Nb-Ta fractionation in peraluminous granites: a marker of the magmatic-hydrothermal transition

C. BALLOUARD [1*], M. POUJOL [1], P. BOULVAIS [1], Y. BRANQUET [1,2], R. TARTESE [3], J.L. VIGNERESSE [4]

[1]Géosciences Rennes, UMR CNRS 6118, OSUR, Université Rennes 1, 35042 Rennes Cedex, France (*correspondence: christophe.ballouard@univ-rennes1.fr)
[2]ISTO, UMR 6113 CNRS, Université d'Orléans, BRGM, Campus Géosciences, F-45071 Orléans Cedex 2, France
[3]IMPMC, Muséum National d'Histoire Naturelle, Sorbonne Universités, CNRS, UPMC, IRD, 75005 Paris, France
[4] Université de Lorraine, UMR 7539 GéoRessources, BP 23, F-54501 Vandoeuvre Cedex, France

In their last stages of evolution (i.e. at the magmatic-hydrothermal transition), peraluminous granitic melts exsolve a large amounts of fluids which can modify the chemical composition of whole-rock granitic samples and lead to the deposition of economicaly significant mineralization (Sn, W).

Nb and Ta are lithophile elements considered to be "geochemical twins" because they have the same charge and a similar ionic radius. However, Nb/Ta ratios are highly variable in granites. Some authors have demonstrated that the Nb/Ta ratios decrease in granites during fractional crystallization [1]. Other studies have suggested that Nb and Ta could be fractionated in evolved peraluminous granites during the interaction with late magmatic fluids [2].

In this study [3], we demonstrate, using a compilation of whole-rock geochemical data available in the litterature that fractional crystallization alone is not sufficient to explain the distribution of Nb-Ta in most peraluminous granites. However, we notice that most of the granitic samples displaying evidence of interactions with fluids have Nb/Ta < ~5. We propose that the decrease of the Nb/Ta ratio in evolved melts is the consequence of both fractional crystallization and sub-solidus hydrothermal alteration. We suggest that the Nb/Ta value of ~5 fingerprints the magmatic-hydrothermal transition in peraluminous granites. Furthermore, a Nb/Ta ratio of ~5 appears to be a good marker to discriminate mineralized from barren peraluminous granites.

[1] Stepanov, A., Mavrogenes, J.A., Meffre, S., Davidson, P. (2014) *Contrib. Mineral. Petr.* **167**, 1009–1016. [2] Dostal, J. and Chatterjee, A.k. (2000) *Chem. Geol.* **163**, 207–218. [3] Ballouard, C., Poujol, M., Boulvais, P., Branquet, Y., Tartèse, R., Vigneresse, J.L. (2016) *Geology* **44** *, 231-234.*