

Clovis at the end of the world

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Of the scores of North American archaeological sites claimed to provide evidence of human hunting of now-extinct Pleistocene mammals, only about a dozen have compelling evidence of such predation. In all instances, the animals involved were mammoth and mastodon (1). In PNAS, Sanchez et al. (2) contend that a third genus of proboscidean (elephants and their near relatives), the gomphothere *Cuvieronius*, should be added to the small list of large mammals pursued by Clovis hunters. It is an intriguing claim; skeptics, however, might require more proof than is currently available.

The investigations of Sanchez et al. at the aptly named site of El Fin del Mundo, situated in a remote region of Mexico's Sonoran Desert (Fig. 1), are noteworthy in several respects. The work documents a genus that has rarely been reported from the late Pleistocene fossil record of North America; it shows an apparent association of the gomphotheres (two subadults found several meters apart in locality 1) with Clovis artifacts; it is one of the very few cases in which there is an associated camp; and it is among

the earliest of radiocarbon-dated Clovis sites. As rare as sites of this age are and as distinctive as El Fin del Mundo is, it will surely figure prominently in subsequent discussions of Clovis culture. For that matter, it will likely also be marshalled into several ongoing debates regarding Clovis origins and adaptations. Which way its evidence will lean depends, as it so often does, on how to interpret incomplete and sometimes ambiguous archaeological data and what may yet come from this important site.

Did Clovis Begin at World's End?

Conventional wisdom long held that the Clovis culture, the hallmarks of which have never been found in Siberia, must have arisen in North America. It was thought to have developed as groups traveled south from Alaska down an ice-free corridor that had recently opened when the Pleistocene came to a close, and the massive ice sheets that had long buried much of Canada retreated. Clovis sites in North America should therefore be time transgressive, oldest on the northern Plains where groups exited the corridor and

ever-younger toward the south, marking their dispersal across the continent (3).

El Fin del Mundo, Sanchez et al. suggest, raises an alternative possibility: its age, ~13,390 calibrated radiocarbon years before present, puts it among the oldest Clovis sites in North America and thus supports the idea the Clovis culture originated far to the south. In this, they seem on solid chronological ground. Clovis sites on the southern Plains and in the southwest tend to be older (often by centuries) than Clovis sites elsewhere in North America, essentially reversing the expected time-transgressive trend. Nonetheless, given that well-dated Clovis sites remain rare (4), it is possible that the chronological pattern is a by-product of sampling bias. Likewise, the oldest sites are not necessarily the original sites, only the earliest ones known. Even so, El Fin del Mundo does little to buttress conventional wisdom and must be accounted for in discussions of when and where Clovis culture emerged.

Clovis Adaptations

Sanchez et al. (2) thoroughly document the geological context of the gomphothere remains and their close stratigraphic association with the artifacts at locality 1. However, as skeptics would note, the mere co-occurrence of artifacts and faunal remains on the same stratigraphic surface does not a predator-prey relationship make. Demonstrating humans were responsible for the death of an animal requires artifacts intimately associated with the faunal remains, evidence of contemporaneity of archaeological and gomphothere remains (within the limits of radiocarbon dating), and compelling traces on the bones: butchering marks, human-caused bone breakage, or other clear indications of skeletal manipulation (1).

Unfortunately, the El Fin del Mundo gomphothere bones were so badly eroded that they precluded recognition of human modification, and radiocarbon dating of the teeth failed to yield reliable ages (2, *SI Appendix*). In the absence of direct skeletal clues to the timing, cause of death, or the butchering and processing of the carcasses,



Fig. 1. Excavations in locality 1 at El Fin del Mundo, January 2011. As Sanchez et al. described in their *SI Appendix* (2), locality 1 was originally on the floor of a wetland basin, but subsequent erosion left it standing as an isolated remnant above its immediate surroundings. Photograph by David J. Meltzer.

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Sanchez et al. (2) necessarily fall back on circumstantial evidence: namely the “non-anatomical position of the bone in two distinct piles,” the presence of Clovis points among the bones, and the observation that a point found 2 m from one of the gomphotheres remains appears to have broken on impact, indicative of its use as a weapon.

