



Orion Minerals

ASX/JSE RELEASE: 10 September 2018

High tenor Ni-Cu-Co-PGE sulphides intersected at Rok Optel, Northern Cape, South Africa

▶ **Initial drilling confirms presence of high tenor polymetallic sulphide mineralisation within two zones of a complex multiphase mafic conduit-style intrusion.**

▶ **Massive sulphide veinlets occurring in swarms attain a maximum of 1-2% by volume in the wide swarm intersections drilled in the first hole.**

▶ **Base metals within the better mineralised sulphide zones attain maximum tenors of 15% Ni and 4% Cu indicating that the target massive sulphide may be of premium quality.**

▶ **Follow up down-hole electro-magnetic surveys detect conductors typical of bulk massive sulphide bodies, presenting high priority drill targets for immediate follow-up.**

Orion's Managing Director and CEO, Errol Smart, commented:

"Having confirmed that narrow injected massive sulphides veins intersected in recent drilling have high base and precious metal tenors and also having detected very strong down-hole EM conductors which may indicate wide lenses of sulphide with similar quality to the narrow veins already intersected, we are looking forward to the results of follow up drilling already underway."

Orion Minerals Limited (**ASX/JSE: ORN**) (**Orion** or the **Company**) is pleased to provide an update on ongoing exploration at the Rok Optel Ni-Cu-Co-PGE target on the Namaqua and Disawell mineral rights (**Disawell**) in the Areachap Belt, South Africa (Figure 1). Assay and whole rock geochemical results have been received for OROD001 and interpreted together with detailed core logging and follow up down-hole geophysics. The integrated results confirm the conduit setting of mineralisation and have identified better targets for massive sulphide discovery.

At the Rok Optel Prospect (Figure 2), drill hole OROD001 (refer ASX release 30 July 2018) intersected sulphide bearing mafic to ultramafic intrusive rocks over a down-hole width of 186.86m. The hole was completed at 412.06m. The drill hole intersected multiple thin massive sulphide veinlets varying from 1-50mm in width displaying injection features and occurring in swarms or concentrated within sulphide mineralised zones. While the sulphide content within the individual veins attains volumetric content of >90%, the bulk concentration of veins over the swarm width is generally <5%. The total sulphide content over assay intervals is generally less than 5% with maximum sulphur grade of 7.15% over 0.62m from 201.05m.

The assay data indicates that the sulphide mineralisation varies in metal tenor, from low base metal tenors (2.5 - 5% Ni, 1.5 - 3% Cu) in the upper parts of the intrusion and within veinlets hosted by country rocks, to high tenors (10 - 15% Ni and 3-4% Cu) within veinlets and blebs in the more primitive parts of the intrusion, which occur deeper in the intersection. The composite analytical data are illustrated by Table 1 and discussed in detail in Appendix 1.

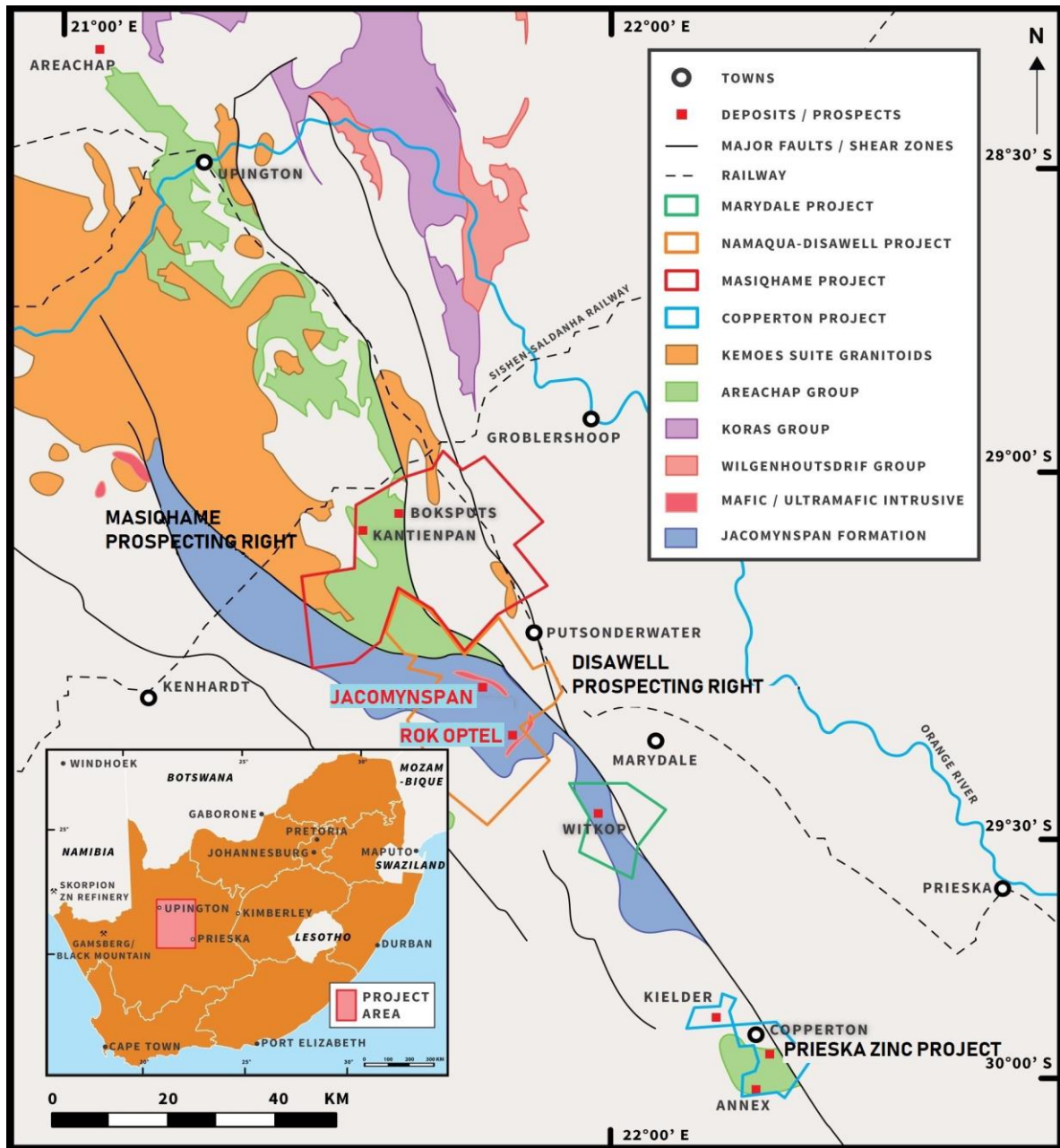


Figure 1: Areachap Project summary geology map showing the Masiqhame and Disawell prospecting right.

Drill Hole	Cut Off	From m	Width m	Ni wt%	Cu wt%	Co wt%	2PGE + Au g/t	Ni Tenor wt%	Cu Tenor wt%
OROD001	0.2% Ni	201.05	8.99	0.24	0.163	0.016	0.22	3.80	2.58
OROD001	0.2% Ni	292.09	7.29	0.28	0.115	0.013	0.66	9.29	3.65
OROD001	0.3% Ni	297.44	1.94	0.38	0.149	0.015	1.45	10.22	3.86
OROD001	0.5% Ni	201.05	1.22	0.45	0.569	0.047	0.16	2.90	3.66

Table 1: Drill intersections from OROD001 calculated using SG-weighting at various cut-off grades. The Ni and Cu tenors are calculated using the methodology of Kerr (2003) (see Appendix 2). The widths are intersection widths and have not been corrected to true width.

While precious metal tenors are not calculated for the intersections, the assay grades including high gangue dilution, indicate potential for extremely high precious metal tenor within the sulphides.

A second hole, OROD002 was completed on 1 September 2018 testing a cluster of Fixed-Loop Time Domain Electro Magnetic (**FLTDEM**) plate models with conductance of up to 9,400S. The hole intersected a complex sequence of interfingering mafic to ultramafic sills from 25.73m to the end of hole at 491.95m. Four conduit-style cross cutting intrusions are present, the upper three, intersected from 25.73m – 233.66m depth are interpreted from logging to be equivalent to the OROD001 sequence. A fourth, lower intrusion was intersected over 61.8m from 330.15m - 491.95m. This intrusion has the same rock suite and very similar poly-mineralic mineralisation to the upper intrusions.

Sulphide mineralisation was intersected at several horizons in OROD002, including massive, injected stringers, coarse blebs and patchy network styles, all of which are typical of conduit-style mineralisation. The most continuous mineralised zone intersected is 6.14m (intersection width) from 215.62m, which included a 13cm massive sulphide vein (>95% sulphide by volume) at 215.62m. A single high priority assay has been received for this vein, returning 0.90% Ni, 0.17% Cu, 0.03g/t 2PGE + Au over a 65cm sample from 357.37m. This assay is typical of the lower tenor zone of sulphide mineralisation intersected in the upper part of OROD001. Assay data from the remainder of the intersections are awaited.

Downhole electromagnetic (**EM**) surveys have been completed for OROD001 and OROD002 which has provided important 3D data collection and enabled more detailed resolution of the conductive bodies. While early interpretation focused on a simplified single conductor plate, the downhole EM surveys clearly indicate multiple stacked conductors, the strongest of which are off-hole. These conductors now become high priority targets to intersect larger volumes of the high tenor sulphides intersected in the narrow veins. The conductance of the plates infers a sulphide source.

Drilling has commenced on a third hole to test a 10,500S conductor with plate centre located 146m from drill hole OROD001. A >16,000S conductor located below and offset from OROD002 remains to be tested.

