The multiple dimensions of the Black Sea degassing

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The Black Sea is the largest anoxic basin in the world that holds great promise for new non-traditional energy sources to supply the Black Sea countries and most of Europe as well due to the presence of huge methane resources stored in gas hydrates beneath the sea floor. The presence of methane is evident from outbursts of submarine mud volcanoes as well as numerous high-intensity gas seeps that release huge quantities of methane into the water column. While gas hydrates accumulate methane, submarine mud volcanoes, gas seeps, and gas bogs release it into the water column. This presentation identifies these Gas Related Features (GRFs) as either accumulating or degassing. GRFs are well known proxies for predicting the presence of oil and gas fields at depth.

Since 1990, the Ukrainian team of scientists headed by Acad. Shnyukov has investigated GRFs in the Black Sea over the course of numerous marine expeditions providing unique geological, geophysical, and geochemical data on GRFs obtained by high resolution hydro-acoustic, seismic-acoustic, and gravity methods, geothermal observations of the thermal regime of the water and uppermost sediments, gravity core sampling of bottom deposits, dredges and buckets, and study of these samples by lithological, geochemical, palaeontological, and biological methods.

It was discovered that a majority of gas seepages occur along the shelf breaks in areas of fault scarps on the sea floor, shallow subsurface faults, small grabens, and conical depressions on domes of gently sloping anticlinal rises. In regions of methane seepages, specific biogeochemical processes are evident that relate to the activity of methane-oxidizing bacteria resulting in the formation of diagenetic minerals (e.g., carbonate build ups). The distribution of gas facies shows major gas accumulations close to the sea floor in the coastal area and along the shelf break, as well as ubiquitous gas migration from the deeper subsurface on the shelf, and gas hydrate occurrences on the lower slope (below 750 m water depth). Gas release at the sea floor is abundant at water depths shallower than 725 m, which corresponds to the minimum theoretical depth for methane hydrate stability, but it occurs only exceptionally at water depths where hydrates can form. As such, gas entering the hydrate stability field appears to form hydrates, acting as a buffer for gas migration toward the sea floor and subsequent escape. In addition to structural features distinguishing sites of seepage, the composition of fluids and discharge rate often vary substantially, as does the diversity and abundance of seep-associated biota. A current analysis of the faunal biogeography in different seep ecosystems is completely lacking, however. Characterization of the variability in seep phenomena requires an interdisciplinary and integrated approach dedicated to seeps and their impact on oceanic budgets. This presentation will outline the main gaps in our knowledge and main directions of future research.