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Delineating subduction polarity based on different PT-evolutions of basement gneisses in the Meso-Archaean Barberton Mountain Land, South Africa.

A. Dziggel (1), A.F.M. Kisters (2)

(1) Institute of Mineralogy and Economic Geology, RWTH Aachen, Wüllnerstr. 2, 52062 Aachen, Germany, (2) Department of Geology, University of Stellenbosch, Private Bag X1, Matieland 7602, South Africa

The existence and modalities of plate-tectonic processes during the formation of the Early Earth is one of the central controversies in Archaean geology. The ca. 3500-3200 Ma Barberton greenstone belt and its surrounding granitoid-gneiss terrain in South Africa are one of the best studied Archaean terrains. Particularly the unique degree of preservation of the rocks affords us with an opportunity to study and semiquantitatively describe the geodynamic processes responsible for the formation of this Meso-Archaean continental nucleus. It is now widely accepted that the granitoid-greenstone terrain formed during the collision of a Northern and Southern terrane in an arc-trench setting at ca. 3230 Ma. Although structural styles and sedimentary environments seem to be in accordance with uniformitarian tectonic models, the location and geometry of the subduction zone remain elusive. Here, we present evidence, though circumstantial, that may be taken to indicate the presence of the subduction zone and the direction of subduction. On both sides of the belt, the sheared granite greenstone contacts are characterized by condensed metamorphic gradients. These marginal zones have been interpreted to represent an extensional detachment along which high-grade metamorphic basement gneisses were exhumed and juxtaposed against the low-grade supracrustal belt during the orogenic collapse of the overthickened orogen [1]. In basement gneisses of the southern terrane, the peak assemblages in greenstone enclaves record high-P, intermediate-T metamorphism of up to 650-700˚C and 8-12 kbar, indicating burial of the continental rocks to depths of 35-45 km along a low appar-

ent geothermal gradient of ca. 20 ˚C/km [2,3]. In contrast, basement rocks exposed along the northern margin of the greenstone belt experienced high-T, intermediate pressure metamorphism (ca. 600-700˚C and 5 $\pm$ 1 kbar), implying a substantially higher geothermal gradient of close to 40˚C/km. This northern margin is also characterized by voluminous synkinematic granitoid intrusions. Similar to basement rocks in the south, these mid-crustal rocks underwent a clockwise retrograde PT-evolution during one progressive exhumation event that is characterized by a near isothermal decompression to conditions of ca. 475-620 ˚C and 1-3 kbar. Both the presence of 3230 Ma old synkinematic granitoids in the Northern terrane, together with the higher geothermal gradients, probably as a result of advective heating of the gneisses by the granitoids, suggest that the northern margin of the greenstone belt represented the upper plate during north to north-west-directed subduction of the downgoing southern plate.

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