USE OF GEOCHEMICAL FEATURES TO IDENTIFY CHANGES IN RECENT SEDIMENTATION ON SEAMOUNTS OF THE DJIBOUTI BANKS AREA (NW ALBORAN BASIN)

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Abstract

The geochemical features in surficial sediments on seamounts of the Djibouti Banks allow determining a boundary between two sediment groups which fits with the seamounts summit break. The differences between these groups seem to be related not only with a physiographic limit but also with the influence of bottom currents, external inputs and geochemical processes.

Keywords: Sediments, Geochemistry, Trace Elements, Alboran Sea

Introduction and oceanographic setting

Changes in sediment features on seamounts can be related with both source and oceanographic conditions, but also geochemical interactions can be involved once particles are settled or along the water column. In order to ascertain the relation of those processes with the geochemical composition of recent deposits, a group of 28 sediment grab samples have been analyzed on two seamounts of the Djibouti Banks area (NW Alboran Basin). The studied seamounts are Avempace and Djibouti that show a tabular configuration at top with both tectonic and volcanic origin. The water masses involved in this area are the salty and dense Mediterranean water and the lighter Atlantic surficial water, which mixing process causes valuable effects on the geochemical transference between dissolved and particulate phases.

Results and discussion

Studied sediments are sandy mud and muddy sand with sand-sized foraminifera and ostracoda tests that also include variable amounts of glauconite grains. Neither heavy minerals nor quartz grains are observed in quite amount, what implies the sediment origin is mainly related to authigenic, pelagic and dust sources. Rare earth elements (REE) are quite sensitive to environmental changes. In order to evaluate the length of the fractionation along the series (Fig. 1), they have been normalized by Shale [1]. It can be observed an increase on $(La/Yb)_{Shale}$ index with depth as a result of the progressive enrichment of Light REE (LREE: La to Gd) that it is not showed by Heavy REE (HREE: Tb to Lu). This is due to the preferential removal of LREE by adsorption and/or scavenging onto clay-sized Al-bearing minerals. Otherwise, HREE are preferentially retained in solution as consequence of the formation of steady carbonate-ion complex in seawater [2] and almost do not show variation with depth, except if any external input is involved. In this latter case a possible Sahara dust input could enhance the Yb concentration observed in the sediment, but further studies are required to find the right relationship with this source.

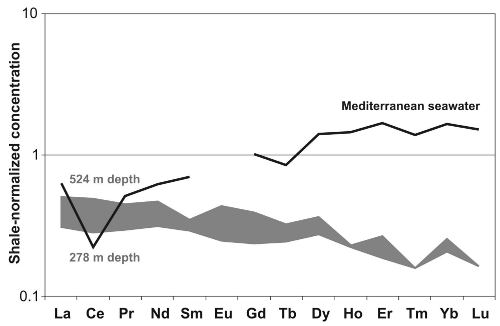

Fig. 1. Range of REE-Shale normalized pattern for sediment (ppm) with depth and average Mediterranean seawater (pmol kg^{-1}) [3].

Additionally, the depth evolution of selected elements has been studied in order to be used as geochemical proxies of sediment origin. The relation of Fe/K and Ca/Sr with depth (Fig. 2) show two main depths related to glauconite formation from foraminifera tests. Those depths are around 300 and 380 m for Djibouti and Avempace, respectively, and imply a low sedimentation rate on both summits. It is also in good agreement with the minimum content of lithogenic elements (Al, Li, Th, V, Ti) observed in the sediment composition that later increase with depth as a consequence of the phyllosilicate dominance on deep water sediments. This could be related with sedimentary inputs coming from bottom currents of Mediterranean origin that somehow prevent biogenic deposition at the slope of the seamounts.

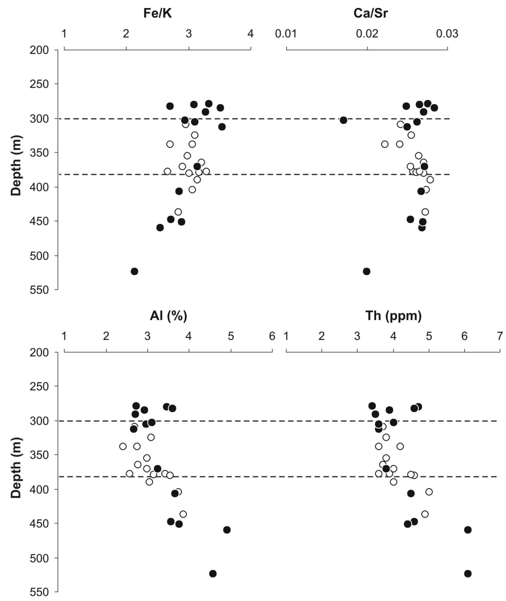

Fig. 2. Geochemical features of sediments with indication of the depth boundary (dashed line) where main changes occur on Avempace (open dot) and Djibouti (black dot) seamounts.

Conclusions

Preliminary results suggest a change on geochemical features in sediments deposited around 300 and 380 m depth for Djibouti and Avempace, respectively, that approximately fits with the physiographic summit break of both seamounts. According to this boundary two different sediment groups can be identified in recent deposits on the Djibouti Banks area. Shallower sediments are depending on geochemical reactions along the water column and biogenic deposition, while deep water sediments could be related with Mediterranean bottom currents and external inputs of Sahara dust.

References

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