HAMERSLEY IRON PTY LIMITED

A.C.N. 004 558 276

Resources - Division

SUMMARY OF THE

FRANCES CREEK IRON DEPOSITS

NORTHERN TERRITORY

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Recent work by the Northern Territory Geological Survey highlighted the potential for further mineralisation to be located in the Francis Creek area approximately 25km to the north of Pine Creek. This area produced almost 8Mt from 1966–1974 at a grade of >59% Fe and <0.080% P. Mining ceased due to damage sustained by cyclone Tracey at the port facilities in Darwin and the start up of the Paraburdoo Mine in Western Australia by Hamersley Iron Pty Limited (HI).

A brief field reconnaissance of the area and review of the stored diamond core was undertaken in late October 1999 by HI geologists to assess the potential of the area. Work to date has consisted of collating the historical data to compile summaries of the drilling, diamond drilling, resources and complete stacked sections on selected deposits. The total resources for the area, from historical sources, have been calculated to total almost 11Mt at an average grade of 62.1% Fe and 0.078% P – note that approximately 8Mt of this resource has already been mined and shipped.

Based on the results of the recent work it is interpreted that the mineralisation was formed from hypogene fluids derived mainly from the intrusion of granites along the southern edges of the better deposits (possible Skarn type deposits?). This type of event formed the high-grade hematite/specularite deposits such as Helene 6/7 and the related, but distal, Mt Bundey area. These fluids exploited the previous pathways developed by earlier faulting and dolerite dykes. Later supergene style mineralisation has then overprinted these deposits, possibly helping to leach some of the phosphorous also.

The supergene type of mineralisation becomes more dominant towards the north of the Francis Creek area where it can be seen that for the deposits identified the Fe% decreases and the P% increases. These deposits consist of a cap of latertised material (up to 20m) formed on top of weakly altered carbonaceous sediments.

Although the material mined and observed in the field is of high quality and grade it would appear that the potential to find more than 20Mt of further material is extremely limited. Given also that the area is either covered by tenements or under application and that the mineralisation identified is thin (12-15m thick) and discontinuous it is recommended that at present HI should undertake no further work within the existing area.

However, as a low priority task it would be worthwhile undertaking a regional review of the relationships between certain parts of the stratigraphy and the later granite intrusives. Due to the recent colluvium cover aeromagnetics is seen as the primary tool for trying to distinguish the stratigraphy and structure regionally.

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SUMMARY

Recent work by the Northern Territory Geological Survey highlighted the potential for further mineralisation to be located in the Francis Creek area approximately 25km to the north of Pine Creek. This area produced almost 8Mt from 1966–1974 at a grade of >59% Fe and <0.080% P. Mining ceased due to damage sustained by cyclone Tracey at the port facilities in Darwin and the start up of the Paraburdoo Mine in Western Australia by Hamersley Iron Pty Limited (HI).

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Based on the results of the recent work it is interpreted that the mineralisation was formed from hypogene fluids derived mainly from the intrusion of granites along the southern edges of the better deposits (possible Skarn type deposits?). This type of event formed the high-grade hematite/specularite deposits such as Helene 6/7 and the related, but distal, Mt Bundey area. These fluids exploited the previous pathways developed by earlier faulting and dolerite dykes. Later supergene style mineralisation has then overprinted these deposits, possibly helping to leach some of the phosphorous also.

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1.0 INTRODUCTION

The Francis Creek Iron Deposits in the Northern Territory (Figure 1) were visited by M. Pal, S. Bowden and M. Flis from Hamersley Iron Pty Limited (HI) as part of a general reconnaissance of the area from 18-22 October 1999. The main purpose of this visit was to review the work that the Northern Territory Geological Survey (NTGS) had completed on iron ore occurrences. This work had highlighted the high quality iron deposits within the Francis Creek area and also the possibility of concealed mineralisation. The Francis Creek Iron Mining Corp Pty Ltd mined the deposits of the area from 1966–1974, producing almost 8Mt of high-grade product.

1.1 Location and Access

The main Francis Creek Iron Deposits are located approximately 25km north of the Pine Creek township (Figure 2). A moderate condition gravel road heads due north at a point 3km along the sealed Kakadu Highway from Pine Creek. The other main gravel track into the area is along the now abandoned rail spur from the disused North Australia Railway to the old Francis Creek mine camp. These two lines intersect at a point 7km to the north of Union Hill. The abandoned rail spur formwork can be seen from the air, but no rail iron or sleepers remain. Total length of the spur is almost 13km.

Various other minor gravel tracks link the northern deposits with the main southern mining area (Plans 1 and 2).

1.2 Restrictions

The Mary River in the northeastern part of the Francis Creek area forms the southwestern boundary of the Kakadu National Park (Figure 2). To date all the main deposits previously identified sit outside the park. Abutting the Kakadu National Park to the west (ie. to the north of the Francis Creek area) is a defence weapon testing area. This area does not cover any identified deposits, but does cover the target lithologies along the northward extension of the area.

1.3 Tenure

Several exploration licences cover the main southern Francis Creek Iron Deposits (8313R1 and RO1329) whilst the remaining area consists of a number of applications waiting to be granted. Reference should be made to Plan 3 which shows the 1:250,000 published geology and current tenements at a scale of 1:100,000. Most of the tenements granted or under application have been taken to search for base metals and gold. Appendix 1 from the Department of Mines and Energy (Northern Territory) lists the tenement information for the area as of October 1999.

Figure 1. Northern Territory Location Plan - Scale 1:2,500,000

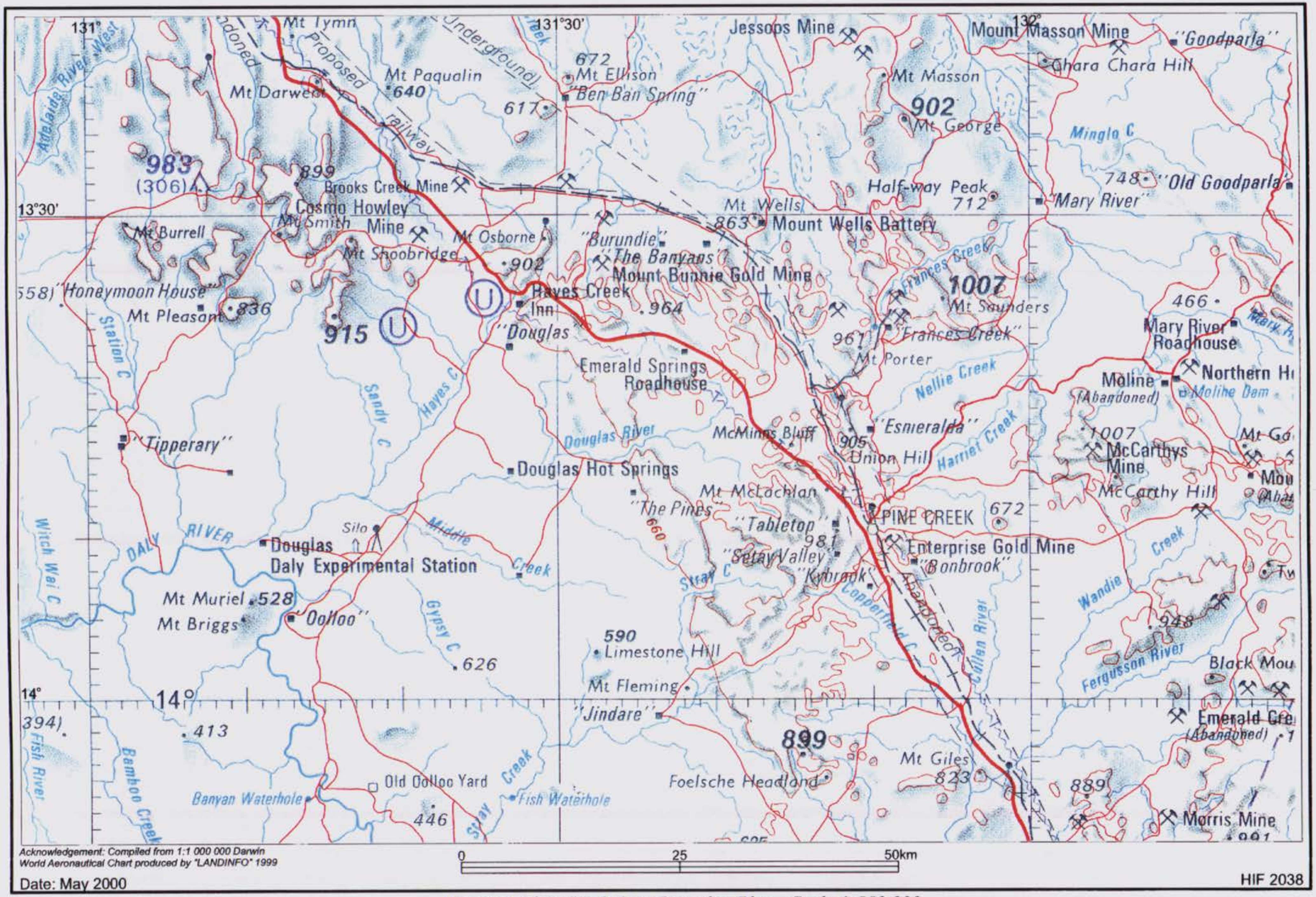

Figure 2. Pine Creek Area Location Plan - Scale 1:550,000

2.0 GEOLOGY

2.1 Regional Geology

The Francis Creek Iron Deposits are located in the central region of the Pine Creek Geosyncline (PCG). This Early Proterozoic sedimentary basin covers an area of at least 66,000km2, with the margins concealed by younger strata (Ref 1). The total PCG sequence is up to 14km thick and is considered to be an intracratonic structure formed as a result of rifting within the Archaean basement. The later Cullen Batholith (predominantly I- type granitoids) dated at 1800–1850 Ma intrudes throughout the PCG (Ref 2). Recent Upper Cretaceous to Middle Tertiary laterisation has occurred over most of the PCG (Figure 3).

2.2 Local Geology

Figure 4 shows the generalised stratigraphic column for the central region of the PCG. A brief description of the main units (refer to Ref 2 for more detail) is included below. Figure 5 shows the local geology of the Francis Creek area and clearly shows the tight folding within the sedimentary units and the proximity of the granite intrusions.

Mason Formation (Pnm)

This unit is an approximate 1000m thick sequence of brown carbonaceous phyllite, slate, siltstone, quartzite and minor dolomites. This sequence appears to have been deposited in a low energy marine environment and unconformably overlies the Archaean granitic complexes and sediments. No significant mineralisation within this unit has been noted, although the low grade Francis Creek East Iron deposits are hosted by this unit.

Mundogie Sandstone (Ppm)

This unit unconformably overlies the Mason Fm and comprises a sequence of up to 500m thick coarse clastic sediments deposited in shallow marine and fluvial environments. The unit contains coarse to pebbly feldspathic quartzites, minor pebble conglomerates and some pelitic lenses. Minor occurrences of vein type Pb-Zn-Cu, Sn and Au occur regionally within this unit.

Wildman Siltstone (Ppw)

This unit is at least 750m thick and consists of mainly red, brown and grey pelitic sediments with minor sandstone (10%). Informally the unit has been divided into two members. The lower sequence (400m thick) is composed of carbonaceous phyllite, ironstone, siltstone and phyllite. At depth most of the strata is pyritic and carbonaceous. The ironstone lenses and some altered basic tuff units contain the main Francis Creek Iron Deposits.

The upper sequence (350m thick) is composed of phyllite, siltstone and carbonaceous phyllite, with minor sandstone also present. Mineral deposits identified within the Wildman Siltstone include strataform (?) Fe and veins of Au, Sn and Pb-Zn-Cu.

