

Minerals Availability System

**A Decision Oriented Minerals Reserve/Resource
Classification System**

BuMines OFR 171-84

Minerals Availability Nickel Deposit Abstracts

Bureau of Mines Open File Report 171-84

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The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies or recommendations of the Interior Department's Bureau of Mines or the U.S. Government.

No patentable features are contained in this report.

FOREWORD

This Bureau of Mines open file report on nickel is one of a series of minerals availability commodity deposit abstracts. Nonconfidential information from the Minerals Availability Program data base covering domestic and foreign nickel properties and deposits has been abstracted for use in this report. Abstracts include applicable data on location, published reserves and resources, geology, mine and beneficiation systems, and operational information.

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By W. L. Rice¹

INTRODUCTION

This publication is one of a series based on the Bureau of Mines Minerals Availability System (MAS). It is intended to provide Government personnel and the general public with site-specific information on major identified domestic and foreign nickel properties and deposits. It is a compilation of nonproprietary deposit information abstracted from the MAS data base. Included in the abstracts are locational information, published reserve and resource estimations, geological descriptions, mine and beneficiation systems, and actual or estimated operational parameters.

The Bureau's Minerals Availability System conducts engineering and economic availability appraisals of nonfuel mineral commodities. These appraisals are made after systematic resource and engineering-cost evaluations of site-specific deposits have been conducted and the data entered into the MAS data base. Deposits are chosen for evaluation based on their contribution or potential to significantly contribute to the overall availability of a commodity.

The reserve and resource data presented in this report are from published sources. Minerals Availability System assessments on reserve and resource data often are based on company confidential data supplied by mining firms; this information cannot be presented in non-aggregated form. The published resource/reserve data presented herein may, therefore, not represent the information being utilized in the Bureau's analyses, or may not be the current reserve at a given property. Aggregated domestic and foreign nickel resources currently being used in the Bureau analyses are shown in table 1. Table 2 lists select nickel deposits and properties included in country resource totals expressed in table 1.

Reserve/resource information in this and other MAS reports may differ from estimates from other sources, owing to variations in terminology, changes in data with time, and the source of the estimates. Factors affecting such changes include the number of deposits considered, changes in economic conditions, additional exploration efforts, and depletion of ore due to production. Additional information on MAS appears in Information Circular 8887, "The Bureau of Mines Minerals Availability System: An Update of Information Circular 8654".

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TABLE 1. - Nickel resources by country
(for select deposits as shown on table 2)

Region and country	Number of de- posits and/or properties	In situ ore		Contained nickel 10 ³ t	Recoverable nickel, 10 ³ t
		10 ³ t	Grade, pct		
SULFIDE ORE					
Africa:					
Botswana	1	38,084	1.03	392	171
South Africa	4	1,020,119	.26	2,652	2,086
Zimbabwe	9	700,620	.25	1,728	1,348
Southwest Pacific:					
Australia	7	392,756	.73	2,870	2,104
Philippines	1	1,000	.55	6	4
Europe:					
Finland	2	8,203	.56	46	34
North America:					
Canada	33	1,310,656	1.02	13,368	10,649
United States	9	3,837,326	.19	7,290	4,981
Total or average	67	7,308,764	.39	28,591	21,377
LATERITE ORE					
Africa:					
Other ¹	4	364,000	1.20	4,368	3,755
Southwest Pacific:					
Australia	2	171,540	1.10	1,715	1,565
Indonesia	3	285,827	1.85	5,288	3,944
New Caledonia	13	940,322	1.65	15,515	13,345
Philippines	11	3,131,188	.72	22,669	20,343
Europe:					
Greece	2	230,000	1.10	2,530	1,871
South America:					
Brazil	9	335,587	1.45	4,866	4,203
Other ²	4	152,375	2.20	3,352	3,016
North America:					
United States	4	77,020	.85	655	611
Total or average	52	55,687,859	1.08	61,429	52,653
Grand total or average	119	12,996,623		90,020	74,034

¹Includes India, Ivory Coast, and Madagascar.

²Includes Colombia, Dominican Republic, and Guatemala.

NOTE.--Data may not add to totals shown because of independent rounding.

TABLE 2. - Select nickel deposits and properties
(included in country resource totals in table 1)

Australia..	Agnew Nickel Deposit. Greenvale. Kambalda and St. Ives Nickel Operation. Mount Keith. Ora Banda. Sherlock Bay. Wannaway. Windarra, South Windarra. Wingellina Mine.	Canada--Continued	Soab. Stobie. Strathcona Mine. Texmont. Thompson Mine. Totten Mine. Cerro Matoso. Ure.
Botswana...	Selebi-Phikwe.	Columbia.....	Falcondo Bonao.
Brazil.....	Barro Alto. Jussara. Montes Claros. Morro do Engenho Mine. Morro do Niquel. Niquelandia. Niquelandia (Codemin). San Felix Do Xingu. Sao Joao Do Piaui.	Dominican Republic.	Hitura.
Canada.....	Birchtree Mine. Bowden Lake. Bucko Lake. Clarabelle. Copper Cliff North. Copper Cliff South. Crean Hill Mine. Creighton Mine. Dumont Nickel. Expo Ungava. Falconbridge East. Falconbridge Mine. Fraser Mine. Frood. Garson Mine. Key Lake. Levack. Little Stobie. Lockerby Mine. McCreedy West. Moak Lake Deposit. Mystery Lake. Onaping Mine. Pipe Mine. Pipe Surface Mine. Raglan. Shebandowan Mine.	Finland.....	Kotalahti.
		Guatemala.....	Exmibal.
		Greece.....	Euboia. Hagios Ioannis (Larymna).
		India.....	Sukinda.
		Indonesia.....	Gag Island. Pomalaa. Soroako.
		Ivory Coast.....	Biankouma Region.
		Madagascar.....	Ambatovy-Analamy. Valazoro.
		New Caledonia.....	Goro. Ile Art. Kouaoua. Moneo. Nakety Mine. Nepoui. Ouaco/Lafleur District. Quinne Mine. Poum. Poro. Prony Mine. Tiebaghi. Thio.
		Philippines.....	Acoje Nickel Project. Borongon. Dinagat Deposit. Infanta (Ipilan). Ipilan. Makambal. Mount Kadig. Nonoc. Rio Tuba Mine. Sablayan Deposit. Sta. Cruz Mine Area, Barrios Vil. Soriano Palawan.

TABLE 2. - Select nickel deposits and properties--Continued

Republic of		United States--Continued	
South Africa.....	Der Brochen		Nickel Mountain Mine.
	(Derbroken).		Partridge River Area.
	Impala (operations).		Pine Flat Mountain
	Rustenburg Section.		Deposits.
	Western Platinum		Red Flat.
United States.....	(Marikana).		Yakobi Island.
	Birch Lake Area.	Zimbabwe..	Empress.
	Brady Glacier.		Epoch Nickel Mine.
	Crawford Pond		Hartley.
	Deposit.		Madziwa.
	Dunka River Area.		Musengezi.
	Ely Spruce.		Selukwe.
	Gasquet Laterite.		Shangani.
	Madison Mine.		Trojan Mine.
	Minnamax.		Wedza.

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ORGANIZATION OF DEPOSIT ABSTRACTS

The abstracts have been divided into domestic and foreign sections. Domestic deposits are listed alphabetically by state and county; foreign deposits are listed by country and political subdivision. Within each country or political subdivision, deposits are listed by MAS sequence number¹. The number of domestic deposits is summarized in table 3 and the number of foreign deposits in table 4.

¹The sequence number is a unique 10-digit reference number assigned to each deposit. For domestic deposits, the first three digits designate the state, the next three digits designate the county, and the last four digits designate a number unique to each deposit within that state and county. For foreign deposits, the first three digits designate the nation, the next three digits designate the political subdivision, and the last four digits designate a number unique to each deposit within that nation and political subdivision.

TABLE 3. - State totals of domestic nickel deposits

	<u>Number of deposits</u>		<u>Number of deposits</u>
Alaska	5	Missouri	11
California	5	Montana	3
Maine	1	Oregon	5
Minnesota	5	Washington	3
		Total	38

TABLE 4. - Country totals of foreign nickel deposits

	<u>Number of deposits</u>		<u>Number of deposits</u>
Australia	9	India	1
Botswana	1	Indonesia	3
Brazil	9	Ivory Coast	1
Canada	38	Madagascar	2
Colombia	2	New Caledonia	13
Dominican Republic	1	Philippines	12
Finland	2	Republic of South Africa	4
Greece	2	Upper Volta	1
Guatemala	1	Zimbabwe	6
		Total	108

Each deposit abstract consists of six data sets. These are listed below in the order in which they appear within an abstract.

1. Location and General Deposit Information.
2. Published Reserve and Resource Information.
3. Deposit Historical Information.
4. Geological and Spatial Characteristics of Deposit.
5. Mine and Mill Information.
6. Bibliographic Records.

Each abstract is composed of screened data elements of an individual deposit selected from the MAS data base. Proprietary data elements have been omitted. Mine and mill operational information is included only for nickel deposits that are currently producing or temporarily shut down. Metric units are used throughout the abstract listings.

Two appendices have been included. Appendix A presents an alphabetical listing of abstracts by deposit name. Appendix B presents a listing of abstract data sets, subsets, and data elements that may appear in the abstracts; terms with usage particular to these abstracts are defined in brackets.

DOMESTIC DEPOSITS

ALASKA

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: BRADY GLACIER	SEQUENCE NUMBER: 0021110007
NATION: USA STATE: ALASKA	COUNTY: MT. FAIRWEATHER
TYPE OF OPERATION: UNDERGROUND	CURRENT STATUS: DEVELOPED DEPOSIT
LATITUDE: N 58 DEG 33 MIN 25 SEC	LONGITUDE: W 136 DEG 55 MIN 0 SEC
UTM - ZONE: 8 HEMISPHERE: NORTHERN	NORTHING: 6492100 EASTING: 388477
POINT OF REFERENCE: CLAIM	PRECISION: 100 METERS
ELEVATION: 1,052 METERS	PRECISION: 10 METERS
DATUM: SEA LEVEL	

TYPE OF MINERAL HOLDING: PATENTED: PRIVATE LEASE

ALTERNATE NAMES: NUNATAK

OWNERSHIP	STATUS
NEWMONT EXPLORATION, LTD.	OPERATOR
ROYAL D. ALWORTH, JR.	OWNER
J. C. CAMPBELL, JR.	OWNER
GUILFORD HARTLEY	OWNER
J. G. SELLWOOD	OWNER
H. B. FRYBERGER, JR.	OWNER

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	COPRODUCT
COBALT		COPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED	75,860,000
UNITS	MT ORE
YEAR/DATA	1976

IN SITU GRADE:	ASSAY/FORM	GRADE	UNIT	MINERAL FORM
	NI	0.535	WT-PCT	SULFIDE
	CU	.330	WT-PCT	SULFIDE

RESERVE/RESOURCE REMARKS

SOURCE: FLUOR UTAH, INC. PRELIMINARY ENGINEERING STUDY AND ORDER OF MAGNITUDE ESTIMATE---BRADY GLACIER PROJECT, DIXON HARBOR, ALASKA. 1974, 74 PP.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

ORE-MINERAL NOT IN PLACE

YEAR OF DISCOVERY: 1958

-----EXPLORATION METHODS-----

CORE DRILLING/GEOLOGICAL INFERENCE

SURFACE GEOLOGIC MAPPING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STOCKWORK

MODE OF ORIGIN: MAGMATIC DIFFERENTIATION

SHAPE OF ORE BODY: PIPELIKE

CONTROLLING FEATURES: IGNEOUS

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 120

MINIMUM DEPTH/METERS: 0

STRIKE/DIP: N30W:30E

AVERAGE LENGTH/METERS: 229

AVERAGE WIDTH/METERS: 229

AVERAGE THICKNESS/METERS: 518

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 120

LITHOLOGY:

NAME OF FORMATION: CRILLON-LAPEROUSE STOCK

GEOLOGIC AGE: MESOZOIC

DEFORMATION DESCRIPTION: INTRUSION: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION

GEOLOGIC AGE:

ROCK TYPE:

GABBRO IS ORE: GANGUE

PERIDOTITE IS ORE: GANGUE

DIORITE IS ORE: GANGUE

APLITE IS ORE: GANGUE

DUNITE GANGUE

SCHIST ENCLOSURES ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PICOTITE	MESOZOIC	OXIDES (EXCLUDING SiO ₂)
PYROXENE	MESOZOIC	SILICATES
OLIVINE	MESOZOIC	SILICATES
EPIDOTE	MESOZOIC	SILICATES
FORSTERITE	MESOZOIC	SILICATES
ENSTATITE	MESOZOIC	SILICATES
AUGITE	MESOZOIC	SILICATES
SERPENTINE	MESOZOIC	SILICATES
CHALCOPYRITE	MESOZOIC	SULFIDES
PYRRHOTITE	MESOZOIC	SULFIDES
PENTLANDITE	MESOZOIC	SULFIDES
CHALCOPYRITE	MESOZOIC	SULFIDES
QUARTZ	MESOZOIC	FORMS OF SiO ₂

MINERALIZATION:

MINERAL NAME
PLAGIOCLASE
BIOTITE
TREMOLITE

MINERAL CLASS

SILICATES
SILICATES
SILICATES

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BOLDT, J. R., JR. THE WINNING OF NICKEL. D. VAN NOSTRAND CO., PRINCETON, NJ, 1967, 487 PP.

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U.S. SENATE. STATEMENTS BY SENATOR TED STEVENS ON BRADY GLACIER NICKEL DEPOSIT. CONGR. REC., V. 122, NO. 12, FEB. 3, 1976, PP. 1112-1113.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: FUNTER BAY

SEQUENCE NUMBER: 0021120072

NATION: USA STATE: ALASKA

COUNTY: JUNEAU

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: DEVELOPED DEPOSIT

LATITUDE: N 58 DEG 13 MIN 55 SEC

LONGITUDE: W 134 DEG 51 MIN 21 SEC

UTM - ZONE: 8 HEMISPHERE: NORTHERN

NORTHING: 6454332 EASTING: 508466

POINT-OF REFERENCE: ORE BODY

PRECISION: 100 METERS

ELEVATION: 518 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: LOCATED CLAIM: PATENTED

ALTERNATE NAMES: FUNTER BAY NICKEL
ADMIRALTY ALASKA GOLD

OWNERSHIP

ADMIRALTY-ALASKA GOLD MINING COMPANY

STATUS

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

COPRODUCT

COBALT

SULFIDE

COPRODUCT

GOLD

LODE

RECOVERABLE

LEAD

SULFIDE

ZINC

SULFIDE

PUBLISHED RESERVE/RESOURCE INFORMATION

INFERRED 532,000

UNITS MT ORE

YEAR/DATA 1946

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

MINERAL FORM

NI

0.46

WT-PCT

SULFIDE

Cu

0.41

WT-PCT

SULFIDE

CO

0.07

WT-PCT

SULFIDE

RESERVE/RESOURCE - REMARKS

SOURCE: HOLT, S. P., AND J. M. MOSS. A NICKEL-COPPER-COBALT DEPOSIT AT FUNTER BAY, ADMIRALTY ISLAND, ALASKA. BUMINES INTERNAL REP., 1946, 2 PP; AVAILABLE FOR CONSULTATION DURING WORKING HOURS ONLY AT THE BUMINES LIBRARY, JUNEAU, AK.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	TEST DRIFT/CROSSCUT/TEST SHAFT/TEST ADIT/
YEAR OF DISCOVERY: 1886	CORE DRILLING/BEDROCK SAMPLING/
YEAR OF INITIAL PRODUCTION: 1895	SURFACE GEOLOGIC MAPPING
YEAR OF FINAL PRODUCTION: 1939	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: PIPELIKE
CONTROLLING FEATURES: OTHER
WALL ROCK ALTERATION: OTHER
DEGREE OF ALTERATION: SLIGHT

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 50	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N10E: 30E	
AVERAGE LENGTH/METERS: 274	AVERAGE WIDTH/METERS: 30
AVERAGE THICKNESS/METERS: 20	

UNCONSOLIDATED MATERIAL:
AVERAGE THICKNESS/METERS: 2

LITHOLOGY:
NAME OF FORMATION: UNNAMED IGNEOUS GEOLOGIC AGE: PERMIAN
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
ROCK TYPE:
GABBRO IS ORE: ENCLOSES ORE

LITHOLOGY:
NAME OF FORMATION: UNNAMED METAMORPHIC GEOLOGIC AGE: PALEOZOIC
DEFORMATION DESCRIPTION: FOLDING :FAULTING: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION
ROCK TYPE:
SCHIST NEAR ORE: LIES ALONG ORE
SLATE NEAR ORE: LIES ALONG ORE
PHYLLITE NEAR ORE: LIES ALONG ORE
HORNFELS NEAR ORE: LIES ALONG ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
OLIVINE	PERMIAN	SILICATES	VARIABLE
PYRRHOTITE	PERMIAN	SULFIDES	VARIABLE
LABRADORITE	PERMIAN	SILICATES	VARIABLE
HORNBLende	PERMIAN	SILICATES	VARIABLE
PENTLANDITE	PERMIAN	SULFIDES	VARIABLE
CHALCOPYRITE	PERMIAN	SULFIDES	VARIABLE
BIOTITE	PERMIAN	SILICATES	VARIABLE
SERPENTINE	PERMIAN	SILICATES	VARIABLE
CHLORITE	PERMIAN	SILICATES	VARIABLE
MAGNETITE	PERMIAN	OXIDES (EXCLUDING SiO2)	VARIABLE
AUGITE	PERMIAN	SILICATES	VARIABLE
PYRITE	PERMIAN	SULFIDES	VARIABLE
HYPERSTHENE	PERMIAN	SILICATES	VARIABLE
TALC	PERMIAN	SILICATES	VARIABLE
ANTHOPHYLLITE	PERMIAN	SILICATES	VARIABLE
CALCITE	PERMIAN	CARBONATES	VARIABLE
PLAGIOCLASE	PERMIAN	SILICATES	VARIABLE
AUGITE	PERMIAN	SILICATES	VARIABLE
HORNBLende	PERMIAN	SILICATES	VARIABLE
MAGNETITE	PERMIAN	OXIDES (EXCLUDING SiO2)	VARIABLE
BIOTITE	PERMIAN	SILICATES	VARIABLE
CHLORITE	PERMIAN	SILICATES	VARIABLE
QUARTZ	PALEOZOIC	FORMS OF SiO2	VARIABLE
SERICITE	PALEOZOIC	SILICATES	VARIABLE
BIOTITE	PALEOZOIC	SILICATES	VARIABLE
ORTHOCLASE	PALEOZOIC	SILICATES	VARIABLE
CORDIERITE	PALEOZOIC	SILICATES	VARIABLE
GRAPHITE	PALEOZOIC	NATIVE ELEMENT	VARIABLE
PYRRHOTITE	PALEOZOIC	SULFIDES	VARIABLE
PYRITE	PALEOZOIC	SULFIDES	VARIABLE

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: YAKOBI ISLAND SEQUENCE NUMBER: 0021140017

NATION: USA STATE: ALASKA COUNTY: SITKA
TYPE OF OPERATION: SURFACE CURRENT STATUS: DEVELOPED DEPOSIT
LATITUDE: N 57 DEG 58 MIN 40 SEC LONGITUDE: W 136 DEG 25 MIN 25 SEC
UTM - ZONE: 8 HEMISPHERE: NORTHERN NORTHING: 6426912 EASTING: 415799
POINT OF REFERENCE: MAIN ENTRY PRECISION: 1 KILOMETER(S)
ELEVATION: 275 METERS PRECISION: 100 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: LOCATED CLAIM

ALTERNATE NAMES: BOHEMIA BASIN
 SIDE HILL
 MAYFLOWER CLAIMS
 SOUTH TAKANIS
 TUNNEL
 PORTIA CLAIMS
 NORTH MUSKEG
 EAST TRIPOD
 SOUTH MUSKEG
 WEST TRIPOD

OWNERSHIP		STATUS
INSPIRATION DEVELOPMENT COMPANY		OWNER-OPERATOR
COMMODITY	MODIFIER	MARKETABILITY
COPPER	SULFIDE	COPRODUCT
NICKEL	SULFIDE	COPRODUCT
COBALT	SULFIDE	BYPRODUCT
PLATINUM GROUP		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 21,860,000
UNITS MT ORE
YEAR/DATA 1978

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT	MINERAL FORM
CU	0.18	WT PCT	SULFIDE
NI	0.31	WT PCT	SULFIDE
CO	0.04	WT PCT	SULFIDE

RESERVE/RESOURCE REMARKS

SOURCE: INSPIRATION DEVELOPMENT COMPANY, PHOENIX, ARIZONA. FACT SHEET
RELEASE, MAR. 1978, 2 P.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	TEST ADIT/TEST PIT/SURFACE GEOLOGIC MAPPING/
YEAR OF DISCOVERY: 1921	GEOLOGICAL INFERENCE/CORE DRILLING/TRENCHING/
	MAGNETIC SURVEY

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STOCKWORK
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: MASSIVE
CONTROLLING FEATURES: IGNEOUS

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 5	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: S60W: 45N	
AVERAGE LENGTH/METERS: 375	AVERAGE WIDTH/METERS: 250
AVERAGE THICKNESS/METERS: 150	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 5

LITHOLOGY:

NAME OF FORMATION: UNNAMED DIORITE GROUP GEOLOGIC AGE: MESOZOIC
DEFORMATION DESCRIPTION: INTRUSION: METAMORPHISM
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
ROCK TYPE:
 GABBRO IS ORE
 GABBRO GANGUE
 DIORITE GANGUE
 QUARTZ DIORITE GANGUE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	TERTIARY	SULFIDES
PENTLANDITE	TERTIARY	SULFIDES
CHALCOPYRITE	TERTIARY	SULFIDES
MAGNETITE	TERTIARY	OXIDES (EXCLUDING SiO2)

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MIRROR HARBOR SEQUENCE NUMBER: 0021140068

NATION: USA STATE: ALASKA COUNTY: SITKA
TYPE OF OPERATION: SURFACE CURRENT STATUS: DEVELOPED DEPOSIT
LATITUDE: N 57 DEG 47 MIN 7 SEC LONGITUDE: W 136 DEG 18 MIN 25 SEC
UTM - ZONE: 8 HEMISPHERE: NORTHERN NORTHING: 6405343 EASTING: 422285
POINT OF REFERENCE: ORE BODY PRECISION: 100 METERS
ELEVATION: 20 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL
TYPE OF MINERAL HOLDING: LOCATED CLAIM

ALTERNATE NAMES: S. H. P. VEVELSTAD
JUNEAU SEA LEVEL COPPER MINES
ALASKA NICKEL MINES
ALASKA TRUST
FLEMING ISLAND
DAVISON BAY
ILENE CLAIMS

OWNERSHIP		STATUS
INSPIRATION DEVELOPMENT COMPANY		OWNER-OPERATOR
COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	COPRODUCT
COBALT		COPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INFERRED 892,500
UNITS MT ORE
YEAR/DATA 1944

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT	MINERAL FORM
NI	0.2	WT-PCT	SULFIDE
CU	0.1	WT-PCT	SULFIDE

RESERVE/RESOURCE REMARKS

SOURCE: U.S. BUREAU OF MINES. MIRROR HARBOR, CHICHAGOF ISLAND, ALASKA.
WAR MINERALS REP. WMR 333, JAN. 1945, 9 PP.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	TEST SHAFT/TEST DRIFT/CROSSCUT/TRENCHING/
YEAR OF DISCOVERY: 1911	SUBSURFACE GEOLOGIC MAPPING/CORE DRILLING/ GEOLOGICAL INFERENCE

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: IGNEOUS: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 10	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N20W: 10W	
AVERAGE LENGTH/METERS: 244	AVERAGE WIDTH/METERS: 52
AVERAGE THICKNESS/METERS: 24	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 1

LITHOLOGY:

NAME OF FORMATION: UNNAMED MAFIC INTRUSIVE
GEOLOGIC AGE: CRETACEOUS
DEFORMATION DESCRIPTION: FAULTING: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
ROCK TYPE:
GABBRO ENCLOSURES ORE: NEAR ORE
DIORITE NEAR ORE

LITHOLOGY:

NAME OF FORMATION: UNNAMED METAMORPHICS GEOLOGIC AGE: CRETACEOUS
DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING: INTRUSION: METAMORPHISM
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
ROCK TYPE:
SCHIST NEAR ORE
GREENSTONE NEAR ORE

MINERALIZATION:

MINERAL NAME	MINERAL CLASS	GRAIN SIZE
PYRRHOTITE	SULFIDES	VARIABLE
PENTLANDITE	SULFIDES	VARIABLE
CHALCOPYRITE	SULFIDES	VARIABLE
AMPHIBOLE	SILICATES	VARIABLE
PYROXENE	SILICATES	VARIABLE
PLAGIOCLASE	SILICATES	VARIABLE

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: SNIPE BAY

SEQUENCE NUMBER: 0021160025

NATION: USA STATE: ALASKA
TYPE OF OPERATION: SURFACE-UNDERGROUND
LATITUDE: N 56 DEG 25 MIN 25 SEC
UTM - ZONE: 8 HEMISPHERE: NORTHERN
POINT OF REFERENCE: ORE BODY
ELEVATION: 145 METERS
DATUM: SEA LEVEL

COUNTY: PORT ALEXANDER
CURRENT STATUS: DEVELOPED DEPOSIT
LONGITUDE: W 134 DEG 57 MIN 17 SEC
NORTHING: 6253015 EASTING: 502793
PRECISION: 100 METERS
PRECISION: 10 METERS

TYPE OF MINERAL HOLDING: LOCATED CLAIM

ALTERNATE NAMES: SNIPE 899, 900, 976, 998, 1000
SNIPE 1096-1100
BARANOF TRUST
SNIPE BAY LODGE
SNIPE BAY NICKEL-COPPER
INSPIRATION DEVELOPMENT COMPANY
VEVELSTAD

OWNERSHIP
ROBERT M. JOHNSON

STATUS
OWNER-OPERATOR

COMMODITY
NICKEL
COPPER

MODIFIER
SULFIDE
SULFIDE

MARKETABILITY
PRIMARY
COPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INFERRED 390,000
UNITS MT ORE
YEAR/DATA 1942

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT	MINERAL FORM
NI	0.3	WT-PCT	SULFIDE
CU	0.3	WT-PCT	SULFIDE

RESERVE/RESOURCE - REMARKS

SOURCE: REED, J. C., AND G. D. GATES. NICKEL-COPPER DEPOSIT AT SNIPE BAY, BARANOF ISLAND, ALASKA. U.S. GEOL. SURV. BULL. 936-M, 1942, PP. 321-328.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:
ORE-MINERAL IN PLACE
YEAR OF DISCOVERY: 1953

-----EXPLORATION METHODS-----
GEOLOGICAL MAPPING/TRENCHING/TEST PIT/
GEOLOGICAL INFERENCE/BEDROCK SAMPLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: TABULAR: IRREGULAR
CONTROLLING FEATURES: IGNEOUS: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 0	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N10W: 90	
AVERAGE LENGTH/METERS: 76	AVERAGE WIDTH/METERS: 27
AVERAGE THICKNESS/METERS: 59	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 1

LITHOLOGY:

NAME OF FORMATION: UNNAMED INTRUSIVE
GEOLOGIC AGE: JURASSIC
DEFORMATION DESCRIPTION: METAMORPHISM: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
ROCK TYPE:
MAFIC IGNEOUS IS ORE
AMPHIBOLITE IS ORE

LITHOLOGY:

NAME OF FORMATION: SITKA GRAYWACKE
GEOLOGIC AGE: JURASSIC
DEFORMATION DESCRIPTION: METAMORPHISM: INTRUSION: MAJOR FAULTING: FAULTING
ROCK TYPE:
QUARTZITE NEAR ORE
SCHIST NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
CHALCOPYRITE	JURASSIC	SULFIDES	VARIABLE
PYRRHOTITE	JURASSIC	SULFIDES	VARIABLE
PENTLANDITE	JURASSIC	SULFIDES	VARIABLE
PYRITE	JURASSIC	SULFIDES	VARIABLE
MAGNETITE	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
HORNBLende	JURASSIC	SILICATES	VARIABLE
ALABANITE	JURASSIC	SILICATES	VARIABLE

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CALIFORNIA

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME:	GASQUET LATERITE	SEQUENCE NUMBER:	0060150008
NATION:	USA	STATE:	CALIFORNIA
COUNTY:	DEL NORTE	TYPE OF OPERATION:	PROSPECT
CURRENT STATUS:	EXPLORED DEPOSIT	LATITUDE:	N 41 DEG 50 MIN 37 SEC
LONGITUDE:	W 124 DEG 0 MIN 51 SEC	UTM - ZONE:	10
HEMISPHERE:	NORTHERN	POINT OF REFERENCE:	ORE BODY
PRECISION:	10 METERS	ELEVATION:	100 METERS
PRECISION:	10 METERS	DATUM:	SEA LEVEL

TYPE OF MINERAL HOLDING: LOCATED CLAIM

OWNERSHIP	STATUS
CALIFORNIA NICKEL CORPORATION	OWNER

COMMODITY	MODIFIER	MARKETABILITY
NICKEL		COPRODUCT
COBALT		COPRODUCT
CHROMIUM	CHROMITE	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED	20,800,000
UNITS	MT ORE
YEAR/DATA	1982

IN SITU GRADE:

ASSAY/FORM	UNIT
NI	WT PCT
CO	WT PCT
MGO	WT PCT
CR ₂ O ₃	WT PCT

RESERVE/RESOURCE REMARKS

SOURCE: MINING MAGAZINE. GASQUET MOUNTAIN - A U.S. NICKEL LATERITE PROJECT.
V. 147, NO. 3, 1982, PP. 170-171.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	DRILLING/TRENCHING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: OXIDATION: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY: FRACTURING

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 0 MINIMUM DEPTH/METERS: 0
AVERAGE THICKNESS/METERS: 6.2

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE
GEOLOGIC AGE: JURASSIC
DEFORMATION DESCRIPTION: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
GEOLOGIC AGE: CRETACEOUS
ROCK TYPE:
 SAXONITE REPLACED BY ORE: ORE IN FRACTURES
 SERPENTINITE REPLACED BY ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
CHALCEDONY	CENOZOIC	FORMS OF SiO ₂	APHANITIC
CHROMITE	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
GARNIERITE	CENOZOIC	SILICATES	VARIABLE
GOETHITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
HEMATITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
MONTMORILLONITE	CENOZOIC	SILICATES	APHANITIC
SERPENTINE	CENOZOIC	SILICATES	VARIABLE
TALC	CENOZOIC	SILICATES	APHANITIC
WAD	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	APHANITIC

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RICE, S. J. NICKEL. IN MINERAL COMMODITIES OF CALIFORNIA. CA DIV. OF MINES BULL. 176, 1957, PP. 391-399.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: PINE FLAT MOUNTAIN DEPOSITS SEQUENCE NUMBER: 0060150082

NATION: USA	STATE: CALIFORNIA	COUNTY: DEL NORTE
TYPE OF OPERATION: PROSPECT		CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 41 DEG 59 MIN 35 SEC		LONGITUDE: W 123 DEG 59 MIN 29 SEC
UTM - ZONE: 10	HEMISPHERE: NORTHERN	NORTHING: 4649266 EASTING: 417883
POINT OF REFERENCE: ORE BODY		PRECISION: 10 METERS
ELEVATION: 762 METERS		PRECISION: 10 METERS
DATUM: SEA LEVEL		

TYPE OF MINERAL HOLDING: LOCATED CLAIM

ALTERNATE NAMES: PINE FLAT BENCH
DIAMOND FLAT

OWNERSHIP
HANNA MINING COMPANY

STATUS
OWNER

COMMODITY	MODIFIER	MARKETABILITY
NICKEL		COPRODUCT
COBALT		COPRODUCT
CHROMIUM	CHROMITE	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

INFERRED 4,000,000
UNITS MT ORE
YEAR/DATA 1956

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	0.88	WT-PCT

RESERVE/RESOURCE - REMARKS

SOURCE: APPLING, R. N., JR. A RECONNAISSANCE OF NICKEL DEPOSITS OF SOUTHWEST OREGON AND NORTHWEST CALIFORNIA. UNPUBL. BUMINES REP., 1956, 23 PP; AVAILABLE FOR CONSULTATION AT BUMINES, WESTERN FIELD OPERATIONS CENTER, SPOKANE, WA.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:
ORE-MINERAL IN PLACE
YEAR OF DISCOVERY: 1950

-----EXPLORATION METHODS-----
GEOLOGICAL INFERENCE/ROTARY DRILLING/AUGER
RECONNAISSANCE SOIL SAMPLING/TEST PIT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE: DISSEMINATED: STOCKWORK
MODE OF ORIGIN: RESIDUAL CONCENTRATION: OXIDATION
SHAPE OF ORE BODY: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY: FRACTURING

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 0	MINIMUM DEPTH/METERS: 0
AVERAGE LENGTH/METERS: 1,620	AVERAGE WIDTH/METERS: 800
AVERAGE THICKNESS/METERS: 3.5	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 0	MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVES
GEOLOGIC AGE: JURASSIC
DEFORMATION DESCRIPTION: MAJOR FAULTING: MINOR FOLDING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION
GEOLOGIC AGE: UPPER CRETACEOUS
ROCK TYPE:
PERIDOTITE LIES UNDER ORE: REPLACED BY ORE
SERPENTINITE LIES UNDER ORE: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
KAOLIN	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
WAD	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
GARNIERITE	CENOZOIC	SILICATES	VARIABLE
CHALCEDONY	CENOZOIC	SILICATES	VARIABLE
CHROMITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
SERPENTINE	CENOZOIC	SILICATES	VARIABLE
TALC	CENOZOIC	SILICATES	VARIABLE
HEMATITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
GOETHITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
CHROMITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
SERPENTINE	CENOZOIC	SILICATES	VARIABLE
TALC	CENOZOIC	SILICATES	VARIABLE

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: LITTLE RATTLESNAKE MOUNTAIN DEPOSIT SEQUENCE NUMBER: 0060150178

NATION: USA	STATE: CALIFORNIA	COUNTY: DEL NORTE
TYPE OF OPERATION: PROSPECT		CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 41 DEG 41 MIN 46 SEC		LONGITUDE: W 123 DEG 58 MIN 18 SEC
UTM - ZONE: 10	HEMISPHERE: NORTHERN	NORTHING: 4616279 EASTING: 419145
POINT OF REFERENCE: ORE BODY		PRECISION: 100 METERS
ELEVATION: 862 METERS		PRECISION: 10 METERS
DATUM: SEA LEVEL		

TYPE OF MINERAL HOLDING: LOCATED CLAIM

OWNERSHIP	STATUS
DEL NORTE MINING COMPANY	OWNER

COMMODITY	MODIFIER	MARKETABILITY
NICKEL		COPRODUCT
COBALT		COPRODUCT
CHROMIUM	CHROMITE	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	TRENCHING/AUGER
YEAR OF DISCOVERY: 1956	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY: OTHER

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 3	MINIMUM DEPTH/METERS: 1.5

UNCONSOLIDATED MATERIAL:	
AVERAGE THICKNESS/METERS: 0	MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVES

GEOLOGIC AGE: JURASSIC

DEFORMATION DESCRIPTION: MAJOR FAULTING

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

SAXONITE REPLACED BY ORE: LIES UNDER ORE

SERPENTINITE REPLACED BY ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GOETHITE	TERTIARY	OXIDES (EXCLUDING SiO_2)
MONTMORILLONITE	TERTIARY	SILICATES
SERPENTINE	TERTIARY	SILICATES

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SIEMENS, R. E. RECOVERY OF NICKEL AND COBALT FROM LOW-GRADE DOMESTIC LATERITES. BUMINES RI 8027, 1975, 14 PP.

_____. PROCESS FOR THE RECOVERY OF NICKEL, COBALT, AND COPPER FROM DOMESTIC LATERITES. MIN. CONG. J., V. 63, NO. 1, 1977, PP. 29-34.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: LOWER ELK CAMP RIDGE DEPOSIT SEQUENCE NUMBER: 0060150184

NATION: USA	STATE: CALIFORNIA	COUNTY: DEL NORTE
TYPE OF OPERATION: MINERAL LOCATION		CURRENT STATUS: RAW PROSPECT
LATITUDE: N 41 DEG 51 MIN 9 SEC		LONGITUDE: W 123 DEG 56 MIN 3 SEC
UTM - ZONE: 10	HEMISPHERE: NORTHERN	NORTHING: 4633608 EASTING: 422454
POINT OF REFERENCE: ORE BODY		PRECISION: 10 METERS
ELEVATION: 533 METERS		PRECISION: 10 METERS
DATUM: SEA LEVEL		

TYPE OF MINERAL HOLDING: LOCATED CLAIM

ALTERNATE NAMES: RIDGE CLAIMS
GTR NOS. 1-18

OWNERSHIP		STATUS
CALIFORNIA NICKEL CORPORATION		OWNER
COMMODITY	MODIFIER	MARKETABILITY
NICKEL		COPRODUCT
COBALT		COPRODUCT
CHROMIUM	CHROMITE	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOLOGICAL INFERENCE	TRENCHING/AUGER/AERIAL COLOR PHOTOGRAPHY
	SURFACE GEOLOGIC MAPPING/SEISMIC SURVEY

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 0.45	MINIMUM DEPTH/METERS: 0.15

UNCONSOLIDATED MATERIAL:	
AVERAGE THICKNESS/METERS: 0.45	MINIMUM THICKNESS/METERS: 915

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVES

GEOLOGIC AGE: JURASSIC

DEFORMATION DESCRIPTION: MAJOR FAULTING: METAMORPHISM

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

SAXONITE

REPLACED BY ORE: LIES UNDER ORE

SERPENTINITE

REPLACED BY ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
CHROMITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)
ENSTATITE	CENOZOIC	SILICATES
OLIVINE	CENOZOIC	SILICATES
GOETHITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)
HEMATITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)
ANTIGORITE	CENOZOIC	SILICATES
CHRYSTILE	CENOZOIC	SILICATES

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ROWE, W. A. GEOLOGY OF THE NICKEL MOUNTAIN MINE, RIDDLE, OREGON. PRES. AT SOC. MIN. ENG.-AIME FALL MEETING, DENVER, CO, SEPT. 1-3, 1976.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: RED MOUNTAIN LATERITE SEQUENCE NUMBER: 0060450137
NATION: USA STATE: CALIFORNIA COUNTY: MENDOCINO
TYPE OF OPERATION: PROSPECT CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 39 DEG 54 MIN 36 SEC LONGITUDE: W 123 DEG 40 MIN 12 SEC
UTM - ZONE: 10 HEMISPHERE: NORTHERN NORTHING: 4417773 EASTING: 442732
POINT OF REFERENCE: ORE BODY PRECISION: 1 KILOMETER
ELEVATION: 1,243 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: LOCATED CLAIM: PRIVATE LEASE: FEE OWNERSHIP

ALTERNATE NAMES: LITTLE RED MOUNTAIN NICKEL LATERITE
RED MOUNTAIN NICKEL LATERITE

OWNERSHIP		STATUS
HANNA MINING COMPANY		OWNER
COMMODITY	MODIFIER	MARKETABILITY
NICKEL		COPRODUCT
COBALT		COPRODUCT
CHROMIUM	CHROMITE	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	SURFACE GEOLOGIC MAPPING/CHURN DRILLING
YEAR OF DISCOVERY: 1955	CORE DRILLING/AUGER/TRENCHING/AUGER
	AERIAL COLOR PHOTOGRAPHY

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: OXIDATION: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: IRREGULAR: OTHER
CONTROLLING FEATURES: LITHOLOGY: OTHER

MINERALIZED ZONE:
AVERAGE DEPTH/METERS: 0.5 MINIMUM DEPTH/METERS: 0.3

UNCONSOLIDATED MATERIAL:
AVERAGE THICKNESS/METERS: 0.5

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVES

GEOLOGIC AGE: JURASSIC

DEFORMATION DESCRIPTION: INTRUSION: METAMORPHISM: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

SAXONITE

REPLACED BY ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GOETHITE	TERTIARY	OXIDES (EXCLUDING SiO_2)	APHANITIC
MONTMORILLONITE	TERTIARY	SILICATES	APHANITIC

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SIEMENS, R. E. RECOVERY OF NICKEL AND COBALT FROM LOW-GRADE DOMESTIC LATERITES. BUMINES RI 8027, 1975, 14 PP.

_____. PROCESS FOR THE RECOVERY OF NICKEL, COBALT, AND COPPER FROM DOMESTIC LATERITES. MIN. CONG. J., V. 63, NO. 1, 1977, PP. 29-34.

MAINELOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: CRAWFORD POND DEPOSIT SEQUENCE NUMBER: 0230130001

NATION: USA STATE: MAINE COUNTY: KNOX
TYPE OF OPERATION: SURFACE CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 44 DEG 9 MIN 50 SEC LONGITUDE: W 69 DEG 14 MIN 30 SEC
UTM - ZONE: 19 HEMISPHERE: NORTHERN NORTHING: 4889887 EASTING: 480677
POINT OF REFERENCE: ORE BODY PRECISION: 1 KILOMETER
ELEVATION: 36 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: FEE OWNERSHIP: PRIVATE LEASE

ALTERNATE NAMES: HARRIMAN PROSPECT
EAST UNION DEPOSIT

OWNERSHIP	STATUS
KNOX MINING CORPORATION (A JOINT VENTURE)	OWNER-OPERATOR
THE HANNA MINING COMPANY	OWNER
BASIC INCORPORATED	OWNER

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	BYPRODUCT
COBALT	SULFIDE	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INFERRED 6,710,000
UNITS MT ORE
YEAR/DATA 1971

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT	MINERAL FORM
CU	0.49	WT-PCT	SULFIDE
NI	0.99	WEIGHT PERCENT	SULFIDE

RESERVE/RESOURCE REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. EXPLORATION ROUND-UP. V. 172,
NO. 5, MAY 1971, P. 122.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	SURFACE GEOLOGIC MAPPING/MAGNETIC SURVEY
YEAR OF DISCOVERY: 1908	ELECTROMAGNETIC SURVEY/RESISTIVITY SURVEY
	CORE DRILLING/INDUCED POLARIZATION

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: IGNEOUS
WALL ROCK ALTERATION: OTHER
DEGREE OF ALTERATION: MODERATE

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 53.3	MINIMUM DEPTH/METERS: 0.0
STRIKE/DIP: N20E	
AVERAGE LENGTH/METERS: 8,500	AVERAGE WIDTH/METERS: 1,250
AVERAGE THICKNESS/METERS: 22.9	

LITHOLOGY:

NAME OF FORMATION: PENOBSCOT FORMATION
GEOLOGIC AGE: CAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION: METAMORPHISM: MINOR FOLDING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
GEOLOGIC AGE: DEVONIAN
ROCK TYPE:
PERIDOTITE ENCLOSURES ORE
SCHIST ENCLOSURES ORE
PEGMATITE GANGUE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
PYRRHOTITE	DEVONIAN	SULFIDES	PHANERITIC-FINE
PENTLANDITE	DEVONIAN	SULFIDES	PHANERITIC-FINE
CHALCOPYRITE	DEVONIAN	SULFIDES	PHANERITIC-FINE
OLIVINE	CAMBRIAN	SILICATES	PHANERITIC-FINE
MILLERITE	DEVONIAN	SULFIDES	PHANERITIC-FINE
GERSDORFFITE	DEVONIAN	SULFIDES	PHANERITIC-FINE
NICCOLITE	DEVONIAN	ARSENIC AND ANTIMONY COMPOUND	PHANERITIC-FINE
COBALTITE	DEVONIAN	SULFIDES	PHANERITIC-FINE
QUARTZ	DEVONIAN	SILICATES	VARIABLE
FELDSPAR	DEVONIAN	SILICATES	VARIABLE
PYROXENE	DEVONIAN	SILICATES	PHANERITIC-MEDIUM
HORNBLende	CAMBRIAN	SILICATES	PHANERITIC-MEDIUM
BIOTITE	CAMBRIAN	SILICATES	PHANERITIC-MEDIUM
GARNET	CAMBRIAN	SILICATES	PHANERITIC-FINE
CHLORITE	DEVONIAN	SILICATES	PHANERITIC-FINE
GRAPHITE	CAMBRIAN	NATIVE ELEMENT	PHANERITIC-FINE
TALC	DEVONIAN	SILICATES	PHANERITIC-FINE

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MINNESOTA

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME:	ELY SPRUCE	SEQUENCE NUMBER:	0270750003
NATION:	USA	STATE:	MINNESOTA
COUNTY:	LAKE		
TYPE OF OPERATION:	SURFACE	CURRENT STATUS:	EXPLORED PROSPECT
LATITUDE:	N 47 DEG 50 MIN 0 SEC	LONGITUDE:	W 91 DEG 41 MIN 0 SEC
UTM - ZONE:	15	HEMISPHERE:	NORTHERN
NORTHING:	5298396	EASTING:	598535
POINT OF REFERENCE:	TRENCH	PRECISION:	100 METERS
ELEVATION:	450 METERS	PRECISION:	10 METERS
DATUM:	SEA LEVEL		

TYPE OF MINERAL HOLDING: PRIVATE LEASE: FEDERAL LEASE: FEE OWNERSHIP

ALTERNATE NAMES: INCO PROSPECT
INCO NORTH LEASE
INCO SPRUCE ROAD
SPRUCE LAKE MINE
SPRUCE MINE SITE
SPRUCE MINE

OWNERSHIP	STATUS	
INTERNATIONAL NICKEL COMPANY	OWNER-OPERATOR	
COMMODITY	MODIFIER	MARKETABILITY
COPPER	SULFIDE	PRIMARY
NICKEL	SULFIDE	COPRODUCT
COBALT	SULFIDE	BYPRODUCT
PLATINUM GROUP	PLATINUM	BYPRODUCT
PLATINUM GROUP	PALLADIUM	BYPRODUCT
GOLD	NATIVE ELEMENT	BYPRODUCT
SILVER	NATIVE ELEMENT	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED	300,000,000
INDICATED	195,000,000
INFERRED	240,000,000
UNITS	MT ORE
YEAR/DATA	1975

IN SITU GRADE:	ASSAY/FORM	GRADE	UNIT	MINERAL FORM
	CU	0.62	WT-PCT	SULFIDE
	NI	.21	WT-PCT	SULFIDE

RESERVE/RESOURCE - REMARKS

SOURCE: NIELSEN, B. V. AND B. H. BURTON. MINERALS AVAILABILITY SYSTEM - NICKEL IN MINNESOTA. FINAL REPORT OF INVESTIGATIONS FOR GRANT. DEP. OF INTERIOR, BU MINES G0144126, 1975, 13 PP.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOPHYSICAL ANOMALY	SURFACE GEOLOGICAL MAPPING
YEAR OF DISCOVERY: 1957	CORE DRILLING/TEST PIT/GEOPHYSICAL

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: REPLACEMENT
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: CONTACT METASOMATIC
SHAPE OF ORE BODY: TABULAR: MASSIVE
CONTROLLING FEATURES: CONTACT ZONE: LITHOLOGY
WALL ROCK ALTERATION: OTHER
DEGREE OF ALTERATION: SLIGHT

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 2	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N35E	
AVERAGE LENGTH/METERS: 1 524	AVERAGE WIDTH/METERS: 600
AVERAGE THICKNESS/METERS: 350	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 2

LITHOLOGY:

NAME OF FORMATION: DULUTH GABBRO/COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
IRON FORMATION LIES UNDER ORE: REPLACED BY ORE
GABBRO IS ORE: ENCLOSES ORE
ANORTHOSITE IS ORE: ENCLOSES ORE
PERIDOTITE LIES UNDER ORE: LIES ALONG ORE
GRANITE LIES UNDER ORE
HORNFELS LIES ALONG ORE: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PYRRHOTITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
TROILITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
COVELLITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
CHALCOCITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
DIGENITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
CUPRITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO2)	PHANERITIC-COARSE
COPPER	PRECAMBRIAN	NATIVE ELEMENT	PHANERITIC-COARSE
BORNITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
SPHALERITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
BRAVOITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
MAGNETITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
ILMENITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE

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VEITH, D. L. HYPOTHETICAL MINE MODELS AND INPUT-OUTPUT REQUIREMENTS FOR COPPER-NICKEL MINING IN MINNESOTA. PRES. AT SOC. MIN. ENG.-AIME FALL MEETING, MINNEAPOLIS, OCT. 22-24, 1980. PREPRINT NO. 80-330, 21 PP.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: BIRCH LAKE AREA SEQUENCE NUMBER: 0270750028

NATION: USA STATE: MINNESOTA COUNTY: LAKE
TYPE OF OPERATION: PROSPECT CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 47 DEG 49 MIN 0 SEC LONGITUDE: W 91 DEG 44 MIN 0 SEC
UTM - ZONE: 15 HEMISPHERE: NORTHERN NORTHING: 5296481 EASTING: 594824
POINT OF REFERENCE: ORE BODY PRECISION: 500 METERS
ELEVATION: 450 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: FEDERAL LEASE: STATE LEASE: PRIVATE LEASE

OWNERSHIP	STATUS
INCO UNITED STATES, INC.	OWNER
THE HANNA MINING COMPANY	OWNER
DUVAL CORPORATION	OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
COPPER	SULFIDE	COPRODUCT
NICKEL	SULFIDE	COPRODUCT
COBALT	SULFIDE	BYPRODUCT
PLATINUM GROUP	PLATINUM	BYPRODUCT
PLATINUM GROUP	PALLADIUM	BYPRODUCT
GOLD	NATIVE ELEMENT	BYPRODUCT
SILVER	NATIVE ELEMENT	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 2,090,000,000
UNITS MT ORE
YEAR/DATA 1980

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT	MINERAL FORM
CU	0.65	WT-PCT	SULFIDE
NI	.20	WT-PCT	SULFIDE

RESERVE/RESOURCE-REMARKS

SOURCE: LISTERUD, W. H., AND D. G. MEINEKE. MINERAL RESOURCES OF A PORTION OF THE DULUTH COMPLEX AND ADJACENT ROCKS IN ST. LOUIS AND LAKE COUNTIES, NORTHEASTERN MINNESOTA. MN DEP. OF NAT. RESOUR. REP. 93, 1977, 73 PP.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOPHYSICAL ANOMALY	SURFACE GEOLOGIC MAPPING/GEOPHYSICAL
YEAR OF DISCOVERY: 1957	CORE DRILLING/BEDROCK SAMPLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: REPLACEMENT
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: CONTACT METASOMATIC
SHAPE OF ORE BODY: TABULAR: MASSIVE
CONTROLLING FEATURES: CONTACT ZONE: LITHOLOGY
WALL ROCK ALTERATION: OTHER
DEGREE OF ALTERATION: SLIGHT

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 150	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N20E: 25E	
AVERAGE LENGTH/METERS: 12,000	AVERAGE WIDTH/METERS: 1,600
AVERAGE THICKNESS/METERS: 100	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 2

LITHOLOGY:

NAME OF FORMATION: DULUTH GABBRO/COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:

IRON FORMATION	LIES UNDER ORE: REPLACED BY ORE
GABBRO	IS ORE: ENCLOSES ORE
ANORTHOSITE	IS ORE: ENCLOSES ORE
PERIDOTITE	LIES UNDER ORE: LIES ALONG ORE
GRANITE	LIES UNDER ORE
HORNFELS	LIES ALONG ORE: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PYRRHOTITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
TROILITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
COVELLITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
CHALCOCITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
DIGENITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
CUPRITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-COARSE
COPPER	PRECAMBRIAN	NATIVE ELEMENT	PHANERITIC-COARSE
BORNITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
SPHALERITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
BRAVOITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
MAGNETITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-COARSE
ILMENITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-COARSE

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: PARTRIDGE RIVER AREA SEQUENCE NUMBER: 0271370003

NATION: USA STATE: MINNESOTA COUNTY: ST LOUIS
TYPE OF OPERATION: PROSPECT CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: N 47 DEG 34 MIN 34 SEC LONGITUDE: W 92 DEG 2 MIN 20 SEC
UTM - ZONE: 15 HEMISPHERE: NORTHERN NORTHING: 5269417 EASTING: 572282
POINT OF REFERENCE: ORE BODY PRECISION: 500 METERS
ELEVATION: 476 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: FEDERAL LEASE: STATE LEASE: PRIVATE LEASE

OWNERSHIP STATUS
AMAX INC. OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
COPPER	SULFIDE	COPRODUCT
NICKEL	SULFIDE	COPRODUCT
COBALT	SULFIDE	BYPRODUCT
PLATINUM GROUP	PLATINUM	BYPRODUCT
PLATINUM GROUP	PALLADIUM	BYPRODUCT
GOLD	NATIVE ELEMENT	BYPRODUCT
SILVER	NATIVE ELEMENT	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 272,000,000
UNITS MT ORE
YEAR/DATA 1980

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT	MINERAL FORM
CU	0.65	WT PCT	SULFIDE
NI	.20	WT PCT	SULFIDE

RESERVE/RESOURCE REMARKS

SOURCE: LISTERUD, W. H., AND D. G. MEINEKE. MINERAL RESOURCES OF A PORTION OF THE DULUTH COMPLEX AND ADJACENT ROCKS IN ST. LOUIS AND LAKE COUNTIES, NORTHEASTERN MINNESOTA. MN DEP. OF NAT. RESOUR. REP. 93, 1977, 73 PP.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD: -----EXPLORATION METHODS-----
GEOPHYSICAL ANOMALY SURFACE GEOLOGIC MAPPING/GEOPHYSICAL
YEAR OF DISCOVERY: 1957 CORE DRILLING/BEDROCK SAMPLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: REPLACEMENT
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: CONTACT METASOMATIC
SHAPE OF ORE BODY: TABULAR: MASSIVE
CONTROLLING FEATURES: CONTACT ZONE: LITHOLOGY
WALL ROCK ALTERATION: OTHER
DEGREE OF ALTERATION: SLIGHT

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 150	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N20E:25E	
AVERAGE LENGTH/METERS: 2,000	AVERAGE WIDTH/METERS: 1,600
AVERAGE THICKNESS/METERS: 100	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 2

LITHOLOGY:

NAME OF FORMATION: DULUTH GABBRO/COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:

IRON FORMATION	LIES UNDER ORE: REPLACED BY ORE
GABBRO	IS ORE: ENCLOSES ORE
ANORTHOSITE	IS ORE: ENCLOSES ORE
PERIDOTITE	LIES UNDER ORE: LIES ALONG ORE
GRANITE	LIES UNDER ORE
HORNFELS	LIES ALONG ORE: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PYRRHOTITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
TROILITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
COVELLITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
CHALCOCITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
DIGENITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
CUPRITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-COARSE
COPPER	PRECAMBRIAN	NATIVE ELEMENT	PHANERITIC-COARSE
BORNITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
SPHALERITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
BRAVOITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
MAGNETITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-COARSE
ILMENITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-COARSE

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: DUNKA RIVER AREA SEQUENCE NUMBER: 0271370004

NATION: USA STATE: MINNESOTA COUNTY: ST. LOUIS
TYPE OF OPERATION: PROSPECT CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 47 DEG 38 MIN 45 SEC LONGITUDE: W 91 DEG 53 MIN 0 SEC
UTM - ZONE: 15 HEMISPHERE: NORTHERN NORTHING: 5277322 EASTING: 583868
POINT OF REFERENCE: ORE BODY PRECISION: 500 METERS
ELEVATION: 488 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: FEDERAL LEASE: STATE LEASE: PRIVATE LEASE

OWNERSHIP STATUS
UNITED STATES STEEL CORPORATION OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
COPPER	SULFIDE	COPRODUCT
NICKEL	SULFIDE	COPRODUCT
COBALT	SULFIDE	BYPRODUCT
PLATINUM GROUP	PLATINUM	BYPRODUCT
PLATINUM GROUP	PALLADIUM	BYPRODUCT
GOLD	NATIVE ELEMENT	BYPRODUCT
SILVER	NATIVE ELEMENT	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

	RECORD 1	RECORD 2
INDICATED	726,000,000	
INFERRED		4,800,000
UNITS	MT ORE	MT ORE
YEAR/DATA	1980	1980

IN SITU GRADE:

RECORD	ASSAY/FORM	GRADE	UNIT	MINERAL FORM
1	CU	0.65	WT-PCT	SULFIDE
	NI	.16	WT-PCT	SULFIDE
2	CU	2.84	WT-PCT	SULFIDE
	NI	.52	WT-PCT	SULFIDE

RESERVE/RESOURCE - REMARKS

SOURCE: STEVENSON, R. J., P. J. KREISMAN, AND N. P. SATHER. MINERAL RESOURCE POTENTIAL, IN REGIONAL COPPER-NICKEL STUDY. MN ENVIRON. QUALITY BOARD, V. 3, CH. 2, 1980, 122 PP.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOPHYSICAL ANOMALY	SURFACE GEOLOGIC MAPPING/GEOPHYSICAL
YEAR OF DISCOVERY: 1957	CORE DRILLING/BEDROCK SAMPLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: REPLACEMENT
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: CONTACT METASOMATIC
SHAPE OF ORE BODY: TABULAR: MASSIVE
CONTROLLING FEATURES: CONTACT ZONE: LITHOLOGY
WALL ROCK ALTERATION: OTHER
DEGREE OF ALTERATION: SLIGHT

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 150	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N20E: 25E	
AVERAGE LENGTH/METERS: 2,000	AVERAGE WIDTH/METERS: 1,600
AVERAGE THICKNESS/METERS: 100	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 2

LITHOLOGY:

NAME OF FORMATION: DULUTH GABBRO/COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

IRON FORMATION	LIES UNDER ORE: REPLACED BY ORE
GABBRO	IS ORE: ENCLOSES ORE
ANORTHOSITE	IS ORE: ENCLOSES ORE
PERIDOTITE	LIES UNDER ORE: LIES ALONG ORE
GRANITE	LIES UNDER ORE
HORNFELS	LIES ALONG ORE: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PYRRHOTITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
TROILITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
COVELLITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
CHALCOCITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
DIGENITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
CUPRITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO2)	PHANERITIC-COARSE
COPPER	PRECAMBRIAN	NATIVE ELEMENT	PHANERITIC-COARSE
BORNITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
SPHALERITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
BRAVOITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
MAGNETITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO2)	PHANERITIC-COARSE
ILMENITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO2)	PHANERITIC-COARSE

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MINNAMAX	SEQUENCE NUMBER: 0271370006
NATION: USA STATE: MINNESOTA	COUNTY: ST. LOUIS
TYPE OF OPERATION: UNDERGROUND	CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 47 DEG 38 MIN 28 SEC	LONGITUDE: W 91 DEG 52 MIN 59 SEC
UTM - ZONE: 15 HEMISPHERE: NORTHERN	NORTHING: 5276797 EASTING: 583897
POINT OF REFERENCE: APPROXIMATE	PRECISION: 100 METERS
ELEVATION: 488 METERS	PRECISION: 10 METERS
DATUM: SEA LEVEL	

TYPE OF MINERAL HOLDING: STATE LEASE: PRIVATE LEASE: FEDERAL LEASE

ALTERNATE NAMES: BABBITT LAKE
MINNAMAX PROJECT SITE

OWNERSHIP		STATUS
BEAR CREEK MINING COMPANY		OWNER
COMMODITY	MODIFIER	MARKETABILITY
COPPER	SULFIDE	PRIMARY
NICKEL	SULFIDE	COPRODUCT
COBALT	SULFIDE	BYPRODUCT
PLATINUM GROUP	PLATINUM	BYPRODUCT
PLATINUM GROUP	PALLADIUM	BYPRODUCT
GOLD	NATIVE ELEMENT	BYPRODUCT
SILVER	NATIVE ELEMENT	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED	100,000,000
INDICATED	50,000,000
INFERRED	70,000,000
UNDETERMINED	360,000,000
UNITS	MT ORE
YEAR/DATE	1974

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT	MINERAL FORM
CU	0.62	WT-PCT	SULFIDE
NI	.21	WT-PCT	SULFIDE

RESERVE/RESOURCE - REMARKS

SOURCE: NIELSEN, B. V., AND B. H. BURTON. MINERALS AVAILABILITY SYSTEM - NICKEL IN MINNESOTA. FINAL REPORT OF INVESTIGATIONS FOR GRANT. DEP. INTERIOR. BUMINES G0144126. 1975. 13 PP.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

ORE-MINERAL IN PLACE
YEAR OF DISCOVERY: 1957

-----EXPLORATION METHODS-----

GEOLOGICAL/GEOPHYSICAL
CORE DRILLING/GEOCHEMICAL

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: REPLACEMENT
MODE OF ORIGIN: CONTACT METASOMATIC: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: TABULAR: MASSIVE
CONTROLLING FEATURES: CONTACT ZONE: LITHOLOGY
WALL ROCK ALTERATION: CARBONITIZATION
DEGREE OF ALTERATION: SLIGHT

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 490	MINIMUM DEPTH/METERS: 430
STRIKE/DIP: N45W: 17E	
AVERAGE LENGTH/METERS: 4,600	AVERAGE WIDTH/METERS: 600
AVERAGE THICKNESS/METERS: 46	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 10

LITHOLOGY:

NAME OF FORMATION: DULUTH GABBRO/COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:

IRON FORMATION	LIES UNDER ORE: :EPLACED BY ORE
GABBRO	IS ORE: ENCLOSSES ORE
ANORTHOSITE	IS ORE: ENCLOSSES ORE
PERIDOTITE	LIES UNDER ORE: LIES ALONG ORE
GRANITE	LIES UNDER ORE
HORNFELS	LIES ALONG ORE: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PYRRHOTITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
TROILITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
COVELLITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
CHALCOCITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
DIGENITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE
CUPRITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO2)	PHANERITIC-COARSE
COPPER	PRECAMBRIAN	NATIVE ELEMENT	PHANERITIC-COARSE
BORNITE	PRECAMBRIAN	SULFIDES	PHANERITIC-COARSE

SPHALERITE
BRAVOITE
MAGNETITE
ILMENITE

PRECAMBRIAN
PRECAMBRIAN
PRECAMBRIAN
PRECAMBRIAN

SULFIDES
SULFIDES
SULFIDES
SULFIDES

PHANERITIC-COARSE
PHANERITIC-COARSE
PHANERITIC-COARSE
PHANERITIC-COARSE

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SCHLUTER, R. B., AND A. B. LANDSTROM. CONTINUOUS PILOT PLANT TESTING CONFIRMS FLOATABILITY OF DULUTH COMPLEX SULFIDES. ENG. AND MIN. J., APR. 1976, V. 177, NO. 4, PP. 80-83.

