RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

MELBOURNE, AUSTRALIA

PROJECT:— PRP/7/100

REPORT No.:— 9/1958

RESULTS OF INVESTIGATIONS AND PROPOSED DIAMOND DRILLING ON SAVAGE RIVER IRON ORE DEPOSITS

by

H. E. Jensen

FILE REFERENCE:— 8D/20F

MAP REFERENCE:—

DATE:— 19/8/1958

RESULTS OF INVESTIGATIONS AND PROPOSED DIAMOND DRILLING ON SAVAGE RIVER IRON ORE DEPOSIT NORTH WEST TASMANIA

by

H. E. Jensen

C O N T E N T S

P L A N S & S E C T I O N S

Plan Nos.	Description	Scale
T67	Geological Map, Savage River Area	200' = 1"
G288-4	Magnetic Vertical Force Contours	400' = 1"
T423 to T425	Longitudinal Sections	200' = 1"
T426 to T433	Transverse Sections	100' = 1"

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INTRODUCTION

Preliminary investigations of the Savage River Iron Ore Deposit were carried out during April and May 1957 by State Geologist T. Hughes, and party of the Tasmanian Geological Survey in conjunction with R. S. Matheson and H. E. Jensen. The Tasmanian Government allocated £15,000 to carry out further exploration. Rio Tinto Australian Exploration Pty. Limited acted as supervisors of diamond drilling, and carried out further field work. The results from No. 1 diamond drill hole were satisfactory and to allow a second hole to be completed the Tasmanian Government made a further £5,000 available.

Assays of samples, and ore dressing investigations were done at the Department of Mines' Laboratory at Launceston under the supervision of Mr. Manson, the Chief Chemist and Metallurgist.

The diamond drilling was done on contract by Associated Diamond Drillers who employed four men to carry out the drilling on two shifts each day.

Rio Tinto Australian Exploration supplied a cook, one field assistant and based Geologist W. Atkinson at the camp to supervise the work.

The A.N.A. Sycamore helicopter was chartered to transport camping material and diamond drilling equipment in the deeply dissected, heavily forested country.

Service to the camp was provided by the T.A.A. Hiller helicopter, and when this was unavailable a pack horse was used.

The camp was established on 15th October, 1957; and on 2nd June, 1958 diamond drilling equipment, and the greater portion of camping material were removed from the area.

A stadia survey was made to locate diamond drill holes, pits, adits and to establish relative reduced levels. This survey does not agree closely with the traverse done by the Commonwealth Department of the Interior and can be accepted as approximate only until checked.

The pits were put down to obtain samples of the outcrop. Adits were put in some years ago being part of an exploration programme carried out by Hoskins.

The investigations have proved a substantial deposit which, however, contains some impurities that will, to some extent, affect its economic value.

The ore from the primary zones can be beneficiated by magnetic concentration, increasing the grade from approximately 45% Fe to 65% Fe when ground to a -60 mesh.

This treatment reduces the percentages of S, P_2O_5, and SiO_2 to figures generally acceptable; however, there is little reduction of the TiO_2 content which is approximately 1.7%.

Enquiries have been made, both overseas and in Australia, as to the demand for this type of ore. It is reported that iron ores containing a TiO_2 content of up to 2% can be of economic value.

Broken Hill Proprietary Ltd. have had no experience with this type of ore, however, it is possible that it could be mixed with other ore to constitute a satisfactory charge to their blast furnaces.

Details of investigations are given in the following pages.

DIAMOND DRILLING

The diamond drilling was done on contract by Associated Diamond Drillers who drilled two "Ax" size holes with a Mindrill E2000 machine.

No. 1 Hole (Plan No. T67) was collared on the west slope of the ridge and drilled at a depressed angle of 41 degrees in an easterly direction to a total depth of 668 feet. Core recovery was poor, being 43.5%, and was due principally to the numerous patches of friable ore.

No. 2 Hole (Plan No. T67) was collared some 600 feet north of No. 1 hole on the east slope of the ridge and drilled at a depressed angle of 45 degrees in a westerly direction to a depth of 863 feet. The excellent core recovery of 93.9% was due to the adoption of a split core barrel. It was intended to drill this hole to a total depth of 1400 feet to reach at depth the projected position of a gossan showing on the surface.

On account of the difficulties encountered in drilling the last 13 feet in a shear zone, the hole finally had to be abandoned at the depth of 863 feet.

Schedules Nos. 1 and 2 give complete details of the analyses of core and sludge samples.

Schedule No. 3 gives details of performances in drilling the two holes.

Schedule No. 4 gives details of times and costs of the A.N.A. Sycamore Helicopter to transport material and equipment.

ASSAY RESULTS OF COMPOSITE SAMPLES FROM D.D. HOLE NO. 1, SAVAGE RIVER

FROM 401 FEET TO 631 FEET

Sample No.	From Feet	To Feet	Inters. Feet	Core Rec. Ft.	Core Rec. Ins.	Fe HCl Sol %	SiO_2 %	TiO_2 %	Mn %	P_2O_5 %	S %	Available Fe HCl.Sol. to Sulphide Iron Calculated %
D	401	421	20	6	5	52.2	11.2	2.31	0.12	Trace	0.98	53.1
E	421	440	19	4	6	58.1	6.9	1.86	0.12	0.05	0.23	58.3
F	440	471	31	15	0	51.9	12.2	1.82	0.12	0.05	0.18	52.1
G	471	487	16	9	1	28.3	29.5	1.26	0.13	0.07	1.61	29.7
H	487	508	21	7	8	59.3	14.1	1.88	0.12	Trace	0.43	58.7
42	508	515	7	3	6	13.6	Impurities not determined					
I	515	520	5	2	0	20.5	29.6	0.72	0.08	0.02	0.84	21.2
T	520	540	20	10	11	43.1	15.4	1.32	0.11	0.02	0.83	43.8
V	540	563	23	12	11	41.3	16.5	1.37	0.11	0.02	0.69	41.9
X	563	572	9	5	2	28.3	23.0	1.30	0.09	0.11	1.31	29.4
Z	572	595	23	6	10	51.1	10.3	1.89	0.13	0.07	0.92	51.9
AB	595	611	16	6	7	46.9	12.6	1.60	0.14	0.25	1.21	48.0
AD	611	631	20	9	4	44.5	14.4	0.74	0.14	0.14	0.98	45.4
Av. Values			230	99	11	45.8	14.7	1.59	0.12	0.06	0.78	46.48

ASSAY RESULTS OF COMPOSITE SAMPLES FROM D.D. HOLE NO. 2, SAVAGE RIVER FROM 313 FEET TO 718 FEET 6 INCHES

Sample No.	From Feet	To Feet	Inters. Feet	Core Rec. Feet	Fe Hcl Sol. %	SiO_2 %	TiO_2 %	Mn %	P_2O_5 %	S %	Available Fe Hcl. Sol. to Sulphide Iron. Calculated %
BA	313'0"	337'0"	24'0"	22'11"	46.6	13.8	1.65	0.10	0.04	0.27	46.8
BB	337'0"	370'0"	33'0"	30' 4"	43.0	16.7	1.68	0.10	0.03	0.40	43.4
BC	370'0"	388'0"	18'0"	6' 4"	56.3	8.1	1.86	0.11	0.11	0.57	56.8
BDs	(372'0")	(388'0")	Sludge Sample		49.4	13.9	1.40	0.09	0.06	0.94	50.2
BE	388'0"	408'6"	20'6"	20' 6"	45.2	12.4	1.63	0.13	0.21	0.94	46.0
BF	408'6"	430'6"	22'0"	21' 5"	24.9	25.1	1.44	0.11	0.18	0.95	25.7
BG	430'6"	457'0"	26'6"	26' 0"	53.8	9.6	1.88	0.12	0.08	0.38	54.1
BH	457'0"	479'0"	22'0"	21'10"	42.2	16.2	1.68	0.11	0.11	0.44	42.6
BI	479'0"	502'0"	23'0"	23' 0"	45.1	13.3	1.45	0.10	0.06	1.14	46.1
BJ	502'0"	512'0"	10'0"	10' 0"	21.8	29.8	0.96	0.08	0.05	0.96	22.6
BK	512'0"	538'0"	26'0"	25' 6"	50.1	11.4	1.87	0.15	0.05	0.45	50.5
BL	538'0"	560'0"	22'0"	22' 0"	50.3	11.0	1.69	0.10	0.05	0.21	50.5
BM	560'0"	581'0"	21'0"	21' 0"	53.1	9.3	2.03	0.10	0.04	0.11	53.2
BN	581'0"	605'0"	24'0"	18' 6"	46.9	13.1	2.07	0.14	0.09	0.27	47.1
BO	605'0"	617'0"	12'0"	11'10"	9.1	41.6	1.55	0.14	0.13	0.46	9.5
BP	617'0"	637'0"	20'0"	19' 7"	50.2	10.7	2.17	0.17	0.07	0.18	50.4
BQ	637'0"	651'0"	14'0"	14' 0"	54.7	8.1	2.32	0.17	0.04	0.17	54.9
BR	651'0"	669'0"	18'0"	17'11"	27.1	24.5	1.47	0.09	0.05	0.28	27.3
BS	669'0"	696'0"	27'0"	26' 7"	46.3	13.0	1.96	0.14	0.09	0.63	46.9
BT	696'0"	718'6"	22'6"	21' 4"	44.5	14.1	2.11	0.16	0.08	0.43	44.9
Core only	313'0"	718'6"	405'6"	380' 7"	44.15	14.88	1.78	0.12	0.08	0.48	44.57

Nickel 0.01%

EX.63

SCHEDULE 2

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0. 005

SCHEDULE NO. 3

SUMMARY OF FEET DRILLED, CASING USED, & TIME LOST

Month 1957	DRILLING		CASING, REAMING, CEMENTING				DELAYS			TOTAL SHIFTS
	Feet	Shifts	Feet Casing used Nx	Bx	Ax	Shifts	Shifting & erecting Plant Shifts	Renewing Casing Shifts	Stuck Rod Line Shifts	
Oct.	5	1					24			25
Nov.	515	38	40	74	240	6			5	49
Dec.	148	16			278	1			10	27
1958 Jan.	200	6	108	131	-	2	22	5		35
Feb.	351	26		70	304	6			9	41
Mar.	182	17			241	8			18	43
Apr.	117	8			188	7			12	27
May	13	6			126	1	8	2	17	34
Totals	1531	118	148	275	1377	31	54	7	71	281

Note: Two men were engaged on each shift.

Average advance per drilling shift 12.97 feet.

Average advance per shift 5.45 "

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SCHEDULE NO. 4

TRANSPORTATION OF EQUIPMENT BY THE A.N.A.