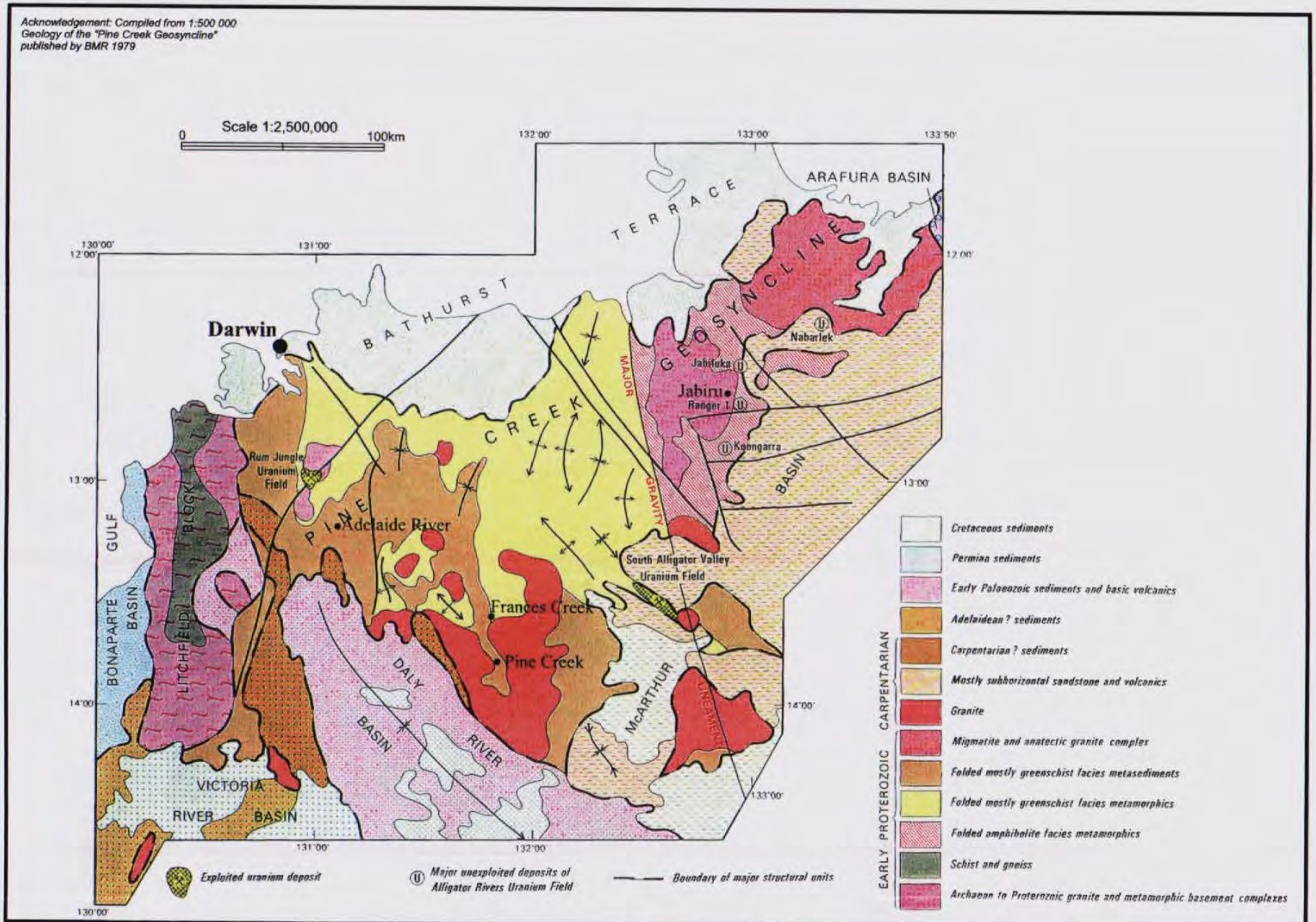

Figure 3. Regional simplified Geology and major structural units.

HIF 2039

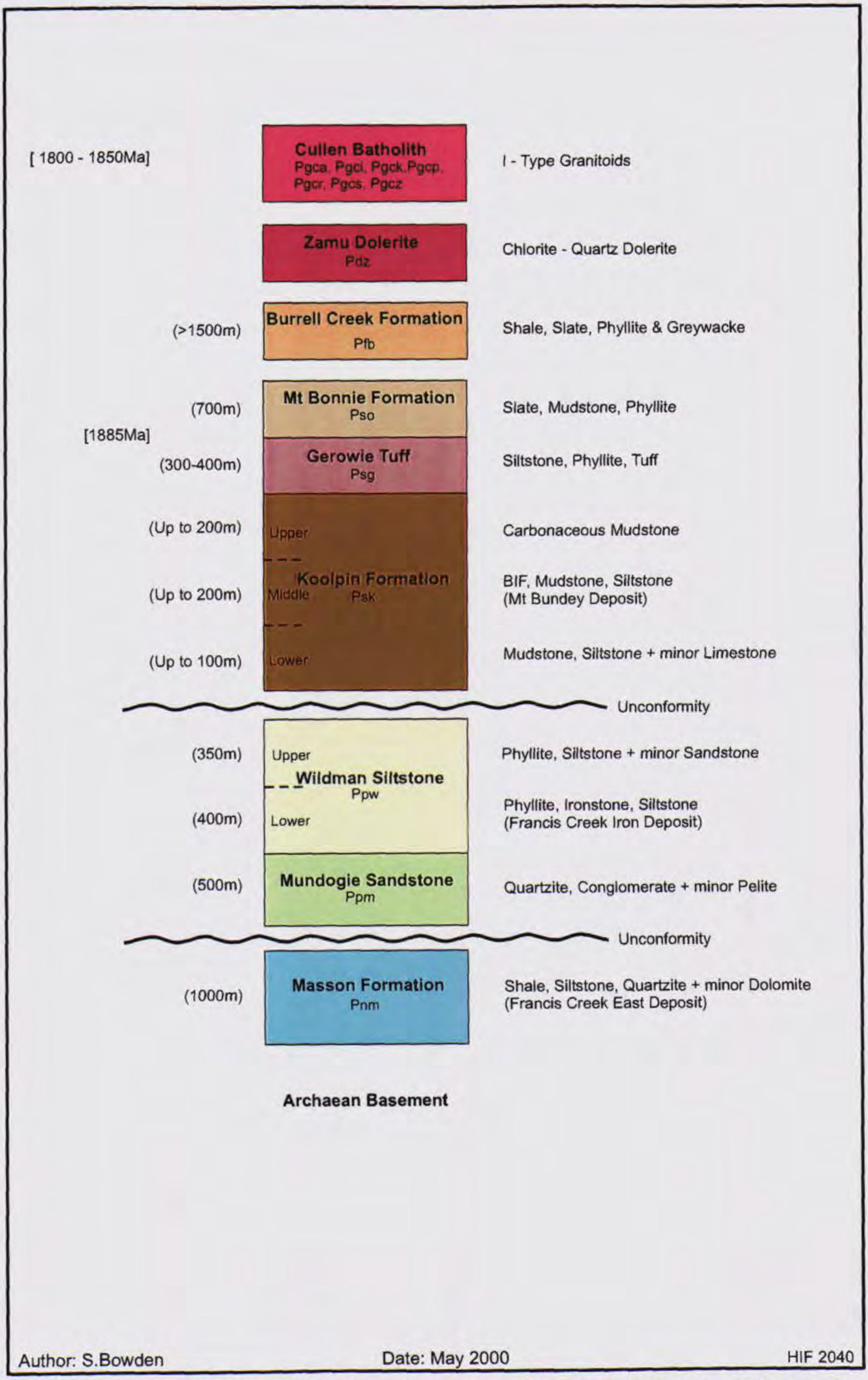

Figure 4. Generalised Stratigraphic Column for the Central Region of the Pine Creek Geosyncline. (Modified from the NTGS Pine Creek Sheet SD 52-8)

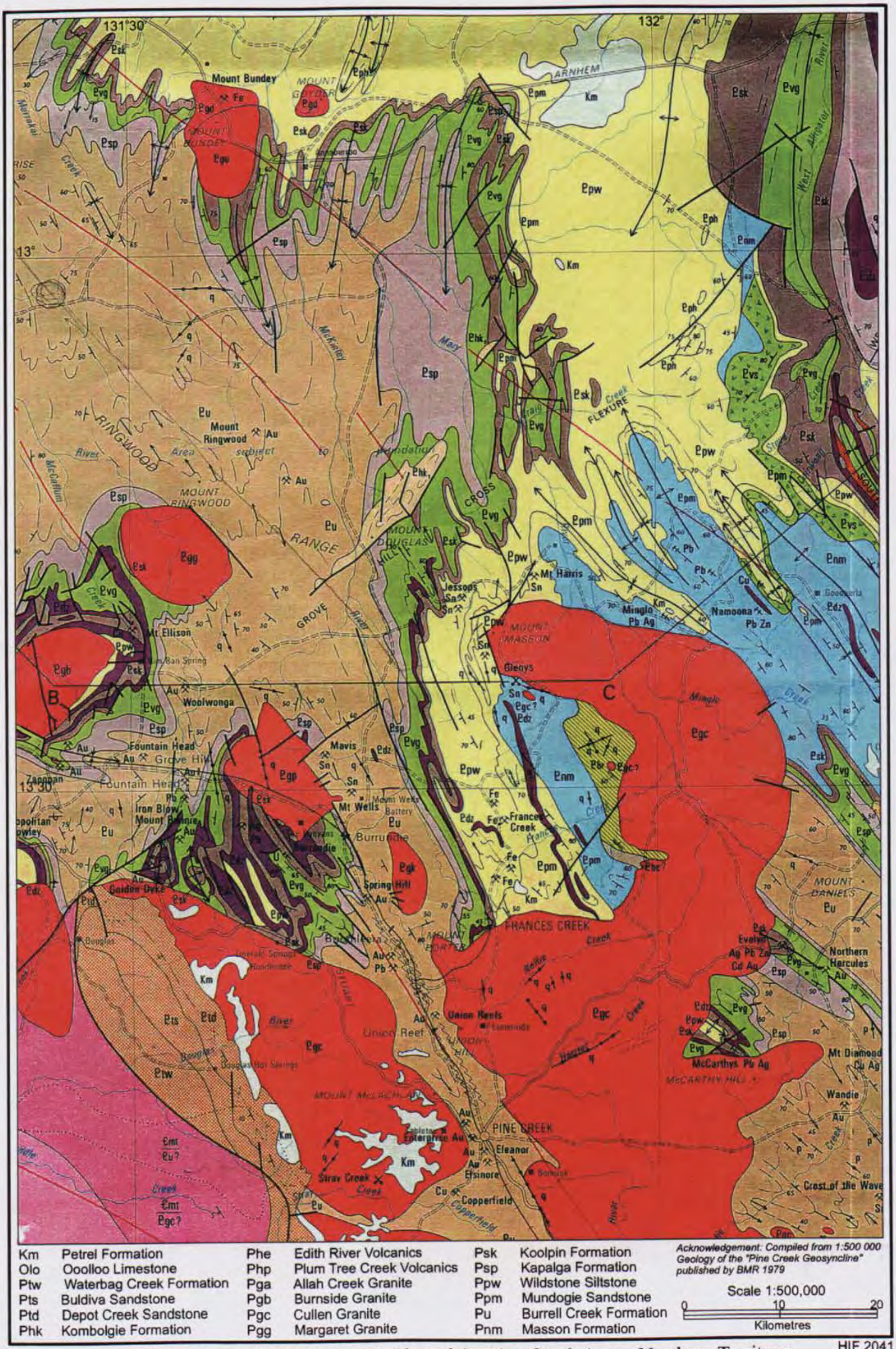

Figure 5. Geological Location Plan of the Pine Creek Area - Northern Territory.

HIF 2041

Koolpin Formation (Psk)

The thickness of the unit ranges from 100m in the east to almost 500m in the Francis Creek area. An unconformity separates this unit from the underlying Wildman Siltstone. This sequence is informally divided into three members. The lower member consists of up to 100m of carbonaceous mudstone, mudstone, siltstone, minor limestone and extends to the base of the first appearance of BIF.

The middle member contains BIFs, mudstone, carbonaceous mudstone and siltstone and may attain a thickness of 200m. The BIFs appear at surface as gossanous, hematite-limonite bodies (the Mt Bundey iron ore deposit – 1.5Mt @ 62.6% Fe and 0.049%P – sits within this member). Samples from drilling and mining have shown these iron formations to be composed of ferro-actinolite, iron rich chlorite, garnet, siderite, quartz, carbonates and sulphides. These rocks host a number of Au orebodies and contain high concentrations of Pb-Zn-Cu.

The upper member consists of mainly carbonaceous mudstone with minor mudstone and siltstone. Several thin tuff bands are present at certain locations. This unit generally has high magnetic susceptibility due to the presence of pyrrhotite and shows as highs on aeromagnetic contour plans.

Gerowie Tuff (Psg)

This unit ranges in thickness from 300-400m and is composed of siltstone, phyllite and tuff (25%). Minor chert nodules similar to those in the Koolpin Fm are also present. The tuffaceous horizons range from 30-150cm in thickness. No mineralisation has been identified within this unit.

