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TASMANIA MINES LIMITED

RETENTION LICENCE APPLICATION

WITHIN E.L. 17/68

MINES	
File Ref.	
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Resubmit to	Date

RECORDED

2nd October, 1990

TASMANIA MINES LIMITEDAPPLICATION FOR A RETENTION LICENCE - E.L. 17/68

In view of the impending relinquishment of Exploration Licence 17/68 on 3rd November 1990, Tasmania Mines Limited elects to submit an application for a RETENTION LICENCE over a selective area of the E.L. (8.15sqkms).

This proposed R.L. area embraces proven deposits of both magnetite and wollastonite which at the present time could not be commercially developed. The area also includes strong geological potential for additional reserves of scheelite ore.

A review of past Tasmania Mines Limited work plus results on the area in question, and justification for the actual application are summarised in the present report.

W. White

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2/RL ✓	Retention Licence Application Area - GEOLOGY (Part A)	1:10,000
3/RL ✓	Hampshire Magnetite Skarn (Part B) - Ground Magnetic Survey <i>Nov 78</i>	1:10,000 1:1,000
4/RL ✓	Hampshire Magnetite Skarn (Part B) - Drill Site Location <i>Aug 79</i> X	1:500
5/RL ✓	Loudwater Creek/Hampshire Magnetite Anomaly - Ground Magnetics <i>Aug 79</i> (Part B)	1:1,000
6/RL ✓	Wollastonite Deposits - Limestone Creek - Location Plan <i>1980</i> (Part B)	1:1,000
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- Appendix A1 - ANZECC - Drill auger results 1973-77
- Appendix A2 - Tasmania Mines Ltd - Percussion Drilling Programme
- A2.1 - Holes assayed - Intersection/Fe Assay
- A2.2 - Drill Assay Logs
- A2.3 - Drill collar AMG co-ordinates 1973-77
- A2.4 - Tonnage and Grade Calculations
- Appendix A3 - Surface Rock samples - Au assays 1981
- Appendix A4 - BHP Beneficiation Test Work - Lump Magnetite

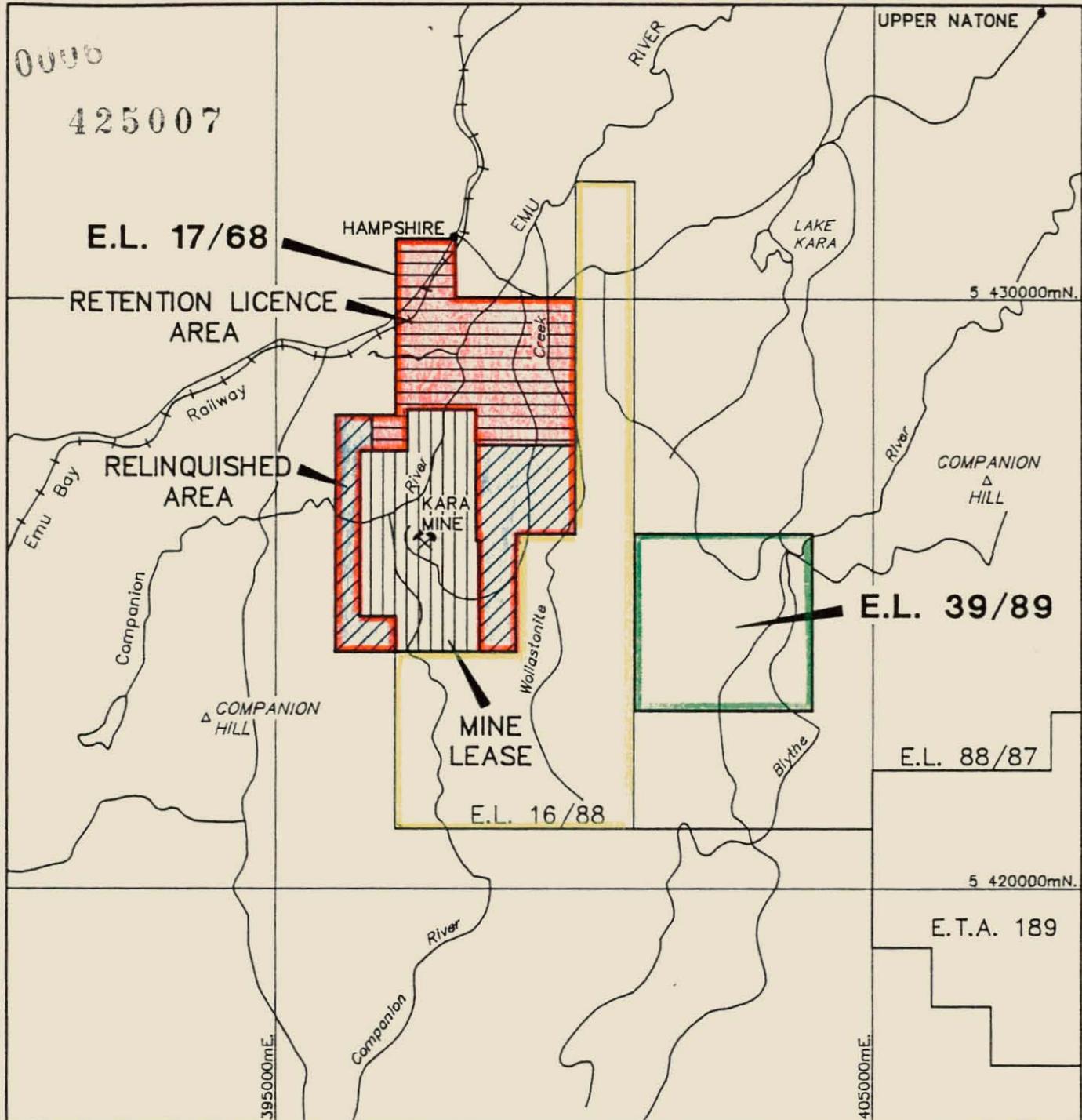
Appendix B - Wollastonite Investigations

- Appendix B1 - ZETETIC - "A preliminary report on the Wollastonite Creek Area: - Nov. 1985
- Appendix B2 - Mineralogical - Petrological Studies Wollastonite and Calc-Silicate drill samples E.L. 17/68 W. Fander, C.M.S., Adelaide 1986
- Appendix B3 - Surface rock samples - Analytical Results
- Appendix B4 - Wollastonite Percussion drilling programme - Drill Logs/Assay Results 1977
- Appendix B5 - Diamond drilling programme DOM519, 520 1977
- Appendix B6 - Abermet/CMS. Bench test work results.
- Appendix B7 - Department of Mines metallurgical test work - Upgrading wollastonite sample
- Appendix B8 - Mineral Sands Consultancy Group - Metallurgical upgrading of wollastonite
- Appendix B9 - Commodity review - wollastonite

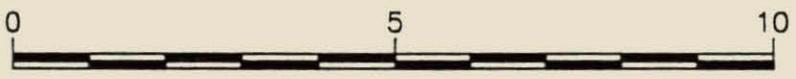
TASMANIA MINES LIMITEDRETENTION LICENCE APPLICATION E.L. 17/68A. AREA UNDER APPLICATION

The area under application for RETENTION LICENCE status by Tasmania Mines Limited is:-

- Specifically delineated on accompanying Plan No 1/RL and shown in Figure 1.
- The R.L. boundaries conform to the 1,000 metre grid line co-ordinate system.
- In size encompasses 8.15sqkms, situated immediately south of Hampshire.
- "Lies" entirely within the current Exploration Licence 17/68 area, specifically within the north-central section.
- The R.L. southern boundaries are contiguous with existing Consolidated Mines Lease (1371P/M) surrounding the current mining operations at the Kara operation (Figure 1).



E.L. 17/68



RETENTION LICENCE AREA UNDER APPLICATION

SCALE 1:100,000

E.L. 16/88 RELINQUISHED SEPT. 1990

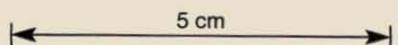
E.L. 17/68 AREA TO BE RELINQUISHED

TASMANIA MINES LIMITED
E.L. 17/68 & 39/89

E.L. 39/89 CURRENT

PROPOSED STRUCTURE - R.L. AREA AND CORRELATED LEASES

13/9/90



B. JUSTIFICATION FOR THE R.L. APPLICATION

The reasoning behind the current RETENTION LICENCE application is essentially to secure title over two mineral deposits and additional areas of potential reserves which have in the past been delineated and evaluated by Tasmania Mines Limited, and ones which at the present time can not be economically developed or mined.

