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cation. Many with the most boarding school education retained the values of their tribes, continuing to participate in sun dances, and some even became key leaders in the peyote religion. One returned Haskell student, Baldwin Twins, "Black Bob" in the Cheyenne tribal rolls, became one of the most respected keepers of the Sacred Arrows. Plains Indian artists like Carl Sweezy of the Arapahos and Dick West of the Cheyennes, both of whom attended off-reservation schools, almost exclusively used tribal themes and events in their artistic productions.

Our Hearts Fell to the Ground is intended for instructional use. The editor's selection of documents is excellent, all reflecting the book's themes. The introduction and headnotes synthesize a vast amount of information clearly and intelligently. Each of the book's fourteen content chapters could easily serve as reading for a class discussion or be combined with others devoted to the same theme. There are relatively few errors or misstatements in the editor's introductions and headnotes, and they can be easily corrected in subsequent editions. I regret that this volume was not available when I taught an undergraduate course on Plains Indians.

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Paleoindian Geoarcheology of the Southern High Plains. By Vance T. Holliday. Austin: University of Texas Press, 1997. 297 pages. \$50 cloth; \$24.95 paper.

Vance T. Holliday has done archeologists, as well as geoscientists, an immense favor. He has chosen to synthesize "the available data on the stratigraphic, geomorphologic, chronologic, and paleoenvironmental contexts of Paleoindian occupations in the Southern High Plains," or the Llano Estacado of eastern New Mexico and western Texas. Holliday also summarized much of the extant information about the paleoenvironment of this very important region—a region that not only contains an invaluable record of Paleoindian occupation but also has been subjected to fairly intense scrutiny by archeologists since the early discoveries at Clovis and the "nearby" Folsom site.

These objectives are accomplished within five chapters and two appendices. The chapters include an introduction to

Paleoindian studies and the Southern High Plains region, a succinct history of Paleoindian archeology, detailed accounts of the geology and chronology of seventeen Paleoindian sites (including seven tables of radiocarbon dates from twelve Paleoindian sites), a comparison of the Llano Estacado sites to sixty-one Paleoindian sites from adjacent regions, and an extensive discussion and conclusion chapter about Southern High Plains cultural chronologies, paleoenvironments, and artifact assemblages. The extensive archeological record of Paleoindians throughout this region was exposed by erosion during two major drought periods in the 1930s and 1950s. Given its spectacular prehistoric record, the Llano Estacado—130,000 km² of flat to slightly undulating mixed prairie-grassland—has been the focus of relatively intensive geoarcheological study for nearly three decades. Considerable Paleoindian research was conducted within two very significant multidisciplinary investigations—the High Plains Paleocology Project in the early 1960s and the Lubbock Lake Project that began in the early 1970s.

Holliday provides fairly detailed accounts of the discovery, excavation, content, geomorphology, and radiometric dating for select Paleoindian sites in this vast region. This site-specific information is presented for seventeen Paleoindian sites within three major geomorphological subdivisions of the Southern High Plains including: (1) Draws—Anderson Basin, Clovis, Lubbock Lake, Lubbock Landfill, Marks Beach, Midland, and Plainview; (2) Playa sites—Miami, Ryan, San Jon, and seven others; (3) Dunes—Winkler-1, Shifting Sands, Bedford Ranch, Wyche Ranch, Elida, Milnesand, and Ted Williamson; and (4) Additional sites—Horace Rivers, Rex Rodgers, and Big Lake.

Holliday's detailed discussions of Paleoindian archeology and environment ultimately contributes to archeologists' reassessment of existing interpretations of late Pleistocene hunter-gatherers in the Great Plains. Many "textbook" distinctions between "mammoth-hunting Clovis" versus "Bison antiquus-hunting Folsom" peoples and basic assumptions about their lifeways have begun to blur. For example, at the Clovis site near Blackwater Draw in New Mexico, we find that both mammoth and bison (*Bison antiquus*) were found in association with "Clovis weapon points." This association of a Clovis camp and chipped stone implements with a *Bison antiquus* kill has also been found at the Aubrey site in Texas

beneath six to eight meters of floodplain sediments. Holliday also describes yet another "anomaly" for traditional archeology—the association of unfluted Plainview or Clovis points, side- or corner-notched (San Patrice-like) points, and the bones of several *Bison antiquus* at the Rex Rodgers site south of Amarillo, Texas.

Holliday mentions, almost in passing, that the mammoth remains from the Clovis site (Blackwater Draw Locality No. 1) that were the basis for archeologists' earliest reconstructions of the Clovis "big game hunting tradition" were probably scavenged carcasses. As he points out, a recent reexamination of the "Cotter mammoths" by Saunders and Daeschler (1994) in their article entitled "Descriptive Analyses and Taphonomical Observations of Culturally-Modified Mammoths Excavated at the 'Gravel Pit,' near Clovis, New Mexico in 1936" (Proceedings of the Academy of Natural Sciences of Philadelphia 145: 1-28) concludes that Mammoth 1 and 2 had been fed upon when the carcasses were dry and stiff. Compression fractures along the margins of mammoth foot bones may have been produced by the sharp ends of bone foreshafts found with these remains. They may have been used as "pry bars" to gain access to the fat pads within the mammoths' feet. Ecological and ethnoarcheological studies in East Africa suggest that scavenging can be a viable food-getting strategy—particularly in an "elephant-rich habitat." Archeologists concerned with Paleoindian adaptations in the New World have paid little attention to scavenging megafauna carcasses during the Late Glacial Period.