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MISSOURILOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME:	BUICK MINE	SEQUENCE NUMBER:	0290930007
NATION:	USA	STATE:	MISSOURI
TYPE OF OPERATION:	UNDERGROUND	COUNTY:	IRON
LATITUDE:	N 37 DEG 36 MIN 21 SEC	CURRENT STATUS:	PRODUCER
UTM - ZONE:	15	LONGITUDE:	W 91 DEG 7 MIN 21 SEC
HEMISPHERE:	NORTHERN	NORTHING:	4163535
POINT OF REFERENCE:	MAIN ENTRY	EASTING:	665730
ELEVATION:	427 METERS	PRECISION:	100 METERS
DATUM:	SEA LEVEL	PRECISION:	10 METERS

TYPE OF MINERAL HOLDING: FEDERAL LEASE: FEE OWNERSHIP: MINERALS ONLY

OWNERSHIP	STATUS
AMAX LEAD COMPANY OF MISSOURI	OWNER
HOMESTAKE LEAD COMPANY OF MISSOURI	OWNER
AMAX LEAD COMPANY OF MISSOURI	OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
LEAD	SULFIDE	PRIMARY PRODUCT
ZINC	SULFIDE	BYPRODUCT
COPPER	SULFIDE	BYPRODUCT
CADMIUM	BYPRODUCT	AFFECT MARKETABILITY
SILVER	SULFIDE	BYPRODUCT
NICKEL	SULFIDE	RECOVERABLE
COBALT	SULFIDE	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

	RECORD 1	RECORD 2
INDICATED	47,400000	
INFERRED		43,940,000
UNITS	MT ORE	MT ORE
YEAR/DATA	1979	1980

IN SITU GRADE:

RECORD	ASSAY/FORM	GRADE	UNIT	MINERAL FORM
1	PB	7.0	WT-PCT	SULFIDE
	ZN	1.9	WT-PCT	SULFIDE
2	PB	6.1	WT-PCT	SULFIDE
	ZN	1.6	WT-PCT	SULFIDE

RESERVE/RESOURCE - REMARKS

REC. 1 - AMAX, INC. ANNUAL REPORT - 1965. 1966, P. 2.
REC. 2 - ENGINEERING AND MINING JOURNAL. INTERNATIONAL DIRECTORY OF MINING
AND MINERAL PROCESSING OPERATIONS. 1980, P. 199.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOLOGICAL INFERENCE	SUBSURFACE GEOLOGIC MAPPING/CORE DRILLING
YEAR OF DISCOVERY: 1960	GEOLOGICAL INFERENCE/CHURN DRILLING
YEAR OF INITIAL PRODUCTION: 1969	
YEAR OF FINAL PRODUCTION: PRODUCING	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: BRECCIA FILLING: DISSEMINATED: REPLACEMENT
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY: FRACTURING
WALL ROCK ALTERATION: DOLOMITIZATION: SILICIFICATION: PYRITIZATION
DEGREE OF ALTERATION: MODERATE

UNCONSOLIDATED MATERIAL:
AVERAGE THICKNESS/METERS: 40

LITHOLOGY:
NAME OF FORMATION: BONNETERRE
GEOLOGIC AGE: UPPER CAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PALEOZOIC
ROCK TYPE:
DOLOMITE REPLACED BY ORE: ORE IN FRACTURES
SHALE LIES OVER ORE
SANDSTONE LIES UNDER ORE
CONGLOMERATE LIES UNDER ORE
LIMESTONE NEAR ORE

MINERALIZATION:			
MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GALENA	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
SPHALERITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CHALCOPYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
PYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
MARCASITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
LINNAEITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DOLOMITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
CALCITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
QUARTZ	PALEOZOIC	FORMS OF SiO ₂	PHANERITIC-MEDIUM
BRAVOITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DICKITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM
KAOLINITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM
MILLERITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
BORNITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
ARSENOPYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: ROOM AND PILLAR 10-34

CAPACITY: 6,350

UNITS: MT ORE/DAY

CHARACTERISTIC OF ROCK: ONE SYSTEM OF WEAKNESS PLANES

ROCK AND WATER CONDITIONS: SOFT NONPLASTIC FISSURED, MODERATE WATER

ROCK/MINE SUPPORT: SUPPORTING, BACK MAY SLAB-POST, HEADBOARD, CAPS, ROOF BOLTS

CONDITION OF WORKINGS: OPEN

TOTAL LENGTH OF WORKINGS:

INCLINES - NUMBER: 1

AVERAGE LENGTH: 244 METERS

SLOPE: 8 DEGREES

ADITS - NUMBER: 0

SHAFTS - NUMBER: 2

AVERAGE DEPTH: 418 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: BUICK MINE

LATITUDE: N 37 36 21

LONGITUDE: W 91 07 21

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: CONVEYOR

DISTANCE (KM): 0.1

DESTINATION FACILITY: MILL (ON-SITE)

LOCATION: BUICK MILL

LATITUDE: N 37 36 17

LONGITUDE: W 91 07 20

BENEFICIATION:

METHOD: FLOTATION

-----DESCRIPTION OF MILLING -----

DESIGN CAPACITY: 5,443

ORE/CRUSH/GRIND/FLOAT PB/FLOAT ZN

UNITS: MT ORE/DAY

DEPOSIT PERCENT USED: 100

TOTAL PERCENT USED: 100

TRANSPORTATION FOR PRODUCT: PB CONCENTRATE

ORIGINATING FACILITY: MILL (ON-SITE)

LOCATION: USA MISSOURI

LATITUDE: N 37 36 17

LONGITUDE: W 91 07 20

METHOD OF TRANSPORTATION: RAIL

DISTANCE (KM): 3.5

DESTINATION FACILITY: SMELTER

LOCATION: BUICK SMELTER

LATITUDE: N 37 38 03

LONGITUDE: W 91 07 54

TRANSPORTATION FOR PRODUCT: ZN CONCENTRATE

ORIGINATING FACILITY: MILL (ON-SITE)

LOCATION: USA MISSOURI

LATITUDE: N 37 36 17

LONGITUDE: W 91 07 20

METHOD OF TRANSPORTATION: RAIL

DISTANCE (KM): 200

DESTINATION FACILITY: SMELTER

LOCATION: SAUGET, ILLINOIS

LATITUDE: N 38 37 03

LONGITUDE: W 91 09 03

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MAGMONT MINE

SEQUENCE NUMBER: 0290930008

NATION: USA STATE: MISSOURI

COUNTY: IRON

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: N 37 DEG 38 MIN 21 SEC

LONGITUDE: W 91 DEG 7 MIN 21 SEC

UTM - ZONE: 15 HEMISPHERE: NORTHERN

NORTHING: 4167234 EASTING: 665655

POINT OF REFERENCE: MAIN ENTRY

PRECISION: 100 METERS

ELEVATION: 427 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: FEDERAL LEASE: PRIVATE LEASE: FEE OWNERSHIP

OWNERSHIP

STATUS

COMINCO AMERICAN INCORPORATED

OWNER-OPERATOR

DRESSER MINERALS DIV OF DRESSER INDUSTRIES, INC. OWNER

COMMODITY

MODIFIER

MARKETABILITY

LEAD

SULFIDE

PRIMARY

ZINC

SULFIDE

BYPRODUCT

COPPER

SULFIDE

BYPRODUCT

NICKEL

SULFIDE

RECOVERABLE

CADMIUM

BYPRODUCT

BYPRODUCT

SILVER

SULFIDE

BYPRODUCT

COBALT

SULFIDE

RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

UNDETERMINED 6,349,000

UNITS MT ORE

YEAR/DATA 1980

IN SITU GRADE: NO PUBLISHED IN SITU GRADE AVAILABLE

RESERVE/RESOURCE - REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. INTERNATIONAL DIRECTORY OF MINING AND MINERAL PROCESSING OPERATIONS. 1980, P. 199.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

GEOLOGICAL INFERENCE

YEAR OF DISCOVERY: 1962

YEAR OF INITIAL PRODUCTION: 1968

YEAR OF FINAL PRODUCTION: PRODUCING

-----EXPLORATION METHODS-----

SURFACE GEOLOGIC MAPPING/MAGNETIC SURVEY

GEOLOGICAL INFERENCE/GRAVITATIONAL SURVEY

SUBSURFACE GEOLOGIC MAPPING/CORE DRILLING

AERIAL PHOTOGRAPHY/INDUCED POLARIZATION

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: BRECCIA FILLING: DISSEMINATED: REPLACEMENT
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY: FRACTURING

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 320	MINIMUM DEPTH/METERS: 274
STRIKE/DIP: NOOS	
AVERAGE LENGTH/METERS: 2,816	AVERAGE WIDTH/METERS: 762
AVERAGE THICKNESS/METERS: 32	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 40

LITHOLOGY:

NAME OF FORMATION: BONNETERRE
GEOLOGIC AGE: UPPER CAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PALEOZOIC
ROCK TYPE:
DOLOMITE REPLACED BY ORE: ORE IN FRACTURES
SHALE LIES OVER ORE
SANDSTONE LIES UNDER ORE
CONGLOMERATE LIES UNDER ORE
LIMESTONE NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GALENA	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
SODA NITER	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CHALCOPYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
PYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
MARCASITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
LINNAEITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DOLOMITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
CALCITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
QUARTZ	PALEOZOIC	FORMS OF SiO ₂	PHANERITIC-MEDIUM
BRAVOITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DICKITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM
KADLINITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM
MILLERITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
SPHALERITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: ROOM AND PILLAR

CAPACITY: 3,809

UNITS: MT ORE/DAY

CHARACTERISTIC OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES

ROCK AND WATER CONDITIONS: SOFT NONPLASTIC FISSURED, MODERATE WATER

ROCK/MINE SUPPORT: SUPPORTING, BACK MAY SLAB-POST, HEADBOARD, CAPS, ROOF BOLTS

CONDITION OF WORKINGS: OPEN

TOTAL LENGTH OF WORKINGS: 33,900

SHAFTS - NUMBER: 2

AVERAGE DEPTH: 373 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LATITUDE: N 37 38 21

LONGITUDE: W 91 07 21

PERCENT SHIPPED: 100

DISTANCE (KM): 0

DESTINATION FACILITY: MILL (ON-SITE)

LATITUDE: N 37 38 21

LONGITUDE: W 91 07 21

BENEFICIATION:

METHOD: FLOTATION

DESIGN CAPACITY: 3,809

UNITS: MT ORE/DAY

DEPOSIT PERCENT USED: 100

TOTAL PERCENT USED: 100

-----DESCRIPTION OF MILLING-----

ORE/CRUSH/GRIND/CU-PB BULK FLOAT/

SEPARATE CU AND PB/FLOAT ZN

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: ANNAPOLIS MINE SEQUENCE NUMBER: 0290930011

NATION: USA STATE: MISSOURI COUNTY: IRON
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: PAST PRODUCER
LATITUDE: N 37 DEG 21 MIN 53 SEC LONGITUDE: W 90 DEG 34 MIN 9 SEC
UTM - ZONE: 15 HEMISPHERE: NORTHERN NORTHING: 4137901 EASTING: 715271
POINT OF REFERENCE: MAIN ENTRY PRECISION: 100 METERS
ELEVATION: 195 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: PRIVATE LEASE: FEE OWNERSHIP

OWNERSHIP STATUS
ST. JOE MINERALS CORPORATION OWNER

COMMODITY	MODIFIER	MARKETABILITY
LEAD	SULFIDE	PRIMARY
ZINC	SULFIDE	BYPRODUCT
COPPER	SULFIDE	BYPRODUCT
NICKEL	SULFIDE	RECOVERABLE
COBALT	SULFIDE	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	CORE DRILLING/CHURN DRILLING
YEAR OF DISCOVERY: 1865	PERCUSSION DRILLING/TEST SHAFT
YEAR OF INITIAL PRODUCTION: 1915	TEST DRIFT/CROSSCUT
YEAR OF FINAL PRODUCTION: 1931	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: REPLACEMENT: BRECCIA FILLING
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: LENTICULAR: TABULAR
CONTROLLING FEATURES: LITHOLOGY: CONTACT ZONE
WALL ROCK ALTERATION: DOLOMITIZATION: PYRITIZATION: SILICIFICATION
DEGREE OF ALTERATION: MODERATE

LITHOLOGY:

NAME OF FORMATION: BONNETERRE

GEOLOGIC AGE: UPPER CAMBRIAN

DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION

GEOLOGIC AGE: PALEOZOIC

ROCK TYPE:

DOLOMITE	REPLACED BY ORE: ORE IN FRACTURES
SHALE	LIES OVER ORE
SANDSTONE	LIES UNDER ORE
CONGLOMERATE	LIES UNDER ORE
LIMESTONE	NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GALENA	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
SPHALERITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CHALCOPYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
PYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
MARCASITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
SIEGENITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
MILLERITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
LINNAEITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CALCITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
DOLOMITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
QUARTZ	PALEOZOIC	FORMS OF SiO ₂	PHANERITIC-MEDIUM
DICKITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM
BRAVOITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MADISON MINE

SEQUENCE NUMBER: 0291230004

NATION: USA STATE: MISSOURI
TYPE OF OPERATION: UNDERGROUND
LATITUDE: N 37 DEG 32 MIN 59 SEC
UTM - ZONE: 15 HEMISPHERE: NORTHERN
POINT OF REFERENCE: MAIN ENTRY
ELEVATION: 252 METERS
DATUM: SEA LEVEL

COUNTY: MADISON
CURRENT STATUS: PAST PRODUCER
LONGITUDE: W 90 DEG 16 MIN 20 SEC
NORTHING: 4159150 EASTING: 740978
PRECISION: 500 METERS
PRECISION: 10 METERS

TYPE OF MINERAL HOLDING: PRIVATE LEASE

ALTERNATE NAMES: FREDERICKTOWN MINE

OWNERSHIP
ANSCHUTZ MINING CORPORATION

STATUS
OWNER

COMMODITY	MODIFIER	MARKETABILITY
COBALT	SULFIDE	PRIMARY
NICKEL	SULFIDE	BYPRODUCT
LEAD	SULFIDE	BYPRODUCT
COPPER	SULFIDE	BYPRODUCT
IRON	SULFIDE	AFFECT MARKETABILITY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:
ORE-MINERAL IN PLACE
YEAR OF DISCOVERY: 1847
YEAR OF INITIAL PRODUCTION: 1944
YEAR OF FINAL PRODUCTION: 1961

-----EXPLORATION METHODS-----
GEOLOGICAL INFERENCE/RESISTIVITY SURVEY
CHURN DRILLING/SURFACE GEOLOGIC MAPPING
VERTICAL TEST/SUBSURFACE GEOLOGIC MAPPING
CORE DRILLING/MAGNETIC SURVEY

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: REPLACEMENT: BRECCIA FILLING
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY: CONTACT ZONE
WALL ROCK ALTERATION: DOLOMITIZATION: SILICIFICATION: PYRITIZATION
DEGREE OF ALTERATION: MODERATE

LITHOLOGY:

NAME OF FORMATION: BONNE TERRE
GEOLOGIC AGE: UPPER CAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PALEOZOIC
ROCK TYPE:
DOLOMITE REPLACED BY ORE: ORE IN FRACTURES
SHALE LIES OVER ORE
SANDSTONE LIES UNDER ORE
CONGLOMERATE LIES UNDER ORE
LIMESTONE NEAR ORE

LITHOLOGY:

NAME OF FORMATION:
DEFORMATION DESCRIPTION: INTRUSION: MAJOR FAULTING
ROCK TYPE: QUARTZ LATITE

LITHOLOGY:

NAME OF FORMATION: PORPHYRITIC QUARTZ MONZONITE
GEOLOGIC AGE: OLIGOCENE
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: COMPLEX
GEOLOGIC AGE: OLIGOCENE
ROCK TYPE:
QUARTZ MONZONITE ENCLOSURES ORE: GANGUE

LITHOLOGY:

NAME OF FORMATION: BIOTITE GRANITE PORPHYRY
GEOLOGIC AGE: OLIGOCENE
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
GEOLOGIC AGE: OLIGOCENE
ROCK TYPE:
GRANITE ENCLOSURES ORE: GANGUE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GALENA	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CHALCOPYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
LINNAEITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
PYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
MARCASITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
SPHALERITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CALCITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
DOLOMITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
QUARTZ	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MINE LA MOTTE GROUP SEQUENCE NUMBER: 0291230005

NATION: USA STATE: MISSOURI COUNTY: MADISON

TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: PAST PRODUCER

LATITUDE: N 37 DEG 36 MIN 43 SEC LONGITUDE: W 90 DEG 16 MIN 25 SEC

UTM - ZONE: 15 HEMISPHERE: NORTHERN NORTHING: 4166051 EASTING: 740654

ELEVATION: 260 METERS PRECISION: 10 METERS

DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: PRIVATE LEASE

OWNERSHIP STATUS

ANSCHUTZ MINING CORPORATION OWNER

COMMODITY	MODIFIER	MARKETABILITY
LEAD	SULFIDE	COPRODUCT
ZINC	SULFIDE	COPRODUCT
COPPER	SULFIDE	COPRODUCT
COBALT	SULFIDE	RECOVERABLE
NICKEL	SULFIDE	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	SURFACE GEOLOGIC MAPPING/TEST SHAFT
YEAR OF DISCOVERY: 1820	GEOLOGICAL INFERENCE/CHURN DRILLING
YEAR OF INITIAL PRODUCTION: 1827	TEST DRIFT/CROSSCUT/CORE DRILLING
YEAR OF FINAL PRODUCTION: 1959	SUBSURFACE GEOLOGIC MAPPING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: REPLACEMENT: DISSEMINATED: BRECCIA FILLING

MODE OF ORIGIN: HYDROTHERMAL

SHAPE OF ORE BODY: TABULAR

CONTROLLING FEATURES: LITHOLOGY: CONTACT ZONE

LITHOLOGY:

NAME OF FORMATION: BONNETERRE

GEOLOGIC AGE: UPPER CAMBRIAN

DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION

GEOLOGIC AGE: PALEOZOIC

ROCK TYPE:	
DOLOMITE	REPLACED BY ORE: ORE IN FRACTURES
SHALE	LIES OVER ORE
SANDSTONE	LIES UNDER ORE
CONGLOMERATE	LIES UNDER ORE
LIMESTONE	NEAR ORE

MINERALIZATION:

MINERAL NAME:	AGE	MINERAL CLASS	GRAIN SIZE
GALENA	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CHALCOPYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
LINNAEITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
PYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
MARCASITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
SPHALERITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CALCITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
DOLOMITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
QUARTZ	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM
BRAVOITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
MILLERITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: FLETCHER DIVISION SEQUENCE NUMBER: 0291790003
NATION: USA STATE: MISSOURI COUNTY: REYNOLDS
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: PRODUCER
LATITUDE: N 37 DEG 27 MIN 59 SEC LONGITUDE: W 91 DEG 6 MIN 34 SEC
UTM - ZONE: 15 HEMISPHERE: NORTHERN NORTHING: 4148085 EASTING: 667193
POINT OF REFERENCE: MAIN ENTRY PRECISION: 100 METERS
ELEVATION: 360 METERS PRECISION: 100 METERS

TYPE OF MINERAL HOLDING: FEDERAL LEASE: PRIVATE LEASE

OWNERSHIP STATUS
ST. JOE MINERALS CORPORATION OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
LEAD	SULFIDE	COPRODUCT
ZINC	SULFIDE	COPRODUCT
COPPER	SULFIDE	COPRODUCT
SILVER	SULFIDE	BYPRODUCT
CADMIUM	SULFIDE	BYPRODUCT
NICKEL	SULFIDE	BYPRODUCT
COBALT	SULFIDE	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHOD-----
GEOLOGICAL INFERENCE	SURFACE GEOLOGIC MAPPING/TEST SHAFT/
YEAR OF DISCOVERY: 1958	GEOLOGICAL INFERENCE/CHURN DRILLING/
YEAR OF INITIAL PRODUCTION: 1967	PERCUSSION DRILLING/TEST DRIFT/
YEAR OF FINAL PRODUCTION: PRODUCING	CROSSCUT/SUBSURFACE GEOLOGIC MAPPING/
	CORE DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: REPLACEMENT: BRECCIA FILLING
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY: CONTACT ZONE
WALL ROCK ALTERATION: DOLOMITIZATION: SILICIFICATION: PYRITIZATION
DEGREE OF ALTERATION: MODERATE

MINERALIZED ZONE:

STRIKE/DIP: NOOS

AVERAGE LENGTH/METERS: 8,046

AVERAGE WIDTH/METERS: 300

AVERAGE THICKNESS/METERS: 6

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 46

LITHOLOGY:

NAME OF FORMATION: BONNETERRE

GEOLOGIC AGE: UPPER CAMBRIAN

DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION

GEOLOGIC AGE: PALEOZOIC

ROCK TYPE:

DOLOMITE

REPLACED BY ORE: ORE IN FRACTURES

SHALE

LIES OVER ORE

SANDSTONE

LIES UNDER ORE

CONGLOMERATE

LIES UNDER ORE

LIMESTONE

NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GALENA	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CHALCOPYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
LINNAEITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
PYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
MARCASITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
LINNAEITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DOLOMITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
CALCITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
QUARTZ	PALEOZOIC	FORMS OF SiO ₂	PHANERITIC-MEDIUM
BORNITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
COVELLITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CHALCOCITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DIGENITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
GERSDORFFITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
TENNANTITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DICKITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM
KAOLINITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM
BRAVOITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: ROOM AND PILLAR

CAPACITY: 4,535

UNITS: MT ORE/DAY

CHARACTERISTIC OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES

ROCK AND WATER CONDITIONS: SOFT NONPLASTIC FISSURED, MODERATE WATER

ROCK/MINE SUPPORT: SUPPORTING, BACK MAY SLAB-POST, HEADBOARD, CAPS, ROOF BOLTS

CONDITION OF WORKINGS: OPEN

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LATITUDE: N 37 27 59

PERCENT SHIPPED: 100

DESTINATION FACILITY: MILL (ON-SITE)

LATITUDE: N 37 27 59

LONGITUDE: W 91 06 34

DISTANCE (KM): 0

LONGITUDE: W 91 06 34

BENEFICIATION:

METHOD: FLOTATION

DESIGN CAPACITY: 4,535

UNITS: MT ORE/DAY

DEPOSIT PERCENT USED: 100

TOTAL PERCENT USED: 100

-----DESCRIPTION OF MILLING-----

ORE/CRUSH/GRIND/CU AND PB BULK FLOAT/

SEPARATE CU AND PB/FLOAT ZN

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: BRUSHY CREEK DIVISION SEQUENCE NUMBER: 0291790005

NATION: USA STATE: MISSOURI COUNTY: REYNOLDS
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: PRODUCER
LATITUDE: N 37 DEG 32 MIN 18 SEC LONGITUDE: W 91 DEG 7 MIN 44 SEC
UTM - ZONE: 15 HEMISPHERE: NORTHERN NORTHING: 4156034 EASTING: 665315
POINT OF REFERENCE: MAIN ENTRY PRECISION: 100 METERS
ELEVATION: 375 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: FEDERAL LEASE: PRIVATE LEASE

OWNERSHIP STATUS
ST. JOE MINERALS CORPORATION OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
LEAD	SULFIDE	PRIMARY
ZINC	SULFIDE	BYPRODUCT
COPPER	SULFIDE	BYPRODUCT
SILVER	SULFIDE	BYPRODUCT
CADMIUM	SULFIDE	AFFECT MARKETABILITY
NICKEL	SULFIDE	RECOVERABLE
COBALT	SULFIDE	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOLOGICAL INFERENCE	SURFACE GEOLOGIC MAPPING/TEST SHAFT/
YEAR OF DISCOVERY: 1959	GEOLOGICAL INFERENCE/CHURN DRILLING/
YEAR OF INITIAL PRODUCTION: 1973	PERCUSSION DRILLING/TEST DRIFT/
YEAR OF FINAL PRODUCTION: PRODUCING	CROSSCUT/SUBSURFACE GEOLOGIC MAPPING/
	CORE DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: BRECCIA FILLING: DISSEMINATED: REPLACEMENT
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY: CONTACT ZONE
WALL ROCK ALTERATION: DOLOMITIZATION: SILICIFICATION: PYRITIZATION
DEGREE OF ALTERATION: MODERATE

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 305	MINIMUM DEPTH/METERS: 228
STRIKE/DIP: N00S	
AVERAGE LENGTH/METERS: 8,080	AVERAGE WIDTH/METERS: 180
AVERAGE THICKNESS/METERS: 11	

LITHOLOGY:

NAME OF FORMATION: BONNE TERRE
GEOLOGIC AGE: UPPER CAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PALEOZOIC
ROCK TYPE:
DOLOMITE REPLACED BY ORE: ORE IN FRACTURES
SHALE LIES OVER ORE
SANDSTONE LIES UNDER ORE
CONGLOMERATE LIES UNDER ORE
LIMESTONE NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GALENA	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
SPHALERITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CHALCOPYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
PYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
MARCASITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
LINNAEITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DOLOMITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
CALCITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
QUARTZ	PALEOZOIC	FORMS OF SiO ₂	PHANERITIC-MEDIUM
BRAVOITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DICKITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM
KAOLINITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM

MINE/MILL INFORMATION**UNDERGROUND MINING:**

METHOD: ROOM AND PILLAR
CAPACITY: 4,535 UNITS: MT ORE/DAY
CHARACTERISTICS OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES
ROCK AND WATER CONDITIONS: SOFT NONPLASTIC FISSURED, MODERATE WATER
ROCK/MINE SUPPORT: SUPPORTING, BACK MAY SLAB-POST, HEADBOARD, CAPS, ROOF BOLTS
CONDITION OF WORKINGS: OPEN
TOTAL LENGTH OF WORKINGS:
SHAFTS - NUMBER: 2 AVERAGE DEPTH: 378 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: MISSOURI, USA
LATITUDE: N 37 32 18	LONGITUDE: W 91 07 44
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: CONVEYOR	DISTANCE (KM): 0
DESTINATION FACILITY: MILL (ON-SITE)	LOCATION: MISSOURI, USA
LATITUDE: N 37 32 18	LONGITUDE: W 91 07 44

BENEFICIATION:

METHOD: FLOTATION
DESIGN CAPACITY: 4,535
UNITS: MT ORE/DAY
DEPOSIT PERCENT USED: 100
TOTAL PERCENT USED: 100

-----DESCRIPTION OF MILLING-----
ORE UNDERGROUND CRUSHING/
SURFACE SECONDARY CRUSHING/
1ST FLOAT CU-PB-DEPRESS ZN/
2ND FLOAT ZN FROM TAILING/
3RD REFLOAT 1ST CONC/FLOAT CU/DEPRESS PB

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: WEST FORK DEPOSIT SEQUENCE NUMBER: 0291790006

NATION: USA STATE: MISSOURI COUNTY: REYNOLDS
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: N 37 DEG 29 MIN 33 SEC LONGITUDE: W 91 DEG 6 MIN 32 SEC
UTM - ZONE: 15 HEMISPHERE: NORTHERN NORTHING: 4150984 EASTING: 667185
POINT OF REFERENCE: ORE BODY PRECISION: 500 METERS
ELEVATION: 300 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: FEDERAL LEASE: PRIVATE LEASE

ALTERNATE NAMES STATUS
ASARCO PROPERTY OWNER

COMMODITY	MODIFIER	MARKETABILITY
LEAD	SULFIDE	PRIMARY
ZINC	SULFIDE	BYPRODUCT
COPPER	SULFIDE	BYPRODUCT
SILVER	SULFIDE	BYPRODUCT
CADMIUM	BYPRODUCT	AFFECT MARKETABILITY
NICKEL	SULFIDE	AFFECT MARKETABILITY
COBALT		AFFECT MARKETABILITY

PUBLISHED RESERVE/RESOURCE INFORMATION

UNDETERMINED 13,605,000
UNITS MT ORE
YEAR/DATA 1980

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
PB	5.5	WT-PCT
ZN	1.2	WT-PCT
AG	10.29	GM/MT

RESERVE/RESOURCE - REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. ST. JOE MINERALS: GROWING THROUGH
DIVERSIFICATION. V. 177, NO. 11, 1976, PP. 69-86.

NO PUBLISHED GRADE DATA FOR COPPER, CADMIUM, NICKEL, AND COBALT.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOLOGICAL INFERENCE	GEOLOGICAL INFERENCE/CORE DRILLING/
YEAR OF DISCOVERY: 1959	CHURN DRILLING/ROTARY DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: BRECCIA FILLING: DISSEMINATED: REPLACEMENT
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY: CONTACT ZONE
WALL ROCK ALTERATION: DOLOMITIZATION: SILICIFICATION: PYRITIZATION
DEGREE OF ALTERATION: SLIGHT

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 256

STRIKE/DIP: NOOS

LITHOLOGY:

NAME OF FORMATION: BONNETERRE

GEOLOGIC AGE: UPPER CAMBRIAN

DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION

GEOLOGIC AGE: PALEOZOIC

ROCK TYPE:

DOLOMITE	REPLACED BY ORE: ORE IN FRACTURES
SHALE	LIES OVER ORE
SANDSTONE	LIES UNDER ORE
CONGLOMERATE	LIES UNDER ORE
LIMESTONE	NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GALENA	PALEOZOIC	SULFIDES	PHANERITIC-FINE
SPHALERITE	PALEOZOIC	SULFIDES	PHANERITIC-FINE
CHALCOPYRITE	PALEOZOIC	SULFIDES	PHANERITIC-FINE
PYRITE	PALEOZOIC	SULFIDES	PHANERITIC-FINE
MARCASITE	PALEOZOIC	SULFIDES	PHANERITIC-FINE
LINNAEITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DOLOMITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
CALCITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
QUARTZ	PALEOZOIC	FORMS OF SiO ₂	PHANERITIC-MEDIUM
BRAVOITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DICKITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM
KAOLINITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: FRANK R. MILLIKEN MINE SEQUENCE NUMBER: 0291790008
NATION: USA STATE: MISSOURI COUNTY: REYNOLDS
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: PRODUCER
LATITUDE: N 37 DEG 21 MIN 35 SEC LONGITUDE: W 91 DEG 8 MIN 53 SEC
UTM - ZONE: 15 HEMISPHERE: NORTHERN NORTHING: 4136183 EASTING: 664010
POINT OF REFERENCE: MAIN ENTRY PRECISION: 10 METERS
ELEVATION: 360 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: PRIVATE LEASE: FEE OWNERSHIP: MINERALS ONLY

ALTERNATE NAMES: OZARK MINE
SWEETWATER

OWNERSHIP STATUS
KENNECOTT COPPER CORPORATION OWNER-OPERATOR
(OZARK LEAD COMPANY)

COMMODITY	MODIFIER	MARKETABILITY
LEAD	SULFIDE	PRIMARY
ZINC	SULFIDE	BYPRODUCT
COPPER	SULFIDE	AFFECT MARKETABILITY
NICKEL	SULFIDE	RECOVERABLE
COBALT	SULFIDE	RECOVERABLE
CADMIUM	SULFIDE	RECOVERABLE
SILVER	SULFIDE	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED 10,000,000
UNITS MT ORE
YEAR/DATA 1979

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT	MINERAL FORM
PB	4.3	WT-PCT	SULFIDE
ZN	0.7	WT-PCT	SULFIDE

RESERVE/RESOURCE - REMARKS

SOURCE: KENNECOTT COPPER CORPORATION. 1978 FORM 10-K ANNUAL REPORT SEC FILE NO. 1-1369, 1979, P. 5.

NO PUBLISHED GRADES FOR COPPER, NICKEL, COBALT, CADMIUM AND SILVER.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOLOGICAL INFERENCE	SURFACE GEOLOGIC MAPPING/CORE DRILLING
YEAR OF DISCOVERY: 1962	ROTARY DRILLING
YEAR OF INITIAL PRODUCTION: 1968	
YEAR OF FINAL PRODUCTION: PRODUCING	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: BRECCIA FILLING: DISSEMINATED: REPLACEMENT
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: CONTACT ZONE: LITHOLOGY
WALL ROCK ALTERATION: DOLOMITIZATION: SILICIFICATION: PYRITIZATION
DEGREE OF ALTERATION: MODERATE

LITHOLOGY:

NAME OF FORMATION: BONNETERRE FORMATION
GEOLOGIC AGE: UPPER CAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PALEOZOIC
ROCK TYPE:
BRECCIA ENCLOSES ORE: REPLACED BY ORE
DOLOMITE REPLACED BY ORE

LITHOLOGY:

NAME OF FORMATION: LAMOTTE SANDSTONE
GEOLOGIC AGE: UPPER CAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PALEOZOIC
ROCK TYPE:
SANDSTONE LIES UNDER ORE
CONGLOMERATE LIES UNDER ORE
SHALE LIES UNDER ORE

LITHOLOGY:

NAME OF FORMATION: DAVIS FORMATION
GEOLOGIC AGE: UPPER CAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PALEOZOIC
ROCK TYPE:
SHALE LIES OVER ORE
CONGLOMERATE LIES OVER ORE
LIMESTONE LIES OVER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GALENA	PALEOZOIC	SULFIDES	PHANERITIC-FINE
SPHALERITE	PALEOZOIC	SULFIDES	PHANERITIC-FINE
CHALCOPYRITE	PALEOZOIC	SULFIDES	PHANERITIC-FINE
LINNAEITE	PALEOZOIC	SULFIDES	PHANERITIC-FINE
CALCITE	PALEOZOIC	CARBONATES	PHANERITIC-FINE

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: ROOM AND PILLAR

CAPACITY: 8,165

UNITS: MT ORE/DAY

CHARACTERISTIC OF ROCK: ONE SYSTEM OF WEAKNESS PLANES

ROCK AND WATER CONDITIONS: SOFT NONPLASTIC FISSURED, MODERATE WATER

ROCK/MINE SUPPORT: SUPPORTING, BACK MAY SLAB POST, HEADBOARD, CAPS, ROOF BOLTS

CONDITION OF WORKINGS: OPEN

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: NEW SHAFT COLLAR

LATITUDE: N 37 21 00

LONGITUDE: W 91 08 53

PERCENT SHIPPED: 33

METHOD OF TRANSPORTATION: CONVEYOR

DISTANCE (KM): 0.9

DESTINATION FACILITY: MILL (ON-SITE)

LOCATION: F. R. MILLIKEN MILL

LATITUDE: N 37 21 33

LONGITUDE: W 91 08 51

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: OLD SHAFT COLLAR

LATITUDE: N 37 21 35

LONGITUDE: W 91 08 53

METHOD OF TRANSPORTATION: CONVEYOR

DISTANCE (KM): 0.1

DESTINATION FACILITY: MILL (ON-SITE)

LOCATION: F. R. MILLIKEN MILL

LATITUDE: N 37 21 33

LONGITUDE: W 91 08 51

BENEFICIATION:

METHOD: FLOTATION

-----DESCRIPTION OF MILLING-----

DESIGN CAPACITY: 8,165

ORE/CRUSH/GRIND/LEAD FLOAT/ZINC FLOAT

UNITS: MT ORE/DAY

DEPOSIT PERCENT USED: 100

TOTAL PERCENT USED: 100

TRANSPORTATION FOR PRODUCT: LEAD CONCENTRATE

ORIGINATING FACILITY: MILL (ON-SITE)

LOCATION: F. R. MILLIKEN MINE

LATITUDE: N 37 21 33

LONGITUDE: W 91 08 51

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: TRUCK

DISTANCE (KM): 64

DESTINATION FACILITY: SMELTER/REFINERY

LOCATION, GLOVER, MISSOURI

LATITUDE: N 37 29 12

LONGITUDE: W 90 41 36

TRANSPORTATION FOR PRODUCT: ZINC CONCENTRATE
 ORIGINATING FACILITY: MILL (ON-SITE) LOCATION: F. R. MILLIKEN MINE
 LATITUDE: N 37 21 33 LONGITUDE: W 91 08 51
 PERCENT SHIPPED: 100
 METHOD OF TRANSPORTATION: TRUCK DISTANCE (KM): 48
 DESTINATION FACILITY: SMELTER/REFINERY LOCATION: BARTLESVILLE, OKLAHOMA
 LATITUDE: N 36 44 42 LONGITUDE: W 90 41 36

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: BONNE TERRE MINE	SEQUENCE NUMBER: 0291870004
NATION: USA STATE: MISSOURI	COUNTY: ST. FRANCOIS
TYPE OF OPERATION: UNDERGROUND	CURRENT STATUS: PAST PRODUCER
LATITUDE: N 37 DEG 55 MIN 19 SEC	LONGITUDE: W 90 DEG 32 MIN 54 SEC
UTM - ZONE: 15 HEMISPHERE: NORTHERN	NORTHING: 4199783 EASTING: 715499
POINT OF REFERENCE: MAIN ENTRY	PRECISION: 100 METERS
ELEVATION: 248 METERS	PRECISION: 10 METERS
DATUM: SEA LEVEL	

TYPE OF MINERAL HOLDING: FEE OWNERSHIP: PRIVATE LEASE

OWNERSHIP	STATUS
ST. JOE MINERALS CORPORATION	OWNER-OPERATOR
COMMODITY	MARKETABILITY
LEAD	PRIMARY
ZINC	BYPRODUCT
COPPER	BYPRODUCT
NICKEL	RECOVERABLE
COBALT	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	SURFACE GEOLOGIC MAPPING/CORE DRILLING/
YEAR OF DISCOVERY: 1864	SUBSURFACE GEOLOGIC MAPPING/TEST SHAFT/
YEAR OF INITIAL PRODUCTION: 1868	CHURN DRILLING/GEOLOGICAL INFERENCE/
YEAR OF FINAL PRODUCTION: 1960	PERCUSSION DRILLING/TEST DRIFT/CROSSCUT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: REPLACEMENT: BRECCIA FILL
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: LENTICULAR: TABULAR
CONTROLLING FEATURES: LITHOLOGY: CONTACT ZONE
WALL ROCK ALTERATION: DOLOMITIZATION: PYRITIZATION: SILICIFICATION
DEGREE OF ALTERATION: MODERATE

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 60	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N45E	
AVERAGE LENGTH/METERS: 4,000	AVERAGE WIDTH/METERS: 2,000
AVERAGE THICKNESS/METERS: 30	

UNCONSOLIDATED MATERIAL:
AVERAGE THICKNESS/METERS: 10

LITHOLOGY:

NAME OF FORMATION: BONNE TERRE
GEOLOGIC AGE: UPPER CAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING: MAJOR FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING-DURING-FOLLOWING
DEFORMATION
GEOLOGIC AGE: PALEOZOIC
ROCK TYPE:
DOLOMITE REPLACED BY ORE: ORE IN FRACTURES
SHALE LIES OVER ORE
SANDSTONE LIES UNDER ORE
CONGLOMERATE LIES UNDER ORE
LIMESTONE NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GALENA	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
SPHALERITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CHALCOPYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
PYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
MARCASITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
LINNAEITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
BRAVOITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CALCITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
DOLOMITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
DICKITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM
QUARTZ	PALEOZOIC	FORMS OF SiO2	PHANERITIC-MEDIUM

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: INDIAN CREEK DIVISION SEQUENCE NUMBER: 0292210021
NATION: USA STATE: MISSOURI COUNTY: WASHINGTON
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: PAST PRODUCER
LATITUDE: N 38 DEG 2 MIN 27 SEC LONGITUDE: W 90 DEG 55 MIN 0 SEC
UTM - ZONE: 15 HEMISPHERE: NORTHERN NORTHING: 4212188 EASTING: 682824
POINT OF REFERENCE: MAIN ENTRY PRECISION: 100 METERS
ELEVATION: 323 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: PRIVATE LEASE

OWNERSHIP STATUS
ST. JOE MINERALS CORPORATION OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
LEAD	SULFIDE	PRIMARY
COPPER	SULFIDE	BYPRODUCT
SILVER	SULFIDE	BYPRODUCT
ZINC	SULFIDE	AFFECT MARKETABILITY
NICKEL	SULFIDE	AFFECT MARKETABILITY
COBALT	SULFIDE	AFFECT MARKETABILITY
CADMIUM	BYPRODUCT	AFFECT MARKETABILITY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOLOGICAL INFERENCE	SURFACE GEOLOGIC MAPPING/CHURN DRILLING/
YEAR OF DISCOVERY: 1948	SUBSURFACE GEOLOGIC MAPPING/TEST SHAFT/
YEAR OF INITIAL PRODUCTION: 1954	PERCUSSION DRILLING/CORE DRILLING/
YEAR OF FINAL PRODUCTION: 1982	GEOLOGICAL INFERENCE/TEST DRIFT/CROSSCUT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: REPLACEMENT: BRECCIA FILLING
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY: CONTACT ZONE
WALL ROCK ALTERATION: DOLOMITIZATION: SILICIFICATION: PYRITIZATION
DEGREE OF ALTERATION: MODERATE

LITHOLOGY:

NAME OF FORMATION: BONNE TERRE
GEOLOGIC AGE: UPPER CAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PALEOZOIC
ROCK TYPE:
DOLOMITE: REPLACED BY ORE: ORE IN FRACTURES
SHALE LIES OVER ORE
SANDSTONE LIES UNDER ORE
CONGLOMERATE LIES UNDER ORE
LIMESTONE NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GALENA	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
SPHALERITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
CHALCOPYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
PYRITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
MARCASITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
LINNAEITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DOLOMITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
CALCITE	PALEOZOIC	CARBONATES	PHANERITIC-MEDIUM
QUARTZ	PALEOZOIC	FORMS OF SiO_2	PHANERITIC-MEDIUM
BRAVOITE	PALEOZOIC	SULFIDES	PHANERITIC-MEDIUM
DICKITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM
KAOLINITE	PALEOZOIC	SILICATES	PHANERITIC-MEDIUM

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MONTANA

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: STILLWATER PGM RESOURCES SEQUENCE NUMBER: 0300970003

NATION: USA STATE: MONTANA COUNTY: SWEET GRASS
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 45 DEG 27 MIN 34 SEC LONGITUDE: W 110 DEG 5 MIN 18 SEC
UTM - ZONE: 12 HEMISPHERE: NORTHERN NORTHING: 5034177 EASTING: 571278
POINT OF REFERENCE: MAIN ENTRY PRECISION: 100 METERS
ELEVATION: 2,210 METERS PRECISION: 100 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: LOCATED CLAIM

ALTERNATE NAMES: M PROSPECT
STILLWATER PLATINUM PROJECT

OWNERSHIP	STATUS
MANVILLE CORPORATION	OWNER
CHEVRON RESOURCES	OWNER

COMMODITY	MODIFIER	MARKETABILITY
PLATINUM GROUP	PLATINUM	COPRODUCT
PLATINUM GROUP	PALLADIUM	COPRODUCT
PLATINUM GROUP	RHODIUM	BYPRODUCT
PLATINUM GROUP	IRIDIUM	BYPRODUCT
PLATINUM GROUP	OSMIUM	BYPRODUCT
PLATINUM GROUP	RUTHENIUM	BYPRODUCT
GOLD		BYPRODUCT
NICKEL		BYPRODUCT
COPPER		BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
UNKNOWN	CORE DRILLING/SURFACE GEOLOGIC MAPPING/
YEAR OF DISCOVERY: 1973	SUBSURFACE GEOLOGIC MAPPING/TRENCHING/
	BEDROCK SAMPLING/STREAM SEDIMENT SAMPLING/
	RECONAISSANCE SOIL SAMPLING/TEST ADIT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STRATIFORM LAYER
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: IGNEOUS: FAULTING

MINERALIZED ZONE:

STRIKE/DIP: N60W: 55S
AVERAGE LENGTH/METERS: 40,234
AVERAGE THICKNESS/METERS: 1.83

MINIMUM DEPTH/METERS: 0

AVERAGE WIDTH/METERS: 701

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: STILLWATER COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: FAULTING: FOLDING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
GEOLOGIC AGE: CRETACEOUS
ROCK TYPE:
ANORTHOSITE ENCLOSURES ORE
GABBRO LIES OVER ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
PLATINUM	PRECAMBRIAN		PHANERITIC-FINE
PALLADIUM	PRECAMBRIAN		PHANERITIC-FINE
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
PYRRHOTITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
GOLD	PRECAMBRIAN		PHANERITIC-FINE
SILVER	PRECAMBRIAN		PHANERITIC-FINE
PLAGIOCLASE	PRECAMBRIAN	SILICATES	VARIABLE
OLIVINE	PRECAMBRIAN	SILICATES	VARIABLE

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: STILLWATER VERDIGRIS CREEK SEQUENCE NUMBER: 0300950002

NATION: USA	STATE: MONTANA	COUNTY: STILLWATER
TYPE OF OPERATION: SURFACE		CURRENT STATUS: DEVELOPED DEPOSIT
LATITUDE: N 45 DEG 22 MIN 44 SEC		LONGITUDE: W 109 DEG 54 MIN 00 SEC
UTM - ZONE: 12	HEMISPHERE: NORTHERN	NORTHING: 5025411 EASTING: 586126
POINT OF REFERENCE: ORE BODY		PRECISION: 1,000 METERS
ELEVATION: 1,700 METERS		PRECISION: 100 METERS
DATUM: SEA LEVEL		

TYPE OF MINERAL HOLDING: PATENTED: LOCATED CLAIM: FEDERAL LEASE

ALTERNATE NAMES: MOUAT MINE
 MOUAT-SAMPSON MINE

OWNERSHIP	STATUS
THE ANACONDA COMPANY	OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	COPRODUCT
COPPER	SULFIDE	COPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED	136,050,000
UNITS	MT ORE
YEAR/DATA	1971

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT	MINERAL FORM
NI	0.25	WT-PCT	SULFIDE
CU	0.25	WT-PCT	SULFIDE

RESERVE/RESOURCE - REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. OCT. 1971, P. 77.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	DRILLING/CORE DRILLING/TEST ADIT
YEAR OF DISCOVERY: 1883	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STRATIFORM LAYER
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: LENTICULAR
CONTROLLING FEATURES: BEDDING: LITHOLOGY
WALL ROCK ALTERATION: CARBONITIZATION

MINERALIZED ZONE:

STRIKE/DIP: N70W: 60W

AVERAGE LENGTH/METERS: 3,000

AVERAGE WIDTH/METERS: 300

AVERAGE THICKNESS/METERS: 150

LITHOLOGY:

NAME OF FORMATION: STILLWATER COMPLEX

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: MAJOR FAULTING: FOLDING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

HORNFELS

LIES UNDER ORE: REPLACED BY ORE

GABBRO

LIES OVER ORE

ULTRAMAFIC IGNEOUS REPLACED BY ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
PENTLANDITE	PRECAMBRIAN	SULFIDES	VARIABLE
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	VARIABLE
PYRRHOTITE	PRECAMBRIAN	SULFIDES	VARIABLE
CHROMITE	PRECAMBRIAN	SULFATES AND CHROMATES	VARIABLE

MINE/MILL INFORMATION**SURFACE MINING:**

METHOD: BENCH (BERM)

CAPACITY: 25,396

UNITS: MT ORE/DAY

TRANSPORTATION (MINE TO MILL):

ORIGINATING FACILITY: MINE

LOCATION: STILLWATER MINE

LATITUDE: N 45 22 44

LONGITUDE: W 109 54 00

PERCENT PRODUCT SHIPPED: 100

DESTINATION FACILITY: MILL (ON-SITE)

LOCATION: ON-SITE MILL

LATITUDE: 45 22 44

LONGITUDE: 109 54 00

BENEFICIATION:

METHOD: FLOTATION

DESIGN CAPACITY: 25,396

SIZING: FLOTATION

UNITS: MT ORE/DAY

PRODUCT	ASSAY/FORM	RECOVERY (PERCENT)	CONC. GRADE (PERCENT)	CONC. GRADE UNITS
NI CONC.	NI	53	5.42	WT-PCT
CU CONC.	CU	86	8.80	WT-PCT

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: ANACONDA PGM DEPOSIT SEQUENCE NUMBER: 0300950032

NATION: USA STATE: MONTANA COUNTY: STILLWATER
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 45 DEG 23 MIN 16 SEC LONGITUDE: W 109 DEG 52 MIN 45 SEC
UTM - ZONE: 12 HEMISPHERE: NORTHERN NORTHING: 5026422 EASTING: 587743
POINT OF REFERENCE: MAIN ENTRY PRECISION: 100 METERS
ELEVATION: 1,600 METERS PRECISION: 100 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: LOCATED CLAIM

ALTERNATE NAMES: MINNEAPOLIS ADIT PROJECT

OWNERSHIP STATUS
THE ANACONDA COMPANY OWNER

COMMODITY	MODIFIER	MARKETABILITY
PLATINUM GROUP	PLATINUM	COPRODUCT
PLATINUM GROUP	PALLADIUM	COPRODUCT
PLATINUM GROUP	RHODIUM	BYPRODUCT
PLATINUM GROUP	IRIDIUM	BYPRODUCT
PLATINUM GROUP	OSMIUM	BYPRODUCT
PLATINUM GROUP	RUTHENIUM	BYPRODUCT
GOLD		BYPRODUCT
COPPER		BYPRODUCT
NICKEL		BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STRATIFORM LAYER
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: IGNEOUS: FAULTING

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 350	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N80W: 55N	
AVERAGE LENGTH/METERS: 1,829	AVERAGE WIDTH/METERS: 701
AVERAGE THICKNESS/METERS: 1.8	

UNCONSOLIDATED MATERIAL:
AVERAGE THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: STILLWATER COMPLEX

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: FAULTING: FOLDING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION

ROCK TYPE:

ANORTHOSITE

ENCLOSES ORE

GABBRO

LIES OVER ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
PLATINUM	PRECAMBRIAN		PHANERITIC-FINE
PALLADIUM	PRECAMBRIAN		PHANERITIC-FINE
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
PYRRHOTITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
GOLD	PRECAMBRIAN		PHANERITIC-FINE
SILVER	PRECAMBRIAN		PHANERITIC-FINE
PLAGIOCLASE	PRECAMBRIAN	SILICATES	VARIABLE
OLIVINE	PRECAMBRIAN	SILICATES	VARIABLE

