

10 September 2018

Ramu Mineral Resource and Ore Reserve Update

Highlands Pacific Limited (ASX:HIG) has received updated Mineral Resource and Ore Reserve estimates for the Ramu nickel and cobalt deposit from the project manager Ramu NiCo Management Limited (MCC).

These reports were prepared for and are the responsibility of Ramu NiCo Management (MCC) Limited, the operator and manager of the joint venture.

The updated Mineral Resource estimate, as at 15 June 2018, is a total of 136 million tonnes at an average grade of 0.9% nickel and 0.1% cobalt. This compares with the previous estimate, as at December 2016, of 124 million tonnes at 1.0% nickel and 0.1% cobalt, which has been depleted by mining and increased by drilling in the intervening period.

The full Mineral Resource estimate is set out in the following table, at a cut-off grade of 0.5% Nickel.

Category	Mineral Resource	Average grade	
	Mt	Ni%	Co%
Measured	34	0.9	0.1
Indicated	42	0.9	0.1
Subtotal	**76**	**0.9**	**0.1**
Inferred	60	1.0	0.1
Total	**136**	**0.9**	**0.1**

Notes:
1. Totals may not equal the sum of the component parts due to rounding adjustments.
2. Ore tonnes (dry) represent the -2 mm economic portion of resource mineralization in the rocky saprolite

COMPETENT PERSON'S STATEMENT
The information in this report that relates to the Ramu Mineral Resources is based on information compiled by Zhang Xueshu, who is a Fellow of the Australasian Institute of Mining and Metallurgy. Mr Zhang Xueshu is a full-time employee and Chief Geologist of Sinomine Resources Exploration Co and has sufficient experience which 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 2012 Edition of the Australasian Code for reporting of Exploration Results, Mineral Resources and Ore Reserves. Mr Zhang Xueshu consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.



The updated Ore Reserve estimate, as at 15 June 2018, is a total of 56 million tonnes at an average grade of 0.9% nickel and 0.1% cobalt. This compares with the previous estimate, as at 31 December 2016, of 49 million tonnes at 1.0% Ni and 0.1% Co, which has been depleted by mining and increased by drilling in the intervening period.

Category	Ore Reserve	Average grade (%)	
	Mt	Ni%	Co%
Proved	24	0.9	0.1
Probable	33	0.9	0.1
Total	**56**	**0.9**	**0.1**

Notes:
1. Totals may not equal the sum of the component parts due to rounding adjustments.
2. Ore tonnes (dry) represent the -2 mm economic portion of resource mineralization in the rocky saprolite.
3. Based on a nickel price of US$12,000/t, and cobalt price of US$48,501/t.

COMPETENT PERSON'S STATEMENT
The information in this report that relates to the Ramu Ore Reserves is based on information compiled by Mr Gao Xiang, who is a Member of the Australasian Institute of Mining and Metallurgy. Mr Gao Xiang is a part-time employee of Sinomine Resources Exploration Co and has sufficient experience which 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 2012 Edition of the Australasian Code for reporting of Exploration Results, Mineral Resources and Ore Reserves. Mr Gao Xiang consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

The full Resource and Reserve statement is attached to this announcement. Extracts of the report are reproduced here in accordance with the ASX Listing Rules 5.8 and 5.9.

Geology and Geological Interpretation
Ramu mining area is located on the northern margin of New Guinea thrust fold zone in New Guinea orogenic zone. The outcrop in this area is the Tertiary (N1) Marum basic-ultra basic rock zone (ophiolite complex), which is the main ore source rock of lateritic nickel ore. The laterite horizons containing Ni, Co in the mining area are distributed on the dunite, orthopyroxene peridotite and peridotite of Marum ultra basic rock zone. The ultra-basic rocks are distributed on a series of highland platforms, forming the landform surrounded by faults to have horst characteristics.

This deposit is typical lateritic NiCo ore formed by ultra basic rock after weathering and leaching. The laterite NiCo deposits are occurred in the dunite weathering crust. The laterite weathering crust exposed in the drilling engineering includes 6 mineralization horizons: from top to bottom, Humic layer (Q), Red limonite (O), Yellow limonite (L), Saprolite(S), upper rocky saprolite (R1) and lower rocky saprolite (R2). In the Humic layer, Ni<0.5%, belonging to the mineralization horizon and not constituting the ore bed of industrial significance, Red limonite Al≥5%, locally Ni≥0.5% containing ore, mostly containing no ore, which is the main cover of the mining area. The Yellow limonite, Saprolite, and upper, lower rocky saprolite are the main ore-bearing horizons of this area.



All ore beds are not varied a lot in thickness, not distributed uniformly, and deficient in local sections. Ni, Mg, Co, Al, Mn, Sc, Fe and other elements in each core bed are different in distribution, but the content distribution generally has a certain rule, where the contents of Ni, Mg are gradually increased from top to bottom in the laterite weathering crust; to the bottom of the lower rocky saprolite, the content of Ni is reduced obviously, and the content of Mg is gradually increased; the content of Al is reduced to the increasing depth, and the contents of Co, Mn are slightly higher in the Saprolite.

Sampling and Sub-sampling Techniques

All holes are sampled continuously in productive exploration in 2016, with the basic sampling length as 1m. When the distance between sampling point and the lamination position is no more than 0.5m, combined sampling may be applied; separate sampling shall be applied when the distance is greater than or equal to 0.5m. The sample splitting knife is applied for 1/2 splitting the soil horizon for sampling as chemical analysis, and the rest of 1/2 sample is discarded; the full-core sampling is applied for the rocky saprolite. Part of cores was reserved in the intensive exploration in 2017.

The core was split by a sampling knife, with 1/2 for sampling; all cores from the gravel-containing horizon were No non-core sample was sampled. The sample processing and the preparation of chemical analysis sample were conducted as per Chinese specifications. Sample processing is divided into coarse crushing and fine crushing. Every stage also includes crushing, screening, uniformly mixing and splitting. The processing method is suitable for lateritic nickel ore and complies with the requirements of mine.
Cores were not reserved in 2016, part of cores was reserved in 2017 and the acquisition test of replicate sample of core was not conducted. The sample size matched with the granularity of the sampled target mineral.

Drilling Techniques

For core drilling, the method of hard alloy drilling accompanied by diamond drilling was mainly applied in drilling exploration. Φ94~110mm open hole and Φ91mm final hole. Cores were not oriented.

The 2016 productive exploration and 2017 productive and drilling exploration were carried out by Hubei Geological Survey Institute of Coal, and the 2017 prospective and drilling exploration was carried out by Sinomine Resource Exploration Co., Ltd.

Sample Analysis Method

The sample analysis was carried out by the testing laboratory of the mine. Test method: test samples are dissolved by hydrochloric acid, nitric acid, hydrofluoric acid and perchloric acid. In the nitric acid medium, the inductively coupled plasma emission spectrometer (Varian 700-ES) is used to measure the mass concentration. The measured scope of NiCo for the method is 0.02~10.0%, which satisfies the production need of the mine. According to the data of the mine, the detection limits of Varian 700-ES for Ni and Co are 5.0μg/L and 13.0μg/L respectively, which meet the needs of test method.



Estimation Methodology
The horizontal projection method was used in the productive exploration in 2016 for resources estimation. The ultra-high grade treatment was not enabled, and the boundary of ore body was subject to drilling without extrapolation.

The software GEOVIA Surpac was used for the intensive prospecting in 2017. Based on statistical analysis, the ultra-high grade treatment was not enabled, the boundary of ore body was subject to drilling without extrapolation, the size of ore block was 25m×25m×1m (north × east × height), and the inverse distance method was used for grade difference.

By means of above methods, the resources were estimated by Hubei Geological Survey Institute of Coal in 2016 productive exploration and 2017 productive exploration and by Sinomine Resource Exploration Co., Ltd. in 2017 prospective exploration. The resources levels were subject to minor adjustment on the basis of this resources estimation.

Material Assumptions
The nickel price is calculated as per USD 12,000/t, and the cobalt price is calculated as per USD 48,501/t. Combining the market sales in 2017, the nickel containing valuation coefficient of nickel cobalt hydroxide is considered as 75%, and the cobalt containing valuation coefficient considered as 68%. The price of NiCo is determined by the prediction of institutions including the World Bank and the sales status of the mine.

Ramu has in place offtake agreements for MHP. MCC relies upon advisory sources when assessing future trends and factors influencing supply and demand. The Ore Reserve estimate has been completed on the basis that all product can be sold. Ramu is an operating asset and has established relationships with customers and market acceptance for its product.

The criteria used for classification, including the classification of the Mineral Resources on which the Ore Reserves are based and the confidence in the modifying factors applied
Based on the mineralization characteristics of ore body and the production practice in mine, the grid of 50×50m in drilling exploration was defined as the measured resources, grid of 100×100m as the indicated resources and grid greater than or equal to 200×200m as the inferred resources. All of R2 resources were defined as the inferred resources.

The relative accuracy of the Mineral Resource estimate is reflected in the reporting of the Mineral Resources to a Measured, Indicated and Inferred classification as per the guidelines of the 2012 JORC code.

The mining method selected and other mining assumptions, including mining recovery factors and mining dilution factors
A plurality of open mining pits is employed in mine production and quarrying is suitable for the actual production of the mine.

Mining surface parameters: Bench height: 5m~10m; Working berm width: 40m~50m; Face angle of working bench: 65°.



The stripping ratio is 0.51, the mining loss rate is 5% and the mining dilution rate is 3%. The inferred mineral resources are not used in mining study and are treated as waste. It is a mine that has been put into production in the Project, with infrastructure in good condition.

The processing method selected and other processing assumptions, including the recovery factors applied and the allowances made for deleterious elements;

Through ore washing, concentration and other ore dressing processes, the ore slurry with concentration of 20% is thickened and pumped to the lone-distance ore slurry pipeline transportation system. The slurry pipeline adopts the "low concentration, large pipe diameter centrifugal pump turbulent transportation" process scheme for dredging, namely the centrifugal pump turbulent transportation scheme with inner pipe diameter of 610mm.

The nickel recovery rate in the ore slurry is 97.5%, and the cobalt recovery rate is 91.91%. Hydrometallurgy includes high pressure acid leaching, ore slurry neutralization, CCD countercurrent washing, removal of iron and aluminum, nickel cobalt hydroxide precipitates by neutralization, obtaining the intermediate product of nickel cobalt hydroxide, and the tailing are discharged to the deep sea landfilling procedure for treatment upon neutralization. For smelting recovery rate, the nickel is 89%, and the cobalt is 88%.

This ore dressing and smelting process has been verified by the 5-year production of ore.

The basis of the cut-off grade(s) or quality parameters applied

The boundary grade is 0.5%, the eliminating thickness of horsestone is 2m and the minimum minable thickness is 0.5m.

Material modifying factors, including the status of environmental approvals, mining tenements and approvals, other governmental factors and infrastructure requirements for selected mining methods and for transportation to market

Mining License (SML8) covers an area of 54.4km2, and the validity expires on July 26, 2040. The prevailing unincorporated joint venture mode of international large mining development project is used for Ramu Project. Three foreign shareholders: MCC Ramu NiCo Management (MCC Ramu) Limited and the former project developer Highlands Pacific Ltd., local companies on behalf of Papua New Guinea and local land owners constitute the joint venture of Ramu Project. MCC Ramu holds 85% shares of the Project, and other shareholders hold 15% shares of the Project. Ramu NiCo Management (MCC) Limited (Ramu Management) is jointly entrusted by shareholders of the joint venture to take charge of construction, development and operation of the Project as the manager of the joint venture.

In 2015, an environmental independent audit was passed and the OEMP permit approved by the Ministry of Environment of Papua New Guinea was obtained.

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ASX Code: HIG
POMSoX Code: HIG
Shares on Issue: 1,093 million
Performance Rights: Nil

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Craig Lennon, MD/CEO
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Management
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About Highlands Pacific Limited
Highlands Pacific is a PNG incorporated and registered mining and exploration company listed on the ASX and POMSoX. Its major assets are interests in the producing Ramu nickel cobalt mine and the Frieda River copper gold project; with exploration in progress in the Star Mountains. Highlands also has exploration tenements at on Normanby Island (Sewa Bay).

Ramu Nickel Cobalt Mine
The producing Ramu nickel cobalt mine is located 75km west of the provincial capital of Madang, PNG. Highlands holds an 8.56% interest in the Ramu project, however this will increase to 11.3% at no cost to Highlands once Highlands' share of Ramu project debt is repaid to the project manager and joint venture partner Metallurgical Corporation of China (MCC). Highlands recently announced plans to repay the debt to MCC following finalization of a streaming transaction with Cobalt27. Highlands also has an option to acquire an additional 9.25% interest in Ramu at fair market value, which could increase the company's interest in the mine to 20.55% if the option were exercised.

Star Mountains Prospects
The Star Mountains exploration tenements are located approximately 20km north of the Ok Tedi mine, in the West Sepik Province, PNG. They lie within the highly prospective New Guinean Orogenic Belt, which hosts the Grasberg, Ok Tedi, Porgera and Hidden Valley mines, as well as the Frieda deposit.

Frieda River Copper/Gold Project
The Frieda River copper gold project is located 175km north-west of the Porgera gold mine and 75km north-east of the Ok Tedi mine. Highlands has a 20% interest in the project and Frieda River Limited (a wholly owned subsidiary of PanAust Limited which in turn is a wholly owned subsidiary of Guangdong Rising Assets Management Co. Ltd.) has 80%.

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SINOMINE RESOURCE EXPLORATION CO., LTD.

Report

Ramu NiCo Resource & Ore Reserve Estimate 2017

Ramu NiCo Management (MCC) Limited

Effective Date of the Report: 15 June, 2018

Effective Date of Drilling Database: 10 April, 2018

Preparaped By

Sinomine Resource Exploration Co., Ltd.

15th June, 2018

CONTENTS

DISCLAIMER 1

GLOSSARY 2

ABSTRACT 3

1. INTRODUCTION 9

1.1 PURPOSE AND TASK OF THE PROJECT 9
1.2 FIELD INVESTIGATION BY COMPETENT PERSON 9
1.3 LOCATION AND TRAFFIC 10
1.4 MINING RIGHT SETTING 10
1.5 OVERVIEW OF PHYSICAL GEOGRAPHY 12

2. GEOLOGY OF RAMU PROJECT 14

2.1 REGIONAL GEOLOGICAL BACKGROUND 14
2.2 GEOLOGY OF MINING AREA 17

3. DEPOSITS TYPE 22

4. MINERALIZATION 22

5. EXPLORATION 24

5.1 GEOLOGICAL EXPLORATION BEFORE 1999 24
5.2 INFILL EXPLORATION 27

6 TOPOGRAPHY AND ENGINEERING SURVEY 30

6.1 PRODUCTIVE EXPLORATION IN 2016 30
6.2 INFILL EXPLORATION IN 2017 31

7 DRILL 31

7.1 PRODUCTIVE EXPLORATION IN 2016 31
7.2 INFILL EXPLORATION IN 2017 33

8 SAMPLING AND LOGGING 35

8.1 CORE SAMPLING 35
8.2 CORE LOGGING 37

9 SAMPLE PREPARATION, ANALYSES AND SECURITY 39

9.1 SAMPLE PREPARATION 39
9.2 SAMPLE ANALYSIS AND TEST 45
9.3 QA/QC 49
9.4 SAMPLE SECURITY 54

10 DATA VERIFICATION 56

10.1 DATABASE 56
10.2 ON-SITE VERIFICATION 56

11 MINERAL RESOURCE ESTIMATE 57

11.1 ESTIMATION RESULTS OF PREDECESSORS 57
11.2 COMMENTS ON THE HISTORICAL RESOURECS ESTIMATION 64
11.3 ESTIMATION RESULTS 65
11.4 RELIABILITY 67
11.5 MINING SITUATION 67
11.6 REMAINED IN-SITU RESOURCE 68

12 MAKET ASSESSMENT 70

12.1 NICKEL 70
12.2 COBALT 71

13 INFRASTRUCTURE AND LOGISTICS 73

13.1 PROJECT OVERVIEW 73
13.2 PLANT SITE 74
13.3 WATER SUPPLY 74
13.4 POWER SUPPLY 74
13.5 OTHERS 74

14 MINING PLAN 75

14.1 STRIPPING PROCESS 75
14.2 MINING PROCESS 76

15 PROCESSING PLAN 77

16 METALLURGICAL PLAN 78

17 ENVIRONMENT 78

18 FINANCIAL ANALYSES 80

18.1 INVESTMENTS 80
18.2 COSTS 80
18.3 SALES REVENUE, TAXES AND PROFITS 80

19 ORE RESERVE ESTIMATE 81

19.1 RESERVE CLASSIFICATION 81
19.2 FIELD INVESTIGATION 81
19.3 RESERVE ESTIMATION RESULTS 81

REFERENCES 82

TABLES

TABLE 1-1 METEOROLOGICAL DATA STATISTICS OF KURUMBUKARI MINING AREA IN 2007 14

TABLE 5-1 MAIN GEOLOGICAL SURVEY WORKLOAD IN RAMU MINING AREA BEFORE 1999 26

TABLE 7-1 STATISTICS OF RECOVERY RATES OF STRATA 33

TABLE 9-1 STATISTICAL TABLE FOR ANALYSIS QUALITY INSPECTION OF REPLICATE SAMPLES 51

TABLE 9-2 STATISTICAL TABLE FOR ACCURACY QUALITY INSPECTION OF HIGH GRADE (NI>1.05%) STANDARD SAMPLES 53

TABLE 9-3 STATISTICAL TABLE FOR ACCURACY QUALITY INSPECTION OF LOW GRADE (NI<0.6%) STANDARD SAMPLES 53

TABLE 11-1 SUMMARY FOR PRODUCTIVE EXPLORATION RESOURCES ESTIMATION RESULTS OF RAMU NICO IN 2016 59

TABLE 11-2 SUMMARY FOR PRODUCTIVE EXPLORATION OF THE LOWER ROCKY SAPROLITE (R2) RESOURCES ESTIMATION RESULTS OF RAMU NICO IN 2016 59

TABLE 11-3 STATISTICAL TABLE OF SPECIFIC GRAVITY SAMPLE AND MOISTURE MEASUREMENT RESULTS OF ORE 61

TABLE 11-4 SPHEROID PARAMETER FOR RESOURCES ESTIMATION SEARCHING OF RAMU NICO AT PROSPECTIVE AREA IN 2017 62

TABLE 11-5 RESULT TABLE FOR RESOURCES ESTIMATION OF RAMU NICO AT PROSPECTIVE AREA IN 2017 63

TABLE 11-6 RESOURCES ESTIMATION RESULTS TABLE OF RAMU NICO AT PRODUCTIVE EXPLORATION AREA IN 2017 64

TABLE 11-7 RESOURCES ESTIMATION RESULTS TABLE FOR PRODUCTIVE EPLORATION AREA IN 2016 65

TABLE 11-8 RESOURCES ESTIMATION RESULTS TABLE FOR PROSPECTIVE EXPLORATION AREA IN 2017 65

TABLE 11-9 RESOURCES ESTIMATION RESULTS TABLE FOR PRODUCTIVE EXPLORATION AREA IN 2017 66

TABLE 11-10 RESOURCES ESTIMATION RESULTS TABLE FOR EXPLORATION AREA IN 2016-2017 66

TABLE 11-11 ESTIMATION RESULTS TABLE FOR RESOURCES CONSUMED WITHIN RAMU PROJECT 67

TABLE 11-12 THE REMAINED IN-SITU RESOURCE WITHIN ALL RAMU PROJECT AREA 69

TABLE 11-13 RESULTS OF THE RAMU MINERAL RESOURCES ESTIMATE 2016 69

TABLE 19-1 RESULTS OF ORE RESERVES ESTIMATION WITHIN ALL RAMU PROJECT AREA 81

TABLE 19-2 31TH DECEMBER 2016 RAMU ORE RESERVE BY CLASSIFICATION 82

FIGURES

FIG. 1-1 GEOLOGICAL LOCATION OF MINING AREA 10

FIG. 1-2 LOCATION MAP OF MINING RIGHTS (EL193 AND SML8) 11

FIG. 1-3 EXPLORATION AREA IN 2016-2017 12

FIG. 2-1 TECTONIC UNIT OF PAPUA NEW GUINEA 15

FIG. 2-2 REGIONAL GEOLOGICAL MAP OF RAMU NICO MINING AREA 15

FIG. 2-3 OXBOW LAKE SAW ON THE AERIAL PHOTO OF RAMU NICO MINING AREA 16

FIG. 2-4 SCHEMATIC DIAGRAM FOR DIVISION OF RAMU NICO WEATHERING CRUST HORIZON .. 18

FIG. 2-5 HUMIC LAYER AND RED LIMONITE 18

FIG. 2-6 YELLOW LIMONITE AND ELUVIUM 19

FIG. 2-7 SAPROLITEWITH MNCO SOIL 20

FIG. 2-8 DUNITE GRAVEL IN THE UPPER ROCKY SAPROLITE 20

FIG. 2-9 LOWER ROCKY SAPROLITE AND DUNITE BEDROCK 21

FIG. 4-1 PROFILE OF RAMU LATERITE WEATHERING CRUST 23

FIG. 9-1 COMPARISON FOR THE GRADE OF NI IN REPLICATE SAMPLES AND ORIGINAL SAMPLES 51

FIG. 9-2 COMPARISON FOR THE GRADE OF CO IN REPLICATE SAMPLES AND ORIGINAL SAMPLES 52

FIG. 9-3 DISTRIBUTION FOR THE GRADE OF NI OF BLANK SAMPLES 54

FIG. 9-4 DISTRIBUTION FOR THE GRADE OF CO OF BLANK SAMPLES 54

FIG. 11-1 RAMU NICO MINING AREAL MAP 68

FIG. 12-1 AVERAGE ANNUAL SPOT PRICE OF INTERNATIONAL NICKEL (LME) FROM 2007 TO 2016 71

FIG. 12-2 DOMESTIC AND INTERNATIONAL COBALT PRICE CHANGING CURVE 73

FIG. 16-1 PROCESS FLOW DIAGRAM FOR SMELTING 79

APPENDIXS

APPENDIX A- Competent Person's Consent Form

APPENDIX B- Compliance Statements

APPENDIX C-JORC TABLE 1

Disclaimer

This report is only for Ramu NiCo Management (MCC) Limited to use, and it must be used in whole, without being quoted out of context. In case of use by the third party, please refer to the disclaimer in this report.

Instruction to the third party

This report is only for Ramu NiCo Management (MCC) Limited to use. If you are not from Ramu, please note:

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Glossary

Term	Definition
℃	degrees Celsius
Co	cobalt
E	East
g	Gram
GPS	global position system
JORC	Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves prepared by the Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia (JORC), December 2012.
kg	Kilogram
km	Kilometre
km^2	square kilometre
m	Metre
M	Million
m^3	cubic metre
Mt	million tonnes
N	North
Ni	nickel
QA/QC	quality assurance/quality control
RTK	real-time kinematic
S	South
t	Tonne
W	West
>	greater than
<	less than
%	percent

Abstract

Project Background

Ramu NiCo Project, located in Madang Province, Papua New Guinea, is a world-class mining project integrating mining, dressing and smelting. To promote upgrading of resources, increase recoverable reserves, effectively prolong the service life of mine, in 2016-2017, Ramu NiCo Management Limited carried out infill exploration and prospective exploration within the mining right. The resources and reserves in 2016-2017 within the scope of work are estimated in this report according to the exploration work in 2016-2017, in combination with the predecessor's work in this area and according to the requirements of the specification JORC (2012). The effective date of resources and reserves estimation is June 15, 2018.

Field Investigation by Competent Person

The competent person Zhang Xueshu carried out field investigation on July 1-6, 2017, and the supervision work in other times was executed by field supervisors based on QA/QC procedures audited by the competent person or under the supervision of the competent person.

Traffic and Location

Ramu NiCo Project, located in Madang Province, Papua New Guinea, consists of mine (including washery), smelting plant and 135km ore slurry pipeline connecting the mine and the smelting plant. The mine is located in Kurumbukari, 75km from the southwest of Madang, the smelting plant is built along Basamuk Bay, 55km from the southeast of Madang City, the mine is about 90km from the smelting plant, and about 135km from the ore slurry pipeline. Madang City is connected with the port city Lae by an expressway, called as Madang-Lae Expressway. From Brahman in the middle of the expressway to Kurumbukari in the Ramu mining area, there is 60km expressway connected in the mining area.

Mining Right

The Exploration License (EL193) of Ramu NiCo Project covers an area of 194.95km^2, and the validity expires on February 26, 2018. The Mining License (SML8) covers an area of 54.4km^2, and the validity expires on July 26, 2040. The drilling exploration area within the scope of Mining License is about 25km^2,

consisting of Kurumbukari area, western Ramu area, Great Ramu area, collectively known as Ramu mining area.

The prevailing unincorporated joint venture mode of international large mining development project is used for Ramu Project. Three foreign shareholders: MCC Ramu NiCo Management (MCC Ramu) Limited and the former project developer Highlands Pacific Ltd., local companies on behalf of Papua New Guinea and local land owners constitute the joint venture of Ramu Project. MCC Ramu holds 85% shares of the Project, and other shareholders hold 15% shares of the Project. Ramu NiCo Management (MCC) Limited (Ramu Management) is jointly entrusted by shareholders of the joint venture to take charge of construction, development and operation of the Project as the manager of the joint venture.

Geological Background

Ramu NiCo mining area is located on the northern margin of New Guinea thrust fold zone in New Guinea orogenic zone. The outcrop in this area is the Tertiary (N_1) Marum basic-ultra basic rock zone (ophiolite complex), which is the main ore source rock of lateritic nickel ore. The laterite horizons containing Ni, Co in the mining area are distributed on the dunite, orthopyroxene peridotite and peridotite of Marum ultra basic rock zone. The ultra-basic rocks are distributed on a series of highland platforms, forming the landform surrounded by faults to have horst characteristics.

This deposit is typical lateritic NiCo ore formed by ultra basic rock after weathering and leaching. The laterite NiCo deposits are occurred in the dunite weathering crust. The laterite weathering crust exposed in the drilling engineering includes 6 mineralization horizons: from top to bottom, Humic layer (Q), Red limonite (O), Yellow limonite (L), Saprolite(S), upper rocky saprolite (R1) and lower rocky saprolite (R2). In the Humic layer, Ni<0.5%, belonging to the mineralization horizon and not constituting the ore bed of industrial significance, Red limonite Al≥5%, locally Ni≥0.5% containing ore, mostly containing no ore, which is the main cover of the mining area. The Yellow limonite, Saprolite, and upper, lower rocky saprolite are the main ore-bearing horizons of this area.

All ore beds are not varied a lot in thickness, not distributed uniformly, and

deficient in local sections. Ni, Mg, Co, Al, Mn, Sc, Fe and other elements in each core bed are different in distribution, but the content distribution generally has a certain rule, where the contents of Ni, Mg are gradually increased from top to bottom in the laterite weathering crust; to the bottom of the lower rocky saprolite, the content of Ni is reduced obviously, and the content of Mg is gradually increased; the content of Al is reduced to the increasing depth, and the contents of Co, Mn are slightly higher in the Saprolite.

