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Kara and other nearby magnetite resources

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CONTENTS

Summary

These notes briefly review the magnetite skarn deposits at Kara and elsewhere around the Housetop Granite. They also summarise what is known of the measured, indicated and inferred resources of magnetite skarn. Note that it is the skarn rather than iron or magnetite for which resource figures are given. The magnetite skarns contain +30% Fe and can range up to greater than 65% Fe but the average grade and the distribution of grades are generally poorly known. There are WO_3 credits in the magnetite skarns. These credits are patchy and localised but nonetheless they are substantial and mean that the skarns *in toto* should be viewed as more than simply potential iron ore.

Most of the magnetite skarn deposits are held by Tasmania Mines Ltd who produced a review of their magnetite resources in 1985 (Whitehead, 1985, *in* TCR 88-2759C). Subsequently the company has worked on improving the resources data for the Hampshire deposit and the various Kara No. 2 deposits. The resources data cited in these notes are mostly from Tasmania Mines reports numbered TCR 88-2759C, 89-3025C, 90-3199R and 91-3233C. There appears to be considerable potential for additional resources of potentially open-cuttable magnetite skarn in Tasmania Mines' leases.

The bulk of the known magnetite skarn resources associated with the Housetop Granite are in the 5 km belt of country extending from near Kara No. 1 to Hampshire. In this belt there is a minimum, combined measured-indicated-inferred resource of 11–14 Mt of magnetite skarn which is open-cuttable (Table 1). This does not include the ore remaining within the original design limits of the Kara No. 1 pit but does include an estimate of the material stockpiled at Kara No. 1. The open-cuttable resource in the Kara–Hampshire belt is probably considerably smaller than the underground resource. For example, the Kara North Magnetite Anomaly alone has an underground potential of 5.4 Mt of magnetite skarn per 100 m of strike length.

There is a further open-cuttable resource of 1.3 Mt of inferred magnetite skarn in Tasmania Mines' deposits outside the Kara–Hampshire belt.

Magnetite skarn deposits that are not held by any exploration company are present at Highclere, L1, Laurel Creek West, Suttons Skarn and in the St Valentines area. Some of these deposits warrant further assessment. Aeromagnetic anomalies at Camena and Basils Road also warrant further assessment. Skarns at Natone and Redwater Creek have so far proven to contain only minor magnetite-bearing assemblages but possibly warrant some further drilling. Minor skarn and related mineralisation at localities L9, 10, 11, 12 west of Kara No. 1 appear to be of little interest.

INTRODUCTION

The main aim in preparing these notes has been to ascertain what iron resources are available in the magnetite skarns associated with the Housetop Granite, and also to determine what scope there is for further assessment of these resources.

GEOLOGY

Magnetite resources around the Housetop Granite occur in skarns that are mostly developed in the Wurawina Supergroup, although some (Highclere, Natone) are developed in Precambrian to Cambrian rocks. As well as magnetite-rich assemblages in the skarns there are also silicate-rich assemblages which are poor in magnetite.

Most of the magnetite skarns occur in the belt of country extending from near Kara No. 1 to Hampshire, a distance of about five kilometres. The skarns are favourably developed in transition beds between the Moina Sandstone and Gordon Group, both of which are units in the Wurawina Supergroup. These units form a simple regional syncline trending from Kara No. 1 towards Hampshire, with the mineralised transition beds cropping out along the western limb (Kara No. 1 to L13) and the eastern limb (Bobs Bonanza to Hampshire). Subsurface mineralisation occurs deeper in the synclinal structure or is overlain by Tertiary basalt and younger alluvium.

GRADE OF Fe

The grade of Fe in the magnetite-rich skarn is not well known. A figure of +30% Fe is applicable to the magnetite skarns identified by Whitehead (1985, p. 8) in his resource calculations.

It seems that in the magnetite-amphibole facies of the magnetite skarns there is 30–70% of the mineral magnetite, whilst in the garnet-diopside-magnetite facies there is 10–40% magnetite (Whitehead, 1985, p. 4). More recent work at Kara No. 2 indicates a magnetite content of over 80% (Whitehead, 1992) in that skarn.

Up until 1985 only one diamond drill hole on the Kara properties had been assayed for Fe (Whitehead, 1985, p. 5). There is thus considerable work yet to be done in determining the grade of Fe in the skarns.

