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Tube worm fossils or relic methane expulsing conduits?

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ABSTRACT

Chemosynthetic ecosystems teeming with tubeworm colonies were discovered at hydrothermal vents in the Galapagos Ridge in 1977 and at cold seeps at the base of the Florida Escarpment in 1984. As a result of these reports a number of fossil examples were identified in the rock record. One such assemblage was recognized in the Western Interior Seaway, in the Middle Campanian Pierre Shale Formation, where previous researchers noted siboglinid (formerly vestimentiferan and pogonophoran) tubeworms in methane-derived nodular limestones with tubules. On the inside these tubules have an outer ring of micrite with microparticulate siliciclastic materials and a core of calcite cement. Alternatively, they have an outer annulus of calcite cement and a core of microparticulate siliciclastic materials with calcite cements. Interestingly, the cemented cores can contain meniscate and vesiculate fabrics in association with the microparticulate linings. With this evidence we infer that the tubules preserve fabrics of former gas bubbles; the microparticulate linings are deposits that accumulated on the walls of the tubules as fluids streamed through them. Methane bubbles would have carried adhered siliciclastic microparticles and bubble wakes would have held entrained microparticles. We, thus, interpret the tubules to be former, small, subseafloor conduits along which fluid and particulate transport occurred. Particle transport by gas bubbles is a well-known process in chemical and mineral industries. Our observations highlight this process for the first time in an ancient geologic conduit system and provide a mechanism for maintaining particulate plumes that accompany effusing methane streams at modern seeps and vents.