

# **Geographic Information Systems applied to mineral exploration. Case studies in North Portugal**

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One of the most important features for mineral resources exploration is the existence of spatial information from multi-sources, multi-dimensions, multi-types, multi-variables and multi-application fields. Therefore, speed and high efficiency are required when working in mineral exploration, a process including several stages which starts with small scale and after developed into larger scale. In every stage, geological, topographical, geophysical, geochemical data are collected, processed and integrated. Then, after finishing every stage is produced a mineral potential map. The main objective in using the spatial analysis is to delineate the main targets in a multistage mapping from regional to local scale. GIS can be useful in many stages of mineral exploration processes: data acquisition, storage, manipulate, and reporting. All types of geological datasets such as; geological maps, geochemical logs, geophysical images, boreholes, and mineral concentrations, can be shown and interpreted immediately using GIS. In a first case study GIS was used for the inventory, characterization and prediction of gold deposits. Integration of all information in a single reference system in order to make greater use of previous predictive studies performed on gold systems, and it is helpful also in the classification of the different kind of gold deposits. The study area was Lagoa Negra an old gold mine in northwest of Portugal. The methodologies that were used were very useful because outcrops are scarce. The integration and interpretation in a GIS of the geophysical profiles and geochemical data (soil sampling) allowed identify a structure with Au-Sb and As-Au mineralizations that can be extend to SE of Lagoa Negra until Rates where in fact was collected a chip sample with Au > 30 g/t on a old Sb mine, in the same alignment of the mentioned anomalies. Another application was focused on of the most important lithium pegmatite fields that are being explored in the Barroso-Alvão aplite-pegmatite field. This work demonstrates how to take advantage of stream sediment campaigns and GIS in exploration programs covering wide areas. A methodology has been developed for exploration of mineralized pegmatites using geochemical data (catchment basins) combined with GIS, helping on predicting the ore mineralogy. In this case study, our GIS-approach allowed to confirm the three types of pegmatite dikes, characterised by different mineralogical aspects: i) dominant petalite bearing dikes; ii) dominant spodumene -I bearing dikes; iii) pegmatites with petalite and spodumene-II + quartz (resulting from petalite breakdown). The type (i) and (iii) are place in catchment basins with high lithium and tin contents, whereas type (ii) is insert in catchment basins with high lithium and lower content in tin.

**Keywords:** Database, Exploration, GIS, Metallic minerals.