PROGRESS REPORT ON THE EXPLORATION OF THE SAVAGE RIVER IRON ORE DEPOSITS

By J. G. Symons

SUMMARY

The first stage of the exploration of the Savage River iron ore deposits consisted of an airborne magnetometer survey, followed by a ground magnetometer survey and two diamond drill boreholes drilled in the northern section together with ore dressing investigations carried out on the core from the drill holes.

The second stage commenced in 1959 with the construction of an access road from the Corinna-Waratah Highway to the central section of the deposit.

A camp site for drilling crews was established in a central position and a comprehensive diamond drilling programme to outline the deposit between the Savage River and Magnetite Creek was planned.

Diamond drill boreholes No. 3 to 10 were drilled in the area by the Department of Mines, then an Exploration Licence was granted to E. R. Hudson of Industrial and Mining Investigations Pty. Ltd., who undertook to investigate the deposits with the object of establishing a steel industry. The company drilled boreholes Nos. 11 to 16. All drill holes intersected ore and established that the deposit in this section is continuous over a length of at least 6,000 feet.

Magnetometer surveys conducted by the Bureau of Mineral Resources have been continued and the survey to date has shown the presence of two large magnetic zones—the Savage River zone being 4½ miles in length, and the nearby Long Plains zone being 2½ miles in length.

Using the information from the diamond drill boreholes, an open cut was designed to extract that part of the ore in the central section between the Savage River and Magnetite Creek to a depth of 400 feet below the surface, excepting in the northern end where the presence of the Savage River may limit the depth of the open cut workings. The ore intersection in borehole D.D.H. No. 14 was omitted from the calculations, as although the borehole intersected ore at depth of 950 feet below river level, the ore would be on the northern side of the river.

The calculations indicated that an open cut 5,300 feet long would mine:—

- 82 million tons of ore.
- 17 million tons of low grade material @ 17.3% Fe.
- 62 million tons of waste.

It is estimated that of the 82 million tons of ore, 23 million tons of high grade ore assaying 60-65% Fe occurs on or near the surface, but the remainder of the ore below approximately 100 feet from the surface would assay 43.8% Fe, 0.42% Ti, 0.13% P, 4.73% S, 0.31% V.

