



Review

The structural setting of mineralisation at Kolomela Mine, Northern Cape, South Africa, based on fully-constrained, implicit 3D modelling



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A B S T R A C T

Kolomela Mine, formerly known as the Sishen South Project, is located approximately 9 km from Postmasburg, in the Northern Cape Province of South Africa. Iron ore is primarily concentrated near the top of the Asbesheuwels or Asbestos Hills Subgroup, within the Kuruman Formation. High-grade, hematite-rich, iron-ore deposits in South Africa have been addressed in the literature, although much of this work focusses on their geochemical or isotopic signatures and the role of paleosinkholes in ore preservation. Recent work on high-grade, BIF-hosted Fe deposits, in South Africa and elsewhere, emphasizes the role of deformation in iron mineralisation and upgrading of BIF over a sequence of events, either punctuated by supergene enrichment or terminating with a supergene overprint. The proximity of the Kheis orogenic front, the protracted tectonic history of the area, a recently-resolved local structural framework and an emerging set of literature on superimposed hypogene, metasomatic, hydrothermal, hydrothermal and deformation-induced processes, justify a re-examination of the Kolomela deposits. Closely-spaced drillhole data, pit mapping over a period of four years and re-interpretation of the tectonic setting from high-resolution geophysical data, have been incorporated into fully-constrained 3D models of the five principle Kolomela deposits, which are presented here and analysed in terms of their geometry, tectonic setting, relationship to major structures, the geometry of the underlying dolomite contact and the possible role of gabbroic intrusions. A strong spatial correlation between thicker ore and thicker, underlying gabbroic bodies, in the forms of sills, is evident. We propose that protracted, multi-phase tectonic evolution, complete with several compressional-extensional events at this margin of the Kaapvaal Craton provided an ideal setting for “preparation” of BIF by early low-grade metamorphism, deformation and porosity creation, followed by fluid movement along interconnected contacts, unconformities, gabbro contacts and major structures.

1. Introduction

Kolomela Mine, formerly known as the Sishen South Project, is located approximately 9 km from Postmasburg, in the Northern Cape Province of South Africa. The mine produces direct shipping iron ore and as of November 2011, it contained 101.3 Mt of proven reserves grading at 64.4% Fe and 98.7 Mt of probable reserves grading at 64.5% Fe. The mine consists of several separate deposits: Kapstevl North (KSN), Kapstevl South (KSS), Leeuwfontein (LF), Klipbankfontein (KF) and Ploegfontein (PF), of which KSN, LF and KF are presently mined. The deposits consist of competent, massive ore, laminated ore and

conglomeratic ore and the bulk of mineralisation comprises granular and microplaty hematite with specularite veining. Commercial production commenced in 2011 and the operation has an estimated mine life of at least 29 years.

Kolomela Mine is situated at the southern termination of a range of low hills, with 60 km of strike extent, along the western limit of the Maremane Anticline or Maremane Dome. This dome is rimmed by lithologies of the Griqualand West and Olifantshoek Supergroups (Fig. 1) and the deposits are generally cited as being hosted in a Lake Superior-type banded iron formation (Gross, 1993; Beukes and Gutzmer, 2008), which formed in a passive-margin setting. Ore is

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