The two deposits and additional areas of potential reserves are:-

HAMPSHIRE MAGNETITE DEPOSIT

This deposit of magnetite was originally discovered by the Tasminex N.L./Anzeco J.V. in 1972, and since that date has been both delineated, and more recently (1988/89) the most northern section of the deposit has been investigated by evaluation drilling.

The occurrence is a near surface magnetite deposit, of high grade Fe content (in-situ 52% Fe) and one so disposed as to readily present itself for open pit mining with a low overburden stripping ratio, and one within easy access to existing bulk handling facilities at the Burnie port. The most northerly 125m strike extent of the deposit has been drilled and evaluated, and a total of 158,769 tonnes of high grade 52.56% Fe magnetite indicated geological reserves have been calculated. Resources of magnetite over the entire strike length of the deposit are estimated to be in the order of 500,000 tonnes for each 10m depth extension of the deposit. The development of the deposit will be deferred until the current Kara properties magnetite mining infrastructure is further established.

WOLLASTONITE DEPOSITS - LIMESTONE CREEK

This occurrence has been investigated in detail by Tasmania Mines Limited since 1985 to the current date. Investigations have included geologic mapping, drilling, metallurgical investigations and marketing evaluations. A marketable product of wollastonite can be achieved by beneficiation and future development of open pit mine operations at the deposit would be low cost. It is admitted feasibility studies and further technical development need to be finalised, but are temporarily deferred until such time that the current Kara scheelite/magnetite operations have been put on a firm footing with a positive cash flow.

POTENTIAL RESERVES

The Retention Licence area would include potential reserves along strike from both the above mentioned deposits of magnetite and wollastonite.

It would also include ground covering potential scheelite reserves north of the blocked out reserves at both the Location L5 and the Kara North scheelite deposits.

C. PREVIOUS WORKC1. HAMPSHIRE MAGNETITE SKARN DEPOSITC1.1 - GENERAL REVIEW

This skarn zone was discovered in 1972, and since that date has been investigated during a number of different exploration campaigns, namely Anzeco/Tasminex 1972-74, McInyre Mines/Tasminex 1983-84 and more recently Tasmania Mines Limited 1988-89.

At this present stage, the deposit could be classified as one constituting reserves/resources of magnetite, of high grade quality and of open pit mining potential. It obviously will in the future, together with other magnetite deposits such as Kara South and Kara No 2 form a future source of magnetite supplies to Tasmania Mines.

The deposit occurs in the extreme north west corner of the present E.L. 17/68 and is peripheral to the western margin of the Hampshire granite stock immediately south of the Hampshire railway siding.

The skarn zone itself has been delineated by a combination of surface mapping, ground magnetic surveys and drilling over a total strike distance of 480 metres, and follows, and is separated from the margin of the Hampshire granite stock by an approximate 20-25m wide zone of sandstone/quartzite (epidotised) unit.

The most northerly section of the deposit was recently (1989) percussion drilled over approximately 125m of strike. Drilling, although only shallow showed the magnetite to have excellent in-situ total Fe values ranging between 40-60% Fe. Drilling to date restricts classification of the deposit to one of indicated geological reserves and potential resources.

The following notes summarise the history and salient results of exploration work/investigations during the E.L. term.

C1.2 ANZECC (J.V. WITH TASMINEX N.L.)

(1972 - 1974)

- Regional pan concentrate geochemical sampling of drainage around Hampshire. Recognition of scheelite in drainage. Follow up sampling discovered the presence of a weathered magnetite skarn zone.
- Surface mapping and ground magnetic surveys (reconnaissance), delineated N part Hampshire magnetite skarn, which was surface exposed over approximately 150m strike distance.
- The above section was grid soil sampled and grid Gemco power augered, in total, 28 holes with a total drilled depth of 1010 feet. Samples were assayed at 3 feet intervals and assayed for WO_3 content. The maximum WO_3 value was in order of 1000ppm, but other anomalous values were generally in range of 250-400ppm.
- Anzecc terminated any further interest in the tungsten potential of the deposit because of the above limit of WO_3 values and weathered nature of the deposit.

Drill auger results are documented - Appendix A1.

C1.3 McINTYRE MINES (AUSTRALIA) PTY LTD (J.V. WITH TASMINEX N.L.)
(1983 - 1985)

The true extent of the Hampshire Magnetite Skarn Zone south-east from the near and on-surface deposit of magnetite rubble previously outlined by Auzeco was delineated by detailed grid ground magnetic surveys completed by McIntyre Mines during the period 1983-85.

Magnetic surveys (5m intervals) were run on grid lines established at 25-30m intervals across the entire eastern limb of the Kara synform from Location LS to Hampshire. These surveys were designed to investigate trends and disposition of buried magnetite skarn zones within the Ordovician Transition Series along the fore mentioned structure. Please refer to Plans 5/RL and 8/RL.

As a result of this work, the Hampshire magnetite skarn was accurately delineated and proven to be of far greater magnitude (480m strike length) than previously anticipated. Its extent is outlined in detail on Plan No 3/RL.

C1.4 TASMANIA MINES LIMITED

(1989 - 1990)

Recent Associated Forest Holdings Pty Ltd tree felling operations just south of the Hampshire Railway siding permitted the ideal opportunity and access for a shallow percussion drilling programme to be carried out over the extreme northern section of the Hampshire magnetite skarn zone.

Over a total strike distance of approximately 150m, 58 shallow percussion holes were drilled using the Tasmania Mines Limited Tamrock mine rig. In total 495.5m were drilled - average hole depth 8.5m. The holes were sampled at 3m intervals and 90 samples were submitted for total Fe and WO_3 analysis.

Plan No 4/RL shows drill site locations, and Appendix A2 documents summary drill logs and assay results of holes drilled and drill collar AMG co-ordinates.

Although drilling was restricted to shallow depths (maximum 15m) a very high grade magnetite skarn zone (40-60% total Fe values) was confirmed. The zone could be delineated over a 125m strike distance over a width of between 18-42m.

As documented in the E.L. 17/68 Annual Report the following reserves/tonnages have been calculated.

- Indicated Geological Reserves:-

158,769 tonnes of high grade magnetite averaging 52.56% Fe.

The deposit is open ended along strike to both the NW and SE and a drill depth of 12.8 metres was the limit used in reserve calculations.

It is also estimated that the potential resources of magnetite over the above entire 480m strike length of the deposit would total 500,000 tonnes for each 10m down dip extension of the zone from surface.

Metallurgical test work on a bulk 100kg sample of magnetite from this deposit was carried out by the BHP Central Research Laboratories, NSW. These investigations showed the ore was amenable to beneficiation and that by magnetic separation on topsize material of 0.1mm a marketable product with a concentrate grade of 65% Fe was achievable. (Appendix A4).

WO₃ assays (Appendix A2.2) of the skarn at this particular section of the Hampshire magnetite skarn revealed negative WO₃ anomalism.

Also during 1989, surface samples of magnetite skarn from this location were collect and assayed for possible Au anomalism. As documented in Appendix A3 results were negative.

C2. WOLLASTONITE DEPOSITS - LIMESTONE CREEKC2.1 GENERAL REVIEW

Wollastonite occurrences were known in the area encompassed by the licence long before its establishment in 1968. However, it has not been until the period 1985 to the present date that investigations have been undertaken by Tasmania Mines Limited on the commodity and its potential.

The occurrences are found in the central sections of the E.L. outcropping in Limestone Creek, 1km south of the Hampshire-Upper Natone Road, approximately 3km SE of Hampshire. The surrounding area forms part of an active forestry project managed by Associated Forest Holdings.

The deposits of wollastonite were originally investigated by the Mines Department/Tas. Geol. Survey (Hughes 1957 and Longman 1961). They completed surface examinations and sampling, concluding the potential for a one million tonne deposit of "wollastonite rich material". Since 1985 Tasmania Mines Limited have completed programmes of geologic mapping, surface sampling, drilling (percussion/diamond drilling), metallurgical testwork, bulk sample upgrading and marketing reviews.

The E.L. 17/68 wollastonite occurs in metamorphosed Ordovician Gordon Limestone sequences. These consist of marbles and calc-silicate beds which include horizons or lenses of wollastonite. One initial area of concern was that the wollastonite horizons would be too narrow in thickness and interbedded with other "dirty" calc-silicate or non-wollastonite rich calcareous horizons, but drilling and more delineated surface geologic examinations tended to dispell this worry. Preliminary analytical/mineralogical work although not discouraging established both a significant pyrrhotite content within

the deposit, and that the diopside/calcite content was variable. Again bulk scale metallurgical test work (crushing, grinding, magnetic separation, flotation) was encouraging and indicated that a product constituting 51.8% of the sample having a calculated 70.5% wollastonite content was achievable.