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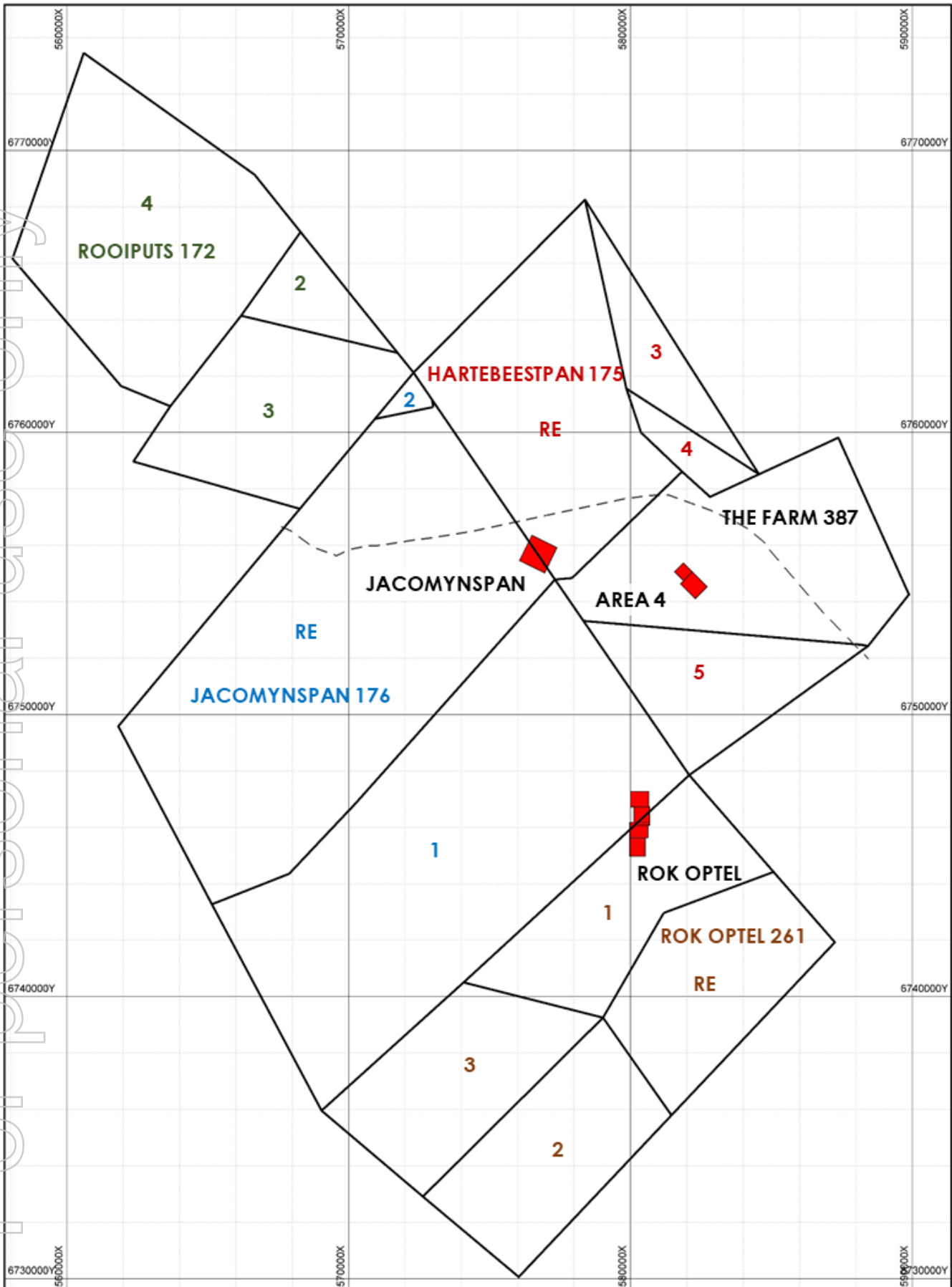


Figure 2: Project Plan illustrating the Ni Prospects and FLEM Loops completed.

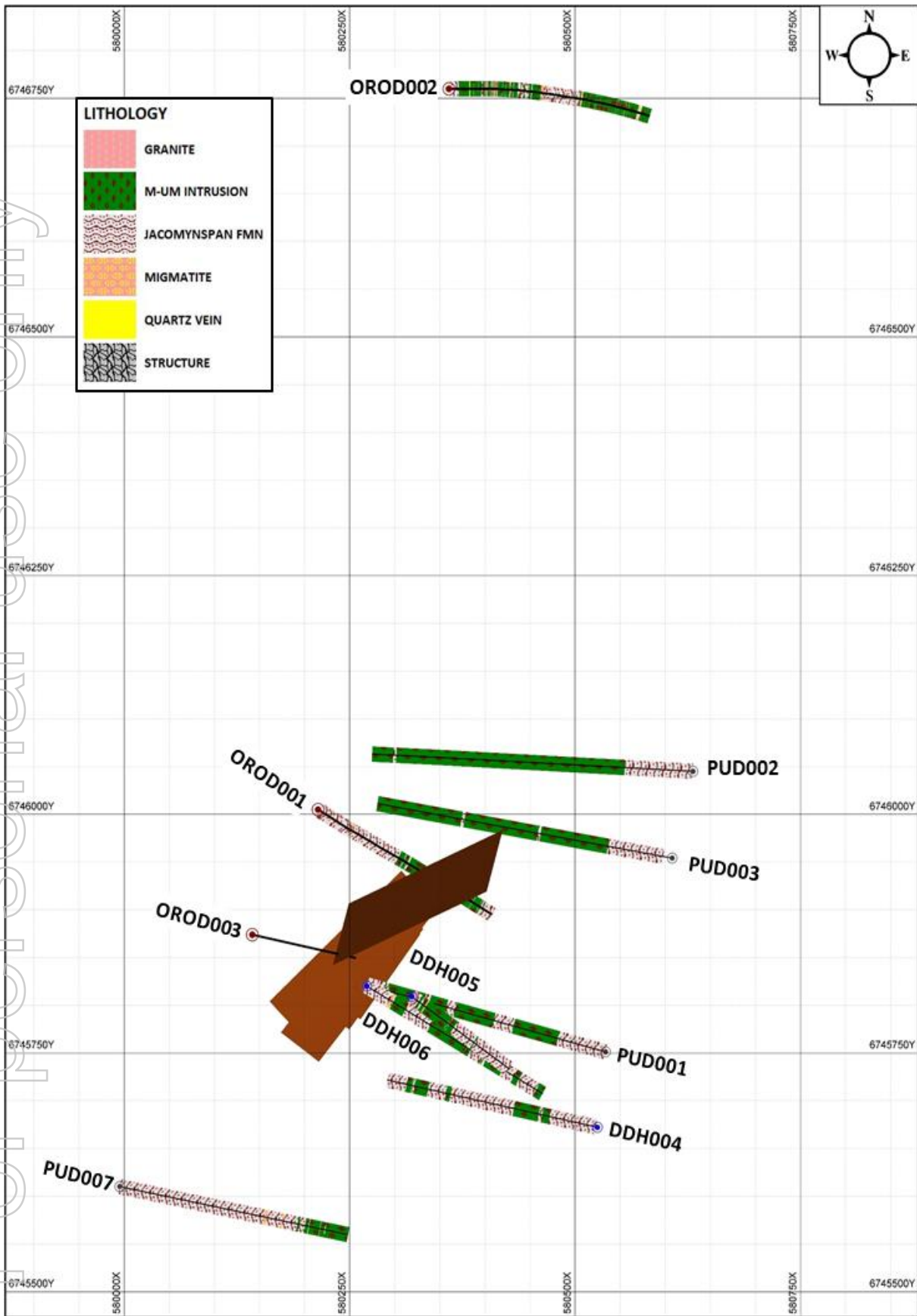
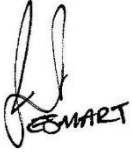


Figure 3: Rok Optel drill plan. Orion drill holes have OROD series numbers and historic holes with PUD and DDH series numbers. The new DHTDEM plates are shown, together with the new drill hole OROD003.



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Competent Person Statement

The information in this report that relates to Exploration Results is based on information compiled by Mr Richard Hornsey (Pr.Sci.Nat.) Registration No: 400071/96, a Competent Person who is a member of the South African Council for Natural Scientific Professionals, a Recognised Overseas Professional Organisation (**ROPO**). Mr Hornsey is a Consultant to Orion. Mr Hornsey has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the JORC Code. Mr Hornsey consents to the inclusion in this announcement of the matters based on his information in the form and context in which it appears.

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Drill Hole	X UTM34S	Y UTM34S	Elevation (m)	Initial Depth (m)	Final Depth (m)	Dip (degrees)	Azimuth (degrees)
OROD001	580,215	6,746,005	1,059	0	412.06	-60	120
OROD002	580,360	6,746,760	1,559	0	491.95	-65	090
OROD003	580,142	6,745,874	1,057	0	450.00 ⁽¹⁾	-70	102

Table 2: Orion drill hole Information.

⁽¹⁾ Target drill hole depth.

Appendix 1: Technical Update on the Exploration Completed at Rok Optel

This brief overview summarises and contextualises the recent and ongoing multi-disciplinary geological, geochemical and geophysical work that has been undertaken at the Rok Optel Prospect.

Overview

The focus of recent exploration has been the drilling of two new drill holes into the Rok Optel Prospect to:

- Verify the setting of the intrusion in terms of time and space relative to the Namaqua-Natal orogeny, especially important given that the neighbouring Jacomynspan intrusion is now interpreted to have been emplaced at a late stage during the orogeny.
- Verify the historic work undertaken and interpretation of the intrusion to be a steeply-dipping body emplaced parallel to the regional gneiss fabric (NNE-strike, with steep dips to the west). This previous interpretation was not supported by the FLTDEM plates that inferred shallower dips.
- Identify the causative geological features for the airborne electromagnetic (**AEM**) and FLTDEM anomalies that could include sulphide mineralisation, graphite, or a conductive formational feature.
- Capture the maximum amount of quality new data from the drill hole core to enable construction of an interpretative and fully-inclusive predictive geological model to understand the sequences and mineralisation intersected and assess whether the EM anomalies have been fully explained or quantified. This data includes geological logging, detailed structural logging, completed before core cutting for analysis; and detailed sampling, description and quantification of mineralisation, followed by analysis.
- Interpret the assay results within the context of the intrusive rocks intersected and described to assess the nature, style, and distribution of the base and precious metals. Variation of sulphide tenor and relationships to lithological packages may be of importance to vector to the discovery of bulk massive sulphide lodes.
- Provide a platform to undertake DHTDEM surveys that provide “within mineralisation” detail to enable better resolution of the conductive stratigraphy and identify deeper-seated conductors that may be related to massive sulphide. Magma conduits are characterised by the presence of several stacked conductors related to mineralised stratigraphy. This introduces complexity to target plate modelling that can only be resolved by down-hole surveying. The FLTDEM plate models present an average derived from a surface of the earth 2D survey platform, whereas the DHTDEM plate models are derived from 3D survey data.

This work has been supported by:

- Georeferencing and characterization of the 1977 Newmont mapping followed by field mapping of the Rok Optel prospect, comprising a 10-day focused program by three geologists. This work has significantly advanced detailed understanding of the prospect,
- Mineralogy has been undertaken on field grab samples from Rok Optel and Area 4 for comparison to Jacomynspan. The final reporting on this work is awaited.
- Lithogeochemical interpretation of the Rok Optel and Area 4 grab sample analytical data has been undertaken to assess whether the intrusions trace element characteristics show that the intrusions are part of the same magma suite. This database will become more valuable going forward as it provides Orion with a tool for rapid assessment of newly identified, potentially mineralised intrusions.

