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Company Announcements

Australian Securities Exchange Limited
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Via E-lodgement

EXCELLENT MINERALOGY RESULTS

- **Excellent results from an independent mineralogical report on samples from the Youkou Project**
- **Low Phosphorous, High Grade Hematite up to 68.8%Fe**
- **Average of 66wt% Iron with hematite being the main Iron mineral**

Waratah Resources Limited (ASX: WGO) ("Waratah"), the African-focused iron ore explorer and developer, is pleased to announce excellent results from an independent mineralogical report on samples collected from the promising Youkou project, in the Republic of Congo.

Analyses of the eight samples supplied to Snowden Mining Consultants ("Snowden") and Mintek South Africa ("Mintek") show an average of 66wt% Iron (Fe) with hematite being the main iron mineral. Potentially deleterious elements such as silica, aluminum and phosphorous are present in such small quantities that Snowden considers these rocks to be acceptable to be classified as high-grade iron ore.

Waratah submitted eight rock samples to Snowden and Mintek South Africa. Mineral identification and petrographic descriptions were undertaken using X-ray diffraction (XRD), petrographic optical microscope and X-ray Fluorescence (XRF) methods.

It was found that hematite is the dominant mineral identified, and it forms in banded ironstone, as well as a sometimes massive structures. The Loss On Ignition results are pleasingly low varying from 0.38% in YOK1 to 2.12% in YOK8.

A full copy of the Snowden Report is attached to this announcement.

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A summary table of the best eight samples taken around Latitude 0.80º North, and 14.46º East is shown below.

Sample Name	MgO%	Al_2O_3%	SiO_2%	P_2O_5%	Total Fe%	Fe as Fe_2O_3%	Sum of Oxides %
YOK 2	0.08	0.18	0.56	0.20	68.8	98.38	99.50
YOK 3	0.16	0.35	0.79	0.30	66.7	95.34	97.31
YOK 4	0.10	0.92	4.13	0.25	64.2	91.82	97.35
YOK 5	0.95	0.99	1.48	0.22	65.5	93.73	96.66
YOK 6	0.59	0.77	1.07	0.22	66.0	94.39	96.54
YOK 7	0.08	0.56	0.87	0.09	66.6	95.28	97.04
YOK 8	<0.05	0.44	0.62	0.20	64.8	92.68	94.01
YOK 10	0.12	<0.05	4.59	0.11	63.9	91.33	96.12

ENDS

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Competent Person Statement

The information in this report that relates to Exploration Results, Mineral Resources or Ore Reserves is based on information compiled by Mr WJA Witham B.Sc (Hons), MAIG an employee of Waratah Resources Limited. Mr Witham has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the 2004 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves. Mr Witham consents to the inclusion in the report of the matters based on this information in the form and context in which it appears.

SNOWDEN

Final

Waratah Gold Ltd: Youkou iron ore review
Project No. **J2011**

Republic of Congo
19 April 2011

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This report has been prepared by Snowden Mining Industry Consultants ('Snowden') on behalf of Waratah Gold Ltd.

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1 Executive Summary

Snowden Mining Industry Consultants (Snowden) was requested by Waratah Gold Ltd (Waratah) to undertake a desktop review of the Youkou iron ore asset (Youkou project) in the Republic of Congo (ROC) and provide independent comment on the prospectivity of the area. Snowden also commented on the mineralogy and chemical properties of a set of iron-rich samples collected from the Youkou project.

Based on the review Snowden found that:

- Analyses of the eight samples supplied to Snowden show an average iron content of 66 wt% Fe with hematite representing the major iron ore mineral. Potentially deleterious elements such as SiO_2, Al_2O_3, P_2O_5 and CaO are present in quantities that Snowden considers to be reasonable for high grade iron ores. The samples collected are of excellent tenor and chemistry, on par with that of other iron ores in the West African sub-region and in the world.
- The project area has been explored on a limited scale. Scope exists to improve this by employing modern exploration techniques to delineate the source deposit of these samples. The presence of many iron ore projects in Gabon, Cameron and ROC sharing similar geological attributes and many that are reporting Mineral Resources, suggests that exploration potential exists for the Youkou project.
- The favourable investment climate in ROC is a potential advantage for development of the Youkou project. Snowden has sighted documentation that shows progressive and updated mining legislation that is favourable for foreign investment.

Based on the review, Snowden has identified items for potential improvement:

- The eight samples analysed to date cannot be considered representative of the area. As Waratah has already initiated reconnaissance exploration in the area and has identified geophysical anomalies, a systematic geological mapping and sampling program to define the extent of the potential mineralisation with the eventual of defining a resource needs to be implemented. Initial focus for this work should be on the geophysical anomalies already identified ahead of trenching and drilling to test the anomalies. A site visit by a Snowden geologist is also recommended.
- The hand specimens provided to Snowden show potential for the presence of hematite and itabirite iron ores. Snowden recommends that these and all future sample localities should be clearly marked, with appropriate GPS points, to guide delineation of potential zones of mineralisation. Further, a larger sample set will be needed to determine what proportions of the Youkou project area are dominated by hematite or itabirite ore types.
- Snowden has not had sight of an updated exploration permit. Snowden suggests that this document be made available for review. The number of years for which the permit remains valid should be determined as this will impact on the timing of the exploration program.
- While the geochemical properties of the samples ore appears comparable with others in the world, further geological and metallurgical study is required to determine whether iron can be successfully liberated from the host rock.

2 Introduction

2.1 Project brief

Snowden Mining Industry Consultants (Snowden) has been requested by Waratah Gold Ltd (Waratah) to undertake a desktop review of the Youkou iron ore deposit (Youkou project) in the Republic of Congo (ROC) and provide independent comment on the prospectivity of the area. Waratah has provided historical data and recent geophysical data to Snowden for review and comment.

Waratah also requested Snowden to provide comment on the petrographic and chemical properties of a set of iron-rich samples which are reported to have been collected from the Youkou project.

Waratah is an Australian listed (ASX: WGO) junior mining company with gold interests in Australia. Waratah has recently acquired an iron ore prospect in ROC and wishes to add value to the property by prospecting and exploring it for iron ore. In this venture, Waratah has partnered with Solethu Mining and RRL Grindrod, a South African based rail group, who have extensive logistics interest and currently provide support to the locomotive industry in ROC.

2.2 Republic of Congo

The ROC is located in Central Africa and is bordered by Gabon, Cameroon, the Central African Republic (CAR), the Democratic Republic of the Congo, the Angolan exclave province of Cabinda and the Gulf of Guinea (Figure 2.1). The major cities are Brazzaville (the capital) and Pointe Noire, situated on the Atlantic coast.

Figure 2.1 Geographical map of the Republic of Congo

Source: www.yourchildlearns.com/online-atlas/images/congo-brazzaville-map.gif

The ROC enjoys relative political and social stability and current mining legislation (Mining Code Law 4-2005) is progressive and largely supportive of foreign investment, putting the country on par with several others in the sub-region where iron ore is being exploited.

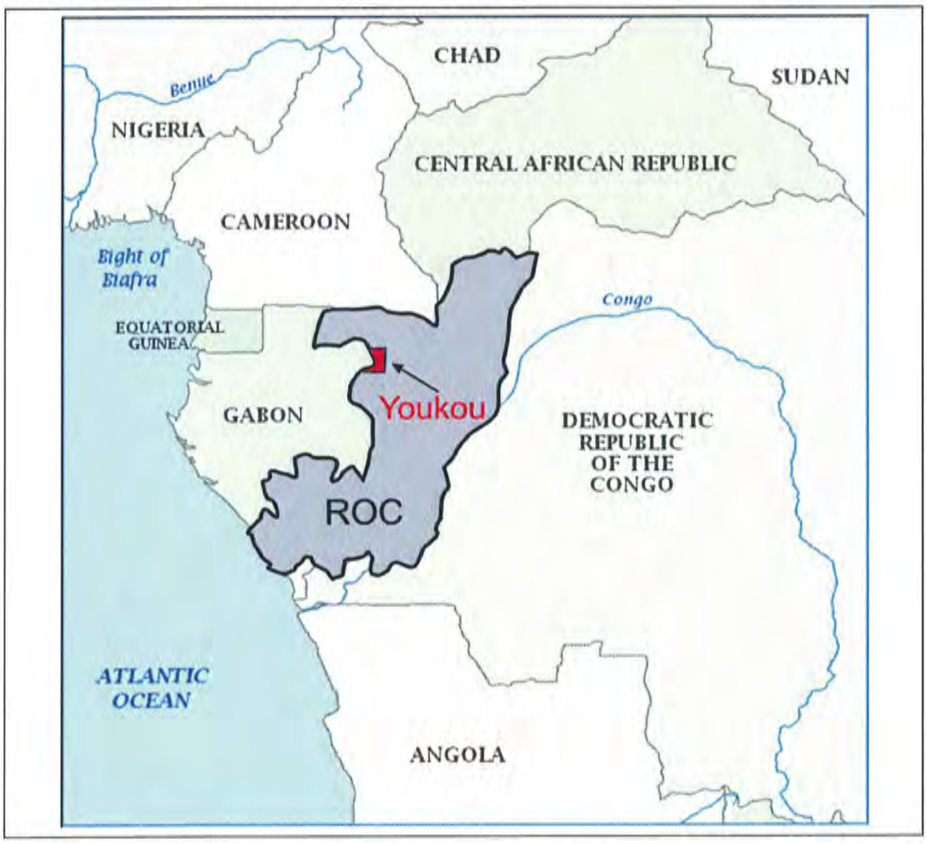
Waratah was first awarded a prospecting permit in November 2007 by the Ministry of Mines, Industrial Mining and Geology, ROC. The permit number is 311/MMIMG//DGG/DRG/SC. The ROC Mining Code states that such a permit is issued for a period of one year and is not subject to transfer or lease out. Snowden has been informed that this permit has been converted into an exploration license but has not had sight of the exploration permit.