Mt Bonnie Formation (Pso)

This unit is a 700m thick sequence of interbedded slate, mudstone, phyllite, siltstone, feldspathic greywacke, minor tuffaceous chert and rare BIF and dolomite. The unit is interpreted to represent a transition from low energy, shallow water environment of the Koolpin Fm and Gerowie Tuff to a high-energy environment of the overlying Burrell Creek Fm. This unit hosts a number of vein type Au, Pb-Zn-Cu and Sn deposits. The BIFs host stratabound Au-Pb-Zn-Cu-Ag polymetallic deposits.

Burrell Creek Formation (Pfb)

This unit consists of interbedded shale, slate, phyllite, siltstone, greywacke and rare volcanolithic pebble conglomerates. The thickness of the unit is difficult to ascertain, being at least 1500m. This unit hosts a variety of vein type Au, Sn, Pb-Zn-Cu deposits.

Zamu Dolerite (Pda)

Sills (chloritised quartz dolerite and amphibole) of this unit are extensively exposed around the Francis Creek area with these preferentially intruding the pelite rich units of the Koolpin Fm, Wildman Siltstone and Mason Fm. The thickness of the sills ranges from 20-150m. Dykes are also present within the other units and it is interpreted that this unit intruded prior to the emplacement of the granitoids. The dolerite sills have sharp contacts with the sediments with only minor contact metamorphism noted. No significant mineral occurrences are contained within this unit.

Cullen Batholith (Pgca, Pgci, Pgck, Pgcp, Pgcr, Pgcs, Pgcz)

During the Early Proterozoic the central region of the PCG was intruded by syn- to post-orogenic predominantly I-type granitoids. To date 19 phases within the Pine Creek area have been identified. The various granitoids within the Cullen Batholith are predominantly calc-alkaline and contain magnetite as an important accessory mineral.

The Frances Creek Iron Deposits are surrounded by the following granites (refer to Figure 5); the Allanbar Springs Granite (Pgca) which sits only 3km to the south of the main mined areas (Helene deposits), the McKinlay Granite (Pgck) to the west, the Prices Spring Granite (Pgcp) to the north-west, the Minglo Granite (Pgci) to the north and the Francis Creek Granite (Pgcr) to the east. Intergranite boundaries within the Allanbar Springs Granite, as shown on Figure 5, include the Bludells Monzonite (Pgcz) and the Saunders Granite (Pgcs).

3.0 PREVIOUS WORK

The Francis Creek Iron Deposits extend in a northerly direction for almost 25km along a series of undulating hills and ridges from the main southern deposits. Thirty-one named iron prospects lie within a series of discontinuous, stratiform gossanous ridges (up to 25m high), within pyritic and carbonaceous shales, phyllites and minor altered basic tuff units of the lower Wildman Siltstone. Three of the prospects (McFarrars, Boots and Egg Cup) sit within the northern part of the area in pyritic carbonaceous shales of the upper Wildman Siltstone. The Francis Creek East deposits, which lie 10km to the east of the main series of ridges, are hosted by carbonaceous phyllites and shales of the Mason Fm.

The iron deposits were mined by the Francis Creek Iron Mining Corp. Pty Ltd from 1996–1974 and produced almost 8Mt of ore grading at >59% Fe and <0.080% P. Most of this ore was mined from the Helene 6/7 deposit with minor amounts coming from the Helene 1 to 4 deposits, Thelma 1 and 2, Rosemary and Jasmine. Mining ceased in 1974 due to number of issues. Firstly, cyclone Tracey caused extensive damage to the loading facilities at Darwin and secondly the introduction of a cheaper higher quality product from the new Paraburdoo Mine (HI) meant that the economics of the project were marginal at best. A summary of the deposits is shown below in Table 1, which gives the location of the deposits (AMG co-ordinates in zone 52) and a brief overview of the geology. The Mt Bundey deposit is included for reference as its regional setting is similar to that found at Helene 6/7.

The iron deposits within the area consist of massive, micaceous and specular hematite with varying degrees of shale fragments and quartz grains. The ore within the main mined area (Helene 6/7) was hosted within a tight to open folded northwest trending synclinal structure which plunges nearly parallel with the topography to the west. Brecciation of the massive ore is evident on the eastern side of the Helene 6/7 open cut where a northwest trending fault (dipping at 70 degrees to the south) intersects the ore. It is interpreted that this brecciation was the result of the earlier faulting and possibly the intrusion of the dolerite dykes along these faults.

Past fieldwork within the area has consisted of geological mapping (refer to the drill hole plans), rock chip sampling and minor magnetic surveying. This surveying consisted of four traverse lines, which at the time did not encourage any further use of the method.

Table 1 : Francis Creek Iron Deposit Summary

Deposit	AMG E	AMG N	Formation	Lithology	Mineralogy	Bedding
Helene 11	808300	8494900	Wildman Zst	Shale, zst	Goe, Hem, Lim	053/65 NW
Helene 10	808000	8493200	Wildman Zst	Shale, zst	Goe, Hem, Lim	053/65 NW
Helene 9	808000	8494100	Wildman Zst	Shale	Hem, Lim	020/60 S
Helene 8	808000	8493500	Wildman Zst	Shale	Hem, Lim	060/60 NW
Helene 6/7	808800	8494100	Wildman Zst	Shale (Dol)	Hem, Spec	345/60 W
Helene 5	808800	8494700	Wildman Zst	Shale	Hem, Lim	345/65 W
Helene 4	808800	8494800	Wildman Zst	Shale	Hem, Lim	345/60 S
Helene 3	808700	8495500	Wildman Zst	Shale (Dol)	Hem, Lim	345/65 W
Helene 2	808500	8495800	Wildman Zst	Shale (Dol)	Hem, Lim	350/70 W
Helene 1	808500	8496600	Wildman Zst	Shale (Dol)	Hem, Lim	330/65 W
Thelma 1	809300	8497500	Wildman Zst	Shale (Dol)	Hem, Lim	290/60 S
Thelma 2	809700	8497100	Wildman Zst	Shale	Hem, Lim	320/75 SW
Thelma 3	810000	8496600	Wildman Zst	Shale	Hem, Lim	300/60 S
Thelma Rosemary	810400	8496500	Wildman Zst	Shale	Hem, Lim	320/50NE
Rosemary	810500	8497000	Wildman Zst	Shale	Hem, Lim	340/65 W
Jasmine West	810600	8497500	Wildman Zst	Shale	Hem, Lim	280/75 N
Jasmine Centre	811100	8497300	Wildman Zst	Shale	Hem, Lim	295/80 N
Beryl	810500	8498300	Wildman Zst	Shale	Hem, Lim	330/65 W
Eliz. Marion	807700	8498300	Wildman Zst	Shale	Hem, Lim	330/55 SW
Francis Ck East 1	821200	8497800	Masson Fm	Shale	Hem, Lim	300/40 SE
Francis Ck East 2	819900	8497800	Masson Fm	Shale	Hem, Lim	?
Francis Ck East 3	819900	8499200	Masson Fm	Shale	Hem, Lim	?
Ochre Hill	809000	8502200	Wildman Zst	Shale	Hem, Lim	320/70 NE
Saddle East	808200	8494200	Wildman Zst ?	Shale	Hem, Lim	?
Saddle	808200	8503400	Wildman Zst	Shale	Hem, Lim	335/80 SW
Saddle West	806600	8505300	Wildman Zst	Shale	Hem, Lim	n/a
Saddle Extended	806500	8506400	Wildman Zst	Shale	Hem, Lim	330/75 SW
Millers	804500	8512200	Wildman Zst	Shale, Greywacke	Hem, Lim, Pyrolusite	345/60 W
Bowerbird	804800	8513400	Wildman Zst	Shale	Hem, Lim, Pyrolusite	320/60 SW
Big Hill	804400	8514300	Wildman Zst	Shale	Hem, Lim	345/60 W
Porcupine	804000	8514900	Wildman Zst	Shale	Hem, Lim	330/55 W
Egg Cup	802300	8514100	Upper Wildman	Shale	Hem, Lim	340/60 W
McFarrars	801500	8514400	Upper Wildman	Shale	Lim, Pyrolusite	330/45 E
Boots	800700	8518200	Upper Wildman	Shale, Breccia	Hem, Lim, Pyrolusite	335/75 E
Jessops East	809600	8527000	Wildman Zst ?	Shale	Hem, Lim	?
Jessops West	811200	8527000	Wildman Zst ?	Shale	Hem, Lim	?
Mt Bundey	781300	8578100	Koolpin Fm	Metasediments	Hem, Goe	045/80 SE

3.1 Drilling

A review of all the drilling data collected on the Francis Creek Iron Deposits is included as Appendix 2. This work covers most of the drilling thought to have occurred within the area, however some holes will be missing due to not having all the reports. The drilling is generally referred to as "wagon drilling" and was completed in two main phases. One in the mid-sixties before mining commenced as part of the exploration work and the other in the late sixties during mining. The high grade (>60% Fe) intervals for each drill hole are included as part of the table in Appendix 2.

The diamond drill hole summaries (Appendix 3) are attached for reference. These diamond drill hole summaries include the actual Fe grades for each mineralised interval as well as the orientation of the hole.

Summarised in Table 2 is an overview of the drilling data currently collected. It can be seen that the average thickness of mineralisation within the area is almost 12m at a grade of 63% Fe. The main mined deposit of Helene 6/7 has slightly thicker mineralisation than the whole area with an average of 15.5m at a grade of just over 64% Fe. No phosphorous grades were available from the current data. Also note that the diamond drilling has intersected the thicker parts of the mineralisation within the Helene 6/7 mine with an average of 18.5m at 66.8% recorded. The rest of the diamond drilling in the other deposits, which all sit to the north, has failed to intersect any high-grade mineralisation.

3.2 Resources

Previous work has lead to a number of resource calculations having been undertaken. The figures presented in Table 3 are a combination of several different pieces of historical data and represent the most realistic estimate for each of the deposits. It is important to note that the average Fe grades differ from those shown in Table 2 due to the fact that different cut-offs have been used. The waste to ore stripping ratios, where available, is also shown.

Total resources for the area are approximately 11Mt at an average grade of 62.1% Fe and 0.078% P – keeping in mind that almost 8Mt of this material has already been mined and shipped to Japan. Of this total the largest tonnage deposits were/are Helene 6/7 (6Mt @ 63.1% Fe and 0.051% P), Helene 5 (1.1Mt @ 63.1% Fe and ??? %P), Thelma 2 (0.5Mt @ 65.1% Fe and 0.185%P) and Ochre Hill (1.2Mt @ 58.5% Fe and 0.090% P). The Mt Bundey resources of 1.5Mt @ 62.6% Fe and 0.049% P is included for completeness. It is important to note that generally the highest grade lower phosphorous deposits sit in the south of the area and that the iron content decreases with phosphorous increasing northwards.

None of the resources have been re-calculated during this review. Numerous checks were made during production and again in the late 1970's. No noticeable changes were made and these figures have been assumed to be fairly close to the actual tonnages and therefore quoted throughout this report.