SYCAMORE HELICOPTER

Date	POSITIONING PLANE		FREIGHTING MATERIAL				
	From	To	Time Hr.	Min.	Weight lb.	Time Hr.	Min.	Total Time Hr. Min.
1957								
Oct.14	Melbourne	Devonport	5	30				
15	Devonport	Savage River	1	40	1,687	0	30	
16					12,566	3	40	
17					4,834	1	35	
18					7,393	1	55	
19	Savage River	Waratah	0	20	16,768	4	35	
20	Waratah	Devonport	1	35				
Nov. 4	Devonport	Melbourne	4	45				
1958								
June 1	Melbourne	Waratah	5	25				
2	Waratah	Savage River	0	35				
2	Savage River	Waratah	0	15	21,410	4	20	
6	Waratah	Melbourne	5	35				
			25	40	64,658	16	35	42 15

COSTS

	TIME		COSTS		WEIGHT	COSTS	
	Hr.	Min	Rate per Hr.		LB	Per lb. pence	per lb mile pence.
Positioning plane	14	40	90	£1,320. -. -	-	-	-
" "	11	00	95	£1,045. -. -	-	-	-
Freighting material	16	35	90	£1,492.10. -	64,658	5.5	3.7
Total	42	15		£3,857.10. -	64,658	14.3	9.5

SAMPLING RESULTS

A number of pits were sunk at regular intervals to obtain samples of outeropping ore on both the north and south deposits.

Plan No. T67shows the positions of these pits together with percentages of Hcl soluble iron obtained from assays of samples.

A number of adits were driven some years ago by Hoskins as part of an exploration programme. Those accessible were sampled and their positiohs are shown on Plan No. T67.

The following schedules show details of the analyses of samples obtained from pits and adits.

Analyses of Samples from Pits on the Northern Deposit

Location	Composite of	% Fe Hcl.Sol.	% SiO_2	% TiO_2	% P_2O_5	% S
North end	9 samples	64.2	2.25	1.89	0.07	0.06
Centre section	10 "	64.6	7.90	2.15	0.08	0.02
South end	5 "	66.9	1.00	1.89	0.02	0.02
Arithmetic Averages		65.2	3.72	1.98	0.06	0.03

Analyses of Samples from Pits on the Southern Deposit

Location	Composite of	% Fe Hcl.Sol.	% SiO_2	% TiO_2	% Mn	% P_2O_5	% S
North End	6 samples	64.6	2.1	0.91	0.10	0.63	0.17
Centre section	"	64.5	2.1	1.30	0.06	0.15	0.04
South end	"	65.2	1.4	1.01	0.06	0.19	0.05
Arithmetic Averages		64.8	1.9	1.07	0.07	0.32	0.09

Analyses of Samples from Adits.

Location	Width Sampled Feet	% Fe Hcl.sol.	% SiO_2	% TiO_2	% Mn	% P_2O_5	% S
(A) S.end N.deposit	65	54.1	9.1	2.64	0.13	nil	0.12
(B) N. " S.deposit	45	38.6	12.7	0.81	0.09	0.40	5.74
(C) S. " S.deposit	31	65.7	2.1	1.76	0.09	0.03	0.02
(D) S. " S.deposit	75	59.5	3.6	0.37	0.08	0.29	2.04

not confirmed

ORE DRESSING AND MINERAGRAPHIC INVESTIGATIONS

Ore dressing investigations have been carried out at the Department of Mines Laboratory at Launceston under the supervision of Mr. Manson, the Chief Chemist and Metallurgist.

Representative samples of the ore intersected by Diamond Drill Holes Nos. 1 and 2 were ground to various sizings ranging from -½ inch to -200 mesh and subjected to beneficiation tests by magnetic separation.

The ore is amenable to this treatment with good results when grinding to -60 to -100 mesh; the grade is enhanced to approximately 65% Fe with the elimination of most impurities with the exception of the TiO_2 content.

The results of beneficiation tests of a spot sample of ore taken from the adit D (Plan No. T67) are outstanding.

Copies of Mr. Manson's reports are included as an appendix.

The Commonwealth Scientific and Industrial Research Organisation was supplied with two samples of oxidised ore for Mineragraphic Investigations.

A copy of the report is included as an appendix.

MAGNETOMETER SURVEY

The report on the magnetometer survey which was done by the Bureau of Mineral Resources has not been released, however, on the request of the Tasmanian Government, a plan (No.G288-4) of the magnetic vertical force contours was made available.

Over a length of approximately 2.3 miles, 18 lines in a general east west direction were cut through the dense rain forest to allow the magnetometer survey to be made.

The distances between these traverses are too great to allow for a precise interpretation.

The results indicate a series of lenses striking approximately N25°E and dipping steeply to the east.

The two diamond drill holes on the northern deposit disclosed ore in positions agreeing approximately with the boundaries shown by the magnetometer survey. This applies particularly to the east boundary, or footwall, while the western boundary as shown on Section 3 is not checked so precisely.

The concentration of ironstone scree on the steep western slope of the ridge could give high magnetometer readings further west than the true position of the western boundary of ore body.

Indicated Ore Reserves are based on diamond drill hole ore intersections and magnetic contours shown on Plan G288-4. The magnetometer registered readings in excess of 70,000 gammas in the regions covered by the two diamond drill holes. Traverses at closer spacing would be of value to check continuity of ore and confirm that the lenses conform to the outlines shown on Plan No. T67.

ORE RESERVES

Indicated ore reserves are divided into two categories -

(a) Probable ore indicated by diamond drill holes,

(b) Possible ore indicated by the ground magnetometer survey done by the Bureau of Mineral Resources.

In making the calculations a factor of 7.5 cubic feet per long ton is taken.

The magnetometer survey has indicated concentration of ore in three separate lenses, which are the only occurrences included in the indicated ore reserve estimates. These are referred to as the Northern Deposit, Southern Deposit Western lense, and Southern deposit Eastern lense respectively (Plan No. T67.)

The traverses of the magnetometer survey were so widely spaced that no precise interpretation can be made. However, sample pits and adits have exposed iron ore outside the perimeters of the ore reserve boundaries and for this reason it is considered that the estimates are conservative.

Longitudinal sections (Plans T423, T424, T425) show the dimensions of length and depth, and transverse sections Nos. 1 to 8 indicate the widths taken in calculating the tonnages.

Additional reserves are available from "scree" material and other strong magnetic zones, particularly one between traverses C12 and D (Plan G288-4).

The following table sets out the estimates of indicated ore into the two catagories.

Deposit	Probable Tons (Long)	Possible Tons (long)	Totals Tons (long)
Northern Deposit	9,990,000	30,323,000	40,313,000
Southern Deposit, West lense		33,440,000	33,440,000
Southern Deposit, East Lense		7,636,000	7,636,000
Totals	9,990,000	71,399,000	81,389,000

No grades are shown as there are insufficient data available, however sampling of diamond drill cores (primary zone) and of surface oxidised ore show values of approximately

45% and 65% Fe (soluble HCl) respectively.

Further exploratory work is required to establish the approximate depths of oxidation, and if this is done estimates could be made to give quantities of the higher grade ore.

PROPOSED DIAMOND DRILLING

Provided it is positively established that ore having TiO_2 content of up to 2% is of commercial value, further diamond drilling is recommended to assess precise tonnages, and to obtain cores for analyses.

Present sampling has shown the oxidised ore to be approximately 50% higher in iron content than the ore intersected in the primary zones by the diamond drill holes.

Ore from the oxidised zone would require no treatment provided the sulphur content is not excessive. Further drilling is recommended to establish the extent of oxidation and thus enable a tonnage to be assessed of this higher grade material.

These drill holes would be positioned to establish the true dips of the ore body and thus allow for an intelligent planning of mining operations.

Naturally as drilling proceeds more data will be available and these would be used in directing and determining the amount of work required.

Initially two diamond drill holes are proposed to test the oxidised zone, entailing approximately 800 feet of work; These holes are shown on sections 2 and 3, Plan No. T427 and T428.

It may be necessary to drill holes from the western side of the ridge, and also at other positions along the strike to gain confirmatory data.

Another programme is needed to prove continuity of length on both the northern and southern deposits.

It is recommended to space the drilling initially at intervals of 500 feet along the strike, and on results obtained to plan the future work. On the northern ore deposit a 520 ft. hole is proposed and this is shown on Section 4 Plan No. T429.

On the southern ore body it is proposed initially to drill a hole 850 feet to test both the conjectural eastern and western lenses. This hole is shown on Section 7 Plan No. T432.

EXPENDITURE

The following statement sets out the charges paid by the Tasmanian Government to date.

Associated Diamond Drillers	11,750. 2. 9
A.N.A. Charter of helicopter	3,857.10. -
T.A.A. helicopter service	1,904. 3. 4
Freight	210.15. 4
Stores	169. 3.11
Cartage	260. 1. -
General	151.19. 6
	£18,303.15.10

Freight charges on equipment back to Melbourne are still outstanding.

H. E. Jensen

H. E. Jensen
Assistant Exploration Manager

19th August, 1958.

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APPENDIX

DEPARTMENT OF MINES LABORATORY

Launceston, 23rd January, 1958.

ORE DRESSING INVESTIGATION

R. 326.

Savage River - Iron Ore

Beneficiation by Magnetic Separation

Summary

1. In anticipation of consideration of beneficiation a weighted composite sample of ground core samples from Bore No. 1 was submitted to cleaner wet magnetic separation using a 4 inch submerged belt type Crockett separator. The results obtained resulted in the production of a high grade magnetite concentrate with very effective elimination of undesirable impurities, particularly sulphur and phosphorus. Recovery of the magnetite was approximately 98 per cent.

   The composite untreated sample contained 41 per cent of iron, 0.7 per cent of sulphur, 0.07 per cent of phosphorus and 18 per cent of silica. The magnetic concentrate contained 65 per cent of iron and only 0.06 per cent of sulphur, 0.01 per cent of phosphorus and 3.6 per cent of silica.

2. The sample was prepared from finely ground split core samples forwarded by Rio Tinto Australian Exploration Pty. Ltd. for analysis. The size of grind may be unnecessarily fine for the most useful and economic results, but no other sample is available for further tests. Fifty two samples were used in making up the composite which gave a mean iron value of 41 per cent. In this composite seven low grade samples ranging from 9 to 22 per cent of iron were included. The derived value of the remaining 45 samples was 47 per cent of iron.

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Test Details

	PERCENT								DISTRIBUTION						
	Wght.	Fe	S	P	SiO_2	Al_2O_3	Mn	TiO_2	Fe	S	P	SiO_2	Al_2O_3	Mn	TiO_2
Magnetite Conc.	61.5	65.0	0.06	0.01	3.64	0.01	0.1	1.63	97.8	5.2	8.6	12.5	0.2	53.0	62.1
Tailing	38.5	2.37	1.74	0.17	40.84	6.96	0.14	1.59	2.2	94.8	91.4	87.5	99.8	47.0	37.9
Composite	100.0	40.9	0.7	0.07	17.96	2.68	0.11	1.61	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(Magnetic assays were conducted on the above products, the HCl soluble iron determined in the magnetic products. This procedure showed a recovery of 99.4 per cent of the magnetite as compared with HCl soluble Fe method of 97.8 per cent.)

Sizing Analysis of Magnetite Product

Sizing B.S. Screen

+ 60	2.3 per cent	2.3 per cent cum.
+ 85	3.9 "	6.2 " "
+ 100	3.3 "	9.5 " "
+ 150	17.6 "	27.1 " "
+ 200	7.1 "	34.2 " "
- 200	65.8 "	100.0

The iron content of the minus 200 mesh fraction was 67.2 per cent.

The following determinations have also been made.

	PERCENT			
	CaO	MgO	H_2O+	H_2O-
Magnetic	Trace	3.46	n.d.	0.11
Non-Magnetic	3.32	27.39	8.1	0.33

(Signed) W.St.C. Manson
Chief Chemist & Metallurgist.

