitivity to subtle cues, seeing and feeling when core geometry permits productive striking, recognising platform angles enabling controlled removal. This perceptual skill develops through sustained engagement, enabling practitioners to perceive affordances invisible to novices. Much technical competence resists verbalisation, with knowledge residing in practised bodies and accessed through doing rather than articulated as explicit principles (Pelegrin, 2005). Analysis accesses this tacit dimension through examining material outcomes. Sequential organisation becomes legible through traces of embodied action materialised in stone.

Dimension 3: Technical choices and contexts

Understanding technology requires recognising that specific techniques are selected from available alternatives based on multiple interacting factors operating within the material and embodied constraints established above. Economic contexts, i.e., raw material availability, procurement costs, transport distances, time constraints, mobility patterns, and anticipated tool needs shape technique selection (Kuhn, 2020). Mobile foraging groups often invest in formal tool production enabling curation and transport, while residually stable groups may employ expedient strategies producing tools as immediately needed, differences reflecting broader subsistence-settlement organisation rather than arbitrary stylistic preference (Binford, 1979). Social contexts prove equally significant: who performs which technical activities, whether certain techniques are gendered, whether specialists produce particular tool types or production remains generalised across community members, how access to technical knowledge structures social relations (Dobres, 2000; Dobres & Hoffman, 1994). Technical choices often materialise social organisation and power relations. Cultural contexts further shape technique selection through aesthetic preferences, traditional practices, and symbolic associations. Functional equivalence frequently masks cultural variability. Multiple technical solutions may solve the same practical problem, with choices reflecting cultural values and transmitted traditions rather than optimisation alone (Lemonnier, 1986).

Technology materialises through choices emerging from multiple, interacting contextual factors. Diverse technical approaches reflect different configurations of economic, social, cultural, and material circumstances rather than convergence toward single “optimal” solutions. This theoretical commitment to understanding technology as socially embedded and contextually responsive practice provides safeguard against interpreting technological patterns as driving or determining human history independently of human agency and social context (technological determinism).

Dimension 4: Social dimensions

Social organisation of technical production emerges clearly through chaîne opératoire analysis, revealing technology as a fundamentally social phenomenon as opposed to isolated individual activity (Cresswell, 2003; Schlanger, 1991). Division of labour questions, as in who acquires raw materials, who knaps, who uses tools, who maintains or resharpsens them, find potential answers in evidence of differential access to materials, concentration of

production debris, or variable product quality indicating specialised versus generalised production, expertise or age-based participation patterns (Hildebrand, 2012; Pigeot, 1990), and/or gendered task divisions (Dobres, 1995; French, 2024; Frieman, 2024). Learning and transmission processes structure technical competence acquisition. Apprenticeship requires expert-novice interaction, observable archaeologically in spatial co-location of crude and refined products, concentrated knapping areas where teaching occurs, or progressive skill improvement over time (Pigeot, 2011; Roux & Bril, 2005; Stout, 2002). Demonstration-based learning differs from trial-and-error discovery, leaving different material signatures. Production contexts, or whether knapping occurs communally or individually, leave spatial signatures, with concentrated debris suggesting communal knapping episodes and dispersed patterns indicating individual household production. Even in mobile foraging societies, evidence occasionally suggests emerging craft specialisation, with standardised products, production site concentration, or distribution patterns indicating certain individuals or groups specialised in tool production for wider distribution (Kuhn, 2020). The social dimensions thus reveal that operational sequences exist not as individual cognitive schemas independently invented and executed but as socially transmitted, collectively maintained, and culturally meaningful practices structuring relationships, enabling knowledge transmission, and materialising community identities through shared technical traditions.

Dimension 5: Variability and diversity

Technical variability within and across assemblages receives close analytical attention, with diversity interpreted as revealing skill variation, contextual adaptation, cultural transmission patterns, and situational constraints. Assemblages frequently contain products demonstrating variable technical competence—crude, error-prone pieces alongside refined, technically “sophisticated” pieces—suggesting production by individuals with different skill levels, whether novices learning alongside experts, differential investment in practice, or contextual differences in effort expended (Pigeot, 1991). Technical approach often varies with circumstances, with expedient production (minimal investment, opportunistic material use, simple reduction) contrasting with formal production (systematic preparation, intensive reduction, careful finishing) in ways correlating with anticipated tool needs, mobility patterns, and raw material availability. Assemblages showing both strategies indicate flexible, contextually responsive technical repertoires. Variability patterns illuminate questions of cultural tradition versus innovation: diversity may reflect transmitted operative schemes, culturally standardised approaches, or individual innovation and experimentation. Standardisation suggests strong social learning and normative pressure; heterogeneity may

indicate weak transmission, rapid innovation, or aggregation of multiple learning lineages (Tostevin, 2012). Material limitations (poor quality stone, unexpected flaws), tool breakage requiring expedient replacement, or time pressure shape technical outcomes, with competent practitioners adapting pragmatically to circumstances (Bamforth & Bleed, 1997). This analytical attention to variability further reinforces the framework's resistance to technological determinism by demonstrating that technical practice encompasses diverse, adaptive responses to multiple factors.

Dimension 6: Economic and adaptive embedding

Operational sequences articulate with broader subsistence, mobility, and settlement systems rather than constituting isolated technical activities, integrating the material, embodied, social, and variable dimensions within functional lifeways. The timing of operational sequence execution reflects broader subsistence-settlement organisation structuring economic life. Sequences may execute seasonally in advance of need, anticipatorily before mobility events, or immediately as requirements arise, with these temporal patterns revealing how technical activities integrate within economic cycles. The spatial distribution of operational sequence stages across landscapes structures how technical activities unfold temporally and geographically. Primary reduction typically occurs at raw material sources to reduce transport costs, secondary reduction and tool finishing at residential bases, use and maintenance at task-specific locations, and final discard at consumption sites (Andrefsky, 2005; Bamforth & Bleed, 1997; Binford, 1979; Kuhn, 2020). This spatial organisation reveals technology as landscape-scale process rather than localised activity. Technological organisation reflects adaptive strategies: curation patterns respond to mobility constraints by favouring elaborate sequences producing maintainable, transportable tools; reduction intensity indicates material scarcity (exhaustive multi-stage sequences maximising raw material utility) or abundance (expedient minimal sequences discarding substantial unused potential); tool design and sequential investment anticipate use contexts and replacement schedules within subsistence rounds (Kuhn, 2020). How operational sequences articulate with mobility strategies, subsistence patterns, and settlement organisation reveals technology as integrated component of adaptive systems materialising economic decisions through sequential choices about investment, timing, and spatial organisation of *making*.

Dimension 7: Temporal dynamics

Technological persistence, change, and innovation across temporal scales illuminate cultural transmission processes and historical trajectories, revealing how operational sequences and

all the preceding dimensions unfold through time. Sequences can remain stable across long periods, indicating strong cultural transmission maintaining traditional sequential pathways through effective social learning and normative pressure perpetuating specific operational logics. Technical approaches change in response to various factors: environmental shifts altering raw material availability requiring sequential adjustments, population movements introducing new sequential traditions through contact and interaction, innovations emerging through experimentation with alternative operational pathways, changing selective pressures favouring different sequential strategies for adaptive reasons (Lycett, 2015; Tostevin, 2012). Conservatism and innovation coexist in complex ways, with some sequential domains showing remarkable persistence while others demonstrate rapid transformation. Core reduction strategies may remain stable while finishing sequences vary, or primary flaking may change while use-maintenance sequences persist. Understanding these patterns requires attention to transmission processes, or how sequential knowledge passes between generations, what mechanisms maintain or erode sequential traditions, how innovations in operational organisation spread or fail to spread across populations, what factors promote sequential standardisation versus diversification. Temporal analysis reveals that operational sequences themselves have histories, emerging, elaborating, simplifying, or disappearing through cultural processes operating across multiple timescales. The long-term archaeological record documents both remarkable sequential persistence (e.g., Acheulean sequences maintained across hundreds of thousands of years) and rapid transformation (e.g., Upper Palaeolithic sequential diversification), demonstrating that technology's temporal dynamics reflect complex interactions between cultural transmission, environmental change, demographic processes, and innovation dynamics.

Analytical framework: Applying *chaîne opératoire* to museum lithics

The dimensions constitute a framework developed specifically for analysing museum lithics while grounded in an archaeological understanding of technology. In archaeological analysis, lithic materials are examined directly to reconstruct past technological practice. In museum analysis, the same dimensions are examined through institutional mediation—that is, through the combined effects of assemblage composition, display apparatus, and interpretative materials (Table 4.2). The framework thus employs *chaîne opératoire* concepts to examine the representation and accessibility of technology within museum settings, rather than to reconstruct technological practice itself.

Table 4.2. Technological dimensions of lithic artefacts in archaeological versus in museum contexts

<i>Dimension</i>	<i>Archaeological lithic objects</i>	<i>Museum lithic objects</i>
1. Material engagement	Lithic properties, material-knapper interactions through attribute recording and experimental replication	Material properties accessible through specimen diversity, geological sourcing; visual and/or tactile examination
2. Sequential organisation and embodied practice	Reduction sequence reconstruction from lithic elements, technical gestures from technical attributes	Sequential information derived from different reduction stages present in collections, specimens representing stages within broader processes, reconstructed spatial relationships
3. Technical choices and contexts	Why particular techniques were selected given material, economic, social, cultural factors	Technical decisions readable through morphological and technological attributes preserved on objects, within environmental and spatial contexts
4. Social dimensions	Divisions of labour, learning processes, production organisation	Social organisation discernible through assemblage-level patterns of variability, standardisation, and diversity
5. Variability and diversity	Assemblage diversity as revealing skill differences, contextual adaptation, cultural transmission	Technological variability observable through range of specimens, reduction stages, and techniques present in collections
6. Economic and adaptive embedding	Technology within subsistence-settlement systems through curation studies, reduction intensity, raw material economy	Connections to subsistence systems, mobility patterns, and resource use established through integration with associated materials, site documentation, and environmental data available in museum contexts
7. Temporal dynamics	Technological persistence, change, innovation across time through diachronic comparison and transmission studies	Temporal patterns accessible through chronologically organised collections, comparative analysis across time periods, and diachronic assemblages

In synthesis, under this approach technology is treated as a complex, integrated system. More precisely: operational sequences (1) engage with materials (2) through embodied gestures, involving choices (3) shaped by economic, social, and cultural contexts, organised socially (4) through divisions of labour and knowledge transmission, producing variable outcomes (5) reflecting skill differences and contextual adaptation, embedded within lifeways (6) as components of adaptive systems, demonstrating temporal patterns (7) of persistence and change through cultural transmission and innovation. The framework's strength lies precisely in recognising these interconnections, understanding technology as integrated

phenomenon rather than collection of separate attributes. This comprehensive understanding provides the reference framework for the present study's analysis: understanding whether and how museum representation enables the public to encounter these multiple dimensions. These seven dimensions are also the basis for identifying the interpretive patterns and mechanisms that emerge later in the thesis.

Adopting technology as analytical focus requires explicit engagement with technological determinism—the problematic assumption that technical factors determine social, economic, or cultural outcomes, or that technological “progress” drives human history unidirectionally. The chaîne opératoire framework employed here explicitly counters such determinism through its core theoretical commitments. As will be further elaborated, adapted anthropological perspectives on technology emphasise an understanding of technology beyond artefacts and their material existence, origin, creation, and use, to include human bodies, skills, traditions, processes, and socio-technical systems (Bruun & Wahlberg, 2022).

4.2.3. Museology and mediating lithic technology

While prehistoric archaeology and the anthropology of technology provide the conceptual foundations for understanding lithic technology, as well as the analytical framework for examining its representation in museum contexts, museology offers the necessary perspective for understanding how such representation is institutionally produced. As museum theory has consistently emphasised, objects do not enter museums as neutral entities; they are transformed through processes of selection, classification, conservation, and display that reconstitute them as museum objects (Bennett, 1995; Hooper-Greenhill, 1992). These institutional practices mediate the technological knowledge embedded in the objects, determining what is visible, legible, and intelligible to the public.

In this study, museology is understood in a broad sense that incorporates the heritage perspectives that shape how museums construct authenticity, authority, and value. Heritage scholarship has shown that museum objects acquire meaning through institutional regimes of authenticity and authorised heritage discourse (Benjamin, 1968; Macdonald, 1998; Smith, 2006), as well as through conservation ethics that govern what forms of material intervention or access are permissible (Appelbaum, 2007; Pye, 2001). These perspectives illuminate how decisions about what counts as an “authentic” object, how it should be preserved, and what forms of mediation are considered legitimate directly influence the communicability of

technological knowledge. Likewise, work on digital heritage demonstrates that emerging technologies introduce new representational possibilities while simultaneously reproducing existing institutional assumptions about authority, realism, and evidential value (Cameron & Kenderdine, 2007; Huggett, 2020; Parry, 2007).

Museology also encompasses the interpretive and communicative dimensions of exhibition practice. Display traditions, including typological arrangements and diorama-based representational strategies, shape how prehistoric technologies are framed and understood (Conkey, 1997; Moser, 1992; Wonders, 1993). Visitor studies research highlights how attention, fatigue, object competition, and spatial design influence what visitors actually perceive and retain (Bitgood, 2013; Falk & Dierking, 2000; Hein, 1998). These insights are essential for understanding how technological dimensions may be emphasised, flattened, or rendered invisible through exhibition design, interpretive language, and spatial organisation.

Museology therefore directs attention to the ways in which lithic collections exist through the simultaneous interaction of material presence, their presentation within exhibitions, and the institutional contexts in which they are curated. The processes of acquisition, documentation, classification, conservation, exhibition design, narrative construction, and audience targeting all shape not only what is displayed but how it is communicated and understood. Technological dimensions do not simply “appear” in museum collections; they are enabled, structured, emphasised, marginalised, or obscured through curatorial decisions and institutional priorities.

Integrating museology into the framework thus allows the study to move beyond assessing whether technological dimensions are theoretically present, toward analysing how institutional conditions shape their visibility and communicability. It becomes possible to examine not only what technological knowledge is available in collections, but how museum structures facilitate or constrain its transmission to publics, revealing the role of museological and heritage practices in the valorisation of prehistoric collections.

4.3. Data collection and analysis

Data collection operationalises the interdisciplinary framework presented above, integrating perspectives from prehistoric archaeology, anthropology, and museology. Archaeological methods guide the examination of lithic assemblages, enabling systematic recording of material attributes, reduction sequences, and technological variability. Anthropological methods, in particular semi-structured key informant interviews (KII) with museum professionals, document curatorial practices, institutional knowledge, and social processes involved in the management and interpretation of lithic collections. Museological perspectives inform structured observation of exhibitions and display units, to assess how institutional and museographic choices shape the legibility of technological knowledge. By explicitly linking disciplinary approaches to different aspects of data collection, this study ensures that the empirical analysis is both conceptually grounded and methodologically transparent.

Documentation at each of the three scales (macro, meso, micro) employed standardised protocols ensuring comparable data while permitting narrative field notes capturing context-specific observations: photographic documentation of gallery views, display configurations, object arrangements, labels, diagrams, and interpretative materials; transcription of labels, panels, and interpretative texts capturing language, terminology, and framing approaches. Field notes also included reflexive observations about analytical assumptions potentially affecting observations, researcher positionality enabling certain observations while potentially biasing others, and contextual factors affecting documentation quality. Analysis occurred simultaneously with collection through application of the seven-dimension framework detailed above, documenting for each display unit which dimensions the assemblage composition enabled, how museography affected dimensional observability and interpretation, and patterns of alignment or tension amongst aspects.

4.3.1. Data collection

A. Macro level: Institutional context

Institutional-level documentation addressed organisational factors shaping curatorial possibilities. Data collection occurred through multiple sources depending on institutional

accessibility: published materials (exhibition catalogues, guidebooks, institutional histories, strategic plans, annual reports), digital resources (institutional websites, online collections databases, educational materials), direct observation (building architecture and condition, exhibition design quality, staffing patterns during visits, posted programmes and schedules), museum communications, noting research permissions and restrictions that affected data collection scope. Institutional profiles enabled understanding of how disciplinary traditions, resource configurations, audience profiles, and historical trajectories shaped what became materially and professionally feasible regarding lithic display and interpretation.

Organisational characteristics:

- *Institution type*: national, regional, local, university, site museum
- *Disciplinary framework*: archaeological museum, natural history museum, multidisciplinary institution
- *Scale indicators*: building size, collection extent, staff numbers where observable
- *Mission statements*: from websites, publications, displayed materials
- *Target audiences*: stated or inferable from programming, label language, exhibition design

Historical trajectory:

- *Display installation dates*: from labels, catalogues, institutional communications
- *Most recent updates or renovations*: observable through design consistency, technology integration
- *Exhibition age indicators*: design style, label production quality, multimedia technology vintage
- *Historical information about collections*: from catalogues, institutional histories, website content

Resource indicators:

- *Curatorial expertise*: credentials observable from labels, publications, website profiles
- *Educational programming*: guided tours, workshops, public lectures, school programmes—from schedules, websites, posted materials
- *Technological infrastructure*: multimedia capabilities, interactive elements, digital systems

- *Exhibition design quality*: professional production values, lighting systems, case construction, graphic design
- *Conservation facilities*: observable through building infrastructure, mentioned in materials

B. Meso level: Gallery/exhibition

Gallery-level documentation addressed exhibition-wide frameworks and interpretative strategies, examining how exhibitions structured lithic materials conceptually. At this level, organisational principles, narrative transcriptions, spatial characteristics, and everything related to curation were recorded.

Exhibition organisation:

- *Organisational principle*: Primary structuring logic (typological, chronological, functional, site-based, technological, thematic, aesthetic, cognitive-evolutionary, mixed approaches), explicit statement of principle (in introductory panels, guidebooks, labels), consistency of application across exhibition, hierarchical organisation where multiple principles operated.
- *Gallery structure*: Room sequence and circulation pattern (linear progression, open exploration, directed pathways), spatial hierarchy (entry galleries, central spaces, peripheral areas), lithic positioning within broader exhibition context (central to narrative, marginal illustrations, cognitive evolution evidence, economic indicators, cultural markers, technological demonstrations).
- *Narrative framework*: Overarching themes conveyed (technological evolution, cultural identity, human creativity, subsistence adaptation, cognitive development, chronological sequence), explicit narrative statements (in main panels, introductory texts, guidebooks), consistency of narrative across different galleries or sections, connections drawn between lithics and other materials.
- *Framing approaches*: Whether lithics presented as tools, symbols, cognitive evidence, economic indicators, or multiple framings; whether focus emphasised chronological placement, manufacturing techniques, functional applications, or cultural significance; whether lithics contextualised individually or within reconstructed behavioural, environmental, or social contexts.
- *Disciplinary framework*: Archaeological versus natural history versus anthropological approaches evident in organisational logic, terminology,

interpretative emphases; alignment with or divergence from current archaeological and museological thought.

Exhibition-wide interpretative apparatus:

- *Main interpretative panels:* Introductory texts structuring exhibition narrative (transcribed verbatim or extensively excerpted), section headers and thematic divisions, explanatory depth and accessibility, terminology employed (specialist versus accessible language), framing approaches (objects versus processes versus people).
- *Interpretation tools and techniques:* Objects, text panels, models, drawings, photographs, dioramas, tableaux, information sheets, guidebooks, worksheets; multimedia elements (audio guides, videos, documentaries), interactive displays (touchscreens, digital interfaces, augmented reality applications), hands-on elements (replica handling, tactile engagement opportunities); guided tours, lectures, workshops, educational programmes; website and virtual exhibition components.
- *Thematic organisation:* How interpretation structured knowledge across multiple display units, connections drawn between different galleries or sections, supplementary materials affecting whole exhibition (audio guides, gallery guides, educational booklets), coordination between physical display and digital content.

Gallery spatial configuration:

- *Physical layout:* Gallery dimensions and proportions, ceiling heights, natural versus artificial lighting, architectural features affecting display possibilities (windows, columns, alcoves), floor materials and circulation space.
- *Display unit distribution:* Number and types of display units (wall-mounted vitrines, freestanding cases, platforms, dioramas), spatial density (crowded versus generous spacing), arrangement patterns (symmetrical, clustered, linear progression), hierarchical positioning (prominent central cases, peripheral displays).
- *Visitor circulation:* Directed routes versus open exploration, entry and exit points, sightlines and visual connections across gallery, accessibility considerations (wheelchair access, viewing heights, rest areas), crowding and visitor flow patterns observed during visits.
- *Contextual relationships:* Lithic galleries' relationship to adjacent exhibitions (isolated prehistory section, integrated with natural history, positioned within broader

archaeological narrative, connected to ethnographic collections), thematic or chronological connections to other galleries.

C. Micro level: Display units

Display unit-level documentation employed comprehensive observation of lithic collection composition and museography.

Lithic Collection Composition

- *Lithic assemblage specimen types and quantities:* Raw materials (unworked nodules), cores (showing reduction stages), production elements (flakes, debris, finished/retouched tools), experimental replicas (modern knapping products), refitted pieces (demonstrating specific reduction events).
- *Typological characteristics:* Morphological diversity observable (range of tool forms), presence of diagnostic types, classification systems evident, consistency of typological attribution, accuracy of identifications where assessable.
- *Technological attributes:* Raw material types observable (flint, chert, quartzite, obsidian, other lithologies), material quality variation, knapping/reduction strategies evident (*façonnage, débitage*) and technological variation (multiple reduction strategies represented, single approach dominant), reduction intensity indicators (heavily worked versus minimally reduced), curation and maintenance (retouch presence and characteristics).
- *Preservation and presentation state:* Original specimens versus casts or replicas, restoration or reconstruction status, completeness (whole specimens, fragments, refitted pieces), patination or weathering patterns, post-depositional modification visible, mounting affecting preservation assessment.
- *Curatorial data observable:* Accession numbers visible, provenance information provided, acquisition dates or contexts mentioned, excavation contexts cited, collector information, historical collection significance.

Museographic Aspect

Physical infrastructure

- *Display type:* Wall-mounted vitrine, freestanding case, open platform, diorama, reconstruction, touchable display

- *Mounting systems*: Support types (pins, stands, platforms, transparent supports), mounting methods (adhesives, mechanical fasteners, custom mounts), what features mountings obscure, rotation possibilities enabling multiple surface observation, stability and conservation appropriateness of mounting.
- *Object positioning*: Orientation (horizontal, angled, vertical), spacing between specimens (isolated, grouped, touching), three-dimensional arrangement (flat display, stacked, layered), visual hierarchy (central placement, peripheral positioning).
- *Arrangement patterns*: Isolated specimens emphasising individual objects, typological groupings clustering similar forms, chronological sequences suggesting temporal progression, functional clusters connecting related activities, production sequences showing operational stages, site assemblages preserving contextual associations, technological groups demonstrating reduction strategies, comparative arrangements (raw materials beside finished tools, experimental replicas beside archaeological specimens).
- *Spatial density*: Objects per case affecting individual prominence, crowded displays versus generous spacing, hierarchical arrangement (featured specimens, supporting materials), democratic distribution treating all specimens equally.

Physical infrastructure documentation prioritised object positioning and arrangement patterns. Additional display characteristics (lighting conditions, background treatments, case materials) were noted but received less systematic attention.

Unit-specific interpretative materials

- *Object labels*: information categories documented (object nomenclature, typological designations, raw material identifications, provenience, chronological attributions, cultural affiliations, functional interpretations, production technique descriptions, technical choice discussions, use-life sequences, social contexts, symbolic meanings).
- *Label language characteristics*: Terminology employed (specialist technical language, accessible vocabulary, jargon-free explanations, multilingual presentations), sentence structure (simple declarative, complex subordinated, technical descriptions, narrative approaches), grammatical voice (active emphasising human agency, passive emphasising objects), framing approaches (finished products

as classificatory endpoints, processes of making as transformative sequences, human agents as skilled practitioners).

- *Interpretative depth*: Minimal identification (name and date only), moderate contextualisation (provenance and basic interpretation), extensive interpretation (detailed technological, functional, social, economic contexts), explanatory mechanisms (how production occurred, why choices made, what activities involved).
- *Case labels and panels*: Thematic titles, section introductions, explanatory texts (transcribed), narrative structures employed, connections drawn to other displays, questions posed to visitors, interpretative frameworks made explicit.
- *Graphics and diagrams*: Illustrations (line drawings, photographs, artistic reconstructions), diagrams (typological classifications, morphological variations, size comparisons), chaîne opératoire representations (reduction sequence diagrams, operational schematics, gestural illustrations showing knapping actions), maps (raw material sources, site distributions, territorial ranges), accuracy and clarity assessment, relationship to displayed objects, pedagogical effectiveness.
- *Multimedia elements*: Videos demonstrating knapping techniques, interactive touchscreens providing additional information, audio elements (ambient sound, explanatory narration), digital reconstructions (3D models, virtual manipulation), augmented reality applications, QR codes linking to online content, integration quality with physical display.

Supplementary elements

- *Experimental replicas*: Presence or absence, positioning relative to archaeological specimens (adjacent for comparison, separate display, integrated within sequence), labelling clarity (clearly identified as modern, explained as comparative materials), explanation of experimental purpose (demonstrating techniques, showing production sequences, enabling tactile engagement).
- *Comparative materials*: Modern tools providing functional analogues, ethnographic examples showing parallel technologies, alternative materials (bone, antler, metal) for technological comparison, contextual specimens (fauna indicating subsistence, environmental materials suggesting ecological contexts).
- *Contextual materials*: Site photographs showing excavation contexts or landscape settings, excavation documentation (field drawings, stratigraphic sections, spatial distributions), environmental reconstructions (palaeoecological information, climate

data, vegetation patterns), associated archaeological materials (fauna, botanical remains, features, structures).

D. Consultations

Where institutional access permitted, museum professional consultations supplemented observational documentation through semi-structured interviews with curators, directors, or

educators (Table 4.3; for further details, see APPENDIX B).

Co). Access to staff varied across institutions. Some museums facilitated extended conversations with multiple professionals; others permitted only brief informal exchanges during visits; with some it was not possible to have staff access beyond routine visitor services. Where interviews occurred, they provided valuable insight not fully apparent through observation alone. Interviews provided crucial context for understanding observational findings, revealing institutional factors shaping curatorial choices, decision-making processes, resource constraints affecting display possibilities, professional motivations informing interpretative approaches, and institutional perspectives on challenges and opportunities not only in lithic presentation but in overall museum operations. However, the core analytical framework relied on systematic observation across the three scales mentioned above, ensuring comparable data collection regardless of interview availability.

Table 4.3. Consultations/Interviews conducted

Museum	Role of interviewee	
Museo Archeologico Nazionale di Verona	Museum guide/Scientific mediator	Specialist in art history and archaeology; responsible for educational programming
Museo Nazionale del Paleolitico di Isernia	Director	Specialist in prehistory and zooarchaeology, museum curation, and heritage management
Museo e Istituto Fiorentino di Preistoria “Paolo Graziosi”	Director	Specialist in prehistory and lithic analysis; professor of Palethnology.

Museum	Role of interviewee	
Museo Civico di Storia Naturale e Archeologia di Montebelluna	Conservator archaeologist & Deputy director	Archaeologist and museum curator
Museo della Preistoria “Luigi Donini”	Director	Specialist in prehistory and archaeology, museum studies
Museo di Archeologia e Paleontologia “Carlo Conti”	Co-director & Conservator	Specialist in art history and heritage conservation
Museo Civico di Apricena	Staff in-charge	Administrative support in library and archives management and museum activities

Interviews were semi-structured, flexible in duration (45-60 minutes typically), and adapted to specific institutional contexts and professional roles. After routine introduction, context establishment, informed consent, and warm-up questions (interviewee introduction, professional background, institutional role), thematic question areas guided discussion while permitting organic conversation flow. Not all questions proved relevant to all contexts; protocols were modified based on museum type, interviewee role, and conversation development.

Institutional context. Museum mission and focus, target audiences and how these influence display choices, organisational structure and decision-making processes, institutional priorities and strategic directions, positioning within regional or national museum landscape.

Display design and decision-making. Role of prehistoric lithics within overall museum narrative and collections, design process for lithic displays (who involved, timeline, decision points), primary themes or messages displays aim to convey, criteria for artefact selection (visual appeal, rarity, representativeness, scientific significance, educational value), balance between technical detail and accessibility for general audiences, challenges or constraints faced (budgetary, spatial, conservation, interpretative, audience-related).

Interpretative strategies. Decisions about interpretative tools and techniques (why chosen, who decides, budget factors, effectiveness assessment), approaches to making technical information accessible, use of experimental archaeology or replicas, integration of multimedia or interactive elements, coordination between different interpretative layers (labels, graphics, programmes).

Visitor engagement. Observed visitor responses to lithic displays, patterns in engagement or interest, feedback mechanisms, adaptation of displays based on visitor input, differences in engagement across audience types (specialists, general public, school groups, tourists).

Valorisation approaches. Strategies for enhancing visibility and value of collections, specific events, programmes, or initiatives promoting lithics, digital valorisation efforts (social media, virtual exhibitions, online educational content), challenges in valorising lithics compared to other artefact categories, perceived public interest in prehistoric technology.

Collaboration and resources. Collaborations with archaeologists, researchers, or other institutions in display design, use of external resources (academic research, visitor feedback, professional networks), access to specialist expertise, training opportunities for museum staff, resource limitations affecting display quality or sophistication.

Professional reflection. Assessment of display effectiveness considering institutional mission, areas for improvement identified by professionals, satisfaction with current approaches, tensions between different institutional objectives (research, education, tourism, preservation).

Future directions. Plans for updating or modifying lithic displays, innovations or trends in museology potentially applicable to lithic presentation, ideal changes if resources were unlimited, evolving approaches to archaeological display, emerging technologies or techniques of interest.

4.3.2. Integrated analysis of museum lithics

Operational criteria for analysing technological dimensions were developed as an interpretive framework applied to data collected during fieldwork. These criteria operationalise the seven chaîne opératoire dimensions into specific analytical indicators on the three scales: material foundations (collection characteristics), museographic mediation (display arrangements and interpretation), and institutional influences (curatorial frameworks and organisational contexts) (**Table 4.4**). For each dimension, the criteria specify which material conditions, display features, and institutional factors shape dimensional accessibility. The framework provides systematic structure for interpreting how

each dimension manifests across documented museum contexts and what factors affected their accessibility.

Table 4.4. Operational criteria for analysing technological dimensions of museum lithic objects

<i>Dimension</i>	<i>Material foundations</i>	<i>Museographic mediation</i>	<i>Institutional influences</i>
1. Material engagement	Raw material diversity in collections; specimen availability for comparison	Viewing conditions; display enabling material examination; labelling of stone types and sources	Specialist expertise in raw materials; documentation practices
2. Sequential organisation	Cores,debitage, blanks, and tools present; completeness of reduction stages	Spatial arrangement showing sequences; process vs product emphasis; visual aids (diagrams, reconstructions)	Collecting focus on finished tools vs production debris; curatorial knowledge of technological approaches
3. Technical choices and contexts	Range of reduction strategies present; preservation of diagnostic attributes	Viewing conditions for technical details; comparative displays; interpretation of techniques and decisions	Technological expertise available; exhibition narratives incorporating technical analysis
4. Social dimensions	Assemblage size; range of skill levels represented; learning pieces and errors present	Selection of diverse vs perfect specimens; displays revealing assemblage patterns; interpretation connecting objects to makers	Typological vs technological collecting priorities; frameworks for interpreting variability
5. Variability and diversity	Morphological and technical variation present; atypical and expedient pieces included	Display space for diverse examples; presentation of variation as meaningful	Emphasis on diagnostic types vs flexible practice; classification approaches
6. Economic and adaptive embedding	Co-presence of lithics with faunal/botanical materials; contextual documentation	Spatial integration with other materials; site-based organisation; interpretation linking to subsistence/mobility	Disciplinary separation vs integration of material categories; multi-specialist collaboration
7. Temporal dynamics	Chronological breadth of collections; assemblages from multiple periods	Chronological display organisation; interpretation addressing change and continuity	Culture-historical vs processual exhibition frameworks; temporal coverage priorities

At the level of collection composition, the analysis examined which materials make each dimension observable. For example, material engagement requires raw material diversity and visible fracture properties; sequential organisation requires specimens representing different stages of reduction; social dimensions require variation in skill or production quality; technical choices require evidence of alternative strategies; variability requires specimens beyond finished tools; economic embedding requires indicators of curation or transport; and temporal dynamics require diachronic representation.

At the level of display conditions, the analysis assessed how curatorial strategies and interpretive design shaped the accessibility of each dimension. This included evaluating whether object positioning permitted recognition of relevant features; whether mounting systems obscured or revealed critical characteristics; whether spatial arrangements suggested meaningful relationships (e.g., production sequences, skill hierarchies, strategic alternatives, or temporal changes); and whether lighting, case design, or object density facilitated or hindered close observation.

At the level of interpretive mediation, the analysis examined how labels, diagrams, and multimedia structured understanding of the dimensions. This involved assessing the clarity and depth of label language, the extent to which terminology rendered technological concepts accessible, the framing of human agency (process versus product), and the explanatory value of diagrams or digital elements. The analysis also considered whether interpretive materials supported non-specialist comprehension of technological processes or reinforced simplified, typological, or static representations.

4.3.3. Pattern identification and synthesis

The integrated analysis conducted through the seven technological dimensions generates a large body of observations concerning how lithic technology is represented, emphasised, or obscured within museum contexts. While each dimension provides a focused analytical lens, the interpretive value of the framework emerges most clearly when these observations are examined relationally. Recurring tendencies, such as the consistent suppression of embodied practice, the privileging of typological form over technological process, or the institutional emphasis on authenticity and conservation, become visible only when patterns are traced across dimensions and across case studies.

This stage of the analysis therefore involves synthesising dimension-level findings into broader interpretive patterns. These patterns reflect the ways in which institutional, spatial, and representational conditions shape the visibility and intelligibility of technological knowledge. By examining how multiple dimensions are simultaneously affected by similar curatorial or institutional practices, it becomes possible to identify higher-order regularities that transcend individual displays or collections. These recurring regularities form the basis for the interpretive mechanisms developed in the study's analytical synthesis. The

mechanisms capturing the structural tendencies through which museum practice mediates, transforms, or constrains the technological knowledge embedded in lithic artefacts emerge from the dimensions. This synthesis enables the study to move from descriptive analysis toward explanatory interpretation, revealing how museum conditions shape the public encounter with prehistoric technology.

5.

RESULTS

5.1. Case study museums

This chapter presents the empirical findings from the systematic examination of Palaeolithic lithic displays across the ten Italian museums selected as case studies. Data collection operated at three spatial scales—institutional (macro), gallery/exhibition (meso), and display unit (micro)—and combined systematic observation protocols, photographic documentation, interpretative material analysis, bibliographic consultation, and, where possible, semi-structured interviews with museum professionals including directors, curators, and scientific mediators. The interviews provided critical insights into institutional decision-making processes, resource constraints, strategic priorities that contextualise observable display characteristics, as well as professional (and personal) experience in terms of public engagement. The analysis examined 1) lithic collection composition, 2) museographic apparatus and interpretative infrastructure, and 3) institutional contexts and operational frameworks, providing complementary perspectives on how museum lithics are constituted, mediated, and contextualised within Italian museum practice.

For ease of reference for the following sections, **Table 5.1** summarises the permanent exhibitions examined, their installation dates, organisational approaches to lithic displays, and collection scope. Lithic presentation reflects diverse temporal contexts. Recent renovations between 2022-2023 characterise several institutions (Museo delle Civiltà, MAN Verona, MSN Milano, Museo del Paleolitico). The rest maintaining permanent displays installed in earlier periods are either awaiting comprehensive reinstallation but are in the meantime employing incremental updates addressing accessibility, interpretation, or interactive elements (such as Graziosi and Donini Museums), or investing more in temporary exhibitions (Montebelluna Museum). Organisational approaches range from chronothematic frameworks to site-specific contextual displays reflecting the varied curatorial philosophies and institutional mandates. Collection scopes span from highly localised assemblages documenting specific sites to international comparative materials illustrating evolutionary narratives. Additional data on each of the ten museums are consultable in the Appendix.

Table 5.1. Overview of case study museums: exhibition structure, lithic display organization, and collection geographic scope

	Museum	Permanent exhibition/ section in focus	Since	Organisation of lithic displays	Scope of lithic collection
1	Museo delle Civiltà – former Museo “Luigi Pigorini” (RM)	Prehistory? Stories from the Anthropocene	2022	Chrono-thematic	Regional (Rome, Lazio and central Italy, beginning Lower Palaeolithic)
2	Museo Archeologico Nazionale di Verona (VR)	Prehistory & Protohistory	2022	Chrono-thematic; site-based within periods	Regional (Verona province and territory, beginning Middle Palaeolithic)
3	Museo Civico di Storia Naturale di Milano (MI)	Human evolution gallery: Traces	2023	Chrono-thematic; emphasis on cognitive evolution	International materials ⁴³
4	Museo Civico Archeologico di Bologna (BO)	Prehistory (Bologna)	2007	Chrono-typological	Local/regional (Bologna territory, beginning Lower Palaeolithic)
5	Museo Nazionale del Paleolitico (IS)	Isernia La Pineta room; Prehistory in Molise	2023	Site-based; regional chrono-typological; thematic highlights	Local/regional (Molise with focus on Isernia La Pineta)
6	Museo e Istituto Fiorentino di Preistoria “Paolo Graziosi” (FI)	Prehistory (Italy)	1998–	Chrono-typological	Italian sites and some international examples (especially within the region of Toscana and African stone tools, beginning Lower Palaeolithic)
7	Museo Civico di Storia Naturale e Archeologia di Montebelluna (TV)	Prehistory (Montebelluna)	1984–	Chrono-typological	Local (Montebelluna and territory, beginning Middle Palaeolithic)
8	Museo della Preistoria “Luigi Donini” (BO)	First humans/“Primi uomini”	2003	Chrono-thematic; typological-geographic	Local/regional (San Lazzaro di Savena & Bologna appenine hills territory)
9	Museo di Archeologia e Paleontologia “Carlo Conti” (VC)	Prehistory	2007–	Site-based; thematic	Local (Valsesia/Monte Fenera cave sites, beginning Middle Palaeolithic)
10	Museo Civico di Apricena (FG)	Pirro Nord gallery	2017	Site-based; emphasis on site formation, excavation, and discovery processes	Local (Pirro Nord, Lower Palaeolithic)

⁴³ The museum lithic collection from the Milan exhibit is comprised of archaeological specimens from various African and European sites, as well as replicas integrated in the palaeoanthropological displays.

5.2. Museum lithics: Material foundations

Material presence constitutes the foundational aspect determining what museum lithics *are*. The lithic collections—which specimen types appear, in what quantities and configurations, and what supplementary materials accompany them—establish the material baseline for subsequent analysis of how these materials are displayed, institutional contexts shaping their presentation, and what technological dimensions they make observable.

Museum lithic displays comprise various material elements derived from archaeological contexts, sometimes supplemented by modern experimental reproductions. While it is acknowledged that museums can only display material recovered from the archaeological contexts they represent, what is materially present or absent in displays nonetheless determines how visitors encounter and engage with stone tools within the museum setting, and therefore constitutes the basis for public understanding of lithic technology, irrespective of collection constraints.

Raw material nodules and knapping implements

Some museums explicitly address raw material diversity in displays, though this appears contingent on the archaeological context represented. In regions or periods where assemblages demonstrate significant lithological variation—multiple raw material types with different sources, qualities, or technological applications—museums incorporate raw material as an interpretive category. When present, it is common practice to provide labels identifying raw materials with geological source information for lithological varieties. Most local museums highlight varieties from regional sources, such as the Civic Museum in Bologna and Museo Donini presenting primarily sources from around the territory, and the MAN Verona and Montebelluna Museum with flint varieties in Veneto. In any case, unworked nodules rarely appear. Raw materials are more commonly deliberately represented through photographic panels showing geological outcrops or as separate geological/mineralogical specimens. Unworked nodules are rarely recovered from Palaeolithic sites in significant quantities anyway—they are more common at quarry/procurement sites which are less frequently excavated, and the recovery of unknapped stones vary depending on observed fieldwork protocols. Percussion tools such as hammerstones, organic hammers (antler, bone), and other knapping implements (e.g., anvils, punch) used in lithic production do appear, though infrequently and typically in

contexts explicitly focused on production processes and experimental archaeology (e.g., **Figure 5.1**; **Figure 5.14**).



Figure 5.1. MuCiv-Pigorini. Palaeolithic display case. The captions read: 1) Different types of stones suitable for knapping (flint, limestone) and different forms (nodules, pebbles); 2) Experimental stone knapping; 3) Limestone tools (Lower Palaeolithic: Venosa, Basilicata; Ischitelia, Apulia); 4) Flint cores (Upper Palaeolithic: Polesini Grotto, Tivoli, Latium).

Cores

Cores appear regularly in museum displays. The category *core* encompasses objects with different technological interpretations, and their display frequency varies by chronological context. Shaped cores (produced through *façonnage*, where the core itself constitutes the intended tool, generally speaking—pebble industries, handaxes) function as typologically classifiable tools due to their morphological distinctiveness and predominate Lower Palaeolithic/early Middle Palaeolithic displays (e.g., **Figure 5.2**). Débitage cores (from which the detached flakes are the intended tools) show varied presence but generally present as *finished* morphological objects. Middle Palaeolithic displays frequently feature Levallois cores, with discoid cores also present. Upper Palaeolithic exhibitions include laminar cores (prismatic blade and bladelet cores). Lower Palaeolithic débitage cores (as distinct from shaped core-tools) appear less consistently.



Figure 5.2. Museo Donini. One of the main vitrines in the Prehistory section demonstrating different lithic elements from the Lower and Middle Palaeolithic of the Bologna Apennines.

Flakes and retouched tools

Complete, well-formed examples—Levallois flakes, blades, and other pieces exhibiting the standardised forms and typologically diagnostic features used in classification—feature prominently in displays. The types of blanks commonly displayed vary by period but are quite uniform among the museum samples. Lower Palaeolithic collections feature substantial quantities of large unretouched flakes. Material characteristics of displayed flakes include clear bulbs of percussion, readable dorsal scar patterns, and intact or partially intact butts. Complete or near-complete outlines predominate. In assemblages with substantial size ranges, flakes from the smaller end of the distribution appear systematically excluded from displays (so that the lithic collection seems to be standardised in size). Middle Palaeolithic displays accord special status to Levallois products that exhibit distinctive predetermined blank morphologies (**Figure 5.2**; **Figure 5.3**). Flakes produced from other knapping methods are also present (e.g., Discoid) but appear relatively less prominently (**Figure 5.4**). Retouched tools are highly visible in the displays when represented in the assemblage. Upper Palaeolithic displays generally privilege blades among other blanks and demonstrate most notably diverse retouched tool industries: side scrapers, endscrapers, burins, backed pieces, and microliths, for example (**Figure 5.5**). Bladelets and microblades also often appear in displays where relevant to assemblage character.



Figure 5.3. MAN Verona. Middle Palaeolithic display showing Levallois method, flakes, and retouched tools (Grotte di Fumane).



Figure 5.4. Museo Civico di Montebelluna. Display case showing artefacts from Montebelluna and territory, representing different lithic elements from the Middle Palaeolithic to the Mesolithic.



Figure 5.5. Museo delle Civiltà. Upper Palaeolithic display case showing retouched tools.

Patterns

For the case studies, consistent material selection criteria can be observed regardless of specificities and with only a few exceptions. Displayed pieces share observable physical characteristics: complete or largely complete outlines, minimal post-depositional alterations that allow for visibility of clear bulbs of percussion and readable dorsal scar patterns. Size operates as a criterion across all periods, with museums selecting from the larger end of assemblage size distributions. Where assemblages contain substantial size variation, smaller specimens appear systematically excluded; where assemblages consist entirely of small pieces, size ceases to operate as an exclusionary criterion. Where present and especially in more comprehensive collections (i.e., not typically within site-based museums), the most common objects are retouched tools. Scrapers, bifaces, burins, points, and other typologically classifiable implements constitute the majority of exhibited lithic material across museum contexts. Debitage blanks are also well represented in displays. Complete flakes, particularly blades and Levallois flakes appear frequently. Microliths, which despite their small size are typologically distinctive retouched tools and appear regularly in Upper Palaeolithic and Mesolithic displays, are well-represented. Cores are displayed mostly as shaped tools and relatively less frequently as representing débitage. When present, large and morphologically distinctive cores (particularly Levallois and blade cores) appear more frequently than fragmentary or exhausted examples.

The pattern creates a display assemblage heavily skewed towards completeness and relative size, morphological distinctiveness, and *finished* products. Systematic, complete, visually distinctive examples predominate over expedient, exhausted, fragmented, or ambiguous forms. Furthermore, the composition of collections reflects how displays generally organise around specific technological categories by period: Lower Palaeolithic collections centre on handaxes, Middle Palaeolithic collections emphasise Levallois products, and Upper Palaeolithic collections foreground blade and bladelet technologies, with some exceptions (at Isernia the Acheulean Lower Palaeolithic is represented by handaxe shaping and Levallois débitage, the Mousterian Middle Palaeolithic by Levallois and laminar débitage). Based on displays alone, it is unclear whether and to what extent the range of lithic elements present represents the archaeological assemblages and contexts from which they derive. Certain categories of lithic material present in excavated assemblages do not appear in museum displays. Debris or flakes and chips produced during core preparation, striking platform maintenance, and core rejuvenation are absent from displays. Other typical

conditions encountered in an archaeological assemblage such as products of knapping errors or lithics with post-depositional alterations are not represented.

Site-based museums presenting materials from single archaeological contexts operate under different constraints than regional or synthesis-focused institutions. Where assemblages are numerically limited—such as early Pleistocene sites with restricted recovery—museums display broader ranges of available material including smaller pieces and less diagnostic specimens that would be excluded from displays drawing on larger, more varied collections. The Pirro Nord assemblage at the Civic Museum of Apricena exemplifies this pattern: with small dimensions and limited overall assemblage size, the display includes the full-size range of recovered materials (**Figure 5.6**). This contrasts with displays representing abundant assemblages, where selection operates to exclude smaller specimens in favour of larger, more morphologically distinctive pieces. Site-focused displays thus materialise different selection logics, one more determined by inherent assemblage characteristics rather than by any other criteria.



Figure 5.6. Museo Civico di Apricena. Lithic collection from the site of Pirro Nord.

5.3. Museographic aspects

Museums employ diverse strategies for organising, displaying, and interpreting lithic collections. These museographic approaches, encompassing display technologies, spatial configurations, organisational principles, and interpretive apparatus, shape how the material aspects become accessible and comprehensible to viewers.