The final produced sample of wollastonite has been forwarded to potential buyers in Asia, Europe and North America. Response was variable, but encouraging enough to justify initiation of future full scale feasibility studies on the development and extraction of the richer near surface tonnages of wollastonite.

C2.2 PREVIOUS EXPLORATION WORK

Both the Department of Mines and Tasmanian Geol Survey personnel had completed investigations in the area prior to any detailed work by Tasmania Mines Limited. The former included:-

- 1924, Reid mapped large areas of limestone around the headwaters of Limestone Creek.
- 1943, Thomas and Henderson investigated the Limestone Creek area for possible production of wollastonite.
- 1950 and 1957, Hughes sampled wollastonite material within Limestone Creek.
- 1961, Longman carried out a detailed sampling programme, mapping and some thin section work.

C2.3 TASMANIA MINES LIMITED - EXPLORATION INVESTIGATIONS
(1985 - 1990)

ZETETIC (CONSULTANT GEOLOGISTS)

The initial assessment of known wollastonite occurrences in the Limestone Creek area was completed by ZETETIC - consulting economic geologists - during the period October/November 1985. Their work was preliminary and consisted of the following:-

- Literature review.
- Regional mapping to set the Limestone Creek area in its geological content.
- Detailed geological mapping of the Limestone Creek wollastonite occurrences.
- Topographical survey of the area encompassing the wollastonite mineralisation and part of Limestone Creek.

Their work recommended that a more detailed appraisal in the form of drilling should be completed at the deposit.

Appendix B1 summarises work completed by Zetetic.

MINERALOGICAL/PETROLOGICAL WORK

Specimen wollastonite rock samples were collected from the Limestone Creek occurrences, and together with selective drill core samples of miscellaneous calc-silicate rock suites from various drilled skarn locations in E.L. 17/68 (emphasis placed on Locatoin L5 and Kara North Magnetite Anomaly) were submitted for mineralogical and petrological examination to W. Fander, Central Mineralogical Services, Adelaide.

The results of this work are summarised in Appendix B2.

GEOLOGICAL EXAMINATIONS

During 1986-87 the following surface work was completed at the wollastonite occurrences:-

- Completion of a detailed topographical survey, scale 1:1000, Plan No 6/RL.
- The initiation of reconnaissance geological mapping in the Limestone Creek area, and detailed mapping of identified wollastonite deposits. Geological map - Plan No 7/RL. Scale 1:2500.
- Surface sampling of wollastonite outcrops and other calc-silicate horizons. Sample Nos LST/10 to LST/20 were submitted for chemical analysis, and these are shown as Appendix B.

DRILLING PROGRAMMES

At the wollastonite occurrences location the following drilling programmes have been completed.

i) Percussion Drilling:-

Nine shallow percussion holes (Nos WL1 to WL9) were drilled during January - February 1987. The maximum hole depth was 32m, and total drilled metres was 187m.

Appendix B4 itemises assay results of these drill samples. During the course of this drilling, three of the four known wollastonite outcrop areas previously outlined by the Department of Mines (1958) were investigated (Plan No 7/RL)

ii) Diamond Drilling:-

During August/September 1987, two diamond drill holes Nos 519 and 520, each of 200 metres depth, were drilled.

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Both holes were terminated in altered Ordovician Gordon Limestone Transition Beds sequences.

Appendix B5 provides details of assay results on samples of core from these holes, namely DOM519, 3.05m to 28.30m, and DOM520, 2.00m to 40.00m.

- METALLURGICAL INVESTIGATIONS

i) Abermet/Department of Mines April 1986

Crushing, grinding and high intensity magnetic separation test work was completed by ABERMET, Burnie, on a bulk sample of wollastonite. Follow up chemical/mineralogical test work on the various magnetic products was made at the Department of Mines laboratories, Launceston.

Appendix B6 documents details of these investigations and their results.

ii) Department of Mines, Launceston (Mid 1988)

A 20kg wollastonite sample from surface exposures at the Limestone Creek area was subjected to bench scale metallurgical tests and mineralogical/chemical analyses by the Department of Mines laboratory personnel, Launceston.

The prime objective of the work was to assess various possible techniques of upgrading the material to a wollastonite concentrate suitable for economical evaluation.

The test work consisted of the following:-

- Crush to minus 4mm.
- Grind (ball mill) to minus 600 microns.
- Jones wet magnetic separation.

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- Non-magnetic product subjected to calcite froth flotation (Denver laboratory flotation cell).
- Flotation tailing product (wollastonite concentrate) subjected to silica froth flotation.
- Products are submitted for chemical analyses (primarily L.O.I., CaO, SiO₂, MgO, Fe₂O₃, Al₂O₃).
- Products submitted for mineralogical examination.

Test work resulted in producing a rougher flotation tail product constituting 51.8% of the sample and having a calculated 70.5% wollastonite content. However, the conventional silica flotation tests of this sample did not achieve any additional wollastonite content concentration or SiO₂ removal.

Chemical analyses showed the following:-

	<u>CaO</u>	<u>SiO₂</u>	<u>MgO</u>	<u>Fe₂O₃</u>	<u>Al₂O₃</u>	<u>L.I.O.</u>
Head Sample	39.5	41.4	3.5	1.3	2.3	9.0
Rougher Wollastonite Concentrate	41.5	52.1	2.7	0.8	2.4	0.62

Firing test (electric furnace for 6 hours at 1000°C) on the produced wollastonite concentrate (to assess its ceramic potential) produced a slight pinkish coloured product (oxidization of contained iron).

Detailed results on the above work are contained in Appendix B7.

iii) Mineral Sands Consultancy Test Work (1988)
(Warman, Readings, Amdel and W. Fander)

Metallurgical tests on a 5kg representative sample of wollastonite material from the Limestone Creek deposit were completed and co-ordinated by Mineral Sands Consultancy.

The techniques applied were as follows:-

- Rolls crush to minus 300 micron (Fow-Anamet, Sydney).
- Process through Wet High Intensity Magnetic Separator (Readings).
- Whims non-magnetic fraction subjected to flotation tests (Amdel) after regrinding to minus 150 micron. An anionic float was used to reject calcite, followed by cationic float to reject silica/quartz.
- The products were examined mineralogically and chemically.

Flotation tests showed that a wollastonite product was produced, which by Amdels chemical assessment contained 57.56% wollastonite, and 70% by W. Fanders mineralogical examination. The remaining contaminant in the product was believed to be diopside.

Appendix B8 shows the results of this test work.

WOLLASTONITE COMMODITY REVIEW - MARKET SPECIFICATIONS/REQUIREMENTS
(1989/90)

- i) A general wollastonite commodity review and current work production/specifications/requirements study has been completed. The results of this review are documented as Appendix B9.
- ii) A 10kg sample of wollastonite material was upgraded (rolls crushing, H.I. magnetic separation and flotation) by the Department of Mines Laboratories to a final wollastonite concentrate. Representative samples of this were given to potential buyers of the commodity in North America, Asia and Europe.

C3. POTENTIAL SCHEELITE RESERVES NORTH OF LOCATIONS L5 AND L13

The combined exploration efforts of Anzeco, McIntyre Mines and Tasmania Mines Limited, have over the years, been successful at identifying controls of ore genesis and delineating economic zones of tungsten mineralisation. It is believed the proposed Retention Licence area contains additional resources of the latter north of Location L5.

For a number of years it has been recognised that all the important magnetite skarn bodies and associated tungsten mineralisation in E.L. 17/68 are associated with the Ordovician "Transition Beds" - a series of sandstones with calcareous interbeds of variable thickness (15-120m) sandwiched between the Moira Sandstone and Gordon Limestone. A knowledge of specific controls of mineralisation and a combination of controls within these host horizons (e.g. structural controls, nature of bordering intrusive, degree of metamorphism/metasomatism) has gradually been learnt, and this combined with the detailed execution of field exploration work, has been the basis for pinpointing drill targets and delineating zones of mineralisation.

On the Kara properties, the prospective metamorphosed Transition Beds occur within a synform type structure warped around underlying Devonian granite intrusive, the structure itself having a N-S trending axis and general regional northerly plunge from the Kara No 1 deposit. Although the majority of the region is masked by a highly variable thickness of Tertiary basalt/sediments, the two main limbs of the synform have been accurately delineated from Kara No 1 to the northern border of the current E.L. area.

The eastern limb of the above mentioned synform proceeds from Kara No 1, Bobs Bonanza, Eastern Ridge and then subsurfaces towards the Hampshire Magnetite Skarn.