DEPARTMENT OF MINES LABORATORY.

624015

LAUNCESTON, 13th June, 1958.

ORE DRESSING INVESTIGATION.

No. 334.

Savage River-Magnetite.

Beneficiation by Magnetic Separation.

Sample.

Beneficiation tests were requested by the Director of Mines on diamond drill core from No.2 Hole which had been received from the Rio Tinto(Australian)Exploration Pty. Ltd. The core had been previously split by the Rio Tinto Company and half submitted to the department for assaying. Half of the split core from 313 feet to 718 feet 6 inches in alternative 3 inch lengths was used as a sample for this investigation, irrespective of core recovery. This sample weighed approximately 100 lbs. and after crushing to minus ½ inch size the sample was halved and one half reserved for future use. A composite was assembled from test products and was assayed as a head sample with the following results.

	Percent
Iron	46.2
Sulphur	0.44
P_2O_5	0.05
SiO_2	13.6
Al_2O_3	2.3
TiO_2	1.8
Mn	0.11

Previous Literature.

Mines Department Ore Dressing Investigation No. 326, January, 1958.

C.S.I.R.O. Mineragraphic Investigation No. 736, March, 1958.

Investigation.

Magnetic separation has been investigated from sizings ranging from minus ½ inch size to minus 200 mesh. Preliminary crushing to minus ½ inch was undertaken in a jaw crusher, and minus ¼, minus 8 and minus 18 mesh B.S. were roll crushed. Finer sizings were produced by stage wet ball mill grinding of minus 18 mesh ore. These sizings were minus 60, 100 and 200 mesh B.S.

To obtain reasonable accuracy it was necessary to stage crush and magnetically separate at each sizing from minus ½ inch to minus ¼ inch, and the first samples assayed were products from the minus ¼ inch separation. Results at coarser sizings were derived from these assays. A quantity of minus ½ inch ore was roll crushed to minus 18 mesh B.S. and separate quantities of this were used for the remaining tests. Coarse separations were made with a permanent magnet to plus 44 mesh size, and the minus 44 mesh fractions were separated wet in a Dings-Crockett separator. The minus 18 mesh grind and all finer grinds were separated in the Crockett unit. The minus 18 mesh grind was sized into plus 60, plus 200, and minus 200 mesh fractions and each treated separately. The minus 60 mesh and minus 100 mesh grinds were sized to plus and minus 200 mesh and treated separately.

All wet magnetic separations were cleaned, and rechecked, unless otherwise stated. U.S. Screens were used throughout except the ¼ and ½ inch screen which have apertures of 0.2775, 0.371 and 0.132 of an inch respectively.

No responsibility is accepted for the results shown in this report except in so far as they apply to the sample tested.

All iron determinations reported herein are HCl soluble and generally represent the iron from magnetite.

SUMMARY.

1. The sample of magnetite ore contained 46.2 percent of iron, 0.44 percent of sulphur and 0.05 percent of phosphorus. Other determinations are shown under "Sample".

2. The tests from minus ½ inch to minus 200 mesh in seven separate sizings clearly indicate the problem of beneficiation as related to iron content and the removal of impurities.

   At ½ inch the magnetic fraction contained 68.3 percent of iron, 0.33 percent of sulphur. At minus 1 mesh the iron content was 61.2 percent, and the sulphur was dropped to 0.14 percent. The three remaining sizes show gradually increased quality to a maximum of 68.6 percent of iron and 0.02 percent of sulphur.

   The phosphorus content in all magnetic products ranged from 0.01 to 0.03 percent. Other impurities are shown in the table below.

3. Yields of magnetic concentrate ranged from 67.4 to 81 percent, with high recoveries of the iron of the order of 98 percent.

Magnetic Products.

Sizing	Percent Wgt.	Fe	% Fe Dist.	Percent S	P_2O_5	SiO_2	Al_2O_3	MnO	CaO
- ½ inch	81.1	68.3	97.1	0.33	0.03	8.3	0.91	1.09	0.13
- ¼ "	81.0	68.1	98.3	0.29	0.03	7.9	0.86	2.0	0.12
- 8 "	80.7	68.4	98.5	0.27	0.02	7.7	0.83	2.0	0.13
- 1 mesh	74.6	61.2	97.7	0.14	0.02	4.9	0.71	1.92	0.13
- 60 "	70.7	64.9	97.6	0.06	0.01	3.0	0.38	1.78	0.10
-100 "	69.7	66.4	98.1	0.04	0.01	2.3	0.35	1.61	0.11
-200 "	67.4	68.4	98.1	0.02	0.01	1.6	0.3	1.61	0.10
No Beneficiation.	100.0	46.2		0.44	0.05	13.6	2.3	1.8	0.11

4. The rejection of impurities follow a variable pattern. From ½ inch size to minus 200 mesh the percentage rejection of impurities was as follows:

	Reduction Size.			Mesh B.S.			
	½"	¼"	⅛"	18	60	100	200
Sulphur	46	52	56	78	92	94	97
Phosphorus	56	66	68	81	89	93	89
Silica	52	54	55	72	83	88	93
Alumina	70	72	72	78	89	90	92
Titanium	10	10	10	18	27	41	43
Manganese	13	13	13	25	32	33	39

6. Effectiveness of magnetic separation in fine sizes is dependent upon low feed rates and repeated cleaning to reduce mechanically entrained impurities, and the results shown in this report can be regarded as of optimum separation.

The following results indicate the difference between rougher separation and cleaner separation consisting of three passes through the separator.

Sizing	Separation: Rougher Percent			Re-cleaner Percent		
	Fe	S	P_2O_5	Fe	S	P_2O_5
- 18 mesh	59.2	0.17	0.02	61.2	0.14	0.02
- 60 "	61.4	0.13	0.03	64.9	0.06	0.01
-100 "	61.6	0.15	0.03	66.4	0.04	0.01
-200 "	62.7	0.21	0.03	68.4	0.02	0.01

Test Results.

(M = Magnetic and N.M = Non-magnetic)

Test Flowsheet

Minus ½ inch ore

(A) M 81.12 % (B) N M 18.88 %

M (C) ¼" N M (D) M (E) 2.31% ¼" 16.57% (F) N M

78.71 % 2.41 %

M (G) ¼" (H) N M (I) ⅛" (J) M (K) N M (L) M (M) (N)

77.76% 0.95% 0.21% 2.2% 2.1% 0.21% 0.6% 15.

Minus ½ inch products sampled and assayed. After reduction to minus 18 mesh B.S. portions of the samples were mixed as a composite for subsequent tests.

Minus 18 and Minus 60 Mesh Tests.

- 18 Mesh

-18+60		-60+200		-200	
M (Q)	(P)N M	M (Q)	(R)N M	M (S)	(T)N M
49.7%	13.8%	16.3%	4.6%	8.6%	7.3%

Treatment of finer sizings are shown under "Investigation".

Analyses of Products.

Product	Percent							
	Wghts	Fe	S	P_2O_5	Al_2O_3	SiO_2	Mn	TiO_2
G -⅛ Mag.	77.7	57.5	0.24	0.02	0.77	7.05	0.13	2.04
H -⅛ N M	1.0	5.7	2.59	0.25	3.71	35.4	0.08	0.96
I -⅛ Mag.	0.2	19.4	1.36	0.18	2.07	29.7	0.04	0.52
J -⅛ N M	2.2	3.8	2.42	0.39	4.35	37.7	0.08	0.91
(A)-¼" Mag. Prod.	81.1	55.3	0.33	0.03	0.91	8.3	0.13	1.99
K -⅛ Mag.	2.1	33.4	0.93	0.13	2.22	22.3	0.08	1.06
L -⅛ N M	0.2	3.5	1.97	0.22	3.41	40.6	0.05	0.43
M -⅛ Mag.	0.7	16.6	1.40	0.16	3.25	32.0	0.05	0.59
N -¼ N M	15.9	3.4	1.22	0.19	10.20	40.3	0.08	1.00
(B) -¼" Non Mag. Prod.	18.9	7.2	1.21	0.18	8.99	38.0	0.07	0.99
Comp.--¼" Ore	100.0	46.3	0.50	0.06	2.43	13.9	0.12	1.80
G -⅛ Mag.	77.7	57.5	0.24	0.02	0.77	7.05	0.13	2.04
H -⅛ N Mag.	1.0	5.7	2.59	0.25	3.71	35.4	0.08	0.96
K -⅛ Mag.	2.1	33.4	0.93	0.13	2.22	22.3	0.08	1.06
L -⅛ N M	0.2	3.5	1.97	0.22	3.41	40.6	0.05	0.43
(C + E)-¼" Mag. Prod.	81.0	56.1	0.29	0.03	0.85	7.9	0.13	2.00
I -⅛ Mag.	0.2	19.4	1.36	0.18	2.07	29.7	0.04	0.52
J -⅛ N M	2.2	3.8	2.42	0.39	4.35	37.7	0.08	0.91
M -⅛ Mag.	0.7	16.6	1.4	0.16	3.25	32.0	0.05	0.59
N -¼ N M	15.9	3.4	1.22	0.19	10.20	40.3	0.08	1.00
(D + F)-¼" Non Mag. Prod.	19.9	4.1	1.37	0.21	9.18	38.6	0.08	0.97
Composite-¼" Ore	100.0	46.3	0.50	0.06	2.43	13.9	0.12	1.80

Beneficiation at -2"

Beneficiation at -¼"

Product

	Percent.							
	Wht.	Fe	S	P_2O_5	Al_2O_3	SiO_2	Mn	TiO_2
C -½ Mag.	77.7	57.5	0.24	0.02	0.77	7.05	0.13	2.04
I -½ "	0.2	19.4	1.36	0.18	2.07	29.7	0.04	0.52
-½ "	2.1	33.4	0.93	0.13	2.22	22.3	0.08	1.06
-½ "	0.7	16.6	1.40	0.16	3.25	32.0	0.05	0.59
-½ Mag. Prod.	80.7	56.5	0.27	0.02	0.83	7.7	0.13	2.00
H -½ Non Mag.	1.0	5.7	2.59	0.05	3.71	35.4	0.08	0.96
J -½ "	2.2	3.8	2.42	0.39	4.35	37.7	0.08	0.91
L -½ "	0.2	3.5	1.97	0.22	3.41	40.6	0.05	0.43
-½ "	15.9	3.4	1.22	0.19	10.20	40.3	0.08	1.00
-½ Non Mag. Prod.	19.3	3.5	1.44	0.22	9.13	39.8	0.08	0.98
Composite Ore	100.0	46.3	0.59	0.06	2.43	13.9	0.12	1.80

-14 Mesh Grind.

C -14+60 Mag.	49.7	59.3	0.18	0.02	0.85	5.90	0.15	2.07
-60+200 "	16.3	63.7	0.08	0.01	0.59	3.50	0.11	1.79
-200 "	8.6	67.4	0.05	0.01	0.16	1.90	0.08	1.32
-14 Mesh Mag. Comp.	74.6	61.2	0.14	0.02	0.71	4.80	0.13	1.92
-14+60 Non Mag.	13.5	4.4	1.41	0.25	N.D.	37.00	0.15	0.93
-60+200 "	4.6	4.7	2.47	0.19		35.9	0.09	0.89
-200 "	7.3	3.1	1.17	0.18		36.7	0.13	1.95
-14 Mesh Non Mag. Comp.	25.4	4.1	1.53	0.22		36.7	0.13	1.21

-60 Mesh Grind.