5.3.1. Exhibition strategies and organisational principles

The ten museums employ organisational frameworks that structure how lithic materials are spatially arranged, grouped, and presented to visitors. Archaeological and history museums typically employ chronological organisation at the macro (museum) level—prehistoric galleries situated within broader sequences including protohistoric and historic periods. Natural history museums like MSN Milano organize at the macro level through disciplinary domains (geology, palaeontology, human evolution, biodiversity), with human evolution constituting one gallery among others. At MuCiv Rome, the prehistory section represents one museum within the larger Museo delle Civiltà complex, and alongside others like the ethnographic museum and that of popular arts and traditions, does not necessarily fall within a chronological framework.

At the meso (exhibition) level, moreover, chrono-thematic organisation dominates across the sample (**Table 5.2**). Four museums (MuCiv, MSN Milan, MAN Verona, and Donini) employ chronological progression integrated with thematic frameworks as their primary organising logic. Isernia and Carlo Conti employ chrono-thematic organisation with site-based focus, centring displays on specific archaeological sites while maintaining chronological and thematic frameworks. Graziosi, Montebelluna, and Bologna employ chrono-typological organisation with straightforward temporal progression and typological grouping within periods. The Civic Museum of Apricena employs site-based organisation focused on archaeological site formation, excavation, and discovery processes.

Table 5.2. Exhibition organisational frameworks across case study museums

Framework	Primary characteristics	Museum	Additional characteristics
Chrono-thematic	Chronological progression integrated with interpretive themes	MuCiv	Anthropocene themes
		MSN Milan	Human evolution/cognitive evolution themes
		MAN Verona	Site-based grouping within periods
		Donini	Typological-geographic grouping within periods
Chrono-thematic (site-based focus)	Chronological progression with thematic framing centred on specific site(s)	Isernia	Site-based focus with thematic highlights; regional chronological gallery
		Carlo Conti	Thematic within Monte Fenere and Middle Palaeolithic focus
Chrono-typological	Chronological periods with typological grouping within temporal divisions	Graziosi, Montebelluna, Bologna	
Site-based	Site assemblage integrity with emphasis on excavation, discovery, and site formation	Apricena	Focus on investigative practice and stratigraphic context

Chrono-thematic

Chrono-thematic frameworks structure temporal progression through interpretive themes rather than simple chronological succession. This approach appears across museums with different institutional profiles, collection types, and interpretive objectives, suggesting widespread curatorial preference for thematic presentation even when maintaining chronological outlines.

MuCiv's *Prehistory? Stories from the Anthropocene* integrates chronological sequence with Anthropocene themes, situating prehistoric development within deep-time environmental relationships and contemporary concerns. Milano's *Traces* structures human evolution chronologically through four sections—*Who We Are*, *An African Bush*, *Out of Africa*, and *Homo sapiens*—with cognitive evolution themes particularly prominent in lithic presentations. The dedicated panel *Mano, gesto, utensile* (Hand, gesture, tool) and *Pietra scheggiata* (Knapped stone) address technological development within this evolutionary framework. Verona presents chronological progression through themes including *Birth of Art* (Middle Palaeolithic/early Upper Palaeolithic), *Last Hunter-Gatherers* (late Upper Palaeolithic/Mesolithic), and *World of the Dead* (Iron Age). Within these chrono-thematic divisions, materials are organised by site provenance—Middle Palaeolithic Grotta di Fumane materials appear separately from Upper Palaeolithic Grotta di Fumane and Riparo Tagliente materials, creating three-tier organisation: chronological period, thematic framing,

site-based grouping. Donini structures chronological progression from African origins through the *Long Palaeolithic* to Neolithic and Metal Ages, integrating thematic components including *A Day 200,000 Years Ago*. Within the Palaeolithic section, materials are organised typologically and geographically, creating layered organisation: chronological macro-structure, thematic presentations, typological-geographic grouping.

These chrono-thematic arrangements share chronological progression as temporal frame and at the same time employ themes to structure content within periods. The themes vary depending on the curatorial approach, human evolution and cognitive development (MSN Milan), Anthropocene environmental relationships (MuCiv), cultural achievements and adaptive strategies (MAN Verona). Material selection, spatial arrangement, and label content serve thematic objectives within clear temporal contexts.

Chrono-thematic with site-based focus

Museo del Paleolitico Isernia and Museo Carlo Conti employ chrono-thematic frameworks centred on specific archaeological sites, integrating site assemblages as primary exhibition content but while maintaining chronological and thematic organisational principles. Isernia's organisation combines intensive site presentation with regional chronological context. The La Pineta palaeosurface presents over 6,000 artefacts *in situ*, with adjacent cases highlighting thematic aspects—the *H. heidelbergensis* tooth and reconstruction, toolmaking, faunal assemblages and environments. A separate gallery presents regional Molise prehistory chronologically. The chrono-thematic framework operates both at the site level (thematic highlights within La Pineta materials) and regionally (presenting other sites in Molise). Carlo Conti Museum focuses on Monte Fenere cave materials organised with themes such as *The life of Neanderthals (economic and social aspects)*, *The Palaeolithic industries* (**Figure 5.7**), *Hunting and butchery*. This focus enables thematic organisation to function as the primary framework within the prehistoric exhibition, though the museum presents other materials chronologically across prehistoric periods.

Chrono-typological

Graziosi Museum and the Civic Museums of Montebelluna and Bologna (**Figure 5.8**) employ chrono-typological frameworks where chronological periods provide macro-structure, and typological grouping organises materials within temporal divisions. Materials are first separated into temporal units (Lower Palaeolithic, Middle Palaeolithic, Upper Palaeolithic), then grouped by morphological tool categories. Labels identify specimens by

typological designation, usually including site provenance and chronological attribution as secondary information. This organisational pattern produces spatial separation between morphologically similar specimens from different periods and between morphologically different specimens from the same period or site.

Site-based organisation

In the Civic Museum of Apricena, a site-based framework is employed. It foregrounds archaeological context and investigative practice, with lithic and faunal materials presented as typological or functional categories but also as components of documented stratigraphic sequences. The gallery's dedication to Pirro Nord reflects its significance as one of the oldest sites of human occupation in Europe so display logic necessarily emphasises content pertinent to this, such as archaeological evidence, stratigraphic integrity, and archaeological recovery methods. It is important, moreover, given the town context of Apricena, to highlight the difference and importance of archaeological excavation from quarrying—a distinction particularly relevant given that Pirro Nord is located within an active quarry and that quarrying constitutes a major local industry in Apricena. Such organisational framework then functions to present the archaeological importance of the site of Pirro Nord but also to clarify archaeological practice to local residents and visitors.



Figure 5.7. Museo Carlo Conti. Palaeolithic lithic display. Photo courtesy V. Gili (2023).



Figure 5.8. Museo Civico di Bologna. Lower and Middle Palaeolithic display cases demonstrating different lithic elements and Levallois variability.

Organisational implications

The organisational frameworks museums employ determine which materials appear together or separately, which relationships become spatially visible, and which classificatory or conceptual systems receive primary emphasis in both spatial arrangement and labelling. Chrono-thematic organisation foregrounds interpretive questions while maintaining temporal progression, with material selection and spatial arrangement serving thematic objectives. Chrono-thematic frameworks with site-based focus centre exhibitions on specific archaeological contexts while employing thematic structures. Chrono-typological organisation emphasizes morphological classification within temporal divisions. Site-based organisation answers to more specific objectives.

5.3.2. Interpretive strategies

Museums employ diverse interpretive frameworks that assign meaning to lithic objects within displays, positioning identical material forms within fundamentally different conceptual systems. A tool may function as typological exemplar within morphological classification schemes, as behavioural evidence within subsistence reconstructions, as cognitive proxy within evolutionary narratives, or as technological product within operational sequence demonstrations. These interpretive frameworks operate through spatial arrangement, thematic grouping, label content, and integration with supplementary materials

(fossils, faunal remains, graphic illustrations, experimental replicas). Individual specimens frequently participate in multiple interpretive systems simultaneously. The interpretive strategies museums deploy determine which material characteristics become salient, which relationships among objects become visible, and which meanings visitors construct from encounters with lithic collections.

Paleoanthropological associations: lithics as material culture

Exhibits with human evolution sections incorporate lithic materials in the displays associating stone tools with hominin fossil specimens to demonstrate the cultural materials corresponding to hominin taxa. For Graziosi, these displays appear in the introductory exhibition sections where different hominin species and their dispersals are presented (**Figure 5.9**). These are colour-coded displays which then have corresponding sections in the second hall where more comprehensive lithic collections organised by period are accessible. A similar arrangement is observed at Montebelluna (**Figure 5.10**).

In MSN Milan's exhibition, some lithic artefacts are also incorporated in the displays of hominin fossils. For example, associating Mode 1 (Oldowan) tools with early Homo and Mode 2 (Acheulean) materials with *H. ergaster*. Label content describes technological progression from "crude flakes and intentionally knapped pebbles" to "sophisticated bifacial technique," employing terminology that characterises technological advancement. While in these particular cases labels do not explicitly invoke cognitive evolution or increasing behavioural complexity, the paleoanthropological framework and progressive technological characterisation position lithics as evidence differentiating hominin capacities.



Figure 5.9. Museo Graziosi. Display case within the human evolution exhibit showing hominin fossils and their associated stone tools.



Figure 5.10. Museo Civico di Montebelluna. Display case within the human evolution exhibit showing hominin fossils and their associated stone tools.

Lithic technology and operational sequences

Certain displays employ interpretive strategies that present lithic reduction, materialising the processes that lithic artefacts represent. These approaches integrate archaeological materials with graphic representations to demonstrate sequential production stages, knapping gestures, and relationships between the different lithic elements.

The Museum of the Palaeolithic in Isernia demonstrate reduction sequences through combined use of archaeological pieces and schematic diagrams overlaid on display surfaces. Archaeological materials from prehistoric sites in Molise are displayed to exemplify

multiple reduction sequences, including handaxe shaping, Levallois production, and blade manufacture, employed in consistent display organisation. Text annotations identify specific technical operations involved in the production. Spatial arrangement reinforces illustrated sequences, positioning archaeological evidence of each reduction stage adjacent to corresponding schematic representations (**Figure 5.11**).

The Verona display of Epigravettian artefacts from Riparo Tagliente demonstrates technological relationships through spatial arrangement. The strategic positioning of cores adjacent to their characteristic products reinforces technological relationships between these elements, with the diagram providing sequential illustration of core-to-blade transformation and the knapping gestures involved (**Figure 5.12**). A separate Early Neolithic display presents an alternative approach through showing a refitted core. It exemplifies the transformation of a flint pebble into a core and the sequential production of flakes through successive detachments, creating direct visual connections between natural stone and knapping outcomes (**Figure 5.13**).



Figure 5.11. Museo del Paleolitico di Isernia. Display showing the process of Acheulean handaxe shaping using artefacts from Lower Palaeolithic sites in Molise.



Figure 5.12. MAN Verona. Epigravettian display showing technological relationships between cores and blade products through spatial arrangement and diagrams.



Figure 5.13. MAN Verona. Neolithic display case featuring a refitted flint core.

In *Traces* in Milan, the section dedicated to stone tools comprises a 3-part panel presented to demonstrate lithic technology (**Figure 5.14**). *Mano, gesto, utensile...* (Hand, Gesture, Tool) contains concepts on knapping, knapping techniques, and raw materials. It presents lithic production as requiring specific physical gestures, material knowledge, and technical control. By cataloguing distinct percussion techniques and linking raw material properties to fracture outcomes, the display frames knapping as technical practice requiring learned motor skills and understanding of material behaviour. *Pietra Scheggiata* (Knapped Stone) reinforces the importance of such artefacts as culturally significant technology requiring investigation through experimental methods in archaeology. By framing lithic production as conditional on environmental resources and functional needs, the text positions stone tool making as adaptive practice responsive to material availability and use requirements, which

can be understood and verified through experimental knapping. The associated display includes tools in different raw materials (flint, quartzite, obsidian, and even fossilised wood) from international sites, as well as knapping implements. *Utensili di pietra: Appunti di un percorso* presents lithic specimens arranged to show technological changes and increasing complexity through time. The display incorporates a vertical timeline indicating temporal progression and organises materials to demonstrate typological and technological diversity spanning different modes and periods. Specimens include archaeological materials from different European and African sites.



Figure 5.14. MSN Milan. Dedicated section to stone tool technology.

Not within specific displays but incorporated generally also are reduction sequence diagrams which appear in almost all museums, visualising operational sequences through illustrations. Less frequent but also present are visual aids to understand knapping gestures, depicting body positioning, percussion techniques, and tool support strategies.

Behavioural and subsistence contexts

Donini incorporates a life-scene reconstruction titled *Un giorno 200,000 anni fa* (A Day 200,000 years ago) presenting sculptural figures engaged in hunting and butchery activities (Figure 5.15). The diorama situates lithic tool use within reconstructed behavioural contexts, showing implements in relation to subsistence practices. Stone tools appear as functional components of past lifeways, integrated within broader reconstructions of Palaeolithic activities, human-animal interactions, and social dynamics.



Figure 5.15. Museo Donini. Stone tools placed in contextual reconstructions. a) “Un Giorno 200,000 anni fa” representing the use of stone tools in hunting and butchery activities; b) environmental reconstruction during the Pleistocene incorporated in a vitrine.

Cognitive and symbolic interpretations

MuCiv’s prehistory exhibit includes vitrines grouping lithic specimens under thematic headings. Materials appear classified as evidence for *complex and symbolic thinking* (Figure 5.16) in addition to as evidence with technological characteristics, morphological types, or of chronological periods as seen in other groupings in the same exhibit. Although no deliberate visual differences distinguish lithic artefacts in this vitrine from those elsewhere in the same exhibition, the interpretive framework confers meaning—positioning these objects as proxies for mental and cognitive aspects—through thematic classification and spatial arrangement.



Figure 5.16. Museo delle Civiltà. Stone tools displayed as manifestation of *complex and symbolic thinking*

Analytical methods and archaeological practice

Other than displays focused on technological processes, subsistence strategies, and cognitive aspects, certain museums employ interpretive strategies in lithic presentation that foreground archaeological and analytical methodologies, materialising the investigative practices through which lithic assemblages are studied and interpreted.

Isernia presents use-wear analysis through displays incorporating magnified photographs of lithic use traces (**Figure 5.17**). The central illustration depicting hands manipulating stone tools against what appears to be a large mammal long bone immediately establishes the functional context. The display shows actual specimens alongside enlarged images revealing microscopic traces. The integration of the magnifying glass system provides visitors with an accessible representation of microscopy in archaeological methodology. Interpretive content addresses how archaeologists study these traces to reconstruct tool functions and use patterns, explicating analytical methodologies rather than presenting archaeological interpretations as established facts, demonstrating the investigative processes through which functional inferences are derived from material evidence.



Figure 5.17. Museo del Paleolitico di Isernia. Display case featuring lithic use-wear analysis.

5.3.3. Display technologies and spatial arrangements

Vitrines and non-vitrine installations

Display apparatuses across the ten museums are generally standard although varying in spatial configurations and viewing accessibility. Glass case display technologies appear universally in the sample, reflecting standard conservation and security practices. Wall-mounted and freestanding vitrines are both common, regardless of exhibit age, but object placement and internal organisation create different conditions for viewing.

Display configurations varied across three parameters: display plane orientation (vertical, horizontal, angled), object mounting (2D/3D), and viewer access. Most museums combine vertical, horizontal, and angled orientations with flat and 3D mounting in one display case (Figure 5.2), also depending on the position of the vitrine itself. Freestanding vitrines sometimes function as double-sided cases, featuring opaque internal divisions so that independent display fields on both the front and back were created, allowing for space optimisation (e.g., Graziosi). Horizontal display surfaces regardless of vitrine type is the most common for 3D-mounting, although still utilised selectively (i.e., only for cores but not for all flakes, e.g., Figure 5.12). Fully transparent freestanding vitrines enable a volumetric presentation of objects, not only with 3D mounting on a horizontal plane but

even when they are flat mounted vertically (e.g., MuCiv; **Figure 5.5**). Moreover, viewer access did not correlate consistently with case structure. Freestanding cases in island placements as in MuCiv permits circumferential viewing as opposed to those positioned against a wall or a post (e.g., Apricena; **Figure 5.6**).

Other installations include dioramas and open displays, mostly for life-sized reconstructions, creating immersive contexts (Donini and Isernia are great examples for this). Where dioramas were also enclosed in vitrines together with objects, the scaled environments, as in other scenographic displays, remain visually prominent within exhibition spaces.

Generally speaking, denser arrangements per display case characterise older installations. In any case, however, most exhibition spaces employ multiple display configurations and strategies simultaneously to complement different scales and objectives. Museums sometimes keep or combine traditional infrastructure with updated interpretation, improving lighting and revising specimen arrangements within old cases, for example.

Label content patterns and terminologies

Label integration within cases varies from individual specimen labels (rare except in smaller collections) through small group labels (common) to case-level interpretive panels (frequent). Label positioning affects readability: labels placed beneath or adjacent to specimens (individual or grouped) permit immediate reference, as opposed to numbered specimens requiring cross-referencing to label lists.

Lithic-related terminology across the ten museums drew from a standard disciplinary vocabulary encompassing lithic element categories (cores, flakes, blades, débitage, etc.), reduction methods (bifacial, Levallois, discoid, laminar), typological classifications of industries and retouched tools (scrapers, burins, points), and associated Palaeolithic cultural attributions (Olduvaian, Acheulean, Mousterian, etc.) also matched with Clarkian lithic modes (1-5). No fundamental terminological differentiation emerged between institutions; variation appeared instead in the extent and depth of explanatory text accompanying this shared vocabulary.

Presentation strategies correlated with curatorial approach and installation age. Thematic exhibitions employed narrative frameworks with extended contextual explanations (e.g., Verona). Typology-based arrangements provided more systematic object identification with

emphasis on provenience data. Older installations (Donini, Graziosi) consistently foregrounded collection history and excavation attribution alongside chronological, geographic, and typological information. Information density also varied within single institutions. Hierarchical labelling strategies were observed, wherein minimal identifications for most specimens are available, moderate contextual labels for representative examples, and extended interpretive text reserved for featured objects demonstrating particular significance. Text-heavy primary display panels are generally avoided (also confirmed with interviews), but it is common for specialised museums (Isernia) and recent renovations to employ supplementary interpretive installations—thematic text panels, technological process explanations, methodological overviews—positioned as optional consultation resources. This stratified information architecture accommodates diverse visitor engagement levels without overwhelming primary object displays.

Visual interpretative aids and multimedia elements

Featuring visual and multimedia content, either to supplement traditional display or to present separate original content, is an increasingly common museum practice, also as a strategy to match the changing ways people consume information. Visual aids and multimedia elements potentially address limitations of static display and text-based interpretation, with museums employing diagrams, photographs, videos, interactive elements, and digital technologies to varying degrees and effectiveness.

The research identifies specific areas where lithic analytical methods intersect with museum practice. Digital documentation systems increasingly accommodate three-dimensional recording techniques familiar to lithic analysts, yet implementation remains uneven across institutions. Research access policies reveal ongoing tensions between collection preservation and the iterative nature of lithic studies, which often require repeated handling and examination of materials. Documentation of display strategies reveals the practical challenges institutions face when presenting lithic materials to public audiences. The data shows consistent patterns in how museums attempt to render technological complexity visible through various interpretive devices: experimental replicas, process demonstrations, microscopic imagery, and multimedia presentations. However, the effectiveness of these approaches varies considerably based on available resources, curatorial expertise, and institutional priorities. Storage and organisation systems across the surveyed museums demonstrate varying degrees of integration with contemporary lithic analytical frameworks. While some institutions have restructured their collections to facilitate technological studies

and comparative analysis, others maintain legacy systems that can impede research access and limit analytical potential. These organisational approaches directly influence how Palaeolithic collections function as active research resources versus historical repositories.

Tactile engagement

Graziosi, under their accessibility programming objectives, positioned cast reproductions of selected lithic materials incorporated in the human evolution section, available to touch (the vitrines can be opened when necessary; **Figure 5.9**). This enables haptic examination while maintaining archaeological originals within enclosed vitrines. These reproductions permitted experiencing the weight, texture, and ergonomic properties of artefacts, especially important for lithic tools.

Digital and multimedia technologies

Interactive touchscreen displays and multimedia installations constitute increasingly common non-vitrine technologies that enable dynamic content and visitor-controlled engagement, although so far in limited and specialised contexts. Isernia features an interactive display enabling detailed examination of a *Homo heidelbergensis* tooth through digital magnification and manipulation, as well as a multimedia station allowing visitors to explore archaeological surfaces through three-dimensional scans with touch-sensitive displays. MSN Milan's *Traces* exhibition also employs immersive spatial installations. More common are video installations featuring experimental knapping demonstrations, field excavations, archaeological methods in action. In MAN Verona, multimedia stations also provide access to digital reconstructions of sites and even games. It also features a dedicated room with wall-sized projections and virtual reality equipment.

Production quality and technical reliability vary substantially. For example, audio installations at Donini were non-functional during fieldwork documentation due to technical obsolescence, and technical malfunctions—non-responsive interfaces, frozen displays—if not complete inaccessibility due to museum operator not being around—also occurred in other institutions during fieldwork visits.

5.4. Institutional dynamics

The material foundations and museographic approaches examined emerge through institutional contexts shaping how lithic collections are developed, maintained, and presented. Interview findings reveal complex interactions between factors that systematically influence how museums approach lithic valorisation and museum functioning in general, such as historical trajectory (path dependency, acquisition history, prestige), organisational structure (autonomous vs dependent, funding logics, bureaucracy, disciplinary composition (staff training, authority hierarchies, marginalisation of prehistory), spatial/positional factors (urban centrality vs peripheral location, visitor flows, symbolic capital of place), and the type of publics reached. These institutional dynamics operate as active forces structuring what becomes materially possible, professionally legitimate, and institutionally sustainable regarding museum presentation.

Institutional scales

Scale categories based on collection size, geographic scope, and institutional capacity are included to understand different operational scales and research capacities within this museum sample, enabling comparison across administrative structures and revealing how historical collecting opportunities, territorial focus, and institutional development create varying scales of operation and public engagement regardless of governance type. These classifications reflect this study's assessments and are not official museum designations (**Table 5.3**). To understand the reasoning for placements that might not be immediately obvious, especially where administrative structure (municipal vs state) does not align with operational scale, or where institutional character (research institute vs public museum) affects the classification, further clarifications are indicated accordingly.

Large-scale museums (Museo delle Civiltà, MSN Milano, Museo Civico Archeologico di Bologna) typically operate comprehensive collections serving broad research and public programming functions, medium museums focus on substantial specialised or regional collections with active research programmes, while small museums typically emphasise focused territorial heritage and community education. Furthermore, the categorisation contextualises how different administrative models support varying scales of cultural heritage management and research activity and demonstrate that municipal museums can achieve extensive collections comparable to state institutions while some state museums

maintain focused territorial mandates. In the sample here, notably, large museums appear across different administrative types (state autonomous, state not-autonomous, municipal), which suggests that institutional scale does not necessarily correlate with administrative level. Local civic museums like Milano and Bologna achieve major status through historical development and collection significance. In terms of operational parameters, large museums require specialised departments (e.g., conservation, research, administration, mediation), multiple curators for different collections, security staff, and technical support. They also operate in extended hours; tourist destinations are more demanding of accessibility, weekend operations, and special events. Large museums usually draw national/international audiences, school groups, and record high visitor numbers annually.

Medium-scale museums have the core professional staff with some specialisation, but departmental divisions are fewer, operating in regular institutional hours with some weekend/holiday access, attracting specialised interest groups but in steady visitor flow. Medium-scale institutions operate as regional hubs combining research and public engagement at more focused scales. The Museo Nazionale del Paleolitico (Isernia) functions as a purpose-built research and museum centre, maintaining medium-to-small sized professional staff (research, education, visitor services) with seasonal operational variations (~30-35 hours weekly). Annual visitation remains modest but steady (12-17k reported), reflecting specialised research audiences and regional educational programming. MAN Verona is a national museum, relatively new, and operating with regionally significant collections, maintaining professional curatorial and conservation staff serving ~32 hours weekly. The Museo Civico of Montebelluna is also a regional civic museum that maintains large collections and significant programming.

Small-scale museums (Museo Donini, Museo Graziosi, Museo Carlo Conti, Museo Civico of Apricena) are director-led with minimal staff (not necessarily specialised) and practice heavy reliance on volunteers or part-time workers. They operate in restricted schedules, usually a few hours a day a few days a week, if not on appointment basis, or have seasonal opening. Small museums have a more focused/specialised public and conduct dedicated events for local organisations and school groups, and niche tourism.

Table 5.3. Museum case studies - classification based on institutional scale

	Museum	Building/Collections	Opening Hours	Staff	Visitors/Audience	Classification
1	Museo delle Civiltà - “Luigi Pigorini” (Rome)	Huge building (part of a national museums complex) with ethnographic, prehistoric, and archaeological holdings of national and international significance.	~66 hrs/week Tue–Sun 08:00–19:00	Large (dozens; full curatorial, research, education, and admin staff).	National-level museum, wide domestic and international audience	Large
2	Museo Civico di Storia Naturale (Milan)	One of Italy’s oldest and largest natural history museums; multiple wings and permanent galleries; major collections in zoology, palaeontology, mineralogy, etc.	~39 hrs/week Tue–Sun 10:00–17:30	Large (broad curatorial, research and education staff).	Major city museum, steady attendance, popular with families and tourists	Large
3	Museo Civico Archeologico (Bologna)	Large historic civic museum in city centre, important archaeological collections (Etruscan, Egyptian, Roman).	~40–45 hrs/week Mixed weekly schedule, usually open most days	Large (municipal staff, conservators, education services).	Important cultural institution, high visitation for a city museum	Large
4	Museo Archeologico Nazionale (Verona)	National archaeological museum housed in a former convent/barracks; extensive regional collections.	~32 hrs/week Fri–Mon 10:00–18:00	Medium (national museum staff structure).	National museum, significant but regionally focused visitor numbers	Medium ⁴⁴
5	Museo Nazionale del Paleolitico (Isernia)	Purpose-built museum and site complex around the La Pineta Palaeolithic area; important research and educational role.	~30–35 hrs/week (seasonal variation)	Medium (research, education, and visitor staff).	Regional research museum; steady visitors (c. 12–17k annually reported)	Medium ⁴⁵
6	Museo di Storia Naturale e Archeologia (Montebelluna)	Provincial civic museum in converted villa; important natural history and archaeology collections of local scope; substantial temporary exhibit space	~25–30 hrs/week Tue–Fri afternoons, Sat/Sun longer (10–18)	Small (municipal staff with education/curation roles).	Regional audience; active school programmes, strong local, family visitor base	Medium ⁴⁶

⁴⁴ Despite being a national museum, its limited weekly hours, focused collections, and moderate tourist flow make it smaller in practice than big civic or natural history museums.

⁴⁵ Regional focus and visitor numbers too modest for large but collections and research role exceed small.

⁴⁶ The building is provincial in scale, but the importance of its natural history and archaeological collections, regular opening, and stronger visitor services and events for the public suggests a bigger scale compared to the small museums in this list.

	Museum	Building/Collections	Opening Hours	Staff	Visitors/Audience	Classification
7	Museo Fiorentino di Preistoria “Paolo Graziosi” (Florence)	Specialist prehistoric collections; modest exhibition area but significant research and lab work.	~10–12 hrs/week Mixed weekly slots: Mon afternoon, Tue/Thu, Sat mornings	Small (research-focused staff, minimal front-of-house).	Specialist/research audience; steady public outreach	Small ⁴⁷
8	Museo della Preistoria “Luigi Donini” (San Lazzaro)	Specialist prehistory museum in suburban villa; focused and relatively small but very important (esp. Palaeolithic) permanent collections	~10–12 hrs/week By reservation and limited public slots	Small (lean team with education and research support).	Mainly schools and researchers, modest general attendance	Small ⁴⁸
9	Museo Carlo Conti (Borgosesia)	Local archaeological/palaeontological museum with significant finds from Monte Fenera; housed in small civic building	~10–12 hrs/week Limited weekly schedule (2–3 days); usually by appointment	Small (small professional staff, highly dependent on volunteers and interns).	Local museum with mostly local and school audiences; occasional dedicated events	Small
10	Museo Civico (Apricena)	Small civic museum with four thematic sections (prehistory to Roman)	~10–15 hrs/week Typical municipal hours, part-week operation	Small (municipal staff, limited curators).	Low visitor turnout annually (<500); mostly school groups	Small

⁴⁷ Small in scale but is institutionally strong because of its history, disciplinary prominence, and university-latched structure.

⁴⁸ Substantial didactic role with schools in addition to research. Slightly larger than some micro-museums in this list but still lacks the scale of a medium museum.

Institutional scale patterns influence research accessibility (comprehensive comparative collections versus site-specific or regionally focused holdings), visitor engagement frameworks (broad national audiences versus specialised or community-based visitation), and heritage management structures (sustained national investment versus municipal or regional funding dependencies). Recognising these scalar differences provide insights on how prehistoric heritage curation operates across divergent institutional contexts, from nationally centralised repositories to locally sustained community heritage initiatives.

Historical and institutional legacy

Collection histories shape current display possibilities and institutional identities. Museums housing historic collections from pioneering archaeologists maintain institutional identities partially defined by founding acquisitions. Interview data revealed tensions between maintaining historic collection visibility and developing contemporary interpretive approaches. Moreover, infrastructural constraints from older buildings and exhibition cases also limit representation possibilities. Inherited infrastructure constraints such as historic buildings with fixed architectural features, traditional cases incompatible with contemporary mounting systems, gallery layouts reflecting outdated circulation patterns require huge works to change even if permitted. Renovation costs prove prohibitive for comprehensive updates. Interview data documented awareness of contemporary exhibition design possibilities constrained by implementation costs within historic buildings. Institutional identities tied to founding collections and historic missions create operational continuities and maintain organisational approaches reflecting those origins, although in the case of MSN Milan, updates in the exhibitions demonstrate capacity for substantial reinterpretation. Institutions founded emphasising regional territorial heritage (municipal museums) continue prioritising local materials and community connections. These historical patterns create institutional path dependencies influencing current practice—comprehensive reference collections maintain systematic presentation approaches, regionally focused institutions prioritise territorial heritage, historic buildings constrain physical adaptations—while providing institutional coherence and distinctive identities within Italian museum contexts.

Disciplinary expertise and orientations

All museums in the sample developed their exhibitions with specialist consultation during initial installation. Variation emerges in subsequent, ongoing management and interpretive updating, as well as general decision-making. Specialised museums like Donini and Isernia have professional staffing including archaeologists with Palaeolithic specialisation

maintaining active scholarly engagement. The latter also functions as a national centre for Palaeolithic research. Graziosi Museum, moreover, functions simultaneously as research centre and public museum, operating research laboratories, specialised library, and archives alongside exhibition spaces. Museums often have active research collaborations with universities, mostly for excavations but also for museum interventions, ensuring ongoing research integration and methodological currency. Bigger museum institutions such as National Archaeological Museums or combined Civic Natural History and Archaeology have more access to professional and disciplinary expertise that can be specialist or generalist coming from broader archaeological or natural history training. Smaller civic museums like Carlo Conti and Apricena tend to operate with limited staff. While initial installations are made possible by enhanced university collaboration, and continuous engagement is not completely inaccessible, Apricena's lack of dedicated personnel resulting to management by adjacent public library staff reflects in interpretive development possibilities as well as institutional priorities for public engagement. Innovation attempts also demonstrate institutional commitment to improved prehistoric interpretation despite resource constraints.

The documentation reveals consistent patterns across Italian institutions while highlighting significant variations in approach and effectiveness. Institutional identity profoundly influences how Palaeolithic lithics function within broader museum narratives, with natural history museums framing stone tools within evolutionary contexts and archaeological institutions emphasising regional prehistoric sequences. Technical accuracy correlates strongly with specialist involvement, whether through direct employment, academic partnerships, or ongoing research collaborations. Museums operating independently of specialist networks demonstrate higher rates of classification errors and outdated interpretive frameworks. Display innovation occurs primarily at institutions with dedicated prehistoric mandates or strong research partnerships. Traditional presentation methods persist at many civic and regional museums, reflecting resource constraints rather than curatorial preference. Educational effectiveness depends upon integration of specialist knowledge with public communication strategies, with the most successful examples combining technical accuracy with accessible interpretive frameworks that convey technological sophistication without overwhelming general audiences.

Resource allocation

Budget limitations profoundly shape lithic representation across institutions, with particularly severe constraints affecting smaller municipal museums and institutions without substantial state or university support. Interview data consistently revealed resource scarcity effects on interpretive possibilities. Conservation versus accessibility negotiations reveal institutional priorities when resources constrain comprehensive solutions. Museums consistently emphasised conservation as paramount, accepting accessibility limitations rather than compromising security or environmental control. Insurance requirements, professional standards, and ethical frameworks establish conservation parameters within which accessibility adaptations occur. This reflects legitimate professional obligations regarding irreplaceable cultural materials but creates systematic barriers to alternative display approaches potentially enhancing communication. Interpretive investment patterns demonstrate differential resource allocation. Interview data revealed competition for resources internally within the institution, between different functions and investments (e.g., conservation, research, public engagement), so it was necessary to prioritise among competing demands when budgets prove insufficient for comprehensive investment.

Geographic positioning

Central or peripheral positioning creates substantially different operational contexts. Museums in major cities (Rome, Milan, Bologna, Firenze, Verona) access large resident populations but more importantly substantial tourist flows, comprehensive transportation infrastructure, and established cultural institution networks. These conditions enable higher visitor numbers, diverse audience demographics, collaborative opportunities with other institutions, and visibility within national cultural frameworks. This positioning also generates intense competition for visitor attention among numerous cultural attractions, requirements to accommodate high visitor volumes, and institutional expectations for facilities comparable to other major museums. It is worth noting, however, that the location and accessibility of the Museo delle Civiltà in the EUR district take away from its positioning within the capital city. Museums in more peripheral or provincial positions (Isernia, Borgosesia, Apricena; Montebelluna and San Lazzaro di Savena to a lesser extent than the others) face contrasting operational conditions. These institutions typically attract fewer visitors, serve primarily regional audiences, and generally operate with more limited resources. However, data also reveal distinctive characteristics: closer community relationships, sustained engagement with local schools and organisations, authentic spatial associations with archaeological sites and prehistoric landscapes, and opportunities for

specialised programming. Site museum contexts present specific opportunities and constraints. Institutions associated with significant archaeological sites (Isernia with La Pineta, Carlo Conti with Ciota Ciara) maintain direct spatial connections to research contexts and prehistoric landscapes. Site positioning creates immediate material-context relationships, though may constrain broader comparative frameworks and reduce accessibility for audiences beyond dedicated archaeological or local tourism.

Tourist flows create operational pressures influencing institutional practices. Museums in major tourist circuits experience substantial seasonal variation in visitor numbers. Interview data documented adaptive programming: guided tours and educational activities during school year, individual access during tourist season when staff cannot accommodate groups. Tourism patterns create requirements for multilingual interpretation, accommodation of brief visit durations, and visual displays not requiring extended engagement—factors also influencing exhibition development.

Funding and policy frameworks

Resource constraints operate differently across institutional types. State museums operating within Ministry of Culture structures benefit from relatively stable funding but must satisfy bureaucratic requirements, reporting obligations, and policy priorities established centrally. These requirements create standardisation pressures while sometimes misaligning with local institutional needs. Museum professionals express frustrations with centralised decision-making not completely aligned with operational realities. Municipal institutions demonstrate greater flexibility but operate within limited budgets. Heritage legislation provides protective frameworks but also create operational challenges. Italian cultural heritage laws ensure collection preservation but are also noted to complicate research access and innovations in display approaches. The centralised approval processes required for major exhibition changes can delay curatorial responses to new research developments.

Recent PNRR (Piano Nazionale di Ripresa e Resilienza) investments in cultural heritage has created substantial opportunities alongside implementation challenges. Museums accessing PNRR funding for digital technology implementation described both excitement about new possibilities and concerns about sustainability. Multiple institutions noted that digitalisation funding supports initial hardware and software acquisition but provides insufficient resources for ongoing maintenance, content updates, and technical support. Interview data documented sustainability concerns regarding digital infrastructure developed through time-

limited funding programmes. Grant requirements at times shape programming toward fundable activities not necessarily responding to institutional missions.

A significant pattern emerging from institutional analysis involves museum mediators and external educators playing crucial roles in valorisation efforts. Museums like MuCiv and Isernia outsource public engagement and educational programming to specialised external organisations (selected via public tender following Italian public administration contracting requirements) who conduct guided tours, school programmes, family activities, and workshops. This outsourcing arrangement enables access to specialised pedagogical expertise, flexible staffing responding to seasonal demand variation, and professional educational programming without permanent salary commitments. Smaller museums like Donini employ project-based staffing models for educational programming, hiring personnel on fixed-term contracts contingent on external funding availability. These positions remain separate from permanent institutional staff, with employment duration and programme continuity dependent on successful grant acquisition and renewed funding cycles. Live mediation activities are highly appreciated by the public and acknowledged by the museum institution. Summer schools and community workshops represent important valorisation avenue distinct from but connected to permanent exhibitions. These activities create engagement opportunities unavailable through static displays, enabling hands-on experience, extended learning, and community building around prehistoric heritage. However, the reliance on external structures also creates sustainability concerns, as educational programming remains contingent on funding availability and contract renewal, with programme continuity uncertain across budgetary cycles.

Findings demonstrate that similar institutional contexts produce variable lithic representation depending on specific configurations of expertise, priorities, and strategic choices. This variation reveals spaces for intervention that do not require fundamental institutional restructuring. Strong curatorial vision, strategic resource deployment, innovative partnerships, and targeted professional development can enhance lithic representation within existing institutional contexts. The challenge involves identifying which interventions prove feasible within which institutional configurations rather than proposing universal solutions ignoring institutional diversity.

Reputational networks and collaborations

Museum networks, functioning mainly on regional/territorial scales (and sometimes University systems) enable collaboration, resource sharing, and professional development. Interview data emphasised benefits of such associations: shared training programmes, coordinated temporary exhibitions, collective marketing initiatives, and professional communities providing support and expertise exchange. These networks prove particularly valuable for smaller institutions in terms of publicity and exposure. However, network participation requires institutional capacity for sustained engagement. Smaller museums with limited staff face challenges maintaining active involvement in collaborative initiatives while also managing core operational responsibilities. Interview data revealed that network benefits accrue unevenly as institutions with dedicated staff for external relations are able to capitalise better on collaborative opportunities, while resource-constrained museums struggle to participate despite potential advantages. Furthermore, network structures influence institutional priorities and programming directions. Regional collaborative frameworks create incentives for thematically aligned exhibitions, standardised educational approaches, and coordinated interpretation facilitating visitor movement across network institutions. While this coordination enhances regional cultural tourism infrastructure, it may constrain individual institutional distinctiveness or discourage programming diverging from network consensus approaches.

5.5. Technological dimensions of museum lithics

The analysis applied the seven-dimension framework derived from *chaîne opératoire* (material engagement, sequential organisation, technical choices, social dimensions, variability and diversity, economic embedding, temporal dynamics) to assess which technological dimensions museum lithics render observable, interpreted, or invisible. For each museum examined, systematic assessment documented what materials enabled dimensional visibility, how physical display conditions affected observability, and how interpretative apparatus addressed or ignored technological understanding.

Dimension 1: Material engagement

Material engagement addresses how stone properties shape technological possibilities, how knappers select and manipulate different lithologies, and how material characteristics influence reduction strategies. Enabling this dimension requires both the presence of diverse raw materials and interpretive support that makes material–technology relationships intelligible.

Across the museums, this dimension achieved visibility primarily where institutions displayed raw materials alongside worked artefacts, allowing visitors to compare natural stone characteristics with technological outcomes. MuCiv and Isernia exemplify this approach: both present nodules, pebbles, and worked pieces in proximity, enabling direct observation of material variability and its technological implications. Milan’s lithics panel similarly highlights preferential raw material selection, explicitly linking lithology to knapping suitability. However, in most museums, raw materials were either absent or present but uninterpreted. Several institutions displayed a variety of stone types within their collections yet did not articulate how material properties influenced technological decisions. Unworked nodules were rarely shown, and when they were absent, interpretation seldom compensated by explaining how knappers recognised and selected suitable materials.

As a result, material engagement achieved partial visibility across the case studies: museums with diverse materials and comparative arrangements enabled some dimensional observation, but interpretation rarely developed systematic explanations of material–technology relationships. Where both raw materials and interpretive framing were lacking, the dimension remained effectively invisible, regardless of other curatorial strengths.

Dimension 2: Sequential organisation and embodied practice

Sequential organisation concerns how operational sequences unfold from raw material acquisition through core reduction and tool finishing, and how technological knowledge is enacted through embodied gestures. Enabling this dimension requires materials representing multiple stages of reduction, spatial arrangements that suggest temporal progression, and interpretation that foregrounds processes rather than products.

Across the museums, the idea of reduction sequences was widely acknowledged, yet the degree of sequential visibility varied significantly. Material presence alone proved insufficient: many institutions possessed artefacts that could document sequences, but display arrangements often obscured their operational relationships. Cores, flakes, and retouched tools were frequently shown together without explicit indication that they formed part of a technological process, or they were separated into typological categories that disrupted sequential coherence. Where only finished tools were displayed, sequential observation was materially impossible, though in some cases this reflected genuine limitations in the archaeological assemblage.

Interpretation played a decisive role. Museums that explicitly adopted a *chaîne opératoire* perspective, notably Isernia and, to a lesser extent, Verona, provided labels describing reduction stages, technical procedures, and the gestures involved. This process-oriented language made operational logic visible even when material sequences were incomplete. In contrast, museums that emphasised typology over process tended to render the dimension effectively invisible, even when their collections contained materials capable of illustrating sequences.

Sequential organisation achieved full visibility at Isernia, where convergent material sequences, spatial progression, and explicit interpretive framing aligned. Verona also demonstrated high visibility, though with less detail. In most other museums, sequential organisation remained partially visible: materials and arrangements offered potential insight, but limited interpretive support prevented visitors from recognising technological processes. Thus, the dimension's visibility depended not only on the presence of sequential materials but on the museum's willingness to frame lithic technology as a process rather than a set of finished forms.

Dimension 3: Technical choices and strategic decisions

Technical choices concern the intentional decision-making that structures technological practice: why knappers selected particular reduction strategies, how they adapted approaches to raw material constraints or functional requirements, and what factors influenced choices among alternative procedures. Observing this dimension requires both material evidence of strategic diversity and interpretive framing that foregrounds agency, contingency, and decision contexts rather than presenting technologies as fixed cultural traits.

Across the museums, technological diversity was generally well represented. With the exception of the site-focused Apricena museum, all institutions displayed assemblages containing multiple reduction strategies. Even chrono-typological arrangements, such as Bologna's Middle Palaeolithic displays, made variability visible through Levallois diversity and contrasting approaches within the same period. Graziosi's international collections and the human evolution exhibit similarly presented a broad range of strategies across time, while Montebelluna offered a smaller but still varied set of examples. However, material diversity alone proved insufficient: without interpretive support explaining why different strategies existed, visitors could observe variation but not understand its technological significance.

Interpretation varied considerably in how it framed agency. Some museums employed active constructions that emphasised decision-making, adaptability, and strategic reasoning. Others adopted more deterministic framings, presenting technologies as cultural givens or evolutionary stages, thereby minimising the role of choice. Most institutions used a mixed approach, occasionally acknowledging agency but primarily describing technologies as attributes of cultural periods. Addressing the reasons behind choices required contextual interpretation linking decisions to functional demands, resource availability, or mobility patterns, an interpretive layer that few museums developed systematically. Isernia offered occasional connections between technological strategies and site function or resource contexts. Museo Carlo Conti is a notable case: although its displays do not visually communicate strategic diversity, its text panels draw on detailed research from Ciota Ciara, where the assemblage clearly demonstrates decision-making processes.

Technical choices achieved strongest visibility at Isernia, where technological diversity, occasional contextual interpretation, and agency-focused language converged. Moderate

visibility characterised museums that presented diverse assemblages with intermittent references to choice. In many institutions, however, interpretive gaps dominated: technological diversity was present, but interpretation emphasised classification and cultural attribution rather than strategic reasoning. Museums with narrow technological ranges (Carlo Conti, Apricena) faced material constraints limiting observable diversity, though interpretation could still have addressed why specific strategies characterised those sites. Overall, the dimension's visibility depended on the combination of material diversity and interpretive willingness to frame technology as a field of choices rather than a sequence of predetermined forms.

Dimension 4: Social organisation and knowledge transmission

Social dimensions concern how technological knowledge was shared, learned, and maintained within communities: apprenticeship, collaborative production, skill variation, and the social contexts in which knapping was taught and transmitted. Observing this dimension requires either material evidence that hints at differential skill levels or learning contexts, or interpretive framing that situates technology within social relationships rather than treating it as an isolated technical act.

Across the museums, this dimension proved the most challenging to render visible. Material selection practices consistently favoured artefacts based on size and *recognisability*. As documented in Section 5.2, this reflects a broader curatorial preference for recognisable, aesthetically coherent specimens. Although study collections at sites such as Isernia undoubtedly contain variable-quality pieces, these rarely enter the exhibition space. In many cases, this is not simply a curatorial omission: identifying skill variation requires detailed technological analysis that is often absent from the archaeological knowledge base available to museums. Without explicit interpretive support or comparative assemblages, the material signatures of teaching, learning, or social differentiation (gender/age dynamics) remain difficult to communicate.

Interpretation addressing social dimensions remain rare. None of the surveyed museums systematically discussed apprenticeship, knowledge transmission, or social organisation of production. However, the Donini reconstruction of two Palaeolithic people butchering an animal is a good example. Occasional references also appeared in terms like *experts*, *communities*, and in MuCiv “Palaeolithic *civilisations*,” but systematic social interpretation

remained absent. Moreover, labels employing individualistic language reinforce impressions of technology as individual rather than social practice.

As a result, social organisation achieved minimal visibility across all museums (token mention at best). Material evidence capable of supporting this dimension existed in some collections but was not mobilised interpretively, while the speculative nature of prehistoric social reconstruction posed additional challenges. Traditional archaeological narratives emphasising typology and chronology further displaced social contexts. This consistent pattern across institutions of different scales and traditions suggests a broader structural difficulty: translating the inherently social nature of technological knowledge into museum representation requires interpretive strategies that extend beyond what is typically foregrounded in lithic displays.

Dimension 5: Variability and adaptation

Variability concerns the observable range and diversity of technological forms within assemblages: the spectrum of reduction techniques, the variety of tool types, and the differing levels of technological investment that reflect adaptation to raw materials, functional needs, and local contexts. Enabling this dimension requires displays that present a broad sample of technological forms and interpretive framing that explains what such diversity signifies.

