

What are the differences between relative and absolute dating methods and why is dating important in Archaeology?

At the core of archaeological practice is the desire to understand the past. In doing so we must establish a sense of chronology that, if absent from the written records, can only arise from dating. The two schools of archaeological dating, namely relative and absolute, are integral to the reconstruction of human history through a retrospective lens. They more importantly, however, offer us a crucial degree of objectivity which is seldom found in historic investigation. This essay will therefore aim to assert that the excavation of the material record as a source of both historical and prehistoric knowledge is only valuable so long as we are able to date our findings.

Principally, it is vital that we outline the fundamental distinctions between relative and absolute dating. Relative dating refers to the methods that allow us to construct a basic order of events based on stylistic comparison and stratigraphic assumption, however they do not produce metric data for the age of an artefact. Absolute dating, on the other hand, relies on scientific techniques that do in fact yield a chronometric age range of a given artefact, rendering them much more precise.¹ These methodologies, despite their association with techniques and results of different natures, which will henceforth be discussed, collaborate to produce the most accurate account of our chronology, which was a turning point in historical investigation.

Stratigraphy is a particular branch of relative dating that is concerned with examining the formation of rock layers and applying this to the location of our findings in order to construct an idea of which artefacts came first. It was a theory developed geologically by Charles Lyell and William Smith before it was archaeologically applied. The book 'Principles of Geology' had been published by Lyell in 1830,² which outlined core stratigraphic ideas such as the interrelationship between fossils, strata and interfaces and discussed the idea of their relation to chronology to which Smith later advanced. Smith discovered, while working on a canal, that strata displayed regular depositary patterns and contained the same types of fossils in each layer, which allowed geologists to identify organic matter from the same period from one place to another.³ The law of superposition, which holds that within a sequence of sedimentary layers, the base layer is the oldest, with the layers getting progressively younger as they ascend, was thus established. Unequivocally, this laid the foundation upon which relative dating within early archaeology would develop in the 19th century; arguably the discipline may have never evolved without it.

Archaeologists may generally operate by stratigraphy, however we must consider that archaeological stratification usually deals with man-made objects which are not necessarily confined by the same laws of geological stratification put forth by Lyell. The artefacts dealt with are created, preserved or indeed destroyed by human agents and thus do not adhere to a natural life cycle or may have been recreated by later civilisations, yielding sequential anomalies. For instance, the case of the Nampa figurine. According to Cremona, the clay figure of a woman, discovered in 1889, was found approximately 295 feet underground by a group of workers searching for water near Nampa, Idaho. Professor Albert A. Wright described the

¹ Ruiz J.F., Rowe M.W. (2014) Dating Methods (Absolute and Relative) in Archaeology of Art. In: Smith C. (eds) Encyclopedia of Global Archaeology. Springer, New York, NY.

² Lyell, Charles, Sir. (1830). *Principles of geology : being an attempt to explain the former changes of the earth's surface, by reference to causes now in operation* (v. 3). John Murray

³ Edward C. Harris, (2014) Principles of Archaeological Stratigraphy, Edition 2 (revised), Pg. 8, Elsevier >

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figurine as “the image of a person of high civilisation, artistically attired”.⁴ Should the position of this artefact be used to stratigraphically date it, the doll would be around 2,000,000 years old. This is decisively impossible, given that homo sapiens were just evolving in Africa during this time, therefore reputable archaeologists have refuted its authenticity as an object of such an age. In particular, contemporary American geologist J.W. Powell immediately recognised it merely as a clay toy native to the nearby Pocatello people. He criticised Wright’s infatuation with it in ‘*Popular Science Monthly*’ (1893), mocking him as “that well-known government geologist?”.⁵ Its stratigraphic position in the ground is sufficiently explained by natural processes such as fissures in rock and mining activity or perhaps it never resided so deeply to begin with, therefore showing no correlation to the age of the doll. This instance serves to outline the shortcomings of stratigraphy as a relative method of archaeological dating, despite its general adequacy in establishing the fundamental chronology of our findings.