In late 1982, McIntyre Mines initiated a step out drilling programme to test the potential of buried magnetite skarns along the eastern limb of the synform. The programme was extremely successful in proving a new ore lens of high grade scheelite mineralisation at

Location L5. Ten diamond drill holes (DDH 326-335) over a total strike distance of 90 metres blocked out approximately 98,000 tonnes of high grade 1.5%WO₃ scheelite bearing ore. Mineralisation was open ended both along strike to the north and south, and also down dip.

The success of the Location L5 drilling programme obviously enhanced the delineated magnetic trends along strike to the south and north buried beneath Tertiary sequences, and in view of this, the 1985-86 Tasmania Mines Limited exploration programme included detailed work at these regions.

The 1.4km strike length area south of Location L5 to the Eastern Ridge tungsten deposits, and the 2.6km strike area north of Location L5 to Loudwater Creek and then to the Hampshire Magnetite skarn were covered by detailed ground magnetic surveys providing better definition/interpretation of subsurface geology plus optimise specific locations of drill sites and targets of buried magnetite skarn. (Please refer to Plan No 8/RL).

Subsequent exploratory diamond drilling south of Location L5 was successful in defining subsurface magnetite bodies and the intersection of new scheelite ore grade mineralisation was made at two areas. These discoveries further enhance the recognised potential north along strike from Location L5 within the proposed area of the Retention Licence.

Along the western limb of the Kara Synform, similar magnetic survey investigations have been completed north of the Kara North scheelite deposits towards Location L13. (Please refer to Plan No 9/RL). This area is likewise included in the area under R.L. application.

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D. SUMMARY

- On the impending relinquishment of E.L. 17/68, Tasmania Mines Ltd make an application for a RETENTION LICENCE covering an area of 8.15sqkms north of Consolidated Lease 1371P/M - Kara.

- The retention licence area embraces the following evaluated deposits.
 - The Hampshire magnetite deposit.

 - Wollastonite deposits, Limestone Creek.

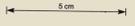
- The Hampshire magnetite was discovered by Anzeco/Tasminex in 1972, and during th course of E.L. 17/68 activities, both above deposits have been investigated in detail, and now constitute evaluated reserves of mineral.

- The Hampshire Magnetite skarn is a high grade Fe deposit, of future open pit potential. Its development will however, be deferred until the current Kara magnetite mining infrastructures at Kara N° 1 and Kara South are further developed and markets established.

- The wollastonite deposits show a marketable product of wollastonite can be achieved, and although feasibility studies and further technical appraisals need to be finalised, it would be preferable if these were delayed until a positive cash flow can be developed at the current scheelite/magnetite operation at Kara.

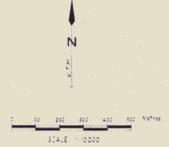

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-  RETENTION LICENCE APPLICATION AREA
-  EXISTING E.L. 17/68
-  RELINQUISHED AREA E.L. 17/68
-  CONSOLIDATED MINING LEASE 1371 P/M
-  EXPLORATION LICENCE 39/89



