TR5-162-179

SAVAGE RIVER IRON DEPOSITS—PROGRESS REPORT

by T. D. Hughes.

SUMMARY

Drilling has continued at Savage River during 1960 and a total of ten holes has now been completed. Geophysical work was resumed during the summer months and a further programme is intended for January-March 1961. No further geological work beyond the selection of drill sites and the logging and sampling of core was carried out. The figure of possible ore reserves of two hundred million tons mentioned in 1957 (Technical Reports No. 2) has not been invalidated by either drilling or geophysical work, but, in the assessment of grade, the likelihood of areas of country rock included in bodies of magnetite must be recognised.

DRILLING

The results of Bores 1, 2 and 3 have been given previously (Technical Reports Nos. 3 and 4). Bore No. 4 was completed in 1959 and Bores 5-10 put down in 1960. Early in 1961 Bore No. 10 was abandoned at 440 feet because of drilling difficulties. The location of the holes south of the Savage River and sections of holes including the main details, are shown in the accompanying figures. The plan showing the position of the bores, traverse lines and other information is approximate only. A detailed survey of the whole area, including all the traverses, is at present being undertaken by the National Mapping Office but their map is not yet available.

In the following descriptions of the bores, only the broad outline of the iron content, rock type and core recovery is given. Where appreciable iron was seen, the core was split and an assay made approximately every five feet, depending on grade and core recovery, for HCl soluble iron, and about every twenty feet for impurities. The HCl soluble iron does not include the iron contained in the pyrite or in the silicate minerals. The analyses of the principal impurities are shown in the accompanying figures.

Details of the bores are as follows:—

No. 3 Bore

Location, 414 feet west on Traverse B8.
R.L., 1,364 feet.
Bearing, 270° (approx.).
Dip, 45°.
Depth, 944 feet.

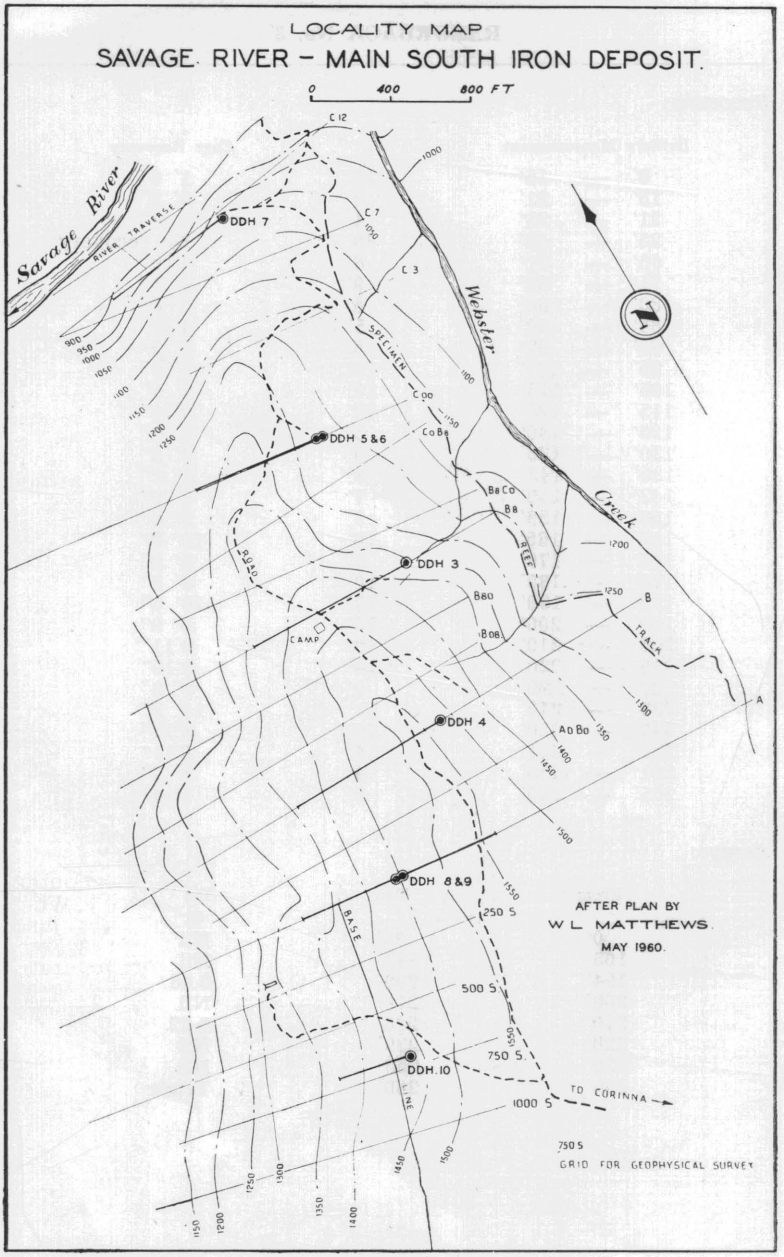
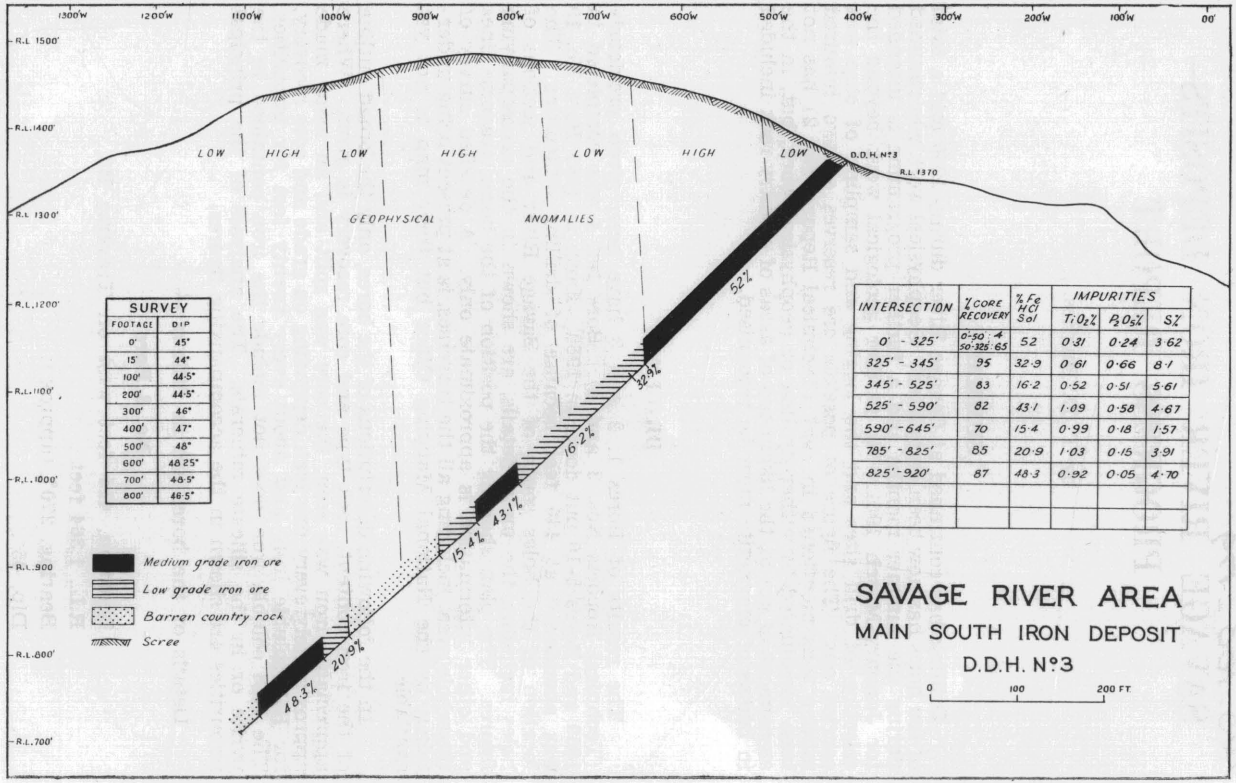


