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Decolonizing Archaeological Heritage

Establishing when an object was made, when a site was occupied, and how long a particular cultural practice persisted are among the most fundamental questions in archaeological research. The development of scientific dating techniques over the twentieth century transformed the discipline's capacity to answer these questions, moving chronology from a largely relative exercise, dependent on typological comparison and stratigraphic sequence, to an increasingly absolute one. This essay examines three of the most widely used dating methods in contemporary archaeology: radiocarbon dating, stratigraphic analysis, and potassium-argon dating, considering both their technical principles and the conditions that limit their application.

Radiocarbon Dating

Radiocarbon dating, developed by Willard Libby in the late 1940s, is based on the known rate at which the radioactive isotope carbon-14 decays after the death of an organism. Because living organisms continuously exchange carbon with the atmosphere, the ratio of carbon-14 to stable carbon-12 remains relatively constant during life. After death, carbon-14 decays at a predictable rate with a half-life of approximately 5,730 years, allowing archaeologists to estimate the age of organic materials including bone, charcoal, seeds, and textile fibre. The technique is effective for materials up to approximately 50,000 years old. Its main limitation is the requirement for organic material: stone tools, fired ceramics, and metal objects cannot be dated directly by radiocarbon. Additionally, raw radiocarbon dates must be calibrated against known atmospheric carbon variation curves using specialist software.

Stratigraphic Analysis

Stratigraphic analysis, derived from geological principles and formalised for archaeological use by General Pitt Rivers in the nineteenth century, provides relative chronology by establishing the sequential order of soil layers at an excavation site. The fundamental principle, the law of superposition, holds that in an undisturbed deposit, earlier layers lie beneath later ones. By recording the physical relationships between layers and the artefacts they contain, archaeologists can establish which cultural phases preceded which, even without access to absolute dates. Stratigraphy is particularly valuable at complex urban sites where centuries of occupation have produced deep, stratified deposits. Its limitation is that it establishes sequence but not duration: two successive layers may be separated by a decade or a millennium, and stratigraphic analysis alone cannot distinguish between them.

Potassium-Argon Dating

Potassium-argon dating is used primarily for sites predating the effective range of radiocarbon, particularly those associated with early hominin remains in East Africa. The method is based on the decay of the radioactive isotope potassium-40 to argon-40 in volcanic rock. When volcanic material is heated to melting point, any accumulated argon is released; as the rock cools and solidifies, it begins to accumulate argon again from the decay of potassium-40. By measuring the ratio of potassium-40 to argon-40 in a volcanic rock sample associated with hominin remains or stone tools, archaeologists can estimate the date of the volcanic event. The technique has been fundamental to establishing the chronology of early human evolution at sites such as Olduvai Gorge and the Turkana Basin.

Conclusion

No single dating method is universally applicable: each technique has a specific effective range, specific material requirements, and specific sources of error. The most robust chronological frameworks in archaeology are built from multiple independent lines of dating evidence, each applied to the material conditions for which it is most suited. Understanding the principles and limitations of these methods is essential for evaluating archaeological claims about when events in the human past occurred.