Exploration History

Ramu laterite NiCo deposit was found by Bureau of Mineral Resources of Australia in 1962. Since then, the deposit has experienced different degrees of geological work by different corporations in multiple phases. 2,868 holes were bored before 1999. Since commencement of capital construction, Ramu NiCo Project has successively carried out capital construction prospecting for two phases, respectively in 2013, 2015, 2016 and 2017, and conducted intensive exploration for KBK area in the current working range and local peripheral section, totally including 3,300 bore holes. 14,854m/1,031 holes were bored in 2016-2017.

Sample Collection, Preparation and Security

The competent person considers sample collection, preparation and security in 2016-2017 to meet industry standards and satisfy the demands on mine production.

Data Verification

The competent person verifies the data, and considers the prospecting sample to be tested in the mine by experiment, meeting the demands on mine production; but in 2016, QA/QC procedure was not executed for sample analysis and test, and the credibility was reduced; in 2017, QA/QC procedure was executed for sample analysis and test, meeting the demands on mine production.

Resources Estimation

Up to June 15, 2018, the depleted resource within all Ramu project area (removal of consumed resources) are 136Mt, Ni0.9%, Co 0.1%; measured resources are 34Mt, Ni0.9%, Co 0.1%; indicated resources are 42Mt, Ni0.9%, Co 0.1%; inferred resources are 60Mt, Ni1.0%, Co 0.1%.

Category	Ore Resource	Average grade (%)		Remarks
	（Mt）	Ni	Co	
Measured	34	0.9	0.1	
Indicated	42	0.9	0.1	
Subtotal	76	0.9	0.1	
Inferred	60	1.0	0.1	
Total	136	0.9	0.1	

Notes:
1.The Ni cut off grade is at 0.5%Ni,and the minimum mineable thickness is at 0.5m.
2.Totals may not equal the sum of the component parts due to rounding adjustments.
3.Ore tonnes (dry) represent the -2 mm economic portion of resource mineralization in the rocky saprolite
4.The QA/QC is not executed in the Productive Exploration in 2016, so 2016 exploration result is not included.
5.The resource and Ore reserves is updated on June 15th, 2018

Reserves Modifying Factors

Ramu NiCo Project, located in Madang, Papua New Guinea, is a world-class mining project integrating mining, dressing and smelting. The Project consists of major processes and supporting facilities, such as laterite quarrying, ore slurry pipeline transportation, metallurgy by high pressure acid leaching, deep-sea tailing drainage. Since full production was realized at the end of 2012, the production capacity of Ramu NiCo Project has reached the basic design index through production operation practice over five years, and achieved operation up to production and standard.

The current working is still fit for quarrying, opening up by highway automotive transportation, stripping and mining by hydraulic excavator and articulated truck, and using the mode of considering “mechanical mining + hydraulic mining in partial mining area”. The spoil soil is transported to the designated storage yard or goaf, and ore is directly loaded on the truck and transported to the concentrating mill. Reclamation includes backfilling and reclamation of goaf, which are carried out stepwise in the mining process, to prevent water and soil loss and control erosion. The current annual mining capacity of the mine is 3.56Mt (dry weight), with stripping ratio of 0.51, mining loss rate of 5% and mining dilution rate of 3%.

The concentrating mill consists of ore washing workshop, chromite separation workshop and concentration workshop. The ore washing workshop adopts two-time sieving and two-section scrubbing flow, producing -3mm ore slurry (chromium separation material), saw dust and +3mm spoil. -3mm ore slurry

is pumped to the chromium separation workshop, +350mm gravel is transported to the existing raw ore pretreatment workshop for crushing by truck, and the crushed gavel is delivered to the existing ore washing workshop for ore washing, thus recycling high-grade laterite adhered on the surface of gravel; -350mm~+50mm gravel is used as the road stone, and -50mm~+3mm gravel and saw dust residue are used as the reclamation fill of the goaf. The nickel recovery rate in the ore slurry is 97.5%, and the cobalt recovery rate is 91.91%. The concentration workshop concentrates into 20% ore slurry by using the high efficiency concentrator, and the ore slurry is pumped to lone-distance ore slurry pipeline transportation system.

Hydrometallurgy includes high pressure acid leaching, ore slurry neutralization, CCD countercurrent washing, removal of iron and aluminum, nickel and cobalt hydroxide precipitates by neutralization, obtaining the intermediate product of nickel and cobalt hydroxide, and the tailing are discharged to the deep-sea landfilling procedure for treatment upon neutralization. For smelting recovery rate, the nickel is 89%, and the cobalt is 88%。

The final product of the Project is nickel and cobalt hydroxide. The nickel price is calculated as per USD 12,000/t, and the cobalt price is calculated as per USD 48,501/t. Combining the market sales in 2017, the nickel containing valuation coefficient of nickel and cobalt hydroxide is considered as 75%, and the cobalt containing valuation coefficient considered as 68%. Through estimation, the Project has better economic benefits.

Reserves Estimation

Up to June 15, 2018, the lateritic NiCo ore reserves within all Ramu project area(removal of consumed reserves) are 56Mt, Ni 0.9%, Co 0.1%; where proved reserves are 24Mt, Ni 0.9%, Co 0.1%; probable resources are 33Mt, Ni 0.9%, Co 0.1%.

Category	Ore Reserve	Average grade (%)		Remarks
	（Mt）	Ni	Co	
Proved	24	0.9	0.1	
Probable	33	0.9	0.1	
Total	56	0.9	0.1	

Notes:

1.The Ni cut off grade is at 0.5%Ni, and the minimum mineable thickness is at 0.5m.
2.Totals may not equal the sum of the component parts due to rounding adjustments.
3.Ore tonnes (dry) represent the -2 mm economic portion of resource mineralization in the rocky saprolite
4.The QA/QC is not executed in the Productive Exploration in 2016, so 2016 exploration result is not included.
5.The resource and Ore reserves is updated on June 15th, 2018

1. INTRODUCTION

1.1 Purpose and Task of the Project

NiCo Project, located in Madang Province, Papua New Guinea, is a world-class mining project integrating mining, dressing and smelting. To promote upgrading of resources, increase recoverable reserves, effectively prolong the service life of mine, in 2016-2017, Ramu NiCo Management Limited carried out intensive production exploration and peripheral complementary exploration within the mining right. The resources and reserves in 2016-2017 within the scope of work are estimated in this report according to the exploration work in 2016-2017, in combination with the predecessor's work in this area and according to the requirements of the specification JORC (2012). The deadline of resources and reserves estimation is June 15, 2018.

1.2 Field Investigation by Competent Person

The competent person Zhang Xueshu carried out investigation for field drilling exploration, sample collection, processing and field laboratory on July 1-6, 2017, and developed sample collection, processing and quality management and quality control flow (QA/QC); the supervision work in other times was executed by field supervisors based on QA/QC procedures audited by the competent person under the supervision of the competent person. Zhang Xueshu also review the mining and processing operating at Kurumbukari Basamuk during visit the mining area.

Although the competent person Mr. Xiang GAO has not been to mine site, but due to the mine has put into operation over five years since 2012, and open pit mining was adopted with a conventional turck and excavator operating as well as hydraulic mining within partial area. Mr GAO relied on the understanding and finding during site visiting by Zhang Xueshu for the statement of ore reserve.

1.3 Location and Traffic



Fig. 1-1 Geological Location of Mining Area

Ramu NiCo Project, located in Madang Province, Papua New Guinea, consists of mine (including washery), smelting plant and 135km ore slurry pipeline connecting the mine and the smelting plant. The mine is located in Kurumbukari, 75km from the southwest of Madang, the smelting plant is built along Basamuk Bay, 55km from the southeast of Madang City, the mine is about 90km from the smelting plant, and about 135km from the ore slurry pipeline. See Fig. 1-1 for the traffic position.

Madang City is the provincial capital of Madang Province, located in the northeast of Papua New Guinea. Madang City is connected with the port city Lae by an expressway, called as Madang-Lae Expressway. From Brahman in the middle of the expressway to Kurumbukari in the Ramu mining area, there is 60km expressway connected in the mining area.

Madang City has scheduled domestic flights to and fro the capital Port Moresby, where there are international flights flying to each major city of Singapore and Australia. Madang and Lae nearer to the project location are both provided with available port facilities, and materials and equipment transported by sea will be transported to the location of the mine by highway.

1.4 Mining Right Setting

Exploration License (EL193) of Ramu NiCo Project covers an area of

194.95km^2, and the validity expires on February 26, 2018. Mining License (SML8) covers an area of 54.4km^2, and the validity expires on July 26, 2040. The drilling exploration area within the scope of Mining License is about 25km^2, consisting of Kurumbukari area, western Ramu area, Great Ramu area, collectively known as Ramu mining area (see Fig. 1-2). The area of the exploration range in 2016-2017 is about 7.9km^2, and the specific range is as shown in Fig. 1-3.

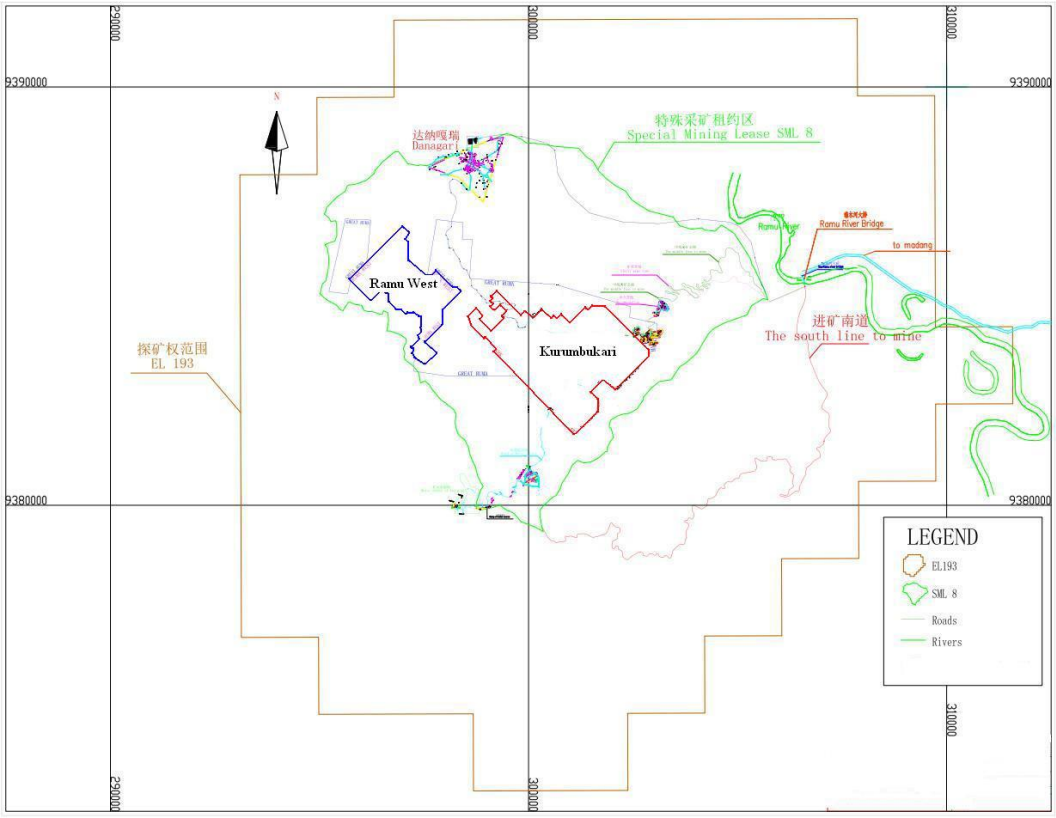

Fig. 1-2 Location Map of Mining Rights (EL193 and SML8)

The prevailing unincorporated joint venture mode of international large mining development project is used for Ramu Project. Three foreign shareholders: MCC Ramu NiCo Management (MCC Ramu) Limited and the former project developer Highlands Pacific Ltd., local companies on behalf of Papua New Guinea and local land owners constitute the joint venture of Ramu Project. MCC Ramu holds 85% shares of the Project, and other shareholders hold 15% shares of the Project. Ramu NiCo Management (MCC) Limited (Ramu Management) is jointly entrusted by shareholders of the joint venture to take charge of construction, development and operation of the Project as the manager of the joint venture.

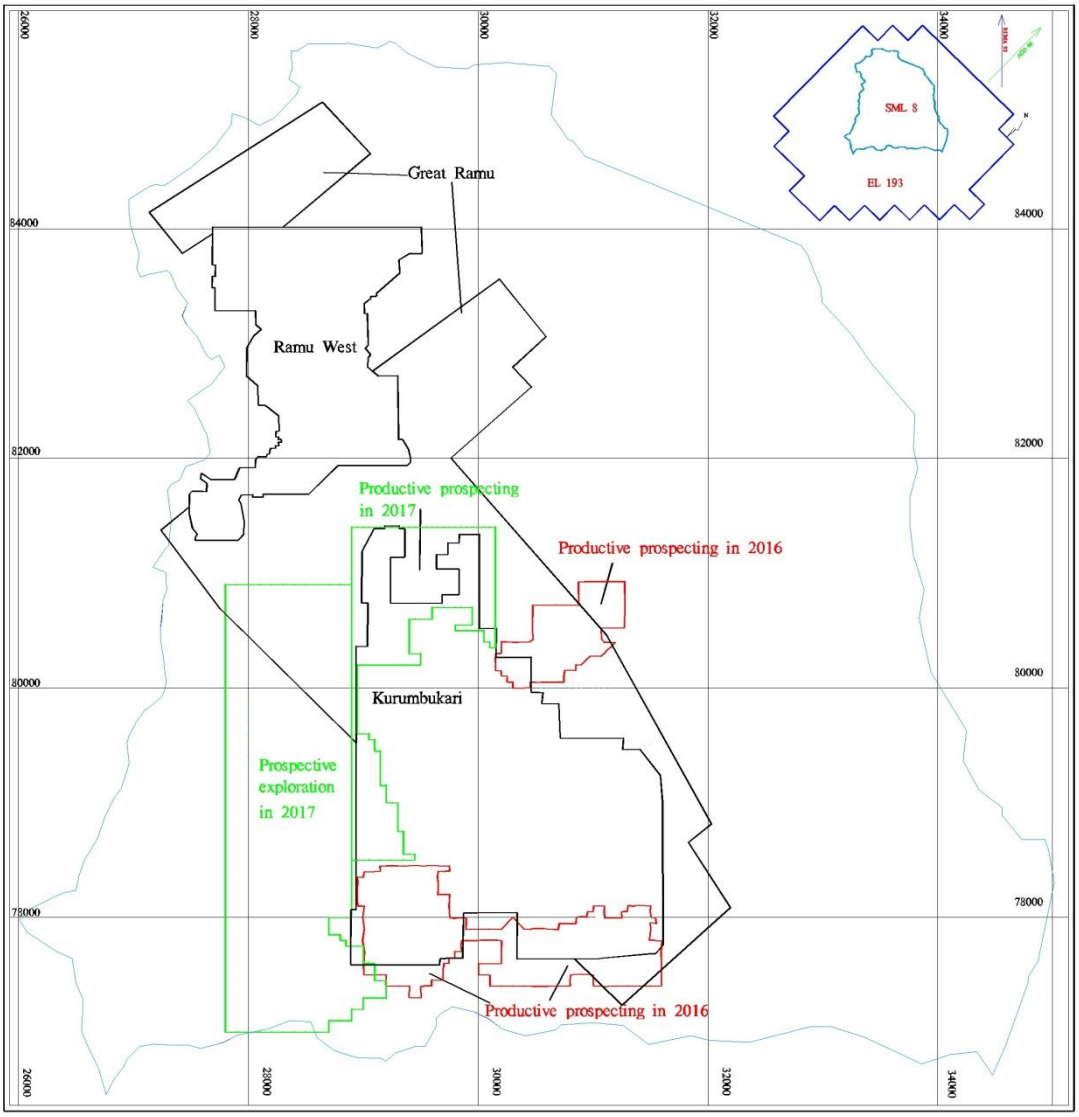

Fig. 1-3 Exploration Area in 2016-2017

1.5 Overview of Physical Geography

Papua New Guinea is located in the southwest of the Pacific, borders on Irian Jaya, Indonesia in the west, and is separated from the Torres Strait, looking at each other with Australia. The national population is 7,620,000 (2014), including 98% Melanesians, others are Micronesians, ethnic Chinese and Caucasians, etc. Papua New Guinea is a developing country with rich resources and backward economy; the rural population accounts for 85%, and a considerable portion of people have led a self-sustaining life of the primitive tribe. The mineral resources, petroleum, fishery and cash crops are pillar industries of Papua New Guinea economy. The gold, copper outputs are in front of world, and the petroleum, natural gas are abundant. Main agricultural products are copra,

cocoa beans, coffee, natural rubber and palm oil. The forest resources are rich, and the tropical primeval forest covers an area of 330,000km^2, accounting for about 72.5% of the national territorial area; the total forest stock is about 5.2 billion m^3, and the recoverable stock is 1.3 billion m^3. In 2016, the GDP gross of Papua New Guinea was USD 21.63 billion, and the per capita GDP was about USD 2,704. The economic growth rate in 2017 was about 2.7%. The proportion of industry in GDP in 2015 was 33.7%. The gross export of minerals in 2016 was PGK 8.751 billion, accounting for 35.27% of the gross export.

The residents in the mining area are mainly Micronesians, living in different tribes. The local economy is quite backward, and the main sources of residents' income are to plant banana, sweet potato, cassava, maize and other crops, living very hard. The industry of Madang Province is very undeveloped, and most industrial products and daily living equipment depend on import.

The mining area belongs to inland, and the regional landform is relatively flat, showing undulation, vividly called as "highland platform" by predecessors. The average elevation is about 700, the gradient is 10~25°, vegetation is very developed, and the coverage rate approaches 100%. The 2016-2017 prospective exploration area is located beyond KBK, with steep terrain, relative height difference of about 200m and gradient of 20~40°.

The east of the mining area is Ramu River, 100~200m wide, with higher river discharge, running all the year round. The west of the mining area is Gagayo River, which is the water source area of the mine, with lower river discharge in dry season, so that the production water is intense.

Ramu mining area belongs to the tropical rainy climate, the dry season is from every May to October, and the rainy season is from November to next April. According to the observation data provided by KBK meteorological station in the mining area, the meteorological data statistics in 2007 is as shown in Table 1-1.

Table 1-1 Meteorological Data Statistics of Kurumbukari Mining Area in 2007

Maximum average temperature in rainy season	27.6℃	Minimum average temperature in rainy season	19.2℃
Maximum average temperature in dry season	29.2℃	Minimum average temperature in dry season	18.5℃
Annual maximum temperature	29.9℃	Annual minimum temperature	18.1℃
Annual precipitation	6341mm	Annual average humidity	86.9%
Annual evaporation	1218 mm	Prevailing wind direction	SSE (occurrence frequency: 19.68%)
Maximum wind speed	2.5 m/s	Annual mean wind speed	1.4 m/s

2. GEOLOGY OF RAMU PROJECT

2.1 Regional Geological Background

The tectonic structure of Papua New Guinea is located in the joint part of eurasian plate, Indo-Australian plates and the pacific plate. Since the Late Cretaceous Epoch, Papua New Guinea has experienced a complex geological tectonic evolution process in Papua New Guinea, and the convergence, collision, subduction and decoupling, spreading and other geological processes of different plates form the geological tectonic unit characterized by southern craton, central Papua New Guinea orogenic belt and northern island-arc belt, producing important mineral resources, such as porphyry type and epithermal hydrothermal copper-gold deposit, lateritic nickel ore.

Ramu NiCo mining area is located on the northern margin of New Guinea thrust fold zone in central New Guinea orogenic zone (Fig. 2-1). The outcrop in this area is the Tertiary (N_1) Marum basic-ultra basic rock zone (ophiolite diamictite), which is the main ore source rock of lateritic nickel ore (Fig. 2-2).

The outcrop of Marum basic-ultra basic rock zone mainly includes two types of magmatic rocks, i.e., (1) hypersthene gabbro, intercalated with a little gabbro, vein-like anorthosite and gabbro pegmatite, distributed in the north and south. (2) Ultra basic rock, including fresh dunite, serpentinite, pyroxenolite, as well as a small amount of orthopyroxene peridotite and peridotite, distributed in the middle part. The peridotite is distributed in some gabbros with auxiliary mineral chromite. In addition, main strata outcropped in the north of the mining area are Pleistocene

and Holocene river alluviums. Both banks of Ramu River are distributed with Holocene river alluviums.

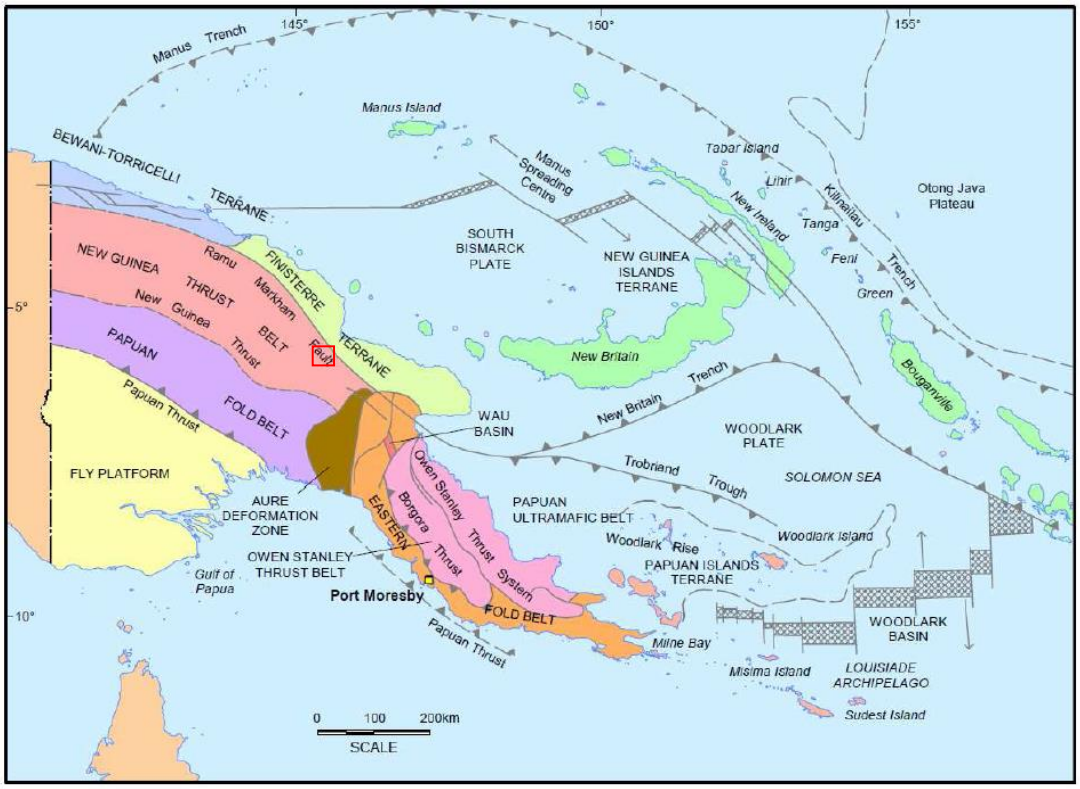

Fig. 2-1 Tectonic Unit of Papua New Guinea (□ is the location of the mining area)

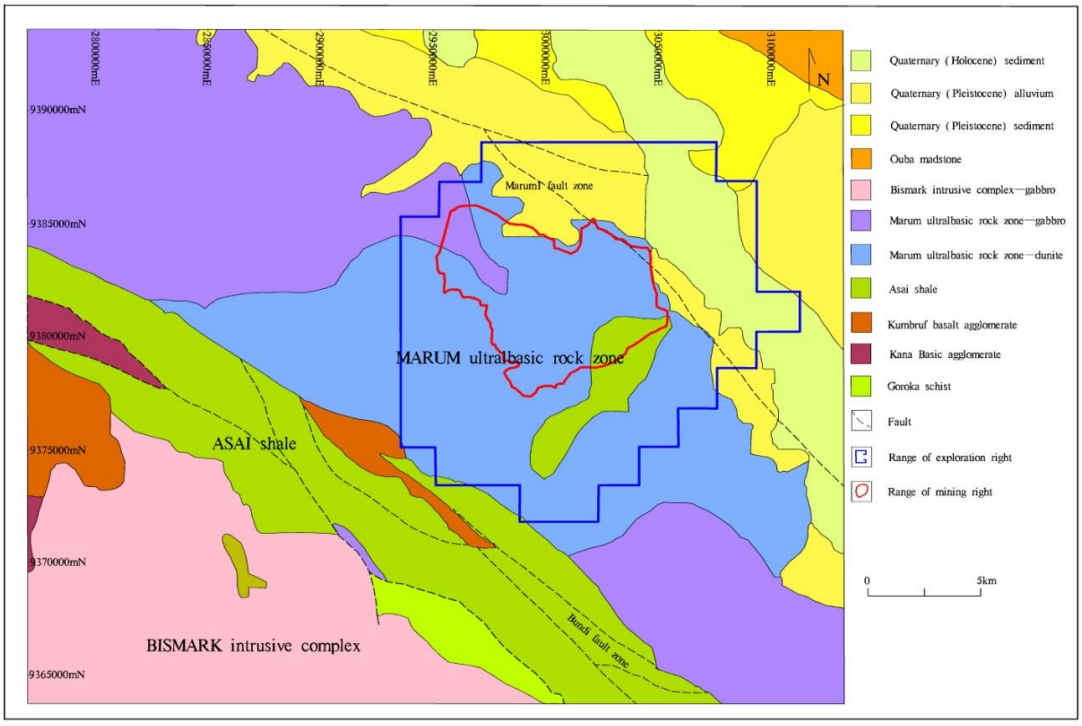

Fig. 2-2 Regional Geological Map of Ramu NiCo Mining Area

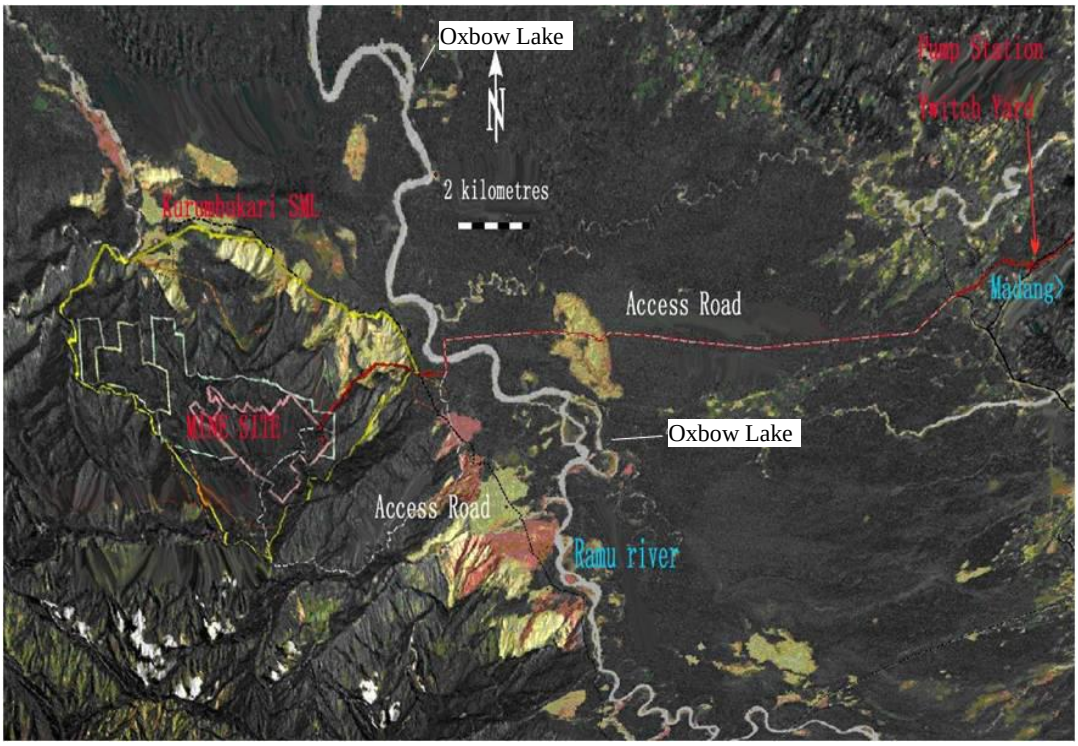

Fig. 2-3 Oxbow Lake Saw on the Aerial Photo of Ramu NiCo Mining Area

The laterite horizons containing Ni, Co in the mining area are distributed on the dunite, orthopyroxene peridotite and peridotite of Marum ultra basic rock zone. These sets of ultra basic rocks are distributed on a series of highland platforms, forming the landform surrounded by faults to have horst characteristics. Marum ultra basic rock zone is truncated by NW Bundi fault zone and Ramu-Markham fault zone in the northeast and southwest, respectively. The fault throw of Ramu-Markham fault reaches 400m. The highland platform in Ramu region is distributed parallel to the above fault. Small structures can be found in some regions of the mining area, such as shear fracture. They have slightly wavelike smooth structural planes, on which there is obvious striation, adhered with mottling chromite magnesite and kaolin; saprolitesubstances among gravels can be observed to have squeezing, kneading, as well as diastrophism between dunite gravel and saprolitesubstances. However, the structure is not developed in the overlying ore-bearing horizon (i.e., Yellow limonite). It can be seen from the aerial photo and the large scale topographic map that, multiple places of oxbow lake (Fig. 2-3) are distributed on the first order terraces of both sides of Ramu modern river bed; after entering the Quaternary Holocene Epoch, the erosion of river is dominated by side erosion, and the plot is at the stage of descending relatively

stably and slowly. It indicates that the fracture movement tends to be calm after the Holocene Epoch.

