

Discovery of the Deep Flatreef PGE-Ni-Cu-Au Deposit on Turfspruit Farm, Northern Limb, Bushveld Complex, South Africa

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ABSTRACT

Ivanhoe Mines' Platreef Project is located in the southern sector of the Northern Limb of the Bushveld Complex. The Complex comprises a regionally extensive, generally steeply dipping sequence of pyroxenite-norite-harzburgite at the base, which hosts PGE-Ni-Cu-Au mineralization and is termed the Platreef. Following acquisition of the project in the early 2000s, an initial stage of exploration through 2003 resulted in definition of a large, low-grade open-pit resource. Its development would have required relocation of a local townsite. These factors combined with encouragement from deep exploration on AfriOre's Akanani project to the north prompted Ivanhoe's commencement of a deep drill programme at Turfspruit in early 2007. The programme continued intermittently into 2010, a time during which industry and academic geologists generally held that the southern sector of the Platreef contained only sub-economic resources.

However, by mid-2010 several drill holes in the northern part of Turfspruit had intersected an apparently consistent mineralized zone at the top of the Platreef, which appeared to be flattening westwards. An initial "selectively mineable" estimated mineral resource of small tonnage but high grade, provided encouragement for Itochu Corporation to purchase a 2% stake in the project for \$US10 million. This funding supported drilling that, in conjunction with in-house geologically constrained geophysical (magnetic) inversions, resulted in the definition of a major underground high-grade PGE-Ni-Cu-Au resource, named the "Flatreef". In early 2011, an Itochu-led consortium purchased an additional 8% share in the project for \$US280 million. By late 2011 thirty drill rigs were active on the project, resulting in the definition of indicated and inferred mineral resources. In 2012, a geologically constrained inversion of an airborne gravity gradiometer survey resulted in identification of a southwards extension of the flat-lying portion of the deposit, and additional inferred mineral resources. The project is now under development with shaft-sinking in progress. Keys to success were persistence, willingness to drill-test new ideas in the face of negative "wisdom", funding, and support from in-house geophysical expertise.

INTRODUCTION

Ivanhoe Mines' Platreef Project is located in the 2.05 Ga Bushveld Complex, the world's largest layered intrusion and host to majority of the world's platinum group elements (PGE) resources, in addition to major resources of Au, Cu, Ni, V, Fe, Sn, fluorite and dimension stone (Cawthorn, 1999), Figure 1. Mining of two PGE-(Au, Ni, Cu)-mineralized chromitiferous horizons ("reefs"), the Merensky Reef and UG2, in the Eastern and Western Limbs of the complex has occurred since the 1920s. These horizons occur at and near the top of a ~2 km-thick section of gently dipping, cyclically layered dunite, harzburgite, pyroxenite, norite, and chromitite, termed the Lower and Critical Zones, overlain by gabbro-norite of the Main Zone (Cawthorn, 1999). In contrast, PGE-Ni-Cu-Au mineralization in the Northern Limb of the Bushveld Complex is contained within a regionally extensive, 10s to 100s of metres-thick, generally steeply dipping sequence of pyroxenite, norite, and harzburgite (the "Platreef"). The Platreef occurs between the overlying Main Zone gabbro-norite and hornfelsed metasedimentary rocks of the Transvaal Supergroup and Archean granite in the floor of the complex (Kinnaird, 2005; McDonald and Holwell, 2012). Lithostratigraphic correlation

within the Platreef and between the Platreef and the well-defined Lower and Critical Zone strata of the Eastern and Western Limbs has been difficult and contentious.

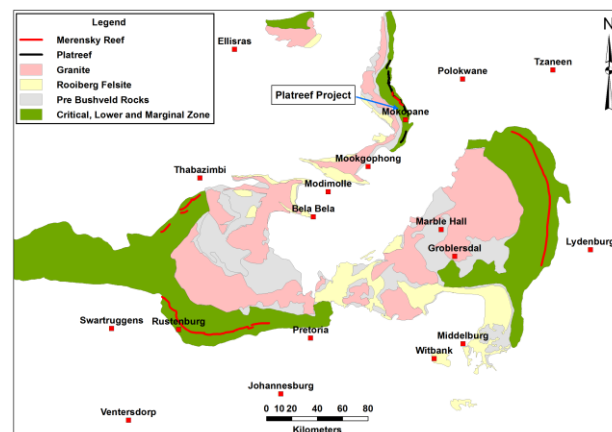


Figure 1: Geological map of the Bushveld Complex showing the Western Limb, Eastern Limb and Northern Limb, and the location of the Platreef Project in the Northern Limb.

Mining of the Platreef was attempted unsuccessfully in the 1920s, but following a ~70 year hiatus was reinitiated at Anglo Platinum's Mogalakwena operation (formerly PPRust) in the central sector of the Platreef in 1992. Mogalakwena currently operates five open pits with an annual production of 96 million tonnes ore and 412,000 ounces platinum (Anglo American Platinum Limited, 2016).

