Geoarchaeological Insights from Indian Sands, a Late Pleistocene Site on the Southern Northwest Coast, USA

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Geoarchaeological investigations of site 35C167C at the Indian Sands locality, along Oregon’s southern coast, provide many insights useful for considering various aspects of a Late Pleistocene coastal migration hypothesis. The geographic and geomorphic setting of terminal Pleistocene human occupation at Indian Sands provides important contextual examples that may aid in the discovery of other early coastal sites. During the Terminal Pleistocene, hunter-gatherers exploited naturally occurring sources of chert toolstone available at the Indian Sands locality.

Stratigraphic records at Indian Sands show changes in aeolian sedimentation, pedogenesis, and landscape evolution. Taken together, these records reflect the presence of nonanalogous Terminal Pleistocene paleoenvironmental conditions, suggesting a coastline much colder and drier than today. Developing paleoenvironmental proxy records from Pleistocene-age terrestrial deposits in coastal settings will help improve our understanding of early coastal cultural ecology. © 2006 Wiley Periodicals, Inc.

INTRODUCTION

Archaeologists have set their theoretical sights on the Pacific coast of the New World as a potential Late Pleistocene route of entry for the First Americans (e.g., Mandryk et al., 2001). Although the idea of a coastal migration route is not new (Fladmark, 1979; Gruhn, 1994, 1998), discoveries of Pleistocene-age coastal sites are few and far between and have yet to reach temporal expectations of a pre-11,500 yr B.P. timing of human migration. The paucity of early coastal sites is typically attributed to the effects of significant geomorphic processes on postglacial coastal landscapes, which have served to obscure, alter, and destroy sites throughout the Late Pleistocene and Holocene epochs (e.g., Waters, 1992).

Perhaps because of the difficulties involved in finding early archaeological sites in a changing coastal landscape, few examples of early coastal-site geoarchaeology are available. To date, New World coastal sites dating to the Terminal Pleistocene (TP) (i.e., 10,000 to ~15,000 yr B.P.) are known from only three areas along the northwest coast (Figure 1). These include K1 Cave on the west coast of Haida Gwaii,
British Columbia, which contained two fragmentary stemmed projectile points stratigraphically positioned between the skeletal remains of a Black bear. Four radiocarbon ages on Black bear bones bracket these two points between 10,525 to 10,660 yr B.P. and 10,510 to 10,960 yr B.P. (Fedje et al., 2004). Daisy Cave on southern California’s San Miguel Island, contains an early occupation dating to ~10,400 yr B.P. (Erlandson, 1993, 1994; Erlandson et al., 1996). Last, the Indian Sands locality, located along Oregon’s southern coast, includes a site (35CU67C) with extensive lithic materials associated with a 10,430 yr B.P. paleosol (Davis et al., 2004).

Although each of these sites are important in their own right, the archaeological components they contain are not old enough to directly evaluate hypotheses of coastal migration. Nevertheless, the geologic record and the geoarchaeological context of early human occupation at these sites provides important examples of what other early coastal sites might look like, where they may be preserved, and how some aspects of TP coastal environments were structured. Armed with this knowledge, we can begin to build a basic understanding of where geoarchaeological research efforts should be focused in a search for early coastal sites. Here, I will illustrate specific lessons drawn from geoarchaeological study at site 35CU67C at the Indian Sands locality to suggest productive avenues for the discovery of other TP sites along the Pacific coast of the New World. Discussion will be organized along geoarchaeological themes of site context, site formation and taphonomy, and paleoenvironmental context.
Figure 2. Photos of site 35CU67C at the Indian Sands locality. Upper-left photo shows an overview of 35CU67C looking south, including the position of the IS-1 stratigraphic section, an exhumed portion of the 4BsB horizon (A), active dune sands (B), and the deflated surface of 35CU67C. Upper-right photo shows a view to the north from 35CU67C, with an exhumed 4BsB horizon, active dune, and deflated site surface at A, B, and C, respectively. Intense wind erosion created the large blowout feature seen in the background (D). The 2 m x 2 m excavation unit shown in the foreground was filled with dune sand to a depth of 50 cm in one evening. Bottom-right photo shows a closer view of the IS-1 stratigraphic section and the deflated surface of 35CU67C (C). Bottom-left photo shows 2003 excavations in progress near deflated surface (C) with windbreak at right. Photographs taken by Timothy Goggin.

