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Interstitial and adsorbed light hydrocarbons in shallow sediments at coral reefs and pockmarks on the Norwegian Continental Shelf

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Judging from the visual and acoustic documentation of visible seepage of light hydrocarbons (methane - butane) through the seafloor, they apparently only occur at very few, specific locations on the Norwegian Continental Shelf (NCS). However, since 1983, Statoil and StatoilHydro have conducted numerous local geochemical sediment sampling studies for investigating links with surface features, such as pockmarks, carbonate crusts, bacterial mats, and coral reefs. The results show that even in shallow, oxic muddy sediments, low, but significant concentrations of light hydrocarbons are found, both interstitially and adsorbed to clay also probably carbonate particles. Because light hydrocarbons will be oxidized rapidly in an oxic environment, this fact alone demonstrates that there must be a continuous net flux of such hydrocarbons to the surface sediments, probably mainly from local buried source rock formations. Thus many basins of the world have geographically widespread microseepages of thermogenic hydrocarbons, as gas and as heavier hydrocarbons, up to C̃20. The results in the case of our study areas reveal that the concentrations vary locally, more-or-less in harmony with topographical and surface organic and inorganic features. These hydrocarbon concentrations correlate with topographical features such as normal and 'unit' pockmarks, with the location of bacterial mats, carbonate crusts, and, to some degree, with the location of coral reefs. The highest hydrocarbon concentrations have consistently been found inside pockmark craters, proving that they have been and probably still are sites of varying scales of seepage. Although some of the investigated deep-water coral reefs correlate with geochemical concentration trends, there are still too few results to make this into a statistically valid conclusion. Geochemical results are presented from the following locations: North Sea: Gullfaks and Tommeliten; Norwegian Sea: Haltenpipe, Nyegga, and Morvin. There are pockmarks at all these locations, bacterial mats / carbonates at Tommeliten and Nyegga, and coral reefs at Haltenpipe and Morvin.