Ivanplats (at the time, Platreef Resources) concluded its first mineral lease agreement in 2001 on two farms (licenses), Turfspruit 241 KR and Macalacaskop 243 KR, covering an area of 78 km² in the southern sector of the Platreef, and adjoining Anglo Platinum's property to the north. Mineralized Platreef was known from regional drilling by Anglo Platinum to underlie the property, but had not been explored. Following a multiphase exploration and evaluation programme, Ivanplats obtained a mining right in 2014. The Platreef Project is projected in its initial 4Mtpa phase to produce annually 117 million tonnes ore, 203,000 ounces platinum, 212,000 ounces palladium, 14,000 ounces rhodium, 26,000 ounces gold, 20 million pounds nickel and 12 million pounds copper (OreWin, 2014). The project is now under development with shaft-sinking in progress, and is jointly owned by Ivanplats (Pty) Ltd. (64%; a subsidiary of Ivanhoe Mines); local communities, employees and entrepreneurs (26%); and ITC Platinum Development Ltd. (10%; a Japanese consortium led by ITOCHU Corp.).

OPEN PIT EXPLORATION PROGRAMME

From 2000–2003, exploration drilling on the sub-cropping and steeply west-dipping Platreef sequence focused in central Turfspruit, with lesser focus on northern Macalacaskop (Figure 2). On completion of the programme, a total of 575 exploration holes (including deflections) were drilled, producing 195, 209 m of core.

Potentially open-pittable, indicated mineral resources containing 520 Mt grading 0.86 g/t Pt+Pd+Au ("3PE"), 0.2% Ni and 0.14% Cu were defined primarily on Turfspruit (Figure 2), (AMEC, 2011). These grades were significantly lower than those known and being mined on Anglo's Mogalakwena property, and PGE mineralization occurred largely as non-sulphide arsenides, antimonides, bismuthides and tellurides (Hutchinson and Kinnaird, 2005). The lower grades and non-sulphide nature of PGE-bearing minerals resulted in poor metallurgical recoveries. In 2004–2006, extensive geological re-logging, re-interpretation, re-modelling and metallurgical testing were conducted, with the objective of optimizing mineral resources and improving recoveries. A significant portion of the resource underlay a community of 3700 households at the time, hence relocation planning and community engagement was an integral part of the project work.

Extensive geological research was also undertaken (summarized in Kinnaird et al., 2005) coincident with numerous studies on other parts of the Platreef, primarily Mogalakwena (see review by McDonald and Howell, 2012). Most of these findings were presented and discussed at periodic informal Platreef Workshops, which brought together industry and academic geologists active in the Northern Limb. Through these and earlier studies, a model of the Northern Limb was generally

accepted that invoked its separation into three sectors, southern, central, and northern, with economic resources known only in the central (Mogalakwena) sector. High PGE tenors and Pt/Pd ratios present in the central sector, versus much lower tenors and ratios in the southern sector (e.g. Turfspruit), were variously postulated to map proximal versus distal relationships to a source conduit, differences in magma contamination by floor rocks, and differences in magma fertility. These led to a generalized consideration that the likelihood of economic PGE mineralization existing in the southern sector was low.

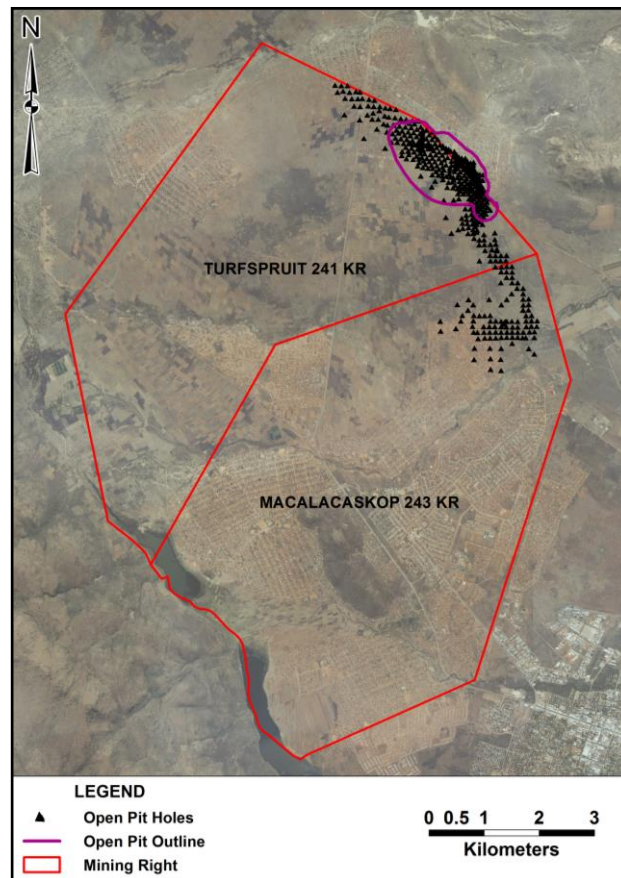


Figure 2: Ivanplats mining license covering Turfspruit and Macalacaskop farms, showing location of open pitable resource exploration holes, and Indicated mineral resource located within a potential open pit (purple-line boundary) as proposed in 2004.

