# STRATIGRAPHIC LOCATION OF PLATINUM MINERALISATION IN THE KAPALAGULU INTRUSION OF WESTERN TANZANIA.

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**Introduction:** The Kapalagulu Intrusion lies near the shore of Lake Tanganyika in Western Tanzania and forms part of a series of mafic intrusions that include Musongati and Kabanga, known as the Burundi Nickel Belt.

Disseminated copper and nickel sulphide in harzburgite near the base of the Kapalagulu Intrusion has attracted the attention of prospectors for over a hundred years. In the late 1990's, Broken Hill Proprietary found platinum mineralisation associated with nickel-bearing lateritic regolith. During 2001 and 2003, Goldstream Mining, in partnership with Lonmin plc, identified sulphide-chromitite horizons in harzburgite below the lateritic regolith that contain platinum-group-element (PGE) mineralisation with grades of between 1 and 12g/t PGE.

**Geology of intrusion:** The 32 kilometre long by one to three kilometre wide Kapalagulu Intrusion is, in the northwest, sandwiched between erosionally-resistant quartzite and phyllite of the Middle Proterozoic Bukoban Group and high grade metamorphic rocks of the Ubendian Belt. In the southeast, the intrusion is completely surrounded by Ubendian metamorphic rocks. Internally, the layered igneous rocks of the Kapalagulu Intrusion can be divided into lower ultramafic and upper mafic sequences. Together, these layered igneous rocks form a 2,400m thick folded and faulted stratigraphic succession that occupy a sygmoidal dyke-like body.

The primary stratigraphic sequence of the Kapalagulu Intrusion was first established for the northern half of the Kapalagulu Intrusion in 1959 by van Zyl (1959) and later adapted by Wadsworth and others (1981) on the basis of petrological investigations in the 1960's. With minor modifications, the standard sequence (with approximate thicknesses) follows.

| Sequence | Lithological Unit | Thickness (m) | Total thickness (m) |
|---|---|---|---|
| Upper Mafic | Banded gabbro | 100 | 1,355 |
| | Magnetite gabbro | 215 | |
| | Upper gabbronorite | 550 | |
| | Anorthosite | 90 | |
| | Lower gabbronorite | 170 | |
| | Troctolite | 230 | |
| Lower Ultramafic | Harzburgite * | 1,000 | 1,050 |
| | Basal norite | 50 (?) | |

* Data from Goldstream–Lonmin diamond drilling

The various lithological stratigraphic units of the Kapalagulu Intrusion are shown in the geology map of Fig. 1.

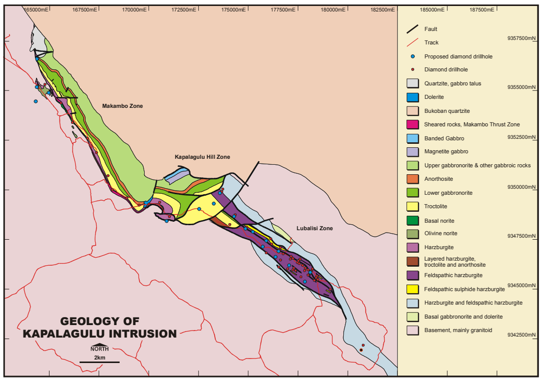


**Fig. 1**. Geology of Kapalagulu Intrusion.

**Lower ultramafic sequence:** Most of the lower ultramafic sequence in the Kapalagulu Intrusion is preserved in an elongate fault-bounded graben that forms the southern half of the dyke-like intrusion. Here, the harzburgite that make up the ultramafic sequence is covered by a thick blanket of lateritic regolith that contains nickel and residual PGE mineralisation. In the northern half of the Kapalagulu Intrusion, much of the ultramafic sequence has been structurally removed by a major shear and fault zone. In this area, remnants of the basal harzburgite are steeply dipping and in places overturned. A small embayment or sill structure filled with olivine norite and harzburgite is present below the basal shear and fault zone near the northwestern end of the intrusion. Nickel-bearing massive sulphides are present in the basal shear in the vicinity of the sill structures.

PGE-bearing sulphide and chromite horizons are present in the harzburgite of the lower ultramafic sequence present in the southwestern part of the Kapalagulu Intrusion which is known as the Lubalisi Zone. Within the Lubalisi Zone, a longitudinal shear – fault zone divides the harzburgite into inward-dipping synclinal stratigraphic sequences that fill two fault-bounded grabens. The southwestern graben known as the Central Graben, is deeper than the northeastern North Central Graben, and consequently preserves a more complete stratigraphic succession of the layered harzburgite. A schematic cross-section of the harzburgite stratigraphy within the two central grabens of the Lubalisi Zone is shown in Figure 2.