Table 2 : Francis Creek Iron Deposits - Drilling Summary

Deposit	AMG E	AMG N	RC Drilling	No. of RC Holes >60% Fe	Total >60% Fe Thickness	Average >60% Thickness	Average RC Hole Fe%	Dia Drilling	No. of Dia Holes >60% Fe	Total >60% Fe Thickness	Average >60% Thickness	Average Dia Hole Fe%
Helene 11	808300	8494900	61 holes - 4,640 ft	5 (+?)	130ft (39m)	26ft (8m)	62.4					
Helene 10	808000	8493200	2 holes - 208 ft	0								
Helene 9	808000	8494100	5 holes - 484 ft	2	24ft (7.2m)	12ft (3.5m)	61.9					
Helene 8	808000	8493500	2 holes - 208 ft	1	4ft (1.2m)	4ft (1.2m)	61.4					
Helene 6/7	808800	8494100	147 holes - 17,863 ft	104	5,341ft (1,765m)	51.5ft (15.5m)	64.4	8 holes - 1,486 ft	7	434ft (94m)	62ft(18.5m)	66.8
Helene 5	808800	8494700	7 holes - 720 ft	4	36ft (10.8m)	9ft (2.7m)	61.0					
Helene 3	808700	8495500	5 holes - 156 ft	4	76ft (22.8m)	19ft (5.7m)	62.7					
Helene 2	808500	8495800	2 holes - 184 ft	1	28ft (8.4m)	28ft (8.4m)	64.0					
Helene 1	808500	8496600	3 holes - 220 ft	0								
Thelma 1	809300	8497500	13 holes - 1,281 ft	6	252ft (75.5m)	42ft (12.5m)	63.4					
Thelma Rosemary	810400	8496500	60 holes - 5,088 ft	24	440ft (132m)	18.3ft (5.5m)	62.9					
Rosemary	810500	8497000	31 holes - 1,427 ft	6	44ft (13m)	7.3ft (2.2m)	61.5					
Jasmine Centre	811100	8497300	17 holes - 1,090 ft	4	24ft (7m)	6ft (1.8m)	62.0					
Beryl	810500	8498300	8 holes - 776 ft	0								
Eliz. Marion	807700	8498300	9 holes - 728 ft	0				WDH K3 & K4	?			
Francis Ck East 1	821200	8497800	No data									
Ochre Hill	809000	8502200	11 holes - 775 ft	1	9ft (2.7m)	9ft (2.7m)	62.5	5 holes - 1,148 ft	0			
Saddle East	808200	8494200	14 holes - 377 ft	?								
Saddle	808200	8503400	9 holes - 812 ft	0								
Saddle Extended	806500	8506400	9 holes - 645 ft	3	22ft (6.5m)	7.3ft (2.2.m)	61.7					
Millers	804500	8512200	No data	?				3 holes - 382 ft	0			
Big Hill	804400	8514300	No data	?				6 holes - 798.5 ft	0			
		TOTALS	**414 RC holes - 37,682 ft**	**165**	**6,430ft (1,929m)**	**39ft (11.7m)**	**63.1**	**24 dia holes - 3,814.5 ft**	**7**	**434ft (94m)**	**62ft(18.5m)**	**66.8**
Mt Bundey	781300	8578100	12 holes - 212m (1989)	?				16 holes - 623m (1964)	?			

Table 3 : Francis Creek Iron Deposits - Resources Summary

Deposit	AMG E	AMG N	Formation	kt	Fe%	P%	Strip Ratio
Helene 11	808300	8494900	Wildman Zst	50	60.8	0.169	1 ; 0.7
Helene 10	808000	8493200	Wildman Zst	40	61.2	0.169	1 ; 0.7
Helene 9	808000	8494100	Wildman Zst	57	60.3	0.137	
Helene 8	808000	8493500	Wildman Zst	n/a			
Helene 6/7	808800	8494100	Wildman Zst	6,140	63.4	0.051	1 ; 1.5
Helene 5	808800	8494700	Wildman Zst	1,070	63.1	?	
Helene 4	808800	8494800	Wildman Zst	70	60.2	0.068	
Helene 3	808700	8495500	Wildman Zst	62	64.9	0.074	1 ; 0.7
Helene 2	808500	8495800	Wildman Zst	64	62.5	0.074	1 ; 1
Helene 1	808500	8496600	Wildman Zst	9	57.0	0.060	1 ; 1
Thelma 1	809300	8497500	Wildman Zst	65	62.9	0.100	1 ; 0.6
Thelma 2	809700	8497100	Wildman Zst	460	65.1	0.185	1 ; 1.7
Thelma 3	810000	8496600	Wildman Zst	14	65.1	0.185	
Thelma Rosemary	810400	8496500	Wildman Zst	250	62.3	0.140	1 ; 1.2
Rosemary	810500	8497000	Wildman Zst	140	61.3	0.090	1 ; 1
Jasmine West	810600	8497500	Wildman Zst	88	63.3	0.060	
Jasmine Centre	811100	8497300	Wildman Zst	116	61.6	0.054	1 ; 0.8
Beryl	810500	8498300	Wildman Zst	n/a			
Eliz. Marion	807700	8498300	Wildman Zst	n/a			
Francis Ck East 1	821200	8497800	Masson Fm	150	60.0	?	
Francis Ck East 2	819900	8497800	Masson Fm	n/a			
Francis Ck East 3	819900	8499200	Masson Fm	n/a			
Ochre Hill	809000	8502200	Wildman Zst	1,210	58.5	0.090	1 ; 0.5
Saddle East	808200	8494200	Wildman Zst ?	140	60.0	0.100	
Saddle	808200	8503400	Wildman Zst	267	57.8	0.200	
Saddle West	806600	8505300	Wildman Zst	n/a			
Saddle Extended	806500	8506400	Wildman Zst	230	61.5	0.250	
Millers	804500	8512200	Wildman Zst	n/a			
Bowerbird	804800	8513400	Wildman Zst	n/a			
Big Hill	804400	8514300	Wildman Zst	300	50.0	?	
Porcupine	804000	8514900	Wildman Zst	n/a			
Egg Cup	802300	8514100	Upper Wildman	n/a			
McFarrars	801500	8514400	Upper Wildman	n/a			
Boots	800700	8518200	Upper Wildman	n/a			
Jessops East	809600	8527000	Wildman Zst ?	n/a			
Jessops West	811200	8527000	Wildman Zst ?	n/a			
			TOTAL	**10,992**	**62.1**	**0.078**	
Mt Bundey	781300	8578100	Koolpin Fm	1,528	62.6	0.049	0.14% S

4.0 1999/2000 WORK

During October 1999 M. Pal, S. Bowden and M. Flis from HI undertook a helicopter assisted reconnaissance of the Francis Creek area with B. Cotton (RTE – Darwin) and M. Ahmen (NTGS – Darwin) from the 19^{th} to the 20^{th}. The 21^{st} and 22^{nd} of October were spent with P. Ferenczi (NTGS – Darwin) reviewing and sampling parts of the original diamond core and collating open file material held at the NTGS Darwin office.

4.1 Rock Chip Geochemistry

The geochemistry from the fourteen rock chip samples is presented below in Table 4. These samples were taken from what was considered to typical material at each site landed, although a range of rock types was collected form the Helene 6/7 deposit to understand the background geochemistry. What can be seen from the results below is that generally the Fe% decreases and the P% increases to the north (ie. P ranges from 0.018% at Helene 6/7 to 0.316% at Porcupine). These results confirm the early 1960s sampling work which showed good surface results. Note that the high grade (usually >64% Fe) samples have been highlighted in the Table 4. The geochemistry tabulated includes all the trace element information (K_20, V, Cu, Ni, Co, Pb, Zn, Cr, As, Sn, Na_2) and Cl) as well as the standard ten elements (Fe, LOI, SiO_2, Al_2O_3, P, S, CaO, TiO, Mn and MgO). Sample AIN827 returned (Dolerite dyke in Helene 6/7) values of 0.22% Cu, 0.34% Ni and 0.83% Zn. No other anomalous results were identified.

Figures 6 to 19 show typical photographs of the deposits visited and sampled as part of this brief reconnaissance. Appendix 4 includes the petrological descriptions for each rock chip sample collected.

4.2 Diamond Drill Hole Geochemistry

Six diamond holes were viewed and sampled (Figures 20 to 25 are included after the main text and before the appendices) with quarter core samples sent for geochemistry (Table 5) and petrology (Appendix 4). The geochemistry confirms the rock chip sampling undertaken and correlates well with the original iron values returned form the work in the 1960s. Detailed petrographic descriptions of the quartered core taken are included in Appendix 4. The diamond drill holes sampled were taken from Helene 6/7 (DDH2 and DDH8), Ochre Hill (DDH5 and DDH1), North Millers (DDH1) and from Big Hill (DDH3). The genesis of the mineralisation varies in the descriptions from being interpreted to be hydrothermal for the Helene 6/7 deposit to supergene for the northern areas. Again a definite decrease in Fe% and increase in P% can be seen in the northern holes (Ochre Hill – DDH5) when compared to the southern holes (Helene 6/7/ - DDH2 and DDH8).

Two samples were also collected from other iron deposits outside of the Francis Creek area. These were one from the Daley River deposit (AIN886 – low grade) and one from the Mt Bundey (DDH4A) mine area (AIN887 – 67% Fe and 0.013% P).

As with the rock chip samples the trace elements are also tabulated with the standard range of elements. Some high K_20 results were returned for AIN846 (5.2%), AIN 850 (5.3%) and AIN866 (2.3%), but these samples were all collected from shales. It is also worth mentioning that the samples collected from the North Miller DDH1 hole all returned high Mn results (3.3 to 13.9%).

Table 4 : Francis Crrek Iron Deposits - Rock Chip Geochemistry (Nov '99)

Id	Type	Area	AMG East	AMG North	Fe	LOI	SiO2	Al2O3	P	S	CaO	TiO2	Mn	MgO	K2O	Total
AIN826	Hem	Helene 6/7	808900	8494200	68.53	0.34	1.33	0.2	0.018	-0.001	0.02	0.01	0.01	0.04	0.018	100.03
AIN827	Dolerite	Helene 6/7	808920	8494150	11.03	8	45.4	15.42	0.006	-0.003	0.02	1	0.1	11.81	0.696	99.68
AIN828	Hem	Helene 6/7	808920	8494200	67.6	0.56	1.93	0.39	0.017	0	0.02	0.01	0.03	0.11	0.022	99.81
AIN829	Cht/Shl/Hem	Helene 6/7	808925	8494205	52.41	2.58	18.4	2.87	0.103	0.01	0.02	0.1	0.01	0.08	0.068	99.53
AIN830	Hem/Breccia	Helene 6/7	808900	8494100	59.79	0.72	11.6	1.1	0.04	0.001	0.03	0.06	0.03	0.08	0.088	99.35
AIN831	Protore	Helene 2	808500	8496300	45.97	1.89	22.89	6.01	0.077	0.033	0.08	0.24	0.01	0.25	1.024	98.49
AIN832	Hem	Helene 2	808530	8496305	68.29	0.41	0.73	0.33	0.096	0.006	0.18	0.01	0.01	0.06	0.031	99.69
AIN833	Shl/Hem	Jasmine	810700	8497500	65.42	0.79	3.39	1.28	0.132	0.002	0.02	0.04	0.01	0.08	0.198	99.71
AIN834	Hem	Frances Ck E	821500	8497700	64.47	2.18	2.33	1.71	0.341	0.004	0.05	0.11	0.06	0.07	0.037	99.59
AIN835	Hem/Goe	Jessops	805800	8526800	56.42	5.87	7.46	3.35	0.274	0.072	0.04	0.09	0.02	0.14	0.285	99.28
AIN836	Chert/Qtz	Boot	800700	8517900	12.3	2.39	79.85	0.53	0.062	0.003	0.03	0.01	0.1	0.04	0.018	100.79
AIN837	Hem/Goe/Mn	Millers	804500	8512200	55.29	7.04	2.47	0.62	0.121	0.023	0.13	0.02	5.74	0.31	0.076	97.82
AIN838	Hem/Goe	Millers	804505	8512205	60.76	8.75	2.33	0.48	0.156	0.014	0.05	0.02	0.38	0.06	0.009	99.77
AIN839	Hem	Porcupine	804800	8514900	66.56	2.29	0.64	0.67	0.316	0.015	0.05	0.01	0.02	0.02	0.025	99.83

Id	Type	Area	AMG East	AMG North	V	Cu	Ni	Co	Pb	Zn	Cr	As	Sn	Na2O	Cl
AIN826	Hem	Helene 6/7	808800	8494100	0	0.002	0.006	0	0.006	0.003	0	0.016	0	0	0.007
AIN827	Dolerite	Helene 6/7	808820	8494120	0.039	0.219	0.342	0.015	0	0.825	0.031	0	0	0	0
AIN828	Hem	Helene 6/7	808920	8494200	0	0.006	0.006	0	0.005	0.01	0	0.012	0.012	0	0.006
AIN829	Cht/Shl/Hem	Helene 6/7	808925	8494205	0.007	0.032	0	0	0.008	0.026	0	0.071	0.064	0	0.008
AIN830	Hem/Breccia	Helene 6/7	808900	8494100	0.009	0.003	0	0	0.007	0.007	0	0.017	0.013	0	0.008
AIN831	Protore	Helene 1	808500	8496300	0.009	0.004	0.007	0.005	0.007	0.003	0	0.034	0.025	0.021	0.008
AIN832	Hem	Helene 1	808530	8496305	0	0.003	0.017	0	0.006	0.006	0	0.014	0.008	0	0.006
AIN833	Shl/Hem	Jasmine	810700	8497500	0	0.003	0.014	0	0.008	0.007	0	0.015	0.008	0	0.008
AIN834	Hem	Frances Ck E	821500	8497700	0	0.009	0.007	0.007	0.005	0.008	0	0	0.024	0	0.005
AIN835	Hem/Goe	Jessops	805800	8526800	0.008	0.015	0.029	0.008	0.041	0.185	0	0.196	0.029	0	0.044
AIN836	Chert/Qtz	Boot	800700	8517900	0	0.003	0	0.012	0.006	0.018	0	0	0.006	0	0.007
AIN837	Hem/Goe/Mn	Millers	804500	8512200	0.007	0.001	0.031	0.019	0	0.287	0	0.013	0.01	0	0
AIN838	Hem/Goe	Millers	804505	8512205	0.007	0.026	0.032	0.011	0.006	0.197	0	0.025	0.008	0	0.006
AIN839	Hem	Porcupine	804800	8514900	0	0.006	0.02	0	0.007	0.049	0	0	0.08	0	0.007