-60 + 200 Mag.	51.1	63.8	0.07	0.01	0.43	3.5	0.1	1.90
-200 Mag.	19.6	67.8	0.04	0.01	0.25	1.8	0.08	1.43
-60 Mag. Comp.	70.7	64.9	0.06	0.01	0.38	3.0	0.10	1.78
-60+200 Non Mag.	13.6	3.5	2.06	0.18	N.D.	37.2	0.09	1.17
-200 Non Mag.	15.7	3.8	1.09	0.18		36.0	0.13	2.01
-60 Mesh Non Mag. Comp.	29.3	3.7	1.54	0.18		36.6	0.11	1.62

Concentration at -8#

DEPARTMENT OF MINES LABORATORY 624020

SHEET No. 5.

Product	Percent Wgt.	Fe	S	P_2O_5	Al_2O_3	SiO_2	Mn	TiO_2
-100 Mesh Grind.								
-100 +200 Mag.	36.3	64.9	0.05	0.01	0.40	2.90	0.11	1.54
-200 Mag.	33.4	68.1	0.03	0.01	0.29	1.70	0.10	1.49
-100 Mag. Comp.	69.7	66.4	0.04	0.01	0.35	2.30	0.11	1.51
-100 +200 Non Mag.	9.1	3.2	2.21	0.17	N.D.	37.30	0.10	1.59
-200 Non Mag.	21.8	2.8	1.07	0.19		40.5	0.13	2.82
-100 Non Mag. Comp.	30.8	2.9	1.41	0.18		39.5	0.12	2.45
-200 Mesh Grind.								
-200 Mesh Mag.	67.4	68.4	0.02	0.01	0.30	1.5	0.1	1.51
-200 Mesh Non Mag.	32.6	2.8	1.36	0.18	N.D.	38.6	0.13	2.40

Sizings.

Fraction	Size of Reduction -2"	-1"	-½"
-2" + 1"	70.2		
+ ½"	9.3	42.2	
+ 44 Mesh	16.0	46.3	84.8
- 44 Mesh	4.5	11.5	15.2

B.S. Fraction	Size of Reduction (B.S. Screen) 18	60	100
-18 + 60	63.2		
+200	20.9	64.7	45.4
-200	15.9	35.3	54.6

Chief Chemist & Metallurgist.

620

624021

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION

MINERAGRAPHIC INVESTIGATIONS

Report No. 746 June 12th., 1958

OXIDISED IRON ORE FROM SAVAGE RIVER, TASMANIA

Two samples of oxidised iron ore from Savage River, Tasmania, have been submitted by Rio Tinto Australian Exploration Pty. Ltd. for mineragraphic examination. The samples were described as follows:-

"Sample A: Magnetite with very minor amounts of hematite staining. From costean at baseline E.8.

Sample B: Granular magnetite, somewhat friable, with minor amount of weathered country (clay). From outcrop 150 ft. west of D.30."

Sample A.

Microscopic examination of polished sections revealed that Sample A originally consisted almost completely of magnetite, with minor amounts of ilmenite, rutile and hematite. With the onset of oxidation, however, the magnetite has been converted almost entirely to hematite (martite) and smaller amounts of limonite. The nature of the alteration is revealed by the preservation of the original magnetite grain outlines, which could be compared with the unoxidised ore (Mineragraphic Report No. 736), and by the excellent pattern of pseudo "parquet twinning", displayed by the hematite.

In addition the ilmenite and rutile, which occurred originally as exsolution bodies in the magnetite, remain as residuals in the hematite. As in the primary ore, the ilmenite occurs as lamellae which are commonly about 0.005 mm. long and 0.001 mm. wide and are oriented parallel to the (111) planes of the original magnetite. These lamellae are distinctly pleochroic and isotropic; beside the hematite they have a pinkish brown colour.

In addition to the lamellae, ilmenite also occurs as larger (up to 0.1 mm. x 0.1 mm.), irregularly shaped particles in the grain boundaries of the former magnetite grains. These particles have resulted from more complete segregation from the original magnetite-ilmenite solid solution. They almost invariably contain rows of minute exsolution bodies of hematite lying in the (0001) planes of the ilmenite.

Rutile lamellae also occur oriented parallel to (111) planes of the original magnetite. While not as numerous as the ilmenite lamellae, they tend to be larger, some ranging up to 0.1 mm. x 0.05 mm. in size. They are light grey in colour and are pleochroic and strongly anisotropic. Rutile also occurs as larger and irregularly shaped particles, but these are not as abundant as the corresponding ilmenite types.

Limonite occurs as irregular areas throughout the hematite, some areas being up to several millimetres in diameter. It is slightly darker grey than the hematite and has a distinct "dusty" appearance. It is further character-

Mineragraphic Report No. 746 June 12th., 1958

ised by strong red internal reflections. The limonite appears to have been formed by alteration of hematite close to the surface.

The sample is non-magnetic, and only a few very small and isolated residuals of the original magnetite were observed.

Sample B.

Sample B, by contrast, is strongly magnetic, and proved, on microscopic examination, to consist of almost unaltered primary magnetite, with associated ilmenite, rutile and hematite. The hematite is rare, most of it occurring as minute exsolution bodies in ilmenite.

The friable nature of the sample, which led to some difficulty in the preparation of polished surfaces, is due to the presence of relatively high proportions - up to 40 per cent - of fine-grained gangue. Weathering processes have concentrated on the gangue mineral, leaving the magnetite largely unaltered.

The lamellae of ilmenite and rutile oriented in the (111) planes of the magnetite are rare in this sample. These minerals, where present, commonly occur as the larger particles of irregular shape.

K.L. Williams
Research Officer

A.B. Edwards
Officer-in-Charge

MAIN SOUTH IRON DEPOSIT
WEST LENSE
SOUTH DEPOSIT
EAST LENSE
MAIN NORTH IRON DEPOSIT
Magnetite outcrops and boulders
NORTH DEPOSIT
IRON DEPOSIT (MAGNETITE)
Basalt outcrops and boulders
Cellular quartz gossan with pyrite No.175
Webster Creek
Savage River
Halls Creek
Grid Line 00
Section Samples
Section 1
Section 2
Section 3
Section 4
Section 5
Section 6
Section 7
Section 8
D.D.H Site 1
D.D.H Site 2
D.D.H Site 3
D.D.H Site 4
D.D.H Site 5
D.D.H Site 6
Collar D.D.H No1
Collar D.D.H No2
End of Hole
Old Shaft
Pyrite sample
Sample No.180
Sample No.177
Sample No.174
Sample No.175
Sample No.181
Sample No.183
Sample No.184
Sample No.185
Outcrop of sulphides
Sulphides Sample No.183
Corner pegs lease 623M
Adit Sample No.176
Gossan limonite
Quartz chlorite amphibolite schist
Gabbro boulders
Iron boulders
Light clay
Boulders of siliceous dolomite
Boulders amphibolite & siliceous dolomite
Iron floaters
Iron boulders yellow clay
Yellow clay
Pale clay
Amphibolite schist
Amphibolite schist with magnetite
Amphibolite outcrop
Graphitic schist
Talcose schist
Quartz chlorite schist
Chlorite schist
Siliceous schist
Gabbro amphibolite
Gabbro boulders
Massive amphibolite
Magnetite boulders
Magnetite with banded silica
Cellular quartz gossan
Weathered amphibolite schist
Magnetite
Gabbro
Sheared gabbro limonite capping
Cutting
Adit
Observed boundary
Inferred boundary
Aneroid reading in feet — An. 900
Sample number — No. 174
Strike and dip of schistosity — 40
Old shaft
Adit
Trench
Proposed diamond drill hole
Proposed helicopter landing areas — A
Iron deposits in ore reserve estimates
Basalt (Tertiary)
Gossan
Main magnetic anomalous zones from preliminary geophysical results
Pits and percentage of iron — 66.5%
5 cm
58 - 239
022

RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

GEOLOGICAL MAP
SAVAGE RIVER AREA
N. W. TASMANIA

SCALE 200 FEET TO 1 INCH

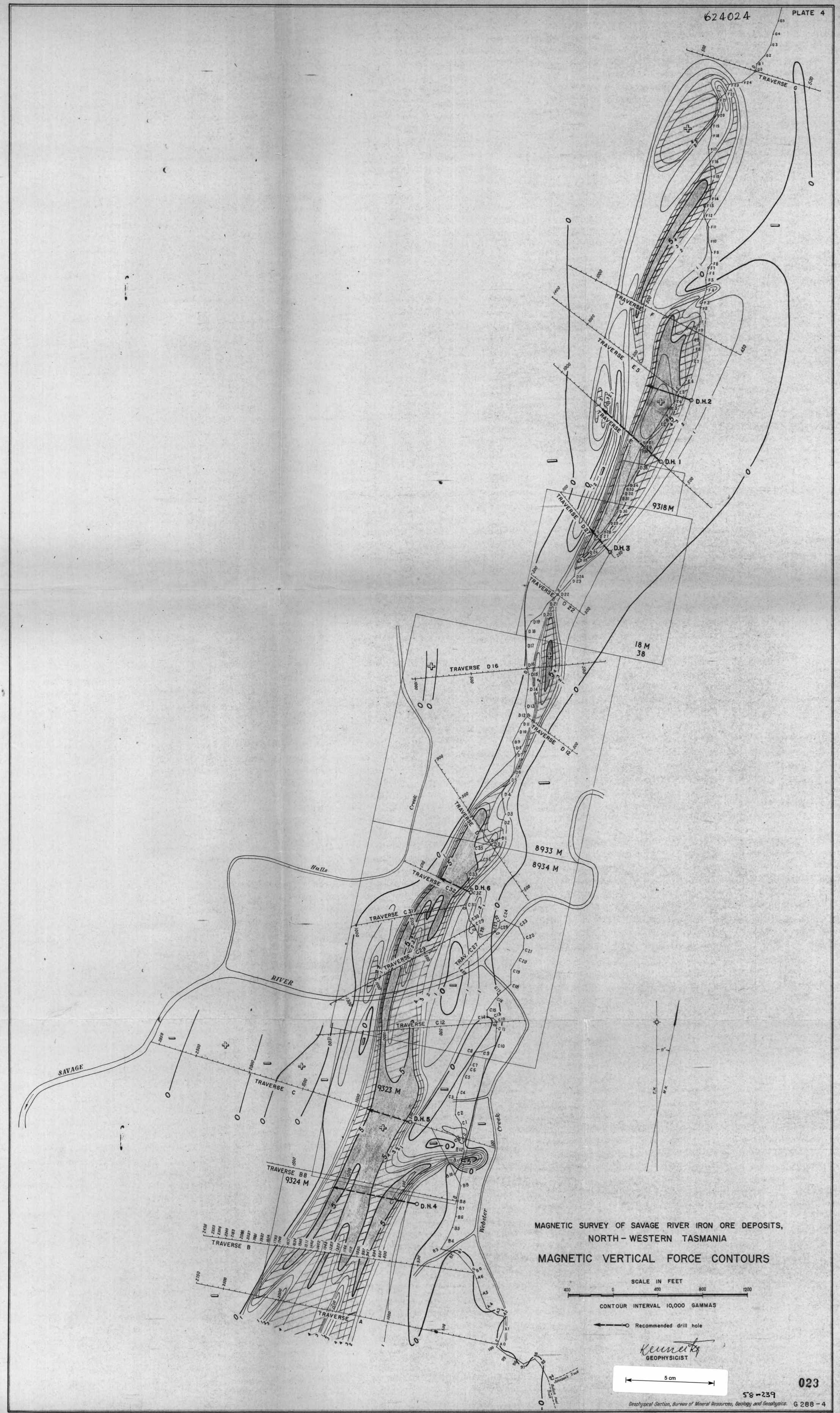
Authority PRP/7/100

PLATE 2

T 67

624024

PLATE 4



MAGNETIC SURVEY OF SAVAGE RIVER IRON ORE DEPOSITS,
NORTH - WESTERN TASMANIA

MAGNETIC VERTICAL FORCE CONTOURS

SCALE IN FEET

400 0 400 800 1200

CONTOUR INTERVAL 10,000 GAMMAS

Recommended drill hole

Kennedy
GEOPHYSICIST

5 cm

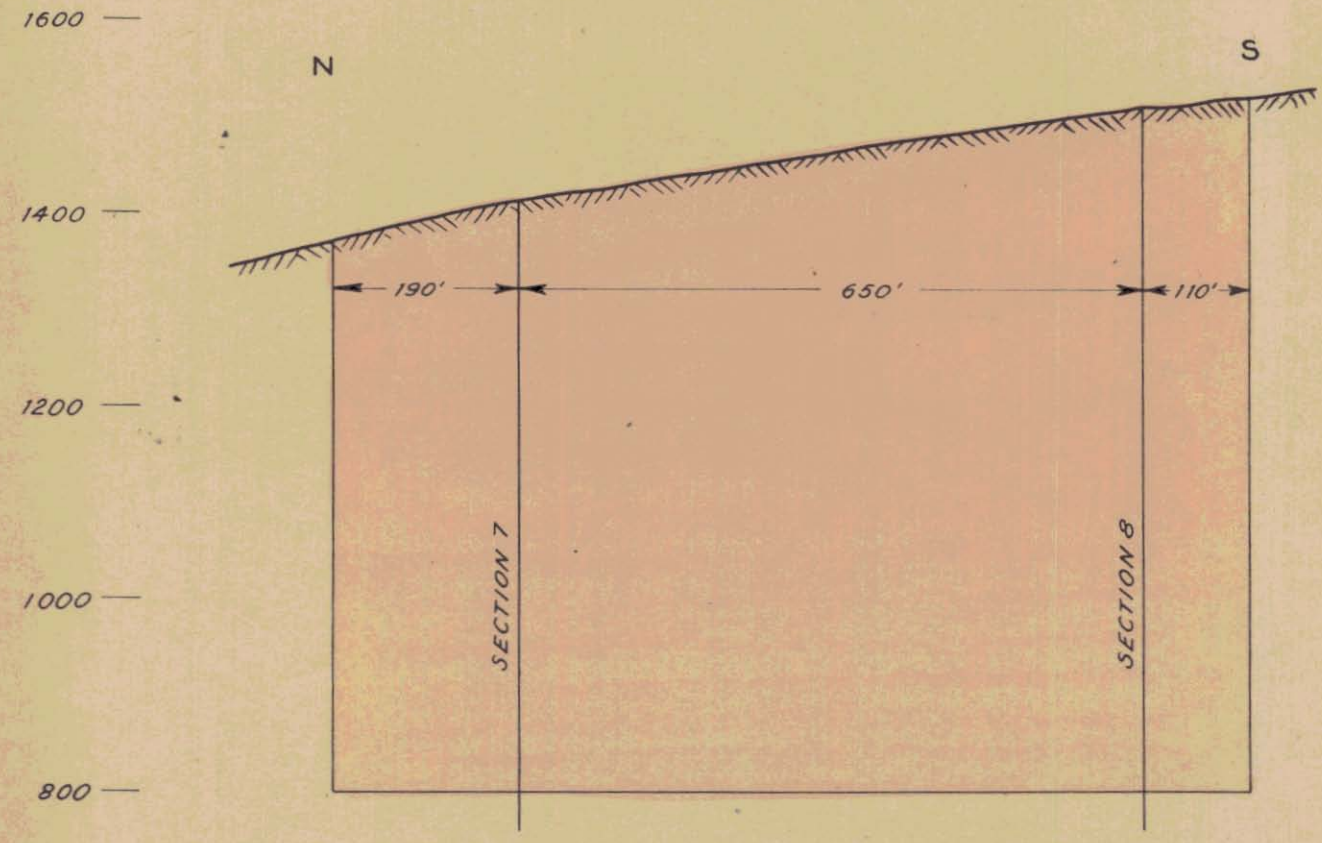
023

58-239

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics. G 288 - 4

Tm 375

624025



58 - 239

Possible Ore indicated by surface exposure and Magnetic Survey.

5 cm

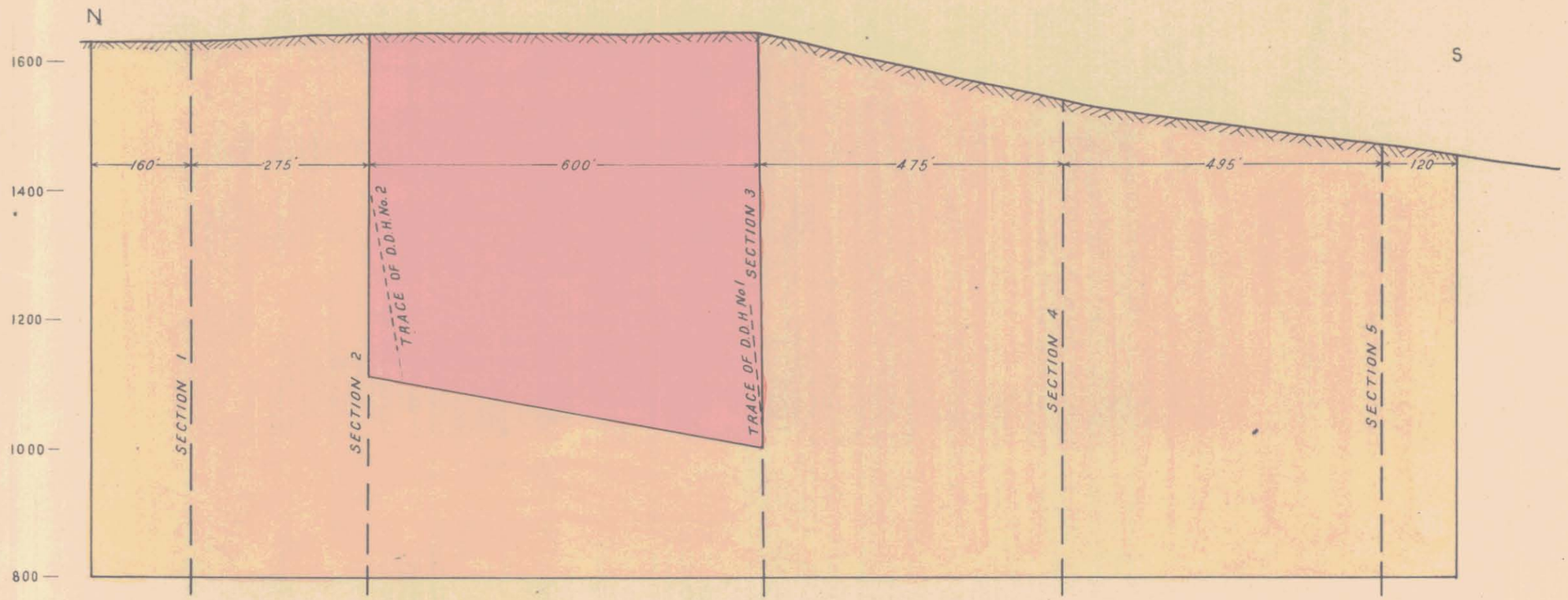
RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

SAVAGE RIVER IRON ORE BODY

SOUTH ORE DEPOSIT (EAST DEPOSIT) 021

LONGITUDINAL SECTION

15th August 1958.	SCALE: 200 Feet to 1 inch	PRP/7/100	Plan No T 423



Ore indicated by Diamond Drilling.

Possible Ore indicated by surface exposures and Magnetic Survey.

5 cm

RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

SAVAGE RIVER IRON ORE BODY
NORTHERN ORE DEPOSIT
LONGITUDINAL SECTION

SCALE 200 FT. TO 1 INCH DATUM: DOO = 1000 FT.

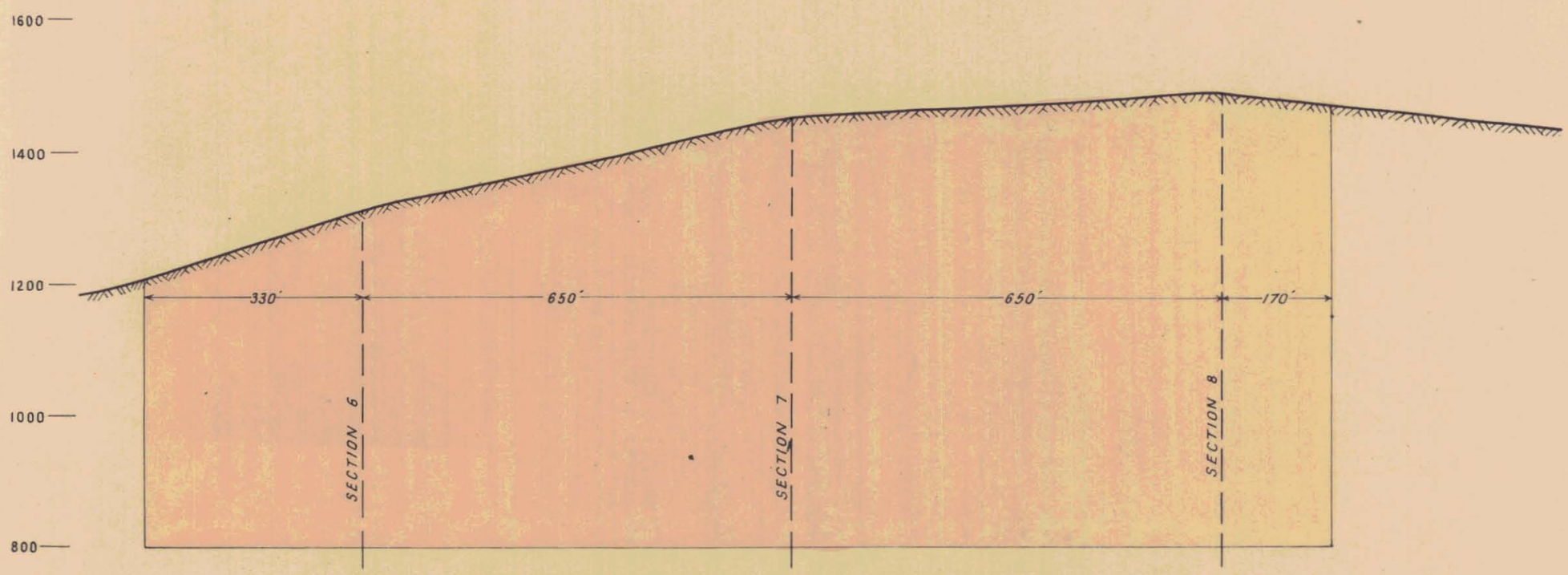
P.R.P. 7/100

Plan Nº T 424

S 8 234

025

624026



5 cm

Possible Ore indicated by surface exposures and Magnetometer Survey.

RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

SAVAGE RIVER IRON ORE BODY
SOUTH ORE DEPOSIT (WEST DEPOSIT)
LONGITUDINAL SECTION

SCALE 200FT. TO 1 INCH DATUM : DOO = 1000FT.

P.R.P. 7/100

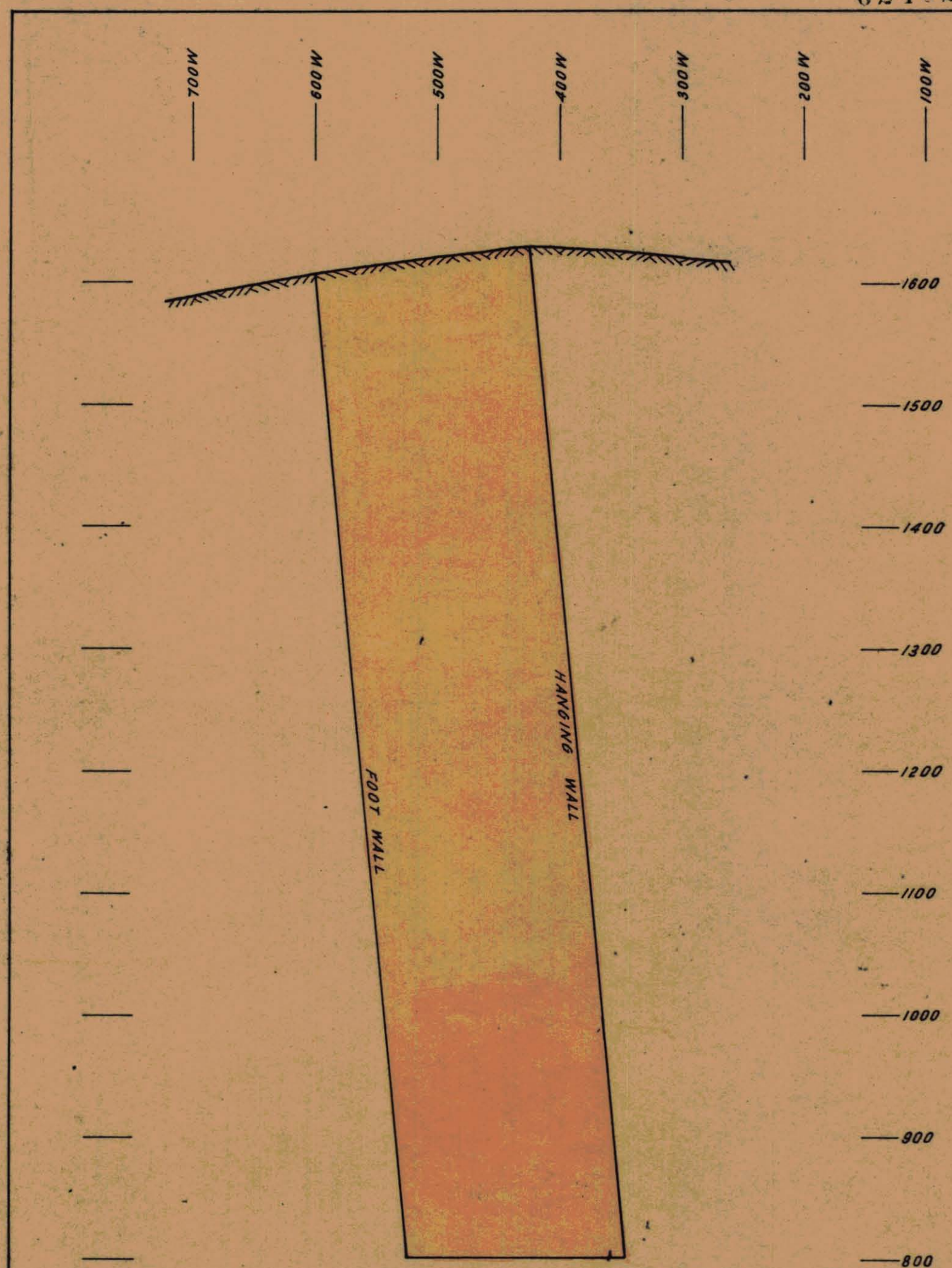
Plan Nº T425

78-239

920

120429

624028



5 cm

58-239

027

RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

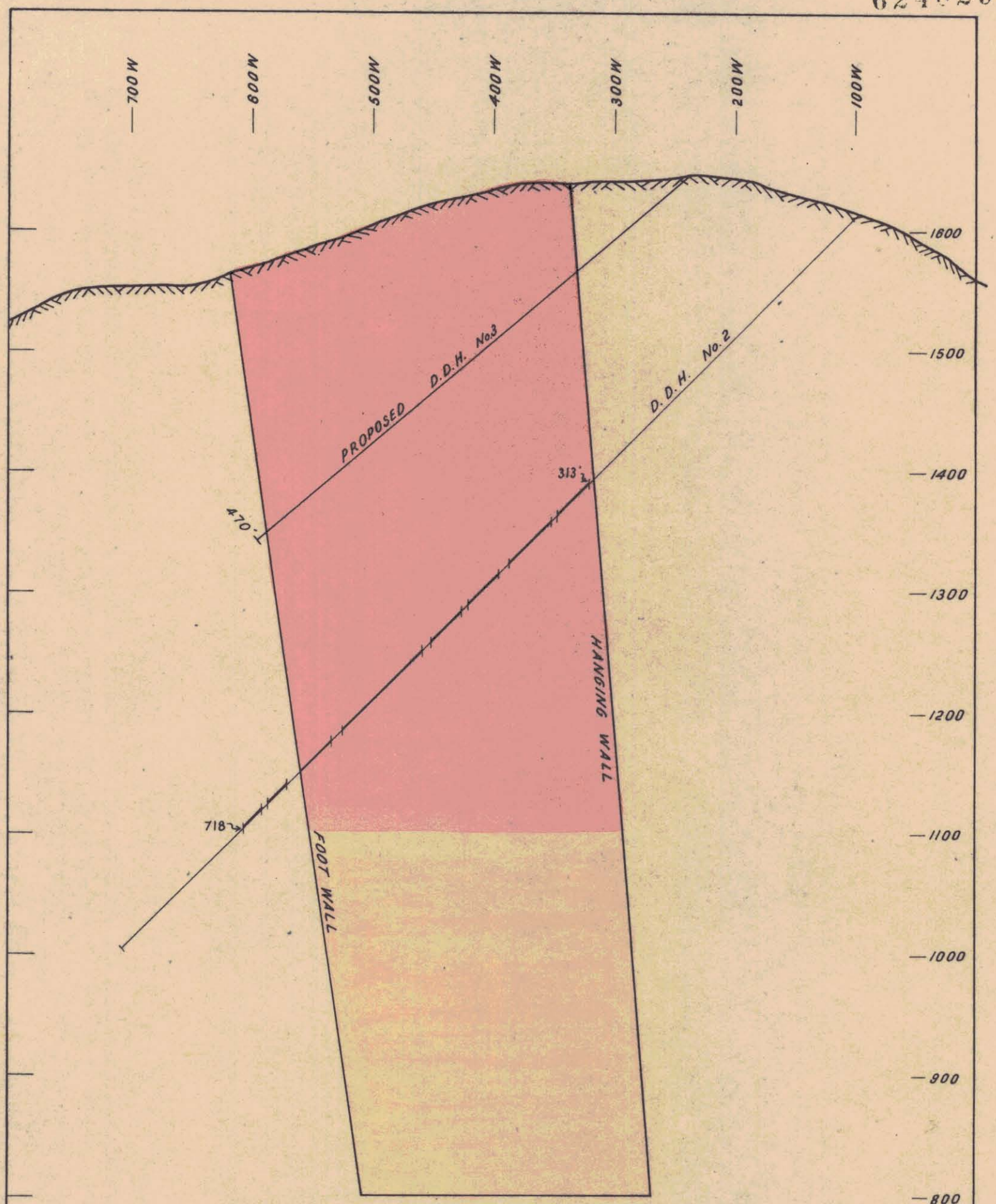
SAVAGE RIVER IRON ORE BODY
NORTH ORE DEPOSIT
TRANSVERSE SECTION 1.

SCALE 100 FT TO 1 INCH

P.R.P. 7/100

T426

624029



ANALYSES OF CORE FROM D.D.H. No 2

FROM ~ TO	Fe% HCl. SOL.	SiO_2%	TiO_2%	Mn%	P_2O_5%	S%
313 ~ 718·5	44·1	14·88	1·78	0·12	0·08	0·48

58-239 028

RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED.