FIGURE 39.



5 cm

FIGURE 40.

Details:—

Depth	Core Recovery %	Geological	HCl Soluble Iron %
0′ — 50′	4	Magnetite with bands of amphibolite — weathered pyrite first at 50′	52
50′ — 325′	65		
325′ — 345′	95	Magnetite with amphibolite altering to serpentine	32.9
345′ — 525′	83	Amphibolite altering to serpentine sheared locally-pyrite variable magnetite in local concentrations	16.2
525′ — 590′	82	Massive magnetite, much pyrite patches of serpentine	43.1
590′ — 645′	70	Massive amphibolite with local shearing. High grade magnetite 630-636′ and other narrower veins	15.4
645′ — 785′	98	Massive amphibolite narrow seams of magnetite-pyrite	....
785′ — 825′	85	Sheared amphibolite containing concentrations of magnetite	20.9
825′ — 920′	87	Magnetite with plentiful pyrite, little serpentine—talc	48.3
920′ — 944′	31	Sheared amphibolite	....

Average percentages of the principal impurities in the sections for which iron assays are given are:—

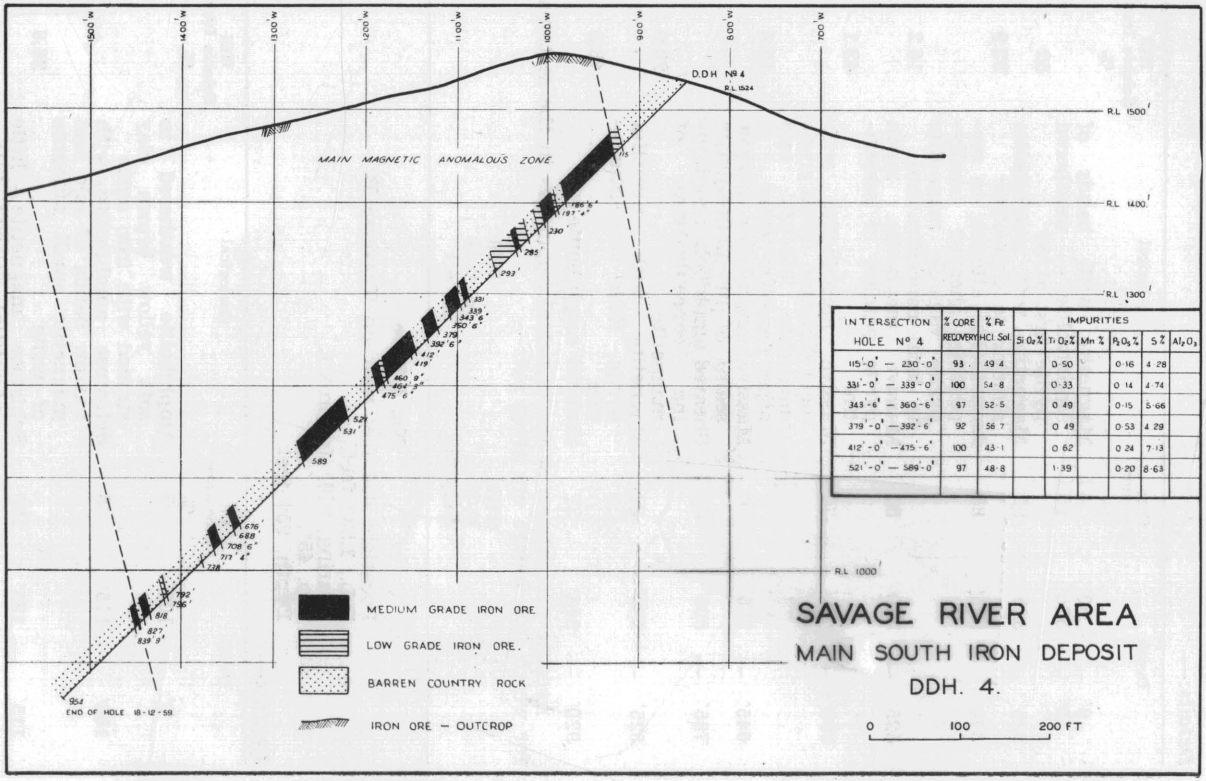
TiO_2	0.59
P_2O_5	0.31
Sulphur	4.1

No. 4 Bore

Location, 850 feet west on Traverse B.
R.L., 1,532 feet.
Bearing, 270° (approx.).
Dip, 45°.
Depth, 954 feet.

