Heavy metal and rare earth element geochemistry in the mining influenced sediments of Mejerda watershed (Northern Tunisia).

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Abstract

In order to assess the impact of industrial activity mining, seventy two superficial sediments were collected from Mejerda river, tributaries and mining residues, in March 2002, October and November 2003. Studies have been based on trace metals and rare earth elements (REE) in the fraction < 63 µm. These elements were analysed by the neutron activation method. The results were expressed by binary diagrams, spidergrams and curves showing the concentration evolution against distance. NASC normalised REE display flat spectra illustrating the detrital or lithologic component of the sediment, resulting from the heritage of Mejerda watershed substratum. The homogeneity of these spectra reveals a unique source of sediment which corresponds probably to the Hoggar shield. Binary curves allowed ranging the elements in three groups: detrital, metallogenic and biogenic. NASC normalised metals allowed to quantify the mining impact on the Mejerda river sediment. The spidergrams show that Sb, Cs, Ag, As and Zn have high enrichment factor (EF >1000) in the mining residues, while in tributaries and mejerda river, it is either, relatively high (Sb, Cs, As), or have a value near to 1 (Zn, Ag, Pb). Moreover, the Mejerda river sediments are enriched with Cd and Br. Obviously, the latter are related to the triasic evaporates and carbonates, while the other elements have a metallogenic source. Zn, Ag and probably Pb are remobilised with iron in the mining residues, then are transported towards the sea. This study allowed understanding the contamination processes by metals in the rivers.

Key words: Tunisia, Mejerda watershed, Sediments, Mining residues, Impact, Metals, REE.

I. INTRODUCTION

The Mejerda River furrows the North of Tunisia and covers a distance of 500 km from its source in Algeria to the Mediterranean sea. River and its tributaries cross a watershed of 23700 km^2 surface and substratum composed mainly of evaporitic, argillous, carbonate and sandstone rocks from the Triassic to the present time age. The only magmatic event known in this basin side of Tunisia is represented by an effusive and intrusive alkaline magmatism (basalts and their differentiated trachytic products). An important mining activity has allowed the extraction of sulphide, sulphate and oxyde ores.

Actually, the river is overloaded with liquid and solid effluents produced by agricultural, urban and mining industrial activities. If pollution by heavy metals is well studied in Northern Mediterranean countries, it is on the other hand less known in southern ones, except some works which have started in the nineties (Rifaat and al., 1992; Ben Hamza, 1995; Sahnoun and al., 2005). In addition, the studies on the marine sediments highlighted the impact of the mines on the heavy metal concentrations in these mediums (Added and al., 2005; Oueslati and Added, 2006).The authors have shown that the pre-industrial sediments present metal concentrations rather high compared with those in the delta of the Rhone (Added, 1981).