TUNGSTEN CREDITS

For the past two decades scheelite has been regarded as the principal resource in the skarns associated with the Housetop Granite. The scheelite is late formed and occurs in enriched lenses, mainly in magnetite skarn. Most mineral exploration work around the granite has been concerned with locating these WO_3 (and Sn) enriched lenses in the skarns. As a consequence, knowledge of the magnetite skarns themselves tends to be fragmental, as the magnetite skarns are of greater lateral extent than the WO_3 lenses. For example, the Kara North 266 Zone is open ended with respect to magnetite, both to the north and south (Whitehead, 1985, p. 15).

With changing circumstances the skarns associated with the Housetop Granite, particularly in the Kara–Hampshire belt, might come to be regarded as iron resources containing sporadic tungsten credits. For example, the open-cuttable Kara North 266 segment of the Kara–Hampshire belt contains 0.971 Mt of 57.15% Fe (Table 1) with a tungsten credit of 0.23 Mt of 0.912% WO_3 (Whitehead, 1990*c*). As well as enhancing the open-cut potential of magnetite skarns, the tungsten credits may improve the feasibility of underground mining of some magnetite resources.

FURTHER WORK

In the context of establishing the most economic approach to developing the magnetite resources around the Housetop Granite it would be useful to design an assessment programme to cover the entire Kara–Hampshire belt, as most skarn occurs within this belt. There is a fair degree of continuity of the skarn, and the belt is only five kilometres long. Such a programme could only be carried out by Tasmania Mines or with their collaboration. Useful complementary work might entail studies of the feasibility of mining polymetallic Fe-W ore underground and studies of a unified mining plan for the entire Kara–Hampshire belt, together with the outlying satellite deposits. Such complementary studies would be particularly useful if an increased production rate over a longish term was envisaged.

Outside the Kara–Hampshire belt Tasmania Mines is proceeding with appraisal of its Kara No. 2 deposits which have particularly high Fe, low SiO_2, and which may be suited to specialised uses (Whitehead, 1992) rather than as simple iron ore. At Tasmania Mines' Kara South deposit there is a need to upgrade the resource data from inferred (0.8 Mt of magnetite skarn) to measured.

Potential exists outside the Tasmania Mines leases for additional tonnages of magnetite skarn but the deposits are widely scattered and previous work indicates that deposits such as Highclere and Laurel Creek West are small and very weathered. Suttons Skarn, L1 and the St Valentines area are sufficiently close to the Kara–Hampshire belt to warrant further assessment as potential satellite deposits, although they apparently do not contain WO_3 credits.

Aeromagnetic anomalies at Camena and around Basils Road warrant further assessment. They may correspond to magnetite skarns developed in 'transition beds' which are covered by Tertiary basalt and alluvium.

INDIVIDUAL DEPOSITS

The following is a list of skarns and possibly related features which occur around the Housetop Granite. The listing commences with the Highclere deposit and proceeds in a generally clockwise fashion. The positions of the skarns are shown on Figure 1.

HIGHCLERE

This deposit is interpreted as a deeply-weathered magnetite skarn developed in carbonate units within the Precambrian Burnie Formation. The deposit comprises clay, limonite, hematite and magnetite. Information from four diamond drill holes indicates inferred resources comprising two lenses of about 14 000 and 13 000 tonnes, probably averaging 55–60% Fe, which are contained in a larger mass

Figure 1.

The Housetop Granite and associated skarns. Positions of the skarns are given more precisely in Taheri and Green (1989) and in the various company reports cited in the text. The skarns are numbered as follows: (1–12 mark the Kara–Hampshire belt; 26 and 27 are aeromagnetic anomalies which may be related to skarn)

1. Kara No. 1
2. Western Limb
3. Companion
4. Kara North 266
5. Kara North Magnetite Anomaly
6. L13
7. Bobs Bonanza
8. Eastern Ridge
9. L5
10. L4
11. Hampshire Silver Mine
12. Hampshire
13. L1
14. Highclere
15. Natone
16. Redwater Creek
17. Laurel Creek West
18. Blythe River
19. Kara No. 2 South
20. Kara No. 2 East
21. Kara No. 2 Main
22. Suttons
23. Lohreys pits
24. Kara South
25. St Valentines area (several)
26. Camena
27. Basils Road

Rock units are:

A. Precambrian turbiditic quartzwacke, pelite, minor dolomite (Burnie Formation)
B. Middle Cambrian sedimentary rocks
C. Late Cambrian to Ordovician quartzose sandstone and conglomerate
D. Ordovician limestone and impure limestone
E. Late Devonian Housetop Granite
F. Cainozoic cover of mainly Tertiary basalt

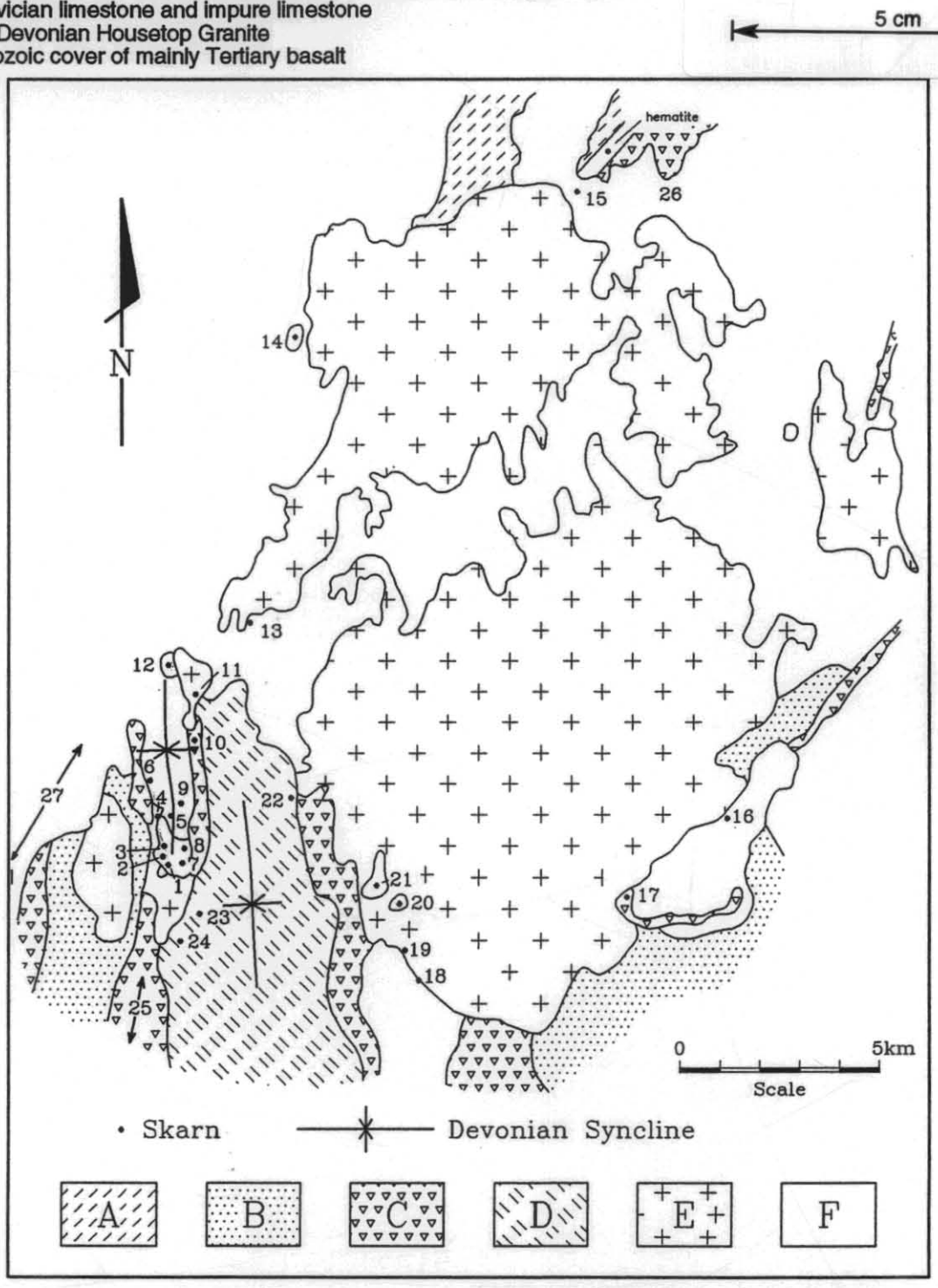

Table 1.