Across the museums, technological variability was consistently well represented at the material level. All institutions displayed assemblages exhibiting internal diversity, though the degree to which this diversity was made meaningful varied. Bologna's Middle Palaeolithic collection demonstrates Levallois variability, showing diverse core preparation strategies, variable predetermined flake morphologies, and different reduction intensities within the Mousterian industry. The display presents multiple Levallois cores alongside varied products, making technological diversity directly observable. Verona displays technological range across Upper Palaeolithic materials from Fumane and Riparo Tagliente, showing blade production variability, diverse retouched tool types (endscrapers, burins, backed pieces), and microliths. Isernia presents variability throughout all the periods, with assemblages including both elaborate prepared core technologies (Levallois, handaxe shaping) and opportunistic flake production, heavy-duty tools and delicate retouched implements. Graziosi's international collections enable observation of geographic and temporal variability, presenting diverse lithologies, multiple reduction strategies, and tool

forms spanning African and European Palaeolithic traditions. Montebelluna and Donini display variability within regional assemblages, showing diverse lithic elements from cores through various flake types to retouched tools, demonstrating that even territorially focused collections exhibit substantial technological range. Even site-based museums with limited collections (Apricena) display broader ranges by necessity (lesser selection opportunities), though assemblage size constraints rather than curatorial philosophy drive this inclusivity.

Variability receives explicit visual presentation and achieves high visibility through material presence and display strategies. However, visibility remains primarily observational rather than interpretive. Museums make variability visible, but interpretation typically does not explain what variability signifies. Museums present diversity without addressing whether variation reflects functional specialisation, differential skill levels, raw material constraints, or contextual adaptation. Labels identify diverse types without explaining why assemblages show such variation. Within the displays, moreover, the variability is reduced with more samples shown as impressions of uniformity is produced in terms of scale. This contradicts assemblage realities where variable quality, expedient alongside elaborate technologies, and diverse reduction intensities typically characterise archaeological contexts. The display material selection pattern following regular and standardised criteria systematically obscures the technological flexibility and adaptive variability present in actual assemblages. The dimension achieves material and spatial visibility while lacking interpretive development addressing what technological variability reveals about prehistoric practice.

Dimension 6: Economic and adaptive embedding

Economic embedding addresses how stone tool technologies articulated with broader subsistence-settlement systems, resource procurement strategies, and environmental contexts. Unlike Dimension 3 (strategic choices about reduction techniques) or Dimension 5 (technological diversity within assemblages), this dimension examines connections between lithic technologies and adaptive systems—how tools enabled specific subsistence activities, how technological strategies related to mobility patterns and landscape use, and how stone tool production integrated with faunal exploitation and environmental conditions.

Across the museums, site- and territory-focused institutions provided the strongest material foundations for this dimension, through spatial connections to archaeological contexts and integration of lithic materials with faunal remains, environmental data, and site documentation. Isernia integrates lithics with substantial faunal assemblages from La Pineta,

particularly elephant remains, within palaeosurface displays and adjacent interpretive cases. The museum presents site stratigraphy, environmental reconstructions, and subsistence evidence alongside lithic materials. Carlo Conti situates lithics within cave occupation contexts at Ciota Ciara, presenting materials alongside environmental information about Monte Fenera karstic landscapes. Donini incorporates environmental reconstructions showing Pleistocene landscapes with lithic materials positioned within dioramas depicting hunting and butchery activities. Museums without site associations present lithics with minimal subsistence or environmental materials, as in Milano (due to curatorial theme), and Bologna and Graziosi where lithics are displayed primarily for chronological/typological categories.

Most museums provide functional identifications but without emphasis on how implements articulated with certain economic themes like how resource procurement patterns enabled raw material access, how tool curation or discard related to mobility strategies, or how technological investments connected to settlement duration or landscape use intensity—themes that are heavily addressed in archaeological research where applicable. Labels mentioning functions provide simple categorical identification rather than economic contextualisation, although such information can sometimes be found in text panels.

Economic dimension thus achieves very limited visibility across surveyed museums. Museums lacking site associations demonstrate near-total economic invisibility. Lithics appear as specimens for chronological placement, morphological classification, or evolutionary sequences but not as components of integrated adaptive systems. This reflects both material constraints—museums acquiring only lithics cannot integrate them with subsistence evidence they do not possess—and interpretive traditions emphasising frameworks that do not incorporate economic perspectives. Even where materials enabling economic interpretation to exist, systematic analysis addressing resource procurement, technological investment relative to settlement patterns, or tool production/use within documented subsistence activities remains rare.

Dimension 7: Temporal dynamics

Temporal dynamics address technological persistence and change across time, innovation patterns, tradition maintenance, and diachronic trajectories. It focuses on how technologies changed or persisted through time—what innovations emerged, how technological traditions maintained continuity, what patterns characterise transitions between periods, and how

temporal sequences reveal processes of technological development, replacement, or transformation.

Museums with comprehensive chronological coverage offered the strongest material foundations for temporal observation. Most of the museums in the sample present materials spanning Lower through at least Upper Palaeolithic, enabling observation of technological development across hundreds of thousands of years. Milano's stone tool section explicitly presents temporal progression from Mode 1 through Mode 5, organising materials chronologically to demonstrate technological elaboration. Verona and Montebelluna cover Middle through Upper Palaeolithic within Veronese territory, enabling regional temporal analysis across roughly 200,000 years. Museums with restricted temporal coverage include Carlo Conti (Middle Palaeolithic emphasis on Mousterian materials), and Apricena (Lower Palaeolithic Pirro Nord assemblage). These institutions materially constrain temporal observation as single-period or limited-range collections cannot demonstrate change patterns requiring comparative materials spanning temporal sequences, but interpretive frameworks help in contextualisation.

Chronological organisation plays a central role in structuring temporal visibility. Museums employing chrono-thematic or chrono-typological frameworks (documented in 5.3.1) position materials in temporal progression—visitors encounter Oldowan/Mode 1 materials, then Acheulean/Mode 2, Middle Palaeolithic prepared cores, Upper Palaeolithic blade technologies, observing technological elaboration through gallery sequences. This spatial progression makes temporal elaboration materially and visually accessible. However, simple chronological ordering can also imply linear, inevitable development, presenting technological change as a unidirectional march toward increasing complexity. Milano's organisation presents technological change as increasing complexity through modes, though label contents do not necessarily systematically analyse what drove transitions, how innovations emerged, or why certain technologies persisted while others disappeared. The vertical timeline and progressive arrangement enable observation of elaboration, but interpretation emphasises descriptive sequence rather than change processes.

Museums varied also in how they interpret technological change through time. Traditional frameworks present change as progressive development—technological “*perfezionamento*” (refinement), “*crescente complessità*” (increasing complexity), “*sviluppo*” (development)—suggesting linear advancement from crude to sophisticated technologies. This evolutionary

framing, while capturing genuine elaboration patterns oversimplifies temporal dynamics involving persistence of effective strategies alongside innovations, regional variation in adoption patterns, and contextual factors driving change. However, Bologna with its presentation of Levallois variability in late Lower Palaeolithic/Middle Palaeolithic, as well as Isernia with presenting early Levallois and early laminar débitage appearances in the archaeological record address continuity and transitions instead of abrupt changes.

Overall, temporal dynamics achieved moderate visibility in museums with comprehensive chronological coverage and spatially progressive organisation. Enabling observation of technological development through gallery sequences presenting successive periods make temporal change materially and spatially visible. However, visibility remains primarily observational, or better, change *is* visible but processes driving transformation receive limited interpretive development. Museums present temporal sequences as descriptive chronology, occasionally employing evolutionary progressivism emphasising advancement and certain considerations on contextual factors (environmental shifts, population movements, adaptive pressures), but systematic communication of innovation emergence, tradition maintenance, regional variation in change patterns, or prompting technological transformations remains rare.

5.6. Synthesis: Trends, patterns, divergences

The examination of Palaeolithic lithic displays across the ten Italian museums reveals systematic patterns in how collections are constituted, displayed, and interpreted, alongside significant institutional variations reflecting divergent curatorial philosophies, resource contexts, and disciplinary orientations. This section synthesises findings from material foundations, museographic aspects, institutional dynamics, and technological dimensional analysis to identify cross-museum patterns, disciplinary effects, resource correlations, and curatorial orientations shaping lithic representation.

5.6.1. Dimensional consensus and variation

Certain technological dimensions demonstrate similar treatment across institutions while others show high variation. Systematic patterns emerge revealing how technological visibility and invisibility operate through identifiable mechanisms and are not random institutional “failures.” The dimensional hierarchy reveals that visibility correlates with observability—dimensions manifesting through visual material properties (raw materials, chronological sequences) achieve baseline recognition, while dimensions requiring complex interpretation (social contexts, economic integration) require more rigorous and effective interpretive frameworks.

Material engagement achieves moderate visibility across most museums through diverse lithologies present in collections, though systematic interpretation of material-technology relationships remains rare regardless of institutional type. Museums possessing raw material diversity but also those lacking it both demonstrate interpretive gaps where material significance receives minimal explanation.

Sequential organisation shows high variation reflecting institutional commitment to process-oriented interpretation. Isernia achieves full visibility through explicit chaîne opératoire frameworks, spatial arrangements reinforcing progression, and process-oriented labels. Verona demonstrates substantial visibility through similar approaches. However, most museums demonstrate interpretive gaps despite possessing materials enabling sequential observation—typological organisation fragments observable relationships, creating systematic invisibility of reduction processes.

Technical choices achieve limited visibility across all museums. Even institutions displaying technologically diverse assemblages rarely develop systematic interpretation of decision-making contexts. Occasional agency-emphasising language appears but comprehensive analysis of strategic factors remains absent universally.

Social dimensions demonstrate systematic invisibility across the sample. No museum explicitly addresses apprenticeship, skill hierarchies, or collaborative production systematically. Material selection excludes specimens that could suggest learning processes. This consensus reflects shared curatorial practices privileging accomplished specimens, interpretive challenges addressing social contexts, and disciplinary frameworks emphasising typology over social analysis.

Variability achieves high visibility materially and spatially across most museums. Bologna, Verona, Isernia, Graziosi, Montebelluna, and Donini present substantial technological diversity through multiple specimen types and varied reduction strategies. However, interpretive development remains limited as museums make diversity observable without explaining significance, creating observational visibility lacking analytical depth.

Economic embedding shows near-universal minimal visibility. Site museums possess material foundations through faunal integration and environmental data but develop limited systematic economic analysis in the presentations. Museums lacking site associations demonstrate near-total economic invisibility, prioritising lithics as markers of other concepts (chronology, typology) but not of adaptive system components.

Temporal dynamics achieve high visibility in museums regardless of the selective interpretations that are promoted in the process. Chronological organisation enables observation of change through progressive gallery sequences, though interpretation emphasises descriptive succession or evolutionary progressivism rather than examining innovation processes, persistence patterns, transitions, or transformation drivers.

5.6.2. Disciplinary tradition effects

Disciplinary orientations systematically shape dimensional approaches across museums. Institutions with contemporary prehistoric archaeology frameworks (Isernia particularly,

updated Verona sections) demonstrate strongest sequential organisation visibility through explicit chaîne opératoire interpretation, process-oriented language, and spatial arrangements reinforcing operational sequences. These museums employ analytical frameworks current in specialist research, translating technological organisation concepts into public interpretation. Chrono-typological traditions within archaeological museums (Bologna, Graziosi) maintain morphological classification within temporal divisions. These museums achieve high variability visibility through presenting diverse tool types and reduction strategies but demonstrate systematic sequential organisation gaps—typological grouping fragments observable technological relationships despite materials enabling process observation. Bologna's Levallois variability display exemplifies this pattern: substantial diversity visible, spatial arrangement potentially enabling sequential interpretation, but labels emphasising typological identification.

Museums with natural history and palaeoanthropological orientations (Milano, elements of MuCiv) frame lithics within evolutionary contexts emphasising cognitive development and behavioural modernity. Milano's stone tool section positions technological progression as evidence of increasing complexity through Modes 1-5, employing terminology suggesting evolutionary advancement. This framework achieves strong temporal dynamics visibility through chronological organisation demonstrating elaboration patterns, though technical choices and sequential organisation receive less systematic development compared to process-oriented archaeological institutions. Moreover, as also seen in Graziosi's and Montebelluna's human evolution sections, lithics are associated with hominin taxa, positioning tools as material culture corresponding to fossil specimens. This approach achieves moderate material engagement visibility through diverse lithologies associated with different hominin species, and strong temporal dynamics through evolutionary sequences, but minimises sequential organisation and technical choices interpretation in favour of cognitive evolution narratives.

Community-oriented site museums (Apricena) emphasise archaeological practice demonstration and territorial heritage over technological analysis, achieving moderate temporal contextualisation but limited dimensional development beyond material presentation.

5.6.3. Resource correlations

Museum scale, specialist expertise, and infrastructure correlate variably with dimensional accessibility patterns, revealing that resources enable but do not necessarily determine interpretive outcomes.

Specialist expertise demonstrates strongest correlation with dimensional visibility. Isernia's status as national Palaeolithic research centre with active scholarly engagement enables chaîne opératoire interpretation, process-oriented framing, and systematic technological analysis absent from museums with different resources. Verona's collaboration with the universities that conduct the excavations in their territory provides access to current analytical frameworks reflected in 2022 installation's process orientation. However, specialist expertise is subject to curatorial decision-making and institutional commitments to public interpretation translation, as in Carlo Conti and Ciota Ciara research. This demonstrates that research knowledge requires deliberate curatorial effort to achieve public accessibility, and that curatorial decisions have priorities not necessarily focusing on certain valorisation aspects.

Institutional scale correlates weakly with most dimensions. Large museums achieve high variability and temporal dynamics visibility through comprehensive collections spanning periods and regions, enabling observation of diversity and change impossible for small site-focused institutions. However, scale does not predict sequential organisation or technical choices visibility. This pattern reveals that collection comprehensiveness enables certain dimensions (temporal, variability through diversity) but not process-oriented interpretation quality which is likely correlated to specialist focus and curatorial philosophy.

Infrastructure, resources, and budget limitations enable and correlate with interpretive investment patterns but do not determine dimensional outcomes uniformly. Recent installations with contemporary exhibition infrastructure (Verona 2022, Milano TRACCE 2023, MuCiv 2022, Isernia 2023 updates) demonstrate capacity for multimedia integration, spatial flexibility, and interpretive innovation, but this does not predict dimensional emphasis. Museums making substantial interpretive investments developed professional labels, commissioned diagrams, and installed multimedia systems supporting sequential organisation and technical choices visibility. However, resource-constrained institutions demonstrate variable responses—some maintain traditional typological approaches (limited-

resource municipal museums), while others innovate within constraints (Graziosi's tactile accessibility programming with cast reproductions). Infrastructure constraints limit certain interpretive possibilities that affect presentation quality rather than determining dimensional priorities—museums could develop sequential or technical choices interpretation within existing infrastructure through label revision and spatial rearrangement, though physical limitations prevent optimal specimen visibility and comparative arrangements. Resource scarcity most consistently affects social dimensions and economic embedding visibility, which remain minimal across all museums regardless of scale or budget. This universal invisibility suggests these dimensions face interpretive and conceptual challenges exceeding resource solutions—museums possess neither material evidence enabling social hierarchy demonstration nor interpretive frameworks translating social organisation into accessible public content. Similarly, economic embedding requires integration of lithics with subsistence evidence, environmental data, and settlement patterns rarely available to museums acquiring only lithic collections, creating material constraints resources alone cannot overcome.

5.6.4. Curatorial orientations

Museums position variably along key curatorial spectrums, with orientations shaping dimensional emphasis and interpretive strategies.

Object-centred ↔ Context-centred

Museums employing object-centred approaches emphasise morphological characteristics, typological classification, and aesthetic presentation. Bologna, Graziosi's main galleries, and Montebelluna privilege specimen quality, systematic typological grouping, and visual coherence, achieving high variability visibility through diverse well-formed examples while minimising sequential organisation and economic embedding. Object-centred displays select complete, morphologically distinctive specimens, arrange them by formal categories, and provide labels identifying types, raw materials, and provenience. This orientation creates systematic barriers to process interpretation—typological grouping fragments observable reduction sequences, aesthetic selection excludes expedient technologies and learning-context materials, morphological emphasis minimises functional and subsistence connections. Context-centred approaches integrate lithics within broader archaeological, environmental, or behavioural frameworks. Isernia positions materials within La Pineta palaeosurface context, integrating lithics with faunal assemblages, site stratigraphy, and

environmental reconstructions to demonstrate adaptive systems. Donini employs dioramas situating tools within hunting and butchery activities. Carlo Conti presents materials within Monte Fenere cave occupation contexts. Context-centred orientation enables economic embedding visibility through material integration and achieves moderate sequential organisation where context emphasises production processes. However, context-centred approaches do not guarantee technological interpretation—Donini’s behavioural reconstructions demonstrate subsistence contexts without developing systematic reduction sequence or technical choices analysis. Most museums employ mixed orientations, combining object-focused typological cores with contextual thematic elements. Verona presents typologically organised materials within thematic frameworks, MuCiv employs object groupings serving Anthropocene themes, Milano integrates specimen displays with cognitive evolution narratives. These hybrid approaches achieve variable dimensional outcomes depending on which orientation dominates specific displays.

Specialist ↔ Public-oriented

Specialist-oriented museums serve research communities alongside public audiences, maintaining comprehensive study collections, technical terminology, and analytical frameworks current in scholarly discourse. Public-oriented museums prioritise general accessibility, family engagement, and educational programming. Donini, Verona, and Isernia demonstrate public orientation through school-focused programming, accessible language, visual interpretive elements, and visitor studies informing exhibition development. Public orientation correlates with stronger didactic emphasis, hierarchical information provision, and interpretive innovation. In terms of technological dimensions visibility, specialist-oriented museums are expectedly presenting high visibility for most if not all dimensions, but empirically speaking, most museums in the sample are somewhere in the middle of this range. Public orientation does not predict dimensional visibility patterns uniformly public museums may emphasise cognitive/symbolic dimensions and behavioural contexts (accessible themes) while minimising technical choices requiring complex explanation.

Static ↔ Narrative

Static approaches present specimens as study collections enabling systematic observation and comparison. Chrono-typological museums (Bologna, traditional Graziosi sections) employ static logic: specimens arranged by formal categories within temporal divisions, labels providing identification and provenience, minimal narrative framing. Static displays achieve high variability visibility through comprehensive specimen ranges and enable

specialist consultation but provide limited guidance for non-specialist visitors seeking meaning beyond morphological observation. Narrative approaches construct interpretive stories guiding visitor understanding. MuCiv's Anthropocene framework, Milano's cognitive evolution sequence, Verona's thematic progression, and Donini's human origins narratives employ storytelling structures positioning lithics within broader explanatory frameworks. Narrative orientation enables temporal dynamics visibility through diachronic trajectories, achieves moderate economic embedding where narratives address subsistence (Donini), and supports technical choices interpretation where narratives emphasise problem-solving and adaptation. However, narrative emphasis may subordinate technological analysis to story requirements. For example, cognitive evolution narratives privilege lithics as intelligence proxies, Anthropocene themes emphasise environmental relationships.

Museums increasingly employ narrative elements within systematic frameworks, combining chronological organisation with thematic interpretation. This hybrid approach attempts to maintain comprehensive coverage while providing accessible entry points for diverse visitors, though success varies based on narrative-systematic balance and integration quality.

5.6.5. Other insights: Determining factors and minimum requirements

Disciplinary and organisation frameworks determine dimensional emphasis patterns. Contemporary prehistoric archaeology orientations systematically prioritise sequential organisation through chaîne opératoire concepts. Natural history frameworks emphasise temporal dynamics and cognitive evolution. Chrono-typological traditions achieve variability visibility while constraining process interpretation. These framework effects operate independently of resources—specialist focus outperforms comprehensive coverage on sequential dimensions, while the reverse holds for variability through diversity requiring extensive collections. Material presence establishes absolute constraints for certain dimensions: economic embedding proves impossible without faunal materials, environmental data, and site documentation; temporal dynamics require assemblages spanning chronological sequences. Variability observation requires either diverse assemblages or multiple specimens demonstrating internal variation. However, material constraints operate asymmetrically. Museums possessing enabling materials frequently fail to achieve visibility through inappropriate organisation fragmenting relationships. Material presence thus constitutes necessary but insufficient condition—enabling materials require

appropriate spatial arrangement and interpretive support to achieve dimensional accessibility.

Minimum requirements below which dimensions become impossible emerge clearly. Sequential organisation requires minimally cores and debitage or refitted materials demonstrating reduction events. Material engagement requires multiple lithologies or explicit raw material interpretation. Temporal dynamics requires minimally two chronological periods enabling change observation.

Social dimensions and economic embedding demonstrate highest threshold requirements. Social organisation visibility requires quality variation materials, specialist analytical frameworks identifying learning contexts, and interpretive innovation translating abstract social concepts into observable phenomena—thresholds exceeding current practice across the sample. Economic embedding requires faunal integration, environmental data, site spatial contexts, and interpretive frameworks connecting technologies to adaptive systems. These threshold patterns reveal that certain dimensions resist museum representation not through curatorial choice but through combined material, analytical, and interpretive requirements exceeding available resources, expertise, or conceptual frameworks. Universal invisibility of particular dimensions reflects structural challenges rather than individual institutional failures.

6.

DISCUSSION

Lithic artefacts constitute the most abundant and temporally extensive evidence of early human behaviour, forming the empirical foundation upon which prehistoric archaeology and human origins research are built. These materials define prehistoric collections in museums worldwide, often representing the most substantial component of Palaeolithic collections. Yet despite this material dominance and foundational archaeological importance, lithic displays frequently achieve marginal interpretive impact within museum spaces. The research problem asks: why do lithic artefacts struggle to communicate technological knowledge to non-specialist publics, and how can their communicative potential be enhanced?

The dimensional analysis demonstrated that the visibility of lithic technology in museums is not determined solely by the objects themselves, but by the institutional, spatial, and interpretive conditions through which they are mediated. Across the case studies, these conditions affected multiple technological dimensions simultaneously, producing recurring tendencies in how technological knowledge became accessible, partial, or obscured. This chapter presents these recurring tendencies as **mechanisms through which museums reconfigure lithic technology**. Each mechanism captures a consistent way in which curatorial, museographic, or institutional practices shape the representation of lithic technology—whether by constraining material engagement, fragmenting sequential information, privileging typological form, or framing authenticity and authority in particular ways.

Each mechanism identified in this chapter emerges from recurring cross-dimensional patterns observed during the analysis. Material-based mechanisms (6.1) arise where material engagement, variability, and fracture properties are systematically flattened or transformed. Display-based mechanisms (6.2) emerge where sequential organisation, technical choices, and temporal dynamics are shaped by spatial, visual, and linguistic mediation. Knowledge-transformation mechanisms (6.3) arise where embodied practice, social dimensions, and contextual information are lost, reframed, or re-encoded. Finally, a cross-cutting epistemic mechanism (6.4) reflects the systematic reframing of archaeological knowledge into museal forms. These mechanisms reveal how museum conditions mediate the technological dimensions and shape the public encounter with lithic technology.

6.1. The material reality of knapped stone

The mechanisms in this domain arise primarily affect the material and perceptual dimensions of lithic technology: material engagement, supported by variability, technical choices, and aspects of sequential organisation and temporal dynamics (Dimensions 1, 5, 3, 2, 7, respectively). Across the case studies, the analysis showed that material engagement was consistently flattened: fracture qualities, raw material diversity, and tactile affordances were rendered inaccessible through visual-only display and conservation-driven distancing. Variability and technical choices were similarly constrained, as the material properties that underpin technological reasoning were rarely legible. These recurring cross-dimensional effects revealed that museums systematically transform stone from an active, responsive material into a passive visual object. This pattern produced the mechanisms in this domain: the ontological complexity of stone tools becomes simplified; form is treated as self-explanatory; scale and affordances are distorted by display conditions; and the shift from archaeological to museal context alters the material meaning of stone. In short, the mechanisms emerge from the consistent suppression of material engagement across multiple dimensions.

6.1.1. From rock to tool: Ontological complexity of stone tools

Ontology, in its philosophical sense, concerns the nature of being and the categories through which entities are understood to exist. It asks what kinds of things populate the world and how these things can be meaningfully grouped, differentiated, and conceptualised (Hofweber, 2023). Within archaeology, the ontological perspective highlights the implicit assumptions that structure how scholars classify artefacts, materials, and practices, and it interrogates the metaphysical commitments embedded in archaeological typologies and interpretive frameworks (Hodder, 2012). Against this background, the term *ontological complexity* describes the situation in which a single entity cannot be adequately captured by a stable categorical identity. An entity is ontologically complex when it oscillates between, or simultaneously occupies, multiple modes of being or relational states. Stone artefacts exemplify this. A pebble is a geological object with physical properties derived from natural formation processes. Once knapped, it becomes an artefact, intentionally produced through culturally situated technological practices, but does not necessarily lose its geological identity. This status complicates the binary distinction between natural and artificial

categories. Philosophical discussions of artefacts moreover acknowledge that objects such as unmodified stones used for particular purposes occupy an intermediate ontological position between natural entities and fully designed artefacts (Preston, 2022; Van Dyke, 2013). Archaeological work further demonstrates that the selection, modification, and use of stones is embedded in relational ontologies, where materials are perceived not merely as inert matter but as participants in social (e.g., Stout, 2002) or cosmological relations (e.g., Assaf & Romagnoli, 2021). Some perspectives emphasise tool manufacture as involving perceptual, embodied, and material engagements in which stones and toolmakers mutually shape one another, making the resulting artefact a product of distributed agency rather than unilateral human design (Ingold, 2000, 2013; Malafouris, 2013).

This ontological complexity creates distinct challenges for museums, which rely on clear, communicable categories. Results demonstrated that museums achieve differential success in representing these dimensions, with certain aspects of technological complexity proving more amenable to museum representation than others. Exhibition environments typically privilege functional or typological labels, concise narratives, and visually legible differences. A museum display that presents a stone tool as a discrete finished object foregrounds only one aspect of its being. Archaeological interpretations highlight that a tool's identity arises through its *chaîne opératoire*, the operational sequence of gestures, choices, and transformations that precede and follow its *final* form (Leroi-Gourhan, 1964; Tostevin, 2011). Materiality-focused approaches likewise stress that the meanings of tools are distributed across networks of relations rather than reducible to morphology alone (Hodder, 2012; Latour, 1994, 2005). Consequently, the visitor who encounters a stone tool in a glass case encounters only a thin slice of the object's ontology. The museum, structured around object-centred display, often struggles to convey these processual and relational dimensions. The result is that stone tools risk appearing simplistic or self-evident when their archaeological significance depends precisely on their multiple modes of being.

Gascons (2022) establishes the same recognition: as prehistoric lithic tools present “ontological multiplicity (and of meaning),” inherent complexities are created in their museum exhibition and valorisation, elaborated through the observation that valorisation methods themselves “ramify the ontological characteristics” of tools. Gascons even consider other representations of stone tools—two-dimensional drawings and scientific illustrations, as the object of fantasised interpretations of the Palaeolithic, as identical objects manufactured by contemporary society (experimental reproductions and moulds), and as

completely dematerialised forms in audiovisual displays—as additional lithic identities. These “plural ontological variations themselves complicate the polysemy of the tool” as each mode of representation—whether pedagogical diagram, artistic reconstruction, or audiovisual display—adds interpretive layers that both enable and complicate public comprehension. Furthermore, Gascons frames this transformation as the tool acquiring successive “lives”: from functional object in prehistory, to inert geological deposit, being designated as heritage and musealised, it is “now metamorphosed into image” a condition in which the physical object becomes inseparable from its various representational surrogates. This ontological multiplication creates a fundamental tension in museum practice: while para-exhibition devices are necessary to render lithics intelligible to non-specialist audiences, they simultaneously risk displacing visitor attention from the material evidence itself toward interpretive frameworks that may ossify into perceived certainties despite representing contingent scholarly interpretations.

6.1.2. Poverty of form

A further challenge arising from the material reality of knapped stone is what can be described, cautiously, as a *poverty of form*, meant to capture the perceptual condition that many stone tools possess minimal, non-intuitive morphological elaboration, which compound representational challenges. The issue stems from the interaction between stone’s physical constraints, the technological strategies used to modify it, and the perceptual frameworks through which modern audiences identify *tools*.

Stone tools result from reductive manufacturing processes that *remove* material rather than adding identifying features. Knapping creates implements optimised for efficiency within physical constraints imposed by fracture mechanics, raw material properties, and functional requirements. The degree to which this reductive process yields visually recognisable forms varies across the different periods in prehistory, especially in the Palaeolithic. Lower and early Middle Palaeolithic lithic assemblages are often characterised by restrained formal differentiation relative to later periods, with variability expressed primarily through technological organisation and reduction strategies rather than through strongly diagnostic end-product morphologies (Shea, 2016). Informational richness from technical traits that constitute dense technological signatures in some tools—especially flakes (big/small, unmodified/retouched) but also some large, shaped tools—are not visually salient and may appear to the observers as irregular or incomplete fragments or crude pebbles. Acheulean

handaxes constitute a partial exception in that they are formally recognisable; however, much of their variability reflects reduction intensity, raw material specificities, and resharpening histories rather than readily interpretable functional or stylistic differentiation (García-Medrano et al., 2023; Lycett & Gowlett, 2008). Later periods, from the late Middle Palaeolithic but especially towards the Upper Palaeolithic, show the emergence of greater typological differentiation and formally recognisable tools. Technological organisation becomes more visibly structured with prepared-core methods and regionally recognisable toolkits (Binford, 1973, 1979; Bordes, 1961). Nevertheless, these too remain formally restrained. Key differences between variants (for example, recurrent versus preferential Levallois, centripetal versus unidirectional reduction) are intelligible only through analytical literacy; morphological differences are subtle and rely on technological, sometimes even microscopic (for retouch), criteria rather than overt form. Consequently, tool types through time (at least thousands of years) and across space can appear remarkably similar, obscuring the cultural specificity, diversity, and technological innovation they actually represent. The visual austerity persists, even as the underlying technological systems become increasingly *complex* (Bar-Yosef & van Peer, 2009; Boëda, 2013; Shea, 2016). With the Upper Palaeolithic and later periods, lithic technologies produce forms that align more intuitively with modern expectations of “tools.” Standardised blade production systems, backed pieces, burins, and geometric microliths, for instance, introduce clearer patterns of symmetry, edge regularity, and occasionally aesthetic refinement (Bar-Yosef & Kuhn, 1999; Kuhn, 2020). The recognisability of Upper Palaeolithic forms, however, does not fully resolve the perceptual problem more than it illustrates that the degree of visible form varies historically.

Studies on cognition offer explanations regarding such differential recognition thresholds based on proximity to prototypes (e.g., modern knives, axes, or chisels) when inferring form and function. Basic-level categorisation effects (Rosch et al., 1976) indicate that objects are most readily recognised at a “basic level” (e.g., knife) rather than superordinate (“tool”) or subordinate (“Acheulean handaxe”). Crucially, basic-level recognition depends on distinctive shape or overall configuration that makes a knife “look like a knife.” Stone tools often diverge sharply from these prototypes, especially for tool morphologies shaped by knapping choices rather than by stylistic conventions. In museum contexts specifically, this creates categorical visibility. For instance, a hafted blade may read as a knife; a simple flake reads as... a rock? An unfinished tool? The flake so far lacks sufficient diagnostic features to activate the knife prototype. The perceptual symbol systems theory (Barsalou, 1999) is moreover relevant here, indicating that recognition involves matching perceived features to

stored perceptual simulations. The more features overlap (shape, symmetry, edge morphology), the faster and more confident the recognition. In this case, a blade has high feature overlap with modern knives; a flake has minimal overlap. Thus, the *poverty of form* is not an intrinsic attribute of museum lithic technology; it is a relational effect produced when early technologies meet modern perceptual expectations.

The museum implications are significant. Once again, the formal austerity of lithics means that their technological and behavioural complexity is not materially self-evident. Unlike pottery vessels or metal weapons, whose forms clearly suggest their utility, stone tools often possess subtle functional features that require expert interpretation to understand. Ethnographic studies of museum behaviour demonstrate that visitors construct understanding through rapid visual assessment, seeking obvious meanings before engaging with detailed interpretation (Falk & Dierking, 2000). Stone tools' lack of immediate visual legibility creates barriers to this primary interpretive mode. Museum mediators report difficulties developing engaging programming around lithic collections composed of small sized elements, subtle morphological variation, and lacking striking visual characteristics (Gascons, pers.comm., 2025; Honnorat, pers.comm., 2023; Volpe, pers.comm., 2023). Without explicit cuing (labels, use-demonstration images, comparative displays), visitors default to prototype matching which may create grounds for either misinterpretation or simply lack of curiosity. The *poverty of form* problem therefore remains central to understanding the complexity of valorising stone tools in the museum context and the need for museum displays to actively compensate for these material constraints.

6.1.3. Scale and affordances

In lithic assemblages, scale varies considerably—from large, shaped implements to microliths—and this variability directly shapes the affordances of each artefact category. Following Gibson's (1979) concept of affordances adapted to archaeological materiality by Knappett (2005) and Malafouris (2013), the perceptual and functional possibilities that an artefact offers emerge from its material properties, its geometry, and its scale. Larger artefacts typically afford broader visual legibility at a distance, while smaller pieces restrict the perceptibility of technological attributes to close-range, often tactile inspection. In prehistoric contexts, such affordances were integral to the practical use and social transmission of lithic technology, where handling, rotation in the hand, and embodied demonstration constituted key modes of engagement (Stout et al., 2015). Museum display

environments frequently inhibit these affordances, since both large and small artefacts lose degrees of perceptual and interactive accessibility when viewed behind glass and out of handling contexts. As a result, scale-related affordances are systematically suppressed, limiting the perceptual access through which technological knowledge is typically transmitted. The material reality of knapped stone, in this case, poses inherent challenges to museum representation due to the spatial and tactile conditions necessary for apprehending its technological character being structurally incompatible with standard exhibition formats.

6.1.4. Changing contexts and material transformations

The transition of lithic implements from their systemic contexts of use to their archaeological contexts of deposition involves extensive material transformations that fundamentally reshape what survives for later interpretation. [Schiffer's \(1972\)](#) distinction between systemic context—the domain of objects as active components of behavioural systems—and archaeological context—the domain of objects in post-depositional settings—remains analytically indispensable because it emphasises that context is not merely conceptual but materially enacted.

For knapped stone, this transition is characterised by a suite of reductive processes that selectively diminish the physical properties through which technological and functional meaning were originally expressed. In systemic contexts, lithic implements may have existed as components of composite technologies, involving hafts, bindings, adhesives, pigments, and residues arising from use. These materials would have not only contributed to the operational capabilities of the tool but also encoded aspects of technological skill, craft investment, and social knowledge. Once deposition occurs, however, organic components decay rapidly relative to stone. This material filtering produces archaeological artefacts that are not direct reflections of systemic tools but rather attenuated remains shaped by taphonomic selection. What reaches the museum has therefore already undergone at least two phases of contextual “loss”: first through the systemic–archaeological transformation; second through archaeological recovery. In this respect, the museum presence of lithics is conditioned not only by their intrinsic material properties but also by the cumulative material losses that occur long before curatorial intervention. The object behind the glass is thus doubly removed from its systemic reality: materially reduced by taphonomy and

contextually abstracted by archaeological recovery. It has already been acknowledged that the separation of artefacts from their site contexts is inevitable, as objects need to be retrieved and moved, 1) to the laboratory so that the authenticity and therefore scientific value may be revealed through analysis, and 2) to the museum to allow all audiences to perceive their heritage value (Sémah, 2015b). Recognising this process of material contextual loss is essential for appreciating the limits of what stone tools can communicate visually with their eventual setting within exhibition environments.

The results have demonstrated that some museums address preservation bias through reconstructive materials (hafted tool replicas, organic technology demonstrations, contextual illustrations), although appearing sporadically in certain institutions and remaining exceptional rather than standard practice. While it is often explained in text panels that archaeological sites and materials are dependent on preservation, discovery, and recovery, it is common for displays to present lithics without explicit acknowledgment that these represent partial remains of more complex technological systems, potentially reinforcing rather than countering biased impressions created by differential preservation.

6.2. The strengths and limits of display

The mechanisms in this domain emerge from recurring patterns affecting sequential organisation, technical choices, variability, and temporal dynamics (Dimension 2, 3, 5, 7, respectively). The dimensional analysis showed that display arrangements repeatedly fragmented operational sequences, obscured decision-making, and compressed technological diversity. Sequential organisation was disrupted by spatial separation and static case design; technical choices were overshadowed by typological grouping; variability was visible but not interpretable; and temporal dynamics were flattened into broad, schematic chronologies. These cross-dimensional tendencies revealed that display itself is a powerful mediating force: it determines what becomes visible, what relationships are legible, and what forms of technological reasoning are possible. At the same time, replicas, casts, and experimental pieces introduced new possibilities: they could reveal gestures, reduction stages, or raw material variability that original artefacts could not. Digital media similarly offered expanded interpretive potential, although often reproduced the same visual biases as vitrines. These cross-dimensional tendencies revealed that display, in all its material and digital forms, is a powerful mediating force: it determines what becomes visible, what relationships are legible, and what forms of technological reasoning are possible. From these patterns emerged the mechanisms of this domain: the dynamics between ubiquity and rarity, the spatial fragmentation of sequences, the emphasis on material solutions over technological processes, and the persistent language dilemma, now understood as operating across both physical and digital display environments.

6.2.1. Ubiquity and rarity

In some institutions, lithic artefacts numerically dominate Palaeolithic displays, comprising 60-80% of exhibited prehistoric material culture. Conversely, in other museums, lithic collections are underrepresented in the displays in favour of other types of artefacts (e.g., human fossils, faunal remains and reconstructions). While museum type, focus, and exhibition parameters influence curatorial decisions regarding the size and prominence of stone tool displays (i.e., that a dedicated prehistory museum such as the Museo Donini would exhibit more extensive lithic collections compared to the Museo Civico di Milano, where lithics occupy a section within the Anthropology exhibit, or that civic museums prioritising alternative institutional identities focus collections accordingly rather than on lithics), the

fact remains that curatorial practices shape display dynamics and therefore the public perception of lithic artefacts.

The systematic presentation of numerous stone artefacts within single exhibition spaces reflects display practices established during the disciplinary formation of prehistoric archaeology and the evolution of museum practice in the late 19th and early 20th centuries (Pitt-Rivers, 1891). Early museums adopted display strategies directly derived from archaeological analytical methods, creating exhibitions that mirrored the comparative approaches fundamental to prehistoric research. The influence of typological thinking established classification systems based on formal variation that encouraged comprehensive specimen display. Museums during this formative period operated within epistemological frameworks that prioritised empirical demonstration through material abundance. The scientific credibility of prehistoric archaeology depended partly on its capacity to present substantial material evidence supporting claims about human antiquity and cultural development. The cabinet of curiosities tradition, though predating scientific archaeology, contributed to expectations for comprehensive material presentation that influenced later museum practice. Early collectors and exhibitors valued abundance as evidence of scholarly dedication and institutional prestige, creating cultural associations between extensive displays and curatorial authority that persist in contemporary practice. The transformation of private collections into public museums often involved the wholesale transfer of comprehensive assemblages (e.g., Museo Civico di Bologna), establishing institutional precedents for exhaustive rather than selective presentation. The extensive international networks established by Italian scholars during the formative period of prehistoric archaeology facilitated the systematic exchange and comparison of lithic collections across European institutions (Guidi, 2008), resulting in the development of comparative collections within individual museums where lithic assemblages from different regions and periods were systematically arranged to demonstrate technological evolution and cultural variation. The practice of maintaining extensive comparative displays became embedded in curatorial tradition through these early international exchanges (Cova, 2010), reinforcing the association between comprehensive presentation and scholarly authority that continues to characterise lithic exhibitions in contemporary museums.

These inherited display practices have been subsequently legitimated through pedagogical assumptions about public learning that emerged with the professionalisation of museum education. Contemporary museum education discourse emphasises that visitors construct

their own meaning from cultural experiences (Falk & Dierking, 2000; Hein, 2006). Curators invoke educational logic suggesting that repetition enhances comprehension and that multiple examples clarify concepts that might remain unclear through single specimen presentation. This reasoning proposes that visitors require extensive material evidence to grasp abstract concepts. However, contemporary learning theory challenges these assumptions. Italian museological scholarship recognises the tension between educational approaches (*approccio educativo*) focused on predetermined learning objectives and learning approaches (*approccio apprenditivo*) centred on spontaneous, interest-driven processes (Margnelli, 2024). The constructivist approach to museum learning, as articulated by Hein (1995; 2006) and discussed in Italian museological contexts, emphasises that learning represents an active construction of meaning through experience rather than passive reception of information (Minello, 2018). The constructivist museum considers both social change and social responsibility, aiming to facilitate appropriate teaching-learning processes respectful of contemporary educational theories. The tension between typological display traditions inherited from 19th-century museum practice and current understanding of how visitors construct meaning creates systematic conditions wherein comprehensive lithic presentations, though reflecting established pedagogical logic, may produce outcomes opposite to their intended educational effects. In current practice, comprehensive displays are also justified by institutional considerations. Bigger museums often contain collections from different archaeological sites, creating expectations for representative display that justifies acquisition and storage investments. Curators face implicit obligations to make visible the scope and significance of institutional holdings, particularly when collection development has required substantial resources or when displays serve to validate curatorial expertise in prehistoric archaeology. The research value attributed to lithic assemblages encourages presentation strategies that emphasise quantity as evidence of scholarly rigour and institutional authority.

However, ubiquity produces counterintuitive outcomes through material oversaturation. *Museum fatigue*, first systematically described by Gilman (1916), manifests as a predictable decline in attention, interest, and engagement with exhibits over time, characterised by reduced viewing duration and increased selectivity in what is observed. Repetitive visual patterns produce information overload where material abundance impedes rather than facilitates communication. Morphological similarities compound this effect, as stone tools may appear similar to untrained observers, making individual specimen discrimination challenging. Visitors confronting dozens of similar-appearing stone tools may experience

satiation—a decrease in attention after repeated exposure to homogenous stimulation, wherein viewing a number of monotonous objects produces decline in attention accompanied by decline in enjoyment (Bitgood, 2009; Gilman, 1916). Dense lithic arrangements may overwhelm visitors' capacity for focused attention, creating scanning behaviours where individual objects blur into undifferentiated material backgrounds. It has been observed that after brief initial exertion, visitors resign themselves to seeing practically everything imperfectly and by passing glance (Bitgood, 2009; Gilman, 1916). A similar explanation is that on *object competition*, in which the concurrent presentation of multiple stimuli results in competition for attention, and either attention declines due to increased object density (Bitgood, 2010; Bitgood et al., 2013; Melton, 1935), or visitors turn to a value assignment system. In the latter, attention is awarded to higher value stimuli based on perceived higher utility (interest/familiarity) and lower cost (time and effort) (Bitgood, 2010; Bitgood et al., 2013).

Conversely, however, minimised lithic presence in museum displays appears to produce equivalent outcomes through opposite mechanisms. Observations across the museum contexts studied reveal instances of stone tool assemblages being in minimal quantities that consequently relegate them to relatively peripheral positions within exhibition spaces and narratives. Where ubiquity produces perceptual occlusion paradoxically through the counterintuitive mechanism of oversaturation, rarity operates through straightforward logic: materials with limited physical presence achieve correspondingly limited visitor engagement; objects absent or minimally represented cannot sustain attention regardless of their archaeological significance. A display case containing a very low number of lithic specimens, however carefully selected and interpreted, cannot demonstrate technological variation, reduction sequence diversity, or manufacturing skill ranges that comprehensive assemblages theoretically enable. However, a straightforward framing between quantity and visibility obscures the institutional mechanisms producing selective exclusion. Museum professionals explain this curatorial choice mainly through adaptations to lithic assemblages being represented, but also implying interconnected assumptions about public interest, interpretive complexity, and exhibition effectiveness that reflect institutional anxieties about prehistoric material culture accessibility, mostly based on experience. Curatorial decision-making, in this case, prioritises visitor engagement over archaeological representativeness. Often these considerations are related to budget allocation as limited investment opportunities result to prioritising materials that maximise visitor impact per unit of interpretive investment.

Whether manifesting through material abundance (ubiquity) or systematic exclusion (rarity), both pathways transform archaeologically significant collections into marginal displays. The convergence of opposite approaches on identical outcomes reveals the complexity of lithic valorisation: optimal specimen quantities for effective communication remain scarcely understood. Addressing it would require experimental visitor studies comparing comprehension and engagement outcomes across different specimen quantities per collection, controlled comparisons examining how varying densities affect understanding, and systematic measurement of learning outcomes to establish evidence-based criteria for curatorial decision-making.

6.2.2. Spatial and physical aspects

The glass case, or vitrine, and scenographic reconstructions such as environmental diorama represent two fundamental display technologies in traditional and contemporary museum practice, each designed to address specific challenges in presenting archaeological materials to public audiences ([Merriman, 2016](#); [Rivière & Visser, 1960](#)). These technologies embody contrasting but actually complementary approaches to the central museological challenge of making cultural objects simultaneously accessible and comprehensible within a display: vitrines focus on objects and prioritise their protection and systematic presentation, while dioramas emphasise contextualised reconstructions. Data indicates the universal adoption of vitrine display technologies across all surveyed institutions, while dioramas are absent in particularly smaller institutions. It is apparent how these complementary technologies shape visitor engagement with lithic collections across all surveyed institutions, where present, creating distinctive conditions for communication that merit examination.

Vitrines serve essential functions that have made them indispensable to museum practice. From a conservation perspective, controlled display environments provide demonstrable protection against the primary causes of object deterioration: fluctuating temperature and humidity, airborne pollutants, and physical handling damage ([Merriman, 2016](#); [Rivière & Visser, 1960](#)). For artefacts that are susceptible to chemical weathering, thermal stress, and mechanical damage, climate-controlled cases provide measurably superior preservation conditions that extend object lifespans. Security considerations further justify protective display through documented reductions in theft, vandalism, and accidental damage. The administrative benefits also include physical protection to include simplified monitoring,

standardised maintenance protocols, and reduced staff supervision requirements that enable museums to operate efficiently with limited resources. Educational accessibility represents another significant advantage of vitrine display. Glass cases enable simultaneous viewing by multiple visitors, accommodate diverse physical abilities and ages, and provide consistent viewing conditions regardless of crowd density or visitor behaviour. The controlled environment allows precise positioning of objects, optimal lighting arrangements, and integration of interpretive materials in ways that unprotected display cannot achieve. For lithic collections that may appear similar to untrained observers, systematic arrangement within cases provides essential visual organisation that supports comparative examination and educational programming. The standardisation of vitrine technology has created economies of scale that make protective display increasingly cost-effective for institutions of all sizes. Commercial manufacturers offer modular systems that can be configured for diverse object types, integrated with security and climate control systems, and maintained through established service networks. This infrastructure enables even small museums to achieve professional standards of object protection and presentation that would be prohibitively expensive through custom solutions.