SCALE: 1:10,000

DATE: - Oct, 1990

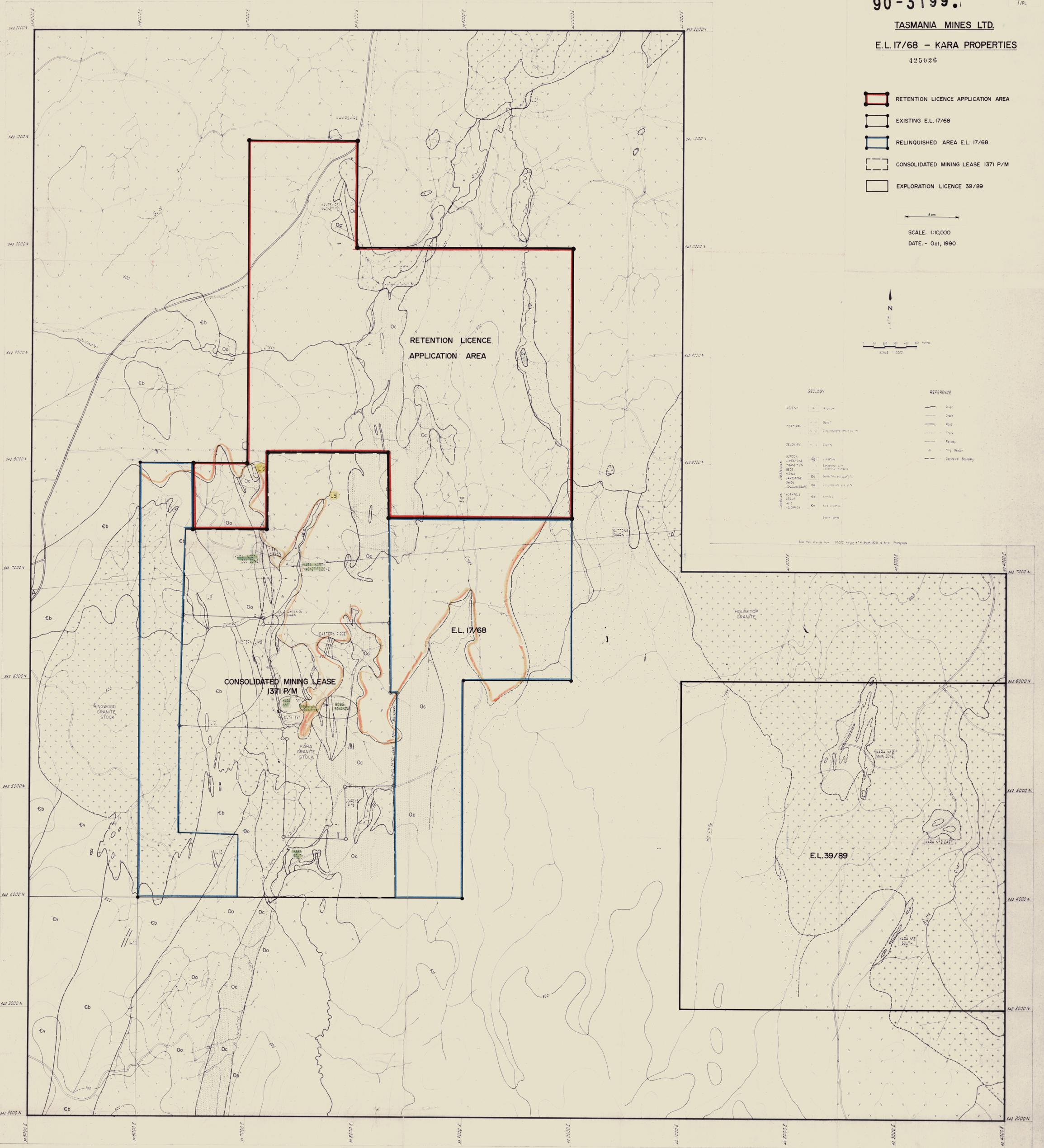


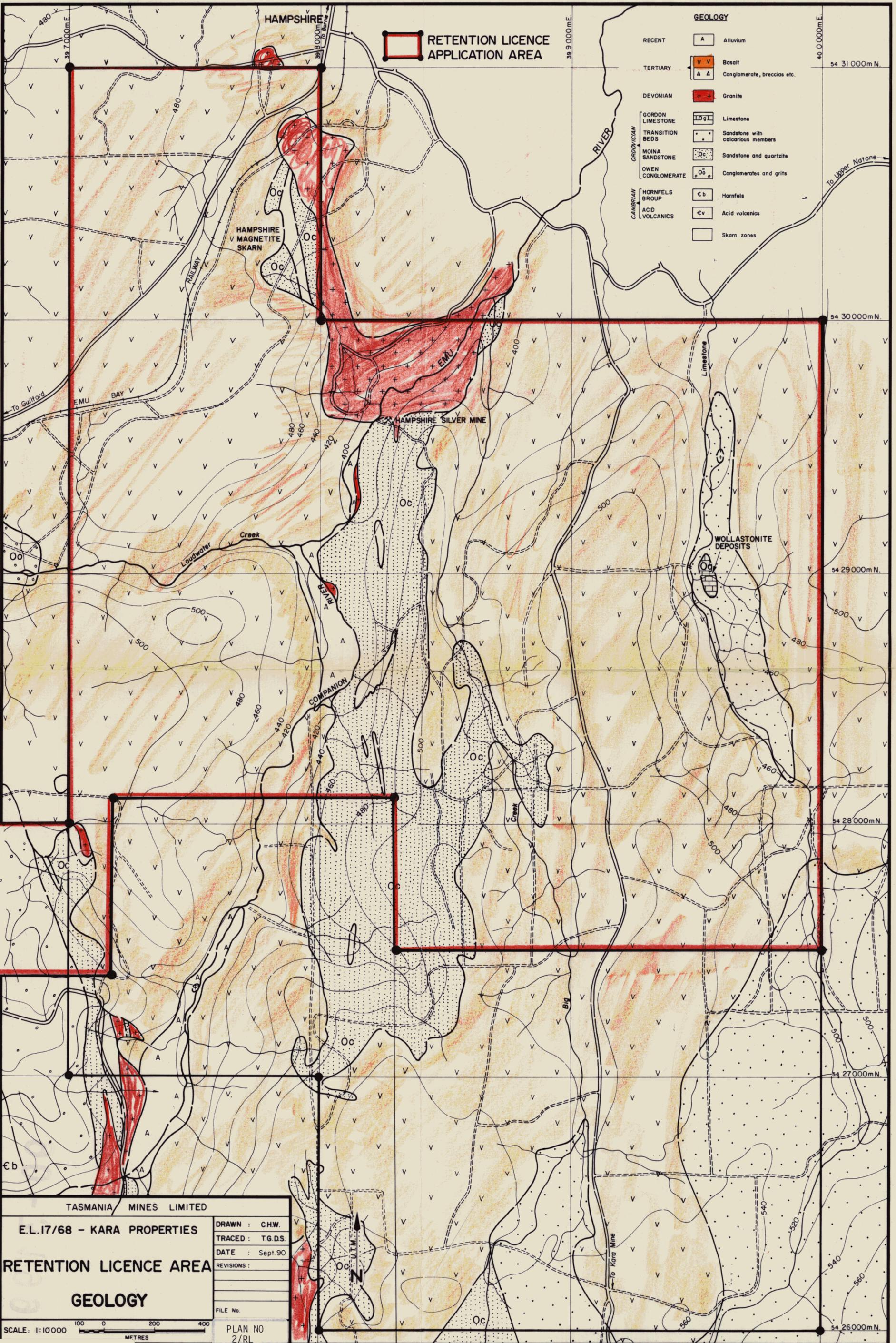
GEOLOGY

- RECENT: A Alluvium
- TERCIARY: B Sand
- DEVONIAN: C Conglomerate, shales etc.
- DEVONIAN: D Granite
- ORISSA: E Metamorphic rocks
- ORISSA: F Sandstone, shales etc.
- ORISSA: G Sandstone, shales etc.
- ORISSA: H Sandstone, shales etc.
- ORISSA: I Sandstone, shales etc.
- ORISSA: J Sandstone, shales etc.
- ORISSA: K Sandstone, shales etc.
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- ORISSA: S Sandstone, shales etc.
- ORISSA: T Sandstone, shales etc.
- ORISSA: U Sandstone, shales etc.
- ORISSA: V Sandstone, shales etc.
- ORISSA: W Sandstone, shales etc.
- ORISSA: X Sandstone, shales etc.
- ORISSA: Y Sandstone, shales etc.
- ORISSA: Z Sandstone, shales etc.

REFERENCE

-  Road
-  Track
-  Fence
-  Railway
-  Trig Beacon
-  Section Boundary





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v 2/2

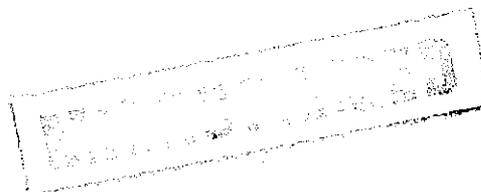
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MINES	
File Ref.	
- 4 OCT 1990	
Doc. Ref.	
Action Officer	Initials
Resubmit to	Date

TASMANIA MINES LIMITED

RETENTION LICENCE APPLICATION

WITHIN E.L. 17/68



2nd October, 1990

RETENTION LICENCE APPLICATIONEXPLORATION LICENCE 17/68PART BAPPENDICES

- APPENDIX A - Hampshire Magnetite Skarn
 APPENDIX B - Wollastonite Deposit - Limestone Creek

LIST OF PLANS

<u>Plan No</u>	<u>Title</u>	<u>Scale</u>
3/RL	Hampshire Magnetite Skarn - Ground Magnetic Survey	1:10,000
4/RL	Hampshire Magnetite Skarn - Drill Site Location	1:500
5/RL	Loudwater Creek/Hampshire Magnetite Anomaly - Ground Magnetics	1:1,000
6/RL	Wollastonite Deposits - Limestone Creek - Location Plan	1:1,000
7/RL	Wollastonite Creek - Geological Interpretation	1:2,500
8/RL	Ground Magnetic Surveys - Kara Properties	1:2,500
9/RL	Location L13 - Ground Magnetics	1:1,000

0030

425030

APPENDICES

023

APPENDIX A - HAMPSHIRE MAGNETITE SKARN

- APPENDIX A1 - ANZECCO - Drill auger results
- APPENDIX A2 - Tasmania Mines Ltd - Percussion drilling programme
- A2.1 - Holes assayed - Intersection/Fe assays
- A2.2 - Drill Assay Logs
- A2.3 - Drill Collar AMG co-ordinates
- A2.4 - Tonnage and Grade Calculation
- APPENDIX A3 - Surface Rock samples - Au assays
- APPENDIX A4 - BHP Beneficiation Test Work - Lump Magnetite

0033

HAMPSHIRE MAGNETITE SKARNAPPENDIX A1

ANZECC - Auger Hole Reports (Lithological/Assay Results)

Hole Nos 26 - 53

LOCATION HAMPSHIRE MAGNETITE

DATE DECEMBER 27, 1973

PROJECT E.L. 1/69

DRILLER P. McCORMICK

TOTAL DEPTH 51 feet

SAMPLER REG

DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	< 20	0-12	rd-brn basaltic soil
2	3-6	< 20		
3	6-9	70		
4	9-12	< 20		
5	12-15	< 20	12-21	tan-brn fine gr. sand
6	15-18	< 20		
7	18-21	< 20		
8	21-24	< 20	21-51	Pk v. fine gr sd to cl-sd
9	24-27	20		
10	27-30	20		
11	30-33	30		
12	33-36	150		
13	36-39	20		
14	39-42	30		
15	42-45	20		
16	45-48	30		
17	48-51	30		
				At 51 feet hit water table (stopped hole)
				Samples sent to McPhar 21/12/73

004

AUGER HOLE REPORT

NO. 35

LOCATION HAMPSHIRE MAGNETITE DATE DECEMBER 28, 1973
 PROJECT E.L. 1/69 DRILLER P. McCormick
 TOTAL DEPTH 37 feet SAMPLER Reg
 DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	30	0-3	Dk rd-brn basaltic soil w/ some hem
2	3-6	< 20	3-6	Lt rd-brn basaltic soil
3	6-9	< 20	6-9	Lt brn basaltic clay
4	9-12	< 20	9-12	Gry-brn basaltic clay
5	12-15	< 20	12-18	Gray basaltic clay
6	15-18	< 20		
7	18-21	< 20	18-30	Gry-brn basaltic clay
8	21-24	< 20		
9	24-27	< 20		
10	27-30	< 20		
11	30-33	< 20	30-37	Brn basaltic clay
12	33-36	< 20		
13	36-37	< 20		
				At 37 feet hit water table (stopped hole)
				Bottomed hole in basalt
				Samples sent to McPhar 31/12/73

425043

AUGER HOLE REPORT

NO. 36 B

0043

LOCATION HAMPSHIRE HEMATITE DATE DECEMBER 28, 1973
 PROJECT E.L. 1/69 DRILLER P. McCormick
 TOTAL DEPTH 39 feet SAMPLER Reg
 DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	< 20	0-6	Rd-brn basaltic soil
2	3-6	< 20		
3	6-9	< 20	6-9	Lt brn basaltic clays
4	9-12	20	9-24	Gry-brn basaltic clays
5	12-15	30		
6	15-18	< 20		
7	18-21	30		
8	21-24	20		
9	24-27	40	24-39	Gray basaltic clays
10	27-30	20		
11	30-33	20		
12	33-36	< 20		
13	36-39	25		
				36 A went to 6 feet - 2 samples < 20 < 20
				At 39 feet hit water table (stopped hole)
				Bottomed in basalt
				Samples sent to McPhar 31/12/73

0040

AUGER HOLE REPORT

NO. 38

LOCATION	HAMPSHIRE MAGNETITE	DATE	JANUARY 22, 1974
PROJECT	E.L. 1/69	DRILLER	P. McCormick
TOTAL DEPTH	30 feet	SAMPLER	Reg
DESCRIPTION BY	D.R. KRUGER		