2.3 Location of project area

The Youkou project is situated in the north west of the Mbombo district, in the northern part of ROC near the border with Gabon (Figure 2.2). Youkou can be accessed from Gabon by the N4 national road, which is continuous into ROC. Within the Mbombo district, the project area is located 9 miles north-east of the village Edjiandja in Kelle district.

The general morphology of the area is represented by undulating hills and gentle slopes covered in dense equatorial forest. The dense vegetation and deep weathering profile, characteristic of equatorial regions, obscures the underlying bedrock. The large number rivers and streams present in the adjacent area in Gabon are less dense in the Youkou project area.

Figure 2.2 Location map of the Youkou project area



Source: modified from www.yourchildlearns.com/online-atlas/images/congo-brazzaville-map.gif

3 Geological Setting

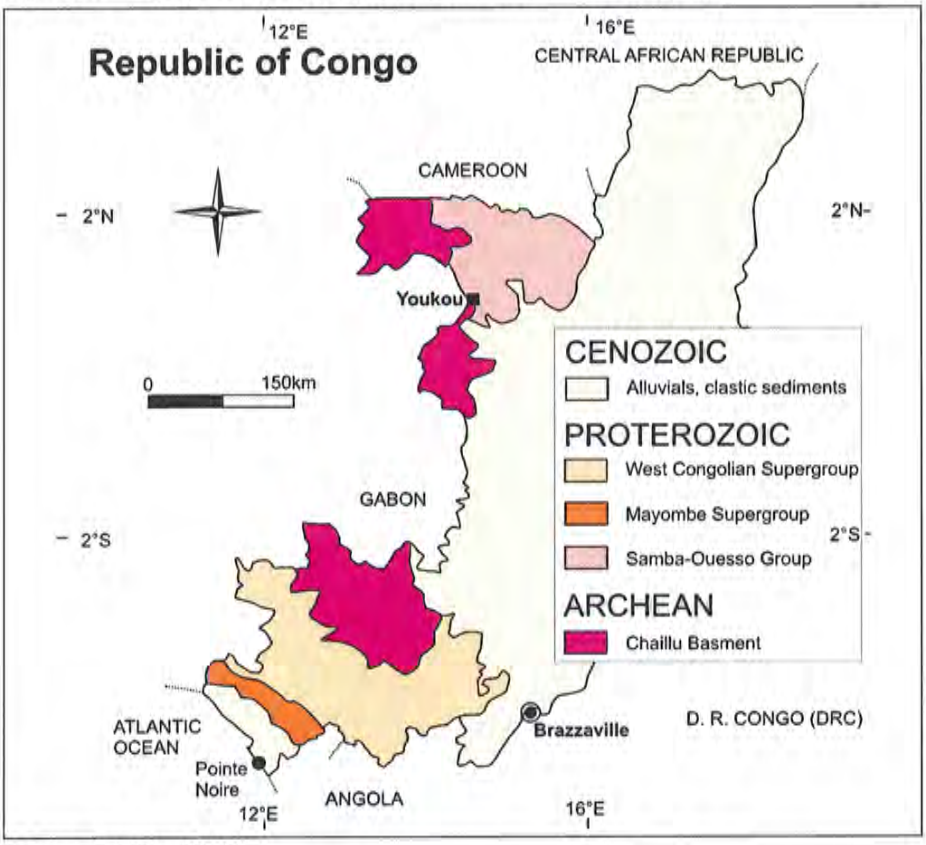
3.1 Regional geological setting

The basement geology of the ROC is represented by Precambrian rocks which are exposed in the northwestern and southwestern part of the country (Figure 3.1). These are overlain by Cenozoic alluvial sediment cover of the Congo Basin, which is extensively developed over the eastern part of the country.

The oldest rocks in ROC belong to the Archean Congo craton, which is represented by the Chaillu Basement metamorphic rocks in the south and its geological time equivalent, the Haut Ivindo Massif, in the northwest. Chaillu Basement rocks are represented by a vast granitoid massif outcropping in the south western and north western parts of the country, extending into neighboring Cameroon where it is concealed by younger rocks. The rocks of the Samba-Ouesso Group are closely related but are younger than the Chaillu massif, comprising quartzites, shales, conglomerates and dolomites. The West Congolian and Mayombe Supergroups constitute a mobile belt that extends from Gabon into ROC through to northern Angola. The West Congolian Supergroup contains volcano-sedimentary rocks whereas metamorphic and sedimentary rocks comprise the Mayombe Supergroup (Figure 3.1).

In the south west, Cenozoic marine sediments of the coastal basin include phosphatic sequences and evaporates. This Cretaceous to Quaternary coastal basin borders the rocks of the Mayombe Supergroup to the east.

Figure 3.1 Simplified geological map of the Republic of Congo (ROC)



Source: Schlüter (2008)

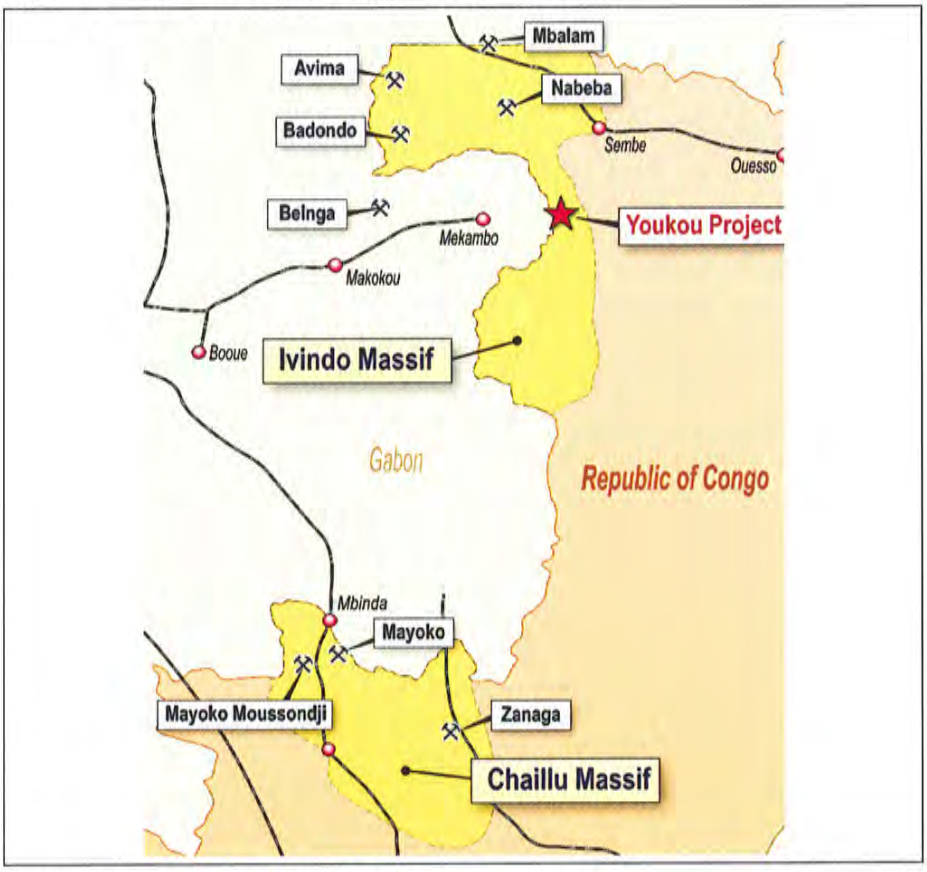
3.2 Iron ore projects in the region

A number of iron ore projects in the ROC, Gabon and Cameroon share similar geographic and geological attributes. They all occur in areas with intense rainfall and dense vegetation and are typically itabirite-rich with supergene hematite ores.

The term itabirite is borrowed from South America where it is used to define metamorphosed banded iron formations (BIFs). Itabirites are Precambrian metamorphosed iron ores originally deposited as alternating quartz, magnetite and hematite layers. In South America, where itabirites are exploited for iron ore, they have an average chemical content of 35% to 40% Fe but can yield 62% to 68% Fe on beneficiation.

In ROC, iron ore projects are located on the Ivindo massif with others further south on the Chaillu massif (Figure 3.2). In Gabon and Cameroon, the deposits are located on extensions of these granite massifs and have a similar mineralisation style.

Figure 3.2 Iron ore exploration projects in ROC and Gabon



Source: Waratah Gold (February, 2011)

3.2.1 Iron ore projects in ROC

The Avima project is situated in the northwest part of the ROC, in the Sangha region, lies close to the Gabon border to the west and the Cameroon border to the north (Figure 3.2 and Table 3.1). The major deposit is Mount Avima, a mineralised ridge of approximately 40 kilometre (km) strike length and rising 200 metre (m) to 900 m above sea level.

The Badondo project, also in the northwest, includes a ridgeline more than 7 km long of outcropping iron mineralisation.

The Oyabi iron ore project lies south of the Youkou project located on the southern portion of the Ivindo Massif, near Okoyo. It covers all of the southern part of the Massif.

The Mayoko iron ore project is located in the south-west region of ROC (Figure 3.2). The project lies on the basement rocks of the Chaillu Massif and covers an area of 1,000 km². The bulk of the mineralisation is hosted within highly weathered supergene enriched iron ore cap rocks.