SITE CONTEXT

The Indian Sands locality lies about 8.5 km north of Brookings, Oregon. Site 35CU67C is situated on a bluff about 30 m above and 100 m east of the Pacific Ocean, in the central part of the locality (Figure 1). The surficial geology of the locality is dominated by Late Pleistocene dune sands (Davis et al., 2004), which are underlain by chert-bearing breccias and conglomerates of the Jurassic Otter Point Formation (Beaulieu and Hughes, 1976). The influence of wind erosion is clearly seen at Indian Sands as seasonally intense Pacific winds create large blowouts, reactivate dunes, and form deflated lithic pavements (Figure 2). Holocene-age archaeological sites are known from Indian Sands, including surficial scatters of marine shell and lithic artifacts, and a buried shell midden with semi-subterranean house features (Berreman, 1985; Ross, 1976; Minor, 1986; Moss and Erlandson, 1995; Erlandson and Moss, 1996). As part of a research program designed to discover TP sites along the southern
Oregon coast, the author led initial field investigations between 2000 and 2001, which included a geoarchaeological study at Indian Sands.

The Indian Sands locality was included on a long list of potential study areas during the 2000–2001 field investigations for several reasons. First, Moss and Erlandson (1995) report radiocarbon ages ranging from 7790 ± 70 yr B.P. to 8250 ± 80 yr B.P.
from burned and unburned mussel shells collected from the surface of 35CU67C. This discovery illustrated the existence of an early Holocene occupation, which was, at the time, the earliest on the Oregon coast. Second, geological research by Beckstrand (2001) has helped to clarify the timing and source of Late Pleistocene dune deposits along the Oregon coast, and provided a conceptual framework for understanding the presence of large dunes at Indian Sands. Third, our research team investigated natural and human-made stratigraphic exposures in numerous river valleys, lake basins, and coastal headlands, including Indian Sands, to build a detailed landscape history model for the southern Oregon coast.

Investigations of natural stratigraphic exposures at the Indian Sands locality, on the northern edge of site 35CU67C, revealed a stratified sequence of aeolian sediments and paleosols dated between 28,830 ± 330 yr B.P. and 15,600 ± 1800 cal B.P. (Davis et al., 2004) (Figure 3). Considering Moss and Erlandson's (1995) reported Early Holocene ages on marine shells from the surface of 35CU67C, it appeared that an TP-age paleosol might be preserved at the site. Although close visual examination of the paleosol in natural exposures did not reveal any associated cultural materials, the chronostratigraphy of 35CU67C was compelling enough to warrant archaeological test excavations during the following year. As a result of excavations at 35CU67C during the summer of 2002, Davis et al. (2004) reported the discovery of debitage and lithic tools from the 3Ab paleosol, in a position stratigraphically beneath the Early Holocene-age shells. Dispersed charcoal from the lower portion of 3Ab, in the same stratigraphic position as fire-modified rocks and debitage, returned an age of 10,430 ± 150 yr B.P., establishing a TP human presence at Indian Sands.

Understanding why the Indian Sands locality was attractive to TP hunter-gatherers may help predict the distribution of early sites elsewhere along the Pacific coast of the New World. The TP archaeological component from 35CU67C suggests early hunter-gatherers were attracted to locally available cherts present in the Jurassic Otter Point formation at Indian Sands, and the site may have served as a quarry and tool refurbishing station (Willis, 2003; Davis et al., 2004). Because high-quality toolstone was needed for early hunter-gatherer technologies, early sites may be found near particular toolstone-bearing geologic formations. In areas where lithic quarries are associated with high-resolution depositional environments, such as dune fields, stratified occupation records may be preserved, enhancing the quality of archaeological data.

