

## Biostratigraphic evidence supports Paleoindian population disruption at $\approx 12.9$ ka

Buchanan *et al.* (1) interpret an  $\approx 40\%$  reduction in the cumulative probabilities of radiocarbon dates at the beginning of the Younger Dryas ( $\approx 12.9$  ka) as noisy data inconsistent with human population decreases predicted by the extraterrestrial impact hypothesis (2). This reduction is, in fact, consistent with other biostratigraphic evidence suggesting an abrupt environmental perturbation at the onset of the Younger Dryas affecting human populations. Haynes (3) described a black sedimentary layer at 70 localities across North America dating to  $\approx 12.9$  ka as a stratigraphic marker horizon—where Clovis artifacts and select Rancholabrean fauna occur just below, but never within or above. Archeological sites containing both Clovis and immediately post-Clovis material are rare and, where present, are nearly always separated by culturally sterile sediments. Of the 11 well-dated credible Clovis sites (4), none has post-Clovis materials immediately above, suggesting a potential disruption in settlement or landscape use. The Clovis-age material at Blackwater Draw in New Mexico is poorly dated but is capped by a black sedimentary layer indicating a terminal age of 12.9 ka as summarized by Haynes (3) and ref-

erences therein. Folsom-age materials occur above the Clovis materials, but a hiatus of  $\approx 500$  years is suggested by an intervening sterile deposit (10–35 cm) and radiocarbon ages of 12.4–11.8 ka (3). This is also the case at the well-dated Clovis deposits at Shawnee-Minisink ( $\approx 12.9$ –12.8 ka) in Pennsylvania, which are separated from an upper Early Archaic deposit ( $\approx 11.5$  ka) by 1.71 m of sterile deposits (5). When biostratigraphic and radiocarbon evidence are taken together, they point to a post-Clovis decline in human populations consistent with the Younger Dryas impact hypothesis.

**James P. Kennett<sup>a,1</sup> and Allen West<sup>b</sup>**

<sup>a</sup>*Department of Earth Science and Marine Science Institute, University of California, Santa Barbara, CA 93106;* <sup>b</sup>*GeoScience Consulting, P.O. Box 1636, Dewey, AZ 86327*

1. Buchanan B, Collard M, Edinborough K (2008) Paleoindian demography and the extraterrestrial impact hypothesis. *Proc Natl Acad Sci USA* 105:11651–11654.
2. Firestone RB, *et al.* (2007) Evidence for an extraterrestrial impact 12,900 years ago that contributed to the megafaunal extinctions and the Younger Dryas cooling. *Proc Natl Acad Sci USA* 104:16016–16021.
3. Haynes CV, Jr (2008) Younger Dryas “black mats” and the Rancholabrean termination in North America. *Proc Natl Acad Sci USA* 105:6520–6525.
4. Waters MR, Stafford TW, Jr (2007) Redefining the age of Clovis: Implications for the peopling of the Americas. *Science* 315:1122–1126.
5. McNett CW, Jr (1985) *Shawnee Minisink: A Stratified Paleoindian-Archaic Site in the Upper Delaware Valley of Pennsylvania* (Academic, New York).

Author contributions: J.P.K. and A.W. wrote the paper.

The authors declare no conflict of interest.

<sup>1</sup>To whom correspondence should be addressed. E-mail: kennett@geol.ucsb.edu.

© 2008 by The National Academy of Sciences of the USA