Table 5 : Francis Creek Iron Deposits - Diamond Hole Geochemistry (Jan '00)

	Area	Drill Hole	Depth	Lithology	Fe	Original Fe%	LOI	SiO2	Al2O3	P	S	CaO	TiO2	Mn	MgO	Total
AIN841	Helene 6/7	DDH 2	64'	Spec Hem	65.9	67.3	1.2	2.43	1.91	0.048	0.012	0.05	0.08	0.02	0.11	100.49
AIN842	Helene 6/7	DDH 2	89'	Micaceous Hem	68.8	68.9	0.7	1.02	0.72	0.025	0.005	0.03	0.02	0.02	0.05	101.19
AIN843	Helene 6/7	DDH 2	108'	Micaceous Hem	68.8	68.8	0.7	0.88	0.60	0.039	0.005	0.03	0.02	0.05	0.04	100.82
AIN844	Helene 6/7	DDH 2	146'	Micaceous Hem	61.3	67.6	2.5	8.44	1.61	0.085	0.015	0.03	0.04	0.03	0.04	100.67
AIN845	Helene 6/7	DDH 2	164'	Massive Mica Hem	68.5	69.0	0.7	0.92	0.80	0.074	0.01	0.06	0.02	0.03	0.05	100.81
AIN846	Helene 6/7	DDH 8	138'	Shale	3.5		2.9	68.50	16.22	0.039	0.008	0.03	0.64	0.01	1.34	99.98
AIN847	Helene 6/7	DDH 8	157'	Micaceous Hem	68.1		0.7	1.95	1.00	0.018	0.005	0.04	0.04	0.02	0.08	101.35
AIN848	Helene 6/7	DDH 8	210'	Micaceous Hem	67.1	66.4	0.8	2.42	1.27	0.028	0.002	0.08	0.05	0.03	0.09	100.94
AIN849	Helene 6/7	DDH 8	215'	Shale/Hem	36.4		2.6	32.67	8.12	0.05	0.008	0.04	0.32	0.02	0.72	98.63
AIN850	Helene 6/7	DDH 8	218'	Shale	3.4		2.8	69.01	15.87	0.022	0.001	0.03	0.67	0.01	1.46	100.05
AIN851	Ochre Hill	DDH 5	170'	Ferruginous Shale	29.8		5.6	31.73	10.85	0.058	0.008	0.02	0.33	0.05	7.99	99.78
AIN852	Ochre Hill	DDH 5	172'	Shale	10.9		5.2	57.57	15.33	0.031	0.007	0.03	0.93	0.05	3.49	100.01
AIN853	Ochre Hill	DDH 5	180'	Sil Hem + Spec Hem	61.9		6.0	2.76	1.68	0.388	0.007	0.04	0.06	0.05	0.16	100.73
AIN854	Ochre Hill	DDH 5	200'	Sil Hem + Spec Hem	61.6		6.2	2.52	1.73	0.427	0.007	0.05	0.06	0.06	0.13	100.26
AIN855	Ochre Hill	DDH 5	227'	Siliceous Hem	54.2		9.2	9.84	1.58	0.366	0.004	0.03	0.06	0.16	0.26	100
AIN856	Ochre Hill	DDH 1	214'	Mic Hem + Shale	42.1		3.1	22.80	5.65	0.435	0.009	1.21	0.22	0.02	5.21	99.79
AIN857	Nth Miller	DDH 1	23'	Brecciated Hem/Goe	55.7		7.9	2.41	0.52	0.096	0.031	0.08	0.02	5.47	0.38	98.74
AIN858	Nth Miller	DDH 1	35'	Brecciated Hem/Goe	52.4		8.1	2.32	0.57	0.104	0.04	0.07	0.02	7.92	0.42	97.26
AIN859	Nth Miller	DDH 1	40'	Hem/Goe+ mnr spec	48.3		8.8	2.45	0.50	0.084	0.021	0.1	0.02	10.96	0.33	96.18
AIN860	Nth Miller	DDH 1	43'	Hem/Goe+ mnr spec	47.3		6.5	1.63	0.59	0.071	0.032	0.11	0.03	13.88	0.25	95.36
AIN861	Nth Miller	DDH 1	60'	Hem/Goe	52.4		10.0	4.48	1.04	0.141	0.022	0.04	0.04	5.35	0.42	98.61
AIN862	Nth Miller	DDH 1	83'	Hem/Goe	55.8		10.8	2.83	0.43	0.135	0.02	0.05	0.01	3.28	0.31	99.19
AIN863	Nth Miller	DDH 1	102'	Hem/Goe/Lim	50.7		10.6	3.48	1.35	0.122	0.022	0.07	0.05	6.9	0.39	98.13
AIN864	Big Hill	DDH 3	7'	Hem/Goe	58.3		8.9	3.40	2.20	0.443	0.1	0.03	0.05	0.15	0.08	99.97
AIN865	Big Hill	DDH 3	12'	Hem/Goe with clay	49.7		7.6	12.43	4.65	0.376	0.058	0.03	0.19	0.11	0.29	98.71
AIN866	Big Hill	DDH 3	58'	Shale	30.3		5.2	36.16	9.22	0.311	0.035	0.02	0.37	0.04	0.5	98.12
AIN867	Big Hill	DDH 3	74'	Siliceous Shale	52.5		9.6	8.05	3.25	0.485	0.003	0.04	0.06	0.08	0.33	98.8
AIN869	Helene 6/7	DDH2	177'	Hem	68.0	68.3	0.5	2.29	0.43	0.031	0.004	0.04	0.01	0.03	0.04	100.74
AIN875	Ochre Hill	DDH 1	180'	Hem/Goe with Shale	47.2		2.3	20.02	5.82	0.224	0.007	0.15	0.25	0.04	1.33	98.82
AIN876	Ochre Hill	DDH 3	180'	Hem/Goe	59.3		10.3	2.43	1.10	0.513	0.054	0.03	0.01	0.12	0.04	100.42
AIN886	Daley River	DDH 2	32' 7"	Goethite Ore	54.9		13.5	3.48	2.47	0.335	0.012	0.08	0.08	0.26	0.25	99.7
AIN887	Mt Bundey	DDH 4A	94'	Hem	67.0		2.0	1.94	0.54	0.013	0.066	0.22	0.03	0.02	0.18	101.13

Table 5 : Francis Creek Iron Deposits - Diamond Hole Geochemistry (Jan '00)

	Area	Drill Hole	Depth	Lithology	V	Cu	Ni	Co	Pb	Zn	Cr	As	Sn	K2O	Na2O	Cl
AIN841	Helene 6/7	DDH 2	64'	Spec Hem	0.005	0.002	0.002	0	0.003	0.006	0	0.014	0.011	0.218	0.031	0
AIN842	Helene 6/7	DDH 2	89'	Micaceous Hem	0	0.005	0.019	0	0.004	0.004	0	0.019	0	0.024	0.132	0.005
AIN843	Helene 6/7	DDH 2	108'	Micaceous Hem	0.005	0.002	0.031	0	0.003	0.004	0.003	0.022	0.008	0.018	0.03	0
AIN844	Helene 6/7	DDH 2	146'	Micaceous Hem	0	0.004	0.022	0	0.004	0.003	0.002	0	0.014	0.011	0.033	0
AIN845	Helene 6/7	DDH 2	164'	Massive Mica Hem	0	0.004	0.054	0	0.004	0	0.016	0.015	0.022	0.03	0.037	0.005
AIN846	Helene 6/7	DDH 8	138'	Shale	0.026	0	0.007	0	0	0.008	0.006	0	0.01	5.19	0	0
AIN847	Helene 6/7	DDH 8	157'	Micaceous Hem	0	0.004	0.009	0	0.005	0.005	0	0.013	0.012	0.071	0.02	0.006
AIN848	Helene 6/7	DDH 8	210'	Micaceous Hem	0.005	0.003	0.009	0	0.006	0.013	0	0.018	0.015	0.154	0.015	0.007
AIN849	Helene 6/7	DDH 8	215'	Shale/Hem	0.015	0.003	0.002	0.006	0.006	0.012	0.002	0.003	0.01	1.87	0.014	0.007
AIN850	Helene 6/7	DDH 8	218'	Shale	0.029	0	0	0.006	0	0.011	0.002	0	0.008	5.269	0	0
AIN851	Ochre Hill	DDH 5	170'	Ferruginous Shale	0.017	0.002	0.089	0.009	0.005	0.041	0	0.017	0	0.187	0	0.005
AIN852	Ochre Hill	DDH 5	172'	Shale	0.034	0	0.016	0.007	0	0.02	0.016	0	0.007	1.664	0.063	0
AIN853	Ochre Hill	DDH 5	180'	Sil Hem + Spec Hem	0	0.005	0.078	0.006	0.004	0.112	0	0.015	0	0.199	0.122	0
AIN854	Ochre Hill	DDH 5	200'	Sil Hem + Spec Hem	0	0.005	0.07	0.008	0.004	0.1	0	0.01	0.007	0.23	0	0
AIN855	Ochre Hill	DDH 5	227'	Siliceous Hem	0	0.003	0.1	0.009	0	0.118	0	0.007	0.005	0.222	0	0
AIN856	Ochre Hill	DDH 1	214'	Mic Hem + Shale	0.009	0.002	0.031	0.005	0.004	0.024	0	0	0.005	0.314	0.031	0.005
AIN857	Nth Miller	DDH 1	23'	Brecciated Hem/Goe	0.006	0.005	0.028	0.015	0	0.168	0	0.007	0.005	0.14	0.063	0
AIN858	Nth Miller	DDH 1	35'	Brecciated Hem/Goe	0.005	0	0.028	0.014	0	0.11	0	0.011	0	0.101	0.024	0
AIN859	Nth Miller	DDH 1	40'	Hem/Goe+ mnr spec	0.008	0.003	0.033	0.024	0	0.149	0	0.008	0	0.266	0.036	0
AIN860	Nth Miller	DDH 1	43'	Hem/Goe+ mnr spec	0.005	0	0.04	0.022	0	0.163	0	0.006	0.007	0.199	0.062	0
AIN861	Nth Miller	DDH 1	60'	Hem/Goe	0	0.001	0.025	0.012	0	0.137	0	0.007	0	0.154	0	0
AIN862	Nth Miller	DDH 1	83'	Hem/Goe	0	0.001	0.036	0.015	0	0.18	0	0.007	0.007	0.127	0.027	0
AIN863	Nth Miller	DDH 1	102'	Hem/Goe/Lim	0	0.001	0.039	0.017	0	0.199	0	0	0.005	0.094	0.028	0
AIN864	Big Hill	DDH 3	7'	Hem/Goe	0	0.035	0.048	0.01	0	0.357	0	0.016	0	0.143	0	0
AIN865	Big Hill	DDH 3	12'	Hem/Goe with clay	0.008	0.019	0.033	0.009	0	0.274	0	0.01	0	1.035	0	0
AIN866	Big Hill	DDH 3	58'	Shale	0.013	0.016	0.023	0.009	0	0.097	0	0.015	0	2.308	0.022	0
AIN867	Big Hill	DDH 3	74'	Siliceous Shale	0	0.002	0.086	0.011	0	0.253	0	0	0.007	0.818	0.012	0
AIN869	Helene 6/7	DDH2	177'	Hem	0.006	0.004	0.002	0	0.004	0.004	0	0.021	0.005	0.039	0.018	0
AIN875	Ochre Hill	DDH 1	180'	Hem/Goe with Shale	0.012	0.002	0.011	0.005	0.007	0.024	0	0	0	0.897	0.016	0.007
AIN876	Ochre Hill	DDH 3	180'	Hem/Goe	0	0.029	0.078	0.011	0	0.167	0	0	0.006	0.032	0	0
AIN886	Daley River	DDH 2	32' 7"	Goethite Ore	0.028	0.008	0.007	0.008	0.016	0.018	0	0.007	0.005	0.115	0.05	0.017
AIN887	Mt Bundey	DDH 4A	94'	Hem	0	0.012	0	0	0.005	0.007	0	0	0.009	0.1	0.061	0.006

4.3 Deposit Discussions

A brief discussion of most of the worked deposits is included below.

