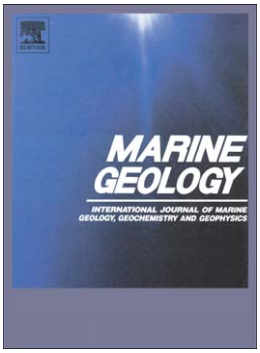

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PII: S0025-3227(15)00044-4
DOI: doi: 10.1016/j.margeo.2015.02.008
Reference: MARGO 5267

To appear in: *Marine Geology*

Received date: 23 September 2014
Revised date: 16 December 2014
Accepted date: 18 February 2015

Please cite this article as: Novikova, Sofya A., Shnyukov, Yevgeny F., Sokol, Ella V., Kozmenko, Olga A., Semenova, Dina V., Kutny, Vladimir A., A Methane-Derived Carbonate Build-Up at a Cold Seep on the Crimean Slope, North-Western Black Sea, *Marine Geology* (2015), doi: 10.1016/j.margeo.2015.02.008

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

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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 ($MgCO_3$ = 9-13 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 (<< 1 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 ($\delta^{13}C$ = -46.5 to -33.0 ‰ VPDB) and remnant bacterial mats ($\delta^{13}C$ = -76.9 to -81.6‰ VPDB) provide evidence of a biogenic methane source for the build-