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Paleoproterozoic banded iron formation-hosted high-grade hematite iron ore deposits of the Transvaal Supergroup, South Africa

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Banded iron formation-hosted high-grade (> 60 wt% iron [Fe]) hematite ore deposits make up the bulk of the world's iron ore production and reserves. They developed mainly through supergene and/or hydrothermal leaching of silica from the iron formation host rock under oxidizing conditions. Early Paleoproterozoic iron formations of the Transvaal Supergroup host several such high-grade hematite ore deposits. The largest ones are developed in the Asbesheuwels Subgroup iron formation on the Maremane Dome, between Sishen and Postmasburg in the Northern Cape Province of South Africa. These deposits currently produce virtually all of South Africa's supply of about 68 Mt of high-grade hematite ore, to the local and export market from the Sishen, Khumani, Beeshoek and Kolomela Mines. These represent ancient supergene deposits formed along the approximately 2.2 to 2.0 Ga unconformity at the base of the Gamagara/Mapedi red bed succession of the Keis (formerly Kheis) Supergroup. Smaller ancient supergene deposits are also developed along the same unconformity such as where it intersects the Rooinekke Iron Formation of the Koegas Subgroup at the Rooinekke Iron Ore Mine to the south of the Maremane Dome and where it intersects the Hotazel Iron Formation of the Voëlwater Subgroup of the Transvaal Supergroup, in the Kalahari Manganese Field to the north of the dome. The supergene ores occur in four types, namely laminated, massive, brecciated and conglomeratic ores, the latter forming part of the Gamagara/Mapedi red bed succession. With the exception of the ore at Rooinekke, which is manganiferous, the supergene ores are of high grade (>60 wt% iron) and they also have low silica and phosphorous contents. Normalized rare earth elements, in contrast to the banded iron formation protolith, show light rare earth element depletion and the oxygen isotopes are slightly depleted to slightly enriched in ^{18}O.

Hydrothermally enriched deposits include: Thabazimbi, situated in the Penge Iron Formation of the Transvaal outcrop area of the Transvaal Supergroup in the metamorphic aureole of the Bushveld Complex; and the Bovenzeekoebaart deposit and the magmatic hydrothermal Nauga East deposit, both located in the Kuruman Iron Formation of the Asbesheuwels Subgroup, along the southern extremity of the Griqualand West outcrop area of the Transvaal Supergroup. These hydrothermal iron ores are all developed at the bottom contact between the host iron formation and underlying carbonaceous shale which marks the transition into the Malmani-Campbellrand carbonate platform succession below. In some instances this contact is faulted. The ore grades upwards into oxidized iron formation, with isolated lenses sometimes developed at higher stratigraphic levels. Fault systems intersect the iron formations and the mineralization is concentrated between mafic sills, higher up in the iron formations and the bottom shale contact. At Nauga East, mineralization is developed in contact with a steeply dipping zoned syenite-carbonatite dyke. The hydrothermal ores are of high grade (>60 wt% iron), but can have higher phosphorous contents of up to 0.25 wt%. Normalized rare earth elements are enriched but similar to that of the host iron formations and the oxygen isotopes are generally depleted in ^{18}O.

The mining of iron ore in South Africa dates from between 800 and 1200 AD, with modern exploration and mining starting from 1916. The first production of high-grade banded iron formation-hosted ore commenced in 1931 from the Maremane Dome and Thabazimbi. The first truly world class iron ore mine in South Africa, Sishen, was opened in 1953 and still operates today. The deposits at Khumani and Welgevonden have gone into production as recently as 2008 and 2011 respectively. Current estimates place the life of mine of the larger deposits at between 15 and 40 years.