Fossil worm tubes from the middle Miocene Bessho Formation in Matsumoto City, Nagano Prefecture, Central Japan

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Worm tubes are representative dwellers of present vents and seeps as with chemosynthetic bivalves such as vesicomyids, but worm tube fossil records are rare in comparison with bivalves. For example, Japanese fossil sites of worm tubes are only seven, while those of vesicomyid bivalves are over one hundred. This study reports worm tube fossils in a float of muddy concretion in Junizawa area, Mastumoto City, Japan. From Junizaawa, floats containing Adulomya uchimuraensis were also reported, but their original outcrops of fossil worm tubes and vesicomyids have not been confirmed.

The float containing worm tube fossils is spheroid with 20 cm long axis, and composed of muddy dolomite (δ^{13}C 4.43–5.58‰; δ^{18}O -1.68–-2.49‰ VPDB). The fabric shows irregular mixture of fracturing fragments of dolomicrite (creamy white on float surface, black on polished slab) and yellowish muddy surroundings. The boundary of dolomicrite and the muddy surroundings is gradual or sharply interfingering. The muddy surroundings sometimes show jigsaw break-up maybe caused by volumetric shrinkage during concretion. Muddy matrix contains brecciated grains of sparry calcite, over 1 cm in maximum length, which were maybe originally cavity-fill cement as generally observed in seep carbonates rich in vesicomyid fossils. Brecciated grains of sparry calcite also form small patches, 1 mm in diameter, with volcanic glass grains in muddy matrix. These suggest multiple fluidization and fracturing during consolidation of the muddy sediments.

The float contains more than 50 worm tube fossils, but the occurrence is restricted in dolomicritic parts. The tubes are same in size, 3 to 4 mm in diameter, with their inner space filled by silica, and gently curved, over 27 mm long. Almost all tubes are vertical to the long axis of the float. The tubes are not touched each other, but formed patches, a few centimeters in diameter. These suggest that the tube fossils are autochthonous in the original outcrop.

The tube walls and outer surface sculpture could not be recognized with naked eyes, but microscopic observation confirmed the tube to be only composed of thin organic sheet, less than 10 μm. The inner space of tubes were fulfilled by chalcedony, the growth of which flexibly deformed and scraped the organic wall. As far as is known, worm tubes only composed of such flexible organic wall in seep environments are siboglinids or chaetopterids.

Dolomite concretions containing vesicomyid bivalve fossils have been frequently reported, but in many case shells were dissolved and the space were amalgamated before concretion. In this case, tube fossil outline were preserved by chalcedony filling the inner space. This suggests that silicification timing is key for tube fossil preservation.

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