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Archaeological formation theory and geoarchaeology: State-of-the-art in 2016

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ABSTRACT

Since the influential work of Michael B. Schiffer on formation processes has been published in 1987, much has advanced on the part of environmental formation processes also known as N-transforms. Most new knowledge is the result of research conducted by geoarchaeologists. On the theoretical level, a huge leap forward was made with the realization that occupation deposits are artifacts of human activity. The focus of formation theory thus shifted from the artifact to the deposit. Methodological innovations and a geoarchaeological tool-kit, notably including the contextual technique of micromorphology, followed. Empirical studies of archaeological occupation deposits contributed new spatial and stratigraphic knowledge and understanding. A holistic middle-range methodology termed geo-ethnoarchaeology was developed, whereby macroscopic and microscopic artifacts are studied together with their associated sediments in ethnographic contexts, providing contextual (social) information about the relationship between artifacts and the surrounding sediments as archaeological assemblages form. This method is especially powerful when sequentially dated abandoned settlements or features are studied to provide mechanistic understanding of assemblage and/or site formation through degradation. Because geo-ethnoarchaeology is based on general chemical, biological and physical laws, the resultant mechanistic models are applicable globally, for any time period, culture, and environment. The new tools and mechanistic understanding by which N-transforms are currently studied, provide means to more reliably interpret the archaeological record, which is crucial for the credibility of archaeology. Therefore, when studying archaeological assemblages one should utilize the tool-kit developed by geoarchaeologists to first assess the states of preservation of the various material assemblages (macroscopic and microscopic), as it should be borne in mind that assemblages identified to be well-preserved will produce the most reliable archaeological interpretation. The theory and method of geoarchaeology have matured enough to allow responsible archaeological research into the meaning of spatial and temporal (stratigraphic) patterns at any given site.

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1. Background: the early phase of research

Formation theory is one of the most important achievements in modern archaeology, identifying mechanisms that allow archaeologists to better understand and interpret the archaeological record. This body of method and theory was conceived and promoted by many, notably by M.B. Schiffer in his seminal book "Formation Processes of the Archaeological Record" (Schiffer, 1987). In brief, formation theory posits that the archaeological record, in most cases, is not a mirror reflecting living societies but an assemblage of materials that underwent various transformations during and after human activities. Therefore, the processes responsible to the formation of archaeological sites are divided into those related to human activities, also known as cultural transformations or C-transforms, and those related to natural/environmental processes, also known as Non-cultural transformations or N-transforms (Schiffer, 1987).

Schiffer's (1987) book came after much deliberation among archaeologists about the definition of archaeological contexts (e.g., primary vs. secondary deposits), what does the archaeological record represent (e.g., Binford, 1982; Flannery, 1976; Schiffer, 1972), and how should archaeological research be designed (e.g., Binford, 1964). This culminated in the 1970s and 80s. With an interest in deciphering C-transforms, archaeologists rightly turned to ethnoarchaeology, the best method that can serve as means to observe the inter-relationship between people and their material culture.[1] Ethnoarchaeological studies exemplified the role of human decision making, artifact use life, and discard patterns, among other important parameters that are eloquently summarized by David and Kramer (2001). Early research on N-transforms focused mostly on vertebrate taphonomy (e.g., Brain, 1967; Lyman, 1994).

Research into site formation processes flourished in the 1980s and 1990s. It focused on macroscopic items of material culture – mainly bones, pottery and stone tools – and included ethnoarchaeolgical as well as experimental studies. Research exploring microscopic artifacts and chemical signatures in artifacts and ecofacts (e.g., stable isotope analyses) started budding; however, most studies looking into the microscopic aspects of archaeological materials were related to either reconstruction of climate and diet, or artifact conservation, and less so on formation processes in the larger sense. It is important to note that the studies during this time period were incorporated within "middle range theory"; discussions about how to turn static material culture remains, with the aid of formation theory, into dynamic past human societies. The focus was thus on C-transforms (Fig. 1, left-hand side).