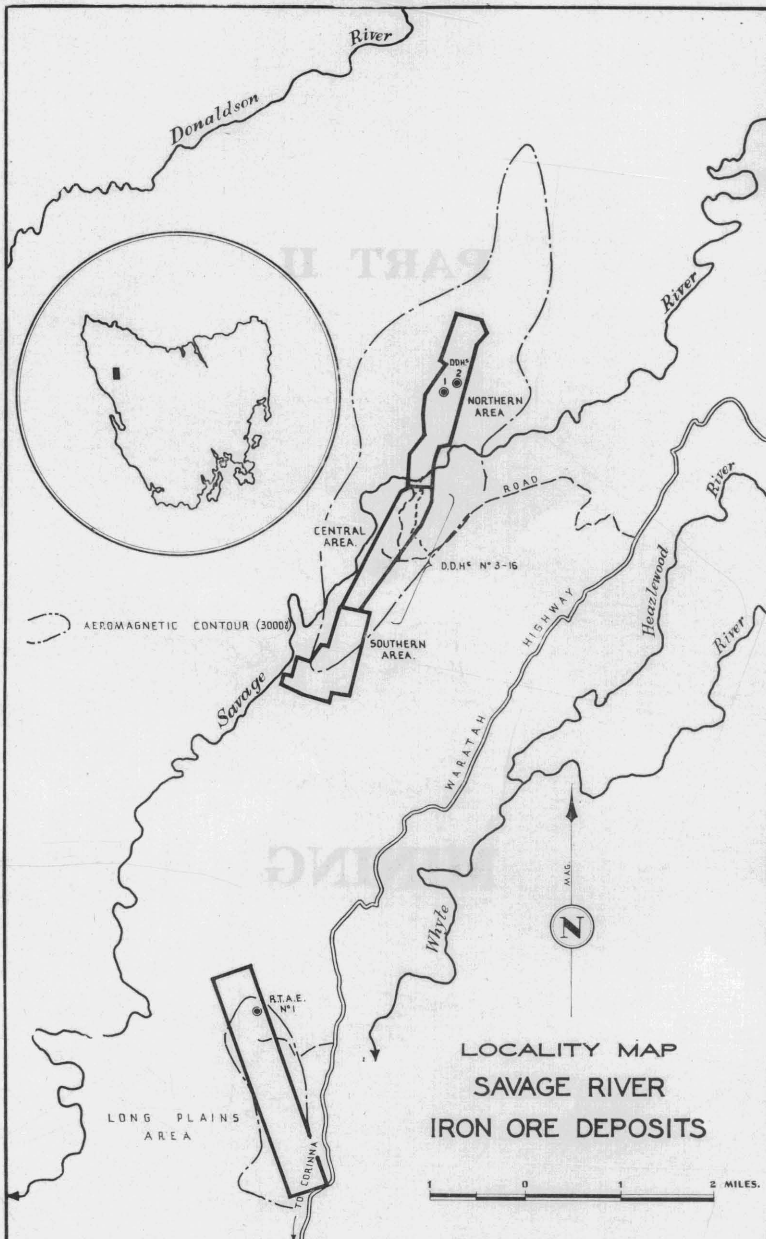

FIGURE 29

5 cm

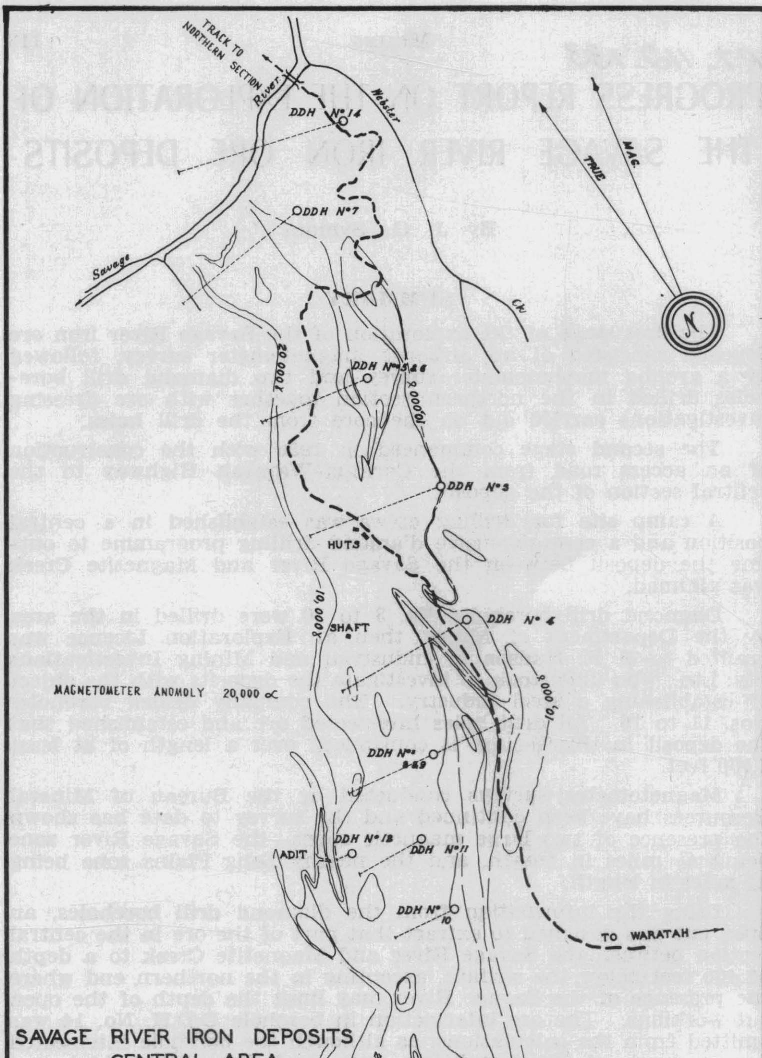

FIGURE 30.

5 cm

It is noted that the titanium content of the ore in this section is very much less than in the northern section.

The results of recent magnetometer surveys indicate that the total reserves of the Savage River and Long Plains deposits are enormous.

Further ore dressing research was completed, and indicated that the unaltered ore at depth can be easily up-graded to 65% Fe with a 97% recovery and a satifactory reduction of impurities. A parcel of 28 tons of ore was sent to the United States of America where it was tested to determine its suitability for smelting in the Strategic Udy Process. The final report indicated that high quality iron and steel can be made from the Savage River iron ore at competitive costs.

HISTORY

The history of the deposits up to 1958 was published by Symons (1959) and a comprehensive list of references to date is given at the end of this report.

Construction of an access road to the central area commenced in 1959 and diamond drilling started in the central area in April, 1959, with Borehole D.D.H. No. 3. Rio Tinto Australian Exploration Pty. Ltd. drilled one hole in the Long Plains anomaly in July, 1959.

The area of the iron reservation was increased to 147 square miles in late 1960, to include the areas of Savage River, Long Plains and Rocky River.

The area previously included in the reserve was granted to E. R. Hudson of Industrial and Mining Investigations Pty. Ltd., in February, 1961, when the applicant undertook to continue diamond drilling of the deposit, to arrange smelting tests, and to investigate the proposal to establish an integrated steel plant in Tasmania to smelt the iron ore.

Diamond drilling continued until Borehole D.D.H. No. 16 was completed in June, 1962, when drilling was suspended as it was not possible to move the drill to the next drill sites. A bridge had been constructed over the Savage River, but wet conditions had prevented the building of access roads to future drill sites.

ACCESS

The original diamond drilling programme consisted of two drill holes situated in the northern section of the orebody and all equipment was transported to the area by helicopter. Servicing was done mainly by helicopter, although some supplies were packed in, using an old pack track. The cost of helicopter transport was naturally high and before commencing the second drilling stage, an access track suitable for motor vehicles was planned, to give access to the iron deposits on the south side of the Savage River. The new track followed the old pack track from the Waratah-Corinna Road for most of the distance but near the deposit it deviated somewhat to give flatter grades. The access road was constructed in 1959 as far as a centrally located camp site where two wooden huts were built for the use of drilling crews and other personnel. The track was extended from the camp site to the sites of the various drill holes as necessary.

The track as originally constructed was suitable for four wheel drive vehicles, but with the increased traffic it became impassible after heavy rains. During 1960 it was gravelled for its whole length and in addition, it was extended to the Savage River and to other diamond drill sites. The road to the camp site is now accessible for normal vehicles in all weather.

