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Supplementary Materials for

Late Ediacaran trackways produced by bilaterian animals with paired appendages

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Geological setting

The upper Ediacaran Dengying Formation (ca. 551–541 Ma) is well exposed in the Yangtze Gorges area (Fig. 1). It overlies the Doushantuo Formation, which has been dated between 635 Ma and 551 Ma (*40*). It can be subdivided into three lithostratigraphic units: the Hamajing, Shibantan, and Baimatuo members. The Hamajing Member consists of ~30 meters of light gray peritidal dolostone, with tepee structures and karstification features (*15*). The Shibantan Member consists of >100 meters of dark gray, thin-bedded, laminated micritic limestone deposited in subtidal environments (*15*). It contains a number of soft-bodied Ediacara-type fossils (*39*), animal trails and undermat burrows (*13, 15, 19*), problematic fossils (*41-43*), as well as potential biomarkers (*18*). The overlying Baimatuo Member consists of ~100 meter of light gray massive peritidal dolostone, characterized by abundant dissolution vugs and breccia (*15*). The lightly biomineralized tubular animal fossil *Sinotubulites* have been reported from this member and possibly the uppermost Shibantan Member (*44*). The Baimatuo Member is overlain by dolostone, limestone, and phosphatic cherts of the Yanjiahe Formation, which contains basal Cambrian small shelly fossils that allow the recognition of three successive assemblage biozones—the *Anabarites trisulcatus–Protohertzina anabarica*, the *Purella antiqua*, and the *Aldanella yanjiaheensis* assemblage biozones (*45*). The *Anabarites trisulcatus–Protohertzina anabarica* assemblage biozone stratigraphically coincides with a negative $\delta^{13}C_{carb}$ excursion (*46*), both of which have been used to approximate the Ediacaran-Cambrian boundary in South China (*47*). Insofar as the Ediacaran-Cambrian boundary is estimated to be ~ 541 Ma (*40*), the Shibantan Member is constrained between ~551 Ma and 541 Ma. This is consistent with a SHRIMP zircon U-Pb age of 546.3 ± 2.7/3.8 Ma from the Jiucheng Member of the middle Dengying Formation

in Yunnan Province, which is thought to be equivalent to the Shibantan Member (*48*) and a plethora of recently published new ages from Ediacaran-Cambrian boundary strata in South China (*49*, *50*).

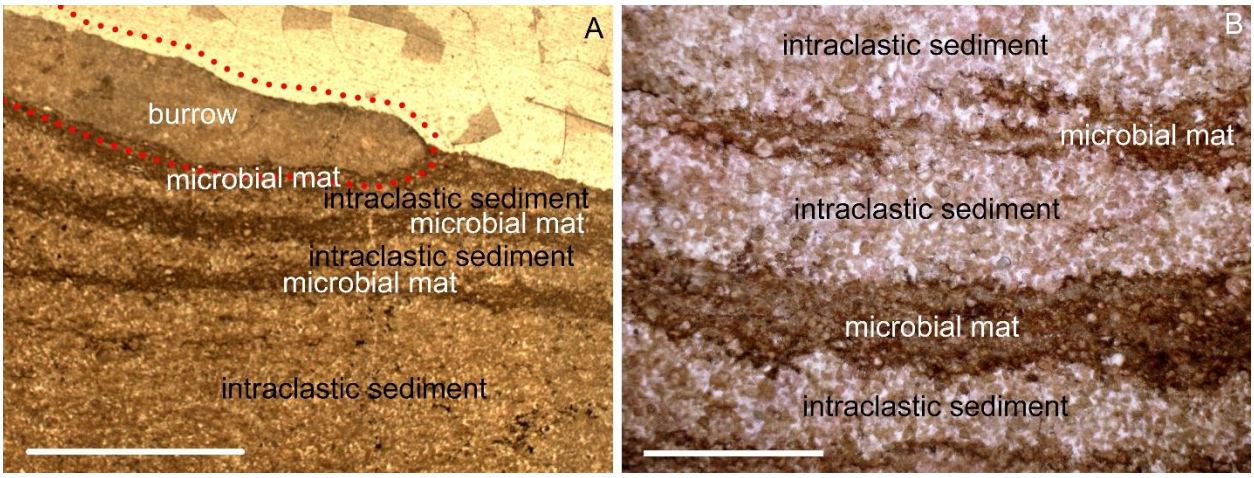

fig. S1. Transmitted light microscopic images of petrographic thin sections. (**A**) Oblique section of a Shibantan burrow that is filled with intraclastic sediment but typically with greater amount of cement than intraclastic sediment in the matrix. (**B**) Close-up image showing intraclastic sediment layers intercalated with microbial mat layers. Scale bar in (A) = 5 mm, in (B) = 1 mm.