Details:—

Depth	Core Recovery %	Geological	HCl Soluble Iron %
0′ — 100′	5	Amphibolite weathered to soft yellow brown clay stained with iron oxide	....
100′ — 115′	66	Schistose amphibolite with narrow bands of talc and magnetite small amounts of pyrite	26.6
115′ — 186′	100	Schistose magnetite — little interstitial chlorite, talc—serpentine—much pyrite	54.4

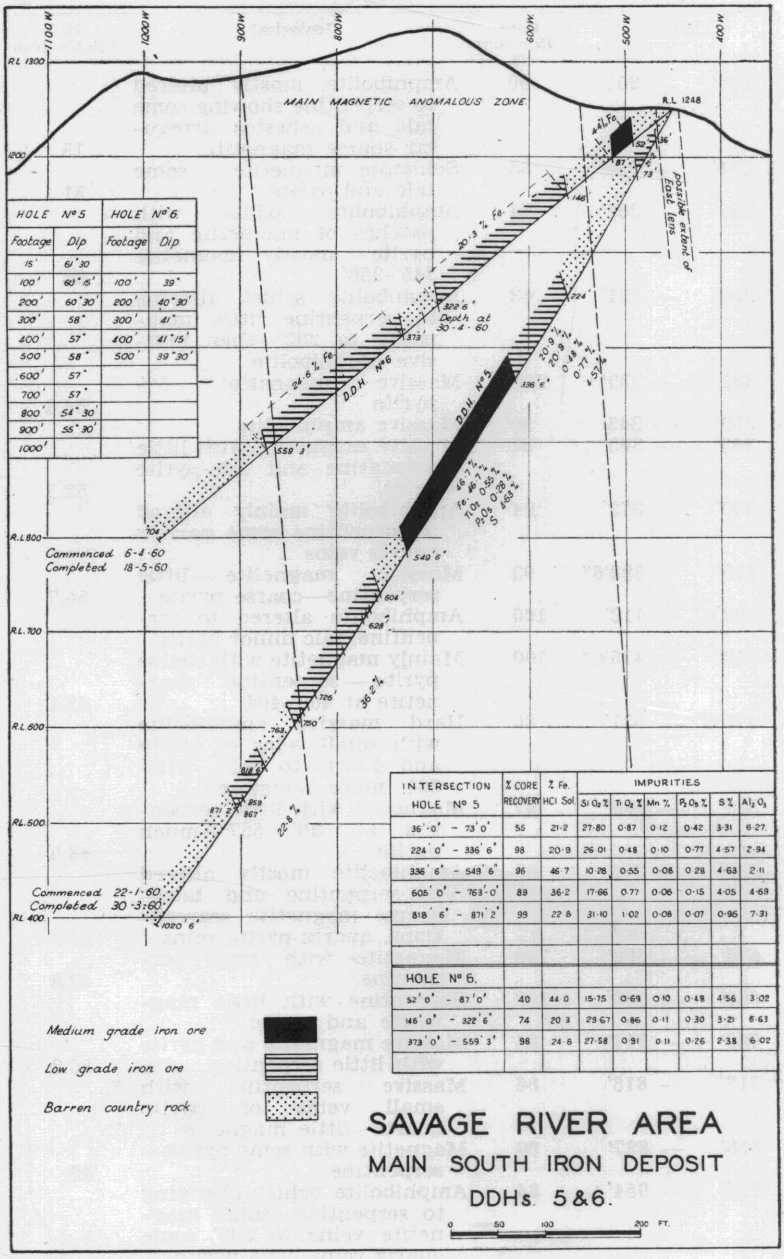


INTERSECTION HOLE No 4	% CORE RECOVERY	% Fe. HCl Sol.	IMPURITIES					
			SiO_2 %	$Ti O_2$ %	Mn %	P_2O_5 %	S %	Al_2O_3
115'-0" — 230'-0"	93	49·4		0·50		0·16	4·28	
331'-0" — 339'-0"	100	54·8		0·33		0·14	4·74	
343'-6" — 360'-6"	97	52·5		0·49		0·15	5·66	
379'-0" — 392'-6"	92	56·7		0·49		0·53	4·29	
412'-0" — 475'-6"	100	43·1		0·62		0·24	7·13	
521'-0" — 589'-0"	97	48·8		1·39		0·20	8·63	

5 cm

FIGURE 41.

