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The Temaguessine Fe-cordierite orbicular granite (Central Hoggar, Algeria): U–Pb SHRIMP age, petrology, origin and geodynamical consequences for the late Pan-African magmatism of the Tuareg shield

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Abstract

The Temaguessine high-level subcircular pluton is intrusive into the LATEA metacraton (Central Hoggar) Eburnian (2 Ga) basement and in the Pan-African (615 Ma) granitic batholiths along a major NW–SE oriented major shear zone. It is dated here (SHRIMP U–Pb on zircon) at 582 ± 5 Ma. Composed of amphibole–biotite granite and biotite syenogranite, it comprises abundant enclaves: mafic magmatic enclaves, country-rock xenoliths and remarkable Fe-cordierite (#Fe = 0.87) orbicules. The orbicules have a core rich in cordierite (40%) and a leucocratic quartz–feldspar rim. They are interpreted as resulting from the incongruent melting of the meta-wacke xenoliths collapsed into the magma: the breakdown of the biotite + quartz assemblage produced the cordierite and a quartz–feldspar minimum melt that is expelled, forming the leucocratic rim. The orbicule generation occurred at $T < 850°$ and $P < 0.3$ GPa. The Fe-rich character of the cordierite resulted from the Fe-rich protolith (wacke with 4% Fe_2O_3 for 72% SiO_2). Strongly negative ε_{Nd} (−9.6 to −11.2), Nd T_{DM} model ages between 1.64 and 1.92 Ga, inherited zircons between 1.76 and 2.04 Ga and low to moderately high I_{Sr} (0.704–0.710) indicate a Rb-depleted lower continental crust source for the Temaguessine pluton; regional considerations impose however also the participation of asthenospheric material. The Temaguessine pluton, together with other high-level subcircular pluton, is considered as marking the end of the Pan-African magma generation in the LATEA metacraton, resulting from the linear delamination along mega-shear zones, allowing asthenospheric uprise and melting of the lower continental crust. This implies that the younger Taourirt granitic province (535–520 Ma) should be considered as a Cambrian intraplate anorogenic event and not as a very late Pan-African event.

Keywords: Fe-cordierite; Orbicule; U–Pb zircon; Pan-African; Tuareg shield

1. Introduction

The Tuareg shield is made up of about 40% granitoids, among which most are post-collisional high-K calc-alkaline (Black et al., 1994; Fig. 1A). Most are of batholitic size, and intrude in the 620–580 Ma time interval along mega-shear zones linked to Pan-African post-collisional

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