

Pan-African granitoids in Nigeria: petrogenesis and potential for metallogenesis

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Nigeria is crossed by Pan-African orogenic belts, formed during the Neoproterozoic to Cambrian amalgamation of Gondwana. Within these belts are extensive post-collisional granitoid plutons, which are associated with Ta-bearing pegmatites that are mined by artisanal methods. Recent geochemical mapping by the British Geological Survey (BGS) and Nigerian Geological Survey Agency (NGSA) has identified anomalous levels of critical metals for new technologies (e.g. REE, Nb and Ta) around the post-collisional granitoids.

The granitoids in the area between Minna and Abuja form large plutons, varying from a few kilometres up to 100 km across. They vary from massive and structureless to intensely deformed where they are transected by shear zones. Compositions are dominated by hornblende or biotite granite, with rarer granodiorite, diorite and gabbro. Late-stage pegmatites are common, both within the plutons and around the margins. The majority of the granitoids are of syn-collisional type, with a few having alkaline, intraplate-type chemistry. New age dating constrains these granitoids to around 600 Ma.

Geochemistry and petrography show that less evolved compositions such as diorites contain REE-bearing minerals, and have higher bulk-rock REE contents. This contrasts with Nb and Ta, which are enriched in certain pegmatites but at relatively low contents in the main plutons. Thus, REE enrichments are produced by crystallisation of REE-bearing minerals at an early stage in the crystallisation sequence, whereas Nb and Ta contents are highest in more evolved, late-stage magmas. Understanding these processes is of fundamental importance in exploration for the critical metals.