The Zanaga project, also on the Chaillu Massif, (Figure 3.2) is an advanced exploration project with the bulk of the mineralisation hosted in the Zanaga Greenstone Belt of the Chaillu Massif. It comprises near surface enriched BIF (itabirite) above a hematite-magnetite banded iron formation with around 43% Fe and 20% SiO_2 (Arab Steel, 2006).

The Mayoko-Moussondji (Figure 3.2) project, also in the southwest, has an estimated global exploration target of between 2.3 billion tonnes and 3.9 billion tonnes of hematite and itabirite mineralisation at a grade of 30% to 65% Fe.

Table 3.1 Iron ore projects in Central and West Africa

Country	Company	Project	Million Tonnes (Mt)	Grade (Fe %)
ROC	Zanaga Iron Ore Company	Zanaga	3,340	32.8
ROC	Core Mining	Avima	195	62
ROC	Stirling Minerals/DMC	Mayoko	33	55
ROC	Equatorial Resources	Badondo Mayoko-Moussondji	2,300 -3,900	30 – 65
ROC	***Waratah Gold***	***Youkou***	***N/A***	*
ROC/Cameroon	Sundance Resources	Nabeba	200	63.1
Cameroon	Sundance Resources	Mbalam	800	60
Gabon	CMEC	Belinga	500	64

* Determined later in report

3.2.2 Iron ore projects in Gabon

The Belinga deposit is situated in the Makokou district and crops out as a series of north-south iron formation-rich ridges over an area of 35 km by 10 km (Figure 3.2 and Table 3.1). The ridges rise to heights of about 500 m above the surrounding countryside and have steep slopes, except where relict canga (ferruginous laterite developed from iron-bearing rock) deposits are preserved. The principal ore mineral is hematite with accessory goethite and magnetite.

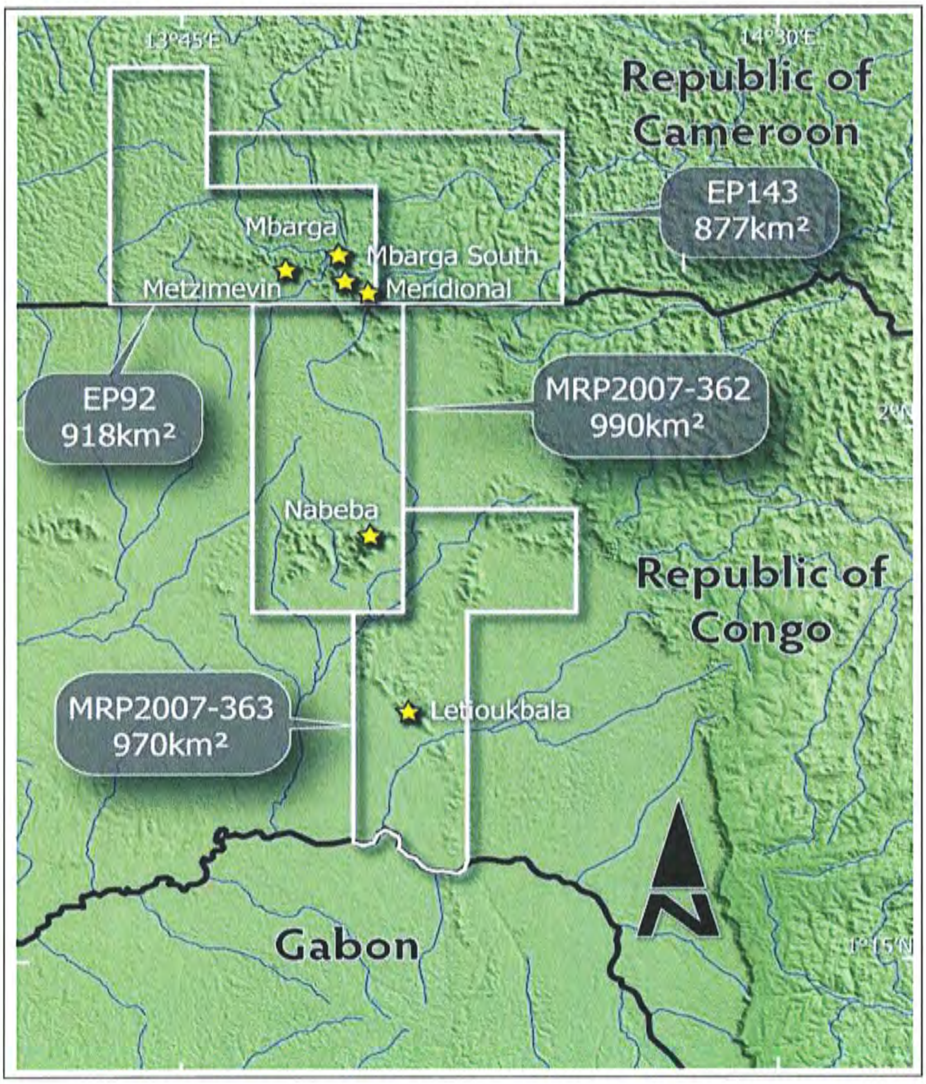
3.2.3 Iron ore projects in Cameroon

The Mbalam (Table 3.1) iron ore project is located near the southern border with ROC and about 150 km north-northwest of the iron deposits at Belinga (Figure 3.2). This project targets iron ore deposits straddling the Cameroon and ROC border, including Mbalam (Mbarga and Metzimevin) and Nebeba (Figure 3.3).

Like the other closely related deposits in the region (Gabon and ROC), the Mbalam deposit is also located on the Chaillu granite-greenstone. There are two main deposits at Mbalam, namely Mbarga and Metzimevin, which lies on a contorted and disrupted 35 km long magnetic iron formation.

The Nabeba deposit is located 42 km south of the Mbarga Deposit (Figure 3.3) at close to the ROC and Cameroon border. The host rocks are similar to those of the two Mbalam deposits.

Figure 3.3 Sundance Resources Iron ore projects



Source: http://mining-reporter.cn/index.php/component/content/article/422-sundance-resources-limited/2628-sundance-resources-drilling-commences-at-key-nabeba-deposit-encl-pictures?directory=1

4 Geology of Youkou project

4.1 Local geology

The Youkou project is located the Ivindo Massif, a granite-gneissic Archaean basement complex which contains layers of volcano-sedimentary rocks as well as acid and basic intrusions. The local geology is dominated by an iron quartz schist of approximately 20 km in strike length, locally known as the Youkou ridge. The ridge trends in a north-northwest to south-east and is comprised of a package of rocks that include phyllites, quartzites, itabirites, micaceous- quartz schists and magnetite amphibole schists. The Youkou ridge is interpreted to be an antiformal structure plunging southwards.

The iron ore mineralisation of the project area, as seen at other projects in the sub-region, is interpreted to occur as a capping derived from supergene enrichment of the underlying upright itabirite protore lithologies. In general, iron bearing rocks (itabirites) in the ROC have typical thicknesses of up to 200 m.

The major ores at the Youkou project area are itabirites and supergene hematite ores. At Youkou, the itabirites are layered with alternating light and dark bands made of quartz and magnetite with little or no hematite.

Throughout the world, itabirite ores and their supergene caprocks appear to be a feature of iron ore deposits located in the equatorial regions. This is because they formed by lateritic weathering, a feature typical of climatic regions characterised by high temperatures and intense rainfall.

4.2 Exploration history

Reliable geological maps of the Youkou project are unavailable. However, the general geology of the area is described from regional geological maps, geophysical surveys as well as historical technical reports compiled by BRGM (Bureau de Recherches Géologiques et Minières) during the 1950s.

Historically, the project has been considered prospective for hematite and magnetite rich itabirite iron ore mineralisation. A historic outcrop of iron ore workings occurs in the area with recorded hematite and itabirite mineralisation (00°48'22" and 14°28'39"). Additionally, Colchine (1950) reported a hematite-rich capping of about 1 km along the crest of an itabirite cliff. An assay, grading 69% Fe, 0.08% P2O5 and 0.5% SiO_2 was returned from a specimen collected while prospecting for gold between the years of 1936 and 1939 (Colchine, 1950).

Like most areas in the ROC, very little large scale exploration with modern techniques has been carried out on the Youkou project. The area has been explored for gold. Historical gold production in the area varied from one to three grams per day. No exploration for other commodities is recorded (Colchine, 1950).

