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Forum Reply

The oldest evidence of bioturbation on Earth

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Gámez Vintaned and Zhuravlev (2013) offer an alternative explanation for the Ediacaran-age ichnofabric observed in the Khatyspyt Formation of arctic Siberia (Rogov et al., 2012). The ichnofabric is developed in 70 m of thickness in sections located 35 km apart. Assuming that it was produced as a result of activity of mycetozoan pseudoplasmodia (slugs), the population density of these organisms would have been enormous (comparable to modern soils). Pseudoplasmodia form as a result of starvation; therefore, such a massive occurrence of slug traces as seen in finely laminated calcitic mudstones of the Khatyspyt Formation would require periodic basin-scale episodes of nutrient deprivation. Furthermore, these slugs would have been gigantic (compared to recent pseudoplasmodia, which are usually 2–4 mm long and 0.1 mm wide) and capable of active displacement of sediment. The only problem is that slime molds are strictly terrestrial; the aggregation of cells is achieved by chemical signaling, which is not possible in an unlimited aquatic environment (Bengtson et al., 2007).

These difficulties can be overcome by taking into account early diagenetic silicification processes. Backfilled burrows preserved in flint often exhibit distinctly irregular margins, with no trace of wall lining, eccentrically nested menisci, and significant variation in shape and width of the menisci (Bromley and Ekdale, 1984). The meniscate structures in silicified calcitic mudstones of the Khatyspyt Formation are virtually indistinguishable from the silicified backfilled burrows (Rogov et al., 2012, 2013) (Figs. 1A and 1B). In many instances, a sharp boundary of the meniscate structure can be established (Fig. 1C). Gámez Vintaned and Zhuravlev argue that the vertical meniscate structure (Rogov et al., 2012, our figure DR2 in GSA Data Repository item 2012122) cannot be an escape burrow because it does not conform with the slow sedimentation. However, this is not the case. The sedimentary layer with the ichnofabric is immediately overlain by a relatively thick event bed, and the ichnofabric is occasionally cut by erosional scours (Rogov et al., 2012, our figure DR3). The only explanation that we could find was that the Khatyspyt ichnofabric could only result from a purposeful burrowing by heterotrophic eukaryotes with an integrated, motile food-capturing and processing system based on a differentiated gut and complex motor-neuron control.

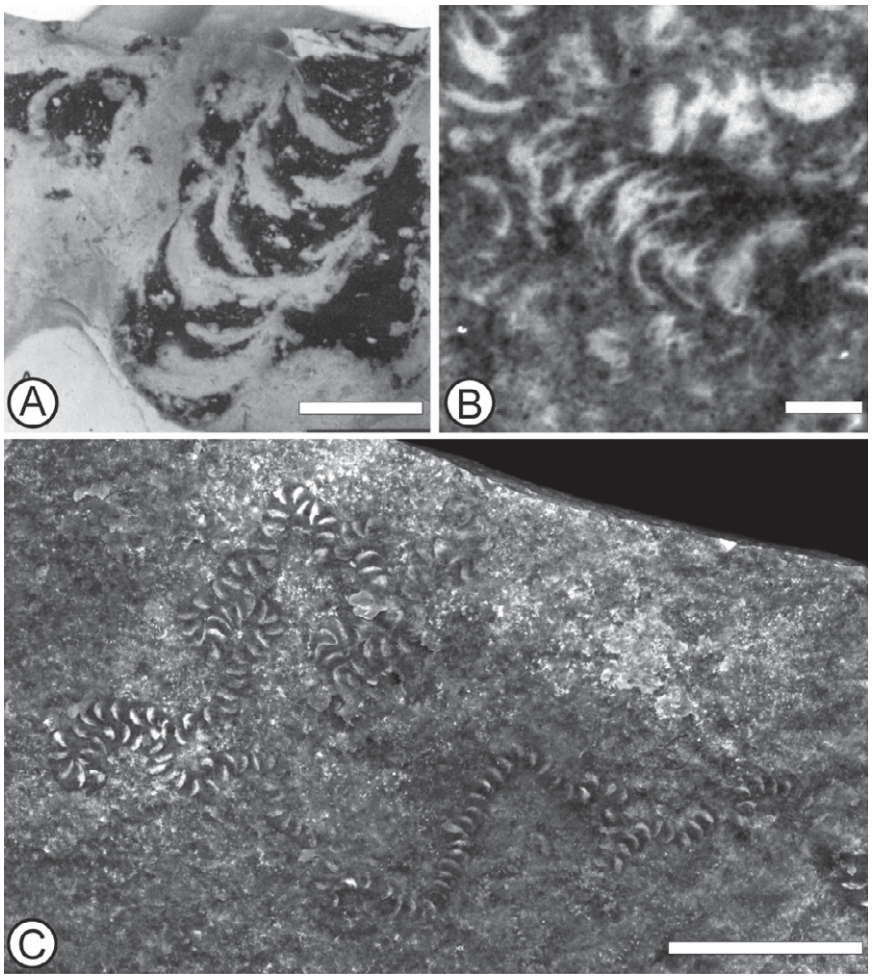

Figure 1. Taphonomy of the meniscate structure. A: Preservation of a backfilled burrow in flint, lower Danian chalk of Nye Kløv, northeastern Jylland, Denmark (Bromley and Ekdale, 1984, their Fig. 4A). B: Preservation of a meniscate structure in silicified finely laminated calcitic mudstones of the Khatyspyt Formation, arctic Siberia. C: Meniscate structure with a clearly defined boundary, Khatyspyt Formation, arctic Siberia. Scale bars: A, C = 10 mm; B = 1 mm.

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