Rend. Online Soc. Geol. It., Suppl. n. 2 al Vol. 35 (2015) Congresso SIMP-SGI-So.Ge.I-AIV 2015

Mineralogical and geochemical spatial analyses of waste-rock dumps: a case study from the abandoned Rio Bansigo sulphide mine (eastern Liguria, Italy)

Marescotti P.*[1], Solimano M.[1], Marin V.[2], Salmona P.[2], Vassallo P.[1], Brancucci M.[3] & Lucchetti G.[1]

1. DISTAV, Università di Genova. 2. Dipartimento di Scienze per l'Architettura, Università di Genova.
3. Geospectra S.r.l. (Spin Off Università di Genova).

Corresponding email: marescot@dipteris.unige.it

Keywords: Field portable EDXRF, waste-rock dumps, ecotoxic metals.

The waste-rock dumps are heterogeneous deposits piled up during mining exploitation which are often sites of environmental concern because they commonly contain high concentrations of metals and metalloids, which may be released to the circulating waters during weathering. One of the major problems in characterizing the chemistry and the metals distribution of the waste-rock dumps is represented by the significant vertical and lateral heterogeneities in grain size, lithology and mineralogy. In fact, these deposits are commonly piled up during the different phases of mining exploitation over tens of years and contain either low-grade mineralizations or several types of host rocks. Moreover, the erosion processes continuously transform the deposit redistributing sediments downslope. For these reasons, the design of a sampling and analysis plan by means of traditional techniques may have unsustainable costs due to the large number of samples required. With this work we investigated the chemical composition and the metals distribution within a sulphide-bearing waste-rock dump using a field portable energy dispersive X-ray fluorescence spectrometer (FP-EDXRF, XMET7500,Oxford Instruments). The FP-EDXRF analyzer is designed to provide rapid, real-time analysis of metal concentrations in soil and mining samples. With this instrument, elements of atomic number ≥ 12 (Mg) can be detected and quantitated from trace level (ppm) to 100% in few minutes. The site chosen for this study is a small-sized dump (about 3500 m^2) from an abandoned Cu-sulphide mine (Rio Bansigo mine, eastern Liguria, Italy).

The use of FP-EDXRF allowed to perform a sampling plan using a sampling grid of 5 x 5 m within the waste rock dump perimeter and to apply a radial grid centered on selected metals hot spots resulted from the preliminary in situ analyses. The average throughput was 10 to 15 analyses per hour using a live count of 120 seconds. Analyses were performed on sample cups filled with sieved samples (< 2 mm).

Grain size, color, mineralogy, mineral chemistry and acid mine drainage potential were also determined on selected samples. The analytical data were processed using one-way analysis of variance (ANOVA) and the multidimensional scaling (MDS). Very detailed contour maps were then drawn for each metals, which allowed to evaluate the metal distribution in the entire mine dump area. Our results evidenced the feasibility of a detailed evaluation of metal hazard within waste-rock dumps using field-portable XRF device. The results obtained with the geostatistical elaboration promise to be a powerful tool to discern the composition of mine dumps and support the exploitation and remediation phases.