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	<20	0-3	Rd-brn soil w/ magnetite pebbles
2	3-6	<20	3-6	Drk-brn clayey soil
3	6-9	<20	6-9	Drk-brn clayey soil w/ some magnetite pebbles
4	9-12	20	9-17	Very fine white sand
5	12-15	100		
6	15-18	90	17-18	Yel-brn cly-sd
7	18-21	210	18-24	Brn-yel clay
8	21-24	260		
9	24-27	370	24-30	Brn clay w/ magnetite & hem pebbles
10	27-30	250		
11	30	500	30	Brn-black magnetite skarn
BH sample				
Hole hit rock at 30 feet also water table at same level				
Samples sent to McPhar 25/1/74				

425047

AUGER HOLE REPORT

NO. 40

0047

LOCATION HAMPSHIRE MAGNETITE DATE JANUARY 23, 1974
 PROJECT E.L. 1/69 DRILLER P. McCormick
 TOTAL DEPTH 33 Feet SAMPLER Req
 DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	70	0-3	Dk brn magnetite soil
2	3-6	110	3-9	Lt brn clay-sd soil
3	6-9	60		
4	9-12	80	9-12	Yel sd-clay w/ ss and qtz pebbles
5	12-15	70	12-15	V dk-brn sd-clay w/ hem chips
6	15-18	<20	15-33	Brn-blk to blk disseminated magnetite in a mud slurry
7	18-21	<20		
8	21-24	<20		
9	24-27	<20		
10	27-30	<20		
11	30-33	<20		
12	33	20	33	Disseminated magnetite w/ yel-grn skarn material
13				Hard magnetite at 15 feet
				Hard magnetite at 33 feet
				Water table at 12 feet
				Samples sent to McPhar 25/1/74

0948

425048

AUGER HOLE REPORT

NO. 41

LOCATION	HAMPSHIRE MAGNETITE	DATE	JANUARY 24, 1974
PROJECT	E.L. 1/69	DRILLER	P. McCormick
TOTAL DEPTH	32 feet	SAMPLER	Reg
DESCRIPTION BY	D.R. KRUGER		

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	< 20	0-3	Dk rd-brn magnetite soil
2	3-6	< 20	3-9	Lt rd-brn sd-cl soil & disseminated magnetite
3	6-9	< 20		
4	9-12	< 20	9-12	Blk-brn disseminated magnetite
5	12-15	< 20	12-18	Brn cl-sd w/ disseminated magnetite
6	15-18	< 20		
7	18-21	< 20	18-23	Dk gry-blk sd-cl w/ disseminated magnetite
8	21-24	< 20		
9	24-27	< 20	23-32	Med brn cly-sd w/ abundant disseminated mag
10	27-30	< 20		
11	30-32	< 20		
12	32	< 20	32	Yellow fine gr sandstone w/ some mag chips
h Sample				
				At 32 feet hit hard rock
				at 24 feet hit water table
				Samples sent to McPbar 25/1/74

425049

AUGER HOLE REPORT

NO. 42

0049

LOCATION HAMPSHIRE MAGNETITE DATE JANUARY 24, 1974
 PROJECT E.L. 1/69 DRILLER P. McCormick
 TOTAL DEPTH 39 feet SAMPLER Reg
 DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	< 20	0-3	Dk rd-brn magnetite soil
2	3-6	< 20	3-9	Dk brn sd-clay soil w/ magnetite skarn
3	6-9	50		
4	9-12	50	9-15	Med brn cl-sd w/ some magnetite skarn
5	12-15	40		
6	15-18	< 20	15-27	Lt brn very fine sand
7	18-21	< 20		
8	21-24	< 20		
9	24-27	< 20		
10	27-30	40	27-30	Med brn sand
11	30-33	20	30-39	Med brn very fine cl-sd
12	33-36	< 20		
13	36-39	< 20		
14	39	20	39	Tan resistant sandstone
2h sample				
				At 39 feet hit hard rock
				At 30 feet hit water table
				Samples sent to McPhar 25/1/74

0-500

AUGER HOLE REPORT

425050

NO. 43

LOCATION HAMPSHIRE MAGNETITE DATE JANUARY 24, 1974
 PROJECT E.L. 1/69 DRILLER P. McCormick
 TOTAL DEPTH 35 feet SAMPLER Reg
 DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	< 20	0-3	Rd-brn sd-cl soil w/ mag pebbles
2	3-6	< 20	3-9	Brn fine grain sand
3	6-9	20		
4	9-12	< 20	9-12	Grn-brn sand
5	12-15	< 20	12-30	Lt yel-brn fine grain sand
6	15-18	< 20		
7	18-21	< 20		
8	21-24	< 20		
9	24-27	30		
10	27-30	< 20		
11	30-33	< 20	30-35	Brn cl-sd
12	33-35	< 20		
13	35	20	35	Brn hematite & magnetite chips
pn sample				
				At 35 feet hit hard rock
				At 30 feet hit water table
				Samples sent to McPhar 25/1/74

0051

AUGER HOLE REPORT

NO. 44

LOCATION HAMPSHIRE MAGNETITE DATE JANUARY 24, 1974
 PROJECT E.L. 1/69 DRILLER P. McCormick
 TOTAL DEPTH 36 feet SAMPLER Req
 DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	<20	0-6	Lt red-brn sdy magnetite soil
2	3-6	<20		
3	6-9	30	6-12	Brn to lt brn fine grain cl-sd
4	9-12	70		
5	12-15	50	12-15	Yel-brn fine grain sd
6	15-18	40	15-24	White to v lt yel v fine sd
7	18-21	50		
8	21-24	30		
9	24-27	50	24-27	Tan fine grain sd
10	27-30	50	27-30	Lt brn fine grain sd
11	30-33	120	30-33	Med brn cly-sd
12	33-36	200	33-36	Med brn sd-cly
13	36	420	36	Yl-brn magnetite skarn
At 36 feet hit hard rock				
At 24 feet hit water table				
Samples sent to McPhar 25/1/74				

AUGER HOLE REPORT

NO. 45

033

LOCATION HAMPSHIRE MAGNETITE DATE JANUARY 24, 1974

PROJECT E.L. 1/69 DRILLER P. McCormick

TOTAL DEPTH 63 feet SAMPLER Reg

DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	< 20	0-6	Dk brn sd-cly soil (basaltic soil?)
2	3-6	< 20		
3	6-9	< 20	6-12	Med brn clay
4	9-12	< 20		
5	12-15	< 20	12-18	Lt brn clay (sludge)
6	15-18	< 20		
7	18-21	< 20	18-33	Dk grn-brn clay w/ disseminated magnetite
8	21-24	< 20		
9	24-27	< 20		
10	27-30	< 20		
11	30-33	50		
12	33-36	110	33-36	Lt grn-brn clay (sludge) w/ disseminated mag
13	36-39	50	36-39	Med grn-brn clay (sludge) " " "
14	39-42	30	39-63	Lt grn-brn ci-sd (sludge) " " "
15	42-45	50		
16	45-48	40		
17	48-51	60		
18	51-54	60		
19	54-57	50		
20	57-60	60		

cont./

0980

425055

AUGER HOLE REPORT

NO. 47

LOCATION HAMPSHIRE MAGNETITE DATE JANUARY 24, 1974
 PROJECT E.L. 1/69 DRILLER P. McCormick
 TOTAL DEPTH 27 feet SAMPLER Req
 DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	120	0-3	Dk rd-brn hematite soil
2	3-6	120	3-6	Gry-brn magnetite soil
3	6-9	140	6-15	Med brn fine grain sand
4	9-12	100		
5	12-15	90		
6	15-18	130	15-18	Dk brn cl-sd
7	18-21	130	18-24	Dk brn sand
8	21-24	90		
9	24-27	110	24-27	Dk brn cl-sd
10	27	100	27	Brn clay w/ some magnetite chips
				At 27 feet flights tightened up. Did not reach water table
				(Original hole went only 2 feet, moved 5 feet to the east.)
				Samples sent to McPhar 31/1/74

AUGER HOLE REPORT

NO. 48

LOCATION	HAMPSHIRE MAGNETITE	DATE	JANUARY 29, 1974
PROJECT	E.L. 1/69	DRILLER	P. McCormick
TOTAL DEPTH	44 feet	SAMPLER	Reg
DESCRIPTION BY	D.R. KRUGER		