2. Disillusionment vis-a-vis the development of geoarchaeology

As ethnoarchaeological research progressed in the 1990s, it became apparent that human behavior is not governed by general rules and may produce variable patterns (artifact assemblages) under seemingly similar social and cultural conditions. Incidentally (or not) this disillusionment occurred at the time that post-modernist approaches to archaeology became prominent. Complexities on the part of C-transforms and their effect on the archaeological record became apparent, as for example maintenance activities in habitation sites and post-abandonment secondary activities were found to obscure primary depositional patterns, forming what is known as palimpsests. These complexities, entangled with post-modernist notions, led to disillusionment in regard to formation theory. In 1998 M. Shott (1998:321) wrote with disappointment on the status of formation theory on the verge of the 21st century:

1) "… formation theory is viewed as the province of lithic or faunal analysts and the study of forager societies"
2) There are "… daunting complexities of assemblage formation"
3) "Two factors may explain our collective indifference to formation theory. First is our legitimate interest in cultural – not narrowly archaeological – understanding of the past. Assemblage formation theory seems an unpleasant distraction from this concern".

Shott (1998) basically noted that (a) formation theory in its form during the 1990s is irrelevant for the study of complex, especially urban, societies, and (b) that archaeologists purposefully ignore formation theory because it may undermine interpretations they would like to advocate. This methodological criticism should have been taken seriously, yet, post-modernist approaches changed much of the focus of archaeological research, and the dealing with formation theory was almost abandoned. Formation theory was then reduced into a methodological specialization.

Still in the 1980–90s though, quiet progress was made in geoarchaeology, then a young sub-field of archaeology. Gaining recognition in the 1960s (Rapp and Hill, 2006), geoarchaeologists traditionally focused on soils and sediments within and outside archaeological sites. The early geoarchaeological studies mostly concentrated on the scale of the landscape, studying various open-air geomorphological contexts including alluvial, slope and coastal depositional environments (e.g., Rapp and Hill, 2006; Stein and Farrand, 1985; Waters, 1992). Due to the nature of these geomorphological environments, most studied sites were rather ephemeral, often representing single-component prehistoric sites. Geoarchaeology was taken, at the time, as means to understand the interplay between deposition, erosion and post-depositional disturbance such as bioturbation, all informing about the stratigraphic integrity of whole or portions of sites, which by extrapolation is related to site formation processes (Butzer, 1982; Schiffer, 1987). It therefore became apparent that the appropriate unit of analysis of site formation processes should be the deposit, or the sediments and soils that contain the archaeological artifact assemblages, rather than the artifacts themselves (Stein, 2001). This conceptual change, though, focused primarily on natural deposits (e.g., aeolian or alluvial sediments, and soils) containing artifacts, utilizing techniques associated primarily with the soil sciences such as particle size analysis, pH and nutrient determination (Holliday, 2004).

In the 1970s and 1980s, in parallel to the developments summarized above, a few geoarchaeologists started exploring sediments associated with long-term multiple-component sheltered archaeological sites, mostly in prehistoric caves (e.g., Goldberg, 1980). It had quickly became apparent that soil science methods may not be suitable to studying deposits in these sites because (a) they were not strictly soils or natural sediments, and (b) these sediments underwent severe chemical changes. Studying such

[1] Actualistic (experimental) studies as well as historical and ethnographic accounts are also means that allow production of inferences on the relationship between people and material culture, yet these are less straight-forward than ethnoarchaeology. First, experimental studies mostly focus on replication thus even when replication is successful it does not necessarily indicate that the experimental replication reflects activities conducted in the past. Second, experimental studies rarely consider time-depth – see more below under Section 3. Third, historic and ethnographic accounts may describe relationships between people and material culture, but as they did not stem from an archaeological problem in the first place, most often the information found in them is insufficient for the desired depth of archaeological interpretation.