Figure A-1 is a Rok Optel prospect drill plan including the current plate models from the FLTDEM and DHTDEM surveys. The data are overlain on the SkyTEM™ first vertical derivative, reduced to the pole magnetic image that corrects the data to plot anomalies into their correct spatial locality. The image shows that the magnetic stratigraphy changes characteristics and becomes more banded to the east of Rok Optel. This has now been characterised by surface mapping to represent a lithological boundary between biotite-garnet-sillimanite gneiss to the west, and plagioclase-hornblende gneiss to the east. The FLTDEM plates are shown in dark red, and the DHTDEM plates in dark green. Drill hole OROD003 is testing the new 10,500S plate derived from the DHTDEM survey.

Drill Hole OROD001

Certified results from the 96 analytical samples have been received from ALS Chemex. The drill hole intersected 192.63m of intrusive rocks, 104.41m of which host magmatic sulphide mineralisation, including massive sulphide (201.23m – 201.55m, 203.54m – 203.61m, 287.05m – 287.08m), and stringer mineralisation (240.05m - 242.14m, 248.08m – 248.69m). Figure A-2 presented previously (refer ASX release 30 July 2018) has been updated to indicate the tenors of the illustrated sulphide mineralisation. Figures A-3 to A-7 are various drill hole plots of assay data and calculated parameters. The drill hole logs are simplified to show intrusive rocks, gneiss, granite, migmatite, veins and major structures.

- Figure A-3 shows Ni and Cu (ppm). Mineralisation is hosted over three main intervals. The uppermost sample, from 201.05m - 201.67m, returned the highest Ni and Cu grades (6940ppm and 4870ppm respectively). The sample (Figure A-2) contains injected semi-massive to massive sulphide.
- Figure A-4 shows Pt+Pd+Au (2PGE + Au)(g/t) and S (%). This plot is more revealing as it very clearly indicates the zones of better quality mineralisation in terms of metal content within sulphide, referred to as tenor. Apart from two samples with semi-massive sulphide at 201.05m and 287.04m, the S content is generally below 5% of the sample. This indicates that the base metal tenors of the better grade zones will be elevated. The PGE are rapidly diluted within high sulphide zones of mineralisation. The 2PGE + Au plot indicates that there is no direct correlation between Sulphur and PGE, but that the PGE are concentrated within two well-defined zones within the sequence coincident with peak Ni and Cu tenor. As the PGE strongly partition into the sulphide phase, the PGE tenor of the sulphide mineralisation may be extremely high.
- Figure A-5 shows the calculated Ni and Cu tenors using the methodology of Kerr (2003) (Reference provided in the JORC table, Appendix 2). It is acknowledged that the S contents are relatively low, therefore the calculation may provide indicative values only, however the PGE data provide an independent confirmation of the elevated sulphide tenors. Sulphide tenor is the calculated metal content of 100% sulphide, using the base metal and sulphur grades within the rocks, corrected based upon the observed quantity of olivine within the rock. Olivine hosts some Ni, therefore this is deducted from the Ni assay value. Cu is less incorporated into the silicates but may be hosted by clinopyroxene or amphibole. Correction factors of 100ppm have been applied. The plot provides a clear indication of the high base metal tenor of the upper and lower zones of mineralisation. The best quality sulphides are located towards the base of the lower zone, coincident with the highest PGE + Au grades (maximum Ni tenor of 14.52% from 299.38m to 300.08m). This indicates that, should a bulk massive sulphide body be associated with this magma influx, it would be of premium base and precious metal grade.
- Figure A-6 shows MgO and CaO (%), derived from the raw assay data by application of standard correction factors to convert from element to oxide. This diagram further indicates the lithological variation, and relationships between rock type and mineralisation. MgO content provides a proxy for the mafic to ultramafic characteristics, particularly for fine grained, very dark, or slightly altered rocks. MgO of < 6.5% indicates mafic rocks (norite and gabbro), 6.5 – 13% pyroxenites, and >13% olivine dominant ultramafic rocks. It is clear from this plot that the upper mineralised zone is hosted by mafic rocks, and the lower mineralised zone by ultramafics. The CaO plot enables discrimination between orthopyroxene and clinopyroxene-bearing rocks. CaO of >7.25% indicates that the rocks are clinopyroxene bearing (gabbronorite to gabbro), whereas <7.25% indicates orthopyroxene-dominant norite. The upper and lower mineralised zones are hosted by orthopyroxene-dominant rocks. The lower mineralised zone is particularly anomalous within this dataset. These parameters will be utilised to derive a stratigraphy for the intrusion that will lead to more robust correlation as more data becomes available.

Figure A-7 shows drill hole OROD001 relative to the DHTDEM plates. The uppermost plate correlates to the centre of the mineralised zones intersected. The lowermost (10,500S) plate centre is located approximately 146m south west of OROD001.

Drill Hole OROD002

Drill hole OROD002 has been completed with 87 analytical samples submitted to ALS Chemex for assay. The drill hole intersected a complex sequence of interfingering mafic to ultramafic sills from 25.73m to the end of hole at 491.95m. Four conduit-style cross cutting intrusions are present, the upper three, intersected from 25.73m – 233.66m depth are interpreted from logging to be equivalent to the OROD001 sequence. A fourth, lower intrusion was intersected over 61.8m from 330.15m - 491.95m and also has the same rock suite and very similar poly-mineralic mineralisation to the upper intrusions. A suite of lithogeochemical samples have been selected to characterise the intrusions and facilitate between hole correlation.

Figure A-8 shows an oblique section looking north section of OROD002 illustrating the summarised lithology, mineralised zones (expressed as sulphide percentage estimated during core logging), and photographs of the sulphide mineralisation styles intersected.

Geophysics

The drill holes have been surveyed by Terratec Geophysical Consultants from Windhoek, Namibia using the DigiAtlantis DHTeM probe. This has assisted in resolving the complex geology and better-defined the locations of the numerous conductive features within the intrusive conduit complex. This complexity is a typical feature of mineralised conduit intrusions within which the responses from several conductors interact.

The OROD001 results indicate a 10,500S off-hole conductor is located approximately 70m to the southwest of the drill hole with plate centre at approximately 146m. A follow-up hole, OROD003 has been collared to test the plate centre (Figure A-7).

The DHTeM survey of OROD002 also indicates a complex series of conductive features, the uppermost of which was intersected by the drill hole (Figure A-8). A very strong off-hole conductor (16,000S) has been identified within the latest-time EM channels located below and to the west of the drill hole. Plate modelling is in progress, and this anomaly will be drill tested during the coming campaign.

The EM plate models are summarised by Table 3.

Target	Method	Loop	Conductor Model	Plate Dimensions (m)	Plate Conductance (Siemens)	Approximate Plate Depth (m)
Jacomynspan	FLTDEM	HP2A	HP2_2022	1000 x 1000	250	150
			HP2_2527	1100 x 1100	325	200
			HP2_3032	1000 x 1000	490	310
			HP2_3335	1000 x 1000	575	400
Area 4	FLTDEM	A4A	A4A_1820	150 x 90	350	75
			A4A_2023	125 x 80	400	75
			A4A_2325	150 x 75	450-500	100
		A4B	A4B_1820	400 x 50	650	50
			A4B_2023	300 x 50	900	50
			A4B_2224	325 x 50	1100	50
			A4B_2527	325 x 40	1750-2000	50
Rok Optel	FLTDEM	ROK1	ROK1_2730	475 x 90	2050	230
			ROK1_2932	475 x 90	2500	250

Target	Method	Loop	Conductor Model	Plate Dimensions (m)	Plate Conductance (Siemens)	Approximate Plate Depth (m)	
		ROK2	ROK1_3133	475 x 85	3600	280	
			ROK2_2528	475 x 100	1250	200	
			ROK2_2729	500 x 95	1700	225	
		ROK3	ROK2_2932	475 x 85	2900	275	
			ROK3_2325	130 x 300	850	275	
			ROK3_2527	135 x 250	950	300	
		ROK4	ROK3_2729	120 x 275	1250	300	
			ROK4_3335	100 x 330	5250	295	
			ROK4_3537	90 x 300	7200	310	
		OROD001 DHTDEM	ROK2	ROK4_3639	80 x 300	9400	320
				OROD001_1_2830	70 x 250+	1250-1500	~240 DH
				OROD001_2_3335	75 x 200	7200	~335 DH
	OROD002 DHTDEM	ROK4	OROD001_2_3537	75 x 125	10500+	~335 DH	
			OROD002_1_3739	70 x 325	7500	~355 DH	
				OROD002_2_3739	60 x 250	16000+	~390-400 DH

Table 3: Summary of the plate model dimensions and conductance for the Rok Optel prospect.

Field Mapping

Field mapping over a 10-day period was undertaken at Rok Optel by two MSc students from the University of the Witwatersrand supervised by expert consultant Richard Hornsey. This work has added control and context to the ongoing exploration. Field observations indicate that the Jacomynspan Formation comprises two major units within the area studied. This has been further refined using the airborne datasets into eastern mafic gneiss (hornblende-plagioclase) and western biotite-garnet-sillimanite gneiss terranes. Target intrusions are located within both terranes, but display different outcrop characteristics, weathering negatively in the biotite-garnet-sillimanite terrane (Rok Optel intrusion) and positively in the mafic gneiss terrane. A large body of structural data have been captured that is currently being interpreted and used for 3d modelling.

The initial data have been compiled into a project geological map (Figure A-9).

Subsequent reconnaissance field mapping has identified two new norite intrusions located on Jacomynspan portion 1 that are visually very similar to Rok Optel. Grab samples have been submitted for lithogeochemistry. This further confirms the prospectivity of this terrane, and the opportunity to detect new intrusions by undertaking basic fieldwork.

Geochemistry

Lithogeochemical and preliminary mineralogical data have been received from grab samples that confirm that the Jacomynspan, Rok Optel, and Area 4 intrusions are all geochemically related. Figure A-10 shows a spider diagram of selected major and trace elements showing samples from Jacomynspan compared to the new data from Rok Optel and Area 4. The samples from Rok Optel and Area 4 have been characterised mineralogically as hornblende-bearing olivine norite (Draft report by Solly Theron, SJT Metmin Services (Pty) Ltd). These rocks are plagioclase and titanomagnetite-bearing, whereas the Jacomynspan samples do not host either of these elements, therefore these mineralogical differences are reflected within this plot for Ti (titanomagnetite), Sr and Eu (plagioclase). The remainder

of the plot shows excellent correlation between the samples from the three intrusions. This strongly infers that the three intrusions form part of a potentially extensive suite of related intrusions.

