How Old is MVII?—Seaweeds, Shorelines, and the Pre-Clovis Chronology at Monte Verde, Chile

Jon M. Erlandson,1 Todd J. Braje,2 and Michael H. Graham3
1Department of Anthropology and Museum of Natural and Cultural History, University of Oregon, Eugene, Oregon, USA
2Department of Anthropology, Humboldt State University, Arcata, California, USA
3Moss Landing Marine Laboratory, Moss Landing, California, USA

Most archaeologists now accept that the Americas were settled earlier than the appearance of the Clovis and Nenana technological traditions (between ~13,500 and 13,000 calendar years ago), but some skeptics still remain. In a paper published recently in Science, Dillehay et al. (2008) reported important new radiocarbon (14C) dates on seaweeds that further support a Pre-Clovis occupation at Monte Verde II (MVII) near the Pacific Coast of Chile (see Dillehay 1989, 1997; Meltzer 1997). These new dates should help convince those archaeologists who still question that humans occupied MVII and other New World sites earlier than 13,500 years ago. The seaweeds, fortuitously preserved in waterlogged site deposits and recently identified in stored samples, are convincing evidence that Paleoindians at MVII foraged in estuarine and marine ecosystems as much as 15 and 90 km distant, respectively—or traded with people who did. Seaweeds and other uncarbonized plant remains rarely preserve in archaeological sites, but coastal peoples around the Pacific Rim collected and consumed a variety of marine plants in historic times, often drying, storing, and transporting or trading them over considerable distances. The presence of several types of seaweed at MVII—including the giant kelp, Macrocystis pyrifera—along with the presence of Pre-Clovis peoples near the coast of Chile, supports the kelp highway hypothesis (Erlandson et al. 2007; Steneck et al. 2002) and the idea that...
an early coastal migration contributed to the peopling of the Americas (see Dixon 1999; Erlandson 1994:268, 2002; Fedje et al. 2004; Fladmark 1979).

Equally significant are two relatively high-resolution AMS $^{14}$C dates on red algae ($Gigartina$ sp. and $Mazzaella$ sp.)—the first $^{14}$C dates from MVII on clearly short-lived samples processed with modern extraction and purification protocols, as well as high-precision AMS counting techniques. Both dates have calibrated (two sigma) age ranges between $\sim 14,220$ and $13,980$ cal BP, which now represent the best estimate for the age of the MVII occupation. An age estimate of $\sim 14,600$ cal BP is repeatedly cited by Dillehay et al. (2008) and other researchers (e.g., Goebel et al. 2008:1499) for the site, based on the average of multiple dates (with $1\sigma$ standard deviations of 440–120 years) for bone, ivory, wood, and charcoal samples presented earlier (see Dillehay and Pino 1997:44). The accuracy and precision of the conventional $^{14}$C dates obtained 20 or more years ago on samples of bone and ivory could be affected by now well-documented problems with dating ancient bone samples, while both conventional and AMS $^{14}$C dates on wood and charcoal measure the growth of the dated wood sample—not its death, as reported by Dillehay and Pino (1997:42)—and not its use by humans, an ‘old wood effect’ that can exaggerate the age of a cultural event by centuries (Schiffer 1986). Dillehay and Pino (1989:144–142) tried to compensate for this problem by identifying the types of wood dated and estimating the number of years represented by the growth of each sample. Trees can remain standing for many years after they die, however, and wood can preserve remarkably well when submerged or buried in saturated sediments.

Except for one clear outlier, a charcoal sample dated to $13,565 \pm 250$ RYBP (TX-3208), Dillehay and Pino (1989, 1997) argued that an older cluster of dates most accurately represents the age of the MVII occupation. The new, high-precision dates on short-lived red algae samples suggest otherwise. In fact, several of the previously reported dates obtained for bone, ivory, and burned or carbonized wood from the cultural stratum at MVII are consistent with these new AMS $^{14}$C dates. Rather than accept that these younger dates might define the most likely age of what is argued to be a single and relatively short-term human occupation at MVII, Dillehay and Pino (1997:48) reject them in favor of five dates for culturally modified wood, with $^{14}$C ages ranging from $12,230 \pm 140$ RYBP (Beta-6755) to $12,780 \pm 240$ RYBP (Beta-59082), with an average radiocarbon age of $12,570$ RYBP, or approximately $14,670$ cal BP. To justify this, they argue that ‘old wood’ would not last long in a temperate rainforest environment—although some trees killed in an AD 1700 earthquake along the mesic coasts of Oregon and Washington are still standing—and that Monte Verde’s occupants “probably did not have the stone tool technology to fell large trees or to cut large, older branches,” although they also note that a large quartzite biface recovered from the site “could easily cut through wood” (Dillehay and Pino 1997:48–49).

