AGE AND TECTONIC SIGNIFICANCE OF THE VOLCANIC BLOUBERGSTRAND MEMBER IN THE PAN-AFRICAN SALDANIA BELT, SOUTH AFRICA

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ABSTRACT

A zircon LA-ICP-MS U-Pb concordia age of 554.5 ± 5.4 Ma (2σ) from a felsic tuff of the Bloubergstrand Member (Tygerberg Formation) in the Pan-African Saldania Belt of the Western Cape provides the first direct age constraint on the deposition of the low-grade metamorphic volcanosedimentary sequence, collectively referred to as the Malmesbury Group. This age is identical within uncertainty to previously documented U-Pb ages of detrital zircons in the metaturbiditic Tygerberg Formation and constrains deposition of the Malmesbury Group to the latest Neoproterozoic. The age of the sub-aerial volcanism is, within error, identical to the emplacement of the earliest granites of the Cape Granite Suite that cross-cut regional metamorphic fabrics and structures of the Malmesbury Group. This suggests sedimentation and volcanism along an active convergent margin and is consistent with the findings of regional studies that postulate sedimentation and subsequent deformation of the Malmesbury Group in a fore-arc region. Concordant spot ages obtained from inherited xenocrystic cores of zircons in the Bloubergstrand Member define four main age groups at ca. 1200 to 1020 Ma, ca. 970 to 950 Ma, ca. 750 to 720 Ma and ca. 660 Ma. These ages can be correlated with earlier magmatic and/or metamorphic events in terrains to the north of the Saldania belt and point to a trench-parallel sediment supply from north to south and during the diachronous closure of the Adamastor ocean in the late Neoproterozoic.

Introduction

The Saldania belt in the Western Cape forms the southernmost extension of Pan African belts in southern Africa (Hartnady et al., 1985). For the most part, the belt is underlain by low-grade metamorphic, mainly clastic sedimentary rocks, collectively referred to as the Malmesbury Group, that are intruded by granites of the Cape Granite Suite between ca. 550 and 510 Ma (Figure 1) (Rogers, 1903; Hartnady et al., 1974; South African Committee for Stratigraphy (SACS), 1980; Scheepers and Schoch, 2006). Poor outcrop and the monotony of the Malmesbury Group have not only resulted in conflicting subdivisions of the sequence, but also hampered correlations with adjoining Pan-African belts (Rozendaal et al., 1999; Belcher and Kisters, 2003; Frimmel, 2009; Frimmel et al., 2013). This is compounded by a lack of absolute age constraints for the deposition of the Malmesbury Group. Armstrong et al. (1998) and, more recently, Frimmel et al. (2013) reported detrital zircon ages from the Tygerberg Formation in the western parts of the Malmesbury Group as young as ca. 560 to 555 Ma. The age of this youngest zircon population is, within error, identical to the ca. 550 Ma ages of the oldest syn- to late-tectonic granites of the Cape Granite Suite that cross-cut regional-scale folds and metamorphic fabrics (Schoch and Burger, 1976; Scheepers, 1995; Da Silva et al. 2000; Scheepers and Armstrong, 2002; Villaros et al., 2011). Given the relatively uniform lower- to mid- greenschist-facies grades of metamorphism of rocks in the Saldania belt, the prefix "meta-" is assumed for all lithological descriptions, if not stated otherwise.

The Bloubergstrand Member of the Tygerberg Formation is one of only three, but the by far best exposed and preserved volcanic unit in the mainly clastic sedimentary succession of the Malmesbury Group (Figure 2) (Hartnady et al., 1974; Theron et al., 1991; Slabber, 1995). Coastal exposures of the amygdaloidal mafic- to intermediate lavas, agglomerates and tuffs can intermittently be followed for some 1.5 km along the Atlantic West Coast, outside Bloubergstrand, some 15 km north of Cape Town. The volcanic rocks are interlayered and/or in faulted contact with shales and greywackes of the Tygerberg Formation (Von Veh, 1983). In this study, we present U-Pb zircon ages from a pyroclastic unit of the Bloubergstrand Member in order