DEEP DRILLING PROGRAMME AND FLATREEF DISCOVERY

Recognizing the difficulties that would be associated with mining the low-grade open pit resource on Turfspruit, Ivanplats refocused its drilling programme on the area down-dip. Encouragement came from the success of AfriOre's deep drilling programme at the Akanani Project, located down-dip from Mogalakwena's Zwartfontein open pits and approximately 20 km north of Ivanplats' Turfspruit farm (Figure 3). AfriOre's drilling programme intersected the Platreef (termed the P2 Unit) from depths of 800 m to 2000 m below surface. On completion of the drilling programme, 249.1Mt inferred mineral resources

grading 4.2 g/t 4PE, 0.24% Ni and 0.14% Cu were declared on the Akanani property, with an average reef thickness of 19 m (Witley, 2006).

Ivanplats' initial phase of deep drilling commenced in the last quarter of 2006 and drilling began in April 2007. The planning phase focused on the interpretation of geological sections from the known near-surface resources and interpolation into down-dip areas, taking into consideration structural, gravity and magnetic data. The first exploration hole (UMT001) collared in central Turfspruit and was planned to intersect the Platreef at a depth of 1040 m (Figure 4). However, the Platreef was intersected shallower than planned, at a depth of 955 m. The mineralized intersection (reef) in the upper section of the Platreef returned 10 m at 4.7 g/t 3PE, 0.41% Ni, 0.2% Cu from a depth of 998 m. Mineralization occurred as disseminated interstitial sulphides and platinum group minerals (PGMs).

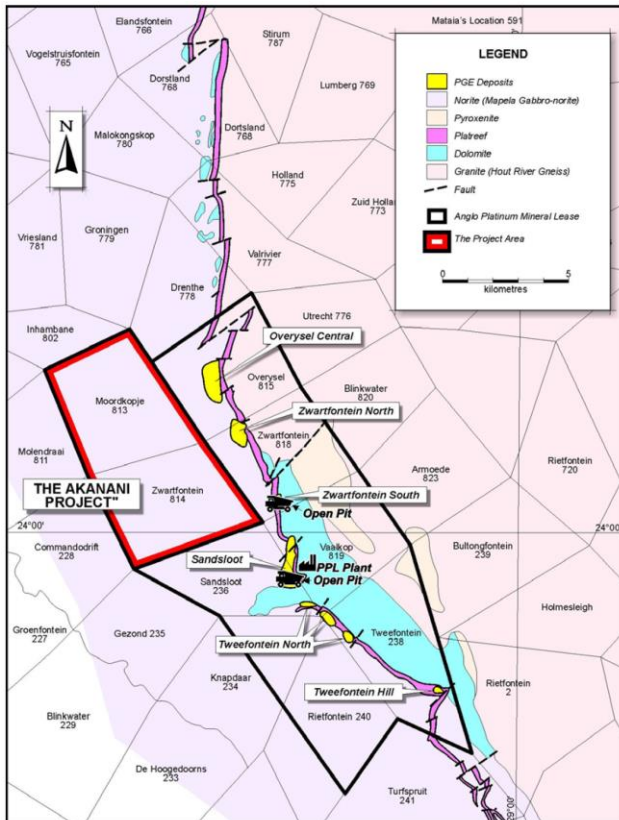


Figure 3: Plan view showing the Platreef sub-outcrop (dark pink line) on Anglo Platinum's Mogalakwena properties and the Akanani Project area to the west and down-dip. Akanani prospecting right area shown by a red rectangle. (Source: Witley, 2006).

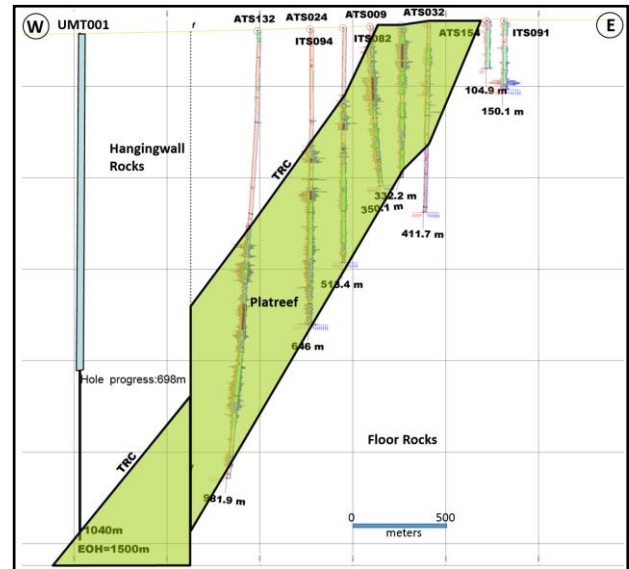


Figure 4: West-east drill section showing drilling progress of the first hole (UMT001) on Ivanplats' deep drilling programme. TRC refers to "top reef contact". A normal fault with a throw of about 150 m was interpreted from regional structural data in the area. Open pit resource holes are plotted to the right of the interpreted fault. The Platreef is represented by the green-shaded area. Platinum and nickel values are plotted in blue and orange bars, respectively.