However, these practical advantages create systematic limitations for visitor engagement with material culture, proving particularly problematic for lithic collections. The spatial organisation required by protective display diminishes object significance through what Bennett (1995) terms “exhibitionary discipline” or the systematic arrangement of objects within controlled viewing conditions that prioritise institutional authority over visitor agency. Moreover, the vitrine fundamentally alters the phenomenological relationship between visitors and objects by eliminating the tactile and kinaesthetic engagement that Merleau-Ponty (1945) identifies as essential to human material understanding (Bruun & Wahlberg, 2022). While visual access remains intact, the haptic exploration through which humans naturally comprehend object weight, texture, balance, and ergonomic properties becomes impossible within protective display environments. This phenomenological limitation proves especially significant for lithic artefacts, whose cultural meaning depends largely on understanding the embodied knowledge systems involved in their production and use. Unlike decorated pottery or metalwork that communicate symbolic content through visual inspection, stone tools encode technical gestures, motor skills, and craft knowledge that become comprehensible only through direct, haptic material engagement. The vitrine, while preserving the physical object, creates separation from the embodied experience that would make technological and cultural significance accessible. Research on museum

materiality demonstrates that protective display can create “material absence” despite physical presence, creating an existential distance between visitor experience and object meaning (Dudley, 2010; Wood & Latham, 2014).

The fundamental challenge stems less from the existence of conservation requirements than from the institutional frameworks that position preservation and communication as inherently contradictory rather than potentially complementary objectives. Conservation science operates according to temporal logics that prioritise long-term physical preservation while educational missions depend on immediate cultural engagement, in turn creating systematic conflicts that current museum practice struggles to resolve effectively (Appelbaum, 2007). Professional training reinforces these tensions through ethical frameworks that establish object preservation as the paramount institutional responsibility, often without equivalent attention to communicative effectiveness or visitor experience. While these priorities reflect legitimate concerns about irreversible object damage and institutional liability, they can create museum cultures that view public engagement as inherently threatening rather than complementary to preservation objectives. Moreover, the economic dimensions favour protective solutions that provide predictable, measurable benefits over interactive approaches with uncertain costs and maintenance requirements. Alternative display strategies that might enhance communication often involve ongoing experimentation, specialised maintenance, and variable insurance coverage that creates unpredictable budget impacts.

Dioramas emerged in the late 19th century as museum technologies designed to address the interpretive limitations of isolated object display through environmental reconstruction and narrative contextualisation. The technology developed from theatrical and artistic traditions, gaining particular prominence in natural history institutions where the communication of ecological relationships and behavioural patterns required more than specimen presentation alone could provide (Wonders, 1993). Dioramas are mostly a natural history museum tradition that have been adopted into other settings. In prehistory, dioramas represent attempts to restore the spatial, temporal, and social contexts that archaeological excavation necessarily fragments, enabling museums to present stone tools within reconstructed 1) depositional surfaces/stratigraphic layers to communicate their archaeological contexts, or 2) scenes where stone tools are narratively contextualised in systemic contexts highlighting their technological and cultural functions.

Dioramas enable museums to address collection gaps and interpretive challenges through reconstruction rather than acquisition. Institutions lacking comprehensive material assemblages can create compelling prehistoric presentations by contextualising available lithic specimens within reconstructed environments, effectively multiplying the interpretive value of limited holdings while avoiding expensive acquisition programmes or loan negotiations. Educationally, they serve essential functions in communicating complex archaeological interpretations that isolated object displays struggle to convey. Environmental reconstructions can integrate multiple lines of evidence—lithic assemblages, faunal remains, palaeoenvironmental data, site stratigraphy—within coherent spatial narratives that demonstrate the interdisciplinary nature of prehistoric research. For lithic collections specifically, dioramas can restore the landscape contexts that give stone tools their archaeological significance: raw material procurement areas, knapping locations, use contexts, and disposal patterns that systematic excavation documents but museum cases necessarily fragment, although with varying levels of perceptibility and effectiveness. Dioramas also provide accessible entry points for diverse audiences by offering intuitive visual frameworks that do not require specialist knowledge to comprehend. Families, school groups, and casual visitors can engage with reconstructed prehistoric environments through familiar cognitive frameworks of spatial navigation and environmental interpretation, potentially developing interest in archaeological materials that might otherwise appear incomprehensible or irrelevant.

From an institutional perspective, dioramas offer compelling operational advantages that make them attractive investments for museum management. Unlike object-focused displays that require extensive specialist interpretation, environmental reconstructions provide self-explanatory visual narratives that reduce demands on educational programming and guided tour services. This operational efficiency enables institutions to serve larger visitor volumes with limited staffing while maintaining educational effectiveness, which is particularly important for museums operating under resource constraints or seasonal visitor fluctuations. Dioramas, furthermore, excel as institutional marketing tools through their capacity to generate memorable visitor experiences and photogenic content for promotional materials. Environmental reconstructions create distinctive visual signatures that differentiate museums from competitors while providing readily available imagery for social media, tourism marketing, and donor cultivation ([Alexander et al., 2017](#)). The experiential nature of diorama engagement generates positive visitor reviews and word-of-mouth recommendations that support institutional reputation and attendance objectives without

requiring ongoing marketing investments. From funding perspectives, dioramas appeal to donors and grant agencies because they provide tangible, permanent outcomes that demonstrate institutional achievement and educational impact. Unlike conservation work or collection storage that remains largely invisible to stakeholders, completed environmental reconstructions offer lasting monuments to philanthropic investment that can be showcased to current and potential supporters. The longevity of diorama installations, often remaining effective for decades with minimal maintenance, creates favourable cost-per-visitor calculations that appeal to budget-conscious administrators.

However, these institutional and educational advantages require careful implementation to maintain interpretive transparency. Like all prehistoric interpretations, dioramas involve reconstruction from incomplete archaeological evidence. The three-dimensional, visually immersive character of environmental reconstructions can convey interpretive certainty where archaeological data remain fragmentary or debated. Museums employing dioramas thus face the challenge of communicating both the reconstructed scenarios and the degrees of confidence underlying specific interpretive elements—distinguishing well-supported inferences from more speculative details while preserving the diorama’s educational effectiveness and visual coherence.

When not careful, the temporal compression inherent in diorama display creates additional problems for representing prehistoric lifeways, which unfolded across seasonal cycles, generational knowledge transmission, and technological development sequences that static scenes cannot capture. A single reconstructed moment may inadvertently suggest that prehistoric peoples lived in unchanging environments using static technologies, obscuring the dynamic adaptation and innovation that lithic assemblages actually document ([Gamble, 2007](#)). The “frozen moment” effect can reinforce linear evolutionary narratives while obscuring the experimental, iterative, and contextually responsive practices that characterise actual technological development. Furthermore, dioramas risk reinforcing primitivist stereotypes by presenting prehistoric peoples within “natural” environments that emphasise their integration with non-human nature rather than their cultural distinctiveness and technological capacities. When human figures appear as components of ecological scenes rather than agents of technological innovation, environmental reconstructions may inadvertently diminish recognition of prehistoric cultural achievements while appearing to celebrate them ([Conkey, 2010](#); [Moser, 1998](#)).

The relationship between dioramas and associated object displays creates additional interpretive tensions. Visitors may focus on dramatic environmental scenes while overlooking the lithic specimens that provide the actual archaeological evidence for reconstructed activities. This attention dynamic can reverse the intended pedagogical relationship, making hypothetical reconstructions more memorable and authoritative than the empirical materials they ostensibly interpret.

6.2.3. Material solutions and technologies

Casts, experimental reproduction, digital models and remakes

The relationship between authentic artefacts and their various reproductions constitutes a fundamental tension within contemporary museum practice that significantly impacts the presentation and interpretation of lithic collections. For prehistoric collections, authenticity carries particular significance because stone tools represent direct physical evidence of early human technological achievement, creating material links across millions of years. Curators interviewed across multiple institutions expressed the view that authentic specimens provide visitors with genuine encounters with prehistoric material culture that reproductions cannot replicate, regardless of their technical quality or interpretive utility ([Ménard, pers.comm., 2023](#); [Nespoulet, pers.comm., 2023](#)). Visitor expectations further support this authenticity valuation through cultural assumptions about museum authority and educational value, with reportedly consistent public preferences for viewing “real” rather than reproduced objects ([Macdonald, 2006](#); [Smith, 2004](#)). This visitor orientation reflects broader cultural attitudes that associate authenticity with educational legitimacy and cultural significance, creating institutional pressures to emphasise original specimens despite their display limitations.

Nonetheless, there is a growing acknowledgement among museum professionals that while authenticity remains essential for institutional legitimacy and visitor expectations, scientifically accurate and high-quality lithic replicas can restore the haptic engagement essential for understanding prehistoric technological achievement while maintaining conservation standards for original collections ([Nespoulet, pers.comm., 2023](#); [Tuzi, pers.comm., 2023](#); also see [Pye, 2007](#)). When visitors can handle, examine, and manipulate reproduced stone tools, they gain access to weight, texture, balance, and ergonomic properties that communicate embodied knowledge systems in ways that visual inspection cannot achieve ([Martini, pers.comm., 2023](#); [Tuzi, pers.comm., 2023](#)). The educational effectiveness of tactile engagement through reproductions proves particularly significant for

diverse learning styles and accessibility requirements (**Figure 6.1**). Visitors with visual impairments can gain meaningful access to lithic collections through handling experiences that protective display necessarily excludes. Children and students benefit from manipulative learning opportunities that develop spatial understanding and technical appreciation through direct material interaction. Adult learners often report that handling reproductions provides insights into prehistoric technological achievement that purely visual museum experiences cannot communicate.

The authenticity question becomes particularly complex for lithic collections because high-quality experimental archaeology reproductions can achieve morphological and technical accuracy that renders them virtually indistinguishable from original specimens (**Figure 6.2**). Experimental archaeology programmes that produce lithic reproductions using authentic techniques offer particularly valuable interpretive resources because they embody the same technical knowledge and motor skills that created original specimens (Stone & Molyneaux, 1994). Moreover, unlike other types of artefacts (such as pottery) where aesthetic details, patination, or surface wear provide visual cues for authenticity “assessment,” skilfully knapped stone tools create *legitimate* reproductions of prehistoric originals. Consequently, lithic collections occupy a unique position within museum authenticity hierarchies where the distinction between “authentic” and “reproduction” may be less materially evident and more institutionally constructed than for other categories of cultural objects. This creates opportunities for innovative educational programming that emphasises technological knowledge and cultural process over individual object provenance, while simultaneously requiring careful institutional navigation of visitor expectations and professional standards regarding authentic cultural heritage.



Figure 6.1. Musée de Préhistoire Île-de-France. Supplementary tactile display featuring a handaxe cast.



Figure 6.2. Musée de Préhistoire Île-de-France. Vitrine-incorporated scenographic representation of flintknapping.

Walter Benjamin's (1935) analysis of mechanical reproduction and artistic aura, though originally developed for art, provides essential theoretical framework for understanding the tensions surrounding lithic replicas and their institutional positioning. Benjamin argues that original artworks possess "aura," or unique presence deriving from their particular history and authentic existence that mechanical reproduction cannot duplicate. However, the

application of this framework to archaeological materials raises complex questions about the nature and location of cultural significance in prehistoric technological objects. For lithic artefacts, the question of aura becomes particularly complex because stone tools derive their cultural significance primarily from the embodied knowledge and technical processes that they represent rather than from individual aesthetic or symbolic qualities. Unlike artistic objects whose aura may depend on unique creative expression, lithic implements embody technological solutions and craft knowledge that are inherently reproducible and culturally transmitted. The “aura” of a Palaeolithic biface may reside not in its individual uniqueness but in its capacity to communicate prehistoric technological capability, a quality that skilled experimental reproduction might actually enhance rather than diminish. Benjamin’s framework suggests that mechanical reproduction democratises access to cultural objects by liberating them from elite institutional control, enabling broader public engagement with materials traditionally confined to specialist domains. Applied to lithic collections, this perspective supports expanded use of high-quality reproductions that could make prehistoric technological heritage accessible to audiences currently excluded by protective display requirements and institutional access limitations. However, the institutional resistance to reproduction reflects legitimate concerns about maintaining standards of evidence and scholarly authority that distinguish museum interpretation from popular entertainment or commercial exploitation. The challenge lies in developing reproduction strategies that enhance rather than compromise institutional credibility while expanding access to prehistoric technological heritage.

Contemporary digital technologies offer new approaches to reproduction that potentially transcend traditional authenticity hierarchies while addressing both conservation concerns and tactile engagement limitations. Three-dimensional scanning and modelling enable creation of virtual replicas that preserve detailed surface information, dimensional accuracy, and morphological data with precision exceeding traditional casting techniques (Parry, 2007). Digital models can provide access to object characteristics invisible even through direct handling while maintaining unlimited reproducibility and institutional control. Virtual reality and augmented reality applications enable visitor interaction with digital lithic collections that combines tactile simulation with enhanced analytical capabilities. Visitors can virtually handle stone tools while accessing interpretive information about their technological characteristics, cultural contexts, and archaeological significance. However, digital reproduction faces its own authenticity challenges through institutional and visitor scepticism about virtual experience as legitimate cultural engagement. While digital

technologies can provide analytical capabilities that exceed direct handling opportunities, they necessarily involve translation of material properties into virtual representations that may diminish rather than enhance appreciation for prehistoric technological achievement. More importantly, the haptic feedback systems available in current virtual reality technologies cannot replicate the weight, texture, and resistance characteristics essential for understanding lithic production techniques and functional properties. Digital handling experiences may create impressions of material engagement while actually preventing the tactile learning that handling programmes using physical reproductions can provide.

The institutional tendency to position digital technologies as superior to traditional interpretive methods may inadvertently devalue the material presence that represents museums' distinctive educational advantage over other cultural institutions (Cameron, 2007). When digital experiences become primary rather than supplementary interpretive tools, they may contribute to the broader cultural trend toward virtual rather than material engagement that potentially undermines public appreciation for authentic cultural heritage. The effectiveness of digital models depends on their integration within broader interpretive frameworks that position virtual interaction as valuable cultural experience rather than inadequate substitution for authentic material encounter.

Digital technologies: Promise and limitations

Digital technologies have emerged as potentially transformative tools for addressing the systematic barriers to lithic communication documented throughout contemporary museum practice. Information and Communication Technologies (ICT) offer theoretical solutions to the spatial isolation created by protective display, the interpretive challenges posed by morphologically similar objects, and the temporal compression that static exhibitions impose on dynamic technological processes. The data presented in this research reflects a widespread institutional investment in digital mediation technologies across surveyed museums, from basic audio guides and touchscreen displays to sophisticated virtual reality applications and three-dimensional modelling systems, also following the Italian national government's recent commitments to digitalisation. However, this technological optimism must be evaluated against the actual implementation outcomes and visitor engagement patterns that determine whether digital solutions enhance or merely reproduce existing barriers to meaningful prehistoric heritage communication.

Virtual reality applications can provide immersive environmental contexts that restore the landscape relationships eliminated by vitrine display, enabling visitors to experience stone tool production and use within reconstructed prehistoric settings without the interpretive limitations of static diorama presentation. Interactive touchscreen displays offer opportunities for comparative analysis that systematic object arrangement cannot achieve, enabling visitors to examine multiple specimens simultaneously, access detailed morphological information, and explore technological relationships across different time periods and cultural contexts (Parry, 2007). Digital databases integrated with display systems can provide multilingual interpretation, varied complexity levels for different audience needs, and dynamic content updates that keep pace with advancing archaeological research, addressing several persistent challenges in traditional museum communication.

Augmented reality (AR) applications theoretically enable the overlay of interpretive information directly onto physical displays, creating hybrid experiences that combine authentic material presence with enhanced analytical capabilities. Visitors using AR interfaces can access technical information about knapping sequences, raw material properties, and functional interpretations while maintaining visual engagement with original specimens. This technological approach promises to resolve tensions between protective display requirements and educational accessibility by providing detailed interpretive access without compromising conservation standards. Digital reconstruction technologies also enable temporal engagement that static displays cannot provide. Animation sequences can demonstrate tool production processes, use patterns, and technological development over time, making visible the dynamic relationships between human behaviour and material culture that archaeological analysis reconstructs but museum cases reduce to typological categories. Virtual knapping demonstrations can communicate embodied knowledge systems without requiring physical handling programs or experimental archaeology expertise.

The gap between potential and practice

Despite these theoretical capabilities, the actual implementation of digital technologies in museum contexts often fails to achieve meaningful enhancement of lithic interpretation. As seen in the results of this work, systematic patterns where sophisticated digital systems function primarily as technological novelties rather than integrated educational tools, reproducing rather than resolving fundamental barriers to public engagement with prehistoric technological heritage.

Many digital implementations suffer from the assumption that introducing advanced technologies automatically improves educational effectiveness without addressing underlying interpretive challenges (Huggett, 2012; Parry, 2007). Touchscreen displays often reproduce the same categorical information available through traditional labels, merely transferring text from physical to digital media without exploiting interactive capabilities for comparative analysis or temporal engagement. Audio guide systems frequently provide linear narrative content that mirrors guided tour formats rather than enabling visitor-directed exploration of technological relationships and archaeological evidence. The interface design of digital systems often prioritises technological sophistication over user experience, creating barriers to engagement that exceed those imposed by traditional display methods. Complex navigation systems, unclear interaction protocols, and technically advanced features that require digital literacy can exclude visitors who might benefit from enhanced interpretive access. Elderly visitors, families with young children, and audiences with limited technological experience may find digital interfaces more challenging than traditional museum interpretation. Technical reliability issues compound these usability challenges through equipment failures, software glitches, and maintenance requirements that render digital systems periodically inaccessible (Di Nucci, pers.comm., 2023; Nenzioni, pers.comm., 2023). Museums operating with limited technical support often struggle to maintain digital installations at functional levels, creating visitor frustration when promised technological enhancements prove unavailable or dysfunctional. The institutional investment required for ongoing digital maintenance often exceeds initial installation costs, creating long-term financial commitments that strain museum resources .

More fundamentally, digital technologies often reproduce existing interpretive assumptions and institutional biases (Huggett, 2012) rather than addressing the systematic barriers that create lithic *semi-invisibility*. Digital databases typically organise lithic collections according to the same typological categories that static displays employ, reinforcing rather than challenging reductive approaches to prehistoric technological diversity. Virtual reality environments may as well reproduce the same primitivist assumptions about prehistoric lifeways sometimes presented in traditional displays; the development of digital content often occurs within institutional frameworks that prioritise technical innovation over archaeological accuracy or educational effectiveness.

6.2.4. Technical terminology vs accessible language: The language dilemma

The tension between specialist knowledge and public understanding presents both prehistoric archaeologists and museum professionals with genuine communicative dilemmas. Specialist lithic knowledge exists within highly technical vocabularies developed for scholarly communication. Translating this expertise into publicly accessible narratives proves challenging even for the specialists themselves, who must find ways to convey analytical concepts without losing essential technical content. Prehistoric archaeologists often struggle to articulate why subtle formal variations represent significant technological innovations, or how seemingly crude stone flakes demonstrate sophisticated problem-solving strategies. Museums, in turn, must work with these materials to create displays that engage visitors while maintaining scholarly accuracy. Museum interpretation traditionally operates through frameworks prioritising accessibility, stability, and immediate comprehension. Visitors expect clear explanations enabling rapid understanding without requiring specialist training or extended engagement with analytical complexity (Falk & Dierking, 2000). The communication chain from specialist research to public understanding involves multiple translation stages, each potentially introducing distortion or oversimplification. This communication challenge extends beyond museums to popular media, educational materials, and academic outreach, creating a broader pattern where lithic technologies remain poorly understood despite their fundamental importance to human origins evolution and heritage.

Institutional continuity and terminological inertia

Once established, archaeological terminology exhibits remarkable persistence despite changing theoretical frameworks and empirical discoveries. The continued use of outdated terms like *Homo sapiens sapiens* in popular vocabulary, or even the persistence of Clarkian lithic modes and Palaeolithic cultures despite many continuous criticisms, demonstrates how terminological systems sometimes develop momentum independent of their analytical utility. This inertia reflects several factors: 1) bibliographic continuity (existing outdated literature); 2) regional traditions (local archaeological communities maintain familiar terminology); and 3) international communication (established terms facilitate cross-regional comparison).

The communication of lithic technological knowledge within museum contexts confronts fundamental tensions between the precision required for accurate scientific representation and the accessibility necessary for effective public engagement. Contemporary lithic studies employ technical vocabularies that enable precise description of morphological variation, technological processes, and cultural distinctions. Terms such as *débitage*, *core preparation*, *retouch patterns*, provide analytical precision that supports rigorous scientific description and cross-cultural comparison (Inizan et al., 1995/1999). Morphological terminology includes detailed descriptive systems for technical lithic traits (Andrefsky, 2005; Boëda, 2023; Inizan et al., 1995/1999). Technological process terminology similarly enables precise description of production sequences, decision-making patterns, and skill levels that characterise different lithic traditions. The terminology used to describe the different knapping methods (e.g., *Levallois*, *discoïd*, *Quina*) represent analytical frameworks that communicate complex technological relationships through established professional vocabularies (Boëda, 1994; Pelegrin, 2000). However, these terms presuppose familiarity with archaeological methods and prehistoric technological systems. Similarly, functional and cultural terminology provides interpretive frameworks for understanding stone tool significance within broader prehistoric cultural systems. Terms such as *technological organisation*, *curation strategies*, *mobility patterns*, and *resource optimisation* enable communication about the social and ecological contexts that influenced technological choices and cultural practices (Andrefsky, 1994; Lemonnier, 1986, 1992). Yet to fully understand these concepts may require understanding of anthropological theory and archaeological methodology.

The adoption of these specialist terminologies within museum contexts—if not incomprehensible to museum visitors lacking archaeological training (and sometimes even to those who have)—can also be simply unnecessary. Research findings revealed consistent institutional struggles with language choices that create apparent dichotomies between scientific accuracy and public accessibility, resulting in interpretive approaches that may achieve comprehensibility at the expense of technological sophistication or maintain technical precision while excluding non-specialist audiences.

“Simplification” and the challenge of maintaining analytical precision

Museum attempts to address technical terminology barriers through simplification represent legitimate institutional responses to documented challenges in public science communication. The replacement of precise technical terms with more accessible descriptive

language reflects professional recognition that comprehensible information serves publics more effectively than technically accurate but incomprehensible terminology (Durant et al., 1989). When *Levallois cores* become “prepared stone blocks” or *pressure flaking* becomes “fine edge sharpening,” these are reflections of museums’ attempt to prioritise visitor understanding over technical precision, acknowledging that partial comprehension may prove more valuable than complete confusion. These accessibility strategies reflect institutional awareness that museum audiences possess diverse educational backgrounds, specialist knowledge, and engagement objectives that require flexible interpretive approaches. Professional curators consistently report that technical archaeological terminology creates barriers for family audiences, school groups, and casual visitors who constitute the majority of museum constituencies (Falk & Dierking, 2000; Fyfe & Jones, 2016; Merriman, 1989). Perhaps not even worthy to be called “simplification,” adaptive language translation approaches attempt to maintain essential information about technological processes and cultural significance while eliminating vocabulary that might exclude non-specialist audiences from meaningful engagement.

The functional translation of multifunctional implements into more recognisable categories, such as into *knives* and *arrowpoints*, similarly represents institutional attempts to provide accessible entry points into technological understanding. While these categories may not capture the full range of tool functions and cultural meanings, they offer familiar frameworks that enable visitors to begin developing understanding and appreciation. Museum professionals acknowledge that temporal narratives employing terms such as *development* and *advancement* may not accurately represent the complexity of prehistoric cultural change, yet these familiar frameworks provide accessible structures for communicating technological variation and cultural adaptation to wider audiences (Gascons, pers.comm., 2023; Nespoulet, pers.comm., 2023; Nenzioni, pers.comm., 2023). Recognising that some degree of interpretive compromise may be necessary is reflexivity in terms of effective public communication.

Reconsidering the expert-public knowledge relationship

The apparent tension between scientific precision and public accessibility reflects ongoing challenges within museum practice rather than inherent limitations in visitor learning capabilities or institutional communication potential. Contemporary research in science communication (Durant et al., 1989) suggests that the dichotomy between expert and public knowledge may be less absolute than traditional museum practice assumes, with visitors

often demonstrating considerable capacity for engaging with sophisticated concepts when provided with appropriate interpretive frameworks and educational support. Museum professionals increasingly recognise that accessibility challenges may result from presentation strategies rather than audience limitations. The expertise model that positions archaeological knowledge as inherently challenging for general audiences reflects legitimate concerns about visitor experience and educational effectiveness rather than assumptions about intellectual capacity (Förster, 2014).

Educational research suggests that complexity reduction may sometimes impede rather than enhance learning outcomes, particularly when simplification eliminates conceptual relationships and analytical frameworks that enable deeper understanding (Durant et al., 1989). However, museum professionals must balance these educational principles against practical constraints including limited visitor attention, diverse learning objectives, and institutional expectations for broad public appeal and accessibility. The digital literacy and educational backgrounds of contemporary museum audiences increasingly support engagement with complex content, particularly when presented through multimedia formats and interactive technologies. Nevertheless, museums serve diverse constituencies with varying levels of background knowledge, available time, and engagement objectives, requiring flexible interpretive approaches that can accommodate multiple visitor needs simultaneously.

6.3. Knowledge transformation processes

The translation of archaeological knowledge into that of the museum involves systematic processes of selection, interpretation, and translation that inevitably transform scientific understanding into accessible public communication. For lithic collections, this translation process creates particularly acute challenges because stone tool technologies encode multidimensional information about prehistoric human cognition, social organisation, environmental adaptation, and technological innovation (Dimensions 3, 4, and 6) that resist straightforward museum interpretation. Findings from the studied museum institutions suggest that the complex analytical frameworks that drive contemporary lithic research undergo substantial transformation in their *way* to public presentation. Museum displays necessarily operate within different constraints and objectives than academic research, requiring adaptation of technical knowledge for diverse audiences with varying levels of specialist background and interest, sometimes with the risk of putting in place simplified presentations that may inadvertently obscure rather than illuminate the technological complexity they purport to communicate. From the interplay of loss and creation emerged the mechanisms within this domain: the partial erasure of technical gesture, the dual processes of de- and re-contextualisation, and the phenomenon of knowledge being simultaneously lost in translation and re-articulated through mediation. These mechanisms therefore capture the transformative—not merely reductive—nature of museal knowledge production.

6.3.1. Technical gestures and embodied knowledge

The translation of lithic technological knowledge from archaeological analysis to museum presentation confronts fundamental challenges in communicating embodied practices and procedural understanding that resist visual representation through static display. Stone tool production represents a fundamentally kinaesthetic activity involving intense motor coordination, sensory feedback, and tacit knowledge systems that develop through extended practical engagement with materials and techniques ([Pelegrin, 1990](#)). Museum displays, constrained by institutional requirements for object preservation and visual accessibility, must communicate these dynamic technological processes through static arrangements that privilege morphological observation over procedural understanding, creating systematic gaps between archaeological knowledge and public comprehension.

The nature of lithic technical knowledge

Lithic technology represents one of the most thoroughly studied domains of prehistoric technical knowledge, yet its complexity remains largely invisible to museum visitors encountering finished stone tools without reference to the complex cognitive and motor processes required for their production. Contemporary experimental archaeology and technological analysis have documented the skill requirements, decision-making processes, and embodied knowledge systems that characterised even apparently *simple* stone tool technologies (e.g., Roux & Bril, 2005). The production of effective cutting implements requires understanding of raw material properties, fracture mechanics, force application techniques, and error correction strategies that develop only through extensive practice and cultural transmission. Mauss's (1935) concept of "techniques of the body" provides a foundational framework for understanding these embodied dimensions. Technical activities rely on learned bodily dispositions, motor habits, and sensory skills acquired through participation rather than formal instruction. In lithic production, this translates into complex sensorimotor coordination, spatial awareness, and material sensitivity developed over years of practice (Bamforth & Bleed, 1997). Leroi-Gourhan's (1964; 1993) work further emphasises the interplay between technical objects and embodied skill, arguing that tools externalise human motor functions and cognitive capacities. Stone tools thus encode bodily knowledge as much as functional solutions.

Contemporary research in cognitive archaeology has further documented the complex mental processes involved in stone tool production, including spatial reasoning, sequential planning, working memory coordination, and error monitoring capabilities that rival those required for other cultural activities (Stout, 2011). Neurological studies of contemporary stone knappers reveal activation patterns in brain regions associated with complex motor planning, tool use, and language processing, suggesting that lithic technology involved cognitive capabilities comparable to other forms of symbolic behaviour (Stout et al., 2008).

The sensory dimensions of technological practice—tactile, auditory, and visual feedback—enable skilled practitioners to assess material properties, monitor progress, and adjust techniques in real time (Bril et al., 2010). Experienced knappers recognise subtle variations in stone quality, anticipate fracture outcomes, and correct errors through finely tuned feedback systems. These capabilities require extensive training and are central to technological effectiveness. Motor skills in knapping involve precision, coordination, and

controlled force application. Effective flake removal depends on managing impact dynamics, angles, and energy transmission while avoiding errors or breakage. Hand-eye coordination integrates visual processing, spatial reasoning, and motor control ([Biryukova & Bril, 2008](#)). Biomechanical studies further reveal how body positioning, grip strategies, and support arrangements optimise force transmission and reduce risk ([Williams et al., 2014](#)). These embodied, cognitive, and biomechanical dimensions represent extraordinary human achievement, yet they remain almost entirely invisible in static museum displays.

Visible attributes vs. invisible complexities

Museum presentations of lithic collections typically emphasise the morphological characteristics that remain visible in finished tools: form, size, raw material, surface modification, while the technological processes, cognitive demands, and embodied skills required for production remain entirely invisible to visitor experience. This visibility bias creates systematic distortions in public understanding of prehistoric technological capability by foregrounding the most accessible aspects of stone tool technology while obscuring the sophisticated knowledge systems that represent their primary archaeological and cultural significance.

The reduction sequence approach that dominates contemporary lithic analysis provides detailed understanding of the operational chains through which raw materials were transformed into finished implements ([Boëda, 1994](#); [Inizan et al., 1995/1999](#); [Leroi-Gourhan, 1964](#)). These sequences involve complex decision-making processes about core preparation, platform selection, force application, angle management, and error correction that require great understanding of material properties and fracture mechanics. Museum visitors encountering finished tools without reference to these production processes may develop impressions of stone tool technology as simple and intuitive rather than recognising the extraordinary skill and knowledge that effective lithic production actually required. The technological choices embedded within lithic assemblages reflect understanding of functional requirements, raw material constraints, mobility patterns, and cultural preferences that archaeological analysis can reconstruct but museum display struggles to communicate ([Bamforth & Finlay, 2008](#)). Different knapping techniques produce tools with specific performance characteristics suited to particular tasks and use contexts, requiring technological knowledge that encompasses not merely production methods but comprehensive understanding of functional requirements and use-life expectations.

Museum interpretation of lithic collections frequently relies on simplified functional narratives that identify tools according to presumed activities, e.g., scrapers, points, choppers, without necessarily communicating the technological complexity and multi-functional capabilities that characterised most prehistoric implements (Keeley, 1980). These functional categories, while providing accessible frameworks for visitor understanding, may inadvertently reduce highly complex technological achievements to simple mechanical solutions while obscuring the decision-making processes and cultural knowledge that tool design and production involved. Use-wear analysis and experimental archaeology have demonstrated that most stone tools performed multiple functions throughout their use-lives, with specific activities varying according to situational requirements, material availability, and cultural preferences (Odell, 2004). The multifunctional capabilities of stone implements reflect design strategies that optimised tool performance across diverse task requirements while minimising raw material investment and transport costs. Museum presentations that emphasise single-function interpretations may misrepresent the flexibility that characterised prehistoric technological systems. The hafting systems that enhanced stone tool effectiveness involved complex technological knowledge about organic material properties, adhesive preparation, binding techniques, and composite tool design that archaeological evidence reveals but museum display rarely communicates (Rots, 2010). Many stone tools functioned as components of complex composite implements that integrated multiple materials and manufacturing techniques, requiring technological knowledge that involve not only stone working but also a comprehensive understanding of organic material processing, adhesive technology, and mechanical engineering principles.

The cognitive processes involved in lithic production include complex spatial reasoning about three-dimensional form modification, sequential planning of multi-stage reduction processes, working memory coordination of multiple task demands, and real-time adjustment to material variability and production errors (Nonaka et al., 2010). These mental capabilities represent sophisticated cognitive achievements that exceed those required for many other prehistoric cultural activities, yet they remain entirely invisible when visitors encounter finished tools without reference to their production contexts. The technological choices evident in lithic assemblages reflect sophisticated optimisation strategies that balanced multiple competing demands including functional effectiveness, raw material economy, transport requirements, maintenance possibilities, and cultural preferences (Andrefsky, 1994). These optimisation processes required technological knowledge that encompassed comprehensive understanding of material properties, use contexts, mobility

patterns, and resource availability patterns that enabled effective technological decision-making across diverse and changing circumstances.

Static museum displays face fundamental limitations in communicating the procedural knowledge and temporal sequences that constitute the core of technological understanding. Stone tool production involves extended sequences of preparatory activities, core reduction episodes, tool modification processes, use activities, maintenance cycles, and disposal decisions that unfold over considerable time periods and spatial contexts (Schlanger, 1996). These temporal dimensions remain entirely invisible in museum presentations that display finished products without reference to their production histories or use-life trajectories. The learning processes through which technological knowledge develops involve extended apprenticeship relationships, practice sequences, error correction episodes, and skill refinement activities that require years of development and community participation (Lave & Wenger, 1991). Ethnographic studies of contemporary stone tool production document the complex social relationships and extended time investments required for technological competence development, revealing intricate cultural institutions for knowledge transmission that archaeological evidence suggests characterised prehistoric societies as well (Stout, 2002). The cultural transmission studies that examine how technological knowledge develops and spreads within and between communities reveal complex social processes that influence technological change, innovation adoption, and knowledge preservation across generations (Shennan, 2002). These studies demonstrate that technological knowledge represents social phenomena that require community institutions, teaching relationships, and cultural practices for effective transmission and maintenance over time.

6.3.2. De-contextualisation and re-contextualisation

The landscape contexts that originally surrounded lithic production encompass geological formations that provided raw materials, water sources necessary for knapping activities, seasonal resource areas that influenced tool design requirements, and topographical features that structured human movement and site selection. These environmental relationships prove particularly significant because stone tool technologies represent adaptive responses to specific ecological challenges and resource opportunities that shaped both technical choices and cultural practices (Ingold, 2000). Social and economic contexts involve the knowledge systems, learning relationships, and cultural practices that enabled technological transmission across individuals and generations (Lemonnier, 1992; Leroi-Gourhan, 1964;

[Mauss, 2006](#)). Stone tool production required a high-level understanding of raw material properties, fracture mechanics, and functional requirements that developed through extended apprenticeship relationships and community participation. The tools themselves functioned within broader technological systems that included organic components, complementary implements, and coordinated activities that archaeological recovery typically fragments or obscures entirely. Archaeological lithics exist within spatial relationships that provide them meaning—tools clustered at butchery sites, debitage concentrated at knapping locations, transported implements indicating mobility patterns, cached materials revealing anticipatory planning.

While excavation and post-excavation processes are commonly framed as sequences of contextual depletion, these transitions simultaneously generate new relational environments. Removal from a systemic context entails the loss of behavioural associations; insertion into an archaeological matrix yields taphonomic and stratigraphic associations that constitute meaningful contexts in their own right. Likewise, incorporation into laboratory, typological, or curatorial infrastructures produces new comparative and classificatory contexts that enable forms of inference unavailable *in situ*. Context is therefore not simply eroded but reconstituted through successive material and institutional translations.

The presentation of lithic collections within museum environments necessitates the extraction of stone tools from the complex spatial, temporal, and social contexts that originally gave them meaning within prehistoric technological systems. Archaeological contexts are inherently fragmented due to preservation, and the removal from excavation contexts to laboratory and museum represents further transformation: specimens lose original spatial, temporal, and associational relationships while gaining new meanings through scientific analysis, comparative study, and heritage designation. This recontextualisation represents an inevitable consequence of archaeological recovery and museum organisation, as objects must be physically removed from their original positions and integrated within institutional frameworks designed for preservation, study, and public presentation (e.g., [Semah, 2015b](#)). However, the methods through which museums address this contextual separation significantly influence how visitors understand prehistoric technological achievements and the sophisticated relationships that characterised early human material culture. Archaeological contexts for lithic materials encompass multiple interconnected dimensions that extend beyond spatial location to include technological, social, environmental, and temporal relationships that structured prehistoric tool production

and use. In their systemic context, stone tools originally existed within what assemblage theorists term “distributed networks” of materials, processes, and human activities that spanned considerable geographic areas and temporal sequences (Schiffer, 2008).

Museums must navigate these transformations, wherein objects extracted from one set of meaning-making relationships (systemic archaeological context) enter another (institutional museum context) without simply replicating either. The challenge lies not in eliminating transformation, which is inevitable, but in managing it strategically so that essential dimensions of technological, cultural, and temporal significance remain accessible despite contextual displacement. Currently, this transformation often proceeds through systematic simplification: technical terminology becomes generic description, procedural knowledge reduces to finished products, interpretive uncertainty converts to authoritative claims. The language dilemma between technical precision and public accessibility typically resolves through oversimplification that eliminates analytical sophistication without achieving genuine comprehension. These translation processes reflect genuine institutional dilemmas rather than curatorial inadequacy, yet they systematically render archaeologically rich materials culturally impoverished within display contexts.

Museum approaches to contextual presentation

Contemporary museums employ various strategies to address the contextual challenges posed by decontextualised lithic collections, with approaches ranging from systematic typological organisation to reconstructed environmental settings. Data presented here reveals institutional preferences for presentation methods that emphasise morphological classification and chronological sequence over spatial or social relationships, reflecting both practical constraints and interpretive traditions inherited from earlier periods of museum development. Typological organisation represents the most common approach to lithic presentation, arranging tools according to formal categories that enable comparative analysis while providing systematic frameworks for visitor comprehension. This organisational strategy offers clear educational advantages through its capacity to demonstrate technological variation, cultural distinctions, and chronological development across different prehistoric periods (Trigger, 2006). However, typological arrangement necessarily abstracts individual tools from their specific contextual relationships, presenting them as representatives of broader categories rather than components of particular technological systems or cultural practices. Geographic organisation, employed by some institutions, attempts to maintain spatial relationships by presenting lithic assemblages according to their

regional or site-specific origins. This approach can communicate landscape associations and environmental adaptations while preserving some connection to original contexts. Nevertheless, geographic presentation faces limitations when dealing with mobile prehistoric populations whose technological activities spanned multiple locations and resource areas, potentially obscuring the dynamic relationships between people, materials, and environments that characterised much prehistoric technology. Chronological approaches emphasise temporal development and technological change over time, enabling museums to communicate evolutionary sequences and cultural transformation that static displays might otherwise obscure. These presentations can effectively demonstrate long-term technological development while situating individual tools within broader narratives of human adaptation and innovation. However, chronological organisation may inadvertently suggest linear progression and technological determinism while underemphasising the contextual factors that influenced technological choice and cultural practice.

Site-specific museums and contextual preservation

Site-specific museums, developed at or adjacent to archaeological locations where lithic materials were originally recovered, theoretically offer superior opportunities for maintaining contextual relationships through direct spatial connection to original discovery locations. Findings documented how these institutions attempt to preserve landscape associations, environmental contexts, and spatial relationships that more distant museums cannot easily communicate. However, site-specific presentation faces its own contextual challenges through the temporal disconnection between contemporary museum environments and prehistoric contexts. Modern landscapes may differ substantially from past environmental conditions due to climate change, vegetation succession, geological processes, and human modification that obscure original relationships between sites, resources, and technological activities. Archaeological sites themselves represent palimpsests of multiple occupation episodes that span considerable time periods, potentially creating misleading impressions about the coherence and temporal specificity of recovered assemblages.

Site museums also confront interpretive challenges when attempting to reconstruct prehistoric contexts using incomplete archaeological evidence. The material remains that survive archaeological recovery represent only partial indicators of past technological systems, with organic components, spatial arrangements, and activity patterns requiring interpretive reconstruction that exceeds available evidence. These reconstructive efforts,

while educationally valuable, risk presenting speculative interpretations as established facts while potentially misrepresenting the uncertainty and complexity that characterise archaeological knowledge.

Implications for public understanding

The recontextualised presentation of lithic collections creates systematic patterns in public understanding that shape broader perceptions of prehistoric technological capability and cultural sophistication. When stone tools appear as isolated specimens within museum cases, visitors may develop impressions of prehistoric technology as simple, individualistic, and disconnected from broader cultural systems. This atomised presentation potentially reinforces evolutionary assumptions about technological progression while obscuring the planning, social coordination, and environmental knowledge that prehistoric technologies actually required.

The separation of tools from their landscape contexts may contribute to perceptions of prehistoric peoples as disconnected from environmental relationships or lacking sophisticated understanding of resource management and territorial organisation. When lithic assemblages appear without reference to the geological formations, seasonal patterns, and resource distributions that structured their production and use, visitors may underestimate the ecological knowledge and adaptive capability that prehistoric technologies represented. Similarly, the absence of social context may contribute to individualistic interpretations of technological achievement that overlook the collaborative knowledge systems, teaching relationships, and cultural transmission processes essential for maintaining technological traditions across generations. When tools appear as products of individual skill rather than community knowledge systems, museum presentations may inadvertently diminish recognition of prehistoric social complexity and cultural achievement.

6.3.3. Lost in translation, found in mediation?

Live mediation and alternative knowledge pathways

Museum interpretation extends beyond permanent displays to include guided tours, educational programming, handling sessions, and workshop activities delivered by museum mediators. Museum mediators represent a distinct mode of knowledge transformation that operates alongside museum displays. Unlike fixed interpretive materials, live mediation

introduces dynamic, dialogic processes through which specialist archaeological knowledge encounters public audiences. First of all, dialogic interaction permits responsive explanation, where mediators adjust vocabulary and conceptual frameworks based on visitor questions and comprehension levels, introducing possibilities for negotiated meaning-making that monologic displays structurally exclude. These affordances address specific constraints identified in material reality and display limitations: temporal processes become visible, material properties become tangible, and epistemological distance narrows through guided experience that modifies physical, sociocultural, and personal contexts simultaneously (Falk & Dierking, 2000).

Museum education research demonstrates that visitors construct meaning through interaction with objects, texts, and social contexts rather than passively receiving information (Falk & Dierking, 2000; Hein, 2006); mediators function as pedagogical translators, possessing expertise in filtering complex archaeological frameworks into accessible activities based on accumulated experience of what resonates with non-specialist audiences. This filtering reflects pedagogical content knowledge—understanding how to transform subject matter for teaching—which differs fundamentally from archaeological expertise itself (Shulman, 1986). Knowledge transformation through live mediation thus involves two successive stages: archaeological analysis becomes mediator comprehension, which then becomes visitor engagement, extending existing chains of mediation that already structure museum objects (Macdonald, 2002).

Live mediation introduces distinct transformations alongside its affordances. The distinction between epistemological access—understanding the knowledge systems archaeologists use to interpret technology—and experiential engagement—feeling connected to prehistoric practice—remains analytically critical. Visitors may enjoy making stone tools without comprehending the analytical frameworks archaeologists employ to interpret them.

The pedagogical imperative—creating activities that appeal to diverse publics and generate mindful engagement rather than passive browsing—shifts emphasis from technological complexity toward accessible craft experience, sometimes reinforcing perceptions of simplicity rather than challenging them. How mediators approach knowledge translation further structures what transformation occurs. Operating from deficit models—assuming publics lack knowledge that experts possess—mediators may simply simplify archaeological frameworks through linear transmission. Contextual models recognize that publics possess

existing knowledge systems and legitimate interests that shape engagement with specialist knowledge (Lewenstein, 2003), prompting mediators to build bridges between archaeological and visitor frameworks rather than merely reducing complexity. These underlying communication philosophies shape whether mediation produces genuine epistemological access or reproduces patterns of undervaluation through pedagogical apparatus.

The temporal and spatial characteristics of live mediation distinguish it from permanent display apparatus. Educational programmes operate episodically—weekend workshops, summer camps, scheduled tours—reaching limited audiences during specific timeframes. Unlike static displays available continuously, mediated engagement depends on coordination between institutional programming and visitor availability. Spatial requirements compound these limitations: knapping demonstrations require dedicated areas separated from display galleries, hands-on workshops need storage for raw materials and tools, and educational activities often occur in spaces distinct from exhibition contexts. Live mediation typically supplements rather than replaces static display as the primary communicative mode for collections.

Static and mediated knowledge pathways involve both complementarity and transformation. Mediators address specific constraints of display apparatus—revealing temporal processes, enabling material engagement, responding to visitor incomprehension—while transforming archaeological knowledge through pedagogical priorities and experiential frameworks. The prehistory summer camp participant who successfully produces a flake encounters technology through embodied practice impossible in static display, experiencing material resistance and technical constraints that generate phenomenological understanding. Yet this encounter may not correspond to archaeological understanding of technological organisation, variability, or cultural significance. Live mediation represents alternative transformation, with distinct affordances, constraints, and epistemological implications for how museum publics engage material heritage.

6.4. Archaeological vis-à-vis museal ways of knowing

The systematic challenges documented throughout contemporary lithic presentation reflect fundamental epistemological tensions between the knowledge production practices that characterise archaeological science and the communication requirements that govern museum practice. Archaeological knowledge develops through specialist analytical methods, theoretical frameworks, and interpretive conventions that emphasise precision, complexity, and ongoing revision, while museum communication operates within institutional frameworks that prioritise accessibility, stability, and immediate comprehension (Wylie, 2002). These divergent epistemological requirements create systematic tensions that influence how prehistoric technological knowledge moves between specialist and public domains. On one hand, archaeological interpretation of lithic collections depends on analytical approaches that acknowledge uncertainty, embrace complexity, and maintain openness to alternative interpretations based on new evidence or theoretical developments. The approaches that drive contemporary lithic research produce nuanced understandings of prehistoric technological behaviour that resist simple summary or definitive conclusion. Museum presentation, on the other, requires interpretive stability and accessible conclusions that enable visitors to develop clear understanding of prehistoric technological achievement without requiring specialist training or extended engagement with analytical complexity.

Archaeological understanding of lithic technological systems develops through accumulation of evidence, refinement of analytical methods, and theoretical development that may fundamentally alter interpretive frameworks over extended time periods (Trigger, 2006). Museums must balance these ongoing knowledge developments against institutional requirements for interpretive consistency and visitor comprehension that favour established conclusions over evolving understanding. The collaborative and cumulative nature of archaeological knowledge production creates additional tensions with museum communication frameworks that typically emphasise individual institutional authority and interpretive ownership.