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	40	0-6	Rd-brn sandy soil
2	3-6	40		
3	6-9	120	6-33	Lt brn to med brn very fine sand
4	9-12	120		
5	12-15	110		
6	15-18	120		
7	18-21	120		
8	21-24	50		
9	24-27	40		
10	27-30	40		
11	30-33	30		
12	33-36	60	33-36	Silty sdy-clay (lt brn)
13	36-39	40	36-44	Brn cl?-sd (slurry)
14	39-42	40		
15	42-44	40		
16	44	60	44	White sand w/ small chips of hematite
on Sample				At 36 feet hit water table
				At 44 feet hit hard rock
				Samples sent to McPhar 31/1/74

AUGER HOLE REPORT

NO. 49

LOCATION HAMPSHIRE MAGNETITE DATE JANUARY 29, 1974
 PROJECT E.L. 1/69 DRILLER P. McCormick
 TOTAL DEPTH 78 feet SAMPLER Reg
 DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	< 20	0-12	Med brn to lt brn basaltic soil
2	3-6	< 20		
3	6-9	< 20		
4	9-12	< 20		
5	12-15	< 20	12-15	Gry-brn basalt
6	15-18	< 20	15-21	Dk gry basalt
7	18-21	40		
8	21-24	20	21-27	Med brn fine grain sand
9	24-27	30		
10	27-30	40	27-33	Lt brn cl-sd
11	30-33	40		
12	33-36	30	33-63	Med brn sand (fine to med)
13	36-39	40		
14	39-42	50		
15	42-45	40		
16	45-48	40		
17	48-51	40		
18	51-54	30		
19	54-57	40		
20	57-60	40		

LOCATION _____ DATE _____
 PROJECT 0000 _____ DRILLER _____
 TOTAL DEPTH _____ SAMPLER _____
 DESCRIPTION BY _____

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
21	60-63	70		
22	63-66	50	63-78	Gry-brn sand w/ disseminated magnetite?
23	66-69	50		
24	69-72	80		
25	72-75	90		
26	75-78	110		
27	78	190	78	Rd-brn hem & mag (definite)
On sample				
				At 78 feet hit hard rock
				At 27 feet hit water table
				Samples sent to McPhar 31/1/74

0059

AUGER HOLE REPORT

425059

NO. 50

LOCATION HAMPSHIRE MAGNETITE DATE JANUARY 29, 1974
 PROJECT E.L. 1/69 DRILLER P. McCormick
 TOTAL DEPTH 76 feet SAMPLER Reg
 DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	20	0-18	Rd-brn basaltic soil
2	3-6	20		
3	6-9	<20		
4	9-12	60		
5	12-15	<20		
6	15-18	20		
7	18-21	50	18-36	Yel-brn fine grain sand
8	21-24	30		
9	24-27	30		
10	27-30	40		
11	30-33	60		
12	33-36	80		
13	36-39	380	36-48	Dk brn fine grain sand
14	39-42	400		
15	42-45	300		
16	45-48	400		
17	48-51	380	48-60	Dk brn cl-sd
18	51-54	400		
19	54-57	400		
20	57-60	390		

cont.

425061

0061

AUGER HOLE REPORTNO. 51

LOCATION HAMPSHIRE MAGNETITE DATE JANUARY 29, 1974
 PROJECT E.L. 1/69 DRILLER P. McCormick
 TOTAL DEPTH 35 feet SAMPLER Reg
 DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	< 20	0-6	Dk brn basaltic soil
2	3-6	< 20		
3	6-9	810	6-9	Dk brn cly soil w/ hem & mag pebbles
4	9-12	200	9-18	Med brn cl-sd
5	12-15	120		
6	15-18	130		
7	18-21	60	18-33	Lt tan-brn weathered granite
8	21-24	60		
9	24-27	100		
10	27-30	50		
11	30-33	50		
12	33-35	40	33-35	V lt grn tan granite
13	35	40	35	Granite
GH sample				
				At 35 feet hit hard rock (granite)
				At 33 feet hit water table
				Samples sent to McPhar 3/1/74

AUGER HOLE REPORT

NO. 52

0348

LOCATION HAMPSHIRE MAGNETITE DATE JANUARY 29, 1974

PROJECT E.L. 1/69 DRILLER Peter McCormick

TOTAL DEPTH 42 feet SAMPLER Reg

DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	200	0-3	Rd-brn hematite soil
2	3-6	80		
3	6-9	180	6-12	Lt rd-brn soil w/ hem & Mag pebbles
4	9-12	250		
5	12-15	340	12-15	Dk brn clayer soil w/ large mag chips
6	15-18	430	15-18	Dk brn sd-cl w/ some mag chips
7	18-21	250	18-27	Med brn cl-sd
8	21-24	120		
9	24-27	110		
10	27-30	70	27-33	Lt brn cl-sd
11	30-33	60		
12	33-36	90	33-42	Med brn clay
13	36-39	80		
14	39-42	80		
15	42	80	42	Some hematite chips?
				At 42 feet hit hard rock
				At 33 feet hit water table
				Samples sent to McPhar 31/1/74

0063

AUGER HOLE REPORTNO. 53

LOCATION HAMPSHIRE MAGNETITE DATE JANUARY 30, 1974
 PROJECT E.L. 1/69 DRILLER P. McCormick
 TOTAL DEPTH 60 feet SAMPLER Reg
 DESCRIPTION BY D.R. KRUGER

ANALYTICAL RESULTS			LITHOLOGIC DESCRIPTION	
Sample No.	Interval (feet)	ppm W	Interval (feet)	Description
1	0-3	20	0-12	Med rd-brn basaltic soil
2	3-9	20		
3	9-12	20		
4	12-15	20	12-15	Med rd-brn basaltic soil w/ hem pebbles
5	15-18	150	15-18	Lt brn cl-sd w/ some hem pebbles
6	18-21	490	18-24	Dk brn sd-clay w/ abundant hem & mag pebbles
7	21-24	340		
8	24-27	320	24-33	Dk brn clay sludge w/ very abundant mag & hem chips
9	27-30	340		
10	30-33	270		
11	33-36	260	33-39	Dk brn clay sludge w/ mod mag & hem chips
12	36-39	340		
13	39-42	280	39-60	Lt brn clay sludge?
14	42-45	340		
15	45-48	260		
16	48-51	190		
17	51-54	200		
18	54-57	170		
19	57-60	160		
20	60	120	60	Hem & mag chips

BH sample

At 60 feet hit hard rock. At 24 feet hit water table
 Samples to McPhar 31/1/74

HAMPSHIRE MAGNETITE SKARNAPPENDIX A2Tasmania Mines Limited - Percussion Drilling Programme

- A2.1 - Holes Assayed - Intersection/Fe Assays
- A2.2 - Drill Assay Logs
- A2.3 - Drill Collar A.M.G. Co-ordinates
- A2.4 - Tonnage and Grade Calculation

0000

E.L. 17/68HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

Dates Drilled	29th May, 1989	-	16th June, 1989
No of Holes Drilled	-	58	
Hole Nos	-	HM.1 to HM.44	
Total Drilled Metres	-	495.5m	
Av Depth	-	8.54m	

APPENDIX A2.1: HOLES ASSAYED - INTERSECTION/Fe ASSAYS

APPENDIX A2.2: DRILL ASSAY LOGS

E.L. 17/68 HAMPSHIRE MAGNETITE SKARN ZONEPERCUSSION DRILL PROGRAMME

(29TH MAY - 16TH JUNE, 1989)

Summary - Holes Assayed and Fe Intersections/Assays

<u>Hole No</u>	<u>Depth Drilled (m)</u>	<u>Fe Intersections</u>	
		<u>Drill Length</u>	<u>% Total Fe</u>
HM.1	13.50	0.0 - 13.5	47.97
HM.2	4.50	0.0 - 3.0	49.10
HM.2A	12.00	0.0 - 12.0	50.28
HM.3	4.50	0.0 - 4.5	43.70
HM.3A	11.50	3.0 - 11.5	60.48
HM.4	9.00	0.0 - 6.0	50.85
HM.5	13.50	0.0 - 6.0	52.20
HM.6	12.00	0.0 - 6.0	53.20
HM.7	7.50	0.0 - 7.5	54.25
HM.7A	14.00	0.0 - 14.0	56.44
HM.8	15.00	0.0 - 12.0	54.93
HM.9	11.00	6.0 - 11.0	51.65
HM.11	3.00	0.0 - 3.0	58.50
HM.11A	15.00	0.0 - 6.0	54.05
HM.12	6.00	0.0 - 6.0	60.00
HM.13	15.00	0.0 - 12.0	52.78
HM.14	15.00	0.0 - 9.0	55.86
HM.15	15.00	0.0 - 15.0	46.64
HM.17	9.00	0.0 - 3.0	45.40
HM.18	3.00	0.0 - 3.0	55.90
HM.18A	6.50	0.0 - 6.5	44.68
HM.19A	7.00	0.0 - 7.0	58.43
HM.29	15.00	3.0 - 9.0	55.70
HM.33	11.00	6.0 - 11.0	50.70