The third exploration hole, UMT003, collared in southern Turfspruit approximately 1064 m along strike southeast from UMT001, and intersected the top of the Platreef at a depth of 632 m. A highly mineralized "lower Platreef" of pegmatitic norite was intersected from 1151 m, below the anticipated floor contact, and reported 10 m at 12 g/t 3PE, 1.8% Ni+Cu combined. Mineralization in this intersection occurred in the form of blebs of chalcopyrite, pyrrhotite and pyrite (order of abundance). In order to determine the lateral extent of the high-grade zone, a down-hole electromagnetic geophysical survey was conducted in UMT003, using an Atlantis B-Field DHEM probe. The survey measurements were taken at a station spacing of 1-10 m, using a frequency of 1 Hz, which is appropriate to energize and detect conductive zones. Unfortunately, the technique was unsuccessful in mapping the targeted zone, but instead, succeeded in mapping three other conductive zones hosting lower grade mineralization in the Platreef. The lack of detection of the targeted zone was attributed to the non-conductive nature of the mineralized zone. This was supported by high resistivity and low magnetic susceptibility measurements (of the mineralized zone) recorded by downhole geophysical wireline logging (Figure 5). The remaining holes from the 2007 drill programme (UMT002, 004 and 011) returned mixed results.

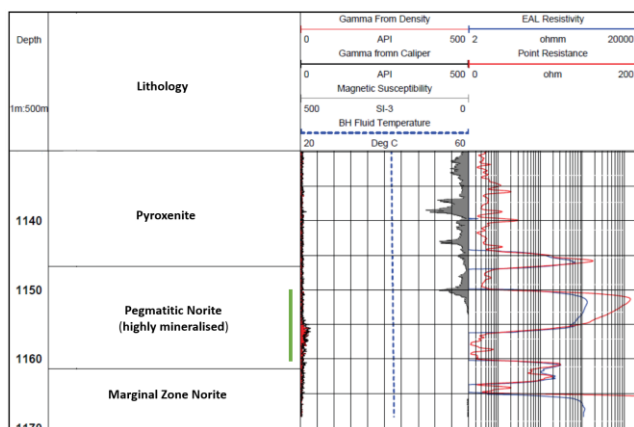


Figure 5: A reduced plot of downhole wireline logging in UMT003 showing responses in density, magnetic susceptibility and resistivity within the high-grade pegmatitic norite unit. The “lower Platreef” mineralized zone is shown by the green bar.

The high-grade zone in the “lower Platreef” of UMT003 sparked interest and encouragement and led to the inclusion of nine holes in southern Turfspruit and northern Macalacaskop in the planned 2008 drill programme. This programme consisted of 31 holes to test the entire 5000 m of strike length (from north to south) on Turfspruit and northern Macalacaskop. The central and northern holes returned mixed results, whereas five of nine holes in southern Turfspruit and northern Macalacaskop returned thick intersections with significant Ni and Cu values associated with local massive sulphides (e.g. UMT017, 87.7m @ 1.88 g/t 3PE, 0.55% Ni, 0.45% Cu. This was considered a potentially attractive underground bulk-mining target and became the focus of the 2009 drilling programme.

A total of 13 holes were drilled in 2009 to infill the bulk-mining target at 150 m to 200 m centres. In September 2010, a mineral resource model containing 700 Mt grading 1.07 g/t 3PE, 0.24% Ni and 0.16% Cu was estimated by AMEC E&C Services Inc. (AMEC, 2011), for the southern Turfspruit area at a 0.15% Ni cutoff. This was deemed insufficient to warrant further work and in 2010 exploration shifted back to central and northern Turfspruit, to step out from earlier deep holes that had yielded good results.

The first two step-out holes, UMT035 and UMT040 (planned hole numbers were not necessarily drilled in sequence), intersected the Main Zone – Platreef contact at a similar depth to the “up-dip” holes UMT033 and 007, respectively (Figure 6), with correlative high-grade mineralization hosted in similar pegmatoidal pyroxenite and harzburgite. These step-out holes provided the initial indication of a change in Platreef dip, although it was unclear whether this represented post-ore faulting, a localized fold, or a laterally extensive “flattening”. Empirical re-examination of available ground gravity data by the geological team in mid-August suggested the latter, and, while awaiting new drill funding, additional step-outs to test the interpretation were planned. Following a meeting of the Ivanhoe global exploration group in September, in-house geophysicists were tasked with inversion and re-interpretation of available gravity and magnetic data to help improve targeting.

