LETTER

Incomplete Bayesian model rejects contradictory radiocarbon data for being contradictory

Kennett et al. (1) apply a Bayesian chronological model in an effort to support the hypothesis of Firestone et al. (2) that "a major cosmic episode of multiple airbursts/impacts occurred at 12,800 ± 300 [B.P.]." Bayesian modeling is a powerful tool because it is intended to incorporate and account for all available evidence. However, Kennett et al. (1) do not include radiocarbon data by Boslough et al. (3) and others in their new analysis because they found it contradictory, undermining their own objectives. Moreover, Kennett et al. (1) dismiss issues raised by the key data they omitted for being contradictory rather than incorporating it their Bayesian model.

Kennett et al. (1) cite our paper listing the arguments and evidence against the Younger Dryas impact hypothesis (3). The first citation was with a question in their introduction: "Have other researchers raised valid age-related issues?" (1). The second citation asserted the answer in the conclusions: "Bayesian analyses of 354 dates at 23 sites in 12 countries across four continents demonstrate that modeled YDB [Younger Dryas boundary] ages are consistent with the previously published range of 12,950–12,650 Cal B.P. . . ., contradicting claims that previous YDB age models are inaccurate" (1). However, Kennett et al. never mention or provide evidence contradicting our actual data or arguments in the body of their paper. For example, Gainey was one of nine key sites that Firestone et al. (2) presented as containing markers of a comet impact at the YDB. Among the putative markers were nanodiamond-containing carbon spherules. The carbon spherule radiocarbon data we published (3, 4) contradict a YDB age for the presumed markers. Gainey was not included in the Kennett et al. (1) Bayesian analysis because (according to figure 2 in ref. 1) it had the following disadvantages: few dates, large uncertainties, contradictory dates, bioturbation, and redeposition. However, our (3, 4) excluded spherule date of 207 ± 87 y B.P. has smaller uncertainty than other dates selected by Kennett et al. (1). Bioturbation and redeposition does not apply to our data because we directly dated one of the signature markers that was used to define the hypothesized event. More data on other presumed markers would indeed be useful, and we hope that sample splits will be made available to us for independent radiocarbon dating. Nevertheless, Kennett et al. (1) have no logical bases to exclude our data (3) from their Bayesian model or dismiss our conclusions that their previous age models were inaccurate. It is because they reject dates that contradict their model that Kennett et al. (1) arrive at a conclusion that contradicts ours.

ACKNOWLEDGMENTS. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under Contract DE-AC04-94AL85000 (to M.B.). A.C.S. was supported by Emeritus Fellowship EM-2012-054 from the Leverhulme Trust.

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1 Kennett JP, et al. (2015) Bayesian chronological analyses consistent with synchronous age of 12,835–12,735 Cal B.P. for Younger Dryas boundary on four continents. *Proc Natl Acad Sci USA* 112(32): E4344–E4353.

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(41): 16016–16021.

3 Boslough M, et al. (2012) Arguments and evidence against a Younger Dryas impact event. *Climates, Past Landscapes, and Civilizations, Geophysical Monograph Series*, eds Giosan L, et al. (American Geophysical Union, Washington, DC), Vol 198, pp 13–26.

4 Boslough M (2013) Faulty protocols yield contaminated samples, unconfirmed results. *Proc Natl Acad Sci USA* 110(18):E1651.

Author contributions: M.B. designed research; M.B., K.N., T.L.D., A.C.S., P.C., J.L.G., J.R.M., and P.J.B. performed research; and M.B., K.N., T.L.D., A.C.S., P.C., J.L.G., J.R.M., and P.J.B. wrote the paper.

The authors declare no conflict of interest.

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