Figure 30 shows the layout of the track and camp in relation to the drill holes.

During 1962 a bridge was constructed on the Savage River by Industrial and Mining Investigations Pty. Ltd., to give access to the drill sites on the northern side of the river. Heavy rains caused a landslide to block access tracks on the northern side of the river, but this will be cleared when weather conditions allow.

GEOLOGICAL MAPPING.

Geological mapping of the area in the vicinity of the outcrop between the Savage River and Magnetite Creek has been completed in detail. The new mapping has not altered the basic understanding of the iron deposits. Mapping in this area of dense scrub and thick forest is difficult, rock exposures are few, and most of the area near the iron deposit is covered with a considerable thickness of iron ore scree. Further mapping between Magnetite Creek and the Long Plains area has been planned for the coming summer field season.

MAGNETOMETER SURVEYS

The predominant mineral in the Savage River deposit is magnetite and hence the most useful method of determining the trend of the iron deposits is the ground magnetometer survey. The Bureau of Mineral Resources have worked in the area every summer since 1957 and have now completed surveys over an area approximately nine miles in length and 2,000 feet in width.

The most recent report on this work is by Eadie (1962) who gives the results of the work for the Northern, Central and Southern areas covering a length of four and a half miles. Magnetic anomalies continue throughout the length of the area surveyed, and indicate that the iron formation will be continuous over the full length. Magnetometer surveys completed after those included in the report indicate that anomalies extend beyond the most southerly point in the southern area and that another large anomaly, 2½ miles in length, occurs in the Long Plains area. It is now known that an iron bearing zone exists over a length exceeding seven miles.

The area tested by magnetometer survey is illustrated in Figure 29.

DIAMOND DRILLING

Following the completion of the access track to the area south of the Savage River, diamond drilling of that section of the deposit between the Savage River and Magnetite Creek was commenced in May, 1959. Drilling was continued until June, 1962, during which time diamond drill boreholes Nos. 3 to 16 were completed. Boreholes Nos. 3 to 10 were bored by a contractor for the Department of Mines with Rio Tinto Australian Exploration Pty. Ltd., acting as agents as the area was then reserved. When the area was granted as an Exploration Licence to Industrial and Mining Investigations Pty. Ltd., the licence holder continued the drilling and completed boreholes Nos. 11 to 16. Total footage drilled in these thirteen boreholes was 11,293 feet.

Figure 30 illustrates the position of drill holes Nos. 3 to 16. All drill holes intersected iron ore and the results indicate that the iron ore is continuous over the length of 6,000 feet drilled. A diamond drill borehole was drilled at Long Plains in 1959 by Rio Tinto Australian Exploration Pty. Ltd., to test a magnetic anomaly in this area. The iron ore intersected in this drill hole was consistent in width and grade with those drilled at Savage River and from the later geophysical work it must be assumed that the Long Plains iron deposits are an extension of the Savage River iron deposits. Complete logs of drill holes Nos. 3 to 10 are included in reports on Savage River Iron by Tetlow (1960) and Hughes (1961).

A summary of the results of drill holes 3-13, 15, 16, is as follows:—

DIAMOND DRILL BOREHOLE, No. 3

LOCATION: Traverse B8, 414′ W.
R.L.: 975′

BEARING: 271°

DIP OF HOLE: 45°

Depth From To		Intersection (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
			%	%	%	%	%	%	%	%	%
0–325..	..	325.0	0–50 4 50–325 65	52.0	5.7	0.9	0.19	0.12	0.10	3.6	..
325–345..	..	20.0	95	32.9	..	..	0.37	..	0.29	8.1	..
345–525..	..	180.0	83	16.2	..	..	0.31	..	0.22	5.6	..
525–590..	..	65.0	82	43.1	11.6	2.9	0.65	0.15	0.26	4.7	..
590–645..	..	55.0	70	15.4	..	..	0.59	..	0.08	1.6	..
785–825..	..	40.0	85	20.9	8.9	1.4	0.62	0.05	0.07	3.9	..
825–920..	..	95.0	87	48.3			0.55		0.02	4.7	..

DIAMOND DRILL BOREHOLE, No. 4

LOCATION: Traverse B00, 850′ W.
R.L.: 1130′

BEARING: 263°

DIP OF HOLE: 45°

Depth From	To	Inter-section (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
			%	%	%	%	%	%	%	%	%
100	–115	15.0	67	26.9	27.0	3.1	0.53	0.06	0.02	2.0	..
115	–235	120.0	90	48.9	9.1	2.0	0.30	0.06	0.07	4.3	..
235	–248	13.0	85	20.7	28.3	0.4	0.11	0.03	0.29	3.4	..
258	–266.5	8.5	100	14.7							
270	–275	5.0	26	8.1	33.8	2.4	0.21	0.09	0.10	4.2	..
285	–293	8.0	73	13.2							
331	–339	8.0	100	54.8	5.3	1.4	0.20	0.08	0.06	4.7	..
343.5	–360.5	27.0	97	52.5	6.0	1.3	0.29	0.13	0.07	5.2	..
379	–392.5	13.5	92	56.7	4.2	0.8	0.29	0.13	0.11	4.3	..
412	–475.5	63.5	100	43.1	9.7	1.1	0.37	0.19	0.10	7.1	..
521	–590.7	69.7	97	48.8	5.4	1.7	0.83	0.17	0.09	8.6	..
676	–688	12.0	100	43.9	9.7	2.3	0.76	0.06	0.15	4.6	..
708.5	–717.5	9.0	83	55.4	5.5	1.6	1.06	0.07	0.03	3.8	..