Summary of the Project Status and Ongoing Work

The exploration undertaken at Rok Optel and surrounding areas has significantly advanced the exploration model. The following working hypotheses are being advanced and tested:

- The Jacomynspan Suite of intrusions are part of a suite of high magnesian tholeiitic komatiite to basalt conduit-style intrusions emplaced at a late stage of the Namaqua-Natal orogeny. As such they share characteristics with several other similar intrusive complexes, including the Fraser Range.
- The Rok Optel intrusion has now been confirmed to be PGE-endowed. Previous assays did not include the PGE.
- The Rok Optel working model indicates that the intrusion is a series of sill-like stacked intrusions forming a magma conduit. Several horizons within the intrusion host sulphide mineralisation of variable metal content, base metal and PGE characteristics, and tenor, indicating repeated influxes of magma.
- Nine drill holes have been drilled into the intrusion of which six have intersected significant mineralisation. The westerly directed holes drilled by previous explorers may have drilled at a shallow angle to the zones intersected in OROD001 and OROD002, resulting in false wide intersections. The mineralised intrusions extend over an extent of approximately 1.3km from north to south, and there is no indication that the intrusions, or their mineralisation, are terminating in either direction.
- The above observation needs to be related to the AEM geophysical anomaly and the initial FLEM datasets. The drilling is indicating offset, deeper-seated conductors at both OROD001 and OROD002. Within a complex conduit setting, the potential for deeper zones of mineralisation must always be considered and adequately tested.
- Drill hole OROD003, the follow-up hole to OROD001 will provide important information for the ongoing exploration of Rok Optel and assist to plan the forthcoming Area 4 program.

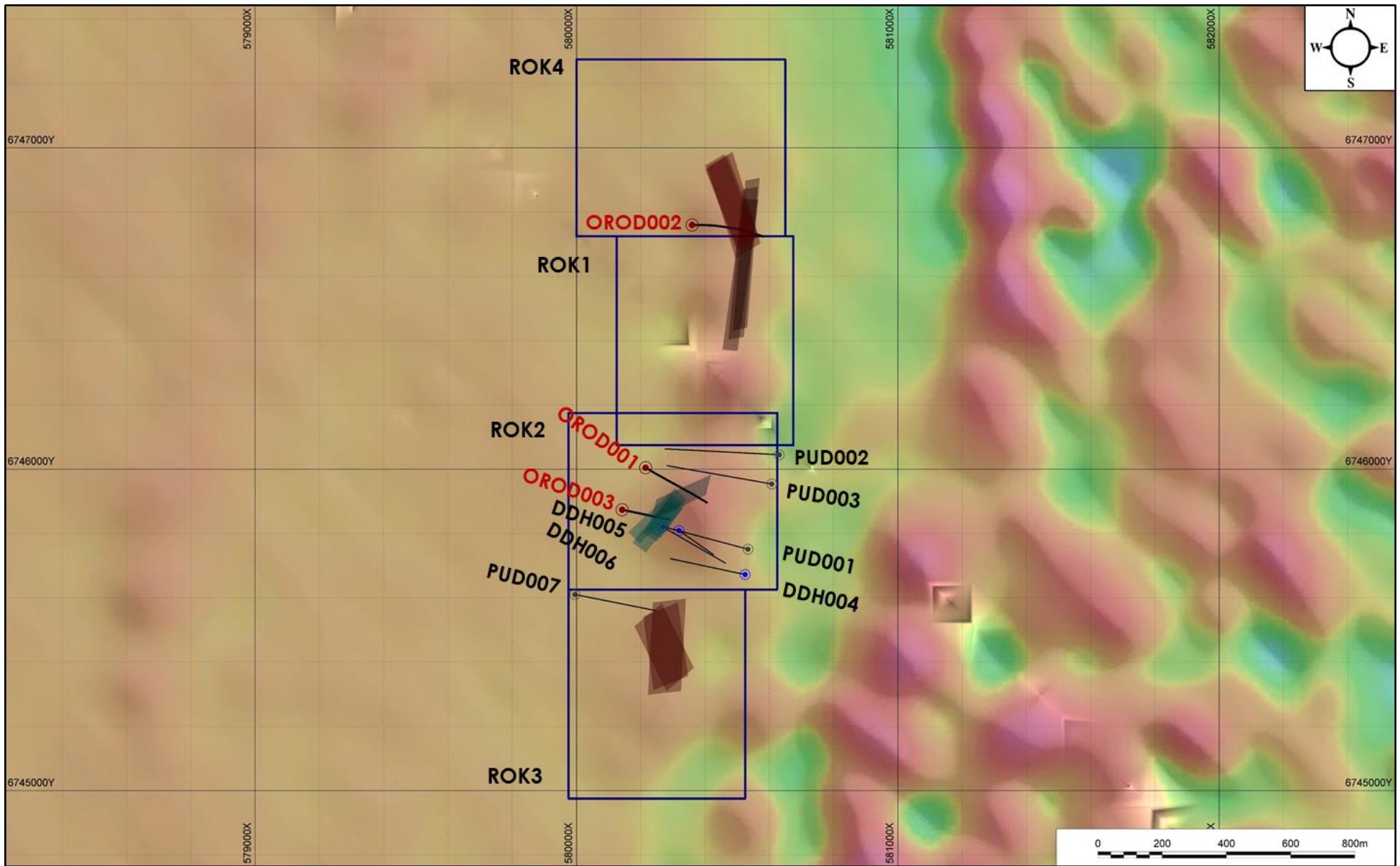


Figure A-1: Rok Optel drill plan with the FLTDEM loops, FLTDEM plates (dark red) and DHTDEM plates (blue-green). The historic drill holes (DDH = Hochmetals SA; PUD = Newmont) and new holes are shown. The plan is overlain on the 1VD RTP magnetic image.



201m: Intrusion top contact, upper chill sharply cross-cut by a sulphide-mineralised pyroxenite magmatic breccia. **INTERMEDIATE TENOR**



201m: massive sulphide intruding and brecciating the host pyroxenite. Note the marginal sulphide veins that penetrate along the pyroxene grain boundaries and display fractionation from Ni to Cu sulphide. This is typical Type 2 magmatic sulphide. **INTERMEDIATE TENOR**



241m: zone with several Type 2 massive sulphide veins intruding the lithified pyroxenite along grain boundaries and stopping/entraining silicate autoliths. Note the metal fractionation to Cu-dominant margins. **HIGH TENOR**



248m: 7m-thick zone with patchy and injected sulphide mineralisation causing incipient brecciation of the host norite. The sulphide mineralisation is polyminerally, hosting large grains of chalcopyrite derived from metal fractionation during sulphide liquid cooling. **HIGH TENOR**



287m: 4cm thick massive sulphide stringer hosted within coarse-grained hybridised gabbro including partially assimilated gneiss xenoliths. **INTERMEDIATE TENOR**

Figure A-2: Typical sulphide mineralisation from drill hole OROD001 showing the injected semi-massive and stringer sulphide, very coarse blebby sulphide and infiltration sulphide. The percentage of sulphide in a sample interval rarely exceeds 5%, but the high tenor zones are enriched in base and precious metals.

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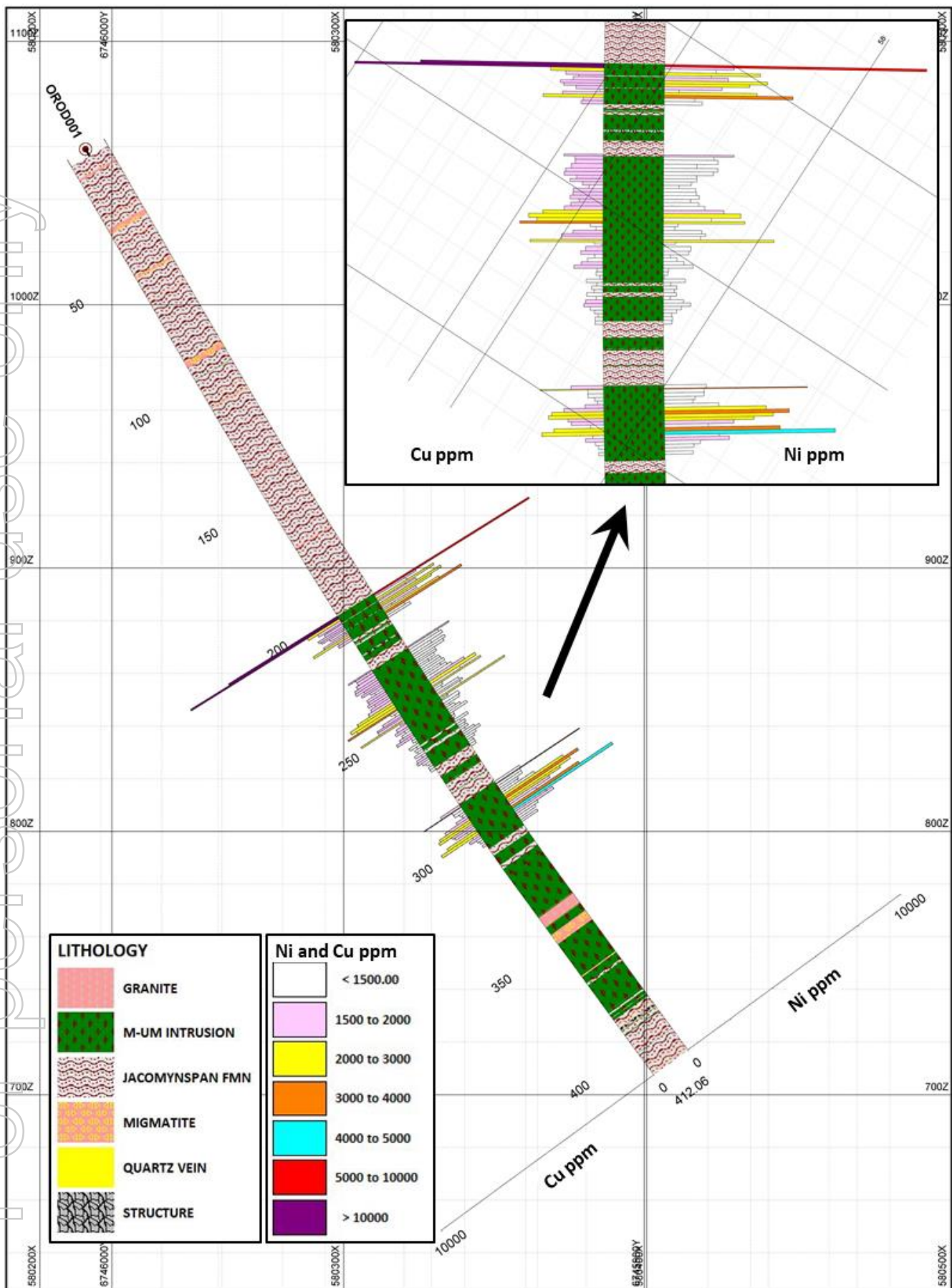


Figure A-3: Drill hole OROD001 Ni and Cu analyses (ppm).

