Abundant marine sulphate in the Palaeoproterozoic: Models come and go, but the rock record endures

V.A. MELEZHIK[1,2]*, A.E. FALLICK[3], D.V. RYCHANCHIK[4] AND FAR-DEEP DRILLING TEAM

[1]NGU, Postboks 6315, N-7491 Trondheim, Norway (*correspondence: victor.melezhik@ngu.no)
[2]University of Bergen, Postboks 7803, N-5020 Bergen, Norway
[3]SUERC, East Kilbride, Glasgow G75 0QF Scotland
[4]Geological Institute, 185610 Ptrozavodsk, Russia

An important consequence of progressive oxygenation of the Earth's biosphere through the Proterozoic was an increased rate of sulphide oxidation during continental weathering, with concomitant increase in marine sulphate concentration. Hence, accurate assessment of the marine sulphate reservoir is crucial for correct interpretation and reconstruction of the oxygenation history of Earth's early emvironments. The currently accepted view is that the Proterozoic biosphere shows protracted oxidation, but marine sulphate remains low until c. 800 Ma [1]. This view and the estimated size of the marine sulphate reservoir through the Proterozoic, was essentially based on (*i*) a model that involves S isotope variability, and (*ii*) the absence of massive Ca-sulphates in the geological record until the late Mesoproterozoic. A contrasting, and less popular view, based on geological evidence, suggests otherwise [2]. Recently, the controversy has been resolved by discovery of massive anhydrites [3]. At a depth of 2115 m in a c. 3500-m-deep drillhole in the Onega Basin in eastern Fennoscandian Shield ^{13}C-rich dolostones of Lomagundi-Jatuli age (335 m) were intersected followed by massive anhydrite and anhydrite-magnesite rocks (c. 100 m), nodular shale interbedded with massive anhydrite (190 m) and a c. 194-m-thick halite formation (70-75% halite, 12-20% anhydrite, 10-15% magnesite) containing large blocks (up to 1 m) of bedded, coarse-grained anhydrite and magnesite. The c. 500-m-thick sulphate-halite interval survived orogenic deformation and associated greenschist metamorphism. Thick dissolution-collapse breccias occurring basin-wide at more shallow depths suggest that the preserved section represents only a small fraction from that what was originally precipitated. Hence, the geological record in the Onega basin endured and revision of current models is essential.

[1] Kah *et al*. (2004) *Nature* **431**, 834–838. [2] Melezhik *et al*. (2005) *Terra Nova* **17**, 141–148. [3] Morozov *et al*. (2010) *Doklady Earth Science, Geochemistry* **435**, 230–233.

U-Pb dating of columbite-tantalite from Variscan rare-elements granites and pegmatites

J. MELLETON[1], E. GLOAGUEN[1], D. FREI[2] AND A. LIMA[3]

[1]BRGM, Mineral Resources Division, Orléans, France (j.melleton@bgrm.fr, e.gloaguen@bgrm.fr)
[2]Stellenbosch University, Central Analytical Facility & Department of Earth Sciences, Stellenbosch, South Africa (dirkfrei@sun.ac.za)
[3]Porto University, Center of Geology, Porto, Portugal (allima@fc.up.pt)

Rare-elements (Li, Cs, Ta, Be, Sn…) magmatism is well expressed in the European Variscan belt with mainly pegmatites and granites. These bodies are known in most of the different realms of the belt, but they are particularly abundants in localized parts of the Iberian massif, the French Massif Central and the Bohemian Massif.

U-Pb dating of columbite-tantalite from selected Variscan rare-elements granites and pegmatites of these three massifs has been performed using laser ablation system connected to a single collector magnetic SectorField - Inductively Coupled Plasma - Mass Spectrometer (LA-SF-ICP-MS). The main aims of this study are to investigate the timing of this magmatism in the Variscan belt and the chronological relationship with the surrounding granitoid suites. Our results highlighted the existence of several emplacement episods :

- in the Moldanubian domain of the Bohemian Massif, rare-elements pegmatites emplaced at around 340-330 Ma.
- in the North of French Massif Central, the Montebras and Beauvoir granites and the Chèdeville pegmatite lead to emplacement age at 315-310 Ma.
- in the North of Iberian massif, three different events have been recognized, with the emplacement of the Argemela granite at 326 ± 3 Ma, a first group of pegmatites emplaced at 310 ± 5 Ma, a second at 301 ± 3 Ma.

In this context, rare-elements magmatism do not look to be related to lower crust processes (i.e. granulitic metamorphism) and rare metal magmatism event appears diachroneous and polyphased.