2.2 Geology of Mining Area

2.2.1 Ultrabasic bedrock

The ultra basic rock in the mining area is occurred in form of bedrock, and the joint in the rock is more developed; the anti-weathering ability is poor (Fig. 3-1), which contributes to developing the weathering crust, consequently to form the weathering crust deposit in this area. The rock type is dunite, locally developed with a little augite peridotite, peridotite, etc. The rock is often grayish green, yellowish green, medium-coarse grained, automorphic equigranular, xenomorphic structure, massive structure, and the mineral is olivine, with the content accounting for 85%~98%; the secondary mineral is serpentine, talc, chromite, with the content of about 2%~15%.

The olivine is often yellowish green, hypautomorphic crystal long columnar, short columnar, locally xenomorphic and irregularly granular, and the contact part with the ore-bearing horizon is highly weathered; the rock is often of relic structure.

The talc is flake, fibrous aggregate, distributed on the edge of olivine, between particles and in the crack; the serpentine is fibrous, micro-granular, occurred in the crack; the chromite is automorphic or irregular aggregate, distributed between olivine particles.

2.2.2 Laterite weathering crust

The laterite weathering crust exposed in the drilling engineering is divided into: from top to bottom, Humic layer (Q), Red limonite (O), Yellow limonite (L), Saprolite (S), upper rocky saprolite (R1) and lower rocky saprolite (R2).

(1) Humic layer (Q): black, dark brown, grayish brown, colloidal girdle structure, earthy, loose structure. Plant roots can be found (Fig. 2-5). The main constituent is clay, colloidal goethite, olivine fragment and sandy chromite, etc. The goethite is occurred locally in form of girdle. The vegetation coverage rate of the mining area is 100%, and it is distributed at the surface low-lying place of the mining area, so the thickness is generally 0.2-1.05cm. The nickel content of this horizon is 0.5% lower than the cutoff grade.

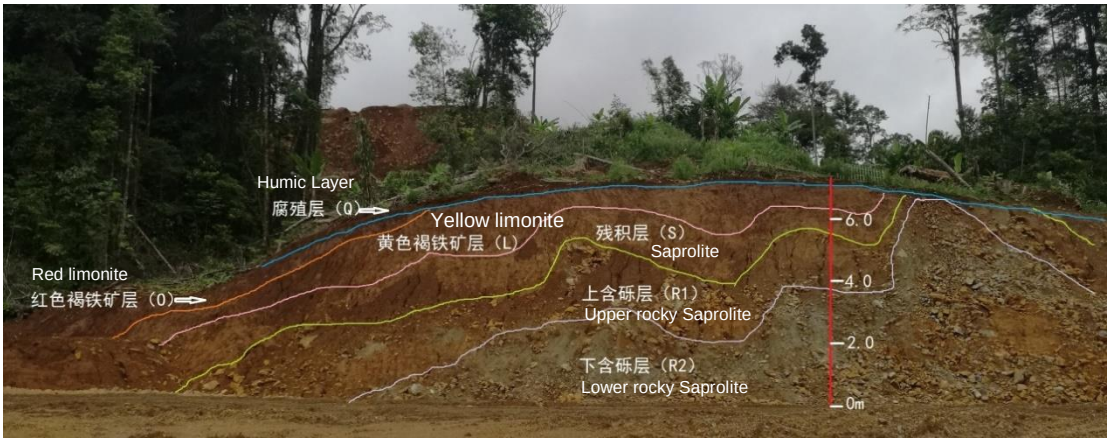

Fig. 2-4 Schematic Diagram for Division of Ramu NiCo Weathering Crust Horizon

(2) The Red limonite (O): brownish red, maroon, loose, colloidal structure, earthy, massive structure, and the main constituent is clay, goethite, olivine fragment, chromite, talcs and gibbsite ($Al(OH)_3$) and other minerals (Fig. 2-5), which is the main cover of the mining area; the northern gradient of the sandstone highway in the mining area is gentle relatively, distributed more widely, and sporadically distributed in the south. The contents of Ni, Mg in this horizon are low, the content is AL is greater than 5%, and the content of local Ni exceeds the cutoff grade. It shows a gradual transition relation with the overlying Humic layer and the underlaying Yellow limonite. The thickness of this horizon is generally 0.5-46.6m, and the average thickness is 4.37m.



Fig. 2-5 Humic layer and Red limonite

(3) Yellow limonite (L): grayish yellow, brownish yellow, brown, colloidal structure, earthy, massive structure, a little raw rock weathering relic structure occasionally found in the local part. The main constituent is clay, limonite, goethite, and the secondary constituent is gibbsite $Al(OH)_3$, talc, chalcedonite,

chromite and debris, etc. (Fig. 2-6).

This horizon is one of main ore-bearing horizons in the mining area, showing a gradual transition relation with the underlying eluvium. It is also outcropped on the mountain ridge of the mining area and the steeper slope section; the thickness of this horizon is 0.3~19.05m, and the average thickness is 4.57m.



Fig. 2-6 Yellow limonite and Eluvium

(4) Saprolite(S): light greyish-green, brown, variegated, earthy loose structure, earthy, massive structure, relic structure, micro-texture stratified structure. This horizon consists of saprolite and clay. The saprolite content is 5%-15%, and the main constituent is peridotite, secondary constituent is alterated serpentine, chalcedonite, quartz, etc. The clay content is 95~85%, and the main constituent is goethite, chromite, talc, gibbsite $Al(OH)_3$, iddingsite, MuCo earth ore, etc. (Fig. 2-7); this horizon basically contains no gravel. This horizon is occasionally outcropped with a small area in the south of the sandstone highway, having thickness of 0.4~13.35m and average thickness of 13.83m.



Fig. 2-7 Saprolite with MnCo soil

(5) Rocky saprolite (R): The main feature of this horizon is peridotite containing gravel. It is divided into upper rocky saprolite (R1, with gravel content of less than 30%) and lower rocky saprolite (R2, with gravel content of greater than 30%) according to the gravel content; the average gravel content of the upper rocky saprolite (R1) is 17.22%, and the average gravel content of the lower rocky saprolite (R2) is 51.20%.

1) Upper rocky saprolite (R1): light yellow, light brown, earthy structure, brecciated structure, earthy, massive structure. This horizon consists of gravel and saprolite earth layer. The gravel mainly consists of dunite, which is angular, sub-angular, perfectly round, with particle sizes of 5~50cm, irregularly distributed, and gravel content of 4~30%. The saprolite earth layer is of weathering relic structure, earthy, massive structure, micro-texture stratified, flaky structure. Fig. 2-Fig. 8 are peridotite gravel in the upper rocky saprolite, light green, smaller particles.

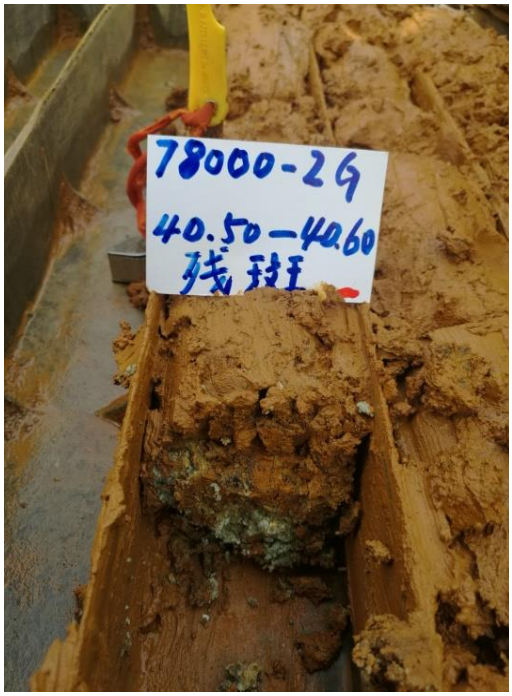

Fig. 2-8 Dunite Gravel in the Upper Rocky Saprolite

This horizon is one of the main ore-bearing horizons, outcropped in the north

of the mining area and the steep section in the south of the sandstone road, with thickness of 0.4~21.20m and average thickness of 2.75m.

2) Lower rocky saprolite (R2): greyish green, light greyish green, light brown iron stained locally, weathering relic structure, brecciated, earthy, massive structure. This horizon is similar to the gravel-containing horizon, consisting of gravel and saprolite earth layer, and only the content of gravel is different. The rubble content in this horizon is greater than or equal to 30%, up to 91% maximally; the particle size is of great disparity, generally 5~50cm, small to only 5~10cm; the rubble constituent is dunite, and the main mineral is olivine. The olivine is automorphic or xenomorphic, and fine talc can be founded to be filled along the cleavage or particles. The content of saprolite earth layer is lower than that of the upper rocky saprolite, and its constituent is talc, serpentine, chromite, goethite, followed by hydroxides of iron, etc. (Fig. 2-9). This horizon is one of the ore-bearing horizons in the mining area, outcropped in the steep section in the south of the mining area, with thickness of 0.30~13m and average thickness of 2.70m.



Fig. 2-9 Lower Rocky saprolite and Dunite Bedrock

3. DEPOSITS TYPE

This deposit is typical lateritic NiCo ore formed by ultra basic rock after weathering and leaching. When the ultra basic rock (dunite, peridotite) is subject to strong weathering and leaching, the olivine, augite and other minerals rich in Ni, Co and other useful elements are subject to oxygenolysis; the released SiO_2 is taken away by underground (surface) water in form of colloid or silicic acid, and the low valent iron is oxidized and converted into hydroxide and oxide (such as lepidocrocite, goethite and hydrohematite) with high valent iron, left in situ. Nickel, cobalt and other elements are fed into the solution in form of ion, absorbed by the clay in the saprolite, or directly precipitated from the colloidal solution, or enriched in form of secondary nickel silicate mineral, consequently to form weathering (oxidization) crust lateritic nickel deposit.

4. MINERALIZATION

The laterite NiCo deposits in this area are occurred in the dunite weathering crust. There weathering crust exposed in the drilling engineering includes 6 mineralization horizons: from top to bottom, Humic layer (Q), Red limonite (O), Yellow limonite (L), Saprolite(S), upper rocky saprolite(R1) and lower rocky saprolite (R2) (see Fig. 4-1). In the Humic layer, Ni<0.5%, belonging to the mineralization horizon and not constituting the ore bed of industrial significance, Red limonite Al≥5%, locally Ni≥0.5% containing ore, mostly containing no ore, which is the main cover of the mining area. The Yellow limonite, eluvium, and upper, lower gravel-bearing eluviums are the main ore-bearing horizons of this area.

All ore beds are not varied a lot in thickness, not distributed uniformly, and deficient in local sections. Ni, Mg, Co, Al, Mn, Sc, Fe and other elements in each core bed are different in distribution, but the distribution still has a certain rule, where the contents of Ni, Mg are gradually increased from top to bottom; to the bottom of the lower gravel-bearing horizon, the content of Ni is reduced obviously, and the content of Mg is gradually increased; the content of Al is reduced to the increasing depth, and the contents of Co, Mn are slightly higher in the eluvium.

Table 4-1 **Statistics for Ore Body Grade, Scale Parameter by Prospective Exploration in 2017**

Ore (bed) body ID	Maximum burial depth of ore body (m)	Ore body thickness			Grade of Ni		Grade of Co	
		Average (m)	Maximum (m)	Coefficient of variation	Average (%)	Coefficient of variation	Average (%)	Coefficient of variation
O	1.05	4.49	46.60	150%	0.558	36%	0.06	49%
L	46.60	4.65	19.05	72%	0.766	23%	0.087	41%
S	24.00	3.89	13.35	60%	0.826	23%	0.099	38%
R1	47.20	2.81	21.20	100%	0.767	29%	0.083	49%
R2	51.20	2.61	12.90	81%	0.778	26%	0.08	53%

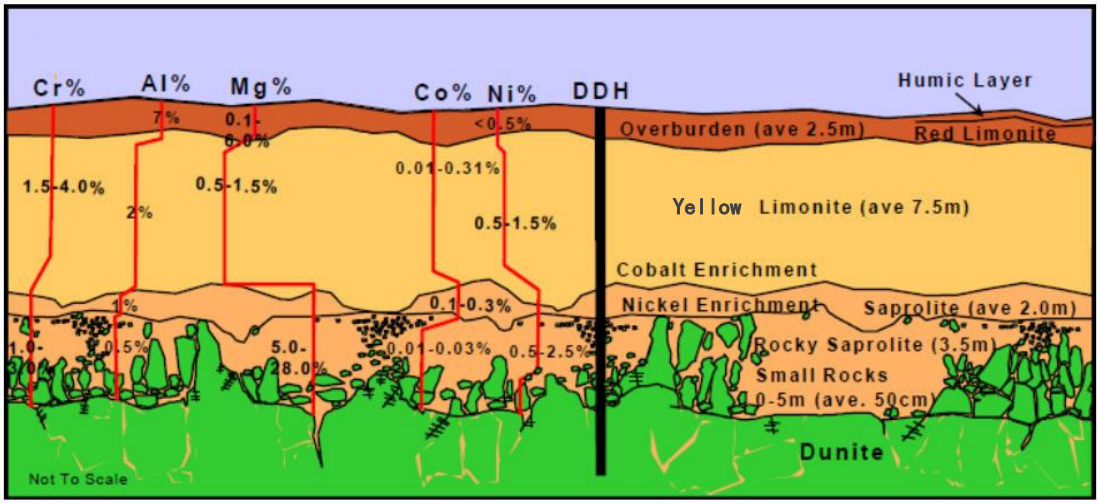

Fig. 4-1 Profile of Ramu Laterite Weathering Crust

Generally dominated by topography and other factors, the plane form of ore body is simple. The profile form of ore body is closely associated with topography and landform. It occurs as stratified or lenticle beds. Moreover, it is essentially consistent with the topography in the whole, with the dip angle as 10°~35°. The form of ore body is strictly dominated by the ore-bearing horizons and exposed by borehole. For this, most ore bodies will be missed. As a result of this, the ore body occurs as discontinuous lenticle beds in profile. The dip angle of the bedrock is 5°~35° generally, even may reach 45° at local section.

Ore bodies are hosted in the laterite above the dunite-based bedrock. Nickel mainly occurs both in goethite and serpentine, but its grade is mostly 0.5~1%, generally low. Industrial types of ores in this mining area are mainly divided by contents of Mg and Ni in all ore-bearing horizons. Both their industrial types and natural types belong to weathering crust lateritic NiCo ores.

Based on the MgO content, the weathering crust lateritic NiCo ore is divided into: iron ore: MgO<10%; ferromagnesian ore: MgO: 10%~20%; magnesium ore: MgO>20%. From the entire area, the contents of such impurity elements as Mg, Al, Fe and Mn are generally low.

When the average content of MgO in the O, L and S (limonite bed) ore bodies is less than 10%, it belongs to low-magnesium ore; when the average content of MgO in the R1 (upper rocky saprolite) ore body is 18%, it belongs to iron ore; when the average content of MgO in the R2 (lower rocky saprolite) ore body is 20.44%, it belongs to magnesium ore.

5. EXPLORATION

5.1 Geological Exploration Before 1999

Ramu nickel laterite deposit was found by Bureau of Mineral Resources of Australia in 1962. Since then, the deposit has experienced the different degrees of geological work borne by different corporations in multiple phases. As of 1999, see Table 5-1 for geological exploration work carried out in and main exploration quantities put into the mining area.

Depending on the work depths and achievements, Highlands Pacific Ltd. (HGP), the former project developer, divided the exploration history Ramu project before 1999 into four stages.

At the preliminary exploration stage between 1962 and 1970, the auger and the exploratory trench (pit) are applied for prospecting. About 23km^2 exploration area is mainly finished by INSEL. CEC made an assessment on the mineral deposit, and considered that further exploration work was needed based on the market condition and technology at that time.

The first stage lasted from 1970 to 1982. CEC set up a joint venture with EPML to develop Ramu laterite in 1971. As the joint venture manager, CEC invested exploration for Ramu laterite. By virtue of applying the large density sample and dressing and smelting test sample, the preliminary result was obtained, and 69Mt ore resources were detected. The average grades of Ni and Co were 1.29% and 0.105% respectively. CEC considered that the project was not feasible at that time. In 1978, Nord joined development and exploration of the project as the joint venture partner, and continued exploration for Ramu laterite as the joint venture manager and executive. 129 test pits, 1,081 augers and 200 core drills were put into at the end of 1980. Later on, Nord also made an assessment on chromite alluvial mineral deposit, through which the ore resource was estimated as 4.1Mm^3. On this basis, 60kg of chromite concentrate may be

recovered per cubic meter averagely. With the ferrochromium ratio as 1.3:1 in the concentrate and other elements, no further work is made for the mineral deposit even if it has the exploration potential.

The second stage lasted from 1989 to 1990. For change of nickel market in the world in 1989, Nord restarted exploration for Kurumbukari NiCo resources. Meanwhile, HGP also purchased the shares of the joint venture project from CEC, and put it into core drilling and auger boring. Located in the middle of Ramu, the drilling engineering was directed to search resources with Ni grade greater than 1.5%. See Table 5-1 for the finished quantities. Through this prospecting, the core drilling exploration grid reached 150m×150m, and the core drilling exploration holes were densified and supplemented by the auger.

The third stage lasted from 1993 to 1994. HGP obtained 60% shares of the Project in 1992, and PGK 5 million was invested for risk exploration. In 1993, HGP started large-scale exploration, by which 56.5km was measured by the geological radar and 10,200m was drilled. See Table 5-1 for the detailed quantities. By this exploration, 24.2M t of total mineral resources was obtained, average grades of Ni and Co were 0.90% and 0.08% respectively, and the cutoff grade was 0.5%Ni. Besides, environmental monitoring and drilling, seismic analysis, hydrologic survey, density sampling and drilling core re-sampling were finished.

The fourth stage lasted from 1997 to 1999. To meet the feasibility research requirement in 1997, the drilling engineering with the grid of 100m×100m was started to confirm the grades of resources in Great Ramu Area. The grid covered the extending parts in the middle, east and middle of Ramu, with area of 6.3km^2. See Table 5-1 for quantities finished till July 1998. In the meantime, 13 core drills and 25 augers were constructed in the south of Ramu. When the drilling grid was 50m×50m in the local section, the grade change was determined by comparing the areas with this grade with the area having the grade as 300m×300m. Besides, two test pits were further constructed, by which the density sample and the dressing and smelting test sample were applied.

Table 5-1 Main Geological Survey workload in Ramu Mining Area Before 1999

Year / Corporation	1962	1963～1965	1965～1970	1970～1978	1978～1982	1989～1990	1993～1994	1997～1998.7		1999
	BMR	INSEL	CEC	EPML & CEC JV	Nord & CEC JV	HGP & Nord JV	HGP & Nord JV	HGP & Nord JV		HGP & Nord JV
Auger (Nr.)		72		1098		60(406m)			25	
Auger (With hole coordinate)						70(528m)				
Diamond drill (Nr.)				207		67(1160m)	414 / 10200m	660	13	88
PQ diamond drill							25(650m)	69		
GPR (km)							56.5			29.9
Exploratory trench (pit)		115		39						
Large exploratory trench (Nr.)				2		7(155m)				
Pilot production (Nr.)								2		
Remarks	The mineral deposit was found.	Ore prospecting was carried out within the 23km^2.	In retrospect of the previous jobs, it was considered that further exploration was needed on account that the exploration degree of the mineral deposit was sufficient.	The preliminary dressing and smelting test was finished by taking bulk sample.		Potential resources with grade greater than 1.5% in the middle were assessed.	Detailed resource assessment was finished.	100m×100m in the middle and 300m×300m in the eastern extension part. 50×50 grid in the middle was used for assessing change of the degree of mineralization.	Drilling exploration was started in the south.	When the west grid was 200m×200m, the geological radar with 1m resolution was implemented in the west.

6. Notes：BMR—Bureau of Mineral Resources； INSE—International Nickel Southern Exploration Ltd；CEC—Carpentaria Exploration Company；EPML—Eastern Pacific Mines Ltd；Nord—Nord Resources Corp；HGP—Highlands Gold Properties Pty Ltd；JV—Joint Venture

HGP put 88 core drills to the west of Ramu in 1999, so the control degree of the west reached 200m×200m and 29.9km geological radar measured was conducted.

5.2 Infill exploration

Since commencement of capital construction, Ramu NiCo Project has successively carried out capital construction exploration for two phases, respectively in 2013, 2015, 2016 and 2017, and conducted intensive exploration for KBK area in the current working range and local peripheral section.

1) First-stage construction exploration

Between April 2007 and December 2007, Sinomine Resource Exploration Co., Ltd. carried out the first-stage construction exploration for the production scope of the first year in the basic design of KBK area. All deposits were systematically controlled by the 25m×25m drilling engineering spacing. The finished main physical quantity included 0.48km^2 of 1:500 topographic survey and 0.28km^2 of 1:500 topographic survey. 6,052.08m/450 holes were obtained by core drilling. There were 4,577 basically analyzed samples. In the meantime, *Report on Capital Construction Exploration for Ramu NiCo KBK (A) Area in Madang, Papua New Guinea* was submitted in July 2009. Upon evaluation, in the submitted report, the total ore resource was 200.88×10^{4}t, the Ni metal content was 2.26×10^{4}t, and the Co metal content was 0.22×10^{4}t in the capital construction exploration scope; the average Ni grade was 1.13% and the average Co grade was 0.11%.

2) Second-stage construction exploration

Between September 2007 and May 2009, Sinomine Resource Exploration Co., Ltd. carried out second-stage construction prospecting for KBK (B') area. Its exploration scope was determined by the basic design of the mine at the second year. All deposits were systematically controlled by the 25m×25m drilling engineering spacing. The finished main physical quantity included

0.32km^2 of 1:500 topographic survey and 0.36km^2 of 1:500 topographic survey. 8,382m/549 holes were obtained by core drilling. There were 5,887 basically analyzed samples. In the meantime, *Report on Capital Construction Exploration for Ramu NiCo KBK (B') Area in Madang, Papua New Guinea* was submitted in September 2009. Upon evaluation, in the submitted report, the total ore resource was 316.61×10^{4}t, the Ni metal content was 3.15×10^{4}t, and the Co metal content was 0.47×10^{4}t in the capital construction exploration scope; the average Ni grade was 1.00% and the average Co grade was 0.15%.

3) Infill exploration in 2013

In 2013, the management corporation entrusted Hubei Geological Survey Institute of Coal to explore the periphery of the capital construction exploration area in KBK area, and submitted *Instructions to Estimation on Peripheral Resources/Reserves of Capital Construction Exploration Area in Ramu NiCo KBK Area in Madang, Papua New Guinea* on October 20, 2015. According to the instructions, the detailed exploration area of KBK was 1.855km^2, and the exploration engineering spacing was 50m×50m; 780 boreholes were constructed in the detailed exploration scope; through estimation on the total resources in the detailed exploration area, the ore amount was 2,106.16×10^{4}t, the Ni metal content was 20.67×10^{4}t, and Co metal content was 2.43×10^{4}t; the average grades of Ni and Co were 0.98% and 0.115%, respectively.

4) Infill exploration in 2015

Between March 2015 and March 2016, Hubei Geological Survey Institute of Coal performed productive exploration in the northeast of KBK area and local areas of the adjacent Great Ramu Area. Between May 2015 and November 2015, 5,683.21m/490 holes were drilled, 4,561 basically analyzed samples were collected, and the engineering spacing was 50m×50m. Also, *2015 Productive exploration Report on Ramu NiCo Project in Madang, Papua New Guinea* was submitted. Through estimation in the report, the total ore resource was 320.48×10^{4}t, the average grade of Ni was 1.14%, and its metal content was 3.64×10^{4}t; the average grade of Co was 0.11%, and its metal content was

0.34×10^4t. In 2015, productive exploration went beyond the scope of KBK area, mostly located in Great Ramu Area. The productive exploration scope beyond the KBK area was about 0.66 km^2.

5) Productive exploration in 2016

In 2016, the management corporation entrusted Hubei Geological Survey Institute of Coal to carry out productive exploration for the south and north of KBK area and local area of the adjacent Great Ramu Area, and submitted *2016 Productive exploration Report on Ramu NiCo Project in Madang, Papua New Guinea* in March, 2017. Based on the report, the productive exploration degree area was 1.46km^2; the area at the detailed exploration stage was 0.447km^2, and the prospective exploration area was 0.301km^2. The exploration engineering spacing was 50m×50m at the productive exploration stage, 100m×100m at the detailed exploration stage, and 200m×200m at the prospective prospecting stage. Between June and November 2016, 9,729.28/668 holes were drilled, and 8,398 basically analyzed samples were collected. It was estimated that the total ore resource was $1,868\times10^4$t, the average grade of Ni was 1.03%, and the average grade of Co was 0.11%.