SITE FORMATION AND TAPHONOMY

Coastal sites are often subjected to high-energy geomorphic processes that contribute to their alteration or destruction. Whereas headland sites can be protected from many coastal processes, such as marine transgression, tidal erosion, and burial beneath Holocene dunes and floodplains, they are particularly susceptible to other geomorphic factors. Headland sites often retain evidence of erosion, exhibited by partially deflated surficial deposits, truncated paleosols, and lagged pavements of artifacts (Figure 2). In areas along the southern Oregon coast, headland sites show various stages of deposition, deflation, and extended periods of surficial stability, which can produce intact stratified sites or cultural palimpsests (Davis et al., 2006).
Study of the stratigraphic record at 35CU67C (Figure 3) reveals a number of different site-formation events worth considering here. Starting from the base of the IS-1 profile, the 6Cb3 to 6Cb1 horizons reflect dune growth before 28,000 yr B.P. An incipient paleosol developed between ~26,000 and 28,000 yr B.P. and signals a period of surficial stability. Erosion and subsequent burial of the 5Ab surface followed an extensive fire, which denuded the landscape and produced large quantities of charcoal. In the absence of significant ground cover, dune sands re-advanced during a period up to and after ~22,800 cal yr B.P., creating the 4Cb2 and 4Cb1 deposits. A return to surficial stability is indicated once again by pedogenic development of the 4BsB horizon, which postdates a 15,600 ± 1800 cal yr B.P. thermoluminescence age on its parent material but predates a 10,430 yr B.P. radiocarbon age on charcoal from the overlying 3Ab paleosol. The erosional boundary separating the 4BsB and 3Ab horizons indicates another period of surficial instability and helps explain the absence of an A horizon for the truncated 4BsB paleosol at IS-1. In some parts of 35CU67C, the 3Ab horizon is overlain by a layer of dune sand, designated as 2C. Mussel shells on the surface of the 2C horizon returned radiocarbon ages between 7790 and 8250 yr B.P. (Moss and Erlandson, 1995).

Based on this history of site formation, we should expect to find TP components in the 3Ab horizon and potentially concentrated on the surface of the 4BsB horizon. If TP components are found on the surface of the 4BsB horizon, they will likely represent secondarily redeposited archaeological deposits that form a cultural palimpsest. Establishing a direct chronometric age on such a palimpsest will be difficult in the absence of organic artifacts, remnant cultural features, or faunal materials unequivocally related to human activities, particularly because bioturbation could potentially move artifacts and ecofacts downward to accumulate along the 3Ab-4BsB boundary. Visual examination of artifacts from a hypothetical 4BsB palimpsest might reveal surficial abrasion produced by exposure to aeolian weathering. This weathering pattern is apparent at 35CU67C among lithic artifacts found on and in the 2C horizon, which exhibit abraded and polished flake scars and edges that contrast with unabraded lithic artifacts from the 3Ab horizon. If present at the 3Ab-4BsB boundary, such abrasion would suggest a period of subaerial exposure to aeolian weathering prior to burial by 3Ab parent materials.

PALEOENVIRONMENTAL CONTEXT

The paleoenvironmental context of the New World Pacific coastline during the TP is largely unknown, save for a few particularly well-investigated areas in British Columbia (Mathewes, 1989, 1997; Fedje, 1993; Josenhans et al., 1995, 1997). However, in the absence of protected inlets and island archipelago waterways, defining the paleoenvironmental context of the TP Pacific coastline south of Puget Sound may prove much more difficult. Nevertheless, the stratigraphic record of sites like 35CU67C provide proxy records for interpreting environmental conditions in TP coastal settings.

During the last glacial maximum (LGM) at 21,000 yr B.P., the Pacific Ocean was ~10 km west of the Indian Sands locality, but by 10,000 yr B.P., the ocean was only
1.5–2.0 km away (Davis et al., 2004, Figure 6). Coastal headlands positioned along the modern southern Oregon coast probably appeared as a prominent bedrock palisades rising abruptly from a broad coastal plain during the TP. If so, easy access into the uplands would have been limited to a few key places and figuring out those places would be useful to finding early sites along routes of movement to inland areas. The presence of Pleistocene-age dune sands at the Indian Sands locality, presently more than 30 m above sea level, suggests that a large dunal ramp connected the coastal plain with the headland prior to Holocene levels of marine transgression. Coastal hunter–gatherers could easily access the uplands by climbing these dunes, in contrast to travel along steep and winding coastal stream valleys.