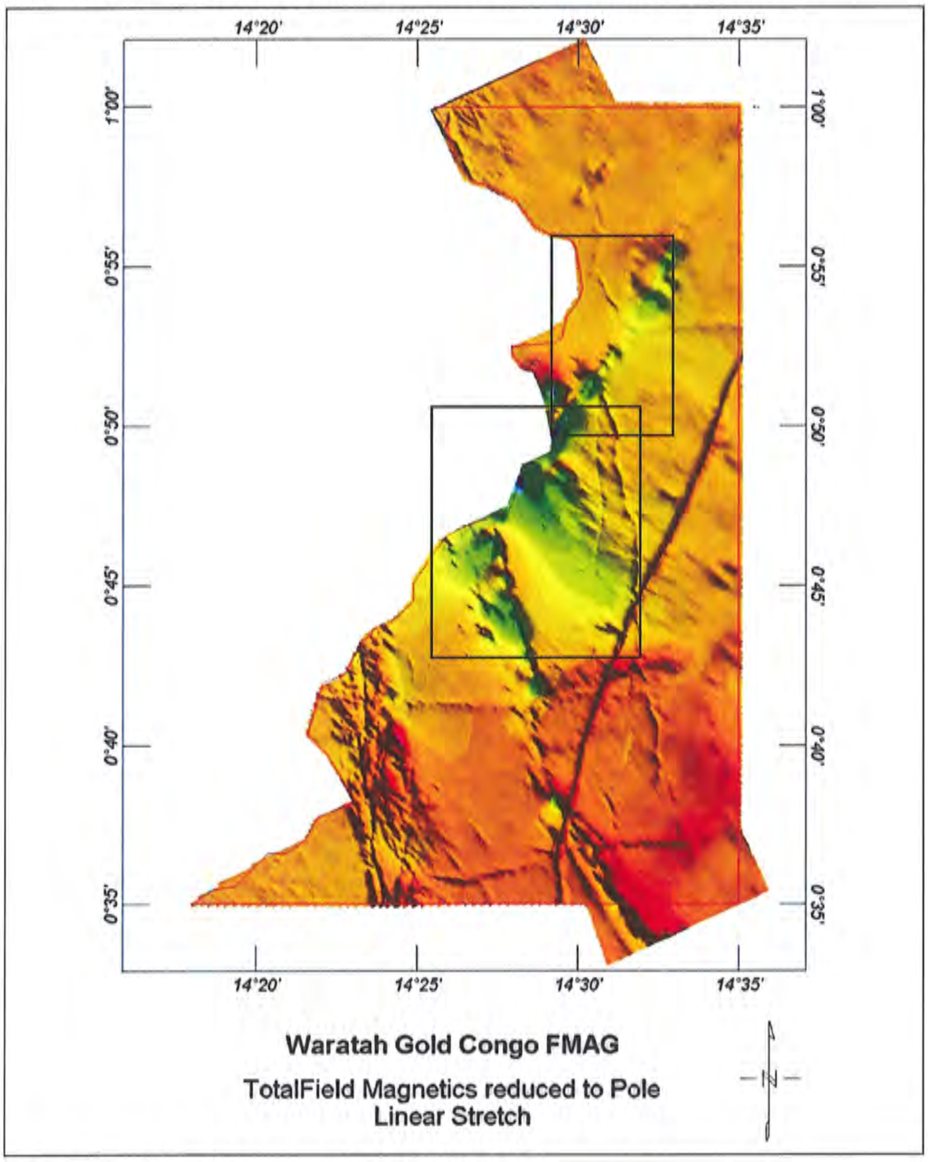
In recent years limited regional exploration for iron ore has been undertaken in the project area and consequently detailed technical literature on the area is scarce. There is evidence from historic workings that indigenous communities exploited iron ore for domestic tools. Extensive soil cover obscures underlying geological formations and most boulders and cobbles of itabirites and/or altered hematite are to be found in stream beds.

5 Geophysical Surveys

In the absence of outcrop, geophysical surveys have proved invaluable for identification of iron ore bearing units in the West and Central African sub-region. Waratah therefore initiated airborne magnetic and radiometric surveys over their permit area in January 2011 with the aim of identifying potential drill targets for resource definition later in the year.

Waratah provided processed geophysical data to Snowden for comment. The Total Field Magnetics aeromagnetic maps clearly show linear trends of potential iron mineralisation (Figure 5.1). These have been delineated by Waratah and will be targeted for exploratory and resource drilling. Snowden geo-referenced the aeromagnetic map in *Google Earth*™ and overlaid it with historic data. Based on this exercise, the initial target area would correspond to an area represented by a greenish hue on Figure 5.1.

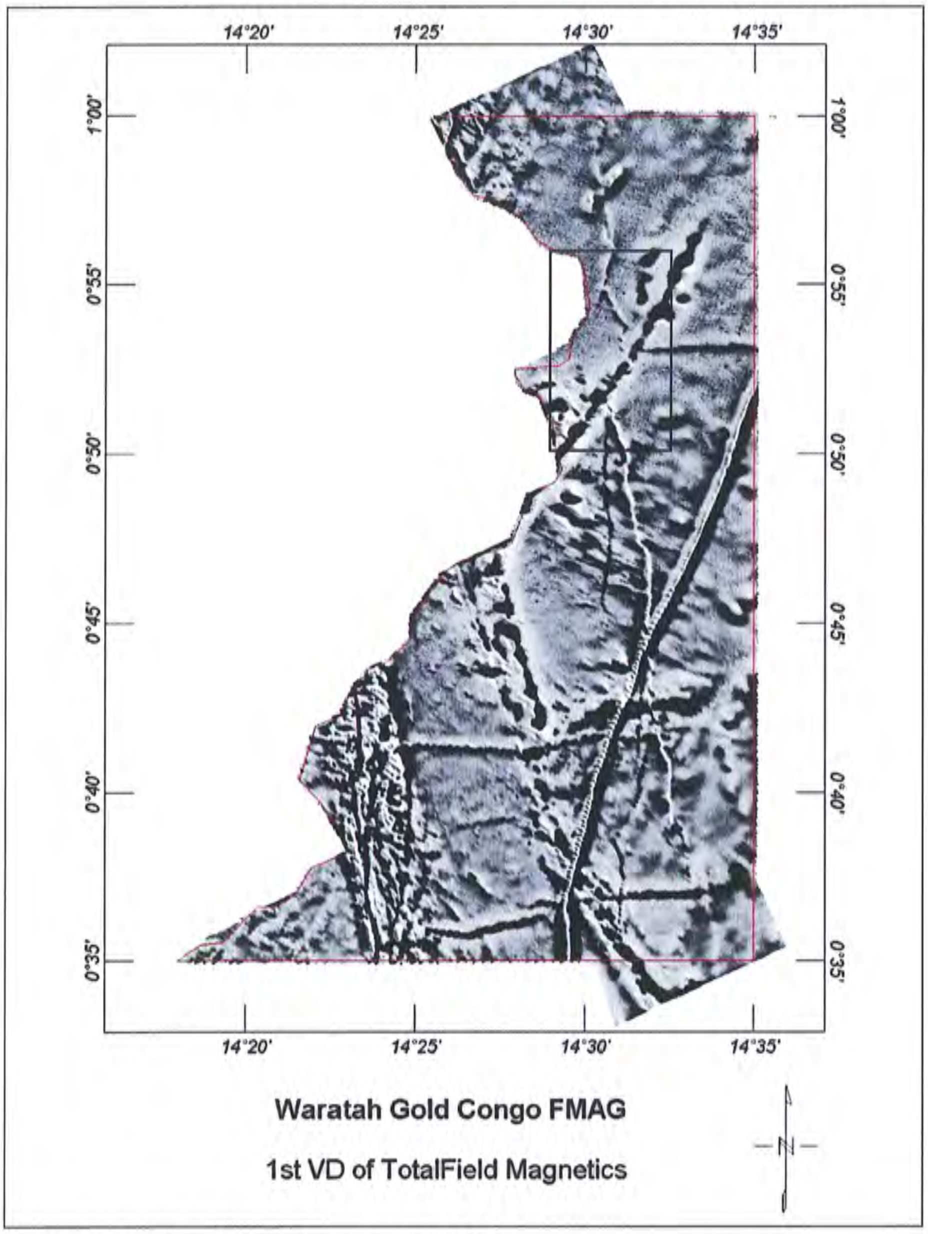
Figure 5.1 Total Field Magnetics pole linear stretch map of the Youkou project



Source: Waratah Gold geophysical survey (2011)

Additionally, the target area is coincident with and bounded by northwest and northeast trending structures, identified on a 1st vertical derivative (VD) Total Field Magnetics pole linear stretch map (Figure 5.2). The north-east anomaly (oblong block) observed in Figure 5.1 is much more defined in Figure 5.2.

Figure 5.2 1st VD Total Field Magnetics pole linear stretch map of the Youkou project



Source: Waratah Gold geophysical survey (2011)

The two targets identified appear reasonable and coincident with areas from which iron-rich samples have been collected in the past, as shown by historical information. Snowden, however, feels that these target areas need to be confirmed by a detailed geological interpretation based on ground follow up.

6 Petrography and geochemistry of Youkou iron ores

Waratah undertook a reconnaissance exploration visit to its Youkou project to collect a set of iron bearing specimens with a view to determining the physical and geochemical characteristics of the deposit. However, Snowden has not had sight of the map showing the sample localities for this exercise. The results should be used to comment on the tenor and suitability of the iron ore and, be incorporated into Waratah's exploration model for any future work.

Waratah collected a total of eight (8) hand samples from their Youkou property. Snowden subdivided two of these to increase the number of samples for analysis to 10 and submitted these to Mintek laboratories for mineralogical and chemical examination. The study involved bulk mineralogical analysis, petrography and chemical analysis. Petrographic study entailed mineral identification and description of the iron bearing phases and mineral associations. The analytical methodology and results of Mintek's analyses are attached in Appendix A.

Mintek is a well known laboratory specialising in mineralogical investigation and metallurgical studies. It is accredited by the South African National Accreditation System (SANAS) for Quality Management Systems (ISO 9001), Testing and Calibration (ISO 17025), Environmental Management System (ISO 14001) and Occupational and Health Management System (OHSAS 18001).

6.1 Description of hand samples

The samples were all iron bearing. Almost all samples appear greyish in colour with a distinct metallic lustre. Three samples (YK02, YK03, and YK04) are typically dense and are composed of dominantly of hematite, although in places the rocks appear vuggy, where hematite has been leached out.

The other five samples (YK01, YK05 – YK10) are characterized by distinct laminations. These were collected as stream bed pebbles. Of these YK01 and YK09 have a texture typical of itabirites, with alternating quartz and iron rich bands visible. Where the samples have been weathered, they display a yellow-brownish coloration.

Historical descriptions of grab samples of iron rich rocks at Youkou mention that they are hard and compact. On the fresh surface, the ore is clearly grey, sometimes with a metallic lustre and produces a red streak characteristic of hematite (Figure 6.1).

