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Relationship Between Fluid Flux Rates And Seafloor Features In The Northern Gulf Of Mexico Continental Slope

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Rapid and widespread fluid expulsion at the seafloor is a major characteristic of the northern Gulf of Mexico continental slope. A variety of seafloor features are associated with hydrocarbon venting from a leaky subsurface petroleum system. It is suggested that fluid flux rate determines the types of seafloor features, the occurrence of gas hydrate and chemosynthetic communities, and the degree of hydrocarbon biodegradation. The rates of fluid venting were qualitatively defined as rapid, moderate and slow. Mud volcanoes and mud flows represent the rapid flux settings. These are mud-prone environments that host only limited and localized chemosynthetic communities and have little evidence of hydrocarbon biodegradation. High heat flow is often associated with rapid fluid flux environments and retards the crystallization of gas hydrate. Residence time at these vent sites is so short that that gas and oil may be relatively unaltered by bacterial oxidation. Moderate flux settings include gas hydrate mounds outcropping on the seafloor. These environments are characterized by the most diverse, dense and widespread chemosynthetic communities that consist of bacterial mats, clams, tube worms, mussels and accessory organisms. Finally, slow flux environments are mineral-prone and include areas where authigenic carbonates precipitate from hydrocarbons oxidized by bacteria. The carbonates occur as nodular masses in sediments, hardgrounds, slabs, and mound-like buildups on the seafloor. Very localized chemosynthetic communities and highly biodegraded hydrocarbons are associated with slow flux environments. The qualitative approach to fluid expulsion sites as outlined above is a reasonably quick method to estimate fluid flux rates in the Gulf of Mexico. However, direct fluid flux measurements are critical to better establish the relationship between flux rates and seafloor features, and represent an important direction of future research.