

Biosignatures in authigenic carbonates from Hydrate Ridge

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Authigenic carbonates from Hydrate Ridge show complex assemblages of microbially mediated mineral precipitates. Miniaturized biomarker analyses combined with electron microprobe (EMP) and $\delta^{13}\text{C}_{\text{carbonate}}$ analyses were employed to attribute specific biosignatures to individual mineral phases.

Phase-specific biomarker analyses showed that most of the lipids (>90%_{w/w}) related to the anaerobic oxidation of methane (AOM) are concentrated within only a minor mineral phase (~20%_{vol}) of the Hydrate Ridge carbonates, whitish aragonite (Fig. 1). A second phase consisting of lucent aragonite contains only trace amounts of lipid biomarkers, whereas a third phase, gray micrite, shows minor amounts of AOM-biomarkers but a strong signal of water-column derived compounds. EMP mapping of the areas sampled for biomarkers revealed specific inorganic traits for these phases (Fig. 1), whereas $\delta^{13}\text{C}_{\text{carbonate}}$ values of all phases are in the range of methane-derived carbonates.

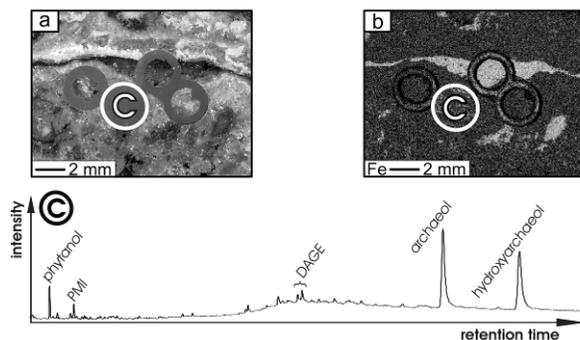


Figure 1: (a) Authigenic carbonate sampled for biomarker analyses and (b) EMP map showing Fe distribution (bright = high concentrations). (c) GC/MS chromatogram of the corresponding sample with source-specific biomarkers.

The results suggest that the whitish aragonite represents fossilised biofilms of mainly archaea of the ANME-2 group and sulphate reducing bacteria, whereas the lucent aragonite lacked the immediate proximity of microorganisms during formation. By contrast, the gray micrite formed by incorporation of allochthonous matter during carbonate precipitation induced by AOM involving ANME-1 archaea.

Impact of hypoxia on the remobilization of arsenic and selenium in the Lower St. Lawrence Estuary (Québec, Canada)

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Since the 1930s, bottom water dissolved oxygen concentrations in the Lower St. Lawrence Estuary (LSLE) have decreased by more than 50%, from about 135 μM to 60 μM , and have become permanently and severely hypoxic (i.e. $[\text{O}_2] < 62.5 \mu\text{M}$) since the 1980s [1]. This condition has major impacts on the diagenetic behavior of redox-sensitive elements in the sediments, such as manganese, iron, arsenic and selenium. These metals, which normally accumulate in the oxic layer of the sediment, may escape to the overlying waters in response to a thinning of the sediment oxygen penetration depth as the overlying dissolved oxygen concentrations decrease. Arsenic and other toxic metal concentrations may therefore increase in the water column and have adverse effects on the health of this aquatic environment.

Iron, manganese, arsenic and selenium fluxes at the sediment-water interface were measured following short-term (~48 hours) controlled-laboratory incubations at various overlying water oxygen concentrations. The results show no significant increase of iron, manganese and arsenic fluxes (selenium analyses are on going) as the overlying water O_2 concentration was decreased. In contrast, a comparison of cores sampled between 1982 [2] and 2007 brings to light changes in sediment chemistry over the last 25 years in the LSL. Porewater iron and arsenic concentrations within and below the suboxic zone have significantly increased, whereas the total solid concentrations are invariant. The dissolved phase is very sensitive and responds more rapidly to variations of environmental conditions. Hence, we may be observing a progressive response to the hypoxic conditions which established themselves at the beginning of the 80's.

[1] Gilbert *et al.* (2005) *Limnol. Oceanogr.* **50** (5), 1654–1666.

[2] Belzile (1988) *GCA* **52**, 2293–2302.