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OREGON

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: RED FLAT	SEQUENCE NUMBER: 0410150161
NATION: USA STATE: OREGON	COUNTY: CURRY
TYPE OF OPERATION: PROSPECT	CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 42 DEG 21 MIN 8 SEC	LONGITUDE: W 124 DEG 17 MIN 54 SEC
UTM - ZONE: 10 HEMISPHERE: NORTHERN	NORTHING: 4689486 EASTING: 393066
POINT OF REFERENCE: ORE BODY	PRECISION: 100 METERS
ELEVATION: 762 METERS	PRECISION: 100 METERS
DATUM: SEA LEVEL	

TYPE OF MINERAL HOLDING: LOCATED CLAIM

ALTERNATE NAMES: NORTH RED FLATS
RED FLAT PLACERS

OWNERSHIP	STATUS
HANNA MINING COMPANY	OWNER
RED FLATS NICKEL CORPORATION	OWNER
BIG BASIN NICKEL CORPORATION	OWNER

COMMODITY	MODIFIER	MARKETABILITY
NICKEL		PRIMARY
COBALT		BYPRODUCT
CHROMIUM	CHROMITE	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	SURFACE GEOLOGIC MAPPING/CHURN DRILLING/
YEAR OF DISCOVERY: 1930	INFRARED PHOTOGRAPHY/AUGER/TRENCHING/
	GEOLOGICAL INFERENCE/BEDROCK SAMPLING/
	TEST SHAFT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY: OTHER

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 0.5
STRIKE/DIP: N29W: 00E
AVERAGE LENGTH/METERS: 3,100
AVERAGE THICKNESS/METERS: 5.5

MINIMUM DEPTH/METERS: 0
AVERAGE WIDTH/METERS: 1,980

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 5.5

LITHOLOGY:

NAME OF FORMATION: PERIDOTITE
GEOLOGIC AGE: UPPER JURASSIC
DEFORMATION DESCRIPTION: OTHER: FAULTING: MINOR FOLDING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION
GEOLOGIC AGE: CRETACEOUS
ROCK TYPE:
SAXONITE REPLACED BY ORE: LIES UNDER ORE
SERPENTINITE REPLACED BY ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
ENSTATITE	CENOZOIC	SILICATES	VARIABLE
OLIVINE	CENOZOIC	SILICATES	VARIABLE
QUARTZ	CENOZOIC	SILICATES	VARIABLE
MONTMORILLONITE	CENOZOIC	SILICATES	VARIABLE
CHLORITE	CENOZOIC	SILICATES	VARIABLE
GOETHITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
GARNIERITE	CENOZOIC	SILICATES	VARIABLE

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: NICKEL MOUNTAIN MINE SEQUENCE NUMBER: 0410190001

NATION: USA STATE: OREGON COUNTY: DOUGLAS
TYPE OF OPERATION: SURFACE CURRENT STATUS: PAST PRODUCER
LATITUDE: N 42 DEG 57 MIN 50 SEC LONGITUDE: W 123 DEG 26 MIN 32 SEC
UTM - ZONE: 10 HEMISPHERE: NORTHERN NORTHING: 4756683 EASTING: 463933
POINT OF REFERENCE: ORE BODY PRECISION: 100 METERS
ELEVATION: 995 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: FEE OWNERSHIP: PRIVATE LEASE: OTHER

ALTERNATE NAMES: RIDDLE NICKEL LATERITE DEPOSIT
HANNA NICKEL MINE

OWNERSHIP	STATUS
HANNA NICKEL MINING COMPANY	OWNER-OPERATOR
HANNA NICKEL SMELTING COMPANY	OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL		PRIMARY
IRON	HEMATITE-MAGNETITE	COPRODUCT
COBALT		RECOVERABLE
CHROMIUM	CHROMITE	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	AERIAL COLOR PHOTOGRAPHY/ROTARY DRILLING
YEAR OF DISCOVERY: 1865	TRENCHING/BEDROCK SAMPLING
YEAR OF INITIAL PRODUCTION: 1954	
YEAR OF FINAL PRODUCTION: 1982	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE: SHEAR ZON: STOCKWORK
MODE OF ORIGIN: RESIDUAL CONCENTRATION: OXIDATION
SHAPE OF ORE BODY: IRREGULAR
CONTROLLING FEATURES: FAULTING: FRACTURING

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 0	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N45E: 35S	
AVERAGE LENGTH/METERS: 1,830	AVERAGE WIDTH/METERS: 915
AVERAGE THICKNESS/METERS: 15	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 3

MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVES

GEOLOGIC AGE: UPPER JURASSIC

DEFORMATION DESCRIPTION: INTRUSION: FOLDING: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

ROCK TYPE:

SAXONITE REPLACED BY ORE: IS ORE

DUNITE REPLACED BY ORE: IS ORE

SERPENTINITE ENCLOSURES ORE

LITHOLOGY:

NAME OF FORMATION: DOTHAN FORMATION

GEOLOGIC AGE: UPPER JURASSIC

DEFORMATION DESCRIPTION: FOLDING: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

ROCK TYPE:

SANDSTONE LIES ALONG ORE

SHALE LIES ALONG ORE

CONGLOMERATE LIES ALONG ORE

CHERT LIES ALONG ORE

GREENSTONE LIES ALONG ORE

LITHOLOGY:

NAME OF FORMATION: RIDDLE FORMATION

GEOLOGIC AGE: UPPER JURASSIC

DEFORMATION DESCRIPTION: FOLDING: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

ROCK TYPE:

SILTSTONE NEAR ORE

SANDSTONE NEAR ORE

SHALE NEAR ORE

CONGLOMERATE LIES ALONG ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GARNIERITE	MIOCENE	SILICATES	VARIABLE
LIMONITE	MIOCENE	OXIDES (EXCLUDING SiO ₂)	VARIABLE
CHALCEDONY	MIOCENE	SILICATES	VARIABLE
SEPIOLITE	MIOCENE	SILICATES	VARIABLE
SERPENTINE	MIOCENE	SILICATES	VARIABLE

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: EIGHT DOLLAR MOUNTAIN LATERITE SEQUENCE NUMBER: 0410330251

NATION: USA STATE: OREGON COUNTY: JOSEPHINE
TYPE OF OPERATION: PROSPECT CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 42 DEG 13 MIN 22 SEC LONGITUDE: W 123 DEG 39 MIN 26 SEC
UTM - ZONE: 10 HEMISPHERE: NORTHERN NORTHING: 4674506 EASTING: 445759
POINT OF REFERENCE: ORE BODY PRECISION: 100 METERS
ELEVATION: 410 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: LOCATED CLAIM: PRIVATE LEASE

ALTERNATE NAMES: EIGHT DOLLAR NICKEL DEPOSIT
HORSTMAN GROUP

OWNERSHIP	STATUS
CALIFORNIA NICKEL CORPORATION	OWNER
HANNA MINING COMPANY	OWNER
MERIDIAN RESOURCES LTD	OWNER
PAN ARCTIC	OWNER

COMMODITY	MODIFIER	MARKETABILITY
NICKEL		COPRODUCT
COBALT		COPRODUCT
CHROMIUM	CHROMITE	RECOVERABLE
IRON		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	TEST PIT/AUGER/CHURN DRILLING/
YEAR OF DISCOVERY: 1942	TRENCHING/INFRARED PHOTOGRAPHY

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION: OXIDATION
SHAPE OF ORE BODY: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY: FRACTURING

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 0.5	MINIMUM DEPTH/METERS: 0.5
STRIKE: N25E	
AVERAGE LENGTH/METERS: 4,800	AVERAGE WIDTH/METERS: 4,000
AVERAGE THICKNESS/METERS: 4.5	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 5.0

MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: JURASSIC

DEFORMATION DESCRIPTION: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

SAXONITE

REPLACED BY ORE: ORE IN FRACTURES

SERPENTINITE

REPLACED BY ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
CHALCEDONY	CENOZOIC	FORMS OF SiO ₂	APHANITIC
CHLORITE	CENOZOIC	SILICATES	APHANITIC
CHROMITE	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
DIASPORE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	APHANITIC
ENSTATITE	JURASSIC	SILICATES	VARIABLE
GARNIERITE	CENOZOIC	SILICATES	APHANITIC
GIBBSITE	CENOZOIC	OTHER	APHANITIC
GOETHITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	APHANITIC
ILMENITE	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
KAOLINITE	CENOZOIC	SILICATES	APHANITIC
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	APHANITIC
MAGNETITE	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
MONTMORILLONITE	CENOZOIC	SILICATES	APHANITIC
NONTRONITE	CENOZOIC	SILICATES	APHANITIC
SERPENTINE	CENOZOIC	SILICATES	VARIABLE
SPINEL	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
TALC	CENOZOIC	SILICATES	APHANITIC

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: WOODCOCK MOUNTAIN LATERITE SEQUENCE NUMBER: 0410330424

NATION: USA	STATE: OREGON	COUNTY: JOSEPHINE
TYPE OF OPERATION: PROSPECT		CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 42 DEG 7 MIN 13 SEC		LONGITUDE: W 123 DEG 40 MIN 43 SEC
UTM - ZONE: 10 HEMISPHERE: NORTHERN		NORTHING: 4663139 EASTING: 443903
POINT OF REFERENCE: ORE BODY		PRECISION: 100 METERS
ELEVATION: 403 METERS		PRECISION: 10 METERS
DATUM: SEA LEVEL		

TYPE OF MINERAL HOLDING: LOCATED CLAIM: OTHER

ALTERNATE NAMES: WOODCOCK MOUNTAIN NICKEL DEPOSIT

OWNERSHIP	STATUS
HANNA MINING COMPANY	OWNER
INSPIRATION DEVELOPMENT COMPANY	OWNER
CALIFORNIA NICKEL CORPORATION	OWNER

COMMODITY	MODIFIER	MARKETABILITY
NICKEL		COPRODUCT
COBALT		COPRODUCT
CHROMIUM	CHROMITE	RECOVERABLE
IRON		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	AUGER/TRENCHING/DETAIL SOIL SAMPLING/
YEAR OF DISCOVERY: 1941	SURFACE GEOLOGIC MAPPING/
	INFRARED PHOTOGRAPHY

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY: FRACTURING

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 0.5	MINIMUM DEPTH/METERS: 0.5
STRIKE: N10E	
AVERAGE LENGTH/METERS: 4,000	AVERAGE WIDTH/METERS: 800
AVERAGE THICKNESS/METERS: 8.6	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 9.1

MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: JURASSIC

DEFORMATION DESCRIPTION: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

SAXONITE

REPLACED BY ORE: ORE IN FRACTURES

SERPENTINITE

REPLACED BY ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
CHALCEDONY	CENOZOIC	FORMS OF SiO ₂	APHANITIC
CHLORITE	CENOZOIC	SILICATES	APHANITIC
CHROMITE	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
DIASPORE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	APHANITIC
ENSTATITE	JURASSIC	SILICATES	VARIABLE
GARNIERITE	CENOZOIC	SILICATES	APHANITIC
GIBBSITE	CENOZOIC	OTHER	APHANITIC
GOETHITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	APHANITIC
ILMENITE	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
KAOLINITE	CENOZOIC	SILICATES	APHANITIC
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	APHANITIC
MAGNETITE	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
MONTMORILLONITE	CENOZOIC	SILICATES	APHANITIC
NONTRONITE	CENOZOIC	SILICATES	APHANITIC
SERPENTINE	CENOZOIC	SILICATES	VARIABLE
SPINEL	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
TALC	CENOZOIC	SILICATES	APHANITIC

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LIBBEY, R. W., W. D. LOWRY, AND R. S. MASON. NICKEL-BEARING LATERITE, RED FLAT, CURRY COUNTY, OREGON. ORE BIN, V. 9, NO. 3, 1947, PP. 19-27.

SIEMENS, R. E., AND J. D. CORRICK. PROCESS FOR RECOVERY OF NICKEL, COBALT, AND COPPER FROM DOMESTIC LATERITES. MIN. CONG. J., V. 63, NO. 1, 1977, PP. 27-34.

SIEMENS, R. E., P. C. GOOD, AND W. A. STICKNEY. RECOVERY OF NICKEL AND COBALT FROM LOW-GRADE DOMESTIC LATERITES. BUMINES RI 8027, 1975, 14 PP.

SINGMASTER AND BREYER. NICKEL RECOVERY FROM WESTERN SOURCES, TASK I - REPORT - TECHNICAL AND ECONOMIC EVALUATION. BUMINES (CONTRACT NO. J025007). BUMINES OFR 65-76, 1975, 138 PP.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: ROUGH AND READY LATERITE SEQUENCE NUMBER: 0410330452
NATION: USA STATE: OREGON COUNTY: JOSEPHINE
TYPE OF OPERATION: PROSPECT CURRENT STATUS: EXPLORED DEPOSIT
LATITUDE: N 42 DEG 4 MIN 57 SEC LONGITUDE: W 123 DEG 44 MIN 45 SEC
UTM - ZONE: 10 HEMISPHERE: NORTHERN NORTHING: 4658991 EASTING: 438309
POINT OF REFERENCE: ORE BODY PRECISION: 100 METERS
ELEVATION: 488 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: LOCATED CLAIM: PRIVATE LEASE

ALTERNATE NAMES: ROUGH AND READY NICKEL GROUP

OWNERSHIP		STATUS
INSPIRATION DEVELOPMENT COMPANY		OWNER
WALT FREEMAN		OWNER
COMMODITY	MODIFIER	MARKETABILITY
NICKEL		COPRODUCT
COBALT		COPRODUCT
CHROMIUM	CHROMITE	RECOVERABLE
IRON		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	GEOLOGICAL INFERENCE/TRENCHING/AUGER/
YEAR OF DISCOVERY: 1953	AERIAL COLOR PHOTOGRAPHY/CHURN DRILLING/
	SEISMIC SURVEY/INFRARED PHOTOGRAPHY

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY: FRACTURING

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 0.5	MINIMUM DEPTH/METERS: 0.5
STRIKE/DIP: N50W	
AVERAGE LENGTH/METERS: 4,800	AVERAGE WIDTH/METERS: 4,800
AVERAGE THICKNESS/METERS: 2.1	
UNCONSOLIDATED MATERIAL:	
AVERAGE THICKNESS/METERS: 2.6	MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: JURASSIC

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

SAXONITE

REPLACED BY ORE: ORE IN FRACTURES

SERPENTINITE

REPLACED BY ORE: LIES UNDER ORE

DIABASE

LIES UNDER ORE

UNSPECIFIED SEDIMENTARY

IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
CHALCEDONY	CENOZOIC	FORMS OF SiO ₂	APHANITIC
CHLORITE	CENOZOIC	SILICATES	APHANITIC
CHROMITE	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
DIASPORE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	APHANITIC
ENSTATITE	JURASSIC	SILICATES	VARIABLE
GARNIERITE	CENOZOIC	SILICATES	APHANITIC
GIBBSITE	CENOZOIC	OTHER	APHANITIC
GOETHITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	APHANITIC
ILMENITE	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
KAOLINITE	CENOZOIC	SILICATES	APHANITIC
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	APHANITIC
MAGNETITE	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
MONTMORILLONITE	CENOZOIC	SILICATES	APHANITIC
NONTRONITE	CENOZOIC	SILICATES	APHANITIC
SERPENTINE	CENOZOIC	SILICATES	VARIABLE
SPINEL	JURASSIC	OXIDES (EXCLUDING SiO ₂)	VARIABLE
TALC	CENOZOIC	SILICATES	APHANITIC

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SIEMENS, R. E., P. C. GOOD, AND W. A. STICKNEY. RECOVERY OF NICKEL AND COBALT FROM LOW-GRADE DOMESTIC LATERITES. BUMINES RI 8027, 1975, 14 PP.

SINGMASTER AND BREYER. NICKEL RECOVERY FROM WESTERN SOURCES, TASK I - REPORT - TECHNICAL AND ECONOMIC EVALUATION. BUMINES (CONTRACT NO. J025007). BUMINES OFR 65-76, 1975, 138 PP.

WASHINGTON

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: BLEWETT IRON-NICKEL DEPOSIT SEQUENCE NUMBER: 0530070005

NATION: USA STATE: WASHINGTON COUNTY: CHELAN
TYPE OF OPERATION: PROSPECT CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: N 47 DEG 23 MIN 58 SEC LONGITUDE: W 120 DEG 39 MIN 44 SEC
UTM - ZONE: 10 HEMISPHERE: NORTHERN NORTHING: 5251985 EASTING: 676403
POINT OF REFERENCE: ORE BODY PRECISION: 100 METERS
ELEVATION: 1,006 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: LOCATED CLAIM

OWNERSHIP: STATUS:
WASHINGTON NICKEL MINING AND ALLOYS, INC. OWNER

COMMODITY	MODIFIER	MARKETABILITY
IRON		COPRODUCT
NICKEL		COPRODUCT
CHROMIUM	CHROMITE	AFFECT MARKETABILITY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	GEOLOGICAL/TEST ADIT/BEDROCK SAMPLING/
YEAR OF DISCOVERY: 1860	SURFACE GEOLOGIC MAPPING/TRENCHING/
	SUBSURFACE GEOLOGIC MAPPING/
	MAGNETIC SURVEY/CORE DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: SEDIMENTATION: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: LENTICULAR
CONTROLLING FEATURES: LITHOLOGY: FRACTURING
WALL ROCK ALTERATION: OTHER
DEGREE OF ALTERATION: INTENSE

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 35	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N60W: 55S	
AVERAGE LENGTH/METERS: 160	AVERAGE WIDTH/METERS: 227
AVERAGE THICKNESS/METERS: 8.5	

UNCONSOLIDATED MATERIAL:
AVERAGE THICKNESS/METERS: 2

LITHOLOGY:

NAME OF FORMATION: SWAUK FORMATION
GEOLOGIC AGE: EOCENE
DEFORMATION DESCRIPTION: METAMORPHISM: MAJOR FAULTING: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
GEOLOGIC AGE: EOCENE
ROCK TYPE:
CONGLOMERATE LIES OVER ORE: IS ORE
MUDSTONE IS ORE

LITHOLOGY:

NAME OF FORMATION: IGNEOUS INTRUSIVE
GEOLOGIC AGE: TERTIARY
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION
GEOLOGIC AGE: TERTIARY
ROCK TYPE:
PERIDOTITE LIES UNDER ORE
SERPENTINITE LIES UNDER ORE

LITHOLOGY:

NAME OF FORMATION: IGNEOUS INTRUSIVE
GEOLOGIC AGE: EOCENE
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
GEOLOGIC AGE: EOCENE
ROCK TYPE:
DIABASE NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
BIOTITE	TERTIARY	SILICATES	VARIABLE
CHLORITE	TERTIARY	SILICATES	VARIABLE
CHROMITE	TERTIARY	OXIDES (EXCLUDING SiO ₂)	VARIABLE
HEMATITE	TERTIARY	OXIDES (EXCLUDING SiO ₂)	VARIABLE
MAGNETITE	TERTIARY	OXIDES (EXCLUDING SiO ₂)	VARIABLE
PYRITE	TERTIARY	SULFIDES	VARIABLE
SERPENTINE	TERTIARY	SILICATES	VARIABLE
SPINEL	TERTIARY	SILICATES	VARIABLE

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ZONE, CHELAN AND KITTITAS COUNTIES, WASHINGTON. WA DIV. OF GEOL. RI 11,
1944, 63 PP.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: CLE ELUM IRON-NICKEL DEPOSIT SEQUENCE NUMBER: 0530370003

NATION: USA	STATE: WASHINGTON	COUNTY: KITTITAS
TYPE OF OPERATION: PROSPECT		CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: N 47 DEG 26 MIN 57 SEC		LONGITUDE: W 121 DEG 3 MIN 5 SEC
UTM - ZONE: 10	HEMISPHERE: NORTHERN	NORTHING: 5256702 EASTING: 646900
POINT OF REFERENCE: ORE BODY		PRECISION: 100 METERS
ELEVATION: 880 METERS		PRECISION: 100 METERS
DATUM: SEA LEVEL		

TYPE OF MINERAL HOLDING: FEE OWNERSHIP

ALTERNATE NAMES: BALFOUR GUTHRIE GROUP

OWNERSHIP:	STATUS:
BURLINGTON NORTHERN RAILROAD	OWNER

COMMODITY	MODIFIER	MARKETABILITY
IRON	HEMATITE-MAGNETITE	PRIMARY
NICKEL		COPRODUCT
CHROMIUM	CHROMITE	COPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

	RECORD 1	RECORD 2	RECORD 3
MEASURED	2,902,000		
INDICATED		590,000	
INFERRED			2,177,000
UNITS	MT ORE	MT ORE	MT ORE
YEAR/DATA	1951	1951	1951

IN SITU GRADE:

RECORD	ASSAY/FORM	GRADE	UNIT	MINERAL FORM
1	FE	40.75	WT-PCT	OXIDE A203
	NI	0.82	WT-PCT	
	CR203	2.39	WT-PCT	OXIDE A203
2	FE	42.12	WT-PCT	OXIDE A203
	NI	.91	WT-PCT	
	CR203	2.47	WT-PCT	OXIDE A203
3	FE	41.01	WT-PCT	OXIDE A203
	NI	.86	WT-PCT	
	CR203	2.41	WT-PCT	OXIDE A203

RESERVE/RESOURCE REMARKS

SOURCE: LAMEY, C. A., AND P. E. HOTZ. THE CLE ELUM MICKELIFEROUS IRON DEPOSITS, KITTITAS COUNTY, WASHINGTON. U.S. GEOL. SURV. BULL 978-B, 1951, 65 PP.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

ORE-MINERAL IN PLACE
YEAR OF DISCOVERY: 1887

-----EXPLORATION METHODS-----

TRENCHING/TEST SHAFT/TEST TUNNEL/
SURFACE GEOLOGIC MAPPING/CORE DRILLING
MAGNETIC SURVEY

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: LENTICULAR
CONTROLLING FEATURES: LITHOLOGY: FRACTURING

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 90	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N25E: 30W	
AVERAGE LENGTH/METERS: 730	AVERAGE WIDTH/METERS: 500
AVERAGE THICKNESS/METERS: 5	

LITHOLOGY:

NAME OF FORMATION: FOSSIL LATERITE
GEOLOGIC AGE: TERTIARY
DEFORMATION DESCRIPTION: METAMORPHISM: MINOR FOLDING: FAULTING: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
GEOLOGIC AGE: CRETACEOUS
ROCK TYPE:
CONGLOMERATE LIES OVER ORE
UNSPECIFIED METAMORPHIC IS ORE
PERIDOTITE LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
MAGNETITE	CRETACEOUS	OXIDES (EXCLUDING SiO ₂)	VARIABLE
CLIACHITE	CRETACEOUS	OXIDES (EXCLUDING SiO ₂)	VARIABLE
DIASPORE	CRETACEOUS	OXIDES (EXCLUDING SiO ₂)	VARIABLE
SPINEL	CRETACEOUS	OXIDES (EXCLUDING SiO ₂)	VARIABLE
SERPENTINE	CRETACEOUS	SILICATES	VARIABLE
BOEHMITE	CRETACEOUS	OXIDES (EXCLUDING SiO ₂)	VARIABLE
GIBBSITE	CRETACEOUS	OXIDES (EXCLUDING SiO ₂)	VARIABLE
HEMATITE	CRETACEOUS	OXIDES (EXCLUDING SiO ₂)	VARIABLE
CALCITE	CRETACEOUS	CARBONATES	VARIABLE
TALC	CRETACEOUS	SILICATES	VARIABLE
PYROXENE	CRETACEOUS	SILICATES	VARIABLE
CHLORITE	CRETACEOUS	SILICATES	VARIABLE
DICKITE	CRETACEOUS	SILICATES	VARIABLE
CLINOZOISITE	CRETACEOUS	SILICATES	VARIABLE
QUARTZ	CRETACEOUS	FORMS OF SiO ₂	VARIABLE
PYRITE	CRETACEOUS	SULFIDES	VARIABLE
PYRRHOTITE	CRETACEOUS	SULFIDES	VARIABLE
MILLERITE	CRETACEOUS	SULFIDES	VARIABLE
CHALCOPYRITE	CRETACEOUS	SULFIDES	VARIABLE

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RAVITZ, S. F. ELECTRIC SMELTING OF LOW-GRADE NICKEL ORES. BUMINES RI 4122, 1947, 39 PP.

ZOLDOK, S. W. CLE-ELUM IRON-NICKEL DEPOSITS, KITTITAS COUNTY, WASHINGTON. BUMINES RI 4189, 1948, 8 PP.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MOUNT VERNON DEPOSIT SEQUENCE NUMBER: 0530570184
NATION: USA STATE: WASHINGTON COUNTY: SKAGIT
TYPE OF OPERATION: PROSPECT CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: N 48 DEG 22 MIN 12 SEC LONGITUDE: W 122 DEG 18 MIN 7 SEC
UTM - ZONE: 10 HEMISPHERE: NORTHERN NORTHING: 5357441 EASTING: 551699
POINT OF REFERENCE: MAIN ENTRY PRECISION: 100 METERS
ELEVATION: 91 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: FEE OWNERSHIP

OWNERSHIP: STATUS:
PACIFIC NICKEL COMPANY OWNER

COMMODITY	MODIFIER	MARKETABILITY
NICKEL		COPRODUCT
GOLD		COPRODUCT
SILVER		

PUBLISHED RESERVE/RESOURCE INFORMATION

INFERRED 45,000,000
UNITS MT ORE
YEAR/DATA 1941

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	0.27	WT-PCT
AU	.67	GM/MT

RESERVE/RESOURCE REMARKS

SOURCE: HOBBS, S. W., AND W. T. PECORA. NICKEL-GOLD DEPOSIT NEAR MOUNT VERNON, SKAGIT COUNTY, WASHINGTON. U.S. GEOL. SURV. BULL 931-D, 1941, PP. 57-78.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	TEST ADIT/TRENCHING/CORE DRILLING/
YEAR OF DISCOVERY: 1936	SURFACE GEOLOGIC MAPPING/TEST ADIT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: BRECCIA FILLING: REPLACEMENT
MODE OF ORIGIN: RESIDUAL CONTENT: HYDROTHERMAL
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: FRACTURING

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 0
STRIKE/DIP: N70W: 85S
AVERAGE LENGTH/METERS: 3,200
AVERAGE THICKNESS/METERS: 60

MINIMUM DEPTH/METERS: 0
AVERAGE WIDTH/METERS: 440

LITHOLOGY:

NAME OF FORMATION: SEDIMENTS
GEOLOGIC AGE: TERTIARY
DEFORMATION DESCRIPTION: METAMORPHISM: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION
ROCK TYPE:
QUARTZITE ORE IN FRACTURES: LIES ALONG ORE
PHYLLITE ORE IN FRACTURES: LIES ALONG ORE

LITHOLOGY:

NAME OF FORMATION: INTRUSIVES
GEOLOGIC AGE: TERTIARY
DEFORMATION DESCRIPTION: MAJOR FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION
ROCK TYPE:
PERIDOTITE REPLACED BY ORE: LIES UNDER ORE
LATITE NEAR ORE

LITHOLOGY:

NAME OF FORMATION: CHUCKANUT
GEOLOGIC AGE: EOCENE
DEFORMATION DESCRIPTION: FAULTING
ROCK TYPE:
CONGLOMERATE LIES OVER ORE
SANDSTONE LIES OVER ORE
SHALE LIES OVER ORE

LITHOLOGY:

NAME OF FORMATION: CALC-SILICATE ROCK
GEOLOGIC AGE: EOCENE
DEFORMATION DESCRIPTION: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
ROCK TYPE:
PERIDOTITE REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
QUARTZ	TERTIARY	FORMS OF SiO ₂	VARIABLE
OPAL	TERTIARY	FORMS OF SiO ₂	VARIABLE
CHALCEDONY	TERTIARY	FORMS OF SiO ₂	VARIABLE
ANKERITE	TERTIARY	CARBONATES	VARIABLE
MAGNESITE	TERTIARY	CARBONATES	VARIABLE
DOLOMITE	TERTIARY	CARBONATES	VARIABLE
CALCITE	TERTIARY	CARBONATES	VARIABLE
MARCASITE	TERTIARY	SULFIDES	VARIABLE
PYRITE	TERTIARY	SULFIDES	VARIABLE
BRAVOITE	TERTIARY	SULFIDES	VARIABLE
CHROMITE	TERTIARY	OXIDES (EXCLUDING SiO ₂)	VARIABLE
SERPENTINE	TERTIARY	SILICATES	VARIABLE

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HOBBS, S. W., AND W. T. PECORA. NICKEL-GOLD DEPOSIT NEAR MT. VERNON, SKAGIT, COUNTY, WASHINGTON. U.S. GEOL. SURV. BULL. 931-D, 1941, PP. 57-78.

HUNTING, M. T. GOLD IN WASHINGTON. WA DIV. OF GEOL. BULL. 42, 1955, P. 87.

FOREIGN DEPOSITS

AUSTRALIA

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: GREENVALE	SEQUENCE NUMBER: 6020350010
NATION: AUSTRALIA	SUBDIVISION: QUEENSLAND
TYPE OF OPERATION: SURFACE	CURRENT STATUS: PRODUCER
LATITUDE: S 18 DEG 58 MIN 0 SEC	LONGITUDE: E 145 DEG 6 MIN 0 SEC
UTM - ZONE: 55 HEMISPHERE: SOUTHERN	NORTHING: 7901908 EASTING: 299953
ELEVATION: 500 METERS	PRECISION: 100 METERS
DATUM: SEA LEVEL	

OWNERSHIP:	STATUS:
FREEPORT QUEENSLAND NICKEL	OWNER-OPERATOR
METALS EXPLORATION QUEENSLAND (PROPRIETARY), LTD.	OWNER-OPERATOR

COMMODITY	MARKETABILITY
NICKEL	PRIMARY
COBALT	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED	45,000,000
UNITS	MT ORE
YEAR/DATA	1976

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.57	WT-PCT
CO	0.12	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: QUEENSLAND NICKEL PTY. LTD. BROCHURE, 1976.

TONNAGE PRIOR TO STARTUP DECEMBER 1974.

DEPOSIT HISTORICAL INFORMATION

YEAR OF INITIAL PRODUCTION: 1974	-----EXPLORATION METHODS-----
YEAR OF FINAL PRODUCTION: PRODUCING	DRILLING/TEST PIT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
 MODE OF ORIGIN: RESIDUAL CONCENTRATION
 SHAPE OF ORE BODY: TABULAR: IRREGULAR
 CONTROLLING FEATURES: LITHOLOGY: FRACTURING

MINERALIZED ZONE:

AVERAGE LENGTH/METERS: 1,800
AVERAGE THICKNESS/METERS: 8

AVERAGE WIDTH/METERS: 1,800

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 11.5

MINIMUM THICKNESS/METERS: 1

LITHOLOGY:

NAME OF FORMATION: BOILER GULLY COMPLEX

GEOLOGIC AGE: ORDOVICIAN

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION

ROCK TYPE:

SERPENTINITE IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
SERPENTINE	TERTIARY	SILICATES
LIMONITE	TERTIARY	OXIDES (EXCLUDING SiO2)
CHALCEDONY	TERTIARY	FORMS OF SiO2

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT

CAPACITY: 7,058

UNITS: MT ORE/DAY

DESCRIPTION OF COVER: HARDPAN

HARDNESS OF ORE: HARDPAN

SURFACE AREA OF MINE: 350 HECTARES

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: QUEENSLAND

LATITUDE: S 18 58 00

LONGITUDE: E 145 06 00

METHOD OF TRANSPORTATION: RAIL

DISTANCE (KM): 225

DESTINATION FACILITY: MILL (OFF-SITE)

LOCATION: YABULU, QUEENSLAND

LATITUDE: S 19 00 00

LONGITUDE: E 146 20 00

BENEFICIATION:

METHOD: HYDROMETALLURGY

DESIGN CAPACITY: 7058

UNITS: MT ORE/DAY

DEPOSIT PERCENT USED: 100

TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----

ORE/CRUSH AND SCREEN/AMMONIUM LEACH/

NICKEL RONDELLES/

COBALT SULFIDE CONCENTRATE

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI RONDELLES	NI	73	90.0	WT-PCT
CO SULFIDE CONC.	CO	59	16.5	WT-PCT

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MINING MAGAZINE. DEC. 1973, PP. 504-512.

QUEENSLAND NICKEL PTY, LTD. BROCHURE. 1976.

REGISTER OF AUSTRALIAN MINING. 1980, PP. 97-98, 108.

U.S. BUREAU OF MINES. MINERALS YEARBOOK, 1978-1979. P. 636.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: AGNEW NICKEL DEPOSIT	SEQUENCE NUMBER: 6020550015	
NATION: AUSTRALIA	SUBDIVISION: WESTERN AUSTRALIA	
TYPE OF OPERATION: UNDERGROUND	CURRENT STATUS: PRODUCER	
LATITUDE: S 27 DEG 28 MIN 0 SEC	LONGITUDE: E 120 DEG 42 MIN 0 SEC	
UTM - ZONE: 51 HEMISPHERE: SOUTHERN	NORTHING: 6959939 EASTING: 272714	
POINT OF REFERENCE: ORE BODY		
ELEVATION: 525 METERS	PRECISION: 10 METERS	
DATUM: SEA LEVEL		
OWNERSHIP:	STATUS:	
SELTRUST MINING CORPORATION	OWNER	
MOUNT ISA MINES, LTD.	OWNER	
AGNEW MINING COMPANY, LTD.	OPERATOR	
COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED	45,200,000
UNITS	MT ORE
YEAR/DATA	1979

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	2.05	WT-PCT
CU	0.10	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: MINING MAGAZINE. DEC. 1979, PP. 556-557.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	MAGNETIC SURVEY/GEOCHEMICAL/
YEAR OF DISCOVERY: 1971	SURFACE GEOLOGIC MAPPING
YEAR OF INITIAL PRODUCTION: 1979	
YEAR OF FINAL PRODUCTION: PRODUCING	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: SHEAR ZONE
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: OXIDATION AND SUPERGENE ENRICHMENT
SHAPE OF ORE BODY: LENTICULAR
CONTROLLING FEATURES: FAULTING: IGNEOUS ACTIVITY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 500
STRIKE/DIP: N10W: 75W
AVERAGE LENGTH/METERS: 2,500

MINIMUM DEPTH/METERS: 0
AVERAGE WIDTH/METERS: 90

LITHOLOGY:

NAME OF FORMATION: W. AUSTRALIA ARCHEAN SHIELD
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: FAULTING: IGNEOUS ACTIVITY
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
ROCK TYPE:
ULTRAMAFIC IGNEOUS NEAR ORE
GREENSTONE NEAR ORE
UNSPECIFIED SEDIMENTARY NEAR ORE
ULTRAMAFIC IGNEOUS IS ORE

MINERALIZATION:

MINERAL NAME	MINERAL CLASS
PENTLANDITE	SULFIDES
PYRRHOTITE	SULFIDES
PYRITE	SULFIDES
CHALCOPYRITE	SULFIDES
VIOLARITE	SULFIDES
MAGNETITE	OXIDES(EXCLUDING SiO2)

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: HORIZONTAL CUT AND FILL WITH TAILINGS
CAPACITY: 3,333 UNITS: MT ORE/DAY
ROCK/MINE SUPPORT: SUPPORTING, MAY BACK SLAB: ROCK BOLTS
CONDITION OF WORKINGS: OPEN
TOTAL LENGTH OF WORKINGS:
INCLINES - NUMBER: 1 SLOPE: 3 DEGREES
SHAFTS - NUMBER: 2 AVERAGE DEPTH: 900 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: AGNEW, AUSTRALIA
LATITUDE: S 27 28 00	LONGITUDE: E 120 42 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	DISTANCE (KM): 1
DESTINATION FACILITY: MILL (ON-SITE))	LOCATION: AGNEW, AUSTRALIA
LATITUDE: S 27 28 00	LONGITUDE: E 120 42 00

BENEFICIATION:

METHOD: FLOTATION	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 3,333	ORE/CRUSH/GRIND/FLOAT/THICK/FILTER/
UNITS: MT ORE/DAY	DEWATER/DRY
DEPOSIT PERCENT USED: 100	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI CONC.	NI	85	10.50	WT-PCT
	CU	86	0.83	WT-PCT

TRANSPORTATION FOR PRODUCT: NI CONCENTRATE

ORIGINATING FACILITY: SMELTER	LOCATION: LEONORA, AUSTRALIA
LATITUDE: S 28 54 00	LONGITUDE: E 121 20 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: RAIL	DISTANCE (KM): 230
DESTINATION FACILITY: REFINERY	LOCATION: KALGOORLIE, AUSTRALIA
LATITUDE: S 30 49 00	LONGITUDE: E 121 29 00

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ENGINEERING AND MINING JOURNAL. MAY 1977, P. 37.

MARTIN, J. E. AND P. D. ALLCHURCH. PERSERVERANCE NICKEL DEPOSIT, AGNEW. ECON. GEOL. OF AUSTRALIA AND PAPUA NEW GUINEA, V. 1, 1975, P. 149.

MINING JOURNAL. AUG. 15, 1980, PP. 127-129.

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NICKEL, E. H. SUPERGENE ALTERATION AT THE PERSEVERANCE NICKEL DEPOSIT, AGNEW, WESTERN AUSTRALIA. ECON. GEOL. OF AUSTRALIA AND PAPUA NEW GUINEA, V. 72, 1977, P. 184.

SELTRUST HOLDINGS, LTD. MIN. S. 57 REPORT: THE STOCK EXCHANGE RESEARCH SERVICE. MAY 29, 1980.

YOUNG, D. THE AGNEW NICKEL PROJECT. MIN. MAGAZINE, V. 141, NO. 6, DEC. 1979.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: KAMBALDA AND
ST. IVES NICKEL OPERATION

SEQUENCE NUMBER: 6020550016

NATION: AUSTRALIA
TYPE OF OPERATION: UNDERGROUND
LATITUDE: S 31 DEG 12 MIN 0 SEC
UTM - ZONE: 51 HEMISPHERE: SOUTHERN
POINT OF REFERENCE: ORE BODY
ELEVATION: 454 METERS
DATUM: LOCAL DATUM

SUBDIVISION: WESTERN AUSTRALIA
CURRENT STATUS: PRODUCER
LONGITUDE: E 121 DEG 40 MIN 12 SEC
NORTHING: 6547655 EASTING: 373287

PRECISION: 100 METERS

ALTERNATE NAMES: KAMBALDA
ST. IVES

OWNERSHIP:
WESTERN MINING CORPORATION, LTD.

STATUS:
OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	BYPRODUCT
COBALT	SULFIDE	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 21,219,000
UNITS MT ORE
YEAR/DATA 1978

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	3.24	WT-PCT

PUBLISHED RESERVE/RESOURCE REMARKS

SOURCE: FINANCIAL TIMES. MINING INTERNATIONAL YEARBOOK, 1980. P. 583.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:
ORE MINERAL IN PLACE
YEAR OF DISCOVERY: 1966
YEAR OF INITIAL PRODUCTION: 1967
YEAR OF FINAL PRODUCTION: PRODUCING

-----EXPLORATION METHODS-----
CORE DRILLING/PERCUSSION DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: OTHER: DISSEMINATED: FISSURE VEIN
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: OXIDATION
SHAPE OF ORE BODY: LENTICULAR: IRREGULAR
CONTROLLING FEATURES: FAULTING: IGNEOUS
WALL ROCK ALTERATION: OTHER
DEGREE OF ALTERATION: MODERATE

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 120	MINIMUM DEPTH/METERS: 30
STRIKE/DIP: N30W: 40N	
AVERAGE LENGTH/METERS: 1,500	AVERAGE WIDTH/METERS: 500
AVERAGE THICKNESS/METERS: 275	

LITHOLOGY:

NAME OF FORMATION: KAMBALDA DOME
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: MAJOR FAULTING: INTRUSION: MINOR FOLDING

METAMORPHISM

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

ULTRAMAFIC IGNEOUS	ENCLOSES ORE
BASALT	NEAR ORE
SHALE	NEAR ORE
UNSPECIFIED SEDIMENTARY	LIES OVER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
MILLERITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: HORIZONTAL CUT AND FILL WITH WASTE ROCK 10-60
CAPACITY: 5,200 UNITS: MT ORE/DAY
CHARACTERISTIC OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES
ROCK AND WATER CONDITIONS: HARDROCK WITH LITTLE WATER
ROCK/MINE SUPPORT: SUPPORTING POST, HEADBOARD, CAPS, ROOF BOLTS
CONDITION OF WORKINGS: OPEN
SHAFTS - NUMBER: 2

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: KAMBALDA, AUSTRALIA
LATITUDE: S 31 09 00	LONGITUDE: E 121 39 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	DISTANCE (KM): 1
DESTINATION FACILITY: MILL (ON-SITE)	LOCATION: KAMBALDA, AUSTRALIA
LATITUDE: S 31 09 00	LONGITUDE: E 121 39 00

BENEFICIATION:

METHOD: FLOTATION
 DESIGN CAPACITY: 5,200
 UNITS: MT ORE/DAY

----- DESCRIPTION OF MILLING -----
 ORE/CRUSH/GRIND/FLOAT/DEWATER/DRY/
 FILTER/THICK

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CONC.	NI	89	12.0	WT-PCT
	CU	93	1.0	WT-PCT
	CO	50	0.2	WT-PCT

TRANSPORTATION FOR PRODUCT: NI-CONCENTRATE

ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: KAMBALDA, AUSTRALIA
LATITUDE: S 31 09 00	LONGITUDE: E 121 39 00
PERCENT SHIPPED: 50	
METHOD OF TRANSPORTATION: RAIL	DISTANCE (KM): 650
DESTINATION FACILITY: REFINERY	LOCATION: KWINANA, AUSTRALIA
LATITUDE: S 32 15 00	LONGITUDE: E 113 46 00

TRANSPORTATION FOR PRODUCT: NI-CONCENTRATE

ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: KAMBALDA, AUSTRALIA
LATITUDE: S 31 09 00	LONGITUDE: E 121 39 00
PERCENT SHIPPED: 50	
METHOD OF TRANSPORTATION: RAIL	DISTANCE (KM): 40
DESTINATION FACILITY: SMELTER	LOCATION: KALGOORLIE, AUSTRALIA
LATITUDE: S 30 49 00	LONGITUDE: E 121 29 00

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KEELE, R. A. AND E. N. NICKEL. THE GEOLOGY OF A PRIMARY MILLERITE-BEARING
 SULPHIDE ASSEMBLAGE AND SUPERGENE ALTERATION AT THE OTTER SNOOT, KAMBALDA,
 WESTERN AUSTRALIA. ECON. GEOL., V. 69, 1974, PP. 1102-1117.

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WESTERN MINING CORPORATION HOLDINGS, LTD. ANNUAL REPORT, 1975. PP. 6-8.

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: WINDARRA/SOUTH WINDARRA SEQUENCE NUMBER: 6020550017
NATION: AUSTRALIA SUBDIVISION: WESTERN AUSTRALIA
TYPE OF OPERATION: SURFACE-UNDERGROUND CURRENT STATUS: TEMPORARY SHUTDOWN
LATITUDE: S 28 DEG 32 MIN 0 SEC LONGITUDE: E 122 DEG 9 MIN 0 SEC
UTM - ZONE: 51 HEMISPHERE: SOUTHERN NORTHING: 6843594 EASTING: 416837
POINT OF REFERENCE: ORE BODY
ELEVATION: 500 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

ALTERNATE NAMES: MT. WINDARRA/SOUTH WINDARRA

OWNERSHIP:	STATUS:
WESTERN MINING CORPORATION, LTD.	OWNER
SHELL MINERALS EXPLORATION (AUSTRALIA)	OWNER
WINDARRA NICKEL MINES PTY., LTD.	OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	COPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 9,200,000
UNITS MT ORE
YEAR/DATA 1980

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.39	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: WESTERN MINING CORPORATION HOLDINGS, LTD. ANNUAL REPORT, 1980.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1969	-----EXPLORATION METHODS -----
YEAR OF INITIAL PRODUCTION: 1974	TEST SHAFT/DRILLING
YEAR OF FINAL PRODUCTION: 1978	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: BRECCIA FILLING
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: IRREGULAR: LENTICULAR
CONTROLLING FEATURES: IGNEOUS: LITHOLOGY
WALL ROCK ALTERATION: OTHER
DEGREE OF ALTERATION: MODERATE

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 122

STRIKE/DIP: N90E: 45S

MINIMUM DEPTH/METERS: 45

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 30

MINERALIZATION:

MINERAL NAME	MINERAL CLASS
PENTLANDITE	SULFIDES
CHALCOPYRITE	SULFIDES
PYRITE	SULFIDES
PYRRHOTITE	SULFIDES
CHROMITE	OXIDES (EXCLUDING SiO ₂)
MAGNETITE	OXIDES (EXCLUDING SiO ₂)
ANTIGORITE	SILICATES
TALC	SILICATES

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ROBINSON, W. D., E. C. STACK, AND R. WRIGHT. THE DISCOVERY AND EVALUATION OF THE WINDARRA NICKEL DEPOSITS. AUSTRALIAN IMM CONF., MAY 1973.

WESTERN MINING CORPORATION HOLDINGS, LTD. ANNUAL REPORT, 1980.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MOUNT KEITH	SEQUENCE NUMBER: 6020550018
NATION: AUSTRALIA	SUBDIVISION: WESTERN AUSTRALIA
TYPE OF OPERATION: PROSPECT	CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: S 27 DEG 43 MIN 0 SEC	LONGITUDE: E 120 DEG 32 MIN 0 SEC
UTM - ZONE: 51 HEMISPHERE: SOUTHERN	NORTHING: 6931917 EASTING: 256792
POINT OF REFERENCE: ORE BODY	PRECISION: 500 METERS
ELEVATION: 43 METERS	PRECISION: 10 METERS
DATUM: SEA LEVEL	
OWNERSHIP:	STATUS:
METALS EXPLORATION, LTD.	OWNER-OPERATOR
FREEPORT	OWNER-OPERATOR
AUSTRALIAN CONSOLIDATED MINERALS N.L.	OWNER-OPERATOR
COMMODITY	MARKETABILITY
NICKEL	PRIMARY
COBALT	BYPRODUCT
MODIFIER	
SULFIDE	
SULFIDE	

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED	263,000,000
INFERRED	27,000,000
UNITS	MT ORE
YEAR/DATA	1981

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	0.60	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: BURT, D. R. L., AND N. R. SHEPPY. MOUNT KEITH NICKEL SULFIDE DEPOSIT. ECON. GEOL. OF AUSTRALIA AND PAPUA NEW GUINEA, 1976, PP. 159-168.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1968

-----EXPLORATION METHODS-----
ELECTROMAGNETIC SURVEY/DRILLING/
TEST SHAFT/AERIAL COLOR PHOTOGRAPHY

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: OXIDATION AND SUPERGENE ENRICHMENT
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: IGNEOUS ACTIVITY: FAULTING
WALL ROCK ALTERATION: CARBONATIZATION
DEGREE OF ALTERATION: INTENSE

MINERALIZED ZONE:

STRIKE/DIP: S10E: 90
AVERAGE LENGTH/METERS: 1,830
AVERAGE THICKNESS/METERS: 180

AVERAGE WIDTH/METERS: 500

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 85

LITHOLOGY:

NAME OF FORMATION: MOUNT KEITH BELT
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: MAJOR FOLDING: FAULTING: INTRUSION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
DUNITE IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
MILLERITE	PRECAMBRIAN	SULFIDES
VIOLARITE	PRECAMBRIAN	SULFIDES
VALLERITE	PRECAMBRIAN	SULFIDES
MAGNETITE	PRECAMBRIAN	OXIDES(EXCLUDING SiO2)
CHROMITE	PRECAMBRIAN	OXIDES(EXCLUDING SiO2)

BIBLIOGRAPHY RECORDS

BURT, D. R. L., AND N. R. SHEPPY. MOUNT KEITH NICKEL SULFIDE DEPOSIT.
ECON. GEOL. OF AUSTRALIA AND PAPUA NEW GUINEA, 1976, PP. 159-168.

METALS EXPLORATION, LTD. MINING INTERNATIONAL YEARBOOK, 1978. PP. 383-384.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: WINGELLINA MINE	SEQUENCE NUMBER: 6020550019
NATION: AUSTRALIA	SUBDIVISION: WESTERN AUSTRALIA
TYPE OF OPERATION: SURFACE	CURRENT STATUS: RAW PROSPECT
LATITUDE: S 26 DEG 3 MIN 0 SEC	LONGITUDE: E 129 DEG 58 MIN 0 SEC
UTM - ZONE: 52 HEMISPHERE: SOUTHERN	NORTHING: 7118583 EASTING: 596705
POINT OF REFERENCE: ORE BODY	PRECISION: 100 METERS
ELEVATION: 575 METERS	
DATUM: SEA LEVEL	
OWNERSHIP:	STATUS:
TEXASGULF AUSTRALIA, LTD.	OWNER
COMMODITY	MARKETABILITY
NICKEL	PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED	57,100,000
UNITS	MT ORE
YEAR/DATA	1976

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.28	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: SPRIGG, R. C., AND K. ROCKOW. WICKELIFEROUW OCHRES IN THE HINCHLEY (W. A.) AND TOMKINSON (S. A.) RANGES (DAISEY BAT WINGELLA FIELD). ECON. GEOL. OF AUSTRALIA AND PAPUA NEW GUINEA, V. 1, 1975, P. 1008.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOLOGICAL INFERENCE	SURFACE GEOLOGICAL MAPPING/DRILLING
YEAR OF DISCOVERY: 1955	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: IRREGULAR: TABULAR
CONTROLLING FEATURES: BEDDING: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 60	
AVERAGE LENGTH/METERS: 10,000	AVERAGE WIDTH/METERS: 1,500
AVERAGE THICKNESS/METERS: 110	

LITHOLOGY:

NAME OF FORMATION: MUSGRAVE BLOCK

GEOLOGIC AGE: PRECAMBRIAN

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

ROCK TYPE:

GABBRO	LIES OVER ORE: ENCLOSURES ORE
PYROXENITE	LIES OVER ORE: ENCLOSURES ORE
GRANITE	NEAR ORE
ULTRAMAFIC IGNEOUS	LIES OVER ORE: ENCLOSURES ORE
DUNITE	LIES OVER ORE: ENCLOSURES ORE
SERPENTINITE	ENCLOSURES ORE: LIES OVER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
NICKEL IRON	TERTIARY	SULFIDES	PHANERITIC-MEDIUM
LIMONITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO_2)	PHANERITIC-MEDIUM
QUARTZ	PRECAMBRIAN	SILICATES	PHANERITIC-MEDIUM
CHRYSOPTASE	PRECAMBRIAN	SILICATES	PHANERITIC-MEDIUM
MAGNESITE	PRECAMBRIAN	CARBONATES	PHANERITIC-MEDIUM

BIBLIOGRAPHY RECORDS

ROSS, L. HEALTH CHART IS GEARED TO AMERICA'S ECONOMY. REGISTER OF AUSTRALIAN MINING, 1982-83, PP. 166.

SPRIGG, R. C., AND K. ROCKOW. NICKELIFEROUS OCHRES IN THE HINCHLEY (W. A.) AND TOMKINSON (S. A.) RANGES (DAISEY BAT WINGELLA FIELD). ECON. GEOL. OF AUSTRALIA AND PAPUA NEW GUINEA, V. 1, 1975, P. 1008.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: WANNAWAY

SEQUENCE NUMBER: 6020550069

NATION: AUSTRALIA

SUBDIVISION: WESTERN AUSTRALIA

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: S 31 DEG 36 MIN 0 SEC

LONGITUDE: E 121 DEG 31 MIN 0 SEC

UTM - ZONE: 51 HEMISPHERE: SOUTHERN

NORTHING: 6503131 EASTING: 359276

POINT OF REFERENCE: ORE BODY

ELEVATION: 50 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

ANACONDA AUSTRALIA, INC.

OWNER

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

COPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 4,500,000
UNITS MT ORE
YEAR/DATA 1975

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.22	WT-PCT
CU	0.1	WT-PCT

RESERVE/RESOURCE REMARKS

REC. 1 - DALGARNO, C. R. NICKEL DEPOSITS OF THE WIDGIE MOOLTHA DOME;
REDROSS, WANNAWAY, WIDGIE MOOLTHA, DORDIE. ECON. GEOL. OF AUSTRALIA AND PAPUA
AND NEW GUINEA, V. 1, 1975, P. 129.

REC. 2 - REGISTER OF AUSTRALIAN MINING. 1980 EDITION, P. 104.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1966

-----EXPLORATION METHODS-----
TEST SHAFT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STOCKWORK

MODE OF ORIGIN: MAGMATIC DIFFERENTIATION

SHAPE OF ORE BODY: MASSIVE: LENTICULAR

CONTROLLING FEATURES: IGNEOUS: FAULTING

MINERALIZED ZONE:

STRIKE/DIP: N25E: 65W

AVERAGE LENGTH/METERS: 400

AVERAGE THICKNESS/METERS: 9

AVERAGE WIDTH/METERS: 20

LITHOLOGY:

NAME OF FORMATION: WIDGIE MOOLTHA DOME

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: INTRUSION: FAULTING: METAMORPHISM

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION

ROCK TYPE:

ULTRAMAFIC IGNEOUS

NEAR ORE

BASALT

NEAR ORE

AMPHIBOLITE

NEAR ORE

GRANITE

NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERIAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHLORITE	PRECAMBRIAN	SILICATES
TREMOLITE	PRECAMBRIAN	SILICATES

BIBLIOGRAPHY RECORDS

DALGARNO, C. R. NICKEL DEPOSITS OF THE WIDGIEMOOLTHA DOME; REDCROSS, WANNAWAY, WIDGIEMOOLTHA, DORDIE. ECON. GEOL. OF AUSTRALIA AND PAPUA NEW GUINEA, V. 1, 1975, P. 82.

METALS EXPLORATION LTD. ANNUAL REPORT, 1976.

REGISTER OF AUSTRALIAN MINING. 1980 EDITION, P. 104.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: SHERLOCK BAY

SEQUENCE NUMBER: 6020550087

NATION: AUSTRALIA

SUBDIVISION: WESTERN AUSTRALIA

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: S 20 DEG 48 MIN 0 SEC

LONGITUDE: E 117 DEG 32 MIN 0 SEC

UTM - ZONE: 50 HEMISPHERE: SOUTHERN

NORTHING: 7700030 EASTING: 555503

POINT OF REFERENCE: CLAIM

PRECISION: 10 METERS

ELEVATION: 400 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

AUSTRALIAN INLAND EXPLORATION, LTD.

TEXAS GULF

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE

GEOLOGICAL/BEDROCK SAMPLING

YEAR OF DISCOVERY: 1907

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STOCKWORK

MODE OF ORIGIN: HYDROTHERMAL

SHAPE OF ORE BODY: LENTICULAR

CONTROLLING FEATURES: IGNEOUS

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 300

STRIKE/DIP: N90E: 85N

AVERAGE LENGTH/METERS: 2,000

AVERAGE THICKNESS/METERS: 30

MINERALIZATION:

MINERAL NAME

AGE

MINERAL CLASS

PENTLANDITE

PRECAMBRIAN

SULFIDES

CHALCOPYRITE

PRECAMBRIAN

SULFIDES

BIBLIOGRAPHY RECORDS

MILLER, L. J., AND M. E. SMITH. SHERLOCK BAY NICKEL-COPPER. ECON. GEOL. OF AUSTRALIA AND PAPUA NEW GUINEA, V. 1, 1975, PP. 168-174.

LITHOLOGY:

NAME OF FORMATION: ARCHEAN ULTRAMAFIC COMPLEX

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: OTHER: METAMORPHISM: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

DUNITE	LIES UNDER ORE: REPLACED BY ORE
PERIDOTITE	NEAR ORE: REPLACED BY ORE
GREENSTONE	NEAR ORE
GRANITE	NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	CRETACEOUS	OXIDES (EXCLUDING SiO_2)
LIMONITE	CRETACEOUS	OXIDES (EXCLUDING SiO_2)
CHLORITE	CRETACEOUS	SILICATES
MAGNESITE	CRETACEOUS	CARBONATES

BIBLIOGRAPHY RECORDS

LOFTUS-HILLS, W.A.G.D. ORA BANDA LATERITE NICKEL DEPOSITS. ECON. GEOL. OF AUSTRALIA AND PAPUA NEW GUINEA, V. 1, 1975, P. 1010.