It is important to note that form the recent work, and some of the historical reports, it is interpreted that hypogene fluids derived mainly from the intrusion of the nearby southern granites formed the high-grade hematite/specularite deposits. These fluids exploited the previous pathways developed by the earlier faulting and dolerite dykes. The other precursor to mineralisation in this area appears to be the tight folding within the units of Wildman Siltstone which appear to pre-date the intrusions. These regional scale folds can clearly be seen on Plan 3 and Figure 5. The mineralisation appears to favour synclinal features but can also be seen on some anticlinal limbs. The bulk of the brecciation is believed to be associated with this earlier phase. This model implies that the best deposit should sit closer to the granites as occurs at Helene 6/7 and the isolated Mt Bundey deposits. Later supergene type mineralisation has then overprinted the original hypogene style, probably helping leach some of the phosphorous.

The deposits which sit to the north of the main mined areas appear to be primarily supergene in origin with a cap of latertised material (up to 20m) formed on top of weakly altered carbonaceous sediments. It would be reasonable to suggest that the hydrothermal event seen in the southern areas did not migrate more than 5-10km north of the actual intruding granite. This means that unless there are further concealed granites in the northern area, unlikely given our present interpretation, then the potential to find further high grade material more than the 5-10km from the granite intrusions is very remote.

4.3.1 Helene 6/7

The original mapping of this deposit is shown on Plan 4. This map shows the outcropping hematite mineralisation within the Wildman Siltstone, topography and the drill hole locations. The interpreted syncline is shown running through the centre of the deposit in the stacked cross sections (Plan 5). The cross sections highlight the high-grade intersections of >60% Fe. No plans showing the actual final pit levels have been found to date. However, the bulk of the mineralisation was extracted during the mining operations up to the end of 1972.

The thickest areas of mineralisation from the drilling occur within the fold hinges, generally the synclinal closures. Several thick high grade intersections can be seen with the best being on Section Line 6.0 with drill hole H152 having a 75m interval @ 66.8% Fe and P unknown. The average thickness for the deposit is only 15.5m with a grade of 64.4% Fe. Also occurring throughout the deposit is a fault zone breccia (movement direction unknown) which in places is mineralised (Figures 6 and 7).

Five rock chip samples (AIN 826 – 830) were collected from a variety of units from this deposit. Appendix 5 contains the results of the petrology work from two mineralised, two partially mineralised brecciated and one dolerite sample (table 4 contains the chemical analysis for these samples). It is interesting to note that no dolerite dykes have been mapped or included in the original sections although these could be clearly seen in the pit (orientated generally N-S) when visited. It is interpreted form the few samples collected that the primary source of mineralisation appears to be hydrothermal in origin.

Figure 6 : Helene 6/7 (19/10/99) - main mineralised zone and folded shales. Looking NNE from one of the benches. Zone 10-12m wide and almost vertical, with some brecciation also observed.

Figure 7 : Helene 6/7 (19/10/99) - view of mine looking SSE towards hematite body (10m thick) and shows some dolerite dykes. Structurally complex with shales dipping steeper on E side.

Figures 8 to 10 contain general pictures of the deposit and surrounds. Figure 10 shows the mined out portion of the deposit that is now filled with water. No water table depths are recorded in any of the data viewed.

4.3.2 Thelma – Rosemary – Jasmine

Two samples were also collected from the small Helene 2 deposit which sits to the north of the main Helene 6/7 area (refer to Plan 1 and Figure 11). Sample AIN831 was collected from some outcropping protore (Figure 12) which from the petrology is described as hematised quartzose shale. The second sample (AIN832) was taken from a small outcrop of remaining mineralised material (68.3% Fe and 0.096% P). This sample is interpreted as being derived from low temperature hydrothermal alteration. It would appear that this deposit, along with the Thelma – Rosemary – Jasmine deposits are the northern extent of the high-grade hydrothermal mineralisation. The samples collected and the previous resources calculated show that the P% is increasing to the north.

The Thelma – Rosemary – Jasmine areas were flown over during the reconnaissance trip with a sample (AIN833 @ 65.4% Fe and 0.132% P) collected from a faulted and highly folded zone of hematite altered metapelite (shale) at Jasmine. Figure 13 shows the thin mineralised zone that had been mined at Rosemary. Most of the mineralisation from these areas appears to have been mined. Plans 6 to 8 show the original mapped hematite – goethite outcrops, drill holes (refer to Appendix 2 for full details) and the original interpreted cross sections with the >50% Fe intercepts.

From the mapping and cross sectional interpretations it would appear that the mineralisation is restricted to thin ironstone units (average thickness of >60% Fe intervals for the deposits is almost 10m) within the Wildman Siltstone. Note that the fold hinges have the obviously thicker intervals of high grade mineralisation and that the down dip extensions have only been tested fully at Rosemary (Plan 7) which is the more complexly folded area. No further work is warranted on any of these deposits.

4.3.3 Ochre Hill – Saddle

The mineralised ridge at Ochre Hill was field checked during the 1999 helicopter trip. No samples were taken from the hematite – goethite outcrop which is orientated almost N-S and is approximately 12m wide (Figure 14). The original mapped geology and cross sections are shown on Plan 9. Not all the drill hole data has been collated for this deposit, those that are can be referred to in Appendix 2. However, Plan 9 does show the >50% Fe mineralised units (ironstones?) with the proposed pit outline also shown. Unfortunately the drill hole labels do not match from Plan 9 to those in Appendix 2. To date, no mining has occurred with the resource figures quoted as being 1.2Mt @ 58.5% Fe and 0.090% P.

Figure 8 : Helene 6/7 (19/10/99) - view of surrounding area looking NW. Shows hills, topography, vegetation and old crusher area.

Figure 9 : Helene 6/7 (19/10/99) - looking north towards main vertical part of ore zone.

Figure 10 : Helene 6/7 (19/10/99) - view of mine looking west from a bench on the eastern section of the pit.

Figure 11 : Helene 2 (19/10/99) - view of narrow pit looking south.

Figure 12 : Helene 2 (19/10/99) - mineralised outcrop (AIN831) with veins of specular hematite (could be hydraulic related). Zone 8-10m and has shales either side plus minor silica. Looking south.

Figure 13 : Rosemary (19/10/99) - view of pit looking south east towards thin ore zone (5-8m) and shows highly folded shales on east side.

Figure 14 : Ochre Hill (19/10/99) - outcrop hydrated surface with minor specular hematite with goethite underneath (looking south). Zone 8-10m wide. More specular hematite towards hill and slightly more magnetite.

Figure 15 : Francis Creek East (19/10/99) - looking south towards deposit with shales in foreground. Outcrop 10-15m wide.

Other deposits just to the north of Ochre Hill include the Saddle, Saddle East and Saddle West deposits. All these deposits are hosted within the Wildman Siltstone but are small (<0.3Mt) and of moderate grade (<60% Fe and >0.100% P). The drill hole and geology plan plus the stacked cross sections for the Saddle East deposit are shown on Plan 10. This deposit is restricted to a thin ironstone/carbonate shale unit striking N-S. From the past work it can be seen that the mineralisation does not continue to depth and appears to be supergene in origin.

4.3.4 Francis Creek East

From previous work and the regional scale mapping the host lithology for this deposit (refer to Plans 1 and 3) is the underlying Mason Fm. No drill hole data or deposit plans have been located during the current review. Resources are small and low grade. Sample AIN834 (64.5% Fe and 0.341% P) was collected during the filed visit. The petrology completed on the sample suggests that low temperature supergene mineralisation has occurred on this brecciated hematised shale. Figure 15 shows the deposit with Figure 16 showing a close up of atypical bedding in a possible ironstone unit.

4.3.5 Millers – Big Hill – Porcupine

The next main area of mineralisation includes the Millers, Big Hill and Porcupine areas. Several samples were collected during the fieldwork (AIN837–839). Sample AIN839 from the Porcupine deposit (Figure 19) returned an assay value of 66.6% Fe and 0.316% P with the sample described as a latertised hematite breccia. The other two samples, taken from the Millers area (Figure 18), returned only moderate results (Table 4).

The only area to have had resources calculated is Big Hill which is quoted as having an inferred resource of 0.3Mt at a grade of 50% Fe. Plan 11 shows the mapped geology and the cross sections from this deposit. It would appear that the mineralisation is restricted to possible ironstone units within the Wildman Siltstone.

4.3.6 Northern Deposits

The Jessops and Boots deposits comprise the northern end of the Francis Creek iron area. Two samples (AIN835 and 836) were collected, with both being low grade. No drilling has been undertaken in these areas and the outcrops visited appeared to be thin surficial supergene altered caps. Figure 17 shows a hydrated outcrop at Jessop.

Figure 16 : Francis Creek East (19/10/99) - small outcrop showing pseudo-bedding which could perhaps be a BIF? Sample AIN834 collected nearby (high grade and very high P) which did not have any specular hematite.

Figure 17 : Gessops (20/10/99) - hydrated outcrop looking south along ridge. Sample AIN835 (low grade hematite/goethite) collected. Unit only 8-10m thick.

Figure 18 : Millers (20/10/99) - view of outcrop looking towards 140° which shows iron/laterite ridge which is ~10-25m thick and almost 200m long. However, appears quite thin with hematite/goethite cap only 2-4m thick. Sample AIN837 collected - has low grade but high Mn.

Figure 19 : Porcupine (20/10/99) - view of outcrop looking NNE which shows 5m cap with track in foreground. Sample AIN839 (high grade, high P) collected. Outcrop 20m wide and 500m long, with ridge trending N-S.

5.0 CONCLUSIONS

To help streamline the thought process required to see whether further work is needed the conclusions have been divided into positive and negative points in order to properly assess the potential for the area.

5.1 Pro's

Things that appear to be in favour of the Francis Creek area are listed below:

- High grade, generally low P material.
- From the brief field inspection it would be estimated that a moderate lump return can be achieved.
- Closeness to infrastructure with the spur line formwork still in place, the new Darwin – Alice Springs rail line to be built in the next couple of years, sealed roads close to the main area and an established moderate capacity port located ~220km to the northwest at Darwin.
- The exploration potential still remains with respect to mineralisation concealed down dip of the main outcropping and mined areas.
- Exploration potential for further concealed high-grade deposits located adjacent to the later granite intrusions remains over a large area to the north and northwest.

5.2 Con's

Things that are currently against the project area are listed below:

- The mineralised zones so far identified are thin (12-15m) and not always continuous.
- Fe% decreases and P% increases to the north. This highlights that the best mineralisation sits in the south (Helene 6/7) adjacent to the later granite intrusion in what appears to be hypogene related alteration.
- The supergene component observed is just a latertised cap with poorly mineralised altered country rock sitting under the caps in the northern half of the area.
- Most of the ground on which the current deposits and possible extensions sit are covered by either existing exploration licences or under application.
- With the future exploration targets lying under cover the waste to ore striping ration will climb to over 2:1. With such a thin potential unit, even when folded, and low overall tonnage it would be expected that the economic margins will be low.
- Whilst this area sits close to existing and planned infrastructure it is still 220km from Darwin and it is uncertain how much it will cost to share the new rail line and what volume it will handle.

5.3 Recommendations

Although the material mined and observed in the field is of high quality and grade it would appear that the potential to find more than 20Mt of further material is extremely limited. Therefore it is recommended that at present HI should undertake no further work on the existing area.

It is interesting to note that the Mt Bundey mine (1.5Mt @ 62.6% Fe and 0.049% P), although sitting in a different stratigraphic unit, does lie adjacent to one of the later granite intrusions in a similar setting to the Helene 6/7 deposit. Therefore it would be worthwhile undertaking a regional review of the relationships between the lower Wildman Siltstone, the middle Koolpin Fm and the later granite intrusives. Due to the recent colluvium cover aeromagnetics is seen as the primary tool for trying to distinguish the stratigraphy and structure regionally. This is seen as low priority, but worthy of follow up.

6.0 REFERENCES

1. Needham, R.S and DeRoss, G. J., 1990. Pine Creek Inlier – Regional Geology and Mineralisation, in Geology of Mineral Deposits of Australia and Papua New Guinea, pp 727-737 (AusIMM).

