Chapter 1
Introduction – New Methods and Technologies of Natural Sciences for Archaeological Investigations in Nasca and Palpa, Peru

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1.1 Natural Sciences in Archaeology

Applications of natural sciences in archaeology have actually a long tradition. In particular the chemical composition of metal artefacts was sporadically used for more than two hundred years, mainly for the purpose of material classification. One of the earliest examples is the quantitative analysis of Roman coins in 1799 by Martin Heinrich Klaproth in Berlin, a chemist who is better known as the discoverer of the element uranium. Based on the material composition of dominant remains, the Danish archaeologist Christian Jürgensen Thomsen formally introduced in the 1820s the three-age system of prehistoric archaeology into three consecutive time periods: the Stone Age, the Bronze Age, and the Iron Age.

Especially during the second half of the twentieth century, natural scientific approaches in archaeology experienced a nearly explosive increase. It became obvious that, when trying to reconstruct the past as comprehensively as possible, the archaeologist needs to take into consideration all sources of relevant information including those which are hidden to the naked eye, being the foremost tool of an archaeologist’s perception, and which are only revealed by scientific studies. Terms such as ‘science-based archaeology’ or simply ‘archaeometry’ are used for this new discipline. Originally coined in 1958 as the title for a journal (M. Aitken, in Olin, 1982, p. 142) and subsequently also used for an international symposium, ‘archaeometry’ was increasingly adapted within the past few decades for this field of research. It is acknowledged in the meantime by most archaeologists as an indispensable and integral part of archaeology.
1.2 Archaeometry

In our understanding ‘archaeometry’ designates the development and application of natural scientific methods and concepts in order to contribute to the solution of cultural–historical questions (Wagner, 2007). In this multidisciplinary, most extensive scope, archaeometry is the interface between the natural and the cultural–historical sciences. Archaeometry is both archaeology by ultimate aim (αρχαιολογία), but natural science by approach (μετρουν). In this broad definition all disciplines of natural sciences that may contribute to archaeology are included, that is, not only physics, chemistry, and mathematics, but also the biological sciences, anthropology, geological sciences, astronomy, and remote sensing. Inasmuch as all of these disciplines describe natural phenomena quantitatively they readily identify themselves with the μετρουν aspect of archaeometry.

As part of cultural history, which generally is concerned with the behaviour of past man, archaeology is the study of the material remains of man’s past with the aim to get broad insights into ancient human cultures, specifically their tools, techniques, economy, works of art, language, ideas, beliefs, customs, and so on. In achieving this goal, natural sciences enter archaeology twofold: first, by their application to inorganic artifacts (e.g., chemical analysis of ceramics) as well as biomaterials (e.g., isotopic studies of bones). Second, natural objects and phenomena as such are of archaeological importance for reconstructing the former environmental situation, such as landscape and climate. Because the natural environment sustains culture, the understanding of the interaction between nature and culture requests combined efforts of both the cultural–historical as well as the natural sciences, and thus the archaeo-environment is a subject of archaeometry.

Archaeometric projects should focus on relevant archaeological questions (e.g., prehistoric chronology), to which one tries to contribute by gaining primary data with an appropriate method (e.g., $^{14}$C), followed by scientific evaluation (e.g., reliability and meaning of the age value) and ultimately by archaeological interpretation (e.g., chronological significance). In other words, at first an archaeological question needs to be transformed into a natural scientific one, and then the scientific result needs to be translated back into an archaeological one. Archaeological topics, for which commonly archaeometric support is demanded, comprise mainly the identification, manufacture, and provenance of material remains, as well as the geophysical prospection, dating, and archaeo-environment of whole sites.

The occasionally raised dispute of whether archaeometry is research in its own or service to archaeology, is needless in such cooperation. There are cases where an archaeological problem triggers the development of a new technology, and other cases where an available technology stimulates the archaeologist towards fresh questions. An intensive and sustained interchange between natural scientists generating the data and those interpreting them