

Incorporating Lessons from Geoarchaeology and Geoforensics into the Search for Non-Terrestrial Agnostic Biosignatures

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Impetus: Weighed against the regularity of biological extinction across geologic time due to routine events, such as planetary impacts (e.g., Hartmann et al., 2007) and galactic supernovae (e.g., Diehl et al., 2006), it appears likelier that the first evidence of extraterrestrial life will be extinct, not extant, in nature. As a result, one of the greatest biases in the search for evidence of life beyond Earth may be in the inclination to seek out evidence of extant life, and further, that such evidence will be necessarily biochemical in nature (Capelotti, 2010). Despite relatively recent suggestions by Haqq-Misra and Kopparapu (2012) and Davis and Wagner (2013) that the potential search for and discovery of “data-poor,” “non-terrestrial” artifacts in the Solar System should be considered, (arguably overlapping terms with “agnostic biosignatures,”) little further progress has been achieved in clearly defining the scope of what might be considered such an artifact nor identifying potential rigorous methodologies for their potential detection, confirmation, analysis, or interpretation.

Archaeological Crossroads: Meanwhile, fruitful conceptual inroads relevant to the search for and study of agnostic biosignatures beyond Earth have been and are continually being made under the auspices of archaeology and geoforensics, with which neither the astrobiology community nor the archaeological communities themselves may be fully aware. While suffering clear terrestrial biases, archaeological investigations are continuously maturing to include increasing use of robust geophysical and remote-sensing survey and data-collection methodologies, which possess potentially-significant implications in a non-terrestrial context. Specifically, the use of geoarchaeological techniques in the identification of grain-sized, anomalous sedimentological evidence (micro-artifacts) of human activity on Omaha Beach, Normandy, warrants specific mention in its ready potential for application in a non-terrestrial context (McBride and Picard, 2011), as does the burgeoning use of spectral and multispectral geoforensics survey techniques in the identification of non-geological structural or topographical features of interest that are obscured by subsequent deposition and/or indicate a highly improbable natural mixing and partitioning of geological source material (Moussa, 2001).

Discussion: By cross-pollinating planetary science, astrobiology, and Search for Extraterrestrial Intelligence (SETI) research with recent, relevant methods and findings from the archaeological and geoforensics communities, the search for evidence of extraterrestrial life via agnostic biosignatures may be matured. Further, such efforts will simultaneously help to clarify badly-conflated and poorly-confined or defined terms used to describe potential evidence of extraterrestrial life. It is therefore suggested that the search for agnostic biosignatures by astrobiologists, the search for non-terrestrial artifacts traditionally suggested by SETI researchers (e.g., Frietas, 1983), and the potential study of artifacts of non-terrestrial origin suggested by space archaeologists (Capelotti, 2010), are each in fact different views of the same pursuit and would benefit greatly from the use of current archaeological investigations as non-terrestrial analogs.

References:

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