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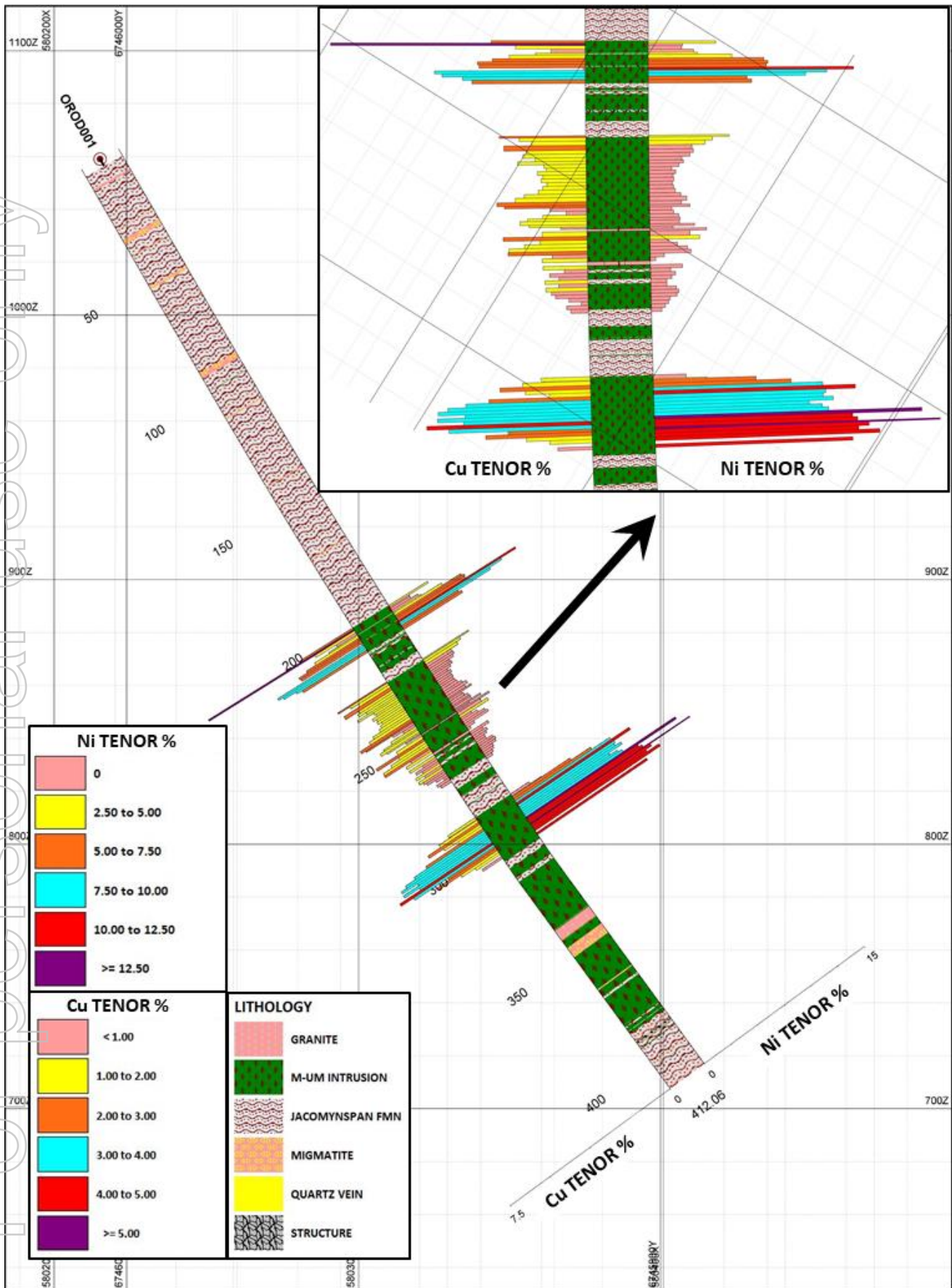
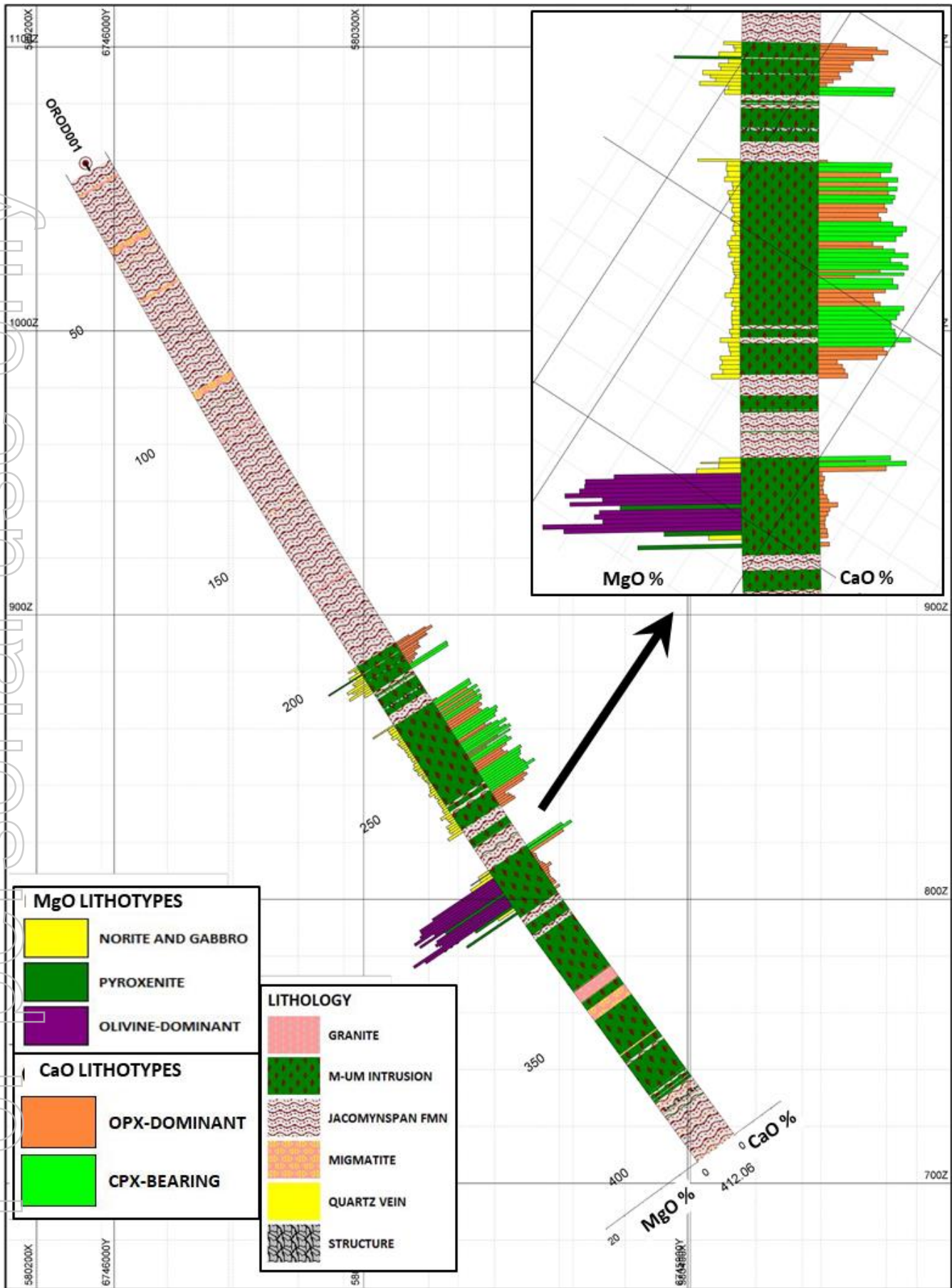


Figure A-5: Drill hole OROD001 Ni and Cu tenor (%) (calculated using the analysed Ni, Cu, and S data using the method of Kerr, 2003).

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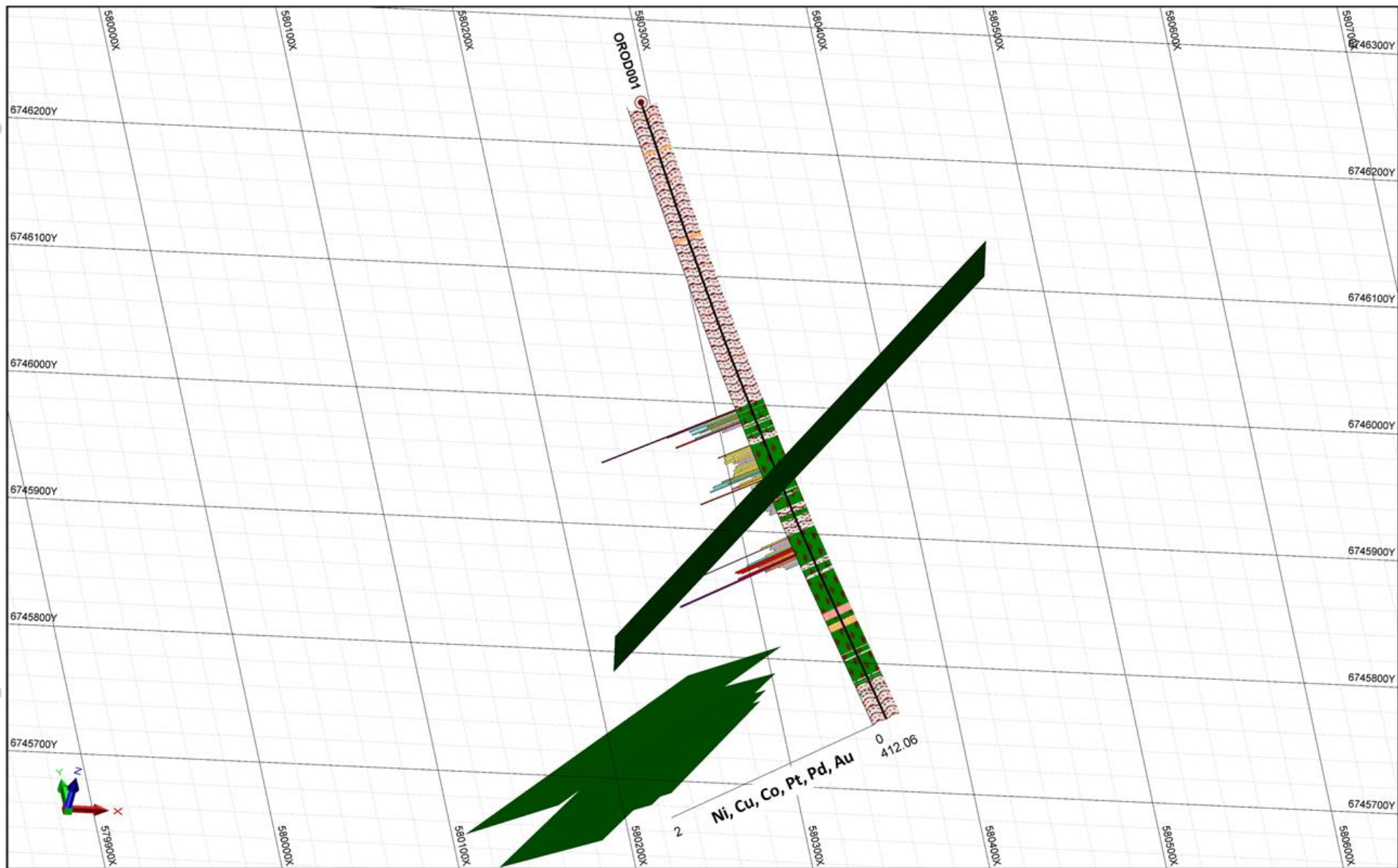


Figure A-7: OROD001 drill section indicating the DHTM plates and a combined metal plot to illustrate the mineralised horizons. The lower plate has 10,500 S conductance and is being targeted by drill hole OROD003.

