Cold seep systems: A source or sink for REEs in the ocean?

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Venting of methane-rich fluids is a widespread phenomenon on continental margins. Biogeochemical processes at cold seeps are being increasingly understood, but little is known about the impact of fluid seepage on ocean chemistry. For many trace elements, continental margins are the location of intense sediment/seawater exchange processes, which control their distribution in the water column, but have yet to be fully understood. Assessing whether cold seeps represent a net source or sink for these elements in seawater is important for better understanding marine biogeochemical cycles. Rare Earth Elements (REEs) are typically enriched 10-1,000 times in pore waters relative to seawater, and hence represent a potential tracer for fluid venting activity.

Here, we report REE data for seawater samples collected from the Niger Delta area in 2008, as a part of the ERIG-3D project funded by TOTAL and IFREMER. Samples were collected in depth profiles and bottom-water transects at several locations (pockmarks, mud volcano, reference site). REE were measured by SF-HR-ICPMS, using the Tm addition method [1]. Methane and dissolved trace metal contents were also determined on the same samples, which provided clear evidence for active fluid seepage in the studied area.

All samples display typical seawater patterns, and show no direct correlation with well-established tracers of fluid seepage (i.e. methane, dissolved Mn). However, the samples collected above areas of active fluid venting exhibit slightly higher REE contents relative to the reference site, suggesting that cold seeps may act a source of REE to overlying waters. Additional analyses for Nd isotopes in selected seawater samples and REE in pore waters will allow further understanding of the geochemistry of REE at cold seeps.

[1] Bayon *et al.* (2009) *Geostand. Geoanal. Res.* **33**, 51-62.

The geotechnical properties of Köstere (Torul-Gümüshane) landslide, NE Turkey

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In this study, engineering geological studied were conducted in order to facilitate safety analysis and mitigation of Köstere landslide (Torul-Gümüşhane, NE Turkey) and internal structure of the landslide and its surrounding environment were determined. The studied area is morphologically very mountainous and steep land. Besides, the study area and its around is exposed to high variations of precipitation during the year. Thus, heavy precipitation causes variable environmental problems such as landslides. The landslide under investigation is located 39 km north-western of Gümüşhane City (NE Turkey) in Köstere Village at the northern part of Torul Town. The study area is located in the Southern Zone of the Eastern Pontides. The Eastern Pontides is commonly subdivided into Northern and Eastern Zones on the basis of structural and lithological differences. The Northern zone is dominated by Late Cretaceous and Middle Eocene volcanics and volcaniclastic rocks, whereas pre-Late Cretaceous rocks are widely exposed in the Southern Zone. The oldest unit in studied area is Liassic aged basalt and agglomerate. Late Jurassic-Early Cretaceous aged unit consists of clayey limestone and massive structured karstic limestone. In the study area, Late Cretaceous units contain marl, clayey limestone, and dacite, riodacite and pyroclastics. The youngest lithologies are Quaternary aged talus and alluvium. The landslide happened on west slope of the Trabzon-Gümüşhane national highway and it affected the area with 13000 square meters. This landslide occurred on the talus with 20 meters in thickness have caused annual 5-20 cm displacement of the highway. Landslide developing as creep has endangered the traffic and the road safety. If the slope collapses down, in case of not taking precautions, sliding material can cause to form a lake by closing in front of Köstere stream. In the field, to determination of reliable stability analyses and mitigation, four boreholes were planned and detailed geotechnical studies were suggested. On the other hand, it can be proposed to be strengthened by piles and anchorages, and unstable slope should be rearranged with excavation.

[1] Robinson (1995) Turkey. *J. Geol. Soc*. **152**, 861-872.
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