6) Infillexploration in 2017

A. Prospective exploration

In 2017, the management corporation entrusted Sinomine Resource Exploration Co., Ltd. to carry out prospective exploration in the west side of KBK area, and submitted *2017 Geological Exploration Report on Prospective Area of Ramu NiCo in Madang, Papua New Guinea* in May 2018. According to the report, the exploration work area was located in the west side of KBK, with the area as 4.1km^2 and exploration engineering spacing as 100m×100m. Between July 2017 and January 2018, 5125.02m/363 holes were drilled, and 4,606 basically analyzed samples were collected. Through estimation, the total ore resource was $2,587\times10^4$t, the average grade of Ni was 0.744%, and its metal content was 19.13×10^4t; the average grade of Co was 0.082%, and its metal content was 2.14×10^4t.

B. Productive exploration

In 2017, the management corporation entrusted Hubei Geological Survey Institute of Coal to carry out productive exploration for the north side of KBK area, and submitted *2017 Productive exploration Report on Ramu NiCo Project in Madang, Papua New Guinea* in May 2018. According to the report, the exploration work area was located in the north side of KBK, with the area as 1.6km^2 and exploration engineering spacing as 50m×50m. Between July 2017 and January 2018, 9,026.44m/702 holes were drilled, and 8,586 basically analyzed samples were collected. Based on the report, it was estimated that the total resource (ore reserve) was 1,225.15×10^{4}t, the average grade of Ni was 0.943%, and the average grade of Co was 0.099%.

This estimation for work resources in exploration between 2016 and 2017 mainly involves a small amount of boreholes in “productive exploration in 2016”, “productive exploration in 2017” and “geological exploration before 1999” within the aforesaid scope of work.

6 TOPOGRAPHY AND ENGINEERING SURVEY

6.1 Productive exploration in 2016

RAMU93 coordinate system (independent coordinate system of the mining area) was applied for the plane coordinate of the survey area, and RAMU93 elevation system (independent elevation system of the mining area) for elevation.

1.06km^2 of 1:1000 topographic survey was finished in the mining area, and 668 boreholes were surveyed.

Hi-Target Statistic GPS was applied for surveying the first-stage planar control measurement in the mining area. For the mapping method of topographic map of the mining area, the total station (TOPCON EOS602) was applied for acquiring field topographic points, and the GASS7.1 mapping software was applied for mapping indoors. RTK or total station was applied for borehole survey.

Surveying and mapping work meets the construction demands. It passed Party A's spot check for quality and the review for competent person.

6.2 Infill exploration in 2017

6.2.1 Prospective exploration

Both the coordinate system and the elevation system are consistent to productive survey in 2016.

2.96km^2 of 1:1000 topographic survey was finished, and the 363 boreholes were surveyed.

Control points mapped in 2006 and 2013 were preserved well. Upon check, plane and elevation precisions met demands of this survey. Mapping base points were surveyed directly by virtue of GPS-RTK. If GPS-RTK cannot be applied in the dense vegetation area, the total station polar method and the connecting traverse method were applied. The field mapping method of total station was applied in the dense vegetation area of the survey area, and GPS-RTK field mapping method for the rest of areas. South CASS9.2 mapping software was applied for mapping indoors. The total station was applied for borehole survey.

Surveying and mapping work meets the requirements of design and Chinese standards. It passed the Supervisor's check for quality and the review for competent person.

6.2.2 Productive exploration

The coordinate system, elevation system and survey method are consistent to productive survey in 2016. 702 boreholes were surveyed.

Surveying and mapping work meets the requirements of design and Chinese standards. It passed the Supervisor's check for quality and the review for competent person.

7 DRILL

7.1 Productive exploration in 2016

668 boreholes were constructed, with the different engineering spacing as

50m~200m. Straight hole drilling was applied as the drilling method, and the method of alloy drilling (mainly used for soil horizon construction at the upper part of bedrock) and clad sheet drilling (mainly used for bedrock construction) as the drilling technology. The borehole is of an open (final) hole with the diameter of 94mm. Single tube was used for coring when the rock core was recovered, with the coring diameter as 89mm.

The core recovery rates of all ore beds and full borehole core were required to be no lower than 75.00%. The full borehole core recovery rates of the constructed 668 boreholes were between 79.05% and 100.00%. The quality essentially conformed to the regulation and design requirements.

The standard drilling rig was applied for this drilling exploration, so borehole depth has no error. The quality met the requirements of the regulations. Based on visual survey on the site, the drilling rig was straight and the borehole depth was shallow, so no curvature test was conducted. Round trip water level was not measured in boring construction in case of applying dry drilling or small pump drilling. When drilling to the rocky saprolite, leakage was found in most boreholes. For this, steady water level was not observed. However, the leakage position in the borehole was recorded in the blank of the tour report. Boreholes were landfilled with mineralized clay in the vicinity of the orifice for sealing. Timber piles (marked with borehole number, borehole depth and construction date, etc.) were buried in the orifice as the mark for drilling orifice.

Upon Party A’s site acceptance, it was believed that various technical indicators of the drilling engineering conformed to the requirements of Chinese drilling specification. The obtained results reached the expected geological objective, the engineering quality was reliable, and the qualities of 668 constructed boreholes were qualified. The drilling quality was reviewed to be qualified by the competent person.

7.2 Infill exploration in 2017

7.2.1 Prospective exploration

This exploration object has a shallow burial depth and a thin ore bed. For this, XY-1 drilling rig was applied for drilling construction. Drilling with short round trip and small pump was applied to preventing the core from being damaged in construction. Dry hole drilling was applied in soil horizon drilling; when the rocky saprolite was drilled, gravels differed in size and solid (peridotite). Small-pump water supply drilling was applied, and dry drilling was applied to making sure core recovery rate when passing through the gravels. In order to meet requirements of geological sampling and various analytical tests, the drilling construction method of hard alloy drilling, accompanied by diamond drilling was mainly applied in drilling exploration. The drilling structure involves Φ110mm open hole and Φ91mm final hole. It was generally drilled to the bedrock (about 1-2, fresh dunite was found) for finishing drilling hole. 363 boreholes was constructed in this exploration and totally qualified, with total footage as 5,125.02m.

According to Party A's requirements, the full-horizon recovery rates of Q, O, L, S, R1 and B horizons were lower than 80%, and the full-horizon recovery rate of R2 was no lower than 75%. The full-borehole recovery rates of 363 boreholes were between 85% and 100.00%. The average full-borehole recovery rate was 94%, and the average recovery rates of the horizons were 87-98% (see Table 7-1), all of which met the regulation and design requirements.

Table 7-1 Statistics of Recovery Rates of Strata

Stratum	Design requirement (%)	Recovery rate (%)
(Q) Humic layer	80	94
(O) red limonite bed	80	98
(L) yellow limonite bed	80	98
(S) saprolite	80	96
(R1) upper rocky saprolite	80	93
(R2) upper rocky saprolite	75	87

Upon drilling, the depth of hole was corrected. The drilling rig was measured by the steel tap, with reading accurate to two decimal places and the hole depth error less than 1‰. It met the requirements of the regulations. Boreholes of design construction were straight holes. Upon installation of the drilling rig, the base was leveled. The two-side drop hammer method was applied for correcting the vertical shaft to make sure the vertical shaft at 90 degrees. The axial lead of the vertical shaft of drilling rig, and the centers of crown block and orifice were ensured on the same vertical line. All drilling curvatures met the design requirements.

For the construction area located at the top of mountain body, dry drilling was applied for the clay stratum which is aquiclude at the upper part in drilling construction. Small-pump drilling was applied for the lower gravel stratum which is leakage stratum, without backwater. No water level was found in the borehole. Dry drilling position and leakage position in the borehole were recorded accurately in the hydrogeologic observation content. Moreover, no water level was found in all boreholes.

After drill-hole was finished, the boreholes were landfilled with mineralized clay in the vicinity of the orifice for sealing. Timber piles were buried in the orifice and red strips (marked with borehole number, borehole depth and construction date, etc.) were bound as the marks for drilling orifice.

The Project Technical Engineer, Supervisor and Ground Survey Chamber of Mine inspected the quality on the site once to twice a week. After construction, Ground Survey Chamber of Mine and the Supervisor assumed that all boreholes were controlled, top and bottom plates of the ore beds were disclosed, various indexes and related parameters met the quality requirements of the regulations and standards upon their inspection and acceptance. On this basis, the geological objective was achieved, the engineering quality was reliable, and 363 constructed boreholes were qualified. The drilling quality was reviewed to be qualified by the competent person.

7.2.2 Productive exploration

702 boreholes were constructed, with most engineering spacing as 50m. Drilling exploration is consistent to prospective exploration in 2017.

The Project Technical Engineer, Supervisor and Ground Survey Chamber of Mine inspected the quality on the site once to twice a week. After construction, Ground Survey Chamber of Mine and the Supervisor assumed that all boreholes were controlled, top and bottom plates of the ore beds were disclosed, various indexes and related parameters met the quality requirements of the regulations and standards upon their inspection and acceptance. On this basis, the geological objective was achieved, the engineering quality was reliable, and 702 constructed boreholes were qualified. The drilling quality was reviewed to be qualified by the competent person.

8 SAMPLING AND LOGGING

8.1 CORE SAMPLING

8.1.1 Productive exploration in 2016

8,398 basically analyzed samples were collected from 668 boreholes.

(1) Sampling layout of chemical analysis sample

Sampling target stratum: full-section continuous sampling.

Sampling layout principles

Considering sample representatives and minable thicknesses of different ores, the principle shall be met in sampling layout:

1) The same sample shall not go across different apertures;

2) The same sample shall not go across different rock and mineral beds;

3) The same sample shall not go across natural types and industrial grades of different ores;

4) The true thickness represented by the single sample length shall not exceed the industrially minable thickness of the mineral generally;

5) The same sample shall not go across the round trip with greater

recovery rate difference.

(2) Layout of chemical sample section

In all recorded cores, chemical samples were deployed one by one based on the aforesaid principle for the sample target stratum. The “Core Sample Sign” (or sampling baffle plate) was filled and place into the bottom boundary of the sample in the core. Meanwhile, sample number and well depth were recorded in the geological record table. The chemical sample of the core was taken by the designated sample man after being arranged by the geological logging personnel.

(3) Sampling method

All holes are sampled continuously, with the basic sampling length as 1m. When the distance between sampling point and the lamination position is no more than 0.5m, combined sampling may be applied; separate sampling shall be applied when the distance is greater than or equal to 0.5m. The sample splitting knife is applied for 1/2 splitting the soil horizon for sampling as chemical analysis, and the rest of 1/2 sample is discarded; the full-core sampling is applied for the rocky saprolite.

After sampling is inspected and accepted by the Supervisor and Mine, its quality meets the requirements of the regulations. The sampling quality was reviewed to be qualified by the competent person.

8.1.2 Infill exploration in 2017

8.1.2.1 Prospective exploration

4,606 basically analyzed samples were collected from 363 boreholes.

(1) Sampling target stratum: full-section continuous sampling is made for the ore bed (mineralization-bearing bed).

(2) Sampling layout principles

Samples shall be laid to meet continuous sampling on the basis of “Five No-cross” for the same sample. That is: it does not exceed different ore beds, different ores, different lithologic members and lithological characters, different

apertures, and round trips with great round trip recovery rate difference.

(3) Sampling method

All holes are sampled continuously, with the basic sampling length as 1m. When the distance between sampling point and the lamination position is no more than 0.5m, combined sampling may be applied; separate sampling shall be applied when the distance is greater than or equal to 0.5m. 1/2 split core sampling was applied for the soil horizon for chemical analysis, and the rest of 1/2 was discarded (except for core reserved drilling); full-core sampling was applied for the upper and lower gravel-bearing horizons.

After the sample was packaged into the self-sealed plastic bag, the sample label was filled accurately and clearly corresponding to the sampling register form, and then sealed with the adhesive tape, and finally packaged into the corresponding sample bag after check without error. Every 6-8 samples were packaged into one woven bags. The exterior of each woven bag were marked with borehole number and sample number with permanent pen. The woven bags were transported to the sampling room by the drilling rig unit.

After sampling is inspected and accepted by the Supervisor and Mine, its quality meets the requirements of the regulations. The sampling quality was reviewed to be qualified by the competent person.

8.1.2.2 Productive exploration

8,347 basically analyzed samples (inclusive of 239 blank samples) were collected from 702 boreholes.

The sampling method is consistent with the productive exploration in 2017.

After sampling is inspected and accepted by the Supervisor and Mine, its quality meets the requirements of the regulations. The sampling quality was reviewed to be qualified by the competent person.

8.2 CORE LOGGING

8.2.1 Productive exploration in 2016

Drilling and recording were conducted when drilling construction was

conducted. The recording location is in the drilling construction site, and the recording time is before the core fails to be denuded and weathered after being taken from the borehole.

Recording contents mainly include inspection for drilling exploration tour report, core sorting and inspection, round trip data record, core photographing, lithology lamination, geological description, etc.

Drilling record data were bound in a volume after check and correction as well as sorting and improvement. The borehole bar chart with scale of 1:100 was drawn in a format of CAD2004 in the computer.

All drilling data were inspected and accepted by the Supervisor and Mine, and the quality met the requirements of the regulations. The recording quality was reviewed to be qualified by the competent person.

8.2.2 Infill exploration in 2017

8.2.2.1 Prospective exploration

The geological record shall execute the related Chinese specifications.

After the drill hole was finished, the geologist arrived at the site for geological recording promptly. Recording contents mainly include: 1) inspection for drilling exploration tour report and core; 2) observation and record: core lamination and photographing, round trip data record, geological description, etc.

The drilling record data was bound in a volume upon inspection and check as well as sorting and improved; the related data about original geological record, sampling and sample processing was recorded into borehole database for further statistical analysis, drawing and modeling whenever possible.

All 363 drilling data were inspected and accepted by the Supervisor and Mine, and the quality met the requirements of the regulations. The recording quality was reviewed to be qualified by the competent person.

8.2.2.2 Productive exploration

The drilling record is consistent to prospective exploration in 2017.

All 702 drilling data were inspected and accepted by the Supervisor and

Mine, and the quality met the requirements of the regulations. The recording quality was reviewed to be qualified by the competent person.

9 SAMPLE PREPARATION, ANALYSES AND SECURITY

9.1 Sample Preparation

9.1.1 Productive exploration in 2016

Chemical analysis sample shall be prepared in accordance with the requirements of *Specification of Testing Quality Management for Geological Laboratories - 13 Preparation Procedures of Rock-Mineral Analysis Test Sample* (DZ0130.13-94). Sample processing is divided into preliminary crushing and fine crushing. Every stage also includes crushing, screening, uniformly mixing and splitting.

This sample preparation was carried out in the built sample processing room. After the Sample Processing Chamber received the sample, the number of samples was checked by contrasting the sample list to confirm sample amount and sample number to be consist to the sample list, and then sample was processed. Sample processing procedures are as follows:

(1) Sample loading and weighing: after all samples of the same borehole are arranged in sequence, and then the samples are sequentially poured into the sample tray for weighing and recording based on the sample numbers. When the samples are poured, the sample labels in the sample tray are inspected carefully to prevent the sample numbers from being gone wrong. In case of any problem on the sample label, the sample is sealed promptly, and then checked with the logging personnel and sampler, and finally weighed again when no error is ensured for the sample number. The sample tray is frequently washed to keep clean, so as to prevent cross contamination of the sample.

(2) Sample drying: wet samples are dried for 4-6h after being weighed, in order to shorten the sample processing time. It is required to strive for stabilization of the dried samples in the course of going in and out of the oven, so as to prevent the samples from scattering. Samples are generally dried for 10h at 95°C. When samples are totally dried (constant weight), dry weights of samples are weighed and recorded.

(3) Sample rolling: gravel-free Red limonite, Yellow limonite and saprolitesamples are broken with wooden rolling pin. The preliminarily sample has a particle size of 16-20 meshes (1mm-0.83mm). The rocky saprolite sample is rolled after the sample is washed and dried.

(4) Sample splitting: splitting is carried out after the particle size of sample meets the requirements. Samples are mixed for no less than three times before splitting, so as to try to make sure uniformity coefficient of the sample. The quarter diagonal method is applied for splitting. When the samples are excessive, the quarter diagonal method is used for secondary splitting again till the total weight of soil sample is about 400g. For sample splitting, the processing flow is prepared by the chechott formula, in which the splitting coefficient is K value, generally 0.1. The chechott formula is $Q=Kd^2$.

In which, Q-minimum reliable quality of the sample, kg; d - maximum crushing particle diameter of the sample, mm; K - splitting coefficient determined by the characteristics of the rock and mineral sample.

(5) Sample crushing: The split sample is put into the sample grinder to be ground into -200 meshes, and then split into original and duplicate samples. The sample of every part is about 100g. Then, the two samples are respectively packaged into the paper sample bags, and the surplus samples are abandoned to the raw material yard of the ore-washing plant.

(6) Gravel-containing sample processing: all rocky saprolite samples are processed. Its processing procedure is as follows: A. after the sample is dried and weighed, the wooden rolling pin is used for breaking the sample, and then the obvious gravels are selected for separate storage. B. The rolled samples

are screened by 2mm sieve; the undersize samples are stored separately; the oversize gravel samples and the gravels in process A are mixed together. C. Soil adhered to the gravels are brushed with the steel wire brush, and then all samples are screened with the -2mm sieve. D. Samples with particle size of below 2mm in the process C are included into the samples separately stored in the process B, and then the fully and uniformly mixed samples are crushed and splitted. Gravels in process C are discarded after being weighed and recorded.

(7) Data sorting: wet and dry weights of samples and weight of gravels are recorded in sample processing, and the data is sorted into the electric file; after moisture content of the sample and weight percentage of travel are calculated, he data is provided to Party A on schedule.

(8) Sample delivery: original and duplicate samples with maximum particle size of -200 mesh through processing are handed over to the testing laboratory of Party A's Project Department of the mine promptly together with the sample delivery list once a week.

The processing method is approved by the mine, and its quality complies with the requirements of regulations upon the mine's inspection and acceptance. The processing quality was reviewed to be qualified by the competent person.

9.1.2 In-fill exploration in 2017

9.1.2.1 Prospective exploration

(1) Basic requirements for sample preparation

1) This sample processing refers to drying, crushing and splitting of core sample, blank sample and replicate sample. All samples shall be delivered to Ground Survey Chamber of Mine in batches. The specifications of every sample shall be as follows: the original sample with granularity of 200 meshes is 50~100g, and the duplicate sample is 130g.

2) The room of sampling chamber shall be provided by the mine. Main sampling equipment shall include jaw crusher, sampling machine, thermostatic drier box, vibrating screen, vacuum pump, etc.

3) The total loss rate of entire sample processing shall be no more than

5%, and the splitting error of the sample shall be no more than 3%.

(2) Sample processing flow

Chemical analysis samples shall be prepared in accordance with the requirements of *Specification of Testing Quality Management for Geological Laboratories - 13 Preparation Procedures of Rock-Mineral Analysis Test Sample* (DZ0130.13-94). Sample processing is divided into coarse crushing and fine crushing. Every stage also includes crushing, screening, uniformly mixing and splitting.

1) After the sampling chamber receives the sample, the quantities and numbers of samples shall be checked by contrasting the sample list, and then samples are processed upon confirmation.

2) Sample loading and weighing: after all samples of the same borehole are arranged in sequence, and then the samples are sequentially poured into the sample tray for weighing and recording based on the sample numbers. When the samples are poured, the sample labels in the sample tray are inspected carefully for confirmation. Samples having problems in labeling shall be sealed up for safekeeping, and shall be verified with logging personnel and sampling personnel. When there is no error for sample No., the procedure of weighing shall be conducted. To prevent the cross contamination of samples, sample pan shall be cleaned up for use without cross infection after weighted every time.

3) Sample drying: Gloves shall be put on to put samples in and take out samples from the stove, steadily without spilling. Samples shall be baked for 12h under the temperature of 95~105°C. When samples are totally dried (constant weight), dry weight of samples shall be weighed and recorded.

4) Coarse crushing of samples: Coarse crushing shall be conducted directly for samples containing no gravel from Red limonite, yellow limonite layer and eluvium. Coarse crushing can be carried out after gravel-containing samples from saproliteare washed, processed and dried. Before and after the coarse crushing of each sample, alligator crusher shall be cleaned up without

cross infection. The particle size of samples after coarse crushing shall be 16 mesh~20 mesh (1mm~0.83mm).

5) Sample crushing: After coarse crushing and splitting of samples, original samples shall be put in the grinding machine and ground to -200 mesh. The rest of residual samples shall be discarded to a specific place.

6) Sample splitting: Splitting mass of samples shall be calculated according to Qeqott formula as follows:

$$Q = K \times d^2$$

Where: Q - minimum reliable mass obtained when splitting (kg)

K - splitting coefficient, taking (0.1~0.3) generally

d - maximum particle size of pulverized samples (mm)

Splitting of sample coarse crushing: K takes the value of 0.2; d takes the value of 1mm~0.83mm; Q is calculated as around 400g.

Splitting of sample crushing: K takes the value of 0.2; d takes the value of 0.074mm; Q is calculated as around 100g.

Splitting ration is estimated according to the weight of samples and calculated reliable mass of Q splitting.

Automatic splitter is employed for all samples to complete splitting one time.

7) Processing of gravel-containing samples: The processing method is the same as that of productive exploration in 2016.

8) After samples are crushed to 200 mesh, original samples with about 50~100g shall be packed fractionally while duplicate sample with about 130g shall be packed fractionally. Redundant samples shall be discarded to a specific place.

9) Blank sample: Original samples are the limestone debris provided by Ground Survey Chamber of Mine in batches. Samples shall be mixed with the same batch of sample No. before processing. The weight of a single blank sample is greater than 400g with the granularity of 1~6mm. After crushed to 200 mesh, 100g shall be taken to be packed and handed with the same batch

of core samples. According to the calculation of three processed blank samples for each 100 core samples, the core samples are 4,606 in total for this time, 154 blank samples shall be prepared, 159 pieces are transferred actually, so the design work amount is completed successfully.

(3) Organization of data

During sample processing, wet weight and dry weight of samples and weight of gravel shall be recorded at any time. Relevant data of processed samples on the current day shall be organized as an electronic file, and the percentage of moisture content of samples and weight percentage of gravel shall be calculated. Data shall be provided to the Ground Survey Chamber of Mine in time.

(4) Transfer of samples

With respect to original samples (50~100g) and duplicate samples (130g) obtained after 200 mesh crushing and splitting, one batch of samples shall be transferred to the Ground Survey Chamber of Mine every week, 18 batches in total, 4,765 pieces (including 159 blank samples). After samples are checked and accepted by the Supervisor and the appointed person of the Ground Survey Chamber, a sample handover list shall be signed, then samples can be send to the testing laboratory by the Ground Survey Chamber.

(5) Quality inspection of sample preparation

The quality of sample preparation shall be inspected according to the requirement of *Specification of Testing Quality Management for Geological Laboratories* - 13 *Preparation Procedure for Rock Ore Analysis Sample* (DZ/T 0130-2006).

Sample loss rate during preparation: According to the statistics, the loss rate of sample preparation for this time is smaller than 5%, and the qualification rate is 100%.

Splitting error of sample preparation: According to the statistics, the splitting error for this time is smaller than 3%, and the qualification rate is 100%.

The processing method is recognized by the mine, checked and accepted

by the Supervisor and the mine. Its quality complies with the requirement of specifications. The processing quality was reviewed to be qualified by the competent person.

9.1.2.2 Productive exploration

Sample processing is consistent with the prospective exploration in 2017.

Core samples are 8,347 in total for this time, and 239 blank samples are prepared, so the design work amount is completed successfully. One batch of samples shall be transferred to the Ground Survey Chamber of Mine every week, 8,586 pieces in total (including 239 blank samples).

The processing method is recognized by the mine, checked and accepted by the Supervisor and the mine. Its quality complies with the requirement of specifications. The processing quality was reviewed to be qualified by the competent person.

9.2 Sample Analysis and Test

9.2.1 Productive exploration in 2016

(1) Measurement of density

500 samples from 668 boreholes are collected for small density test. Small density samples shall be laid as construction progress according to the design borehole, 100 pieces shall be taken from layers of O, L, S, R1 and R2 respectively. Weight shall be measured during the sample processing.

Small density samples are 1m-long regular soil samples with the total core recovery of 100%, and the diameter of core is 7cm, so the volume of samples is 3,846.5cm³ through calculation and the weight is measured by an electronic scale. In this way, design requirements are met and test purpose is reached.

The calculation formula for wet density is as follows:

$$P_0 = \frac{m_0}{V}$$

Where: P_0 - wet density of sample (g/cm^3)

m_0 - mass of wet soil sample (g)

V - volume of sample 3,846.5 (cm^3)

The calculation formula for dry density is as follows:

$$P_d = \frac{P_0}{1 + W_0}$$

Where: Pd - dry density of sample (g/cm^3)

W_0 - moisture content of sample (water/dry soil) %

Density shall be measured through parallel determination twice. The difference of these two measurements shall be no greater than 0.03g/cm^3, the mean value shall be taken.

(2) Measurement of humidity

The specification of *Standard for Soil Test Method* (GB/T50123-1999) shall be applied for the measurement of sample humidity (moisture content).

The calculation formula for moisture content is as follows:

$$W = (\frac{m_0 - m_d}{m_0}) \times 100$$

Where: W - moisture content of sample (%)

m_0 - mass of wet soil sample (g)

m_d - mass of wet soil sample (g)

Humidity shall be measured through parallel determination twice. When moisture content is smaller than 40%, the difference of these two measurements shall take 1%, while if moisture content is greater than 40%, the difference shall take 2%, then the mean value shall be taken.

(3) Measurement of gravel content

Test procedure: First, weigh the samples, pick out large gravel, place the remaining samples on rubber plate and grind them with an iron mill, brush off the mud on large gravel with a wire brush, and weigh the samples in the sieve and under the sieve after sieving from a 2mm sieve; use a 2mm water sieve to sieve samples in the sieve and gravel picked out, put samples in 95°C oven and bake for 10h, and weigh the samples and gravel with an electronic scale.

