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Geoarchaeology and the search for the first Americans

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ABSTRACT

Research into the origins and subsequent development of the first American cultures ("Paleoindians"), in particular the timing and place of their arrival, has provoked heated, contentious debates in North American archaeology since the 19th century. Many of the questions in this archaeological puzzle are fundamentally geological and thus many of the answers have come from the geosciences, including geology, geography, and soil science, and at a wide range of spatial scales. Stratigraphy, perhaps the most basic principle in both archaeology and geology, first established the antiquity and chronology of the earliest artifact assemblages at sites such as Folsom and Clovis in New Mexico by demonstrating clear association of artifacts and Pleistocene fauna. Geologists and paleontologists further provided age estimates of sites in the absence of other forms of numerical age control. Geologists also were prominently involved in developing the radiocarbon method and applying it to Paleoindian sites. Many Paleoindian sites also yielded not only extinct fauna, but stratigraphic records with evidence of markedly different depositional environments in the past. These sites were inviting to geologists because many investigators had backgrounds in Pleistocene paleontology. The ancient fauna and the striking contrasts between past and present depositional environments drew the attention of archaeologists and earth scientists alike who recognized the paleoenvironmental implications. At regional, subcontinental scales the peopling of the New World has been a question revolving around lowered seas levels and fluctuating glacier margins. Modeling sea-level changes and the paleogeography of the "Bering Land Bridge" and the high-precision dating of ice retreat over Canada is helping to understand the environmental conditions faced by Native American forbears in Beringia and the environment, route(s), and timing of their entry into North America.

1. Introduction

The peopling of the New World is a topic of considerable research and debate (often acrimonious) among American archaeologists and their various interdisciplinary collaborators such as geoarchaeologists. Determining when humans first arrived in the Americas, and where they came from and how they got here, are some of the most fundamental issues in American archaeology and have been so in some form since the initial European colonization of the continent. Because chronology and geography are key themes in these fundamental questions, the geosciences have long been an intimate component of the archaeological investigations.

This paper is a look at the some of the many ways in which geoarchaeology has contributed to our understanding of the peopling of the New World. It provides a sampling of the many geoscientific approaches that have been employed at all scales of space from continental to microscopic to focus on this key issue in American archaeology, known as Paleoindian archaeology. The issues involved in understanding the peopling of the New World include archaeologists and their collaborators in both North and South America, of course. This paper will focus on North America, however, because there is a much larger, more extensive and more integrated English-language literature on the topic from North America. The paper begins with a brief historical sketch of the debate over the antiquity of humans in the Americas and the role of geology in resolving the issue. The historical sketch includes discussion of geology in helping to resolve issues of chronology, but the role and significance of radiometric dating and geochronology is not otherwise dealt with. The topic is vast and its role in Paleoindian archaeology has been addressed elsewhere (Haynes, 1992; Holliday, 2000). The main part of the paper follows, providing examples from a variety of studies across North America to illustrate the broad array of geoscientific approaches to understanding the peopling of the New World.

2. Background

The geosciences is but one of many disciplines that have been brought to bear to enhance our understanding the peopling of the New World. It was the first discipline employed, however, just as American archaeology itself was taking form. The discovery of a human prehistory in "deep time" was first made in Europe in the middle of the 19th century (Grayson, 1983), but the notion quickly spread to the U.S.

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scientific community and launched a search for an equally ancient archaeological record in North America (Meltzer, 1983, 1994, 2006a). The result was a ferocious debate that lasted for decades over the antiquity of Native American populations (see Meltzer, 1983, 1991, 1994, 2006a); essentially whether humans had been in the New World since the Pleistocene (an "American Paleolithic") or were very recent arrivals. Geologists were key players in the debate, offering observations and opinions regarding the age of "rude" implements, based on stratigraphic relationships to inferred glacial deposits or to Pleistocene fauna. By the early 20th century the debate shifted somewhat to the antiquity of human remains or obvious artifacts, with the answer usually provided, once again, by demonstrating or disproving stratigraphic relationships with Pleistocene fauna (Meltzer, 1983, 2006a). The debate was finally resolved during excavations near Folsom, in northeastern New Mexico (1926–1928) (Fig. 1), when well-made projectile points were found in intimate and undisputed association with the bones of extinct, Late Pleistocene *Bison* (Meltzer, 2006a,b).

From the outset, geology and what would become geoarchaeology has been an important, even key aspect of Paleoindian archaeology. One of the early investigators, E.B. Howard (not a geologist) was explicit in his belief that interdisciplinary research, especially geology, was a prerequisite to understanding Paleoindian archaeology:

> Geology, particularly its allied branches of palaeontology, physiography, and glacial geology, must be called upon to explain many phases of the subject [of the peopling of the New World] that involve a wide variety of converging lines of research, presenting many peculiar difficulties. The archaeologists, starting from the point where the historian usually leaves off, soon finds it necessary to lengthen his perspective, and eventually he is faced, so far as America is concerned, with a geological problem. The recognition on his part of the importance of special studies relating to such factors as climatic changes, studies of invertebrates, analysis of diatoms, or pollen that may be found in a given deposit marks a step in the right direction. Therefore the archaeologist must familiarize himself with these and other phases of geology which bear upon the problem, such as the study of terraces, buried soil levels, loess deposits, varved clays, ancient lakes and shore lines, and any other factors which may give a clue to the environment in which early man lived in America... [T]he importance of a field of investigation which lies somewhere between geology and archaeology...is becoming increasingly apparent as a number of scientists recognize (1935:62).