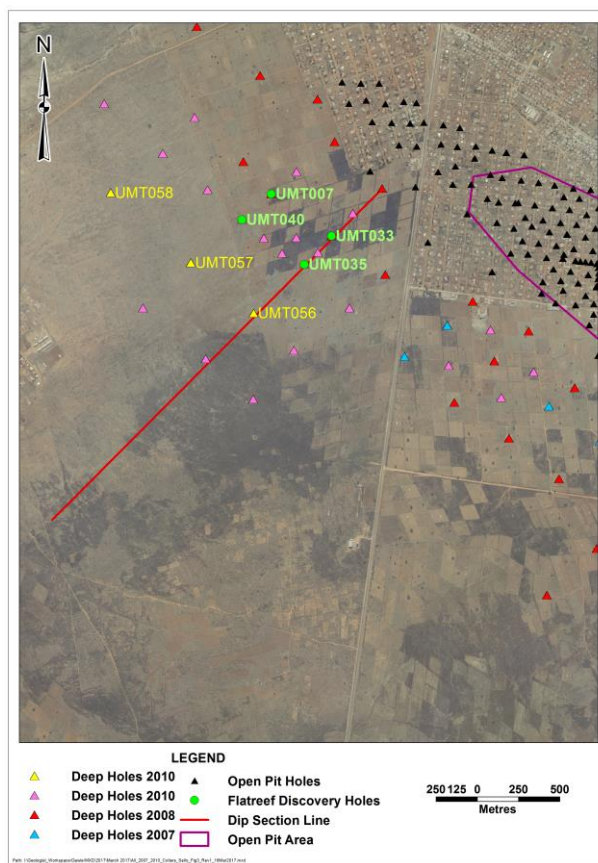


Figure 6: Location of open-pittable resource holes, earlier holes of the deep drilling programme, and the Flatreef discovery holes (highlighted in green).

During Q3 2010, an initial “selectively mineable” high-grade inferred mineral resource estimate was completed for the deep Platreef containing 17.8 Mt grading 4.65 g/t 3PE, 0.41% Ni and 0.19% Cu, at a 3 g/t 3PE cutoff. This estimate helped finalize the September 2010 investment by Itochu Corporation of \$US 10 million in the project, in exchange for 2% project ownership. With the new funding from Itochu in place, three additional step-out holes were collared in early October 2010, along a strike section 400 m further to the west. The first of these holes, UMT056, again intersected the Platreef and mineralized pegmatoidal pyroxenite and harzburgite at a shallow geometry, and returned 11.7 m grading 9.42 g/t 3PE, 0.50% Ni and 0.20% Cu. Holes 57 and 58 also confirmed a laterally extensive gently dipping geometry and the new zone was termed the “Flatreef”.

GEOLOGICALLY CONSTRAINED GEOPHYSICAL INVERSIONS AND RESOURCE EXPANSION

In September 2010, the need for predictive geophysical modelling of density and magnetic contrasts between the Main Zone and Platreef, and hence of the geometry of the deep Platreef, led to the involvement of Barry de Wet and subsequently Nicholas Williams, both then with Ivanhoe Australia. Technical details of their work on the Flatreef

discovery are described in Williams et al. (2016). Essentially, their work involved inversion of the airborne magnetic and gravity data collected by Fugro Airborne Surveys (Pty) Ltd. in two separate surveys.

Geophysical Survey Details

The magnetic data were collected in 2001 using a helicopter survey, covering an area of 168 km². The horizontal magnetic gradient and positional data were recorded by the RMS DGR33 acquisition system, at a sampling rate of 5 m (0.1 s) intervals (Fugro, 2001). The area was flown at a 100 m line spacing, trending east-west, with terrain clearance between 20–25m. The gravity data were collected in 2012 using a Cessna 208A turbo propeller aircraft and recorded using a FALCON airborne gravity gradiometry data acquisition system (Fugro, 2012a). The area flown covered 57.8 km² at a line spacing of 200 m, trending northwest, and a terrain clearance of 100 m. The recording equipment comprised the Scintrex CS-3 for airborne Caesium magnetometer with a bandwidth of 0.01–1 Hz, and the Geometrics G-823B and Scintrex CS-2 Caesium sensors for the ground magnetometers. The ground magnetometers used a sampling of 1 Hz. Both surveys covered the mining license area, including the Flatreef area.

Magnetic Inversions

Following an indication by Letts et al. (2009) that the stratigraphy of the Bushveld Complex comprises strong remanent magnetization, Williams and de Wet selected the magnetic vector inversion (MVI) algorithm to invert the magnetic data of the Platreef Project (Figure 7). The MVI was preferred over other potential field inversion algorithms (“traditional magnetic inversions”) based on its ability to manage the effect of strong remanent magnetization. Magnetic susceptibilities on the project varied from $2.2 \pm 2.5 \times 10^{-3}$ SI for the Main Zone gabbro-norites to $10.7 \pm 7.7 \times 10^{-3}$ SI for the Critical Zone and Lower Zone pyroxenites, to $4.3 - 7.0 \times 10^{-3}$ SI for the norites. Modelling of the magnetic data was mainly based on the contrast between susceptibilities of the Main Zone gabbro-norites and the Critical Zone pyroxenites (Figure 8).

The initial vector remanent magnetic inversion (VRMI) indicated a potential Flatreef area extending 1000 m west of the holes UMT056, 057 and 058 (Figure 6). Step-out exploration holes in this area continued to intersect correlative, ~flat-lying high-grade mineralization with attractive thicknesses of up to 32 m. By end 2010, 14 holes from the 2010 drill programme were successfully completed in the Flatreef discovery.

This drilling resulted in a ten-fold expansion of the initial selective high-grade resource tonnage, at similar grades and a 3 g/t 3PE cutoff, from 17.8 to 180 Mt grading 4.56 g/t 3PE, 0.41% Ni and 0.2% Cu, within a mineral resource estimate released in March 2011. The new estimate and the potential for further resource expansion resulted in the purchase by an Itochu-led Japanese Consortium, ITC Platinum Development Ltd., of an additional 8% stake in the project for \$US280 million.

