In a valuable synthesis, Osborn (2014) summarized the distribution of eyed bone needles and spurred gravers in Paleoindian sites in North America. He suggested that nearly all these artifacts date to the unusually cold Younger Dryas period, between ~12,900 and 11,650 calibrated years before present (cal B.P.), and that such needles were associated with the sewing of close-fitting, tailored clothing essential to human survival during frigid Younger Dryas winters. We found support for Osborn’s conclusions in our recent studies of a Paleoindian component at Tule Lake Rock Shelter (CA-SIS-218A), located in the high desert region of Northern California.
historical low temperatures of -28 degrees Fahrenheit (F.) (The Weather Channel 2014)—which probably would have been even more severe during the Younger Dryas Cold Event.

Background Data

Tule Lake Rock Shelter is situated near the west shore of Tule Lake (Figure 1) at ~4,085 feet above sea level. It contains several shallow rock shelters at the base of a sheer basalt cliff located behind the Tule Lake National Wildlife Refuge headquarters. The cliff face and rock shelters appear to have been formed by erosion associated with a high lake stand, probably during the Last Glacial Maximum. Two of the rock shelters (A and D) were excavated in 1989 and 1990 by archaeologists led by John Beaton of the University of California (UC) at Davis. In Shelter A, Beaton’s team excavated a small trench in several contiguous 1-x-1-m test units, one of which (Unit 0S/1W) exposed a 2.5 m deep cultural sequence, the lowest 50 cm (Levels 21–25) of which resulted from Paleoindian occupation. A chunk of charred wood from the uppermost Paleoindian level (21) was dated to 11,450 ± 340 radiocarbon years before present (B.P.) (Beaton 1991; see also Erlandson 1994), suggesting the potential for a pre-Clovis occupation. Beaton noted that the Paleoindian levels contained the bones of birds, fish, and mammals associated with non-diagnostic stone tools. He left UC Davis before his analysis was completed and work on the collection stalled until 2010, when we borrowed it for detailed analysis at the University of Oregon.

The Paleoindian Assemblage at Tule Lake Rock Shelter: Chronology and Contents

Since that time, we have obtained nine accelerator mass spectrometry (AMS) radiocarbon assays for short-lived samples (carbonized twigs) from the deep cultural sequence (Table 1), seven of them from the Paleoindian levels (21–25). Attempts to
to extract purified collagen from large mammal and bird bones from the Paleoindian levels were unsuccessful. Dates on burned twigs from the Paleoindian levels suggest that Beaton’s early radiocarbon age estimate was influenced by the “old wood” effect (Schiffer 1986). An ephemeral Clovis-age occupation may be represented by two nearly identical dates of 11,100 B.P. (13,090–12,935 cal B.P.) from the base of the sequence, but no artifacts diagnostic of a Clovis presence were recovered. This could be interpreted as evidence that Paleoindians of the Western Stemmed Tradition occupied the area during Clovis times (Beck and Jones 2010; Jenkins et al. 2012), but the oldest dated twigs could also be associated with wildfires or later cultural burning of woody debris found on the shelter floor. The recovered assemblage from the basal Paleoindian level is also too small to be confident of its technological affiliation.

A later Paleoindian occupation of CA-SIS-218A is much better supported by five assays from Levels 21–24 that all fall between ~10,500 and 10,300 B.P. (13,090–12,935 cal B.P.) from the base of the sequence, but no artifacts diagnostic of a Clovis presence were recovered. This could be interpreted as evidence that Paleoindians of the Western Stemmed Tradition occupied the area during Clovis times (Beck and Jones 2010; Jenkins et al. 2012), but the oldest dated twigs could also be associated with wildfires or later cultural burning of woody debris found on the shelter floor. The recovered assemblage from the basal Paleoindian level is also too small to be confident of its technological affiliation.

Among the mammal bone remains recovered from Level 23 in Unit OS/1W, Nelson and Erdlandson identified 32 bones from the feet of a single adult human skeleton. Along one wall of the test unit, it seems likely that Beaton’s crew inadvertently removed the lowest extremities of a human burial that appears to be of Paleoindian age. Stratigraphic drawings and field notes suggest that the human remains came from (and were sealed) beneath a nearly continuous layer of angular rocks. Without opening the trench and re-examining the site stratigraphy, it is unclear if this rock layer is of natural or cultural origin. Below the rock layer, the human bones were found in a matrix of yellow sandy soil containing rounded pebbles from a beach deposit associated with a late Pleistocene high-stand of Tule Lake. This yellow matrix is quite different from the darker grayish-brown midden soils overlying the Paleoindian levels, and no evidence of a burial pit or intrusive sediments was found to penetrate the rock layer or the yellow sand.