Resource figures mainly from Whitehead, 1985; 1988; 1989; 1990*b*, *c*; 1991; 1992. The asterisk indicates underground resources. The terms inferred, indicated and measured have their usual connotations of increasing certainty of measurement, although readers should refer to the original documents for the exact basis of each measurement.

Deposit	Magnetite Skarn (million tonnes)			Grade Fe (%)	WO_3 Credits	
	Measured	Indicated	Inferred		million tonnes	WO_3 %
Kara–Hampshire Belt						
Kara No. 1	0.603 (1983)	mostly mined out		64.6	0.603	?0.75
	0.385 (1983)			+30	nil	
		3.36			>0.06	0.40
(stockpile)			0.4–0.45 (1985)	high	minor	
W. Limb		4.702			0.154	0.47
Companion			1.0–3.2	+30	unknown	
Kara N 266	0.971			57.15	0.23	0.912
Kara N Mt.*			>5.4	+30	?nil	
L13			unknown	+30	unknown	
Bobs Bonanza			0.25–0.75	+30	unknown	
E. Ridge*			unknown	+30	0.039	0.449
E. Ridge–L5*			unknown	+30	unknown	
L5*			unknown	+30	unknown	up to 3.47
L4*			unknown	+30	unknown	
Hampshire Ag			minor	+30	?nil	
Hampshire		0.159		52.56	nil	
			>0.5	+30	?nil	
Other Deposits						
L1			0.5–1.5	?	?nil	minor
Highclere			0.027	55–66	?nil	minor
			0.25	+30	?nil	minor
Natone			minor	?	nil	minor
Redwater			minor	?	nil	minor
Laurel W			?minor	+30	nil	minor
Blythe River			?minor	?	?nil	minor
Kara 2 S			0.5 (1985)	+30	nil	minor
Kara 2 E			0.02 (1985)	+30	nil	minor
Kara 2 Main			unknown	?	nil	minor
Suttons			?minor	?	nil	minor
Valentines			unknown	?	?nil	minor
L9, 10, 11, 12			minor	?	nil	minor
Kara S			0.8	+30	0.06	minor
Lohreys			minor		?nil	

of some 250 000 tonnes averaging 30% Fe. WO_3 values are low.

See Jack, 1965.

NATONE

The Natone skarn is developed in Precambrian to Cambrian dolomite in a sequence which overlies the Burnie Formation and underlies the Wurawina Supergroup. Six diamond drill holes have been drilled by Minops and Shell to investigate the skarn. It comprises mostly silicate assemblages with pyrrhotite and magnetite as disseminations and as occasional massive bands.

Magnetite (and pyrrhotite) intersected by drilling appears to be insufficient to account for the ground magnetics and thus a more substantial body of magnetite skarn may be present at depth.

There are surface exposures of hematitic ironstone (Natone iron) in the vicinity of the skarn which may be gossan or may have some other origin. If other deposits of hematitic ironstone which occur along strike to the northeast near Cuprona are of similar origin to those at Natone, then it would seem unlikely that the deposits at Natone are gossan related to the skarn.

See Ruxton, 1983; Kwak, 1983; Ruxton, 1984a; Whitehead, 1990a.

CAMENA AEROMAGNETIC ANOMALY

This large anomaly has been attributed to a deep source, possibly an ultramafic or mafic body or, more specifically, a basalt feeder. However, basalt rubble in the anomaly area is only weakly magnetic, and the anomaly occurs over ground which is topographically low rather than over a higher area (hill or ridge) where basalt-related magnetic anomalies usually occur.

A possible alternative interpretation of the anomaly follows from the regional geology. Although the anomaly and surrounding area are underlain by Tertiary basalt and Quaternary alluvium, it appears that the anomaly is near the sub-outcropping contact of the Housetop Granite. It also appears to be near the sub-outcropping top of the siliceous, basal unit of the Wurawina Supergroup, that is, close to that part of the stratigraphy in which the magnetite skarns at Kara are favourably developed. Thus, the anomaly is worthy of further testing.

See Ruxton, 1984b.

REDWATER CREEK SKARN

The Redwater Creek skarn is developed in Gordon Group rocks at the contact with the Housetop Granite. It has been diamond drilled by Comalco (3 holes), Shell (2 holes) and Tasminex (2 holes). The predominant skarn assemblages are calcsilicate with only thin magnetite-rich intervals. WO_3 and Sn values are low.

Shell tentatively concluded that the amount of magnetite intersected by drilling did not account for the ground magnetics. Thus, further drilling may be warranted.