Figure 6.1 Hand specimen sample of typical Youkou iron ore

Source: Waratah Gold (February, 2011)

6.2 Petrography and mineralogy

Full petrographic and mineralogical descriptions are provided in Appendix A. The major mineral is hematite, with subordinate quartz and goethite present in almost all the samples. Hematite occurs in a wide variety of shapes, as anhedral equidimensional aggregates, acicular needles, massive and globular grains ranging in grain size from approximately 20 µm to 200 µm. Quartz, whenever present appears to be intergrown with hematite and sometimes occupies pore spaces. In the samples that show banding (for example, YK01 and YK09) quartz forms its own distinct bands that may be up to 1.5 millimetre (mm) in thickness. Magnetite is virtually absent in all the samples.

In some samples, hematite has succumbed to weathering (YK07 and YK08). In these samples, in addition to hematite, lepidocrocite and goethite occur. These two minerals are weathered varieties of hematite and typically occur as radial or acicular aggregates. They are responsible for the yellow, rusty color observed in hand specimen.

6.3 Geochemistry

Geochemical analyses focussed on only the major element phases. It is clear that all but two samples have elevated values of Fe_2O_3 (Appendix A, Table 2). The total Fe content of the hematite rich samples ranges from 63.9% to 68.8 % Fe. The samples with elevated total Fe have very low concentrations of the potential contaminants such as SiO_2, MgO, K_2O, P_2O_5 and Na_2O, which all appear to be below detection limit. SiO_2 and CaO have average concentrations of 1.76 wt % and 0.15 wt %, respectively. The concentration of Phosphorous (P) ranges from 0.05 wt % to 0.1 wt % in these samples while the loss on Ignition (LOI) is 0.9 wt % to 2.0 wt%. The samples with these concentrations of Fe and contaminants are similar to ores mined in other parts of the world as hematite ore.

The two relatively Fe-poor samples (YK01 and YK09) have total Fe concentrations of 38.8 wt % and 41.1 wt % and enriched concentrations of silica, 44.8 wt % and 38.8 wt %, respectively. These Fe-poor ores have very low P and LOI which seldom exceed 0.04 wt % and 0.4 wt%, respectively. These samples correspond to itabirite ores.

6.4 Comparison of Youkou iron ores to other iron ores

Snowden compared the average geochemistry of selected major elements from the Youkou sample suite with that of well known high-grade iron ores mined in South Africa, Guinea, Australia and Brazil (Table 6.1 and Appendix A). Overall it is clear that the average concentration of Fe for the Youkou samples compare well with that of the other deposits particularly West African deposits, such as the Simandou Range in Guinea.

Very often the grade of bulk commodities like iron ore is very much dependant on the concentrations of contaminants such as SiO2, Al_2O_3, P_2O_5 and CaO. It is clear from the geochemical results that the concentrations of these elements in the Youkou samples are within acceptable limits compared to those of other deposits (Table 6.1). In general, concentrations of approximately 0.08% P are considered acceptable while for many deposits the CaO content rarely exceeds 0.2 wt % (Gutzmer et al., 2008).

The chemistry of the two itabirite samples (YK01 and YK09) is not dissimilar to that of well known quartz itabirites from South America. The chemical constituents of the common contaminants such as SiO_2, and MgO are also comparable. In South America, where itabirites are exploited for iron ore, they have an average chemical content of 35% to 40% Fe but can yield 62% to 68% Fe upon beneficiation (Rosiere et al., 2008). The similarities can be confirmed with a larger data set of itabirite samples from the Youkou property.

Table 6.1 Comparison of selected average major element geochemistry of iron ore deposits

Major Elements (wt%)	Youkou samples (ROC)	Sishen lumpy (RSA)	Sishen fines (RSA)	Simandou Range (Guinea)	Mt Tom Price (Australia)	Carajas Brazil
	N=10	N=11	N=16	N=35	N=9	N=11
Fe_2O_3	**94.0**	94.8	92.4	93.9	95.7	95.3
Fe_total	**65.8**	66.1	64.7	65.7	66.9	66.7
SiO_2	**1.76**	3.02	4.03	0.90	2.55	0.61
Al_2O_3	**0.6**	1.02	1.49	0.13	0.95	-
P	**0.09**	0.06	0.06	0.02	<0.05	-
CaO	**0.15**	0.21	0.20	0.04	0.03	-

Note: For Youkou individual samples see Appendix A

Source: Gutzmer et al., 2008 and Cope et al, 2008 for average geochemistry of iron ore deposits; and Sishen ore (http://www.kumba.co.za/products_range.php)

7 Conclusions

Snowden was requested to undertake a desktop review of the Youkou iron ore project in the ROC and provide independent comment on the prospectivity of the area. Snowden's comment is based on data and samples provided by Waratah as well as analyses from Waratah's iron-rich samples submitted to Mintek laboratories for assaying.

Based on the review Snowden concludes that:

- The results from analyses of samples collected from the Youkou project confirm that the samples are iron-rich. Qualitative studies have shown that the samples are dominated by hematite with minor quartz and goethite. Geochemical studies show that the average chemical content is Fe 66 wt %. Potentially deleterious elements like Si, K, P and Al have chemical concentrations that are reasonable for high grade iron ores. These analyses indicate excellent tenor and chemistry, on par with that of other iron ores in the West African sub-region and in the world but further study and metallurgical testing is required to determine whether iron can be successfully liberated from the host rocks.
- The Youkou project has been explored on a limited scale and scope exists to improve this and employ modern exploration techniques to delineate the deposit. The presence of many iron ore projects in Gabon, Cameron and ROC which share similar geological attributes, shows that the Youkou project deserves further exploration.
- The favourable investment climate in ROC is a further potential advantage for development of the Youkou project. Snowden has sighted documentation that shows progressive and updated mining legislation that is favourable for foreign investment.

8 Recommendations

Based on the review, Snowden has identified items for potential improvement:

- The eight samples analysed to date cannot be considered representative of the area. As Waratah has already initiated reconnaissance exploration in the area and has identified geophysical anomalies, a systematic geological mapping and sampling program to define the extent of the potential mineralisation with the eventual of defining a resource needs to be implemented. Initial focus for this work should be on the geophysical anomalies already identified ahead of trenching and drilling to test the anomalies. A site visit by a Snowden geologist is recommended.
- The hand specimen samples provided to Snowden show potential for the presence of hematite and itabirite iron ores. Snowden recommends that these and all future sample localities should be clearly marked, with appropriate GPS points, to guide delineation of potential zones of mineralisation. Further, a larger sample set will be needed to determine what proportions of the Youkou project area are dominated by hematite ore and itabirite ore.
- Snowden has not had sight of an updated exploration permit. Snowden suggests that this document be made available outlining the number of years for which it remains valid.

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A Mineralogical analysis of iron-rich samples

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EXTERNAL REPORT

5912

MINERALOGICAL ANALYSIS OF FE-RICH SAMPLES

by

Awelani Moila

Wendy Thompson

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26 April 2011

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TITLE: Mineralogical analysis of Fe-rich samples		
CLIENT: Mr. Benny Chisonga-Snowden Mining Consultants		
DIVISION: Mineralogy(MNL)		PROJECT NO : MNC 5000-1303
AUTHOR: Awelani Moila		COMPACT NO : 2012-2.11
DATE: 26 April 2011	NUMBER PAGES: 16	COPY NO:.. of.. Issued

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SUMMARY

Snowden Mining Consultants submitted ten Fe-rich samples on behalf of Ironbark Gold Ltd. The mineral identification and petrographic descriptions were undertaken using X-ray diffraction (XRD), and the petrographic optical microscope. X-ray Fluorescence (XRF) analyses were undertaken on all samples.

Hematite is the dominant mineral identified, and it forms in a banded ironstone, as well as a massive structure.

Hematite is occasionally inter-layered with quartz and in some samples it is more compact hematite containing localised pores and vugs which are sometimes infilled with iron oxy-hydroxides.

Lepidocrocite occurs as acicular needles penetrating into many vugs, in two of the samples. Goethite occurs as infillings in many of open spaces between hematite grains, and it is also intergrown with hematite.

The XRF chemistry shows Fe_2O_3 values >90% in all samples expect YOK1 and YOK9. The LOI% are relatively low varying from 0.38% in YOK1 to 2.12% in YOK8.

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1. INTRODUCTION

Mr. Benny Chisonga of Snowden submitted ten Fe-rich samples for Ironbark Gold Ltd. The study involved a bulk mineralogical analysis, petrographic and chemical analysis using X-ray Fluorescence. Petrographic studies entailed mineral identification and description of the iron bearing phases and mineral associations. The samples received were labelled as follows:

Table 1: Sample Labels

Client Sample Name	Mintek Labels
YOK1	AMI/11/181
YOK2	AMI/11/182
YOK3	AMI/11/183
YOK4	AMI/11/184
YOK5	AMI/11/185
YOK6	AMI/11/186
YOK7	AMI/11/187
YOK8	AMI/11/188
YOK9	AMI/11/189
YOK10	AMI/11/190

2. EXPERIMENTAL PROCEDURES

2.1. X-ray diffraction (XRD)

To obtain the bulk mineralogical composition the sample was pulverized and subjected to X-Ray diffraction (XRD) analysis. The identification was based on the crystal structure of crystalline phases (i.e., not those that are amorphous to XRD), and occur in amounts of more than ~3 mass %.

2.2. Petrographic studies

Polished thin sections were prepared from each sample for investigation by optical microscopy; to verify the Fe-bearing minerals detected by XRD, as well as to identify textures and associations of the various Fe-bearing minerals and their association with other minerals.