Depth	Core Recovery %	Geological	HCl Soluble Iron
186′ — 201′	90	Amphibolite mostly altered to serpentine showing some talc and asbestos—irregular sparse magnetite	15
201′ — 230′	85	Schistose magnetite — some talc and pyrite	51
230′ — 266′	74	Amphibolite schist with patches of magnetite and pyrite — mostly magnetite 245′-258′	30
266′ — 331′	63	Amphibolite schist altering to serpentine little magnetite to 293′—then massive amphibolite	
331′ — 339′	100	Massive magnetite, 5% pyrite	54.8
339′ — 343′	90	Massive amphibolite	
343′ — 360′	97	Massive magnetite with little serpentine and talc-pyrite veins	52.5
360′ — 379′	94	Amphibolite mainly altered to serpentine some narrow quartz veins	
379′ — 392′6″	92	Massive magnetite — little serpentine—coarse pyrite	56.7
392′6″ — 412′	100	Amphibolite altered to serpentine, talc minor pyrite	
412′ — 475′6″	100	Mainly magnetite with coarse pyrite — serpentine magnetite at 460′-464′	43.1
475′6″ — 521′	86	Hard massive amphibolite with small veins of pyrite and quartz to 511′. 511′-521′ more schistose	
521′ — 590′	97	Magnetite with little serpentine at 536′, 557′—much pyrite	48.8
590′ — 676′	85	Amphibolite mostly altered to serpentine and talc—sparse magnetite segregations, quartz pyrite veins	
676′ — 688′	100	Magnetite with some serpentine	43.8
688′ — 708′	100	Serpentine with little magnetite and pyrite	
708′ — 717′	84	Massive magnetite and pyrite with little serpentine	56.3
717′ — 818′	86	Massive serpentine with small veins of pyrite quartz—little magnetite	
818′ — 827′	80	Magnetite with some pyrite—serpentine	46
827′ — 954′	84	Amphibolite schist changing to serpentine—small magnetite veins to 889′ some quartz veins little pyrite	



HOLE No 5		HOLE No 6.	
Footage	Dip	Footage	Dip
15'	61°30		
100'	60°15'	100'	39°
200'	60°30'	200'	40°30'
300'	58°	300'	41°
400'	57°	400'	41°15'
500'	58°	500'	39°30'
600'	57°		
700'	57°		
800'	54°30'		
900'	55°30'		
1000'			

INTERSECTION HOLE No 5	% CORE RECOVERY	% Fe. HCl Sol	IMPURITIES					
			SiO_2 %	TiO_2 %	Mn %	P_2O_5 %	S %	Al_2O_3
36'-0" – 73'0"	55	21·2	27·80	0·87	0·12	0·42	3·31	6·27
224'0" – 336'6"	98	20·9	26·01	0·48	0·10	0·77	4·57	2·94
336'6" – 549'6"	96	45·7	10·28	0·55	0·08	0·28	4·63	2·11
605'0" – 763'0"	89	36·2	17·66	0·77	0·06	0·15	4·05	4·63
818'6" – 871'2"	99	22·8	31·10	1·02	0·08	0·07	0·95	7·31
HOLE No 6.								
52'0" – 87'0"	40	44·0	15·75	0·69	0·10	0·48	4·56	3·02
146'0" – 322'6"	74	20·3	23·67	0·86	0·11	0·30	3·21	6·63
373'0" – 559'3"	98	24·6	27·58	0·91	0·11	0·26	2·38	6·02

FIGURE 42.

Average percentages for the principal impurities in the sections for which iron assays are given are:—

TiO_2	0.73
P_2O_5	0.20
Sulphur	6.0

No. 5 Bore

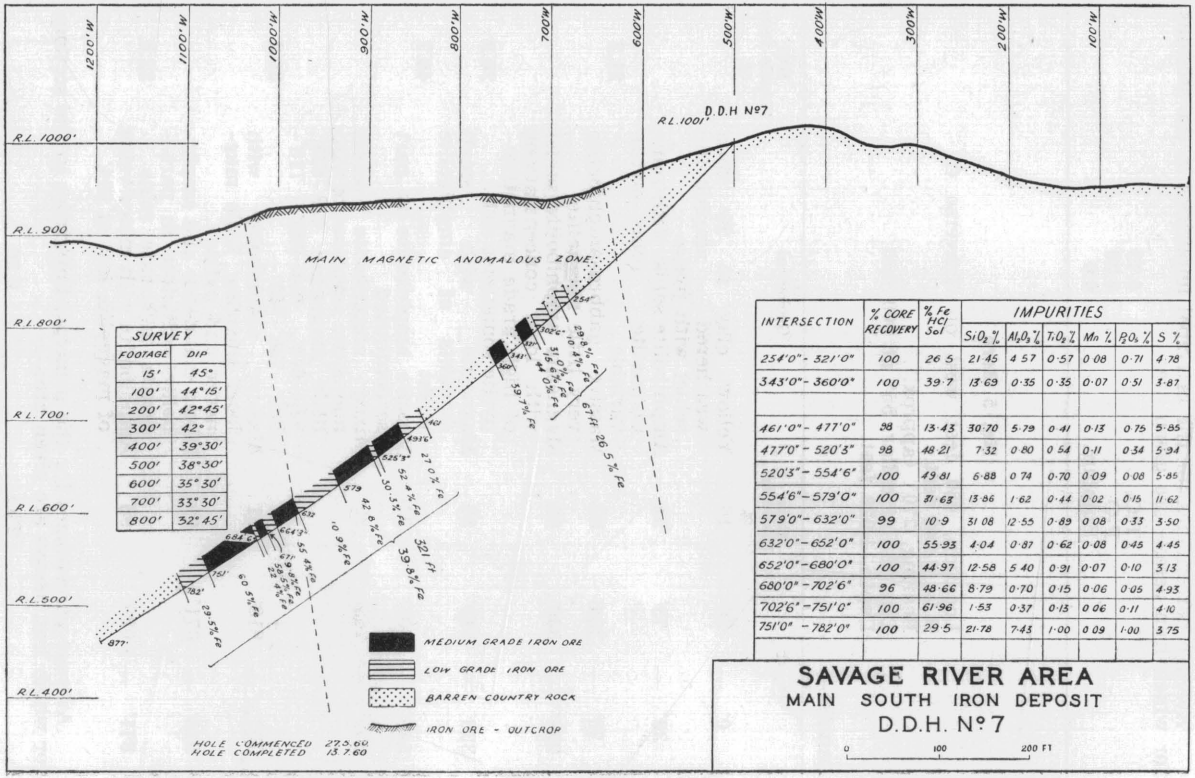
Location, 450 feet west on Traverse C.
R.L., 1,248 feet.
Bearing, 270° (approx.).
Dip, 60° at collar, 55° at 900 feet.
Depth, 1,020 feet.