Rephrased in a more contemporary context "the prominent role of geology in Paleoindian archaeology...is explained [in part] by...the distinctive archaeological, paleoenvironmental, and evolutionary problems that are addressed by students of the Paleoindian period" (Ferring, 1994:57).

A variety of circumstances explain why geology and geologists were involved in Paleoindian research from the outset. As alluded to above, stratigraphy and paleontology (which was in the domain of geology) were crucial to estimating the age of archaeological sites in the years prior to the development of radiometric dating (e.g., Haynes, 1990; Holliday, 1997, 2000). Further, Paleoindian sites were inviting because many investigators had interests in Pleistocene stratigraphy and paleontology (e.g., Haynes, 1990; Holliday, 1997; Mandel, 2000; Meltzer, 2006a). The presence of a Pleistocene archaeological record in North America was "an enormous stimulus to research" (Bryan, 1941:508) by geologists on Paleoindian sites (Wilmsen, 1965). Geologic research was inseparable from their approach to archaeology. Finally, and more

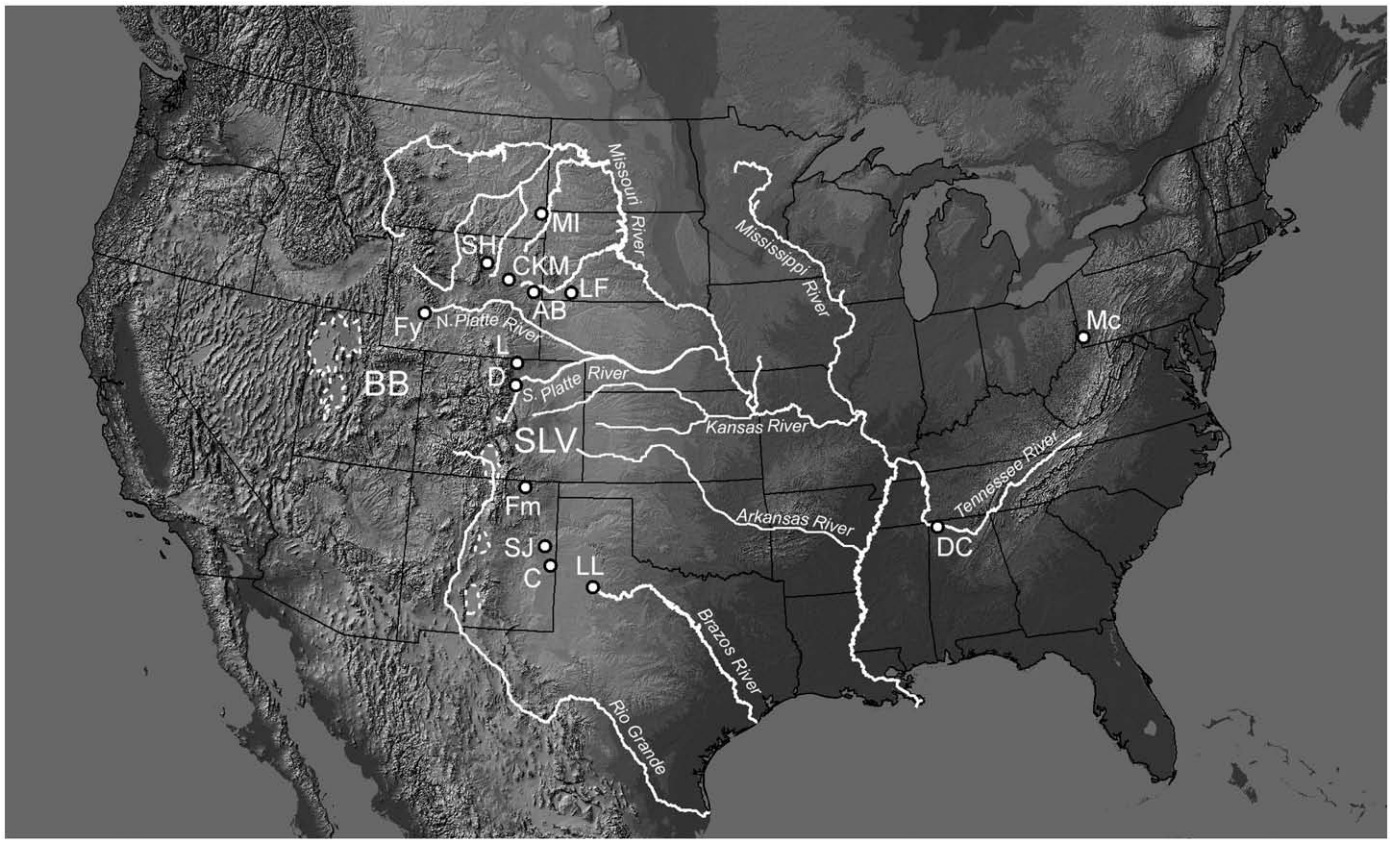

Fig. 1. The Unites States and parts of Canada and Mexico showing the location of sites, rivers, and selected physiographic features mentioned in the text. Archaeological sites: AB = Agate Basin; C = Clovis; CKM = Carter/Kerr-McGee; D = Dent; DC = Dust Cave; Fm = Folsom; Fy = Finley; L = Lindenmeier; LF = Lange-Ferguson; LL = Lubbock Lake; Mc = Meadowcroft; MI = Mill Iron; SH = Sister's Hill; SJ = San Jon. Basins: BB = Bonneville Basin; SLV = San Luis Valley.