2.3. Chemical Analysis

Ten representative milled samples were submitted to Mintek's Analytical Services Division for bulk major element analysis using X-ray Fluorescence analyses (XRF).

3. RESULTS

3.1. X-ray Diffraction (XRD)

Crystalline minerals identified by XRD analysis and their ideal chemical formulae are reported in Table 1.

The bulk mineralogy determined by XRD analyses shows hematite as the predominant mineral in all ten samples. Samples YOK1, YOK4, YOK 5, YOK6 show trace amounts of quartz and sample YOK9 contains minor amounts of quartz. Trace amounts of goethite were detected in sample YOK 2, YOK 3, YOK 4, YOK7, YOK 8 and YOK 10. Quartz was not detected YOK 2, YOK 3, YOK7, YOK 8 and YOK 10; and goethite was not detected in YOK1, YOK 5, YOK 6 and YOK9.

Table 2 X-ray diffraction analysis

	Hematite	Quartz	Goethite
Sample Name	Fe_2O_3	SiO_2	FeO(OH)
YOK1	Predominant	Trace	nd
YOK2	Predominant	nd	Trace
YOK3	Predominant	nd	Trace
YOK4	Predominant	Trace	Trace
YOK5	Predominant	Trace	nd
YOK6	Predominant	Trace	nd
YOK7	Predominant	nd	Trace
YOK8	Predominant	nd	Trace
YOK9	Predominant	Minor	nd
YOK10	Predominant	nd	Trace

predominant (>50 mass%); major (25-50 mass%); intermediate (15-25 mass%); minor (5-15 mass%); trace (< 5 mass%); nd = not detected

3.2. Petrography

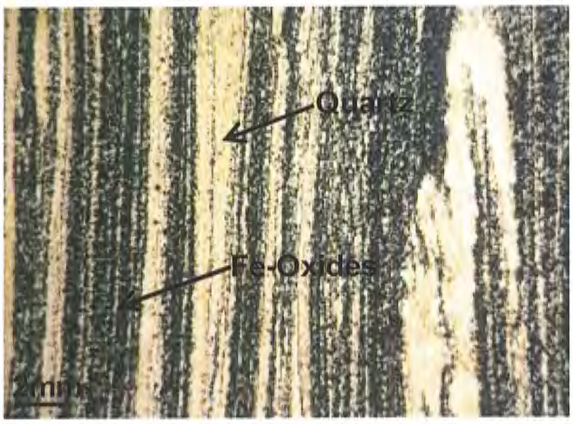
SAMPLE NUMBER and MINERALOGICAL NAME: YOK1

ESTIMATED MODAL % AND IDENTIFICATION OF MINERALS

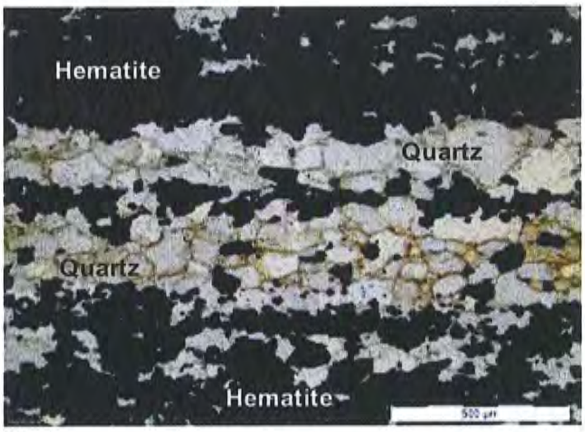
MINERAL %		**ALTERATION AND ACCESSORY MINERALS %**	
Quartz	32	Iron oxy-hydroxides	8
Hematite	60		

BRIEF DESCRIPTION OF SAMPLE:

The Fe-bearing layers consist of a porous type hematite where individual grains are approximately 150μm, in size, frequently equidimensional in shape, and engulfing equally sized grains of quartz. Occasional acicular needles of specular hematite are evident. Occasionally the cores of individual grains have oxidized to goethite/hematite. There is no evidence of maghemite in the sample.



Low Magnification



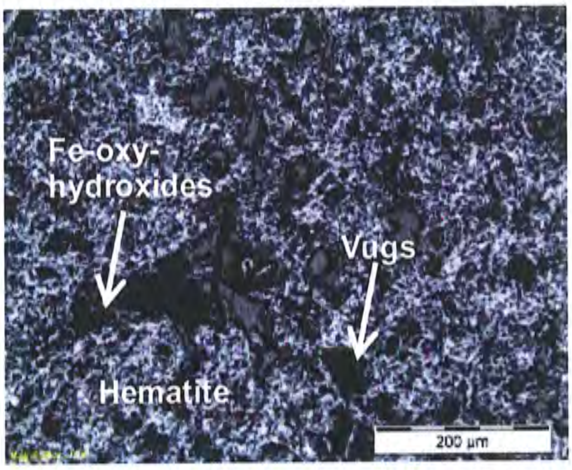
Transmitted plane polarised light (PPL).

Figure1: Fe-bearing (Hematite) layers, inter-layered with quartz.

SAMPLE NUMBER and MINERALOGICAL NAME: YOK2			
ESTIMATED MODAL % AND IDENTIFICATION OF MINERALS			
MINERAL %		**ALTERATION AND ACCESSORY MINERALS %**	
Hematite	100	Iron oxy-hydroxides	Trace

BRIEF DESCRIPTION OF SAMPLE:

The sample is compact massive hematite containing numerous pores and vugs which have been infilled with iron oxy-hydroxides. The size of the vugs varies from ~30μm to 500μm in size. The hematite shows no layering or banding, and quartz is not present. There is no evidence of maghemite in this sample. Under high magnification the hematite is porous, often presenting as acicular grains.



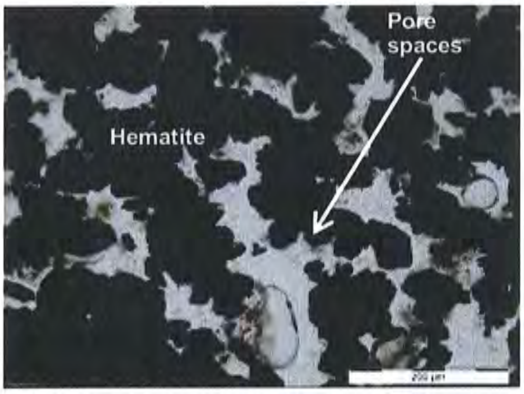
Reflected Light

Figure 2: Compact hematite with numerous pores and vugs.

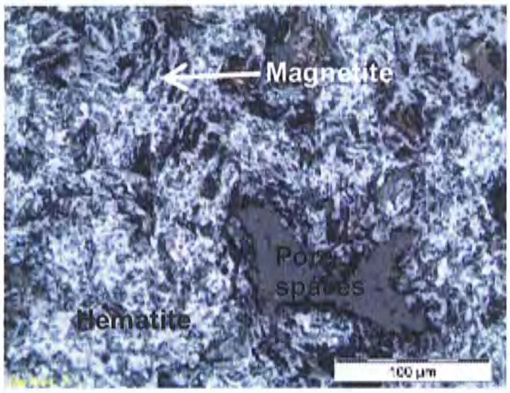
SAMPLE NUMBER and MINERALOGICAL NAME: YOK3			
ESTIMATED MODAL % AND IDENTIFICATION OF MINERALS			
MINERAL %		**ALTERATION AND ACCESSORY MINERALS %**	
Hematite	88	Iron oxy-hydroxides	10
		Magnetite	2

BRIEF DESCRIPTION OF SAMPLE:

This sample is identical to YOK2 except it is more oxidized. The hematite is massive, as opposed to being layered, and it forms in globular sub-rounded accumulations ranging in grain sizes from 50-400μm. Goethite infills many of the porous spaces between these sub-rounded hematite grains, and also occurs intergrown with hematite. The hematite is quite porous under high magnification. Occasional relict cores of magnetite occur within hematite and these cores are approximately 20μm in size.



Transmitted plane polarised light (PPL).



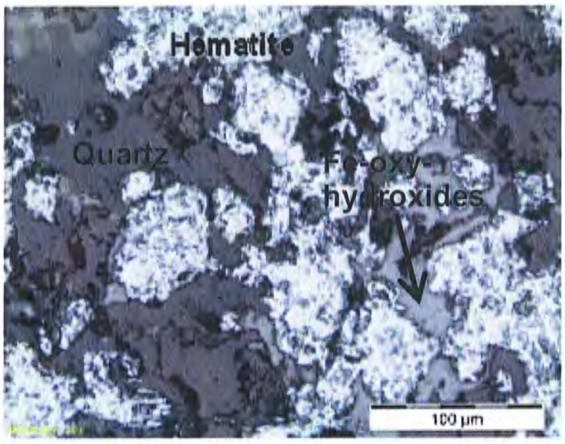
Reflected light.

Figure 3: Traces of magnetite within sub-rounded hematite grains

SAMPLE NUMBER and MINERALOGICAL NAME: YOK4			
ESTIMATED MODAL % AND IDENTIFICATION OF MINERALS			
MINERAL %		**ALTERATION AND ACCESSORY MINERALS %**	
Quartz	4	Iron oxy-hydroxides	4
Hematite	92		

BRIEF DESCRIPTION OF SAMPLE:

The polished thin section displays a massive type hematite to the naked eye that under high magnification consists of fine equidimensional anhedral grains of hematite in a loose packing structure. Very small open spaces and voids occur in ~20µm size, between fine aggregates of hematite. Occasionally these are intergrown with fine quartz grains, which do not exhibit any orientation or layering. The quartz is sporadic and the largest grain is ~100µm. In reflected light, the hematite is in the form of very fine wisps, and is porous and oxidized to goethite/limonite. The sample shows infilled fractures ~300µm wide, which contain quartz veins containing a goethite matrix.