Details:—

Depth	Core Recovery	Geological	HCl Soluble Iron
	%		%
0′ — 36′	16	Yellow clay to 29′ then weathered amphibolite schist with pyrite	....
36′ — 73′	55	Amphibolite schist with some magnetite veins—pyrite variable	21.2
73′ — 224′	82	Massive gabbro-amphibolite very little magnetite	....
224′ — 336′	98	Magnetite amphibolite schist with local concentrations of high grade magnetite—pyrite sometimes rich	20.9
336′ — 549′	96	Magnetite with small amounts of amphibolite schist	46.7
549′ — 605′	92	Massive amphibolite in part serpentinised	....
605′ — 763′	89	Mixed amphibolite schist magnetite amphibolite with little magnetite 628′-633′, 639′-648′, 655′-669′, 726′-730′, 735′-740′	36.2
763′ — 818′	91	Massive amphibolite with local shearing, little magnetite and pyrite	....
818′ — 871′	99	Mixed magnetite and amphibolite—schistose in part—quartz carbonate veins	22.8
871′ — 1,020′	96	Amphibolite with minor veins of magnetite last at 994′	....

Average percentages for the principal impurities in the sections for which iron assays are given are:—

TiO_2	0.66
P_2O_5	0.34
Sulphur	4.0



INTERSECTION	% CORE RECOVERY	% Fe HCl Sol	IMPURITIES						
			SiO_2 %	Al_2O_3 %	TiO_2 %	Mn %	P_2O_5 %	S %
254'0" – 321'0"	100	26·5	21·45	4·57	0·57	0·08	0·71	4·78
343'0" – 360'0"	100	39·7	13·69	0·35	0·35	0·07	0·51	3·87
461'0" – 477'0"	98	13·43	30·70	5·79	0·41	0·13	0·75	5·85
477'0" – 520'3"	98	48·21	7·32	0·80	0·54	0·11	0·34	5·34
520'3" – 554'6"	100	49·81	6·88	0·74	0·70	0·09	0·08	5·85
554'6" – 579'0"	100	31·63	13·86	1·62	0·44	0·02	0·15	11·62
579'0" – 632'0"	99	10·9	31·08	12·55	0·89	0·08	0·33	3·50
632'0" – 652'0"	100	55·93	4·04	0·87	0·62	0·08	0·45	4·45
652'0" – 680'0"	100	44·97	12·58	5·40	0·31	0·07	0·10	3·13
680'0" – 702'6"	96	48·66	8·79	0·70	0·15	0·06	0·05	4·93
702'6" – 751'0"	100	61·96	1·53	0·37	0·13	0·06	0·11	4·10
751'0" – 782'0"	100	29·5	21·78	7·43	1·00	0·09	1·00	3·75

SAVAGE RIVER AREA
MAIN SOUTH IRON DEPOSIT
D.D.H. Nº 7
0 100 200 FT

5 cm

FIGURE 48.

No. 6 Bore

Location, 450 feet west on Traverse C.
R.L., 1,248 feet.
Bearing, 270° (approx.).
Dip, 40°.
Depth, 704 feet.

Details:—

Depth	Core Recovery %	Geological	HCl Soluble Iron %
0′ — 52′	8	0-25′ yellow clays, 25′-52′ weathered amphibolite	....
52′ — 87′	40	52′-76′ mainly magnetite with minor amphibolite, 76′-87′ alternating magnetite amphibolite	44
87′ — 146′	73	Massive amphibolite	....
146′ — 322′	74	Mixed amphibolite and magnetite	20.3
322′ — 373′	95	Massive amphibolite — little magnetite or pyrite	....
373′ — 559′	98	Mixed amphibolite and magnetite, in places schistose	24.6
559′ — 704′	83	Amphibolite — sheared in places, last magnetite vein at 594′	....

Average percentages for the principal impurities in the sections for which iron assays are given are:—

TiO_2	0.87
P_2O_5	0.3
Sulphur	2.9

No. 7 Bore.

Location, 500 feet west on Traverse C 12.
R.L., 1,001 feet.
Bearing, 259° (approx.).
Dip, 45° at collar to 32° at 800 feet.
Depth, 877 feet.

Details:—

Depth	Core Recovery %	Geological	HCl Soluble Iron %
0′ — 254′	92	Massive gabbro amphibolite little altered in joint planes little pyrite magnetite absent local shear zones ..	....
254′ — 321′	100	Amphibolite schist altering to serpentine and magnetite much pyrite	26.5
321′ — 343′	100	Amphibolite — small quartz veins	..