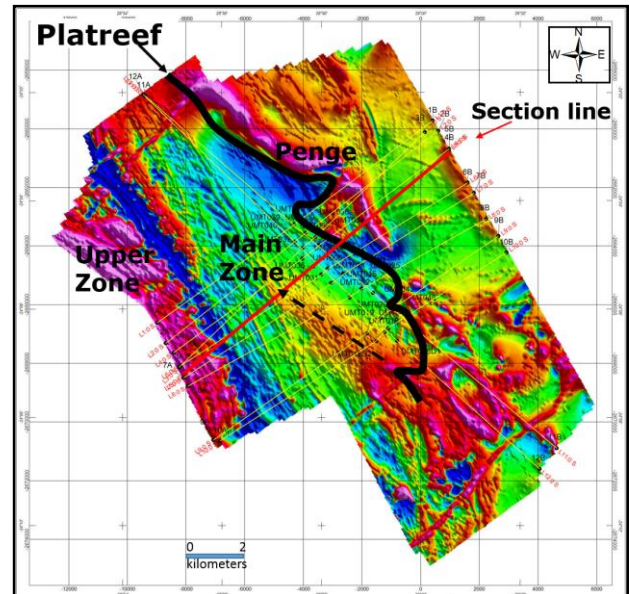


Figure 7: Vector remanent magnetic inversion map covering the Platreef Project area. The thick black line depicts the Platreef sub-outcrop and the red line shows the position of the cross sections below.

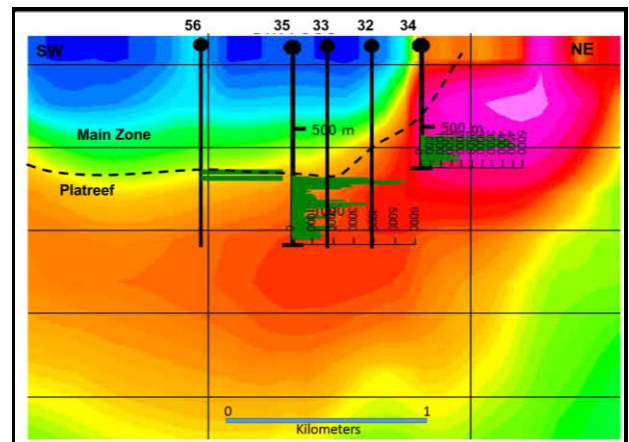


Figure 8: Vector remanent magnetic inversion section through northern Turfspruit, showing the Main Zone–Platreef contact flattening for at least 1000 m to the west of earlier Flatreef holes, suggesting possible extension of resources. UMT drill holes are marked by vertical solid black lines, 3PE grades are indicated by horizontal green bars (measured in g/t) and the Main Zone–Platreef contact shown by a dashed black line.

The 2011 drill programme focused mainly on infill drilling in the Flatreef area, with the objective to delineate indicated mineral resources. The programme rapidly expanded to incorporate 30 drill rigs from five drilling contractors in a 24-hour drilling operation, producing up to 10,000 m of drill core weekly. Sample processing involved the use of four assaying laboratories, both local and international. Up to 12 geologists logged and interpreted data. Within a period of eight months, 230 drill holes and 261,417 m were completed. During this period, integration of on-going drilling information into the

magnetic inversions further refined the predictive capabilities of the geophysical model, and resulted in the successful targeting of a steeply dipping segment of mineralized Platreef, west of the Flatreef area (Figure 9; Williams et al., 2016). In March 2013, an updated mineral resource estimate was released, incorporating 214.4 Mt grading 4.13 g/t Pt+Pd+Rh+Au (“4PE”), 0.34% Ni and 0.17% Cu of Indicated Resources and 415.0 Mt of inferred resources, both at a 2 g/t 4PE cutoff.

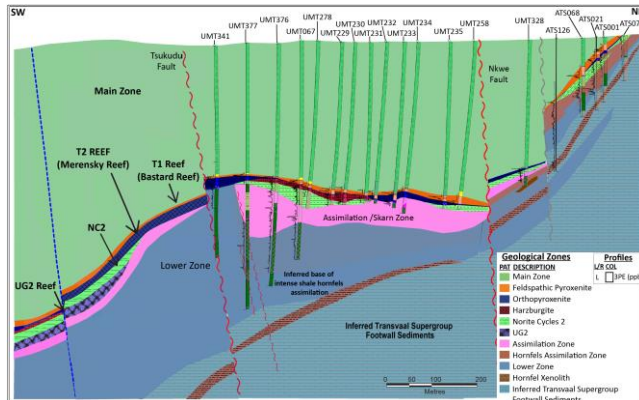


Figure 9: Geological section through northern Turfspruit, showing the segmentation of the Platreef into a steeply dipping near-surface zone, the central gently-dipping Flatreef, and a steeply dipping western zone that was targeted based on in-house geophysical modelling. Deep holes are shown by vertical green lines and faults are represented by sub-vertical dashed red, blue and grey lines.