DIAMOND DRILL BOREHOLE, No. 5

LOCATION: Traverse C00, 450′ W.
R.L.: 840′ BEARING: 271° DIP OF HOLE: 60°

Depth From – To		Inter-section (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
			%	%	%	%	%	%	%	%	%
36 – 73	..	37.0	55	21.2	27.8	6.3	0.50	0.12	0.18	3.3	..
224 –336.5	..	112.5	98	20.9	26.0	2.9	0.29	0.10	0.34	4.6	..
336.5–549.5	..	213.0	96	46.7	10.3	2.1	0.33	0.08	0.12	4.6	..
605 –763	..	158.0	89	36.2	17.7	4.7	0.46	0.06	0.07	4.1	..
818.5–871.2	..	52.7	99	22.8	31.1	7.3	0.61	0.08	0.03	1.0	..

DIAMOND DRILL BOREHOLE, No. 6

LOCATION: Traverse C00, 450′ W.
R.L. 840′ BEARING: 91° DIP OF HOLE: 40°

Depth From – To		Inter-section (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
			%	%	%	%	%	%	%	%	%
52 – 87	..	35.0	40	44.0	15.8	3.0	0.41	0.10	0.21	4.6	..
146 –169.5	..	23.5	79	42.0	14.8	0.5	0.17	0.06	0.23	4.8	..
169.5–316	..	146.5	77	15.0	33.1	7.9	0.56	0.12	0.11	3.0	..
316 –322.5	..	6.5	96	56.3	5.7	1.1	0.74	0.05	0.09	3.6	..
373 –386.5	..	13.5	100	54.7	11.4	2.0	0.73	0.12	0.04	3.0	..
386.5–462.5	..	76.0	97	10.9	37.3	9.2	0.51	0.12	0.06	1.4	..
462.5–487.5	..	25.0	98	55.3	7.7	2.1	0.81	0.11	0.09	1.1	..
487.5–559.5	..	72	95	26.7	28.9	5.3	0.44	0.10	0.19	3.6	..

DIAMOND DRILL BOFEHOLE, No. 7

LOCATION: Traverse C12, 500′ W.
R.L.: 580′

BEARING: 253°

DIP OF HOLE: 45°

Depth From – To		Inter-section (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
			%	%	%	%	%	%	%	%	%
254 –321	..	67.0	100	26.5	21.5	4.6	0.34	0.08	0.31	4.8	..
343 –360	..	17.0	100	39.7	13.7	0.4	0.21	0.07	0.22	3.9	..
461 –477	..	16.0	98	13.4	30.7	5.8	0.25	0.13	0.33	5.9	..
477 –520.3	..	43.3	98	48.2	7.3	0.8	0.32	0.11	0.15	5.9	..
520.3–554.5	..	34.2	100	49.8	6.9	0.7	0.42	0.09	0.03	5.9	..
554.5–579	..	24.5	100	31.6	13.9	1.6	0.26	0.02	0.07	11.6	..
579 –632	..	53.0	99	10.9	31.1	12.6	0.53	0.08	0.14	3.5	..
632 –652	..	20.0	100	55.9	4.0	0.9	0.37	0.08	0.20	4.5	..
652 –680	..	28.0	100	45.0	12.6	5.4	0.55	0.07	0.04	3.1	..
680 –702.5	..	22.5	96	48.7	8.8	0.7	0.09	0.06	0.02	4.9	..
702.5–751	..	48.5	100	62.0	1.5	0.4	0.08	0.06	0.05	4.1	..
751 –782	..	31.0	100	29.5	21.8	7.4	0.60	0.09	0.44	3.8	..

DIAMOND DRILL BOREHOLE, No. 8

LOCATION: Traverse A, 1600′ W.
R.L.: 1085′ BEARING: 89° DIP OF HOLE: 40°

Depth From	To		Intersection (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
				%	%	%	%	%	%	%	%	%
85	–101	..	16.0	98	14.2	23.7	4.3	0.15	0.07	0.31	11.3	..
174.5	–182	..	7.5	47	23.9	21.7	3.3	0.19	0.06	0.16	11.7	..
233	–279.5	..	46.5	75	7.9	40.9	9.0	0.71	0.14	0.09	2.0	..
279.5	–307.5	..	28.0	59	18.6	33.7	9.1	0.84	0.15	0.05	2.5	..
316	–321	..	5.0	90	31.4 }	23.5	6.8	0.34	0.13	0.29	7.1	..
330	–340	..	10.0	96	25.5 }							
340	–380.5	..	40.5	88	11.5	33.3	9.0	0.33	0.14	0.10	3.9	..
448	–471.5	..	23.5	100	35.1	12.7	2.0	0.27	0.05	0.35	11.3	..