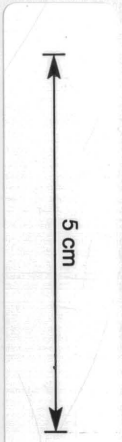
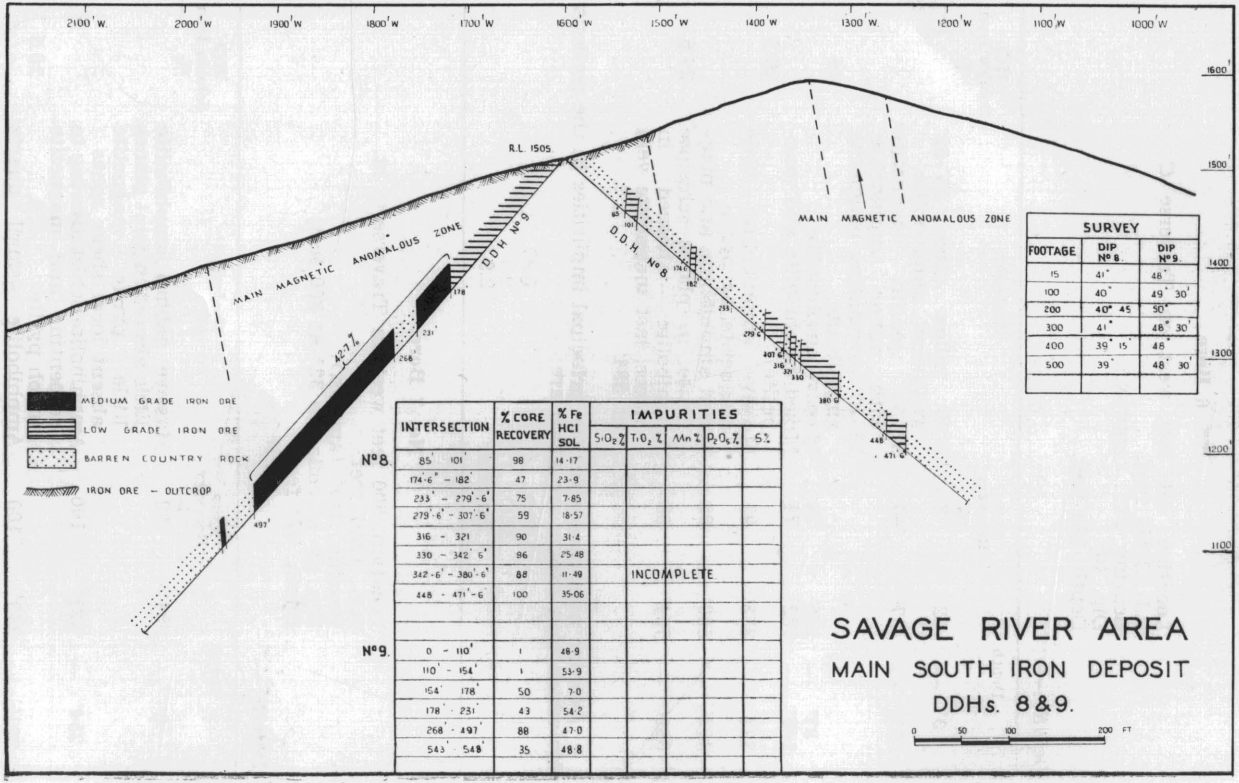


FIGURE 44.



	INTERSECTION	% CORE RECOVERY	% Fe HCl SOL.	IMPURITIES SiO_2 %	TiO_2 %	Mn %	P_2O_5 %	S %
Nº8.	85' – 101'	98	14·17					
	174·6" – 182'	47	23·9					
	233' – 279'·6"	75	7·85					
	279'·6" – 307'·6"	59	18·57					
	316' – 321'	90	31·4					
	330' – 342'·6"	96	25·48					
	342'·6" – 380'·6"	88	11·49	INCOMPLETE				
	448' – 471'·6"	100	35·06					
Nº9.	0' – 110'	1	48·9					
	110' – 154'	1	53·9					
	154' – 178'	50	7·0					
	178' – 231'	43	54·2					
	268' – 497'	88	47·0					
	543' – 548'	35	48·8					

Depth	Core Recovery	Geological	HCl Soluble Iron
	%		%
343′ — 360′	100	Magnetite and amphibolite schist	39.7
360′ — 461′	94	Massive amphibolite	....
461′ — 477′	100	Magnetite — amphibolite schist	13.4
477′ — 579′	99	Magnetite with little altered amphibolite schist	45
579′ — 632′	99	Fairly massive amphibolite in places sheared, magnetite sparse, some pyrite	10.9
632′ — 751′	99	Mostly magnetite, with serpentinised amphibolite 664′-671′ 680′-684′	54.5
751′ — 782′	100	Massive amphibolite, in places sheared altered to serpentine, minor magnetite	29.5
782′ — 877′	70	Amphibolite altering to serpentine pyrite patchy	....

Average percentages for the principal impurities in the sections for which iron assays are given are:—

TiO_2	0.57
P_2O_5	0.4
Sulphur	5.0

No. 8 Bore

Location, 1,600 feet west on Traverse A.
R.L., 1,505 feet.
Bearing, 95° (approx.).
Dip, 40°.
Depth, 554 feet.

Details:—

Depth	Core Recovery	Geological	HCl Soluble Iron
	%		%
0′ — 85′	17	Mostly massive amphibolite some shearing and serpentonisation, albite veins —some hematite and pyrite	....
85′ — 101′	98	Altered amphibolite with magnetite, hematite and talc	14.2
101′ — 174′	89	Massive amphibolite altering to serpentine. Magnetite—pyrite in small amounts at 150′	....
174′ — 182′	47	Altered amphibolite with magnetite—pyrite	23.9

Depth	Core Recovery	Geological	HCl Soluble Iron
	%		%
182′ — 280′	85	Altered amphibolite with talc and little pyrite and magnetite	....
280′ — 308′	59	Fine grained amphibolite with magnetite 292′-294′ and 304′-307′	18.6
308′ — 316′	100	Amphibolite	....
316′ — 321′	90	Altered amphibolite with magnetite and pyrite	31.4
321′ — 330′	95	Amphibolite with some pyrite	....
330′ — 381′	90	Amphibolite with magnetite veins 330′-332′, 338′-343′, 353′-354′, 374′-380′	15
381′ — 448′	88	Massive amphibolite altering to serpentine and talc	....
448′ — 472′	100	Magnetite with talc much pyrite	35.1
472′ — 554′	100	Fine grained with jointed amphibolite	....

No. 9 Bore

Location, 1,600 feet west on Traverse A.
R.L., 1,505 feet.
Bearing, 275°.
Dip, 48-50°.
Depth, 666 feet.

