WASTE ROCK CHARACTERISATION SUPPORTING A BETTER EXPLOITATION AND REMEDIATION DECISION-MAKING

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The exploration and exploitation activities are fundamental to our society, as the demand for raw materials is high. By contrast, more than 95% of the material moved for the extraction of metals and metalloids is accumulated as waste (DA ROSA *et al.,* 1997). Within the mine wastes, the larger volume is made up of *waste rocks,* some of which are earth materials with metal and metalloid concentrations (many of which are *potential toxic elements PTE*) too low to be economic but high enough to be a source of environmental pollution. Waste rocks have a significant environmental impact, particularly since they are one of the main source of superficial and ground waters contamination. The process leading to this pollution is strictly related to a set of chemical reactions known as Acid Rock Drainage – ARD – or Acid Mine Drainage – AMD – (NORDSTROM & ALPERS, 1999; BLOWES *et al.,* 2003). Since companies are now turning to larger deposits with lower grade ores, the amount of mine wastes will increase more and more (HUDSON-EDWARDS *et al.,* 2011). For this reason, all the methodologies of prevention, reuse and recycling of mine wastes are encouraged (LOTTERMOSER, 2011).

To choose the best available methodology and technology, waste rock management should begin with the correct and complete characterisation, including both geochemical, mineralogical and geotechnical features (JAMIESON, 2011). Moreover, geostatistical analysis of the data set allows to optimize the information obtained with respect to time and the money invested. In particular, knowing the correlation among the waste rock features, it is possible to design the further sampling campaigns and extend the analytical results to all the stock piles.

In this study two case histories are reported:

1) The first is the characterisation of the mine dump of Rio Marina (SERVIDA *et al.,* 2009), which is an old abandoned mine site exploited for Fe.

2) The second is the characterisation of the mine dump of Roşia Montană (SERVIDA *et al.,* submitted), which is an already exploited mine site and where an evaluation is going on with the resumption of Au mining.

At Rio Marina, the results show the occurrence of 4.46 x 10^6 m^3 waste rocks with As, Cu, Pb and Zn concentrations higher than Italian law limits for PTE in soils and characterised by high *net acid production potential*. Nevertheless, just upstream of the mining site, a formation of carbonate rocks outcrops, having *acid neutralising capacity*, so a reasonable solution to minimize both the environmental hazard and the invasive remediation could be to mix waste rocks with "in situ" carbonates.

At Roşia Montană, results show that the waste rocks of the Hop dump are composed by two different lithologies, one of which is acid generating while the other one is acid neutralising. ARD could be avoided by a designed stockpiling of waste rocks. Moreover, it was assessed that the mine dump is composed by waste rocks where PTE concentrations are below the limits screening level calculated according to international law (e.g., EPA, 1996), so it could to form the hypothesis that this dump is not the main source of PTE.

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