From the Paleoindian levels, Beaton’s team recovered 293 chipped stone artifacts, including 280 pieces of debitage and 13 tools. The latter include six bifacial point fragments, two biface fragments, four retouched flakes, and one side scraper. Bifacial points are represented by small fragments that appear to have been heavily re-worked; three may represent edge-ground stemmed points. The Paleoindian assemblage also contains seven flakes with heavily ground platforms; these appear to be biface-resharpening
flakes removed from the edges of edge-ground stems, as the stemmed points were being re-worked. No later points (or ground stone tools) were found in the Paleoindian levels, although such points are relatively abundant in the overlying strata.

Further evidence that the Paleoindian stratum is intact comes from a relative abundance (~15 percent) of chert artifacts found in the lower levels compared to the Holocene levels (< 2 percent). Finally, XRF analysis of more than 100 obsidian artifacts (mostly debitage) from the Paleoindian levels documented a strong reliance on obsidian flows to the south in the Medicine Lake Highlands—primarily the Callahan (38.1 percent), East Medicine Lake (21.2 percent), Railroad Grade (13.3 percent), Grasshopper Flat/Lost Iron Well/Red Switchback (GF/LIW/RS, 13.3 percent), and Cougar Butte (2.7 percent) sources (Skinner 2011; see Figure 1). These sources and proportions are very different from those represented among a comparable sample of analyzed obsidian artifacts from the Middle and Late Holocene deposits.

Scattered through the Paleoindian levels of Unit 0S/1W, fragments of four bone needles were recovered (Figure 2). All of these are relatively small, completely shaped by grinding, drilling of...
eye holes, and polishing. All appear to have been made from the cortical bone of large or medium mammals. Two fragments, refitted and glued at UC Davis, comprise a nearly complete needle (Acc. #451-459) 37.6 mm long and 2.5 mm wide, with a roughly circular eye perforation 1.5 mm wide. We identified two fragments of another eyed needle (Acc. #451-1057a) among the faunal remains in Level 23, which had been incompletely sorted and analyzed. Two other fragments are medial pieces from two needles of roughly similar size and shape, including a specimen (Acc. #451-433) from Level 22 that is broken across the eye hole near the proximal end. Significantly, no eyed bone needles were found in a much larger artifact assemblage from the overlying two-meter thick deposits dating to the Middle and Late Holocene.

From Level 23, we also identified two fragments of large mammal cortical bone (probably from a single bone, possibly a mammoth bone) with evidence for “groove and snap” fractures that may be related to needle blank removal (Osborn 2014:49). Attempts to extract purified collagen from this bone for radiocarbon dating were unsuccessful. Among the small sample of stone tools from the Paleoindian levels, no spurred flake gravers were found, although one well-worn flake tool made from obsidian could have served as a graver.

**Conclusions**

Our analyses of the Tule Lake Rock Shelter (CA-SIS-218A) collection supports Osborn’s (2014) thesis that Paleoindian eyed bone needles are associated primarily with the Younger Dryas Cold Event and an increased need for carefully tailored winter clothing. Some eyed bone needles have been recovered from younger deposits in the Far West (e.g., Aikens 1970; Wingard 2001), but they are relatively rare compared to Younger Dryas specimens, especially considering that human population levels were almost certainly much smaller during Paleoindian times. The occasional occurrence of eyed bone needles in later deposits suggests that they were not used exclusively during cold climatic events or for making close-fitting tailored clothing, but Osborn’s hypothesis is worthy of further testing.

The presence of these distinctive artifacts at Tule Lake extends the range of Paleoindian eyed bone needles (Osborn 2014: Fig. 3) into the high desert region of the Klamath Basin, which spans northern California and southern Oregon. While no spurred gravers were found associated with the bone needles at CA-SIS-218A, the assemblage of chipped stone tools recovered is small and the presence of large mammal bones bearing groove and snap scars suggests that such gravers may be present in the Younger Dryas age deposits remaining in the rock shelter.

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