Details:—

Depth	Core Recovery	Geological	HCl Soluble Iron
	%		%
0′ — 154′	1	Yellow clay, not coring, 2′ of iron oxide	....
154′ — 178′	50	Amphibolite sheared in places, some magnetite and pyrite	7
178′ — 231′	43	Magnetite with some pyrite 2 bands of amphibolite ..	54.2
231′ — 268′	22	Amphibolite weathered to soft green clay	....
268′ — 497′	88	Magnetite with bands of amphibolite pyrite variable	47.0
497′ — 543′	75	Amphibolite altering to serpentine, little magnetite and pyrite	....
543′ — 548′	35	Magnetite and pyrite	48.8
548′ — 666′	42	Amphibolite schist very weathered with some magnetite and pyrite	....

No. 10 Bore

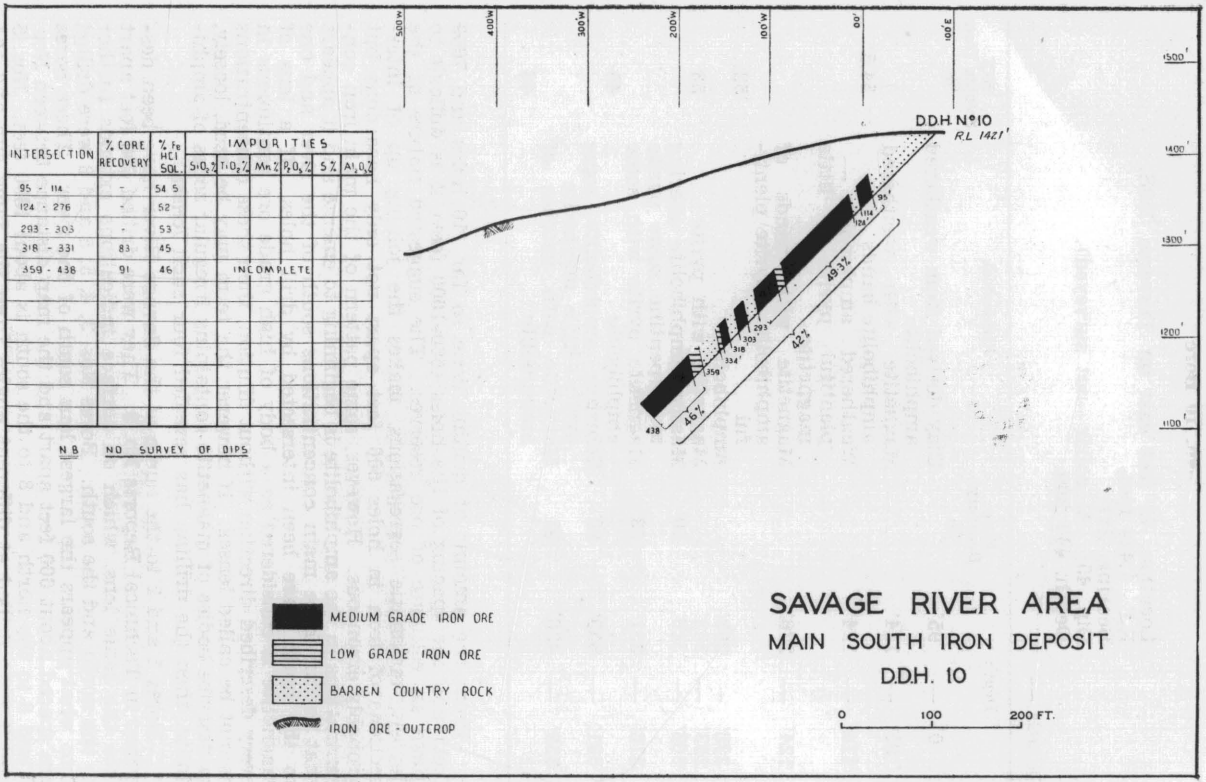
Location, 75 feet east on Traverse 750S.
R.L., 1,424 feet.
Bearing, 277°
Dip, 45° (At collar—not surveyed).
Depth, 440 feet.

Details:—

Depth			Core Recovery %	Geological	HCl Soluble Iron %
0′	—	95′	....	Clay derived from weathered amphibolite	....
95′	—	114′	....	Magnetite with weathered amphibolite bands	54.5
114′	—	124′	....	Weathered amphibolite — plentiful pyrite — little magnetite	....
124′	—	276′	....	Magnetite with bands of amphibolite—pyrite plentiful	52
276′	—	293′	....	Amphibolite	....
293′	—	303′	....	Magnetite with pyrite	53
303′	—	318′	50	Massive amphibolite altering to serpentine some pyrite	....
318′	—	331′	83	Magnetite pyrite with some amphibolite	45
331′	—	359′	90	Schistose amphibolite—some pyrite—little magnetite	....
359′	—	438′	91	Magnetite with patches of amphibolite	46

From the amount of drilling done so far (10 holes and 7659 feet) and the spacing of the holes (600-1000 feet) it is difficult to make an estimate of ore reserves. The suggested nature of the deposit, magmatic segregations, makes the joining up of intersections of iron in holes 600 feet apart not only hazardous but probably erroneous. However, some pattern of the main iron concentrations in the amphibolite is beginning to emerge and it appears that so far three main concentrations south of the river and one to the north have been intersected by drill holes. If a lens of magnetite is considered as a body of high grade ore continuous in every described direction without dilution, then these concentrations cannot be called lenses. If however the term may be used, loosely, to describe bodies of magnetite containing irregular zones of amphibolite, then the drilling has revealed four such lenses.