SAVAGE RIVER IRON ORE BODY
NORTH ORE DEPOSIT
TRANSVERSE SECTION 2

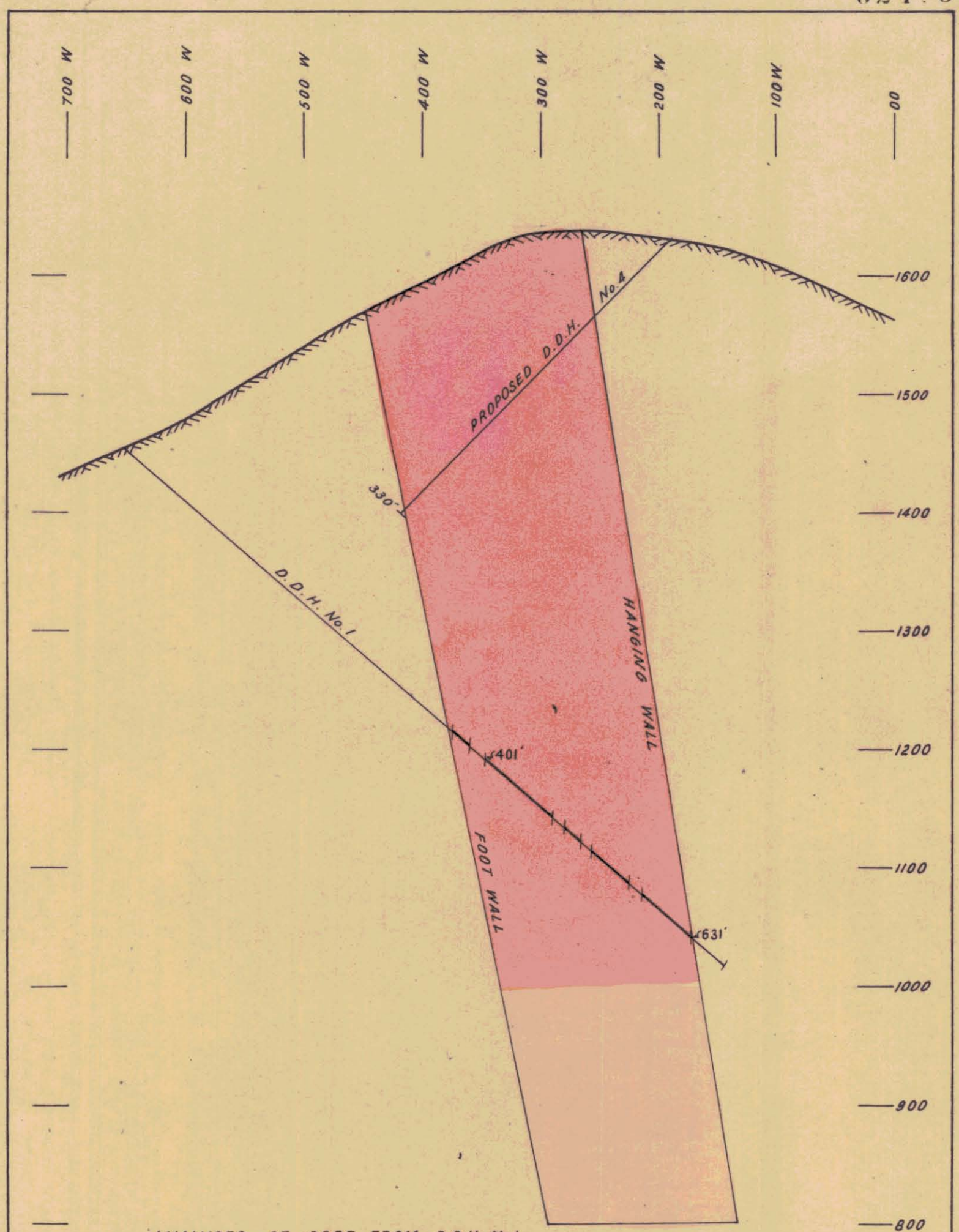
5 cm

SCALE 100 FT TO 1 INCH

P.R.P. 7/100

T427

624030



ANALYSES OF CORE FROM D.D.H. No.1

FROM - TO	Fe % HCl. Sol.	SiO_2 %	TiO_2 %	Mn %	P_2O_5 %	S %
401 - 631	45·8	14·7	1·59	0·12	0·06	0·78