BOTSWANA

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: SELEBI-PHIKWE SEQUENCE NUMBER: 7930000002

NATION: BOTSWANA SUBDIVISION: NOT SUBDIVIDED

TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: PRODUCER

LATITUDE: S 22 DEG 0 MIN 30 SEC LONGITUDE: E 27 DEG 50 MIN 0 SEC

UTM - ZONE: 35 HEMISPHERE: SOUTHERN NORTHING: 7566159 EASTING: 586015

POINT OF REFERENCE: MAIN ENTRY PRECISION: 5 KILOMETERS

OWNERSHIP: STATUS:

BCL, LTD. OPERATOR

BOTSWANA RST, LTD. OWNER

BOTSWANA GOVERNMENT OWNER

COMMODITY	MODIFIER	MARKETABILITY
COPPER	SULFIDE	PRIMARY
NICKEL	SULFIDE	COPRODUCT
COBALT		BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

	RECORD 1	RECORD 2
INDICATED	31,000,000	12,600,000
UNITS	MT ORE	MT ORE
YEAR/DATE	1980	1980

IN SITU GRADE:

RECORD	ASSAY/FORM	GRADE	UNIT
1	CU	1.36	WT-PCT
	NI	1.12	WT-PCT
2	CU	1.50	WT-PCT
	NI	0.74	WT-PCT

RESERVE/RESOURCE - REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. FEB. 1980, PP. 55-62.

COBALT OCCURS AS A REPLACEMENT OF FE/NI IN THE PENTLANDITE. RATIOS OF 16/1 NI:CO ARE COMMON. ASSAYS SHOW COBALT AS TRACE. SPORADIC RECORD OF COBALT PRODUCTION.

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED

MODE OF ORIGIN: METAMORPHISM

SHAPE OF ORE BODY: IRREGULAR

CONTROLLING FEATURES: FOLDING: LITHOLOGY

DEGREE OF ALTERATION: INTENSE

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 400
 AVERAGE LENGTH/METERS: 2,000
 AVERAGE THICKNESS/METERS: 38

MINIMUM DEPTH/METERS: 0
 AVERAGE WIDTH/METERS: 365

LITHOLOGY:

NAME OF FORMATION: LENTSWE-DIKOLOTI GROUP
 GEOLOGIC AGE: PRECAMBRIAN
 DEFORMATION DESCRIPTION: METAMORPHISM: MINOR FOLDING: FAULTING
 RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
 ROCK TYPE:
 AMPHIBOLITE ENCLOSURES ORE
 GNEISS LIES OVER ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	MINERAL CLASS	GRAIN SIZE
PYRRHOTITE	SULFIDES	PHANERITIC-MEDIUM
PENTLANDITE	SULFIDES	PHANERITIC-MEDIUM
CHALCOPYRITE	SULFIDES	PHANERITIC-MEDIUM
MAGNETITE	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-MEDIUM
HORNBLende	SILICATES	PHANERITIC-MEDIUM

MINE/MILL INFORMATION

PHIKWE MINE

UNDERGROUND MINING:

METHOD: HORIZONTAL CUT AND FILL WITH TAILINGS
 CAPACITY: 4,263 UNITS: MT ORE/DAY
 CONDITION OF WORKINGS: OPEN
 TOTAL LENGTH OF WORKINGS:
 SHAFTS - NUMBER: 5 AVERAGE DEPTH: 400 METERS

BENEFICIATION:

METHOD:	DESCRIPTION OF MILLING
FLOTATION	ORE/WASH/CRUSH, 3-STAGE/ GRIND (54%-200 MESH)/ FLOTATION (3-STAGES)/THICKENING
DESIGN CAPACITY: 3,800	
UNITS: MT ORE/DAY	
DEPOSIT PERCENT USED: 100	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
6.27 %CU-NI	CU	95	3.47	WT-PCT
CONC.	NI	78	3.55	WT-PCT

MINE/MILL INFORMATION

PHIKWE SMELTER(PIKWE ORE)

BENEFICIATION:

METHOD:	DESCRIPTION OF MILLING
FLOTATION	ORE/WASH/CRUSH, 3-STAGE/ GRIND (54%-200 MESH)/THICKENING/ FLOTATION (3-STAGES)
DESIGN CAPACITY: 5,714	
UNITS: MT ORE/DAY	
DEPOSIT PERCENT USED: 100	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
CU-NI MATTE	CU	95	3.47	WT-PCT
	NI	78	3.55	WT-PCT

TRANSPORTATION FOR PRODUCT: CU-NI MATTE	
ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: BOTSWANA
LATITUDE: S 21 56 45	LONGITUDE: E 27 51 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: RAIL: OCEAN	DISTANCE (KM): 1288
DESTINATION FACILITY: REFINERY	LOCATION: LOUISIANA, USA
LATITUDE: N 30 00 00	LONGITUDE: W 90 03 00

MINE/MILL INFORMATION

PHIKWE + SELEBI

UNDERGROUND MINING:

METHOD: PILLAR AND CHAMBER	
CAPACITY: 2,147	UNITS: MT ORE/DAY
ROCK AND WATER CONDITIONS: NO WATER PROBLEMS	
CONDITION OF WORKINGS: OPEN	
TOTAL LENGTH OF WORKINGS:	
SHAFTS - NUMBER: 2	AVERAGE DEPTH: 500 METERS

BENEFICIATION:

METHOD: PYROMETALLURGY	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 931	CU-NI CONCENTRATE
UNITS: MT CONCENTRATE/DAY	OUTOKUMPU FLASH SMELTER
DEPOSIT PERCENT USED: 100	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
6.29% CU-NI	CU	95	3.47	WT-PCT
CONC.	NI	78	3.55	WT-PCT

MINE/MILL INFORMATION

PHIKWE SMELTER-PHIKWE-SELEBI ORE

BENEFICIATION:

METHOD: PYROMETALLURGY	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 1,400	CU-NI CONCENTRATE
UNITS: MT CONCENTRATE/DAY	OUTOKUMPU FLASH SMELTER
DEPOSIT PERCENT USED: 100	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
CU-NI MATTE	CU	95	3.47	WT-PCT
	NI	78	3.55	WT-PCT

TRANSPORTATION FOR PRODUCT: CU-NI MATTE	
ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: BOTSWANA
LATITUDE: S 21 56 45	LONGITUDE: E 27 51 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: RAIL: OCEAN	DISTANCE (KM): 1,288
DESTINATION FACILITY: REFINERY	LOCATION: LOUISIANA, U.S.A.
LATITUDE: N 30 00 00	LONGITUDE: W 90 03 00

BIBLIOGRAPHY RECORDS

BOTSWANA RST, LTD. ANNUAL. REPORT, 1976.

COAL, GOLD, AND BASE MINERALS OF SOUTHERN AFRICA. BOTSWANA'S R120M MINE PREPARES FOR ACTION. JULY 1973, PP. 30-33.

GORDON, P. S. L. THE SELEBI-PHIKWE NICKEL-COPPER DEPOSIT, BOTSWANA. SYMPOSIUM ON GRANITES, GNEISSES AND RELATED ROCKS, AUG.-SEPT. 1971, PP. 167-183.

HOPPE, R. SELEBI-PHIKWE: RUNNING A GOOD AND TIGHT UNDERGROUND MINE. ENG. AND MIN. J., FEB. 1980, PP. 55-62.

_____. SELEBI-PHIKWE: CONCENTRATING AND SMELTING THE NICKEL-COPPER ORE. ENG. AND MIN. J., MAY 1980, PP. 75-86.

MINING MAGAZINE. PROGRESS AT BOTSWANA'S SELEBI-PHIKWE PROJECT. SEPT. 1972. PP. 237-239.

SOUTH AFRICA MINING AND ENGINEERING JOURNAL. SELEBI-PHIKWE, A RAY OF HOPE. OCT. 1975, PP. 14-23.

VALLENTINE, R. J. HOW SELEBI-PHIKWE NI-CU PROJECT OVERCAME EARLY PRODUCTION PROBLEMS. WORLD MIN., NOV. 1977, PP. 47-52.

VALLENTINE, R. J. AND T. M. YOUNG. OPERATIONS AT BCL, LTD., SELEBI-PHIKWE, BOTSWANA. PROC. OF THE 11TH COMMONWEALTH MIN. AND MET. CONG., HONG KONG, 1978.

WAKEFIELD, J. THE STRUCTURAL METAMORPHIC EVOLUTION OF THE PHIKWE NI-CU SULFIDE DEPOSIT, SELEBI, PHIKWE, EASTERN BOTSWANA. ECON. GEOL., V. 71, 1976, PP. 988-1005.

WORLD MINING. SELEBI-PHIKWE NICKEL-COPPER ON STREAM. APR. 1974, PP. 38-42.

BRAZIL

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: BARRO ALTO	SEQUENCE NUMBER: 3510170007
NATION: BRAZIL	SUBDIVISION: GOIAS
TYPE OF OPERATION: SURFACE	CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: S 14 DEG 50 MIN 0 SEC	LONGITUDE: W 48 DEG 50 MIN 0 SEC
UTM - ZONE: 22 HEMISPHERE: SOUTHERN	NORTHING: 8359079 EASTING: 733164
POINT OF REFERENCE: ORE BODY	
ELEVATION: 900 METERS	PRECISION: 10 METERS
DATUM: SEA LEVEL	

OWNERSHIP:	STATUS:
BAMINCO-MINERACAO E SIDERURGICA, SOUTH AMERICA	OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SILICATES	PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	TEST PIT/DRILLING/GEOLOGICAL
YEAR OF DISCOVERY: 1945	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 2.5	MINIMUM DEPTH/METERS: 0
AVERAGE LENGTH/METERS: 26,000	AVERAGE WIDTH/METERS: 1,850
AVERAGE THICKNESS/METERS: 7.7	
UNCONSOLIDATED MATERIAL:	
AVERAGE THICKNESS/METERS: 2.5	MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: INTRUSION: METAMORPHISM

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

ROCK TYPE:

PERIDOTITE ENCLOSURES: IS ORE

DUNITE ENCLOSURES: IS ORE

PYROXENITE ENCLOSURES: IS ORE

MINERALIZATION:

MINERAL NAME

MINERAL CLASS

GARNIERITE

SILICATES

LIMONITE

OXIDES (EXCLUDING SiO₂)

BIBLIOGRAPHY RECORDS

INFORMATION FOR THIS REPORT WAS OBTAINED FROM PRIVATE SOURCES.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: NIQUELANDIA	SEQUENCE NUMBER: 3510170008
NATION: BRAZIL	SUBDIVISION: GOIAS
TYPE OF OPERATION: SURFACE	CURRENT STATUS: PRODUCER
LATITUDE: S 14 DEG 33 MIN 0 SEC	LONGITUDE: W 48 DEG 23 MIN 0 SEC
UTM - ZONE: 22 HEMISPHERE: SOUTHERN	NORTHING: 8389925 EASTING: 781980
POINT OF REFERENCE: ORE BODY	
ELEVATION: 600 METERS	PRECISION: 500 METERS
DATUM: SEA LEVEL	

ALTERNATE NAMES: BURITI MINE

OWNERSHIP:	STATUS
COMPANHIA NIQUEL DE TOCANTINS (CNT)	OWNER-OPERATOR
COMMODITY	MARKETABILITY
NICKEL	PRIMARY
COBALT	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED	60,000,000
UNITS	MT ORE
YEAR/DATA	1981

IN SITU GRADE:	ASSAY/FORM	GRADE	UNIT
	NI	1.0	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: MINING JOURNAL. MINING ANNUAL REVIEW. 1981.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:
ORE-MINERAL IN PLACE
YEAR OF DISCOVERY: 1908
YEAR OF INITIAL PRODUCTION: 1980
YEAR OF FINAL PRODUCTION: PRODUCER

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: LENTICULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 10
AVERAGE LENGTH/METERS: 1,400
AVERAGE THICKNESS/METERS: 7

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 3

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

MINERALIZATION:

MINERAL NAME	MINERALIAL CLASS
GARNIERITE	SILICATES
LIMONITE	OXIDES (EXCLUDING SI02)
PYRRHOTITE	SULFIDES
PENTLANDITE	SULFIDES
PYRITE	SULFIDES

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT CAPACITY: 3,000
UNITS: MT ORE/DAY
DESCRIPTION OF COVER: MEDIUM HARD ROCKS
HARDNESS OF ORE: MEDIUM HARD ROCKS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: NIQUELANDIA, BRAZIL
LATITUDE: S 14 33 00	LONGITUDE: W 48 23 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: RAIL	DISTANCE (KM): 1,400
DESTINATION FACILITY: REFINERY	LOCATION: SAN MIQUEL PAULISTA

BENEFICIATION:

METHOD: HYDROMETALLURGICAL	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 3,000	ROAST/LEACH/PRECIPITATE
UNITS: MT ORE/DAY	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI METAL	NI	79	100	WT-PCT
	CO	74	2	WT-PCT
CO METAL	CO	73	100	WT-PCT

BIBLIOGRAPHY RECORDS

MINING JOURNAL. MINING ANNUAL REVIEW. 1981.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: NIQUELANDIA (CODEMIN) SEQUENCE NUMBER: 3510170009
NATION: BRAZIL SUBDIVISION: GOIAS
TYPE OF OPERATION: SURFACE CURRENT STATUS: DEVELOPED DEPOSIT
LATITUDE: S 14 DEG 33 MIN 0 SEC LONGITUDE: W 48 DEG 23 MIN 0 SEC
UTM - ZONE: 22 HEMISPHERE: SOUTHERN NORTHING: 8389925 EASTING: 781980
POINT OF REFERENCE: ORE BODY

ALTERNATE NAMES: CODEMIN

OWNERSHIP: STATUS:
EMPRESA DE DESENVOLVIMENTO DE RECURSOS MINERAIS-CODEMIN OWNER-OPERATOR

COMMODITY
NICKEL
COBALT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD: -----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE CORE DRILLING
YEAR OF DISCOVERY: 1908

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:
AVERAGE DEPTH/METERS: 2.5
AVERAGE LENGTH/METERS: 1,400 AVERAGE WIDTH/METERS: 450
AVERAGE THICKNESS/METERS: 15

LITHOLOGY:
NAME OF FORMATION: ULTRAMAFIC COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSIVE
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
ROCK TYPE:
PYROXENITE REPLACED BY ORE
PERIDOTITE REPLACED BY ORE
SERPENTINITE REPLACED BY ORE

MINERALIZATION:

MINERAL NAME
GARNIERITE
PYRRHOTITE
PENTLANDITE
PYRITE
CHALCOPYRITE
LIMONITE

MINERAL CLASS
SILICATES
SULFIDES
SULFIDES
SULFIDES
SULFIDES
OXIDES(EXCLUDING SiO_2)

BIBLIOGRAPHY RECORDS

INFORMATION FOR THIS REPORT WAS OBTAINED FROM PRIVATE SOURCES.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: JUSSARA	SEQUENCE NUMBER: 3510170010
NATION: BRAZIL	SUBDIVISION: GOIAS
TYPE OF OPERATION: SURFACE	CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: N 15 DEG 50 MIN 0 SEC	LONGITUDE: W 50 DEG 50 MIN 0 SEC
UTM - ZONE: 22 HEMISPHERE: NORTHERN	NORTHING: 1750399 EASTING: 517846
POINT OF REFERENCE: ORE BODY	
ELEVATION: 1,400 METERS	PRECISION: 10 METERS
DATUM: SEA LEVEL	
OWNERSHIP:	STATUS:
COMPANHIA MINERADORA MONTITA LTDA.	OWNER-OPERATOR
COMMODITY	MARKETABILITY
NICKEL	PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:
ORE-MINERAL IN PLACE
YEAR OF DISCOVERY: 1967

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:	
AVERAGE LENGTH/METERS: 9,000	AVERAGE WIDTH/METERS: 6,000
AVERAGE THICKNESS/METERS: 10	

LITHOLOGY:

NAME OF FORMATION: ARAXA GROUP	
GEOLOGIC AGE: CRETACEOUS	
DEFORMATION DESCRIPTION: INTRUSION	
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION	
GEOLOGIC AGE: TERTIARY	
ROCK TYPE:	
ULTRAMAFIC IGNEOUS	REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	TERTIARY	SILICATES
LIMONITE	TERTIARY	OXIDES(EXCLUDING SiO_2)

BIBLIOGRAPHY RECORDS

INFORMATION FOR THIS REPORT WAS OBTAINED FROM PRIVATE SOURCES.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MONTES CLAROS SEQUENCE NUMBER: 3510170011

NATION: BRAZIL SUBDIVISION: GOIAS

TYPE OF OPERATION: MINERAL LOCATION CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: S 15 DEG 20 MIN 0 SEC LONGITUDE: W 51 DEG 30 MIN 0 SEC

UTM - ZONE: 17 HEMISPHERE: NORTHERN NORTHING: 5 155866 EASTING: 500745

ELEVATION: 305 METERS PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP: STATUS:

VATORANTIN FINANCIAL GROUP OWNER

COMMODITY MODIFIER MARKETABILITY

NICKEL SILICATE PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD: -----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE OTHER

YEAR OF DISCOVERY: 1969

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: TABULAR

CONTROLLING FEATURES: LITHOLOGY

LITHOLOGY:

NAME OF FORMATION: ARAXA GROUP

GEOLOGIC AGE: CRETACEOUS

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: TERTIARY

ROCK TYPE:

ULTRAMAFIC IGNEOUS REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	TERTIARY	SILICATES
LIMONITE	TERTIARY	OXIDES (EXCLUDING SiO2)
SERPENTINE	TERTIARY	SILICATES
CHLORITE	TERTIARY	SILICATES
SPINEL	TERTIARY	OXIDES (EXCLUDING SiO2)

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COMPANHIA DE PESQUISA DE RECURSOS MINERAIS. CPRM'S NICKEL ORE DEPOSIT, MORRO DO ENGENHO, GOIAS, BRAZIL. 1976.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MORRO DO ENGENHO MINE SEQUENCE NUMBER: 3510170014
NATION: BRAZIL SUBDIVISION: GOIAS
TYPE OF OPERATION: SURFACE CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: S 15 DEG 22 MIN 0 SEC LONGITUDE: W 51 DEG 43 MIN 0 SEC
UTM - ZONE: 22 HEMISPHERE: SOUTHERN NORTHING: 8301094 EASTING: 423083
POINT OF REFERENCE: ORE BODY
ELEVATION: 1,400 METERS PRECISION: 100 METERS
DATUM: SEA LEVEL

OWNERSHIP: STATUS:
COMPANHIA DO PESQUIRO RECURSOS MINERAIS (CPRM.) OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SILICATE	PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	DRILLING/GEOLOGICAL/OTHER
YEAR OF DISCOVERY: 1969	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE LENGTH/METERS: 400	MINIMUM DEPTH/METERS: 0
	AVERAGE WIDTH/METERS: 400

LITHOLOGY:

NAME OF FORMATION: ARAXA GROUP	
GEOLOGIC AGE: CRETACEOUS	
DEFORMATION DESCRIPTION: INTRUSION	
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION	
ROCK TYPE:	
ULTRAMAFIC IGNEOUS	NEAR ORE
PERIDOTITE	NEAR ORE: ENCLOSURES ORE
DUNITE	NEAR ORE: ENCLOSURES ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-MEDIUM
SERPENTINE	CENOZOIC	SILICATES	PHANERITIC-MEDIUM
CHLORITE	CENOZOIC	SILICATES	PHANERITIC-MEDIUM
SPINEL	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-MEDIUM

BIBLIOGRAPHY RECORDS

COMPANHIA DE PERSQUISAS DE RECURSOS MINERAIS. CPRM'S NICKEL ORE DEPOSIT,
MORRO DE ENGENHO, GOIAS, BRAZIL. 1976, P. 5.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MORRO DO NIQUEL

SEQUENCE NUMBER: 3510170015

NATION: BRAZIL

SUBDIVISION: GOIAS

TYPE OF OPERATION: SURFACE

CURRENT STATUS: PRODUCER

LATITUDE: S 22 DEG 55 MIN 0 SEC

LONGITUDE: W 46 DEG 30 MIN 0 SEC

UTM - ZONE: 23 HEMISPHERE: SOUTHERN

NORTHING: 7465068 EASTING: 346168

ELEVATION: 890 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

MINERACAO MORRO DO NIQUEL

OPERATOR

SOCIETE ANONYME LE NICKEL

OWNER

BANQUE DO L'INDOCHINE

OWNER

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATE

PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED 1,082,500

INDICATED 1,200,000

UNITS MT ORE

YEAR/DATA 1981

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

NI

1.15

WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. INTERNATIONAL DIRECTORY OF MINING.
1982, P. 309.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE

DRILLING/GEOLOGICAL

YEAR OF DISCOVERY: 1922

YEAR OF INITIAL PRODUCTION: 1962

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: TABULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE LENGTH/METERS: 900

AVERAGE WIDTH/METERS: 400

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: MESOZOIC

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION

GEOLOGIC AGE: CENOZOIC

ROCK TYPE:

SERPENTINITE REPLACED BY ORE

SERPENTINITE LIES ALONG ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GARNIERITE	CENOZOIC	SILICATES	APHANITIC
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-FINE

MINE/MILL INFORMATION**SURFACE MINING:**

METHOD: OPEN PIT

CAPACITY: 1,000

UNITS: MT ORE/DAY

DESCRIPTION OF COVER: HAROPAN

HARDNESS OF ORE: HAROPAN

SURFACE AREA OF MINE: 12.57 HECTARES

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: MORRO DO NIQUEL MINE

LATITUDE: S 20 55 00

LONGITUDE: W 46 30 00

PERCENT SHIPPED: 100

DESTINATION FACILITY: MILL (ON-SITE)

LOCATION: MORRO DO NIQUEL

LATITUDE: S 20 55 00

LONGITUDE: W 46 30 00

BENEFICIATION:

METHOD: PYROMETALLURGY

DESIGN CAPACITY: 2,500

UNITS: MT ORE/DAY

----- DESCRIPTION OF MILLING -----
ORE/SCREEN/ROTARY KILNS
REDUCTIVE SMELTING

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
FERRONICKEL	NI	90	21	WT-PCT

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1982, P. 309.

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BRAZIL. INT. LATERITE SYMPOSIUM, 1979, PP. 397-411.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: SAO FELIX DO XINGU	SEQUENCE NUMBER: 3510250004
NATION: BRAZIL	SUBDIVISION: PARA
TYPE OF OPERATION: SURFACE	CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: S 6 DEG 45 MIN 0 SEC	LONGITUDE: W 52 DEG 0 MIN 0 SEC
UTM - ZONE: 22 HEMISPHERE: SOUTHERN	NORTHING: 9253821 EASTING: 389484
POINT OF REFERENCE: ORE BODY	PRECISION: 10 METERS
ELEVATION: 700 METERS	
DATUM: SEA LEVEL	
OWNERSHIP:	STATUS:
MINERACAO SERRAS DO SUL	OWNER
COMMODITY	MARKETABILITY
NICKEL	PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE - MINERAL IN PLACE	DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE	
GEOLOGIC AGE: PRECAMRIAN	
DEFORMATION DESCRIPTION: INTRUSION	
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION	
ROCK TYPE:	
ULTRAMAFIC IGNEOUS	IS ORE: REPLACED BY ORE: ENCLOSURES ORE

MINERALIZATION:

MINERAL NAME	MINERAL CLASS
GARNIERITE	SILICATES
LIMONITE	OXIDES (EXCLUDING SiO2)

BIBLIOGRAPHY RECORDS

INFORMATION FOR THIS REPORT WAS OBTAINED FROM PRIVATE SOURCES.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: SAO JOAO DO PIAUI SEQUENCE NUMBER: 3510330001
NATION: BRAZIL SUBDIVISION: PIAUI
TYPE OF OPERATION: SURFACE CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: S 8 DEG 20 MIN 0 SEC LONGITUDE: W 42 DEG 15 MIN 0 SEC
UTM - ZONE: 23 HEMISPHERE: SOUTHERN NORTHING: 9077855 EASTING: 802912

OWNERSHIP: STATUS:
RIO DOCE GEOLOGIA E. MINERACAO S/A OWNER-OPERATOR

COMMODITY MARKETABILITY
NICKEL PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

UNDIFFERENTIATED 20,000,000
UNITS MT ORE
YEAR/DATA 1978

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.7	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. JAN. 1978, P. 75.

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE LENGTH/METERS: 8 AVERAGE WIDTH/METERS: 4

LITHOLOGY:

NAME OF FORMATION: ULTRABASIC INTRUSIVE
GEOLOGIC AGE: PALEOZOIC
DEFORMATION DESCRIPTION: INTRUSIVE
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION
ROCK TYPE:
OLIVINE IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	CENOZOIC	SILICATES
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO2)

BIBLIOGRAPHY RECORDS

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WORLD MINING. BRAZIL. JULY 1978, P. 71.

CANADA

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: BIRCHTREE MINE

SEQUENCE NUMBER: 1220150020

NATION: CANADA

SUBDIVISION: MANITOBA

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: TEMPORARY SHUTDOWN

LATITUDE: N 55 DEG 42 MIN 9 SEC

LONGITUDE: W 97 DEG 55 MIN 29 SEC

UTM - ZONE: 14 HEMISPHERE: NORTHERN

NORTHING: 6173278 EASTING: 567577

POINT OF REFERENCE: ORE BODY

PRECISION: 500 METERS

ELEVATION: 200 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

INCO METALS COMPANY

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

COPRODUCT

COBALT

COPRODUCT

PLATINUM GROUP

PLATINUM

COPRODUCT

PLATINUM GROUP

PALLADIUM

COPRODUCT

SILVER

SULFIDE

COPRODUCT

GOLD

COPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE

AERIAL PHOTOGRAPHY/DRILLING/

YEAR OF DISCOVERY: 1951

ELECTROMAGNETIC SURVEY/GEOPHYSICAL

YEAR OF INITIAL PRODUCTION: 1968

YEAR OF FINAL PRODUCTION: 1977

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: FISSURE VEIN

MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: METAMORPHISM

SHAPE OF ORE BODY: TABULAR

CONTROLLING FEATURES: FAULTING: BEDDING

MINERALIZED ZONE:

STRIKE/DIP: N45E: 70W

AVERAGE LENGTH/METERS: 1,525

AVERAGE WIDTH/METERS: 5

AVERAGE THICKNESS/METERS: 3

LITHOLOGY:

NAME OF FORMATION: THOMPSON NICKEL BELT

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: MAJOR FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION

ROCK TYPE:

PERIDOTITE	LIES ALONG ORE
SCHIST	LIES ALONG ORE
GNEISS	LIES ALONG ORE
QUARTZITE	LIES ALONG ORE
AMPHIBOLITE	NEAR ORE
SERPENTINITE	NEAR ORE
GRANODIORITE	NEAR ORE
GABBRO	NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PYRITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
BIOTITE	PRECAMBRIAN	SILICATES

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ZURBRIGG, H. F. THOMPSON MINE GEOLOGY. CAN. INST. OF MIN., MONTREAL, CANADA, JUNE 1963.

UNCONSOLIDATED MATERIAL:
AVERAGE THICKNESS/METERS: 150

LITHOLOGY:

NAME OF FORMATION: THOMPSON NICKEL BELT
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION: MAJOR FOLDING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
ROCK TYPE:
SERPENTINITE ENCLOSES: ORE IN FRACTURES
QUARTZITE NEAR ORE: GANGUE
GNEISS NEAR ORE: GANGUE
DOLOMITE ENCLOSES ORE
PHYLLITE LIES ALONG ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
NICKEL SKUTTERUDITE	PRECAMBRIAN	ARSENIDE	PHANERITIC-FINE
PYRRHOTITE	PRECAMBRIAN	SULFIDE	PHANERITIC-FINE
PENTLANDITE	PRECAMBRIAN	SULFIDE	PHANERITIC-FINE
SERPENTINE	PRECAMBRIAN	SILICATE	PHANERITIC-FINE

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CANADA, JUNE 1963.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: PIPE SURFACE MINE SEQUENCE NUMBER: 1220150053

NATION: CANADA SUBDIVISION: MANITOBA
TYPE OF OPERATION: SURFACE CURRENT STATUS: PRODUCER
LATITUDE: N 55 DEG 29 MIN 48 SEC LONGITUDE: W 98 DEG 9 MIN 26 SEC
UTM - ZONE: 14 HEMISPHERE: NORTHERN NORTHING: 6150170 EASTING: 553244
POINT OF REFERENCE: ORE BODY PRECISION: 500 METERS
ELEVATION: 205 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

ALTERNATE NAMES: PIPE NO. 2

OWNERSHIP: STATUS:
INCO METALS COMPANY OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COBALT		COPRODUCT
PLATINUM GROUP	PLATINUM	COPRODUCT
SILVER		COPRODUCT
PLATINUM GROUP	PALLADIUM	RECOVERABLE
GOLD		RECOVERABLE
PLATINUM GROUP		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOLOGICAL INFERENCE	AERIAL PHOTOGRAPHY/MAGNETIC SURVEY/
YEAR OF DISCOVERY: 1956	DRILLING/GEOLOGICAL/GEOPHYSICAL/
YEAR OF INITIAL PRODUCTION: 1980	SURFACE GEOLOGIC MAPPING
YEAR OF FINAL PRODUCTION: PRODUCING	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: OTHER: DISSEMINATED: SHEAR ZONE
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: HYDROTHERMAL
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY: IGNEOUS

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 100	MINIMUM DEPTH/METERS: 100
STRIKE/DIP: N40E: 75E	
AVERAGE LENGTH/METERS: 2,300	AVERAGE WIDTH/METERS: 800
AVERAGE THICKNESS/METERS: 160	

UNCONSOLIDATED MATERIAL:
AVERAGE THICKNESS/METERS: 150

LITHOLOGY:

NAME OF FORMATION: THOMPSON NICKEL BELT
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION: MINOR FOLDING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
SERPENTINITE ENCLOSURES ORE
QUARTZITE NEAR ORE: GANGUE
GNEISS NEAR ORE: GANGUE
DOLOMITE ENCLOSURES ORE
PHYLLITE LIES ALONG ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
NICKEL SKUTTERUDITE	PRECAMBRIAN	ARSENIDES	PHANERITIC-FINE
PYRRHOTITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
SERPENTINE	PRECAMBRIAN	SILICATES	PHANERITIC-FINE

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT	CAPACITY: 6,770
UNITS: MT ORE/DAY	
DESCRIPTION OF COVER: MEDIUM HARD ROCKS	
WASTE TO ORE PERCENTAGE: 11.8	AVERAGE COVER THICKNESS: 150 METERS
HARDNESS OF ORE: HARD ROCKS	SURFACE AREA OF MINE: 352 HECTARES
BENCH HEIGHT: 12 METERS	SLOPE OF PIT: 45 DEGREES

BENEFICIATION:

METHOD: FLOTATION	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 6,000	ORE/CRUSH/FLOTATION/CONCENTRATE/GRIND
UNITS: MT ORE/DAY	
DEPOSIT PERCENT USED: 22	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI CONC.	NI	92	9.0	WT-PCT
	CO	26	0.0619	WT-PCT
	PT	82	.989	GM/MT
	AG	90	8.80	GM-MT
	PD	96	1.259	GM-MT
	AU	98	2.20	GM-MT
	PT GROUP	96	2.41	GM-MT

TRANSPORTATION FOR PRODUCT: NI CONCENTRATE
 ORIGINATING FACILITY: MINE LOCATION: PIPE SURFACE MINE, CANADA
 LATITUDE: N 55 29 48 LONGITUDE: W 98 09 26
 PERCENT SHIPPED: 100
 METHOD OF TRANSPORTATION: TRUCK
 DESTINATION FACILITY: MILL (OFF-SITE) LOCATION: THOMPSON, MANITOBA, CANADA
 LATITUDE: N 55 45 00 LONGITUDE: W 97 54 00

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: THOMPSON MINE

SEQUENCE NUMBER: 1220150023

NATION: CANADA

SUBDIVISION: MANITOBA

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: N 55 DEG 43 MIN 18 SEC

LONGITUDE: W 97 DEG 50 MIN 35 SEC

UTM - ZONE: 14 HEMISPHERE: NORTHERN

NORTHING: 6175493 EASTING: 572675

POINT OF REFERENCE: APPROXIMATE

PRECISION: 100 METERS

ELEVATION: 210 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

INTERNATIONAL NICKEL COMPANY OF CANADA, LTD.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

SILVER

BYPRODUCT

GOLD

BYPRODUCT

COBALT

SULFIDE

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

GEOPHYSICAL DRILLING

YEAR OF DISCOVERY: 1956

YEAR OF INITIAL PRODUCTION: 1961

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: MASSIVE SULFIDE: BRECCIA FILLING

MODE OF ORIGIN: VOLCANOGENIC: METAMORPHISM

SHAPE OF ORE BODY: LENTICULAR: MASSIVE: PIPELIKE

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 1,500

AVERAGE LENGTH/METERS: 5,500

LITHOLOGY:

NAME OF FORMATION: THOMPSON NICKEL BELT

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: INTRUSION: MAJOR FOLDING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION

ROCK TYPE:

GABBRO

LIES OVER ORE: LIES UNDER ORE

SCHIST

LIES OVER ORE: LIES UNDER ORE

PERIDOTITE

LIES OVER ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION**UNDERGROUND MINING:**

METHOD: CUT AND FILL: CAVING METHODS	
CAPACITY: 5,900	UNITS: MT ORE/DAY
ROCK AND WATER CONDITIONS: HARDROCK	
ROCK/MINE SUPPORT: TIMBER: ROOF BOLTS	
CONDITION OF WORKINGS: OPEN	
SHAFTS - NUMBER: 3	AVERAGE DEPTH: 1,200 METERS

BENEFICIATION:

METHOD: FLOTATION	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 5,895	ORE/CRUSH/GRIND/FLOAT
UNITS: METRIC TONS ORE/DAY	NI/CU CONCENTRATE

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI/CU CONC.	NI	92	7.7	WT-PCT
	CU	52	15.0	WT-PCT

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: SOAB

SEQUENCE NUMBER: 1220150024

NATION: CANADA
TYPE OF OPERATION: UNDERGROUND
LATITUDE: N 55 DEG 12 MIN 4 SEC
UTM - ZONE: 14 HEMISPHERE: NORTHERN
POINT OF REFERENCE: MAIN ENTRY
ELEVATION: 225 METERS
DATUM: SEA LEVEL

SUBDIVISION: MANITOBA
CURRENT STATUS: PAST PRODUCER
LONGITUDE: W 98 DEG 25 MIN 17 SEC
NORTHING: 6117108 EASTING: 536828
PRECISION: 500 METERS
PRECISION: 10 METERS

ALTERNATE NAMES: SOAB NORTH MINE

OWNERSHIP:
INCO METALS COMPANY

STATUS:
OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	BYPRODUCT
COBALT	SULFIDE	BYPRODUCT
PLATINUM GROUP		BYPRODUCT
SILVER		RECOVERABLE
GOLD		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:
GEOPHYSICAL ANOMALY
YEAR OF DISCOVERY: 1951
YEAR OF INITIAL PRODUCTION: 1967
YEAR OF FINAL PRODUCTION: 1971

-----EXPLORATION METHODS-----
MAGNETIC SURVEY/AERIAL PHOTOGRAPHY/
ELECTROMAGNETIC SURVEY/DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: OTHER
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: LENTICULAR: MASSIVE
CONTROLLING FEATURES: FRACTURING: IGNEOUS

MINERALIZED ZONE:
AVERAGE WIDTH/METERS: 560
AVERAGE THICKNESS/METERS: 60

LITHOLOGY:

NAME OF FORMATION: WABOWDEN SUBPROVINCE

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: FAULTING: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING/FOLLOWING DEFORMATION

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

PERIDOTITE ENCLOSURES ORE

GNEISS ENCLOSURES ORE

SCHIST ENCLOSURES ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

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CANADA, 1980.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: BOWDEN LAKE

SEQUENCE NUMBER: 1220150025

NATION: CANADA

SUBDIVISION: MANITOBA

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: N 54 DEG 55 MIN 22 SEC

LONGITUDE: W 98 DEG 38 MIN 36 SEC

UTM - ZONE: 14 HEMISPHERE: NORTHERN

NORTHING: 6642658 EASTING: 519941

POINT OF REFERENCE: TOWN

PRECISION: 1 KILOMETER

ELEVATION: 227 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

BOWDEN LAKE NICKEL MINES, LTD.

OWNER

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

	RECORD 1	RECORD 2
MEASURED		27,210,000
INDICATED	80,000,000	
UNITS	MT ORE	MT ORE
YEAR/DATA	1981	1977

INSITU GRADE:

RECORD	ASSAY/FORM	GRADE	UNIT	MINERAL FORM
1	NI	0.60	WT-PCT	SULFIDE
2	NI	.60	GHT PERCENT	SULFIDE

RESERVE/RESOURCE REMARKS

REC. 1) NORTHERN MINER. BOWDEN NICKEL AND PINTO GOLD. NORTHERN MINER, MAR. 3, 1979, P. 7.

REC. 2) WESTERN MINER. BOWDEN LAKE NICKEL. JAN. 1977, P. 49.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

GEOPHYSICAL ANOMALY

GEOPHYSICAL/MAGNETIC SURVEY/

YEAR OF DISCOVERY: 1956

ELECTROMAGNETIC SURVEY/CORE DRILLING/

AERIAL PHOTOGRAPHY/TEST SHAFT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: FISSURE VEIN

MODE OF ORIGIN: HYDROTHERMAL

SHAPE OF ORE BODY: TABULAR: IRREGULAR

CONTROLLING FEATURES: IGNEOUS

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 600
AVERAGE LENGTH/METERS: 1,981
AVERAGE THICKNESS/METERS: 304

MINIMUM DEPTH/METERS: 600
AVERAGE WIDTH/METERS: 366

LITHOLOGY:

NAME OF FORMATION: ULTRABASIC ROCKS
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
ROCK TYPE:

AMPHIBOLITE	NEAR ORE
SERPENTINITE	NEAR ORE

MINERALIZATION:

MINERAL NAME	MINERAL CLASS
PYRRHOTITE	SULFIDES
PENTLANDITE	SULFIDES
CHALCOPYRITE	SULFIDES
PYRITE	SULFIDES

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: BUCKO LAKE

SEQUENCE NUMBER: 1220150027

NATION: CANADA

SUBDIVISION: MANITOBA

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: N 54 DEG 52 MIN 46 SEC

LONGITUDE: W 98 DEG 39 MIN 22 SEC

UTM - ZONE: 14 HEMISPHERE: NORTHERN

NORTHING: 6081214 EASTING: 522064

POINT OF REFERENCE: APPROXIMATE

PRECISION: 500 METERS

ELEVATION: 237 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

BOWDEN LAKE NICKEL MINES, LTD.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

COBALT

SULFIDE

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

GEOPHYSICAL ANOMALY

MAGNETIC SURVEY/

YEAR OF DISCOVERY: 1960

ELECTROMAGNETIC SURVEY/CORE DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF OREBODY: PEGMATITE

MODE OF ORIGIN: HYDROTHERMAL

SHAPE OF OREBODY: IRREGULAR

CONTROLLING FEATURES: IGNEOUS

DEGREE OF ALTERATION: MODERATE

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 335

MINIMUM DEPTH/METERS: 9

STRIKE/DIP: N90S: 75E

AVERAGE LENGTH/METERS: 500

AVERAGE WIDTH/METERS: 152

AVERAGE THICKNESS/METERS: 130

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 11

MINIMUM THICKNESS/METERS: 9

LITHOLOGY:

NAME OF FORMATION: ULTRABASIC ROCKS

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: INTRUSION: METAMORPHISM

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

SERPENTINITE NEAR ORE

GRANITE NEAR ORE

AMPHIBOLITE NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PYRITE	PRECAMBRIAN	SULFIDES

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NORTHERN MINER. TO BOWDEN NICKEL AND PINTO GOLD. MAR. 3, 1979, P. 7.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MOAK LAKE DEPOSIT

SEQUENCE NUMBER: 1220150028

NATION: CANADA

SUBDIVISION: MANITOBA

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: N 55 DEG 56 MIN 8 SEC

LONGITUDE: W 97 DEG 34 MIN 8 SEC

UTM -- ZONE: 14 HEMISPHERE: NORTHERN

NORTHING: 6195664 EASTING: 589624

POINT OF REFERENCE: APPROXIMATE

PRECISION: 500 METERS

ELEVATION: 233 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP

STATUS:

INTERNATIONAL NICKEL COMPANY OF CANADA, LTD. OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

PLATINUM GROUP

PLATINUM

BYPRODUCT

SILVER

BYPRODUCT

PLATINUM GROUP

PALLADIUM

BYPRODUCT

GOLD

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

GEOPHYSICAL ANOMALY

AERIAL PHOTOGRAPHY/MAGNETIC SURVEY/

YEAR OF DISCOVERY: 1952

ELECTROMAGNETIC SURVEY/CORE DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: OTHER

MODE OF ORIGIN: MAGMATIC DIFFERENTIATION

SHAPE OF ORE BODY: MASSIVE: TABULAR

CONTROLLING FEATURES: IGNEOUS: FRACTURING

WALL ROCK ALTERATION: OTHER

DEGREE OF ALTERATION: MODERATE

MINERALIZED ZONE:

AVERAGE LENGTH/METERS: 760

AVERAGE WIDTH/METERS: 30

AVERAGE THICKNESS/METERS: 300

LITHOLOGY:

NAME OF FORMATION: WABOWDEN SUBPROVINCE

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: FAULTING: METAMORPHISM: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING-DURING DEFORMATION

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

SERPENTINITE

UNSPECIFIED SEDIMENTARY

ENCLOSES ORE: NEAR ORE

NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
MARCASITE	PRECAMBRIAN	SULFIDES

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MYSTERY LAKE

SEQUENCE NUMBER: 1220150038

NATION: CANADA

SUBDIVISION: MANITOBA

TYPE OF OPERATION: SURFACE

CURRENT STATUS: DEVELOPED DEPOSIT

LATITUDE: N 55 DEG 49 MIN 42 SEC

LONGITUDE: W 97 DEG 45 MIN 45 SEC

UTM - ZONE: 14 HEMISPHERE: NORTHERN

NORTHING: 6187452 EASTING: 577522

POINT OF REFERENCE: ORE BODY

PRECISION: 500 METERS

ELEVATION: 205 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

INTERNATIONAL NICKEL COMPANY, LTD.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

SILVER

BYPRODUCT

PLATINUM GROUP

PLATINUM

BYPRODUCT

PLATINUM GROUP

PALLADIUM

BYPRODUCT

GOLD

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 50,000,000

UNITS MT ORE

YEAR/DATA 1979

INSITU GRADE:

ASSAY/FORM
NI

GRADE
0.5

UNIT
WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: DEPARTMENT OF ENERGY, MINES AND RESOURCES, MINERAL DEVELOPMENT
SECTOR. PUBLIC DEPOSIT FILES. OTTAWA, ONTARIO, CANADA, 1979.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

GEOPHYSICAL ANOMALY

AERIAL PHOTOGRAPHY/MAGNETIC SURVEY/

YEAR OF DISCOVERY: 1927

ELECTROMAGNETIC SURVEY/CORE DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STOCKWORK: DISSEMINATED: SHEAR ZONE

MODE OF ORIGIN: METAMORPHISM: MAGMATIC DIFFERENTIATION

SHAPE OF ORE BODY: MASSIVE

CONTROLLING FEATURES: CONTACT ZONE: FAULTING

WALL ROCK ALTERATION: DOLOMITIZATION: SERICITIC: PYRITIZATION

DEGREE OF ALTERATION: INTENSE

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 250
AVERAGE LENGTH/METERS: 1,430
AVERAGE THICKNESS/METERS: 30

MINIMUM DEPTH/METERS: 60
AVERAGE WIDTH/METERS: 365

LITHOLOGY:

NAME OF FORMATION: MACKENZIE DIKE SWARM
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION: METAMORPHISM: MAJOR FAULTING: MINOR FOLDING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:

SERPENTINITE	IS ORE
ULTRAMAFIC IGNEOUS	ORE IN FRACTURES
MONZONITE	NEAR ORE
GRANDIORITY	NEAR ORE
GRANITE	NEAR ORE
PERIDOTITE	NEAR ORE
GNEISS	NEAR ORE
QUARTZITE	LIES ALONG ORE
CATACLASTITE	NEAR ORE
MYLONITE	NEAR ORE
DOLOMITE	LIES ALONG ORE
PHYLLITE	NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PYRITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
SPHALERITE	PRECAMBRIAN	SULFIDES

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LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING-DURING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
 GRANITE REPLACED BY ORE
 QUARTZ DIORITE REPLACED BY ORE
 GABBRO ORE IN FRACTURES: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
CUBANITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: SHRINKAGE WITH CUT AND FILL
CAPACITY: 6,800 UNITS: MT ORE/DAY
CHARACTERISTIC OF ROCK: ONE SYSTEM OF WEAKNESS PLANES
ROCK AND WATER CONDITIONS: HARDROCK WITH LITTLE WATER
TOTAL LENGTH OF WORKINGS: 240,400 METERS
AVERAGE DEPTH: 364 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: FROOD
LATITUDE: N 46 31 30	LONGITUDE: W 81 00 30
PERCENT SHIPPED: 100	
DESTINATION FACILITY: MILL (ON-SITE)	LOCATION: FROOD STOBIE MILL
LATITUDE: N 46 31 30	LONGITUDE: W 81 00 30

BENEFICIATION:

METHOD: FLOTATION
DESIGN CAPACITY: 18,150
UNITS: MT ORE/DAY
DEPOSIT PERCENT USED: 28
TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
ORE/CRUSH/GRIND/FLOTATION/
NI/CU BULK

TRANSPORTATION FOR PRODUCT: NI/CU BULK

ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: FROOD STOBIE MILL
LATITUDE: N 46 32 18	LONGITUDE: W 81 01 30
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	DISTANCE (KM): 1,288
DESTINATION FACILITY: MILL	LOCATION: COPPER, CLIFF, ONTARIO
LATITUDE: N 46 27 33	LONGITUDE: W 81 04 45

BENEFICIATION:

METHOD: FLOTATION
 DESIGN CAPACITY: 20,000
 UNITS: METRIC TONS ORE/DAY
 DEPOSIT PERCENT USED: 40
 TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
 NI/CU BULK/FLOTATION
 NI CONCENTRATE/CU CONCENTRATE

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
CU CONC.	CU	93	12.0	WT-PCT
NI CONC.	NI	93	14.0	WT-PCT
	PT	82	2.09	GM/MT
	CO	50	0.0561	GM/MT
	PT GROUP	89	6.559	GM/MT
	PD	90	3.344	GM/MT
	AG	94	21.49	GM/MT
	AU	94	0.717	GM/MT

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: SHEBANDOWAN MINE

SEQUENCE NUMBER: 1220400017

NATION: CANADA

SUBDIVISION: ONTARIO

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: N 48 DEG 35 MIN 58 SEC

LONGITUDE: W 90 DEG 16 MIN 10 SEC

UTM - ZONE: 15 HEMISPHERE: NORTHERN

NORTHING: 5386309 EASTING: 701313

POINT OF REFERENCE: APPROXIMATE

PRECISION: 100 METERS

ELEVATION: 1,600 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

INTERNATIONAL NICKEL COMPANY, LTD.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

COPRODUCT

COBALT

BYPRODUCT

PLATINUM GROUP

PLATINUM

BYPRODUCT

PLATINUM GROUP

PALLADIUM

RECOVERABLE

SILVER

RECOVERABLE

GOLD

RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED 13,605,000
UNITS MT ORE
YEAR/DATA 1973

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.0	WT-PCT
CU	0.55	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: MINING MAGAZINE. INCO'S SHEBANDOWAN MINE OFFICIALLY OPENED.
AUG. 1973, PP. 93, 95.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

GEOLOGICAL INFERENCE

DRILLING/TEST PIT/GEOPHYSICAL/

YEAR OF DISCOVERY: 1913

GRAVITATIONAL SURVEY

YEAR OF INITIAL PRODUCTION: 1965

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: SHEAR ZONE: FISSURE VEIN

MODE OF ORIGIN: HYDROTHERMAL

SHAPE OF ORE BODY: TABULAR

CONTROLLING FEATURES: IGNEOUS: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 400

MINIMUM DEPTH/METERS: 0

STRIKE/DIP: N90W: 90N

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 10

LITHOLOGY:

NAME OF FORMATION: SHEBANOOWAN SHEAR ZONE

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION

ROCK TYPE:

PERIDOTITE LIES ALONG ORE

QUARTZ DIORITE LIES OVER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PYRITE	PRECAMBRIAN	SULFIDES
MAGNETITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: HORIZONTAL CUT AND FILL WITH TAILINGS

CAPACITY: 1,512

UNITS: MT ORE/DAY

ROCK AND WATER CONDITIONS: HARDROCK FISSURED WITH EXCESSIVE WATER

ROCK/MINE SUPPORT: SUPPORTING POST, HEADBOARD, CAPS, ROOF BOLTS

CONDITION OF WORKINGS: OPEN

AVERAGE DEPTH: 731 METERS

BENEFICIATION:

METHOD: FLOTATION

UNITS: METRIC TON ORE/DAY

DEPOSIT PERCENT USED: 100

TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
ORE (2-STEP)/CRUSH/GRIND/FLOTATION

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CU CONC.	NI	88	14.0	WT-PCT
	CU	92	12.0	WT-PCT
	CO	26	0.0479	WT-PCT
	PT	82	5.77	GM/MT
	PT GROUP	82	0.1104	GM/MT
	AG	90	0.1212	GM/MT
	AU	90	0.1212	GM/MT
	PT GROUP	82	0.1104	GM/MT

TRANSPORTATION FOR PRODUCT: NI/CU CONCENTRATE

ORIGINATING FACILITY: MINE

LOCATION: SHEBANDOWAN MINE

LATITUDE: N 48 35 45

LONGITUDE: W 90 14 50

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: OTHER

DESTINATION FACILITY: MILL (ON-SITE)

LOCATION: SHEBANDOWAN, CANADA

LATITUDE: N 48 35 45

LONGITUDE: W 90 14 50

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: CLARABELLE

SEQUENCE NUMBER: 1220400021

NATION: CANADA

SUBDIVISION: ONTARIO

TYPE OF OPERATION: SURFACE

CURRENT STATUS: TEMPORARY SHUTDOWN

LATITUDE: N 46 DEG 31 MIN 6 SEC

LONGITUDE: W 81 DEG 3 MIN 30 SEC

UTM - ZONE: 17 HEMISPHERE: NORTHERN

NORTHING: 5151423 EASTING: 495525

ELEVATION: 315 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

INTERNATIONAL NICKEL COMPANY, LTD.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

PLATINUM GROUP

RECOVERABLE

COBALT

BYPRODUCT

PLATINUM GROUP

PALLADIUM

BYPRODUCT

SILVER

RECOVERABLE

GOLD

RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE MINERAL IN PLACE

CORE DRILLING

YEAR OF DISCOVERY: 1883

YEAR OF INITIAL PRODUCTION: 1889

YEAR OF FINAL PRODUCTION: 1981

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: BRECCIA FILLING

MODE OF ORIGIN: HYDROTHERMAL

SHAPE OF ORE BODY: LENTICULAR: MASSIVE

CONTROLLING FEATURES: FAULTING

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 170

MINIMUM DEPTH/METERS: 0

STRIKE/DIP: N45E: 36N

AVERAGE LENGTH/METERS: 580

AVERAGE WIDTH/METERS: 170

AVERAGE THICKNESS/METERS: 30

UNCONSOLIDATED MATERIAL:

MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: FAULTING: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING-DURING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
GABBRO NEAR ORE: IS ORE
GREENSTONE NEAR ORE
GRANITE IS ORE: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: COLEMAN MINE

SEQUENCE NUMBER: 1220400023

NATION: CANADA

SUBDIVISION: ONTARIO

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PAST PRODUCER

LATITUDE: N 46 DEG 40 MIN 30 SEC

LONGITUDE: W 81 DEG 20 MIN 15 SEC

UTM - ZONE: 17 HEMISPHERE: NORTHERN

NORTHING: 5169132 EASTING: 474186

POINT OF REFERENCE: ORE BODY

ELEVATION: 1,350 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

INCO, LTD.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

COBALT

RECOVERABLE

PLATINUM GROUP

PLATINUM

RECOVERABLE

PLATINUM GROUP

RECOVERABLE

SILVER

RECOVERABLE

PLATINUM GROUP

PALLADIUM

RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

RESERVE/RESOURCE REMARKS

MINE SHUT DOWN IN 1981 DUE TO DEPLETED RESERVES/LOW METAL PRICES.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE

DRILLING

YEAR OF INITIAL PRODUCTION: 1965

YEAR OF FINAL PRODUCTION: 1981

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: BRECCIA FILLING

MODE OF ORIGIN: HYDROTHERMAL

SHAPE OF ORE BODY: IRREGULAR

CONTROLLING FEATURES: IGNEOUS

MINERALIZED ZONE:

STRIKE/DIP: N65E: 50S

AVERAGE THICKNESS/METERS: 30.5

LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: INTRUSION: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING-DURING DEFORMATION

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

PEGMATITE LIES OVER ORE

GABBRO IS ORE: LIES ALONG ORE

QUARTZ DIORITE ENCLOSURES ORE: IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
BORNITE	PRECAMBRIAN	SULFIDES
GALENA	PRECAMBRIAN	SULFIDES
NICCOLITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
GERSDORFFITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
SPERRYLITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
ELECTRUM	PRECAMBRIAN	NATIVE ELEMENT
HESSITE	PRECAMBRIAN	SELENIUM-TELLURIUM COMPOUNDS
QUARTZ	PRECAMBRIAN	FORMS OF SiO ₂

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: COPPER CLIFF NORTH SEQUENCE NUMBER: 1220400024

NATION: CANADA SUBDIVISION: ONTARIO
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: PAST PRODUCER
LATITUDE: N 46 DEG 29 MIN 30 SEC LONGITUDE: W 81 DEG 4 MIN 03 SEC
UTM - ZONE: 17 HEMISPHERE: NORTHERN NORTHING: 5144850 EASTING: 493920
ELEVATION: 400 METERS PRECISION: 100 METERS
DATUM: SEA LEVEL

OWNERSHIP: STATUS:
INTERNATIONAL NICKEL COMPANY, LTD. OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	RECOVERABLE
COBALT		RECOVERABLE
PLATINUM GROUP	PLATINUM	RECOVERABLE
PLATINUM GROUP	PALLADIUM	RECOVERABLE
SILVER		RECOVERABLE
GOLD		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD: -----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE GEOPHYSICAL/BEDROCK SAMPLING

YEAR OF DISCOVERY: 1880
YEAR OF INITIAL PRODUCTION: 1887
YEAR OF FINAL PRODUCTION: 1981

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: BRECCIA FILLING
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: LENTICULAR: IRREGULAR
CONTROLLING FEATURES: IGNEOUS: FAULTING

LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:

GABBRO	LIES ALONG ORE
PEGMATITE	LIES ALONG ORE
PERIDOTITE	IS ORE
QUARTZ DIORITE	IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: COPPER CLIFF SOUTH

SEQUENCE NUMBER: 1220400025

NATION: CANADA

SUBDIVISION: ONTARIO

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: N 46 DEG 27 MIN 33 SEC

LONGITUDE: W 81 DEG 4 MIN 45 SEC

UTM - ZONE: 17 HEMISPHERE: NORTHERN

NORTHING: 5144850 EASTING: 493920

POINT OF REFERENCE: ORE BODY

PRECISION: 100 METERS

ELEVATION: 275 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

INTERNATIONAL NICKEL COMPANY, LTD.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

COBALT

BYPRODUCT

PLATINUM GROUP

PLATINUM

RECOVERABLE

PLATINUM GROUP

PALLADIUM

RECOVERABLE

SILVER

RECOVERABLE

GOLD

RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE

TEST SHAFT/DRILLING

YEAR OF DISCOVERY: 1967

YEAR OF INITIAL PRODUCTION: 1970

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STOCKWORK: SHEAR ZONE

MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: CONTACT METASOMATIC

CONTROLLING FEATURES: IGNEOUS: FOLDING

MINERALIZED ZONE:

STRIKE/DIP: NOOS: 20N

AVERAGE LENGTH/METERS: 4

LITHOLOGY:

NAME OF FORMATION: ONAPING

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: INTRUSION: METAMORPHISM: MAJOR FAULTING: MINOR FOLDING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION

ROCK TYPE:

ULTRAMAFIC IGNEOUS	LIES ALONG ORE
GABBRO	LIES ALONG ORE
PEGMATITE	LIES ALONG ORE
VOLCANIC BRECCIA	LIES ALONG ORE
GNEISS	LIES ALONG ORE
SCHIST	LIES ALONG ORE
PERIDOTITE	IS ORE
QUARTZITE	LIES ALONG ORE
QUARTZ DIORITE	IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: HORIZONTAL CUT AND FILL WITH WASTE ROCK

CAPACITY: 3,120

UNITS: MT ORE/DAY

CHARACTERISTIC OF ROCK: NO PLANES OF WEAKNESS

ROCK AND WATER CONDITIONS: HARDROCK WITH LITTLE WATER

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: CANADA

LATITUDE: N 46 27 33

LONGITUDE: W 81 04 45

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: TRUCK

DESTINATION FACILITY: MILL (OFF-SITE))

LOCATION: CANADA

LATITUDE: N 46 31 06

LONGITUDE: W 81 03 30

BENEFICIATION:

METHOD: FLOTATION

DESIGN CAPACITY: 30,000

UNITS: MT ORE/DAY

DEPOSIT PERCENT USED: 11

TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----

ORE/CRUSH/GRIND/FLOTATION

THICKEN/FILTER/DRY

BULK NI-CU CONCENTRATE

TRANSPORTATION FOR PRODUCT: BULK NICKEL-COPPER

ORIGINATING FACILITY: MILL (OFF-SITE)

LOCATION: CLARABELLE, ONTARIO

LATITUDE: N 46 31 06

LONGITUDE: W81 03 30

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: PIPELINE

DESTINATION FACILITY: SMELTER/REFINERY

LOCATION: COPPER CLIFF, ONTARIO

LATITUDE: N 46 27 33

LONGITUDE: W 81 04 45

BENEFICIATION:

METHOD: FLOTATION
 DESIGN CAPACITY: 14,000
 UNITS: MT ORE/DAY
 DEPOSIT PERCENT USED: 60
 TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
 ORE/CRUSH/GRIND/FLOTATION
 THICKEN/FILTER/DRY/NI CONC.
 CU CONC.