2. Ahmed, M; Wygralak, A. S; Ferencezi, P. A and Bajwah, Z. U., 1993. 1:250,000 Metallogenic Map, Explanatory Notes and Mineral Deposit Data Sheets for Pine Creek SD52-8 (Northern Territory Geological Survey)

3. Various Authors, Reports on the Francis Creek Iron Ore Deposits from 1962 to 1972. GDSR 3857

4. Various Authors, Mt Bundey Reports. GDSR 3859

Figure 20 : Helene 6/7 (21/10/99) - DDH2. Five samples (AIN841-845) taken of ¼ core.

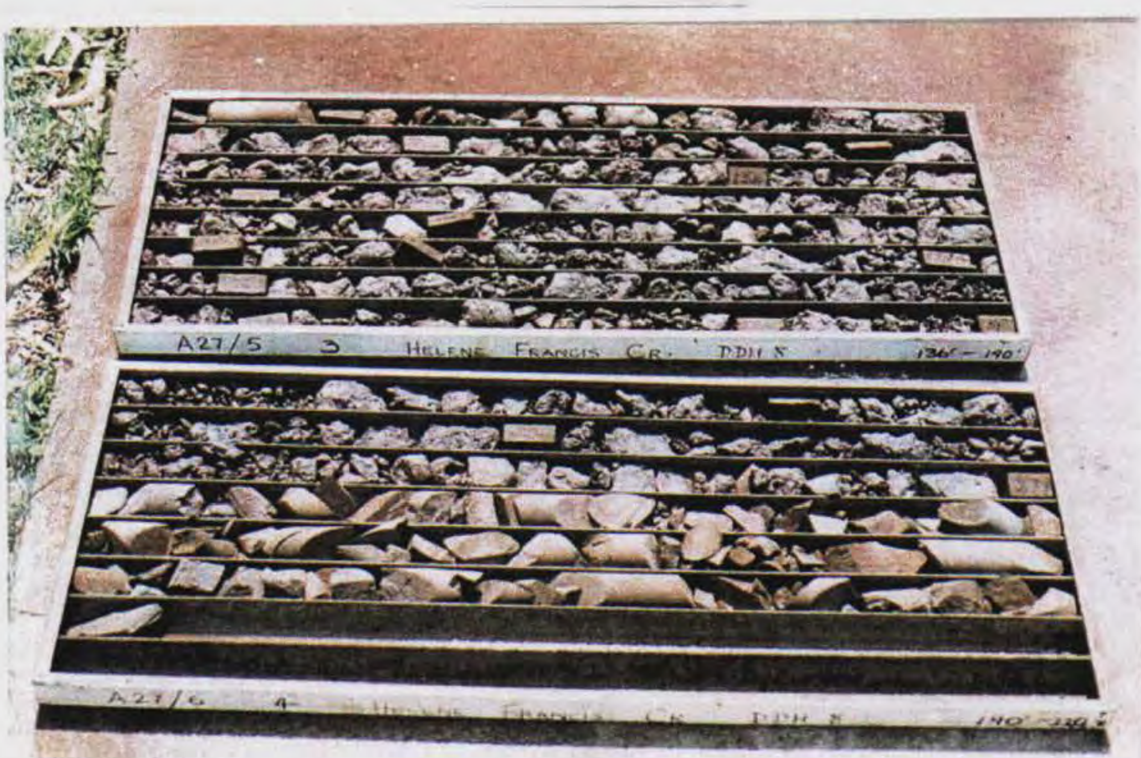

Figure 21 : Helene 6/7 (21/10/99) - DDH8. Five samples (AIN846-850) taken of ¼ core. 136-190 feet and 190-220 feet.

Figure 22 : Ochre Hill (21/10/99) - DDH5. Five samples (AIN851-855) taken of ¼ core. No log for core and core very broken.

Figure 23 : Ochre Hill (21/10/99) - DDH1. One sample (AIN856) of micaeous hematite core taken. Also no log.

Figure 24 : Big Hill (21/10/99) - DDH3 (four trays of core). Four samples (AIN864-867) taken of ¼ core.

Figure 25 : North Millers (21/10/99) - DDH1. Seven samples (AIN857-863) taken of ¼ core.

APPENDIX 1

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MEMORANDUM

To	**Scott Bowden**	**Date**	29, May 2000
From	**Marcus Flis**	**Ref**	Bowden21
Copy	David Andrews, Iain Clementson, Greg Rogers		
Subject	**Magnetic signature of Frances Ck. style Iron Ore, Northern Territory**		

Summary
A clear relationship is seen between interpreted style of iron mineralisation in the Frances Ck area and the magnetics. Five target areas are identified for future follow-up. All are of low priority.

Introduction
The Frances Ck. iron ore occurrences are described in report GDSR 3902 (Scott, 2000). This memorandum describes the magnetic setting and signature of those deposits. Plan HIF 2053 shows the area of interest.

Aeromagnetic survey data specifications
The Frances Ck. area is covered by WGC's multiclient Pine Ck. aeromagnetic survey. Survey specifications are:

Flight line spacing	200 m
Flight line direction	north-south
Nominal sensor height	60 m
Navigation	radio positioning/DGPS
Platform	fixed wing aircraft
Magnetometer	Caesium vapour
Magnetometer sample rate	0.1 s
Equivalent ground sample interval	approx. 7 m
Years flown	1987-1990

Magnetic zones
Plan HIP 2055 and HIP 2054 show images of the Total Magnetic Intensity (TMI) and First Vertical Derivative of the TMI Reduced to Pole, respectively. Both have the known iron occurrences and prospects plotted on them.

The magnetic images may be divided in to four zones. The southern and eastern edges are occupied by the nonmagnetic, early Proterozoic Cullen Batholith. The west and south-west edges are characterised by low to moderate magnetic linear signatures of the Proterozoic Burrell Ck. Fm. This formation is dominated by fine-grained sediments and greywackes. The northeastern third of the area is characterised by the moderately magnetic, broken signatures of the Masson Fm. (shales, siltstones, quartzites, and minor dolomites). Finally, the central northwest trending zone of moderately magnetic, linear anomalies reflects the Koolpin Fm. and, further east, the Mt. Partridge Gp. (Wildman Sandstone).

All of the known iron deposits and prospects lie within this fourth zone.

Correlation between iron occurrences and magnetics

There are two clear correlations between iron occurrences and magnetics. The first group consists of occurrences falling wholly within magnetic lows. These may be broadly assigned a hypogene origin. This is based on some field observations and the understanding that this style results in almost complete oxidation of the proto-ore. Examples are Helene 1 to 6/7, Thelma 1 and 2, Jasmine West, Porcupine, etc.

The second group is occurrences sitting directly on a magnetic high and which are broadly interpreted to be of supergene origin. It is anticipated these represent ferruginous caps atop iron-rich horizons where-in secondary iron species, such as goethite, give rise to magnetic maghaemite . Examples in this group are Frances Ck, Ochre Hill, Saddle, etc.

A third group, occurrences sitting on the flank of magnetic anomalies, is more ambiguous and so have a less certain origin. These include Helene 8 to 11, Frances Ck East, Saddle West, Thelma Rosemary, Rosemary, Boots, etc. Detailed mapping of field relationships would need to be undertaken to understand their origin.

Table I, modified from GDSR 3902, summarises these associations, together with typical magnetic susceptibilities, where available.

Targets

Skarn styles associated with the Cullen Batholith are likely to be indicated by intense magnetic highs. Areas of note are (refer HIP 2055):

Target A: magnetic high surrounded by outcropping mineralisation (Helene 4 to 11 and Saddle East). Interpreted hypogene mineralisation in this area suggests significant fluid movement has occurred, making this anomaly a good candidate for the 'mother lode' to the known occurrences.

Target B: magnetic anomaly on an anticlinal position of the Koolpin Fm.

Target C: magnetic anomaly in folded Mundogie Sandstone. May have shallow Masson Fm., which contains some carbonates, beneath it.

Hypogene iron occurrences, particularly when hosted by ferruginous sediments, are likely to be seen as magnetic quiet zones along an otherwise magnetic high. Examples of this style are:

Target D: an obvious break in a magnetic ridge of the Mundogie Sandstone.

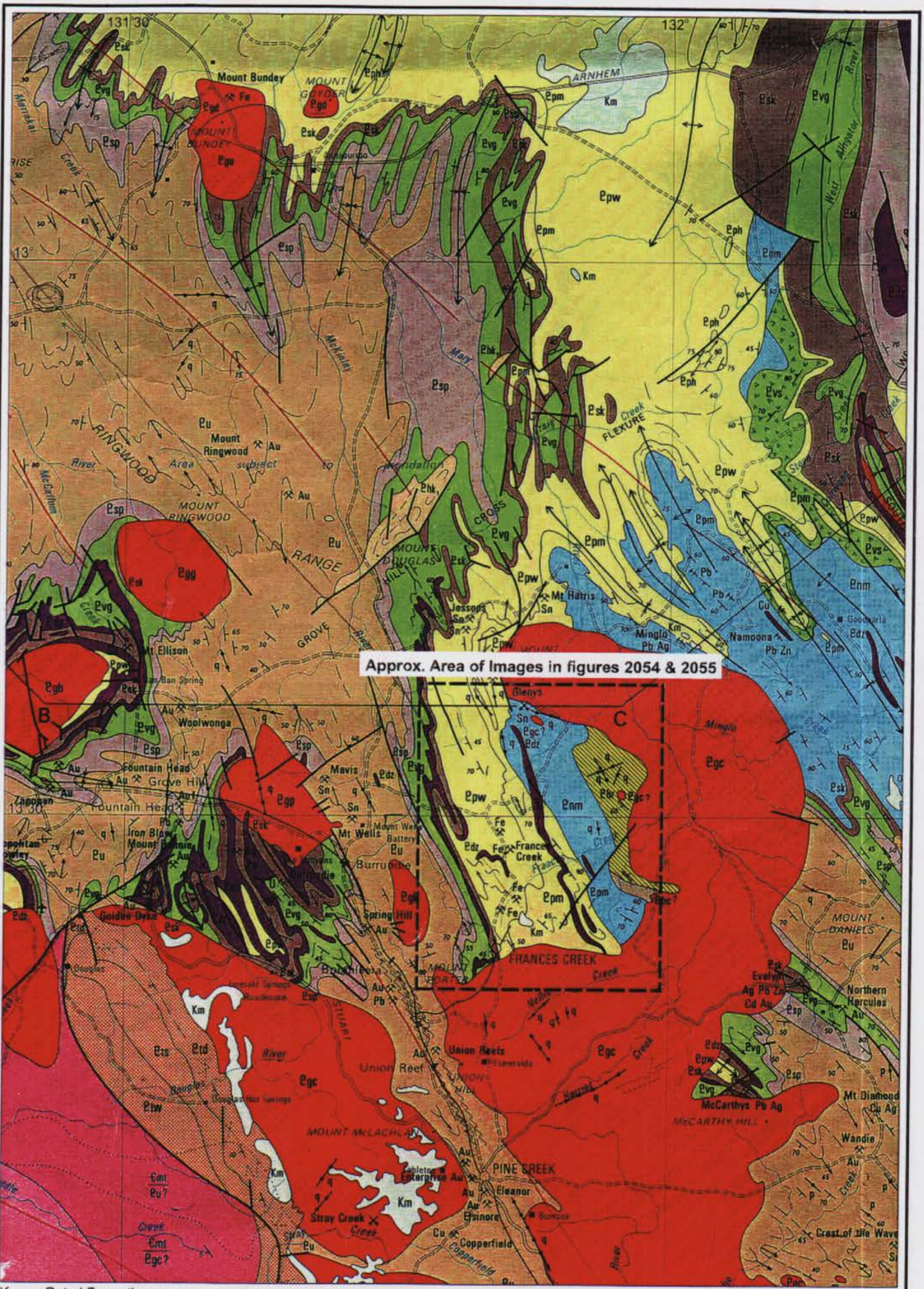
Target E: a magnetic low surrounded by mineralisation (Thelma, Thelma 2 and 3, Thelma Rosemary, Rosemary 2, Jasmine West, etc). The target is associated with a north-west trending fault which may have acted as a conduit for granite-driven fluids from the south.

All targets are relatively small, with any tonnage potential coming from large depth extents.

