LETTER

Layering in the Paleocene/Eocene boundary of the Millville core is drilling disturbance

In a study of a sediment core from the US Atlantic Coastal Plain (Ocean Drilling Program Site 174X-Millville), Wright and Schaller (1) claim to have resolved the onset of the Paleocene/Eocene carbon isotope excursion (CIE) across 13 y. Such a rapid change would require an enormous and instantaneous release of isotopically light carbon into the ocean/atmosphere, implicating comet impact. The claim rests on the interpretation of rhythmic layering in the sediment core as annual couplets but here it is proposed that they are an artifact of drilling disturbance.

When claystones are rotary cored they can fracture into "biscuits" that spin within the core barrel as drilling progresses (2). Slurry can be injected between and around them, later hardening into featureless muddy partings. We have observed similar features in some Eocene cores from Tanzania (3). Alternation of biscuits and partings can be surprisingly uniform, giving the false appearance of rhythmic bedding. However, the partings are congruent with the caking mud and are smooth when sliced, unlike the original sediment, which has a hackly texture. The published core photograph (figure 1 in ref. 1) clearly shows these distinctive features (Fig. 1).

When Millville was drilled, multiple difficulties relating to swelling clays and high pressure in the hole were documented, including slurry injecting the formation ("Operations" in ref. 4). Sediment loggers noted "banding in core may be due to injected drilling mud because of high mud pressure" (ref. 4, Core 91), and similar comments were made for Cores 103, 108, 121, and 139. The core containing the CIE, which is from within this general interval, had a total recovery of 10.5 ft from a drilled interval of only 10 ft (4), evidence of expansion by slurry.

Similar banding is known from three other boreholes in the same formation and one outcrop exposure (1). Judging from the available photographs (ref. 1 and references therein), the boreholes suffer from similar problems to Millville. The outcrop evidence could be critical, but there is no citation. Quasi-cyclic isotopic variations from the Wilson Lake B core that are used to support the claim that the banding is climatic (1) could have been affected by contamination with drilling mud.

The nature of the couplets should be relatively easy to confirm by close observation of the contacts with the encasing mud, geochemical fingerprinting, and thin sectioning. If artificial, thin sections ought to reveal flow and intrusion textures in the partings, which should contrast strongly with true bedding in the biscuits. Another tell-tale feature of this kind of disturbance is that spinning of the biscuits can leave concentric grooves on the contacts with the partings.

Even if heavily disturbed, the Millville core is significant because it appears to show a gradational onset to the CIE. If the duration of this interval can be determined even approximately by other means—for example, by foraminifer accumulation rates—then it still may be possible to test whether the onset was instantaneous and consistent with comet impact.

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Author contributions: P.N.P. and C.J.N. wrote the paper.

The authors declare no conflict of interest.

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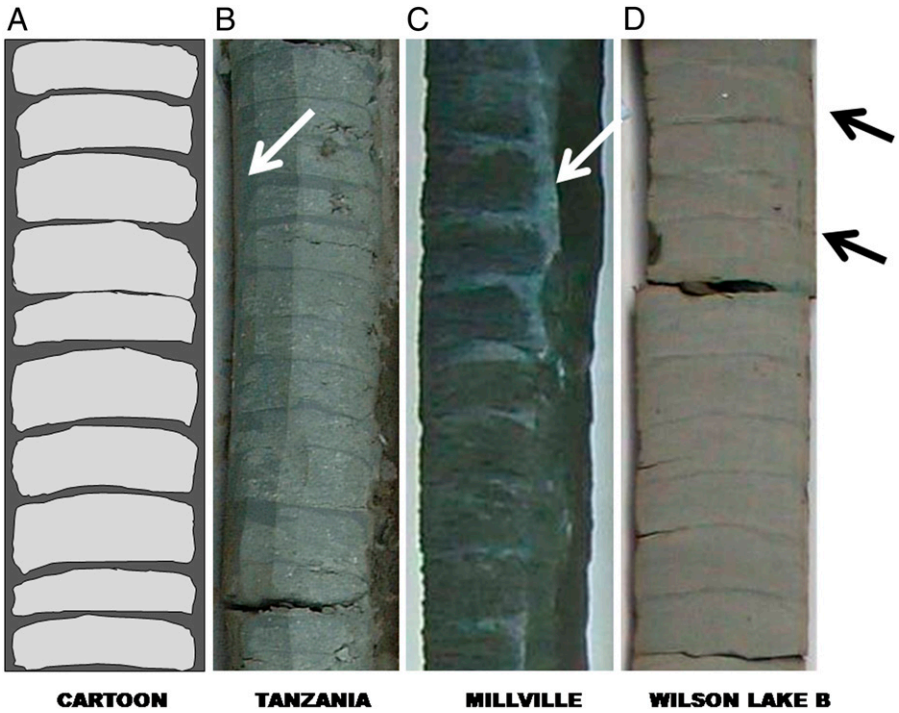

Fig. 1. Biscuiting. (*A*) Conceptual cartoon in which light gray represents biscuits of original core and dark gray represents injected slurry. Biscuits are fairly regular in thickness and tend to be slightly convex upward. (*B*) Detail of Tanzania Drilling Project Site 2, Core 22, external mud mostly scraped off. White arrow indicates continuity between partings and external muddy coat. (*C*) Detail of the CIE interval from Millville from ref. 1, external mud mostly scraped off. White arrow indicates continuity between partings and external muddy coat. (*D*) Detail of Wilson Lake B from ref. 1. Dark arrows indicate possible original bedding at an angle to the biscuiting. Vertical scale is ∼20 cm.