See Weste, 1979; Banwell, 1981; Ruxton, 1982; 1984b.

LAUREL CREEK WEST SKARN

Skarn development is again in the Gordon Group at the contact with the Housetop Granite. A single percussion drill hole intersected 10 m of magnetite skarn with low Sn and WO_3 values.

Ground magnetics suggest that the magnetite skarn may have a strike length of one kilometre, so further drilling may be warranted.

See Ruxton, 1984b.

HOUSETOP AEROMAGNETIC ANOMALY [409 600 mE, 5 427 500 mN]

This anomaly may be due to magnetite occurring in granite or it may be related to skarn development.

See Ruxton, 1984b; Taheri and Green, 1989; Pearson, 1927; Brandt, 1974.

BLYTHE RIVER SKARN

Skarn development is at the base of the Gordon Group and the skarn appears to be a pendant surrounded by granite. The associated ground magnetic feature is 500 m long and has been costeaned in two places 50 m apart. In each costean the skarn dips 25°W but its thickness varies from 15 to 20 metres. Values of WO_3 and Sn are low.

See Lawton et al., 1983.

KARA No. 2 SKARNS (TASMANIA MINES)

The Kara No. 2 skarns are developed in the Wurawina Supergroup. Kara No. 2 Main Zone and Kara No. 2 East are pendants surrounded by granite, whilst Kara No. 2 South is close to the main granite contact. There are some other small skarns developed in the adjacent country rocks.

Resource evaluation is in progress at Kara South with promising prospects of a small, high grade (58–60% Fe) *in situ* magnetite deposit with low SiO_2 (<3%). In 1985 an estimate of 0.5 Mt of inferred magnetite skarn was made for Kara No. 2 South.

See Whitehead, 1985; 1991; 1992.

Resource evaluation is also in progress at Kara No. 2 East, again with good results in terms of high Fe and low SiO_2. In 1985 the estimate for Kara No. 2 East was an inferred 0.025 Mt of magnetite skarn.

See Whitehead, 1985; 1992.

The northern part of the Kara No. 2 Main Zone has been downgraded by recent work. Further work is required to assess the southern part of the zone.

See Whitehead, 1992.

All the Kara No. 2 skarns have low order WO_3 and Sn.

SUTTONS SKARN (LOCATION 12)

This skarn is in Wurawina Supergroup and is magnetite-bearing but has a low aeromagnetic signature. It is about 500 m long, about 75 m wide and contains low order WO_3. In the course of tungsten exploration it was auger drilled to depths of up to about 10 metres. Presumably Suttons Skarn does not represent a significant magnetite resource as it was not considered in Whitehead (1985).

See Brandt, 1974.

KARA SOUTH (TASMANIA MINES)

Only the eastern section of the Kara South skarn, which is in the Moina Sandstone, has been drilled intensively, as this section contains a WO_3 resource of 0.06 Mt at 0.439% WO_3. High grade magnetite skarn is present in the central section but substantial work is required to properly assess the resource. The 1985 estimate was 0.8 Mt of inferred magnetite skarn.

See Whitehead, 1985; 1990c.

LOHREYS PITS (TASMANIA MINES)

These appear to be marked by only minor skarn development, again in the Moina Sandstone.

KARA–HAMPSHIRE BELT (TASMANIA MINES)

This belt of country is about 5 km long and contains most of the magnetite skarn associated with the Housetop Granite. The skarns are developed in the transition beds in the Moina Sandstone below the Gordon Group.

There are many open-cuttable prospects in the belt corresponding to outcropping segments of the western and eastern limbs of a syncline which trends N from Kara No. 1 to Hampshire. There are also underground prospects where the mineralised interval is deeper in the synclinal structure or overlain by Tertiary basalt or Quaternary alluvium. Many prospects have experienced deep weathering, which detracts from the quality of the skarn.

See Whitehead 1985; 1988, 1990c.

Kara No. 1 Open Cut

This resource has now been largely mined out. According to the 1983 data base and mining plan there was a measured 603 081 tonnes of magnetite skarn at 64.6% Fe (Whitehead, 1985) which contained the WO_3 resource that the pit was designed to extract. There was also another measured 385 055 tonnes of magnetite skarn containing no WO_3. At Kara No. 1, outside the designed pit, there is a geological reserve (? indicated resource) of 3 360 031 tonnes of magnetite skarn at +30% Fe. This includes easily mined reserves in the eastern section totalling 644 920 tonnes of skarn containing 59 800 tonnes at 0.40% WO_3. There are also magnetite tailings inferred to total 0.4–0.45 Mt in 1985.