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI CONC.	NI	93	14.0	WT-PCT
	CO	26	0.0684	GM/MT
	PT	82	.6464	GM/MT
	PD	82	.8226	GM/MT
	AG	90	5.288	GM/MT
	AU	90	1.46	GM/MT
	PT GROUP	82	1.38	GM/MT

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: CREAM HILL MINE	SEQUENCE NUMBER: 1220400027
NATION: CANADA	SUBDIVISION: ONTARIO
TYPE OF OPERATION: UNDERGROUND	CURRENT STATUS: PAST PRODUCER
LATITUDE: N 46 DEG 25 MIN 45 SEC	LONGITUDE: W 81 DEG 21 MIN 6 SEC
UTM - ZONE: 17 HEMISPHERE: NORTHERN	NORTHING: 5141573 EASTING: 472980
POINT OF REFERENCE: ORE BODY	PRECISION: 100 METERS
OWNERSHIP:	STATUS:
INTERNATIONAL NICKEL COMPANY, LTD.	OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	BYPRODUCT
COBALT		RECOVERABLE
PLATINUM GROUP	PALLADIUM	RECOVERABLE
GOLD		RECOVERABLE
SILVER		RECOVERABLE
PLATINUM GROUP	PLATINUM	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1885	-----EXPLORATION METHODS-----
YEAR OF INITIAL PRODUCTION: 1905	CORE DRILLING
YEAR OF FINAL PRODUCTION: 1978	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: BRECCIA FILLING
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: LENTICULAR: IRREGULAR
CONTROLLING FEATURES: INTRUSION: FAULTING

MINERALIZED ZONE:	
AVERAGE LENGTH/METERS: 1,000	AVERAGE WIDTH/METERS: 1,300
AVERAGE THICKNESS/METERS: 60	

LITHOLOGY:

NAME OF FORMATION: ELSIE MOUNTAIN BASALT	
GEOLOGIC AGE: PRECAMBRIAN	
DEFORMATION DESCRIPTION: INTRUSION: MAJOR FAULTING	
GEOLOGIC AGE: PRECAMBRIAN	
ROCK TYPE:	
GABBRO	ENCLOSES ORE: IS ORE
GREENSTONE	LIES ALONG ORE: IS ORE
QUARTZITE	LIES ALONG ORE: IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
BORNITE	PRECAMBRIAN	SULFIDES
GALENA	PRECAMBRIAN	SULFIDES
NICCOLITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
GERSDORFFITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
SPERRYLITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
ELECTRUM	PRECAMBRIAN	NATIVE ELEMENT
HESSITE	PRECAMBRIAN	SELENIUM-TELLURIUM COMPOUNDS
QUARTZ	PRECAMBRIAN	FORMS OF SiO2

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: CREIGHTON MINE SEQUENCE NUMBER: 1220400028

NATION: CANADA SUBDIVISION: ONTARIO
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: PRODUCER
LATITUDE: N 46 DEG 27 MIN 40 SEC LONGITUDE: W 81 DEG 10 MIN 45 SEC
UTM - ZONE: 17 HEMISPHERE: NORTHERN NORTHING: 5145079 EASTING: 486241
POINT OF REFERENCE: MAIN ENTRY PRECISION: 500 METERS

ALTERNATE NAMES: CREIGHTON NO. 3 MINE
 CREIGHTON NO. 9 MINE

OWNERSHIP: STATUS:
INTERNATIONAL NICKEL COMPANY, LTD. OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	PRIMARY
PLATINUM GROUP	PLATINUM	RECOVERABLE
COBALT		RECOVERABLE
PLATINUM GROUP	PALLADIUM	RECOVERABLE
SILVER		RECOVERABLE
GOLD		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD: -----EXPLORATION METHODS-----
 GEOPHYSICAL ANOMALY DRILLING
YEAR OF DISCOVERY: 1886
YEAR OF INITIAL PRODUCTION: 1901
YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: FISSURE VEIN: SHEAR ZONE
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
CONTROLLING FEATURES: FAULTING

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 2,500	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N45W: 40W	
AVERAGE LENGTH/METERS: 1,500	AVERAGE WIDTH/METERS: 10
AVERAGE THICKNESS/METERS: 122	

LITHOLOGY:

NAME OF FORMATION: VOLCANIC SEQUENCE
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: MAJOR FAULTING: INTRUSION
ROCK TYPE:
RHYOLITE LIES ALONG ORE
GABBRO ENCLOSURES: IS ORE
AMPHIBOLITE LIES ALONG ORE
GREENSTONE LIES ALONG ORE
QUARTZITE LIES ALONG ORE

LITHOLOGY:

NAME OF FORMATION: MURRAY GRANITE
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
GRANITE NEAR ORE

LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
PEGMATITE NEAR ORE
ANORTHOSITE NEAR ORE

LITHOLOGY:

NAME OF FORMATION: FROOD BRECCIA
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
BRECCIA ORE IN FRACTURES: REPLACED BY ORE

LITHOLOGY:

NAME OF FORMATION: QUARTZ-DIORITE
ROCK TYPE:
QUARTZ DIORITE REPLACED BY ORE: GANGUE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
BORNITE	PRECAMBRIAN	SULFIDES
GALENA	PRECAMBRIAN	SULFIDES
NICCOLITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
GERSDORFFITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
SPERRYLITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
ELECTRUM	PRECAMBRIAN	NATIVE ELEMENT
HESSITE	PRECAMBRIAN	SELENIUM-TELLURIUM COMPOUNDS
QUARTZ	PRECAMBRIAN	FORMS OF SiO ₂
PLAGIOCLASE	PRECAMBRIAN	SILICATES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: OTHER, FILLED STOPE METHODS
 CAPACITY: 11,570 UNITS: MT ORE/DAY
 CHARACTERISTIC OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES
 ROCK AND WATER CONDITIONS: HARDROCK, FISSURED WITH MODERATE WATER
 ROCK/MINE SUPPORT: UNSUPPORTING MAY SLOUGH, TIMBER WITH LAGGING, CONCRETE
 CONDITION OF WORKINGS: OPEN
 TOTAL LENGTH OF WORKINGS:
 INCLINES - NUMBER: 1 AVERAGE LENGTH: 3,392 METERS
 SLOPE: 55 DEGREES
 SHAFTS - NUMBER: 5 AVERAGE DEPTH: 2,350 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE LOCATION: CREIGHTON MINE, CANADA
 LATITUDE: N 46 27 40 LONGITUDE: W 81 10 45
 PERCENT SHIPPED: 100
 METHOD OF TRANSPORTATION: RAIL DISTANCE (KM): 7
 DESTINATION FACILITY: MILL (OFF-SITE) LOCATION: CLARABELLE MILL, CANADA
 LATITUDE: N 46 31 06 LONGITUDE: W 81 03 30

BENEFICIATION:

METHOD: FLOTATION
 DESIGN CAPACITY: 31,750
 UNITS: MT ORE/DAY
 DEPOSIT PERCENT USED: 36
 TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
 ORE/CRUSH/GRIND/FLOAT/NI-CU
 THICK/FILTER/DRY

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI CONC.	NI	93	14.0	WT-PCT
	CU	82	5.34	GM/MT
	PT	26	0.0685	WT-PCT
	CO	82	6.793	GM/MT
	AG	90	43.67	GM/MT
	PD	90	1.456	GM/MT
	AU	90	1.456	GM/MT
	PT GROUP	82	1.375	GM/MT
	CU CONC.	95	12.0	WT-PCT
	PT	82	5.34	GM/MT
CU CONC.	CO	26	.0685	WT-PCT
	PD	82	6.793	GM/MT
	AG	90	43.67	GM/MT
	PT GROUP	82	1.375	GM/MT
	AU	90	1.456	GM/MT

TRANSPORTATION FOR PRODUCT: NICKEL CONCENTRATE
 ORIGINATING FACILITY: MILL (ON-SITE) LOCATION: CLARABELLE MILL, CANADA
 LATITUDE: N 46 31 06 LONGITUDE: W 81 03 30
 PERCENT SHIPPED: 100
 METHOD OF TRANSPORTATION: PIPELINE
 DESTINATION FACILITY: MILL (ON-SITE) LOCATION: COPPER CLIFF MILL, CANADA
 LATITUDE: N 46 27 33 LONGITUDE: W 81 04 45

TRANSPORTATION FOR PRODUCT: NICKEL CONCENTRATE
 ORIGINATING FACILITY: MILL (ON-SITE) LOCATION: COPPER CLIFF MILL, CANADA
 LATITUDE: N 46 27 33 LONGITUDE: W 81 04 45
 PERCENT SHIPPED: 100
 METHOD OF TRANSPORTATION: PIPELINE
 DESTINATION FACILITY: SMELTER LOCATION: COPPER CLIFF SMELTER, CANADA
 LATITUDE: N 46 26 00 LONGITUDE: W 81 04 30

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: FALCONBRIDGE EAST SEQUENCE NUMBER: 1220400032

NATION: CANADA SUBDIVISION: ONTARIO
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: PRODUCER
LATITUDE: N 46 DEG 34 MIN 55 SEC LONGITUDE: W 80 DEG 46 MIN 58 SEC
UTM - ZONE: 17 HEMISPHERE: NORTHERN NORTHING: 5158513 EASTING: 516643
POINT OF REFERENCE: ORE BODY PRECISION: 100 METERS
ELEVATION: 290 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

OWNERSHIP: STATUS:
FALCONBRIDGE NICKEL MINES, LTD. OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	BYPRODUCT
PLATINUM GROUP	PLATINUM	BYPRODUCT
COBALT		BYPRODUCT
PLATINUM GROUP	PLATINUM	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	GEOPHYSICAL/TEST DRIFT/CROSSCUT/ DRILLING
YEAR OF DISCOVERY: 1944	
YEAR OF INITIAL PRODUCTION: 1954	
YEAR OF FINAL PRODUCTION: PRODUCING	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: SHEAR ZONE: BRECCIA FILLING: DISSEMINATED
MODE OF ORIGIN: HYDROTHERMAL
CONTROLLING FEATURES: IGNEOUS: FAULTING
WALL ROCK ALTERATION: SILICIFICATION: PYRITIZATION

MINERALIZED ZONE:
STRIKE/DIP: N90E: 77S AVERAGE WIDTH/METERS: 1,840
AVERAGE LENGTH/METERS: 400
AVERAGE THICKNESS/METERS: 8

LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE
 GEOLOGIC AGE: PRECAMBRIAN
 DEFORMATION DESCRIPTION: INTRUSION: FAULTING
 RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
 GEOLOGIC AGE: PRECAMBRIAN
 ROCK TYPE:
 GABBRO ORE IN FRACTURES: ENCLOSURES ORE
 GREENSTONE ORE IN FRACTURES: ENCLOSURES ORE
 QUARTZ DIORITE ORE IN FRACTURES: ENCLOSURES ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: CUT AND FILL: SUBLEVEL
 CAPACITY: 1,162 UNITS: MT ORE/DAY
 CHARACTERISTIC OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES
 ROCK AND WATER CONDITIONS: HARDROCK: FISSURED WITH MODERATE WATER
 ROCK/MINE SUPPORT: SUPPORTING, POST, HEADBOARD, CAPS, ROOF BOLTS
 CONDITION OF WORKINGS: OPEN
 TOTAL LENGTH OF WORKINGS:
 SHAFTS - NUMBER: 1 AVERAGE DEPTH: 1,200 METERS

BENEFICIATION:

METHOD: FLOTATION	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 2,730	ORE/CRUSH/GRIND/FLOATATION/THICKEN
UNITS: MT ORE/DAY	FILTER/DRY/NI CONC./CU CONC.
DEPOSIT PERCENT USED: 100	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CU CONC.	NI	93	8.3	WT-PCT
	CU	95	5.9	WT-PCT
	PT	82	1.1	GM/MT
	CO	50	0.170	WT-PCT
	PD	82	1.342	GM/MT
	AG	90	13.88	GM/MT
	AU	90	.452	GM/MT
	PT GROUP	82	.317	GM/MT

TRANSPORTATION FOR PRODUCT: NICKEL CONCENTRATE
ORIGINATING FACILITY: MINE LOCATION: FALCONBRIDGE, ONTARIO
LATITUDE: N 46 34 55 LONGITUDE: W 80 48 23
PERCENT SHIPPED: 100
METHOD OF TRANSPORTATION: OTHER
DESTINATION FACILITY: MILL (ON-SITE) LOCATION: FALCONBRIDGE MILL,
ONTARIO
LATITUDE: N 46 34 55 LONGITUDE: W 80 48 23

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: FALCONBRIDGE MINE SEQUENCE NUMBER: 1220400033

NATION: CANADA SUBDIVISION: ONTARIO
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: PRODUCER
LATITUDE: N 46 DEG 34 MIN 55 SEC LONGITUDE: W 80 DEG 48 MIN 2 SEC
UTM - ZONE: 17 HEMISPHERE: NORTHERN NORTHING: 5158509 EASTING: 515281
POINT OF REFERENCE: APPROXIMATE PRECISION: 100 METERS
ELEVATION: 320 METERS PRECISION: 100 METERS
DATUM: SEA LEVEL

OWNERSHIP: STATUS:
FALCONBRIDGE NICKEL MINES, LTD. OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	PRIMARY
PLATINUM GROUP	PLATINUM	RECOVERABLE
COBALT		BYPRODUCT
PLATINUM GROUP	PALLADIUM	RECOVERABLE
SILVER		RECOVERABLE
GOLD		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED 73,416,000
UNITS MT ORE
YEAR/DATA 1977

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT	MINERAL FORM
NI	1.46	WT-PCT	SULFIDE
CU	0.73	WT-PCT	SULFIDE

RESERVE/RESOURCE REMARKS

SOURCE: CANADIAN MINING JOURNAL. MAY 1978, P. 23.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOPHYSICAL ANOMALY	GEOPHYSICAL/DRILLING/GEOLOGICAL/
YEAR OF DISCOVERY: 1901	SURFACE GEOLOGIC MAPPING
YEAR OF INITIAL PRODUCTION: 1929	SUBSURFACE GEOLOGIC MAPPING
YEAR OF FINAL PRODUCTION: PRODUCING	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: SHEAR ZONE: BRECCIA FILLING: DISSEMINATED
MODE OF ORIGIN: HYDROTHERMAL
CONTROLLING FEATURES: FAULTING: IGNEOUS
WALL ROCK ALTERATION: SILICIFICATION

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 53
STRIKE/DIP: N85E: 85N
AVERAGE LENGTH/METERS: 2,410
AVERAGE THICKNESS/METERS: 24.5

MINIMUM DEPTH/METERS: 30
AVERAGE WIDTH/METERS: 1,710

UNCONSOLIDATED MATERIAL:

MINIMUM THICKNESS/METERS: 53

LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: MAJOR FAULTING: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
GREENSTONE ORE IN FRACTURES: ENCLOSURES ORE
GABBRO ORE IN FRACTURES: ENCLOSURES ORE
QUARTZ DIORITE ORE IN FRACTURES: ENCLOSURES ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-MEDIUM
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-MEDIUM
GERSDORFFITE	PRECAMBRIAN	SULFIDES	PHANERITIC-MEDIUM
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-MEDIUM

MINE/MILL INFORMATION**UNDERGROUND MINING:**

METHOD: INCLINED CUT AND FILL
CAPACITY: 2,548 UNITS: MT ORE/DAY
CHARACTERISTIC OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES
ROCK AND WATER CONDITIONS: HARDROCK FISSURED WITH MODERATE WATER
ROCK/MINE SUPPORT: UNSUPPORTING MAY SLOUGH POST, HEADBOARD, CAPS, ROOF BOLTS
CONDITION OF WORKINGS: OPEN
TOTAL LENGTH OF WORKINGS: 24,288 METERS
SHAFTS - NUMBER: 4 AVERAGE DEPTH: 1,082 METERS

BENEFICIATION:

METHOD: FLOTATION	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 2,730	ORE/CRUSH/GRIND/FLOTATION/THICKEN
UNITS: METRIC TONS ORE/DAY	FILTER/DRY/NI-CU CONCENTRATE
DEPOSIT PERCENT USED: 100	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CU CONC.	NI	93	8.3	WT-PCT
	CU	95	5.9	WT-PCT
	PT	82	1.1	GM/MT
	CO	50	0.170	WT-PCT

PD	82	1.342	GM/MT
AG	90	13.88	GM/MT
AU	90	.452	GM/MT
PT GROUP	82	.317	GM/MT

TRANSPORTATION FOR PRODUCT: NICKEL CONCENTRATE

ORIGINATING FACILITY: MINE	LOCATION: FALCONBRIDGE, ONTARIO
LATITUDE: N 46 34 55	LONGITUDE: W 80 48 23
PERCENT SHIPPED: 100	
DESTINATION FACILITY: MILL (ON-SITE)	LOCATION: FALCONBRIDGE MILL, ONTARIO
LATITUDE: N 46 34 55	LONGITUDE: W 80 48 23

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ROCK TYPE:	
SCHIST	IS ORE
QUARTZITE	IS ORE

MINERALIZATION:			
MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
PYRRHOTITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE

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LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
QUARTZ DIORITE REPLACED BY ORE
GABBRO ORE IN FRACTURES: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: COMBINED METHODS
CAPACITY: 7,260 UNITS: MT ORE/DAY
CHARACTERISTIC OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES
ROCK AND WATER CONDITIONS: HARDROCK WITH LITTLE WATER
ROCK/MINE SUPPORT: SUPPORTING POST, HEADBOARD, CAPS, ROOF BOLTS
CONDITION OF WORKINGS: OPEN
TOTAL LENGTH OF WORKINGS: 240,000 METERS
AVERAGE LENGTH: 1,640 METERS
SHAFTS - NUMBER: 1 AVERAGE DEPTH: 1,250 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE LOCATION: STOBIE, ONTARIO, CANADA
LATITUDE: N 46 32 18 LONGITUDE: W 81 59 40
PERCENT SHIPPED: 100
DESTINATION FACILITY: MILL (ON-SITE)
LOCATION: FROOD STOBIE MILL, ONTARIO, CANADA
LATITUDE: N 46 31 30 LONGITUDE: W 81 00 30

BENEFICIATION:

METHOD: FLOTATION	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 18,150	ORE/CRUSH/GRIND/THICK/
DEPOSIT PERCENT USED: 37	NI/CU BULK
TOTAL PERCENT USED: 100	

TRANSPORTATION FOR PRODUCT: NICKEL-COPPER BULK

ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: FROOD STOBIE MILL, ONTARIO, CANADA
LATITUDE: N 46 32 18	LONGITUDE: W 81 01 30
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	LOCATION: COPPER CLIFF, ONTARIO, CANADA
LATITUDE: N 46 27 33	LONGITUDE: W 81 04 45

BENEFICIATION:

METHOD: FLOTATION
 DESIGN CAPACITY: 20,000
 UNITS: MT ORE/DAY
 DEPOSIT PERCENT USED: 40
 TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
 NI-CU BULK/FLOAT/NI CONC./CU CONC.

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
CU CONC.	CU	93	12.0	WT-PCT
NI CONC.	NI	93	14.0	WT-PCT
	PT	82	2.09	GM/MT
	CO	50	0.0561	WT-PCT
	PT GROUP	89	6.559	GM/MT
	PD	90	3.344	GM/MT
	AG	94	21.49	GM/MT
	AU	94	.717	GM/MT

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LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE
 GEOLOGIC AGE: PRECAMBRIAN
 DEFORMATION DESCRIPTION: FAULTING: INTRUSION
 RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING-DURING DEFORMATION
 GEOLOGIC AGE: PRECAMBRIAN
 ROCK TYPE:
 GREENSTONE ORE IN FRACTURES: ENCLOSURES ORE
 GABBRO ORE IN FRACTURES: ENCLOSURES ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-MEDIUM
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-MEDIUM
PYRRHOTITE	PRECAMBRIAN	SULFIDES	PHANERITIC-MEDIUM

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: INCLINED CUT AND FILL
 CAPACITY: 3,891 UNITS: MT ORE/DAY
 CHARACTERISTIC OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES
 ROCK AND WATER CONDITIONS: HARDROCK WITH LITTLE WATER
 ROCK/MINE SUPPORT: SUPPORTING POST, HEADBOARD, CAPS, ROOF BOLTS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: CANADA
LATITUDE: N 46 39 02	LONGITUDE: W 81 22 40
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: RAIL	DISTANCE (KM): 2
DESTINATION FACILITY: MILL (ON-SITE)	LOCATION: CANADA
LATITUDE: N 46 39 02	LONGITUDE: W 81 22 40

BENEFICIATION:

METHOD: FLOTATION	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 8,000	ORE/CRUSH/MAGNETIC SEPARATION
UNITS: MT ORE/DAY	FLOTATION/NI CONC./CU CONC./
DEPOSIT PERCENT USED: 47	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI CONC.	NI	93	14.0	WT-PCT
	PT	82	5.34	GM/MT
	CO	26	0.0685	WT-PCT
	PD	82	6.793	GM/MT
	AG	90	43.67	GM/MT
	AU	90	1.455	GM/MT
	AU	90	1.455	GM/MT
CU CONC.	CU	95	12.0	WT-PCT

TRANSPORTATION FOR PRODUCT: NICKEL CONCENTRATE

ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: CANADA
LATITUDE: N 46 39 02	LONGITUDE: W 81 22 40
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: RAIL	DISTANCE (KM): 40
DESTINATION FACILITY: SMELTER/REFINERY	LOCATION: CANADA
LATITUDE: N 46 26 00	LONGITUDE: W 81 04 30

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: LITTLE STOBIE	SEQUENCE NUMBER: 1220400040
NATION: CANADA	SUBDIVISION: ONTARIO
TYPE OF OPERATION: UNDERGROUND	CURRENT STATUS: PRODUCER
LATITUDE: N 46 DEG 32 MIN 50 SEC	LONGITUDE: W 81 DEG 0 MIN 23 SEC
UTM - ZONE: 17 HEMISPHERE: NORTHERN	NORTHING: 5154632 EASTING: 499510
POINT OF REFERENCE: APPROXIMATE	PRECISION: 500 METERS
ELEVATION: 320 METERS	PRECISION: 10 METERS
DATUM: SEA LEVEL	

ALTERNATE NAMES: LITTLE STOBIE MINE

OWNERSHIP: INTERNATIONAL NICKEL COMPANY, LTD. STATUS: OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	BYPRODUCT
SILVER		BYPRODUCT
GOLD		BYPRODUCT
IRON	SULFIDE	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:
ORE-MINERAL IN PLACE
YEAR OF DISCOVERY: 1885
YEAR OF INITIAL PRODUCTION: 1902
YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: MASSIVE
CONTROLLING FEATURES: FAULTING: IGNEOUS

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MINERALIZED ZONE:
  AVERAGE DEPTH/METERS: 750
  STRIKE/DIP: N60E: 55W
  AVERAGE LENGTH/METERS: 610
  AVERAGE THICKNESS/METERS: 30
  MINIMUM DEPTH/METERS: 0
  AVERAGE WIDTH/METERS: 792
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UNCONSOLIDATED MATERIAL:
AVERAGE THICKNESS/METERS: 110

LITHOLOGY:

NAME OF FORMATION: HURONIAN VOLCANICS
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: MAJOR FAULTING: INTRUSION
RELATIONSHIP TO MINERALIZATION: COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
RHYOLITE LIES ALONG ORE
GABBRO IS ORE: ENCLOSES ORE
AMPHIBOLITE LIES ALONG ORE
GREENSTONE LIES ALONG ORE
QUARTZITE LIES ALONG ORE

LITHOLOGY:

NAME OF FORMATION: MURRAY GRANITE
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
GRANITE NEAR ORE

LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: FAULTING: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
NORITE NEAR ORE
QUARTZ DIORITE REPLACED BY ORE: GANGUE
PERIDOTITE NEAR ORE
PYROXENITE NEAR ORE
ULTRAMAFIC LIES UNDER ORE

LITHOLOGY:

NAME OF FORMATION: SUDBURY BRECCIA
GEOLOGIC AGE: PRECAMBRIAN
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
BRECCIA ORE IN FRACTURES: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
BORNITE	PRECAMBRIAN	SULFIDES
GALENA	PRECAMBRIAN	SULFIDES
NICCOLITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
GERSDORFFITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
SPERRYLITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
ELECTRUM	PRECAMBRIAN	NATIVE ELEMENT
HESSITE	PRECAMBRIAN	SELENIUM-TELLURIUM COMPOUNDS
QUARTZ	PRECAMBRIAN	SILICATES
PLAGIOCLASE	PRECAMBRIAN	SILICATES
PENTLANDITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: FILLED STOPES
CAPACITY: 2,720 UNITS: MT ORE/DAY
CHARACTERISTIC OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES
ROCK AND WATER CONDITIONS: HARDROCK WITH LITTLE WATER
ROCK/MINE SUPPORT: SUPPORTING MAY BACK SLAB: POST, HEADBOARD, CAPS, ROOF BOLTS
CONDITION OF WORKINGS: OPEN
TOTAL LENGTH OF WORKINGS: 3,016 METERS
SHAFTS - NUMBER: 1 AVERAGE DEPTH: 808 METERS

BENEFICIATION:

METHOD: FLOTATION	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 18,150	ORE/CRUSHING/GRINDING/FLOTATION/
UNITS: MT ORE/DAY	MAGNETIC SEPARATION/
DEPOSIT PERCENT USED: 15	TO COPPER CLIFF MILL
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
BULK NI-CU CONC.	NI	82	6.0	WT-PCT
	CU	94	6.8	WT-PCT
PYRRHOTITE	FES	30	46.0	WT-PCT
CONC.				

TRANSPORTATION FOR PRODUCT: BULK NICKEL-COPPER CONCENTRATE

ORIGINATING FACILITY: MILL (OFF-SITE)	LOCATION: FROOD-STOBIE MILL, CANADA
LATITUDE: N 46 32 50	LONGITUDE: W 81 00 23
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: PIPELINE	
DESTINATION FACILITY: MILL (OFF-SITE)	
LOCATION: COPPER CLIFF MILL/SMELTER/REFINERY COMPLEX	
LATITUDE: N 46 29 29	LONGITUDE: W 81 04 03

TRANSPORTATION FOR PRODUCT: PYRRHOTITE CONCENTRATE
 ORIGINATING FACILITY: MILL (OFF-SITE) LOCATION: FROOD-STOBIE MILL, CANADA
 LATITUDE: N 46 32 50 LONGITUDE: W 81 00 23
 PERCENT SHIPPED: 100
 METHOD OF TRANSPORTATION: PIPELINE
 DESTINATION FACILITY: MILL (OFF-SITE)
 LOCATION: COPPER CLIFF IRON ORE PLANT
 LATITUDE: N 46 29 29 LONGITUDE: W 81 04 03

MINE/MILL INFORMATION

BENEFICIATION:
 METHOD: FLOTATION ----- DESCRIPTION OF MILLING -----
 DESIGN CAPACITY: 12,700 CONC. FROM MILLS/CRUSHING/GRINDING/
 UNITS: MT CONCENTRATE/DAY MAGNETIC SEPARATION/FLOTATION

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
CU CONC.	NI	3	1.2	WT-PCT
	CU	74	29.0	WT-PCT
	FES	1	8.0	WT-PCT
NI CONC.	NI	85	9.5	WT-PCT
	CU	24	2.5	WT-PCT
	FES	31	50.0	WT-PCT
PYRRHOTITE CONC.	NI	7	1.1	WT-PCT
	CU	1	0.11	WT-PCT
	FES	41	90.0	WT-PCT

TRANSPORTATION FOR PRODUCT: PYRRHOTITE CONCENTRATE
 ORIGINATING FACILITY: MILL (OFF-SITE) LOCATION: COPPER CLIFF MILL
 LATITUDE: N 46 29 29 LONGITUDE: W 81 04 03
 PERCENT SHIPPED: 100
 METHOD OF TRANSPORTATION: PIPELINE DISTANCE (KM): 21
 DESTINATION FACILITY: MILL (OFF-SITE) LOCATION: COPPER CLIFF IRON ORE PLANT
 LATITUDE: N 46 29 30 LONGITUDE: W 81 00 30

BENEFICIATION:
 METHOD: PYROMETALLURGY ----- DESCRIPTION OF MILLING -----
 DESIGN CAPACITY: 1,820 CINDER/LEACH
 UNITS: MT COMMODITY/DAY PELLETIZE

PRODUCT	ASSAY/FORM	CONC. GRADE	GRADE/UNIT
IRON ORE	NI	0.2	WT-PCT
	CU	.017	WT-PCT
	CO	.017	WT-PCT
	FE	67.0	WT-PCT
	S	.007	WT-PCT
	SI02	2.0	WT-PCT
	P	.004	WT-PCT
	MN	.025	WT-PCT
	MGO	.30	WT-PCT
	AL2O3	.67	WT-PCT
	CR2O3	.03	WT-PCT
	TIO2	.22	WT-PCT

BENEFICIATION:

METHOD: HYDROMETALLURGY
DESIGN CAPACITY: 2,449
UNITS: MT COMMODITY/DAY
PRODUCT: SULFURIC ACID

----- DESCRIPTION OF MILLING -----
SO2 FROM IRON PLANT/SO2 ABSORPTION

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MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: ONAPING MINE SEQUENCE NUMBER: 1220400051

NATION: CANADA SUBDIVISION: ONTARIO

TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: PRODUCER

LATITUDE: N 46 DEG 38 MIN 0 SEC LONGITUDE: W 81 DEG 23 MIN 15 SEC

UTM - ZONE: 17 HEMISPHERE: NORTHERN NORTHING: 5164273 EASTING: 470338

POINT OF REFERENCE: ORE BODY PRECISION: 500 METERS

ELEVATION: 390 METERS PRECISION: 100 METERS

OWNERSHIP: STATUS:

FALCONBRIDGE NICKEL MINES, LTD. OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	PRIMARY
COBALT		BYPRODUCT
PLATINUM GROUP	PLATINUM	BYPRODUCT
PLATINUM GROUP	PALLADIUM	BYPRODUCT
PLATINUM GROUP	RHODIUM	BYPRODUCT
PLATINUM GROUP	RUTHENIUM	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 11,800,000

UNITS MT ORE

YEAR/DATA 1981

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.94	WT-PCT
CU	0.76	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: GLOBE AND MAIL. CRAIG ORE ZONE RESERVES. APR. 28, 1981.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD: -----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE DRILLING

YEAR OF DISCOVERY: 1940

YEAR OF INITIAL PRODUCTION: 1961

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: BRECCIA FILLING

MODE OF ORIGIN: HYDROTHERMAL

SHAPE OF ORE BODY: MASSIVE: LENTICULAR

CONTROLLING FEATURES: FAULTING: IGNEOUS

MINERALIZED ZONE:

MINIMUM DEPTH/METERS: 600

AVERAGE THICKNESS/METERS: 1,200

LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: INTRUSION: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING-DURING DEFORMATION

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

QUARTZ DIORITE LIES ALONG ORE: IS ORE

GABBRO LIES OVER ORE: IS ORE

PEGMATITE LIES OVER ORE

PERIDOTITE OTHER

PYROXENITE OTHER

GRANITE LIES ALONG ORE: IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
MAGNETITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO ₂)
ILMENITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO ₂)
PYRITE	PRECAMBRIAN	SULFIDES
SPERRYLITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: INCLINED CUT AND FILL

CAPACITY: 867

UNITS: MT ORE/DAY

ROCK AND WATER CONDITIONS: HARDROCK WITH LITTLE WATER

ROCK/MINE SUPPORT: SUPPORTING POST, HEADBOARD, CAPS, ROOF BOLTS

CONDITION OF WORKINGS: OPEN

AVERAGE LENGTH: 300 METERS

SLOPE: 45 DEGREES

SHAFTS - NUMBER: 2

AVERAGE DEPTH: 992 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: ONAPING MINE, ONTARIO

LATITUDE: N 46 38 00

LONGITUDE: W 81 23 15

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: TRUCK

DESTINATION FACILITY: MILL (OFF-SITE)

LOCATION: STRATHCONA MILL, ONTARIO

LATITUDE: N 46 38 22

LONGITUDE: W 81 18 00

BENEFICIATION:

METHOD: FLOTATION

UNITS: MT ORE/DAY

DEPOSIT PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
ORE CRUSH/SCREEN/GRIND/NI-CU FLOAT/
THICK/FILTER/DRY/NI-CU CONC.

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CU CONC.	NI	89	7.6	WT-PCT
	CU	93	2.72	WT-PCT
	CO	50	0.14	WT-PCT
	PT	82	.8	GM/MT
	PD	82	1.229	GM-MT
	RH	82	.4136	GM-MT
	RU	82	.3003	GM-MT
	IR	82	.1556	GM-MT
	AU	90	.4139	GM-MT
	AG	90	12.71	GM-MT

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: STRATHCONA MINE

SEQUENCE NUMBER: 1220400057

NATION: CANADA

SUBDIVISION: ONTARIO

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: N 46 DEG 38 MIN 22 SEC

LONGITUDE: W 81 DEG 18 MIN 0 SEC

UTM - ZONE: 17 HEMISPHERE: NORTHERN

NORTHING: 5164923 EASTING: 477038

POINT OF REFERENCE: ORE BODY

PRECISION: 100 METERS

ELEVATION: 300 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

FALCONBRIDGE NICKEL MINES, LTD.

OWNER

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

COPRODUCT

PLATINUM GROUP

PLATINUM

BYPRODUCT

COBALT

BYPRODUCT

PLATINUM GROUP

PALLADIUM

BYPRODUCT

PLATINUM GROUP

RHODIUM

BYPRODUCT

PLATINUM GROUP

RUTHENIUM

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED 476,000

UNITS MT ORE

YEAR/DATA 1981

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

CU

9.31

WT-PCT

NI

0.46

WT-PCT

RESERVE/RESOURCE - REMARKS

SOURCE: CANADIAN INSTITUTE OF MINING. BULL., FEB. 1981, P. 89.

RESERVE FOR "COPPER ZONE" ONLY.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE

DRILLING/TEST DRIFT/CROSSCUT

YEAR OF DISCOVERY: 1955

YEAR OF INITIAL PRODUCTION: 1968

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: BRECCIA FILLING: DISSEMINATED: FISSURE VEIN
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: OTHER: IRREGULAR
CONTROLLING FEATURES: IGNEOUS: FAULTING

MINERALIZED ZONE:

AVERAGE LENGTH/METERS: 800
AVERAGE THICKNESS/METERS: 9

AVERAGE WIDTH/METERS: 305

LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION: METAMORPHISM: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
GABBRO IS ORE: ENCLOSURES ORE
QUARTZ DIORITE LIES ALONG ORE: ENCLOSURES ORE
DIABASE LIES ALONG ORE
GRANITE LIES ALONG ORE: ENCLOSURES ORE
GNEISS LIES ALONG ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
MILLERITE	PRECAMBRIAN	SULFIDES
BORNITE	PRECAMBRIAN	SULFIDES
CUBANITE	PRECAMBRIAN	SULFIDES
GALENA	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: INCLINED CUT AND FILL WITH TAILINGS
CAPACITY: 811 UNITS: MT ORE/DAY
SHAFTS - NUMBER: 1 AVERAGE DEPTH: 1,615 METERS

UNDERGROUND MINING:

METHOD: INCLINED CUT AND FILL WITH TAILINGS
CAPACITY: 7,280 UNITS: MT ORE/DAY
SHAFTS - NUMBER: 2 AVERAGE DEPTH: 960 METERS

BENEFICIATION:

METHOD: FLOTATION	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 8,500	ORE/CRUSH/GRIND/FLOAT/THICK/FILTER/DRY
UNITS: MT ORE/DAY	
DEPOSIT PERCENT USED: 64	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CU CONC.	NI	93	7.6	WT-PCT
	CU	95	5.4	WT-PCT
	PT	82	1.166	GM/MT
	CO	50	0.292	WT-PCT
	PD	82	1.228	GM/MT
	RH	82	.4136	GM/MT
	RU	82	.3003	GM/MT
	AU	90	.4139	GM/MT
	AG	90	12.71	GM/MT
	IR	82	.1556	GM/MT

TRANSPORTATION FOR PRODUCT:

ORIGINATING FACILITY: MILL (ON-SITE)

LOCATION: STRATHCONA, ONTARIO

LATITUDE: N 46 38 22

LONGITUDE: W 81 18 00

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: RAIL

DESTINATION FACILITY: SMELTER

LOCATION: FALCONBRIDGE, ONTARIO

LATITUDE: N 46 35 00

LONGITUDE: W 80 48 00

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: THIERRY MINE

SEQUENCE NUMBER: 1220400060

NATION: CANADA

SUBDIVISION: ONTARIO

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: N 51 DEG 30 MIN 0 SEC

LONGITUDE: W 90 DEG 20 MIN 0 SEC

UTM - ZONE: 15 HEMISPHERE: NORTHERN

NORTHING: 5708582 EASTING: 685091

ELEVATION: 380 METERS

PRECISION: 500 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

UNION MINIERE, S. A. BRUSSELS

OWNER-OPERATOR

TANGANYIKA CONCESSIONS

OWNER

COMMODITY

MODIFIER

MARKETABILITY

COPPER

SULFIDE

PRIMARY

NICKEL

SULFIDE

BYPRODUCT

SILVER

BYPRODUCT

GOLD

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED

11,987,000

UNITS

MT TONS ORE

YEAR/DATA

1978

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

MINERAL FORM

CU

1.52

WT-PCT

SULFIDE

RESERVE/RESOURCE - REMARKS

SOURCE: CRANSTONE, D. A., AND R. T. WILLIAMS. CANADIAN RESERVES OF COPPER, NICKEL, LEAD, ZINC, MOLYBDENUM, SILVER, AND GOLD. DEP. ENERGY, MINES, AND RESOURCES, CANADA, MR 185, 1978, P. 14.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

GEOPHYSICAL ANOMALY

GEOPHYSICAL/DRILLING

YEAR OF DISCOVERY: 1970

YEAR OF INITIAL PRODUCTION: 1976

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: SHEAR ZONE: BRECCIA FILLING

MODE OF ORIGIN: HYDROTHERMAL

SHAPE OF ORE BODY: MASSIVE

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 300
STRIKE/DIP: N55E: 50N
AVERAGE LENGTH/METERS: 1,000
AVERAGE THICKNESS/METERS: 70

MINIMUM DEPTH/METERS: 10

AVERAGE WIDTH/METERS: 55

LITHOLOGY:

NAME OF FORMATION: PICKLE LAKE BELT

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

AMPHIBOLITE	NEAR ORE
PERIDOTITE	NEAR ORE
SCHIST	ENCLOSES ORE
GRANITE	NEAR ORE
GNEISS	NEAR ORE

MINERALIZATION:

MINERAL NAME	MINERAL CLASS
PYRRHOTITE	SULFIDES
CHALCOPYRITE	SULFIDES
PYRITE	SULFIDES
PENTLANDITE	SULFIDES
MAGNETITE	OXIDES (EXCLUDING SiO2)
ILMENITE	OXIDES (EXCLUDING SiO2)
BIOTITE	SILICATES
CHLORITE	SILICATES
HORNBLende	SILICATES
HYALOPHANE	SILICATES
EPIDOTE	SILICATES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: SUBLEVEL

CAPACITY: 3,600

UNITS: MT ORE/DAY

ROCK AND WATER CONDITIONS: HARDROCK FISSURED WITH MODERATE WATER

CONDITION OF WORKINGS: OPEN

SHAFTS - NUMBER: 1

AVERAGE DEPTH: 543 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: THIERRY MINE, ONTARIO

LATITUDE: N 51 30 00

LONGITUDE: W 90 20 00

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: CONVEYOR

DESTINATION FACILITY: MILL (ON-SITE)

LOCATION: THIERRY CONCENTRATOR

LATITUDE: N 51 30 00

LONGITUDE: W 90 20 00

BENEFICIATION:

METHOD: FLOTATION
 DESIGN CAPACITY: 3,600
 UNITS: MT ORE/DAY
 DEPOSIT PERCENT USED: 100
 TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
 ORE/CRUSHING/GRINDING/FLOTATION/
 FILTER/DRY

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
CU-NI CONC.	CU	91	26.0	WT-PCT
	NI	29	1.0	WT-PCT
	AG	80	115.1	GM/MT
	AU	60	1.33	GM/MT

TRANSPORTATION FOR PRODUCT: COPPER-NICKEL CONCENTRATE

ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: THIERRY CONCENTRATOR
LATITUDE: N 51 30 00	LONGITUDE: W 90 20 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	DISTANCE (KM): 275
DESTINATION FACILITY: SMELTER	LOCATION: HORN, QUEBEC
LATITUDE: N 48 17 00	LONGITUDE: W 79 05 00

TRANSPORTATION FOR PRODUCT: COPPER-NICKEL CONCENTRATE

ORIGINATING FACILITY: SMELTER	LOCATION: NORANDA SMELTER, QUEBEC
LATITUDE: N 48 17 00	LONGITUDE: W 79 05 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: RAIL	DISTANCE (KM): 880
DESTINATION FACILITY: REFINERY	LOCATION: MONTREAL, QUEBEC
LATITUDE: N 45 30 00	LONGITUDE: W 73 30 00

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: TEXMONT

SEQUENCE NUMBER: 1220400061

NATION: CANADA

SUBDIVISION: ONTARIO

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PAST PRODUCER

LATITUDE: N 48 DEG 9 MIN 21 SEC

LONGITUDE: W 81 DEG 12 MIN 16 SEC

UTM - ZONE: 17 HEMISPHERE: NORTHERN

NORTHING: 5333421 EASTING: 484794

POINT OF REFERENCE: ORE BODY

PRECISION: 100 METERS

ELEVATION: 300 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: PATENTED

ALTERNATE NAMES: FATIMA

OWNERSHIP:

NEW TEXMONT EXPLORATIONS, LTD. (INCO)

CANICO (INCO)

SHERIDAN GEOPHYSICS

STATUS:

OWNER

OWNER

OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

	RECORD 1	RECORD 2
INDICATED	3,400,000	4,354,000
UNITS	MT ORE	MT ORE
YEAR/DATA	1971	1971

IN SITU GRADE:

RECORD	ASSAY/FORM	GRADE	UNIT	MINERAL FORM
1	NI	1.0	WT-PCT	SULFIDE
2	NI		WT-PCT	SULFIDE

RESERVE/RESOURCE - REMARKS

REC. 1 - TEXMONT MINES, LTD. ANNUAL REPORT. 1971.

REC. 2 - NORTHERN MINER. TEXMONT TIMMINS NICKEL MINE STILL MAINTAINED
ON STANDBY. UNSPECIFIED GRADE. JAN. 9, 1975, P. 3.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

ORE-MINERAL IN PLACE

YEAR OF DISCOVERY: 1950

YEAR OF INITIAL PRODUCTION: 1960

YEAR OF FINAL PRODUCTION: 1972

-----EXPLORATION METHODS-----
GEOPHYSICAL/DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: OTHER
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: IRREGULAR
CONTROLLING FEATURES: FAULTING

MINERALIZED ZONE:

MINIMUM DEPTH/METERS: 0
STRIKE/DIP: NOOS: 75E
AVERAGE LENGTH/METERS: 2,130
AVERAGE THICKNESS/METERS: 300
AVERAGE WIDTH/METERS: 10

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFICS
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION: MAJOR FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
ROCK TYPE:
PERIDOTITE ENCLOSES ORE
GABBRO LIES ALONG ORE
PYROXENITE LIES ALONG ORE
TUFF NEAR ORE

MINERALIZATION:

MINERAL NAME	MINERAL CLASS
PENTLANDITE	SULFIDES
PYRRHOTITE	SULFIDES
PYRITE	SULFIDES
CHALCOPYRITE	SULFIDES
MILLERITE	SULFIDES

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STOPPED AT TEXMONT. MAR. 22, 1973, P. 22.

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LITHOLOGY:

NAME OF FORMATION: ULTRAMAFICS

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: INTRUSION: MAJOR FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

NORITE	ENCLOSES ORE
SLATE	LIES UNDER ORE
GRAYWACKE	LIES OVER ORE
QUARTZITE	NEAR ORE
GREENSTONE	NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: LOCKERBY MINE

SEQUENCE NUMBER: 1220400068

NATION: CANADA

SUBDIVISION: ONTARIO

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: N 46 DEG 25 MIN 27 SEC

LONGITUDE: W 81 DEG 19 MIN 32 SEC

UTM - ZONE: 17 HEMISPHERE: NORTHERN

NORTHING: 5141010 EASTING: 474984

POINT OF REFERENCE: MAIN ENTRY

PRECISION: 100 METERS

ELEVATION: 305 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

FALCONBRIDGE NICKEL MINES, LTD.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY:

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

COBALT

BYPRODUCT

PLATINUM GROUP

PLATINUM

BYPRODUCT

PLATINUM GROUP

PALLADIUM

BYPRODUCT

PLATINUM GROUP

RHODIUM

BYPRODUCT

PLATINUM GROUP

RUTHENIUM

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED 13,478,000

UNITS MT ORE

YEAR/DATA 1971

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

MINERAL FORM

NI

0.84

WT-PCT

SULFIDES

CU

.71

WT-PCT

SULFIDES

RESERVE/RESOURCE REMARKS

SOURCE: FALCONBRIDGE NICKEL MINES, LTD. PROSPECTUS - DEBENTURE ISSUE.
FEB. 24, 1971.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

GEOPHYSICAL ANOMALY

CORE DRILLING

YEAR OF DISCOVERY: 1919

YEAR OF INITIAL PRODUCTION: 1969

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STOCKWORK: DISSEMINATED
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: METAMORPHISM
SHAPE OF ORE BODY: MASSIVE: IRREGULAR
CONTROLLING FEATURES: IGNEOUS: FOLDING

MINERALIZED ZONE:

STRIKE/DIP: N35E: 90
AVERAGE LENGTH/METERS: 1,220
AVERAGE THICKNESS/METERS: 173
AVERAGE WIDTH/METERS: 30

LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: FAULTING: METAMORPHISM: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

NORITE	NEAR ORE
GRANITE	NEAR ORE
RHYOLITE	NEAR ORE
QUARTZITE	NEAR ORE
GREENSTONE	NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: FILLED STOPES
CAPACITY: 1,633
UNITS: MT ORE/DAY
CHARACTERISTIC OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES
ROCK AND WATER CONDITIONS: HARDROCK WITH LITTLE WATER
ROCK/MINE SUPPORT: SUPPORTING MAY BACK SLAB, POST, HEADBOARD, CAPS, ROOF BOLTS
CONDITION OF WORKINGS: OPEN
SHAFTS - NUMBER: 2
AVERAGE DEPTH: 1,301 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: LOCKERBY, ONTARIO
LATITUDE: N 46 25 27	LONGITUDE: W 81 19 32
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	DISTANCE (KM): 48
DESTINATION FACILITY: MILL (OFF-SITE)	LOCATION: STRATHCONA, ONTARIO,
LATITUDE: N 46 38 22	LONGITUDE: W 81 18 00

BENEFICIATION:

METHOD: FLOTATION

DESIGN CAPACITY: 8,500

UNITS: MT ORE/DAY

----- DESCRIPTION OF MILLING -----
 ORE/CRUSH/GRIND/NI-CU FLOAT/THICKEN/
 FILTER/CONCENTRATE

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CU CONC.	NI	92	7.6	WT-PCT
	CU	93	6.0	WT-PCT
	PT	82	1.166	GM/MT
	CO	50	0.292	WT-PCT
	PD	82	1.229	GM/MT
	RH	82	.414	GM/MT
	RU	82	.300	GM/MT
	IR	82	.156	GM/MT
	AU	90	.414	GM/MT
	AG	90	12.71	GM/MT

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: LINDSLEY MINE SEQUENCE NUMBER: 1220400070
NATION: CANADA SUBDIVISION: ONTARIO
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: TEMPORARY SHUTDOWN
LATITUDE: N 46 DEG 33 MIN 30 SEC LONGITUDE: W 80 DEG 59 MIN 25 SEC
UTM - ZONE: 17 HEMISPHERE: NORTHERN NORTHING: 5156332 EASTING: 558253
POINT OF REFERENCE: MAIN ENTRY PRECISION: 1,000 METERS

ALTERNATE NAMES: BLEZARD PROPERTY

OWNERSHIP: STATUS:
FALCONBRIDGE NICKEL MINES, LTD. OWNER-OPERATOR

COMMODITY	MARKETABILITY
NICKEL	COPRODUCT
COPPER	COPRODUCT
PLATINUM GROUP	BYPRODUCT
COBALT	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED 3,89,0006
UNITS MT ORE
YEAR/DATA 1973

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT	MINERAL FORM
NI	0.85	WT-PCT	SULFIDE
CU	.68	WT-PCT	SULFIDE

RESERVE/RESOURCE REMARKS

SOURCE: FINANCIAL POST CORPORATION SERVICE, JUNE 1972.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1886 -----EXPLORATION METHODS-----
YEAR OF INITIAL PRODUCTION: 1886 DRILLING
YEAR OF FINAL PRODUCTION: 1971

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: OTHER
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: CONTACT METASOMATIC
SHAPE OF ORE BODY: MASSIVE
CONTROLLING FEATURES: CONTACT ZONE

LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE

GEOLOGIC AGE: PRECAMBRIAN

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

GABBRO

GANGUE

ANDESITE

NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MCCREEDY WEST

SEQUENCE NUMBER: 1220400094

NATION: CANADA

SUBDIVISION: ONTARIO

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: N 46 DEG 38 MIN 8 SEC

LONGITUDE: W 81 DEG 24 MIN 0 SEC

UTM - ZONE: 17 HEMISPHERE: NORTHERN

NORTHING: 5164525 EASTING: 469382

POINT OF REFERENCE: ORE BODY

PRECISION: 100 METERS

ELEVATION: 355 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

ALTERNATE NAMES: LEVACK WEST

OWNERSHIP:

INTERNATIONAL NICKEL COMPANY, LTD.

STATUS:

OWNER

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

COBALT

BYPRODUCT

PLATINUM GROUP

PLATINUM

BYPRODUCT

PLATINUM GROUP

BYPRODUCT

SILVER

BYPRODUCT

GOLD

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE

DRILLING/TEST ADIT/DRIFT/CROSSCUT

YEAR OF DISCOVERY: 1890

YEAR OF INITIAL PRODUCTION: 1973

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: BRECCIA FILLING: DISSEMINATED: STOCKWORK

MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: CONTACT METASOMATIC

CONTROLLING FEATURES: IGNEOUS

WALL ROCK ALTERATION: SERICITIC: POTASSIC: PYRITIZATION

DEGREE OF ALTERATION: INTENSE

MINERALIZED ZONE:

STRIKE/DIP: N30E: 90

AVERAGE LENGTH/METERS: 450

AVERAGE WIDTH/METERS: 120

AVERAGE THICKNESS/METERS: 351

LITHOLOGY:

NAME OF FORMATION: SUDBURY IRRUPTIVE
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION: MAJOR FAULTING: MINOR FOLDING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
ROCK TYPE:
GRANITE LIES ALONG ORE
MAFIC IGNEOUS LIES ALONG ORE
ALKALIC IGNEOUS LIES ALONG ORE
VOLCANIC BRECCIA LIES ALONG ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: HORIZONTAL CUT AND FILL WITH TAILINGS
CAPACITY: 2,763 UNITS: MT ORE/DAY
ROCK/MINE SUPPORT: UNSUPPORTING MAY SLOUGH-POST, HEADBOARD, CAPS, ROOF BOLTS
CONDITION OF WORKINGS: OPEN
TOTAL LENGTH OF WORKINGS:
SHAFTS - NUMBER: 2

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: MCCREEDY WEST, ONTARIO
LATITUDE: N 46 38 08	LONGITUDE: W 81 24 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: RAIL	
DESTINATION FACILITY: MILL (OFF-SITE)	LOCATION: CLARABELLE, ONTARIO
LATITUDE: N 46 31 06	LONGITUDE: W 81 03 34

BENEFICIATION:

METHOD: FLOTATION
DESIGN CAPACITY: 30,000
UNITS: MT ORE/DAY

----- DESCRIPTION OF MILLING -----
ORE/CRUSH/GRIND/FLOAT/THICKEN/
FILTER/NI CONC.

