

Supplementary Online Material

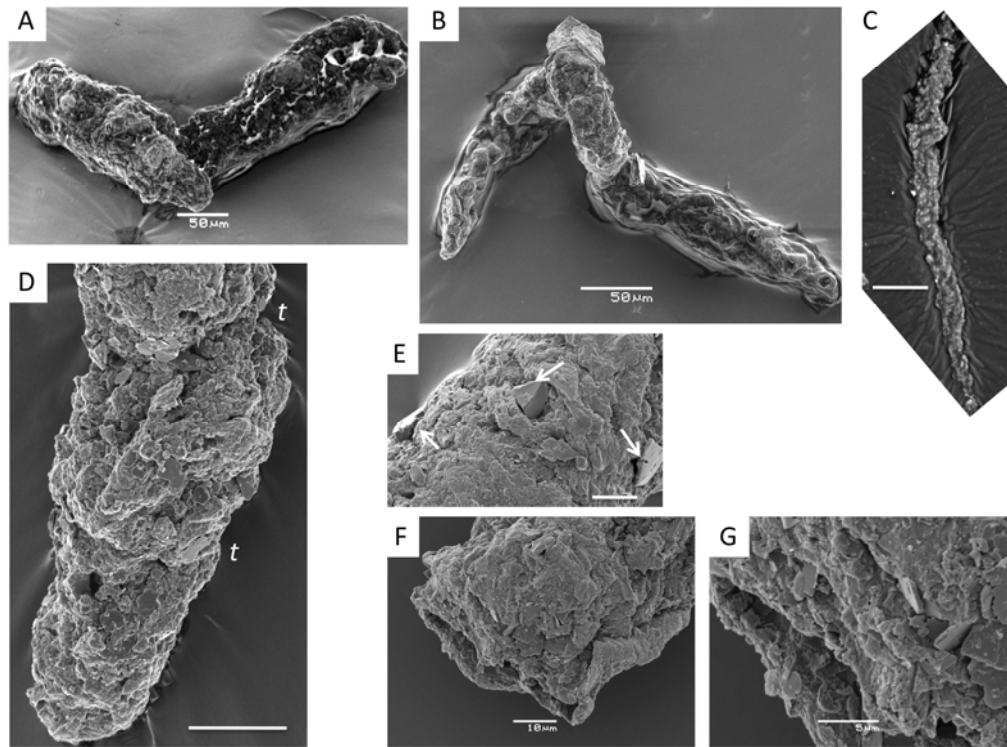


Figure DR1. Scanning electron micrographs of tubular structures. A. Tube with one rounded end. The tube was cut along the middle to expose the $>10\ \mu\text{m}$ thick wall and lumen (arrow). The brightest smooth areas are artifacts caused by the presence of organic glue that was used to mount the specimens. B. Three-dimensionally bent flexible tube. C. Long tube (backscattered SEM) covered by bright mineral grains. D. About $5\text{-}\mu\text{m}$ -thick mineral-covered walls around the lumen of a tube with transverse constrictions (*t*). The same tube is shown in Fig. 2D. E-G. Details of the tube shown in Fig. 2C. E. Larger mineral grains on the surface (arrows) are surrounded by many small platy mineral grains. F. Aperture. G. Aperture (detail) showing the coating of small mineral grains. Scale bars: $50\ \mu\text{m}$ in A, B, $80\ \mu\text{m}$ in C, $25\ \mu\text{m}$ in D, $10\ \mu\text{m}$ in E, F and $5\ \mu\text{m}$ in G.

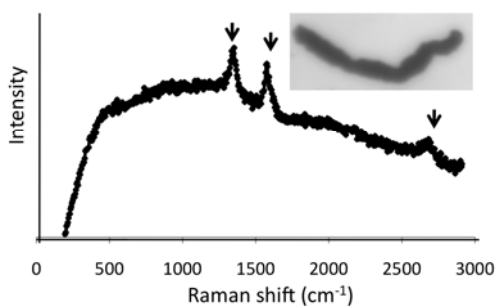


Figure DR2. Compositional analysis of representative tests. Raman spectrum of a representative test. Peaks centered at 1352 relative cm^{-1} and 1608 relative cm^{-1} indicate the presence of carbonaceous material (arrows) and are distinct from the Raman spectra of acetic acid (Mayo et al., 2011) that was used to extract the tests. Transmitted light micrograph of the analyzed test is shown in the inset. The SEM of the same test is shown in Fig. 2E in the main part.