The volume of gravel is calculated through the known density of gravel

(3.086 g/cm^3), and the calculation formula for the gravel volume content is as follows:

$$V_{\text{content}} = \frac{V_0}{V}$$

V_{content} - gravel volume content %

V - volume of sample 3,846.5 (cm^3)

V_0 - volume of gravel sample (cm^3)

$V_0=M_0/P_{\text{gravel}}$

M_0 - weight of gravel (g)

P_{gravel} - density of gravel (3.086 g/cm^3)

(4) Chemical analysis of samples

The basic analysis items of chemical samples shall be determined by KBK testing laboratory of the mine. Analytical elements include Ni, Co, Mg, Al, Fe, Mn and Sc. According to the introduction of the laboratory of the mine, test samples are dissolved by hydrochloric acid, nitric acid, hydrofluoric acid, and perchloric acid. In the nitric acid medium, inductive coupling and other plasma emission spectrometers (Varian 700-ES) are used to measure the mass concentration. The measured scope of NiCo for the method is 0.02~10.0%, which satisfies the production need of the mine. According to the data of the mine, detection limit Ni of Varian 700-ES instrument is 5.0μg/L and Co is 13.0μg/L. This meets the need of the test method.

Sample test analysis is checked and accepted by the mine, and the quality meets the production requirement. Upon the examination of competent persons, the test quality of samples is qualified.

9.2.2 Infill exploration in 2017

9.2.2.1 Prospective exploration

(1) Measurement of density

The test method is consistent with the productive exploration in 2016.

(2) Measurement of humidity

The test method is consistent with the productive exploration in 2016.

(3) Measurement of gravel content

According to the design requirements, the weight of 398 pieces of gravel from all samples of gravel-containing layer is measured. Gravel volume content is calculated for 139 small weight samples.

The test method is consistent with the productive exploration in 2016.

(4) Chemical analysis of samples

All sample analysis this time shall be tested by the testing laboratory of the mine. The test method is the same as the productive exploration in 2016. Basic analysis items: Ni, Co, Mg, Al, Fe, Mn and Sc. 5,120 pieces in total.

4,606 core samples, 159 blank samples, 95 high grade standard samples, 65 low grade standard samples and 195 replicate samples are included. Composite analysis items: The Ground Survey Chamber of Mine makes composite sample analysis on Red limonite (O), Yellow limonite (L), Saprolite (S), and rocky saprolite R1 and R2 according to the need. Analysis element is Cr for 208 pieces in total.

Sample test analysis is checked and accepted by the Supervisor and the mine, and the quality meets the production requirement. Upon the examination of competent persons, the test quality of samples is qualified.

9.2.2.2 Productive exploration

(1) Measurement of density

The test method is the same as the productive exploration in 2016.

(2) Measurement of humidity

The test method is the same as the productive exploration in 2016.

(3) Measurement of gravel content

The test method is the same as the productive exploration in 2016.

(4) Chemical analysis of samples

All sample analysis this time shall be tested by the testing laboratory of the mine. The test method is the same as the productive exploration in 2016. Basic analysis items: Ni, Co, Mg, Al, Fe, Mn and Sc.

Sample test analysis is checked and accepted by the Supervisor and the

mine, and the quality meets the production requirement. Upon the examination of competent persons, the test quality of samples is qualified.

9.3 QA/QC

9.3.1 Productive exploration in 2016

QA/QC procedure is not executed

9.3.2 Intensive exploration in 2017

9.3.2.1 Prospective exploration

QA/QC procedure for the assay analysis includes replicate samples, standard samples and blank samples without external quality inspection.

Replicate samples are from -200 mesh duplicate samples of the same basically analyzed samples, standard samples are from duplicate samples of production prospecting core basic analysis samples in 2016, and blank samples are from the limestone mine of Basamuk smelting plant. The Ground Survey Chamber of Mine shall be responsible for insertion method, quantity and inspection of replicate samples, standard samples and blank samples.

(1) Insertion method of quality control sample

1) The insertion quantity for every 100 samples shall be:

① 92 pieces shall be inserted in 2 high grade standard material samples, while 150 pieces are inserted actually;

② 46 pieces shall be inserted in 1 low grade standard material sample, while 80 pieces are inserted actually;

③ 46 pieces shall be inserted in 1 power replicate sample, while 148 pieces are inserted actually;

④ 138 pieces shall be inserted in 3 blank samples, while 116 pieces are inserted actually;

2) Among 100 samples, 10 sample Nos. shall be kept: any sample with the tail number of 0 shall be kept for the use of quality control samples.

3) Sample Nos. above shall be marked through folding for the avoidance of omission or misuse;

4) There shall be over 40 samples at least between No. location of replicate samples and that of original samples. These samples shall be put in different test batches as possible.

5) Replicate samples and standard samples shall be inserted during or after the sample processing. There shall be a clear process to direct how to insert quality control samples during sample processing in the laboratory;

6) Standard samples, replicate samples and blank samples shall be numbered for the test procedure.

7) Among every 100 samples, quality control samples have their own specific locations, which are managed by technicians who are responsible for sample insertion.

8) Nobody shall know the grade of objective elements in standard materials except sample insertion geologist.

(2) Quality inspection of replicate samples

148 replicate samples are inserted in 3rd-17th batches, with 140 effective samples.

The qualification rate of assay results shall be determined through comparing the allowable limit of relative deviation (Yc) and relative deviation (RD) of assay results. The exact calculation formula is as follows:

$$Y_c = C \times (14.37\overline{X}^{-0.1263} - 7.659)$$

Where:

Yc - allowable limit of relative deviation (%);

C - allowable coefficient of relative deviation; Ni and Co are 0.67; Mg, Al, Fe, Mn and Sc are 1.00.

$\overline{X}$ - Mean mass fraction of original samples and replicate samples (%).

$$RD = \frac{Xi - \overline{X}}{\overline{X}}$$

Where:

RD - relative deviation (%)

X_i - measured mass fraction of replicate samples (%)

$\overline{X}$ - Mean mass fraction of original sample and replicate samples (%)

That the allowable limit of relative deviation (Yc) for replicate samples is greater than and equal to relative deviation (RD) is deemed as qualified, otherwise it shall be deemed as unqualified. See Table 9-1 and Figs. 9-1 and 9-2 below for calculated statistical results. The qualification rate of Ni is 96.43%; that for Co is 94.29%; that for Mn is 97.14%. It is shown through results that the analytical precision complies with the requirement of specifications, the qualification rate of other elements is low and precision of analysis results complies with Party A's requirement.

Table 9-1 Statistical Table for Analysis Quality Inspection of Replicate Samples

Analysis item	Ni	Co	Mg	Al	Fe	Mn	Sc
Quantity of qualified samples	135	132	74	129	113	136	56
Quantity of effective random samples	140	140	140	140	140	140	140
Qualification rate (%)	96.43	94.29	52.86	92.14	80.71	97.14	40.00

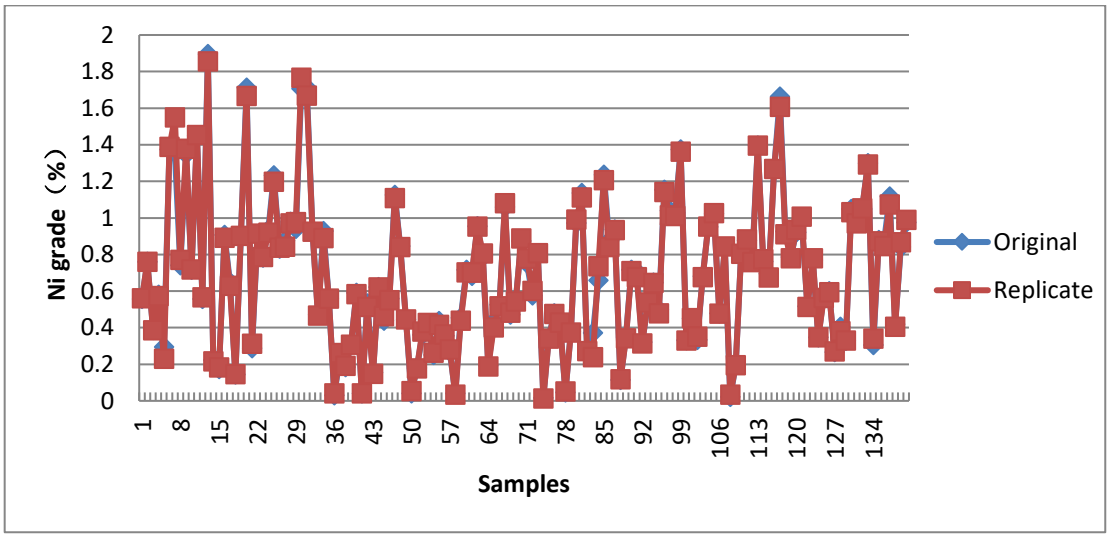

Fig. 9-1 Comparison for the Grade of Ni in Replicate Samples and Original Samples

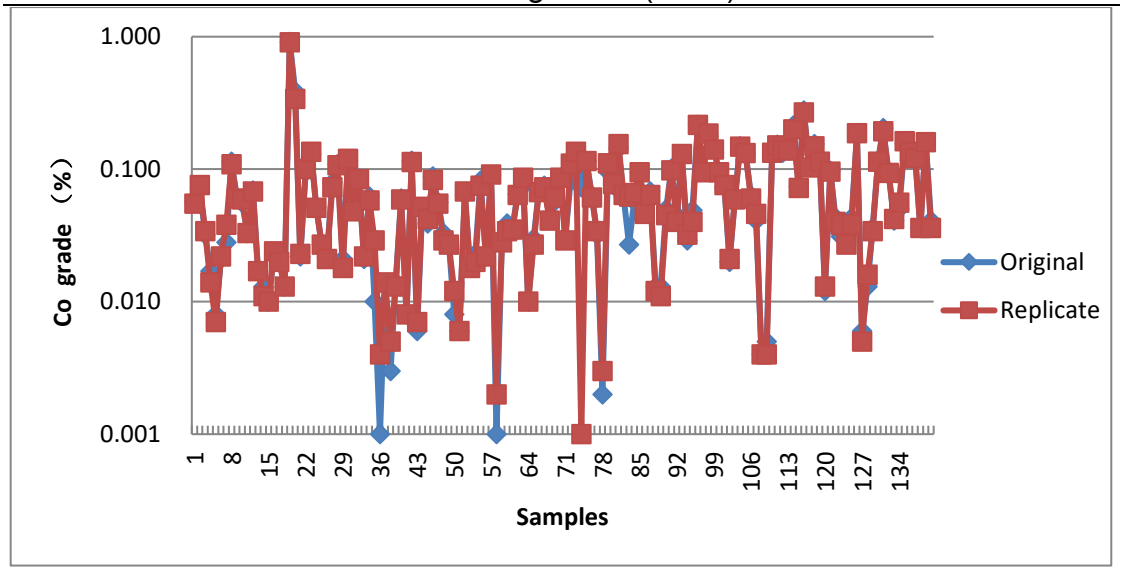

Fig. 9-2 Comparison for the Grade of Co in Replicate Samples and Original Samples

(3) Quality inspection of standard samples

150 high grade standard samples are inserted in 3rd-17th batches, with 71 effective samples. 50 low grade standard samples and 40 effective samples are included.

The qualification rate of assay results shall be determined through comparing the allowable limit of relative deviation (YB) and relative error (RE) of assay results. The exact calculation formula is as follows:

$$Y_B = \frac{1}{\sqrt{2}} C \times (14.37 X_T^{-0.1263} - 7.659)$$

Where:

Y_B - allowable limit of relative deviation (%);

C - allowable coefficient of relative deviation; Ni and Co are 0.67; Mg, Al, Fe, Mn and Sc are 1.00.

X_T - standard value of standard material (%).

$$RE = \frac{Xi - X_T}{X_T}$$

Where:

RE - relative error (%)

X_i - measured mass fraction of standard samples (%)

X_T - truth-value mass fraction of standard samples (%)

That the allowable limit of relative deviation (Y_B) for standard samples is greater than and equal to relative error (RE) is deemed as qualified, otherwise

it shall be deemed as unqualified. See Tables 9-2 and 9-3 below for calculated statistical results.

Table 9-2 Statistical Table for Accuracy Quality Inspection of High Grade (Ni>1.05%) Standard Samples

Analysis item	Ni	Co	Mg	Al	Fe	Mn	Sc
Quantity of qualified samples	32	57	6	36	12	48	12
Quantity of effective random samples	71	71	71	71	71	71	71
Qualification rate (%)	45.07	80.28	8.45	50.70	16.90	67.61	16.90

Table 9-3 Statistical Table for Accuracy Quality Inspection of Low Grade (Ni<0.6%) Standard Samples

Analysis item	Ni	Co	Mg	Al	Fe	Mn	Sc
Quantity of qualified samples	21	16	3	1	8	23	0
Quantity of effective random samples	40	40	40	40	40	40	40
Qualification rate (%)	52.50	40.00	7.50	2.50	20.00	57.50	0.00

It can be seen from the table above that the accuracy of the analysis results is low, so it doesn't comply with the requirement of specifications. It is though through the research and analysis that standard samples inserted for the assay are basic analysis duplicate samples of productive exploration cores in 2016. These standard samples are not national ones. So the verification of accuracy is only for reference and shall not be used as basis for assessment.

(4) Blank samples

116 blank samples (112 effective samples) are inserted in 3rd-17th batches for this assay, so as to inspect if there is cross contamination of samples during the process of sample preparation. Blank samples are from the limestone mine of Basamuk smelting plant.

The test method used by the testing laboratory is: test samples are dissolved by hydrochloric acid, nitric acid, hydrofluoric acid, and perchloric acid. In the nitric acid medium, inductive coupling and other plasma emission spectrometers (Varian 700-ES) are used to measure the mass concentration. The measured scope of NiCo for the method is 0.02~10.0%, which satisfies the

production need of the mine. According to the data of the mine, detection limit Ni of Varian 700-ES instrument is 5.0μg/L and Co is 13.0μg/L. This meets the need of the test method.

The grade of Ni for the blank sample is ≤0.02% (Fig. 9-3), and grade of Co is ≤0.004% (Fig. 9-4). It is shown that blank samples are free of cross contamination during the process of preparation, so the quality of sample preparation meets the requirement of specifications and design.

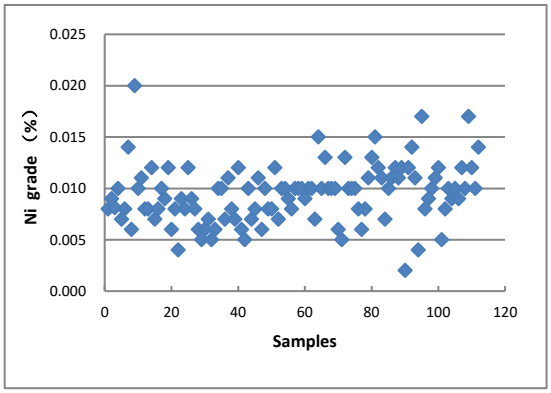

Fig. 9-3 Distribution for the Grade of Ni of Blank Samples

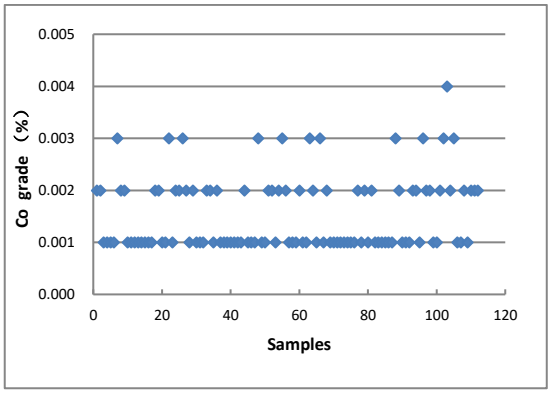

Fig. 9-4 Distribution for the Grade of Co of Blank Samples

QA/QC procedure is executed during the exploration, but part of procedures is not less standard. The test results of samples can meet the production need of the mine.

9.3.2.2 Productive exploration

QA/QC procedure is consistent with the peripheral exploration in 2017, and the test results of samples can meet the production need of the mine.

9.4 Sample Security

9.4.1 Productive exploration in 2016

Hubei Geological Survey Institute of Coal shall take care of samples during the sample collection and processing. Original and duplicate samples with maximum particle size of -200 mesh through processing shall be handed over to the testing laboratory of the Project Department of the mine in time together with the sample delivery list once a week.

Exploratory boring cores shall be abandoned after split-core samples are

collected.

9.4.2 Infill exploration in 2017

9.4.2.1 Prospective exploration

Sinomine Resource Exploration Co., Ltd. takes care samples during the sample collection and preparation. With respect to original (50-100g) and duplicate samples (130g) obtained after 200 mesh crushing and splitting, one batch of samples shall be transferred to the Ground Survey Chamber of Mine every week, 18 batches in total, 4,765 pieces (including 159 blank samples). After samples are checked and accepted by the Supervisor and the appointed person of the Ground Survey Chamber, a sample handover list shall be signed, then samples can be send to the testing laboratory by the Ground Survey Chamber. Duplicate samples shall be kept by the laboratory. Upon the examination of competent persons, the storage quality of samples is qualified.

Spacing of 200m among the holes is required for preserving cores at an early stage, while the Supervisor and the Ground Survey Chamber discuss and determine to use the spacing of 400m at a later stage due to the increasing difficult in construction and the consideration of safety. Core preservation refers that the remaining cores after sampling are transferred to the core library for proper storage. Borehole roundtrip tickets for core preservation is sealed with tape, labels of the samples are placed in empty slot of full-core sampling, and borehole No., Ctn. No. of preservation as well as core depth are marked on both sides of core box. Core storage form shall be drawn up after cores are put in storage, recording Ctn. No. of borehole cores, hole depth and storage date. Core retention transfer form shall be drawn up in batches. After checked by the Supervisor and Ground Survey Chamber of Mine, it shall be handed over to the Ground Survey Chamber of Mine. There are 82 boreholes preserved this time, 270 boxes in total. All cores have been handed over to the place specified by Party A, and accepted by Party A and the Supervisor. The quality complies with the design requirement. Upon the examination of competent persons, the storage quality of cores is qualified.

9.4.2.2 Productive exploration

Sample and core storage procedure is consistent with the peripheral exploration in 2017. Upon the examination of competent persons, the storage quality of samples and cores is qualified.

10DATA VERIFICATION

10.1 DATABASE

Productive exploration database in 2016 was provided by Hubei Geological Survey Institute of Coal in Excel. Productive exploration database of intensive exploration in 2017 was provided by Hubei Geological Survey Institute of Coal in Excel. Prospective exploration database of intensive exploration in 2017 was provided by Sinomine Resource Exploration Co., Ltd. in SURPAC. The estimation process shall be conducted in strict accordance with relevant processes required for the software. After original data used is organized as data file according to the requirement of GEOVIA Surpac software, it shall be checked and amended in contrast with original data one by one through manual work; borehole geology database shall be established after the introduction into GEOVIA Surpac, and relevant data (such as sample length, grade, engineering deficiency or duplication etc.) in data file shall have a data validity check and pass it before modeling, which guarantees the reliability of source data.

10.2 On-Site Verification

From July 1 - 6, 2017, Zhang Xueshu, a competent person, verified the exploration on site, checked the database and deemed that the data in database is reliable. The supervision work at other times was executed by field supervisors based on QA/QC procedures audited by the competent person or under the supervision of the competent person.

11MINERAL RESOURCE ESTIMATE

11.1 Estimation Results of Predecessors

11.1.1 Productive exploration in 2016

(1) Estimation scope

Estimation scope includes 3 parts, namely productive exploration (south area), productive exploration (north area) and productive exploration (prospective area) (see Fig. 11-1). Estimation area reaching productive exploration reserves is 1.46km^2, estimation area of detailed survey reserves is 0.447km^2, and estimation area of prospective exploration resources is 0.301km^2.

(2) Industrial index

1) Limonite horizon: Ni≥0.5%, Mg≤1%;

2) Eluvium: Ni≥0.5%, Mg≥1% (excluding gravel);

3) Rocky saprolite: Ni≥0.5%, Mg≥1% (containing gravel);

4) The standard and method to divide upper and lower rocky saprolite is based on the content of Ni and Mg in gravel samples that are less than 2mm and the proportion of gravel that are more than 2mm. Saprolitemust be found first, namely Ni≥0.5% and Mg≥1%. Secondly, the gravel content in upper rocky saprolite is low, its granularity varies from 2~100mm, and in general, gravel volume content is less than 30%; while the gravel content in lower rocky saprolite is high, its granularity varies from 20~500mm, and in general, volume content is more than 50%.

5) Minable thickness of ore body: 0.5m.

6) Eliminating thickness of horse-stone: 1~2m.

(3) Estimation method and geology interpretation

Ore body is like lamelleted and lentoid, the overall condition is table. So resources/reserves estimation is conducted through horizontal projection. Ore boundaries at different horizons are divided according to industrial index. The resources levels are bordered by the borehole at the extreme edges of different

exploration grids, without extrapolation.

(4) Data processing

From June to November 2016, 9,729.28m/668 holes were completed for exploration (drilling exploration); 8,398 basically analyzed samples were completed, at the same time, part of data from Highlands Pacific Limited was used.

Contents related to ultra high grade were not seen.

(5) Density

Red limonite (O): 0.95t/m^3;

Yellow limonite (L): 0.95t/m^3;

Saprolite(S): 0.87t/m^3;

Upper rocky saprolite (R1): 0.86t/m^3;

Lower rocky saprolite (R2): 0.86t/m^3.

Although >2mm gravel in desity samples collected from the lower rocky saprolite (R2) have been eliminated during the processing, <2mm gravel still takes a great part in samples. Actually measured ore desity of lower rocky saprolite (R2) is 1.20t/m^3, and the error is relatively large. To more accurately calculate the reserves, desity measurement parameter of 0.86t/m^3 in *Report on Capital Construction Prospecting for KBK(B) Area* is employed.

(6) Resources Category

According to the relevant principle of *the Classification for Resources/Reserves of Solid Fuels and Mineral Commodities* and *Specifications for Copper, Lead, Zinc, Silver, Nickel and Molybdenum Mineral Exploration*, and in combination with the geological conditions and exploration engineering control degree in this area, the basis for classification of types is determined as follows:

1) Exploration engineering with the grid of 50×50m has reached the degree of projects at the productive exploration stage. Ore body is delineated, the continuity of ore body is determined, and geologic feature of ore deposit, ore quality as well as mining technology conditions are found out in details. It is

measured economic resource (121).

2) Exploration engineering with the grid of 100×100m has reached the degree of projects at the detailed survey exploration stage. Ore body is delineated, the continuity of ore body is determined, and geologic feature of ore deposit, ore quality as well as mining technology conditions are found out in details. It is indicated economic resources (122).

3) Exploration engineering with the grid of 200×200m has reached the degree of projects at the preliminary survey exploration stage. Ore body is delineated roughly, the continuity of ore body is determined roughly, and geologic feature of ore deposit, ore quality as well as mining technology conditions are basically found out. It is indicated intrinsically economic resources (332).

Gravel content of ore body in lower rocky saprolite (R2) is high, ore body and gravel are mixed, and gravel content varies greatly both vertically and horizontally, therefore, the resource amount is obtained against it independently for the resources estimation, and is not included into the total resource amount.

(7) Estimation results

See Tables 11-1~11-2 for resources estimation results of all area.

Table 11-1 Summary for Productive exploration Resources Estimation Results of Ramu NiCo in 2016

Exploration area	Ore Resource	Average grade (%)		Amount of metal (kt)		Classification
	（kt）	Ni	Co	Ni	Co	
North area	1374	1.04	0.11	15.1	1.6	121
South area	10041.3	0.97	0.12	97.6	11.9	121
Total	11415.3	0.98	0.12	112.7	13.5	121
South area	2155.1	1.05	0.12	22.7	2.5	122
Prospective area	1503.3	1.12	0.11	16.8	1.7	332
Total	15073.7	1	0.12	152.2	17.7	121+122+332

Table 11-2 Summary for Productive exploration of the Lower Rocky Saprolite (R2)

Resources Estimation Results of Ramu NiCo in 2016

Exploration area		Ore Resource	Average grade (%)		Amount of metal (kt)		Remarks
		（kt）	Ni	Co	Ni	Co	
North area		553.0	1.14	0.05	6.3	0.3	
South area	Block 1	1051.5	1.05	0.08	11	0.8	
	Block 2	661.0	1.20	0.08	7.9	0.5	
	Block 3	730.3	1.20	0.08	8.8	0.6	
Prospective area		608.5	1.02	0.03	6.2	0.2	
Total		3604.3	1.12	0.07	40.2	2.4	

11.1.2 In-fill Exploration in 2017

11.1.2.1 Prospective exploration

(1) Estimation scope

The resource estimated object of this time is located between the 77000 exploration line and the 80900 exploration line in the western area of Ramu mine, with the estimated area of about 4.1km^2.

(2) Industrial index

Consistent with the productive exploration in 2016

(3) Estimation method and geology interpretation

In this report, GEOVIA Surpac three-dimensional mineral resources evaluation software developed by Geovia International Mining Software Company is adopted to estimate the delimitation of ore bodies and resources of Ramu, and the interpolation estimation method adopted is inverse distance method. Ore boundaries at different horizons are divided according to industrial index. The resources levels are bordered by the borehole at the extreme edges of different densities of exploration grids, without extrapolation.

(4) Data processing

There are a total of 367 drilling projects collected this time, with the total footage of 5216.27m: In the earlier stage, Highlands Pacific Limited constructed 4 drill holes with the footage of 91.45m, and 363 were constructed in 2017 with the footage of 5124.82m.

There are 1640 primary lithology records are collected, including 17 from Highlands Pacific Limited and 1623 from Sinomine Resource Exploration Co., Ltd.

Ramu NiCo collects 4697 test results in total.

The digital topographic mapping covering the mining area with scale of 1:1000 and 1:2000 is collected and prepared. The 1:1000 topographic data are the working achievements in 2017, while the 1:2000 topographic data are the working achievements made by predecessors in around 2007. The total area is about 4.1km^2. The topography scope of 1:1000 is about 2.96km^2, while the topography scope of 1:2000 is about 1.14 km^2.

Through statistical analysis, the samples have no super high grade, and no super high grade treatment is conducted. The sample combination length is 1m.

(5) Density, moisture and gravel content

Table 11-3 Statistical Table of Specific Gravity Sample and Moisture Measurement Results of Ore

Ore body	Number of samples	Wet density (g/cm^3)	Dry density (g/cm^3)	Average Moisture (%)
O (red limonite bed) ore body	20	1.77	1.13	36.41
L (yellow limonite bed) ore body	64	1.66	0.97	42.40
S (Saprolite) ore body	74	1.55	0.84	46.27
R1 (upper rocky saprolite) ore body	84	1.54 (gravel-containing)	0.92 (gravel-containing)	40.87
R2 (lower rocky saprolite) ore body	55	2.22 (gravel-containing)	1.61 (gravel-containing)	27.90

The ore block gravel mass content is obtained by interpolation processing of the data of sample gravel mass content in software: the gravel content of upper rocky saprolite (R1) is 18.12%; and the gravel content of lower rocky saprolite (R2) is 49.87%.

(6) Ore block model

The size of ore block is 25m×25m×1m (North × East × height), and the size of the smallest block is 12.5 m×12.5 m×0.5 m.

(7) Grade valuation

In order to estimate all the ore blocks in the ore block model, the valuation process will be conducted for three times and the spheroid search radius will be increased gradually by each time. The reference drillhole grid density is 100×100m. The search radius for the first time is 120m, the second time is 240m and the third time is 360m. The block model will be inspected every time

when the valuation process is conducted until all the blocks in the model are valued. The spheroid parameter settings are shown in Table 11-4.

