



Structural interpretation of the Steenkampskraal monazite deposit, Western Cape, South Africa



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ABSTRACT

The Steenkampskraal Monazite Mine was first established in 1952, to extract monazite ore for the production of thorium and rare earth element (REE) concentrate. Refurbishment of the mine in recent years has required the re-inspection and re-evaluation of the mineralized monazite zone (MMZ). This contribution presents a structural review of the MMZ and its emplacement, based on recent data and its setting at the southern extent of the Bushmanland Sub-province of the Namaqua-Natal Metamorphic Belt. New surface and underground mapping confirm that the MMZ is a moderately-dipping body within gneissic host rocks on the southern limb of a broad F_3 antiform. Thickness variations, both down-dip and along-strike, are the result of D_2 and D_3 deformation. The MMZ has been locally transected and steepened by subsequent late- D_3 , “steep-structures”, which are typical of the Okiep copper district, ~150 km north of Steenkampskraal. Geochronological data suggest that the MMZ was intruded, emplaced or formed at 1046 ± 7.5 Ma, at the start of the D_3 Klondikean Episode (1040–1020 Ma). Unlike the analogous copper-bearing Koperberg Suite in the Okiep Copper district, the MMZ was not intruded into Klondikean-aged steep structures, but was rather transected and steepened by these. Local steepening of the otherwise moderately-dipping to flat-lying MMZ makes it locally amenable to detection by soil sampling and radiometric surveys.

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1. Introduction

The Mineralized Monazite Zone (MMZ) of the Steenkampskraal Monazite Mine (Fig. 1) is a variably-dipping, monazite-bearing body within granitic to charnockitic orthogenesis and supra-crustal rocks of the Bushmanland Sub-province of the Proterozoic Namaqua-Natal Metamorphic Province (Andreoli, 1994; Andreoli et al., 1994). The mine, situated approximately 350 km north of Cape Town, was established on the MMZ in 1950 and produced Th and REE concentrate until its closure in 1963 (Andreoli, 1994; Andreoli et al., 1994). An upward surge in commodity prices in 2010, particularly for REE, led to the recent re-establishment and refurbishment of the mine. This initiative required an updated geological model and mineral resource estimation, which in turn necessitated a structural re-interpretation of the MMZ and its host units. This contribution considers the structural re-interpretation of Steenkampskraal and incorporates the interpretation of new

prospect- and mine-scale aeromagnetic and satellite data, underground mapping and surface mapping. This re-interpretation is placed within the context of structural and geochronological data from various historical sources, with a view to establishing both the MMZ's context within the structural evolution of the Bushmanland Sub-province and its relationship to similar deposits in the vicinity.

2. Regional geology

The regional setting and the structural and metamorphic history may be summarized from Clifford and Barton (2012), Clifford et al. (1975, 1981); Kisters et al. (1994; 1996a, b), Gibson et al. (1996), Raith et al. (2003); Eglinton (2006), Thomas et al. (1996), Dewey et al. (2006), Cornell et al. (2006) and Jacobs et al. (2008). The Steenkampskraal mine is located within the Palaeo- to Meso-Proterozoic Namaqua-Natal Metamorphic Province (NNMP), which underlies a large portion of South Africa. The NNMP comprises a series of discrete tectono-stratigraphic sub-provinces which formed during prolonged Paleoproterozoic crustal accretion around an Archaean core. These sub-provinces, which were

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