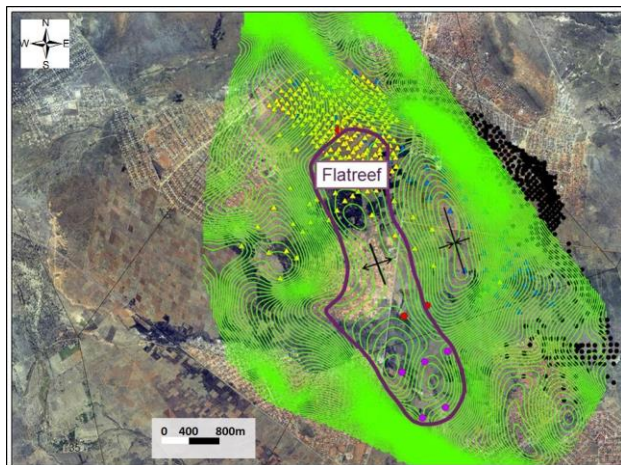


Figure 10: Structural contours of the Main Zone-Platreef contact as predicted by inversion of airborne gravity gradiometry data (green lines), outlining a previously unrecognized southward extension of the Flatreef (purple line). Also shown are drill collars (open pit holes in black, deep holes in yellow, confirmatory holes in the southward extension in red and purple).

Gravity Inversions

Density data collected on core during the drill programme indicated distinct differences between the Main Zone gabbronorites (mean, 2.91 g/cm³) and the Platreef pyroxenites

and norites (means of 3.2 and 3.14 g/cm³, respectively). This prompted the undertaking of a FALCON airborne gravity gradiometry survey in 2012, to predict the location of possible Flatreef extensions. The survey data were modelled and inverted in-house by Williams and de Wet, who first translated geological and density data into a set of prior 3D density models that were then used to guide the inversion towards an end product consistent with both the geological information and observed geophysical data. The resultant gravity inversions predicted a southward extension of the Flatreef in central and southern Turfspruit (Figure 10). This interpretation was confirmed by drilling in 2013 and resulted in the expansion of inferred mineral resources. Figures 11 and 12 display the differences between geologically unconstrained and geologically constrained gravity inversions.

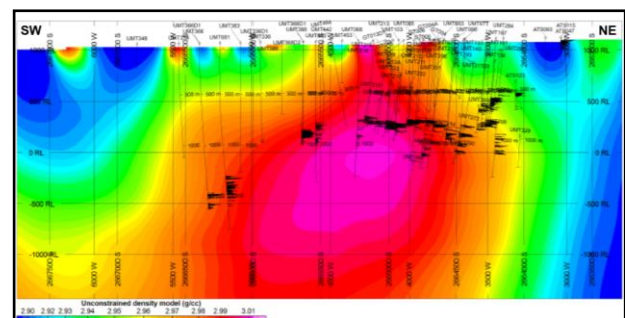


Figure 11: Cross-section through the geologically unconstrained gravity inversion (modified from Williams et al. 2016). Yellow and red colours represent the Critical Zone (pyroxenites and norites), green and blue colours represent the Main Zone gabbronorites. Main Zone-Platreef (Critical Zone) contact not well-defined. Drill holes are represented by thin vertical black lines and 3PE mineralization shown by black horizontal bars.

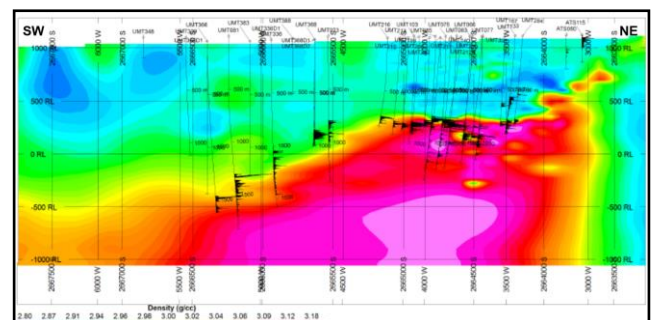


Figure 12: Cross section through the geologically constrained gravity inversion (modified from Williams et al. 2016). The Main Zone-Platreef (Critical Zone) contact is well-defined. Note that some of the drill holes are off-section i.e. mineralization plotting in the Main Zone area.

Follow-up drill programmes in 2014 and 2015 focused on the expansion of indicated mineral resources in northern Turfspruit–the Flatreef discovery area. Exploration activities were completed in early 2015, for a total of 544 exploration holes (including deflections) and 501,766 m over the span of the deep drilling programme. An updated mineral resource statement was issued in May 2016, and the growth of mineral resources from the deep drilling programme is illustrated in Table 1.

Period	Area	Resource Category	Tonnes (millions)	3PE g/t	Ni%	Cu%
October 2010	Northern Turfspruit	Inferred	17.8	4.64	0.41	0.20
March 2011	Northern Turfspruit	Inferred	180.0	4.56	0.41	0.20
	Southern Turfspruit	Inferred	700.0	1.07	0.24	0.16
March 2013	Mining Licence	Indicated	214.4	4.13	0.34	0.17
		Inferred	415.0	3.53	0.33	0.16
May 2016	Mining Licence	Indicated	346.0	3.77	0.32	0.16
		Inferred	506.0	3.24	0.31	0.16

Table 1: Deep drilling mineral resources.
Note: 2013 and 2016 PGE grades are reported in 4PE. Indicated resources only defined in Northern Turfspruit.

