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Gas emissions, gas hydrates and oil seeps in the Eastern Black Sea

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Bathymetric and sidescan sonar data from the Eastern Black Sea revealed a number of deep water cold seeps (gas emissions, near-surface gas hydrates and oil seeps) that have been studied further using coring and direct seafloor observation.

Offshore Novorossiysk (Russia) at least two structures related to fluid seepage have been observed in almost 2000 metres water depth. They have quite different signatures from the well-known mud volcanoes in the Sorokin Trough further west. Both structures are almost rounded with only a few hundred metres in diameter. One structure shows several broken concentric rings. In profile it is a small cone with a surrounding moat while the other structure occurring further offshore is much taller and does not show a moat. Both structures lack the interfingering with surrounding sediments that is characteristic for active mud volcanoes. The small structure is surrounded by "cracks" on the seafloor that are probably related to similar structures not yet fully reaching the seafloor. Sampling of both structures revealed the presence of microbial carbonate crusts and the smaller structures also showed oil seepage.

Some of the most spectacular cold seeps in the Eastern Black Sea are located on the continental slope offshore Batumi (Georgia) in 850-900 metres water depth. These seeps are located on a ridge named Kobuleti Ridge separating two canyons. The walls of one of these canyons show signs for additional, smaller gas seeps. Gas seeps are shown by both acoustic anomalies in the water column on raw sonar records and by

high backscatter intensity area on processed data. The seeps on Kobuleti Ridge are characterised by carbonate deposits at the centre and a much wider area where gas hydrates are present. Fractures of a NW-SE direction are present at the seep site and are probably related to the formation and decomposition of gas hydrate. Individual sites of gas emission apparently exert their influence on a circular area of up to 40-m in diameter. Gas geochemistry from gravity cores shows high gas content and a mixture of biogenic and thermogenic gases together with the presence of gas hydrates. The continental slope further offshore also shows two dome-like structures that show the presence of gas and oil seepage, similar to those offshore Novorossiysk.

Finally, the area east of Samsun shows yet another type of fluid seepage in about 1300 metres water depth. Here several irregular patches of high backscatter are imaged on sidescan sonar data. Some of these patches have almost no relief and correspond to complete acoustic blanking of the underlying sediments, while others show an irregular surface with little relief of less than 20 metres. Sampling of these sites revealed the presence of carbonate crusts and gas hydrates.

In summary the geoacoustic data from the Eastern Black Sea show a great variety in cold seep features and seep styles. In most cases there is no evidence for mud volcanism, rather gas emissions and massive gas hydrates occurring together. Although gas hydrates seem to be composed mainly of methane gas, higher hydrocarbons have been sampled and are evident by several oil seeps. The occurrence of the cold seeps in the eastern Black Sea seems to be related to overpressured hydrocarbon system as a response to the overburden created by the southward thrusting of the Greater Caucasus Fold Belt and the northward thrusting of the Eastern Pontides.