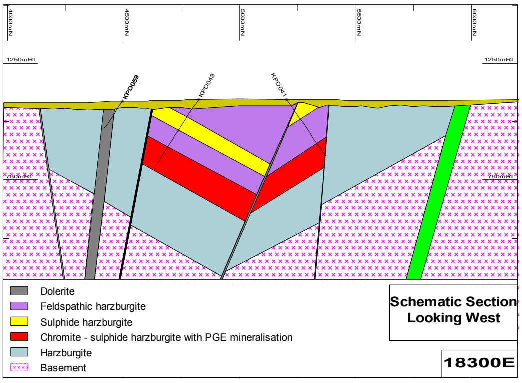


**Fig. 2.** Schematic cross-section 18300E

No drillhole completely penetrates the harzburgite succession and it is therefore difficult to determine the true thickness of the harzburgite lithological unit. The interpreted stratigraphy of the harzburgite is presented in the table below.

| Sequence | Lithological unit | Lithological sub-unit | Lithology | Thickness (m) |
|---|---|---|---|---|
| Upper Mafic | Gabbronorite | | Gabbronorite | 50 |
| | Troctolite | | Troctolite | 120 |
| Lower Ultramafic | Harzburgite | 7 | Layered harzburgite, troctolite and anorthosite | 180 |
| | | 6 | Feldspathic harzburgite | 200 |
| | | 5 | A thin marker horizon of layered troctolite and anorthosite | 1 |
| | | 4 | Feldspathic harzburgite with five 20 to 50m thick chromite – sulphide horizons | 650 |
| | | 3 | Feldspathic harzburgite | 50 |
| | | 2 (MCSS) | Feldspathic harzburgite with chromite – sulphide horizons | 100 |
| | | 1 | Harzburgite | 250 |
| | Hybrid rock | | Hybrid rock, dolerite | 100 |

It appears that the harzburgite lithological unit is made up of a number of distinct lithological sub-units which are divided into upper and lower sub-units by the presence of a thin marker horizon of layered troctolite and anorthosite which marks the first appearance of cumulate plagioclase. The marker horizon is of significance as the PGE mineralisation is located below this horizon in intervals of chromite and sulphide enrichment in lithological sub-units 1, 2 and 4.

The most important lithological sub-unit for PGE mineralisation is that of sub-unit 2. This sub-unit is known as the Main Chromite – Sulphide Succession (MCSS) and is well developed in the North Central Graben. Because the PGE-bearing MCSS crops out below the regolith in the North Central Graben, there is residual PGE mineralisation in the overlying lateritic regolith.

Harzburgite lithological sub-unit 4 is well developed in the Central Graben and contains the thick sulphide-rich harzburgite horizons in which disseminated pyrrhotite, chalcopyrite and pentlandite are present. The sulphides have distinct magmatic textures and in places coalesce to form sulphide-rich patches or semi-massive sulphide where the post cumulus growth of plagioclase and pyroxene has pushed the sulphide grains together. Three of the lowermost chromite – sulphide horizons contain PGE mineralisation.

A mineralogical investigation of core from the chromite – sulphide horizons has identified fifteen different PGM species that include two new species (Cabri, 2004). Various gold alloys are present within the PGM. PGM's include platinum and palladium alloys, hessite, kotulskite, keithconnite, michenerite, moncheite, mertieite, maslovite, sudburyite, sobolevskite, sperrylite, tetraferroplainum and taimyrite.

**Conclusion:** The PGE mineralised chromite – sulphide horizons of the Lubalisi Zone have geological and geochemical features that are similar to the Main Sulphide Zone of the Great dyke and the UG2 of the Bushveld Complex. These include a close association with magmatic sulphide and chromite that is confined to a number of magmatic layers. However, in both the Bushveld and Great Dyke, the PGE mineralised horizons are towards the middle of much larger magma chambers that represent a more evolved stage of magmatic differentiation. In the Kapalagulu Intrusion, the PGE-bearing chromite – sulphide horizons are located near the base of the intrusion in a thick sequence of harzburgite. The Main Sulphide Zone, UG2 and Merensky Reef are, in comparison to the Lubalisi Zone PGE mineralised horizons, much thinner and more laterally extensive. In the Lubalisi Zone, there are stacked intervals of PGE mineralisation associated with chromite – sulphide horizons that display a wide variety of magmatic structures that include chromitite seams, multiple chromitite bands, disrupted chromitite bands and seams, rounded chromitite enclaves and other enigmatic structures that are only partially revealed in the drill core.

**References:**


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## 5 keywords for use in indexing:

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|---|---|---|---|---|
| Kapalagulu Intrusion | Tanzania | Layered Intrusion | Igneous stratigraphy | Platinum mineralisation |