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Provenance of the heavy metals in sand sediments of the Oman Sea (Sistan and Baluchestan district)

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Introduction

Mineral composition of source rock is one of the most important factors for concentration and distribution of heavy metals in sediments. Therefore, study on distribution of these elements and the related minerals in sediments provides information about natural origin of elements. Moreover, the interpretation of origin and distribution of sandy sediments is considerably enhanced by mineralogical and geochemical studies of these sediments.
The main objective of this research is to evaluate distribution of Zn, Cu, Sr, Cd, Fe and Mn in sand sediments of the Oman Sea, their relationship with mineral composition of the sediments and also determining their provenance.

Materials and Methods

Sampling of surface sediments of the Oman Sea was performed in 16 sampling stations. Heavy minerals and rock fragments of the sediments in fine and coarse sand sizes respectively were qualitatively and quantitatively studied by polarizing microscope (Folk, 1974; Pettijohn et al., 1981; Tucker, 1988). Concentration of the heavy metals were also analyzed by AAS method (Mico et al., 2008).

Result

Mineralogical composition of the studied sediments contain quartz, feldspars and heavy minerals in their order of abundances. The rock fragments consist of sedimentary, igneous and metamorphic in their order of frequencies as well. The concentrations of the studied heavy metals (in ppm) in the sediments are Cd (1.42), Cu (9.99), Zn (36.72), Sr (181.18), Mn (377.33) and Fe (20247.55) in their order of abundances.
Distribution of the Zn concentration generally shows decreasing trend from west of the study area to the Guatr Bay. The concentrations of Zn and Cu show close relationship with the frequencies of biotite and muscovite. The Cu concentration also shows positive correlation with the Zn and Fe concentrations. Distribution of the Sr and Cd concentrations is similar to variation of the calcium carbonate content. The Cd and Sr concentrations also show positive correlation with each other and the calcium carbonate content of the sediments.
A close relationship is also observed between the concentrations of Fe and Mn elements and the total amount of heavy minerals. Among the heavy minerals existing in the samples, biotite has the closest relationship with Fe and Mn. Among the rock fragments existing in the sediments, the amount of granitic rock fragments also has a very similar trend to variation of these two elements especially Fe.

Discussion

According to presence of Fe and Mn in structure of many heavy minerals such as biotite (Mange and Wright, 2007; Bradl, 2005), their main provenance can be biotite-bearing granites of Ghalaman complex, granodiorites existing in the ophiolite-melanges and the gabbros located in north of the Fanuch area mostly transported to the Oman Sea via the Rabech and Bahookalat water drainage basins.
The clastic carbonate grains were mostly transported to the Oman Sea by Rabech and Sergan-Mochgar watersheds to the Oman Sea.

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Biotite and muscovite could mainly originate from the granodiorite, granite, ophiolite-melange gabbro and the Eocene flysches of northeast of the region.

The main provenance of Zn could be granodiorites and gabbros existing in the Iranshahr ophiolites and flysches. According to close relationship between Cu and muscovite, provenance of this element can be granites, pegmatites and schists existing in the ophiolites and flysches of the region. Therefore, Zn and Cu are mostly transported to the Oman Sea and Guatr Bay via Bahookalat River.

Provenance of Sr and Cd are mainly the Fanuch and Chabahar carbonate formations. According to the enrichment factor (Sutherland, 2000) of the studied elements, the sediments are extra-highly to very highly enriched in Cd. The enrichment of Sr changes from medium to very high. Zn shows low to medium enrichment and the sediments are depleted in Fe, Cu and Mn.

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References

Bradl, H.B., 2005. Heavy Minerals in the Environment. Springer-Verlag, Berlin, 269 pp.

Folk, R.L., 1974. Petrology of Sedimentary Rocks. Hemphill Publishing Company, Texas, 182 pp.

Mange, M.A. and Wright, D.T., 2007. Heavy minerals in use: Development in Sedimentlogy 58. Elsevier, Amsterdam, 1283 pp.

Micó, C., Recatala, L., Peris, M. and Sanches, J., 2008. Discrimination of lithogenic and anthropogenic metals in calcareous agricultural soils. Soil and Sediment Contamination: An International Journal, 17(5): 467-485.

Pettijohn, F.J., Potter, P.E. and Siever, R., 1981. Sand and Sandstone. Springer-Verlag, New York, 618 pp.

Sutherland, R.A., 2000. Bed sediment-associated trace metals is an urban stream, Oahu, Hawaii. Environmental Geology, 39(6): 661-627.

Tucker, M.E., 1988. Techniques in Sedimentology. Blackwell, London, 394 pp.