Western Limb

This prospect is an outcropping strike extension of Kara No. 1. It has been tested in sections at 40 m spacings along 240 m of strike with 2–4 DDH per section. The indicated resource is 4 701 880 tonnes of magnetite skarn which includes 154 000 tonnes at 0.47% WO_3.

Companion Skarn

This is an outcropping strike extension N of Western Limb. It has been little explored and contains an inferred resource of 1–3.2 Mt of magnetite skarn.

Kara North 266 Zone

The western limb of the Kara–Hampshire syncline is obscured by surficial deposits between the Companion Skarn and Kara North 266 but is presumably continuous. The Kara North 266 zone is also open to the north. The zone itself has been intensively explored and contains a measured resource of 970 848 tonnes of magnetite skarn at 57.15% Fe. This resource contains 0.23 Mt at 0.912% WO_3 (Whitehead, 1990c).

Kara North Magnetite Anomaly

Limited drilling east of the Kara North 266 zone has shown a potentially large magnetite skarn with an inferred underground resource of 5.4 Mt per 100 m of strike length.

Location L13

L13 is a poorly explored, outcropping part of the western limb of the Kara–Hampshire syncline, north of the Kara North 266 zone.

Bobs Bonanza

This outcropping prospect is just east of Kara No. 1 on the eastern limb of the Kara–Hampshire syncline. It contains an inferred resource of 0.25–0.75 Mt of magnetite skarn.

See Whitehead, 1985.

Eastern Ridge

Eastern Ridge is a strike extension north of Bobs Bonanza. It is an essentially underground resource which has been drilled at 40 m intervals over a strike length of 240 metres. Because of the requirement for underground mining Whitehead (1985) did not calculate a magnetite skarn resource. The deposit contains a tungsten resource of 39 393 tonnes at 0.449% WO_3 (Whitehead, 1990c).

Eastern Ridge to L5

Drilling has shown that there are further underground resources in the one kilometre interval of basalt-covered strike extension between Eastern Ridge and the L5 prospect to the north.

See Whitehead, 1988.

L5

At the L5 prospect drilling at 40 m intervals along a strike length of 90 m has shown an underground resource of

magnetite skarn containing particularly high values of WO_3 (3.47%).

See Whitehead, 1981.

L4

This is another, more northerly underground resource on the eastern limb of the syncline. The potential is unknown.

See Whitehead, 1985.

Hampshire Silver Mine

Located still further north on the east limb of the syncline this outcropping prospect appears, on the basis of ground magnetics, to be very small (Whitehead, 1989).

Hampshire Magnetite

This is the most northerly of the known prospects in the Kara–Hampshire belt. Systematic percussion drilling has shown indicated resources of outcropping magnetite skarn of 158 769 tonnes at 52.56% Fe in a small strike interval. Over the entire strike length of the prospect (480 m) there is an inferred resource of 0.5 Mt per 10 m depth.

See Whitehead, 1990b.

L1

This prospect is northeast of the Kara–Hampshire syncline and contains an inferred resource of 0.5–1.5 Mt of magnetite skarn. Skarn is developed at the Gordon Group/granite contact.

See Whitehead, 1985.

L9, 10, 11, 12

These are minor prospects in Cambrian rocks west of Kara.

See Whitehead, 1980.

ST VALENTINES AREA

A N-S aeromagnetic anomaly crosses the eastern slopes of St Valentines Peak. The anomaly is caused by magnetite skarn development in the Moina Sandstone along a strike length of 2.5 kilometres. The skarns range up to 26 m in thickness, and possibly more. They contain low order WO_3 and appear to have been little explored.

See Whitehead, 1980.

BASILS ROAD AEROMAGNETIC ANOMALY

About 3 km west of Kara there is a linear aeromagnetic anomaly which trends NNE for about 5 km and crosses Basils Road. Although the anomaly occurs over basalt, it corresponds to the inferred, approximate sub-outcropping position of the transition beds between the Moina Sandstone and the Gordon Group. Thus, the anomaly warrants further assessment for the possible presence of magnetite skarn associated with sub-outcropping Housetop Granite.

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