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XRF geochemistry of Maya mud volcano (SAGAS 08 cruise Alboran Sea)

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Mud ascent as the result of active diapirism and mud volcanoes on the seafloor are common features in the Alboran Sea. It is thought that these have been developed during a compressional tectonic setting that produced folding and wrench tectonics throughout the basin. During the TTR 17 cruise of the R/V Professor Logachev (2008), several new and previously discovered mud volcanoes and structure mounds were sampled in the southwest sector of Alboran Basin. Most of the investigated mud volcanic deposits, such as Melilla and Maya structures, were covered by a thick drape of hemipelagic mud, suggesting that volcanoes are currently inactive.
The aim of this paper is to demonstrate the ability of high-resolution XRF core scanning based geochemical depth profiles to discriminate between mud volcanoes, mounds and hemipelagic sediments, and also to show high resolution geochemical profiles of the core 419G from Maya mud volcano.
For our purpose U-channels were subsampled from the centre of half-split gravity cores. High-resolution XRF data of 28 major and trace elements were acquired for each core on an Itrax Core Scanner at the University of Vigo by using Mo and Cr lamps. The acquisition was performed with in this case a 300 μm resolution and provided about 100,000 data point (i.e. XRF spectra), for each meter of core. We used carbon dating to estimate the age of the Maya mud volcano sediments. We also used a scanning electron microscope to do microanalysis and to study mineralogy.
The results show that down-core high resolution XRF scanner based geochemical profiles represented a good and quick screening tool for identifying authigenic methane-related carbonate-rich layers that may represent paleo-indicators for ancient methane seepage. Sedimentary Sr/Ca and Mg/Ca ratios have also been explored to infer the presence of authigenic aragonite (Sr-rich) and Mg-rich carbonate phases (high-Mg calcite, dolomite). The coexistence of methane anaerobic oxidation process and sulphate- reduction in the mud facies, indicate a high organic matter accumulation or a quite decreased oxygenation in the bottom. In contrast to the more hemipelagic facies, significant S peaks were detected in mud volcanoes associated facies. This finding is consistent with the occurrence of redox-sensitive elements peaks such as Cu and Zn in this facies, suggesting the presence of sulphidic phases in the anoxic levels.
In general terms, these kind of analysis provide us valuable information to study the meaning of diagenetic reactions related to organic matter degradation and its importance in the ocean global cycles. We can also study the distribution of several important paleo-environmental proxies which allow us to know the climate history and to understand the environmental change.

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