Paper Number: 4565

Developing through the Hex River Fault at 16 Shaft, Impala Platinum, Rustenburg, South Africa

De Klerk, J.[1] and Nkabinde, B.I[2]

[1] Geology Manager, Impala Platinum, Rustenburg, jacolene.deklerk@implats.co.za
[2] Senior Geologist, Impala Platinum, Rustenburg, bongani.nkabinde@implats.co.za

---

Impala Platinum Limited is the world's second largest platinum producer. The company's main mining area (Impala) is situated some 30 km North of Rustenburg in the North West Province, along the Western limb of the Bushveld Complex (see Eales and Cawthorn, 1996, for description of the Bushveld Complex). 16 Shaft is the newest shaft at Impala Platinum, located in the south-eastern corner of the mining area and commissioned during June 2013. The shaft's Mineral Reserves incorporate an area measuring approximately 4.5km on strike and 2.4km on dip with mining depths ranging from 1.2km to 1.5km below surface.

The Merensky Reef at 16 Shaft is generally composed of an upper feldspathic pyroxenite, overlying a thin basal chromitite stringer, followed by an anorthositic to noritic footwall. As an aid to mining operations the Merensky Reef is further defined as being amongst others "A", "B" or "C" Reef where it rests on specific footwall units, i.e. locally termed Footwall 1, 2 and 3 respectively. The UG2 Reef is defined as a main chromitite layer, with most of the PGM and base metal mineralisation confined to this unit, followed by a poorly mineralised pegmatoidal pyroxenite footwall. The Footwall units of the Merensky and UG2 Reefs are distinctive markers, but their thickness varies on strike, at 16 shaft. These markers are used by the 16 Shaft geologists daily to optimise the mine development, (see Leeb-Du Toit, 1986, for full stratigraphic description).

Both mineralised horizons dip in a north-easterly direction at 10° to 12°. The vertical separation between the Merensky and UG2 Reefs varies about 115m at 16 Shaft. The continuity of the reefs may be disrupted by minor and major faults, lamprophyre and dolerite dykes, late stage ultramafic replacement pegmatoid bodies and potholes. The Bushveld Complex, and specifically the mining area at 16 Shaft, is relatively undeformed, but 16 Shaft is divided by one major strike-slip fault, called the Hex River Fault.

The Hex River Fault forms a major lineament that traverses through the 16 Shaft area. It is a major strike-slip shear zone that strikes NNE-SSW with an average dip of 85° to the north-east. The displacement along the fault is primarily horizontal, and has an expected resultant vertical displacement between 3 to 8 metres, which varies along the strike of the fault. The fault is further defined by a central core zone approximately 10 meters wide, that dramatically varies between each raise line. This core zone is highly fractured and mineralogically altered/bleached, with secondary minerals (serpentinite, chlorite and/or calcite) present in the fractures and/or joints. It also contain volumes of water and flammable gases.

Risks associated with developing through the Hex River Fault

Initial attempts to mine through the fault indicated adverse ground conditions with very poor advance rates, flammable gas intersections and intersection of hot, saline water. This posed a potential risk to employees conducting the development. The potential delays in the 16 Shaft's build-up to full production, due to time delays when developing through the Hex River Fault was also seen as a risk.

Strategy Implemented to mitigate risks

Appointed core drilling and grouting specialist, with experience in sealing underground water intersections and consolidating associated poor ground conditions. Core drilling programme, through

fault zone to determine ground conditions, the width of the core central zone, as well as possible water intersections.

References:

Eales, H.V. and Cawthorn, R.G. (1996). The Bushveld Complex, p.181 – 229. In: Cawthorn, R.G Ed., Layered intrusions. Amsterdam, Elsevier. 531pp.

Leeb-Du Toit, A. (1986). The Impala Platinum Mines, p.1091 – 1106. In: Aunhaeusser, C.R., and Maske, S. Eds., Mineral Deposits of southern Africa, II. Geological Society of South Africa, 2335pp.