Behaviour of rare earth and trace elements during fluid venting at cold seeps

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Venting of methane-rich fluids is a widespread phenomenon at ocean margins. Seafloor expressions of focused fluid venting on continental margins are commonly referred to as cold seeps, which include a large range of geological structures such as pockmarks, mud volcanoes, gas chimneys, and brine pools. Because methane, as a greenhouse gas, plays a key role in the Earth’s climate, there have been significant efforts to quantify methane fluxes at continental margins, and assess their relevance to the global carbon budget. In marked contrast, however, very little is known about trace element biogeochemistry at cold seeps, and the impact of fluid seepage on ocean chemistry. Here, we report dissolved and total dissolvable (TD) rare earth and other trace element concentrations, Nd isotopic compositions, and data for well-established tracers of fluid seepage (TDFe, TDMn) for seawater samples collected in the water column above deep-sea fluid-escape structures from the Niger Delta (Gulf of Guinea, West African margin). These results indicate that fluid seepage in this area acts as a source of dissolved REE to bottom waters. Our data suggest however that the net input of dissolved REE from sediment to the ocean is quantitatively buffered through iron and manganese-oxide scavenging at vent sites. The importance of fluid seepage at continental margins on the global marine REE and trace element cycles will be discussed.