DEPARTMENT OF MINES AND ENERGY

SOUTH AUSTRALIA

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Mt. Davies Nickel Ore Investigation
Dated November 1962
AMDL Report 220 (pgs. 4-11)

(No Plans)

185/59

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The Australian Mineral Development Laboratories

Telephone: 79 1662 - 79 1625 - 79 1635

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Address all communications to the Director.

Please quote this reference in your reply

1/1/16

Your reference .....

CONYNGHAM STREET,

PARKSIDE,

SOUTH AUSTRALIA.

The Director,
Department of Mines,
Rundle Street,
ADELAIDE.

Dear Sir,

We are transmitting to you ten copies of AMDL Report 220 entitled "Mount Davies Nickel Ore Investigation", dated November, 1962.

You will see from the conclusions in the report that the low nickel content and its complex occurrence in the ore does not warrant further metallurgical investigation.

We will be pleased to receive your comments on the report.

Yours faithfully,

L. Wallace Coffer

L. Wallace Coffer
Director.

GDS. eo

1 copy filed as DM 185/59
1 " Report Book 56/9
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AMDL Report 220
November, 1962

MOUNT DAVIES NICKEL ORE INVESTIGATION

by

G. D. Sheridan

to

SOUTH AUSTRALIAN GOVERNMENT
DEPARTMENT OF MINES

Investigated by: Metallurgy Section
Officer in Charge: P. K. Hosking

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES
Adelaide South Australia

CONTENTS

1. INTRODUCTION

An investigation into the recovery of nickel from ore from Mount Davies was initiated by the Department of Mines. The investigation was to cover mineralogical examination and chemical leaching tests.

2. SUMMARY

The sample assayed 0.84 per cent nickel. No primary nickel minerals were identified on mineralogical examination of selected specimens of the lump material. Traces of garnierite were found with difficulty because of encrustation of all the minerals by limonite. Ores of this type do not respond well to physical methods of concentration.

Reduction roasting followed by leaching with an ammonia-ammonium carbonate solution resulted in a 76 per cent extraction of the total nickel in the sample. It is doubtful whether this method of beneficiation would be economical because of the low grade and complex nature of the material.

3. MATERIAL EXAMINED

A sample comprising 69 bags of ore and weighing approximately 5 tons, was received.

A head sample assayed 0.84 per cent nickel.

4. EXPERIMENTAL PROCEDURE AND RESULTS

4.1 Sizing Analysis of Head Sample

A sizing was carried out on a head sample and the fractions assayed for nickel. The results are shown in Table 1.

TABLE 1: SIZING ANALYSIS OF HEAD SAMPLE

Mesh BSS	Weight %	Assay Ni %	Distribution Ni %
+ 5	35.9	0.84	40.9
- 5 + 18	20.3	0.82	22.5
- 18 + 72	13.3	0.73	13.1
- 72 + 300	23.0	0.51	15.8
-300	7.5	0.79	7.7
Feed	100.0	0.74 (calculated) 0.83 (assay)	100.0

4.2 Mineralogical

Mineralogical examination of selected specimens of the sample showed that the material consists of highly ferruginous clay encrusted with gypsum. No primary nickel minerals were identified. Traces of garnierite were found with great difficulty as all the minerals are encrusted with, or enclosed in limonite. The material will not respond to heavy media concentration or to superpanning.

4.3 Leaching Test

A sample was reduced by heating in a reducing gas atmosphere. The reduced mass was then subjected to an ammonia-ammonium carbonate leach. The details of this procedure were as follows:

> A 50 g portion of the sample ground to minus 52-mesh BSS and mixed with 0.5 g of salt was heated in an atmosphere of town-gas for 2 hours at 900°C. The reduced residue after cooling, was leached for 3 hours by agitating in a 2 litre uncorked bottle on an agitating rolls with a solution containing -
>
> | | | |
> |---|---|---|
> | Ammonium hydroxide (0.880 SG) | 40 | ml |
> | Ammonium carbonate | 32.4 | g |
> | Distilled water | 132 | ml |
>
> The leach liquor and residue were separated by filtration in a Buchner funnel and both fractions were assayed for nickel.

The amount of nickel extracted from the sample by this method was 76 per cent by weight.

4.4 Differential Thermal Analysis

Three samples were subjected to differential thermal analysis and the report is given in Appendix A.

5. CONCLUSIONS

Because of the low grade and complex occurrence of the nickel in the material examined further metallurgical investigation on the sample is not warranted. Lateritic nickeliferous ores of this type are not amenable to physical methods of concentration. Similar deposits of this type, in Cuba, have been intermittently treated by reduction roasting followed by ammonia-ammonium carbonate leaching of the reduced nickel. The nickel content of these ores is over 1 per cent and the economics of the process are border-line. It is most doubtful that it would be economic to apply this process to the Mount Davies deposit.

APPENDIX A

DIFFERENTIAL THERMAL ANALYSIS

1. SUMMARY

Three samples of nickel ore from Mount Davies were submitted by the South Australian Government Department of Mines for differential thermal analysis.

Each sample gave a differential trace corresponding to goethite.

One of the samples contained some form of limestone as shown by the endothermic peak (at 885°C) characteristic of the reaction $CaCO_3 \longrightarrow CaO + CO_2$. Another of the samples probably contained magnesite since a small endothermic peak appeared at 753°C on the differential trace.