The IS-1 profile at Indian Sands shows a significant change in stratigraphy from 15,000 cal yr B.P. to ~10,500 yr B.P., corresponding to the transition from the 4Bsb to 3Ab horizons, which are interpreted to signal changes in local coastal environments during the TP. Preliminary micromorphological evaluation reveals that the matrix of the 3Ab is mainly comprised of an open framework of subrounded sand grains with finer interstitial silts, clays, and organic matter. Fragments of 4Bsb soil peds seen in the lower portion of the 3Ab horizon are notably compact, created by a dense arrangement of clastic particles forming speckled b-fabrics (Stoops, 2003). Although uncommon in the available samples, planar voids are present in areas of silt and clay, denoting a striated b-fabric. Interstitial illuviation of clays and sesquioxides is also seen in the 4Bsb matrix (cf. Langley-Turbaugh, 1995; Figure 2). At a macroscopic scale, manganese and ferric concretions are common in the 4Bsb horizon (estimated up to 12% of matrix) and laterally discontinuous iron pans (i.e., Ortstein horizons) are exposed in profile in a few areas at the northern edge of 36CU67C. On the basis of these preliminary observations, the compact 4Bsb b-fabrics appear to have been formed through an increase in fine mass density, further enhanced by the addition of ferriargillans. The particular b-fabrics seen in the 4Bsb horizon have qualities that van Vliet and Langohr (1981) attribute to the effects of freezing on late glacial soils of northwestern Europe and suggest that the Oregon coast was much colder during the TP than today.

Pollen and plant macrofossil records from Little Lake, located in Oregon’s central coast range, support this TP paleoenvironmental interpretation. On the basis of paleovegetation assemblages between 24,000 and 13,500 yr B.P., the Oregon coast appears drier and colder than today (Worona, 1993; Worona and Whitlock, 1995). From 13,500 to 10,500 yr B.P., records from Little Lake reflect warmer and wetter conditions, changing to climates warmer and drier than today from 10,500 to 5600 yr B.P. Based on a study of clay mineralogy from headland deposits, Ordway et al. (2003) conclude that loess deposits found along the Oregon coast are derived from aeolian erosion and transport of exposed eastern Pacific shelf areas during the TP, which would help explain the percentages of silt (12.4–23.6%, respectively) and clay (1.7–8.3%, respectively) in the 4Bsb and 3Ab horizons.

The presence of cold, dry, and dusty conditions along the Oregon coast during the TP enhances our understanding of the paleoenvironmental context of a coastal migration route. However, what does the presence of an arid coastal plain mean for early hunter–gatherers following a coastal migration route? Considering the natural
qualities of the modern northwest coast, TP coastal loesses and their soils, and the paleobotanical record from Little Lake, reveal nonanalogous environmental conditions. These environmental conditions are similar to those seen in coastal British Columbia during the TP (Josenhans et al., 1995; Mathewes, 1997) and provides a larger perspective on northwest coast palaeoecology during the TP. Although it is assumed that early coastal migrants would have exploited marine resources (Dixon, 2001), direct or indirect measures of Pacific-maritime and littoral productivity before 11,500 yr B.P. are not yet available. Moreover, the TP coastal plain might have possessed other qualities that were highly advantageous to terrestrial herbivores. These points are not raised to suggest that any particular subsistence specialization should be expected in early coastal sites, but simply to show that because we have a poor understanding of the paleoecological context of the TP eastern Pacific coastline, we should be careful to avoid making premature conclusions about the cultural and ecological context of a coastal migration route.

