THE NATAL BELT: A PRODUCT OF MESOPROTEROZOIC OCEANIC ARC TECTONICS

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This paper outlines our current understanding of the geology and evolution of the Natal belt, the eastern sector of the ~400km-wide Mesoproterozoic Namaqua-Natal Tectonic Province of southern Africa. The Natal belt lies adjacent to the southeastern margin of the Archaean Kaapvaal craton and is divisible, from north to south, into the Tugela, Mzumbe and Margate terranes. The Margate terrane is the structurally highest panel and is characterised by granulite facies rocks. The underlying Mzumbe terrane comprises gneisses at upper amphibolite and locally granulite facies and the Tugela terrane rocks at amphibolite and greenschist facies. The boundaries between the three terranes are everywhere tectonic. New precise U-Pb zircon geochronology indicates that the supracrustal gneisses, granitoid gneisses and intrusive rocks that characterise the belt formed between 1235Ma and 1026Ma. The Natal belt is modelled as a composite arc terrane that developed due to magmatism and supracrustal deposition in an oceanic arc setting in a basin to the south (present co-ordinates) of the Kaapvaal craton. Arc development was followed by deformation, metamorphism and magmatism following closure of the basin during polyphase accretion of the arc terranes to the continental margin of the Kaapvaal craton. Two accretion events have been recognized. The older event occurred between ~1208Ma and ~1155Ma and resulted in the deformation and metamorphism of the supracrustal and plutonic rocks in the Tugela terrane. Ultramafic rocks in the Tugela terrane may represent part of a dismembered ophiolite sequence. The regional foliation in the Tugela terrane is deformed into northeast-vergent asymmetrical folds and transposed along southward dipping, geometrically related, thrust faults and thrust-sense ductile shear zones. These structures are interpreted as a response to syn- and post-accretion uplift that accommodated emplacement of the Tugela terrane onto the southeastern margin of the Kaapvaal craton between ~1155Ma and ~1140Ma. An early phase of deformation and metamorphism also occurred in the Mzumbe terrane in a similar time frame to that in the Tugela terrane but its significance is unclear at this time. The younger accretion event is only recognized from the Mzumbe and Margate terranes. It occurred between ~1091 and ~1070Ma and is recorded by the M_1 granulite facies regional metamorphism in the Margate terrane; intrusion of a number of S-type granitoids and the formation of the regional deformation fabric in these terranes. Post-accretion history of the belt is dominated by the intrusion in the Mzumbe and Margate terranes of A-type rapakivi-textured granitoids and charnockites forming the Oribi Gorge Suite. This magmatism took place in two distinct pulses at around 1070Ma and 1030Ma and resulted in a HT-LP metamorphism. During intrusion of the Oribi Gorge Suite the kinematic pattern of the Natal belt changed from north-vergent fold and thrust tectonics to ENE trending sinistral strike-slip tectonics. The resultant kilometer scale shear zones are interpreted to be a response to continuing NE-SW-directed convergence along the east-west-trending margin of the Kaapvaal craton. The cessation of Mesoproterozoic orogenic activity in the Natal belt is currently constrained by the intrusion of the post-kinematic Mbizana microgranite dykes at ~1026Ma.

The tectonic history of the Natal belt correlates strongly with that documented from the Namaqua belt but is different from the Mesoproterozoic record recognized in the Maud belt of Antarctica, although the final stage of crustal growth, through intrusion of large volumes of charnockitic A-type magma, is common to each of the belts.

Event	Margate terrane	Mzumbe terrane	Tugela terrane	Geochronology
Post-kinematic dykes	Mbizana microgranite dykes			1026±3Ma
	Intrusion of Oribi Gorge Suite	Intrusion of Oribi Gorge Suite		Port Edward pluton 1025±8Ma, Fafa pluton 1032±7Ma, Oribi Gorge pluton, 1070±4Ma
Accretion tectonics: collision of Mzumbe-Margate arc with Tugela-Kaapvaal margin	Crustal thickening to produce the D_2 regional deformation fabrics and metamorphic assemblages, intrusion of the Glenmore Granite, uplift and intrusion of the late to post kinematic S-type granites	Crustal thickening to produce the D_2 regional deformation fabrics and metamorphic assemblages, uplift and intrusion of the late to post kinematic S-type granites e.g. Humberdale granite, Sezela quartz-monzonite		Sezela quartz monzonite 1058±6Ma Glenmore Granite 1091±9Ma
Crustal extension		Intrusion of Equeefa Suite		Equeefa Suite (gabbro) 1082±4Ma
Uplift			Formation of F_3 folds and thrusts, intrusion of Mtungweni granitoids and Mambula Complex, emplacement of Tugela terrane onto margin of Kaapvaal craton	Ar-Ar date on D_3 shear zones Mambula Complex 1145±6Ma Mtungweni granitoids 1155±6Ma
Accretion tectonics and early deformation in Mzumbe terrane	Intrusion of the Sikombe Granite ? Deformation, metamorphism of the Mzimkulu Group?	Intrusion of the Mkomazi, Mzimlilo and Mahlongwa granites Deformation, metamorphism of the Mapumulo Group and the Mzumbe Gneiss suite	Collision of Tugela arc and Mandleni oceanic island with Kaapvaal margin. Crustal thickening, formation of regional deformation fabrics and metamorphic assemblages	Mkondene diorite 1161±9Ma Metamorphic overgrowths on detrital grains 1182±19Ma Mzimlilo granite 1147±8Ma Sikombe Granite 1181±15Ma
Hot-spot activity in Tugela ocean basin			Formation of the Mandleni oceanic island including the. Tugela Rand Complex	Dondwana gneiss at 1175±9Ma Tugela Rand Complex 1189±13Ma
Oceanic arc magmatism		Intrusion of the Mzumbe TTG suite	Intrusion of the Kotongweni tonalite	Kotongweni tonalite 1208±5Ma Mzumbe tonalite 1207±10Ma
Formation of oceanic arcs by subduction away from Kaapvaal craton, deposition of supracrustal rocks in arc basins. Deposition of supracrustal rocks on margin of Kaapvaal craton	? Deposition of the Mzimkulu Group	Deposition of the Mapumulo Group (Quha Formation)	Deposition of the Tugela Group (Manyane arc tholeiite) Deposition of the Mfongosi and Ntingwe Groups on craton margin	Quha Formation 1235±9Ma