Table 11-4 Spheroid Parameter for Resources Estimation Searching of Ramu NiCo at Prospective Area in 2017

Parameter	Operation times		
	1	2	3
Search type	Spheroid	Spheroid	Spheroid
Azimuth angle	0°		
Dipping angle	0°		
Plunge angle	0°		
Principal axis / secondary axis	1.6		
Principal axis / minimum axis	3.7		
Search radius	120m	240m	360m
Minimum project number	3	1	1
Maximum sample number	15	15	15
Ore block discretization	3×3×3	3×3×3	3×3×3

(7) Resources Category

The basis for classification of resource types is determined according to the relevant principle of the *Classification for Resources / Reserves of Solid Fuels and Mineral Commodities* and *Specifications for Copper, Lead, Zinc, Silver, Nickel and Molybdenum Mineral Exploration*, and in combination with JORC（2012） Code and the geological conditions and exploration engineering control degree in this area. When the ore block in the ore block model is estimated, the resources classification of the valued block for the first time searching is determined as 332, the second time is 333, and the third time is 334.

(7) Estimation results

Table 11-5 Result Table for Resources Estimation of Ramu NiCo at Prospective Area in 2017

Ore body	Resources Classification	Ore (kt)	Average grade (%)		Amount of metal (kt)	
			Ni	Co	Ni	Co
O	332	5110	0.551	0.06	28.2	3.1
	333	300	0.674	0.061	2.0	0.2
	334	100	0.683	0.067	0.7	0.1
Subtotal		5510	0.56	0.06	30.9	3.3
L	332	5610	0.769	0.088	43.1	4.9
	333	630	0.768	0.082	4.9	0.5
	334	70	0.809	0.082	0.6	0.1
Subtotal		6310	0.769	0.087	48.5	5.5
S	332	5650	0.822	0.1	46.4	5.6
	333	880	0.85	0.095	7.5	0.8
	334	190	0.831	0.085	1.5	0.2
Subtotal		6720	0.826	0.099	55.5	6.6
R1	332	2890	0.755	0.083	21.9	2.4
	333	310	0.798	0.086	2.5	0.3
	334	190	0.829	0.075	1.6	0.1
Subtotal		3390	0.763	0.083	25.9	2.8
R2	332	3010	0.765	0.083	23.0	2.5
	333	450	0.845	0.077	3.8	0.3
	334	460	0.778	0.066	3.6	0.3
Subtotal		3920	0.775	0.08	30.5	3.2
Total		25850	0.744	0.082	191.3	21.4

11.1.2.2 Productive exploration

The resources estimation method and parameters are consistent with the peripheral exploration in 2017; the classification of resources/reserves is consistent with the productive exploration in 2016, but the R2 ore bed resources/reserves are also estimated by classification this time. The resources/reserves estimation results are shown in Table 11-6.

Table 11-6 Resources Estimation Results Table of Ramu NiCo at Productive exploration Area in 2017

Ore body	Resource Category	Ore (kt)	Average grade (%)		Amount of metal (kt)	
			Ni	Co	Ni	Co
O	121	1818.1	0.786	0.078	14.3	1.4
	122	53.8	0.898	0.116	0.5	0.1
	332	15.4	0.835	0.091	0.1	0
	Subtotal	1887.4	0.790	0.080	14.9	1.5
L	121	2597.1	0.877	0.090	22.8	2.3
	122	90.8	0.804	0.108	0.7	0.1
	332	97.5	0.765	0.085	0.7	0.1
	Subtotal	2785.4	0.870	0.090	24.2	2.5
S	121	4261.8	0.939	0.124	40	5.3
	122	210.3	0.851	0.102	1.8	0.2
	332	126.4	0.955	0.114	1.2	0.1
	Subtotal	4598.4	0.936	0.123	43	5.7
R1	121	1702	1.106	0.096	18.8	1.6
	122	101.2	1.096	0.099	1.1	0.1
	332	41.5	1.107	0.082	0.5	0
	Subtotal	1844.7	1.105	0.096	20.4	1.8
R2	121	945.4	1.175	0.064	11.1	0.6
	122	159.1	0.945	0.063	1.5	0.1
	332	31	1.287	0.063	0.4	0
	Subtotal	1135.6	1.146	0.064	13	0.7
Total		1225.15	12251.5	0.099	11.56	115.6
Grand total	121	11324.4	0.945	0.100	107	11.3
	122	615.2	0.913	0.094	5.6	0.6
	332	311.9	0.943	0.095	2.9	0.3

11.2 Comments on the historical resourecs estimation

The productive exploration work in 2016 basically met the demand for mine production; however, core failed to be reserved and QA/QC did not carried out for sample processing and analysis and test, so that the data reliability was decreased. In addition, the resources of R2 ore bed failed to be classified.

The infill exploration work in 2017 basically met the demand for mine production, but the resources classification of R2 ore bed was slightly higher.

11.3 Estimation results

Original estimation results are directly used for the productive exploration work in 2016. The original 121 reserves are determined as the resources indicated in the JORC code, the original 122 reserves are determined as the resources inferred in the JORC code and the original 332 reserves are determined as the resources inferred in the JORC code. In addition, due to the complex shape and poor continuity of the R2 ore bed, the resources in the R2 ore bed are all determined as the inferred resources. See Table 11-7 for results.

Table 11-7 Resources Estimation Results Table for Productive Eploration Area in 2016

Category	Ore Resource	Average grade (%)		Remarks
	（Mt）	Ni	Co	
Indicated	11	1.0	0.1	
Inferred	7.3	1.1	0.1	
Total	19	1.0	0.1	

Original estimation results are directly used for the prospective exploration work in 2017. The original 332 resources are determined as the indicated resources, the original 333 and 334 resources are determined as the inferred resources. In addition, due to the complex shape and poor continuity of the R2 ore bed, the resources in the R2 ore bed are all determined as the inferred resources. See Table 11-8 for results.

Table 11-8 Resources Estimation Results Table for Prospective Exploration Area in 2017

Category	Ore quantity	Average grade (%)		Remarks
	（Mt）	Ni	Co	
Indicated	19	0.7	0.1	
Inferred	6.6	0.8	0.1	
Total	26	0.7	0.1	

Original estimation results are directly used for the productive exploration work in 2017. The original 121 reserves are determined as the measured resources, the original 122 reserves are determined as the indicated resources and the original 332 reserves are determined as the inferred resources. In

addition, due to the complex shape and poor continuity of the R2 ore bed, the original 121 reserves in the R2 ore bed are determined as the indicated resources, the original 122 reserves and the original 332 resources are all determined as the inferred resources. See Table 11-9 for results.

Table 11-9 Resources Estimation Results Table for Productive Exploration Area in 2017

Category	Ore quantity	Average grade (%)		Remarks
	（Mt）	Ni	Co	
Measured	10	0.9	0.1	
Indicated	1.4	1.1	0.1	
Inferred	0.5	0.9	0.1	
Total	12	0.9	0.1	

Up to June 15, 2018, the total ore resources of lateritic NiCo ores obtained in the exploration area of 2016-2017 are 57Mt, Ni0.9%, Co 0.1%; measured resources are 10Mt, Ni0.9%, Co 0.1%; indicated resources are 32Mt, Ni0.8%, Co 0.1%; inferred resources are 14Mt, Ni0.9%, Co 0.1%. See Table 11-10 for details.

Table 11-10 Resources Estimation Results Table for Exploration Area in 2016-2017

Item	Category	Ore Resource	Average grade (%)		Remarks
		（Mt）	Ni	Co	
2016 Productive exploration	Indicated	11	1.0	0.1	
	Inferred	7.3	1.1	0.1	
	Total	19	1.1	0.1	
2017 Prospective exploration	Indicated	19	0.7	0.1	
	Inferred	6.6	0.8	0.1	
	Total	26	0.7	0.1	
2017 Productive exploration	Measured	10	0.9	0.1	
	Indicated	1.4	1.1	0.1	
	Inferred	0.5	0.9	0.1	
	Total	12	0.9	0.1	
Total	Measured	10	0.9	0.1	
	Indicated	32	0.8	0.1	
	Subtotal	42	0.8	0.1	
	Inferred	14	0.9	0.1	
	Total	57	0.9	0.1	

Notes: 1. The Ni cut off grade is at 0.5%Ni, and the minimum mineable thickness

is at 0.5m.

2.Totals may not equal the sum of the component parts due to rounding adjustments.

3.Ore tonnes (dry) represent the -2 mm economic portion of resource mineralization in the rocky saprolite

4.The QA/QC is not executed in the Productive Exploration in 2016, so 2016 exploration result is not included.

5.The resource and ore reserves is updated on 15th June, 2018

11.4 Reliability

The resources estimation method adopted in the exploration work of 2016-2017 is appropriate. In the estimation of this time, only the resources level is adjusted as per the reliability level of data and according to the JORC code, but it meet the demand of mine production.

11.5 Mining situation

Up to June 15, 2018, the mining scope is shown in Fig. 11-1. From Dcecember 31, 2016 to June 15, 2018, according to the mining data, all the ore resources consumed, mostly in KBK, are 4.3Mt, Ni1.0%, Co 0.1%; measured resources are 3.6Mt, Ni0.9%, Co 0.1%; indicated resources are 0.5Mt, Ni1.3%, Co 0.1%; inferred resources are 0.2Mt, Ni1.2%, Co 0.1%(Table 11-11).

Table 11-11 Estimation Results Table for Resources Consumed within Ramu Project

Category	Resource	Average grade (%)		Remarks
	（Mt）	Ni	Co	
Measured	3.6	0.9	0.1	
Indicated	0.5	1.3	0.1	
Subtotal	4.1	0.9	0.1	
Inferred	0.2	1.2	0.1	
Total	4.3	1.0	0.1	

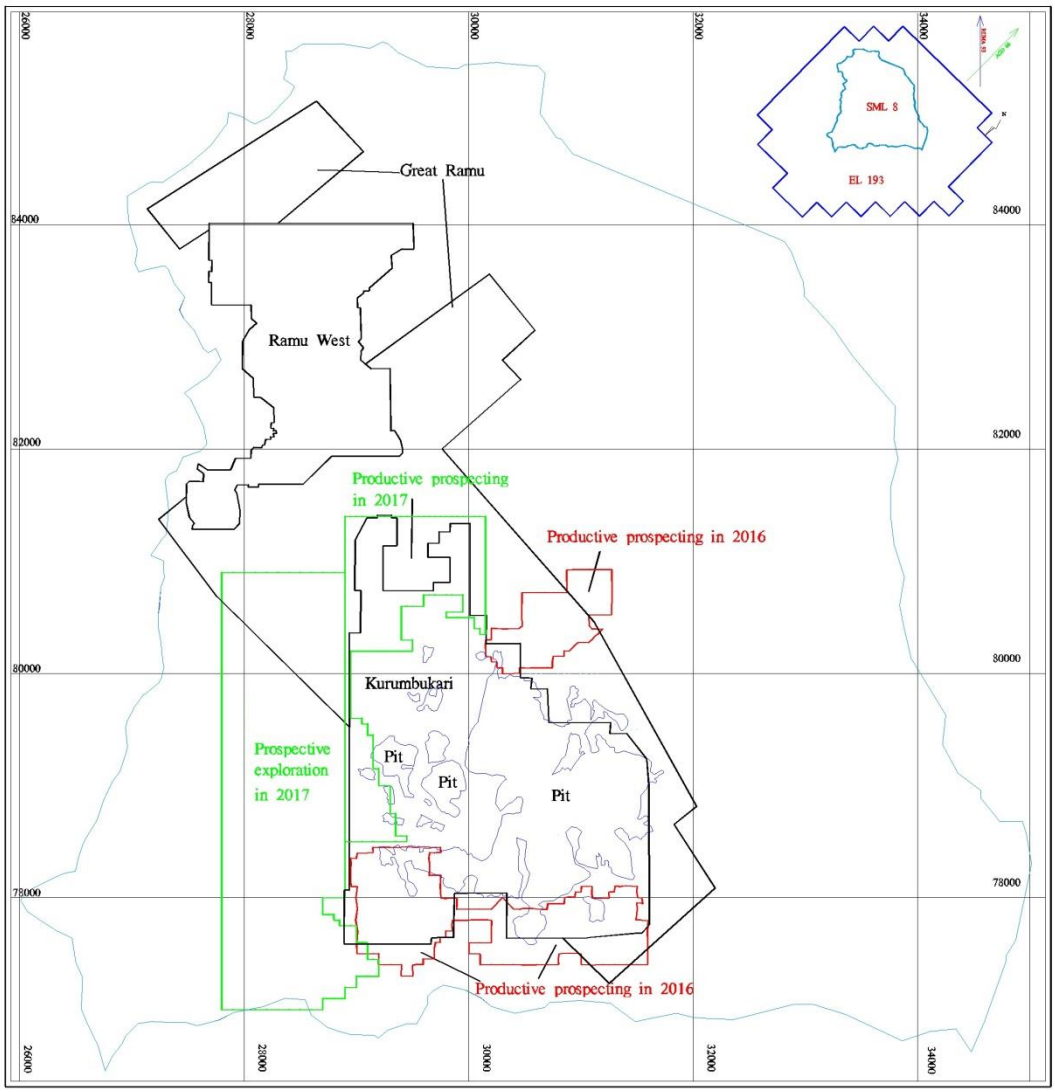

Fig. 11-1Ramu NiCo Mining Areal Map

11.6 Remained In-situ Resource

Ramu project resource Updated the 2017 exploration result, minus resources depleted are remained in-situ resource. Up to June 15, 2018, the in-situ resource within all Ramu project area are 136Mt, Ni0.9%, Co 0.1%; measured resources are 34Mt, Ni0.9%, Co 0.1%; indicated resources are 42Mt, Ni0.9%, Co 0.1%; inferred resources are 60Mt, Ni1.0%, Co 0.1%. See Table 11-12 for details. Because 2017 exploration area is beyond the previous exploration area, even the resource been consumed in 2017, but the total resource is increased compared with the mineral resource in December 31,

2016(Table 11-13).

Table 11-12 The Remained in-situ Resource within all Ramu Project area

Category	Resource	Average grade (%)		Remarks
	（Mt）	Ni	Co	
Measured	34	0.9	0.1	
Indicated	42	0.9	0.1	
Subtotal	76	0.9	0.1	
Inferred	60	1.0	0.1	
Total	136	0.9	0.1	

Notes:

1. The Ni cut off grade is at 0.5%Ni, and the minimum mineable thickness is at 0.5m.
2.Totals may not equal the sum of the component parts due to rounding adjustments.
3.Ore tonnes (dry) represent the -2 mm economic portion of resource mineralization in the rocky saprolite
4.The QA/QC is not executed in the Productive Exploration in 2016, so 2016 exploration result is not included.
5.The resource and ore reserves is updated on June 15th, 2018

Table 11-13 Results of the Ramu Mineral Resources Estimate 2016

Category	Resource	Average grade (%)		Remarks
	（Mt）	Ni	Co	
Measured	37	0.9	0.1	
Indicated	22	1.0	0.1	
Subtotal	59	0.9	0.1	
Inferred	65	1.0	0.1	
Total	124	1.0	0.1	

1. The Ni cut off grade is at 0.5%Ni, and the minimum mineable thickness is at 0.5m.
2.Totals may not equal the sum of the component parts due to rounding adjustments.
3.Ore tonnes (dry) represent the -2 mm economic portion of resource mineralization in the rocky saprolite
4.The QA/QC is not executed in the Productive Exploration in 2016, so 2016 exploration result is not included.
5.The resource and ore reserves is updated on December 31th, 2016

12 MAKET ASSESSMENT

12.1 Nickel

In the global and China nickel consumption structure, stainless steel dominates. However, since 2015, the growth rate of stainless steel consumption has slowed down significantly in recent years. At the same time, the consumption of alloy steels and non-ferrous alloys in the high-end consumption sector has steadily increased, and the nickel consumption in the battery field has increased significantly. Nickel in battery industry is mainly used for NI-MH and nickel cadmium batteries. With the development of new energy vehicles and the release of the Planning for the Development of the Energy-Saving and New Energy Automobile Industry (2012-2020), Lithium ions containing ternary materials (LiNixCoyMn1-x-yO2) will become the main development trend of new energy automobile batteries. Especially, because of the high capacity and high energy density, high nickel ternary materials (NCM811, NCA) will become the main application and development direction of nickel in battery field. It is expected by SMM that the battery nickel consumption in 2016 is about 35 thousand tons, the compound annual growth rate thereafter will be 6.27%, and the nickel consumption is expected to reach 42 thousand tons by 2019.

Since there is still a certain difference in the aspect of per capita consumption comparing with developed countries, although China’s economic growth has slowed, the demand for nickel in the future will maintain a relatively low growth rate at the current level. India currently maintains a high rate of economic growth, and it will see a sharp increase in demand for nickel in the future. Indonesia’s current nickel consumption is not high, but with its economic development, the growth space in the future will be very large. The future demand for nickel in developed countries will not change much. In general, the demand for nickel in the world will continue to grow.

From the perspective of market analysis, although the demand for nickel

in the future will not grow as rapid as in the past, global nickel consumption will continue to increase; nickel production and supply will be difficult to rise in a short term, and will even continue to decline for a certain period of time. This will, to a certain extent, prompt a rebound in nickel prices.

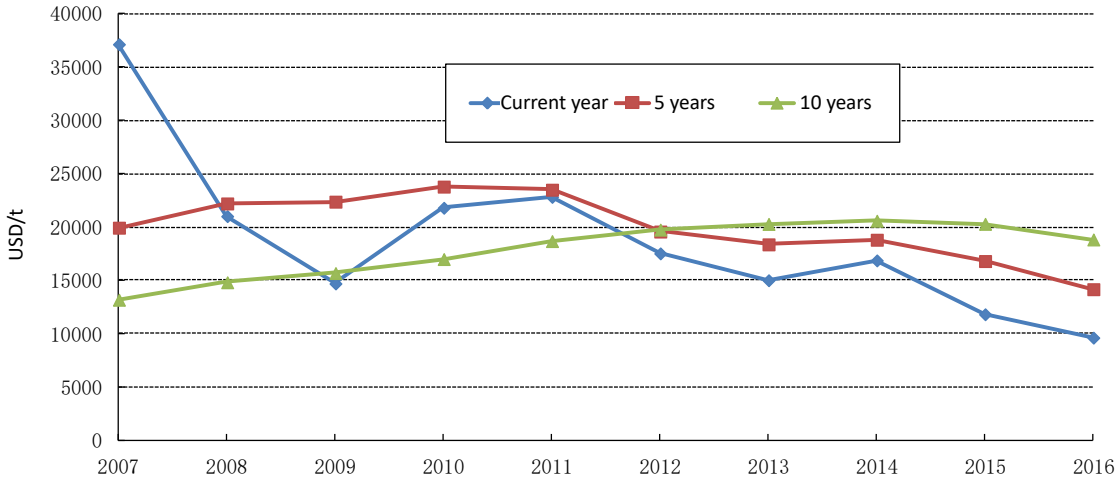

Fig. 12-1Average annual spot price of international nickel (LME) from 2007 to 2016

12.2 Cobalt

As an important strategic metal, cobalt is widely used in industrial and military fields. Cobalt is mainly used to produce lithium batteries, high temperature alloys, heat resistant and corrosion resistant alloys, hard alloys and magnetic materials, etc.

From the perspective of cobalt consumption structure, lithium battery industry has been the largest cobalt consumption sector in the world in recent years. Its main consumption forms include cobalt salts (cobaltosic oxide, cobaltous sulfate) and electrolytic cobalt (Japan will import electrolytic cobalt to process and produce lithium battery materials and finished products). As new green environmental protection products which can be used to replace traditional nickel-cadmium and lead-acid batteries, lithium-ion batteries have many advantages, such as free of mercury, cadmium and other pollutants, long service life and sufficient energy. Because of high added value and high profits, the industry scale is developing rapidly. At present, the lithium-ion batteries are not only widely used in electronic products such as mobile phone, notebook

computer and digital camera, they are also used in some high-power batteries, such as electric vehicles and electric bicycles. In 2012, the proportion of cobalt for batteries was about 38.4% in the global primary cobalt consumption structure, but this proportion had risen to 46.5% by 2016. Therefore, the lithium battery industry is developing rapidly and the development prospects of cobalt for batteries are promising.

Cobalt is also rapidly applied in high temperature alloys. High temperature alloys are irreplaceable materials of high temperature hot section components in aero-engines, rocket engines and gas turbine, etc. At the same time, they are widely used in industries, medical treatment, automobile and national defense and other related fields. With the increase in demand in the aerospace market, the demand for high temperature alloys has also increased. In 2016, due to the resuscitation of market demand for high temperature alloy industry, the cobalt consumption in the field of high temperature alloys reached 15500t, an increase of 6% than 2015. According to the forecast by Darton, a well-known foreign institution, further improvement in the aerospace field and industrial gas turbine market environment will continue to increase the demand for high temperature alloys, and this will continue for about 10 years. In the next five years, the average annual growth rate of global civil airliner deliveries will be close to 4.5%, and it can be expected that the consumption of high temperature alloys will increase steadily.

In recent years, because of the rapid growth of cobalt consumption in battery industry, the consumption of cobalt in the world has been gradually transferred to Japan, China, South Korea and other East Asian regions from the past dominated western developed countries. At present, Japan and China have replaced the United States to be the main consumer of cobalt.

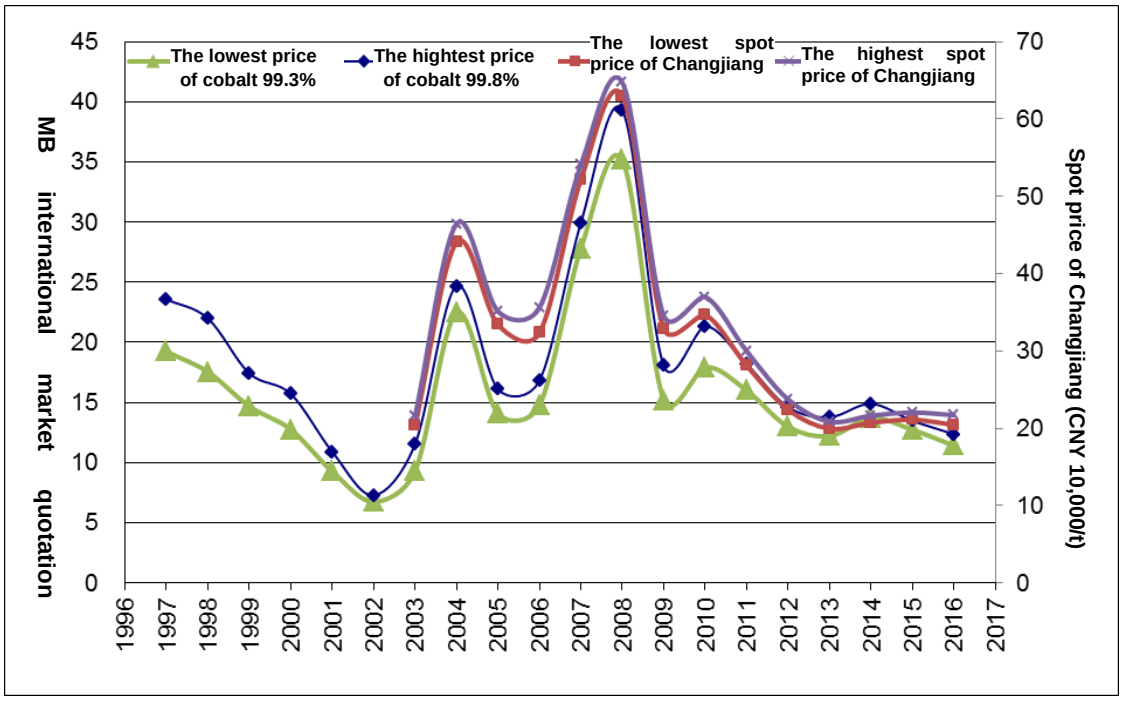

Fig. 12-2Domestic and International Cobalt Price Changing Curve

13 INFRASTRUCTURE AND LOGISTICS

13.1 Project Overview

Ramu NiCo Project, located in Madang, Papua New Guinea, is a world-class mining project integrating mining, dressing and smelting. The Project consists of major processes and supporting facilities, such as laterite quarrying, ore slurry pipeline transportation, metallurgy by high pressure acid leaching, deep-sea tailing drainage. Since full production was realized at the end of 2012, the production capacity of Ramu NiCo Project has reached the basic design index through production operation practice over five years, and achieved operation up to production and standard. In 2017, the company produced 34,664 tons of metal nickel and 3,291 tons of metal cobalt. A special pre-feasibility study was conducted for the exploration work in 2016-2017, and the study reveals that the economic benefits are good.

The mine is located in the Kurumbukari area, 75km southwest of Madang, at an altitude of 600m～800m. The smelting plant is located at the Basamuk seaside, 55km southeast of Madang, at an altitude of 5m～60m. The ore slurry

pipeline is a transport system connecting the mine and smelting plant, with a total length of 135km.

13.2 Plant site

At the Basamuk bay where the smelting plant is located, one 50,000t wharf has been built with the berth length of 335m. The wharf is available for the bulk carriers with capacity within 50,000t and the product oil tankers and general cargo ships with capacity within 40,000t.

There is a natural deep-sea trench near the smelting plant, which is the best place for burial of tailings from the smelting plant in the deep sea. It can fundamentally solve the problem of disposal of tailings.

13.3 Water supply

According to the data, a new water intake facility is set up at the place 4km from the production fire fighting high water pool at the mine. The water source level is 632m, and the assurance rate of water resources of the new water source is assumed to be 100%.

The existing water source at the Yaganon river delta about 3.8km east of the production fire fighting high water pool is the main water source of the smelting plant. The water quality and quantity can meet the water use demand of the smelting plant. The effluent treated from dense overflow of slurry is used as the supplementary water source.

13.4 Power supply

The mining area and smelting plant have already been provided with a power station. At present, the production load is relatively low, so the production demand can be fully met.

13.5 Others

In the process of the development, construction and operation of Ramu NiCo Project, Ramu NiCo Management (MCC) Limited has always been adhering to the concept of “one Ramu, one community” and has been

committed to developing relationships with the Papua New Guinea government, community, shareholders and various social groups for many years and actively fulfilling the obligations of the MOA agreement, thus provided numerous business opportunities for the local community, gained good social repercussions, and achieved good social effects.

At the same time, Ramu NiCo Management (MCC) Limited continuously paid attention to the environmental protection of the project, attached great importance to the communication and exchange with the interested parties of the project, and strived to create an environmentally friendly and sustainable Ruimu project. In 2015, it passed an environmental independent audit and obtained an OEMP permit approved by the Ministry of Environment of Papua New Guinea.

14 MINING PLAN

The current working is still fit for quarrying, opening up by highway automotive transportation, stripping and mining by hydraulic excavator and articulated truck, and using the mode of considering “mechanical mining + hydraulic mining in partial mining area”. The spoil soil is transported to the designated storage yard or goaf, and ore is directly loaded on the truck and transported to the concentrating mill. Reclamation includes backfilling and reclamation of goaf, which are carried out stepwise in the mining process, to prevent water and soil loss and control erosion.