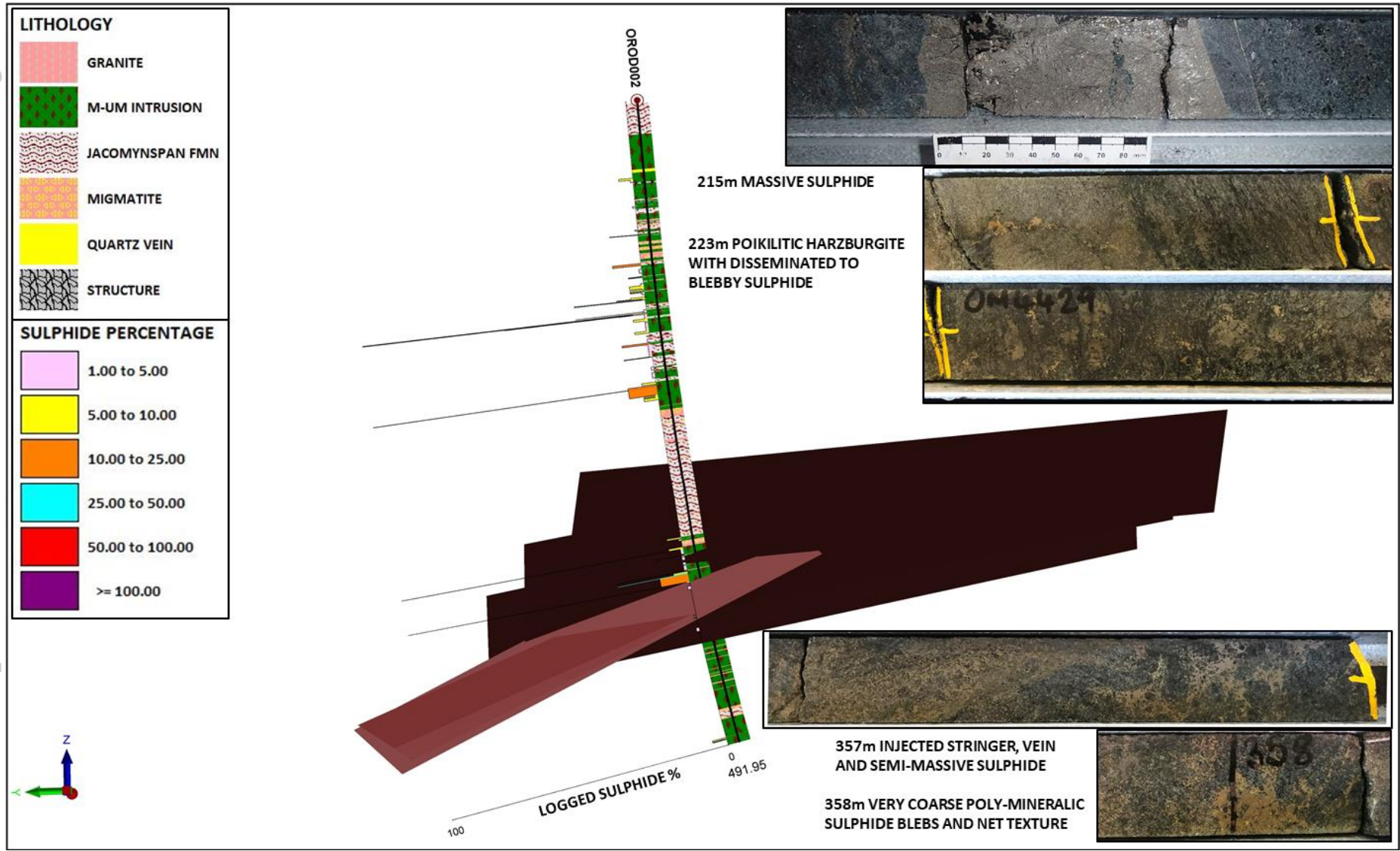


Figure A-8: OROD002 drill section indicating the target plates, lithology, sulphide mineralisation intervals, and photographs of typical sulphide mineralisation intersected.

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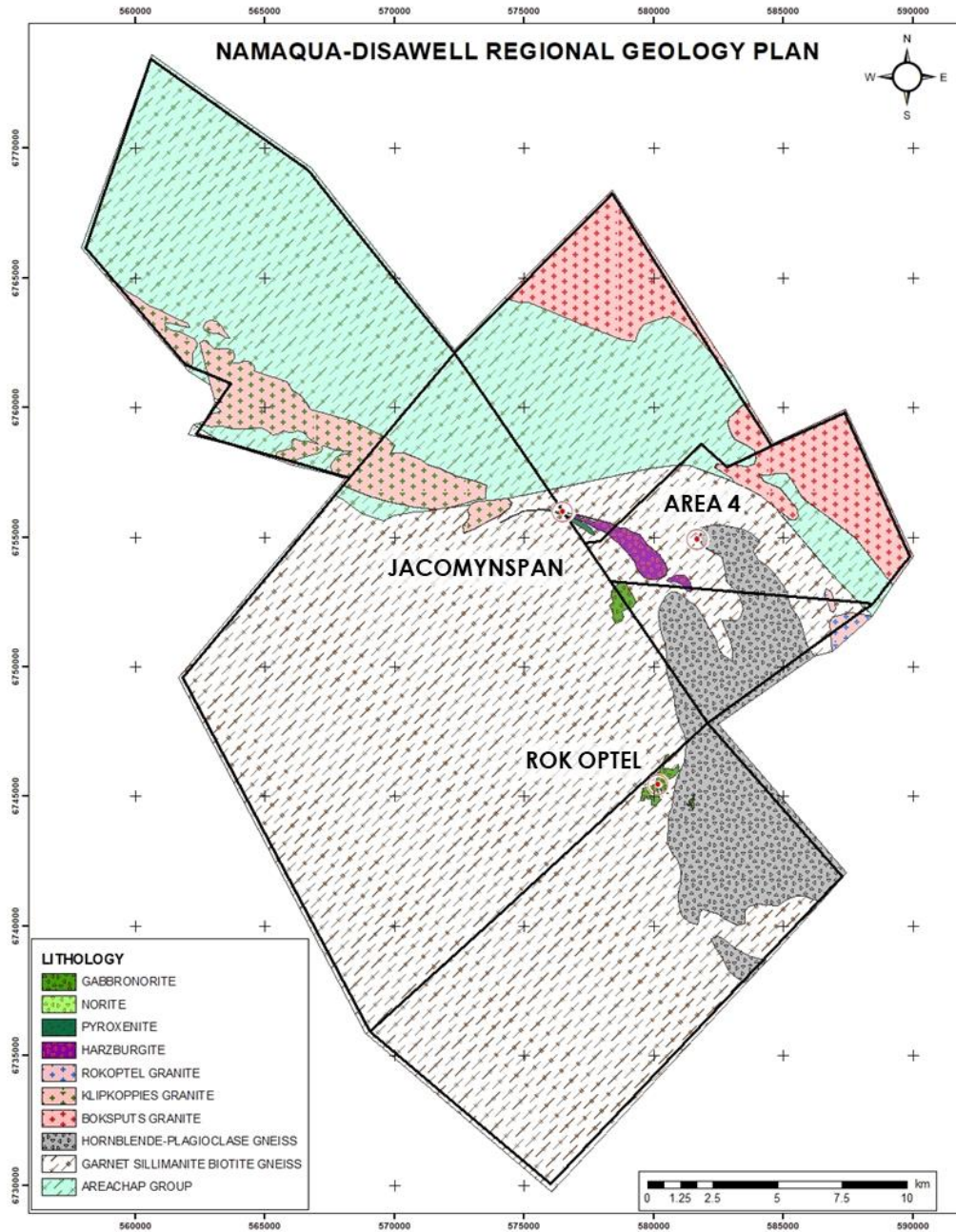


Figure A-9: Updated project geology plan showing the subdivision of the Jacomynspan Formation and locations of the Jacomynspan Suite intrusions.