DIAMOND DRILL BOREHOLE, No. 9

LOCATION: Traverse A, 1600′ W.
R.L.: 1085′

BEARING: 269°

DIP OF HOLE: 45°

Depth From–To		Intersection (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
			%	%	%	%	%	%	%	%	%
0 –154	..	154.0	1	50.3	19.1	1.8	0.25	0.05	0.06	1.8	..
154 –178	..	24.0	50	7.0	39.6	13.2	0.53	0.18	0.09	2.5	..
178 –231	..	53.0	43	54.2	4.9	2.4	0.28	0.07	0.04	6.4	..
268 –497	..	229.0	88	46.9	8.3	2.0	0.62	0.15	0.14	7.0	..
542 –548	..	6.0	22	47.7 }							
562.5–563	..	0.5	100	38.7 }	12.6	3.5	1.04	0.16	0.01	2.5	..
582 –586	..	4.0	63	47.6 }							
603 –611	..	8.0	55	51.9 }							

DIAMOND DRILL BOREHOLE, No. 10

LOCATION: Traverse 750S (25′N) 75′E
R.L.: 1015′ BEARING: 269° DIP OF HOLE: 45°

Depth From To		Intersection (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
			%	%	%	%	%	%	%	%	%
95.5–114	..	18.5	34	55.1	6.6	2.3	0.41	0.05	0.08	3.4	..
124 –276	..	15.2	78	52.0	7.3	2.5	0.30	0.10	0.11	4.7	..
293.5–303	..	9.5	50	53.0	8.7	2.5	0.38	0.11	0.12	2.3	..
318 –331	..	13.0	83	44.7	12.9	3.0	0.34	0.12	0.16	2.8	..
359 –438	..	79.0	91	44.6	12.8	3.8	0.40	0.12	0.13	4.0	..

DIAMOND DRILL BOREHOLE, No. 11

LOCATION: Traverse 250S, 80′E
R.L.: 1030′ BEARING: 265° DIP OF HOLE: 55° to 200′

Depth From To		Intersection (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
			%	%	%	%	%	%	%	%	%
0–190..	..	190.0	24	59.6	2.4	1.5	0.41	0.09	0.06	3.07	0.43
190–205..	..	15.0	70	8.3	35.8	12.4	0.84	0.12	0.09	1.04	0.07
205–307..	..	102.0	80	45.3	10.5	3.4	0.56	0.12	0.09	5.79	0.34
307–358..	..	51.0	74	4.7	46.6	15.2	1.14	0.13	0.06	0.31	0.07
358–362..	..	4.0	25	56.0	7.4	2.0	0.94	0.14	0.15	4.96	0.42
375–450..	..	75.0	85	53.9	5.4	2.0	1.03	0.13	0.13	5.26	0.41
450–473..	..	23.0	87	8.9	46.2	11.8	1.03	0.14	0.09	0.81	0.11
473–526..	..	53.0	37	53.5	8.5	2.4	1.29	0.07	0.08	1.84	0.43

DIAMOND DRILL BOREHOLE, No. 12

LOCATION: Traverse 250S, 270′W
R.L.: 960′ BEARING: 266° DIP OF HOLE: 82°

Depth From To		Inter-section (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
			%	%	%	%	%	%	%	%	%
0–261..	..	261.0	62	56.6	3.4	2.1	0.25	0.09	0.14	3.8	0.42
334–338..	..	4.0 }	90	36.6 }	36.6	9.2	1.02	0.04	0.12	0.7	0.16
340–350..	..	10.0 }		14.0 }							

DIAMOND DRILL BOREHOLE, No. 13

LOCATION Traverse 1490S, 00W
R.L.: 1045′ BEARING: 286° DIP OF HOLE: 65°

Depth From To		Inter-section (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
			%	%	%	%	%	%	%	%	%
129 –186	..	57.0	43	61.0	2.9	1.9	0.32	0.10	0.25	3.1	0.37
350 –372	..	22.0	100	33.1	15.9	3.6	0.27	0.07	0.27	7.8	0.19
461 –502	..	41.0	94	40.7	13.8	3.9	0.40	0.05	0.11	7.3	0.17
502 –566	..	64.0	100	16.6	22.2	5.4	0.25	0.05	0.26	11.9	0.06
566 –678.5	..	112.5	100	51.2	6.1	1.5	0.48	0.14	0.08	6.7	0.38
678.5–690	..	11.5	83	3.7 }	22.0	4.4	0.67	0.14	0.20	5.8	0.19
690 –708	..	18.0	95	43.1 }							
708 –741.5	..	33.5	83	5.8	44.7	12.5	0.94	0.08	0.09	0.6	0.07
741.5–816	..	74.5	100	49.7	5.0	1.2	0.83	0.15	0.24	7.9	0.32
816–1011	..	195.0	82	40.7	12.8	2.8	0.87	0.13	0.05	6.6	0.25

