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Abstract: In order to face the challenges of mineral exploration in inhabited areas, portable XRF (pXRF) is gaining attention as a low-footprint exploration technique. To evaluate it, we revisited historic mining districts, simulating grassroots exploration with pXRF, within the UpDeep project under EIT-RM EU funding. A specific attention was given to strategic metals and mineral resources. A first study on a Sb district was presented at AIMS 2019 (Lemiere et al., 2019).

The second study was led around an historic W and kaolin district (Echassières, central France) where modern Nb-Ta-Li exploration is going on in an agricultural and forested area. We performed top soil sampling (Ah and B horizons) along profiles to understand better the endogenic geochemical anomaly signals.

The survey, limited to a fraction of the mining area, succeeded in recognising fault-controlled anomalies of several types (Cu-Sn-As, Fe-As) besides the cupola type W-Sn-As anomalies. Li and Be being beyond pXRF capabilities were not targeted.

Despite of an expected bias with laboratory analyses, pXRF measurements effectively located the various mineralised structures, thanks to their multi-element capabilities.

Composition data processing (CoDa) and horizon-selective sampling significantly improved the efficiency of the method. On-site measurements allow dynamic sampling and mapping, helping laboratory sample selection for further investigations.

The very high As background extending beyond mineralised areas is actually controlled by a NNE-SSW faults system. It can be used as a guide to possible fertile structures, but also to barren ones. The main Sn-W anomalies are located along a known structure, but much beyond previous mining works. Cu-Sn anomalies along another structure seem to confirm the location of ancient mining works.

Keywords: pXRF; tungsten; niobium; tantalum; arsenic; copper; mineral exploration; Echassières kaolin district