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CU CONC.	NI	93	14.0	WT-PCT
	CU	93	12.0	WT-PCT
	CO	26	0.0687	WT-PCT
	PT	82	5.34	GM/MT
	PT GROUP	89	13.32	GM/MT

TRANSPORTATION FOR PRODUCT:

ORIGINATING FACILITY: MILL (OFF-SITE)	LOCATION: CLARABELLE, ONTARIO
LATITUDE: N 46 31 06	LONGITUDE: W 81 03 30
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: PIPELINE	
DESTINATION FACILITY: SMELTER/REFINERY	LOCATION: COPPER CLIFF, ONTARIO
LATITUDE: N 46 27 33	LONGITUDE: W 81 04 45

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: FRASER MINE

SEQUENCE NUMBER: 1220400098

NATION: CANADA

SUBDIVISION: ONTARIO

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: DEVELOPED DEPOSIT

LATITUDE: N 46 DEG 39 MIN 55 SEC

LONGITUDE: W 81 DEG 21 MIN 5 SEC

UTM - ZONE: 17 HEMISPHERE: NORTHERN

NORTHING: 5167810 EASTING: 473118

POINT OF REFERENCE: ORE BODY

PRECISION: 1,000 METERS

ELEVATION: 405 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

FALCONBRIDGE NICKEL MINES, LTD.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

COBALT

BYPRODUCT

PLATINUM GROUP

PLATINUM

BYPRODUCT

PLATINUM GROUP

PALLADIUM

BYPRODUCT

PLATINUM GROUP

RHODIUM

BYPRODUCT

PLATINUM GROUP

RUTHENIUM

BYPRODUCT

SILVER

BYPRODUCT

GOLD

BYPRODUCT

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

OTHER

DRILLING

YEAR OF DISCOVERY: 1962

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: BRECCIA FILL

MODE OF ORIGIN: HYDROTHERMAL

CONTROLLING FEATURES: IGNEOUS

LITHOLOGY:

NAME OF FORMATION: SUDBURY NICKEL IRRUPTIVE

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING-DURING-FOLLOWING
DEFORMATION

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

GNEISS

LIES UNDER ORE

LITHOLOGY:

NAME OF FORMATION: LEVACK BRECCIA
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: FAULTING
RELATIONSHIP TO MINERALIZATION: COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
BRECCIA ENCLOSES ORE

LITHOLOGY:

NAME OF FORMATION: GRANITE GNEISS COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
GNEISS LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	MINERAL CLASS
PYRRHOTITE	SULFIDES
CHALCOPYRITE	SULFIDES
PENTLANDITE	SULFIDES
MAGNETITE	OXIDES
ILMENITE	OXIDES
PYRITE	SULFIDES
MILLERITE	SULFIDES
BORNITE	SULFIDES

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MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 400
AVERAGE LENGTH/METERS: 2,720

MINIMUM DEPTH/METERS: 183
AVERAGE WIDTH/METERS: 38

LITHOLOGY:

NAME OF FORMATION: BASIC-ULTRABASIC COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
GABBRO IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PYRITE	PRECAMBRIAN	SULFIDES

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_____. PLATINUM GROUP METALS ARE MINED IN CANADA. OCT. 26, 1978, P. 18.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: EXPO UNGAVA

SEQUENCE NUMBER: 1220500078

NATION: CANADA

SUBDIVISION: QUEBEC

TYPE OF OPERATION: SURFACE

CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: N 61 DEG 33 MIN 6 SEC

LONGITUDE: W 73 DEG 28 MIN 12 SEC

UTM - ZONE: 18 HEMISPHERE: NORTHERN

NORTHING: 6824988 EASTING: 581310

ELEVATION: 580 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

EXPO UNGAVA MINES, LTD.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

PLATINUM

BYPRODUCT

PALLADIUM

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

	RECORD 1	RECORD 2
INDICATED	16,300,000	3,690,000
UNITS	MT ORE	MT ORE
YEAR/DATA	1979	1979

IN SITU GRADE:

RECORD	ASSAY/FORM	GRADE	UNIT
1	NI	0.47	WT-PCT
	CU	.52	WT-PCT
2	NI	.97	WT-PCT
	CU	1.04	WT-PCT

RESERVE/RESOURCE REMARKS

REC. 1 AND 2 - DEPARTMENT OF ENERGY, MINES AND RESOURCES. MINERAL
POLICY SECTOR. FILE 506442, OTTAWA, CANADA, FEB. 1979.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1957

-----EXPLORATION METHODS-----
CORE DRILLING/MAGNETIC SURVEY

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: FISSURE VEIN

MODE OF ORIGIN: MAGMATIC DIFFERENTIATION

SHAPE OF ORE BODY: TABULAR

CONTROLLING FEATURES: FOLDING

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 91

AVERAGE LENGTH/METERS: 1,097

AVERAGE WIDTH/METERS: 11

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC ROCKS

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: MINOR FOLDING

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

GABBRO ORE IN FRACTURES

PERIDOTITE ENCLOSED ORE

SERPENTENITE ENCLOSED ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PYRITE	PRECAMBRIAN	SULFIDES

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MINISTERE DES RICHESSES NATURELLES DU QUEBEC. FICHE DEGITE. NO. LAUNAY-10, MAY 1980.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: DUMONT NICKEL

SEQUENCE NUMBER: 1220500072

NATION: CANADA

SUBDIVISION: QUEBEC

TYPE OF OPERATION: SURFACE

CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: N 48 DEG 39 MIN 0 SEC

LONGITUDE: W 78 DEG 26 MIN 0 SEC

UTM - ZONE: 17 HEMISPHERE: NORTHERN

NORTHING: 5391509 EASTING: 689042

POINT OF REFERENCE: APPROXIMATE

PRECISION: 100 METERS

OWNERSHIP:

DUMONT NICKEL MINES, LTD.

TIMISKAMING NICKEL, LTD. OF NEW YORK

STATUS:

OWNER

OWNER-OPERATOR

COMMODITY

NICKEL

MARKETABILITY

PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

	RECORD 1	RECORD 2
INDICATED	203,000,000	350,000,000
UNITS	MT ORE	MT ORE
YEAR/DATA	1971	1980

IN SITU GRADE

RECORD	ASSAY/FORM	GRADE	UNIT	MINERAL FORM
1	NI	0.30	WT-PCT	SULFIDE
2	NI	.324	WT-PCT	SULFIDE

RESERVE/RESOURCE - REMARKS

REC. 1 - WORLD MINING. DUMONT NICKEL IS SULFIDE AND TESTS SHOW IT CAN BE FLOATED. MAR. 1971, P. 51.

REC. 2 - DEPARTMENT OF ENERGY, MINES AND RESOURCES. MINERAL POLICY SECTOR. CANADIAN MINERAL DEPOSITS NOT BEING MINED IN 1980. INTERNAL REP. MBI 80/7, OTTAWA, CANADA, MAY 1980.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

GEOPHYSICAL

YEAR OF DISCOVERY: 1950

-----EXPLORATION METHODS-----

DRILLING/GEOPHYSICAL

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: FISSURE VEIN

MODE OF ORIGIN: HYDROTHERMAL

SHAPE OF ORE BODY: LENTICULAR

CONTROLLING FEATURES: FAULTING

WALL ROCK ALTERATION: INTENSE

DEGREE OF ALTERATION: PROPYLITIC

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 300
STRIKE/DIP: N50E: 70E
AVERAGE LENGTH/METERS: 7,000

MINIMUM DEPTH/METERS: 15
AVERAGE WIDTH/METERS: 600

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 35

MINIMUM THICKNESS/METERS: 15

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC ROCKS

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING-DURING DEFORMATION

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

ULTRAMAFIC IGNEOUS

LIES ALONG ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHROMITE	PRECAMBRIAN	SULFIDES
MAGNETITE	PRECAMBRIAN	SULFIDES

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KENTISH, J. H. PROGRESS REPORT NO. 28. LETTER TO SHAREHOLDERS, SEPT. 25, 1979.

MINISTERE DES RICHESSES NATURELLES DU QUEBEC. FICHE DE GITE. NO. LAUNAY-10, MAY 1980.

NORTHERN MINER. DUMONT MOVES AHEAD ON GOLD PROJECTS, NICKEL DEPOSITS UNDER NEGOTIATION. OCT. 18, 1979, PP. 41-46.

_____. DUMONT NICKEL DISCOVERY. NOV. 17, 1970.

WORLD MINING. DUMONT'S LOW GRADE NICKEL; WILL FLOTATION RECOVER? JAN. 1971,
P. 60, (U.S. ED., P. 48).

_____. DUMONT NICKEL IS SULPHIDE AND TESTS SHOW IT CAN BE FLOATED. MAR.
1971, P. 51.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: RAGLAN

SEQUENCE NUMBER: 1220500076

NATION: CANADA

SUBDIVISION: QUEBEC

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: N 61 DEG 35 MIN 36 SEC

LONGITUDE: W 74 DEG 17 MIN 30 SEC

UTM - ZONE: 18 HEMISPHERE: NORTHERN

NORTHING: 6828879 EASTING: 537595

POINT OF REFERENCE: APPROXIMATE

ELEVATION: 1,700 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

ALTERNATE NAMES: DONALDSON
RAGLAN EAST

OWNERSHIP

RAGLAN QUEBEC MINES, LTD.

NEW QUEBEC RAGLAN MINES, LTD.

FALCONBRIDGE NICKEL MINES, LTD.

STATUS:

OPERATOR

OWNER

OWNER

COMMODITY

NICKEL

COPPER

MODIFIER

SULFIDE

SULFIDE

MARKETABILITY

PRIMARY

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 14,500,000

UNITS MT ORE

YEAR/DATA 1972

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

NI

2.58

WT-PCT

CU

0.71

WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: FALCONBRIDGE NICKEL MINES, LTD. ANNUAL REPORT, 1972. P. 7.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

ORE-MINERAL IN PLACE

YEAR OF DISCOVERY: 1931

-----EXPLORATION METHODS-----

ELECTROMAGNETIC SURVEY/CORE DRILLING

MAGNETIC SURVEY/TEST SHAFT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF OREBODY: STOCKWORK

MODE OF ORIGIN: MAGMATIC DIFFERENTIATION

SHAPE OF OREBODY: TABULAR

CONTROLLING FEATURES: CONTACT ZONE

WALL ROCK ALTERATION: PROPYLITIC: POTASSIC: PYRITIZATION
DEGREE OF ALTERATION: MODERATE

MINERALIZED ZONE:

AVERAGE LENGTH/METERS: 68,000

AVERAGE WIDTH/METERS: 12

LITHOLOGY:

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

SERPENTINITE LIES OVER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
COVELLITE	PRECAMBRIAN	SULFIDES

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DUGAS, J. MINERALISATION DANS LA ZONE DE CAP SMITH-BAIE WAKEHAM. MINISTERE DES RICHESSES NATURELLES DU QUEBEC, E.S. 9, 1971, PP. 8-14.

FALCONBRIDGE NICKEL MINES, LTD. ANNUAL REPORT. 1972, P. 7.

MINING JOURNAL. FALCONBRIDGE REASSESSES QUEBEC RAGLAN PROJECT. JAN. 18, 1980, P. 43.

NORTHERN MINER. NEW QUEBEC RAGLAN NICKEL PROPERTY HELD IN ABEYANCE. APR. 13, 1972.

_____. QUEBEC RAGLAN GETS GO AHEAD NICKEL PROJECT. FEB. 13, 1969.

_____. QUEBEC RAGLAN PROJECT BEING REASSESSED BY FALCONBRIDGE. JAN. 10, 1980.

_____. RAGLAN LOOKING BETTER AS NICKEL PRICES RISE. JUNE 14, 1979, P. 27.

_____. STANDBY AT NEW QUEBEC RAGLAN CONTINUES, SEVERAL FACTORS GOVERN REASSESSMENT. APR. 19, 1979, P. A26.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: KEY LAKE	SEQUENCE NUMBER: 1220550016	
NATION: CANADA	SUBDIVISION: SASKATCHEWAN	
TYPE OF OPERATION: SURFACE	CURRENT STATUS: EXPLORED PROSPECT	
LATITUDE: N 57 DEG 11 MIN 0 SEC	LONGITUDE: W 105 DEG 34 MIN 0 SEC	
UTM - ZONE: 13 HEMISPHERE: NORTHERN	NORTHING: 6337724 EASTING: 465744	
POINT OF REFERENCE: ORE BODY	PRECISION: 100 METERS	
ELEVATION: 530 METERS	PRECISION: 10 METERS	
DATUM: SEA LEVEL		
OWNERSHIP:	STATUS:	
KEY LAKE MINING CORPORATION	OPERATOR	
COMMODITY	MODIFIER	MARKETABILITY
URANIUM	U308 CONTENT	PRIMARY
NICKEL	SULFIDE	RECOVERABLE
COBALT		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1975	-----EXPLORATION METHODS-----
	DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: OTHER
MODE OF ORIGIN: OTHER
SHAPE OF ORE BODY: IRREGULAR
CONTROLLING FEATURES: FAULTING: OTHER
WALL ROCK ALTERATION: INTERMEDIATE ARGILLIC: SERICITIC

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 50	MINIMUM DEPTH/METERS: 10
AVERAGE LENGTH/METERS: 1,500	AVERAGE WIDTH/METERS: 80
AVERAGE THICKNESS/METERS: 70	
UNCONSOLIDATED MATERIAL:	
AVERAGE THICKNESS/METERS: 150	MINIMUM THICKNESS/METERS: 90
MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 50	MINIMUM DEPTH/METERS: 10
AVERAGE LENGTH/METERS: 1,200	AVERAGE WIDTH/METERS: 200
AVERAGE THICKNESS/METERS: 190	
UNCONSOLIDATED MATERIAL:	
AVERAGE THICKNESS/METERS: 40	MINIMUM THICKNESS/METERS: 10

LITHOLOGY:

NAME OF FORMATION: METASEDIMENTS
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: MINOR FOLDING: MAJOR FAULTING: OTHER
RELATIONSHIP TO MINERALIZATION: COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
 PEGMATITE LIES ALONG ORE
 SCHIST LIES ALONG ORE
 GNEISS LIES ALONG ORE: IS ORE

LITHOLOGY:

NAME OF FORMATION: GLACIAL SAND AND GRAVEL
GEOLOGIC AGE: QUATERNARY
RELATIONSHIP TO MINERALIZATION: COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
 SAND LIES OVER ORE: IS ORE
 GRAVEL LIES OVER ORE: IS ORE
 GNEISS LIES ALONG ORE: IS ORE

LITHOLOGY:

NAME OF FORMATION: ATHABASCA
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: MAJOR FAULTING
RELATIONSHIP TO MINERALIZATION: COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
 SANDSTONE LIES OVER ORE: IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
URANINITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO ₂)
COFFINITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO ₂)
GERSDORFFITE	PRECAMBRIAN	SULFIDES
MILLERITE	PRECAMBRIAN	SULFIDES
NICCOLITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS

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DAHLKAMP, F. J., AND B. TAN. GEOLOGY AND MINERALOGY OF THE KEY LAKE U-NI DEPOSITS, NORTHERN SASKATCHEWAN, CANADA. URANEZBERGHAN GMBHLCO, BROM, GERMANY.

FISH, R. THE KEY LAKE DEVELOPMENT: BATTLING SAND AND WATER. CAN. MIN. J., AUG. 1979.

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UNLAND, W., AND N. HOLL. DEWATERING OF PLANNED KEY LAKE OPEN PITS IN NORTHERN SASKATCHEWAN. CAN. INST. MIN. BULL., JUNE 1980.

MINERALIZED ZONE:

STRIKE/DIP: NOOS

AVERAGE LENGTH/METERS: 2,500

AVERAGE WIDTH/METERS: 700

AVERAGE THICKNESS/METERS: 3

LITHOLOGY:

NAME OF FORMATION: OPHIOLITE COMPLEX

GEOLOGIC AGE: CRETACEOUS

DEFORMATION DESCRIPTION: INTRUSION: FAULTING

ROCK TYPE:

DUNITE REPLACED BY ORE

SERPENTINITE REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GOETHITE	CRETACEOUS	OXIDES (EXCLUDING SiO ₂)
MONTMORILLONITE	CRETACEOUS	SILICATES
CHRYSTOTILE	CRETACEOUS	SILICATES
ANTIGORITE	CRETACEOUS	SILICATES

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ANTIOQUIA PROVINCES. TECHNICAL REPORT DP/UN/COL-72-005/7 Y DP/UN/COL-
72-005/8. NEW YORK, SEPT. 17, 1976.

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 10
AVERAGE LENGTH/METERS: 2,000
AVERAGE THICKNESS/METERS: 80

MINIMUM DEPTH/METERS: 0
AVERAGE WIDTH/METERS: 1,700

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 10

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

ROCK TYPE:

PERIDOTITE

LIES UNDER ORE: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	RECENT	SILICATES
LIMONITE	RECENT	OXIDES (EXCLUDING SiO ₂)
CHALCEDONY	RECENT	FORMS OF SiO ₂
QUARTZ	RECENT	FORMS OF SiO ₂
MONTMORILLONITE	RECENT	SILICATES

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DOMINICAN REPUBLIC

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: FALCONDO BONA0 SEQUENCE NUMBER: 2470250001

NATION: DOMINICAN REPUBLIC SUBDIVISION: LA VEGA
TYPE OF OPERATION: SURFACE CURRENT STATUS: PRODUCER
LATITUDE: N 18 DEG 57 MIN 0 SEC LONGITUDE: W 70 DEG 27 MIN 0 SEC
UTM - ZONE: 19 HEMISPHERE: NORTHERN NORTHING: 2095796 EASTING: 347326
ELEVATION: 400 METERS PRECISION: 100 METERS
DATUM: SEA LEVEL

TYPE OF MINERAL HOLDING: FEDERAL LEASE

ALTERNATE NAMES: BONA0 NICKEL MINES
BONA0 FERRONICKEL COMPLEX

OWNERSHIP:	STATUS:
FALCONBRIDGE NICKEL MINES, LTD.	OWNER-OPERATOR
ARMCO STEEL CORPORATION	OWNER
GOVERNMENT OF DOMINICAN REPUBLIC	OWNER
MINORITY SHAREHOLDERS	OWNER
COMMODITY	MARKETABILITY
NICKEL	PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 56,246,000
UNITS MT ORE
YEAR/DATA 1981

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.64	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. APR. 1981, P. 112.

TONNAGE CONVERTED FROM DRY SHORT TONS TO METRIC.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	GEOLOGICAL/MAGNETIC SURVEY
YEAR OF DISCOVERY: 1918	TRENCHING/TEST PIT DRILLING
YEAR OF INITIAL PRODUCTION: 1972	
YEAR OF FINAL PRODUCTION: PRODUCING	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY: FAULTING

MINERALIZED ZONE:

MINIMUM DEPTH/METERS: 0
AVERAGE LENGTH/METERS: 15,000
AVERAGE THICKNESS/METERS: 20

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE
GEOLOGIC AGE: EOCENE
DEFORMATION DESCRIPTION: INTRUSION: FAULTING
RELATIONSHIP TO MINERALIZATION: COMPLEX
GEOLOGIC AGE: TERTIARY
ROCK TYPE:
HARZBURGITE REPLACED BY ORE
DUNITE REPLACED BY ORE
SERPENTINITE REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
SERPENTINE	CENOZOIC	SILICATES
GARNIERITE	CENOZOIC	SILICATES
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)
QUARTZ	CENOZOIC	FORMS OF SiO ₂

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT
CAPACITY: 5,716
HARDNESS OF ORE: HARDPAN
BENCH HEIGHT: 10 METERS
UNITS: MT ORE/DAY

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: FALCONDO BONAIO MINE
LATITUDE: N 18 53 00	LONGITUDE: W 70 24 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	DISTANCE (KM): 2
DESTINATION FACILITY: MILL (ON-SITE)	LOCATION: FALCONDO BONAIO MILL
LATITUDE: N 18 53 00	LONGITUDE: W 70 24 00

BENEFICIATION:

METHOD: PYROMETALLURGY	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 5,716	ORE/CRUSH/GRIND/WASH/PYROMETALLURGY
UNITS: MT ORE/DAY	
DEPOSIT PERCENT USED: 100	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
FERRONICKEL	NI	73	32	WT-PCT

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FINLAND

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: KOTALAHTI	SEQUENCE NUMBER: 4050250002
NATION: FINLAND	SUBDIVISION: KUOPIO
TYPE OF OPERATION: UNDERGROUND	CURRENT STATUS: PRODUCER
LATITUDE: N 62 DEG 31 MIN 26 SEC	LONGITUDE: E 27 DEG 40 MIN 41 SEC
UTM - ZONE: 35 HEMISPHERE: NORTHERN	NORTHING: 6932527 EASTING: 534904
ELEVATION: 150 METERS	PRECISION: 100 METERS
DATUM: SEA LEVEL	

OWNERSHIP:	STATUS:
OUTOKUMPU OY	OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED	3,500,000
UNITS	MT ORE
YEAR/DATA	1982

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	0.54	WT-PCT
CU	.22	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. INTERNATIONAL DIRECTORY OF MINING.
1982, P. 321.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1954	-----EXPLORATION METHODS-----
YEAR OF INITIAL PRODUCTION: 1959	ELECTROMAGNETIC SURVEY/CORE DRILLING
YEAR OF FINAL PRODUCTION: PRODUCING	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: BRECCIA FILLING
MODE OF ORIGIN: MINERALIZATION: HYDROTHERMAL
SHAPE OF ORE BODY: MASSIVE: IRREGULAR
CONTROLLING FEATURES: IGNEOUS
WALL ROCK ALTERATION: PYRITIZATION

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 250

AVERAGE LENGTH/METERS: 1,300

AVERAGE WIDTH/METERS: 100

LITHOLOGY:

NAME OF FORMATION: KOTALATI NICKEL BELT

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: INTRUSION: METAMORPHISM: FAULTING: FOLDING

RELATIONSHIP TO MINERALIZATION: COMPLEX

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

AMPHIBOLITE	IS ORE: ENCLOSURES ORE: ORE IN FRACTURES
GRANITE	IS ORE: ENCLOSURES ORE: ORE IN FRACTURES
QUARTZITE	ENCLOSURES ORE: ORE IN FRACTURES
PERIDOTITE	IS ORE: ENCLOSURES ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
SPHALERITE	PRECAMBRIAN	SULFIDES
GERSDORFFITE	PRECAMBRIAN	SULFIDES
PYRITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: OPEN STOPE

CAPACITY: 1,667

UNITS: MT ORE/DAY

CHARACTERISTIC OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES

CONDITION OF WORKINGS: OPEN

SHAFTS - NUMBER: 2

AVERAGE DEPTH: 550 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: KOTALHTI, FINLAND

LATITUDE: N 62 31 26

LONGITUDE: E 27 40 41

PERCENT SHIPPED: 100

DESTINATION FACILITY: MILL (ON-SITE)

LOCATION: KOTALHTI, FINLAND

LATITUDE: N 62 31 26

LONGITUDE: E 27 40 41

BENEFICIATION:

METHOD: FLOTATION

DESIGN CAPACITY: 1,600

UNITS: MT ORE/DAY

DEPOSIT PERCENT USED: 100

TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
ORE/CRUSH/GRIND/FLOAT/THICKEN
CONCENTRATE

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
	NI	93	6.83	WT-PCT
	CU	90	28.61	WT-PCT

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PP. 103-107.

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ORES. FINLAND, ANNALES ACADEMIAE SCIENTIARUM FINNICAE, 1971, PP. 11-23.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: HITURA	SEQUENCE NUMBER: 4050450004
NATION: FINLAND	SUBDIVISION: OULU
TYPE OF OPERATION: SURFACE	CURRENT STATUS: PRODUCER
LATITUDE: N 24 DEG 56 MIN 34 SEC	LONGITUDE: E 63 DEG 54 MIN 17 SEC
UTM - ZONE: 41 HEMISPHERE: NORTHERN	NORTHING: 2758758 EASTING: 591341
POINT OF REFERENCE: ORE BODY	
ELEVATION: 75 METERS	PRECISION: 10 METERS
DATUM: SEA LEVEL	

ALTERNATE NAMES: POHJOIS-KARJALA

OWNERSHIP:		STATUS:
OUTOKUMPU OY		OWNER-OPERATOR
COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SULFIDE	PRIMARY
COPPER	SULFIDE	COPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED	5,600,000
UNITS	MT ORE
YEAR/DATA	1982

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	0.5	WT-PCT
CU	.15	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. INT. DIRECTORY OF MIN., 1982. P. 320.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ELECTROMAGNETIC SURVEY	ELECTROMAGNETIC SURVEY/CORE DRILLING
YEAR OF DISCOVERY: 1937	
YEAR OF INITIAL PRODUCTION: 1970	
YEAR OF FINAL PRODUCTION: PRODUCING	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: OTHER
MODE OF ORIGIN: HYDROTHERMAL
SHAPE OF ORE BODY: PIPELIKE
CONTROLLING FEATURES: IGNEOUS: FAULTING
WALL ROCK ALTERATION: OTHER
DEGREE OF ALTERATION: MODERATE

MINERALIZED ZONE:
AVERAGE LENGTH/METERS: 750 AVERAGE WIDTH/METERS: 250
AVERAGE THICKNESS/METERS: 80

AVERAGE WIDTH/METERS: 250

LITHOLOGY:
NAME OF FORMATION: KOTALAHTI NICKEL BELT
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION: FAULTING: FOLDING
RELATIONSHIP TO MINERALIZATION: COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
SERPENTINITE NEAR ORE: IS ORE
AMPHIBOLITE NEAR ORE

NAME OF FORMATION: KOTALAHTI NICKEL BELT
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION: FAULTING: FOLDING
RELATIONSHIP TO MINERALIZATION: COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
SERPENTINITE NEAR ORE: IS ORE
AMPHIBOLITE NEAR ORE

MINERALIZATION:		
MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

SURFACE MINING:
METHOD: OPEN PIT
CAPACITY: 1 700
DESCRIPTION OF COVER: HARDPAN
HARDNESS OF ORE: MEDIUM HARD ROCKS
UNITS: MT ORE/DAY

METHOD: OPEN PIT
CAPACITY: 1 700
DESCRIPTION OF COVER: HARDPAN
HARDNESS OF ORE: MEDIUM HARD ROCKS

TRANSPORTATION (ORE):		
ORIGINATING FACILITY: MINE		LOCATION: HITURA, FINLAND
LATITUDE: N 63 54 17		LONGITUDE: E 24 56 34
PERCENT SHIPPED: 100		
METHOD OF TRANSPORTATION: TRUCK		
DESTINATION FACILITY: MILL (ON-SITE)		LOCATION: HITURA, FINLAND
LATITUDE: N 63 54 17		LONGITUDE: E 24 56 34

ORIGINATING FACILITY: MINE LOCATION: HITURA, FINLAND
LATITUDE: N 63 54 17 LONGITUDE: E 24 56 34
PERCENT SHIPPED: 100
METHOD OF TRANSPORTATION: TRUCK
DESTINATION FACILITY: MILL (ON-SITE) LOCATION: HITURA, FINLAND
LATITUDE: N 63 54 17 LONGITUDE: E 24 56 34

BENEFICIATION:		
METHOD: FLOTATION		----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 1,300		ORE/CRUSH/GRIND/FLOAT/THICKEN
UNITS: MT ORE/DAY		FILTER/NI-CU CONC.
DEPOSIT PERCENT USED: 100		
TOTAL PERCENT USED: 100		

METHOD: FLOTATION	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 1,300	ORE/CRUSH/GRIND/FLOAT/THICKEN
UNITS: MT ORE/DAY	FILTER/NI-CU CONC.
DEPOSIT PERCENT USED: 100	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CU CONC.	NI	67	4.0	WT-PCT
	CU	67	1.3	WT-PCT

TRANSPORTATION FOR PRODUCT: NICKEL-COPPER CONCENTRATE
ORIGINATING FACILITY: MILL (ON-SITE) LOCATION: HITURA, FINLAND
LATITUDE: N 63 54 17 LONGITUDE: E 24 56 34
PERCENT SHIPPED: 100

ORIGINATING FACILITY: MILL (ON-SITE) LOCATION: HITURA, FINLAND
LATITUDE: N 63 54 17 LONGITUDE: E 24 56 34
PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: TRUCK DISTANCE (KM): 60
DESTINATION FACILITY: SMELTER/REFINERY LOCATION: HARJAVALTA, FINLAND
LATITUDE: N 61 19 00 LONGITUDE: E 22 10 00

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CONG. PROC., SEC. 3-4, MONTREAL, CANADA, 1972, PP. 215-224.

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FINLAND. ANNALES ACADEMICAE SCIENTIARUM FENNICAE, SERIES A. 109, 1971, PP.1-72

SIIKARLA, T. THE NICKEL OCCURENCE OF HITURA. NIVALA COMMUE, CENTRAL FINNISH
BOTHNIA, GEOEXPLORATION, V.2, NO. 3, 1964, PP. 133-149.

GREECE

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: HAGIOS IOANNIS (LARYMNA) SEQUENCE NUMBER: 4840350001

NATION: GREECE SUBDIVISION: EUBOEA
TYPE OF OPERATION: SURFACE/UNDERGROUND CURRENT STATUS: PRODUCER
LATITUDE: N 38 DEG 30 MIN 0 SEC LONGITUDE: E 23 DEG 15 MIN 0 SEC
UTM - ZONE: 34 HEMISPHERE: NORTHERN NORTHING: 4263485 EASTING: 696211
POINT OF REFERENCE: TOWN PRECISION: 5 KILOMETERS
ELEVATION: 500 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

ALTERNATE NAMES: LARYMNA NICKEL OPERATION
 SANDT JOHANNES LATERITE MINES

OWNERSHIP: STATUS:
SOCIETE MINIERE ET METALLURGIQUE DE LARYMNA (LARCO) S.A. OWNER-OPERATOR
HELLINEC CHEMICAL PRODUCTS AND FERTILIZER COMPANY OWNER
SOCIETE ANONYME LE NICKEL OWNER

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SILICATES	PRIMARY
IRON		AFFECT MARKETABILITY
COBALT		BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED	27,200,000
INFERRED	72,600,000
UNITS	MT ORE
YEAR/DATA	1973

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT	MINERAL FORM
NI	1.4	WT-PCT	SILICATES

RESERVE/RESOURCE - REMARKS

SOURCE: MINING MAGAZINE. JULY, 1973, PP. 12-19.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	TRENCHING/TEST DRIFT/CROSSCUT
YEAR OF INITIAL PRODUCTION: 1953	DRILLING/TEST RAISE
YEAR OF FINAL PRODUCTION: PRODUCING	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION: SEDIMENTATION
SHAPE OF ORE BODY: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY: FOLDING

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 325	MINIMUM DEPTH/METERS: 0
AVERAGE LENGTH/METERS: 3,000	AVERAGE WIDTH/METERS: 325
AVERAGE THICKNESS/METERS: 8	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 5	MINIMUM THICKNESS/METERS: 5

LITHOLOGY:

NAME OF FORMATION: UPPER CRETACEOUS LIMESTONE
GEOLOGIC AGE: UPPER CRETACEOUS
DEFORMATION DESCRIPTION: FOLDING: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
ROCK TYPE:
LIMESTONE LIES OVER ORE: LIES ALONG ORE

LITHOLOGY:

NAME OF FORMATION: TRIASSIC - LOWER CRETACEOUS SEDIMENTS	
GEOLOGIC AGE: TRIASSIC	
DEFORMATION DESCRIPTION: FOLDING: FAULTING	
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING-DURING DEFORMATION	
ROCK TYPE:	
SHALE	LIES UNDER ORE: NEAR ORE
CHERT	LIES UNDER ORE: NEAR ORE
CONGLOMERATE	GANGUE: NEAR ORE
PERIDOTITE	OTHER
UNSPECIFIED SEDIMENTARY	IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GARNIERITE	JURASSIC	SILICATES	PHANERITIC-MEDIUM
LIMONITE	JURASSIC	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-MEDIUM
QUARTZ	JURASSIC	FORMS OF SiO ₂	PHANERITIC-MEDIUM

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: BENCH (BERM)	
CAPACITY: 8643	UNITS: MT ORE/DAY
AVERAGE COVER THICKNESS: 5 METERS	

BENEFICIATION:

METHOD: PYROMETALLURGY
 DESIGN CAPACITY: 8,643
 UNITS: MT ORE/DAY
 DEPOSIT PERCENT USED: 17
 TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
 ORE/CRUSH TO 12 MILLIMETERS/MIX ORES
 KILN REDUCE/ELECTROLYTIC SMELT
 CONVERT/FERRONICKEL

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
FERRONICKEL	NI	0.86	27.0	WT-PCT
	CO	30.0	1.0	WT-PCT
FE PELLETS	FE	33.0	64.0	WT-PCT

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: EUBOIA

SEQUENCE NUMBER: 4840350003

NATION: GREECE

SUBDIVISION: EUBOEA

TYPE OF OPERATION: SURFACE

CURRENT STATUS: PRODUCER

LATITUDE: N 38 DEG 30 MIN 0 SEC

LONGITUDE: E 23 DEG 45 MIN 0 SEC

UTM - ZONE: 34 HEMISPHERE: NORTHERN

NORTHING: 4264670 EASTING: 739821

POINT OF REFERENCE: ORE BODY

PRECISION: 500 METERS

ELEVATION: 50 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

ALTERNATE NAMES: EUBOEA

OWNERSHIP:

STATUS:

LARCO

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATES

PRIMARY

COBALT

BYPRODUCT

IRON

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED 130,000,000

INDICATED 40,000,000

INFERRED 110,000,000

UNITS MT ORE

YEAR/DATA 1982

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

MINERAL FORM

NI

1.15

WT-PCT

SILICATES

RESERVE/RESOURCE REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. INTERNATIONAL DIRECTORY OF MINING AND MINERAL PROCESSING OPERATIONS. GREECE. MCGRAW-HILL, INC., NEW YORK, 1982, P. 329.

DEPOSIT HISTORICAL INFORMATION

YEAR OF INITIAL PRODUCTION: 1969

-----EXPLORATION METHODS-----

YEAR OF FINAL PRODUCTION: PRODUCING

TEST SHAFT/DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION: SEDIMENTATION

SHAPE OF ORE BODY: TABULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE THICKNESS/METERS: 12

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 12

MINIMUM THICKNESS/METERS: 1

LITHOLOGY:

NAME OF FORMATION: UPPER CRETACEOUS LIMESTONE

GEOLOGIC AGE: CRETACEOUS

DEFORMATION DESCRIPTION: FOLDING: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION

GEOLOGIC AGE:

ROCK TYPE:

LIMESTONE

LIES ALONG ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	JURASSIC	SILICATES
SERPENTINE	JURASSIC	SILICATES

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT

CAPACITY: 8,333

UNITS: MT ORE/DAY

DESCRIPTION OF COVER: MEDIUM HARD ROCKS

HARDNESS OF ORE: MEDIUM HARD ROCKS

BENCH HEIGHT: 12 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: GREECE

LATITUDE: N 38 30 00

LONGITUDE: E 23 45 00

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: CONVEYOR

DISTANCE (KM): 1

DESTINATION FACILITY: MILL (ON-SITE)

LOCATION: GREECE

LATITUDE: N 38 30 00

LONGITUDE: E 23 45 00

BENEFICIATION:

METHOD: SIZING

DESIGN CAPACITY: 8,333

UNITS: MT ORE/DAY

DEPOSIT PERCENT USED: 100

TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
ORE/CRUSH/DRY/SCREEN/NI-CO CONC.

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI CONC.	NI	100	1.15	WT-PCT
	CO	100	0.1	WT-PCT
	FE	100	32.0	WT-PCT

TRANSPORTATION FOR PRODUCT: NICKEL CONCENTRATE		
ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: GREECE	
LATITUDE: N 38 30 00	LONGITUDE: E 23 45 00	
METHOD OF TRANSPORTATION: OCEAN	DISTANCE (KM): 28	
DESTINATION FACILITY: SMELTER	LOCATION: GREECE	
LATITUDE: N 38 10 00	LONGITUDE: E 24 15 00	

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GUATEMALA

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: EXMIBAL	SEQUENCE NUMBER: 2050230001
NATION: GUATEMALA	SUBDIVISION: IZABAL
TYPE OF OPERATION: SURFACE	CURRENT STATUS: PAST PRODUCER
LATITUDE: N 16 DEG 30 MIN 00 SEC	LONGITUDE: W 89 DEG 20 MIN 00 SEC
UTM - ZONE: 16 HEMISPHERE: NORTHERN	NORTHING: 1825573 EASTING: 250921
POINT OF REFERENCE: ORE BODY	
ELEVATION: 500 METERS	PRECISION: 100 METERS
DATUM: SEA LEVEL	

OWNERSHIP:	STATUS:
EXPLORACIONES Y EXPLOITACIONES MINERAL IZABAL S.A.	OWNER-OPERATOR

COMMODITY	MARKETABILITY
NICKEL	PRIMARY
COBALT	BYPRODUCT
COPPER	BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED	45,400,000
UNITS	MT ORE
YEAR/DATA	1980

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.80	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: SECURITIES EXCHANGE COMMISSION. 10K REPORT, AMENDMENT. JULY 17, 1980.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	GEOLOGICAL/AUGER/ROTARY DRILLING
YEAR OF DISCOVERY: 1955	TEST PIT
YEAR OF INITIAL PRODUCTION: 1978	
YEAR OF FINAL PRODUCTION: 1981	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR: IRREGULAR
CONTROLLING FEATURES: FAULTING: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 22
AVERAGE THICKNESS/METERS: 5

MINIMUM DEPTH/METERS: 15

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 8

LITHOLOGY:

NAME OF FORMATION: SIERRA DE SANTA CRUZ

DEFORMATION DESCRIPTION: FAULTING: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

ROCK TYPE:

PERIDOTITE	REPLACED BY ORE
SERPENTINITE	REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)
SERPENTINE	CENOZOIC	SILICATES
GARNIERITE	CENOZOIC	SILICATES

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INDIA

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: SUKINDA	SEQUENCE NUMBER: 5330370117
NATION: INDIA	SUBDIVISION: ORISSA
TYPE OF OPERATION: SURFACE	CURRENT STATUS: DEVELOPED DEPOSIT
LATITUDE: N 21 DEG 30 MIN 00 SEC	LONGITUDE: E 85 DEG 45 MIN 00 SEC
UTM - ZONE: 45 HEMISPHERE: NORTHERN	NORTHING: 2377863 EASTING: 370516
POINT OF REFERENCE: ORE BODY	PRECISION: 100 METERS

ALTERNATE NAMES: SUKHINDA

OWNERSHIP:	STATUS
TATA IRON AND STEEL	OPERATOR
ORISSA STATE	OWNER

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SILICATES	PRIMARY
COBALT		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1962
YEAR OF INITIAL PRODUCTION: 1982
YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: LENTICULAR: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:
AVERAGE DEPTH/METERS: 7
AVERAGE THICKNESS/METERS: 30

LITHOLOGY:
NAME OF FORMATION: ULTRAMAFIC INTRUSIVE
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION
ROCK TYPE:
DUNITE REPLACED BY ORE
PERIDOTITE REPLACED BY ORE
SERPENINITE REPLACED BY ORE

MINERALIZATION:

MINERAL NAME

LIMONITE

HEMATITE

MAGNETITE

MONTMORILLONITE

TALC

MINERAL CLASS

OXIDES (EXCLUDING SiO₂)

OXIDES (EXCLUDING SiO₂)

OXIDES (EXCLUDING SiO₂)

SILICATES

SILICATES

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LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE
 GEOLOGIC AGE: TERTIARY
 DEFORMATION DESCRIPTION: INTRUSION
 RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
 GEOLOGIC AGE: CENOZOIC
 ROCK TYPE:
 PERIDOTITE NEAR ORE: REPLACED BY ORE
 SERPENTINITE NEAR ORE: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	CENOZOIC	SILICATES
CHRYSOPTASE	CENOZOIC	OXIDES
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO2)

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT	
CAPACITY: 4,342	UNITS: MT ORE/DAY
DESCRIPTION OF COVER: HARDPAN	
HARDNESS OF ORE: HARDPAN	SURFACE AREA OF MINE: 96,000

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: POMALAA, INDONESIA
LATITUDE: S 04 00 00	LONGITUDE: E 121 00 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	
DESTINATION FACILITY: MILL (ON-SITE)	LOCATION: POMALAA, INDONESIA
LATITUDE: S 04 00 00	LONGITUDE: E 121 00 00

BENEFICIATION:

METHOD: SIZING	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 4,342	ORE/CRUSH/GRIND/DRY/DRIED ORE
UNITS: MT ORE/DAY	
DEPOSIT PERCENT USED: 100	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
DRIED ORE	NI	100	1.9	WT-PCT

TRANSPORTATION FOR PRODUCT: DRIED ORE

ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: INDONESIA
LATITUDE: S 04 00 00	LONGITUDE: E 121 00 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: OCEAN	DISTANCE (KM): 10,000
DESTINATION FACILITY: SMELTER/REFINERY	LOCATION: TOKYO, JAPAN
LATITUDE: N 35 32 00	LONGITUDE: E 139 27 00

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: SOROAKO

SEQUENCE NUMBER: 5600290003

NATION: INDONESIA

SUBDIVISION: SULAWESI ISLANDS

TYPE OF OPERATION: SURFACE

CURRENT STATUS: PRODUCER

LATITUDE: S 02 DEG 30 MIN 00 SEC

LONGITUDE: E 121 DEG 30 MIN 00 SEC

UTM - ZONE: 51 HEMISPHERE: SOUTHERN

NORTHING: 7455841 EASTING: 346262

POINT OF REFERENCE: ORE BODY

PRECISION: 100 METERS

ELEVATION: 500 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

P. T. INCO

OWNER-OPERATOR

JAPANESE INTERESTS

OWNER

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATES

PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1900

-----EXPLORATION METHODS-----

YEAR OF INITIAL PRODUCTION: 1978

DRILLING/TEST PIT

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: TABULAR: IRREGULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 5

MINIMUM DEPTH/METERS: 4

AVERAGE THICKNESS/METERS: 23

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: TERTIARY

DEFORMATION DESCRIPTION: INTRUSION: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: CENOZOIC

ROCK TYPE:

ULTRAMAFIC IGNEOUS

REPLACED BY ORE

CHERT

LIES ALONG ORE

LIMESTONE

LIES ALONG ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	CENOZOIC	SILICATES
WAD	CENOZOIC	OXIDES (EXCLUDING SiO ₂)
SERPENTINE	CENOZOIC	SILICATES
CHLORITE	CENOZOIC	
GOETHITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)
MONTMORILLONITE	CENOZOIC	SILICATES

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT
 CAPACITY: 10,500 UNITS: MT ORE/DAY
 DESCRIPTION OF COVER: MEDIUM HARD ROCKS
 HARDNESS OF ORE: MEDIUM HARD ROCKS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: SOROAKO, INDONESIA
LATITUDE: S 23 00 00	LONGITUDE: E 121 30 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	
DESTINATION FACILITY: SMELTER	LOCATION: SOROAKO, INDONESIA
LATITUDE: S 23 00 00	LONGITUDE: E 121 30 00

BENEFICIATION:

METHOD: PYROMETALLURGY	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 10,500	ORE/CRUSH/DRY/SMELT/FERRONICKEL
UNITS: MT ORE/DAY	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI MATTE	NI	100	78	WT-PCT

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: GAG ISLAND

SEQUENCE NUMBER: 5600370005

NATION: INDONESIA

SUBDIVISION: WEST IRIAN

TYPE OF OPERATION: PROSPECT

CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: S 00 DEG 30 MIN 00 SEC

LONGITUDE: E 129 DEG 45 MIN 00 SEC

UTM - ZONE: 52 HEMISPHERE: SOUTHERN

NORTHING: 9944733 EASTING: 583456

POINT OF REFERENCE: ORE BODY

PRECISION: 100 METERS

ELEVATION: 300 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

P. T. PACIFIC NICKEL

OWNER

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATES

PRIMARY

COBALT

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 160,000,000
UNITS MT ORE
YEAR/DATA 1981

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.64	WT-PCT
CO	0.12	WT-PCT

RESERVE/RESOURCE - REMARKS

SOURCE: MINING MAGAZINE. APR. 1981, P. 287.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE

GEOCHEMICAL/AUGER/TEST PIT

YEAR OF DISCOVERY: 1920

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: TABULAR: IRREGULAR

CONTROLLING FEATURES: IGNEOUS

MINERALIZED ZONE:

AVERAGE THICKNESS/METERS: 12

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

DEFORMATION DESCRIPTION: INTRUSION: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

ROCK TYPE:

PERIDOTITE REPLACED BY ORE

SERPENTINITE REPLACED BY ORE

MINERALIZATION:

MINERAL NAME

MINERAL CLASS

LIMONITE

OXIDES (EXCLUDING SiO_2)

MONTMORILLONITE

SILICATES

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IVORY COAST

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: BIANKOUMA REGION

SEQUENCE NUMBER: 7480250006

NATION: IVORY COAST

SUBDIVISION: QUEST

TYPE OF OPERATION: PROSPECT

CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: N 07 DEG 44 MIN 00 SEC

LONGITUDE: W 07 DEG 37 MIN 00 SEC

UTM - ZONE: 29 HEMISPHERE: NORTHERN

NORTHING: 855011 EASTING: 652555

POINT OF REFERENCE: ORE BODY

ELEVATION: 350 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

IVORY COAST GOVERNMENT

OWNER

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATE

PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE

GEOCHEMICAL

YEAR OF DISCOVERY: 1971

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 8

MINIMUM DEPTH/METERS: 5

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 17

MINIMUM THICKNESS/METERS: 6

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSION

GEOLOGIC AGE: PRECAMBRIAN

GEOLOGIC AGE: MIOCENE

ROCK TYPE:

DUNITE

REPLACED BY ORE

PERIDOTITE

REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	MIOCENE	SILICATES
SERPENTINE	MIOCENE	SILICATES

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MADAGASCAR

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MORAMANGA PROSPECT
(AMBATOVY) SEQUENCE NUMBER: 7880200004
NATION: MADAGASCAR SUBDIVISION: TANANARIVE
TYPE OF OPERATION: SURFACE CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: S 18 DEG 55 MIN 00 SEC LONGITUDE: E 48 DEG 15 MIN 00 SEC
UTM - ZONE: 39 HEMISPHERE: SOUTHERN NORTHING: 7906263 EASTING: 210326
POINT OF REFERENCE: ORE BODY
ELEVATION: 950 METERS PRECISION: 100 METERS
DATUM: SEA LEVEL

ALTERNATE NAMES: AMBATOVY
ANALAMY

OWNERSHIP: STATUS:
MALAGASY REPUBLIC GOVERNMENT OWNER

COMMODITY MODIFIER MARKETABILITY:
NICKEL SILICATES PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 56,000,000
UNITS MT ORE
YEAR/DATA 1961

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.39	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: DELBOS, L., AND M. RANTOANINA. LES GISEMENTS FER NICKEL DES ENVIRONS DE MORAMANGA. SERVICE GEOLOGIQUE, TANANARIVE, MALAGASY, 1961.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD: -----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE GEOLOGICAL/AERIAL PHOTOGRAPHY
YEAR OF DISCOVERY: 1960

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 1.5
AVERAGE LENGTH/METERS: 3,800
AVERAGE THICKNESS/METERS: 20

MINIMUM DEPTH/METERS: 1.5
AVERAGE WIDTH/METERS: 2,500

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 1.5

MINIMUM THICKNESS/METERS: 1.5

LITHOLOGY:

NAME OF FORMATION: SYENITIC-GABBRO MASSIF
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION FOLLOWING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
ROCK TYPE:
SYENITE NEAR ORE
GABBRO NEAR ORE
PERIDOTITE NEAR ORE: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	MINERAL CLASS	GRAIN SIZE
QUARTZ	SILICATES	PHANERITIC-COARSE
GARNIERITE	SILICATES	PHANERITIC-COARSE

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MURDOCK, T. G. THE MINERAL RESOURCES OF THE MALAGASY REPUBLIC. BUMINES IC 8196, 1963, PP. 61-65, 81-82.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: VALAZORO	SEQUENCE NUMBER: 7880250004	
NATION: MADAGASCAR	SUBDIVISION: FIANARANTSOA	
TYPE OF OPERATION: SURFACE	CURRENT STATUS: EXPLORED PROSPECT	
LATITUDE: S 21 DEG 50 MIN 00 SEC	LONGITUDE: E 47 DEG 20 MIN 00 SEC	
UTM - ZONE: 38 HEMISPHERE: SOUTHERN	NORTHING: 7583935 EASTING: 741181	
POINT OF REFERENCE: ORE BODY	PRECISION: 100 METERS	
ELEVATION: 500 METERS	PRECISION: 500 METERS	
DATUM: SEA LEVEL		
OWNERSHIP:	STATUS:	
MALAGASY GOVERNMENT	OWNER	
COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SILICATES	PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED	63,500
UNITS	MT NICKEL METAL
YEAR/DATA	1956

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.7-1.8	WT-PCT

RESERVE/RESOURCE REMARKS

RESERVES FROM 1956 EXPLORATION WORK BY SOCIETE D' ELECTRO-CHIMIE, D' ELECTRO-METALLURGIE ET DES AEIERIES ELECTRIQUES D' UNQIUE, QUOTED IN BUMINES IC 8196, 1963, P. 81.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1910

-----EXPLORATION METHODS-----
TEST PIT/DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR: IRREGULAR
CONTROLLING FEATURES: IGNEOUS

MINERALIZED ZONE:

AVERAGE LENGTH/METERS: 700
AVERAGE THICKNESS/METERS: 7

AVERAGE WIDTH/METERS: 700

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSION

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

ROCK TYPE:

HARZBURGITE

REPLACED BY ORE

MINERALIZATION:

MINERAL NAME

MINERAL CLASS

GARNIERITE

SILICATES

SERPENTINE

SILICATES

MONTMORILLONITE

SILICATES

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MURDOCK, T. G. THE MINERAL RESOURCES OF THE MALAGASY REPUBLIC. BUMINES IC 8196, 1963, P. 81.

NEW CALEDONIA

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MONEO

SEQUENCE NUMBER: 6410350001

NATION: NEW CALEDONIA

TYPE OF OPERATION: SURFACE

CURRENT STATUS: PRODUCER

LATITUDE: S 21 DEG 9 MIN 0 SEC

LONGITUDE: E 165 DEG 29 MIN 0 SEC

UTM - ZONE: 58 HEMISPHERE: SOUTHERN

NORTHING: 7661312 EASTING: 550183

POINT OF REFERENCE: ORE BODY

ELEVATION: 600 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

CGMC/BALANDE

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATES

PRIMARY

COBALT

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE

DRILLING

YEAR OF DISCOVERY: 1950

YEAR OF INITIAL PRODUCTION: 1970

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: IRREGULAR

CONTROLLING FEATURES: LITHOLOGY

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSION

GEOLOGIC AGE: TERTIARY

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: TERTIARY

ROCK TYPE:

PERIDOTITE

NEAR ORE

MINERALIZATION:

MINERAL NAME

AGE

MINERAL CLASS

GARNIERITE

QUATERNARY

SILICATES

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT

CAPACITY: 1,100

UNITS: MT ORE/DAY

DESCRIPTION OF COVER: HARDPAN

AVERAGE COVER THICKNESS: 10 METERS

HARDNESS OF ORE: HARDPAN

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: MONEO, NEW CALEDONIA

LATITUDE: S 21 09 00

LONGITUDE: E16 52 900

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: TRUCK

DISTANCE (KM): 2

DESTINATION FACILITY: SMELTER/REFINERY

LOCATION: JAPAN

LATITUDE: N 35 32 00

LONGITUDE: E 139 27 00

BENEFICIATION:

METHOD: HYDROMETALLURGY

----- DESCRIPTION OF MILLING -----
ORE/CRUSH/GRIND/DRY/MATTE/LEACH/
PRECIPITATE/GRIND/DRYCONCENTRATE

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CO METALS	NI	93	100	WT-PCT
	CO	27	100	WT-PCT

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: MONEO, NEW CALEDONIA

LATITUDE: S 21 09 00

LONGITUDE: E 165 29 00

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: TRUCK

DISTANCE (KM): 2

DESTINATION FACILITY: SMELTER/REFINERY

LOCATION: JAPAN

LATITUDE: N 35 32 00

LONGITUDE: E 139 27 00

BENEFICIATION:

METHOD: PYROMETALLURGY

----- DESCRIPTION OF MILLING -----
ORE/CRUSH/GRIND/DRY/SMELT/FERRONICKEL

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
FERRONICKEL	NI	97	25	WT-PCT

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TROLY, G. NICKEL DEPOSITS IN NEW CALEDONIA, SOME FACTORS INFLUENCING THEIR FORMATION. PRES. AT SOC. MIN. ENG.-AIME INT. LATERITE SYMPOSIUM, NEW ORLEANS, LA, 1979, PP. 85-116.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: POUM

SEQUENCE NUMBER: 6410350002

NATION: NEW CALEDONIA

TYPE OF OPERATION: SURFACE

LATITUDE: S 20 DEG 0 MIN 0 SEC

UTM - ZONE: 58 HEMISPHERE: SOUTHERN

POINT OF REFERENCE: ORE BODY

ELEVATION: 350 METERS

DATUM: SEA LEVEL

CURRENT STATUS: DEVELOPED DEPOSIT

LONGITUDE: E 163 DEG 55 MIN 0 SEC

NORTHING: 7788283 EASTING: 386670

PRECISION: 10 METERS

OWNERSHIP:

COFREMME

PATINO

STATUS:

OWNER-OPERATOR

OPERATOR

COMMODITY

NICKEL

COBALT

MODIFIER

SILICATES

MARKETABILITY

PRIMARY

PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1920

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: TABULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 10

STRIKE/DIP: N45W: 45W

AVERAGE THICKNESS/METERS: 30

MINIMUM DEPTH/METERS: 0

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 10

LITHOLOGY:

NAME OF FORMATION: TIEBAGHI MASSIF

GEOLOGIC AGE: MIOCENE

DEFORMATION DESCRIPTION: OTHER: INTRUSION: METAMORPHISM

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION

GEOLOGIC AGE: MIOCENE

ROCK TYPE:

PERIDOTITE
SERPENTINITE
PYROXENITE
PERIDOTITE

REPLACED BY ORE: NEAR ORE
REPLACED BY ORE :NEAR ORE
NEAR ORE
NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	MIOCENE	SILICATES
MAGNESITE	MIOCENE	CARBONATES
LIMESTONE	MIOCENE	OXIDES

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FORMATION. PRES. AT SOC. MIN. ENG.-AIME INT. LATERITE SYMPOSIUM, NEW ORLEANS,
LA, 1979.

WORLD MINING. APR. 1974, AUG. 1979.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: OUACO/LAFLEUR DISTRICT SEQUENCE NUMBER: 6410350003

NATION: NEW CALEDONIA
TYPE OF OPERATION: SURFACE CURRENT STATUS: PRODUCER
LATITUDE: S 20 DEG 50 MIN 00 SEC LONGITUDE: E 164 DEG 27 MIN 00 SEC
UTM - ZONE: 58 HEMISPHERE: SOUTHERN NORTHING: 7696336 EASTING: 442774
POINT OF REFERENCE: ORE BODY PRECISION: 100 METERS
ELEVATION: 500 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

OWNERSHIP: STATUS:
SOCIETE LE NICKEL (SLN) OWNER
STE. MIN. SUD PACIFIQUE/LAFLEUR OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SILICATES	PRIMARY
COBALT		BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1891 -----EXPLORATION METHODS-----
YEAR OF INITIAL PRODUCTION: 1928 CORE DRILLING
YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:	
AVERAGE DEPTH/METERS: 20	MINIMUM DEPTH/METERS: 15
AVERAGE WIDTH/METERS: 20	AVERAGE THICKNESS/METERS: 15

UNCONSOLIDATED MATERIAL:
AVERAGE THICKNESS/METERS: 2

LITHOLOGY:
NAME OF FORMATION: ULTRAMAFIC INTRUSION
GEOLOGIC AGE: TERTIARY
DEFORMATION DESCRIPTION: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
GEOLOGIC AGE: TERTIARY
ROCK TYPE:
PERIDOTITE NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	QUARTENARY	OXIDES (EXCLUDING SiO ₂)
QUARTZ	QUARTENARY	SILICATES
OPAL	QUARTENARY	FORMS OF SiO ₂
MAGNESITE	QUARTENARY	CARBONATES

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT

CAPACITY: 1,150

UNITS: MT ORE/DAY

DESCRIPTION OF COVER: HARDPAN

BENEFICIATION:

DESIGN CAPACITY: 1,150

UNITS: MT ORE/DAY

----- DESCRIPTION OF MILLING -----
ORE/CRUSH/GRIND/WASH/DRY/DRIED ORE

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
DRIED ORE	NI	100	2.5	WT-PCT
	CO	100	0.02	WT-PCT

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GUY, B., J. P. PARIS, AND A. PRINZHOFER. NOTICE EXPLICATIVES LA FEUILLE KOUAQUA. BUREAU DE RECHERCHES DES MINES ET DE LA GEOLOGIE, NOUMEA, NEW CALEDONIA, 1979.

