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A Ta-rich low-P peraluminous granite: the Rechla cupola (Hoggar, Algeria) and associated pegmatites, the result of extreme fractionation of a A2-type magma.

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In the c. 525 Ma RMG province of the Laouni terrane of the Pan-African Tuareg Shield (Hoggar), the small N20°E elliptic Rechla cupola (200x100 m) is particularized by a rim of Qtz-Kfs-Znw pegmatite. It is a medium-grained Na-Li-F granite, with quartz, albite (An01), rare microcline, topaz, Mn-lepidolite ($\leq$ 8% MnO) and Hf-zircon, and: 71.4 % SiO_2, 0.93% FeO+MgO+MnO (Mg # 0.19, Mg/Mg+Fe+Mn 0.09), 9.22% Na2O+K2O (Na # 0.7), Al-Na-K-2Ca from 55 to 85, and low P2O5 (0.05%) and $\sum$ REE (23 ppm) contents, with a pronounced tetrad effect and <0 Eu anomaly in the REE pattern. Such a composition is typical of a low-P peraluminous RMG deriving from highly potassic calcalkaline suites (A2 type) (Linnen & Cuney 2005), enriched in F (1.6%), Li (1,600 ppm), Zn (300 ppm), Be (7 ppm), Sn (740 ppm), W (40 ppm) and specially Ta (165 ppm, Ta/Nb between 2.4 and 2.6), the latter as columbo-tantalite and Mn-wodginite (Ta # 0.8).
The pegmatite rim comprises, towards the intrusion (i) thick Kfs lenses (palissadic crystals $\geq$ 50 cm), (ii) a laminated quartz-zinnwaldite-(beryl) sequence , and (iii) a discontinuous band of fine-grained granite, with quartz, albite, topaz, Mn-lepidolite and beryl, equally fractionated: 69.4% SiO_2, 0.85% FeO+MgO+MnO (Mg# 0.06, Mg/Mg+Fe+Mn 0.02), Al-Na-K-2Ca = 32, F 0.4%, Li 610 ppm, Ta 240 ppm (Ta/Nb = 2.4), Be 500 ppm. The laminated sequence overprints the Kfs lenses. It comprises thick ($\leq$ 20 m) quartz lenses cross-cut by 10 cm-sized alternating bands of euhedral quartz and Mn-zinnwaldite ($\leq$ 6.5% MnO). REE-patterns of the Mn-Znw display a clear inverse tetrad effect, symmetrical of the granite pattern. At the boundary with the fine-grained internal band, euhedral quartz crystals are projecting toward the inner wall.
The Rechla body and its surrounding pegmatites are intrusive into a porphyritic biotite-granite representative of the evolved magmas of the A2-type Taourirt suite (Azzouni-Sekkal & Boissonnas 1993), with a classical “seagull” pattern and a pronounced <0 Eu anomaly. Geochemical modelling shows that the main Rechla magma is likely the fractionated product of this already differentiated magma, mainly involving quartz and Kfs. The pegmatite rim is interpreted as the result of the sequential crystallization of a Rechla-type melt, with late individualisation of a Fe-rich magmatic-hydrothermal phase responsible for the quartz-zinnwaldite assemblage, leaving a strongly Be-enriched residual liquid (the fine-grained granite).
As demonstrated by the Rechla occurrence, Ta concentration at levels similar to those in Beauvoir-type high-P peraluminous granites may be reached in the low-P low-Ta A2 suites, provided that extreme fractionation processes are established.

Azzouni-Sekkal, A., Boissonnas, J. (1993). Une province magmatique de transition du calco-alcalin à l’alcalin : les granitoïdes pan-africains à structure annulaire de la chaîne pharusienne du Hoggar (Algérie). Bulletin Société Géologique France 164, 597-608.
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