

New Ar⁴⁰/Ar³⁹ data from western, Dronning Maud Land, Antarctica: possible implications for Gondwana amalgamation.

*Geoffrey Hugo Grantham¹, Jan Kramers¹, Erasmus Petrus Burger²

1. Department of Geology, University of Johannesburg, Auckland Park, South Africa, 2. Department of Geology, University of Pretoria, Hillcrest, Pretoria, South Africa

Biotite and amphibole Ar⁴⁰/Ar³⁹ data on mineral separates from gneisses from the Sverdrupfjella and Kirwanveggan areas of Maud Province of western Dronning Maud Land (DML), Antarctica are reported. The samples were collected from “basement gneisses” the crystallisation ages of which are typically ~1000 and ~1200Ma old. The data provide insights into the post-orogenic evolution of western DML recognising that the area was involved in the amalgamations of Rodinia and Gondwana at ~1000-1150 Ma and ~500-600Ma respectively .

The data from the two areas show distinct differences. Data from six samples from Sverdrupfjella show that the dates from Bt-Hbl are similar. The dates range between ~460Ma and ~550Ma except for one severely disturbed Bt sample suggesting a date of ~326Ma. In four of the six samples the dates from Hbl are older than those from Bt with differences between Hbl-Bt pairs of between ~20-40Ma whereas in a sixth sample Bt yields a ~30Ma older date than Hbl.

In contrast data from six samples from Kirwanveggan show greater variability. The dates from four of five Bt samples range between ~498Ma-~520Ma with one sample yielding a date of ~868Ma. The dates from seven Hbl samples range from ~480Ma to ~1260Ma. This latter range in age correlates very crudely spatially with the youngest dates being from northern Kirwanveggan, to the oldest from the most southerly basement exposures in Kirwanveggan at Skappelnabben.

Immediately south of Skappelnabben, virtually undeformed quartz arenites and grits of the Urfjell Formation with ages of ~530Ma (from whole-rock Rb-Sr data), ~566Ma (SHRIMP U/Pb minimum detrital zircon age) and ~579Ma (Ar-Ar detrital muscovite age) are reported. The ages of detrital zircons suggest a provenance area similar to northern Mozambique and/or central to eastern Dronning Maud Land.

The data from Sverdrupfjella suggest a relatively short lived thermal pulse between ~460Ma and ~550Ma with the narrow range between older Hbl and younger Bt pairs being consistent with rapid cooling. In Sverdrupfjella and more broadly, DML, this age range is coincident with widespread granitoid intrusion, inferred to provide an advective heat source during this period. In contrast, in Kirwanveggan, where younger granites are absent, the range in ages for Hbl are consistent with a crustal gradient between N. Kirwanveggan (~5-6kb) and near surface at south central Kirwanveggan at Skappelnabben. The data are consistent with deposition at surface of the Urfjell quartz arenites approximately ~550Ma ago.

The crustal gradient is consistent with post- orogenic erosional uplift of Sverdrupfjella and northern Kirwanveggan with Sverdrupfjella having experienced thermal input from granitoid intrusions and is consistent with the post -orogenic evolution of a mega-nappe collisional model for Gondwana amalgamation proposed by Grantham et al. (2008) in which granitoid genesis is related to anatexis in the footwall of the mega-nappe complex. The crustal gradient described above is consistent with thinning of the nappe complex southwards and termination north of the Urfjell area of Kirwanveggan.

References:

[1] Grantham, G. H. *et al.* (2008) *Geological Society of London, Special Publications*. 308: 91-119

Keywords: Ar40/Ar39 ages, Western Dronning Maud Land, Gondwana