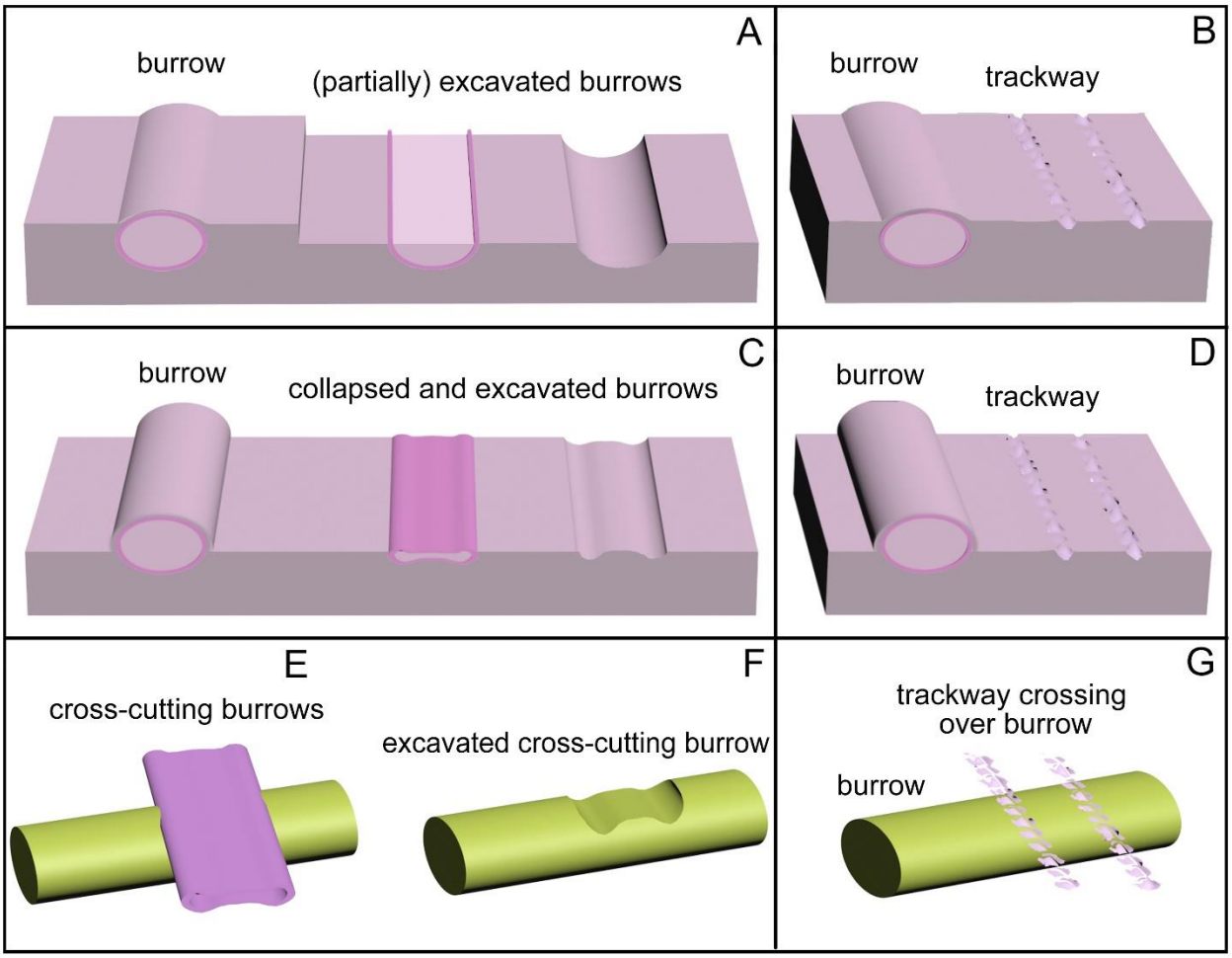

fig. S2. Schematic diagram showing expected differences between preservational variants of burrows and trackways. Schematic diagram showing expected differences between preservational variants of burrows (**A**, **C**, **E**–**F**) and trackways (**B**, **D**, **G**). Left column shows expectations and illustrate three-dimensionally preserved burrows and their various preservational variants, whereas right column shows corresponding observations and illustrate situations with three-dimensionally preserved burrows and trackways. (**A**) Burrows should show evidence of sediment disruption between lateral walls and excavated burrows would be preserved at a slightly different level. (**B**) Shibantan trackways are preserved on the same bedding surface as burrows and there is no evidence of sediment disruption between the two rows of tracks. (**C**) Collapsed burrows are expected to have lateral walls preserved as positive

epireliefs and excavation would reveal evidence for sediment disruption the two lateral walls. (**D**) Same as (B). Shibantan tracks are preserved as negative epireliefs and there is no evidence of sediment disruption between the two rows of tracks. (**E–F**) Cross-cutting burrows would cut into and disrupt pre-existing burrows. (**G**) Other than the imprints of the tracks, Shibantan trackways do not cut into burrows. Figure produced by Z.C. and S.X. using 3DS Max and Adobe Photoshop.