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Biogenic and abiogenic processes in deep sea reducing chemosynthetic hydrothermal vents and cold seeps

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Biogeochemical processes involving hydrogen, methane and sulphur are very active on the deep seafloor where hydrothermal vents and cold seeps are present. Strategies for exploration at different scales show an important flux of matter, energy and gases from the hard rock on mid-oceanic ridges or from mud volcanoes and pockmarks on continental margins. The sources of hydrogen and methane in hydrothermal hot vent fluids are abiogenic and derived from water-rock reactions in the crust and/or mantle, whereas the methane vented from sedimented ridges, hydrocarbon seeps, gas hydrate environments and other oceanic reduced habitats is thermogenic or biogenic. However, methane plumes are observed in both areas, and relations between physical (temperature, nephelometry) and geochemical tracers (Mn, CH_4, He,...) give important informations on fluid circulation and processes occurring in the hydrothermal plumbing system or in the sedimentary conduits. Along the slow spreading Mid-Atlantic Ridge, where methane degassing, hydrothermal activity and serpentinization are associated, the CH_4 anomalies observed in the seawater column are indicative of interactions in hydrothermal systems hosted primarily in basaltic rocks or linked to ongoing serpentinization process in ultramafics. Serpentinized peridotites are important components of oceanic lithosphere and their studies have deep impact on both the InterRidge and MARGINS communities, since they are exposed at slow-spreading mid-oceanic ridges, back-arc basins and sedimented margins. Chemosynthetic communities using methane and sulfide as the principle sources of energy occur in all these environments. In addition, the hydrogen produced in large quantities in ultramafic areas represents a widespread potential energy source for light hydrocarbons and organic molecules synthesis and for microbial metabolism in the subsurface. This hydrogen formed as a first product of serpentinization may be used by chemoautotrophic methanogenic and

acetogenic microorganisms during their fixation of carbon in CO_2 to organic matter, and hydrocarbons derived from CO_2 reduction may have implications for carbon cycling, petrogenesis, and origins of life. On Margins, methane synthesis and anaerobic oxidation of methane (AOM) are processes occurring in the sediments, particularly above gas hydrate layers.

Exploration strategies, tools and procedures at sea and results obtained recently in hot fluids from the Mid-Atlantic Ridge, brine pools on mud volcanoes from the Eastern Mediterranean Sea and gas hydrates collected in different areas will be discussed.