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On morphology of methane-derived authigenic carbonates

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Studies of methane-derived carbonates revealed a great variety their morphological types. Although the processes of these carbonates formation is not clearly understood, it has been suggested that in general bacterially mediated processes of hydrocarbon oxidation, coupled with sulphate reduction, produce unusually high levels of alkalinity and dissolved inorganic carbon in the pore fluids that is partitioned between the precipitating carbonate and CO_2 rich plumes which emanate into the water column (Aharon, 1994).

These carbonates consist by three main $CaCO_3$ polymorphs - calcite, aragonite and dolomite. Carbonates with different petrography cemented from these polymorphs can be classified according to their specific locality mode of formation and biogenic or non-biogenic origin (Greinert et al., 2002). There are classifications for the authigenic carbonates which are based on petrography, morphology, or based on age and origin. In this work we will consider the petrographical and morphological differences of authigenic carbonates.

The large structures vary from 10 to 200 m size, named as chemoherm carbonates. Usually they cemented by pure aragonite with minor Mg-calcite admixture. These chemoherms rise up to 50 m above the seafloor. The structures are irregular in shape and have numerous pores and open pathways resulting from plumbing system of fluid expulsion. This type of authigenic carbonates was observed in the NE Black Sea (Michaelis et al., 2002), at the Hydrate Ridge area (Greinert et al., 2001), at Aleutian accretionary margin (Greinert et al., 2002).

Diagenetic carbonates - carbonate cemented sediments both growing at the seafloor or within the sediment framework and showing a large variety of shapes (chimneys, crusts, concretions est.), with grey to dark-grey color. Petrographically the carbonate cement represents by Mg-calcite, protodolomite and dolomite. The diagenetic carbonates occur widely in the fluid venting areas. In particular, diagenetic carbonate chimneys were observed in the NE Atlantic, in the Gulf of Cadiz (Diaz del Rio et al., 2003), offshore Morocco (Magalhães et al., 2002), at northern Kattegat (Jensen et al., 1992), in the Pobitite Kamani area, in north-eastern Bulgaria (Botz et al., 1993).

Clathrites (gas hydrate carbonates) are formed at the seawater/sediment interface or within the sediment in close contact with gas hydrates and bacterial mats. This type of the authigenic carbonates in direct contact with gas hydrates were identified and described by G. Bohrmann at Hydrate Ridge in 1998. According to (Bohrmann et al., 1998), they characterize by carbonate-cemented breccia composed of angular clasts cementing by Mg-calcite and aragonite. The brecciated structure causes by gas hydrate formation processes. A pure aragonite layers which form in elongated pores formerly occupied by gas hydrate are typical. This pseudomorphism resembles gas hydrate bubble structures. As a whole, clathrites are associated with bacterial mats on the seafloor next to gas hydrates and within the gas hydrate pore structure.

References:

G. Bohrmann, J. Greinert, E. Suess and M. Torres. Authigenic carbonates from the Cascadia subduction zone and their relation to gas hydrate stability: Geology, 1998, v. 26, pp. 647–650.

J. Greinert, G. Bohrmann, and E. Suess. Gas hydrate-associated carbonates and methane-venting at Hydrate Ridge: Classification, distribution, and origin of authigenic lithologies, in Paull, C. and Dillon W.P. ed., Natural gas hydrates: Occurrence, distribution, and detection: Geophysical Monograph 124: 87-98, American Geophysical Union, 2001, pp. 99-113.

J. Greinert, G. Bohrmann, and M. Elvert Stromatolitic fabric of authigenic carbonate crusts in 4850 m water

depth, Aleutian accretionary margin: Result of anaerobic methane oxidation by *Archaea* at cold seeps. International Journal of Earth Sciences, 2002, 91, pp. 698-711.

P. Aharon. Carbon and oxygen isotope tracers of submarine hydrocarbon emissions: Northern Gulf of Mexico. Israel Journal of earth Sciences, 1994, 43, pp. 157-164.

P. Jensen, I. Aagaard, R. A. Burke Jr et al. "Bubbling reefs" in the Kattegat: submarine landscapes of carbonate-cemented rocks support a diverse ecosystem at methane seeps, Mar. Ecol. Prog. Ser., 1992, 83, pp. 103-112.

R.W. Botz, V. Georgiev, P. Stoffers, et al. Stable isotope study of carbonate-cemented rocks from the Pobitite Kamani area, north-eastern Bulgaria. Geologische Rundschau, 1993, 82, pp. 663– 666.

V. Diaz del Rio, L. Somoza, J. Martinez-Frias, et al. Vast field of hydrocarbon-derived carbonate chimneys related to the accretionary wedge/olistostrome of the Gulf of Cadiz. Marine Geology, 2003, 195, pp.177-200.

V**.** Magalhães, C. Vasconcelos, L. Gaspar et al. Methane related aythigenic carbonates, chimneys and crusts from the Gulf of Cadiz, Geophysical Research Abstracts, 2002, Vol. 5, 12842.

W. Michaelis, R. Seifert, K. Nauhaus, T. et al. Microbial Reefs in the Black Sea Fueled by Anaerobic Oxidation of Methane. Science, 2002, 297, pp. 1013-1015.