Museums function as conduits for archaeological knowledge but also as active participants in its construction, validation, and cultural significance through their selection, interpretation, and presentation practices (Shanks & Tilley, 1992; Stevenson, 2022). The curatorial decisions that determine which aspects of lithic research receive public attention

and which interpretive frameworks achieve cultural recognition influence the broader cultural status of prehistoric archaeology and its relevance within contemporary heritage discourse (Bennett, 1995; Smith, 2006). Museum practices thus participate in defining what constitutes legitimate archaeological knowledge and culturally significant prehistoric heritage. The institutional requirements that govern museum practice, e.g., conservation standards, educational objectives, funding constraints, visitor expectations, create systematic filters that influence which aspects of archaeological knowledge achieve public visibility and which remain confined to specialist domains. Complex theoretical discussions about technological organisation, debates about reduction sequence interpretation, and nuanced methodological developments in use-wear analysis may receive limited museum attention if they cannot be translated into accessible interpretive frameworks that support institutional educational objectives (Macdonald, 2002). The temporal compression required for museum interpretation influences the cultural perception of archaeological knowledge by transforming ongoing research processes into stable interpretive conclusions. When museums present archaeological understanding as established knowledge rather than ongoing inquiry, they may inadvertently create public expectations for definitive conclusions about prehistoric technological behaviour while obscuring the uncertainty, complexity, and ongoing revision that characterise actual archaeological research practice. The spatial and visual requirements of museum presentation similarly influence how archaeological knowledge achieves cultural significance by privileging interpretive approaches that translate effectively into display formats and visitor experiences. Archaeological insights that depend on statistical analysis, comparative databases, or theoretical abstraction may struggle to achieve museum representation compared to interpretive conclusions that can be communicated through object display and spatial arrangement.

The presentation strategies that museums employ for lithic collections participate in constructing public perceptions of prehistoric archaeology as a discipline, influencing its cultural status, funding support, and academic recognition within broader scholarly and cultural contexts. When museums present lithic collections through frameworks that emphasise typological classification, chronological sequence, and morphological variation, they communicate implicit messages about archaeological methodology, interpretive priorities, and theoretical sophistication that influence public understanding of disciplinary identity and scholarly legitimacy (Trigger, 1989). The comparative frameworks that position lithic collections in relation to other archaeological materials influence perceptions of prehistoric archaeology's scope, significance, and cultural relevance. When stone tools

receive limited attention compared to artistic objects, monumental architecture, or historical artefacts, museums may inadvertently communicate hierarchical assumptions about archaeological specialisation and cultural significance that influence public support and institutional recognition for prehistoric research. The interpretive language that museums employ for lithic collections shapes perceptions of archaeological analytical sophistication and theoretical development. When museum interpretation relies on simplified functional categories, basic chronological frameworks, and general descriptive language, it may create impressions of prehistoric archaeology as methodologically unsophisticated compared to other archaeological specialisations that appear to address more complex cultural phenomena or employ more advanced analytical approaches.

Implications for the public relevance of prehistoric archaeology

The systematic challenges documented in contemporary lithic presentation have broader implications for prehistoric archaeology's cultural position and public support that extend beyond individual museum contexts to encompass disciplinary funding, academic recognition, and cultural significance within contemporary heritage discourse. The invisibilisation of technological complexity and the persistence of problematic interpretive frameworks may contribute to broader cultural marginalisation of prehistoric research that influences its institutional support and scholarly status. The temporal othering documented in museum presentation may contribute to public perceptions of prehistoric archaeology as addressing culturally irrelevant historical periods that lack contemporary significance or practical application. These perceptions may influence funding decisions, academic priorities, and cultural policies that determine institutional support for prehistoric research and heritage preservation. When prehistoric technological achievement appears culturally distant and personally irrelevant, public investment in its study and preservation may appear less justified compared to more obviously relevant cultural and historical priorities.

The epistemological tensions between archaeological knowledge production and museum communication may create systematic barriers to public appreciation for prehistoric archaeological methodology and theoretical sophistication. When museum presentation cannot effectively communicate the analytical complexity and interpretive nuance that characterise contemporary prehistoric research, public understanding of disciplinary achievement and scholarly contribution may remain limited, potentially influencing academic recognition and institutional support.

The heritage significance that prehistoric archaeological materials achieve through museum presentation influences broader cultural attitudes toward preservation, research funding, and policy development that affect disciplinary sustainability and growth. Materials that achieve recognition as culturally significant heritage resources generate public support for their preservation and study, while collections that remain culturally peripheral may struggle to justify continued institutional investment and research attention.

6.5. Synthesis: From technological knowledge to heritage

The “break” in the transformation of lithic artefacts from archaeological specimens embodying specialist technological knowledge into heritage where such knowledge becomes publicly accessible and meaningful is what constitutes its *semi-invisibility*. The discussion attempts to explain not merely how lithics move between contexts, but what happens when technological understanding—the specialist archaeological frameworks for interpreting production systems, decision-making processes, and embodied practices—must become heritage narratives serving contemporary cultural functions and public engagement objectives.

Archaeological lithic knowledge operates through frameworks examining objects as evidence of technological systems. Through the seven technological dimensions as lens, museum lithics reveal how this manifests in specific analytical challenges. *Material engagement* demands understanding lithics as both natural entities with specific physical properties and cultural materials selected and modified according to need and following technological requirements. *Sequential organisation* requires recognising individual objects as components within extended operational chains rather than isolated finished products. *Technical choices and contexts* depend on interpreting morphological features as evidence of decision-making processes rather than natural or random variations. *Variability and adaptation* reflect intentional cultural practices that must be distinguished from natural heterogeneity. *Social dimensions* involve inferring learning processes, knowledge transmission, and community practices from material traces. *Economic embedding* situates technologies within broader subsistence and mobility systems that extend beyond observable objects. *Temporal dynamics* encompass both the deep time scales of technological change and the immediate timeframes of production, use, and discard episodes.

Because the ontological status of stone tools is constituted across geological, technical, embodied, and social dimensions, much of their significance is not visually self-evident. The “tool-ness” of a lithic artefact is neither inherent nor obvious; it is constituted through culturally situated decisions, gestures, and technical schemes. If stone tools are ontologically complex, then it would follow that their presentation must account for the geological, technological, embodied, and social relations from which they emerge. Without such contextualisation, the museum representation remains ontologically impoverished,

“reducing” artefacts when unable to convey the depth and multiplicity of their being. Acknowledging ontological complexity therefore provides a compelling explanation for why stone tools are uniquely challenging to display meaningfully and why their value is difficult to make visible to a general audience. The poverty of form, scale challenges, functional opacity, and preservation bias operate as intrinsic characteristics of knapped stone rather than problems amenable to museographic solutions alone. Museums cannot make lithics inherently more visually legible, cannot change the intimate scale at which tools functioned, cannot render technological features suddenly visible, cannot restore vanished organic components. These ontological limitations establish boundaries within which valorisation strategies must operate. In any case, the material nature of stone tools does not exclusively determine representational failure. Documented institutions achieve substantial technological visibility despite these intrinsic challenges through appropriate combinations of materials, museographic approaches, and interpretive strategies.

The point is that heritage communication requires fundamentally different frameworks. Public heritage functions through cultural narratives connecting past with present, affective engagement generating emotional resonance with historical materials, pedagogical clarity enabling comprehension without specialist training, and identity construction wherein objects become meaningful through contemporary cultural values rather than archaeological significance alone (Smith, 2006). The transformation from technological knowledge to heritage thus involves categorical shift in what objects are and how they generate meaning.

7.

TRACING LITHIC TRAJECTORIES THROUGH TIME AND SPACE: **A VALORISATION PROPOSAL**

7.1. The foundation for an alternative approach

The analysis presented in Chapter 6 reveals interconnected mechanisms through which lithic collections, despite their archaeological centrality and material importance in prehistoric assemblages, achieve marginal cultural impact within contemporary Italian museum practice. This condition emerges not from isolated curatorial failures but through convergent processes operating across material, spatial, organisational, and epistemological dimensions. There is a need, therefore, for an approach that addresses these mechanisms; that which also entails recognising existing museum practice strengths while targeting specific valorisation opportunities that are unexplored in current frameworks. The foundation of the proposal is established through two complementary components. First, it synthesises the diagnostic findings from the research, demonstrating how material properties, museological apparatus (museographic considerations but also the museum as an institution), knowledge transformation processes, and epistemological tensions explain lithic *semi-invisibility*. Second, it articulates the specific knowledge capacities this approach seeks to cultivate, ensuring that valorisation strategies remain anchored in substantive outcomes. These foundations enable the subsequent methodological framework to address specific mechanisms while maintaining coherence across diverse museum contexts and institutional capacities.

7.1.1. What is valorisation?

In Italian cultural heritage terminology, *valorizzazione* refers to the process of enhancing the value and accessibility of cultural heritage to maximise its social, cultural, educational, and economic potential for present and future generations. The concept encompasses several interconnected dimensions:

- 1) Making heritage accessible and comprehensible. This involves creating conditions for public enjoyment through appropriate infrastructure, interpretation, and communication strategies.
- 2) Activating the intrinsic values of heritage. Rather than creating value where none exists, *valorizzazione* draws out and amplifies the historical, artistic, scientific, and identity-affirming qualities already present in cultural assets.

- 3) Sustainable use and management. The process must balance public access with conservation imperatives, ensuring that utilisation doesn't compromise the heritage's integrity or transmission to future generations.
- 4) Economic and territorial development. While not purely commercial, *valorizzazione* recognises heritage as a resource that can stimulate local economies, tourism, and community development when properly managed.

The term is enshrined in Italian heritage legislation, particularly the *Codice dei Beni Culturali e del Paesaggio* (Legislative Decree 42/2004), which distinguishes *valorizzazione* from *tutela* (protection/conservation). While *tutela* focuses on preservation and preventing damage, *valorizzazione* concerns active promotion and sustainable exploitation of heritage resources.

7.1.2. Problem synthesis

The research articulates five interconnected mechanisms that produce the *semi-invisibility* of Palaeolithic technological heritage. These mechanisms operate at different registers—some are inherent to lithic materiality; others emerge from institutional structures or disciplinary frameworks. While valorisation strategies cannot eliminate material or epistemic constraints, understanding the mechanisms enables targeted interventions addressing the institutional and communicative dimensions of undervalourisation.

Material realities and ontological complexity

Lithics exist simultaneously as geological specimens, technological objects, research evidence, and cultural heritage, creating an ontological complexity which, however, is challenging to communicate effectively because of the artefact's inherent physical properties. Varying degrees of a *poverty of form* is generated by the very features that *make* lithics: durability but sometimes without matching context, the reductive manufacturing process of knapping that “removes” rather than adds visual elaboration, opacity of technological features and knapping principles (edge angles, platform preparation, retouch patterns) that require specialist interpretation to properly appreciate, and modest scale lacking monumental presence (i.e., “broken stones”). Of course, not all stone tools look identical, but while morphological variation exists across knapping methods and Palaeolithic periods (for example, Solutrean laurel leaf points versus Oldowan choppers), even visually refined specimens communicate their technological sophistication primarily through

features inaccessible to untrained observation; that is, “beautiful lithics” may still require specialist literacy to appreciate *why* they are sophisticated. This ontological complexity contributes to undervalorisation by making lithic collections appear undifferentiated or pedagogically intractable compared to more immediately “legible” archaeological materials. Museums facing resource constraints may deprioritise interpretive investment in collections that demand specialist literacy to appreciate, perpetuating cycles where difficult-to-interpret materials receive inadequate curatorial attention.

Museographic aspects

Traditional and contemporary museum display technologies—vitrines, dioramas, casts and replicas, digital tools—fulfil essential preservation, research, and educational functions through established museum protocols. However, these same systems limit engagement possibilities for lithic collections specifically: when ubiquitous it creates cognitive oversaturation; protective display eliminates tactile and kinaesthetic access essential for comprehending objects whose significance derives from embodied knowledge; spatial isolation fragments assemblages whose meaning emerges through technological relationships and contextual associations.

Institutional dynamics

Institutional commitments and organisational priorities shape how museums allocate resources, attention, and interpretive effort across collections. Museums operate according to their own disciplinary traditions, institutional logics, and organisational imperatives. They are a service apparatus for archaeological interpretation but not exclusively; they are autonomous sites of knowledge production and heritage construction with legitimate priorities extending beyond any single material category. Internal logics including institutional mission, curator commitment, disciplinary hierarchies, funding structures, expertise distributions, and historical legacies shape collection treatment alongside external pressures from tourism markets, urban-rural dynamics, regional politics, and distance to archaeological sites. Effective valorisation must therefore work with rather than against these institutional realities, identifying strategic opportunities where lithic-specific interventions align with broader museum objectives and fit within organisational dynamics. These produce undervalorisation when lithic collections compete unsuccessfully for resources against collection categories more aligned with institutional missions, tourism expectations, or established curatorial expertise. Effective valorisation must therefore

identify strategic alignments between lithic-specific needs and existing institutional priorities.

Knowledge transformation

The translation of specialist archaeological knowledge into museum interpretation involves negotiation: dimensions most scientifically significant may not necessarily be productive in communicating value considering museum contexts and specificities. While lithic collections acquire formal heritage status through museum accession and legislative frameworks that recognise their significance, this designation alone does not ensure a heritage function for museum publics. For technological knowledge encoded in lithic assemblages to operate as heritage—as publicly accessible, culturally meaningful inheritance—it must undergo transformation from specialist archaeological understanding to communicative forms that make that significance legible. This transformation is neither automatic nor inevitable but requires deliberate interpretive work. In the process, the museum becomes its own site of archaeological (but not exclusively) knowledge production (Delley & Schlanger, 2022; Stevenson, 2022). Technical gestures and embodied knowledge—motor skills, decision-making processes, sensory feedback systems, and procedural understanding central to stone tool production—resist communication through visual display alone. The recontextualisation of objects as the inevitable consequence of archaeological recovery and museum organisation, represents a movement through contexts (systemic → archaeological → museum/heritage) (Carman, 2010; Schiffer, 1972) resulting to changes in what the objects mean and how these meanings can be known. The language dilemma is a well-defined manifestation of such undercurrents.

Epistemological tensions

Underlying these specific mechanisms, as it becomes revealed, lies a fundamental epistemological divergence between contemporary theoretical approaches to lithic studies and the museological frameworks within which collections are presented. Contemporary Palaeolithic archaeology, drawing from processual emphases on technological organisation and post-processual attention to embodied practice and cultural meaning (e.g., Binford, Clarke, Leroi-Gourhan, Mauss), operates through analytical frameworks that emphasise process over product, assemblages over individual objects, interpretive complexity over authoritative certainty, and specialist methodologies not necessarily designed for public accessibility. Museum communication, however, largely preserves organisational and interpretive structures established during the culture-historical phase of archaeological

development (e.g., Kossinna, Childe, Clark), operating through different priorities: finished objects rather than production sequences, individual specimens rather than statistical patterns, definitive statements rather than provisional interpretations, and conceptual frameworks designed for broad comprehension rather than disciplinary precision. Theoretical transformations since the 1960s have reoriented specialist understanding toward dimensions that resist translation into display paradigms established generations earlier (Bennett, 1995; Trigger, 1989). Developing methodologies that effectively mediate between these two knowledge production systems constitutes the proper domain of museum archaeology, not as auxiliary service to either field, but as a distinct enterprise addressing how specialist archaeological knowledge functions within public heritage contexts and how institutional frameworks might adapt to accommodate transformed theoretical understandings (e.g., Skeates, 2017; Stevenson, 2022). This epistemological divergence underlies and enables other mechanisms of undervalorisation. When museum frameworks cannot accommodate contemporary archaeological understanding, institutions may maintain culture-historical display paradigms not because they are optimal, but because updating interpretive structures to reflect processual and post-processual insights would require fundamental reconceptualisation of exhibition logic. Theoretical lag thus becomes structural inertia, with lithic collections bearing disproportionate consequences due to their dependence on frameworks museums have not yet adopted.

7.1.3. Target knowledge domains: What should lithic valorisation achieve?

The mechanisms interact to produce lithic undervalorisation: material and epistemic challenges combine with institutional constraints and communicative gaps to systematically deprioritise lithic interpretation relative to archaeological significance. The result is the semi-invisibility of Palaeolithic technological heritage—materially present collections whose epistemic content remains inaccessible to museum publics. Valorisation strategies must therefore address this phenomenon through working strategically within institutional realities while developing methodologies that make technological heritage legible despite inherent material and epistemic challenges.

Effective valorisation requires clear articulation of desired outcomes beyond vague aspirations for “better public engagement” or “increased visibility.” Recent scholarship in public archaeology and heritage education has begun articulating frameworks for

archaeological literacy, or “the knowledge, ideas, and habits of mind enabling citizens to engage meaningfully with archaeological heritage” (Franklin & Moe, 2012). Educational research has similarly identified core competencies for understanding prehistoric archaeology, including comprehension of archaeology as scientific discipline, temporal reasoning across deep time scales, and integration of natural science and humanities perspectives (Besse et al., 2019). Building upon these foundations while recognising the specific affordances and constraints of museum contexts, this research defines four interconnected knowledge domains that lithic valorisation seeks to cultivate. These domains are articulated as analytically distinct for clarity but are inescapably overlapping in practice; different museum types may emphasise these domains according to their missions and apply the framework accordingly. Moreover, these represent potential dimensions of visitor engagement rather than prescribed learning outcomes, acknowledging that museum experiences encompass affective, social, and embodied dimensions.

Disciplinary competence: Understanding archaeology and archaeologists

Rather than merely transmitting facts about the past, lithic valorisation should cultivate understanding of archaeology as an interpretive discipline with specific methodological rigour and epistemological constraints. Visitors should apprehend how archaeologists generate knowledge from fragmentary material evidence, what inferences are warranted, and how interpretive uncertainty reflects intellectual honesty rather than professional inadequacy. This includes recognition of how typological categories, chronological frameworks, and functional interpretations emerge from specific analytical methods rather than representing self-evident object properties. For lithics specifically, disciplinary competence involves understanding how specialists infer technological sequences, cognitive capabilities, and cultural practices from subtle morphological variations invisible to untrained observation. This domain does not require visitors to become amateur lithic analysts but to recognise the science of archaeological inference and the legitimate complexity of prehistoric research.

Temporal thinking: Thinking in deep time and non-linear cultural change

Lithic collections span temporalities that exceed conventional historical experience and therefore requires cultivated capacity for deep time thinking that recognises both extraordinary duration (millions of years but from after the extinction of dinosaurs, ideally) and significant variation within apparent technological stasis. Temporal literacy involves understanding that tool traditions, as does human evolution, persisted across vast timelines

operating through complex, non-linear processes influenced by environmental shifts, demographic fluctuations, raw material availability, and cultural transmission mechanisms rather than following inevitable progressive trajectories (i.e., by accident). Visitors should apprehend that Palaeolithic peoples were cognitively solving context-specific problems, not simply evolutionary stages *en route* to contemporary capabilities. A meta-objective of this domain is challenging stereotypes, *othering*, and in general simplistic views of evolution, identified as a persistent problem in current practice.

Technological understanding: Reading material culture as evidence of embodied knowledge

Technological understanding involves capacity to “read” stone tools not merely as finished products but as traces of dynamic production processes involving decision-making, error correction, material constraints, and embodied competence developed through extended cultural transmission (Kuhn, 2020; Leroi-Gourhan, 1993; Pelegrin, 1990; Schlanger, 1996). This includes understanding how technological choices reflect not just functional requirements but raw material availability, mobility patterns, seasonal constraints, and social learning contexts (Ingold, 2000; Roux & Bril, 2005). Visitors developing technological literacy should recognise that morphologically similar tools may represent quite different technological traditions, that apparent simplicity often reflects sophisticated optimisation strategies, and that “waste” debris communicates production methods as effectively as finished implements. This domain particularly addresses the procedural and kinaesthetic dimensions systematically invisibilised by current display practices.

Critical heritage awareness: Understanding collection construction and value systems

Rather than treating museum collections as transparent windows onto the past, heritage awareness involves recognising how institutional practices, disciplinary histories, and cultural values shape what is collected, preserved, exhibited, and valorised. Visitors should understand that lithic collections represent specific research trajectories, excavation histories, and curatorial choices rather than neutral archaeological records. This includes awareness of what gets excluded from collections (for example: unmodified flakes, damaged specimens, isolated artefacts) and how display choices reflect institutional priorities and resource constraints (Smith, 2006). Moreover, critical heritage awareness extends beyond deconstruction of institutional authority. It involves visitors’ capacity for active meaning-making that moves from *archaeological* significance into *contemporary cultural relevance*. Lithic collections can function as sites where publics negotiate connections and relationships

with deep human ancestry and engage emotionally with material traces of shared cognitive and technological capacities ([Holtorf, 2005, 2010](#)). This comprises recognising that heritage value emerges not solely from expert designation but through ongoing public engagement wherein objects acquire contemporary significance through personal, familial, or collective identity formation ([Waterton & Smith, 2010](#)). For lithics specifically, this may include affective responses to “first technologies,” recognition of universal human problem-solving across cultures and time periods, or contemporary relevance of sustainable material practices encoded in stone tool traditions. The objective is not to replace archaeological understanding with unmediated emotional response, but to create space for multiple modes of engagement wherein scientific interpretation and personal meaning-making operate complementarily.

7.2. Conceptual and theoretical dimension

The undervalorisation of lithic collections documented in Chapter 6 emerges through convergent mechanisms operating across material, institutional, communicative, and epistemological dimensions. Addressing this challenge requires theoretical frameworks that reconceptualise relationships between objects, knowledge systems, and publics rather than merely technical improvements to existing display practices.

The proposed valorisation approach is conceptually underpinned by contemporary theoretical developments in archaeology, museum theory, and heritage studies, providing resources for addressing the dimensions of lithic undervalorisation, maintaining pragmatic feasibility within institutional constraints. Rather than prescribing universal solutions, the proposed approach establishes conceptual resources enabling museums to develop context-responsive valorisation strategies appropriate to their specific collections, missions, constituencies, and capacities.

7.2.1. Theorising *visible* technology: From static to dynamic, visual to multisensorial, observational to experiential

The material opacity and “poverty of form” characterising lithic artefacts (**Chapter 6.1.**) require theoretical frameworks that shift interpretive emphasis from finished products to production processes, from visual inspection to embodied knowledge, and from isolated specimens to technological systems. Contemporary theoretical developments in technological anthropology and archaeological theory provide conceptual resources for this reorientation.

Chaîne opératoire

The concept of chaîne opératoire reconceptualises stone tools as materialised traces of dynamic technological processes involving sequential decision-making, motor coordination, material knowledge, and social transmission ([Leroi-Gourhan, 1964, 1993](#)). This framework positions lithic artefacts as embodiments of “gesture and speech” or the intimate coupling of technical action and cognitive capability that characterises human technological evolution. Applied to museum contexts, chaîne opératoire thinking enables interpretation that foregrounds the procedural knowledge, skilled practice, and embodied competence encoded

within morphological features rather than treating these features as merely classificatory attributes (Pelegrin, 1990; Schlanger, 1996). This approach addresses the material opacity problem by providing conceptual basis for communicating what remains invisible in static display. Such frameworks make explicit the technical knowledge embedded in lithic production: the planning sequences preceding manufacture, the sensory feedback enabling real-time error correction, the motor skills developed through years of practice, and the social contexts through which knowledge transmits (Roux & Bril, 2005; Stout, 2011). Rather than attempting to make these invisible dimensions visible—an impossibility constrained by the material properties of stone—chaîne opératoire frameworks enable museums to create interpretive structures through which visitors can conceptually reconstruct the dynamic processes materialised in finished tools.

Embodied knowledge, technical gestures, and direct engagement

Marcel Mauss' (1935) foundational analysis of “techniques of the body” establishes theoretical grounding for understanding how technological knowledge operates through learned bodily dispositions rather than purely cognitive instructions. Stone tool production involves sophisticated sensorimotor integration, spatial reasoning, and material sensitivity developed through extended cultural participation rather than conscious instruction (Bril et al., 2010). This embodied knowledge remains systematically invisible when museums present tools through frameworks emphasising visual inspection and morphological classification while eliminating opportunities for tactile or kinaesthetic engagement. Tim Ingold's (2000, 2013) development of skill-based approaches to technology further theorises how material competence emerges through ongoing engagement within environments of practice rather than through application of abstract mental templates to passive materials. Applied to lithic valorisation, this perspective suggests that understanding prehistoric technological achievement requires appreciation for the relational processes through which humans and materials mutually constitute each other through practices of production, use, and transformation. For museums to operate within these theoretical frameworks means positioning stone tools as active traces of skilled engagement requiring conceptual and, where possible, experiential access to the embodied dimensions of technological knowledge. Experimental archaeology presents the potential to address representational limitations by enabling precisely this form of engagement within museum spaces. Through hands-on engagement—whether via knapping demonstrations, interactive exhibits, or participatory sessions—visitors can apprehend the contingent, processual nature of stone tool production: the variability in raw material quality, the accumulated skill required for controlled fracture,

the frequent production of débitage and unsuccessful attempts alongside *finished* tools. This experiential dimension challenges the static, object-centred narratives privileging morphologically complete specimens by revealing stone tool assemblages as records of decision-making, problem-solving, and embodied technical knowledge. Within a valorisation framework, experimental flintknapping, for one, offer pedagogical opportunities for fostering historical empathy (López-Castilla et al., 2019). Experimental archaeology thus recontextualises museum collections, shifting interpretative emphasis from classification to technological practice and from visual appreciation to multi-sensorial understanding (sensu Classen, 2014) of past lifeways.

7.2.2. Theorising display and institutional practice: Museums as collaborative knowledge production sites

The constraints imposed by museum display technologies (Chapter 6.2) and institutional dynamics (Chapter 6.3) require theoretical approaches that (re)conceptualise museums as active knowledge producers with legitimate epistemologies rather than passive conduits for archaeological interpretation. This reorientation positions display technologies and institutional practices as productive constraints enabling particular forms of engagement rather than barriers to ideal communication, and collaborative frameworks as a potential in addressing the inherently distributed character of lithic collections, expertise, and contextual knowledge.

Productive constraints and multiple engagement modes

Rather than viewing protective display exclusively as limiting factor, theoretical frameworks addressing sensory diversity and accessibility suggest that constraints create opportunities for alternative engagement modes (Candlin, 2010; Dudley, 2010). The visual primacy enforced by vitrine display, while eliminating tactile access to original specimens, enables detailed observation, comparative analysis across multiple objects, and contemplative engagement uninterrupted by handling demands. Digital augmentation technologies, experimental reproductions, and interpretive programming can address haptic and kinaesthetic dimensions without compromising conservation requirements, creating complementary engagement modes as opposed to compensatory substitutions for ideal but unattainable direct handling.

[Fiona Candlin's \(2010\)](#) analysis of touch in museums demonstrates how different sensory modes enable different forms of knowledge, with visual and tactile engagement producing complementary rather than redundant understanding. Applied to lithic valorisation, this suggests that museums need not resolve the tension between protection and handling through compromise solutions but can strategically deploy multiple engagement modes, such as visual inspection of originals, tactile exploration of reproductions, digital manipulation of three-dimensional models, participatory knapping demonstrations, that collectively enable a more engaged understanding impossible through any single mode alone. The theoretical shift from seeking optimal engagement mode to orchestrating multiple complementary modes creates curatorial opportunities from institutional constraints.

Networked knowledge and collective competencies

Institutional recognition must extend beyond individual museums to acknowledge that lithic knowledge, collections, and expertise distribute across multiple institutions, research centres, and sites rather than concentrating in single locations. Museums attempting comprehensive interpretation through isolated institutional resources necessarily produce partial, fragmented understanding compared to networked approaches that pool distributed knowledge resources.

[Pierre Lévy's \(1997\)](#) concept of “collective intelligence” or knowledge and capability emerging through coordination of distributed competencies rather than aggregation of individual expertise, suggests that networked museum approaches can produce interpretive outcomes exceeding what any single institution achieves independently. Applied to lithic collections, this implies that regional or thematic networks connecting museums with complementary chronological coverage, technological traditions, or research relationships could generate a more comprehensive public interpretation while potentially alleviating individual institutional burdens. Network approaches informed by post-colonial theory, moreover, create opportunities for more equitable knowledge-sharing wherein expertise flows multidirectionally rather than descending from prestigious centres to peripheral institutions ([Kreps, 2003](#)). A small civic museum preserving a significant lithic assemblage may possess knowledge resources (e.g., contextual information, site relationships, local research networks) that complement rather than subordinate to national museum holdings. Collaborative interpretation frameworks enable recognition of diverse expertise forms and institutional capacities as legitimate contributors rather than positioning small museums as recipients of knowledge generated elsewhere.

Network approaches enable museums to leverage their specific strengths while accessing complementary knowledge distributed across institutional landscapes, producing richer collective interpretation than standardised approaches could achieve. In this proposal, this theoretical reorientation positions collaboration as an optional enhancement as a response to the distributed nature of lithic knowledge itself, but does not mean to counter or undermine thematic, especially territorial, specificities, and proves essential for lithic valorisation because prehistoric collections distribute across institutional hierarchies in ways that traditional centre-periphery models cannot adequately address.

7.2.3. Theorising contextual transformation: Object itineraries and biographical approaches

The inevitable transformation occurring as lithic artefacts move from archaeological contexts through laboratory analysis to museum display (**Chapter 6.4**) requires theoretical frameworks reconceptualising these movements as knowledge-producing journeys rather than *displacements* from authentic contexts. Object biography and itinerary approaches provide conceptual resources for addressing contextual transformation productively.

Igor Kopytoff's (1986) biographical approach to material culture theorises objects as possessing life histories through which they accumulate meanings, relationships, and values as they move through different contexts and ownership regimes. Applied to archaeological materials, this perspective suggests that lithic artefacts possess complex biographies beginning with raw material procurement, continuing through production, use, discard, and deposition, then extending into archaeological recovery, analysis, museum acquisition, and display (Gosden & Marshall, 1999). Each biographical phase generates new meanings and relationships rather than merely preserving or distorting original significance. Within this framework, museum contexts do not represent terminal endpoints where object biographies cease but as ongoing biographical phase wherein stone tools continue accumulating meanings through research, interpretation, visitor encounter, and heritage designation. The theoretical shift from viewing museums as repositories of static meanings to sites of ongoing biographical development enables recognition that transformation is inevitable and potentially productive rather than problematic. Museums can create interpretive frameworks making these biographical journeys visible and intellectually engaging rather than

attempting to eliminate transformation through mimetic reconstruction of original contexts (Joy, 2009).

Bruno Latour's (1994, 2005) analysis of scientific practice emphasises how objects undergo translation as they move between contexts (field to laboratory, laboratory to publication, publication to museum), with each translation involving simultaneous loss and gain of information, relationships, and meanings. Michael Schiffer's (1972, 2008) foundational work on archaeological context transformation similarly theorises how objects move through systemic (living), archaeological (deposited), and museum (curated) contexts, with each transition fundamentally altering what can be known and how knowledge operates. François Sémah (2015b) also implicitly applies an itinerary perspective to prehistoric objects moving from an archaeological site to a laboratory to the museum and how these materials lose spatial, associational, and taphonomic relationships but gains scientific authentication and heritage status through institutional processing. The theoretical emphasis shifts from preventing transformation, which is impossible (and honestly counterproductive) given the nature of archaeological methods and museum functions, to viewing and therefore intentionally managing contexts as *constructed* rather than as *lost* (Bennett, 1995; Hodder, 1992).

7.2.4. Towards pragmatic, context-responsive valorisation

The theoretical frameworks articulated across these dimensions converge on several core principles structuring the methodological strategies that will eventually be presented. Effective valorisation requires adaptable frameworks enabling museums to develop strategies matching their specific collections, missions, resources, and constituencies rather than standardised solutions applicable regardless of context. The theoretical foundations provide conceptual resources, i.e., ways of thinking about materials, processes, knowledge, and institutions, that museums can deploy selectively according to local needs and capacities. A national museum with extensive collections and substantial resources implements these principles differently from a small site museum operating with limited staffing and funding, yet both can engage productively with the same theoretical commitments through context-appropriate methodologies.

Recognising that visitors possess diverse learning styles, physical capacities, cultural backgrounds, and engagement objectives, effective valorisation orchestrates multiple

complementary modes rather than seeking singular optimal approaches. Visual inspection, tactile exploration, digital interaction, participatory programming, contemplative observation, and social experience each enable distinctive forms of understanding and appreciation. Museums strategically combining these modes create richer, more accessible experiences than those privileging single engagement forms regardless of quality. The theoretical commitment to multiplicity enables institutional creativity while maintaining interpretive sophistication. Recognising that valorisation operates within specific institutional, geographic, and cultural contexts requiring distinctive approaches, effective implementation involves ongoing assessment of which strategies prove successful, which require modification, and which contexts demand alternative methods. The theoretical frameworks provide conceptual foundations, but actual effectiveness emerges through practical application, visitor response, institutional feedback, and iterative refinement. Museums operating as learning organisations that systematically evaluate and adapt their approaches produce more effective valorisation than those implementing fixed programmes regardless of outcomes.

The systematic challenges documented in lithic collection presentation, combined with theoretical developments in heritage studies, museum practice, and archaeological interpretation, provide foundations for alternative approaches that could enhance both cultural significance and public engagement while respecting institutional requirements and professional standards. These alternative approaches must address the structural barriers identified while creating new possibilities for heritage construction and material agency.

Heritage theory emphasises the processual nature of heritage significance, recognising that cultural materials achieve meaning through ongoing community engagement and cultural practice rather than possessing inherent significance determined through expert analysis. Applied to lithic collections, this perspective suggests that stone tools could achieve greater heritage significance through expanded opportunities for community participation in interpretation, meaning-making, and cultural construction (Smith, 2006). Alternative museum approaches might facilitate rather than mediate heritage processes while maintaining scholarly standards and collection integrity.

The concept of “intangible heritage” developed within UNESCO frameworks provides additional theoretical resources for enhancing lithic heritage significance by recognising the knowledge systems, cultural practices, and technological traditions embodied within

material culture. Stone tools represent not merely objects but technological traditions, knowledge systems, and cultural practices that connect contemporary communities with ancestral capabilities and adaptive strategies (Kurin, 2004). Museum approaches that acknowledge and facilitate engagement with these intangible dimensions might enhance heritage significance while addressing educational objectives. Critical heritage studies emphasise the importance of recognising multiple perspectives, community voices, and alternative knowledge systems in heritage construction and interpretation. Applied to lithic collections, this approach suggests possibilities for collaborative interpretation that incorporates diverse cultural perspectives on technological achievement, material significance, and heritage value while maintaining archaeological accuracy and analytical rigour (Harrison et al., 2016). These collaborative approaches might generate innovative presentation strategies while enhancing community investment in prehistoric heritage.

7.3. Methodological dimension: The Lithic Trajectories Framework

The theoretical foundations articulated above establish conceptual resources for addressing lithic undervalourisation, yet effective implementation requires translation of these concepts into practical methodological strategies deployable within actual museum contexts. This proposal presents the *Lithic Trajectories Framework*, an overarching methodological approach organised around following objects through their transformations from raw material to contemporary heritage while maintaining multiple interpretive scales and engagement modes. This framework is conceptualised not as prescriptive blueprint but as flexible toolkit enabling museums to develop context-responsive strategies according to specific collections, resources, missions, and constituencies. The methodological strategies comprising this proposal emerge from observed practices encountered during the Italian museum survey (see **Chapter 5**, **Chapter 6**) and conceptual frameworks identified through broader research into contemporary museum archaeology, experimental archaeology, and digital heritage scholarship. Rather than proposing entirely novel approaches, this framework synthesises effective practices already implemented, often partially or inconsistently, across surveyed institutions, while integrating methodological developments from international museum practice and recent theoretical literature. The Lithic Trajectories approach therefore functions as a synthetic coordination, proposing how museums might combine multiple strategies coherently according to their distinctive circumstances. This synthesis acknowledges existing professional expertise and curatorial creativity and at the same time offer conceptual structure, enabling more systematic, sustained, and theoretically grounded implementation than ad hoc innovations typically achieve.

7.3.1. Tracing lithic trajectories

The concept of *lithic trajectories* reconceptualises museum lithic interpretation as following objects through multiple transformations rather than presenting finished specimens within static classificatory schemes. The framework (**Figure 7.1**) draws its organising logic from chaîne opératoire thinking and object biography approaches, specifically object itineraries. “Trajectories” operates as both metaphor and analytical framework, emphasising movement, transformation, and relational processes, as opposed to “stasis,” “essence,” or isolated properties.

A lithic trajectory encompasses the material journey starting from a *technological phase* in which it occurs in past cultural systems (raw material procurement, tool production, use, modification, discard). This is interpreted and understood through the chaîne opératoire. Following lithic materials from geological sources through procurement, transport, production, and discard reveals landscape knowledge, mobility patterns, and resource management strategies that finished tools cannot necessarily reflect ([Andrefsky, 1994](#); [Inizan et al., 1995/1999](#)). Museums can create interpretive frameworks tracking specific raw materials (distinctive flint types, exotic obsidian, high-quality chert) across the spatial and temporal scales their distribution represents. Raw material trajectories prove particularly effective for site museums connected to significant procurement locations or for institutions whose collections represent extensive geographic areas. Demonstrating that stone tools in museum cases originated from sources several kilometres distant communicates planning capabilities, trade networks, and landscape knowledge that challenges simplistic assumptions about prehistoric spatial organisation and social complexity. Stone tools functioned within use-life sequences involving production, use, maintenance through resharpening or modification, potential recycling for different functions, and eventual discard when no longer serviceable. Use-wear analysis enabling functional interpretation and edge damage studies documenting resharpening episodes provide empirical evidence for these sequences ([Keeley, 1980](#); [Odell, 2004](#)). Museums can present tools as time-averaged traces of extended use-lives involving multiple functional episodes and morphological transformations. This approach addresses the functional opacity problem by demonstrating that tools possess complex use histories involving multiple activities, morphological changes through use and maintenance, and eventual discard dictated by functional exhaustion or by aesthetic or cultural preferences. Use-life interpretation challenges typological thinking by revealing how morphological categories represent analytical constructs imposed on materials whose original significance derived from functional flexibility and adaptive modification.

While the chaîne opératoire interpretation addresses production processes, the object itinerary part foreground post-depositional transformations through which archaeological specimens become museum objects. This methodological strategy makes visible the often-invisible journeys through excavation, analysis, conservation, and interpretation that constitute museum collections. After undergoing deposition within formation processes, the lithic object requires re-discovery through excavation. It then starts its “from excavation to

exhibition” *object itinerary*: recovery moves it to an *archaeological phase* in which it exists in the realm of the archaeologist (lithic analysis and interpretation). It enters a *museum phase* through collection and acquisition, in which it is curated and valorised. Although in most legal frameworks for cultural heritage, archaeological and museum objects automatically obtain a “heritage” status, in this framework, mediation and display are prerequisite to becoming a *heritage object*, the phase which exists in the public realm.

Lithic trajectories: An interpretive framework

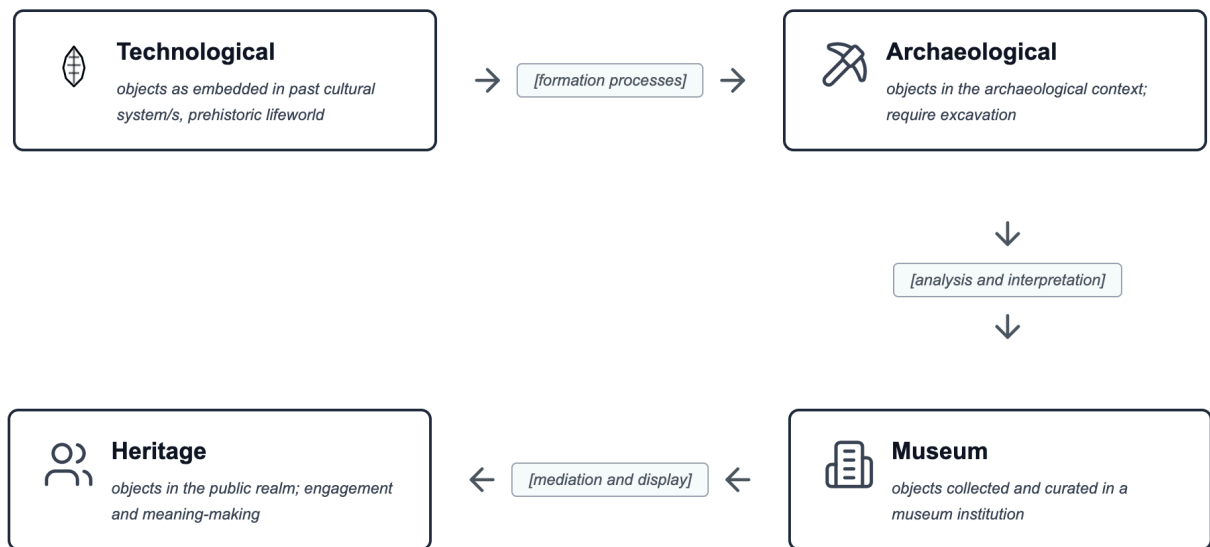


Figure 7.1. Interpretive framework

The framework cultivates what [Michael Shanks \(2012, 2020\)](#) terms “archaeological imagination” or the disciplined capacity to reconstruct the past from material traces through creative yet grounded interpretation. Visitor engagement with lithic trajectories is a practice of “imaginative projection” (sensu [Olivier, 2011](#)) across multiple temporal scales, or of archaeological understanding requiring a backwards projection of present material evidence to infer past actions, relationships, and meanings that objects no longer directly display. By the time interpretation reaches the *heritage phase* (the object’s current museum existence which visitors directly observe), visitors would have already performed such imaginative work, reconstructing the preceding biographical phases that brought materials to their present state. The framework structures this imaginative process through fragmented but concrete material evidence within a methodological “guide,” encouraging visitors to develop archaeological habits of mind wherein fragmentary evidence prompts reconstructive thinking, instead of passive observation or superficial classification.

The framework operates across multiple scales and enables museums to focus interpretation at whichever level proves most appropriate for their collections and constituencies. On an individual object or on an assemblage scale, following a single diagnostic specimen or assemblage through their complete trajectory from raw material source through current museum context; on a collection scale, tracing how museum holdings accumulated through excavation campaigns, donations, purchases, and research programmes; on a regional scale, connecting distributed collections representing related sites, chronological periods, or technological traditions across institutional networks. Collections possess institutional biographies reflecting how museums acquired, researched, and interpreted materials across decades or centuries of operation. These biographies reveal changing disciplinary paradigms, shifting institutional priorities, and evolving public engagement strategies that influenced which materials received attention and how interpretation developed. Museums can create exhibitions exploring their own collection histories, revealing how lithic assemblages accumulated through particular excavation campaigns, how research programmes influenced what received study, and how display practices transformed across institutional lifetimes. Institutional biography exhibitions prove particularly effective for museums with substantial historical depth, extensive archives documenting collection development, or significant research associations with particular archaeologists or excavation programmes. These exhibitions reflect museums' historical situation, potentially cultivating visitor understanding of how heritage institutions function within broader social, political, and intellectual contexts. This scalar flexibility enables diverse museums to implement trajectory-based interpretation appropriately. A site museum might emphasise assemblage-scale operational sequences reconstructed from local excavations; a national museum could trace collection-scale histories demonstrating how institutional research priorities evolved; regional networks might coordinate interpretation across distributed collections representing related technological traditions. The framework accommodates this diversity through its conceptual structure while maintaining coherent organising logic.

The framework requires augmentation rather than replacement of existing museum infrastructure and expertise. Traditional typological organisation, chronological displays, and conservation protocols remain valuable, but trajectory-based interpretation adds processual and biographical dimensions that current approaches do not consider. Museums can implement trajectory thinking selectively, through temporary exhibitions exploring specific transformational sequences, permanent display sections foregrounding operational

chains, or digital augmentation enabling trajectory exploration alongside conventional object presentation. This integration strategy recognises institutional realities while creating pathways for methodological innovation that proves feasible within actual resource constraints and professional expertise distributions.

The trajectory framework addresses multiple valorisation challenges simultaneously. It provides conceptual structure for communicating the procedural knowledge and embodied skills encoded within lithic morphology (responding to material opacity and promoting technological understanding); it acknowledges contextual transformation as knowledge-producing rather than knowledge-destroying (addressing the translation problem); it creates interpretive scaffolding for incorporating multiple temporal scales from geological deep time through archaeological chronology to museum histories (supporting temporal thinking competencies); and incorporated with institutional biographies can facilitate network-oriented presentation approaches.

7.3.2. Experimental archaeology

Experimental archaeology provides methodological resources for addressing the embodied knowledge and procedural understanding dimensions that static display excludes. This strategy operates across two complementary levels: 1) as integrated display components within permanent exhibitions; and 2) as participatory public programmes requiring mediation and facilitation. The core principle underlying this integration involves using replication to render visible the technical knowledge, problem-solving capabilities, and surrounding considerations that remain invisible in the displayed final product tools, and without hands-on engagement and exposure to an understanding of raw material properties, fracture mechanics, force application techniques, and error correction strategies (not necessarily in these technical terms, but in practical terms), which are dimensions that observation through a vitrine alone cannot communicate.

Level 1: Integrated display components within permanent exhibitions

The first implementation level positions experimental reproductions, production debris, and process documentation as permanent interpretive elements within gallery spaces alongside archaeological collections. This approach enables museums to communicate operational sequences, technological choices, and skill requirements without compromising

conservation standards for archaeological specimens, while maintaining continuous visitor access independent of programming schedules or mediator availability.

Display integration strategies include production sequence displays or creating permanent installations exhibiting complete reduction sequences from unmodified raw material blocks through successive reduction stages to finished tools and exhausted cores to materialise complete processes that archaeological assemblages represent only fragmentarily. The permanence of these installations enables repeated visitor engagement and progressive comprehension impossible through temporary programming alone. To reveal that stone tool production involves trial and error, problem-solving, and skill development through practice rather than flawless execution from initial attempts can be projected through displaying experimental materials that document unsuccessful production attempts, technological errors, and learning trajectories rather than exclusively presenting successful outcomes. Materials showing platform collapse, inappropriate force application, or raw material flaws communicate the technical challenges prehistoric knappers routinely navigated while acknowledging that contemporary expertise emerges through extended practice mirroring prehistoric learning contexts (Apel, 2008; Pelegrin, 1990). It is also an idea for permanent displays to have digital screens showing for example, knapping demonstrations, use-wear generation, or experimental hafting, enabling visitors to observe processes generating the static materials surrounding them in the absence of live demonstration. Brief video loops (2-5 minutes) prove most effective, providing procedural information without requiring extended attention and remaining accessible to diverse language abilities through visual communication. This embedded documentation connects static assemblages to dynamic processes while maintaining focus on material objects as primary interpretive subjects.