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: KOUAOUA

SEQUENCE NUMBER: 6410350004

NATION: NEW CALEDONIA

TYPE OF OPERATION: SURFACE

CURRENT STATUS: PRODUCER

LATITUDE: S 21 DEG 17 MIN 00 SEC

LONGITUDE: E 165 DEG 20 MIN 00 SEC

UTM - ZONE: 58 HEMISPHERE: SOUTHERN

NORTHING: 7646596 EASTING: 534577

POINT OF REFERENCE: ORE BODY

ELEVATION: 450 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

PENTECOST NICKEL

STATUS:

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATES

PRIMARY

COBALT

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1865

-----EXPLORATION METHODS -----

YEAR OF INITIAL PRODUCTION: 1980

CORE DRILLING

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: IRREGULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE THICKNESS/METERS: 15

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSION

GEOLOGIC AGE: TERTIARY

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFFORMATION

GEOLOGIC AGE: TERTIARY

ROCK TYPE:

PERIDOTITE

NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	TERTIARY	SILICATES
QUARTZ	TERTIARY	FORMS OF SiO ₂
OPAL	TERTIARY	FORMS OF SiO ₂
MAGNESITE	TERTIARY	FORMS OF SiO ₂
LIMONITE	TERTIARY	FORMS OF SiO ₂

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT	CAPACITY: 1,450
UNITS: MT ORE/DAY	
DESCRIPTION OF COVER: HARDPAN	
HARDNESS OF ORE: HARDPAN	

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: KOUAOUA, NEW CALIFORNIA
LATITUDE: S 21 17 00	LONGITUDE: E 165 20 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: OCEAN	DISTANCE (KM): 1.3
DESTINATION FACILITY: SMELTER/REFINERY	LOCATION: JAPAN
LATITUDE: N 35 32 00	LONGITUDE: E 139 27 00

BENEFICIATION:

METHOD: PYROMETALLURGY

----- DESCRIPTION OF MILLING -----
 ORE/CRUSH/ROAST/REDUCE/NICKEL MATTE

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CO METALS	NI	93	100	WT-PCT
	CO	27	100	WT-PCT

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: KOUADUA, NEW CALEDONIA
LATITUDE: S 21 17 00	LONGITUDE: E 165 20 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: OCEAN	
DESTINATION FACILITY: SMELTER/REFINERY	LOCATION: JAPAN
LATITUDE: N 35 32 00	LONGITUDE: E 139 27 00

BENEFICIATION:

METHOD: PYROMETALLURGY

----- DESCRIPTION OF MILLING -----
 ORE/CRUSH/GRIND/REDUCE/FERRONICKEL

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
FERRO-NICKEL	NI	97	25.0	WT-PCT

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: NEPOUI

SEQUENCE NUMBER: 6410350005

NATION: NEW CALEDONIA

TYPE OF OPERATION: SURFACE

CURRENT STATUS: PRODUCER

LATITUDE: S 17 DEG 23 MIN 00 SEC

LONGITUDE: E 165 DEG 0 MIN 00 SEC

UTM - ZONE: 58 HEMISPHERE: SOUTHERN

NORTHING: 8078154 EASTING: 500000

POINT OF REFERENCE: CLAIM

PRECISION: 100 METERS

ELEVATION: 50 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

SOCIETE LE NICKEL (SLN)

OWNER

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATES

PRIMARY

COBALT

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1865

-----EXPLORATION METHODS-----

YEAR OF INITIAL PRODUCTION: 1875

DRILLING

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: IRREGULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE THICKNESS/METERS: 80

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: TERTIARY

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: TERTIARY

ROCK TYPE:

PERIDOTITE

LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	TERTIARY	SILICATES
ILLITE	TERTIARY	SILICATES
KAOLINITE	TERTIARY	SILICATES
SERPENTINE	TERTIARY	SILICATES
LIMONITE	TERTIARY	OXIDES (EXCLUDING SiO2)

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT
 CAPACITY: 5,000
 DESCRIPTION OF COVER: SAND, GRAVEL

UNITS: MT ORE/DAY

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: NEW CALEDONIA
LATITUDE: S 17 23 00	LONGITUDE: E 165 00 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK: CONVEYOR	DISTANCE (KM): 13
DESTINATION FACILITY: SMELTER	LOCATION: DONIAMBO SMELTER
LATITUDE: S 22 09 36	LONGITUDE: E 166 15 36

BENEFICIATION:

METHOD: PYROMETALLURGY	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 160	ORE/CRUSH/ROAST/REDUCE/NICKEL MATTE
UNITS: MT ORE/DAY	
DEPOSIT PERCENT USED: 40	
TOTAL PERCENT USED: 37	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NICKEL MATTE	NI	90	75.0	WT-PCT
	CO	30	0.3	WT-PCT

TRANSPORTATION FOR PRODUCT: NICKEL MATTE

ORIGINATING FACILITY: SMELTER	LOCATION: DONIAMBO SMELTER
LATITUDE: S 22 09 36	LONGITUDE: E 166 15 36
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: OCEAN	DISTANCE (KM): 22,000
DESTINATION FACILITY: REFINERY	LOCATION: LE HAVRE, FRANCE
LATITUDE: N 49 30 00	LONGITUDE: E 00 10 00

BENEFICIATION:

METHOD: PYROMETALLURGY	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 720	ORE/CRUSH/ROAST/REDUCE/FERRONICKEL
UNITS: MT ORE/DAY	
DEPOSIT PERCENT USED: 60	
TOTAL PERCENT USED: 37	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
FERRONICKEL	NI	87	25	WT-PCT

TRANSPORTATION FOR PRODUCT:

ORIGINATING FACILITY: SMELTER

LATITUDE: S 22 09 36

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: OCEAN

DESTINATION FACILITY: MILL (OFF-SITE)

LATITUDE: N 49 30 00

LOCATION: DONIAMBO SMELTER

LONGITUDE: E 166 15 36

DISTANCE (KM): 22,000

LOCATION: LE HAVRE, FRANCE

LONGITUDE: E 00 10 00

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: PORO

SEQUENCE NUMBER: 6410350006

NATION: NEW CALEDONIA

TYPE OF OPERATION: SURFACE

CURRENT STATUS: PRODUCER

LATITUDE: S 20 DEG 00 MIN 00 SEC

LONGITUDE: E 165 DEG 00 MIN 00 SEC

UTM - ZONE: 58 HEMISPHERE: SOUTHERN

NORTHING: 7788650 EASTING: 500000

POINT OF REFERENCE: ORE BODY

ELEVATION: 50 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

SOCIETE LE NICKEL (SLN)

STATUS:

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATES

PRIMARY

COBALT

BYPRODUCT

PUBLISHED RESERVE/RESOURCE DATA AVAILABLE

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

ORE-MINERAL IN PLACE

-----EXPLORATION METHODS-----

DRILLING

YEAR OF DISCOVERY: 1865

YEAR OF INITIAL PRODUCTION: 1875

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: TABULAR: LENTICULAR

CONTROLLING FEATURES: BEDDING: LITHOLOGY

MINERALIZED ZONE:

AVERAGE THICKNESS/METERS: 90

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: TERTIARY

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: TERTIARY

ROCK TYPE:

PERIDOTITE

REPLACED BY ORE

SERPENTINITE

REPLACED BY ORE

UNSPECIFIED NONCLASTIC

LIES OVER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	TERTIARY	SILICATES
LIMONITE	TERTIARY	OXIDES(EXCLUDING SiO2)
SERPENTINE	TERTIARY	SILICATES

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT	
CAPACITY: 1,267	UNITS: MT ORE/DAY
DESCRIPTION OF COVER: MEDIUM HARD ROCK	
HARDNESS OF ORE: MEDIUM HARD ROCK	

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: PORO MINE, NEW CALEDONIA
LATITUDE: S 20 00 00	LONGITUDE: E 165 00 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	DISTANCE (KM): 150
DESTINATION FACILITY: MILL (OFF-SITE)	LOCATION: DONIAMBO SMELTER
LATITUDE: S 22 09 36	LONGITUDE: E 166 15 36

BENEFICIATION:

METHOD: PYROMETALLURGY	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 720	ORE/CRUSH/DRY/ROAST/REDUCE/FERRONICKEL
UNITS: MT PRODUCT/DAY	
DEPOSIT PERCENT USED: 60	
TOTAL PERCENT USED: 9	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
FERRONICKEL	NI	87	25	WT-PCT

TRANSPORTATION FOR PRODUCT: FERRONICKEL

ORIGINATING FACILITY: MILL (OFF-SITE)	LOCATION: DONIAMBO SMELTER
LATITUDE: S 22 09 36	LONGITUDE: E 166 15 36
PERCENT SHIPPED: 100	
DESTINATION FACILITY: FOB MILL	

BENEFICIATION:

METHOD: PYROMETALLURGY	-----DESCRIPTION OF MILLING-----
DESIGN CAPACITY: 160	ORE/CRUSH/DRY/ROAST/REDUCE
UNITS: MT PRODUCT/DAY	NICKEL MATTE
DEPOSIT PERCENT USED: 40	
TOTAL PERCENT USED: 9	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI MATTE	NI	9	75.0	WT-PCT
	CO	30	0.3	WT-PCT

TRANSPORTATION FOR PRODUCT: NICKEL MATTE	
ORIGINATING FACILITY: SMELTER	LOCATION: DONIAMBO SMELTER
LATITUDE: S 22 09 36	LONGITUDE: E 166 15 36
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: OCEAN	DISTANCE (KM): 22,000
DESTINATION FACILITY: REFINERY	LOCATION: LE HAVRE, FRANCE
LATITUDE: N 49 30 00	LONGITUDE: E 00 10 00

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: THIO

SEQUENCE NUMBER: 6410350007

NATION: NEW CALEDONIA

TYPE OF OPERATION: SURFACE

LATITUDE: S 21 DEG 38 MIN 0 SEC

UTM - ZONE: 58 HEMISPHERE: SOUTHERN

POINT OF REFERENCE: ORE BODY

ELEVATION: 100 METERS

DATUM: SEA LEVEL

CURRENT STATUS: PRODUCER

LONGITUDE: E 165 DEG 7 MIN 0 SEC

NORTHING: 7607893 EASTING: 512073

PRECISION: 1 KILOMETER

PRECISION: 100 METERS

OWNERSHIP:

SOCIETE LE NICKEL

STATUS:

OWNER-OPERATOR

COMMODITY

NICKEL

COBALT

MARKETABILITY

PRIMARY

RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

ORE-MINERAL IN PLACE

YEAR OF DISCOVERY: 1865

YEAR OF FINAL PRODUCTION: PRODUCER

-----EXPLORATION METHODS-----

GEOLOGICAL/DRILLING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: IRREGULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

MINIMUM DEPTH/METERS: 35

UNCONSOLIDATED MATERIAL:

MINIMUM THICKNESS/METERS: 35

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: TERTIARY

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: TERTIARY

ROCK TYPE:	
PERIDOTITE	LIES UNDER ORE: REPLACED BY ORE
SERPENTINITE	LIES UNDER ORE: REPLACED BY ORE
UNSPECIFIED NONCLASTIC	LIES OVER ORE

MINERALIZATION:		
MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	TERTIARY	SILICATES
LIMONITE	TERTIARY	OXIDES (EXCLUDING SiO ₂)
SERPENTINE	TERTIARY	SILICATES

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT	
CAPACITY: 1,750	UNITS: MT ORE/DAY
DESCRIPTION OF COVER: SAND, SILT: HARDPAN	
HARDNESS OF ORE: HARDPAN	SURFACE AREA OF MINE: 6 HECTARES

TRANSPORTATION (ORE):	
ORIGINATING FACILITY: MINE	LOCATION: THIO MINE, NEW CALEDONIA
LATITUDE: S 21 38 00	LONGITUDE: E 165 07 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	DISTANCE (KM): 150
DESTINATION FACILITY: SMELTER	LOCATION: DONIAMBO SMELTER
LATITUDE: S 21 38 00	LONGITUDE: E 154 07 00

BENEFICIATION:	
METHOD: PYROMETALLURGY	-----DESCRIPTION OF MILLING-----
DESIGN CAPACITY: 720	ORE/CRUSH/DRY/ROAST/REDUCE/FERRONICKEL
UNITS: MT PRODUCT/DAY	
DEPOSIT PERCENT USED: 60	
TOTAL PERCENT USED: 13	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
FERRONICKEL	NI	87	25	WT-PCT

BENEFICIATION:	
METHOD: PYROMETALLURGY	-----DESCRIPTION OF MILLING-----
DESIGN CAPACITY: 160	ORE/CRUSH/DRY/ROAST/REDUCE/NICKEL MATTE
UNITS: MT PRODUCT/DAY	
DEPOSIT PERCENT USED: 40	
TOTAL PERCENT USED: 13	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI MATTE	NI	90	75.0	WT-PCT
	CO	30	0.3	WT-PCT

TRANSPORTATION FOR PRODUCT: NICKEL MATTE

ORIGINATING FACILITY: SMELTER

LATITUDE: S 22 09 36

METHOD OF TRANSPORTATION: OCEAN

DESTINATION FACILITY: REFINERY

LATITUDE: N 49 30 00

LOCATION: DONIAMBO SMELTER

LONGITUDE: E 166 15 36

DISTANCE (KM): 22,000

LOCATION: LEHAVRE, FRANCE

LONGITUDE: E 00 10 00

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: TIEBAGHI	SEQUENCE NUMBER: 6410350009
NATION: NEW CALEDONIA	CURRENT STATUS: DEVELOPED DEPOSIT
TYPE OF OPERATION: SURFACE	LONGITUDE: E 164 DEG 10 MIN 00 SEC
LATITUDE: S 20 DEG 25 MIN 00 SEC	NORTHING: 7742322 EASTING: 413056
UTM - ZONE: 58 HEMISPHERE: SOUTHERN	PRECISION: 500 METERS
POINT OF REFERENCE: ORE BODY	
ELEVATION: 500 METERS	
DATUM: SEA LEVEL	
OWNERSHIP:	STATUS:
COFREMMI	OWNER-OPERATOR
PATINO	OPERATOR
COMMODITY	MARKETABILITY
NICKEL	PRIMARY
COBALT	COPRODUCT
MODIFIER	
SILICATE	

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1920

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:	MINIMUM DEPTH/METERS: 0
AVERAGE DEPTH/METERS: 10	
STRIKE/DIP: N45W: 45W	
AVERAGE THICKNESS/METERS: 30	

UNCONSOLIDATED MATERIAL:
AVERAGE THICKNESS/METERS: 10

LITHOLOGY:
NAME OF FORMATION: TIEBAGHI MASSIF
GEOLOGIC AGE: MIOCENE
DEFORMATION DESCRIPTION: OTHER: INTRUSION: METAMORPHISM
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: MIOCENE

ROCK TYPE:

PERIDOTITE	REPLACED BY ORE: NEAR ORE
SERPENTINITE	REPLACED BY ORE: NEAR ORE
PYROXENITE	NEAR ORE
PERIDOTITE	NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	MIOCENE	SILICATES
MAGNESITE	MIOCENE	CARBONATES
LIMONITE	MIOCENE	OXIDES

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LA, 1979.

WORLD MINING. APR. 1974; AUG. 1979.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: GORO

SEQUENCE NUMBER: 6410350010

NATION: NEW CALEDONIA

TYPE OF OPERATION: SURFACE

LATITUDE: S 22 DEG 24 MIN 00 SEC

UTM - ZONE: 58 HEMISPHERE: SOUTHERN

POINT OF REFERENCE: ORE BODY

ELEVATION: 175 METERS

DATUM: SEA LEVEL

CURRENT STATUS: EXPLORED PROSPECT

LONGITUDE: E 167 DEG 1 MIN 00 SEC

NORTHING: 7521649 EASTING: 707607

PRECISION: 10 METERS

PRECISION: 10 METERS

ALTERNATE NAMES: GORO EAST

GORO WEST

OWNERSHIP:

NEW CALEONIAN GOVERNMENT

STATUS:

OWNER-OPERATOR

COMMODITY

NICKEL

COBALT

MODIFIER

SILICATES

MARKETABILITY

PRIMARY

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 1,814,388,100

UNITS MT ORE

YEAR/DATA 1973

IN SITU GRADE:

ASSAY/FORM

NI

GRADE

1.45

UNIT

WT-PCT

MINERAL FORM

SILICATES

RESERVE/RESOURCE REMARKS

SOURCE: MINERALS SOURCEBOOK. GORO NICKEL DEPOSIT. JAN. 29, 1973, (A1048.).

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

GEOLOGICAL INFERENCE

YEAR OF DISCOVERY: 1863

-----EXPLORATION METHODS-----

DRILLING/AUGER/TEST PIT/TRENCHING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: TABULAR: LENTICULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 15

MINIMUM DEPTH/METERS: 0

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: TERTIARY

DEFORMATION DESCRIPTION: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: TERTIARY

ROCK TYPE:

PERIDOTITE LIES UNDER ORE: REPLACED BY ORE

OLIVINE BASALT LIES UNDER ORE

PYROXENITE LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
QUARTZ	QUARTENARY	FORMS OF SiO_2	PHANERITIC-MEDIUM
MAGNESITE	QUARTENARY	CARBONATES	PHANERITIC-MEDIUM
IRON	QUARTENARY	OXIDES (EXCLUDING SiO_2)	PHANERITIC-MEDIUM
GARNEIRITE	QUARTENARY	SILICATES	PHANERITIC-MEDIUM

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MINING MAGAZINE. NICKEL PRODUCTION IN NEW CALEDONIA. 1974, PP. 336-349.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: PRONY MINE

SEQUENCE NUMBER: 6410350012

NATION: NEW CALEDONIA

TYPE OF OPERATION: SURFACE

LATITUDE: S 22 DEG 19 MIN 00 SEC

UTM - ZONE: 50 HEMISPHERE: SOUTHERN

ELEVATION: 400 METERS

DATUM: SEA LEVEL

CURRENT STATUS: EXPLORED PROSPECT

LONGITUDE: E 166 DEG 49 MIN 00 SEC

NORTHING: 7532254 EASTING: 481118

PRECISION: 10 METERS

OWNERSHIP:

PENAMEX

STATUS:

OWNER-OPERATOR

COMMODITY

NICKEL

COBALT

MARKETABILITY

PRIMARY

COPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 362,817,620

UNITS MT ORE

YEAR/DATA 1980

IN SITU GRADE:

ASSAY/FORM

NI

GRADE

1.37

UNIT

WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: FINANCIAL TIMES. MINING INTERNATIONAL YEARBOOK, 1980. P. 59.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

GEOLOGICAL INFERENCE

YEAR OF DISCOVERY: 1863

-----EXPLORATION METHODS-----

DRILLING/AUGER/TEST PIT/TRENCHING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: IRREGULAR: TABULAR

CONTROLLING FEATURES: LITHOLOGY

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: TERTIARY

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: TERTIARY

ROCK TYPE:	
PERIDOTITE	REPLACED BY ORE
OLIVINE BASALT	LIES UNDER ORE
PYROXENITE	LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
QUARTZ	QUARTERNARY	FORMS OF SiO ₂	PHANERITIC-MEDIUM
MAGNESITE	QUARTERNARY	CARBONATES	PHANERITIC-MEDIUM
IRON	QUARTERNARY	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-MEDIUM
GARNIERITE	QUARTERNARY	SILICATES	PHANERITIC-MEDIUM

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MINERALS SOURCEBOOK. PENAMAX NICKEL PROSPECT. APR. 4, 1973.

_____. PENAMAX NICKEL PROSPECT. JAN. 28, 1974 (U1206).

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: OUIINNE MINE

SEQUENCE NUMBER: 6410350014

NATION: NEW CALEDONIA

TYPE OF OPERATION: SURFACE

CURRENT STATUS: PRODUCER

LATITUDE: S 22 DEG 00 MIN 00 SEC

LONGITUDE: E 166 DEG 40 MIN 00 SEC

UTM - ZONE: 58 HEMISPHERE: SOUTHERN

NORTHING: 7566377 EASTING: 672055

POINT OF REFERENCE: ORE BODY

PRECISION: 500 METERS

ELEVATION: 100 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

SOCIETE G. MONTAGNAT ET CIE.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATES

PRIMARY

COBALT

RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

YEAR OF INITIAL PRODUCTION: 1980

-----EXPLORATION METHODS-----

YEAR OF FINAL PRODUCTION: PRODUCING

DRILLING/TEST PIT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: TABULAR: IRREGULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 18

AVERAGE THICKNESS/METERS: 20

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 18

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: MIOCENE

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

ROCK TYPE:

PERIDOTITE

REPLACED BY ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	QUATERNARY	SILICATES
QUARTZ	QUATERNARY	FORMS OF SiO2
OPAL	QUATERNARY	FORMS OF SiO2
MAGNESITE	QUATERNARY	CARBONATES
LIMONITE	QUATERNARY	OXIDES (EXCLUDING SiO2)

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT
 CAPACITY: 587 UNITS: MT ORE/DAY
 DESCRIPTION OF COVER: HARDPAN: SAND: SILT
 HARDNESS OF ORE: HARDPAN

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: QUINNE MINE
LATITUDE: S 22 00 00	LONGITUDE: E 166 40 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK: OCEAN	
DESTINATION FACILITY: SMELTER/REFINERY	LOCATION: JAPAN
LATITUDE: N 35 32 00	LONGITUDE: W 139 27 00

BENEFICIATION:

METHOD: PYROMETALLURGY

----- DESCRIPTION OF MILLING -----
 ORE/CRUSH/DRY/ROAST/REDUCE/FERRONICKEL
 NICKEL MATTE

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
FERRONICKEL	NI	87	25.0	WT-PCT
NI-CO MATTE	NI	96	75.0	WT-PCT
	CO	30	0.3	WT-PCT

TRANSPORTATION FOR PRODUCT: FERRONICKEL

ORIGINATING FACILITY: SMELTER	LOCATION: TOKYO, JAPAN
LATITUDE: S 21 30 00	LONGITUDE: E 166 00 00
PERCENT SHIPPED: 100	
DESTINATION FACILITY: FOB MILL	LOCATION: TOKYO, JAPAN
LATITUDE: N 21 30 00	LONGITUDE: W 166 00 00

TRANSPORTATION FOR PRODUCT: NICKEL-COBALT MATTE

ORIGINATING FACILITY: SMELTER	LOCATION: TOKYO, JAPAN
LATITUDE: S 21 30 00	LONGITUDE: E 166 00 00
PERCENT SHIPPED: 100	
DESTINATION FACILITY: REFINERY	LOCATION: TOKYO, JAPAN
LATITUDE: N 35 32 00	LONGITUDE: W 139 27 00

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: NAKETY MINE

SEQUENCE NUMBER: 6410350018

NATION: NEW CALEDONIA

TYPE OF OPERATION: SURFACE

CURRENT STATUS: PRODUCER

LATITUDE: S 21 DEG 30 MIN 00 SEC

LONGITUDE: E 166 DEG 00 MIN 00 SEC

UTM - ZONE: 58 HEMISPHERE: SOUTHERN

NORTHING: 7622322 EASTING: 603584

POINT OF REFERENCE: ORE BODY

ELEVATION: 400 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

ALTERNATE NAMES: PETITE MINEURS OPERATION

OWNERSHIP:

SOCIETE MINIERE OHLEM

SOCIETE LE NICKEL

STATUS:

OPERATOR

OWNER

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATES

PRIMARY

COBALT

COPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1875

-----EXPLORATION METHODS-----

YEAR OF FINAL PRODUCTION: PRODUCING

DRILLING/AUGER/TEST PIT/GEOLOGICAL/
TRENCHING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: IRREGULAR: TABULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 17

MINIMUM DEPTH/METERS: 15

AVERAGE THICKNESS/METERS: 20

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 17 MINIMUM THICKNESS/METERS: 15

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: TERTIARY

DEFORMATION DESCRIPTION: METAMORPHISM: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: TERTIARY

ROCK TYPE:
 PERIDOTITE LIES OVER ORE: ENCLOSES ORE: REPLACED BY ORE
 PYROXENITE LIES OVER ORE: ENCLOSES ORE: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	CENOZOIC	SILICATES
QUARTZ	CENOZOIC	SILICATES
OPAL	CENOZOIC	SILICATES
MAGNESITE	CENOZOIC	CARBONATES
IRON	CENOZOIC	OXIDES (EXCLUDING SiO ₂)

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT
 CAPACITY: 600 UNITS: MT ORE/DAY
 DESCRIPTION OF COVER: HARDPAN
 HARDNESS OF ORE: HARDPAN

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: NAKETY MINE, NEW CALEDONIA
LATITUDE: S 21 30 00	LONGITUDE: E 166 00 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: OCEAN	
DESTINATION FACILITY: SMELTER	LOCATION: TOKYO, JAPAN
LATITUDE: N 35 32 00	LONGITUDE: E 139 27 00

BENEFICIATION:

METHOD: PYROMETALLURGY	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 600	ORE/CRUSH/DRY/ROAST/REDUCE FE-NI
UNITS: MT ORE/DAY	NICKEL MATTE
DEPOSIT PERCENT USED: 100	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
FERRO-NICKEL	NI	87	25.0	WT-PCT
NI-CO MATTE	NI	90	75.0	WT-PCT
	CO	30	0.3	WT-PCT

TRANSPORTATION FOR PRODUCT: FERRO-NICKEL

ORIGINATING FACILITY: SMELTER	LOCATION: TOKYO, JAPAN
LATITUDE: S 21 30 00	LONGITUDE: E 166 00 00
PERCENT SHIPPED: 100	
DESTINATION FACILITY: FOB MILL	LOCATION: TOKYO, JAPAN
LATITUDE: S 21 30 00	LONGITUDE: E 166 00 00

TRANSPORTATION FOR PRODUCT: NI-CO MATTE

ORIGINATING FACILITY: SMELTER	LOCATION: TOKYO, JAPAN
LATITUDE: S 21 30 00	LONGITUDE: E 166 00 00
PERCENT SHIPPED: 100	

METHOD OF TRANSPORTATION: TRUCK
DESTINATION FACILITY: REFINERY
LATITUDE: N 35 32 00

DISTANCE (KM): 1
LOCATION: TOKYO, JAPAN
LONGITUDE: E 139 27 00

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: ILE ART	SEQUENCE NUMBER: 6410350019
NATION: NEW CALEDONIA	CURRENT STATUS: DEVELOPED DEPOSIT
TYPE OF OPERATION: SURFACE	LONGITUDE: E163 DEG 38 MIN 00 SEC
LATITUDE: S 19 DEG 40 MIN 00 SEC	NORTHING: 7824959 EASTING: 356728
UTM - ZONE: 58 HEMISPHERE: SOUTHERN	PRECISION: 500 METERS
POINT OF REFERENCE: ORE BODY	
ELEVATION: 265 METERS	
DATUM: SEA LEVEL	
OWNERSHIP:	STATUS:
COFREMMI	OWNER-OPERATOR
PATINO	OPERATOR
COMMODITY	MARKETABILITY
NICKEL	PRIMARY
COBALT	COPRODUCT
MODIFIER	
SILICATES	

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1920

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 10
STRIKE/DIP: N45W: 45W
AVERAGE LENGTH/METERS: 20,000
AVERAGE THICKNESS/METERS: 30

MINIMUM DEPTH/METERS: 0
AVERAGE WIDTH/METERS: 2,350

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 10

LITHOLOGY:

NAME OF FORMATION: TIEBAGHI MASSIF
GEOLOGIC AGE: MIOCENE
DEFORMATION DESCRIPTION: OTHER: INTRUSION: METAMORPHISM
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING-FOLLOWING DEFORMATION
GEOLOGIC AGE: MIOCENE

ROCK TYPE:

PERIDOTITE	REPLACED BY ORE: NEAR ORE
SERPENTINITE	REPLACED BY ORE: NEAR ORE
PYROXENITE	NEAR ORE
PERIDOTITE	NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	MIOCENE	SILICATES
MAGNESITE	MIOCENE	CARBONATES
LIMESTONE	MIOCENE	CARBONATES
QUARTZ	MIOCENE	FORMS OF SiO_2
OPAL	MIOCENE	FORMS OF SiO_2
LIMONITE	MIOCENE	OXIDES

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ENGINEERING AND MINING JOURNAL. APRIL 1974, PP. 35-36; MAY 1976, P. 177.

MINING MAGAZINE. DEC. 1969, P. 453; MAR. 1974, P. 149; FEB. 1975, P. 86;
APR. 1978, PP. 297-299; SEPT. 1979, P. 221.

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FORMATION. PRES. AT SOC. MIN. ENG.-AIME INT. LATERITE SYMPOSIUM, NEW ORLEANS,
LA, 1979.

WORLD MINING. APR. 1974; AUG. 1979.

PHILIPPINES

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: STA. CRUZ MINE AREA, SEQUENCE NUMBER: 5650150018
BARRIOS VIL
NATION: PHILIPPINES SUBDIVISION: LUZON
LATITUDE: N 15 DEG 44 MIN 00 SEC LONGITUDE: E 120 DEG 03 MIN 00 SEC
UTM - ZONE: 51 HEMISPHERE: NORTHERN
POINT OF REFERENCE: APPROXIMATE PRECISION: 500 METERS
ALTERNATE NAMES: A HERMOSA, PILAR, MANTANAS, AND CAP
ARIAAN STA. CRUZ, ILOCOS SUR.

OWNERSHIP:
BENGUET CORPORATION

STATUS:
OWNER

COMMODITY
NICKEL

MARKETABILITY
RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED 34,400,000
UNITS MT ORE
YEAR/DATA 1982

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.76	WT-PCT

RESERVE/RESOURCE - REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. INTERNATIONAL DIRECTORY OF MINING.
1982, P. 365.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----
GEOLOGICAL TEST PIT/AUGER

ORE-MINERAL IN PLACE

YEAR OF INITIAL PRODUCTION: 1935

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR: IRREGULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE LENGTH/METERS: 240
AVERAGE THICKNESS/METERS: 4

AVERAGE WIDTH/METERS: 240

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 2

MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: CRETACEOUS

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

ROCK TYPE:

PERIDOTITE

ENCLOSES ORE: IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
MAGNETITE	CENOZOIC	SILICATES
MONMORILLONITE	CENOZOIC	SILICATES
OLIVENE	CENOZOIC	SILICATES
ENSTATITE	CENOZOIC	SILICATES
CHROMITE	CENOZOIC	OXIDES(EXCLUDING SiO_2)
MAGNETITE	CENOZOIC	OXIDES(EXCLUDING SiO_2)

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FILMAG (PHILIPPINES), INC. COMPANY REPORT. APR. 23, 1975.

MINING JOURNAL. FALCONBRIDGE FEASIBILITY STUDY. MAR. 19, 1976.

WORLD MINING. FALCONBRIDGE WILL OPERATE FUTURE LATERITE MINE, PROVIDE TECHNICAL KNOW-HOW. JUNE 1978.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MOUNT KADIG	SEQUENCE NUMBER: 5650150073
NATION: PHILIPPINES	SUBDIVISION: LUZON
TYPE OF OPERATION: SURFACE	CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: N 14 DEG 3 MIN 0 SEC	LONGITUDE: E 122 DEG 25 MIN 0 SEC
UTM - ZONE: 51 HEMISPHERE: NORTHERN	NORTHING: 1553238 EASTING: 437017
POINT OF REFERENCE: CLAIM	PRECISION: 100 METERS
ELEVATION: 726 METERS	PRECISION: 10 METERS
DATUM: SEA LEVEL	
OWNERSHIP:	STATUS:
HORIZON MINERALS AND OIL CORPORATION	OWNER
COMMODITY	MARKETABILITY
NICKEL	PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED	83,129,840
UNITS	MT ORE
YEAR/DATA	1978

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	1.5	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: MIRANDA, F. E., AND P. C. CALEON. GEOLOGY AND MINERAL RESOURCES OF CAMARINES NORTE AND PART OF QUEZON PROVINCE. PHILIPPINE BUMINES RI NO. 93, MANILA, PHILIPPINES, 1979.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:
GEOPHYSICAL ANOMALY

-----EXPLORATION METHODS-----
SURFACE GEOLOGIC MAPPING/
RESISTIVITY SURVEY

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR: IRREGULAR
CONTROLLING FEATURES: FAULTING: LITHOLOGY

MINERALIZED ZONE:
AVERAGE THICKNESS/METERS: 5

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE
GEOLOGIC AGE: CRETACEOUS
DEFORMATION DESCRIPTION: INTRUSION: FAULTING
RELATIONSHIP TO MINERALIZATION: COMPLEX
GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

DUNITE	REPLACED BY ORE
PERIDOTITE	REPLACED BY ORE
PYROXENITE	REPLACED BY ORE
GABBRO	REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
KAOLINITE	CENOZOIC	SILICATES
ILLITE	CENOZOIC	SILICATES

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PHILIPPINE BUREAU OF MINES. DATA ON PHILIPPINE MINERAL RESOURCES. IC NO. 22, MANILA, PHILIPPINES, JAN. 1975, PP. 12, 26.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: ACOJE NICKEL PROJECT SEQUENCE NUMBER: 5650150082
NATION: PHILIPPINES SUBDIVISION: LUZON
TYPE OF OPERATION: SURFACE CURRENT STATUS: PAST PRODUCER
LATITUDE: N 15 DEG 40 MIN 5 SEC LONGITUDE: E 120 DEG 2 MIN 30 SEC
UTM - ZONE: 51 HEMISPHERE: NORTHERN NORTHING: 1734324 EASTING: 182840
POINT OF REFERENCE: ORE BODY
ELEVATION: 800 METERS PRECISION: 500 METERS
DATUM: SEA LEVEL

OWNERSHIP: STATUS:
ACOJE MINING COMPANY, INC. OWNER-OPERATOR

COMMODITY MODIFIER MARKETABILITY
NICKEL SULFIDE PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

	RECORD 1	RECORD 2
MEASURED	510,800	1,060,000
INDICATED	504,500	
INFERRED	1,057,000	
UNITS	MT ORE	MT ORE
YEAR/DATE	1978	1974

IN SITU GRADE:

RECORD	ASSAY/FORM	GRADE	UNIT
1	NI	0.32	WT-PCT
2	NI	.47	WT-PCT

RESERVE/RESOURCE REMARKS

REC. 1 - ENGINEERING AND MINING JOURNAL. INTERNATIONAL DIRECTORY OF MINING.
1982, P. 364.
REC. 2 - ACOJE MINING COMPANY, INC. ANNUAL REPORT. 1979.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD: -----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE TEST PIT/DRILLING
YEAR OF INITIAL PRODUCTION: 1935

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: OXIDATION
SHAPE OF ORE BODY: LENTICULAR: IRREGULAR
CONTROLLING FEATURES: IGNEOUS

MINERALIZED ZONE:
STRIKE/DIP: N20E: 05E
AVERAGE THICKNESS/METERS: 13

LITHOLOGY:

NAME OF FORMATION: ZIMBALES COMPLEX
GEOLOGIC AGE: CRETACEOUS
DEFORMATION DESCRIPTION: MAJOR FAULTING: INTRUSION: METAMORPHISM
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
GEOLOGIC AGE: CRETACEOUS
ROCK TYPE:
ULTRAMAFIC IGNEOUS NEAR ORE
SERPENTINITE NEAR ORE
PERIDOTITE NEAR ORE: IS ORE
DUNITE NEAR ORE: IS ORE
SANDSTONE NEAR ORE
GABBRO NEAR ORE: IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
PYRRHOTITE	CRETACEOUS	SULFIDES	VARIABLE
PENTLANDITE	CRETACEOUS	SULFIDES	VARIABLE
CHALCOPYRITE	CRETACEOUS	SULFIDES	VARIABLE

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MINING AND INDUSTRIAL MAGAZINE. ACOJE'S NICKEL ORE BENEFICATION PLANT. MAY 1970, PP. 9-10.

PARINGIT, R. U. NICKEL SULFIDE DEPOSITS AND EXPLORATION WORKS AT THE ACOJE MINE, ZAMBALES PROVINCE. PHILIPPINES J. OF THE GEOL. SOC. OF THE PHILIPPINES, V. 29, NO. 3, SEPT. 1975, PP. 16-27.

U.S. BUREAU OF MINES. MINERALS YEARBOOKS 1971-1978. CHAPTER ON THE MINERALS INDUSTRY OF THE PHILIPPINES.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: NONOC

SEQUENCE NUMBER: 5650210005

NATION: PHILIPPINES

SUBDIVISION: MINDANAO

TYPE OF OPERATION: SURFACE

CURRENT STATUS: PRODUCER

LATITUDE: N 9 DEG 41 MIN 0 SEC

LONGITUDE: E 125 DEG 41 MIN 0 SEC

UTM - ZONE: 51 HEMISPHERE: NORTHERN

NORTHING: 1071494 EASTING: 794467

ELEVATION: 50 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

ALTERNATE NAMES: INCL. NONOC
AWASAN

OWNERSHIP:

STATUS:

MARINDUQUE MINING AND INDUSTRIAL CORPORATION

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATES

PRIMARY

COBALT

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

	RECORD 1	RECORD 2
INDICATED	144,243,000	125,400,000
UNITS	MT ORE	MT ORE
YEAR/DATA	1975	1980

IN SITU GRADE:

RECORD	ASSAY/FORM	GRADE	UNIT
1	NI	1.22	WT-PCT
	CO	0.12	WT-PCT
2	NI	1.23	WT-PCT
	CO	0.15	WT-PCT

RESERVE/RESOURCE REMARKS

REC. 1 - PRODUCTION TO DATE IS NOT SUBTRACTED FROM RESERVE TOTAL NUMBER.
RESERVE NUMBERS CONVERTED FROM SHORT TONS TO METRIC TONS.

REC. 2 - PHILIPPINE BUREAU OF MINES. SUMMARY OF GEOLOGY, PROSPECTING AND
EXPLORATION OF PHILLIPINE NICKEL DEPOSITS. MANILA, PHILIPPINES,
1980, P. 6.

SOURCE: ENGINEERING AND MINING JOURNAL. INTERNATIONAL DIRECTORY OF MINING.
1981, P. 348. RESERVE NUMBER IS FOR STARTUP OF OPERATIONS IN 1974.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

ORE-MINERAL IN PLACE
YEAR OF DISCOVERY: 1912
YEAR OF INITIAL PRODUCTION: 1974
YEAR OF FINAL PRODUCTION: PRODUCING

-----EXPLORATION METHODS-----
TEST PIT/DRILLING/AUGER

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: FAULTING: LITHOLOGY

MINERALIZED ZONE:

AVERAGE THICKNESS/METERS: 7

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 4

MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: SURIGAO ULTRAMAFIC COMPLEX
GEOLOGIC AGE: CRETACEOUS
DEFORMATION DESCRIPTION: INTRUSION: FAULTING
RELATIONSHIP TO MINERALIZATION: COMPLEX
GEOLOGIC AGE: CRETACEOUS
ROCK TYPE:
DUNITE REPLACED BY ORE
PERIDOTITE REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GEOTHITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)
MONTMORILLONITE	CENOZOIC	SILICATES
GARNIERITE	CENOZOIC	SILICATES

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT
CAPACITY: 13,666 UNITS: MT ORE/DAY
DESCRIPTION OF COVER: HARDPAN: SAND, SILT
AVERAGE COVER THICKNESS: 4 METERS
HARDNESS OF ORE: HARDPAN SURFACE AREA OF MINE: 4500 SQUARE METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: NONOC MINE
LATITUDE: N 09 41 00	LONGITUDE: E 125 41 00
PERCENT SHIPPED: 100	
DESTINATION FACILITY: SMELTER	LOCATION: PHILIPPINES

BENEFICIATION:

METHOD: HYDROMETALLURGY

----- DESCRIPTION OF MILLING

DESIGN CAPACITY: 13,666
ORE/CRUSH/DRY/ROAST/REDUCE/FERRONICKEL
UNITS: MT ORE/DAY
DEPOSIT PERCENT USED: 100
TOTAL PERCENT USED: 100

SULPHIDES TO NI METAL/
NI-CO SLUDGE TO JAPAN

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI METAL	NI	94	99	WT-PCT

BIBLIOGRAPHY RECORDS

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CHAVEZ, M. JR., AND M. T. TENGCO. ECONOMICS OF NICKEL INDUSTRY. MANILA, PHILIPPINES, 1980.

COLVIN, N., AND J. W. GULYAS. THE MARINDUQUE SURIGAO NICKEL REFINERY. PRES. AT SOC. MIN. ENG.-AIME INT. LATERITE SYMP., NEW ORLEANS, LA, 1979, PP. 346-356.

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IRON-NICKEL-COBALT RESOURCES OF NONOC, AWASAN, AND SOUTHERN DINAGAT ISLANDS IN PARCEL 11 OF THE SURIGAO MINERAL RESERVATION, SURIGAO, MINDANAO, PT 2 (PLATES). PHILIPPINE BUMINES, MANILA, PHILIPPINES, 1958.

JOSE, B. A., AND C. T. HENRY. OPEN PIT MINING METHODS OF THE PHILIPPINE NICKELIFEROUS LATERITE MINES. PHILIPPINE BUMINES, MANILA, PHILIPPINES, 1980.

MARINDUQUE MINING AND INDUSTRIAL CORPORATION. ANNUAL REPORT. 1978, 1979.

PHILIPPINE BUREAU OF MINES. GEOLOGY AND GEOCHEMISTRY OF THE NICKELIFEROUS LATERITES OF NONOC AND ADJACENT ISLANDS, SURIGAO PROVINCE. 1961.

_____. IRON-NICKEL-COBALT RESOURCES OF NONOC, AWASAN, AND SOUTHERN DINAGAT ISLANDS IN PARCEL 11 OF THE SURIGAO MINERAL RESERVATION, SURIGAO, MINDANAO, PT 1 (TEXT). 1958.

_____. MINING NEWS SERVICE. NO. 42, NOV. 1961.

_____. SUMMARY OF GEOLOGY, PROSPECTING AND EXPLORATION OF PHILLIPINE NICKEL DEPOSITS. MANILA, PHILIPPINES, 1980, P. 6.

SANTOS, Y. L., AND ESGUERRA, F. GEOLOGY-GEOCHEMISTRY, NICKEL LATERITES OF NONOC AND ADJACENT ISLANDS. PHILIPPINES BUMINES SPEC. PROJECT, SERIES NO. 18, 1961.

U.S. BUREAU OF MINES. MINERALS YEARBOOK, 1976.

WRIGHT, W. S. IRON-NICKEL-COBALT RESOURCES OF PARCEL 2 OF THE SURIGAO.
MINDINAO RESERVE. PHILIPPINE BUMINES SPEC. PROJECT, SERIES NO. 17, 1958.

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ISLAND, SURIGAO, MINDINAO. PHILIPPINE BUMINES RI 14, 1955.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MAKAMBAL

SEQUENCE NUMBER: 5650210022

NATION: PHILIPPINES

SUBDIVISION: MINDANAO

TYPE OF OPERATION: SURFACE

CURRENT STATUS: DEVELOPED DEPOSIT

LATITUDE: N 6 DEG 35 MIN 0 SEC

LONGITUDE: E 126 DEG 0 MIN 0 SEC

UTM - ZONE: 52 HEMISPHERE: NORTHERN

NORTHING: 728638 EASTING: 168209

POINT OF REFERENCE: CLAIM

PRECISION: 100 METERS

ELEVATION: 200 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP

STATUS

LBC AND GREENFIELD MINING COMPANY

OWNER

COMMODITY

MARKETABILITY

NICKEL

PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 90,718,582

UNITS MT ORE

YEAR/DATA 1978

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

NI

1.0

WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: MIRANDA, F. E. DATA ON PHILIPPINE MINERAL RESOURCES. PHILIPPINE
BUMINES IC 22, 1978, PP. 12, 27.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1968

-----EXPLORATION METHODS-----
SURFACE GEOLOGIC MAPPING/GEOPHYSICAL
TEST PIT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: TABULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE LENGTH/METERS: 4,800

AVERAGE WIDTH/METERS: 4,800

AVERAGE THICKNESS/METERS: 5

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: CRETACEOUS

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

ULTRAMAFIC IGNEOUS

LIES ALONG ORE: REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	CENOZOIC	SILICATES
SERPENTINE	CENOZOIC	SILICATES
OLIVINE	CENOZOIC	SILICATES

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MIRANDA, F. E. DATA ON PHILLIPINE MINERAL RESOURCES. PHILIPPINE BUMINES IC 22, 1978, PP. 12, 27.

NICKEL. MINERAL ECONOMICS AND INFORMATION DIVISION, PHILIPPINE BUMINES INFORMATION SERIES NO. 5, 1978, PP. 1-4.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: DINAGAT DEPOSIT	SEQUENCE NUMBER: 5650210026
NATION: PHILIPPINES	SUBDIVISION: MINDANAO
TYPE OF OPERATION: MINERAL LOCATION	CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: N 10 DEG 10 MIN 0 SEC	LONGITUDE: E 125 DEG 41 MIN 0 SEC
UTM - ZONE: 51 HEMISPHERE: NORTHERN	NORTHING: 1124985 EASTING: 794035
OWNERSHIP: MARINDUQUE MINING CORPORATION	STATUS: OWNER
COMMODITY NICKEL	MARKETABILITY PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED	2,700,000,000
UNITS	MT ORE
YEAR/DATA	1980

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	0.75	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: PHILLIPINE BUMINES. SUMMARY OF GEOLOGY, PROSPECTING AND EXPLORATION OF PHILLIPINE NICKEL DEPOSITS. 1980, P. 6.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY:	-----EXPLORATION METHODS----- TEST PIT/AUGER

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: IRREGULAR: TABULAR
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 5	MINIMUM DEPTH/METERS: 0
AVERAGE THICKNESS/METERS: 4	

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 5	MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: SURIAGO ULTRAMAFIC COMPLEX

GEOLOGIC AGE: UPPER CRETACEOUS

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

DUNITE REPLACED BY ORE

PERIDOTITE REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GOETHITE	CENOZOIC	OXIDES(EXCLUDING SiO ₂)
MONTMORILLONITE	CENOZOIC	SILICATES
GARNIERITE	CENOZOIC	SILICATES
MAGNESITE	CENOZOIC	CARBONATES

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_____. SUMMARY OF GEOLOGY, PROSPECTING, AND EXPLORATION OF PHILIPPINE NICKEL DEPOSITS. 1980, P. 6.

U.S. BUREAU OF MINES. MINERALS YEARBOOK, 1976, P. 850.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: SABLAYAN DEPOSIT SEQUENCE NUMBER: 5650230003

NATION: PHILIPPINES SUBDIVISION: MINDORO

TYPE OF OPERATION: MINERAL LOCATION CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: N 13 DEG 4 MIN 0 SEC LONGITUDE: E 121 DEG 9 MIN 0 SEC

UTM - ZONE: 51 HEMISPHERE: NORTHERN NORTHING: 1445150 EASTING: 299403

ELEVATION: 150 METERS PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:
ANGLO PHILIPPINES OIL CORPORATION

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SILICATE	PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE MINERAL IN PLACE	TRENCHING/AUGER

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: IRREGULAR: TABULAR

CONTROLLING FEATURES: INTRUSION

MINERALIZED ZONE:	MINIMUM DEPTH/METERS:
AVERAGE DEPTH/METERS: 0.5	0
AVERAGE THICKNESS/METERS: 5.5	

UNCONSOLIDATED MATERIAL:

MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: CRETACEOUS

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

ULTRAMAFIC IGNEOUS	REPLACED BY ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	CENOZOIC	SILICATES
OLIVINE	CENOZOIC	SILICATES
PYROXENE	CENOZOIC	SILICATES
LIMONITE	CENOZOIC	OXIDES(EXCLUDING SiO_2)
MONTMORILLONITE	CENOZOIC	SILICATES
SERPENTINE		SILICATES

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PHILIPPINE BUREAU OF MINES AND GEOSCIENCES. BUREAU OF MINES 5 AND 10 YEAR INTEGRATED MINERALS RESOURCES DEVELOPMENT PLAN, 1979-1988 AND PERSPECTIVE: YEAR 2000. MANILA, PHILIPPINES, JUNE 1978.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: SORIANO PALAWAN	SEQUENCE NUMBER: 5650270012
NATION: PHILIPPINES	SUBDIVISION: PALAWAN ARCHIPELAGO
TYPE OF OPERATION: SURFACE	CURRENT STATUS: DEVELOPED DEPOSIT
LATITUDE: N 9 DEG 37 MIN 0 SEC	LONGITUDE: E 118 DEG 20 MIN 0 SEC
UTM - ZONE: 50 HEMISPHERE: NORTHERN	NORTHING: 1063247 EASTING: 646309
POINT OF REFERENCE: ORE BODY	
ELEVATION: 450 METERS	PRECISION: 100 METERS
DATUM: SEA LEVEL	

ALTERNATE NAMES: NG BIRONG, MOORSOM POINT
AND LONG POINT DEPOSITS

OWNERSHIP:	STATUS:
ATLAS CONSOLIDATED MINING AND DEVELOPMENT CORPORATION	OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
NICKEL	SILICATES	PRIMARY
COBALT		COPRODUCT
WATER CONTENT	FREE WATER	AFFECT MARKETABILITY
IRON	OXIDES (EXCLUDING SIO2)	AFFECT MARKETABILITY

PUBLISHED RESERVE/RESOURCE INFORMATION

	RECORD 1	RECORD 2
MEASURED		80,200,000
INDICATED	275,000,000	
UNITS	MT ORE	MT ORE
YEAR/DATA	1977	1977

IN SITU GRADE:

RECORD	ASSAY/FORM	GRADE	UNIT
1	NI	1.29	WT-PCT
2	NI	1.42	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: ONG, P. M., AND A. C. SEVILLANO. GEOCHEMISTRY IN THE EXPLORATION OF NICKELIFEROUS LATERITE. J. OF THE GEOL. SOC. OF THE PHILIPPINES, V. 29, NO. 3, SEPT. 1975, PP. 29-46.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOCHEMICAL AND	GEOLOGICAL MAPPING/GEOCHEMICAL
GEOPHYSICAL ANOMALY	GEOLOGICAL INFERENCE/GEOPHYSICAL
YEAR OF DISCOVERY: 1967	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: IRREGULAR: MASSIVE
CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE LENGTH/METERS: 9,500

AVERAGE WIDTH/METERS: 7,167

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: CRETACEOUS

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

PERIDOTITE	ENCLOSES ORE: REPLACED BY ORE
DUNITE	ENCLOSES ORE: REPLACED BY ORE
PYROXENITE	NEAR ORE
GABBRO	NEAR ORE
DIABASE	NEAR ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	CENOZOIC	SILICATES

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MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 7
 AVERAGE LENGTH/METERS: 3,000
 AVERAGE THICKNESS/METERS: 7

MINIMUM DEPTH/METERS: 3
 AVERAGE WIDTH/METERS: 2,500

UNCONSOLIDATED MATERIAL:

AVERAGE THICKNESS/METERS: 7

MINIMUM THICKNESS/METERS: 3

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE
 GEOLOGIC AGE: CRETACEOUS
 DEFORMATION DESCRIPTION: INTRUSION
 RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION
 GEOLOGIC AGE: CRETACEOUS
 ROCK TYPE:
 PYROXENITE LIES UNDER ORE: REPLACED BY ORE
 DUNITE LIES UNDER ORE: REPLACED BY ORE
 PERIDOTITE REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GARNIERITE	CRETACEOUS	SILICATES	PHANERITIC-MEDIUM
DIASPORE	CRETACEOUS	OXIDES (EXCLUDING SiO2)	PHANERITIC-MEDIUM
TALC	CRETACEOUS	SILICATES	PHANERITIC-MEDIUM
CHLORITE	CRETACEOUS	OXIDES (EXCLUDING SiO2)	PHANERITIC-MEDIUM
LIMONITE	CRETACEOUS	OXIDES (EXCLUDING SiO2)	

MINE/MILL INFORMATION

SURFACE MINING:

METHOD: OPEN PIT
 CAPACITY: 1,600
 DESCRIPTION OF COVER: SAND, GRAVEL
 AVERAGE COVER THICKNESS: 7
 HARDNESS OF ORE: HARDPAN
 BENCH HEIGHT: 3

UNITS: MT ORE/DAY

SURFACE AREA OF MINE: 750 HECTARES

BENEFICIATION:

METHOD: SIZING
 DESIGN CAPACITY: 1,369
 UNITS: MT ORE/DAY
 DEPOSIT PERCENT USED: 100
 TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
 ORE/CRUSH/SCREEN

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI CONC.	NI	92	39.8	WT-PCT

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ROCK TYPE:	
SERPENTINITE	NEAR ORE
PERIDOTITE	REPLACED BY ORE
DUNITE	REPLACED BY ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
GARNIERITE	CENOZOIC	SILICATES	PHANERITIC-FINE
CHROMITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-FINE
MAGNETITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-FINE
LIMONITE	CENOZOIC	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-FINE
MONTMORILLONITE	CENOZOIC	SILICATES	PHANERITIC-FINE

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: INFANTA (IPILAN)

SEQUENCE NUMBER: 5650270018

NATION: PHILIPPINES

SUBDIVISION: PALAWAN ARCHIPELAGO

TYPE OF OPERATION: SURFACE

CURRENT STATUS: PAST PRODUCER

LATITUDE: N 8 DEG 31 MIN 0 SEC

LONGITUDE: E 117 DEG 45 MIN 0 SEC

UTM - ZONE: 50 HEMISPHERE: NORTHERN

NORTHING: 941437 EASTING: 582545

POINT OF REFERENCE: CLAIM

PRECISION: 100 METERS

ELEVATION: 425 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

PHILIPPINE GOVERNMENT

OWNER

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATES

PRIMARY

COBALT

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED 4,506,000
UNITS MT ORE
YEAR/DATA 1973

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
NI	2.2	WT-PCT
CO	1.8	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: PHILIPPINE MINING RECORD. JAN. 1974, P. 12.

RESERVES ESTABLISHED ON 11 OF 124 CLAIMS.

RESERVES PRIOR TO PRODUCTION STARTUP IN 1977; MINE PRODUCED FOR 18 MONTHS;
SHUTDOWN 1978.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1970

-----EXPLORATION METHODS-----

YEAR OF INITIAL PRODUCTION: 1977

TEST PIT/BEDROCK SAMPLING

YEAR OF FINAL PRODUCTION: 1978

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: TABULAR: IRREGULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 16

MINIMUM DEPTH/METERS: 13

AVERAGE THICKNESS/METERS: 13

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: CRETACEOUS

DEFORMATION DESCRIPTION: FAULTING: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

PERIDOTITE REPLACED BY ORE

DUNITE REPLACED BY ORE

SAXONITE LIES ALONG ORE

PYROXENITE LIES ALONG ORE

SERPENTINITE LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
GARNIERITE	CENOZOIC	SILICATES
CHRYSOTILE	CENOZOIC	SILICATES
SERPENTINE	CENOZOIC	SILICATES

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BELLEZA, G. V., AND N. R. LAPUZ. SUMMARY OF GEOLOGY, PROSPECTING AND EXPLORATION OF PHILIPPINE NICKEL DEPOSITS. PHILIPPINE BUMINES, 1980.

PHILIPPINE MINING RECORD. INFANTA MINERAL AND INDUSTRIAL CORPORATION. JAN. 1974, PP. 12-14.