Today, standard chronological hygiene practices (see Fitzpatrick 2006; Hunt and Lipo 2006; Spriggs 1989; Waters and Stafford 2007) for evaluating a series of $^{14}$C dates exclude dates with large errors and accept as most reliable the younger and higher precision dates obtained for a single component occupation, especially those dates derived from the analysis of short-lived samples.
Although several fragments of modified wood stakes or timbers from the cultural horizon at MVII were dated, none of the 33 pieces of cordage made from short-lived Juncus or Scirpus reeds were dated. Given that the relatively high-precision AMS dates on seaweeds are the only $^{14}$C dates from the cultural horizon at MVII obtained for clearly short-lived samples, the principles of chronological hygiene would place the most likely date of the human occupation of MVII at approximately 14,100 cal BP, some 500 years younger than the age repeated multiple times by Dillehay et al. (2008). Dillehay et al. (2008) also calibrated the seaweed dates as terrestrial rather than marine samples, arguing that red algae do not incorporate older marine carbon into their tissues. Marine algae can incorporate old marine carbon into their tissues where coastal upwelling occurs (Raven et al. 2002; Robinson 1981), however, so even the dates on seaweeds could potentially exaggerate the age of MVII by a century or two. Today, the northern coast of Chile is characterized by strong marine upwelling, and a deep sea core analyzed by Marchant et al. (1999) shows that upwelling was intense during the postglacial period from $\sim$14,500 to 11,500 cal BP. MVII is located south of this strong upwelling zone, however, in a transitional area of less intense upwelling (Mohtadi et al. 2005) where the oceanographic history is less well understood.

In summary, Dillehay et al. (2008) provided an important contribution to the ongoing debate about the timing and nature of the human colonization of the Americas, as well as the role of plants and marine foods in Paleoindian economies. When combined with the Pre-Clovis age of the site, the presence of marine and estuarine seaweeds in the MVII deposits and its proximity to the Pacific Coast support a high antiquity for the development of New World coastal adaptations and the likelihood that a coastal migration contributed to the initial peopling of North and South America. If the new AMS $^{14}$C dates for seaweed samples strengthen the case for a Pre-Clovis occupation of MVII, however, they also suggest that the occupation of the site took place closer to 14,000 years ago (cal BP; $\sim$12,000 RYBP) rather than the 14,600 cal BP repeatedly cited by Dillehay et al. (2008). Until high-precision $^{14}$C dates are obtained for clearly short-lived organic artifacts such as reed cordage from MVII’s cultural stratum, principles of chronological hygiene support the idea that this younger age is more tenable.

This younger age does not diminish MVII’s status as an extremely important Pre-Clovis site. A difference of 500–600 years is highly significant, however, in modeling early migrations through the Americas, coastal or otherwise. A younger age for MVII is also more consistent with current archaeological evidence for the earliest reasonably well-documented Pre-Clovis occupations in North America, now dated between about 14,600 and 14,200 cal BP (see Gilbert et al. 2008; Goebel et al. 2008). If, as an overwhelming body of genetic and archaeological data suggests, the Americas were colonized from northeast Asia, a shorter MVII chronology helps solve a major mystery: Why is there earlier widely accepted evidence for human occupation in southern South America than in all of North America? The new and more precise dates reported by Dillehay et al. (2008) for short-lived seaweed samples from MVII suggest that there isn’t. To further refine the chronology of one of the most important archaeological sites in the Americas, additional samples of unambiguous artifacts (i.e.,
cordage) or food remains (e.g., burned edible seeds) made from unequivocally short-lived taxa should be submitted for high-precision AMS $^{14}$C dating. If implemented, we predict that such dating will show that MVII was occupied by Pre-Clovis peoples approximately 14,000 ± 100 calendar years ago.

ACKNOWLEDGEMENTS

We thank Mark Clementz, Scott Fitzpatrick, Madonna Moss, and Torben Rick for their comments on an earlier draft of this paper. Our paper was stimulated by Tom Dillehay’s response to minor concerns we expressed to journalists covering the release of the 2008 Science paper, which led us to delve deeper into the topic. Despite the chronological questions raised here, we deeply appreciate the many years of perseverance Tom has shown in leading a team of outstanding researchers who broke the Clovis barrier.

REFERENCES


Raven, J. A., A. M. Johnston, J. E. Kübler, R. Korb, S. G. McInroy, L. L. Handley, C. M. Scrimgeour,