Bores 1 and 2 to the north of the Savage River have been described in Technical Reports No. 3. They were drilled 600 feet apart into the same lens, which on surface indications extends further to the north and the south. Bores Nos. 3, 4, 5, 6 and 8 were drilled into what appears the largest lens south of the river. These bores are spaced about 600 feet apart and the map distance between Nos. 5 and 6 to the north and 8 to the south is about 1800 feet. Nos. 5 and 6 were drilled at different angles from the same site and the relatively poor values obtained in the shallower hole (No. 6) in-



INTERSECTION	% CORE RECOVERY	% Fe HCl SOL	IMPURITIES					
			SiO_2 %	TiO_2 %	Mn %	P_2O_5 %	S %	Al_2O_3 %
95 - 114	-	54·5						
124 - 276	-	52						
293 - 303	-	53						
318 - 331	83	45						
359 - 438	91	46	INCOMPLETE					

N.B. NO SURVEY OF DIPS

5 cm

FIGURE 45.

dicated that this lens was becoming dilute near the surface in this locality. However quite good values were intersected in the steeper hole. The poor values obtained in No. 8 hole indicated a fingering out of the lens to the south at this locality. This had already been indicated in No. 4 bore where the bands of magnetite and hence the values were not as consistent as in No. 3 which seems to be located nearer the centre of the lens.

Number 9 hole was drilled from the same site as No. 8 but in an opposite direction. The reason for two holes here was that the geophysical survey showed a big width of magnetite, too long to intersect with one hole. The values in No. 9 were much better than in No. 8 and indicated a third lens to the south and west of the previous one. This lens can be seen in surface outcrop, in "C" Adit and in No. 10 bore which contained good values from 110 to 440 feet and then had to be abandoned. Iron is outcropping on the surface a further 150 feet along the traverse. The fourth suggested lens is that intersected by the Savage River and by Bore No. 7.

PREVIOUS REPORTS

Recent reports published in Department of Mines Technical Reports are—

Technical Reports No. 2 for 1957—

"Savage River Iron Ore Deposits", T. D. Hughes, pp. 33-41.

Technical Reports No. 3 for 1958—

"Progress Report on Exploration of the Savage River Iron Ore Deposits", J. G. Symons, pp. 151-158.

"Savage River Iron Ore Beneficiation by Magnetic Separation", W. St.C. Manson, pp. 181-189.

Technical Reports No. 4 for 1959—

"Savage River Iron", P. Tetlow, pp. 106-113.

"Savage River Magnetite Beneficiation by Magnetic Separation", W. St.C. Manson, pp. 164-171.

GEOPHYSICAL WORK

An airborne magnetometer survey carried out by the Bureau of Mineral Resources in 1956 indicated some very pronounced anomalies in the Savage River area. Consequently the Bureau undertook a preliminary geophysical survey in 1957. This work was expanded in 1960 and further work is programmed for early 1961. The 1960 programme included the checking of existing traverses south of the river, the interpolation of additional traverses between them, and the extension of the area south from traverse A to 4500 feet south. A well defined anomaly extended to the south beyond this last traverse, so the base line has now been extended to 10,000 feet south and traverses cut every 500 feet in readiness for the geophysical survey to commence early in 1961.

The amphibolites may be seen on the 10,000 feet south traverse and magnetite outcrops round about 5000 feet south and 5800 feet south on the base line. Beyond 6000 feet south much of the surface is covered by thin sheets of Tertiary basalt and Tertiary alluvial deposits, as in the northern-most part of the iron deposits.

MINERAGRAPHIC INVESTIGATIONS

Mineragraphic investigations have been carried out by the C.S.I.R.O. and have been issued as Reports Nos.—

736—11th March 1958.
746—12th June 1958.
806—January 1960.

Report No. 736 deals with core samples from Bore No. 1 and No. 746 with specimens from surface workings and outcrop in the same general locality. The most important part of these reports concerns the titanium content of the samples. Ilmenite, occurring both as lamellae in the planes of the magnetite and as interstitial grains between magnetite grains is much more abundant than rutile and hence much of it remains in the magnetic concentrate. Pyrite appears to be of two generations; the majority of it is post-magnetite and easily separated into the non-magnetitic residue Similarly phosphorus is principally in the form of apatite and goes into the residue. Report No. 806 is concerned with several samples from Bore No. 3 and one from Bore No. 4. The chief interest of this report is the information that the titanium content is largely in the form of rutile which occurs as segregations with a carbonate mineral in the magnetite. Thus in beneficiation, much of the titanium passes into the non-magnetic residue as is shown in tests on the core of No. 3 Bore where the titanium content is reduced from 0.7% to 0.4%. The pyrite in these samples is considered to be contemporaneous with the magnetite and is associated with small amounts of chalcopyrite. Gangue minerals are actinolite and smaller intergrowths of talc and chlorite. An interesting comment on the genesis of the ore may be quoted " The proportions of gangue to magnetite vary widely from place to place, even within a polished section, and generally magnetite rich patches alternate with gangue rich patches, which may be up to 10 mm. across, as though the magnetite and gangue had segregated during crystallization."

CONCLUSION

The question of the development of these iron deposits must be considered in the light of the information suggested in the quotation from the last paragraph of the preceding section. The geophysical surveys and the drilling have indicated that large reserves of magnetite may be expected in this locality. No prediction, however, can be made of the grade of any one section and similar assay values should not be connected up from bore to bore. As long as it is recognised that this deposit is a magmatic segregation, then it must be realised that no controls can be postulated as to the exact relative amounts of magnetite and amphibolite. What can be delineated, however, are the zones in which sufficient magnetite occurs for economic mining. The amount of material mined, however, will not all go to the mill and some must be regarded as overburden.

The drilling, combined with the geophysical work, has indicated four magnetite rich zones so far, and for these probable reserves may be indicated. Assuming an average length of 1000 feet, a width of 200 feet and a depth of 600 feet, then the four "lenses" should yield approximately fifty million tons. A depth of 600 feet is quite arbitrary, of course, as the concentration of magnetite probably extends far below this level. The mining width is greater than 200 feet but this figure allows for dilutions within the magnetite widths.