Precambrian Research 312 (2018) 68–98

Contents lists available at ScienceDirect

Precambrian Research

journal homepage: www.elsevier.com/locate/precamres

Implications of the distribution, age and origins of the granites of the Mesoproterozoic Spektakel Suite for the timing of the Namaqua Orogeny in the Bushmanland Subprovince of the Namaqua-Natal Metamorphic Province, South Africa

P.H. Macey[a,*], R.H. Bailie[b], J.A. Miller[c], R.J. Thomas[a], C. de Beer[a], D. Frei[b,c], P.J. le Roux[d]

[a] Council for Geoscience, PO Box 572, Bellville 7530, South Africa
[b] Department of Earth Sciences, University of the Western Cape, Bellville 7535, South Africa
[c] Department of Earth Sciences, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa
[d] Department of Geological Sciences, University of Cape Town, South Africa

ARTICLE INFO

Keywords:
Spektakel Suite
Namaqua-Natal Metamorphic Complex
U-Pb geochronology
Namaqua orogeny
Mesoproterozoic

ABSTRACT

The Spektakel Suite comprises voluminous late- to post-tectonic granitoids that intruded the pre-tectonic gneisses of the Bushmanland Subprovince (BSP) of the Mesoproterozoic Namaqua-Natal Metamorphic Province (NNMP). Based on new U-Pb zircon geochronology and geochemical data, we redefine the suite as consisting of 22 plutons of porphyritic monzogranite, granodiorite and charnockite that intruded the granulitic core of the BSP between 1097 and 1033 Ma. The new data show that some granites previously incorporated into the Spektakel Suite should be excluded: a) garnetiferous leucogranites (Concordia, Hangsfontein and Ibequas Granites) are excluded on petrological grounds and genetic considerations and b) the porphyritic Nuwefontein Granite (~783 Ma) is younger and is now placed within the Richtersveld Suite. The Spektakel Suite has geochemical and isotopic compositions suggesting that it was derived from recycled Palaeoproterozoic crust with Mesoproterozoic mantle input. The main Namaqua Orogeny (D_2) in the BSP comprises at least two phases of compressional tectonics at ~1200 Ma and ~1110 Ma separated by a period of extension. The new ages for the Spektakel Suite tightly constrain the end of D_2 to between 1109 Ma, the age of the youngest pre-tectonic gneiss and 1097 Ma, the age of the oldest Spektakel Suite granite. Peak low-P, high-T metamorphism (~1050–1020 Ma) occurred well after D_2 and its close spatial and temporal relationship to the Spektakel Suite suggests this prolonged period of granite magmatism was responsible for the transfer of the heat into the BSP. Several other late- to post-tectonic megacrystic granitic suites intruded into other tectonic domains across the NNMP coevally with the Spektakel Suite, indicating widespread granite magmatism at this time, probably due to mafic under- and intra-plating in a back-arc setting as previously suggested.

1. Introduction

During orogenesis, magma generation in the continental crust typically gives rise to voluminous pre-, syn, and post-tectonic granites and related rocks. The nature of these granites (s.l.) is often key to unravelling the tectonic history of different tectonic terranes within an orogenic belt; they can provide a detailed timeline for formation and collapse of the orogen, help constrain its P-T evolution and provide information on the nature of the lower crust and mantle. The Mesoproterozoic (ca. 1.3–1.0 Ga) Namaqua-Natal Metamorphic Province (NNMP) is such a granitoid-rich orogen. It forms a ca. 1400 km long, 400 km wide mobile belt that wraps around the western and southern margins of the Archaean Kaapvaal Craton in southern Africa (inset map in Fig. 1; Nicolaysen and Burger, 1965). It is divided into two parts; the western Namaqua and the eastern Natal Sectors with younger Phanerozoic sediments covering the intervening region (Cornell et al., 2006). In the Natal Sector, the rocks are characterised by a high component of juvenile crustal material formed between ca. 1.3 and 1.0 Ga allowing reconstruction of the position of subduction zones, magmatic arcs and hence terrane boundaries within this portion of the Proto-Kalahari Craton (Thomas, 1989; Jacobs et al., 1993, 2008; Spencer et al., 2015). In contrast, in the Namaqua Sector there is little Mesoproterozoic juvenile crustal material and intensely remelted and tectonically reworked Palaeoproterozoic crust is dominant (e.g. Clifford

* Corresponding author.
E-mail address: pmacey@geoscience.org.za (P.H. Macey).

https://doi.org/10.1016/j.precamres.2018.02.026
Received 17 August 2017; Received in revised form 31 January 2018; Accepted 27 February 2018
Available online 14 March 2018
0301-9268/