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Helium isotope signals observed in active methane seepage areas in the Black Sea and in the Pacific

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The helium (He) isotopic composition of sea water and of sediment pore water is set by atmospheric inputs, radiogenic production and inputs from the earth's crust and mantle (i.e. terrigenic inputs). As He transport in the crust occurs primarily by advection of fluids, He release at the sea floor depends on the presence of geological structures which allow fluid migration. Therefore, specific He isotope signals observed in the sea water and sediments of methane seepage areas may provide insights into the venting activity and the geological constraints of the gas release.

In the Black Sea, high He concentrations measured in the water column above selected methane (CH_4) seeps at the shelf edge indicate that the He release occurs together with the CH_4 seepage at these sites. The observed excess He shows a similar isotope ratio to that generally found in the Black Sea, and seems to have the same terrigenic source, which contains a significant mantle-type component. In contrast, the pore waters of sediment cores from the vicinity of a CH_4-gas releasing mud volcano located in the abyssal of the Black Sea have lower He isotope ratios and show strong vertical concentration gradients that indicate a distinct "mud volcano source" of He. The vertical concentration gradients observed in the sediment cores indicate that He diffuses from the sediment into the water column. No indication of a ^{3}He-rich terrestrial He component was found in the analyzed pore waters. Hence, the studied mud volcanos seem not to be a source of the mantle-type He that has been identified in the deep water of the Black Sea.

The results from the Black Sea will be compared to recent He analyses of water samples from areas of cold seepage off the east coast of New Zealand, where intense CH_4-gas emission takes place.

Reference C. P. Holzner, D. F. McGinnis, C. J. Schubert, R. Kipfer, and D. M. Imboden. Noble gas anomalies related to high-intensity methane gas seeps in the Black Sea. *Earth Planet. Sci. Lett.*, 265(3-4):396-409, 2007. doi: 10.1016/j.epsl.2007.10.029.