WORLD MINING. INFANTA MINERAL CONTRACTS NICKEL ORE SALES TO SUMITOMO. DEC. 1971.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: BORONGAN

SEQUENCE NUMBER: 5650330004

NATION: PHILIPPINES

SUBDIVISION: SAMAR

TYPE OF OPERATION: SURFACE

CURRENT STATUS: EXPLORED PROSPECT

LATITUDE: N 11 DEG 30 MIN 0 SEC

LONGITUDE: E 125 DEG 15 MIN 0 SEC

UTM - ZONE: 51 HEMISPHERE: NORTHERN

NORTHING: 1272147 EASTING: 745436

POINT OF REFERENCE: ORE BODY

PRECISION: 500 METERS

ELEVATION: 350 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

G. Y. ORNOPIA

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SILICATES

PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

INDICATED 13,278,300

UNITS MT ORE

YEAR/DATA 1978

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

NI

0.58

WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: NICKEL. MINERAL ECONOMICS AND INFORMATION DIVISION, PHILIPPINE
BUMINES INFORMATION SERIES NO. 5, MANILA PHILIPPINES, 1978, PP. 1-4.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE

SURFACE GEOLOGIC MAPPING/TEST PIT

YEAR OF DISCOVERY: 1968

GEOCHEMICAL

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE

MODE OF ORIGIN: RESIDUAL CONCENTRATION

SHAPE OF ORE BODY: TABULAR: IRREGULAR

CONTROLLING FEATURES: LITHOLOGY

MINERALIZED ZONE:

AVERAGE THICKNESS/METERS: 5

LITHOLOGY:

NAME OF FORMATION: ULTRAMAFIC INTRUSIVE

GEOLOGIC AGE: CRETACEOUS

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: CRETACEOUS

ROCK TYPE:

ULTRAMAFIC IGNEOUS

REPLACED BY ORE

MINERALIZATION:

MINERAL NAME

AGE

MINERAL CLASS

GARNIERITE

CENOZOIC

SILICATES

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REPUBLIC OF SOUTH AFRICA

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: RUSTENBURG SECTION	SEQUENCE NUMBER: 7910200001
NATION: REPUBLIC OF SOUTH AFRICA	SUBDIVISION: TRANSVAAL
TYPE OF OPERATION: UNDERGROUND	CURRENT STATUS: PRODUCER
LATITUDE: S 27 DEG 45 MIN 36 SEC	LONGITUDE: E 25 DEG 52 MIN 12 SEC
UTM - ZONE: 35 HEMISPHERE: SOUTHERN	NORTHING: 6929042 EASTING: 388644
POINT OF REFERENCE: APPROXIMATE	PRECISION: 5 KILOMETERS
ELEVATION: 1,200 METERS	PRECISION: 100 METERS
DATUM: SEA LEVEL	

TYPE OF MINERAL HOLDING: FEDERAL LEASE: MINERALS ONLY

ALTERNATE NAMES: RUSTENBURG PLATINUM MINE

OWNERSHIP:	STATUS:
RUSTENBURG PLATINUM MINES, LTD.	OWNER-OPERATOR

COMMODITY	MODIFIER	MARKETABILITY
PLATINUM GROUP	PLATINUM	PRIMARY
PLATINUM GROUP	PALLADIUM	BYPRODUCT
GOLD		BYPRODUCT
NICKEL		BYPRODUCT
COPPER		BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
ORE-MINERAL IN PLACE	CORE DRILLING/TEST DRIFT/CROSSCUT
YEAR OF DISCOVERY: 1920	
YEAR OF INITIAL PRODUCTION: 1926	
YEAR OF FINAL PRODUCTION: PRODUCING	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STRATIFORM LAYER
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: IGNEOUS

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 100	
STRIKE/DIP: N82W: 10N	
AVERAGE LENGTH/METERS: 4,500	AVERAGE WIDTH/METERS: 800
AVERAGE THICKNESS/METERS: 1.5	

UNCONSOLIDATED MATERIAL:
AVERAGE THICKNESS/METERS: 2

LITHOLOGY:

NAME OF FORMATION: BUSHVELT IGNEOUS COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: INTRUSION: FAULTING
RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
GABBRO LIES OVER ORE
ANORTHOSITE LIES OVER ORE: LIES UNDER ORE
PYROXENITE LIES OVER ORE: ENCLOSURES ORE
UNSPECIFIED IGNEOUS IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
SPERRYLITE	PRECAMBRIAN	ARSENIC AND ANTIMONY COMPOUNDS
PLATINUM	PRECAMBRIAN	NATIVE ELEMENT
PYROLUSITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO ₂)

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: OPEN STOPE
CHARACTERISTIC OF ROCK: ONE SYSTEM OF WEAKNESS PLANES
ROCK AND WATER CONDITIONS: HARDROCK WITH LITTLE WATER
SHAFTS - NUMBER: 6 AVERAGE DEPTH: 583 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: SOUTH AFRICA
LATITUDE: S 27 45 36	LONGITUDE: E 25 52 12
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: RAIL	DISTANCE (KM): 730
DESTINATION FACILITY: REFINERY	LOCATION: UNITED KINGDOM

BENEFICIATION:

METHOD: GRAVITY
DEPOSIT PERCENT USED: 100

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: IMPALA

SEQUENCE NUMBER: 7910200003

NATION: REPUBLIC OF SOUTH AFRICA

SUBDIVISION: TRANSVAAL

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: S 27 DEG 10 MIN 0 SEC

LONGITUDE: E 25 DEG 45 MIN 0 SEC

UTM - ZONE: 35 HEMISPHERE: SOUTHERN

NORTHING: 7175217 EASTING: 520092

POINT OF REFERENCE: CLAIM

PRECISION: 1 KILOMETER

ELEVATION: 1,200 METERS

PRECISION: 100 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

IMPALA PLATINUM, LTD.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

PLATINUM GROUP

PLATINUM

COPRODUCT

PLATINUM GROUP

PALLADIUM

COPRODUCT

GOLD

BYPRODUCT

NICKEL

SULFIDE

BYPRODUCT

COPPER

BYPRODUCT

COBALT

AFFECT MARKETABILITY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ORE-MINERAL IN PLACE

TEST PIT/TRENCHING/TEST WINZE/

YEAR OF DISCOVERY: 1924

GEOCHEMICAL/GEOPHYSICAL/DRILLING/

YEAR OF INITIAL PRODUCTION: 1969

TEST SHAFT

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STRATIFORM LAYER

MODE OF ORIGIN: MAGMATIC DIFFERENTIATION

SHAPE OF ORE BODY: TABULAR

CONTROLLING FEATURES: IGNEOUS

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 480

MINIMUM DEPTH/METERS: 0

STRIKE/DIP: N45W: 09E

AVERAGE LENGTH/METERS: 12,500

AVERAGE WIDTH/METERS: 7,800

AVERAGE THICKNESS/METERS: 0.9

UNCONSOLIDATED MATERIAL:

MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: BUSHVELD IGNEOUS COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: FAULTING: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
ANORTHOSITE LIES OVER ORE
MAFIC IGNEOUS LIES OVER ORE
PYROXENITE LIES OVER ORE
UNSPECIFIED IGNEOUS NEAR ORE: LIES OVER ORE
PYROXENITE IS ORE
UNSPECIFIED IGNEOUS NEAR ORE: LIES UNDER ORE
ANORTHOSITE LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-MEDIUM
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-MEDIUM
PYRRHOTITE	PRECAMBRIAN	SULFIDES	PHANERITIC-MEDIUM
PYROXENE	PRECAMBRIAN	SILICATES	PHANERITIC-MEDIUM
CHROMITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO ₂)	PHANERITIC-MEDIUM
GRAPHITE	PRECAMBRIAN	NATIVE ELEMENT	PHANERITIC-MEDIUM
PYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-MEDIUM

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: ROOM AND PILLAR
CAPACITY: 15,920 UNITS: MT ORE/DAY
CHARACTERISTIC OF ROCK: NO PLANES OF WEAKNESS
ROCK AND WATER CONDITIONS: HARDROCK WITH LITTLE WATER
ROCK/MINE SUPPORT: SUPPORTING MAY BACK SLAB POST, HEADBOARD, CAPS, ROOF BOLTS
CONDITION OF WORKINGS: OPEN
SHAFTS - NUMBER: 21 AVERAGE DEPTH: 280 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: BAFOKENG MINES
LATITUDE: S 27 10 00	LONGITUDE: E 27 12 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: RAIL	DISTANCE (KILOMETERS): 18
DESTINATION FACILITY: MILL (OFF-SITE)	LOCATION: RUSTENBURG MILL/SMELTER
LATITUDE: S 25 40 00	LONGITUDE: E 27 15 00

BENEFICIATION:

METHOD: FLOTATION	----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 13,645	RUN-OF-MINE ORE/SEMI-AUTOGENOUS GRIND
UNITS: MT ORE/DAY	CYCLONE CLASSIFYING/CONDITION/FLOTATION
DEPOSIT PERCENT USED: 100	DRYING/FEED TO SMELTER
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
CONCENTRATE	PT	95	53.2	GM/MT
	PD	88	33.0	GM/MT
	AU	85	6.6	GM/MT
	NI	84	2.3	WT-PCT
	CU	83	2.27	WT-PCT

BENEFICIATION:

METHOD: PYROMETALLURGY
 DESIGN CAPACITY: 1,000
 UNITS: MT CONCENTRATE DAY
 DEPOSIT PERCENT USED: 100
 TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
 8% H2O CONCENTRATE/ELECTRIC ARC SMELTER
 CONVERTING/COOLING/CRUSH TO 1.3 CM/
 DRUMMING

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
MATTE	PT	97	925.9	GM/MT
	PD	97	574.2	GM/MT
	AU	97	115.0	GM/MT
	NI	97	40.0	WT-PCT
	CU	97	39.0	WT-PCT

TRANSPORTATION FOR PRODUCT: MATTE

ORIGINATING FACILITY: SMELTER
 LATITUDE: S 25 40 00
 PERCENT SHIPPED: 100
 METHOD OF TRANSPORTATION: RAIL
 DESTINATION FACILITY: REFINERY
 LATITUDE: S 26 16 00

LOCATION: RUSTENBURG MILL/SMELTER
 LONGITUDE: E 27 15 00

DISTANCE (KILOMETERS): 220
 LOCATION: SPRINGS REFINING COMPLEX
 LONGITUDE: E 28 26 00

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: WESTERN PLATINUM(MARIKANA) SEQUENCE NUMBER: 7910200005

NATION: REPUBLIC OF SOUTH AFRICA
TYPE OF OPERATION: UNDERGROUND
LATITUDE: S 25 DEG 43 MIN 0 SEC
UTM - ZONE: 35 HEMISPHERE: SOUTHERN
POINT OF REFERENCE: CLAIM
ELEVATION: 950 METERS
DATUM: SEA LEVEL

SUBDIVISION: TRANSVAAL
CURRENT STATUS: PRODUCER
LONGITUDE: E 27 DEG 35 MIN 45 SEC
NORTHING: 7155719 EASTING: 559773
PRECISION: 1 KILOMETER
PRECISION: 100 METERS

ALTERNATE NAMES: MIDDLEKRAAL
LONRHO OPERATIONS

OWNERSHIP:
WESTERN PLATINUM, LTD.
LONRHO SOUTH AFRICA, LTD.
FALCONBRIDGE NICKEL MINES, LTD.
SUPERIOR OIL COMPANY

STATUS:
OPERATOR
OWNER
OWNER
OWNER

COMMODITY	MODIFIER	MARKETABILITY
PLATINUM GROUP	PLATINUM	COPRODUCT
PLATINUM GROUP	PALLADIUM	COPRODUCT
GOLD		BYPRODUCT
NICKEL		BYPRODUCT
COPPER		BYPRODUCT
COBALT		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED	1,929,000
INDICATED	158,880,000
INFERRED	200,000,000
UNITS	MT ORE
YEAR/DATA	1982

IN SITU GRADE:

ASSAY/FORM	GRADE	UNIT
PT GROUP	4.07	GM/MT
NI	0.16	WT-PCT
CU	.10	WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: ENGINEERING AND MINING JOURNAL. INTERNATIONAL DIRECTORY OF MINING.
1982, P. 382.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

ORE-MINERAL IN PLACE
YEAR OF DISCOVERY: 1925
YEAR OF INITIAL PRODUCTION: 1971
YEAR OF FINAL PRODUCTION: PRODUCING

-----EXPLORATION METHODS-----
TEST PIT/TRENCHING/DRILLING/
TEST WINZE

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STRATIFORM LAYER
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: TABULAR
CONTROLLING FEATURES: IGNEOUS

MINERALIZED ZONE:

AVERAGE DEPTH/METERS: 550	MINIMUM DEPTH/METERS: 0
STRIKE/DIP: N80E: 10N	
AVERAGE LENGTH/METERS: 10,000	AVERAGE WIDTH/METERS: 6,090
AVERAGE THICKNESS/METERS: 0.85	

UNCONSOLIDATED MATERIAL:

MINIMUM THICKNESS/METERS: 0

LITHOLOGY:

NAME OF FORMATION: BUSHVELD IGNEOUS COMPLEX
GEOLOGIC AGE: PRECAMBRIAN
DEFORMATION DESCRIPTION: FAULTING: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION
GEOLOGIC AGE: PRECAMBRIAN
ROCK TYPE:
ANORTHOSITE LIES OVER ORE
MAFIC IGNEOUS LIES OVER ORE
PYROXENITE NEAR ORE: LIES OVER ORE
UNSPECIFIED IGNEOUS IS ORE
PYROXENITE NEAR ORE: LIES UNDER ORE
UNSPECIFIED IGNEOUS LIES UNDER ORE
ANORTHOSITE LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS	GRAIN SIZE
PYRRHOTITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
CHALCOPYRITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
PENTLANDITE	PRECAMBRIAN	SULFIDES	PHANERITIC-FINE
PYROXENE	PRECAMBRIAN	SILICATES	PHANERITIC-FINE
CHROMITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO2)	PHANERITIC-FINE

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: ROOM AND PILLAR
CAPACITY: 4,000 UNITS: MT ORE/DAY
CHARACTERISTIC OF ROCK: NO PLANES OF WEAKNESS
ROCK AND WATER CONDITIONS: HARDROCK WITH LITTLE WATER
CONDITION OF WORKINGS: OPEN
TOTAL LENGTH OF WORKINGS: 4,000 METERS
INCLINES - NUMBER: 2 AVERAGE LENGTH: 600 METERS
SHAFTS - NUMBER: 2 AVERAGE DEPTH: 315 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE LOCATION: W. PLATINUM SHAFTS
LATITUDE: S 25 43 00 LONGITUDE: E 27 35 45
PERCENT SHIPPED: 100
METHOD OF TRANSPORTATION: CONVEYOR DISTANCE (KM): 0.6
DESTINATION FACILITY: MILL (OFF-SITE) LOCATION: W. PLATINUM MILL/SMELTER
LATITUDE: S 25 43 30 LONGITUDE: E 27 35 45

BENEFICIATION:

METHOD: FLOTATION ----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 4,000 ORE/2-STAGE CRUSH/GRIND(BALL AND ROD)/
UNITS: MT ORE/DAY ROUGH/CLEAN FLOTATION
DEPOSIT PERCENT USED: 100 FILTER/DRY/FEED TO SMELTER
TOTAL PERCENT USED: 100

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
FLOTATION CONC.	PT	93	19.09	GM/MT
	PD	69	28.53	GM/MT
	AU	91	2.37	GM/MT
	NI	89	2.33	WT-PCT
	CU	89	1.79	WT-PCT

BENEFICIATION:

METHOD: PYROMETALLURGY ----- DESCRIPTION OF MILLING -----
DESIGN CAPACITY: 199.5 CONCENTRATE/ELECTRIC ARC SMELTING
UNITS: MT CONC/DAY CONVERTING/COOLING
DEPOSIT PERCENT USED: 100 CRUSH TO 1.3 CENTIMETERS/DRUMMING
TOTAL PERCENT USED: 100

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
MATTE	PT	97	369.5	GM/MT
	PD	97	397.9	GM/MT
	AU	97	45.95	GM/MT
	NI	97	45.0	WT-PCT
	CU	97	35.0	WT-PCT

TRANSPORTATION FOR PRODUCT: MATTE

ORIGINATING FACILITY: SMELTER LOCATION: W. PLATINUM MILL/SMELTER
LATITUDE: S 25 43 30 LONGITUDE: E 27 35 45
PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: RAIL: OCEAN DISTANCE (KM): 8000
DESTINATION FACILITY: REFINERY LOCATION: KRISTIANSAND, NORWAY
LATITUDE: N 58 08 00 LONGITUDE: E 08 01 00

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LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: DER BROCHEN (DERBROKEN) SEQUENCE NUMBER: 7910200181
NATION: REPUBLIC OF SOUTH AFRICA SUBDIVISION: TRANSVAAL
TYPE OF OPERATION: UNDERGROUND CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: S 25 DEG 7 MIN 0 SEC LONGITUDE: E 30 DEG 7 MIN 30 SEC
UTM - ZONE: 36 HEMISPHERE: SOUTHERN NORTHING: 7219202 EASTING: 210075
POINT OF REFERENCE: ORE BODY PRECISION: 5 KILOMETER
ELEVATION: 9840 METERS PRECISION: 10 METERS
DATUM: SEA LEVEL

OWNERSHIP:

JOHANNESBURG CONSOLIDATED INVESTMENT COMPANY, LTD.
EAST RAND CONSOLIDATED

COMMODITY	MODIFIER	MARKETABILITY
PLATINUM GROUP	PLATINUM	PRIMARY
PLATINUM GROUP	PALLADIUM	RECOVERABLE
NICKEL		RECOVERABLE
COPPER		RECOVERABLE
SILVER		RECOVERABLE
GOLD		RECOVERABLE
COBALT		RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:
ORE-MINERAL IN PLACE

-----EXPLORATION METHODS-----
GEOLOGICAL

BIBLIOGRAPHY RECORDS

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_____. WEST PLATS PROGRESS. JUNE 1972.

PAYNE, A. WESTPLAT SEES EXTRA R20M. RUSTENBURG DAILY MAIL, OCT. 16, 1980.

UPPER VOLTA

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: BOROMO GREENSTONE (BONGA)	SEQUENCE NUMBER: 7600000002
NATION: UPPER VOLTA	SUBDIVISION: NOT SUBDIVIDED
TYPE OF OPERATION: SURFACE	CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: N 11 DEG 57 MIN 0 SEC	LONGITUDE: W 2 DEG 44 MIN 30 SEC
UTM - ZONE: 30 HEMISPHERE: NORTHERN	NORTHING: 132 09 55 EASTING: 528127
POINT OF REFERENCE: TOWN	PRECISION: 10 KILOMETERS
OWNERSHIP: GOVERNMENT	STATUS: OWNER
COMMODITY NICKEL	MARKETABILITY PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:	-----EXPLORATION METHODS-----
GEOCHEMICAL AND GEOPHYSICAL ANOMALY	GEOCHEMICAL/DRILLING/TEST PIT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: LATERITE
MODE OF ORIGIN: RESIDUAL CONCENTRATION
SHAPE OF ORE BODY: IRREGULAR
CONTROLLING FEATURES: IGNEOUS

MINERALIZED ZONE:
AVERAGE THICKNESS/METERS: 20

BIBLIOGRAPHY RECORDS

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ZIMBABWE

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: MADZIWA

SEQUENCE NUMBER: 7960000001

NATION: ZIMBABWE

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: S 17 DEG 0 MIN 0 SEC

LONGITUDE: E 31 DEG 40 MIN 0 SEC

UTM - ZONE: 36 HEMISPHERE: SOUTHERN

NORTHING: 812 00 76 EASTING: 358062

POINT OF REFERENCE: ORE BODY

ELEVATION: 970 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

MADZIWA MINES COMPANY, LTD.

STATUS:

OPERATOR

BINDURA NICKEL CORPORATION, LTD.

OWNER

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

UNDIFFERENTIATED

7,800,000

UNITS

MT ORE

YEAR/DATA

1972

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

NI

1.04

WT-PCT

CU

0.34

WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: MINING MAGAZINE. FEB. 1972, P. 81.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----
TEST SHAFT

ORE-MINERAL IN PLACE

YEAR OF DISCOVERY: 1959

YEAR OF INITIAL PRODUCTION: 1969

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: STOCKWORK: DISSEMINATED

MODE OF ORIGIN: MAGMATIC DIFFERENTIATION

SHAPE OF ORE BODY: PIPELIKE: LENTICULAR

CONTROLLING FEATURES: FAULTING: IGNEOUS

MINERALIZED ZONE:

AVERAGE WIDTH/METERS: 120

AVERAGE THICKNESS/METERS: 30

LITHOLOGY:

NAME OF FORMATION: MADZIWA IGNEOUS COMPLEX

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: FOLDING: FAULTING: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING DEFORMATION

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

AMPHIBOLITE IS ORE

PYROXENITE IS ORE

PERIDOTITE IS ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
PYRITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION**UNDERGROUND MINING:**

METHOD: OPEN STOPE

CAPACITY: 1,500

SHAFTS - NUMBER: 2

UNITS: MT ORE/DAY

AVERAGE DEPTH: 384 METERS

BENEFICIATION:

METHOD: FLOTATION

DESIGN CAPACITY: 1,500

UNITS: MT ORE/DAY

DEPOSIT PERCENT USED: 100

TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
 ORE/CRUSH/GRIND/MAGNETIC SEPARATOR/
 FLOTATION/NICKEL CONC.

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI CONC.	NI	77	10.0	WT-PCT
	CU	87	3.8	WT-PCT

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U.S. BUREAU OF MINES. MINERALS YEARBOOK. 1966-1967.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: TROJAN MINE

SEQUENCE NUMBER: 7960100011

NATION: ZIMBABWE

SUBDIVISION: MASHONALAND NORTH

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: S 17 DEG 19 MIN 48 SEC

LONGITUDE: E 31 DEG 19 MIN 48 SEC

UTM - ZONE: 36 HEMISPHERE: SOUTHERN

NORTHING: 8083283 EASTING: 322530

ELEVATION: 1,530 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

TROJAN NICKEL MINE, LTD.

OWNER-OPERATOR

BINDURA NICKEL CORPORATION, LTD.

OWNER

COMMODITY

MARKETABILITY

NICKEL

PRODUCT

COPPER

BYPRODUCT

COBALT

RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

UNDIFFERENTIATED 10,600,000

UNITS MT ORE

YEAR/DATA 1972

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

NI

0.865

WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: MINING MAGAZINE. FEB. 1972, P. 81.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

-----EXPLORATION METHODS-----

ASSOCIATED MINERAL IN PLACE

GEOLOGICAL/SURFACE GEOLOGIC MAPPING/

YEAR OF DISCOVERY: 1957

DETAIL SOIL SAMPLING/GEOPHYSICAL

YEAR OF INITIAL PRODUCTION: 1969

DRILLING

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: FISSURE VEIN

MODE OF ORIGIN: MAGMATIC DIFFERENTIATION: OXIDATION

SHAPE OF ORE BODY: OTHER

CONTROLLING FEATURES: LITHOLOGY: IGNEOUS ACTIVITY

MINERALIZED ZONE:

STRIKE/DIP: N80W: 84N

AVERAGE LENGTH/METERS: 274

AVERAGE WIDTH/METERS: 180

AVERAGE THICKNESS/METERS: 35

LITHOLOGY:

NAME OF FORMATION: BULAWAYAN GROUP

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: MAJOR FOLDING: FAULTING

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

SERPENTINITE

ORE IN FRACTURES: IS ORE

DUNITE

IS ORE

BASALT

LIES OVER ORE: LIES UNDER ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
MILLERITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES
MAGNETITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO2)
ILMENITE	PRECAMBRIAN	OXIDES (EXCLUDING SiO2)

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: SUBLEVEL

CAPACITY: 3,167

UNITS: MT ORE/DAY

CHARACTERISTIC OF ROCK: ONE SYSTEM OF WEAKNESS PLANES

ROCK AND WATER CONDITIONS: HARDROCK, FISSURED WITH MODERATE WATER

ROCK/MINE SUPPORT: UNSUPPORTING, MAY SLOUGH-POST, HEADBOARD, CAPS, ROOF BOLTS

CONDITION OF WORKINGS: OPEN

AVERAGE LENGTH: 38 METERS

SHAFTS - NUMBER: 3

AVERAGE DEPTH: 550 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: TROJAN MINE, ZIMBABWE

LATITUDE: S 17 20 00

LONGITUDE: E 31 21 00

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: TRUCK

DESTINATION FACILITY: MILL (ON-SITE)

LOCATION: TROJAN MILL, ZIMBABWE

LATITUDE: S 17 20 00

LONGITUDE: E 31 21 00

BENEFICIATION:

METHOD: FLOTATION

DESIGN CAPACITY: 3,167

UNITS: MT ORE/DAY

DEPOSIT PERCENT USED: 100

TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
ORE/2-STAGE CRUSH/2-STAGE GRIND/FLOAT
THICKEN/FILTER/NI-CO-CU CONCENTRATE

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CU-CO CONC.	NI	70	11.0	WT-PCT
	CU	70	1.80	WT-PCT
	CO	35	0.009	WT-PCT

TRANSPORTATION FOR PRODUCT: NI-CU-CO CONCENTRATE

ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: TROJAN MILL, ZIMBABWE
LATITUDE: S 17 20 00	LONGITUDE: E 31 21 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	DISTANCE (KM): 1
DESTINATION FACILITY: SMELTER/REFINERY	LOCATION: BINDURA SMELTER
LATITUDE: S 17 20 00	LONGITUDE: E 31 21 00

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MINING JOURNAL. 1972, PP. 120, 337, 417.

MINING MAGAZINE. NOV. 1972, P. 81.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: EMPRESS

SEQUENCE NUMBER: 7960150009

NATION: ZIMBABWE

SUBDIVISION: MASHONALAND SOUTH

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: S 18 DEG 28 MIN 0 SEC

LONGITUDE: E 29 DEG 25 MIN 0 SEC

UTM - ZONE: 35 HEMISPHERE: SOUTHERN

NORTHING: 7956600 EASTING: 755217

POINT OF REFERENCE: ORE BODY

ELEVATION: 1033 METERS

PRECISION: 10 METERS

DATUM: SEA LEVEL

OWNERSHIP:

STATUS:

EMPRESS NICKEL MINING COMPANY, LTD.

OWNER-OPERATOR

COMMODITY

MODIFIER

MARKETABILITY

NICKEL

SULFIDE

PRIMARY

COPPER

SULFIDE

BYPRODUCT

COBALT

BYPRODUCT

PLATINUM GROUP

PLATINUM

PLATINUM GROUP

PALLADIUM

PUBLISHED RESERVE/RESOURCE INFORMATION

MEASURED 6,900,000

INDICATED 1,727,000

UNITS MT ORE

YEAR/DATA 1979

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

NI

1.27

WT-PCT

CU

WT-PCT

RESERVE/RESOURCE REMARKS

REC. 1 - EMPRESS NICKEL MINING COMPANY, LTD. ANNUAL REPORT. 1979.

REC. 2 - GRADE IS COMBINED NI-CU.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

ORE-MINERAL IN PLACE

YEAR OF DISCOVERY: 1906

YEAR OF INITIAL PRODUCTION: 1968

YEAR OF FINAL PRODUCTION: PRODUCING

-----EXPLORATION METHODS-----

DETAIL SOIL SAMPLING/MAGNETIC SURVEY

ELECTROMAGNETIC SURVEY/DRILLING

TEST TUNNEL/TEST SHAFT

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: MASSIVE
CONTROLLING FEATURES: IGNEOUS
WALL ROCK ALTERATION: POTASSIC
DEGREE OF ALTERATION: INTENSE

MINERALIZED ZONE:

STRIKE/DIP: N45E: 65E

AVERAGE LENGTH/METERS: 600

AVERAGE WIDTH/METERS: 14.4

LITHOLOGY:

NAME OF FORMATION: IGNEOUS COMPLEX

DEFORMATION DESCRIPTION: INTRUSION

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION

ROCK TYPE:

AMPHIBOLITE

IS ORE

QUARTZ MONZONITE

NEAR ORE

MINERALIZATION:

MINERAL NAME

MINERAL CLASS

PYRRHOTITE

SULFIDES

PENTLANDITE

SULFIDES

CHALCOPYRITE

SULFIDES

PYRITE

SULFIDES

CHALCOCITE

SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: SUBLEVEL

CAPACITY: 2,933

UNITS: MT ORE/DAY

ROCK/MINE SUPPORT: SUPPORTING

CONDITION OF WORKINGS: OPEN

TOTAL LENGTH OF WORKINGS:

SHAFTS - NUMBER: 2

AVERAGE DEPTH: 500 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE

LOCATION: EMPRESS MINE

LATITUDE: S 18 28 00

LONGITUDE: E 29 25 00

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: TRUCK

DISTANCE (KM): 1

DESTINATION FACILITY: MILL (ON-SITE)

LOCATION: EMPRESS MILL

LATITUDE: S 18 28 00

LONGITUDE: E 29 25 00

BENEFICIATION:

METHOD: FLOTATION
 DESIGN CAPACITY: 2,933
 UNITS: MT ORE/DAY
 DEPOSIT PERCENT USED: 100
 TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
 ORE/CRUSH/GRIND/
 FLOAT/NI CONCENTRATE

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CU CONC.	NI	85	6.0	WT-PCT
	CU	90	6.1	WT-PCT
	CO	30	0.09	WT-PCT
	PT	82	16.4	GM/MT
	PD	82	16.4	GM/MT

TRANSPORTATION FOR PRODUCT: NI-CU CONCENTRATE

ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: EMPRESS, ZIMBABWE
LATITUDE: S 18 28 00	LONGITUDE: E 29 25 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	DISTANCE (KM): 1
DESTINATION FACILITY: SMELTER	LOCATION: EMPRESS SMELTER, ZIMBABWE
LATITUDE: S 18 28 00	LONGITUDE: E 29 25 00

TRANSPORTATION FOR PRODUCT: NI-CU CONCENTRATE

ORIGINATING FACILITY: SMELTER	LOCATION: EMPRESS SMELTER, ZIMBABWE
LATITUDE: S 18 28 00	LONGITUDE: E 29 25 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	DISTANCE (KM): 10
DESTINATION FACILITY: REFINERY	LOCATION: EIFFEL FLATS, ZIMBABWE
LATITUDE: S 18 10 00	LONGITUDE: E 30 00 00

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SHARPZ, N. W. V. THE EMPRESS NICKEL-COPPER DEPOSIT, SOUTHERN RHODESIA.
PP. 497-508.

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U. S. BUREAU OF MINES. MINERALS YEARBOOK, 1966-1976.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: SHANGANI

SEQUENCE NUMBER: 7960200007

NATION: ZIMBABWE

SUBDIVISION: MATABELELAND

TYPE OF OPERATION: UNDERGROUND

CURRENT STATUS: PRODUCER

LATITUDE: S 19 DEG 42 MIN 00 SEC

LONGITUDE: E 28 DEG 50 MIN 30 SEC

UTM - ZONE: 35 HEMISPHERE: SOUTHERN

NORTHING: 7233720 EASTING: 298150

POINT OF REFERENCE: ORE BODY

PRECISION: 10 METERS

ELEVATION: 1,500 METERS

PRECISION: 500 METERS

DATUM: SEA LEVEL

OWNERSHIP:

J.C.I. (JOHANNESBURG CONSOLIDATED INVESTMENT COMPANY)
SHANGANI MINING CORPORATION, LTD.

STATUS:

OWNER
OPERATOR

COMMODITY

NICKEL

COPPER

COBALT

MODIFIER

SULFIDE

SULFIDE

MARKETABILITY

PRIMARY

BYPRODUCT

BYPRODUCT

PUBLISHED RESERVE/RESOURCE INFORMATION

UNDIFFERENTIATED

16,000,000

UNITS

MT ORE

YEAR/DATA

1975

IN SITU GRADE:

ASSAY/FORM

GRADE

UNIT

NI

0.92

WT-PCT

CU

.12

WT-PCT

RESERVE/RESOURCE REMARKS

SOURCE: MINING MAGAZINE. STARTUP FOR NEW RHODESIAN NICKEL PRODUCER. NOV. 1975, P. 339.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD:

OTHER

-----EXPLORATION METHODS-----

RECONNAISSANCE SOIL SAMPLING

YEAR OF DISCOVERY: 1968

CORE DRILLING

YEAR OF INITIAL PRODUCTION: 1975

YEAR OF FINAL PRODUCTION: PRODUCING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED: OTHER

MODE OF ORIGIN: MAGMATIC DIFFERENTIATION

SHAPE OF ORE BODY: IRREGULAR

CONTROLLING FEATURES: IGNEOUS: LITHOLOGY

WALL ROCK ALTERATION: SERICITIC

MINERALIZED ZONE:

AVERAGE LENGTH/METERS: 140

AVERAGE WIDTH/METERS: 40

LITHOLOGY:

NAME OF FORMATION: BULAWAYAN GROUP

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: METAMORPHISM: MAJOR FOLDING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION FOLLOWING DEFORMATION

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:

ULTRAMAFIC IGNEOUS LIES ALONG ORE

BASALT LIES ALONG ORE

MINERALIZATION:

MINERAL NAME	AGE	MINERAL CLASS
PYRRHOTITE	PRECAMBRIAN	SULFIDES
PENTLANDITE	PRECAMBRIAN	SULFIDES
CHALCOPYRITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION**UNDERGROUND MINING:**

METHOD: BLASTHOLE STOPING

CAPACITY: 3,000

UNITS: MT ORE/DAY

CHARACTERISTIC OF ROCK: HARDROCK

CONDITION OF WORKINGS: OPEN

TOTAL LENGTH OF WORKINGS:

INCLINES - NUMBER: 1

AVERAGE LENGTH: 2000 METERS

AVERAGE DEPTH: 390 METERS

BENEFICIATION:

METHOD: FLOTATION

DESIGN CAPACITY: 2,400

UNITS: MT ORE/DAY

DEPOSIT PERCENT USED: 100

TOTAL PERCENT USED: 100

----- DESCRIPTION OF MILLING -----
ORE/CRUSH/GRIND/FLOAT/DEWATER
THICKEN/FILTER/DRY

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
	NI	80	13.0	WT-PCT
	CU	80	1.84	WT-PCT
	CO	35	0.009	WT-PCT

TRANSPORTATION FOR PRODUCT:

ORIGINATING FACILITY: MILL (ON-SITE)

LOCATION: SHANGANI, ZIMBABWE

LATITUDE: S 19 42 00

LONGITUDE: E 28 50 30

PERCENT SHIPPED: 100

METHOD OF TRANSPORTATION: RAIL

DISTANCE (KM): 520

DESTINATION FACILITY: SMELTER/REFINERY

LOCATION: BINDURA, ZIMBABWE

LATITUDE: S 17 20 00

LONGITUDE: E 31 21 00

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_____. 1972, P. 237.

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_____. 1973, P. 305, 307.

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STANGMAN, M. N. AN OUTLINE OF THE GEOLOGY OF RHODESIA. RHODESIA GEOL. SURV. BULL. NO. 80, PP. 33-34.

U. S. BUREAU OF MINES. MINERALS YEARBOOK, 1967-75.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: EPOCH NICKEL MINE	SEQUENCE NUMBER: 7960200035	
NATION: ZIMBABWE	SUBDIVISION: MATABELLELAND	
TYPE OF OPERATION: UNDERGROUND	CURRENT STATUS: PRODUCER	
LATITUDE: S 20 DEG 26 MIN 0 SEC	LONGITUDE: E 29 DEG 20 MIN 0 SEC	
UTM - ZONE: 35 HEMISPHERE: SOUTHERN	NORTHING: 7738967 EASTING: 743458	
POINT OF REFERENCE: ORE BODY		
ELEVATION: 1,200 METERS	PRECISION: 100 METERS	
DATUM: SEA LEVEL		
OWNERSHIP: TROJAN NICKEL MINE, LTD.	STATUS: OWNER-OPERATOR	
COMMODITY: NICKEL	MODIFIER: SULFIDE	MARKETABILITY: PRIMARY
COPPER	SULFIDE	RECOVERABLE

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

YEAR OF DISCOVERY: 1970	-----EXPLORATION METHODS-----
YEAR OF INITIAL PRODUCTION: 1974	CORE DRILLING/TEST SHAFT
YEAR OF FINAL PRODUCTION: PRODUCING	

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: PIPELIKE
CONTROLLING FEATURES: IGNEOUS: LITHOLOGY

MINERALIZED ZONE:

STRIKE/DIP: N90E: 80S

AVERAGE LENGTH/METERS: 320

AVERAGE WIDTH/METERS: 50

LITHOLOGY:

NAME OF FORMATION: ZEEDFBERGS FORMATION

GEOLOGIC AGE: PRECAMBRIAN

DEFORMATION DESCRIPTION: INTRUSION: METAMORPHISM: FAULTING

RELATIONSHIP TO MINERALIZATION: MINERALIZATION DURING DEFORMATION

GEOLOGIC AGE: PRECAMBRIAN

ROCK TYPE:	
SERPENTINITE	ENCLOSES ORE: NEAR ORE
BASALT	NEAR ORE
DACITE	NEAR ORE
ANDESITE	NEAR ORE
TUFF	NEAR ORE
VOLCANIC BRECCIA	NEAR ORE
AGGLOMERATE	NEAR ORE

MINERALIZATION:		
MINERAL NAME	AGE	MINERAL CLASS
PENTLANDITE	PRECAMBRIAN	SULFIDES
MILLERITE	PRECAMBRIAN	SULFIDES
PYRRHOTITE	PRECAMBRIAN	SULFIDES

MINE/MILL INFORMATION

UNDERGROUND MINING:

METHOD: SUBLEVEL

CAPACITY: 1,400 UNITS: MT ORE/DAY

CHARACTERISTIC OF ROCK: MULTIPLE SYSTEMS OF WEAKNESS PLANES

ROCK AND WATER CONDITIONS: HARDROCK WITH LITTLE WATER

ROCK/MINE SUPPORT: SUPPORTING, POST, HEADBOARD, CAPS, ROOF BOLTS

CONDITION OF WORKINGS: OPEN

SHAFTS - NUMBER: 2 AVERAGE DEPTH: 300 METERS

TRANSPORTATION (ORE):

ORIGINATING FACILITY: MINE	LOCATION: EPOCH, ZIMBABWE
LATITUDE: S 20 26 00	LONGITUDE: E 29 20 00
PERCENT SHIPPED: 100	
METHOD OF TRANSPORTATION: TRUCK	DISTANCE (KM): 1.0
DESTINATION FACILITY: MILL (ON-SITE)	LOCATION: EPOCH, ZIMBABWE
LATITUDE: S 20 26 00	LONGITUDE: E 29 20 00

BENEFICIATION:

METHOD: FLOTATION ----- DESCRIPTION OF MILLING

DESIGN CAPACITY: 1,400	ORE/CRUSH/GRIND/FLOAT/DEWATER/
UNITS: MT UPGRADE/DAY	THICKEN/FILTER/DRY
DEPOSIT PERCENT USED: 100	
TOTAL PERCENT USED: 100	

PRODUCT	ASSAY/FORM	RECOVERY	CONC. GRADE	GRADE/UNIT
NI-CU CONC.	NI	72	15.0	WT-PCT
	CU	72	0.05	WT-PCT

TRANSPORTATION FOR PRODUCT: NI-CU CONCENTRATE

ORIGINATING FACILITY: MILL (ON-SITE)	LOCATION: EPOCH, ZIMBABWE
LATITUDE: S 20 26 00	LONGITUDE: E 29 20 00
PERCENT SHIPPED: 100	

METHOD OF TRANSPORTATION: RAIL
DESTINATION FACILITY: SMELTER
LATITUDE: S 17 20 00

DISTANCE (KM): 550
LOCATION: BINDURA SMELTER
LONGITUDE: E 31 21 00

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WORLD MINING. AUG. 1974.

_____. DEC. 1975, P. 37.

LOCATION AND GENERAL DEPOSIT INFORMATION

DEPOSIT NAME: HUNTERS ROAD	SEQUENCE NUMBER: 7960250047
NATION: ZIMBABWE	SUBDIVISION: MIDLANDS
TYPE OF OPERATION: UNDERGROUND	CURRENT STATUS: EXPLORED PROSPECT
LATITUDE: S 19 DEG 20 MIN 00 SEC	LONGITUDE: E 29 DEG 30 MIN 00 SEC
UTM - ZONE: 35 HEMISPHERE: SOUTHERN	NORTHING: 8987445 EASTING: 805918
OWNERSHIP: UNION CORPORATION, LTD.	STATUS: OWNER-OPERATOR
COMMODITY NICKEL	MARKETABILITY PRIMARY

PUBLISHED RESERVE/RESOURCE INFORMATION

NO PUBLISHED RESERVE/RESOURCE DATA AVAILABLE.

DEPOSIT HISTORICAL INFORMATION

DISCOVERY METHOD: ORE-MINERAL IN PLACE	-----EXPLORATION METHODS----- DRILLING/TEST SHAFT/TEST PIT/TRENCHING

GEOLOGIC AND SPATIAL CHARACTERISTICS OF DEPOSIT

TYPE OF ORE BODY: DISSEMINATED
MODE OF ORIGIN: MAGMATIC DIFFERENTIATION
SHAPE OF ORE BODY: TABULAR: IRREGULAR
CONTROLLING FEATURES: IGNEOUS: FAULTING

LITHOLOGY:

NAME OF FORMATION: SERPENTINITE INTRUSION
DEFORMATION DESCRIPTION: FAULTING: INTRUSION
RELATIONSHIP TO MINERALIZATION: MINERALIZATION PRECEDING-DURING DEFORMATION
ROCK TYPE:
BASALT NEAR ORE
GREENSTONE NEAR ORE
SERPENTINITE IS ORE

BIBLIOGRAPHY RECORDS

MOHIDE, T. P., C. L. WARDEN, AND J. D. MASON. TOWARDS A NICKEL POLICY FOR THE PROVINCE OF ONTARIO. MINERAL POLICY BACKGROUND PAPER NO.4, ONTARIO MINISTRY OF NATURAL RESOUR., 1977, P. 132.

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APPENDIX A.--ALPHABETICAL INDEX TO DIRECTORY BY DEPOSIT NAME

<u>Deposit Name</u>	<u>Country or State</u>	<u>Page</u>
ACOJE NICKEL PROJECT	PHILIPPINES	385
AGNEW NICKEL DEPOSIT	AUSTRALIA	127
ANACONDA PGM DEPOSIT	MONTANA	98
ANNAPOLIS MINE	MISSOURI	65
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BOROMO GREENSTONE (BONGO)	UPPER VOLTA	422
BORONGAN	PHILIPPINES	406
BOWDEN LAKE	CANADA	180
BRADY GLACIER	ALASKA	11
BRUSHY CREEK DIVISION	MISSOURI	75
BUCKO LAKE	CANADA	182
BUICK MINE	MISSOURI	56
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COPPER CLIFF SOUTH	CANADA	213
CRAWFORD POND DEPOSIT	MAINE	38
CREAN HILL MINE	CANADA	219
CREIGHTON MINE	CANADA	224
DER BROCHEN (DERBROKEN)	REPUBLIC OF SOUTH AFRICA	420
DINAGAT DEPOSIT	PHILIPPINES	393
DUMONT NICKEL	CANADA	304
DUNKA RIVER AREA	MINNESOTA	50
EIGHT DOLLAR MTN LATERITE	OREGON	107
ELY SPRUCE	MINNESOTA	41
EMPRESS	ZIMBABWE	428
EPOCH NICKEL MINE	ZIMBABWE	435
EUBOIA	GREECE	327
EXMIBAL	GUATEMALA	330
EXPO UNGAVA	CANADA	302
FALCONBRIDGE EAST	CANADA	231
FALCONBRIDGE MINE	CANADA	237
FALCONDO BONA	DOMINICAN REPUBLIC	315
FLETCHER DIVISION	MISSOURI	72
FRANK R MILLIKEN MINE	MISSOURI	82
FRASER MINE	CANADA	296
FROOD	CANADA	190
FUNTER BAY	ALASKA	14
GAG ISLAND	INDONESIA	340
GARSON MINE	CANADA	240
GASQUET LATERITE	CALIFORNIA	27

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GREENVALE	AUSTRALIA	124
HAGIOS IOANNIS (LARYMNA)	GREECE	324
HITURA	FINLAND	321
HUNTERS ROAD	ZIMBABWE	438
ILE ART	NEW CALEDONIA	379
IMPALA	REPUBLIC OF SOUTH AFRICA	411
INDIAN CREEK DIVISION	MISSOURI	90
INFANTA (IPILAN)	PHILIPPINES	404
IPILAN	PHILIPPINES	402
JUSSARA	BRAZIL	155
KAMBALDA & ST IVES NICKEL OPERATION	AUSTRALIA	130
KEY LAKE	CANADA	309
KOTALAHTI	FINLAND	318
KOUAQUA	NEW CALEDONIA	355
LAC DES ILES	CANADA	300
LEVACK	CANADA	250
LINDSLEY MINE	CANADA	289
LITTLE RATTLESNAKE MOUNTAIN DEPOSIT	CALIFORNIA	32
LITTLE STOBIE	CANADA	256
LOCKERBY MINE	CANADA	285
LOWER ELK CAMP RIDGE DEPOSIT	CALIFORNIA	34
MADISON MINE	MISSOURI	67
MADZIWA	ZIMBABWE	423
MAGMONT MINE	MISSOURI	61
MAKAMBAL	PHILIPPINES	391
MCCREEDY WEST	CANADA	291
MINE LA MOTTE GROUP	MISSOURI	70
MINNAMAX	MINNESOTA	53
MIRROR HARBOR	ALASKA	21
MOAK LAKE DEPOSIT	CANADA	184
MONEO	NEW CALEDONIA	348
MONTES CLAROS	BRAZIL	157
MORAMANGA PROSPECT (AMBATOVY)	MADAGASCAR	344
MORRO DO ENGENHO MINE	BRAZIL	158
MORRO DO NIQUEL	BRAZIL	160
MOUNT KADIG	PHILIPPINES	383
MOUNT KEITH	AUSTRALIA	136
MOUNT VERNON DEPOSIT	WASHINGTON	121
MURRAY	CANADA	262
MYSTERY LAKE	CANADA	187
NAKETY MINE	NEW CALEDONIA	376
NEPOUI	NEW CALEDONIA	358
NICKEL MOUNTAIN MINE	OREGON	103
NIQUELANDIA	BRAZIL	151
NIQUELANDIA (CODEMIN)	BRAZIL	153
NONOC	PHILIPPINES	387
ONAPING MINE	CANADA	265
ORA BANDA	AUSTRALIA	143

<u>Deposit Name</u>	<u>Country or State</u>	<u>Page</u>
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QUINNE MINE	NEW CALEDONIA	373
PARTRIDGE RIVER AREA	MINNESOTA	47
PINE FLAT MOUNTAIN DEPOSITS	CALIFORNIA	29
PIPE MINE	CANADA	168
PIPE SURFACE MINE	CANADA	171
POMALAA	INDONESIA	334
PORO	NEW CALEDONIA	361
PRONY MINE	NEW CALEDONIA	371
POUM	NEW CALEDONIA	351
RAGLAN	CANADA	307
RED FLAT	OREGON	100
RED MOUNTAIN LATERITE	CALIFORNIA	36
RIO TUBA MINE	PHILIPPINES	399
ROUGH AND READY LATERITE	OREGON	113
RUSTENBURG SECTION	REPUBLIC OF SOUTH AFRICA	408
SABLAYAN DEPOSIT	PHILIPPINES	395
STA CRUZ MINE AREA, BARRIOS VIL	PHILIPPINES	381
SELEBI-PHIKWE	BOTSWANA	145
SAO FELIX DO XINGU	BRAZIL	162
SAO JOAO DO PIAUI	BRAZIL	163
SHANGANI	ZIMBABWE	432
SHEBANDOWAN MINE	CANADA	195
SHERLOCK BAY	AUSTRALIA	142
SNIPE BAY	ALASKA	24
SOAB	CANADA	177
SORIANO PALAWAN	PHILIPPINES	397
SOROAKO	INDONESIA	337
STILLWATER PGM RESOURCES	MONTANA	92
STILLWATER VERDIGRIS CREEK	MONTANA	95
STOBIE	CANADA	244
STRATHCONA MINE	CANADA	270
SUKINDA	INDIA	332
TEXMONT	CANADA	277
THIERRY MINE	CANADA	274
THIO	NEW CALEDONIA	364
THOMPSON MINE	CANADA	175
TIEBAGHI	NEW CALEDONIA	367
TOTTEN MINE	CANADA	281
TROJAN MINE	ZIMBABWE	425
URE	COLOMBIA	311
VALAZORO	MADAGASCAR	346
WANNAWAY	AUSTRALIA	140
WEST FORK DEPOSIT	MISSOURI	79
WESTERN PLATINUM (MARIKANA)	SOUTH AFRICA	415
WINDARRA/SOUTH WINDARRA	AUSTRALIA	134
WINGELLINA MINE	AUSTRALIA	138
WOODCOCK MOUNTAIN LATERITE	OREGON	110
YAKOBI ISLAND	ALASKA	18

APPENDIX B.--LISTING OF DATA SETS, SUBSETS, AND DATA ELEMENTS¹

¹Information entries followed by brackets define usage particular to this Directory.

1. Location and General Deposit Information

General Information and Location

- Deposit Name
- Sequence Number
- State or Nation
- County or Political Subdivision
- Type of Operation
 - surface
 - underground
 - surface-underground
 - prospect
 - mineral location
- Current Status
 - producer
 - past producer
 - temporary shutdown
 - explored prospect [quantified reserves]
 - developed deposit
 - raw prospect
- Latitude
- Longitude
- Universal Transverse Mercator - UTM
 - zone
 - hemisphere
 - northing
 - easting
- Point of Reference
 - main entry
 - trench
 - ore body
 - claim
 - plant
 - town
- Precision
- Elevation
- Precision
- Datum
- Year of Informaiton
- Type of Mineral Holdings
 - located claim
 - patented claim
 - federal lease
 - state lease
 - private lease

- fee ownership
- minerals only
- Alternate Names
- Ownership
- Status
- Commodity
- Modifier
- Marketability
 - primary product
 - coproduct
 - byproduct
 - recoverable [potential plant byproduct]
 - affect marketability

2. Published Reserve/Resource Information

Published Information

- Category
 - measured
 - indicated
 - inferred
 - undifferentiated (not categorized)
- Units
 - metric tons ore
- Year/Data
- Record
- In situ Grade
- Assay Form
- Grade
- Unit
 - weight percent
- Reserve/Resource-Remarks
- Source for Records

3. Deposit Historical Information

General Information

- Discovery Method
 - ore-mineral in place
 - ore-mineral not in place
 - auxiliary-mineral in place
 - auxiliary-mineral not in place
 - geochemical anomaly
 - geophysical anomaly
 - geological inference
- Exploration Methods
 - geological
 - surface geologic mapping
 - subsurface geologic mapping
 - geological inference
 - other geological
 - geophysical

gravitational survey
magnetic survey
seismic survey
radioactivity survey
selfpotential survey
resistivity survey
electromagnetic survey
induced polarization
aerial photography
aerial color photography
infrared photography
radar survey
satellite survey
other geophysical
other remote sensing
echo-seismic profile
side scan sonar
bottom photography
television
geochemical
stream sediment sampling
reconnaissance soil sampling
detail soil sampling
humus sampling
mercury sniffer
biological sampling
other geochemical
drilling
core drilling
churn drilling
percussion drilling
auger
rotary drilling
other drilling
box core
piston core
other core
test shaft
test raise
test winze
test adit
test drift/crosscut
test tunnel
test pit
trenching
pipe dredge
trawl dredge
other dredge
bedrock sampling
wire line grab
free fall grab
other

Year of Discovery
Year of Initial Production
Year of Final Production

4. Geologic and Spatial Characteristics of Deposit

General Information

Type of Ore Body

massive sulfide
laterite
stratiform layer
fissure vein
podiform
shear zone
stockwork
breccia filling
disseminated
placer
sedimentary
replacement
pegmatite
other

Mode of Origin

unknown
hydrothermal
contact metasomatic
oxidation
oxidation-enrichment
magmatic differentiation
sedimentation
evaporation
residual concentration
metamorphism
syngenetic
syngenetic-remobilization
volcanogenic
other

Shape of Orebody

unknown
tabular
lenticular
irregular
massive
pipelike
domelike
mantlelike
other

Controlling Features

unknown
folding
fracturing
faulting

- igneous
- bedding
- contact zone
- lithology
- other
- Type of Wallrock Alteration
 - unknown
 - advanced argillic
 - sericitic
 - intermediate argillic
 - propylitic
 - potassic
 - carbonate silication
 - silicification
 - dolomitization
 - bleaching
 - pyritization
 - carbonitization
 - other
- Degree of Wallrock Alteration
 - unknown
 - none
 - slight
 - moderate
 - intense
- Mineralized Zone:
 - Average Depth
 - Minimum Depth
 - Average Width
 - Average Thickness
 - Strike/Dip
 - Average Thickness of Unconsolidated Material
 - Minimum Thickness of Unconsolidated Material
- Lithology:
 - Name of Formation
 - Geologic Age
 - Deformation Description
 - folding
 - faulting
 - major faulting
 - metamorphism
 - intrusion
 - other
 - none
 - Relationship to Mineralization
 - mineralization preceding deformation
 - mineralization during deformation
 - mineralization preceding-during deformation
 - mineralization following deformation
 - mineralization during-following deformation
 - mineralization preceding-during-following deformation
 - complex

Geologic Age of Mineralization

Rock Type

- ore in fractures
- lies along ore
- lies over ore
- lies under ore
- replaced by ore
- encloses ore
- gangue
- is ore

Mineralization

Mineral Name

Mineral Class

- native element
- sulfides
- sulfosalts
- oxides (excluding S102)
- multiple oxides cont. NB, TA, TI
- halides
- carbonates
- nitrates and borates
- sulfates and chromates
- phosphates
- vanadates and uranates
- arsenic and antimony compounds
- selenium-tellurium compounds
- molybdates and tungstates
- forms of S102
- silicates
- other

Grain Size

- aphanitic
- phaneritic-fine
- phaneritic-medium
- phaneritic-course
- pegmatitic
- variable

5. Mine/Mill Information

Surface Mining

Method

- open-pit
- strip-hillside
- stripping
- bench (berm)
- quarry
- glory hole
- alluvial mining
- hydraulicking
- dredging
- nonfloating plant

- Capacity
- Units
 - metric tons/day
- Average Cover Thickness
- Description of Cover
 - sand, silt
 - quicksand
 - sand, gravel
 - hardpan
 - medium-hard rocks
 - hard rocks
- Surface Area
- Average Cover Thickness
- Bench Height
- Slope of Pit
- Percent Waste Rock
- Underground Mining
 - Method
 - open stope
 - gophering [coyoting]
 - breast stoping
 - room and pillar
 - underhand
 - glory hole
 - overhand
 - pillar and chamber
 - sublevel
 - other open stope methods
 - timbered stopes
 - overhand square-set
 - underhand square-set
 - other timbered stopes
 - filled stopes
 - timber with subsequent fill
 - horizontal cut and fill with waste rock
 - horizontal cut and fill with tailings
 - resuing
 - ascending crosscuts
 - descending crosscuts
 - inclined cut and fill
 - other filled stope methods
 - caving methods
 - top slicing
 - inclined top slicing
 - sublevel caving
 - longwall caving
 - other caving mehods
 - shrinkage methods
 - other shrinkage methods
 - combine methods
 - shrinkage with caving
 - shrinkage with timbered methods

- shrinkage with cut and fill
- timbered stopes with caving methods
- caving methods with timbered methods
- auger mining
- solution mining
- fransch process
- Capacity
- Units
 - metric tons ore/day
- Rock and Water Conditions
 - hardrock with little water
 - hardrock fissured with moderate water
 - hardrock fissured with excessive water
 - soft nonplastic with little water
 - soft nonplastic fissured with moderate water
 - soft semiplastic with little water
 - noncoherent with little water
 - noncoherent with excessive water
- Characteristic of Rock
 - no planes of weakness
 - one system of weakness planes
 - multiple systems of weakness planes
 - noncoherent
 - semiplastic or plastic
- Rock/Mine Support
 - supporting
 - supporting when dry
 - supporting may back slab
 - unsupporting no flow
 - unsupporting no slough
 - unsupporting may slough
 - completely incompetent
 - other
 - timber
 - chemical coating
 - post, headboard, caps, roof bolts
 - timber with lagging concrete-unreinforced
 - open steel sets
 - steel with lagging concrete reinforced
 - can not support; fill or cave
- Conditions of Workings
 - caved at portal
 - flooded
 - bad air
 - open
 - plugged
 - sealed
 - no mine entry
 - parts accessible
- Total Length of Workings
- Number of Shafts
- Average Depth of Shafts

- Number of Inclines
- Average Length of Inclines
- Slopes of Inclines
- Number of Adits
- Average Length of Adits
- Transportation - Ore
 - Originating Facility
 - mine
 - Location
 - Latitude
 - Longitude
 - Percent Shipped
 - Method of Transportation
 - truck
 - rail
 - pipeline
 - conveyor
 - ocean
 - lake
 - air
 - river
 - other
 - Distance
 - Destination Facility
 - f.o.b. mine
 - port
 - mill (on-site)
 - mill (off-site)
 - refinery
 - market
 - Location
 - Latitude
 - Longitude
- Beneficiation
 - Method
 - unspecified
 - handsort
 - sizing
 - washing
 - gravity
 - jig
 - classifier
 - heavy media
 - flotation
 - hydrometallurgy
 - leach-precipitation
 - leach-precipitation-float
 - leach-solvent-extraction-precipitation
 - leach-ion exchange
 - crystallization
 - magnetic
 - electrostatic

pyrometallurgy
distillation
thermal decomposition
Design Capacity
Units
metric tons/day
Description of Milling
Transportation - Product
Product
Originating Facility
mill (on-site)
mill (off-site)
Location
Latitude
Longitude
Percent Shipped
Method of Transportation
truck
rail
conveyor
pipeline
ocean
lake
river
other
Distance
Destination Facility
f.o.b. mill
port
market
refinery
other
Location
Latitude
Longitude

6. Bibliography