DIAMOND DRILL BOREHOLE, No. 15

LOCATION: Traverse 2000S, 70′E
R.L.: 1030′

BEARING: 293°

DIP OF HOLE: 50°

Depth From–To		Intersection (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
			%	%	%	%	%	%	%	%	%
173 –261	..	88.0	93	23.7	20.5	4.0	0.45	0.09	1.19	5.9	0.15
261 –286	..	25.0	100	32.6	11.1	3.2	0.25	0.06	1.23	7.3	0.16
286 –325	..	39.0	99	35.8	20.1	1.2	0.14	0.05	0.58	6.1	0.18
325 –415	..	90.0	78	56.4	3.8	1.3	0.24	0.08	0.14	5.1	0.41
421 –435	..	14.0	46	28.3	17.1	3.4	0.63	0.06	0.11	8.3	0.15
540 –708	..	168.0	93	32.5	10.7	3.3	0.58	0.10	0.08	5.0	0.34
721 –725	..	4.0	86	48.3	9.0	2.1	1.08	0.04	Tr.	6.8	0.31
732.5–734	..	1.5	86	53.7	7.0	2.0	1.14	0.07	Tr.	5.3	0.35

DIAMOND DRILL BOREHOLE, No. 16

LOCATION: Traverse 2500S, 66′W
R.L.: 940′

BEARING: 289°

DIP OF HOLE: 60°
500′ 57°
600′ 57°
700′ 56°

Depth From	To	Intersection (*Feet*)	Core Recovery	Fe (HCl Sol.)	SiO_2	Al_2O_3	Ti	Mn	P	S	V
			%	%	%	%	%	%	%	%	%
80–117..	..	37.0	40	18.3	17.6	2.8	0.20	0.05	1.03	15.4	0.05
176–190..	..	14.0	20	29.6	21.8	3.1	0.65	0.07	0.45	5.5	0.16
215–291..	..	76.0	63	30.0	17.8	3.1	0.34	0.09	0.22	5.2	0.17
380–398..	..	18.0	100	28.5	22.3	6.5	0.84	0.09	0.16	3.6	0.21
418–494..	..	76.0	90	36.4	15.9	3.1	0.42	0.08	0.12	2.9	0.25
494–617..	..	123.0	86	54.9	4.5	1.1	0.45	0.11	0.13	5.7	0.37
640–653..	..	13.0	77	47.9 }	11.1	3.1	1.19	0.12	0.02	6.12	0.31
669–673..	..	4.0	75	44.6 }							

ORE RESERVES

Any assessment of ore reserves at Savage River at this stage is impossible as insufficient drilling has been done to enable a proper assessment to be made. The length and depth of the deposit is not known, nor have sufficient estimates been made to establish working costs; hence the cut off grade for mining operations is not known. However, the drilling in the centre section is sufficient to enable some estimates to be made as to the quantity of ore that could be mined between the Savage River and Magnetite Creek. Using core sections prepared from drill hole intersections, an open cut was designed to extract ore to a depth of approximately 400 feet below the surface over a length of approximately one mile. The depth at the northern end would be less, as the presence of the Savage River limits the depth of the operation. The resulting calculations indicated that such an open cut would provide:—

82 million tons of ore

17 million tons of low grade ore at 17.3% Fe

62 million tons of waste

The grade of ore intersected in the boreholes indicated that the grade of ore mined after the oxidized and enriched ore had been removed would be as follows:—

MEDIUM GRADE ORE

Section	Based on D.D.H. No.	1000 tons	Fe HCl Sol.	Ti	P	S	V	Remarks
			%	%	%	%	%	
2500 S	16	3,820	43.4	0.46	0.14	4.86	0.28	
2000 S	15	7,150	39.0	0.33	0.34	4.46	0.31	Includes 1,500,000 tons with estimated assays only
1500 S	13	8,520	40.6	0.64	0.13	6.20	0.25	
750 S	10	10,500	39.6	0.27	0.09	3.37	..	
250 S	11 & 12	8,080	48.0	0.54	0.11	3.77	0.39	
Line A	8 & 9	9,050	46.4	0.44	0.09	5.32	..	
B	4	7,860	48.5	0.44	0.13	6.16	..	
B8	3	17,100	47.0	0.35	0.11	4.12	..	
CO	5 & 6	6,770	36.4	0.44	0.10	4.94	..	Assays averaged between Bores 5 and 6
C12	7	3,315	47.0	0.31	0.13	5.10	..	
Total	..	82,165	43.8	0.42	0.13	4.73	0.31	Assay for Vanadium on 26,690,000 tons only

LOW GRADE ORE

Section	Based on D.D.H. No.	1000 tons	Fe HCl Sol.	Ti	P	S	V	Remarks
			%	%	%	%	%	
2500 S	16	550	24.4	0.46	0.68	10.28	0.11	
2000 S	15	1,170	18.8	0.52	0.92	5.64	0.12	
1500 S	13	Nil	..	..	..	..	..	
250 S	10	888	25.0	..	..	..	..	Fe estimated
250 S	11 & 12	Nil	..	..	..	..	..	
Line A	8 & 9	1,850	13.0	0.52	0.12	4.07	..	
B	4	1,740	11.1	0.13	0.10	2.47	..	
B8	3	6,330	16.0	0.38	0.19	4.68	..	
CO	5 & 6	3,520	20.8	0.44	0.21	5.54	..	Assays averaged between Bores 5 and 6
C12	7	1,315	19.3	0.41	0.24	4.38	..	
Total ..		17,363	17.3	0.40	0.25	4.80	0.12	Impurity averages include only blocks shown as assayed

The surface material would assay between 60 and 65% Fe, and information available to date indicates that this grade may continue to approximately 100 feet below the surface. If this is so, then approximately 23 million tons of ore would be approximately 65% Fe and the balance would assay 43.7% Fe.