Holliday devotes considerable discussion to the vagaries and inconsistencies of Paleoindian projectile point "typologies." On one hand, he makes use of recent studies by Judge, Hoffman, Amick, and others who have accounted for significant variation in Paleoindian chipped stone technologies in terms of hunter-gatherer mobility, raw material conservation, retooling efforts at quarries, and shifts in weapon point design related to numbers of kill episodes and distance traveled from tool stone sources. On the other hand, Holliday strives to clear up the confusion in these long-held archeological chronologies and typologies (e.g., Clovis-Goshen, Folsom-Midland, and Midland-Plainview) that have been created during the past fifty to sixty years. As archeologists are beginning to see, such formal variation in projectile points has much more to "tell us" if we ask questions about raw material availability, retooling

efforts, prey size, weapons systems, and breakage and recycling. The reader needs only to examine many of the projectile point drawings (e.g., Figs. 3.16, 3.19, 3.26, and 3.60) in this book in order to observe how much morphological variation is produced simply by point breakage and resharpening.

Holliday's discussion of the late Pleistocene and early Holocene environment(s) of Paleoindians is grounded firmly in a geoscience perspective. Based on observations from the Domebo site (southwestern Oklahoma) and the Aubrey site (north-central Texas), he proposes that the Clovis environment was characterized by greater effective precipitation, less seasonal change in temperature, and cool, dry upland grasslands. He proposes that the Southern High Plains was an "ideal environment" for Clovis hunter-gatherers because freshwater springs, streams, and lake basins were a ubiquitous feature of the late Pleistocene landscape. Consequently, large and small Pleistocene game animals were "varied and abundant." He takes issue with C. Vance Haynes' arguments for a "Clovis drought," pointing out that the limited evidence for wind erosion at the Clovis site can be explained by other factors and that there is no evidence for drought throughout the Llano Estacado. By 10,900 to 10,800 years ago, Holliday proposes that the environment underwent a dramatic change including increased temperature, decreased effective precipitation, decreased runoff, reduced spring discharge and stream flow, increased aeolian deposition of sand on vegetated surfaces, and the disappearance of "Pleistocene varieties of bison, elephant, horse, camel, bear, and armadillo." This was the nature of the world in which "Folsom" hunter-gatherers lived.

Unlike a number of previous interpretations of the vegetative cover for the Southern Plains in the late Pleistocene, Holliday and others have argued elsewhere that spruce and pine forests did not blanket the Southern Plains as archeologists and palynologists have argued. The arboreal pollen record used to make such former claims, he argues, was derived from upland areas that lay hundreds of miles away. Unfortunately, Holliday devotes little, if any, attention to the problems of environmental reconstruction based on pollen transport mechanisms, differential preservation, and variation in pollen production for different types of vegetation. Holliday makes use of stable carbon isotope analyses ($\delta^{13}\text{C}_{\infty}$ values) of playa sediments to reconstruct a shift from cool-to-warm season grasses that began around 10,000 years ago.

In the concluding section, Holliday discusses the nature of site locations in the Llano Estacado. Draw and playa sites experienced relatively slow down cutting after Paleoindian occupation so that sites were frequently buried and sealed. Paleoindian sites in dune areas underwent periodic burial and exposure due to increased aeolian deposition in the early Holocene. Playa sites like Miami, Ryan, and San Jon are relatively rare but they are probably deeply buried and are only revealed by construction activities such as ponds, lakes, roads, and buildings. Paleoindian sites that resulted from a number of repeated episodes of use are usually situated near former springs.

Holliday compiled tables of data for Paleoindian site frequencies in the Northern Plains, the Rollings Plains (central Texas, central Oklahoma, and eastern Kansas), and the Southern Plains. For example, on the Southern High Plains we see that there are 4 Clovis sites, 3.6 Folsom sites, 2.2 Plainview, and 0.5 Late Paleoindian sites per century (Table 5.8). Although these tables and site-frequency estimates are interesting, there is relatively little that can be said about what, if anything, they mean.

This book provides a very good descriptive, synthetic account of Paleoindian archeology and the paleoenvironment of the Southern High Plains. It should certainly be read by all archeologists interested in geoarcheology, Paleoindians, and North American archeology. Also, it will make a very useful supplemental text for advanced courses in geoarcheology and Paleoindian archeology.

Geoarcheology can provide invaluable insights about the dynamic aspects of the physical landscape for Paleoindians, in this case, and the conditions that affected archeological site formation and subsequent modification. Geoarcheology does not, however, enable us to understand the dynamics of past human behavior. Holliday has certainly laid the groundwork for a new synthesis of Paleoindian archeology in the Southern High Plains and beyond. Now, archeologists must meet the challenge that Holliday's book presents; they must compile complementary volumes about Paleoindians that are firmly grounded in paleoecology, taphonomy, socioecology, and bioarcheology.

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