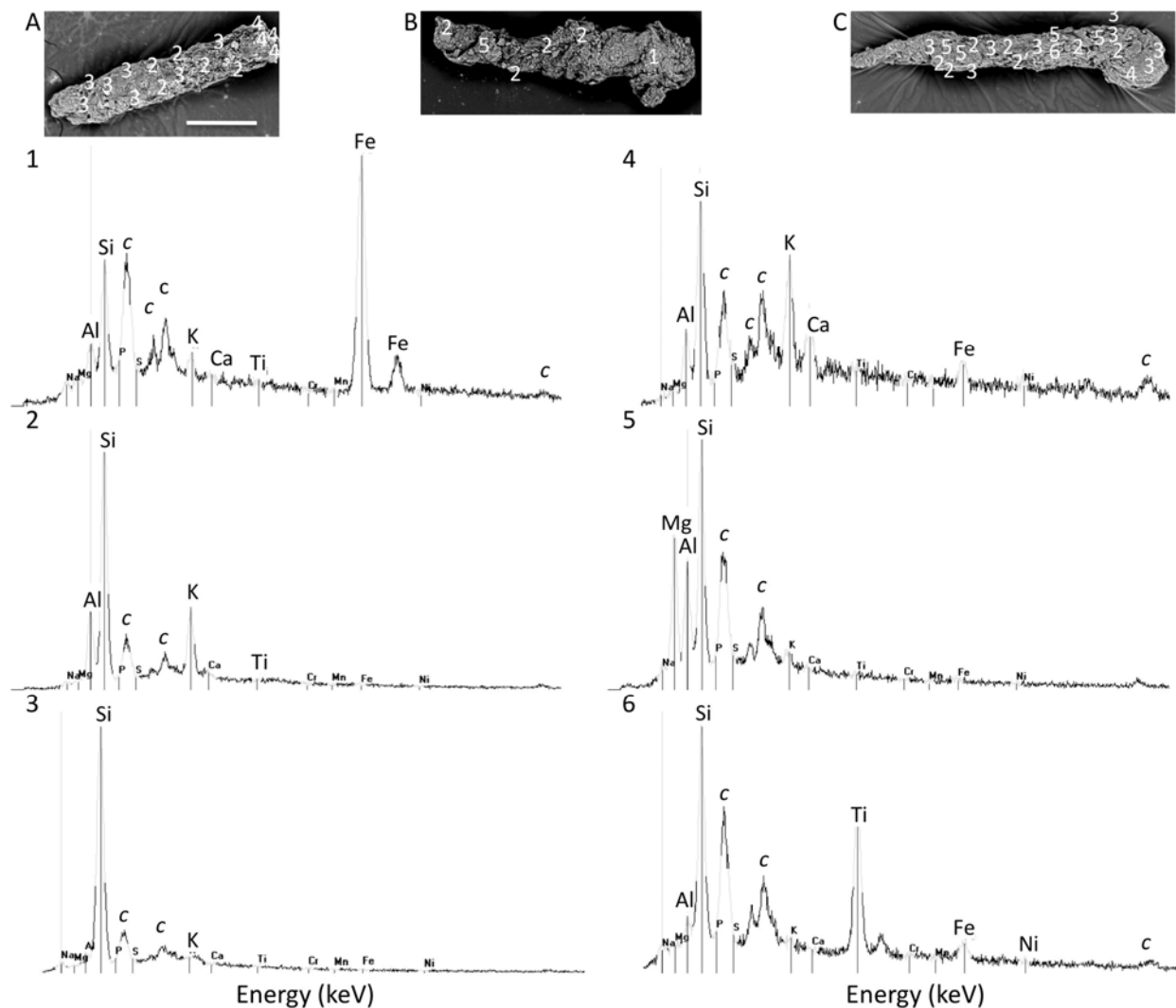


Fig. DR3. Compositional analysis of minerals on the surface of three representative tests by electron dispersive X-ray spectroscopy. A-C. Backscattered SEMs of three tests. Numbers 1-6 indicate the location of analyzed spots on the surfaces of tests and their respective spectra. Au and Pd in the spectra (marked by “c”) are coating artifacts. Spectrum 3 is quartz, the other spectra are consistent with muscovite and microcline. Quartz, muscovite and microcline were identified in the XRD spectra of the >100 μm fraction of the acid-insoluble residue (Bosak et al., 2011). Scale bar in A: 80 μm , B, C: 100 μm .

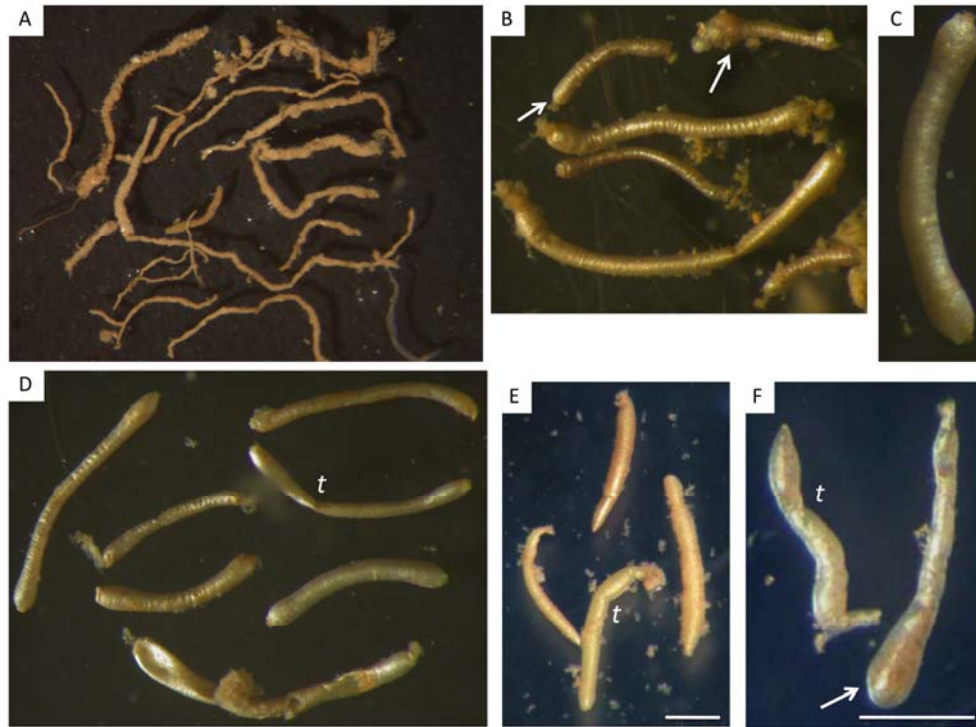


Figure DR4. Modern tubular agglutinated monothalamous foraminiferans analogous to the Cryogenian tubes. The width of these foraminifera varies along the length of the test and tests have bulbous or tapering ends. A. *Pelosina* sp. (photo: A. Gooday). Individual tubes are cm-long. B-D. Silver-brown saccaminids 125-500 μm long (Photo: A. Gooday). The flexible tests exhibit constrictions and many have bulbous ends. E. *Pelosina* sp. (Photo: A. Gooday). F. *Hyperammina* sp. (1). Scale bars in E, F: 100 μm .

References

1. Mayo, D.W., Miller, F.A., and Hannah, R.W. Course Notes on the Interpretation of Infrared and Raman Spectra. Wiley Online Library, 600 p.
2. Bosak, T. et al., Agglutinated tests in post-Sturtian cap carbonates of Namibia and Mongolia. *Earth and Planetary Science Letters*, v. 308, p. 29-40.
3. Majewski, W., Pawlowski, J. & Zajaczkowski, M. Monothalamous foraminifera from West Spitsbergen fjords, Svalbard: a brief overview *Pol Polar Res* **26**, 269-285 (2005).