CHALLENGES OF THE DISCOVERY

Targeting Mineralization

Although gravity and magnetic surveys were successfully used to predict the location of the Main Zone-Platreef contact, and hence the position of the mineralized zone, it was not possible to predict geologically (at the initial 400 x 400 m drill spacing) or geophysically the grade or width of mineralization. Sulphide and PGM abundances in the mineralized zone are too low (commonly <5%) to significantly affect density, and a direct correlation between mineralized magnetite-bearing serpentinized harzburgite and grade is lacking. Lacking a predictive model for grade and width of mineralization, a 100 by 100 m grid drilling pattern over the main Flatreef area was adopted for definition of indicated resources. This spacing required precise and accurate control on the spacing of drill intersections at depths of more than 700 m. The deep drilling programme had initially utilized BQ (36.4 mm core diameter) drill rods and vertical holes, which were prone to deviation below the Main Zone-Platreef contact. As a result, it was difficult to achieve evenly spaced drill intercepts within the mineralized zone. To control deviation, drill rods were changed from BQ to NQ3 (45.1 mm core diameter) size, collar orientations were adjusted to counteract a tendency for westward deviation, and all holes were pre-surveyed near the base of the Main Zone using both electronic multi-shot and non-magnetic gyroscopic tools. These interventions successfully reduced deviation and improved drill targeting.

Geologic modelling

Correlation of lithologies and mineralization within the Platreef sequence was known to be challenging from Mogalakwena, from the initial Turfspruit open-pit drilling phase, and from other properties in the Northern Limb. To date, a coherent stratigraphic architecture remains a work in progress over this part of the Bushveld. Rather than adopting an approach driven by correlation based primarily on grade, as was common in open pit operations, Ivanplats constructed and continually updated and revised a detailed lithologic model for the Flatreef. This model was subsequently expanded to cover the steeply dipping Platreef and most recently, the Main Zone. Most drill holes were relogged more than five times over the course of the 2010–2016 period of drilling and resource estimation. This resulted in the recognition of a coherent magmatic stratigraphy in the Flatreef

and Platreef that greatly aided resource definition and estimation, and led eventually, to correlations with the stratigraphy of the Eastern and Western Limbs. Additional studies to support these correlations are underway.

Metallurgical Recoveries

Metallurgical recoveries in the Bushveld, and particularly in the Northern Limb, can be challenging due mainly to the fine grain size of PGMs, the presence and local dominance of non-sulphide (i.e. poor flotation response) PGMs; and the presence of gangue minerals readily recovered by flotation. Ivanplats and its Japanese partners undertook a long-term systematic geometallurgical approach in parallel with geological studies of mineralized lithologies, to develop a process flow-sheet ensuring economically robust recoveries.

Communities

Ivanplats has conducted exploration within and in the vicinity of communities since the start of exploration in 2000. Substantial time and effort was committed—not without setbacks and disagreements—to foster and eventually ensure broad community support for the project. Unemployment is a major challenge in the area, reaching about 35% in the Limpopo province (Limpopo Provincial Government, 2015). During the peak of exploration in 2011, approximately 361 local people were employed on the project. In acquiring a mining right for the project in 2014, Ivanplats adopted an inclusive, community-focused approach to South Africa's requirement for Broad-Based Black Economic Empowerment (B-BBEE) in mining operations, and implemented a B-BBEE plan whereby local communities own a 20% stake in the project and the remaining 6% is held by local employees and entrepreneurs.

Key factors that led to the Flatreef Discovery

A number of factors and individuals played a significant role in the discovery of the Flatreef deposit. Key factors are summarized as follows:

- Ivanhoe Mines management support
- Funding by the Japanese Consortium and their technical contributions on metallurgical studies
- Integration of geological and geophysical data
- Determination of the geological team and unconditional support from the Platreef Project staff
- Cooperation with local authorities and communities

CONCLUSIONS

The persistence and support of Ivanplats and Ivanhoe Mines management for the exploration and project development teams has played a major role in the success of the Platreef project. It allowed Ivanplats geologists to drill-test new ideas in the face of negative wisdom, wherein industry and academic geologists commonly held that the southern sector of the Platreef contained only sub-economic resources. The support from in-house geophysical expertise played an important role in the definition and expansion of the Flatreef area and mineral resources. Funding and technical input, particularly on metallurgical studies, provided by Itochu Corporation and ITC Platinum

Development Limited, has enabled project advancement from exploration to mine development.

ACKNOWLEDGEMENTS

The authors would like to thank the organizers for inviting Ivanhoe Mines to contribute to the Sixth Decennial International Conference on Mineral Exploration. We also thank Ivanhoe Mines for giving permission to publish this paper. Finally and most importantly, we thank the numerous geologists, geotechnicians and other Ivanplats and Ivanhoe staff who over the years contributed so much to make Platreef a successful project.

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