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Fluid flow associated ecosystems at continental margins

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Ocean margin research of the last decade has provided evidence for a variety of fascinating ecosystems associated with fluid, gas and mud escape structures. Habitats like gas emitting pockmarks, mud volcanoes, gas, brine, petroleum and asphalt seeps and destabilized hydrate reservoirs are colonized by bacterial mats, chemosynthetic fauna and a variety of associated animals. Cold seep systems bear a variety of microhabitats such as surface and subsurface sediments, oxic and anoxic patches, mineral concretions and symbiotic megafauna such as tubeworm aggregations and bivalve beds. Subsurface seep sediments harbor a great diversity and biomass of hydrocarbon degrading anaerobic bacteria and archaea along the fluid and gas escape pathways. Often, the chemosynthetic fauna, which harbors methanotrophic or sulfide oxidizing bacteria, is directly associated with these subsurface microbes. Chemosynthetic animals can directly profit from subsurface hydrocarbon degraders, because they produce sulfide via sulfate reduction. We are just beginning to understand microbial methane cycling in anoxic habitats and its regulation of gas emission, its link to the sulfur and iron cycle, and its relevance in transforming subsurface energy to support benthic communities at the seafloor.

Systems like the mud volcanoes and pockmarks represent distinct geological structures on continental margins, and are excellent natural laboratories for investigation of cold seep ecosystems. In several ESF EUROCORES EUROMARGIN programs we have started to investigate these seep structures such as the Haakon Mosby mud volcano in the Nordic Sea, carbonate concretions in the Gulf of Cadiz and mud volcanoes and pockmarks in the Eastern Mediterranean. The interaction between geological structures forming habitats for chemosynthetic life, and the benthic communities,

which shape these structures through their activities have been evidenced during recent submersible dive observations. The aim of recent studies through EUROMARGIN and other national and international activities is to describe fluid flow driven ecosystems by identifying the key organisms providing sources and sinks of carbon and by knowing their biodiversity and biogeography. This presentation will discuss the questions: Which are the key organisms and biogeochemical pathways shaping anoxic ecosystems of continental margins?; What is the nature of the associations between microbes and invertebrates forming effective filters for greenhouse gas emission?; What are the factors contributing to the spatial variability of community structure?; On which timescales do cold seep ecosystems develop, change and leave imprints in the geosystem?