Although they may be correct in their surmise, it is a challenge to make the case on this evidence. That the gomphotheres carcasses were disarticulated is not unexpected regardless of the cause of the disarticulation, and before the position of the bones can be attributed to human action, it is necessary to account for natural processes that might have moved or removed bone elements from a death assemblage. That so few artifacts were found in immediate association with the bones is somewhat perplexing if the carcasses were fresh kills being butchered for meat, an activity that requires more or less constant resharpening of knives or points being used as knives (as Clovis points often were). Finally, that one of the Clovis points snapped at its base could be a by-product of an impact when stone hit hide or bone, but such fractures have also been shown to result from activities unrelated to the use of a point as a weapon (5). This includes animal trampling, as Sanchez et al. show occurred at El Fin del Mundo, or that might occur when scavenging a toughened carcass—perhaps for meat if the animals were freshly dead, or bones for raw material if they were not (if the latter, the animals may have died at different times). Sanchez et al. (2) reject the idea of meat-scavenging, considering it unlikely two juvenile gomphotheres died together of natural causes, and their carcasses then exploited by Clovis foragers.

Resolving whether the gomphotheres were killed and butchered at El Fin del Mundo, whether their carcasses were scavenged for meat or bones, or even whether the association of points and bones at locality 1 was merely fortuitous might come from the surrounding uplands. There, Sanchez et al. document multiple concentrations of Clovis points and tools and argue these were contemporary with the artifacts found in locality 1, basing their argument on similarities in stone tool morphology, technology, and raw materials between the areas (2, *SI Appendix*). There is even the possibility that flakes found in separate areas might be refit to points or tools in other areas, which would confirm that contemporaneity. The camps have yet to be fully investigated, and thus far, no faunal

remains have been found in them, but if gomphotheres bones are found, these could prove they were indeed on the menu.

Gomphotheres aside, it would not be surprising if bones found in the camp localities included other animals. Such is the pattern at many Clovis sites, even at mammoth and mastodon kills (4). Moreover, many of the points in the camp localities are broken bases, none of which refit to specimens in locality 1. This suggests the points were used and broken elsewhere and their tips lost, perhaps in prey carcasses.

Why Hunt Proboscideans?

El Fin del Mundo is similar to a number of Clovis sites in the San Pedro Valley of Arizona, a few hundred kilometers to the north just across the international border (6). The points are broadly similar, even to the extent of including a Clovis point made of quartz crystal (2, figure 4C, 7). Crystal quartz is challenging to manufacture and vulnerable to shattering on contact (8, 9), making it a puzzling choice with which to fashion a weapon one's life might depend on when hunting a massive, aggressive animal with a thick hide. Proboscidean remains are found in all these sites, although the bones in the San Pedro Valley sites are mammoth, some clearly hunted, some perhaps scavenged (4). Without suggesting El Fin del Mundo and the San Pedro Valley sites were occupied by related groups, the distances separating them were well within the range of Clovis hunter-gatherers, who are known to have tracked (or perhaps traded) across many hundreds of kilometers (10).

Byers and Ugan (11) showed that there is a poor cost/benefit ratio to systematic hunting of large game; among modern hunters, the strategy has a high failure rate and little to recommend it as a reliable subsistence

strategy (12). It begs the question of “whether hunter-gatherers focused on megafauna anywhere during the Pleistocene” (11, pp. 1636–1637), let alone whether hunting caused the massive and widespread extinction of large animals that took place in North America toward the end of the Pleistocene (1).

That being the case, why target gomphotheres at El Fin del Mundo or mammoths in the San Pedro valley? One answer advanced by Speth et al. (13) is that, given the risk of the enterprise, large game hunting was perhaps less about provisioning and more about prestige. Being successful at such a failure-prone activity conveys social status among peers and competitors and provides a public good that marks the hunter as a powerful ally, dangerous adversary, or attractive mate (12). Burnishing that reputation likely had social elements attached to it, perhaps materially reflected in the use of seemingly impractical quartz crystal points, which often had a ceremonial purpose in other times and places (9).

Also, there may have been elements we will never see archaeologically (4), of the sort Teddy Roosevelt glimpsed soon after he took down a bull elephant (and was side-swiped by another) on a postpresidential hunt in Africa: “The gun-bearers, as they walked ahead of us camp ward. . . began to improvise a song, reciting the success of the hunt, the death of the elephant, and the power of the rifles” (14, p. 289). Of course at the core of that story, or whatever story might have been told at El Fin del Mundo at the end of the Pleistocene, there had to be a kill, for “as in other domains of male contest ‘trash talk’ may have its uses, but reputations for delivering the goods cannot be built upon it” (15, p. 64).

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