

Contribution of field portable XRF to the characterization of Columbo-Tantalite placer deposits of Issia, Ivory Coast

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The area of Issia is characterized by the presence of columbo-tantalite (CT) placer deposits redistributed. The placers are observed around granitic formations affected by pegmatite dykes that are more or less weathered. The study is aimed at testing the potential of portable XRF for the determination of the source and Nb-Ta-rich placers and, more generally, for the elaboration of a model of formation for this type of mineral deposits. The first objective was to determine if the pegmatites and granites were fertile. For this purpose, we have used a field portable X-ray fluorescence (FPXRF) for chemical mapping of granites and pegmatites. We found that none of the rocks analyzed were fertile, whereas accessory minerals such as tourmaline and garnet are relatively enriched in Fe with respect to Mn, reflecting a low degree of fractionation of the pegmatites. A second objective was the preliminary characterization of Nb-Ta minerals in the placer deposits, which were placed in the columbo-tantalite diagram. These measurements were validated with EPMA analyses and moderate differences were attributed to Fe-Ti inclusions in CT which affect the XRF measurements. Differences in composition are noted between different localities, whereas compositions are homogeneous for different grains on the same localities. Another objective was to test the capability of FPXRF to determine bulk rock compositions of the granites from multiple analyses. For this purpose, small blocks of granite (sugar shape) were cut and grids of 3*3mm cells were traced. FPXRF measurements were taken for each cell. Chemical maps were derived and reprojected on a picture of rock section using specific software developed in Python language. FPXRF analyses were then compared with bulk-rock ICP-MS analyses on the same samples and show very good agreements for Ti, P, Ca, Fe, K, whereas results are less encouraging for Al, Rb and or Ba. At last, FPXRF analyses were achieved on micas; these mineral are excellent tracers of Nb-Ta mineralization. Concentrations up to 700 ppm of Ta were reported but not confirmed by in-situ LA-ICP-MS measurements, and a better calibration of Ta appears to be required for future studies.

Keywords: columbo-tantalite, pegmatite, x-ray fluorescence, muscovite, phengite, biotite-Fe, zinnwaldite, lithium, cesium.