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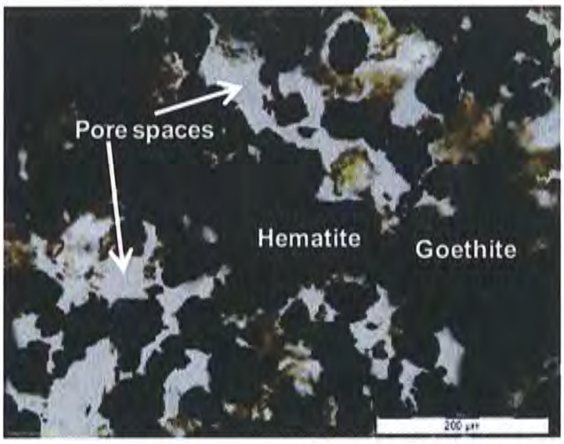


Transmitted plane polarised light (PPL).

Figure 4: Fe-bearing grains (Hematite/goethite) intergrown with fine quartz grains.

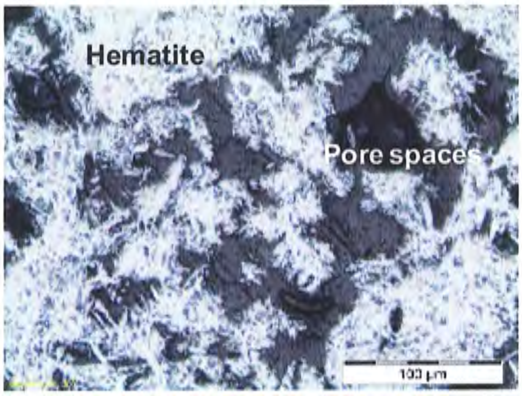
SAMPLE NUMBER and MINERALOGICAL NAME: YOK5

ESTIMATED MODAL % AND IDENTIFICATION OF MINERALS

MINERAL %		ALTERATION AND ACCESSORY MINERALS %	
Hematite	100	Iron oxy-hydroxides	Trace

BRIEF DESCRIPTION OF SAMPLE:

The sample is a finely banded rock where individual hematite bands are ~100μm in width, and they alternate with an open porous band of approximately the same width. The porous open layer consists of inter-connecting fine vugs of irregular shape and size. A few isolated grains of quartz occur, but these are sporadically located. The hematite forms in rhombic shaped grains ~120μm in size, acicular shaped grains ~60μm in size, as well as open porous wispy aggregates. The hematite shows little or no oxidation to goethite/limonite and there is no evidence of maghemite.



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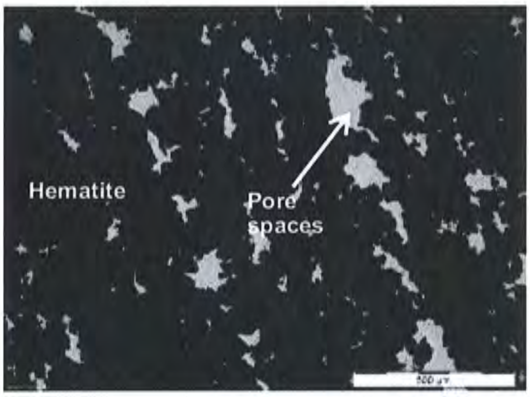
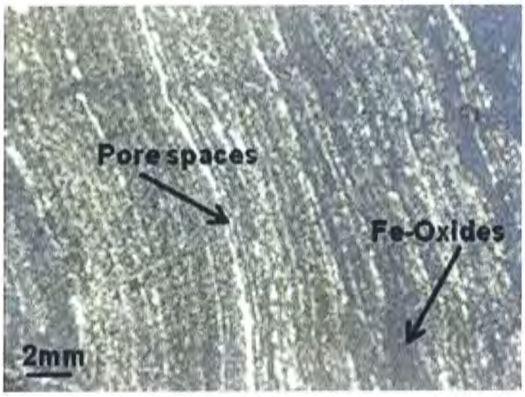


Transmitted plane polarised light (PPL)

Figure 5: Hematite grains with open pore spaces



Low Magnification.

Figure 6: Fe-bearing (Hematite) layers, inter layered with quartz

SAMPLE NUMBER and MINERALOGICAL NAME: YOK6			
ESTIMATED MODAL % AND IDENTIFICATION OF MINERALS			
MINERAL %		**ALTERATION AND ACCESSORY MINERALS %**	
Hematite	100	Iron oxy-hydroxides	Trace

BRIEF DESCRIPTION OF SAMPLE:

This sample is similar to YOK5 with regular fine bands of hematite inter layered with extremely fine bands of porous inter-connecting vugs. Cross-cutting these bands at a high angle are a second orientation of more open irregular shaped pores. Traces of quartz were identified by the XRD analysis. The hematite is very fine grained and in places tightly compacted into layers.

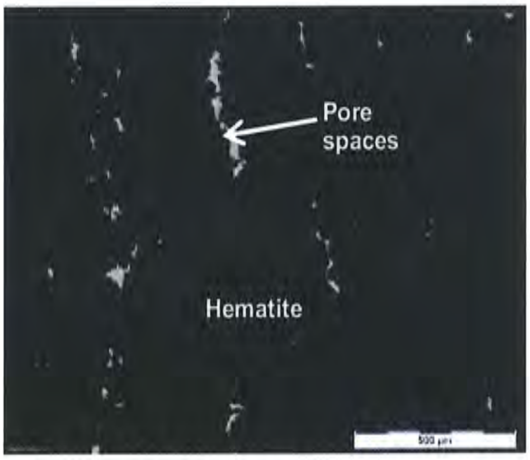


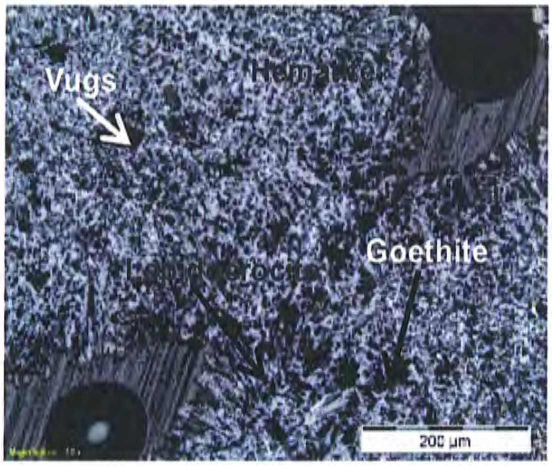
Figure 7: Fine bands of hematite layering , with interconecting vugs

Transmitted plane polarised light (PPL).

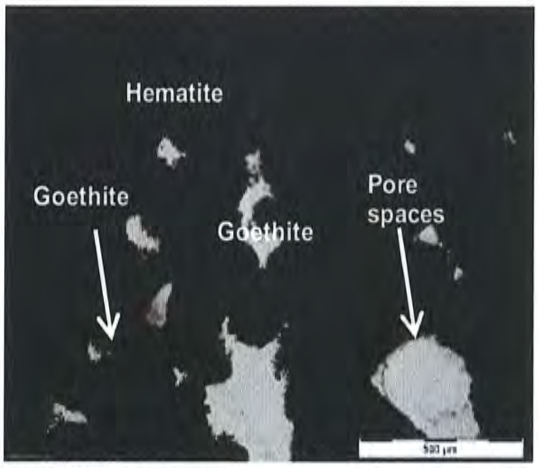
SAMPLE NUMBER and MINERALOGICAL NAME: YOK7			
ESTIMATED MODAL % AND IDENTIFICATION OF MINERALS			
MINERAL %		**ALTERATION AND ACCESSORY MINERALS %**	
Hematite	80	Goethite	Trace
Lepidocrocite	20		

BRIEF DESCRIPTION OF SAMPLE:

Massive to weakly banded hematite with localized porosity. The hematite occurs in fine acicular to radial aggregates intermixed with platy radial aggregates of a darker grey reflecting mineral with deep red internal reflection. This mineral is likely to be lepidocrocite FeO(OH). Lepidocrocite acicular needles penetrate into many vugs, and surround the outer layer of the vug concentrically. Goethite forms in small individual infillings often as a secondary concentric layer within the vugs.



Reflected light.



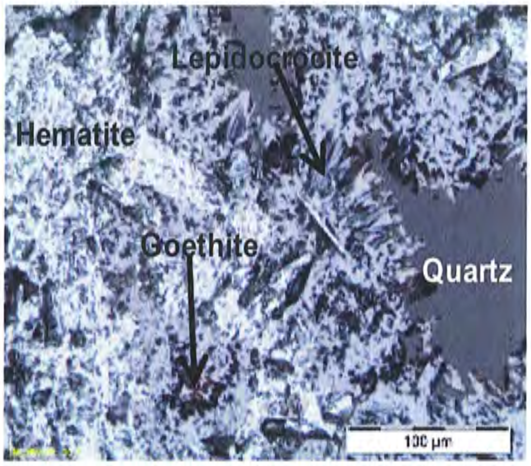
Transmitted plane polarised light (PPL).