029

58-239

RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

SAVAGE RIVER IRON ORE BODY
NORTH ORE DEPOSIT
TRANSVERSE SECTION 3

5 cm

SCALE 100 FT. TO 1 INCH

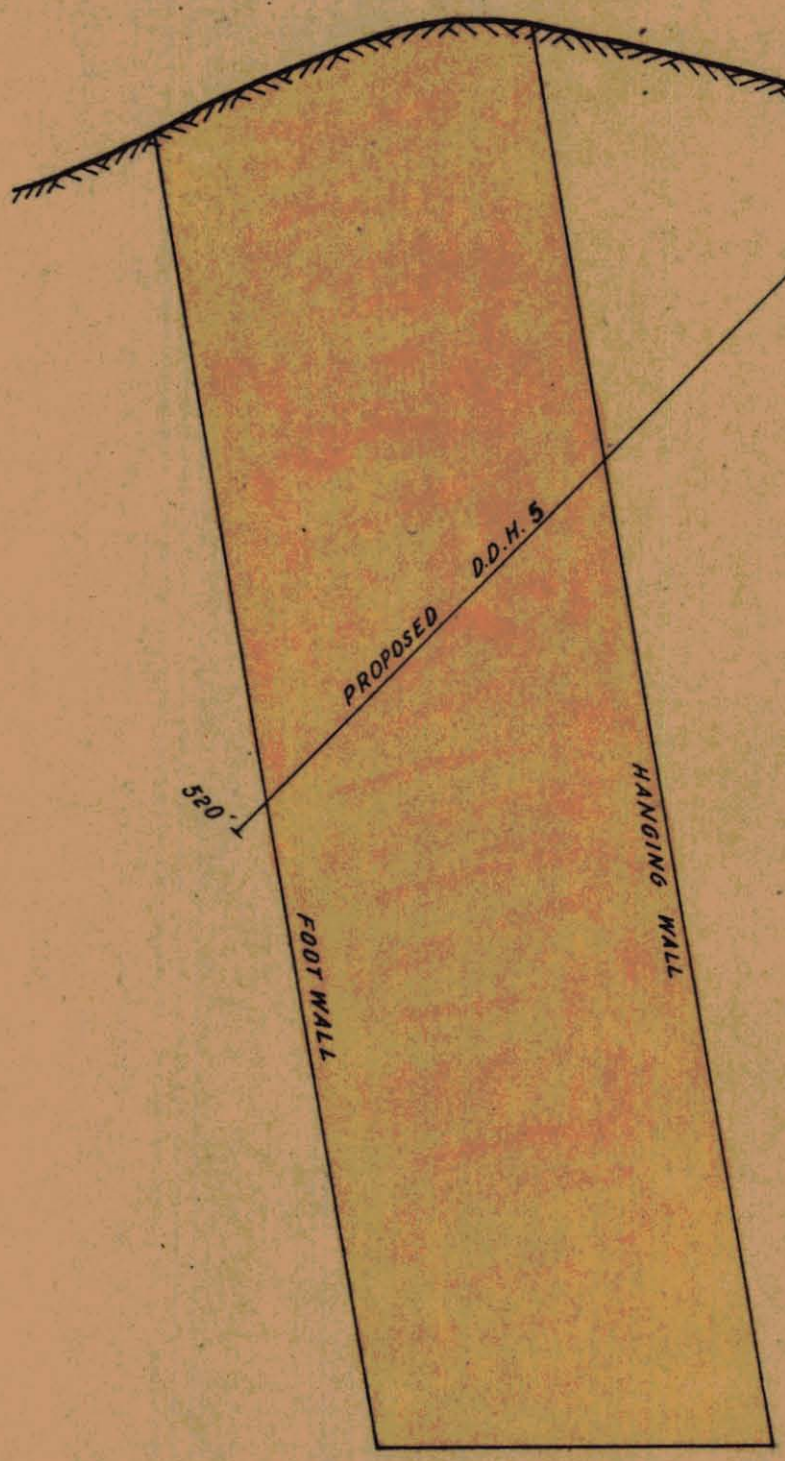
P.R.P. 7/100

T428

624031

600 W | 500 W | 400 W | 300 W | 200 W | 100 W | 00

1600
1500
1400
1300
1200
1100
1000
900
800



5 cm

58-239 030

RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

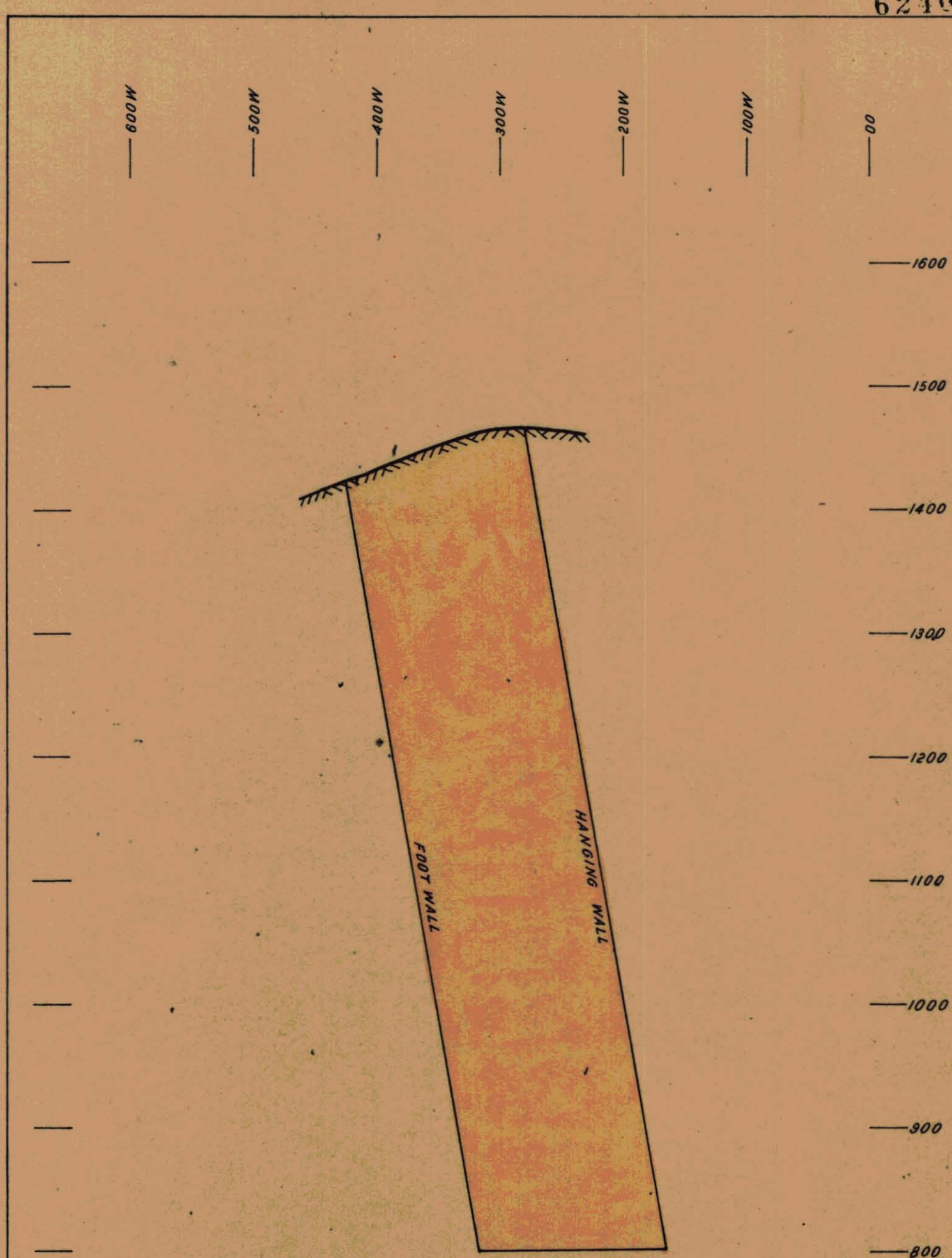
SAVAGE RIVER IRON ORE BODY
NORTH ORE DEPOSIT
TRANSVERSE SECTION 4

SCALE 100 FT. TO 1 INCH

P.R.R. 7/100

T429

624032



5 cm

58-239 031

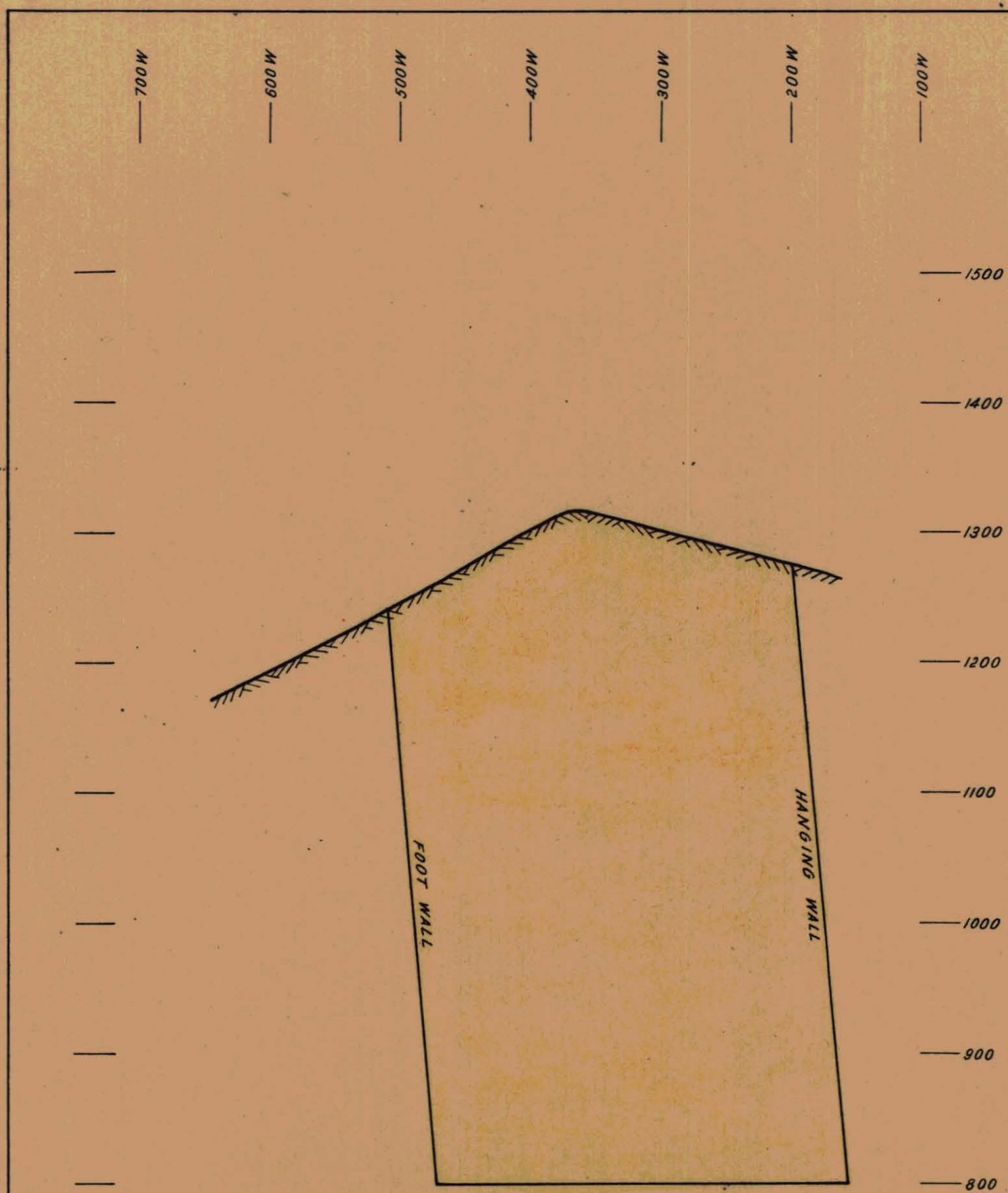
RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

SAVAGE RIVER IRON ORE BODY
NORTH ORE DEPOSIT
TRANSVERSE SECTION 5

SCALE 100FT TO 1 INCH

P.R.P. 7/100 T430

624033



5 cm

032

58-239

RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

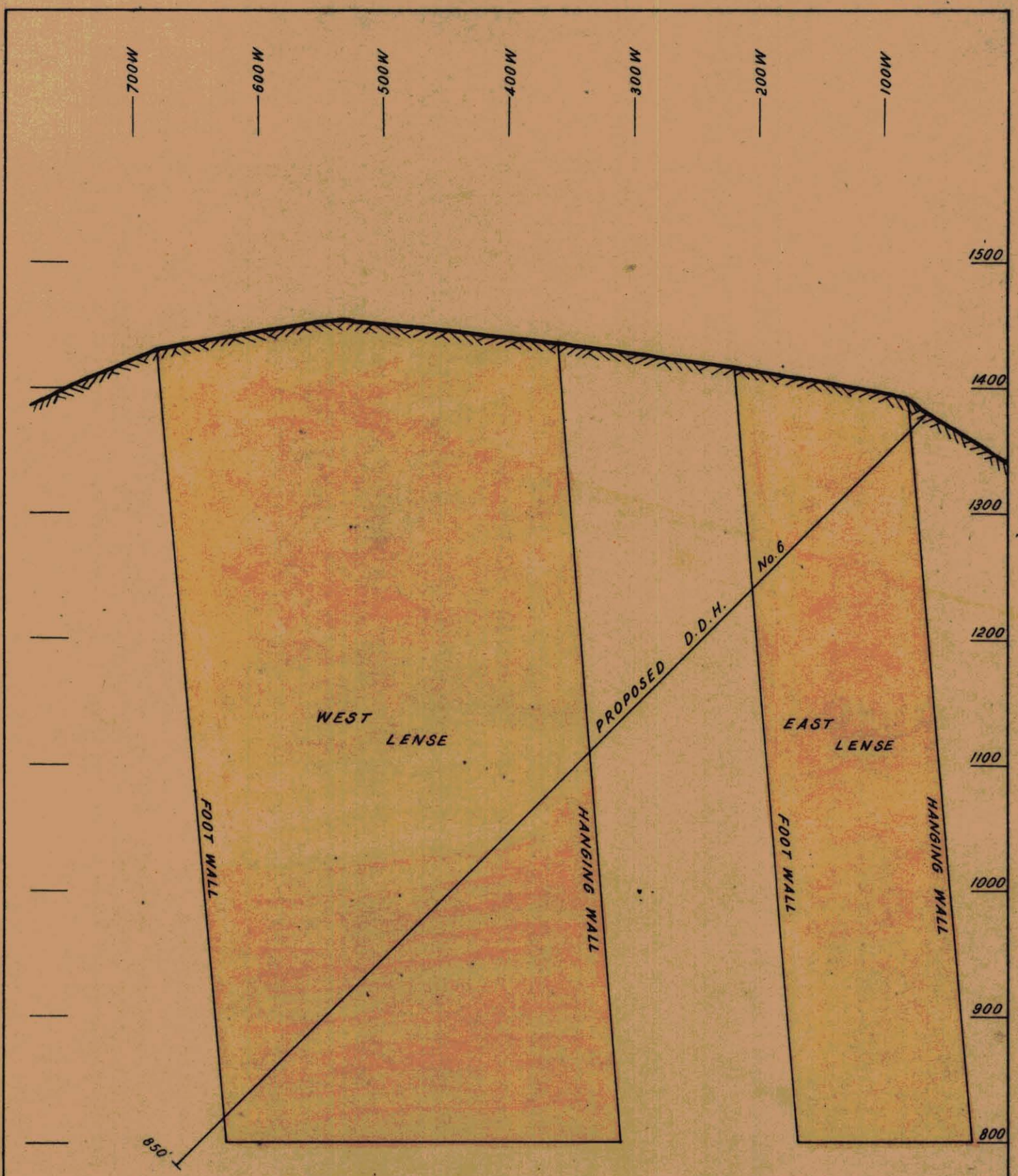
SAVAGE RIVER IRON ORE BODY
SOUTH ORE DEPOSIT
TRANSVERSE SECTION 6

SCALE 100FT TO 1 INCH

P.R.P. 7/100

T431

624034



033

58-239

RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

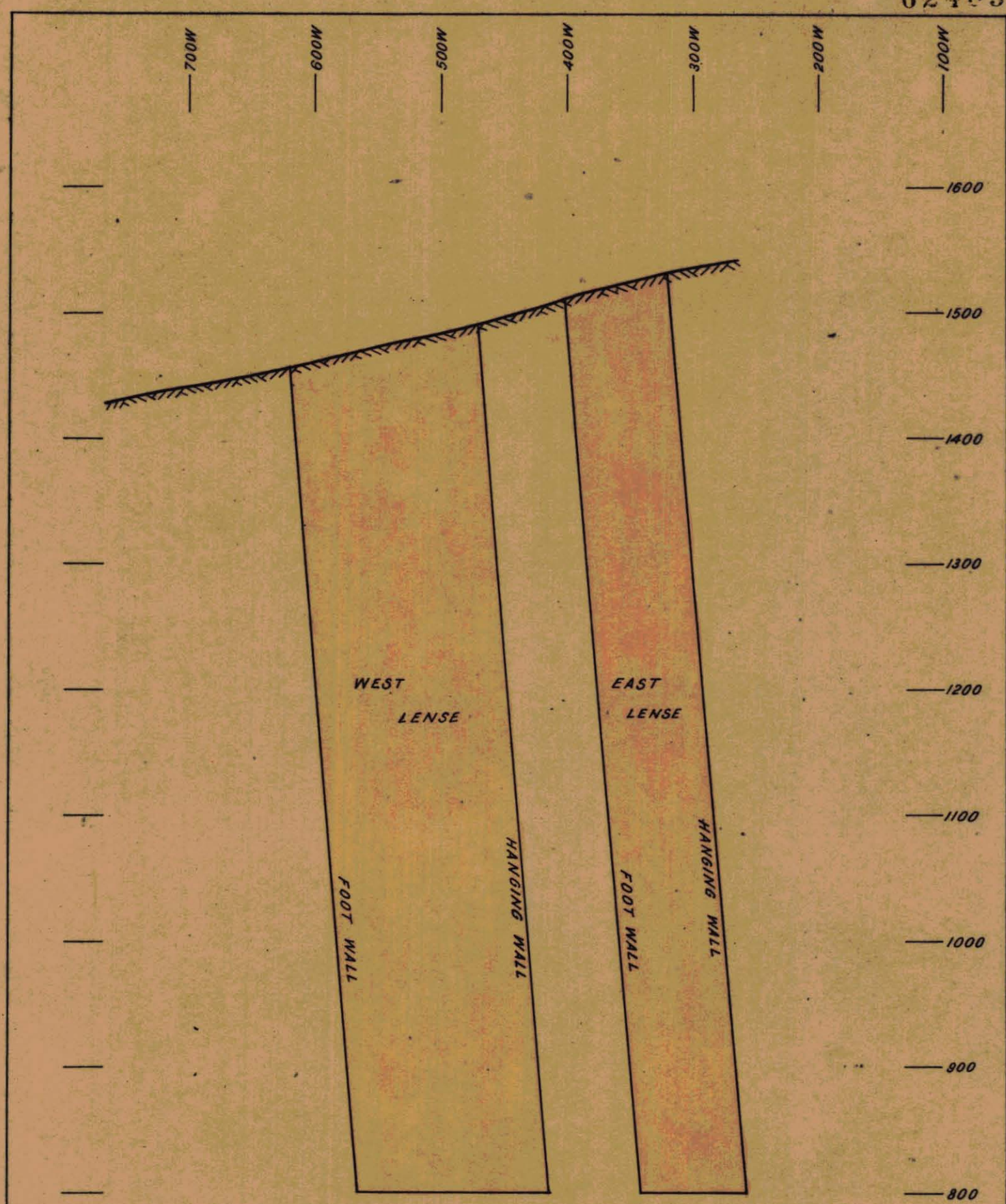
SAVAGE RIVER IRON ORE BODY
SOUTH ORE DEPOSIT
TRANSVERSE SECTION 7

SCALE 100FT TO 1 INCH

P.R.P. 7/100

T432

624035



034

58-239

RIO TINTO AUSTRALIAN EXPLORATION PTY. LIMITED

SAVAGE RIVER IRON ORE BODY
SOUTH ORE DEPOSIT
TRANSVERSE SECTION 8

SCALE 100FT. TO 1 INCH

P.R.P. 7/100

T433

5 cm