
CHAPTER ONE

INTRODUCTION

1.1 OBJECTIVE AND LOCATION

This study aims to characterize two small high-grade iron ore deposits, Zeekoebaart and Nauga East, both located in the Northern Cape Province of South Africa (Fig. 1). The deposits were discovered more than 30 years ago, but neither have been the subject of any thorough scientific investigation. Previous investigations and descriptions, particularly those published in “The Mineral Resources of South Africa” (Wilson and Anhaeusser, 1998) are brief and only concerned with their possible economic potential. During this study the two deposits were investigated to obtain a sound set of field geological, petrographical and geochemical data and to develop ore genetic models. Finally, the results are compared to other well-known high-grade iron ore deposits, and the exploration potential for such deposits in the area is evaluated.

The two high-grade iron ore deposits, Zeekoebaart and Nauga East, are situated approximately 65km and 40km respectively, north west of Prieska in the Northern Cape Province of South Africa (Fig. 1). The Zeekoebaart deposit is located on the farm Bovenzeekoebaart. It is constituted by several stratiform lenses of hard, high-grade hematite ore, hosted by the Paleoproterozoic *Kuruman Iron Formation* of the Asbestos Hills Subgroup of the Transvaal Supergroup. The Nauga East deposit, named after the farm on which it is located, can best be described as a discontinuous rim of hematite ore, developed along the contact between the *Kuruman Iron Formation* and a zoned carbonatite-syenite dyke.

1.2 EXPLORATION

The Zeekoebaart ore deposit has a limited exploration history. It was explored by Iscor and Cape Asbestos South Africa, in the 1950's, and received little interest due to its small size, remote location and consequently low economic potential. The iron ore deposit of

Nauga East, on the other hand, has a much longer and more extensive exploration history. Koegas Asbestos Mine initially explored it in the late 1950's [part of the Cape Asbestos South Africa (Pty.) Ltd company]. In 1965, Iscor, carried out further preliminary surveys, but attempts to purchase the options were declined by Cape Asbestos. In the early 1970's, Cape Blue Operations, located in Prieska, carried out geological and topographical mapping. The ore body was explored by several drill cores and a 370m long prospect drive was developed to evaluate the nature of the ore body. The results showed that the main ore body had an indicated strike of 820m, with a thickness variation of 18-30m, and a depth of approximately 150m (unpublished information supplied by Rand Mines). It was concluded that the tabular ore body is steeply dipping (75°) and located along normal faults in the crest of a large anticlinorium. From the available evidence a proven ore reserve of 6,5 million tons and a possible resource of 12 million tons, at Fe contents of 63,4 wt.%, were calculated. However, mining of the deposit was deemed uneconomical due to the steep topography of the surrounding area, and high operational costs. In the late 1970's Rand Mines took over the mineral rights, from Cape Blue Mines, and continues to hold these mineral rights to this date. Currently, neither deposit is being actively explored, developed or mined.

1.3 DEFINITION OF PROBLEM

Currently, two competing models exist for the origin of banded iron formation (BIF) hosted, high-grade hematite iron ore deposits in South Africa. These are; (1) Sishen-type ancient supergene and (2) Thabazimbi-type hydrothermal deposits (Beukes *et al.*, 2002). In the Sishen-type model, ore formation is related to chemical weathering and residual enrichment along an erosional unconformity, with the hematite ore grading downwards from the unconformity, into the iron formation protore. The Thabazimbi-type model, on the other hand, involves ore formation by hydrothermal fluids that invade banded iron formation along structural contacts, provided by the basal contact between BIF and shale (Beukes, *et al.*, 2002). This study attempts to classify the Zeekoebaart and Nauga East high-grade iron ore deposits and a concise model for their origin.

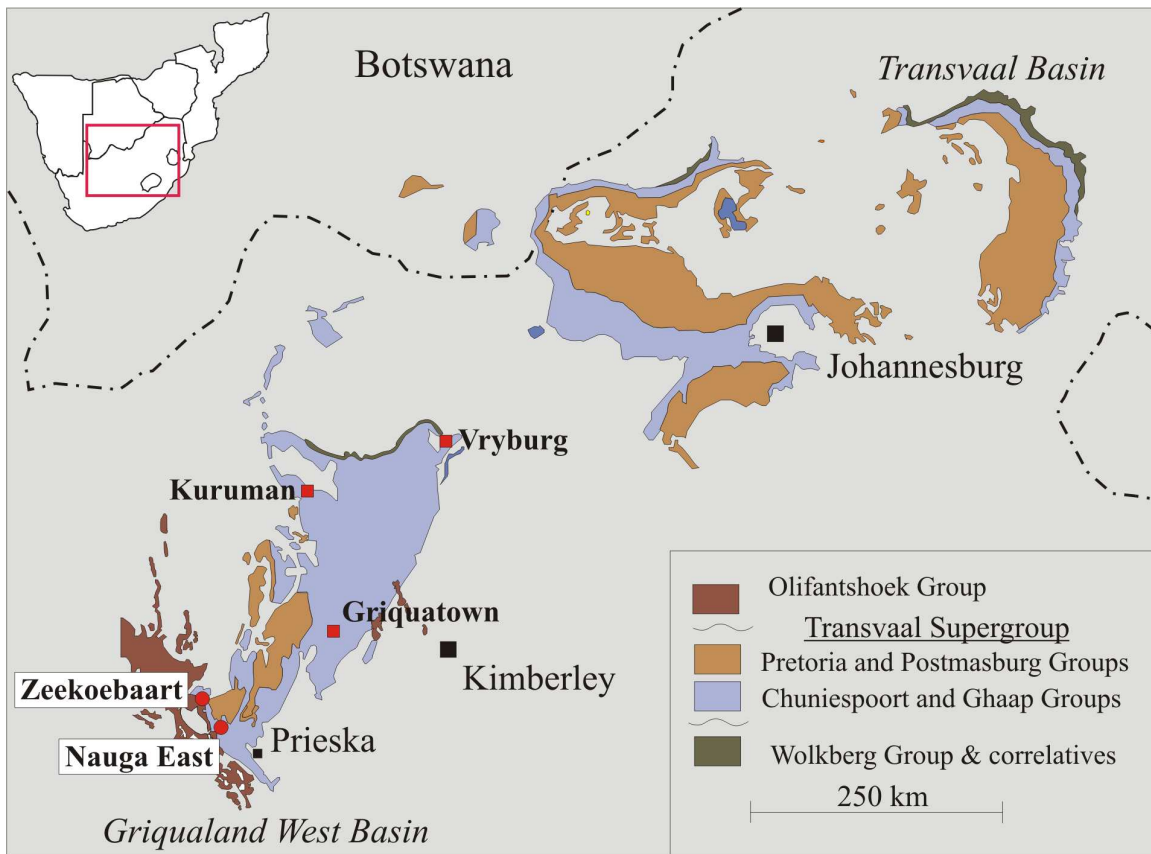


Figure 1: Location and regional geological setting of the Zeekoebaart and Nauga East high-grade iron ore deposits in Griqualand West, Northern Cape Province.

1.4 METHODS

In order to achieve the objective of this study, an investigation integrating field work, petrographic and geochemical studies were carried out. The geological setting and distribution of the ore bodies and their relationship to associated host rocks were studied in the field, and a representative set of samples was collected at both deposits. The samples were collected from surface outcrops, and in the case of the Nauga East deposit, also from underground exposure and exploration drill core. Exhaustive petrographic and mineralogical analyses were conducted with the aid of reflected and transmitted light microscopy, scanning electron microscopy and X-ray powder diffraction. These analyses were complemented by stable isotope and whole rock geochemical analyses.