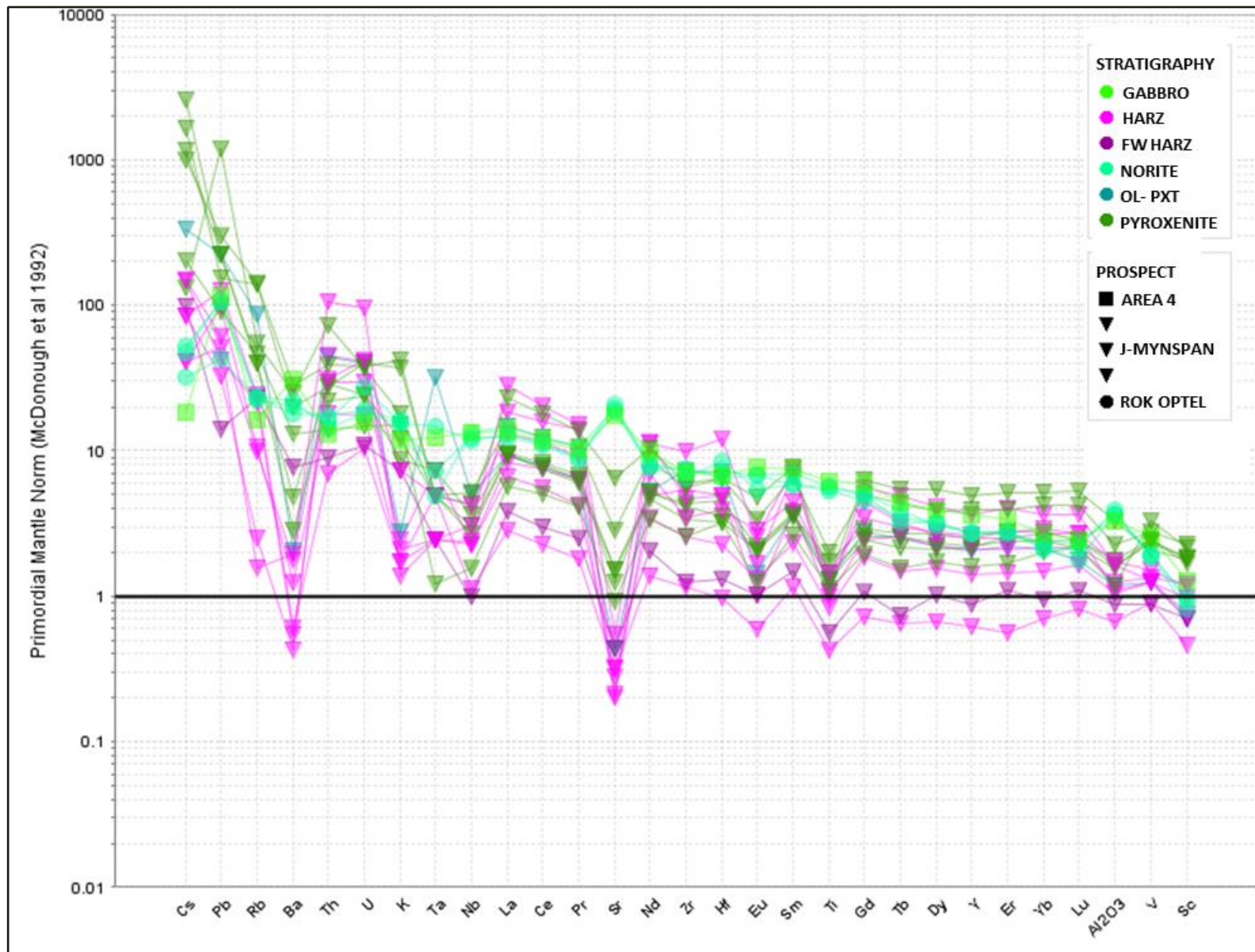


Figure A-10: Lithogeochemical Spider Plot of the data from Jacomynspan, Area 4, and Rok Optel indicating that the trace element signatures are very similar and that all intrusions form part of the same suite.

Appendix 2: The following tables are provided in accordance with the JORC Code (2012) for the reporting of Exploration Results for the Jacomynspan Project.

Section 1 Sampling Techniques and Data

(Criteria in this section apply to all succeeding sections.)

Criteria	JORC Code explanation	Commentary
<p>Sampling techniques</p>	<ul style="list-style-type: none"> Nature and quality of sampling (e.g. cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc.). These examples should not be taken as limiting the broad meaning of sampling. Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used. Aspects of the determination of mineralisation that are Material to the Public Report. In cases where 'industry standard' work has been done this would be relatively simple (e.g. 'reverse circulation drilling was used to obtain 1 m samples from which 3 kg was pulverised to produce a 30 g charge for fire assay'). In other cases more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual commodities or mineralisation types (e.g. submarine nodules) may warrant disclosure of detailed information. 	<ul style="list-style-type: none"> The drill hole is geologically logged, and zones of mineralisation are identified and marked on the core. The core is marked for cutting using the "low point" of the stratigraphy, marking the downhole direction on each core piece to ensure that the cut core is returned to the tray correctly. Half core is sampled. Following cutting, the core returned to the tray. The sampling process is undertaken by a geologist, who checks that all core is returned in the correct order by turning the core to face upward, fitting the core together and marking the metre intervals on the cut face. The core is reviewed, and zones of mineralisation identified. The core sample intervals are marked with due consideration of the percentage of sulphide mineralisation, lithological contacts, and minimum and maximum sample intervals (nominally 30cm to 1.5m). The sampling details are captured onto a paper log sheet that records sample depths, sample number (derived from a standardised sample register) recoveries, mineralisation percentage, sulphide minerals and mineralisation style. A comments field is used to capture ancillary observations or associations. Duplicate samples derived from previous drill hole core (quarter core) are added to the sample list at the end. Following sampling data capture, the core is placed into pre-numbered plastic bags by the responsible geologist. QC samples are assigned empty bags at this point. The sample ticket book is then completed and handed over to the technician. SG determinations are then taken by the technician using an Archimedes Bath. The data are captured and verified by the geologist prior to sample bag sealing. QC samples (standards and blanks) are inserted into the defined sample bags by the technician. The samples are sealed and are placed into polyweave bags for shipping to the analytical laboratory. The bagging schedule is recorded, and all bags are weighed. All hard-copy information pertaining to the above process is filed in the original drill hole log file, and the appropriate data is digitally captured into the MS Excel drill hole log file.

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Criteria	JORC Code explanation	Commentary
		<ul style="list-style-type: none"> • Samples are despatched by courier to the analytical laboratory.
Drilling techniques	<ul style="list-style-type: none"> • <i>Drill type (e.g. core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc.) and details (e.g. core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc.).</i> 	<ul style="list-style-type: none"> • Diamond core drilling was undertaken using HQ core size to drill through the weathered zone (approximately 75m) reducing to NQ core in hard rock. • The OROD001 core was partially oriented. OROD002 was drilled with oriented core.
Drill sample recovery	<ul style="list-style-type: none"> • <i>Method of recording and assessing core and chip sample recoveries and results assessed.</i> • <i>Measures taken to maximise sample recovery and ensure representative nature of the samples.</i> • <i>Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.</i> 	<ul style="list-style-type: none"> • Core recoveries are assessed on a routine basis using drill rig and core yard standard procedures. • At the drill rig, core stick-ups are measured at the end of each run. The core is fitted together and placed into the core trays with a plastic block at the end of each run recording the hole depth and advance. • At the core yard, the length of core is measured for each run. The measured length of core is subtracted from the run length recorded from the driller's stick-up measurements and recorded as a core gain or loss. • During the logging and sampling process, core recoveries are considered, and the cause of loss is quantified and described. The locations of 'bottom breaks' relative to the core run markers are observed. • There is no relationship between grade and recovery. This is a hard-rock style of mineralisation that is being evaluated using diamond drilling, generally with 100% core recovery through the mineralised zones.
Logging	<ul style="list-style-type: none"> • <i>Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies.</i> • <i>Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc.) photography.</i> • <i>The total length and percentage of the relevant intersections logged.</i> 	<ul style="list-style-type: none"> • The drill hole core is geologically logged utilising a standard-format logging template designed specifically for this style of mineralisation. • Both quantitative and qualitative logging is undertaken dependent upon the features being described. Qualitative parameters include lithology, colour, grain size, weathering, structural features, alteration, sulphide and oxide mineralisation, secondary mineralisation, and general contextual comments. Quantitative parameters include intensity of the qualitative parameters, mineralisation percentages, and magnetic properties. • The logs are recorded onto pre-designed templates and captured into digital format at the project office. • The drill hole core is photographed according to standard core yard procedure and the photographs are digitally archived.

Criteria	JORC Code explanation	Commentary
Sub-sampling techniques and sample preparation	<ul style="list-style-type: none"> • If core, whether cut or sawn and whether quarter, half or all core taken. • If non-core, whether riffled, tube sampled, rotary split, etc. and whether sampled wet or dry. • For all sample types, the nature, quality and appropriateness of the sample preparation technique. • Quality control procedures adopted for all sub-sampling stages to maximise representivity of samples. • Measures taken to ensure that the sampling is representative of the in-situ material collected, including for instance results for field duplicate/second-half sampling. • Whether sample sizes are appropriate to the grain size of the material being sampled. 	<ul style="list-style-type: none"> • No specific sub-sampling has been undertaken to date. • The NQ core is saw-cut at the Copperton core yard, and half-core is sampled. • Within the mineralised zones, the entire zone is cut and sampled. Internal waste or non-mineralised zones may not be sampled dependent upon their width. • The duplicate samples are derived from quarter core from previously sampled drill holes. • The sampling methodology is suitable for the style of mineralisation being sampled. The base metals are associated with the sulphide minerals, which are generally reasonably evenly distributed. Although nugget effects are higher for the Precious Metals, they are fine grained and intimately associated with the base metal sulphides, therefore nugget effect is reduced. • Sample preparation is undertaken at the ISO-accredited ALS Chemex analytical laboratory. The samples are processed according to industry best-practice. This involves a sample check-in procedure during which samples are assigned unique bar codes and entered into the LIMS system. The samples are then dried, crushed to <5mm, and pulverised to >85% <75 microns. • ALS Chemex also inserts QC samples into each batch, including 5% CRM's, 2.5% blanks, and 2.5% duplicates.
Quality of assay data and laboratory tests	<ul style="list-style-type: none"> • The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total. • For geophysical tools, spectrometers, handheld XRF instruments, etc., the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc. • Nature of quality control procedures adopted (e.g. standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (i.e. lack of bias) and precision have been established 	<ul style="list-style-type: none"> • The analyses are undertaken by ALS Chemex. The samples are analysed for base metals, precious metals and sulphur using the following methods: • ME-ICP41 – 35-element analysis specifically designed to analyse the acid-soluble portion of the analyte. The sample is digested using aqua regia, with ICP-AES analysis. For the metals of specific interest, Ni, Cu, and Co, the detection limits are 1 – 10,000ppm. For S, the detection limits are 0.01 – 10%. • PGM-ICP23 – standard Pb-collection fire assay with ICP-MS finish using a nominal 30g sample weight (detection limits of 0.005 (Pt) and 0.001 (Au, Pd) to 10.0g/t). • NI, CU-OG46 – is applied to samples that assay > detection limit for Ni and Cu using method ME-ICP41. The method uses aqua regia digestion with ICP-AES or AAS analysis. • Selected samples are submitted for lithochemical analysis to enable comparison of the major and trace element distributions between and within intrusions. This uses the package:

Criteria	JORC Code explanation	Commentary
		<ul style="list-style-type: none"> • CCP-PKG01 – this provides a complete lithogeochemical characterisation of non-poorly mineralised samples to provide major, trace, and the full suite of REE. • The methods utilised are appropriate to the style and grade of mineralisation being explored for. The aqua regia digest provides the most precise analysis of the acid-soluble sulphide hosted mineralisation, without digesting the non-recoverable silicate hosted base metals. • Following receipt of assay data, QC assessment is undertaken using a standard-format spreadsheet that includes all historic assay data. The external standard, blank and duplicate data are processed as well as the internal ALS Chemex standards, duplicates and blanks.
Verification of sampling and assaying	<ul style="list-style-type: none"> • <i>The verification of significant intersections by either independent or alternative company personnel.</i> • <i>The use of twinned holes.</i> • <i>Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols.</i> • <i>Discuss any adjustment to assay data.</i> 	<ul style="list-style-type: none"> • No significant intersections have yet been achieved. • The drill hole data is captured onto paper logs that are kept in specific drill hole log files. The data is captured into a standard-format drill hole MSEXcel spreadsheet by the geologist. The drill hole log is regularly appended to the project database as data is captured. • First-pass quality control is undertaken on a regular basis as the log data are imported into Micromine for visualisation purposes. The Micromine file import verification protocols identify any depth or survey issues should they be present. • No adjustments are made to assay data. The assay certificate is not altered in any manner. The data are captured from the certificate into the drill hole file, merged, QC samples removed, and the data are appended to the Micromine project file. The data are compared to the drill hole logs to assess whether any anomalies are present.
Location of data points	<ul style="list-style-type: none"> • <i>Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation.</i> • <i>Specification of the grid system used.</i> • <i>Quality and adequacy of topographic control.</i> 	<ul style="list-style-type: none"> • The drill hole collars are field located using a handheld Garmin GPS. The drill hole azimuth and dip are surveyed by the driller using an electronic level and verified using a Brunton compass. • Drill hole downhole surveys are undertaken using a North-seeking Gyro instrument. • The data are recorded using the WGS84 datum, UTM Zone 34S. • GPS elevation calibration is undertaken by recording points at a standard datum point.

Criteria	JORC Code explanation	Commentary
Data spacing and distribution	<ul style="list-style-type: none"> • Data spacing for reporting of Exploration Results. • Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied. • Whether sample compositing has been applied. 	<ul style="list-style-type: none"> • The current drilling is part of the discovery phase targeting massive sulphide mineralisation. Although sulphide mineralisation has been intersected it is not intended at this stage to include this in a mineral resource. Seven drill holes were drilled by previous explorers.
Orientation of data in relation to geological structure	<ul style="list-style-type: none"> • Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type. • If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material. 	<ul style="list-style-type: none"> • The mineralisation is primary magmatic sulphide and is not related to any imposed structural control. • The drill holes have intersected the mineralisation at a low to moderate angle to true dip, therefore sampling is representative of the mineralisation. • The drilling orientation is appropriate to the intrusion orientation as currently understood.
Sample security	<ul style="list-style-type: none"> • The measures taken to ensure sample security. 	<ul style="list-style-type: none"> • The samples are managed according to company chain of security protocols, including storage in a locked core yard, and courier of the sealed bags directly to the laboratory.
Audits or reviews	<ul style="list-style-type: none"> • The results of any audits or reviews of sampling techniques and data. 	<ul style="list-style-type: none"> • No specific audit of this project has been undertaken. The sampling process is governed by well-established industry and company procedures and protocols.

Section 2 Reporting of Exploration Results

(Criteria listed in the preceding section also apply to this section.)

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	<ul style="list-style-type: none"> Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings. The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area. 	<ul style="list-style-type: none"> The farm Rok Optel 261 has overlapping rights (in respect of differing minerals) held by two companies. Namaqua Nickel Mining (Pty) Ltd holds a mining right NC 10032MR (over Die Plaas No. 387: Whole Farm Hartebeest Pan 175: RE, Portion 5 Jacomyns Pan 176: RE, Portion 1, Rok Optel 261: RE, Portion 1, Portion 2, Portion 3) for the mining of Nickel, Copper, Cobalt, PGM, Gold. This right was granted on 19 September 2016 subject to certain conditions, which include local community participation and financial guarantees, but is not yet executed. Disawell (Pty) Ltd holds two prospecting rights namely NC 30/5/1/1/2/11010 PR (over Jacomyns Pan 176: RE, Portion 1, Portion 2 Rok Optel 261: RE, Portion 1, Portion 2, Portion 3 Rooi Puts 172: Portion 2, Portion 3, Portion 4) and NC 30/5/1/1/2/10938 PR (over Hartebeest Pan 175: RE, Portion 3, Portion 4, Portion 5 Farm 387: RE), each for the exploration of Zinc, Lead, Sulphur. Disawell and Namaqua entered into an earn-in agreement with Orion Minerals, in terms of which Orion (through its subsidiary, Area Metals Holdings No. 3 (Pty) Ltd) is granted the right to invest in these companies. No historical or environmental impediments to obtaining an operating licence are known.
Exploration done by other parties	<ul style="list-style-type: none"> Acknowledgment and appraisal of exploration by other parties. 	<ul style="list-style-type: none"> On Rok Optel 261, exploration has been undertaken by several parties, although only limited data are available. Hochmetals SWA undertook exploration during the early 1970's and drilled the drill holes previously reported upon by Orion Minerals. Poor quality standardised and summarised geological logs submitted to government are the only information remaining from this period. Newmont undertook exploration from 1975 to 1977. The Hochmetals core was re-analysed. The existing drill hole PUD001 was deepened by 70m and a new hole (PUD007) drilled to 522.90m. A report (Gresse 1977) with drill plans and sections is available and has been captured into the database.

Criteria	JORC Code explanation	Commentary
Geology	<ul style="list-style-type: none"> • <i>Deposit type, geological setting and style of mineralisation.</i> 	<ul style="list-style-type: none"> • The Rok Optel mineralisation is contained within portions of a metamorphosed mafic to ultramafic intrusion at least 150m thick containing magmatic nickel-copper sulphides. The intrusion is predominantly norite and gabbro, with lenticular bodies of pyroxenite to harzburgite. The intrusion is enclosed within quartz-feldspar-biotite-garnet (sillimanite) gneiss country rocks.
Drill hole Information	<ul style="list-style-type: none"> • A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drill holes: <ul style="list-style-type: none"> ○ easting and northing of the drill hole collar ○ elevation or RL (Reduced Level – elevation above sea level in metres) of the drill hole collar ○ dip and azimuth of the hole ○ down hole length and interception depth ○ hole length. • If the exclusion of this information is justified on the basis that the information is not Material and this exclusion does not detract from the understanding of the report, the Competent Person should clearly explain why this is the case. 	<ul style="list-style-type: none"> • See Table 2.
Data aggregation methods	<ul style="list-style-type: none"> • <i>In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (e.g. cutting of high grades) and cut-off grades are usually Material and should be stated.</i> • <i>Where aggregate intercepts incorporate short lengths of high grade results and longer lengths of low grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail.</i> • <i>The assumptions used for any reporting of metal equivalent values should be clearly stated.</i> 	<ul style="list-style-type: none"> • The assay data are captured into a standard-format MS-Excel spreadsheet within which various derived parameters are calculated, including standard metal ratios (Pt/(Pt+Pd) and Cu/(Cu+Ni), major element oxides (using standard conversions), combined Pt, Pd, and Au (2PGE+Au), and base and precious metal tenors (using the methodology of Kerr, A. (2003): Spreadsheets for the calculation and correction of sulphide metal contents. Newfoundland and Labrador Department of Mines and Energy, Geological Survey, Open File NFLD/2805). • The assay data are weighted using the SG and interval width to derive a mass factor that is then applied to the metal grade. Composite intervals are calculated using the mass-weighted values, which are then divided by the sum of the mass factors to derive the metal grade in weight percent. • The assay data are attributed and coloured according to the Ni grade to highlight zones of mineralisation for composite calculation. Composite intersection widths are manually calculated for various cut-off grades on a common-sense basis including minor lower grade intervals if present within a thicker zone of mineralisation.

Criteria	JORC Code explanation	Commentary
Relationship between mineralisation widths and intercept lengths	<ul style="list-style-type: none"> • These relationships are particularly important in the reporting of Exploration Results. • If the geometry of the mineralisation with respect to the drill hole angle is known, its nature should be reported. • If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect (e.g. 'down hole length, true width not known'). 	<ul style="list-style-type: none"> • The drill holes intersected the mineralisation at predominantly moderate to low angles.
Diagrams	<ul style="list-style-type: none"> • Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported. These should include, but not be limited to a plan view of drill hole collar locations and appropriate sectional views. 	<ul style="list-style-type: none"> • The prospect plan indicates the drilled and planned drill hole localities. • The intersection data derived from the abovementioned composite calculations are presented in the report.
Balanced reporting	<ul style="list-style-type: none"> • Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results. 	<ul style="list-style-type: none"> • The analytical data have been reported in a responsible and balanced manner.
Other substantive exploration data	<ul style="list-style-type: none"> • Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances. 	<ul style="list-style-type: none"> • The Time Domain Electromagnetic Surveys are undertaken using a best-in-class electromagnetic receiver manufactured by Electromagnetic Technologies. The source is a custom-built Time Domain Electromagnetic transmitter, capable of transmitting 140 Amps into a 1 x 1km aluminium wire loop. The source is coupled with military grade fluxgate sensors for shallow exploration and super-sensitive high-temperature Super Conducting Quantum Interference Devices (SQUIDs) manufactured in Germany, which are state of the art for deeper exploration. The SQUID system was employed at the ROK4 grid and can detect moderate to super-conductors to approximately 1,000m below surface. Readings are taken every 50-100m on 200m-spaced grid lines. • Down-Hole Time Domain Electromagnetic surveys are undertaken using a Digi-Atlantis EM receiver. The source is a custom-built Time Domain Electromagnetic transmitter, capable of transmitting 140 Amps into a 1 x 1km aluminium wire loop. The drill holes are cased using plastic pipe prior to survey. The survey is undertaken at station intervals of between 2 and 15m dependent upon the location of the mineralisation. Data are quality controlled then forward to the geophysical consultant.

Criteria	JORC Code explanation	Commentary
Further work	<ol style="list-style-type: none"><li data-bbox="421 229 1223 320">1. The nature and scale of planned further work (e.g. tests for lateral extensions or depth extensions or large-scale step-out drilling).<li data-bbox="421 331 1223 422">2. Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.	<ul style="list-style-type: none"><li data-bbox="1245 229 2112 379">• Drill hole OROD001 intersected the base of the Rok Optel intrusion at 387.82m and was completed at 412.06m. The DHTEM survey indicated that although some of the plates were intersected, a conductor is located off-hole. A follow-up hole, OROD003, is underway to test this target.<li data-bbox="1245 391 2112 518">• Drill hole OROD002 intersected a sequence of interlayered intrusive and gneiss rocks from 25.73m to the end of hole at 491.95m. The DHTEM has also indicated the presence of a deeper-seated conductor that will be tested by follow-up drilling.