Trace elements enrichment of coastal sediments near geological complexes: the relevance of defining proxies to element normalization

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Sediment contamination by trace elements (TEs) is usually estimated by comparison to natural levels at uncontaminated reference sites or to Earth's crust composition. Enrichment factors are calculated by dividing concentrations normalized to Al, Fe, Li or Sc to preindustrial values [2, 3, 4]. However, the identification of the source of enrichment is crucial to distinguish between natural enrichment from anthropogenic derived contamination. We examine this problematic from the coastal sediments nearby the geological complex of Cape Ortegal at NW of the Iberian Peninsula (SW Europe).

The northern coast of Galicia includes the Orteguera, Barqueiro and Viveiro Rias and the Cape Ortegal and Estacada-Bares, the northeastern most point of the Iberian Peninsula, surrounded by different geological domains (Fig.1). The Cape Ortegal includes the Ortegal allochthonous complex with abundant ultramafic rocks and metagranulites, lower metamorphic facies with pyroxenes, eclogite, amphibolite and serpentinites [6]. Minerals incorporated in these rocks with high content of Cr and Ni are chromite and gersdorffite and pentlandite (Ni) [7]. Moreover, lithology is dominated by a relative occurrence of rocks composing the series occupying the Ollo de Sapo Domain, which is characterized by metamorphic (mainly gneisses) and granite-type rocks [8].

The distribution of Cr, Ni and Co was similar to Mg, showing elevated values in sediments surrounding the Cape Ortegal, where Cr (760-1670 mg kg⁻¹) decreased gradually eastward shelf and landward rias. Similarly pattern was observed to Ni that varied within two orders of magnitude, from 75 to 1360 mg kg⁻¹. Cobalt content in shelf sediments also mimics the Mg with a gradual decrease from Cape Ortegal to east (70-4.7 mg kg⁻¹ in the shelf) and to the rias heads, down to 1.1 mg kg⁻¹ at Barqueiro.

The results point out the influence of the Ortegal Complex on the distribution of Cr, Ni and Co in surface sediments of that coastal region. In the boundary environments where lithogenic and anthropogenic contributions joined, geological complexes, such as the Cape Ortegal, increases the land-sea exchange of trace metals. Therefore, metal enrichment in sediments due to natural features should be carefully considered in the application of contamination status definition and UE Marine Strategy Framework Directives.

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