Figure 8: Porous hematite grains and lepidocrocite acicular needles

SAMPLE NUMBER and MINERALOGICAL NAME: YOK8			
ESTIMATED MODAL % AND IDENTIFICATION OF MINERALS			
MINERAL %		**ALTERATION AND ACCESSORY MINERALS %**	
Hematite	77	Goethite	3
Lepidocrocite	20		

BRIEF DESCRIPTION OF SAMPLE:

The sample is not layered but compact and sporadically porous. The Fe-bearing minerals are fine platy to acicular aggregates of hematite, intergrown with lepidocrocite. Vugs are lined with radial needles of lepidocrocite, which penetrate into open spaces and are associated with fine sugary grains of goethite. The darker grey lepidocrocite and the hematite are closely associated in the more massive non-porous parts of the sample forming a fine intergrowth.



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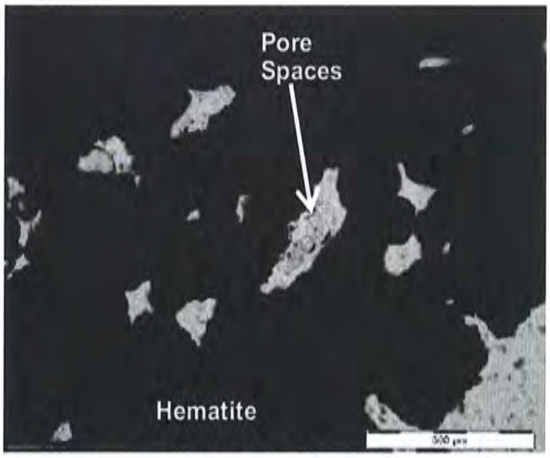


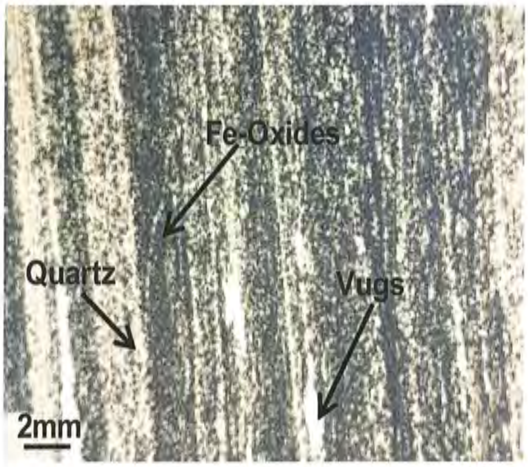
Transmitted plane polarised light (PPL).

Figure 9: Hematite grains and lepidocrocite acicular needles

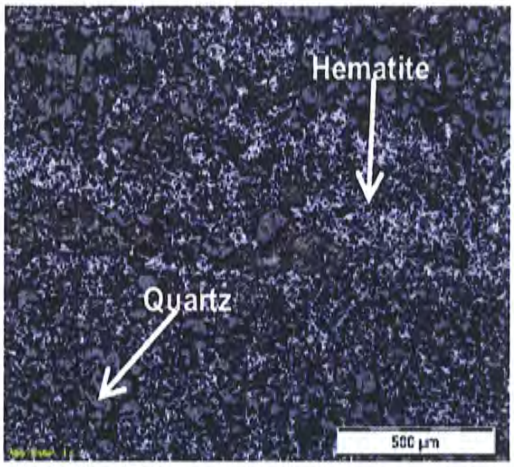
SAMPLE NUMBER and MINERALOGICAL NAME: YOK9			
ESTIMATED MODAL % AND IDENTIFICATION OF MINERALS			
MINERAL %		**ALTERATION AND ACCESSORY MINERALS %**	
Hematite	85		
Quartz	15		

BRIEF DESCRIPTION OF SAMPLE:

The sample is banded with inconsistent layers of hematite complexly inter-mixed with grains of quartz. To the naked eye, the bands appear to be a fairly well defined, but under magnification they show an irregular and interstitial relationship with quartz. Some very fine hematite<10µm creates a scattering amongst quartz grains, and more compact hematite layers are seldom more than 200µm in width. The widest quartz band is ~1,5mm in size. The hematite is intimately intergrown with quartz and these two minerals will be difficult to separate. The hematite is not oxidized to iron oxy-hydroxides and there is no evidence of maghemite.



Low Magnification



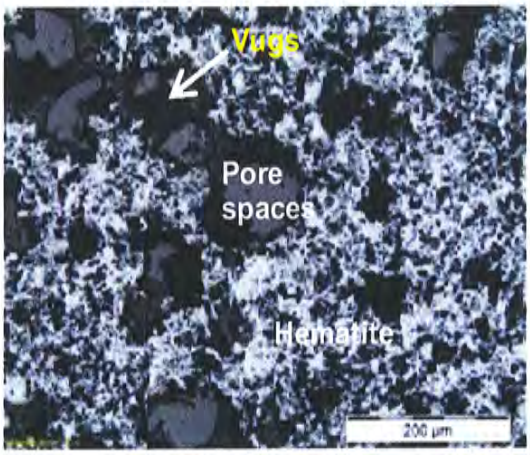
Reflected light.

Figure 10: Hematite inter-mixed with grains of quartz

SAMPLE NUMBER and MINERALOGICAL NAME: YOK10			
ESTIMATED MODAL % AND IDENTIFICATION OF MINERALS			
MINERAL %		**ALTERATION AND ACCESSORY MINERALS %**	
Hematite	90		8
Quartz (variable)	10		

BRIEF DESCRIPTION OF SAMPLE:

This sample is a massive hematite, globular in appearance and containing many large open vugs and porous areas. Many of the vugs are infilled with equidimensional grains of quartz is ~100μm in size. Quartz was not detected in the XRD analysis, and it is sporadic only infilling isolated vugs. The hematite shows a compact form in places, with very little acicular specular hematite evident. There is also no evidence of maghemite.



Reflected Light

Figure 11: Hematite with equidimensional grains.

3.3. Chemical Analysis

The major element bulk chemical analyses are reported in Table 3; and Table 4 presents Loss of ignition (LOI) results.

Table 3: XRF analysis

Sample Name	MgO	Al_2O_3	SiO_2	CaO	MnO	K_2O	P_2O_5	Na_2O	Tot_Fe	Fe as Fe_2O_3	Sum of Oxides
	%	%	%	%	%	%	%	%	%	%	%
YOK 1	0.120	0.223	38.4	0.0799	<0.05	<0.05	0.0516	<0.1	40.7349	58.251	97.075
YOK 1 Repeat	0.135	0.233	38.8	0.0688	<0.05	<0.05	0.0538	<0.1	41.1143	58.793	98.065
YOK 2	0.0853	0.183	0.559	0.0902	<0.05	<0.05	0.202	<0.1	68.7956	98.378	99.499
YOK 3	0.156	0.352	0.789	0.373	<0.05	<0.05	0.303	<0.1	66.6745	95.345	97.307
YOK 4	0.101	0.922	4.13	0.0853	<0.05	<0.05	0.249	<0.1	64.2134	91.825	97.346
YOK 5	0.095	0.993	1.48	0.148	<0.05	<0.05	0.221	<0.1	65.5477	93.733	96.657
YOK 6	0.0589	0.765	1.07	0.0613	<0.05	<0.05	0.216	<0.1	66.0055	94.388	96.538
YOK 6 Repeat	0.0589	0.745	1.04	0.0709	<0.05	<0.05	0.215	<0.1	65.5332	93.712	95.828
YOK 7	0.0825	0.562	0.866	0.159	<0.05	<0.05	0.092	<0.1	66.6279	95.278	97.036
YOK 8	<0.05	0.436	0.621	<0.05	<0.05	<0.05	0.199	<0.1	64.8112	92.680	94.014
YOK 9	0.132	0.305	44.5	0.0501	<0.05	<0.05	0.0869	<0.1	38.8435	55.546	100.602
YOK 10	0.121	<0.05	4.59	0.110	<0.05	<0.05	0.107	<0.1	63.8688	91.332	96.123

SiO_2 content of sample YOK1 and YOK9 is significantly high compared to other samples, whereas the Fe content as Fe_2O_3 of YOK1 and YOK 9 is low compared to other 8 samples.

Table 4: Loss of ignition (LOI).

Sample name	LOI %
YOK1	0.38
YOK2	1.28
YOK2 Repeat	1.27
YOK3	2.02
YOK4	1.20
YOK5	1.28
YOK6	1.16
YOK7	1.00
YOK8	2.12
YOK9	0.32
YOK10	0.92
YOK10	0.94

4. DISCUSSION AND CONCLUSION

- From XRD analyses hematite was identified as the predominant mineral in all ten samples. Samples YOK1, YOK4, YOK 5, YOK6 show trace amounts of quartz and sample YOK9 contains minor amounts of quartz. Trace amounts of goethite were detected in sample YOK 2, YOK 3, YOK 4, YOK7, YOK 8 and YOK 10. Quartz was not detected YOK 2, YOK 3, YOK7, YOK 8 and YOK 10; and goethite was not observed in YOK1, YOK 5, YOK 6 and YOK9.

- Sample YOK1 and YOK9 are similar, with more quartz than other samples. The hematite and quartz are finely inter-layered in these two samples.

- Lepidocrocite is present in YOK 7 and YOK 8 as acicular needles penetrating into many vugs. Goethite occurs as a second layer penetrating into these porous spaces between hematite grains, and as intergrown with hematite.

- Relict cores of magnetite occur within hematite in sample YOK3; indicating maghemite.
- Maghemite is not present in any of the other samples, other than YOK3.
- The XRF results show SiO_2 content in samples YOK1 and YOK9 as significantly high, compared to other samples, whereas the Fe content as Fe_2O_3 in YOK1 and YOK 9 is low compared to other 8 samples
- The LIO% varies from 0.38% in YOK1 to 2.2% in YOK8.

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