The permanent display integration level proves particularly effective for institutions lacking capacity for sustained public programming, operating with limited staff, or serving constituencies preferring self-directed engagement over facilitated activities. It addresses the vitrine limitation partially by enabling conceptual access to embodied knowledge through comparative observation and process documentation while maintaining conservation and security standards. However, this visual emphasis acknowledges significant accessibility limitations: visitors with visual impairments cannot access video content without audio description, *then* tactile exploration of reproductions becomes essential rather than complementary for blind and low-vision audiences. Comprehensive accessibility requires multi-sensory interpretation strategies beyond this framework's current scope, though the

emphasis on haptic engagement through experimental reproductions and participatory programming addresses some dimensions of inclusive access that purely visual displays systematically exclude. Moreover, this level cannot provide the direct experiential engagement and real-time problem-solving appreciation that participatory programming enables.

Level 2: Participatory public programmes requiring mediation

The second implementation level positions experimental archaeology as active engagement through workshops, demonstrations, and hands-on sessions requiring trained mediators and dedicated programming resources. This approach enables direct experiential access to the material resistance, including motor coordination requirements, sensory feedback systems, and cognitive demands characterising stone tool production. At present, other than within archaeology teaching programmes, many archaeologists engage in workshop activities as part of public archaeology initiatives, both in university outreach events and in museums.

Participatory programme formats may include knapping demonstrations by trained experimental archaeologists or skilled knappers, producing tools while explaining decision-making processes, material properties, technical requirements, and problem-solving strategies in real time. Live demonstrations make visible the gestures, audible the distinctive sounds of controlled fracture, and tangible the sensory feedback systems enabling skilled production. Expert commentary transforms technical performance into pedagogical experience by articulating the tacit knowledge guiding motor actions, explaining why specific techniques prove effective, and acknowledging errors or unexpected outcomes requiring adjustment ([López-Castilla et al., 2019](#)). These demonstrations prove particularly effective for audiences preferring observational learning, families with young children for whom direct handling proves inappropriate, or visitors interested in technological aspects without personal production attempts. Structured supervised knapping workshops also enable visitors to attempt basic tool production under expert guidance provide direct experiential access to material properties, motor skill requirements, and planning complexity. Participants discover through embodied experience that effective knapping requires understanding of striking angles, force calibration and immediate response to fracture outcomes. The frustration of unsuccessful attempts, satisfaction of controlled removals, and physical demand of sustained knapping communicate technological achievement dimensions that verbal description cannot convey.

Lithic refitting—the physical or virtual reconstruction of knapped stone assemblages by reconnecting flakes to their parent cores—represents one of experimental archaeology’s most effective demonstrations of operational sequences (Cziesla, 1990; Hofman & Enloe, 1992). Museums can deploy refitting both as permanent display strategy, exhibiting reassembled cores with reattached flakes demonstrating production progression, and as participatory activity wherein visitors attempt puzzle-like reconstruction of experimental assemblages, experiencing directly the analytical reasoning through which archaeologists infer technological behaviour from dispersed materials. The combination of visual *drama* (reassembled cores appearing almost “whole” again), intellectual satisfaction (solving three-dimensional puzzles), and methodological transparency (demonstrating how archaeological interpretation proceeds) makes refitting particularly effective for communicating both technological complexity and disciplinary methodology.

Other potential participatory programmes include experimental use-wear generation and tool function, enabling visitors to use reproduction tools for specific tasks, such as hide scraping, wood working, plant cutting. Participants apprehend efficacy of tools in various functions and apprehend functional analysis through direct, hands-on experience. Advanced programmes may be organised around problem-solving challenges and technological experimentation that position participants as experimental researchers addressing specific technological questions, which prove particularly effective for secondary school groups, university students, or adult learners seeking intellectual challenge rather than purely experiential engagement.

Participatory experimental programmes require substantial institutional commitment beyond permanent display development. Programmes require facilitators possessing both knapping competence and pedagogical skill, capable of safe instruction, troubleshooting participant difficulties, and connecting experiential learning to archaeological interpretation. Museums must invest in staff training, maintain relationships with experimental archaeology specialists, or develop volunteer programmes recruiting skilled knappers willing to provide public instruction. Moreover, knapping produces sharp flakes, flying debris, and requires impact-resistant surfaces, necessitating designated spaces separate from general gallery areas with appropriate safety equipment (eye protection, first aid supplies, controlled access). Outdoor programmes prove effective where weather permits; indoor spaces require ventilation, durable flooring, and layout enabling supervision and maintaining participant safety. Sustained programming requires reliable access to suitable raw materials (glass,

obsidian, or natural stone), tools (antler billets, hammerstone, pressure flakers), and safety equipment. Museums must establish supply relationships, storage protocols, and material budgets supporting ongoing rather than occasional programming. Participatory programmes prove most feasible for institutions with dedicated education departments, sustained funding for public programming, and institutional cultures valuing experiential learning alongside traditional interpretation. They complement rather than replace permanent display integration, with both levels contributing synergistically to comprehensive experimental archaeology valorisation.

Experimental archaeology integration, whether through permanent display or participatory programming, operationalises the chaîne opératoire framework by making operational sequences tangible through material reproduction and embodied experience. It addresses multiple valorisation objectives simultaneously: rendering visible the procedural knowledge and technical gestures systematically invisibilised by static display; cultivating temporal thinking through direct engagement with technologies spanning deep time chronologies; enabling disciplinary competence by demonstrating how archaeological knowledge emerges through experimental methodology; and fostering archaeological imagination.

7.3.3. Exploring alternative interpretation frameworks: Object selection and strategic non-display

Strategic non-display represents the counterintuitive methodological strategy acknowledging that effective valorisation sometimes requires reducing rather than increasing exhibition presence ([Brulon Soares, 2019](#); [Morgan & Macdonald, 2020](#); see also [Jacobi, 2021](#)). It has already been argued that not everything excavated merits conservation or public presentation, and that valorisation succeeds only when archaeologists can narrate rather than merely catalogue, selecting what genuinely warrants preservation based on cultural significance, rarity, and practical sustainability ([Manacorda, 2010](#)). This approach addresses the oversaturation problem wherein ubiquity creates cognitive overload and visual noise but may also present opportunities to enhance research access and specialist engagement.

Rather than exhibiting comprehensive assemblages wherein every specimen competes for attention, strategic approaches select representative materials enabling focused interpretation. However, selection criteria require critical examination: traditional curatorial

preferences for visually striking, morphologically complete, or aesthetically pleasing specimens create systematically distorted representations of archaeological realities and further reinforce problematic assumptions about the archaeological record. The tendency to privilege aesthetically pleasing bifaces, complete projectile points, or visually impressive blade cores but at the same time excluding fragmentary tools, expedient flakes, or morphologically modest implements misrepresents how lithic technologies actually functioned. Archaeological assemblages consist predominantly of broken, fragmentary, expedient, and visually unremarkable materials—the operational debris, exhausted cores, resharpened tool fragments, and opportunistic flakes that constituted everyday technological practice. Museum displays privileging aesthetic specimens is not unfounded—esthetic criteria have rational origins in visibility, public engagement, and collection history that curators prioritise—but may inadvertently suggest that prehistoric peoples produced primarily refined, complete implements, obscuring the pragmatic, situational, and often expedient character of actual stone tool use. Effective strategic selection therefore requires curatorial criteria emphasising technological representativeness not necessarily *over* but at least *with* visual appeal: materials demonstrating reduction sequences (including cores, flakes, and debris showing production progression); tools exhibiting use-wear, damage, or resharpening evidence revealing extended use-lives; expedient implements demonstrating opportunistic material exploitation; and broken or fragmentary specimens reflecting archaeological realities rather than idealised completeness. This approach does not eliminate visually striking materials—refined bifaces or elaborate blade technologies possess legitimate interpretive value—but positions them within broader technological contexts demonstrating the full range of production strategies, tool types, and use patterns characterising actual prehistoric behaviour.

Hierarchical organisation distinguishes primary specimens receiving detailed interpretation (potentially including visually impressive materials attracting initial attention) from secondary materials providing technological context (production debris, expedient tools, fragmentary specimens) and tertiary collections referenced documentarily but not physically present. This creates structured viewing experiences guiding visitor attention and in the process reducing visual clutter and cognitive demands ([Hooper-Greenhill, 1992](#)). Selective display requires confident curatorial decision-making about which materials best serve educational objectives, willingness to exclude materials despite archaeological importance when display inclusion proves counterproductive, and interpretive frameworks acknowledging that exhibited specimens represent larger collections rather than exhaustive

presentations. Museums implementing this strategy must balance specialist desires for comprehensive representation against visitor cognitive limitations and experiential quality concerns.

Strategic non-display does not operate as an arbitrary reduction but as a theoretically informed curation approach wherein selection criteria reflect archaeological realities and interpretive objectives instead of aesthetic preferences or assumptions about visitor expectations. This requires curatorial confidence in defending selections that may appear counterintuitive, i.e., prioritising broken tools over complete specimens, including debris alongside finished products, featuring morphologically modest materials over visually striking pieces, through interpretive frameworks demonstrating how these choices enable more accurate and better understanding of prehistoric technological systems. Labels should be explicit about these choices.

7.3.4. On digitalisation

ICT and digital technologies have revolutionised scientific and public access to cultural heritage and have redefined the traditional museum experience ([Cameron & Kenderdine, 2010](#); [Ioannides *et al.*, 2010](#) in [Alivizatou-Barakou *et al.*, 2017](#)). However, in certain museum contexts, the digitalisation process remains rudimentary, mainly due to a lack of digital literacy on the side of the visitor/user but more importantly on the side of the museum personnel who have the responsibility to use but also troubleshoot any possible technical issues. Other issues for the museum include significant setup, operation, and maintenance costs, and insufficient infrastructure; for the visitor, digital tools that may be not intuitive or user-friendly, or do not integrate seamlessly with the museum's broader experience. Digital technologies, while useful for extending access and enhancing learning, should be integrated thoughtfully to complement rather than replace the in-person experience ([Mandarano, 2021](#)). Additionally, the museum's role as a community hub, where individuals gather to share cultural experiences, depends on the maintenance of physical spaces that foster dialogue and collaboration ([MacDonald, 2020](#)).

Digital solutions present great potential, but are unsustainable at least for the time being, and will remain so without enough stable funding and capacity-building for museum personnel. The proposed project is directly aimed at ICT tools that are simple, user-friendly, and cost-effective from setup to maintenance. The idea of a chaîne opératoire museum display can be

realised with content from documentation of experimental archaeology, animations, projections, and other forms of creative rendering. Moreover, these tools can be available as virtual exhibits, but also well-incorporated not only to supplement existing traditional displays but in the overall physical museum pathway. It can also serve as a starting point for eventual laboratory and didactic activities for visitors. The tools are projected to be adjustable and adaptable to the different type of museums that have lithic collections and can therefore be shared, presenting an excellent opportunity for the creation of a network of museums.

7.3.5. Creating a network: Shared museum functioning

Acknowledging that lithic knowledge, collections, and interpretive capacity distribute across museum networks rather than concentrating in individual institutions, effective valorisation cultivates collaborative relationships enabling resource sharing, collective programming, and coordinated interpretation. These collaborations operate not through hierarchical structures wherein prestigious institutions lead while others follow but through recognition of diverse expertise forms and contextual knowledge distributed across institutional landscapes. Network approaches enable smaller museums to participate meaningfully in sophisticated interpretation while allowing larger institutions to enhance their offerings through partnerships leveraging distributed resources.

Museums within geographic regions often hold complementary lithic collections representing related sites, chronological sequences, or technological traditions whose interpretation benefits from coordination rather than isolated presentation. Regional networks enable collaborative exhibitions, coordinated programming, shared digital infrastructure, and collective marketing creating visitor experiences spanning multiple institutions, all while enabling individual museums to maintain distinctive identities and interpretive emphases. Networks prove particularly effective where site museums, regional museums, and national institutions coexist within geographic areas, enabling hierarchical collaboration, in which different institutional scales address complementary interpretive objectives. By virtually and physically sharing collections, the network initiative establishes a continuity across time and space, clarifying regional variations and temporal developments in ancient technologies, and demonstrating their impact on prehistoric lifeways. This approach also allows smaller museums with limited collections to contribute to a broader

narrative, providing a more comprehensive archaeological context to otherwise individual and isolated assemblages.

In the public administration sense, a network would allow for a shared museum functioning, enhanced collaboration and resource sharing, as the best practices and efforts of one museum can extend to the other naturally through visitor circulation. Museums frequently lack in-house lithic expertise sufficient for high-level interpretation, requiring partnerships with university departments, research centres, or independent specialists providing analytical services, curatorial consultation, and interpretive development. These partnerships enable struggling institutions to achieve interpretive refinement exceeding their permanent staff capabilities and provide researchers with collection access and public engagement opportunities supporting broader intellectual impacts. Effective partnerships require clear agreements about intellectual property, publication rights, and credit attribution and maintaining mutual benefit and institutional autonomy. Similarly, the technical expertise and financial investment required for a high-technology digital interpretation exceed many individual museum capacities, suggesting collaborative development of shared digital platforms, three-dimensional scanning services, or database infrastructure enabling cost distribution and resource access (see [Styliani et al., 2009](#)). Regional or national networks can coordinate digital resource development, providing member institutions with technical infrastructure while enabling individual museums to contribute content and local expertise. Shared digital systems prove particularly valuable for comparative analysis, virtual refitting across distributed collections, or coordinated online exhibitions connecting materials housed in multiple physical locations.

Collaborative programming, furthermore, enables resource sharing for specialised interpretation requiring substantial development investment or rare expertise. Travelling exhibitions created collectively circulate among network participants, amortising development costs across multiple venues, at the same time enabling smaller institutions to host programming they could not independently produce. Coordinated knapping demonstration circuits, experimental archaeology workshops, or specialist lecture series similarly enable expertise sharing and programming diversity exceeding individual institutional capacities. These collaborative approaches require coordination mechanisms, shared governance structures, and mutual commitment without disregarding institutional autonomy and distinctive missions. The key components of the network are digital infrastructure and other than the virtual exhibits, online databases and archives, for which

the SIGEC digital platform may be used by Italian institutions ([Calosso et al., 2008](#); see also [Mangiapane et al., 2019](#)). The structure and organisation must be mainly online based, to be cost-effective, with eventual engagements for public lectures, workshops, and events, as well as collaborative research projects, conservation and restoration programs, and marketing and promotion strategies.

8.

CONCLUSION

8.1. Synthesis of core arguments

This dissertation opened with the assertion of three premises: that human prehistory remains marginal within contemporary cultural discourse; that Palaeolithic lithic artefacts, as the earliest and most persistent material traces of human activity, offer a potent medium through which to revitalise public engagement with deep human time; and that museums, positioned at the intersection of archaeological research and wider society, constitute the most effective institutional setting for undertaking such an endeavour. These premises converge on a central problematic: although lithic artefacts occupy a core position in archaeological research and hold legal status as cultural heritage, they rarely elicit meaningful public engagement or broader cultural resonance within museum contexts.

The research posed two critical questions structuring the investigation: *Why* do lithics, despite their fundamental importance to prehistoric archaeology and their defining presence in museum collections, appear to have limited success in engaging public audiences? And *how* might this dissonance be addressed? Responding to these questions required moving beyond superficial explanations—that lithics are simply “boring stones” or that visitors lack interest in prehistory—toward systematic investigation of the structural conditions producing what this thesis terms lithic *semi-invisibility*: the condition wherein objects remain physically present yet epistemologically marginal, visible yet culturally peripheral, legally protected yet inadequately valorised.

8.1.1. Affirming lithic centrality

Meeting the first research objective, which is to articulate the foundational importance of lithics in prehistoric archaeology, it was established that lithic artefacts have historically been constitutive of prehistoric archaeology’s formation as a discipline, remain methodologically central to contemporary research, and function as *basic science* contributing across multiple domains of human evolutionary research. For approximately 3.3 million years of human prehistory, lithics represent the dominant surviving material record. It has already been established that this archaeological predominance is heuristic and reflects preservation bias rather than necessarily indicating lithics’ relative importance within prehistoric technological systems, but that determining whether lithics were actually central to Palaeolithic life requires evidence that has not survived alongside the stone tools

themselves. Museums inherit this material constraint: regardless of lithics' original significance to Palaeolithic peoples, they constitute the material through which museums *must* communicate prehistoric technological knowledge. This recognition underscores the necessity for valorisation; if museums cannot disregard lithic collections for communicating prehistoric heritage, maximising their interpretive and communicative potential becomes essential.

The second objective, defining the Italian context, was addressed through an examination of disciplinary traditions, legislative frameworks, institutional structures, and heritage management practices, establishing the specific terrain within which investigated archaeological praxis developed and museum practices operate. The third objective, conducting systematic analyses, was fulfilled through the methodological design and producing the empirical results of the research.

8.1.2. Articulating lithic *semi-invisibility*

The dissertation has demonstrated, through investigation across Italian museum contexts combining lithic technological analysis, museographic examination, and institutional inquiry, that lithic *semi-invisibility* is neither accidental nor superficial. Rather, it emerges from structural conditions operating at the intersection of historical trajectories, archaeological knowledge production, museum communication practice, and heritage valorisation frameworks. The research establishes that current challenges in lithic presentation reflect not individual curatorial inadequacies or simple visitor disinterest, but fundamental tensions between the epistemological requirements of archaeological science and the communicative conventions of museum practice.

The fourth objective, synthesising findings through theoretical frameworks, was addressed in the critical discussion, which identified the mechanisms of museum mediation of lithic technological knowledge, that is, the mechanisms of lithic *semi-invisibility*, based on: 1) the material nature and ontological complexity of the stone tool; 2) the strengths and limits of museum display; 3) knowledge transformation processes; and finally, 4) the systematic reframing of archaeological knowledge into museal forms. These mechanisms reveal how museum conditions mediate the technological dimensions and shape the public encounter with lithic technology.

Lithics are ontologically complex because they assume multiple identities (e.g., primarily geological specimens, technological products, scientific research evidence, cultural heritage objects), making it a complicated task to present them in ways that are both accurate and accessible. The reductive nature of lithic manufacturing, i.e., removing material through *façonnage* and *débitage*, create challenges for museums operating within display conventions that privilege visual experience. The features differentiating worked stone from geological specimens are not apparent to untrained eyes, particularly when viewed from inside a vitrine, through a glass case. Museum displays feature static objects, but stone tools are fundamentally haptic, meant to be held as their weight, balance, and functionality that represent technological knowledge are features that visual inspection alone cannot access. Museums, however, are their own institutions; they operate according to established missions, conservation protocols, and operational frameworks extending beyond any single collection type. Lithic collections must therefore fit within pre-existing institutional structures and adapt rather than determine institutional practice.

In terms of knowledge transformation, as lithics move from excavation through laboratory analysis to museum display, embedded knowledge transforms at each stage. Museum display presents recontextualised specimens whose significance depends on interpretive mediation, having *lost* archaeological context but *gained* public visibility and heritage status. These transformations occur within incompatibilities between two different ways of knowing: archaeological and museological. Archaeological knowledge production privileges analytical complexity, embraces interpretive uncertainty, and values specialist precision developed through extended research processes. Museum communication operates through accessible narratives, requires interpretive clarity, and must serve diverse audiences seeking immediate comprehension during potentially brief visits. What counts as rigorous knowledge in archaeological contexts, such as provisional interpretations, competing hypotheses, technical vocabulary, often contradicts what enables effective museum communication. These different epistemological requirements mean that archaeological significance does not automatically translate into museum meaning; rather than treating museums as translation stages where specialist knowledge is simplified for public consumption, effective valorisation requires recognising museums as sites of knowledge production in their own right, where new forms of understanding. The challenge becomes not eliminating epistemological differences but developing frameworks enabling productive negotiation between knowledge systems.

8.1.3. Addressing *semi-invisibility* through valorisation

The fifth research objective, conceptualising new approaches and proposing a valorisation strategy, was addressed through a framework articulated across theoretical, methodological, and practical dimensions. The proposal responds to the conditions identified throughout the thesis: theoretical reconceptualisation reshapes how lithics are understood; methodological tools support the identification and communication of embedded knowledge; and implementation strategies consider feasibility within institutional realities.

The valorisation strategy responds to the dual conceptual framework introduced in the beginning of the dissertation. The first framework established prehistory's marginality, within which lithics are situated through the paradox of their museum *semi-(in)visibility*. The second framework, representing the thesis' main analytical advance, demonstrates how new lenses, models, and methods enable strategies that address such marginality. The *Lithic Trajectories Framework* operationalises this by tracing objects through spatial, temporal, social, and epistemic dimensions, transforming *semi-invisibility* into multi-dimensional interpretive possibility.

Within this context, the thesis proposes such as a counter-marginality strategy, understood here as the set of conceptual and methodological strategies that actively reverse the structural marginalisation of prehistory by making lithic technological knowledge newly legible and meaningful. The research shows how the marginality of prehistory operates through specific material and institutional mechanisms in museum settings, and the valorisation framework offers tools for addressing these mechanisms, enabling museums to challenge *Palaeolithic othering* and reposition lithics as carriers of shared human capacities rather than distant evolutionary curiosities. The counter-marginality emerges as a way of reconceptualising relationships between archaeological knowledge, material agency, institutional practice, and public understanding.

8.2. Contributions and implications for practice

This research makes distinct theoretical contributions to prehistoric archaeology, museum studies, and heritage studies while advancing interdisciplinary dialogue on relationships between specialist knowledge production, material culture, and public engagement. The contributions operate simultaneously at conceptual, methodological, and analytical levels, offering frameworks applicable beyond the specific empirical contexts examined while remaining grounded in systematic investigation of lithic museum collections.

8.2.1. Theoretical advances

The research extends critical heritage studies by theorising specific mechanisms through which chronologically distant heritage becomes culturally marginalised. The concept of *Palaeolithic othering* provides a conceptual framework for understanding how temporal distance (deep time) operates analogously to geographical or cultural distance in producing perceptions of fundamental alterity. This contribution positions prehistoric heritage as an undervalued category but that is structurally marginalised through mechanisms deserving sustained critical attention. The framework enables heritage studies to examine how temporal distance influences heritage significance attribution, policy priorities, and public engagement strategies.

The research also introduces *semi-invisibility* as conceptual framework for understanding how objects can occupy positions of physical prominence while remaining interpretively marginal. This contribution extends beyond documenting lithic marginalisation to theorise structural mechanisms producing this condition. Semi-invisibility operates as analytical concept applicable beyond lithic collections to other material culture categories sharing characteristics of visual modesty, specialist knowledge requirements, or epistemological complexity. The framework enables museums to identify and address marginalisation as systematic institutional pattern rather than isolated curatorial failure.

The thesis contributes nuanced understanding of valorisation as heritage practice by examining how Italian *valorizzazione* operates within contexts of epistemological tension and institutional constraint. The theoretical contribution lies in examining how heritage legislation's requirement to "enhance value and accessibility" operates when object

significance remains opaque without specialist mediation. This analysis reveals valorisation not as straightforward enhancement of inherent value but as complex negotiation between multiple competing requirements within constrained institutional contexts.

The research provides detailed analysis of how epistemological requirements of archaeological knowledge production conflict with communicative conventions of museum practice. Rather than positioning these tensions as resolvable through better communication strategies, the research theorises them as structural conditions requiring fundamental reconceptualisation of relationships between specialist knowledge and public presentation.

The research establishes technological knowledge as a distinctive mode of human understanding that may transcend temporal and cultural boundaries. Drawing on technological anthropology, the thesis demonstrates how *chaîne opératoire* thinking—emphasising operational sequences, gestural knowledge, and material transformation—provides conceptual resources for rendering technological complexity legible without reducing it to simplified categorical assertion. The contribution lies not in claiming technological interpretation as universally superior approach but in theorising specific conditions under which it enables museums to communicate material significance otherwise remaining opaque. This framework may also apply beyond lithic collections to other archaeological materials where technological knowledge constitutes primary cultural significance. Furthermore, building on object biography and itinerary approaches, the research theorises contextual transformation not as loss or distortion of authentic meaning but as knowledge-producing journey through which objects accumulate significance. Applied to museum contexts, this perspective repositions transformation from archaeological to museum contexts as inevitable and potentially productive rather than problematic displacement from original meaning. The theoretical contribution lies in developing frameworks enabling museums to make these transformative journeys visible and intellectually engaging rather than concealing or minimising contextual change. This approach challenges conventional museological emphasis on authenticity and original context by positioning museum contexts as legitimate sites of ongoing object biography. The framework enables reflexive museum practice acknowledging institutional mediation while maintaining scholarly rigour.

The research extends the conceptualisation of lithic studies as *basic science* into public domain by demonstrating that foundational research capable of contributing to human

evolution narratives while articulating significance within interdisciplinary research contexts can also function as resource for public engagement when appropriately mediated. The theoretical contribution positions lithic research as foundational interdisciplinary science that is furthermore knowledge capable of meaningful public communication when fundamental insights about human technological evolution, embodied knowledge, and material intelligence are rendered accessible.

8.2.2. Empirical documentation

The research provides first empirical examination of how Italian museums present Palaeolithic lithic collections, contributing to understanding of museum practice. Though in no way comprehensive, the research documents diversity of institutions holding prehistoric collections in Italy, from national archaeological museums through civic collections to specialist prehistoric centres and university museums. The documentation establishes characteristics distinguishing Italian lithic museum practice from practices documented in other national contexts, revealing particular influence of historical disciplinary traditions (*paletnologia*), strong emphasis on site-based interpretation reflecting territorial heritage frameworks, and characteristic approaches to classification reflecting Italian prehistoric archaeology's specific development.

The technological analysis of museum lithics provides empirical documentation of embedded knowledge rendered visible or invisible through current presentation strategies. The research documented technological features across multiple display units, revealing that examined collections contain technological dimensions although variably observable, establishing that technological *poverty* results partly from object inadequacy but more importantly from a mismatch between interpretive frameworks and rendering observable features meaningful to visitors.

The examination of exhibition strategies, interpretive materials, and communicative ecosystems across sampled institutions provides foundation for understanding how museums mediate lithic significance. The research documented exhibition strategies employed across institutions, establishing empirical typology ranging from comprehensive chronological sequences through thematic arrangements to site-based presentations. This classification enables museums to understand their approaches relative to broader patterns while identifying alternative strategies potentially enhancing technological communication.

The investigation of institutional contexts, operational practices, and decision-making frameworks provides understanding of how museums function as organisations shaping presentation possibilities. The research documented curatorial resources, specialist expertise, conservation facilities, and educational programming capacities, establishing that museums operate under substantial resource constraints affecting display enhancement possibilities. The documentation reveals that marginalisation results not from conscious rejection but from prioritisation of other institutional objectives under constraint.

8.2.3. Implications for practice

The research validates museum professionals' experiences navigating tensions between archaeological complexity and visitor accessibility, providing conceptual vocabulary for understanding these as systematic conditions rather than individual failings. Museum professionals may benefit from frameworks positioning lithic collections as underutilised interpretive resources, rather than inherently difficult materials. The *Lithic Trajectories Framework* offers a structured approach potentially enabling museums to enhance interpretation within existing resource constraints, with scalability allowing institutions to implement interventions matched to available capacities—from modest improvements to comprehensive redevelopment. Network collaborations may enable resource sharing and collective capacity building. Smaller museums might develop partnerships with larger institutions, university programmes, or research centres for specialist consultation, while museums sharing geographical or thematic focuses could coordinate programming or develop touring exhibitions distributing costs.

For prehistoric archaeologists, the research positions museum communication as integral to archaeological knowledge production rather than peripheral application. Archaeologists might engage proactively with museums during research design, identifying interpretive opportunities early in excavation or analytical processes rather than treating public engagement as an afterthought. The findings suggest that specialist lithic analysis contains knowledge that may be accessible to public audiences when appropriately mediated. Chaîne opératoire frameworks central to specialist analysis could function as public interpretation strategies when rendered through appropriate communicative formats, potentially enabling archaeologists to maintain analytical rigour while promoting accessibility. Museum collections may function as research datasets deserving analytical attention, with displayed

lithics enabling research addressing innovative questions. Many museums appear to lack specialist lithic expertise, suggesting opportunities for archaeologists to contribute knowledge supporting institutional development through consultation, training, collaborative research, and review services. These contributions might position archaeologists as partners in museum practice rather than external critics.

For heritage authorities and policymakers, empirical documentation of undervalorisation affecting prehistoric collections across Italian institutions may provide evidence supporting policy interventions for enhanced interpretation. The patterns documented might enable authorities to identify where interventions prove most effective, whether supporting smaller institutions lacking specialist expertise or encouraging larger museums to enhance prehistoric interpretation. The institutional analysis suggests specific factors enabling or constraining effective valorisation—specialist expertise availability, resource constraints, conservation requirements, institutional priorities. Authorities might design support mechanisms addressing identified barriers systematically: training programmes, specialist consultation networks, funding schemes, partnership incentives, etc. The documentation of institutional variation indicates that effective policy might require differentiated support strategies acknowledging how scale, governance structure, disciplinary tradition, and resource availability create different enhancement possibilities. Policy could provide intensive support for smaller institutions while encouraging larger museums to function as network nodes sharing expertise, developing tiered funding schemes and collaborative frameworks acknowledging institutional diversity.

The research reinforces existing public archaeology approaches that emphasise hands-on engagement with manufacturing processes, providing empirical and theoretical foundations for practices already employed by practitioners and mediators. Experimental archaeology, participatory workshops, and demonstration programmes currently function as evidence-informed strategies within the field; the research documents their importance while revealing that these approaches remain underutilised relative to their potential impact on prehistoric heritage valorisation. The documented gaps between displayed collections' potential and communicated meaning demonstrate why practitioners already develop programming extending museum interpretation beyond static display constraints. The research establishes the theoretical basis for why current mediation approaches work: they address the material constraints of museum display (haptic knowledge requires handling), bridge epistemological gaps (procedural understanding through practice), and render technological complexity

accessible (embodied learning rather than abstract description). The research's positioning of museum communication as integral to knowledge production validates practitioners' existing arguments but also provides evidence demonstrating how public programmes contribute to heritage valorisation mandates, serve institutional educational objectives, and address barriers to prehistoric material communication. This enables practitioners to advocate more effectively for integration into research design from project inception, adequate resource allocation matching programmatic importance, and evaluation frameworks assessing public engagement systematically.

The research demonstrates that effective lithic valorisation requires coordination across multiple professional communities—museum professionals providing institutional knowledge, archaeologists contributing specialist expertise, educators designing public programmes, heritage authorities enabling policy support. No single professional community possesses all necessary resources, establishing that sustainable enhancement emerges through collaborative practice leveraging distributed capacities rather than through isolated institutional efforts.

8.3. Limitations, reflexive considerations, and future directions

This research operates within methodological and contextual constraints that define its scope and establishes foundations for productive future investigation. The limitations identified here serve as boundaries clarifying where claims hold and where future research might extend understanding. Each limitation presents specific opportunities for subsequent research building upon frameworks, methodologies, and empirical foundations established through this work.

8.3.1. Geographical scope and comparative potential

The research's concentration on Italian museum contexts enabled detailed engagement with specific disciplinary traditions, legislative frameworks, and institutional practices shaping lithic trajectories within nationally defined heritage systems. This geographical specificity provided analytical depth impossible through broader comparative approaches, enabling nuanced understanding of how palethnological traditions influence contemporary practice, how the *Codice dei Beni Culturali* and *valorizzazione* requirements operate in institutional contexts, how Italian prehistoric archaeology's historical development shapes museum interpretation, and how territorial heritage frameworks affect collection presentation strategies.

This depth necessarily limits direct generalisability to other national contexts but subsequently presents substantial opportunity for comparative research employing equivalent methodologies in other contexts. Comparison could reveal which findings reflect Italian particularities versus widespread museum phenomena, identify nationally specific solutions potentially transferable to other contexts, establish whether epistemological tensions between archaeological and museum knowledge systems operate similarly across national traditions, and determine how different legislative frameworks shape prehistoric heritage valorisation. Comparative research could employ the analytical frameworks developed here—technological knowledge dimensions, *semi-invisibility* mechanisms, *Lithic Trajectories Framework*—testing their applicability across diverse contexts while refining them through specific considerations.

Research could extend beyond Europe to investigate how museums in regions with different relationships to Palaeolithic heritage present lithic collections. African contexts pertinent to conversations in the earliest stages of human evolution might approach Palaeolithic materials differently than European museums, Asian contexts with distinctive prehistoric traditions could reveal alternative valorisation strategies, and settler colonial contexts navigating relationships between Indigenous and archaeological heritage might demonstrate different institutional dynamics. Global comparative research would establish whether theoretical frameworks developed through Italian research operate universally or require cultural adaptation.

8.3.2. Scope of material culture and temporal coverage

The research concentrated on Palaeolithic lithic artefacts, deliberately focusing on stone tools representing earliest and most persistent form of material culture in human prehistory. This focus enabled deep engagement with specific materials, technologies, and interpretive challenges while necessarily excluding other prehistoric material categories and temporal periods. The analytical frameworks developed through lithic analysis may apply to other archaeological materials but require testing through empirical application. Future research could expand analytical scope to test framework transferability, investigate whether *semi-invisibility* operates similarly for other material categories sharing characteristics of visual modesty and specialist knowledge requirements.

Research could assess whether a (*Lithic*) *Trajectories Framework* applies to other artefact types or requires modification reflecting different material properties, manufacturing processes, and cultural significances. Does spatial trajectory thinking work equally well for ceramics, metals, or organic materials? Do temporal biographical approaches prove as effective for shorter-lived materials? Do social network perspectives apply to materials produced in different social contexts? Do epistemic transformations operate similarly across material categories? Research expanding temporal scope could investigate whether prehistoric materials from later periods—Neolithic, Bronze Age, Iron Age—encounter similar marginalisation or whether temporal distance rather than material characteristics primarily drives *semi-invisibility*. Do Neolithic lithics, despite technological sophistication and closer temporal proximity, face presentation challenges, perhaps not in the exact same way as Palaeolithic materials but in some other manner? Does later prehistoric material culture with greater formal diversity and clearer functional identification avoid *semi-*

invisibility? Understanding temporal patterns would clarify whether findings reflect prehistoric heritage broadly or specifically Palaeolithic conditions.

8.3.3. Sampling approach and institutional representation

The museums examined in this work characterise purposive rather than statistically representative sample, selected through combination of collection significance, institutional diversity, and researcher access. This sampling approach enabled comparative analysis across diverse institutional types but precludes statistical generalisation to all Italian institutions holding Palaeolithic collections. The research makes no claims about lithic presentation across Italian museums generally, focusing instead on systematic patterns observable within examined cases. These patterns suggest broader tendencies but require validation through expanded sampling. The absence of comprehensive data regarding Italian museums holding Palaeolithic collections—itself documented through this research—means that statistical sampling remains impossible without preliminary census work establishing population parameters. This limitation creates opportunity for comprehensive survey of Italian museums holding Palaeolithic collections. Such research could establish complete census of institutions, collection characteristics, and presentation approaches, enabling statistical analysis of patterns identified through this research’s purposive sample. Survey research could quantify how many Italian museums hold Palaeolithic lithics, what proportion display these collections publicly, how presentation strategies vary across institutional types and scales, and what factors correlate with enhanced technological interpretation. Survey methodology could employ standardised assessment protocols developed from this research’s analytical frameworks, enabling comparison across large institutional samples. Researchers could develop quantitative measures of technological knowledge visibility, interpretive sophistication, and display effectiveness, producing national baseline against which enhancement initiatives are assessed. Survey research would provide evidence base for heritage policy development by documenting national patterns in prehistoric heritage presentation, identifying institutions requiring support, and establishing priorities for intervention.

The sampling approach also excluded certain institution types warranting future investigation. Private collections, temporary exhibitions in non-museum venues, and digital-only presentations represent contexts where lithic valorisation occurs outside traditional museum settings. Research expanding analytical scope to these contexts could reveal

alternative presentation strategies unconstrained by conventional museum frameworks, innovative approaches to technological interpretation, and successful practices potentially transferable to traditional museum settings.

8.3.4. Focus on displayed collections and public presentation

The research examined displayed lithic collections accessible through public museum spaces, deliberately focusing on public-facing presentation and visitor experience rather than comprehensive institutional collection assessment. This approach provided detailed understanding of what museums choose to make publicly visible, how they communicate lithic significance to diverse audiences, and what visitors encounter during museum experiences. The focus enabled analysis of display configurations, interpretive materials, and communicative strategies while acknowledging that displayed collections represent curated subsets of institutional holdings.

Storage collections could contain materials potentially enhancing display quality—for example, reduction sequences currently dispersed across storage, technologically significant pieces not meeting aesthetic display criteria, experimental materials supporting technological interpretation, and archival documentation contextualising displayed objects. However, investigating storage collections requires different methodological approaches, such as systematic cataloguing, assessment of conservation conditions, evaluation of accessibility for research and display purposes.

This limitation creates opportunity for complementary research investigating relationships between displayed and stored lithic collections. Such research could assess what selection criteria determine display versus storage, whether technologically significant materials remain invisible in storage while less informative pieces occupy display space, how museums balance typological representation with technological storytelling in selection decisions, and what mechanisms might bring storage materials into public view through rotating displays, digital access, or enhanced interpretation. Research could investigate storage collection potential for enhancing technological interpretation through identifying complete reduction sequences retrievable from storage materials, assessing whether storage collections contain technological variability not represented in displays, evaluating feasibility of creating study collections accessible to researchers and advanced visitors, and exploring digital technologies enabling virtual access to storage materials. Such research

would establish whether current displays represent optimal selection from available materials or whether storage collections harbour unrealised interpretive potential.

The exhibition focus also limited engagement with behind-the-scenes museum processes shaping public presentation. While interviews were conducted here, future research could investigate more profoundly the curatorial decision-making processes determining display content, conservation protocols affecting object handling and presentation possibilities, institutional review procedures governing interpretive content, and resource allocation mechanisms affecting prehistoric heritage prioritisation. Ethnographic research methods, such as participant observation, extended curator interviews, institutional document analysis, could provide insights into how institutional cultures, professional networks, and organisational dynamics shape prehistoric heritage valorisation.

8.3.5. Time-bound analysis

The research examined lithic displays during specific visit periods between November 2023 and June 2024, providing snapshot of current practice without longitudinal perspective documenting how presentations evolved over time. Display strategies observed represent particular moments in ongoing institutional trajectories rather than stable endpoints. Museums continuously revise exhibitions, update interpretive materials, and respond to new research, changing visitor expectations, and evolving heritage policy, meaning documented patterns reflect specific historical moment rather than fixed institutional characteristics. Many of the museums examined are actively engaged in exhibition renewal projects, collection reinterpretations, or display modernisation initiatives, meaning that documented conditions may have already changed.

This temporal limitation means the research cannot assess whether current patterns represent stable conditions or transitional states, whether technological interpretation is increasing or decreasing over time, how museums respond to enhanced awareness of prehistoric heritage's marginality, or what factors enable or constrain institutional evolution. However, this creates opportunity for longitudinal research which could document how lithic displays evolve and track whether technological interpretation increases following advocacy and awareness-raising, whether museums implementing enhancements sustain them over time or revert to conventional approaches, how broader museum sector developments influence prehistoric

material presentation, and whether systematic patterns identified through this research persist or shift.

Longitudinal data would enable assessment of valorisation strategy uptake and identification of successful change mechanisms. Researchers could investigate which enhancement approaches museums adopt most readily, what factors enable sustained institutional change versus temporary modifications, how professional networks facilitate innovation diffusion across institutions, and whether policy interventions produce measurable improvements in prehistoric heritage presentation. Longitudinal research could also assess generational change in museum practice, investigating whether newer professionals trained in contemporary archaeological approaches bring enhanced technological sensitivity to prehistoric interpretation.

8.3.6. Absence of visitor research and reception analysis

The research examined lithic presentation from curatorial and specialist archaeological perspectives, employing technological analysis to assess what knowledge collections contain, museographic examination to evaluate how museums communicate this knowledge, and institutional inquiry to understand organisational contexts shaping practice. This approach provided documentation of relationships and gaps between technological potential and communicated meaning, but from professional rather than visitor standpoint.

The absence of visitor studies, audience research, and empirical testing of proposed valorisation strategies represents significant limitation. Claims about public engagement potential remain theoretical rather than empirically validated through visitor response data. This limitation creates substantial opportunity for visitor studies research validating theoretical claims through empirical investigation. Visitor research could employ diverse methodologies and specialist trainings addressing different questions about how people engage with lithic displays and what communication strategies prove effective.

Surveys could investigate visitor interest in technological interpretation through assessing what aspects of lithic collections visitors find most engaging, what information they desire beyond current interpretive content, how satisfied they are with existing prehistoric displays, and whether they would engage with enhanced technological interpretation. Demographic analysis could identify whether interest in technological content varies by age, education,

prior museum experience, or cultural background, enabling targeted interpretation strategies serving diverse audiences. Observation studies could document visitor behaviour in lithic exhibitions through tracking dwell time at displays, observing viewing patterns and object attention, recording social interaction and conversation about objects, and identifying what display elements attract or fail to capture attention. Behavioural data would reveal whether visitors actually engage with interpretive content or merely glance at objects, whether certain display configurations prove more effective than others, and what supplementary elements enhance engagement. Interviews could investigate visitor meaning-making processes through exploring what visitors understand about displayed lithics, how they interpret technological features, what connections they make between prehistoric and contemporary technology, and what emotional responses objects evoke. Qualitative data would reveal whether technological frameworks resonate with visitor interests and whether enhanced interpretation achieves intended cognitive and affective outcomes.

Learning assessment research could measure what visitors actually learn from different presentation strategies through pre/post testing comparing understanding before and after museum visits, experimental designs comparing visitor response to conventional versus enhanced interpretation, long-term follow-up assessing lasting impact of museum experiences, and comparative studies investigating which interpretive approaches produce optimal learning outcomes. Educational research would provide evidence base for valorisation claims by demonstrating whether technological interpretation actually improves public understanding of prehistoric heritage.

Comparative visitor research could test specific valorisation strategies proposed through this research. Museums could implement pilot enhancements in selected galleries while maintaining conventional displays elsewhere, enabling controlled comparison of visitor response to different approaches. Research could assess whether object trajectory frameworks make exhibitions more engaging, whether chaîne opératoire thinking proves accessible to non-specialists, whether experimental demonstrations enhance understanding more effectively than textual interpretation, and whether biographical approaches to objects resonate with visitors. Such research would validate, refine, or challenge assumptions underlying valorisation proposals.

8.3.7. Methodological development and analytical refinement

The research developed frameworks for analysing technological knowledge in displayed collections, examining museographic strategies, and investigating institutional dynamics, but without producing fully standardised protocols enabling consistent application across diverse research contexts. The methodological approaches remained somewhat flexible to accommodate diverse institutional conditions encountered during fieldwork, enabling responsive adaptation but potentially limiting cross-study comparability. This limitation creates opportunity for methodological research refining assessment instruments and establishing standardised protocols. Researchers could develop quantitative measures of technological knowledge visibility enabling statistical analysis across large samples, create reliable coding schemes for interpretive content analysis ensuring inter-rater reliability, establish standardised observation protocols for display configuration assessment, and design interview guides for institutional inquiry. Standardisation would enable meta-analyses combining multiple studies, comparison across national contexts, and longitudinal tracking of enhancement initiatives. Integrating quantitative and qualitative approaches more systematically represents another methodological development opportunity. The research focused on a qualitative analysis, future work could complement with quantitative analyses and employ more sophisticated mixed-methods integration—statistical modelling of factors influencing technological visibility, network analysis of museum collaborations, spatial analysis of display configurations, and geographic information systems mapping institutional patterns. Advanced mixed-methods approaches would provide more robust empirical foundations while preserving interpretive depth.

8.3.8. Researcher positionality and interpretive perspective

The research reflects the author's positioning primarily within prehistoric archaeology, engaging with museum contexts to examine how lithic knowledge intersects with exhibition practices. This perspective allows for the recognition of epistemological tensions between archaeological knowledge production and museum communication, while also acknowledging the potential for interpretive biases that may privilege technological approaches over alternative interpretive strategies.

The analytical framework privileges technological interpretation as valorisation strategy, reflecting researcher's archaeological training and conviction that technological knowledge

provides accessible entry points to prehistoric narratives. This positioning means alternative researchers might prioritise different interpretive strategies—aesthetic appreciation emphasising lithics’ formal qualities, sensory engagement foregrounding material textures and weights, contemporary relevance connecting prehistoric and modern technology, identity construction linking lithics with regional or national heritage, emotional engagement emphasising human connections across time—producing different valorisation proposals from identical empirical observations. This creates opportunity for research investigating alternative interpretive approaches to lithic valorisation, some of which have already been cited in the thesis. Researchers with different disciplinary backgrounds—art history, science communication, education studies, design—might develop complementary frameworks emphasising aspects this research underemphasised. Comparative research could assess relative effectiveness of different interpretive strategies for different audiences, contexts, or objectives. Participatory research involving visitors in exhibition development could reveal what interpretive approaches resonate with diverse audiences rather than assuming professional perspectives reflect public interests. Co-creative methodologies could engage communities in determining how their local prehistoric heritage should be presented, potentially revealing culturally specific valorisation strategies this research's academic perspective overlooked.

8.3.9. Proposal implementation

This research documents current practices and proposes strategies for enhancement, but these strategies cannot be fully evaluated without empirical implementation. Building on the findings and frameworks developed here, there is a clear opportunity to translate these recommendations into practice through collaborative action with museums. Implementation would employ action research methodologies, working collaboratively with museums to design enhancements, implement strategies, document processes, assess outcomes, and refine approaches based on experience. Such would reveal practical challenges, resource requirements, institutional negotiations, and effectiveness measures unattainable through theoretical development alone. Furthermore, implementation could clarify the conditions under which these strategies are feasible and assess the extent to which they can influence museums mediation practices and public engagement with deep human time.

8.4. Final reflections

This research addressed the observation that human prehistory, despite documenting the vast majority of human existence, remains marginal within contemporary cultural discourse. Lithic artefacts crystallise this problematic while offering potential resolution. Stone tools constitute primary surviving evidence of early human technological achievement, yet their archaeological centrality finds limited correspondence in public recognition. Museums possess these collections under legal mandates for valorisation yet systematically encounter challenges rendering their significance accessible.

8.4.1. On the significance of technological knowledge

The research establishes technological knowledge as distinctive mode of human understanding transcending temporal and cultural boundaries. The capacity to transform materials through systematic technical action, to transmit manufacturing expertise across generations, to innovate solutions addressing environmental challenges, and to encode cultural knowledge within material forms represents fundamentally human capability connecting contemporary peoples with earliest ancestors. The idea is that when visitors encounter evidence of these capacities embedded in Palaeolithic stone tools, they access shared cognitive heritage spanning millions of years.

This technological heritage provides a counter-narrative to *Palaeolithic othering* by demonstrating continuities rather than emphasising differences. Early humans confronted material challenges requiring intelligent solutions, developed skilled practices through dedicated learning, made strategic decisions balancing competing requirements, and transmitted knowledge enabling cultural accumulation—capabilities recognisably continuous with contemporary technological practice despite vast temporal distance. Museums making these continuities visible through effective interpretation enable visitors to recognise ancestors as cognitively sophisticated problem-solvers rather than *primitive Others*, potentially transforming how prehistoric heritage achieves contemporary cultural significance.