2. MATERIAL EXAMINED

Three samples designated A462/60, A463/60 and A464/60 were received. The samples had previously been ground to approximately minus 100-mesh for chemical analysis.

3. EXPERIMENTAL PROCEDURE AND RESULTS

A steatite cell, contained in a stainless-steel block with close-fitting lid, was used as the sample container. Platinum-platinum plus 10 per cent rhodium thermocouples were used with the temperature recording couple in the sample. Calcined alumina was used as the inert reference material. A heating rate of 400°C per hour was maintained. Chart speed on both recorders was 16 centimetres per hour.

The weight of sample used and the differential trace obtained are shown in Figure 1. The difference in temperature between the sample and the inert material (ΔT), is plotted against temperature. A peak on the negative side of the zero or base-line represents an endothermic reaction.

4. DISCUSSION

4.1 Sample A462/60

There are three endothermic peaks - at 135°C, 340°C and 753°C. These peaks correspond to evolution of adsorbed water, loss of water of crystallization from goethite, and loss of carbon dioxide from magnesite respectively.

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4.2 Sample A463/60

Three endothermic peaks at 135°C, 340°C, and 885°C correspond to loss of adsorbed water, loss of water of crystallization from goethite and the evolution of carbon dioxide from limestone respectively.

4.3 Sample A464/60

The first part of the curve is similar to that of the other two samples. The endothermic peaks at 135°C and 335°C represent loss of adsorbed water and loss of water of crystallization from goethite respectively.

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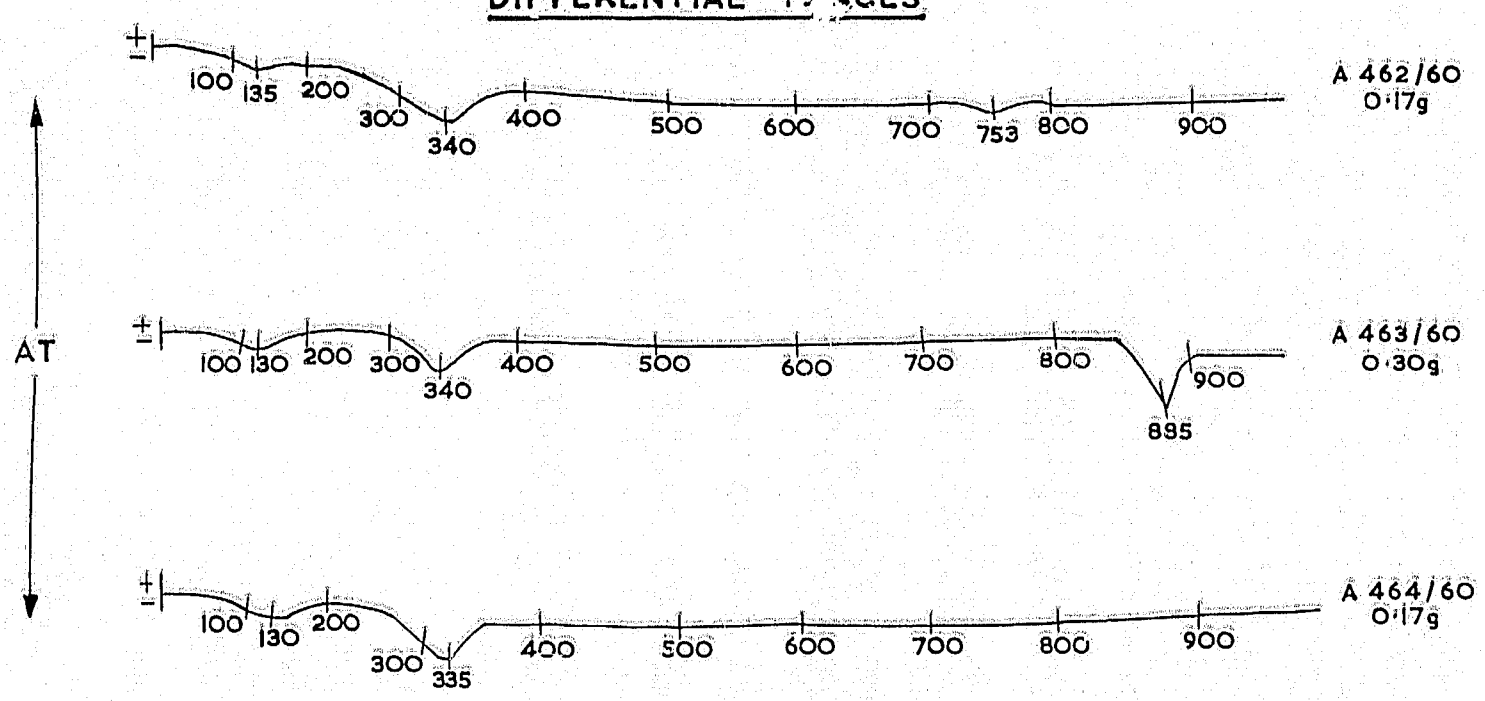
DIFFERENTIAL T. ACES
AT
± 100 135 200 300 340 400 500 600 700 753 800 900
A 462/60
0·17g
± 100 130 200 300 340 400 500 600 700 800 900 895
A 463/60
0·30g
± 100 130 200 300 335 400 500 600 700 800 900
A 464/60
0·17g
TEMPERATURE (°C)

FIGURE