Relative dating furthermore manifests as a useful tool in archaeology through the stylistic comparison of artefacts. The remnants of a civilisation always demonstrate consistency – be it through aesthetic patterns or structural likeness – and inevitably, the tides of social and cultural evolution drag along material culture in its developmental trajectory. We can use this idea to determine from which time period an artefact came; a prime example being the development of stone tools in the neolithic era. We mark the emergence of polished stone tools, from their more archaic unpolished stone tools, as one of the factors that distinguishes the Palaeolithic period from the consecutive Neolithic period. Many of these early polished tools have been excavated in the last 20 years in China with over 10 sites dated to ten thousand years ago.⁶ We are able to use characteristics like these to more efficiently establish the likely era of an artefact, which crystallises the ultimate role of relative dating: to lay the foundation of our understanding of the past, before more recent methods of dating are able to clarify and specify our findings.

Subverting our focus to absolute dating, it is imperative that we explore the scientific nature of yielding a more precise representation of historical chronology. Radiocarbon dating is a primary exemplification of modern absolute dating and operates in accordance with the chemical composition of an artefact. The isotope carbon-14 has a half-life of 5730 ± 40 years, which is to say an age at which half of the nuclei of the original sample will have radioactively decayed. We can use the number of half-lives to determine how much of the original sample remains, which is then compared to the stable isotope, carbon-12 to calculate a more precise age of the sample. This method was developed by Willard Libby in the late 1940s and has revolutionised archaeology since.⁷ Organic material can now be analysed and compared on a world-wide scale therefore serving as a turning point in the depth that historical investigation could foreseeably go. In spite of this, radiocarbon dating is not immune to drawbacks. For instance, anything that predates 50000 years is virtually too old to be tested, as the majority of carbon-14 will have decayed to undetectable levels. Additionally, if the sample comes into contact with other organic material, such as a hand, tests may produce a younger result than

⁴ J.R.Jochmans, Litt.D.,1979, *Strange Relics from the Depths of the Earth(9): Images and Messages from the Incredible Past*

⁵ Powell, J.W. (1893). Are there evidences of man in the glacial gravels? *Popular Science Monthly*, vol. XLIII, 324

⁶ Zhao, C., Wu, X., Wang, T., & Yuan, X. (2004). Early polished stone tools in South China evidence of the transition from Palaeolithic to Neolithic. *Documenta Praehistorica*, 31, 131–137.

⁷ G.Marlowe., Year One: Radiocarbon Dating And American Archaeology, 1947-1948, American Antiquity Vol. 64, No. 1 (Jan., 1999), pp. 9-32 (24 pages), Cambridge University Press

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what is accurate. As a consequence, artefacts recovered must be handled with emphasised caution.⁸ With these factors in consideration, the advent of radiometric dating is strides more precise in the reconstruction of history in contrast with relative dating methods.

Thermoluminescence dating is another absolute method, usually used to date ceramic material and is concerned with the time elapsed since the last firing of the material in order to accurately associate it with the time of manufacturing. Heating the minerals found in the ceramic material releases the trapped luminescence signal, which will have increased over time due to naturally occurring radiation. This allows us to estimate the accumulated charge and time passed since the material was first fired. While thermoluminescence is successful in producing a precise age, there are some fallibilities: the exposure of the material to accidental fires that may have occurred many years following its use could cause an underestimation of the material's age. On the other hand, overestimations may be produced if the ceramic material was found and reused by a later civilisations, as it had likely not been fired since its original manufacturing.⁹ This was an issue particularly within classical antiquity, where the interrelationship between Greek and Roman culture lead to the Roman implementation of various Greek artwork and architecture. A key example would be the ancient theatre of Miletus in Ionian Turkey. This was originally built during Hellenistic Greece and was repurposed by Roman architects, who enlarged it years later. A Byzantine fortification now surmounts it, with the in-cooperated Roman seats embedded into the walls to serve as a means of defence.¹⁰ Its reflective of Roman culture in comparison to their Greek predecessors; infatuated with the beauty of Greek art, custom and entertainment, yet is edged with military associations brought about by the empire's imperialistic nature. There is furthermore the convention of *Damnatio Memoriae*, where the Roman government would advocate for the condemnation of a figure seen as a traitor, tyrant or enemy to the state. It would manifest in the form of chopping the head off a statue and defacing it to dishonour that persons' memory and legacy. The body of the statue, however, would often be reused as the body for later emperors, therefore it becomes difficult to determine what it was originally made for and for how long it was repurposed from relative and contextual analysis alone.¹¹ These instances highlight how thermoluminescence is beneficial in telling us the beginning of an artefacts cultural life-cycle, however bares the limitation of a lack of insight into the length of its employment within a civilisation or in some cases over the span of several civilisations.