14.1 Stripping process

There are two stripping ways: one is the direct bulldozing process by bulldozers, the other is the stripping process by excavators and trucks.

A bulldozer shall be used to push the upper coating of the ore body to a certain area, and then the waste soil shall be pushed to the goaf after the completion of mining. The humus is used for reclamation. The humus shall be stacked in a centralized manner and suitable measures should be taken to protect it from rain scouring. For the coating less than 2m, a bulldozer shall be

used for direct bulldozing. Through the topographic analysis of the mining area, 80% of coating of mining area is less than 2m. When the thickness of coating is greater than 2m, the transportation by excavators and trucks shall be adopted for stripping. Due to the unevenness of the contact plane between the ore body top board and adjacent rocks, depletion shall be reduced in mining as much as possible. Therefore, a procedure of top board cleaning is designed and recommended to be added between the stripping and mining links, with a 1.0m^3～2m^3 hydraulic backhoe being used for cleaning the top board, so as to realize fine stripping.

Parameters of stripping surface:

Road width: 10m;

Width of working berm along the tendency: 50m~80m;

Length of working surface along the trend: 10m~20m;

Maximum slope angle of working line: 25°.

14.2 Mining process

Mining includes loading and transportation. Hydraulic excavators are used for loading and articulated trucks are selected for transportation.

The designed height of working bench: 3m～5m, the face angle of bench: 65°.

Most of the surface slope within the mining range is 0°～30°, and the slope is relatively gentle. There are two types of working berms: combination bench and single bench. For the combination bench which is suitable for the area where the surface slope is greater than 15°, 2~3 benchs are combined for continuous mining. In production, we should consider whether to adopt the combination bench or the single bench according to the situation on site. No matter what form is selected, the working procedure of mining will be the same. When the height of working bench is greater than 10m, or the working security is affected, a bulldozer shall be used to conduct working surface descending; When the thickness of ore body is greater than 15m, two benchs may be

combined for mining.

Mining surface parameters:

bench height: 5m~10m;

Working berm width: 40m~50m;

Face angle of working bench: 65°.

The current annual mining capacity of the mine is 3.56Mt (dry weight) , with stripping ratio of 0.51, mining loss rate of 5% and mining dilution rate of 3%.

15 PROCESSING PLAN

The concentrating mill consists of ore washing workshop, chromium separation workshop and concentration workshop.

The ore washing workshop adopts two-time sieving and two-section scrubbing flow, producing -3mm ore slurry (chromium separation material), saw dust and +3mm spoil. -3mm ore slurry is pumped to the chromium separation workshop, +350mm gravel is transported to the existing raw ore pretreatment workshop for crushing by truck, and the crushed gavel is delivered to the existing ore washing workshop for ore washing, thus recycling high-grade laterite adhered on the surface of gravel; -350mm～+50mm gravel is used as the road stone, and -50mm～+3mm gravel and saw dust residue are used as the reclamation fill of the goaf.

The technological process for chrome selection of “hydrocyclone + spiral chute roughing + table cleaning + table middling re-cleaning + improvement of the ratio of chrome and iron by magnetic separator + control of particle size by closed circuit grinding” is adopted. The spiral chute rejects and table rejects are graded by grinding, and -150μm slurry automatically flows into the concentration workshop. The nickel recovery rate in the ore slurry is 97.5%, and the cobalt recovery rate is 91.91%.

The concentration workshop concentrates into 20% ore slurry by using the high efficiency concentrator, and the ore slurry is pumped to lone-distance ore slurry pipeline transportation system. The slurry pipeline adopts the "low

concentration, large pipe diameter centrifugal pump turbulent transportation" process scheme for dredging, namely the centrifugal pump turbulent transportation scheme with inner pipe diameter of 610mm.

16 METALLURGICAL PLAN

Hydrometallurgy includes high pressure acid leaching, ore slurry neutralization, CCD countercurrent washing, removal of iron and aluminum, nickel cobalt hydroxide precipitates by neutralization, obtaining the intermediate product of nickel cobalt hydroxide, and the tailing are discharged to the deep sea landfilling procedure for treatment upon neutralization. For smelting recovery rate, the nickel is 89%, and the cobalt is 88%。

17ENVIRONMENT

The Ramu NiCo Project is a hydrometallurgical enterprise. Compared with pyrometallurgical process, the emission of three wastes is relatively small. In particular, the pressurized acid leaching process for treating nickel-bearing laterite ore is called “green process”.

In the production process, dust collection systems or exhaust gas scrubbing systems are set at all major pollution points. The concentration of pollutants in the exhaust gas complies with relevant pollutant discharge standards in China and Papua New Guinea. The tropical marine climate in the region located is also conducive to the dilution and diffusion of atmospheric pollutants.

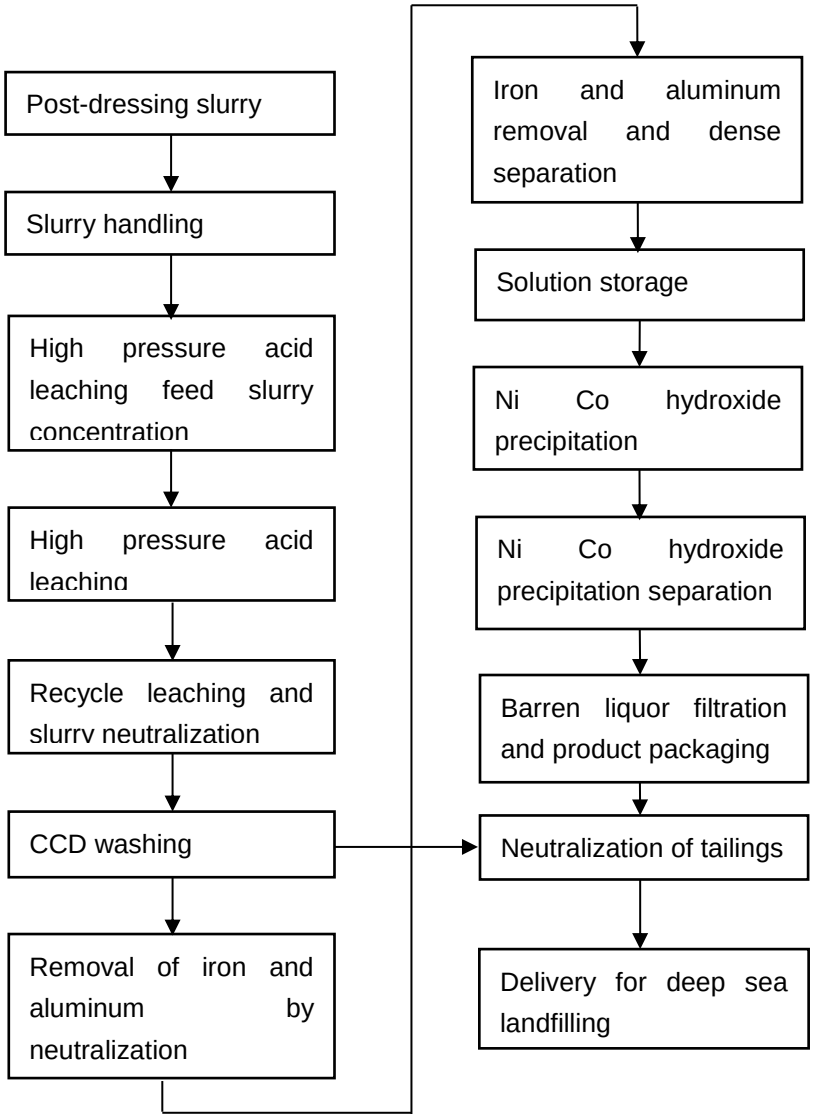

Fig. 16-1Process Flow Diagram for Smelting

The waste water discharged out from the plant is general production waste water without toxic and harmful substances. It will not cause harm to the environment when discharged into the surface water system or into the deep sea upon pH value is adjusted to 7.5 or so by lime.

It will not pollute the environment when the tailings generated in production is directly discharged into the deep sea after neutralizing treatment.

Both the mine and smelting plant are far away from residential areas. In addition, the noise in the plant area is up to standard, and the noise will not pollute the surrounding environment.

Quarrying is adopted for mining. The mining waste rocks and topsoil are used for backfilling and reclamation is conducted to conserve water and soil.

18 FINANCIAL ANALYSES

18.1 Investments

The project is a production mine and no additional investment is required for resource development.

18.2 Costs

The mining, processing and metallurgy cost were USD62.58/t dry ore, sell cost was USD8.75/t dry ore, general and administrative cost was USD2.95/t dry ore. The freight cost of USD35 per tonne of MHP was applied.

Based on existing production capacity, the average annual total cost (exclude taxes) of the project is USD238,712,000, and the total unit cost is about USD 8,480 / (t.Ni).

18.3 Sales revenue, taxes and profits

The price of metals in the economic evaluation of the project is considered on the following basis: The nickel price is calculated as per USD 12,000/t, and the cobalt price is calculated as per USD 48,501/t. Combining the market sales in 2017, the nickel containing valuation coefficient of nickel cobalt hydroxide is considered as 75%, and the cobalt containing valuation coefficient considered as 68%.

The production tax is calculated as per 0.25% of FOB sales revenue and the resource tax is calculated as per 2% of FOB sales revenue after deducting smelting costs (including smelting depreciation and other allocated expenses). According to the tax policy of Papua New Guinea, the enterprise income tax shall be exempted for 10 years since 2016. It is also possible to postpone the application for tax avoidance, but there is some uncertainty. Therefore, it is reliable to calculate the tax expenses as per the tax rate of 15%.

The feasibility study uses operating cost and product selling price to estimate the economic benefits of the project. The results show that the project has good economic benefits.

19 ORE RESERVE ESTIMATE

19.1 Reserve classification

According to reserve modifying factors, the recoverable part from measured resources are classified as proved reserves, and the recoverable part from indicated resources are classified as probable reserves. Inferred resources are treated as waste materials.

19.2 Field investigation

The competent person Mr. Xiang GAO has not been to mine site. However, due to the mine has put into operation over five years since 2012, and open pit mining was adopted with a conventional truck and excavator operating as well as hydraulic mining within partial area. Mr GAO relied on the understanding and finding during site visiting by Zhang Xueshu on July 1-6, considering that the reserve conversion was reasonable to meet the demands of mining production.

19.3 Reserve Estimation Results

Up to June 15, 2018, the lateritic NiCo ore reserves within all Ramu project area are 56Mt, with an average grade of Ni 0.9%, Co 0.1%; where proved reserves are 24Mt@Ni 0.9%, Co 0.1%; probable reserves are 33Mt@Ni 0.9%, Co 0.1%. The ore reserves are increased compared with the ore reserves in December 31, 2016(Table 19-2).

Table 19-1 Results of Ore Reserves Estimation within all Ramu Project Area

Category	Ore Reserve	Average grade (%)		Remarks
	（Mt）	Ni	Co	
Proved	24	0.9	0.1	
Probable	33	0.9	0.1	
Total	56	0.9	0.1	

Notes:

1.The Ni cut off grade is at 0.5%Ni, and the minimum mineable thickness is at 0.5m.
2.Totals may not equal the sum of the component parts due to rounding adjustments.
3.Ore tonnes (dry) represent the -2 mm economic portion of resource mineralization in the rocky saprolite

4.The QA/QC is not executed in the Productive Exploration in 2016, so 2016 exploration result is not included.
5.The resource and Ore reserves is updated on June 15th, 2018

Table 19-2 31th December 2016 Ramu Ore Reserve by classification

Category	Ore Reserve	Average grade (%)		Remarks
	（Mt）	Ni	Co	
Proved	20	0.9	0.1	
Probable	29	1.0	0.1	
Total	49	1.0	0.1	

Notes:

1.Cut-off grade is variable and equates to 0.58% nickel equivalent, including credit forrecovered cobalt metal.
2.Totals may not equal the sum of the component parts due to rounding adjustments.
3.Ore tonnes (dry) represent the -2 mm economic portion of resource mineralization in the rocky saprolite
4.The QA/QC is not executed in the Productive Exploration in 2016, so 2016 exploration result is not included.
5.The resource and ore reserves are updated on December 31th, 2016

REFERENCES

[1] Sinomine Resource Exploration Co., Ltd., July 2009, *Report on Capital Construction Prospecting for Ramu NiCo KBK (A) Area in Madang, Papua New Guinea*

[2] Sinomine Resource Exploration Co., Ltd., September 2009, *Report on Capital Construction Prospecting for Ramu NiCo KBK (B´) Area in Madang, Papua New Guinea*

[3] Hubei Geological Survey Institute of Coal, March 2017, *2016 Productive exploration Report on Ramu NiCo Project in Madang, Papua New Guinea*

[4] Sinomine Resource Exploration Co., Ltd., May 2018, *2017 Geological Exploration Report on Prospective Area of Ramu NiCo in Madang, Papua New Guinea*

[5] Hubei Geological Survey Institute of Coal, May 2018, *2017 Geological*

Exploration Report on Productive exploration Area of Ramu NiCo in Madang, Papua New Guinea

[6] China ENFI Engineering Corporation. May, 2017, *Ramu NiCo Mineral Resources Estimate 2016*

[7] China ENFI Engineering Corporation. May, 2017, *Ramu NiCo Ore Reserve Estimate 2016*

APPENDIX

APPENDIX A- Competent Person's Consent Form

中矿资源勘探股份有限公司
SINOMINE RESOURCE EXPLORATION CO., LTD.

Competent Person's Consent Form

Pursuant to the requirements of ASX Listing Rules 5.6,5.22 and 5.24 and Clause 9 of the JORC Code 2012 Edition:

I, ZHANG XUESHU, confirm that I am the Competent Person for the Report and:

I have read and understood the requirements of the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code, 2012 Edition).

I am a Competent Person as defined by the JORC Code, 2012 Edition, having 12 years field exploration and resources estimation experience since 2006 across Indonesian, Myanmar and Philippines that is relevant to the style of mineralization and type of deposit described in the Report, and to the activity for which I am accepting responsibility.

I am a Fellow Grade Member of The Australasian Institute of Mining and Metallurgy (FAusIMM), with the Member Number is No:320467.

I have reviewed the Report and taken part in the field exploration works relevant to the Report to which this Consent Statement applies.

I am a full time employee and Chief Geologist of the Sinomine Resources Exploration Co., Ltd., and have been engaged by the Ramu NiCo Management (MCC) Limited to carry out field exploration works including drilling, sampling, sample preparation and topographical survey and drill hole collar positioning survey, and to prepare the documentation for the Ramu Ni laterite deposit in Madang Province in Papua New Guinea, On which the Report is based, for the period ended on 30 January,2018, and the effective date on 15 June, 2018, of Mineral Resources and Ore Reserves estimation for the Ramu Ni laterite deposit.

I verify that the Report of the Ramu NiCo Resource & Ore Reserve Estimate 2017 prepared for the Ramu NiCo Management (MCC) Limited, which is based

on and fairly and accurately reflects in the form and context in which it appears, the information in my supporting documentation relating to Exploration Results and Mineral Resources.

I consent to the release of the report and this Consent Statement by the Company and its Directors or its' shareholder of the Ramu NiCo Management (MCC) Limited.

Competent Person: 张宝杉 Signed On: 2018.9.3.

Professional Membership: F. AusIMM Member Number: NO: 320467.

Competent Person's Consent Form

Pursuant to the requirements of ASX Listing Rules 5.6,5.22 and 5.24 and Clause 9 of the JORC Code 2012 Edition:

I, GAO XIANG, confirm that I am the Competent Person for the Report and:

I have read and understood the requirements of the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code, 2012 Edition).

I am a Competent Person as defined by the JORC Code, 2012 Edition, having over 20 years mining and reserves estimation experience since 1989 across Indonesian, Camboia, Philippines and China that is relevant to the style of mineralization and type of deposit described in the Report, and to the activity for which I am accepting responsibility.

I am a Member of The Australasian Institute of Mining and Metallurgy (MAusIMM), with the Member Number is No:306811.

I have reviewed the Report to which this Consent Statement applies.

I am a part-time employee of the Sinomine Resources Exploration Co., Ltd., and have been engaged by the Ramu NiCo Management (MCC) Limited to prepare the documentation for the Ramu Ni laterite deposit in Madang Province in Papua New Guinea, On which the Report is based, for the period ended on 30 January,2018, and the effective date on 15 June, 2018, of Mineral Resources and Ore Reserves estimation for the Ramu Ni laterite deposit.

I verify that the Report of the Ramu NiCo Resource & Ore Reserve Estimate 2017 prepared for the Ramu NiCo Management (MCC) Limited, which is based on and fairly and accurately reflects in the form and context in which it appears, the information in my supporting documentation relating to Ore Reserves.

I consent to the release of the report and this Consent Statement by the Company and its Directors or its' shareholder of the Ramu NiCo Management (MCC) Limited.

Competent Person: Signed On: 高祥

Professional Membership: M. AusIMM Member Number: NO: 306811.

APPENDIX B- Compliance Statements

The information in this announcement that relates to Resources is based on information compiled by or under the supervision of Mr. Zhang Xueshu of Sinomine Resources Exploration Co., Ltd. (“Sinomine” hereinafter), a Competent Person who is a member of The Australasian Institute of Mining and Metallurgy. Mr. Zhang Xueshu is the Sinomine’s Chief Geologist. Mr.Zhang has sufficient experience relevant to the style of mineralization and type of lateritic nickel deposit under consideration and to the activity he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr. Zhang consents to the inclusion in the report of the matters based on his information or information derived from exploration works under his supervision in the form and context in which it appears.

The information in this announcement that relates to Ore Reserves is based on information compiled by or under the supervision of Mr. Xiang GAO of part-time employee of Sinomine Resources Exploration Co., Ltd. (“Sinomine” hereinafter), a Competent Person who is a member of The Australasian Institute of Mining and Metallurgy. Mr.GAO has sufficient experience relevant to the style of mineralization and type of deposit under consideration and to the activity he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves". Mr.GAO consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

APPENDIX C-JORC TABLE 1

Section 1 Sampling Techniques and Data

(Criteria in this section apply to all succeeding sections)

Criteria	Explanation	
Sampling techniques	• 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.	1/2 core splitting sampling of drill core
	• Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used.	All holes are sampled continuously in productive exploration in 2016, with the basic sampling length as 1m. When the distance between sampling point and the lamination position is no more than 0.5m, combined sampling may be applied; separate sampling shall be applied when the distance is greater than or equal to 0.5m. The sample splitting knife is applied for 1/2 splitting the soil horizon for sampling as chemical analysis, and the rest of 1/2 sample is discarded; the full-core sampling is applied for the rocky saprolite. Part of cores was reserved in the intensive exploration in 2017.
	• 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 (eg '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 (eg submarine nodules) may warrant disclosure of detailed information.	The industrial standards of China, JORC standards and mine generation demands were combined for sampling, the way of which was consistent with the lateritic nickel ore.
Drilling techniques	Drill type (eg core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (eg 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).	For core drilling, the method of hard alloy drilling accompanied by diamond drilling was mainly applied in drilling exploration. Φ94~110mm open hole and Φ91mm final hole. Cores were not oriented. The 2016 productive exploration and 2017 productive and drilling exploration were carried out by Hubei Geological Survey Institute of Coal, and the 2017 prospective and drilling exploration was carried out by Sinomine Resource Exploration Co., Ltd.

Criteria	Explanation	
Drill sample recovery	Method of recording and assessing core and chip sample recoveries and results assessed. • Measures taken to maximise sample recovery and ensure representative nature of the samples. • 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.	The core recovery rate was enabled with drilling exploration and recording. The core recovery rates of all the constructed 668 boreholes in the productive exploration in 2016 were between 79.05% and 100.00%. The core recovery rates of all the constructed 363 boreholes in the prospective exploration in 2017 were between 85% and 100.00%, with an average full-borehole recovery rate of 94%. The recovery rate of all the 702 boreholes constructed in the productive exploration in 2017 was qualified. The recovery rate and grade was found irrelevant.
Logging	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. • Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography. •The total length and percentage of the relevant intersections logged.	All boreholes were subject to the detailed geological record to meet the demand of resources estimation. The recording is qualitative and semi-quantitative, and all cores were photographed before sampling. All cores were recorded.
Sub-sampling techniques and sample preparation	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.	The core was split by a sampling knife, with 1/2 for sampling; all cores from the gravel-containing horizon were sampled. No non-core sample was sampled. The sample processing and the preparation of chemical analysis sample were conducted as per Chinese specifications. Sample processing is divided into coarse crushing and fine crushing. Every stage also includes crushing, screening, uniformly mixing and splitting. The processing method is suitable for lateritic nickel ore and complies with the requirements of mine. Cores were not reserved in 2016, part of cores was reserved in 2017 and the acquisition test of replicate sample of core was not conducted. The sample size matched with the granularity of the sampled target mineral.
Quality of assay data and laboratory tests	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 (eg standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (ie lack of bias) and precision	The sample analysis was carried out by the testing laboratory of the mine. Test method: test samples are dissolved by hydrochloric acid, nitric acid, hydrofluoric acid and perchloric acid. In the nitric acid medium, the inductively coupled plasma emission spectrometer (Varian 700-ES) is used to measure the mass concentration. The measured scope of NiCo for the method is 0.02~10.0%, which satisfies the production need of the

Criteria	Explanation	
	have been established.	mine. According to the data of the mine, the detection limits of Varian 700-ES for Ni and Co are 5.0μg/L and 13.0μg/L respectively, which meet the needs of test method. The quality control procedures were not implemented in the productive exploration in 2016. Quality control (including standard sample, blank sample and duplicate sample) was enabled in the intensive exploration in 2017, while the external experimental examination was not, and the standard sample was the nonstandard material sample. The accuracy of analysis and test not met the production requirements of the mine.
Verification of sampling and assaying	The verification of significant intersections by either independent or alternative company personnel. • The use of twinned holes. • Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols. • Discuss any adjustment to assay data.	It was not verified.
Location of data points	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. • Specification of the grid system used. • Quality and adequacy of topographic control.	RAMU93 coordinate system (independent coordinate system of the mining area) was applied for the plane coordinate of the survey area, and RAMU93 elevation system (independent elevation system of the mining area) for elevation. Hi-Target Statistic GPS was applied for surveying the first-stage planar control measurement in the mining area in the productive exploration in 2016. For the mapping method of the topographic map of the mining area, the total station (TOPCON EOS602) was applied for acquiring field topographic points, and South GASS7.1 mapping software was applied for indoor mapping. RTK or total station was applied for borehole survey. 1.06km^2 of 1:1000 topographic survey was finished in the mining area, and 668 boreholes were surveyed. In the prospective exploration in 2017, it was found that the control points mapped in 2006 and 2013 were well preserved, with plane and elevation precision meeting the demands of this survey after check. Mapping base points were surveyed directly by virtue of GPS-RTK. If GPS-RTK cannot be applied in the dense vegetation area, the total station polar method and the connecting traverse method were applied. The field mapping method of total station was applied in the dense vegetation area of the survey area, and

Criteria	Explanation	
		GPS-RTK field mapping method for the rest of areas. South GASS9.2 mapping software was applied for indoor mapping. Total station was applied for borehole survey. 2.96km^2 of 1:1000 topographic survey was finished, and the 363 boreholes were surveyed. The survey method of productive exploration in 2017 was the same as that of prospective exploration in 2017, and 702 boreholes were surveyed. The 1:1000 topography of partial region was formed by processing the 1:2000 topographic map in the prospective exploration in 2017, which had certain effect on the accuracy and reliability of the results of resources estimation.
Data spacing and distribution	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	The grids drilled in different areas in 2016 productive exploration were 50×50m, 100×100m and 200×200m; the drilling grid in 2017 prospective exploration was 100×100m; the drilling grid in 2017 productive exploration was 50×50m. A sample was 1m in length. The data density and distribution met the estimation of the indicated and inferred resources. The 1m long composite sample was used in the intensive exploration in 2017.
Orientation of data in relation to geological structure	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.	The lateritic nickel ore was stably mineralized and mainly affected by lithology and topography and less affected by structure. The boreholes were straight; mineralization was not obviously related to structure.
Sample security	The measures taken to ensure sample security.	Samples were taken care of by Hubei Geological Survey Institute of Coal during sampling and processing in the productive exploration in 2016. Original and duplicate samples with maximum particle size of -200 mesh after processing were delivered to the testing laboratory of the Project Department of the mine in time together with the sample delivery list once a week. Exploratory boring cores shall be abandoned after split-core samples are collected. Samples were taken care of by Sinomine Resource Exploration Co., Ltd. during sampling and processing in the prospective exploration in 2017. With respect to the original (50-100g) and duplicate (130g) samples obtained after smashing and splitting the 200 mesh samples, one batch was transferred to the Ground Survey Chamber of Mine every week, with 18 batches and 4,765 samples in total. After samples are checked and accepted by the Supervisor and

Criteria	Explanation	
		the appointed person of the Ground Survey Chamber, a sample handover list shall be signed, then samples can be send to the testing laboratory by the Ground Survey Chamber. Duplicate samples shall be kept by the laboratory. A hole spacing of 400m was taken for core preservation. Core preservation refers that the remaining cores after sampling are transferred to the core library for proper storage. Borehole roundtrip tickets for core preservation is sealed with tape, labels of the samples are placed in empty slot of full-core sampling, and borehole No., Ctn. No. of preservation as well as core depth are marked on both sides of core box. Core storage form shall be drawn up after cores are put in storage, recording Ctn. No. of borehole cores, hole depth and storage date. Core retention transfer form shall be drawn up in batches. After checked by the Supervisor and Ground Survey Chamber of Mine, it shall be handed over to the Ground Survey Chamber of Mine. There are 82 boreholes preserved this time, 270 boxes in total. All cores were transferred to the location specified by Party A. Samples were taken care of by Hubei Geological Survey Institute of Coal during sampling and processing in the 2017 prospective exploration with the method consistent with that used in 2017 prospective exploration.
Audits or reviews	The results of any audits or reviews of sampling techniques and data.	The competent person Zhang Xueshu investigated on site on July 1-7, 2017, considering that the sampling method and date met the demands of mine generation.

Section 2 Reporting of Exploration Results

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

Criteria	Explanation	
Mineral tenement and land tenure status	•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.	Prospecting License (EL193) of Ramu NiCo Project covers an area of 194.95km^2, and the validity expires on February 26, 2018. Mining License (SML8) covers an area of 54.4km^2, and the validity expires on July 26, 2040. The prevailing unincorporated joint venture mode of international large mining development project is used for Ramu Project. Three foreign shareholders: MCC Ramu NiCo Management (MCC Ramu) Limited and the former project developer Highlands Pacific Ltd., local companies on behalf of Papua New Guinea and local land owners constitute the joint venture of Ramu Project. MCC Ramu holds 85% shares of the Project, and other shareholders hold 15% shares of the Project. Ramu NiCo Management (MCC) Limited (Ramu Management) is jointly entrusted by shareholders of the joint venture to take charge of construction, development and operation of the Project as the manager of the joint venture. The Crocodile Farm around SML is a natural heritage in Papua New Guinea, which shall be protected by the mine. Relevant personnel shall be requested to relocate other related graves and the places with cultural value as per local relocation ceremony prior to the operation of the mine and be compensated.