It will be noted that the ratio of overburden to ore is low and it is anticipated that the depth of the open cut could be increased substantially before the ratio of overburden to ore became too high for economical open cut mining.

As mentioned previously the magnetometer survey has proven the existence of magnetic anomalies over a length of seven miles. Diamond drill boreholes Nos. 1 and 2 in the northern section and Rio Tinto Australian Exploration borehole No. 1 in the Long Plains area confirm the presence of ore of comparable width and grade at widely separated points in the anomaly and it is reasonable to assume that the orebody will be present over the whole length of the magnetic anomaly—that is a distance of approximately seven miles.

If it is assumed that the orebody could be mined profitably by open cut methods along this length to a depth of 400 feet below the surface, then additional inferred ore reserves available for open cut mining could be assessed at approximately 360 million tons.

Diamond drill borehole No. 4 was designed to test for the presence of the orebody at depth, and intersected ore of the average grade for the deposit at a depth of 950 feet below river level. The iron outcrop along the ridge is 700 feet above river level. Hence it must be assumed that the calculation of inferred additional ore reserves of 360 million tons is conservative.

ORE DRESSING RESEARCH

Considerable ore dressing research has been completed in the Department of Mines Metallurgical Research Laboratory to determine the most appropriate method of up-grading the ore intersected in the drill holes to a grade suitable for smelting. As was done previously, ore recovered from diamond drill holes was used as the raw material and testing was done to determine what percentage recovery could be anticipated in preparing iron concentrates of varying grades, and what degree of crushing and grinding was necessary to achieve the appropriate grade of concentrate. It was also necessary to determine whether known impurities could be reduced.

Beneficiation by magnetic separation was investigated at sizings ranging from minus ⅜ inch to minus 200 mesh. Full details of these tests are given in Manson 1959, 1960, 1962. The results of sample R383 which is representative of the ore in the southern section can be summarized as follows:—

Size of Separation	Weight	Fe HCl Sol.	Fe Recovery	S	P	Al_2O_3	Si	Mn	Ti	V
	%	%	%	%	%	%	%	%	%	%
				Crude Ore						
	100.0	47.6	100.0	5.84	0.12	2.04	4.18	0.10	0.42	0.30
				Magnetic Products						
—⅜-inch ..	88.5	53.4	99.3	4.59	0.09	1.49	3.00	0.10	0.40	0.34
¼-inch ..	87.8	53.8	99.2	4.59	0.09	1.47	2.91	0.10	0.40	0.34
⅛-inch ..	86.6	54.6	99.1	4.26	0.08	1.49	2.96	0.10	0.40	0.34
18 mesh ..	74.9	61.8	97.4	1.63	0.03	1.09	1.78	0.10	0.40	0.35
60 mesh ..	70.7	65.1	97.0	0.75	0.02	0.91	1.22	0.10	0.40	0.38
100 mesh ..	68.5	66.7	96.4	0.32	0.02	0.91	0.94	0.09	0.31	0.37
200 mesh ..	67.5	67.9	96.3	0.33	0.02	0.88	0.80	0.09	0.31	0.37

The results of the testing are consistent with the results obtained in the northern section except that the Ti content of the ore is much lower and the S content is much higher in the southern section. The percentages of impurities are progressively reduced by finer grinding excepting in the case of Ti, V and Mn as these elements are apparently combined with the iron in the crystal lattice.

The beneficiation at the various sizings was done because a high grade concentrate is not essential in the electrical smelting being investigated—a grade of 55% Fe being considered an optimum figure.

SMELTING TESTS

The absence of suitable coking coals in Tasmania and the availability of a nearby large potential hydro-electric source created an interest in the possible use of alternative methods of iron ore reduction.

The Strategic Udy process was of considerable interest in view of the titanium content of the ore intersected in the northern zone, and the sulphur content in the central area.

The licence holder arranged for a trial parcel of material of approximately 28 tons representing crude ore and concentrates together with a parcel of Tasmanian coal to be shipped to Niagara Falls pilot plant of Strategic Udy Processes Inc. for appropriate tests to determine its suitablity for this type of plant. Officers of the Department of Mines assisted the holder in the selection of the samples and the Chief Chemist and Metallurgist of the Department of Mines (Mr. W. St. C. Manson) was present during the tests.

The Strategic Udy process has been described in detail in the technical press (Udy, 1959). Briefly, the process in its present modification involves the use of specialized kiln and electric furnace techniques in which the chemical reactions are carefully yet efficiently controlled. The kiln is used to remove sulphur and volatiles from the ore and coal, and to heat and pre-reduce the charge with inexpensive coal and electric furnace off-gases. The electric furnace completes the reduction and produces molten metal and slag. In this furnace, special techniques allow the successful use of hot pre-reduced calcine from the kiln. These techniques result in a control of metal and slag compositions.

