

A NEW ANALOG FAMILY FOR VITRIFIED WASTES : PALEOMETALLURGIC SLAGS

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Vitrification is a more and more used process for stabilization of municipal or nuclear wastes. Frequently, It is important to predict their long term durability of these wastes. The study of natural or anthropic analogs is a method to estimate their behavior in natural conditions. We propose a new family of analogs for periods of time ranging from 100 to 4000 years. This period is intermediate between those of laboratory tests and those of natural analogs like basalts. Two kinds of slags have been studied, coming from two significant types of metallurgy : iron metallurgy and polymetallic metallurgy (for example, copper and lead). The slags present generally a vitrified upper surface. The study of altered zones on these surfaces makes it possible to propose mechanisms and determine the rate of alteration under natural conditions. It is also possible to characterize the toxic elements behavior.

In the iron metallurgical slags, toxic element concentrations are low. However, it is useful to study the alteration of these materials because their chemical composition are very similar to those of vitrified wastes (municipal wastes named "vitrifiats de REFIOM", A and B grade nuclear wastes). Because of the large variation of chemical composition of this type of slags, it is also possible to investigate the effect of composition on the rate of alteration.

Compositions of polymetallic slags are similar to those of iron metallurgical slags, but this material presents in addition high content of toxic elements (Pb, Zn, Co, Ni, As, Sb, Sn, Cu, Ba) sometimes up to several percent.

Observations show that the natural alteration of these ancient slags corresponds to the first step of alteration (formation of an altered layer and oxy-hydroxides), relative to what is observed in natural rocks, such as basalts (formation of clays and zeolites). Pollutant elements (Ba, Pb or Zn) are not retained in this altered layer and are released in the surrounding environment. The average rate of alteration ranges from 20 to 180 $\mu\text{m}/1000\text{y}$, a relatively low value, compared to those

obtained from studies of natural rocks. This rate seems to be correlated with the polymerisation state of the material.