The technological focus developed through this research does not claim exclusive legitimacy or universal applicability. Alternative interpretive strategies—aesthetic appreciation,

emotional engagement, identity construction—provide valuable pathways toward prehistoric heritage engagement serving different purposes. However, technological interpretation offers distinctive advantages for materials whose significance resides primarily in manufacturing processes and embodied expertise rather than visual appeal or straightforward functional identification. For lithics specifically, technological frameworks enable communication of what makes these objects archaeologically important while providing accessible entry points requiring no specialist background beyond common human experience with tool use and material transformation.

8.4.2. On museums as sites of possibility

Museums occupy unique position enabling transformation of specialist archaeological knowledge into publicly accessible heritage. No other institutions combine direct material access, interpretive infrastructure, educational programming capacity, and cultural authority positioning them to mediate between specialist research and public understanding. The research has documented how museums currently struggle fulfilling this mediating function for prehistoric materials, but struggle reflects systematic conditions rather than inherent impossibility. Museums possess collections containing demonstrable technological knowledge, professional staff capable of enhanced interpretation, institutional frameworks supporting innovation, and visitor audiences potentially receptive to sophisticated content when appropriately mediated.

The *Lithic Trajectories Framework* and associated valorisation strategies developed through this research demonstrate that enhancement remains achievable within existing institutional realities. Museums need not await ideal conditions—unlimited resources, specialist expertise, revolutionary technologies—before improving lithic interpretation. Strategic interventions scalable to institutional capacities, collaborative approaches leveraging distributed knowledge, and incremental enhancement building upon established foundations enable progress toward enhanced valorisation regardless of constraint. Small museums can improve through modest interventions while larger institutions pursue comprehensive development, collective advancement emerging through coordinated efforts across institutional hierarchies.

Museums also function as sites revealing archaeology's implicit assumptions about knowledge, evidence, and significance. When archaeological knowledge transforms moving

into museum contexts, this transformation makes visible epistemological structures otherwise remaining implicit within specialist practice. The research has demonstrated how epistemological tensions between archaeological and museum knowledge systems operate, but these tensions need not paralyse practice. Understanding tensions as systematic conditions enables development of strategies working productively with rather than against them, maintaining specialist intricacies while achieving public accessibility through conceptual frameworks enabling rather than constraining communication.

8.4.3. On counter-marginality as achievable transformation

This research provides theoretical foundations positioning technological interpretation as legitimate and productive strategy, methodological frameworks enabling implementation across diverse contexts, and empirical documentation establishing evidence base for advocacy and resource justification. These contributions may serve practitioners (museum professionals, archaeologists, heritage authorities, public engagement specialists) to advance prehistoric heritage valorisation through coordinated efforts leveraging their respective expertise and institutional positions. This highlights counter-marginality as emerging not through individual intervention but through collective strategic action building upon shared conceptual foundations.

The strategy acknowledges that prehistoric heritage will likely never achieve cultural prominence comparable to more recent historical periods benefiting from richer material remains, written records, architectural monuments, and closer temporal proximity. However, cultural significance exists on continuum rather than binary, and prehistoric materials can achieve enhanced recognition, increased public engagement, and greater institutional support without requiring cultural dominance. The research demonstrates that lithics possess untapped interpretive potential currently underutilised through conventional presentation strategies, and realising this potential represents achievable rather than utopian goal.

8.4.4. Closing vision: toward integrated archaeological practice

This research advocates fundamental reconceptualisation of relationships between archaeological research, museum practice, and public engagement. The conventional model positioning research as primary activity followed by optional dissemination through museums and public programming reflects outdated understanding of knowledge production

and cultural relevance. Contemporary archaeology necessarily operates within museum and heritage frameworks that require not only preservation and study but also valorisation and public accessibility. These requirements position effective communication as integral to archaeological practice rather than a peripheral application. Museums emerge as essential rather than optional partners in archaeological knowledge production, providing contexts where specialist understanding achieves cultural significance through transformation into publicly accessible heritage. This positioning requires archaeologists to engage proactively with museum contexts during research design, developing interpretive frameworks alongside analytical methodologies. It requires museum professionals to position themselves as legitimate knowledge producers negotiating between specialist research and public understanding. It requires heritage authorities to recognise distinctive characteristics of prehistoric materials requiring specific policy attention and institutional support.

The vision emerging from this research positions prehistoric archaeology as public-facing science generating cultural knowledge transcending specialist communities. Lithic studies contain content valuable beyond specialist discourse when appropriately communicated through frameworks enabling rather than constraining public accessibility. Museums possess the capacity to realise this communication, and the research offers tools to enhance their ability to do so effectively.

Ultimately, this research concerns how contemporary societies engage with deep human time and what mechanisms enable or constrain meaningful connection with early ancestors. Lithic artefacts provide material links across millions of years, embodying technological knowledge, cognitive capabilities, and adaptive strategies connecting us with early humans. Museums curating these materials thus bear responsibility not only for their physical preservation but for rendering their significance accessible, comprehensible, and culturally meaningful. This study demonstrates that they possess the means to do so more effectively, serving not merely archaeological interests but a broader cultural imperative: to keep humanity's earliest chapters legible, valued, and integrated within contemporary understandings of who we are and how we came to be.

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APPENDIX A:

MUSEUM DATA

i. Museo delle Civiltà, Roma (RM)

The *Museo delle Civiltà* (Museum of Civilizations) in Rome represents one of Italy's major national museum institutions located in the district constructed for the Universal Exposition of Rome (EUR) in 1942. It was established in its current configuration through the 2016 museum reform that merged previously independent museums and collections under a single autonomous administrative structure. It is divided into two buildings: the *Palazzo delle Scienze* houses the collections from the former National Museum of Prehistory and Ethnography, National Museum of Oriental Art, African Museum, Italian Institute for Environmental Protection and Research, and National Museum of the Middle Ages, while the *Palazzo di Arti e Tradizioni Popolari* houses the collections of Italian popular arts and traditions. The museum operates under direct oversight of the Ministry of Culture with autonomous administrative status, enabling independent governance while maintaining state ownership. The museum maintains regular opening hours (Tuesday-Sunday), professional curatorial and conservation staff, educational programmes, and research facilities including specialised libraries and archives.

The MuCiv houses the largest and most comprehensive prehistoric collection in Italy. Its origins can be traced to the pioneering work of Luigi Pigorini that resulted in the establishment of the *Regio Museo Nazionale Preistorico Etnografico* in 1875, whose nucleus was the antiquities and curiosities collection of the Kircherian Museum. It comprises materials from the Palaeolithic through Bronze Age from Italian and international contexts, alongside extensive ethnographic holdings from Africa, Asia, Oceania, and the Americas. By the time of Pigorini's death in 1925, the Museum of Prehistory and Ethnography had amassed more than 150,000 items. The institution underwent significant relocation between 1962 and 1977, moving from the Palazzo del Collegio Romano in the historic city centre to its current site in the Palazzo delle Scienze. The relocation allowed the museum to maintain its original organisation dedicated to prehistory and extra-European ethnography, while providing expanded exhibition and research facilities within purpose-built spaces designed for comprehensive display and study of extensive collections.

The Pigorini museum's original theoretical framework reflected the Darwinian positivist and evolutionary theories gaining prominence in late 19th-century Italy. The institution was designed to reconstruct Western prehistory through comparative study of contemporary

“primitive” cultures, with ethnographic analysis serving to illuminate prehistoric societies where direct archaeological evidence was limited. This approach, while groundbreaking for its time, established problematic comparative frameworks that positioned non-European cultures as representing earlier evolutionary stages, reflecting the colonial and racial ideologies prevalent in European political and academic discourse at the time. Following the 2016 establishment of the Museo delle Civiltà, which absorbed these collections, the institution embarked upon methodological and theoretical repositioning that deliberately departs from many assumptions that characterised its earlier incarnations.

The current exhibition

Prehistory? Stories from the Anthropocene is the new permanent display of the prehistory collections (**Fig. 1**), an exhibition that fundamentally reimagines how prehistory is approached by situating human history within the broader framework of the Anthropocene. The curatorial approach explicitly challenges the traditional concept of *prehistory* as the period “before history” represented by the absence of written sources and instead promoting for a reading of the prehistoric past as composed of innumerable interconnected *stories* that emerge from the analysis and interpretation of naturalistic and archaeological data. This reframing emphasises that prehistoric societies possessed complex systems of thought, cultural innovations, and sophisticated economic, political, and social organisations that defy linear evolutionary narratives. The introductory panel to the exhibition acknowledges the origins and history of understanding prehistory, citing associations between otherness, primitive, prehistoric peoples, and non-European civilisations in support of racial superiority and modernity in a nationalist-colonialist Western world. It then highlights that new research has redefined the understanding of humans to have origins that are polycentric and inter-species in nature, but are now a species, in the Anthropocene, facing challenges of extinction.

The exhibit begins with an overview of human evolution, entitled “Fossils tell the story of our evolutionary history,” represented through various fossils from around the world, arranged chronologically from 7 million years ago to today (**Fig. 2**). The text panel provides a “glimpse of some of the chapters that form this ‘history’” emphasising ancestor bipedalism and African origins, taxonomic diversity within the hominin lineage, geographic dispersal beyond Africa from 1.8mya, and evidence of contact and interbreeding between *Homo sapiens* and contemporaneous hominin populations including Neanderthals and Denisovans. The text panel at the end of this display emphasises humans as animals existing in biological continuity with all other life forms, describes human evolution as a long and entangled

process beginning over 7 million years ago in Africa, notes that *Homo sapiens* are the only surviving representatives of this lineage by chance, and states that human variability cannot be divided into races.



Fig. 1. The opening of the prehistoric exhibition.



Fig. 2. Human evolution display.

The exhibition further includes a 3D reconstruction of a palaeosurface featuring *in situ* deposition of faunal remains and lithic artefacts, and a section called “Science in action. The table of scientists” highlighting how scientific methods inform the interpretation of archaeological artefacts. Significant prehistoric artefacts on display here include the original

Guattari 1 Neanderthal skull from the Guattari Cave at Circeo. Contemporary artistic interventions included in the exhibit provide critical commentary on archaeological practice, national identity formation, and prehistoric conceptualisation, leading museographic narratives toward contemporary questions about human-environment relationships, inequality, and climate change. The exhibition explicitly frames prehistoric content within the Anthropocene discourse, examining the millennial era of human cohabitation with other species and contemporary environmental challenges that threaten sustainable futures.

The lithic collection

The exhibition's approach to lithic presentation reflects the museum's contemporary critical methodology, keeping traditional strategies, i.e., presenting artefact diversity and chrono-cultural sequencing but also positioning lithic evidence within narratives or *stories* on human evolution. The presentation emphasises Palaeolithic archaeological contexts and sites in Rome and wider Lazio as *Palaeolithic civilisations*. The museum's critical approach to prehistoric interpretation and emphasis on contemporary relevance highlights a presentation of lithic assemblages in favour of broader cultural and environmental interpretation, but technical descriptions of stone tools are not absent. This reflects the museum's commitment to accessibility and contemporary relevance and attempt to balance specialist technical content with broader interpretive frameworks designed to engage various audiences.



Fig. 3. Lithic objects with associated fossils.

Strengths, problems, opportunities

The exhibition exemplifies how contemporary museums can engage in critical self-examination of their institutional histories while presenting collections in ways that resonate with current environmental and social concerns. It articulates a connection between ancient material culture and contemporary discussions about human environmental impact, making archaeological artefacts directly relevant to present-day ecological and cultural debates. This exhibition represents a significant potential in museum practice as it demonstrates how institutions can move beyond colonial-era interpretive frameworks towards more inclusive, scientifically current, and environmentally conscious approaches. By questioning fundamental assumptions about prehistory and situating human development within the Anthropocene, it offers visitors a more nuanced and interconnected understanding of human history and our relationship with the planet. The position of the collection within the Museo delle Civiltà creates unprecedented opportunities for developing interdisciplinary programming that connects prehistoric archaeology with ethnography, art history, and contemporary cultural studies, potentially creating unique educational experiences that demonstrate cultural continuities and connections across temporal and geographical boundaries.

ii. Museo Archeologico Nazionale di Verona (VR)

The National Archaeological Museum of Verona represents one of Italy's most recently established major archaeological institutions, having opened to the public in 2022 following decades of planning from initial proposals in 1982. As a national archaeological museum, the institution operates within the broader network of state museums. It is housed within the former Austro-Hungarian military barracks of San Tomaso (Caserma Asburgica San Tomaso), which subsequently served as a tribunal and military prison (**Fig. 4**). The restoration of the structure, funded by the Ministry of Culture, transformed the building into a three-storey museum. At the time of fieldwork, only the top floor dedicated to the Prehistory and Protohistory sections was open to the public. The middle level was intended to host the Roman and Celtic sections and spaces for cultural programming while the ground floor was planned for the Early Medieval period. The museum represents a significant investment in presenting regional prehistory and protohistory, with plans for future expansion to include Roman and Imperial periods.



Fig. 4. MAN Verona's use of space in the former barracks.

Collections encompass the Veronese territory's archaeology from the Palaeolithic through Roman periods, representing decades of archaeological research developed through collaborative efforts between the University of Ferrara, University of Trento, and the SABAP of Verona. Materials derive from significant excavations in the region, with particular emphasis on systematic campaigns conducted by the collaborating universities, such as in the sites of Grotta di Fumane and Riparo Tagliente. The museum employs contemporary exhibition design incorporating multimedia systems, interactive elements, and bilingual interpretive materials (Italian, English). The prehistoric galleries occupy dedicated spaces within the broader chronological organisation, presenting Palaeolithic, Mesolithic, and Neolithic materials through integrated display strategies. The museum maintains educational programmes, temporary exhibition facilities, and research consultation services.

The current exhibition

The Prehistoric and Protohistoric sections present a comprehensive chronological narrative spanning from the Middle Palaeolithic to the Iron Age. The exhibition path is thoughtfully arranged across the attic level of the building, with the displays carefully adapted to work within the distinctive interior layout of the former Austro-Hungarian prison. This adaptive approach has resulted in a series of rooms that correspond naturally to major cultural phases, creating distinct spaces for visitors to engage with different periods of human development in the Verona territory.

The curatorial approach employs a thematic framework that goes beyond simple chronological presentation, i.e., each major period is organised around carefully chosen interpretive themes that illuminate specific aspects of prehistoric life: “The Birth of Art” frames the Middle Palaeolithic and early Upper Palaeolithic materials to highlight the emergence of symbolic behaviour and aesthetic expression; “The Last Hunter-Gatherers” contextualises the late Upper Palaeolithic and Mesolithic periods, emphasising the sophisticated adaptations of mobile societies; while “The World of the Dead” presents Iron Age materials through the lens of mortuary practices and social complexity. This thematic organisation allows visitors to understand materials not only as what people made and used, but as representations of how they lived, thought, and organised their societies. Supporting this interpretive framework, bilingual panels in Italian and English provide comprehensive descriptions of ancient environments and lifeways, while colour-coded signage systems effectively support both visual communication and intuitive wayfinding throughout the exhibition spaces.

The visitor experience begins with a wall-sized digital projection featuring an interactive game complete with sound and music, introducing key objects that are also highlighted as “*da non perdere*” (not to be missed) in the printed museum brochure. This highly digital installation immediately signals the museum’s commitment to contemporary engagement methods while establishing the significance of the collections that follow. Throughout the exhibition, a hybrid museographic approach seamlessly combines traditional display methods with digital media: standout features include the carefully presented display of the ochre-decorated “Shaman” figure from Fumane Cave, which serves as both a centrepiece artefact and the museum’s iconic logo; a detailed reconstruction of the Bovolone well that demonstrates Bronze Age technological capabilities; and a full-scale recreation of an Iron Age necropolis burial featuring both human and horse remains that provides visceral insight into ancient mortuary practices. Perhaps most impressive is the dedicated immersive multimedia room presenting the funeral rites of the so-called “Child Prince,” where visitors can experience Celtic burial practices through audio-visual technology (**Fig. 7**). Children’s activity areas equipped with drawing materials are strategically situated throughout the museum, reflecting a commitment to educational accessibility that extends the museum’s interpretive mission to younger audiences and families.



Fig. 5. Virtual installation dedicated to the Celtic funeral rites.

The lithic collection

The materials in the Palaeolithic and Mesolithic lithic collections at the museum derive primarily from two of the most important archaeological sites in the region: Grotta di Fumane and Riparo Tagliente. From Fumane Cave, the display on the Middle Palaeolithic concerns flint tools showing the diversity of raw material types and lithic forms through 72,000 years of Neanderthal technology (115-43 ka; **Fig. 6**), while on the Early Upper Palaeolithic presents mostly laminar-based technology placed together with bone artefacts and shell ornaments characteristic of the Aurignacian tradition (**Fig. 7**). Formal tool categories on display include a strategically placed blade core surrounded by backed points/blade products. From Tagliente Rockshelter, artefacts demonstrate characteristic features of Late Upper Palaeolithic technology in northeastern Italy, including diverse laminar products (blade and bladelet elements) and retouched tools. Functional diversification within the toolkit is indicated by the presence of domestic implements (scrapers, burins, perforators) and weaponry components (backed points, backed blades, truncated backed blades). The morphological variability in backed elements represent standardised armature production for composite hunting weapons particularly characterising Epigravettian technology.



Fig. 6. Stone tools from different phases of the Middle Palaeolithic from Grotta di Fumane.



Fig. 7. Display case of artefacts recovered from the Aurignacian layers of Grotta di Fumane.

The platform arrangements communicate rather effectively the contrast between technological traditions associated to different sites and temporal contexts. The lithic artefacts are accompanied by illustrations of reduction sequences, forging relationships between cores and products. However, representation essential for understanding production techniques may not be straightforward enough and the mixed assemblage presentation may conflate different operational episodes or reduction strategies. The museum also features substantial finds from Neolithic through Iron Age settlement sites, UNESCO-listed lakeside dwellings, and regional necropoli that demonstrate the continued importance of stone tool technologies throughout regional prehistory.

Strengths, challenges, opportunities

The institution's most evident strength lies in its exceptional collections, particularly the significant prehistoric materials from Fumane Cave, which represent some of Europe's earliest artistic expressions and provide unparalleled insights into the cognitive evolution of early modern humans. The *Sciamao* painted stone and associated Palaeolithic assemblages represent globally important cultural heritage. The broader collections spanning ~200,000 years of regional prehistory offer an extensive documentation of human evolution and cultural changes in this part of northern Italy. These collections are housed within contemporary infrastructure that balances heritage preservation with modern museum

standards, as the thoughtful restoration of the former Austro-Hungarian barracks demonstrates how historic architecture can be sensitively adapted for museum purposes while maintaining both aesthetic integrity and full accessibility provisions.

The museum's innovative presentation methodology represents another significant strength, as the hybrid approach combining traditional archaeological display with digital media () demonstrates understanding of contemporary visitor expectations and learning preferences. The integration of virtual reality, immersive multimedia rooms, and interactive digital projections enhances rather the material culture, creating multiple entry points for engagement while maintaining scholarly rigour. This technological sophistication is supported by strong academic partnerships with leading Italian universities, ensuring continued research development and collection enhancement that positions the museum as an active research centre rather than merely a repository. The educational accessibility reflected in bilingual signage, colour-coded wayfinding systems, and dedicated children's activity areas demonstrates institutional commitment to serving diverse visitor needs and supporting both formal and informal learning experiences.

However, these considerable strengths are undermined by challenges concerning the museum's impact and sustainability, specifically visibility and promotional effectiveness. Tourism integration presents perhaps the greatest immediate opportunity, as enhanced promotional strategies within Verona's established UNESCO World Heritage tourism circuits could dramatically increase visitation while positioning the museum as an essential complement to the city's medieval and Roman attractions. The museum's family-friendly features and innovative educational provisions create natural opportunities for expanding school programmes and educational tourism, potentially developing sustainable visitor bases beyond casual cultural tourists. The strong university partnerships provide foundations for developing the institution into a regional prehistoric research hub. Digital innovation offers additional opportunities for creating unique visitor experiences that could differentiate the museum from traditional archaeological presentations, while its collections provide natural opportunities for international loans and collaborative exhibitions that could significantly raise the institution's global profile within prehistoric archaeology communities. Finally, the planned middle-floor programming spaces create opportunities for developing thematic exhibitions and cultural events that could enhance research dissemination while attracting repeat visitors and establishing the museum as a dynamic cultural centre.

iii. Museo Civico di Storia Naturale di Milano (MI)

The Civic Museum of Natural History of Milan constitutes one of Italy's largest and oldest natural history museums. It was founded in 1838 through consolidation of earlier naturalist collections donated to the city of Milan, a substantial initial collection of over 100,000 specimens that established the museum as a significant scientific repository from its inception. The museum operates under municipal governance as part of Milan's civic museum system, housed in a purpose-built neoclassical palazzo in the Indro Montanelli public gardens. As a comprehensive natural history institution, collections span mineralogy, palaeontology, zoology, and botany, with human prehistory and evolution represented within broader natural sciences frameworks. The prehistoric materials appear primarily within palaeoanthropological contexts, in the Natural History of Man section specifically addressing human origins and evolution alongside other Quaternary fauna. The museum maintains substantial physical infrastructure including multiple permanent galleries, temporary exhibition spaces, research collections, conservation laboratories, and educational facilities. Professional staffing includes curators, conservators, researchers, and education specialists serving diverse institutional functions. The building underwent significant reconstruction following war damage and reopened to the public in 1952, with galleries retaining both historical display traditions and contemporary interventions. Today, the museum holds more than 4.5 million specimens.

The current exhibition: Tracce, Storia dell'Evoluzione Umana

In December 2023, the museum reopened its human evolution gallery (Room IX) as TRACCE, replacing a 1999 exhibition that had remained largely unchanged for over two decades. The previous exhibition employed fixed display cases arranged sequentially along the gallery walls, creating what is characterised as a “book-like” presentation with obligatory linear progression. That installation presented human evolution as relatively complete and static. The accumulation of paleoanthropological discoveries and methodological developments since 1999, the recognition that evolutionary processes are considerably more complex than earlier frameworks suggested, and the objective to propose exhibition methods for better public fruition motivated a complete reconceptualisation rather than incremental updating.

TRACCE explicitly prioritises flexible circulation allowing visitors to navigate the space non-linearly, with primary narrative elements accompanied by supplementary investigation areas. The exhibition design responds to three stated objectives: rendering visible the complexity of human evolutionary history through display systems capable of presenting numerous specimens with scientific documentation; transmitting information that makes spatiotemporal dimensions perceptible; and demonstrating how scientific disciplines continually interpret and add understanding to human origins. The installation incorporates over 450 specimens compared to the more limited displays in the previous exhibition.

The exhibition organises human evolutionary content into four chrono-thematic sections. The first, “Chi siamo” (Who We Are), addresses human position within nature and primate relationships. The second, “Un cespuglio africano” (An African Bush), addresses hominin origins and diversity between approximately 6 and 2 million years ago, emphasising the proliferation and coexistence of multiple bipedal species in Africa including early *Homo*. The third section, “Fuori dall’Africa” (Out of Africa), examines multiple dispersal events through which *Homo* populations expanded beyond Africa over the past 2 million years. The fourth section, “*Homo sapiens*,” addresses modern human origins alongside Neanderthal populations. Each section centres on a transparent display structure containing specimens and multimedia installations. The first houses primate skeletons establishing comparative anatomical frameworks for understanding hominin evolution. The second and fourth incorporate walk-through multimedia environments addressing bipedalism and symbolic cognition. The third presents materials focused on hominin dispersals from Africa. Additional display cases distributed throughout the gallery contain thematically organised specimens and interpretive materials. Timeline installations on the gallery walls provide temporal orientation throughout the exhibition. Three multimedia installations create what the designers characterise as “moments of emotion” intended to fix the concept of *traces*—fragmentary evidence from deep time requiring interpretation.

The exhibition narrative progresses systematically through human evolutionary history, presenting fossil remains in cast form alongside artefacts from early hominins derived from the most important global archaeological sites. The display strategy emphasises the fundamental stages of knowledge development in paleoanthropological and archaeological research, with the exhibition showcasing not only the fossil evidence but also the scholars, discoveries, and theories that have shaped understanding of this continuously evolving scientific field (**Fig. 8**). A focus on both empirical evidence and the history of scientific

discovery provides visitors with both substantive content about human evolution and critical perspective on how scientific knowledge develops through research and interpretation. Over 450 specimens including fossil casts, archaeological objects, anatomical reconstruction models, and comparative zoological materials are presented. Outstanding highlights include nearly complete skeletons of “Lucy” (*Australopithecus afarensis*) and “Turkana Boy” (*Homo ergaster*), alongside skulls of *Homo rudolfensis* and *Homo habilis*, representing key figures in the ongoing narrative of human evolutionary understanding. These key specimens serve as focal points for broader discussions of hominin diversity, evolutionary relationships, and the methodological approaches used to reconstruct human evolutionary history. The exhibition concludes with treatment of complex contemporary themes concerning human-environment relationships.

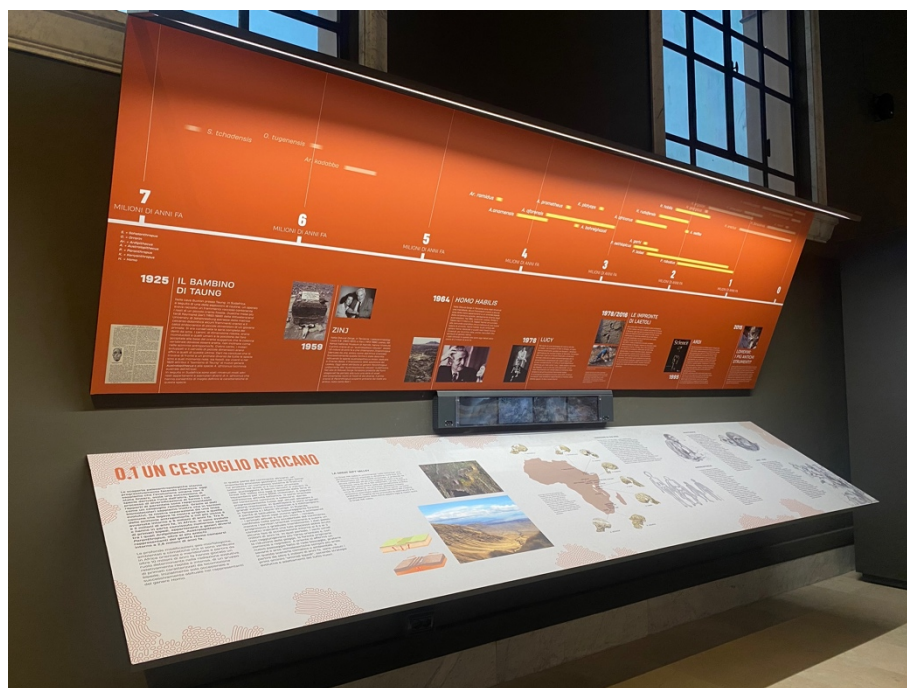


Fig. 8. One of the installations explaining the timeline of discoveries and important personalities and places involved.

The lithic collection

Lithic artefacts constitute one of three “absolute protagonist” categories within TRACCE, alongside primate zoological specimens and hominin fossil remains displayed as casts and 3D reconstructions, according to the curator’s characterisation of the exhibition’s content structure. Stone tools appear integrated throughout the chrono-thematic sections documenting cognitive evolution and adaptive capabilities of different hominins (). Such integration reflects the exhibition’s recognition of the importance of technological evidence for understanding human evolutionary processes, and emphasis on multiple evidence types

for their reconstruction. Natural history museum frameworks contextualising material culture within biological and environmental processes shape lithic presentation within TRACCE.

The exhibition's focus on phylogenetic, morphological, and ecological perspectives on human evolution suggests that lithic materials are presented within interpretive frameworks emphasising technological development as evidence for cognitive evolution and adaptive capabilities. This approach aligns with contemporary paleoanthropological emphasis on technology as a fundamental component of human evolutionary success. The integration of lithic materials within the broader natural history museum context provides opportunities for interpretation connected to evolutionary phenomena.



Fig. 9. Some stone tools on display and their position in the TRACCE exhibition.



Fig. 10. *H. ergaster* fossil remains displayed with associated Mode 2 (Acheulean) lithic artefacts.

Strengths, challenges, and opportunities

The 2023 TRACCE innovation represents explicit recognition of a continuous development of our understanding of human evolution. The shift from book-type, text-heavy displays to open circulation with investigation areas reflects conscious repositioning from presenting evolution as essentially completely understood to communicating ongoing scientific process. The incorporation of multimedia installations and flexible display systems addresses the common tension between permanent exhibition infrastructure and evolving scientific content by providing the possibility to accommodate future content modifications. The exhibition integrates contemporary paleoanthropological research through consultation with Italian specialists, creating pathways between academic knowledge production and public interpretation. The explicit identification of lithic artefacts as “absolute protagonists” alongside fossil and zoological specimens positions technological evidence as fundamental.

The museum’s position within Milan’s cultural and educational landscape creates opportunities for expanded programming that could serve both formal educational curricula and informal lifelong learning audiences, particularly through enhanced family programming, adult education initiatives, and specialised workshops that exploit the

institution's research resources and expertise. The position of human evolution within a natural history programming provides unique opportunities for developing interdisciplinary educational approaches that connect evolutionary biology, environmental science, and archaeological methodology while addressing contemporary concerns about human-environment relationships and conservation challenges. The purpose-built architectural setting within the historic Indro Montanelli Gardens where the museum is located provides an atmospheric and accessible location that attracts diverse visitor populations, offering potential for developing enhanced tourism programming that could position human evolutionary content as a distinctive attraction within Milan's cultural offerings, potentially through thematic exhibitions, special events, and collaborative programming with other cultural institutions.

iv. Museo Civico Archeologico di Bologna (BO)

The Civic Archaeological Museum of Bologna traces its origins to the convergence of academic collecting traditions and municipal cultural development in the late 19th century. The museum was founded in September 1881 through the merging of two significant collections: the University of Bologna's holdings, which inherited the Room of Antiquity belonging to the Academy of Sciences founded in 1714, and the municipal collection, which had been substantially enriched by the exceptional collection acquired by the city in 1860. The museum has been permanently housed in the 15th-century Palazzo Galvani since its official inauguration. Physical infrastructure includes renovated exhibition galleries distributed across multiple building levels, conservation laboratories, storage facilities, and temporary exhibition spaces.

Operating under municipal governance, the institution functions as Bologna's principal archaeological museum covering its territories from prehistory through Roman periods, with additional significant holdings in Egyptian archaeology. Materials derive from regional excavations, donations, and systematic acquisitions spanning more than a century, including Palaeolithic materials from Bolognese territory caves and sites. The museum's collections expanded significantly following its foundation through a fortunate period of urban excavations. The discovery of Etruscan tombs near the Certosa in 1869 initiated years of important archaeological findings within the city and surrounding territory. The museum became the designated repository for materials uncovered during excavations, which were first displayed in rooms adjacent to the Archiginnasio during the V International Congress of Anthropology and Prehistoric Archaeology in 1871. The core collections comprise University collections alongside archaeological materials from regional excavations conducted between the late 19th and early 20th centuries. As a civic institution operating within Bologna's municipal museum network (Musei Civici Bologna), the museum coordinates valorisation of archaeological heritage through shared programmes and conventions with the Archaeological Superintendency of Emilia-Romagna, the University of Bologna, and other archaeological institutions. The museum attracts substantial visitor numbers including international tourists, school groups, and specialist researchers.

The current exhibition

The Museo Civico Archeologico di Bologna presents a comprehensive exhibition programme structured around two main interpretive pathways that allow visitors to engage with the collections from different perspectives. The first pathway focuses on the History of Bologna, providing a chronological narrative from prehistory through the Roman era, encompassing the Lapidarium, prehistoric section, and the development of Etruscan, Celtic, and Roman Bologna. The second pathway explores the Historical Collections, presenting Egyptian, Greek, Etrusco-Italic, Roman antiquities, and the Plaster Cast Collection as discrete cultural assemblages that present broader Mediterranean civilisations. This approach allows the museum to serve both local historical education and broader archaeological scholarship while accommodating diverse visitor interests and academic purposes. The Egyptian section, recognised as the third largest in Italy and among the most important in Europe, features impressive presentations including beautiful funerary statuettes, with specialised sections investigating particular aspects such as funeral instruments, scriptures, and amulets. The upper floors maintain more traditional display methodologies that reflect earlier museological practices, creating an interesting juxtaposition between contemporary presentation techniques and historical museum arrangements.

The lithic collection

The museum houses a collection of early prehistoric materials that documents regional technological development from the Lower Palaeolithic through the Bronze Age. The Palaeolithic period is documented through implements made of flint and other materials, including bifacial choppers, points, scrapers, and cores that demonstrate the technological capabilities of early human populations in the Po Valley region (**Fig. 11**). Materials representing the Mesolithic and Neolithic periods are notably scarce. The Bronze Age collections become substantially more frequent and diverse and include ceramic containers, tools made of bone, horn, and metal, discovered alongside casting moulds in large villages on the plain during the early half of the second millennium BCE. The prehistoric section is further enhanced by comparative materials from other parts of Italy, Europe, and beyond, due to the circulation and exchange of museum objects in the 19th century.

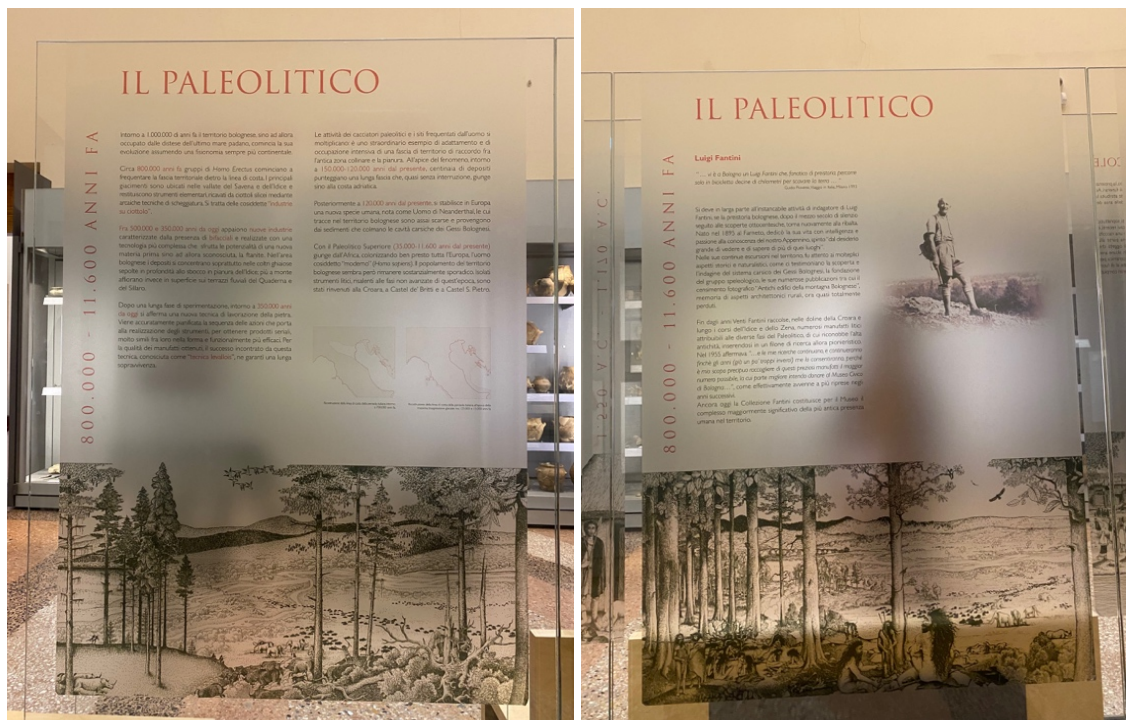


Fig. 11. Panels accompanying Palaeolithic display cases.

The museum's presentation of lithic materials operates within traditional archaeological display paradigms that emphasise typological classification and chronological development. The display methodology for the prehistoric collections reflects earlier display approaches characterised by dense object presentation and limited interactive interpretation, contrasting with the more contemporary presentation techniques employed in other sections of the museum, particularly the Egyptian collections.

Strengths, challenges, and opportunities

The Museo Civico Archeologico di Bologna demonstrates exceptional institutional strengths, particularly through its comprehensive collections that span from prehistoric times through the Roman era with remarkable breadth and depth. The museum's location in the heart of Bologna's historic centre, just steps from Piazza Maggiore, provides exceptional accessibility for both tourists and local visitors. The fifteenth-century Palazzo Galvani creates an atmospheric historical setting that enhances the visitor experience through architectural authenticity. The institution's strong academic partnerships with the University of Bologna and other archaeological institutions ensure continued research development and collection enhancement. The museum incorporates technological enhancements including QR code points, digital information frames, computer-enhanced areas, and a digital model of Roman thermal baths, alongside traditional didactic apparatus and bilingual signage in

Italian and English. The museum actively engages with educational programming through guided tours and workshops for school students.

However, an evident challenge concerns the inconsistent presentation methodology across different collections, with the Egyptian section featuring modern display techniques while other areas, particularly the prehistoric and classical collections, maintain traditional approaches that may appear dated to contemporary visitors accustomed to more “modern” museum experiences. This disparity creates uneven visitor experiences and may limit the museum’s ability to effectively communicate the significance of all its collections. The traditional display density in some sections can overwhelm visitors and impede effective learning, particularly for non-specialist audiences seeking accessible introduction to archaeological materials. Some areas have inadequate lighting and limited interactive elements that could enhance engagement.

The museum faces ongoing challenges related to space limitations within the historic Palazzo Galvani, which constrains exhibition development and may prevent optimal presentation of the extensive collections. The building’s historic character, while providing atmospheric authenticity, also creates practical limitations for implementing contemporary museum technologies and visitor circulation systems. The prehistoric collections suffer from chronological gaps that limit interpretive potential and create incomplete narratives. Notwithstanding, the museum’s comprehensive collections provide opportunities for developing innovative interpretive programming. The prehistoric collections, despite their limitations, provide opportunities for developing comparative regional studies and collaborative research projects that could address chronological gaps through new archaeological investigations and inter-institutional partnerships. The museum’s central location and established visitor base create opportunities for expanded educational programming that could serve both formal school curricula and informal learning audiences, particularly through enhanced family programming and specialised workshops that exploit the diverse cultural collections.

v. Museo Nazionale del Paleolitico di Isernia (IS)

The National Museum of the Palaeolithic in Isernia functions as a specialised national archaeological museum dedicated to Palaeolithic research, formally inaugurated in 1999, though planning commenced in the 1980s following the discovery of the site which inspired its establishment. The site of *Isernia La Pineta*, one of the most significant open-air archaeological sites in Europe, dated to approximately 600,000–700,000 years ago, was identified by researcher Alberto Solinas, after its accidentally discovery during construction roadworks for the Naples-Vasto superhighway. The exceptional importance and age of this Lower Palaeolithic site, considered one of the foremost prehistoric archaeological sites in the region, immediately inspired the idea of creating a museum complex on site. The museum complex, comprising the Excavation Pavilion and the museum building itself, was conceived as both an exhibition space and a research facility.

The Excavation Pavilion was inaugurated in 1999, musealising the site while allowing for systematic archaeological research to continue. In the museum, the hall dedicated to the site opened to the public in 2012, followed by the large central hall in 2014, which features other prehistoric evidence from the region of Molise. The most recent museum setup was inaugurated in 2023, re-emphasising the centrality of the Isernia La Pineta site while also referencing other Molise prehistoric testimonies. The museum operates under state ownership through the regional directorate structure of the Ministry of Culture, combining site museum functions with broader regional archaeological responsibilities for Molise's Palaeolithic heritage. The museum maintains professional staffing including archaeologists with Palaeolithic specialisation, operates regular hours with seasonal variation, provides educational programming including guided site visits, and most importantly, sustains active research collaborations (including excavations) with the University of Ferrara as well as other national and foreign institutions.

The current exhibition

The museum's curatorial identity is directly linked to its scientific mission. The current exhibit offers an immersive experience that integrates traditional archaeological displays with scenic elements. Connected to the Pavilion via an extended portico, the museum building comprises four interconnected galleries. The institution deliberately eschews prescriptive visitor itineraries, instead promoting personalised exploration that allows

individuals to forge their own connections with the museum. Upon entry, visitors encounter a sort of viewing point or belvedere, offering panoramic views of the life-sized megafauna reconstructions positioned on the floor below (Fig. 12), reportedly aimed to create an immediate sense of anticipation and temporal displacement.



Fig. 12. View from the Belvedere.

The *Evoluzione fisica e culturale di Homo* (Evolution Gallery) then begins with a comprehensive timeline of human evolution featuring a series of skull reproductions of various hominins. This foundational display establishes the broader evolutionary context within which the Isernia La Pineta discoveries must be understood. Progressing along a gently descending ramp, visitors encounter large-format panels presenting scientifically accurate pictorial reconstructions that present some of the pivotal developments in human evolution and prehistory. These displays trace the complex narrative of adaptation in changing environments in Africa, hominin dispersals and the successive occupation of Europe and Asia, and the emergence of societies evidenced through archaeological remains. The gallery's design philosophy recognises that human evolution represents not merely biological change but a complex interplay of anatomical, cognitive, technological, and social developments. By presenting this narrative through visual media, the exhibition prepares visitors to appreciate the specific achievements represented at Isernia La Pineta. This introductory sequence culminates in a transition zone where visitors can observe the relationship between evolutionary developments and specific archaeological manifestations, prefacing the evidence from Isernia La Pineta itself. The gallery thus functions as

background information but also as an essential interpretive lens through which the subsequent archaeological displays gain their full significance and meaning.

A central focus of the exhibition is the *Archeosuperficie di Isernia La Pineta* (Isernia La Pineta Room) which displays a substantial portion (approximately 65 square meters) of the most well-known and artefact-rich archaeological surface of the site, referred to as stratigraphic unit 3 *collina* (**Fig. 13**). Nearly 6,000 original artefacts are displayed in their exact discovery positions, resting on a plaster support that faithfully reproduces the palaeosurface. Display cases highlight specific human activities at the site, such as the earliest evidence of bear skinning in Italy, subsistence strategies including the butchery of bison and rhinoceros and fracturing of their bones for marrow extraction, and the production and use of small flint flakes. A multimedia station allows visitors to explore the archaeological surface and its artefacts in detail, as well as content featuring the archaeologists that contributed to the studies in the site.



Fig. 13. Isernia La Pineta archaeosurface.

Adjacent to the archaeological surface is the installation *Uomini, Attività, Ambienti e Animali di Isernia La Pineta* (Humans, Activities, Environments and Animals of Isernia La Pineta), which presents the earliest direct evidence of hominin presence in Italy and amongst the oldest in Europe. This installation centres on a deciduous hominin tooth recovered in 2014, attributed to a juvenile *Homo heidelbergensis* individual estimated at 5-6 years of age and dated to approximately 586,000 years ago. The tooth is housed within a touch-sensitive

display case that enables visitor interaction with its three-dimensional digital scan. Immediately posterior to this case, a life-size reconstruction combines palaeoartistic rendering of the juvenile's complete physiognomy with a paleoenvironmental depiction of the Isernia landscape during the Middle Pleistocene occupation. The scene portrays the child engaged in play, an interpretive choice evidently designed to foster emotional engagement with the specimen. The central hall, moreover, features life-sized reconstructions of major animal species found at the site, including a bear, a bison, a megacero, a rhinoceros, and an ancient elephant, whose sizes and features align with fossil data. These models are placed on display platforms with cases containing scientifically relevant artefacts, such as an ancient elephant tusk (*Elephas antiquus*) and a complete megacero antler. The section on the *Preistoria in Molise* (Prehistory in Molise) presents archaeological materials from other prehistoric sites across the region, covering a chronological span from the Lower Palaeolithic to the Upper Palaeolithic, Neolithic, and Bronze Age.

The lithic collection

Display cases adjacent to the archaeological surface contain selected lithic specimens highlighting specific technological attributes. Sharp-edged flint flakes demonstrate functional characteristics suitable for cutting activities. Limestone hammerstones and anvils illustrate percussion tool categories. Explanatory panels provide technical descriptions of reduction sequences, raw material procurement patterns, and use-wear evidence.

The regional prehistory gallery organises lithic materials according to technological traditions across chronological periods. Display cases present authentic artefacts alongside experimental replicas, positioned against illustrated chaînes opératoires. Written panels provide technical specifications, chronological contexts, and site provenance data. The Lower Palaeolithic is represented by Acheulean handaxe shaping and early Levallois, with Guado San Nicola as a site example. Middle Palaeolithic technology focuses on Levallois debitage from the Mousterian site of Grotta Reali. The display case contains the reduction sequence from prepared cores showing centripetal scar patterns and platform faceting, illustrated through a three-stage reduction diagram. Experimental replicas demonstrate the morphology and dimensions of flake products. Panels present technical terminology including preferential and recurrent Levallois methods. Upper Palaeolithic materials emphasise blade technology as evidenced by surface collections from different sites in the region. Display arrangements focus on diagrams illustrating core preparation and actual blade production.



Fig. 14. Lower Palaeolithic Acheulean Levallois artefacts from Guado San Nicola

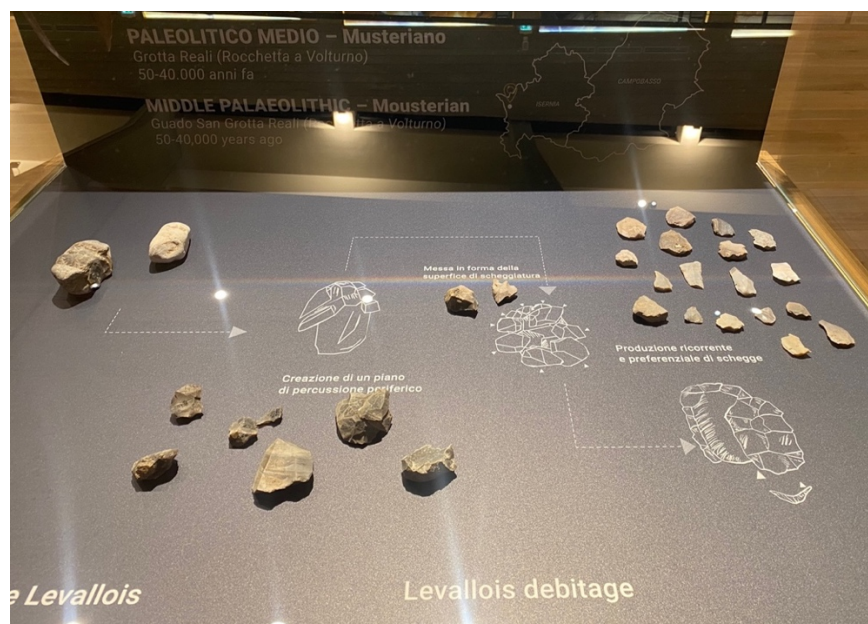


Fig. 15. Display case for Middle Palaeolithic featuring the Levallois debitage.