To more thoroughly stress the impact of absolute dating, the case of Piltdown man sufficiently demonstrates how the development of these techniques was revolutionary in ensuring the objective confirmation of the age and legitimacy of historical findings, where a dependency on relative dating may fall short. Piltdown man was a fossil discovered in 1912 by Palaeontologist Arthur Smith Woodward and antiquarian and solicitor Charles Dawson, who claimed it to be a new hominin they called "Eoanthropus Dawsoni". It was recovered from a gravel deposit near the village of Piltdown, Sussex UK along with primitive stone tools and stained red fragmentary fossil mammals suggesting that the findings were from the early Pleistocene or Pliocene. During the early 20th century several casts were distributed and analysed by anatomists, all the while hominin fossils were found in China, Indonesia and Africa that did not show the unusual combination of an ape-like jaw and human-like brain case which was

⁸ J.Toothman (2010), How has radiocarbon dating changed archaeology?, howstuffworks

⁹ Sanjurjo-Sánchez, J. An Overview of the Use of Absolute Dating Techniques in Ancient Construction Materials. *Geosciences* 2016, 6, 22.

¹⁰ H.Hall, (2013) *Spolia – Recycling the Past*, PeterSommerTravels

¹¹ Balsdon, J.P., Levick, B.M. 2003. *Damnatio memoriae*. In: Hornblower, S., Spawforth, A. eds. *The Oxford Classical Dictionary*. Oxford: Oxford University Press, p. 427.

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suggested by Woodward and Dawson's discovery. This marginalised the Eoanthropus from what we knew about our evolutionary tree, and it was not until Oxford scientists Joseph Weiner and Wilfred Le Gros Clarke as well as Keneth Oakley, Head of Anthropology at the British Museum, shared suspicions that the hoax was revealed.¹² Chemical and DNA testing carried out years following, determined that the specimen was partly constructed of orangutan and human. Radiocarbon dating in particular confirmed that the Piltdown skull (of human origin) was probably less than 800 years old and the Piltdown mandible (of orangutan origin) was slightly younger, assumed to be several centuries old.¹³ This irrevocably proved the discovery to be fabricated, with the two distinct parts of Piltdown man dated centuries apart and, needless to say, hundreds of thousands of years following the Pleistocene or Pliocene period. The Piltdown hoax stands as a cautionary tale that teaches the scientific and archaeological community not to be deceived by preconceived notions, but to adhere to scientific integrity in the presence of novel discoveries.

The practice of absolute dating is a prime example of what it means to maintain scientific integrity, as it offers a sense of objectivity which dispels the often-biased speculation that once plagued early archaeology, particularly in Europe. Ultimately, the marrying of this with relative methods, namely stratigraphy and stylistic comparison, grounds the discipline of archaeological dating as an essential asset to the investigation of the past. Where written documentation is lost, we must rely on these methods as a means of confirming the chronology of our species: something that is required if we are to seek an understanding of how we got here. It thus follows that any attempt to scrutinise our history from a modern lens is rendered futile without a consideration of the objectivity brought about by absolute and relative methods of dating.

¹² I.Groote, L.G. Flink, R. Abbas, S. M. Bello, L. Burgia, L. T. Buck, C. Dean, A. Freyne, T. Higham, C. G. Jones, R. Kruszynski, A. Lister, S. A. Parfitt, M. M. Skinner, K. Shindler and C. B. Stringer, (2016) New Genetic and morphological evidence suggests a single hoaxer created piltdown man', The Royal Society Publishing

¹³ De Vries, H., Oakley, K. Radiocarbon Dating of the Piltdown Skull and Jaw. *Nature* 184, pg. 224-226 (1959).

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