Criteria	Explanation	
Explorationdone by other parties	Acknowledgment and appraisal of exploration by other parties.	Since the discovery in 1962, the deposit has experienced different degrees of geological work borne by different corporations in multiple phases. Exploration was mainly conducted by Highlands Pacific Limited before 1999; since the commencement of capital construction of Ramu NiCo Project, MCC has successively carried out intensive exploration in KBK area and local peripheral sections. The above work already done is reliable.
Geology	Deposit type, geological setting and style of mineralisation.	Typical lateritic NiCo ore is produced on the weathered crust of ultrabasic rock.
Drill hole Information	• 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: • 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.	Only Mineral Resources and Ore Reserves are being reported here. As no exploration results are being reported, this section is not considered applicable.
Data aggregation methods	In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (eg cutting of high grades) and cut-off grades are usually Material and should be stated. • Where aggregate intercepts incorporate short lengths of high grade results and longer	Only Mineral Resources and Ore Reserves are being reported here. As no exploration results are being reported, this section is not considered applicable.

Criteria	Explanation	
	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. • The assumptions used for any reporting of metal equivalent values should be clearly stated.	
Relationship between mineralisation widths and intercept lengths	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 (eg 'down hole length, true width not known').	Only Mineral Resources and Ore Reserves are being reported here. As no exploration results are being reported, this section is not considered applicable.
Diagrams	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.	Only Mineral Resources and Ore Reserves are being reported here. As no exploration results are being reported, this section is not considered applicable.
Balanced reporting	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.	Only Mineral Resources and Ore Reserves are being reported here. As no exploration results are being reported, this section is not considered applicable.
Other substantive exploration data	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.	Only Mineral Resources and Ore Reserves are being reported here. As no exploration results are being reported, this section is not considered applicable.
Further work	The nature and scale of planned further work (eg tests for lateral extensions or depth extensions or large-scale step-out drilling) • Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.	Only Mineral Resources and Ore Reserves are being reported here. As no exploration results are being reported, this section is not considered applicable.

Section 3 Estimation and Reporting of Mineral Resources

(Criteria listed in section 1, and where relevant in section 2, also apply to this section.)

Criteria	Explanation	
Database integrity	• Measures taken to ensure that data has not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for Mineral Resource estimation purposes. • Data validation procedures used.	The laboratory data of all samples were provided by the laboratory of the mine. The data from 2016 productive exploration and 2017 productive exploration and from 2017 prospective exploration were respectively checked and revised by Hubei Geological Survey Institute of Coal and Sinomine Resource Exploration Co., Ltd. The data was checked for overlapping, missing collar,survey, lithological and assay data via Surpac software..
Site visits	Comment on any site visits undertaken by the Competent Person and the outcome of those visits. • If no site visits have been undertaken indicate why this is the case.	The competent person Zhang Xueshu investigated on site on July 1-7, 2017, considering that the database and resources estimation were qualified to meet the demands of mine generation. Mr. Zhang also investigated currently open pit mining and processing operation at Kurumbukari and Basamuk.
Geological interpretation	Confidence in (or conversely, the uncertainty of) the geological interpretation of the mineral deposit. • Nature of the data used and of any assumptions made. • The effect, if any, of alternative interpretations on Mineral Resource estimation. • The use of geology in guiding and controlling Mineral Resource estimation. • The factors affecting continuity both of grade and geology.	There is strong confidence in the geological interpretation of the lateritic layers (rock types) of the orebody. The upper layers, especially the limonite layer are usually continuous, at least in their presence/absence. The absence of the limonite layer is never fortuitous or unexpected, but always due to erosion, and therefore confined to well identified geographic areas. The grades including cobalt, are usually continuous and show little lateral variability. Core recording, sample analysis and surface mapping are

Criteria	Explanation	
		applied to interpret the geological domain of deposit. No other geological interpretation is available at present. The grade and lithological interpretations forms the basis for the modeling. Grades have all been estimated constraining within the lateritic layers (rock types). The lateritic nickel ore in this area is of continuous and stable geological and ore grades and is mainly affected by topography and the degree of weathering.
Dimensions	The extent and variability of the Mineral Resource expressed as length (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource.	The distribution ranges of lateritic nickel ore and dunite were basically consistent. The working area of the exploration in 2016-2017 was 7.9km^2 in total with about 7.8km^2 developed with lateritic nickel ore. The ore bed was 0-30m in thickness and 0-20m in buried depth.
Estimation and modelling techniques	The nature and appropriateness of the estimation technique(s) applied and key assumptions, including treatment of extreme grade values, domaining, interpolation parameters and maximum distance of extrapolation from data points. If a computer assisted estimation method was chosen include a description of computer software and parameters used. • The availability of check estimates, previous estimates and/or mine production records and whether the Mineral Resource estimate takes appropriate account of such data. • The assumptions made regarding recovery of by-products. • Estimation of deleterious elements or other non-grade variables of economic significance (eg sulphur for acid mine drainage characterisation).	The horizontal projection method was used in the productive exploration in 2016 for resources estimation. The ultra-high grade treatment was not enabled, and the boundary of ore body was subject to drilling without extrapolation. The software GEOVIA Surpac was used for the intensive prospecting in 2017. Based on statistical analysis, the ultra-high grade treatment was not enabled, the boundary of ore body was subject to drilling without extrapolation, the size of ore block was 25m×25m×1m (north × east × height), and the inverse distance method was used for grade difference. By means of above methods, the resources were estimated by

Criteria	Explanation	
	• In the case of block model interpolation, the block size in relation to the average sample spacing and the search employed. • Any assumptions behind modelling of selective mining units. • Any assumptions about correlation between variables. • Description of how the geological interpretation was used to control the resource estimates. • Discussion of basis for using or not using grade cutting or capping. • The process of validation, the checking process used, the comparison of model data to drill hole data, and use of reconciliation data if available.	Hubei Geological Survey Institute of Coal in 2016 productive exploration and 2017 productive exploration and by Sinomine Resource Exploration Co., Ltd. in 2017 prospective exploration. The resources levels were subject to minor adjustment on the basis of this resources estimation. The concentration recovery ratio of chromite according to the mine data was 62.96%. The High Pressure Acid Leach system (HPAL) was used in the mine to produce NiCo, and the elements including iron, aluminum, magnesium and manganese in ore were harmful. Above elements in samples were analyzed in 2016 and 2017, indicating that the distribution rules of the elements were consistent. The analysis in 2017 indicated that Al content reduced together with the reduction of weathering degree from top to bottom, with average content reducing from 6.17% in the ore body in Red limonite to 0.89% in the ore body in lower rocky saprolite; average Mg content increased from 0.19% in the ore body in Yellow limonite to 12.24% in the ore body in lower rocky saprolite, which increased from top to bottom with the reduction of weathering degree, and Mg content (0.36%) in Red limonite which mixed with late deluvium was slightly higher that in Yellow limonite due to the steep topography; the firstly increased and then decreased contents of Mn and Co from bottom to top showed an obvious positive correlation which representing that manganese-cobalt soil was more contained in the ore body in saprolitewith an average Mn content of 1.04%. Fe content also

Criteria	Explanation	
		declined from top to bottom with an average content reducing from 44.16% in the ore body in Yellow limonite to 20.5% in the ore body in lower rocky saprolite. Due to the late deluvium mixed in reddish-brown limonite horizon, in which Fe content (36.39%) was slightly lower than in Yellow limonite. A model of ore block with a size of 25m×25m×1m (north × east × height) was employed in the intensive prospecting in 2017. The grid for drilling exploration in this area was 100×100m and the grid of local abandoned bores was 200×200m. The main length of samples was 1m. The triaxial ratio of search ellipsoid was 3.7:1.6:1; the first search radius was 120m with a minimum quantity of works of 3, the second search radius was 240m with a minimum quantity of works of 1, and the third search radius was 360m with a minimum quantity of works of 1. No selective mining units were assumed in this estimate. There was not a strong correlation among elements; the contents of Ni and Mg were gradually increased from top to bottom, and to the bottom of lower gravel-bearing horizon, the content of Ni was obviously reduced while that of Mg was gradually increased; the content of Al was reduced to the increasing depth, and the contents of Co and Mn were slightly higher in eluvium. A geological database was created on Surpac platform with the display style of borehole information (including mineralization, lithology and label) set. A series of profiles along exploration lines were established then. Based on the combination of various

Criteria	Explanation	
		geological factors on the profiles of exploration lines, the form and occurrence horizon of ore body were analyzed; based on the sampling and analysis results, the ore body boundary was delineated on profile with a 0.5% boundary grade of Ni; with reference to Al ≥5% for red limonite ore and Mg ≥1% for lower gravel-bearing residual ore at the same time, ore was delineated in meter percentage (0.25m %) for thin and rich ore body with sample length less than 1m and grade higher than the lowest industrial grade, and the eliminating thickness of horse-stone was 2m. The coefficient of variation of Ni grade was 0.53, which was less than the Sichel-t value of 0.75; the variation of nickel grade was relatively stable without ultra-high grade, the ore body grade was then treated as without ultra-high grade. No upper cut was used. Through the exploration line profiles, the interpolation results of distance power inverse ratio method and the original engineering sample data were compared on 3D space and profile for ore body boundary, ore block grade and resource coding, turning out that the both matched well and the valuation effect was accurate and reliable then.
Moisture	• Whether the tonnages are estimated on a dry basis or with natural moisture, and the method of determination of the moisture content.	Dry weight is used for the weight estimation by tonnage. The wet weight of sample is weighed firstly, the sample is dried in drying baker under a constant temperature of 105°, and then the dry weight is weighed and subtracted from the wet weight to get water weight.

Criteria	Explanation	
Cut-off parameters	• The basis of the adopted cut-off grade(s) or quality parameters applied.	The boundary grade is 0.5%, the eliminating thickness of horse-stone is 2m and the minimum minable thickness is 0.5m.
Mining factors or assumptions	• Assumptions made regarding possible mining methods, minimum mining dimensions and internal (or, if applicable, external) mining dilution. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential mining methods, but the assumptions made regarding mining methods and parameters when estimating Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the mining assumptions made	Open mechanical mining with less open hydraulic mining is employed for ore, with a mining loss rate of deposit of 5% and a dilution rate of 3%. Mining factors are not used in the resources estimation.
Metallurgical factors or assumptions	• The basis for assumptions or predictions regarding metallurgical amenability. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential metallurgical methods, but the assumptions regarding metallurgical treatment processes and parameters made when reporting Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the metallurgical assumptions made.	The main metallurgical criticality of the Resource was how to treat ore with rock in it. Early on the metallurgical test work showed that the grade of the resource may be upgraded by using gravity techniques to remove the barren chromite and fine rock fragments of the in-situ resource. Another point was the rocky saprolite tonnage and grade have been estimated for a -2mm rock free material as this more accurately reflects the potential feed to the proposed beneficiation plant. The tonnage and grade of the rocky saprolite have been estimated from the drill hole intercepts that have been disaggregated into a -2mm and +2mm (rock) fractions which in turn have been weighed and assayed separately. The inclusion of a portion of the rocky saprolite resources in the indicated resource category was studied in detail, this is called the upper rocky saprolite (URS) layer. Only the rock free portion of rocky saprolite is considered as a Resource.The resources in lower gravel-bearing

Criteria	Explanation	
		horizon is defined as the inferred resources. Ore is treated by means of high pressure acid leach technology in the mine, with products as $NI(OH)_2$ and $Co(OH)_2$.The mine department, the processing plant and Metallurgy plan of Ramu nickel project all reach the design capacity at present and the production keeps stable and regular all the way.
Environmental factors or assumptions	• Assumptions made regarding possible waste and process residue disposal options. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider the potential environmental impacts of the mining and processing operation. While at this stage the determination of potential environmental impacts, particularly for a greenfields project, may not always be well advanced, the status of early consideration of these potential environmental impacts should be reported. Where these aspects have not been considered this should be reported with an explanation of the environmental assumptions made.	The natural environment in the mining area is good at present, which maintains the virgin forest. Currently, the ores produced from the mine are processed to be pulp for smelting in BASAMUK smelting plant, the tailings of which are subject to deep sea landfill, greatly reducing the pollution to water sources in mining area. Quarrying results in the reduction of vegetation coverage and serious water and soil loss, then restoration and treatment have been carried out in goaf in the mine by leveling land, covering planting soil and planting in goaf, and the ecological environment in part of goaf has been restored. The household garbage is subject to burying and impermeable treatment, doing no harm to the environment. The pollution and influence of mining on the environment are limited and totally under the controllable range.
Bulk density	• Whether assumed or determined. If assumed, the basis for the assumptions. If determined, the method used, whether wet or dry, the frequency of the measurements, the nature, size and representativeness of the samples.	In the lamination in 2016 productive exploration, 500 pieces (100 pieces per ore bed) were subject to the dry/wet weight/small density tests by calculating the volume of a 1m complete core,

Criteria	Explanation	
	• The bulk density for bulk material must have been measured by methods that adequately account for void spaces (vugs, porosity, etc), moisture and differences between rock and alteration zones within the deposit. • Discuss assumptions for bulk density estimates used in the evaluation process of the different materials.	testing the wet weight of the core, drying the core and testing its dry weight. The gravel over 2mm with weight as that of -2mm ore was removed in the gravel-bearing ore test. The test method of dry/wet weight/small density in the intensive prospecting in 2017 was the same as that in productive exploration in 2016. The result of density test of R2 ore bed in 2016 was significantly higher than the previous result, so the previous data (0.86g/cm^3) was used for the density of R2 ore bed in resources estimation. The density of rock is closely related to a rock type. The bulk density of a rock type is remarkably consistent within the rock type.
Classification	• The basis for the classification of the Mineral Resources into varying confidence categories. • Whether appropriate account has been taken of all relevant factors (ie relative confidence in tonnage/grade estimations, reliability of input data, confidence in continuity of geology and metal values, quality, quantity and distribution of the data). • Whether the result appropriately reflectsthe Competent Person's view of the deposit.	Based on the mineralization characteristics of ore body and the production practice in mine, the grid of 50×50m in drilling exploration was defined as the measured resources, grid of 100×100m as the indicated resources and grid greater than or equal to 200×200m as the inferred resources. All of R2 resources were defined as the inferred resources. Considering that the sample analysis in the productive exploration in 2016 was not subject to QA/QC, the grid of 50×50m in drilling exploration was defined as the indicated resources, and grid greater than or equal to 100×100m as the inferred resources. The Mineral Resources estimate appropriately reflects the view of the Competent Person

Criteria	Explanation	
Audits or reviews.	The results of any audits or reviews of Mineral Resource estimates.	No audits conducted.
Discussion of relative accuracy/ confidence	• Where appropriate a statement of the relative accuracy and confidence level in the Mineral Resource estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors that could affect the relative accuracy and confidence of the estimate. • The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used. • These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	The relative accuracy of the Mineral Resource estimate is reflected in the reporting of the Mineral Resources to a Measured, Indicated and Inferred classification as per the guidelines of the 2012 JORC code. This has been covered in the 'classification' above. The statement relates to global estimates of tonnes and grade. No production data was compared.

Section 4 Estimation and Reporting of Ore Reserves

(Criteria listed in section 1, and where relevant in sections 2 and 3, also apply to this section.)

Criteria	Explanation	
Mineral Resource estimate for conversion to Ore Reserves	• Description of the Mineral Resource estimate used as a basis for the conversion to an Ore Reserve. • Clear statement as to whether the Mineral Resources are reported additional to, or inclusive of, the Ore Reserves.	The resources with purposes conversed to ore reserve are described in detail in Section 1-3 of JORC TABLEE 1. The Mineral Resource estimates referenced above are inclusive of the Ore Reserves.
Site visits	• Comment on any site visits undertaken by the Competent Person and the outcome of those visits. • If no site visits have been undertaken indicate why this is the case.	The competent person Mr. Xiang GAO has not been to mine site. However, due to the mine has put into operation over five years since 2012, and open pit mining was adopted with a conventional turck and excavator operating as well as hydraulic mining within partial area. Mr GAO relied on the understanding and finding during site visiting by Zhang Xueshu on July 1-6, 2017, and considering that the reserve conversion was reasonable to meet the demands of mine generation.
Study status	• The type and level of study undertaken to enable Mineral Resources to be converted to Ore Reserves. • The Code requires that a study to at least Pre-Feasibility Study level has been undertaken to convert Mineral Resources to Ore Reserves. Such studies will have been carried out and will have determined a mine plan that is technically achievable and economically viable, and that material Modifying Factors have been considered.	The feasibility research had done for the Project in 2004. The mine has met the original design capacity since the start of production in 2012. The prefeasibility study has done this time based on available economic and technical data. Above production, operation and research have provided relevant parameters for research conversion.

Criteria	Explanation	
Cut-off parameters	• The basis of the cut-off grade(s) or quality parameters applied.	The boundary grade is 0.5%Ni, the eliminating thickness of internal waste is 2m and the minimum minable thickness is 0.5m.
Mining factors or assumptions	• The method and assumptions used as reported in the Pre-Feasibility or Feasibility Study to convert the Mineral Resource to an Ore Reserve (i.e. either by application of appropriate factors by optimisation or by preliminary or detailed design) • The choice, nature and appropriateness of the selected mining method(s) and other mining parameters including associated design issues such as pre-strip, access, etc. •The assumptions made regarding geotechnical parameters (eg pit slopes, stope sizes, etc), grade control and pre-production drilling. • The major assumptions made and Mineral Resource model used for pit and stope optimisation (if appropriate). • The mining dilution factors used. • The mining recovery factors used. • Any minimum mining widths used. • The manner in which Inferred Mineral Resources are utilised in mining studies and the sensitivity of the outcome to their inclusion. • The infrastructure requirements of the selected mining methods.	A plurality of open mining pits are employed in mine production, and quarrying is suitable for the actual production of the mine. Mining surface parameters: Bench height: 5m~10m; Working berm width: 40m~50m; Face angle of working bench: 65°. The stripping ratio is 0.51, the mining loss rate is 5% and the mining dilution rate is 3%. The inferred mineral resources are not used in mining study and are treated as waste. It is a mine that has been put into production in the Project, with infrastructure in good condition.
Metallurgical factors or assumptions	• The metallurgical process proposed and the appropriateness of that process to the style of mineralisation. • Whether the metallurgical process is well-tested technology or novel in nature. • The nature, amount and representativeness of metallurgical test work undertaken, the nature of the metallurgical domaining applied and the corresponding metallurgical recovery factors applied. • Any assumptions or allowances made for deleterious elements.	Through ore washing, concentration and other ore dressing processes, the ore slurry with concentration of 20% is thickened and pumped to the lone-distance ore slurry pipeline transportation system. The slurry pipeline adopts the "low concentration, large pipe diameter centrifugal pump turbulent transportation" process scheme for dredging, namely the centrifugal pump

Criteria	Explanation	
	• The existence of any bulk sample or pilot scale test work and the degree to which such samples are considered representative of the orebody as a whole. • For minerals that are defined by a specification, has the ore reserve estimation been based on the appropriate mineralogy to meet the specifications?	turbulent transportation scheme with inner pipe diameter of 610mm. The nickel recovery rate in the ore slurry is 97.5%, and the cobalt recovery rate is 91.91%. Hydrometallurgy includes high pressure acid leaching, ore slurry neutralization, CCD countercurrent washing, removal of iron and aluminum, nickel cobalt hydroxide precipitates by neutralization, obtaining the intermediate product of nickel cobalt hydroxide, and the tailing are discharged to the deep sea landfilling procedure for treatment upon neutralization. For smelting recovery rate, the nickel is 89%, and the cobalt is 88%. This ore dressing and smelting process has been verified by the 5-year production of ore.
Environmental	• The status of studies of potential environmental impacts of the mining and processing operation. Details of waste rock characterisation and the consideration of potential sites, status of design options considered and, where applicable, the status of approvals for process residue storage and waste dumps should be reported.	In 2015, an environmental independent audit was passed and the OEMP permit approved by the Ministry of Environment of Papua New Guinea was obtained. The Ramu NiCo Project is a hydrometallurgical enterprise. Compared with pyrometallurgical process, the emission of three wastes is relatively small. In particular, the pressurized acid leaching process for treating nickel-bearing laterite ore is called “green process”. In the production process, dust collection systems or exhaust gas scrubbing systems are set at all major pollution points. The concentration of pollutants in the

Criteria	Explanation	
		exhaust gas complies with relevant pollutant discharge standards in China and Papua New Guinea. The tropical marine climate in the region located is also conducive to the dilution and diffusion of atmospheric pollutants. The waste water discharged out from the plant is general production waste water without toxic and harmful substances. It will not cause harm to the environment when discharged into the surface water system or into the deep sea upon pH value is adjusted to 7.5 or so by lime. It will not pollute the environment when the tailings generated in production is directly discharged into the deep sea after neutralizing treatment. Both the mine and smelting plant are far away from residential areas. In addition, the noise in the plant area is up to standard, and the noise will not pollute the surrounding environment. Quarrying is adopted for mining. The mining waste rocks and topsoil are used for backfilling and reclamation is conducted to conserve water and soil.
Infrastructure	• The existence of appropriate infrastructure: availability of land for plant development, power,water,transportation(particularly for bulk commodities),labour,accommodation; or the ease with which the infrastructure can be provided, or accessed.	It is a mine that has been put into production in the Project, with relatively complete basic design.

Criteria	Explanation	
Costs	• The derivation of, or assumptions made, regarding projected capital costs in the study. • The methodology used to estimate operating costs. • Allowances made for the content of deleterious elements. • The source of exchange rates used in the study. • Derivation of transportation charges. • The basis for forecasting or source of treatment and refining charges, penalties for failure to meet specification, etc. • The allowances made for royalties payable, both Government and private.	It is a mine that has been put into production in the Project, which doesn't require additional investment. Refer to the actual production of the mine for operating cost. The mining, processing and metallurgy cost were USD62.58/t dry ore, sell cost was USD8.75/t dry ore, general and administrative cost was USD2.95/t dry ore. No harmful elements. Exchange rate of USD against CNY: 6.8 Refer to the actual conditions of the mine for transportation cost, was about USD35 per tonne of MHP. The royalty of government is 2%. The production tax is calculated as per 0.25% of FOB sales revenue. Other relevant taxes were considered.
Revenue factors	• The derivation of, or assumptions made regarding revenue factors including head grade, metal or commodity price(s) exchange rates, transportation and treatment charges, penalties, net smelter returns, etc. • The derivation of assumptions made of metal or commodity price(s), for the principal metals, minerals and coproducts.	The nickel price is calculated as per USD 12,000/t, and the cobalt price is calculated as per USD 48,501/t. Combining the market sales in 2017, the nickel containing valuation coefficient of nickel cobalt hydroxide is considered as 75%, and the cobalt containing valuation coefficient considered as 68%. The price of NiCo is determined by the prediction of institutions including the World Bank and the sales status of the mine.

Criteria	Explanation	
Market assessment	• The demand, supply and stock situation for the particular commodity, consumption trends and factors likely to affect supply and demand into the future. • A customer and competitor analysis along with the identification of likely market windows for the product. • Price and volume forecasts and the basis for these forecasts. • For industrial minerals the customer specification, testing and acceptance requirements prior to a supply contract.	• Ramu has in place offtake agreements for MHP. MCC relies upon advisory sources when assessing future trends and factors influencing supply and demand. The Ore Reserve estimate has been completed on the basis that all product can be sold. • Ramu is an operating asset and has established relationships with customers and market acceptance for its product. • The Ore Reserve estimate has been completed on the assumption that all product can be sold, based on MCC and advisory forecasts. • MHP from Ramu is an established product.
Economic	• The inputs to the economic analysis to produce the net present value (NPV) in the study, the source and confidence of these economic inputs including estimated inflation, discount rate, etc. • NPV ranges and sensitivity to variations in the significant assumptions and inputs.	•The discount rate adopted for the optimization and economic analysis is 10%, based on MCC corporate forecasts. • NPV shells are utilized to determine the range of pit shells for various revenue factors The mine has reached the designed production capacity The operational costs are continuously improving but are based on the current performance plus production improvements from defined enhancement projects.

Criteria	Explanation	
Social	• The status of agreements with key stakeholders and matters leading to social licence to operate.	• Ramu has undertaken considerable community consultation in association with local, provincial, and federal PNG government communication resulting in a licence to operate under the relevant licences. • Ramu participates in regular community meetings that assist with the communication of mine development, community feedback, and thus the ongoing social licence to operate.
Other	• To the extent relevant, the impact of the following on the project and/or on the estimation and classificationof the Ore Reserves: • Any identified material naturally occurring risks. • The status of material legal agreements and marketing arrangements. • The status of governmental agreements and approvals critical to the viability of the project, such as mineral tenement status, and government and statutory approvals. There must be reasonable grounds to expect that all necessary Government approvals will be received within the time frames anticipated in the Pre-Feasibility or Feasibility study. Highlight and discuss the materiality of any unresolved matter that is dependent on a third party on which extraction of the reserve is contingent.	Legal and marketing agreements associated with the sale of MHP are in place through the off-take agreements. • The Mine Lease is currently in good standing. Ramu is an approved and operating mine and the relevant environmental and mine closure plans are in place. Waste dumping requirements and areas, along with subsea tailings disposal, have been planned, have regulatory approval and are in operation. Future approvals will be required to allow the full extraction of the Ore Reserve.

Criteria	Explanation	
Classification	• The basis for the classification of the Ore Reserves into varying confidence categories. • Whether the result appropriately reflects the Competent Person's view of the deposit. • The proportion of Probable Ore Reserves that have been derived from Measured Mineral Resources (if any).	The Ore Reserve is classified as Proved and Probable in accordance with the 2012 JORC Code, corresponding to the resource classifications of Measured and Indicated. Inferred Mineral Resources were treated as waste in the Ore Reserve estimate.The Ramu project continues to optimize performance. Like all Ore Reserve statements, it contains both risk and opportunities. The Competent Person feels that the statement provides a reasonable balance and is consistent with industry practice and the intent of the 2012 JORC Code. • No Probable Ore Reserves are derived from Measured Mineral Resources.
Audits or reviews	• The results of any audits or reviews of Ore Reserve estimates.	No audits conducted.
Discussion of relative accuracy/ confidence	• Where appropriate a statement of the relative accuracy and confidence level in the Ore Reserve estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the reserve within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors which could affect the relative accuracy and confidence of the estimate. • The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used. • Accuracy and confidence discussions should extend to specific discussions of any applied Modifying Factors that may have a material impact on Ore Reserve viability, or for	The reserves are estimated by referring to the actual production of mine, the result of which is relatively reliable. • The modifying factors that are most critical to the operation are: Nickel and cobalt price. Ore grade Metallurgical recoveries. Production rates and operational costs.

Criteria	Explanation	
	which there are remaining areas of uncertainty at the current study stage. • It is recognised that this may not be possible or appropriate in all circumstances. These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	