Recording of Weathering Profile Development by Uranyl-Phosphate Minerals

MÁRIO A. GONÇALVES[1], ANDRÉ PINTO[2], JOSÉ MIRÃO[3]

[1]Dep. Geologia and IDL, Faculdade de Ciências Universidade de Lisboa, Lisboa, Portugal; mgoncalves@ciencias.ulisboa.pt

[2]Department of Applied Geosciences, GUtech, Muscat, Sultanate of Oman; andrefilipe.pinto@gutech.edu.om

[3]HERCULES and Dep. Geociências, Universidade de Évora, Évora, Portugal; jmirao@uevora.pt

The Nisa granitic massif in Central Portugal hosts several scattered uranium mineralizations, including the Nisa deposit, the largest known uranium reserve hosted by metamorphosed contact sediments [1]. Mineralization is characterized by uranyl-phosphate minerals resulting from the development of a weathering front that is several meters deep. Torbernite (Cu) is the most abundant uranyl-phosphate in the granitic massif, variably substituted by uranocircite (Ba) in some areas [2]. Torbernite may also be replaced by iron oxy-hydroxides [2]. Other areas show relatively pristine torbernite crystals, such as those found in the centre of the massif. As we move outside the granitic massif into the metassediments, the major uranyl-phosphate becomes saleeite (Mg) and minor autunite (Ca). These minerals may also sometimes be replaced by uranocircite [1].

These uranyl-phosphate minerals primarily record the geochemical background environment where they form and the development of the weathering front. Short-length drill cores show that uraninite and sulphides occur at depth [1]. Therefore, experimental observations of torbernite and saleiite replacement by uranocircite [1, 3] suggests that: i) first stage weathering of sulphides and uraninite provide the ingredients for torbernite precipitation, while saleeite is related to weathering of Mg-bearing minerals such as chlorite and biotite [1]; ii) increasingly weathered feldspars may release Ba that promote the later substitution of torbernite and saleeite; iii) as weathering advances, local substitution of uranyl-phosphate minerals by iron oxy-hydroxides is observed. Such observations can be important to establish possible relations between uranyl-phosphate occurrences and weathering profile development, potentially serving as a proxy to the depth of primary mineralization.

Acknowledgments: FCT funding UIDB/50019/2020 – IDL and UID/04449/2017 – HERCULES.

References: [1] Prazeres, C. *et al*., 2018, *J Iberian Geol*, 44: 497; [2] Pinto, A. *et al*., 2012, *Chem Geol*, 312-313:18; [3] Andrade M. et al., 2015, *Comun Geol*, 102: 27.