

## **Geothermobarometry and U-Pb Geochronology of metapelitic granulites and pelitic migmatites from the Lokoho region, Northern Madagascar**

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### **ABSTRACT**

A region of metamorphosed supracrustal rocks (pelite, quartzite, marble, and graywacke) and coeval intrusive igneous rocks crop out in a 250 km long orogenic belt in northern Madagascar. The NW-SE trending belt is situated between a juvenile Neoproterozoic magmatic arc terrane (to the north) and an Archean craton, strongly reworked in early Neoproterozoic times (~800–670 Ma), to the south. Pelitic schist and granulite exposed along a ~70 km long transect from Andapa to Sambava contain assemblages ranging from sillimanite-garnet-biotite-orthoclase-cordierite to sillimanite-garnet-biotite-orthoclase and sillimanite-garnet-biotite-muscovite. These assemblages crop out over much of the area in which migmatites and hornblende + augite ± hypersthene ± biotite + perthite granites are common. Partial melting, biotite dehydration reactions, and granite emplacement are interpreted to have been nearly synchronous on the basis of field, structural, and petrographic observations.

Pressure and temperature estimates from garnetiferous metapelitic granulite and pelitic migmatite are generally in the range of 6.5–8.5 kbar and 800–900 °C using conventional thermobarometric methods. The occurrence of cordierite moats and discordant, but synmetamorphic, leucosomes in the granulites suggest an isothermal decompression-type path. Similarly, a core-rim *P-T* trajectory indicates ca. 2–3 kbar decompression at high temperature in the metapelitic granulite.

U-Pb geochronology of sphene, monazite, and zircon in various metamorphic and igneous rocks from the same region yields a Cambrian age of 510–520 Ma for the time of gneiss formation, granulite metamorphism, and igneous activity. Calculated minimum cooling rates range from 6 to 18 °C/Ma. Such cooling rates are more rapid than those associated with normal isostatic processes, and suggest that the terrane was tectonically exhumed at high temperature.