During the various stages of the test, three general grades of pig iron were produced with the following analyses:—

	C	Si	S	P	Ti	V
(1)	1.0	0.03	0.27	0.13	0.01	0.05
(2)	1.5	0.25	0.25	0.15	0.02	0.1
(3)	2.5	0.45	0.20	0.20	0.05	0.4

All of the metal produced in the test programme was refined in an oxygen-electric furnace to produce a steel with the following analysis:—

C	Si	S	P	Mn	Ti	V
0.30	0.29	0.04	0.024	0.54	0.002	0.005

The pilot plant smelting by the Strategic Udy process was successful and demonstrated that both pig iron and specification grade carbon steel could be readily produced from Savage River iron ore. The approximate raw materials required for smelting Savage River ore by the Stategic Udy Process are as follows:—

Acid Smelting Route

Equivalent Lime-Silica Ratio = 0.7
Slag-Metal Ratio = 0.28

Feed

3,240 lbs. 62% Fe Concentrate
1,050 lbs. 51.8% F.C. Cornwall Coal
Approximately 1,000-1,500 kWh.

Products

2,000 lbs Pig Iron (0.75% C, 0.03% Si, 0.29% S, 0.13% P, 0.06% V, 0.003% Ti)
580 lbs. Slag (6% Fe, > 2% V)

Basic Smelting Route

Equivalent Lime-Silica Ratio = 1.44
Slag-Metal Ratio = 0.76

Feed

3620 lbs. 55.6% Fe Concentrate
1110 lbs. of Tasmanian Limestone (50.5% CaO, 7.5% SiO_2)
1210 lbs. 51.8% F.C. Cornwall Coal
Approximately 1,050-1,100 kWh

Products

2,000 lbs. Pig Iron (1.5% C, 0.03% Si, 0.24% S, 0.15% P, 0.06% V, 0.007% Ti)
1480 lbs. Slag (4% Fe)

Note: Higher quality limestone than that quoted is available from the nearby Gordon Limestone deposits.

CONCLUSION

The diamond drilling programme together with the magnetometer surveys in the Savage River district have confirmed the presence of very large iron deposits suitable for cheap open cut mining.

Ore dressing and smelting investigations have proven that the ore is suitable for steel production.

Immense deposits of good quality limestone occur 70 miles to the south and are in an extremely favourable position for easy shipment by sea. A large hydro-electric project is planned for the Pieman River and a large quantity of power would be available near the ore deposits. The construction of the dam required for the hydro-electric project creates a large waterway which would give cheap waterborne transport of ore or concentrates from the orebody to a smelting plant near the power station.

The depth of water in the Pieman River below the dam site is sufficient for large capacity ships, and the construction of port facilities within the Pieman River mouth would become possible with the construction of a breakwater to protect the entrance to the river.

REFERENCES

BAKER, G. and EDWARDS, A. B., 1958—Iron ore from the Savage River Tasmania. *Mineragr. Investig. Rep. Comm. Sci. Ind Res. Org.* 736 (*Unpublished*).

EADIE, E. N., 1962.—Savage River geophysical surveys, Tas. 1960-61. *Rec. Bur. Miner. Resour. Aust.*, 1962/166 (*Unpublished*)

EDWARDS, A. B., 1960.—Iron ore from the Savage River, Tasmania, Pt. 3, D.D.H. 3 and 4. *Mineragr. Investig. Rep. Comm. Sci. Ind. Res. Org.* 806 (*Unpublished*).

HUGHES, T. D., 1958.—Savage River iron ore deposits. *Tech. Rep. Dep. Min. Tas.*, 2, 32-41.

HUGHES, T. D., 1960.—Savage River iron. *Tech. Rep. Dep. Min. Tas.*, 4, 57-59.

HUGHES, T. D., 1961.—Savage River iron deposits—progress report. *Tech. Rep. Dep. Min. Tas.*, 5, 162-179.

KEUNECKE, O., 1958.—Savage River iron ore deposits, North Western Tasmania. *Rec. Bur. Miner. Resour. Aust.* 1958/39 (*Unpublished*).

MANSON, W. St. C., 1959.—Savage River iron ore and magnetite: Beneficiation by magnetic separation. R.326, R.334 *Tech. Rep. Dep. Min. Tas.*, 3, 181-185.

MANSON, W. St. C., 1960.—Savage River magnetite: Beneficiation by magnetic separation R.355-R.359. *Tech. Rep. Dep. Min. Tas.*, 4, 164-171.

MANSON, W. St. C., 1962.—Savage River magnetite: Beneficiation by magnetic separation, R.369, R.370, A.383. *Tech. Rep. Dep. Min. Tas.*, 6, 160-170.

SEDMIK, E. C. E., 1961.— Savage River magnetic survey, Tas. 1960. *Rec. Bur. Miner. Resour. Aust.*, 1961/138 (*Unpublished*)

SYMONS, J. G., 1959.—Progress report on the exploration of the Savage River iron ore deposits. *Tech. Rep. Dep. Min. Tas.*, 3. 151-158.

TETLOW, P., 1960a.—The Long Plains South iron ore deposits. *Tech. Rep. Dep. Min. Tas.*, 4, 102-105.
TETLOW, P., 1960b.—Savage River iron. *Tech. Rep. Dep. Min. Tas.*, 4, 106-113.
UDY, M. C., 1959.—Recent developments in the Strategic-Udy smelting processes. *17th Ann. Electric Furnace Conf., Amer., Inst. Min. Metall. Petrol. Eng., Cleveland, Ohio.*
WILLIAMS, K. L. and EDWARDS, A. B., 1958.—Oxidised iron ore from Savage River, Tasmania. *Mineragr. Investig. Rep. Comm. Sci. Ind. Res. Org.* 746. (*Unpublished*).