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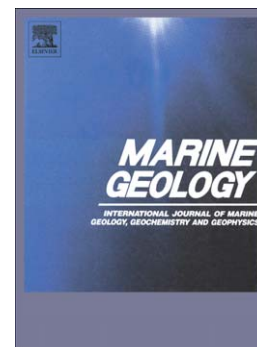
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A Methane-Derived Carbonate Build-Up at a Cold Seep on the Crimean Slope, North-Western Black Sea

Sofya A. Novikova^{a,*}, Yevgeny F. Shnyukov^b, Ella V. Sokol^a, Olga A. Kozmenko^a, Dina V. Semenova^a, Vladimir A. Kutny^b

^a*V.S. Sobolev Institute of Geology and Mineralogy, Siberian Branch of the RAS, 3, Akademik Koptug ave., Novosibirsk, 630090, Russia;*

^b*Government Scientific Institution Department of Marine Geology and Sedimentary Ore Formation, National Academy of Sciences of Ukraine, 55B, O.Gonchar street, Kiev, 01601, Ukraine*

*Corresponding author.

E-mail address: sa_novikova@inbox.ru (S. Novikova)

Abstract

A unique chimney-shaped carbonate build-up was produced by microbially mediated anaerobic oxidation of methane at a deep-sea cold seep. The build-up was sampled from 1600 m water depth in the area of the Lomonosov Rise (NW Black Sea, Crimean shelf slope). The carbonate chimney grew free into the anoxic water column, with its base attached to a steep slope composed of plagiogranite and void of sediments. The perfectly preserved 1.5 m high chimney stores reliable records of the diversity of mineralogy, geochemistry, and stable isotope composition of a deep-sea methane-related carbonates never studied before.

The build-up consists of Mg-calcite ($\text{MgCO}_3 = 9\text{-}13 \text{ mol.}\%$) with minor aragonite. The carbonate matrix encloses organic matter, and *Emiliania huxleyi* coccoliths, as well as minor framboidal pyrite, gypsum, barite, and diatomite fragments. The contribution of detrital silicate material is negligible. Micritic Mg-calcite in the inner zone of the chimney forms obtuse rhombohedrons clustered in hemispherical aggregates (clots) and hosts isolated prismatic aragonite ($\ll 1 \text{ vol.}\%$). In the outer zone, Mg-calcite exists as foliated crystals and spherulites, while aragonite spherulites are restricted to the top surface. The carbon isotope compositions of carbonates ($\delta^{13}\text{C} = -46.5 \text{ to } -33.0 \text{ ‰ VPDB}$) and remnant bacterial mats ($\delta^{13}\text{C} = -76.9 \text{ to } -81.6 \text{ ‰ VPDB}$) provide evidence of a biogenic methane source for the build-

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