Marcus Flis
Principal Geophysicist

Table 1 : Frances Creek Iron Deposits : Summary of magnetic association

Deposit	AMG E	AMG N	Formation	Lithology	Magnetic Association	Indicative magnetic susceptibility x 10^{-5}SI ore	host
Helene 11	808300	8494900	Wildman Zst	Shale, zst	flank of high		
Helene 10/Extended	808000	8493200	Wildman Zst	Shale, zst	flank of high		
Helene 9	808000	8494100	Wildman Zst	Shale	flank of high		
Helene 8	808000	8493500	Wildman Zst	Shale	flank of high		
Helene 6/7	808800	8494100	Wildman Zst	Shale (Dol)	in mag low	75	15
Helene 5	808800	8494700	Wildman Zst	Shale	in mag low		
Helene 4	808800	8494800	Wildman Zst	Shale	in mag low		
Helene 3	808700	8495500	Wildman Zst	Shale (Dol)	in mag low		
Helene 2	808500	8495800	Wildman Zst	Shale (Dol)	in mag low	160	80
Helene 1	808500	8496600	Wildman Zst	Shale (Dol)	in mag low		
Thelma 1	809300	8497500	Wildman Zst	Shale (Dol)	in mag low		
Thelma 2	809700	8497100	Wildman Zst	Shale	in mag low		
Thelma 3	810000	8496600	Wildman Zst	Shale	flank of high		
Thelma Rosemary	810400	8496500	Wildman Zst	Shale	flank of high		
Rosemary	810500	8497000	Wildman Zst	Shale	flank of high		15
Jasmine West	810600	8497500	Wildman Zst	Shale	in mag low		
Jasmine Centre	811100	8497300	Wildman Zst	Shale	flank of high		
Beryl	810500	8498300	Wildman Zst	Shale	in mag low		
Eliz. Marion	807700	8498300	Wildman Zst	Shale	in mag low		
Francis Ck East 1	821200	8497800	Masson Fm	Shale	in mag low	100	
Francis Ck East 2	819900	8497800	Masson Fm	Shale	?		
Francis Ck East 3	819900	8499200	Masson Fm	Shale	flank of high		
Ochre Hill	809000	8502200	Wildman Zst	Shale	on mag high	140	30
Saddle East	808200	8494200	Wildman Zst	Shale	?		
Saddle	808200	8503400	Wildman Zst	Shale	on mag high		
Saddle West	806600	8505300	Wildman Zst	Shale	flank of high		
Saddle Extended	806500	8506400	Wildman Zst	Shale	in mag low		
Millers	804500	8512200	Wildman Zst	Shale, G/wacke	on mag high	300	30
Bowerbird	804800	8513400	Wildman Zst	Shale	in mag low		
Big Hill	804400	8514300	Wildman Zst	Shale	in mag low	45	
Porcupine	804000	8514900	Wildman Zst	Shale	in mag low	60	
Egg Cup	802300	8514100	U Wildman	Shale	in mag low		
McFarrars	801500	8514400	U Wildman	Shale	flank of high		
Boots	800700	8518200	U Wildman	Shale, Breccia	flank of high	100	
Jessops East	809600	8527000	Wildman Zst	Shale	?	80	20
Jessops West	811200	8527000	Wildman Zst	Shale	?		
Mt Bundey	781300	8578100	Koolpin Fm	Metaseds	on mag high		



Km	Petrel Formation	Phe	Edith River Volcanics	Psk	Koolpin Formation
Olo	Ooolloo Limestone	Php	Plum Tree Creek Volcanics	Psp	Kapalga Formation
Ptw	Waterbag Creek Formation	Pga	Allah Creek Granite	Ppw	Wildstone Siltstone
Pts	Buldiva Sandstone	Pgb	Burnside Granite	Ppm	Mundogie Sandstone
Ptd	Depot Creek Sandstone	Pgc	Cullen Granite	Pu	Burrell Creek Formation
Phk	Kombolgie Formation	Pgg	Margaret Granite	Pnm	Masson Formation

Acknowledgement: Compiled from 1:500 000 Geology of the "Pine Creek Geosyncline" published by BMR 1979

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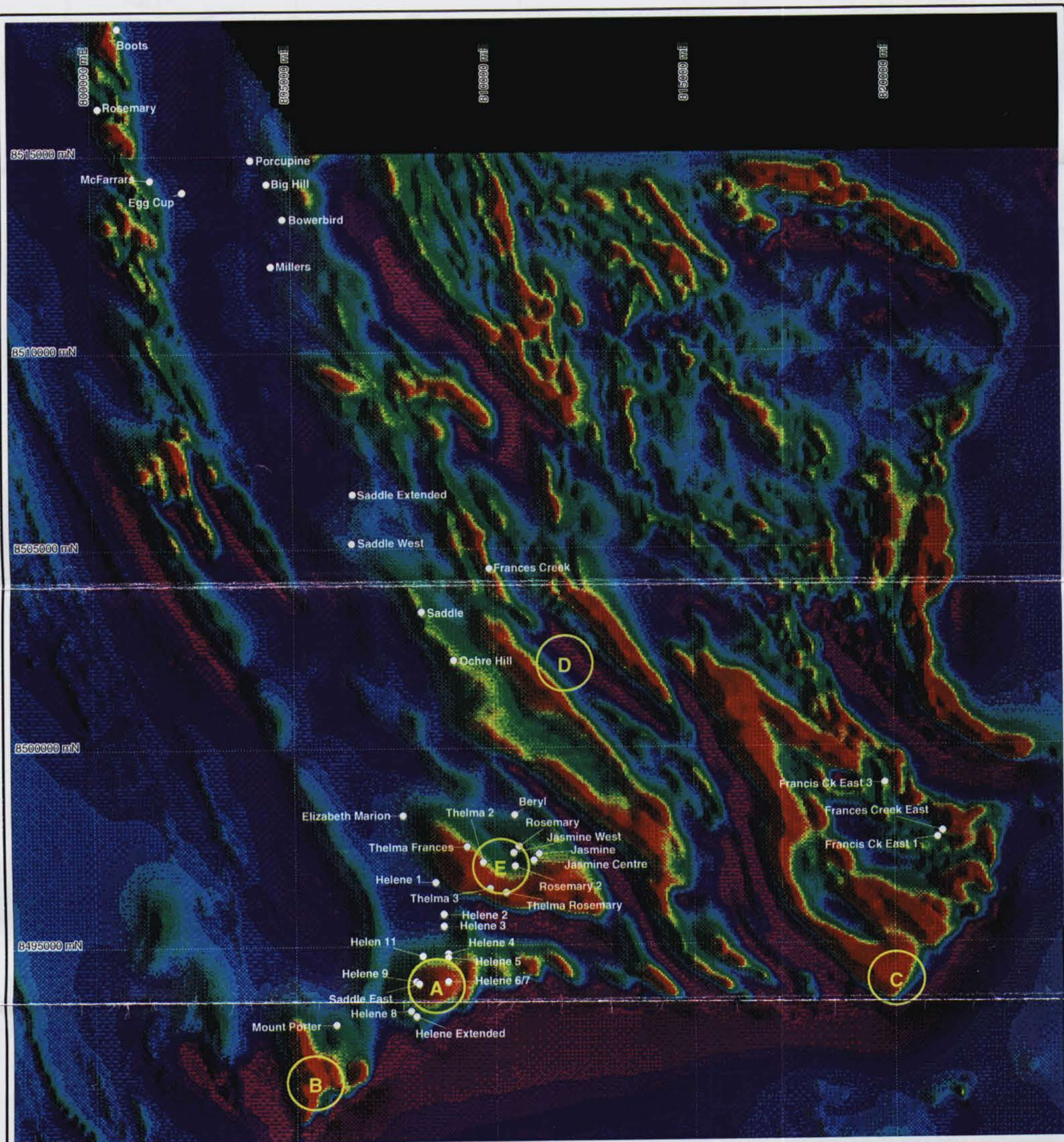
Figure 2053. Location Plan of the Frances Creek Area - Northern Territory.

HIF 2053



N
W E
S

1 0 1 2 3

Kilometres
Scale: 1:100,000
This map is based on AGD84, AMG Zone 52

(A) Geophysical target

Helene ● Known Iron occurrence

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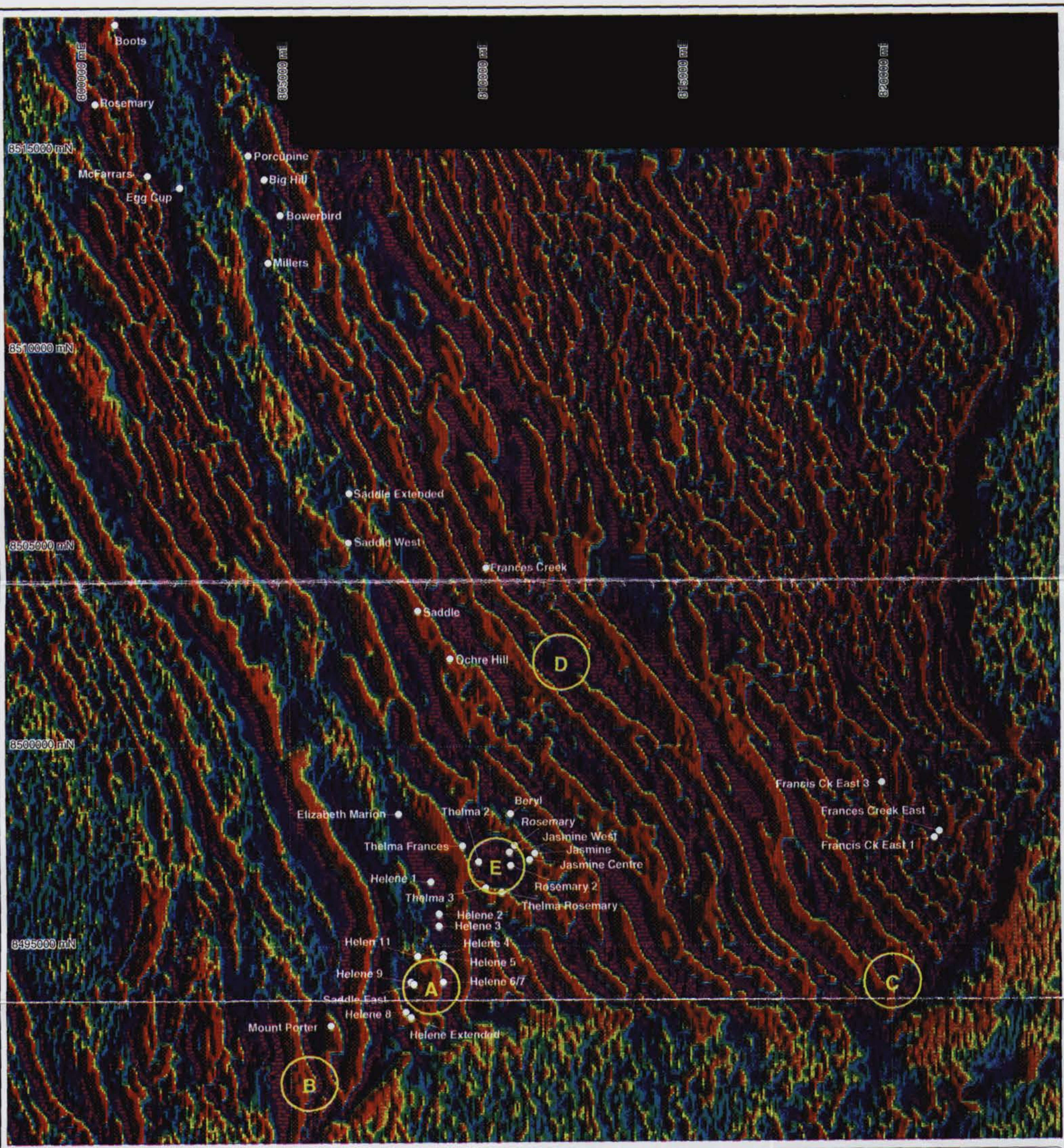
Development Support - Perth

FRANCES Ck., N.T.,
Image of Total Magnetic Intensity,
Showing known Iron occurrences & prospects.

Scale. 1 : 100,000 Date. May 2000	HI Figure File No. 2055



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Kilometres

Scale: 1:100,000

This map is based on AGD84, AMG Zone 52

(A) Geophysical target

Helene ● Known Iron occurrence

HAMERSLEY IRON PTY. LIMITED

Development Support - Perth

FRANCES Ck., N.T.,
Image of The First Vertical Derivative
of Reduced to Pole TMI,
Showing known Iron occurrences & prospects.

Scale. 1 : 100,000 Date. May 2000	HI Figure File No. 2054