Fig. 16. Middle Palaeolithic laminar debitage artefacts from Grotta Reali.

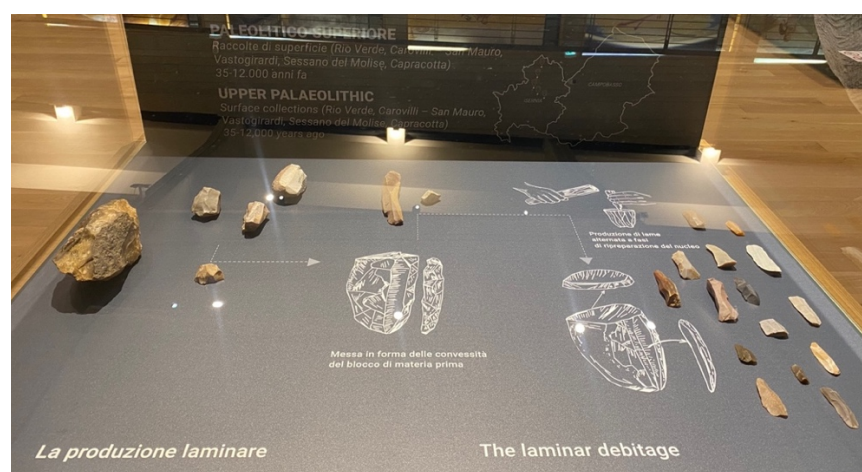


Fig. 17. Upper Palaeolithic laminar debitage artefacts from different surface collections in Molise.

This presentation system employs chaîne opératoire illustrations as interpretive frameworks that contextualise stone artefacts alongside written panels supplying quantitative data, technical terminology, and procedural descriptions. The spatial organisation progresses hierarchically from site-specific (Isernia La Pineta) materials to regional technological traditions, with display cases maintaining consistent lighting and positioning standards to facilitate comparison across categories. Panel texts employ standardised terminology derived from lithic analysis protocols.

Strengths, challenges, opportunities

The Museo Nazionale del Paleolitico represents a specialised model within Italy's museum and cultural heritage landscape that combine rigorous scientific research with innovative public engagement strategies. The museum operates within the centralised structure of the Italian Ministry of Culture and functions under the Regional Directorate of Museums-Molise; notwithstanding, it maintains significant autonomy in curatorial matters.

Complementing this institutional structure, the museum maintains active research partnerships with archaeologists from the University of Ferrara, whose field investigations and laboratory analyses directly inform curatorial methodologies, data interpretation, and evidence-based exhibition content. The 2023 exhibition redesign further demonstrates the institution's commitment to improved public engagement.

The presence of the musealised paleosurface in the museum co-located with the Excavation Pavilion directly upon the archaeological site constitutes a rare museological opportunity. While most archaeological collections are necessarily divorced from their stratigraphic contexts, the unique circumstance at Isernia enables the direct observation of artefacts within their original context and therefore establishes tangible connections between the museum collections and their original archaeological context, an interpretive asset that few institutions can replicate.

These institutional strengths have been further reinforced through Italy's National Recovery and Resilience Plan (PNRR), which has provided essential resources for upgrades in energy efficiency, universal accessibility, and digitalisation in the museum. Efforts to improve immersive experiences that complement traditional display methods, as well as the comprehensive digitalisation of storage collections, are ongoing. Digital innovation offers particularly promising prospects for transformative development: virtual palaeoenvironment reconstructions and comprehensive collection digitalisation not only enhance visitor engagement but also expand research capabilities. The institution's aspiration is to create balanced visitor experiences that combine intellectual stimulation with emotional engagement.

Despite these considerable strengths, the museum faces institutional challenges that constrain its operational flexibility and growth potential. The museum functions as part of a regional network that fundamentally limits independent decision-making authority for strategic initiatives and resource allocation. This administrative framework can substantially impede rapid responses to emerging opportunities and constrains the museum's ability to pursue innovative projects that might require flexibility in resource deployment. Moreover, the hybrid staffing model, which combines Ministry-funded positions with externally contracted roles, reflects these resource limitations while potentially creating coordination challenges that affect operational efficiency.

The museum's market positioning presents additional strategic challenges. Unlike major tourist destinations that benefit from established visitor circuits and comprehensive marketing infrastructure, the museum operates outside mainstream tourism networks, relying primarily on grassroots community engagement and word-of-mouth communication for visitor recruitment. The acknowledged deficit in visual marketing resources particularly limits the institution's ability to reach potential audiences beyond its immediate geographic region.

However, these challenges simultaneously present strategic opportunities for innovative institutional development. The museum's position outside mass tourism circuits also enables preservation of its authentic character while pursuing selective growth strategies aligned with its educational mission. Looking towards future steps, the museum's strategic vision for regional network development represents a thoughtful response to contemporary heritage management challenges. Future development plans include establishing a distributed territorial network linking the museum with other regional archaeological sites, creating a comprehensive approach to Palaeolithic heritage interpretation and preservation. This coordinated programming can further offer innovative alternatives to public engagement, especially educational missions. The network concept offers additional benefits by supporting local communities through integrated cultural tourism strategies that distribute economic benefits across the region while preserving the authentic character of individual sites.

vi. Museo e Istituto Fiorentino di Preistoria “Paolo Graziosi”, Firenze (FI)

The Florentine Museum of Prehistory was established in 1946 by the Florentine anthropologist and palaeontologist Paolo Graziosi, along with his colleague Gaetano Pieraccini, with the purpose of preserving and enhancing prehistoric collections from various sources existing in Florence. The institution emerged in the immediate post-war period as part of broader efforts to reconstruct Italian cultural infrastructure and consolidate dispersed archaeological materials under unified institutional frameworks.

The museum is housed in the former Oblate Sisters convent and occupies the building's first floor with galleries, research laboratories, specialised library, and archives. Initially restricted to specialist access, the museum opened to the general public in 1975, with subsequent renovations in 1998 creating enhanced exhibition areas and accessibility features. The institution operates within broader Tuscan museum networks. It is included among the Museums of Excellence in the Region of Tuscany and maintains collaborations with prestigious national and international museums and academic institutions. The museum's collections encompass materials derived from research conducted by Paolo Graziosi and other scholars in Italy and internationally.

The current exhibition

The exhibition follows chronological organisation through the museum's three spaces, beginning with an introductory hall providing educational summary of human physical and cultural evolution, followed by two main exhibition areas dedicated to Italian prehistoric artefacts, and then African materials. The first and largest exhibition area contains materials from Italy's important prehistoric sites, spanning from the Lower Palaeolithic through the Bronze Age. This section includes a specific itinerary dedicated to prehistoric art, featuring both original pieces and replicas of cave paintings and engravings. The display encompasses stone and bone tools, ceramic pieces, copper and bronze weapons, and artistic creations, accompanied by associated human groups, animal remains, and plant materials. The second exhibition sector focuses on African prehistory, housing Italy's most extensive collection of African prehistoric materials. This section reflects Graziosi's significant research contributions in African archaeology and prehistoric art studies.

The exhibition methodology emphasises chronological presentation while highlighting particular themes in detail, with specific attention to artistic events and burial practices. The museum features copies and casts of rock carvings and paintings alongside original works, providing comprehensive documentation of prehistoric artistic expression. Notable displays include materials from the Grotta del Romito burials in Calabria, featuring double interments that DNA analysis has revealed to represent close familial relationships.



Fig. 18. Introductory section of the museum with colour-coded display cases: Lower and Middle Palaeolithic with early hominin species and their tools (blue); Upper Palaeolithic with *Homo sapiens* and corresponding tools and ornaments (green).

The lithic collection

The lithic component of the museum's collections spans from Archaic Palaeolithic through Bronze Age periods. Materials derive from excavations and research conducted across multiple continents, providing comparative technological datasets from diverse geographical and cultural contexts. The collection includes both original artefacts and study materials, with the majority of lithic specimens housed in museum repositories and made available for specialist research and university education purposes. The Palaeolithic lithic assemblages include materials from Italian sites (e.g., Valdarno, Ventimiglia, Bibbona), as well as comparative assemblages from other European, African, and Asian contexts that reflect Graziosi's international research activities. The museum's display strategy emphasises typological classification within chronological sequences. Display cases and labelling systems reflect earlier museographic approaches that prioritise systematic classification. The emphasis is on chronological organisation raw material variability and regional

technological traditions but there is a limited thematic exploration of technological processes.



Fig. 19. Main exhibition area presenting chronological and colour-coded display cases.

The display cases demonstrate classic museum presentation approaches that reflect both the potential and limitations inherent in communicating stone tool technology to public audiences. The systematic organisation visible in both cases follows traditional typological frameworks. This chronological and technological distinction provides visitors with an overview and visual contrast of tool type diversity and chronological development. Ultimately, these cases represent competent execution of traditional museum practice that successfully organises and preserves lithic materials while providing systematic visual presentation. Nevertheless, from a technological perspective, they would benefit significantly from more process-oriented interpretation strategies that could convey the sophistication and cultural significance of prehistoric stone tool technologies beyond morphological classification.



Fig. 20. Examples of display cases representing Middle Palaeolithic (blue) and Upper Palaeolithic (green) stone tools from different Italian sites.

Strengths, challenges, and opportunities

The Museo Graziosi demonstrates institutional strengths rooted in its distinguished research heritage and comprehensive collection scope. Its dual function as museum and research institute creates unique opportunities for integrating scholarly investigation with public education. The research facilities and archive holdings provide foundations for expanded academic programming including conferences, workshops, and research collaborations. The museum's accessibility commitments and educational infrastructure provide foundations for developing enhanced family programming and school group activities. The specialised library and research collections offer opportunities for developing digital access and online educational resources (that they have already started) that extends the museum's impact beyond physical visitors. The museum's mediation efforts demonstrate commitment to diverse audiences through guided services, workshops, and accessibility provisions for visitors with disabilities. The museum's position within Florence creates potential for developing educational tourism that complements the city's Renaissance heritage with prehistoric perspectives on human cultural development.

However, several challenges constrain the museum's impact and accessibility. The presentation style reflects traditional museographic approaches that may appear dated to contemporary visitors accustomed to interactive and immersive museum experiences. The traditional case-based displays restrict engagement with materials and the emphasis on chronological organisation and material diversity may not satisfy visitors seeking thematic exploration of prehistoric lifeways, technological processes, or cultural relationships. Interactive elements and multimedia displays that might enhance engagement with complex prehistoric content are limited. The traditional display methodology, while maintaining scholarly authority, may not effectively communicate prehistoric significance to visitors without archaeological backgrounds. Limited English translation resources create barriers for international visitors. The museum's location in proximity to Florence's main tourist circuits adds to its accessibility and promotion.

These challenges represent opportunities for institutional development and enhanced public engagement. The museum's research orientation and comprehensive collections provide foundations for developing innovative educational programming that could establish new standards for prehistoric museum interpretation.

vii. Museo Civico di Storia Naturale e Archeologia di Montebelluna (TV)

The Montebelluna Civic Museum is a hybrid municipal museum combining natural history and archaeological collections, reflecting a territorial approach wherein local heritage comprises both environmental and cultural dimensions. Founded in 1984 as part of later 20th-century civic initiatives to preserve regional heritage, the museum serves the Montebelluna territory in Veneto. Collections span geological specimens, palaeontological materials, and archaeological artefacts documenting regional prehistory through historical periods. The museum maintains established collaborative relationships with the SABAP for Veneto-Metropolitan Area and regional university departments conducting archaeological research in the territory, enabling integration of contemporary research with institutional programming.

The current exhibition

The permanent archaeological section occupies substantial exhibition space devoted to a reconstruction of chronological sequences through prehistoric, protohistoric, and Roman archaeological materials recovered from Montebelluna and surrounding territories. The exhibition opens with a display presenting human evolutionary narratives through hominin cranial casts alongside associated lithic implements and global dispersal mapping. The territorial prehistoric section documents occupation from the Palaeolithic through Bronze Age periods across regional sites. An aerial photograph maps archaeological sites throughout the territory (Cornuda-Case Castagna, Valle San Lorenzo, Capo di Monte, Montello localities, Caerano-Le Rive), colour-coded by period. Interpretive text explains that the area's strategic position at the confluence of the Piave Valley plains facilitated intensive prehistoric occupation, evidenced by surface collections and from the 1970s and more recent excavations that expanded knowledge on local archaeology. The Middle Palaeolithic, Upper Palaeolithic, and the Mesolithic are represented mostly by flint tools. Neolithic and Bronze Age materials include ceramics and lithics from Valle S. Lorenzo, Capo di Monte, and Montello sites, with notable holdings including Copper Age axes and Bronze Age metal implements documenting regional occupation spanning the 4th through 2nd millennia BCE. Faunal remains were also presented, mainly in the context of hunting and domestication, and their implications on site activities and the mobility of prehistoric people.

Protohistoric galleries present Iron Age Venetic culture, emphasising the settlement's strategic position connecting Veneto plains with Alpine regions. Materials document funerary practices through tomb reconstructions from Posmon-Via Cima Mandria necropolis. The exhibition highlights decorated *situlae* representing *situla* art—embossed and chased bronze work depicting scenes and motifs characteristic of Venetian artistic traditions. Excavations at Posmon “Le Rive” recovered approximately 300 burials spanning the 7th to 4th centuries BCE, demonstrating necropolis continuity across successive periods. Roman galleries feature the marble Diana/Artemis statue from Montello (late 1st century BCE-early 1st century CE), executed in Greek marble and representing the deity's complex associations with nature, hunting, and lunar divinity. Additional materials document progressive Romanisation processes from the 2nd century BCE.

Lithic collection

The lithic assemblage comprises materials from multiple territorial sites displayed to emphasise typological/technological diversity and chronological development. Stone artefacts from various localities include cores (*nuclei*) and finished implements (e.g., *raschiatoi*, *grattatoi*, *punte*, *bulini*, *microbulini*, *trapezi*, *lame*, *lamelle*). Display arrangement positions cores alongside débitage products that are mostly in the form of finished tools, with graphic reconstructions of incomplete pieces. Labels identify raw materials (flint varieties from specific geological sources) and some technical characteristics related to the knapping method (e.g., *Levallois*, *discoide*, *laminare*).



Fig. 21. Palaeolithic display case, detail.

While the collection is not particularly extensive, its presentation and the integration of technological diagrams with archaeological specimens and explanatory panels do not inspire impressions of insufficiency.



Fig. 22. Displays showing ntegration of illustrations on lithic technology.

The museum has also implemented digital enhancement through QR codes linking to 3D virtual museum models of selected artefacts, enabling detailed digital examination beyond physical display constraints. This integration of digital technologies demonstrates promotion of expanded access but while maintaining primacy of material objects.



Fig. 23. Display case featuring QR codes options.

Strengths, challenges, opportunities

The museum's principal strength lies in its innovative commitment to contemporary museum practice through the *Agenda Sapiens 2030* museum-laboratory space initiative. This

dedicated physical space within the museum, organised according to UN Sustainable Development Goals, provides incorporated capacity for community contributions and participatory programming. The initiative positions the museum as dynamic participatory institution rather than static repository, creating opportunities for enhanced public engagement, education, collaborative research, and community dialogue around heritage interpretation and contemporary sustainability challenges. This approach demonstrates how medium-scale institutions can develop distinctive programming that larger museums may find difficult to implement given bureaucratic constraints and established operational frameworks.



Fig. 24. Exhibition space "Agenda Sapiens 2030"

However, the institution faces constraints characteristic of municipal museums. Limited operating hours and modest staffing potentially restrict visitor access and programming capacity, while dependence on municipal funding constrains resources available for major infrastructure improvements or collection development. The museum's regional focus, though fundamental to institutional identity and community relevance, may limit capacity to attract broader national and international audiences beyond dedicated archaeological tourists. The emphasis on finished implements within lithic displays, while appropriate to territorial heritage mandates and archaeological recovery patterns, constrains opportunities for detailed technological interpretation that might appeal to specialist visitors or support advanced educational programming addressing production processes and material technology.

Nevertheless, the museum's positioning within Veneto's rich cultural landscape and established collaborative networks present significant opportunities for enhanced programming and expanded interpretive initiatives. The innovative museum-laboratory model provides foundations for developing additional participatory frameworks addressing contemporary challenges through archaeological and environmental heritage perspectives. The hybrid natural history-archaeological framework enables unique programming connecting deep-time human-environment relationships with current sustainability concerns, potentially developing distinctive approaches to heritage interpretation addressing Anthropocene challenges. Partnerships with regional universities could enhance research capacity and provide human resources for collection development.

viii. Museo della Preistoria “Luigi Donini”, San Lazzaro di Savena (BO)

The “Luigi Donini” Museum of Prehistory is a dedicated prehistoric museum that offers a comprehensive exploration of human evolution and prehistory in the Emilia-Romagna region of northern Italy, and more specifically to the territory around Bologna, including the eastern Apennine foothills and Po Valley basin near San Lazzaro di Savena. It is situated within the Regional Park of Bolognese Gypsum, an area characterised by unique geological and natural features, including powerful gypsum chains, karst morphologies, and significant prehistoric deposits that have long attracted natural scientists. Investigations conducted in the 1860s by Giovanni Capellini and colleagues laid the groundwork for prehistoric archaeology research in the area, which was systematically expanded through decades of fieldwork by Luigi Fantini starting in 1924, during which he built an extensive collection of Palaeolithic and Eneolithic materials from sites across Bologna. Fantini’s collections were dispersed among multiple institutions: the Municipal Archaeological Museum of Bologna, the University of Bologna’s Anthropology Museum, and an embryonic antiquarium at Croara that became the Donini Museum’s first nucleus. The museum was formally established in 1970 in the 16th-century quadriportico of S. Cecilia della Croara Abbey and was dedicated to preserving the memory of Luigi Donini (1942–1966), a local naturalist and speleologist who died while attempting to rescue fellow speleologists trapped in a cave. It continued to integrate modern research, particularly from the University of Ferrara and the University of Bologna, into its scientific and patrimonial endowment. In 1985, the Municipality of San Lazzaro di Savena took over the museum’s management and relocated it to the town centre, where it received a new arrangement for the custody and display of artefacts, and underwent complete renovation to reopen in 2003 as an innovative institution featuring three main exhibition sections combining original prehistoric artefacts with life-sized 3D reconstructions and employing modern communication strategies rare in Italian museography. Adjacent to the museum, the PrestoPark opened in 2008, an outdoor educational theme park path focusing on the great extinct fauna that inhabited the Apennines during the Last Glacial period, such as the woolly mammoth, woolly rhinoceros, cave lion, cave bear, and hyena. The park hosts guided tours, workshops, and events related to prehistory, and complements the museum’s indoor exhibits.

The lithic collection of Museo Donini represents one of its most significant scientific and didactic assets. Many of these tools are not from formal archaeological excavations and instead were largely acquired through donations, surface finds, and private collections, especially during the 20th century when systematic excavation methods were less consistently applied. Notwithstanding, some materials may be associated with known local contexts, particularly from the Bolognese Apennines and Emilian plains, but the provenance and stratigraphic data are often limited. The museum focuses on public education and exhibition of regional prehistory rather than on presenting material exclusively from scientifically excavated contexts. These materials are used not only to showcase the technological evolution of prehistoric peoples, but also to reconstruct daily life, mobility patterns, and environmental adaptations across different prehistoric periods.

The current exhibition

The Donini Museum's exhibition system comprises three large sections organised chronologically and dedicated to the development of prehistory and protohistory. Recently a fourth section dedicated to the Romanization of the eastern Bolognese territory was opened.

The recommended itinerary begins with *Ambienti Scomparsi* (Extinct Environments), which presents the naturalistic context of the territory. This section includes geological and paleontological collections, along with life-sized skeletal reconstructions and models of animals from the last glaciation, discovered in deposits from the Gessi area. Key features include the reconstruction of a steppe-grassland environment populated by life-sized models of extinct megafauna, such as steppe bison, *Megaloceros*, and wolverine, as well as hyenas, small mammals, and birds in a naturalistic setting, and a cave bear displayed within a replica of a Bolognese Gypsum karst cave. In this section are also large display cases containing fossil collections of fish, molluscs, and plants, meant to illustrate ancient geological environments of the Apennines.



Fig. 25. Exhibit featuring life-sized reconstructions of extinct megafauna.

The second section, *Primi Uomini* (Early Humans), is on human origins, evolution, and prehistory, and is subdivided into: 1) Africa and early human ancestors, 2) the long Palaeolithic, and 3) Neolithic and Metal Age. The first subsection features upon entrance *La Galleria degli Antenati* (The Ancestors' Gallery), a large-scale reconstruction introducing visitors to the broader concept of human evolution by presenting life-sized representations of early hominins "in action." The various hominins were reconstructed as scientifically accurate as possible based on palaeoanthropological data from fossil records, and the figures are positioned to demonstrate behaviours inferred from archaeological evidence. The exhibit illustrates key evolutionary developments, such as bipedalism, dietary adaptation, and tool use, through the juxtaposition of the different hominin species. The extensive portion on the Palaeolithic, furthermore, features displays from the earliest stone tool technologies to the more recent cultures of the Upper Palaeolithic. The exhibition traces the development of stone tool industries and hunting strategies, the spread of early humans across continents, and the emergence of complex behaviours including art, burial practices, and symbolic expression. The final subsection documents the *revolutionary* transition from hunter-gatherer societies to agricultural communities during the Neolithic period, followed by the subsequent Bronze and Iron Ages. This part of the exhibition explores the development of farming, animal domestication, permanent settlements, pottery production, and the eventual mastery of metallurgy.

The third section, *Civiltà del Ferro* (Iron Age Civilisation), centers on the figure of the archaeologist Giovanni Gozzadini and his discovery of the Villanovian necropolis at Caselle di San Lazzaro. It includes archaeological collections showing traces of Villanovian civilisation, which was one of the most important Iron Age cultures in central Italy. The narrative unfolds through the display of grave goods from cremation tombs uncovered during excavations promoted by the Archaeological Superintendency. The section is introduced by the reconstruction of an oval-plan hut with a four-pitched roof supported by wooden beams, inside which are placed a hearth and various implements, providing visitors with a tangible sense of Iron Age domestic life, and is completed by burial evidence located near the valley outlet of the Idice River. The most recently opened section dedicated to Roman San Lazzaro features artefacts recovered from the Pozzo di Via Caselle and reconstructions of Roman structures and settlements.

The (long) Palaeolithic in focus, and the lithic collection

The subsection on the long Palaeolithic presents an extensive assemblage of mostly lithic artefacts, systematically arranged in display cases that circumscribe a central interpretive space. The display cases in the beginning of the exhibition incorporate detailed topographic models that situate archaeological sites within their broader landscape contexts. These three-dimensional terrain models represent specific site locations, in this case also comparing alluvial fan deposits and terraced deposits, in order to communicate site formation processes, spatial relationships, and how specific environments influence Paleolithic settlement patterns and preservation. Lithic artefacts recovered from alluvial deposit contexts, often embedded within or adjacent to the conoid gravels of ancient streams, have been classified under early technological traditions, specifically the Clactonian and proto-Levallois based on their morphological characteristics. The artefacts often show signs of water wear (fluvial transport), indicating they were carried by streams before burial. Many are flakes and retouched pieces, bearing signs of deliberate knapping. Stone tools found in terraced deposits located within valley interiors are similar in appearance. In these deposits, fluvial transport heavily impact the preservation of lithic materials, but the moderate concentration of finds still points to areas of stone knapping.



Fig. 26. Stone tools and reconstruction of different depositional contexts and stratigraphy. a) Diorama reconstruction of Safra quarry and Podere Palazzina; b) reconstruction of the Podere Peverella stratigraphy, showing stone tools associated to stratigraphic

Others still, in a more incorporate three-dimensional reconstructions of excavation site contexts and archaeological stratigraphy, presenting characteristic layered sedimentary deposits with distinct stratigraphic units visible through colour and texture variations in the sediment matrix. Lithic artefacts are positioned associated to and *in-situ* within the stratigraphic sequence, providing visitors with direct visual evidence of the temporal relationships between different tool assemblages, depositional environments, and occupational phases. These presentation strategies are meant to effectively communicate certain fundamental archaeological principles, such as the concept of superposition, relative chronologies, and the careful documentation of artefact provenience within stratified deposits.

The display cases present a comprehensive typological arrangement of stone artefacts from Sillaro, Quaderna, and Idice valleys. The artefacts illustrate a range of Lower Palaeolithic tool types, including bifacially worked handaxes, unretouched and retouched flake tools, and cores. These were knapped from locally available raw materials and are marked by technological features typical of the late Acheulean and proto-Levallois traditions. Most tools display signs of fluvial wear, such as smoothing and edge rounding, though intentional retouch remain identifiable. The assemblages are considered among the most significant early prehistoric records in the Emilian Apennine valleys, despite the challenges posed by

taphonomic alteration. The Middle Palaeolithic is represented by an increase in Levallois products and reduction of bifacial implements.

At the focal point of this arrangement stands a behavioural reconstruction entitled *Un giorno 200,000 anni fa* (A Day 200,000 Years Ago), designed to synthesise archaeological evidence into a plausible scenario of a typical day in prehistory, specifically featuring Middle Paleolithic subsistence activities and technological practices. This central diorama depicts a hypothetical, but archaeologically informed scene of two Palaeolithic hunters engaged in butchery or carcass-processing activities centered around a large rhinoceros (*Stephanorhinus* sp.). employing a technological repertoire that includes several bifacial tools and elongated wooden spears with fire-hardened points. The reconstruction draws from archaeological evidence recovered at the site of Due Pozzi (Pizzocalvo), where Middle Paleolithic occupations have yielded a lithic assemblage dominated by implements manufactured from locally available phthanite, a fine-grained sedimentary rock with excellent knapping properties. Recovered artefacts from the site include debitage products, retouched tools, and unmodified cobbles representing raw material transport from nearby geological sources. Microscopic analysis of tool edges has confirmed their use in meat cutting activities, supporting the butchery scenario depicted in the reconstruction.

The exhibition employs a wall-mounted display system with multiple tiers and sections, allowing for a comparative view of museum objects mounted against neutral grey backing to enhance visibility and contrast. The arrangement follows established archaeological classification systems, grouping artefacts based on a combined techno-typological and chronological sequence. A few explanatory text panels are integrated throughout the display, providing contextual information for each assemblage, such as provenience, associated dates, and technological attributes, but without taking attention away from the objects on display. The lower section of some display cases incorporates a more three-dimensional presentation approach, with artefacts positioned on stepped platforms that create depth and visual hierarchy. This arrangement allows visitors to observe the tools from multiple angles and better appreciate their three-dimensional morphology. Of particular note is the inclusion of reconstructed topographic context displays featuring the geological environments from which the artefacts were recovered, as well as of diorama reconstructions of prehistoric scenes.



Fig. 27. Mesolithic display case featuring stone tools integrated into the artistic rendering of scientifically accurate illustrations.

Strengths, problems, opportunities

The Museo della Preistoria Luigi Donini presents a compelling case study in regional museum development, demonstrating both notable achievements and ongoing challenges within the contemporary cultural landscape. The institution has established itself as a distinctive presence in the regional scene through its innovative approach to prehistoric interpretation and its deep integration with the surrounding territory of the Bologna Apennines. The museum's primary strength is in its commitment to territorial authenticity, with the majority of archaeological finds displayed being recovered from the immediate surrounding area, creating a coherent narrative that directly connects visitors to their local prehistoric heritage. The institution's use of life-sized scenic reconstructions represents a particularly attractive feature. The museum is also particularly noted for its didactic mission. It operates as a major educational centre, regularly offering workshops, guided tours, and hands-on experiences tailored to school groups, families, and general audiences. Activities such as archaeological field simulations, flint knapping demonstrations, and prehistoric making of fire are part of its pedagogical programming.

However, the museum's compact scale, while creating an intimate visitor experience, restricts opportunities for expansion and comprehensive displays. The institution's complete dependence on municipal funding through the Municipality of San Lazzaro di Savena, while ensuring local commitment, potentially constrains resources available for major technological upgrades, acquisitions, or infrastructure improvements that would enhance long-term sustainability. The museum's regional focus, though fundamental to its identity and success, may also limit its capacity to attract broader national and international audiences. This geographical specificity, combined with the apparent absence of comprehensive digital initiatives or robust online presence, suggests potential gaps in contemporary museum practice, particularly regarding digital accessibility and virtual engagement opportunities that have become increasingly important in the post-pandemic cultural landscape.

Nevertheless, significant opportunities exist for institutional development and enhanced cultural impact. The PreistoPark outdoor extension demonstrates the institution's capacity for innovative presentation methods that could serve as a foundation for further experiential development. The growing public interest in experiential and immersive museum experiences aligns particularly well with the museum's existing reconstruction-based interpretive approach, suggesting potential for further development of interactive and participatory elements. Digital technologies including virtual reality, augmented reality, or interactive digital displays could enhance visitor engagement while addressing contemporary educational expectations without requiring major spatial expansion. Partnership opportunities with regional universities present another avenue for development, particularly through research collaboration and student training programmes. The museum's specialised lithic collections and well-documented local archaeological contexts provide excellent opportunities for academic partnerships in prehistoric archaeology and museum studies programmes, potentially enhancing both research output and institutional profile while providing additional human resources for programme development.

ix. Museo di Archeologia e Paleontologia “Carlo Conti”, Borgosesia (VC)

The Museum of Archaeology and Palaeontology “Carlo Conti” is the municipal archaeological and palaeontological museum serving the Borgosesia territory in Piemonte. Established in 2007, the museum combines natural history materials documenting regional karstic landscapes with archaeological collections spanning Palaeolithic through historical periods. The museum is housed in a modest civic building at the centre of Borgosesia and serves primarily local communities and school groups with occasional dedicated events attracting visitors from elsewhere. As a museum located in close proximity to archaeological sites, the institution promotes both cultural and natural heritage through speleological activities, positioning territorial appreciation within integrated cultural-natural frameworks.

The current exhibition

The exhibition opens with a dedicated section on the geology and palaeontology of Monte Fenera, establishing the environmental context for subsequent human occupation. This introductory component features Pleistocene faunal assemblages recovered from local cave sites, including fossil remains of cave bear, cave lion, lynx, aurochs, and rhinoceros. A reconstructed *Ursus spelaeus* skeleton functions as the principal display element in this section. The paleontological material documents environmental and faunal transformations across the last 300,000 years, though the exhibition does not elaborate on correlations between climatic oscillations and species presence.

The prehistoric section concentrates on Middle and Upper Palaeolithic occupation, foregrounding evidence of Neanderthal presence. The display presents an “evolutionary bush” diagram contextualising hominin phylogeny, though this graphic device sits uneasily alongside the materially sparse archaeological record from the region. The protohistoric component addresses Second Iron Age funerary assemblages from the necropolis at ancient Seso, documenting settlement relocation to the Borgosesia area during this period. This section receives limited exhibition space and interpretive development relative to earlier and later periods. The Roman period section presents the most substantial funerary assemblage in the museum, derived from the extensive necropolis discovered by Carlo Conti in early 20th-century excavations within urban Borgosesia. The terminal section displays finds from Vanzone Castle (11th–16th centuries) and addresses early medieval cave reoccupation, though

this period receives comparatively minimal representation due to limited systematic investigation.



Fig. 28. Exhibition space overview. Photo courtesy Museo Carlo Conti.

Two permanent panel exhibitions supplement the material displays: one documents University of Ferrara research programmes at Ciota Ciara cave, and another addresses the Valsesian fossil supervolcano. These didactic components provide contextual information but remain physically segregated from the archaeological material they elucidate, potentially diminishing their interpretive effectiveness.

The museum's organisational structure thus adheres to conventional culture-historical sequencing, presenting material evidence within established chronological periods rather than developing cross-temporal thematic narratives or engaging with processual or post-processual archaeological frameworks. The exhibition privileges stratigraphic and typochronological data while maintaining limited critical engagement with formation processes, sampling biases, or interpretive ambiguities inherent in the collections. This approach reflects both the historical development of the collections and ongoing research collaborations with the Universities of Ferrara and Geneva, which continue to focus on stratigraphic excavation and material analysis rather than museological reinterpretation.

The lithic collection

The Palaeolithic lithic collection at the Museo Carlo Conti receives minimal exhibition space, comprising a single horizontal display case positioned beneath an interpretive panel

titled “Le Industrie Paleolitiche: una tecnologia sempre più complessa.” Materials derive from surface collections and excavations from the Monte Fenera sites and are clustered based on their collection information. Typologically diagnostic artefacts include retouched tools. The few displayed materials attest to a variety of raw material presence and forms, but not straightforward archaeological contexts. While the exhibit is organised through a chrono-thematic framework, and the text panels provide ample information, there is no clear chronological attribution observable in the lithic display itself, with some pieces with labels as vague as “quartz flake: Middle Palaeolithic-Upper Palaeolithic.”



Fig. 29. Lithic artefacts on display arranged per collection provenance

Strengths, challenges, opportunities

The museum’s distinctive strength lies in its productive community engagement and territorial integration. The institution has earned particular prestige among local tourists and excursionists through active programming including conferences, site visits, and guided tours, creating a recognisable “brand” rooted in holistic territorial appreciation combining archaeological, speleological, and natural heritage dimensions. This integrated approach demonstrates how small museums can achieve significant impact through leveraging outdoor recreational contexts and accessible archaeological sites, offering visitors authentic connections between museum collections and prehistoric landscapes impossible in urban institutions divorced from site contexts. The museum’s commitment to public archaeology initiatives demonstrates how small-scale institutions can develop distinctive programming despite resource constraints. Collaborative relationships with volunteers and archaeological

associations enable programming that modest professional staffing alone could not sustain, while strong community connections create audiences deeply invested in territorial heritage preservation.

However, the institution faces challenges characteristic of small municipal museums operating with limited resources. Restricted opening hours and appointment-based access potentially limit visitor reach. Heavy dependence on volunteer labour creates sustainability concerns regarding long-term operational stability. The compact scale restricts opportunities for comprehensive displays or substantial collection expansion, and limited professional archaeological staffing may constrain development of sophisticated interpretive programming or research initiatives.

x. Museo Civico di Apricena (FG)

The Museo Civico di Apricena operates as a small municipal museum in the province of Foggia, positioned within the historic centre and integrated into the town's civic cultural infrastructure. It was established in 2010 by the municipality in collaboration with local cultural associations and is embedded in the regional heritage network through its inclusion in both national and regional catalogues of cultural institutions. Its governance is municipal, with programming coordinated through local heritage bodies and periodic collaboration with regional authorities.

The institution's mandate is primarily archaeological. It functions as the central repository and interpretive hub for material culture originating from the wider Apricena territory. Its collections span prehistory to the Medieval period. Notable among these is that coming from the Palaeolithic site of Pirro Nord, which represents one of the most important sites for early human occupation in Italy but also in Europe. The museum maintains a dedicated section contextualising these findings, inaugurated in 2017.

Operationally, the museum functions as a civic cultural service, hosting temporary exhibitions, guided visits and educational programmes. It is fully integrated into municipal cultural planning and regional tourism circuits, and its practical information, including visiting arrangements, is disseminated through local administrative and heritage communication channels.

The current exhibition

The permanent collection is structured into four chronological sections. The prehistoric assemblage presents material from the Palaeolithic through the Bronze Age. Subsequent displays cover the Daunian and broader Iron Age horizon, followed by Roman-period artefacts that include epigraphic pieces, numismatic material and a documented sundial. The final section addresses the Medieval occupation phases of the territory. The museum prominently features Medieval history, architectural drawings, miniature models, marble sculptures, and artworks celebrating the region's distinguished marble extraction and processing traditions, reflecting Apricena's identity as "the city of stone and marble."



Fig. 30. Museum panel showing an overview of pre and protohistoric sites in Apricena.



Fig. 31. Archaeological material displays with marble sculptures incorporated in the exhibit space.

The lithic collection

The section dedicated to Pirro Nord is the museum's principal scientific asset. Excavations conducted at the site by the University of Ferrara have produced a stratified record that includes a rich vertebrate assemblage and lithic materials linked to early hominin presence, which were then musealised. The displays present panels explaining the site's geological context, emphasising the karstic dynamics that formed the fissure systems in which the palaeontological deposits accumulated. The curatorial strategy uses a large-scale geographic panel to situate Pirro Nord within broader Early Pleistocene research traditions across Europe and the Mediterranean. By embedding site-specific information in a comparative cartographic frame, the exhibit communicates the relevance of Pirro Nord to continental discussions of faunal dispersal, biogeography and early technological behaviours. The section also incorporates installations designed to familiarise visitors with basic excavation and recording procedures. These elements include reconstructed fieldwork excavation setups arranged to mimic contexts and methods as in the site of Pirro Nord. The lithic display features flint cores and flakes representing Lower Palaeolithic opportunistic debitage technology.



Fig. 32. Exhibit panel showing Pirro Nord in the context of Early Pleistocene sites



Fig. 33. Information panels on fauna, lithic technology, and early hominin dispersals relevant to the site of Pirro Nord

Strengths, challenges, opportunities

The Museo Civico di Apricena currently attracts approximately 500 visitors per year, including participants in its educational workshops. While officially open during regular office hours and for occasional special openings, in practice the museum is often closed and only accessible upon request, with library staff covering museum duties in the absence of dedicated personnel. Despite this, the museum maintains free entry and is accessible to visitors of all ages.

The museum staff recognise the need to systematically catalogue artefacts in storage and to enhance exhibits with digital tools, audiovisual panels, and interactive components, which would significantly improve the presentation and understanding of its collections.

The connection with Pirro Nord provides a notable educational and scientific dimension. Each year, during the excavation campaign, the University of Ferrara team organises public events including seminars, workshops, and hands-on activities such as flint knapping, microscopy, and Palaeolithic art. In recent years, they have also introduced pop-up exhibits at their base camp, set in a local school, to display materials recovered from ongoing

excavations. However, the site itself is not directly accessible to visitors due to its quarry conditions, limiting the potential for an immersive heritage experience.

Overall, the Museo Civico di Apricena demonstrates strengths in accessibility, educational outreach, and its link to active archaeological research. At the same time, it faces great challenges related to staffing, opening hours, site accessibility, and the need for modernisation of its collections and exhibit presentation. Addressing these areas could substantially enhance the museum's role as a centre for public engagement and the valorisation of the municipality's prehistoric heritage, in addition to its Medieval history, and industrial heritage and identity as the "city of stone and marble."

APPENDIX B:

CONTRIBUTORS AND COLLABORATING PROFESSIONALS

This appendix lists all individuals who contributed to the development of this research in different capacities over the course of the PhD. Their involvement reflects the collaborative and interdisciplinary nature of work at the intersection of prehistoric archaeology, anthropology, museology, and heritage practice.

The first group comprises museum professionals who participated in the formal interview phase of the study. Their contributions constitute primary research data and are analysed systematically in the dissertation. Each participant is identified by name, role, and institutional affiliation as recorded at the time of the interview.

Annarosa DI NUCCI

Director of the Museo Nazionale del Paleolitico di Isernia; specialist in prehistory and zooarchaeology with professional experience in archaeological research, museum curation focused on Pleistocene-era collections, and Italian heritage management.

Viviana GILI

Co-director and conservator at the Museo di Archeologia e Paleontologia “Carlo Conti”; trained in art history and heritage conservation, with experience in museum operations, educational programming, and heritage project management.

Emanuela GILLI

Conservator archaeologist and Deputy Director at the Museo Civico di Storia Naturale e Archeologia di Montebelluna; responsible for the archaeological collections and exhibits and has professional expertise in archaeology, museum curation, and heritage interpretation, particularly in the conservation, study, and valorisation of prehistoric and protohistoric collections from the local area.

Fabio MARTINI

Director of the Museo e Istituto Fiorentino di Preistoria “Paolo Graziosi” in Florence; prehistory specialist and archaeologist with expertise in Palaeolithic and Mesolithic archaeology, lithic analysis, prehistoric art, and museum research and interpretation. He is also a professor of Paleolithicology at the University of Florence, conducts archaeological fieldwork in Italy and abroad, and contributes to scientific publications on prehistoric cultures and collections.

Grazia Pia MEDUGNO

Collaborator in the staff office of the Mayor of Apricena (Comune di Apricena), involved in administrative support, including the management and activities of the library and Museo Civico di Apricena.

Gabriele NENZIONI

President of the Museo della Preistoria “Luigi Donini”; archaeologist with expertise in prehistory and early human evolution, involved in archaeological research, collection

development, and museum interpretation of prehistoric materials, especially from the area of Bologna. He has contributed to scientific publications and museum studies on prehistoric archaeology.

Alessandra VOLPE

Art historian working with SAP – Società Archeologica at the Museo Archeologico Nazionale di Verona, responsible for educational programming and public engagement, with expertise in archaeology, art history, and museum mediation.

The second group comprises professionals, colleagues, and specialists who contributed to the broader research environment through sustained engagement. Their perspectives informed the conceptual, disciplinary, and practical dimensions of the project through ongoing exchanges, collaborative work, and professional dialogue. Their insights helped refine the research questions, contextualise institutional dynamics, and deepen the interpretive framework within which the study was conducted. Their inclusion recognises the wider intellectual and professional community that shaped the conditions in which the research was carried out.

Marta ARZARELLO

Professor of Prehistory at the University of Ferrara; specialist in Lower Palaeolithic archaeology and lithic technology; directs major excavations, and actively involved in the curation, interpretation, and valorisation of prehistoric collections in museums in Italy and internationally.

Gerard BATALLA

Researcher and archaeological technician at the Musée de Préhistoire de Tautavel – Centre Européen de Recherches Préhistoriques (EPCC); affiliated with UMR 7194 HNHP (Histoire naturelle de l’Homme préhistorique), Muséum national d’Histoire naturelle/CNRS; specialist in Lower Palaeolithic lithic industries and early human behaviour, contributing to research on the Caune de l’Arago and other Eurasian Palaeolithic assemblages.

Adèle CHEVALIER

Researcher at the Muséum national d’Histoire naturelle (Paris); specialist in the history and museology of prehistoric archaeology and ethnographic collections, with research on the constitution, interpretation, and connections between prehistory and collections in European and Asian contexts.

Catherine CRETIN

Chief Heritage Curator (conservatrice en chef du Patrimoine) at the Musée National de Préhistoire (Les Eyzies, France), responsible for the Upper Palaeolithic collections; specialist in Palaeolithic archaeology and rock art studies; affiliated with UMR 5199 PACEA (De la Préhistoire à l’Actuel : Culture, Environnement et Anthropologie), CNRS/Université

de Bordeaux/Ministère de la Culture, and participates in scientific research tied to prehistoric archaeology and museum collections.

Zoé GASCONS

Scientific and cultural mediator and Accessibility Coordinator at the Musée de l'Homme, Muséum national d'Histoire naturelle (Paris); trained in museology at the École du Louvre with a thesis on the presentation of prehistoric tools in museums; specialist in museum mediation, outreach, and the valorisation of prehistoric collections.

Chimène HONNORAT

Scientific mediator at the Musée de Préhistoire des Gorges du Verdon (Quinson); involved in museum mediation, educational programming, and public interpretation of prehistoric archaeological collections (e.g., workshops, outreach programs).

Gianluigi MANGIAPANE

Professor of Anthropology and staff member at the Museo di Antropologia e Etnologia, Sistema Museale Ateneo, University of Turin; specialist in biological anthropology, anthropological and ethnographic collections, art brut and outsider art, and museum studies, with extensive experience in research, collection management, and heritage interpretation.

Clément MÉNARD

Director of the Musée de Préhistoire de Tautavel – Centre Européen de Recherches Préhistoriques (EPCC); affiliated with UMR 5608 TRACES (Travaux et Recherches Archéologiques sur les Cultures, les Espaces et les Sociétés), CNRS/Université Toulouse Jean Jaurès; specialist in prehistoric archaeology with research focus on lithic technologies, cultural change, and Pleistocene archaeological contexts.

George NASH

Professor at the Centro de Geociências da Universidade de Coimbra and at the Instituto Politécnico de Tomar (IPT), Portugal; affiliated researcher with the Instituto Terra e Memória (Earth and Memory Institute); specialist in Palaeolithic rock art, with extensive international research and publication record on prehistoric art, archaeology, and heritage interpretation. At the time of the consultation, he also held a professorial affiliation with the University of Liverpool, Department of Archaeology, Classics & Egyptology.

Ronald NESPOULET

Scientific coordinator for the prehistoric collections at the Musée de l'Homme and Professor at the Muséum national d'Histoire naturelle; affiliated with UMR 7194 HNHP (Histoire naturelle de l'Homme préhistorique), MNHN/CNRS; specialist in prehistoric archaeology, lithic industries and human evolution, and museum collections management.

Luiz OOSTERBEEK

Professor at the Instituto Politécnico de Tomar (Portugal) and UNESCO Chairholder in Humanities and Cultural Integrated Landscape Management; Director of the Museu de Arte Pré-Histórica e do Sagrado no Vale do Tejo (Museum of Prehistoric and Sacred Art in the

Tagus Valley in Mação (Portugal); specialist in prehistoric archaeology, rock art, heritage and landscape management, with ongoing international research and heritage projects.

Carlo PERETTO

Professor of Prehistory at the University of Ferrara; specialist in Lower Palaeolithic archaeology and human evolution; directed multiple archaeological excavations in Italy, contributing to the study, interpretation, and musealisation of early prehistoric collections and sites, notably Isernia La Pineta (Molise).

Benedetto SALA

Professor of Prehistory and Quaternary Palaeontology at the University of Ferrara, specialist in Pleistocene faunal assemblages and human–environment interactions, with major contributions to the study, interpretation, and scientific valorisation of Pleistocene faunal and archaeological collections in Italian museums and research institutions.

François SÉMAH

Professor at the Muséum national d'Histoire naturelle (Paris); specialist in human evolution and Pleistocene archaeology in Eurasia and Southeast Asia; leads major international research and heritage projects in France and Indonesia, with involvement in UNESCO-related scientific and advisory activities, contributing to the valorisation of prehistoric sites.

Zoltán SOMHEGYI

Professor of Art History at Károli Gáspár University of the Reformed Church in Hungary; specialist in aesthetics, art history, museum history, and heritage studies, with publications on aesthetic theory, cultural heritage, and museum practice.

Delphine TUZI

Archaeology Development Officer (Chargée de développement Archéologie) at the Musée de Préhistoire d'Île-de-France (Nemours); in charge of collections management and researcher access and involved in the museum's collection registry and archaeological documentation.

All professional titles, affiliations, and areas of expertise listed here correspond to the positions and roles held by the individuals at the time of their consultation for this research. Changes to positions, affiliations, or responsibilities that may have occurred subsequently are not reflected.