GEOARCHAEOLOGY’S ROLE IN TESTING A PLEISTOCENE COASTAL MIGRATION HYPOTHESIS

Site 35CU67C at Indian Sands shows that relict portions of the TP coastal landscape, and the early sites they contain, remain to be found along the modern-day eastern Pacific coastline. In a similar manner as described here, geoarchaeologists can enable and assist archaeological investigations of early coastal sites by narrowing down pieces of the landscape that hold terrestrial deposits of TP age and help establish their contextual relationship to the coastal environment. Conceptually, this approach is similar to the work of Fedje (1995), Fedje and Chrisensen (1999), and Fedje and Josenhans (2000) in British Columbia, but is instead focused on the terrestrial component of modern coastal environments (cf. Stafford, 1995). Even when this methodological approach is used, regional variability in the geologic history, bedrock lithology and structure, climate, and geomorphic processes present unique and diverse challenges for site discovery. For these reasons, geoarchaeological models of coastal site location and formation need to be defined at regional scales, a point raised by Mandryk et al. (2001). For example, the proximity of the northwest coast region to the Cascade subduction zone results in specific geologic processes and geomorphic events atypical of most eastern Pacific coastal areas.

Beyond these particular issues, in a search for early coastal sites, we must continually ask the question: Knowing how a modern coastal locality appeared during the Terminal Pleistocene, why would humans come to any specific place? More than rhetorical, answering this question requires the consideration of contextual information that can be provided by geoarchaeological study (Stafford, 1995). Knowing that tool-quality lithic sources are found near 35CU67C, future field investigations will be focused on other areas with Jurassic Otter Point Formation outcrops. Contextually based searches for early coastal sites can be further enhanced with the use of locally defined geographic information systems models to establish the location and distribution of high-probability landforms where multiple predictive criteria co-occur (e.g., Punke, 2001).
If we accept that the MV-II component from the Monte Verde site dates to 12,500 yr B.P. (Dillehay, 1997), and that early hunter-gatherers may have arrived in Chile by way of a coastal migration route, then archaeologists need to set their sights a little lower, stratigraphically speaking. Evidence of an initial migration down the Pacific coast should be found in landforms holding pre-12,500 yr B.P. terrestrial deposits. Adopting a geomorphological approach, we must work to locate, define, and map the distribution of Late Pleistocene landforms as a precursor to archaeological investigations. Whereas the remnants of some ancient landforms will be difficult or impossible to evaluate archaeologically (e.g., deeply submerged coastal shelves and infilled coastal river valleys), some, like the Indian Sands locality, are readily accessible in the modern landscape. Armed with a knowledge of the distribution of temporally appropriate landforms and the deposits they contain, we should be able to accelerate the rate at which early coastal sites are discovered.

Geoarchaeology will serve an important role by elucidating the paleoenvironmental context of potential New World coastal migrants. However, in the absence of a clear understanding of TP coastal environmental conditions, we are equally limited in our ability to understand the adaptive problems a coastal migration route posed to early hunter-gatherers. Despite these clear disadvantages to discovery and current limitations on our understanding of TP coastal environments, other early sites must be found. To meet this need, archaeological research programs seeking evidence of early coastal sites must include a well-developed geoarchaeological component. By integrating geoarchaeological concepts and approaches, we vastly improve our chances of site discovery and hasten the accumulation of the archaeological database needed to evaluate a coastal entry hypothesis.

CONCLUSIONS

Archaeological discoveries at sites like Daisy Cave and, more recently, in karstic caves of western British Columbia provide important testimony to the presence of early New World coastal sites and the diversity of their preservation. However, in most areas, coastal caves are rare, and if we are to build a robust database of TP New World coastal sites, we must also develop approaches to finding open sites in the modern coastal landscape, such as site 35CU67C at Indian Sands. This approach must begin with studies of surficial geology by defining areas where TP-age terrestrial deposits are preserved in the modern coastal landscape and progress to stratigraphic investigations designed to elucidate paleosurfaces and potential site localities. Clearly, these are not new ideas but mainstays of basic geoarchaeological practice. Given the diversity of New World coastal environments and their geologic histories, and the fact that we know very little about the cultural ecology of TP coastal peoples, the geoarchaeological study of TP coastlines is critically important. With time and much effort, incremental steps toward site discovery and investigation will eventually permit giant strides toward evaluating the question of a Pleistocene coastal entry into the New World.

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REFERENCES


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