0057

APPENDIX A2.2

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.1CO-ORDINATES: Northing: 27.5N Easting: 71.1EDEPTH DRILLED: 13.5m DATES DRILLED: 29 May 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>56.70</u>	<u><0.005</u>	<u>Magnetite Skarn</u>
<u>3.0</u>	<u>6.0</u>	<u>48.10</u>	<u>0.005</u>	<u>" "</u>
<u>6.0</u>	<u>9.0</u>	<u>50.00</u>	<u><0.005</u>	<u>" "</u>
<u>9.0</u>	<u>12.0</u>	<u>36.40</u>	<u>0.039</u>	<u>" "</u>
<u>12.0</u>	<u>13.5</u>	<u>49.30</u>	<u>0.040</u>	<u>" "</u>

HOLE NO: HM.2CO-ORDINATES: Northing: 50.8N Easting: 48.4EDEPTH DRILLED: 4.50m DATES DRILLED: 29 May 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>49.10</u>	<u>0.006</u>	<u>Magnetite Skarn</u>
<u>3.0</u>	<u>4.5</u>	<u>26.80</u>	<u><0.005</u>	<u>" "</u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.2ACO-ORDINATES: Northing: 52.4N Easting: 47.0EDEPTH DRILLED: 10.50m DATES DRILLED: 29 May 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0	52.40	0.010	Magnetite Skarn
3.0	6.0	55.00	<0.005	" "
6.0	9.0	43.90	0.005	" "
9.0	10.50	49.80	0.005	" "

HOLE NO: HM.3CO-ORDINATES: Northing: 43.8N Easting: 40.6EDEPTH DRILLED: 4.50m DATES DRILLED: 29 May 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0	35.70	0.008	Fe Sands
3.0	4.5	59.70	<0.005	Magnetite Skarn

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

0059

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.3ACO-ORDINATES: Northing: 41.5N Easting: 38.5EDEPTH DRILLED: 11.50m DATES DRILLED: 29 May 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>27.10</u>	<u>0.007</u>	<u>Mag. Qtz.</u>
<u>3.0</u>	<u>6.0</u>	<u>61.30</u>	<u><0.005</u>	<u>Mag Skarn</u>
<u>6.0</u>	<u>9.0</u>	<u>61.50</u>	<u><0.005</u>	<u>" "</u>
<u>9.0</u>	<u>11.50</u>	<u>58.30</u>	<u><0.005</u>	<u>" "</u>

HOLE NO: HM.4CO-ORDINATES: Northing: 59.2N Easting: 50.0EDEPTH DRILLED: 9.00m DATES DRILLED: 30 May 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>58.10</u>	<u><0.005</u>	<u>Mag Skarn</u>
<u>3.0</u>	<u>6.0</u>	<u>43.60</u>	<u><0.005</u>	<u>Mag. Clay</u>
<u>6.0</u>	<u>9.0</u>	<u>16.10</u>	<u><0.005</u>	<u>Quartzite</u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.5CO-ORDINATES: Northing: 60.6N Easting: 44.2EDEPTH DRILLED: 13.50m DATES DRILLED: 30 May 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0	55.70	<0.005	Mag. Skarn
3.0	6.0	48.70	<0.005	" "
6.0	9.0	29.90	<0.005	Skarn
9.0	12.0	19.50	<0.005	Quartzite
12.0	13.50	15.20	<0.005	"

HOLE NO: HM.6CO-ORDINATES: Northing: 70.0N Easting: 43.10EDEPTH DRILLED: 12.00m DATES DRILLED: 30 May 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0	61.30	<0.005	Mag. Skarn
3.0	6.0	45.10	<0.005	" "
6.0	9.0	12.40	<0.005	Quartzite (Fe)
9.0	12.0	25.50	<0.005	" "

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

0073

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.7CO-ORDINATES: Northing: 66.20N Easting: 37.0EDEPTH DRILLED: 7.50m DATES DRILLED: 30 May 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% WQ3	
<u>0.0</u>	<u>3.0</u>	<u>62.50</u>	<u>0.005</u>	<u>Magnetite Skarn</u>
<u>3.0</u>	<u>6.0</u>	<u>45.10</u>	<u>0.006</u>	<u>" "</u>
<u>6.0</u>	<u>7.5</u>	<u>56.00</u>	<u><0.005</u>	<u>" "</u>

HOLE NO: HM.7ACO-ORDINATES: Northing: 65.4N Easting: 33.0EDEPTH DRILLED: 14.00m DATES DRILLED: 30 May 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% WQ3	
<u>0.0</u>	<u>3.0</u>	<u>57.40</u>	<u><0.005</u>	<u>Magnetite Skarn</u>
<u>3.0</u>	<u>6.0</u>	<u>65.80</u>	<u>"</u>	<u>" "</u>
<u>6.0</u>	<u>9.0</u>	<u>56.00</u>	<u>"</u>	<u>" "</u>
<u>9.0</u>	<u>12.0</u>	<u>49.20</u>	<u>"</u>	<u>" "</u>
<u>12.0</u>	<u>14.0</u>	<u>52.50</u>	<u>"</u>	<u>" "</u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989

Assay Method - Fe - 403 Det Limit 0.1%
WQ3 - 403 Det Limit 0.005%

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME MAY - JUNE 1989

HOLE NO: HM.8

CO-ORDINATES: Northing: 67.1N Easting: 27.5E

DEPTH DRILLED: 15.0m DATES DRILLED: 1 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>58.80</u>	<u><0.005</u>	<u>Mag. Skarn</u>
<u>3.0</u>	<u>6.0</u>	<u>60.30</u>	<u>"</u>	<u>" "</u>
<u>6.0</u>	<u>9.0</u>	<u>52.80</u>	<u>"</u>	<u>" "</u>
<u>9.0</u>	<u>12.0</u>	<u>47.80</u>	<u>"</u>	<u>" "</u>
<u>12.0</u>	<u>15.0</u>	<u>38.00</u>	<u>"</u>	<u>" "</u>

HOLE NO: HM.9

CO-ORDINATES: Northing: 24.0N Easting: 45.8E

DEPTH DRILLED: 11.00m DATES DRILLED: 1 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>27.90</u>	<u>0.020</u>	<u>Clay</u>
<u>3.0</u>	<u>6.0</u>	<u>26.30</u>	<u>0.013</u>	<u>Fe Qtz.</u>
<u>6.0</u>	<u>9.0</u>	<u>54.20</u>	<u><0.009</u>	<u>Mag. Skarn</u>
<u>9.0</u>	<u>11.0</u>	<u>49.10</u>	<u>0.005</u>	<u>" "</u>

Assayed - Analabs - Report No 228.1.08.06298
 3rd July, 1989

Assay Method - Fe - 403 Det Limit 0.1%
 W03 - 403 Det Limit 0.005%

0073

425073

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.10CO-ORDINATES: Northing: 124.70N Easting: 53.6EDEPTH DRILLED: 5.00m DATES DRILLED: 1 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>24.40</u>	<u>0.003</u>	<u>Sandstone</u>
<u>3.0</u>	<u>5.0</u>	<u>5.36</u>	<u><0.005</u>	<u>"</u>

HOLE NO: HM.10ACO-ORDINATES: Northing: 123.2N Easting: 50.7EDEPTH DRILLED: 6.00m DATES DRILLED: 2 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>12.90</u>	<u><0.005</u>	<u>Fe Sst</u>
<u>3.0</u>	<u>6.0</u>	<u>7.66</u>	<u><0.005</u>	<u>Sst</u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

EXPLORATION LICENCE 17/68

09/89

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.11CO-ORDINATES: Northing: 110.30N Easting: 45.0EDEPTH DRILLED: 3.0m DATES DRILLED: 2 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>58.50</u>	<u>0.009</u>	<u>Magnetite</u>

HOLE NO: HM.11ACO-ORDINATES: Northing: 104.0N Easting: 45.0EDEPTH DRILLED: 15.00m DATES DRILLED: 2 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>63.60</u>	<u><0.005</u>	<u>Mag. Skarn</u>
<u>3.0</u>	<u>6.0</u>	<u>44.50</u>	<u>"</u>	<u>" "</u>
<u>6.0</u>	<u>9.0</u>	<u>31.10</u>	<u>"</u>	<u>" "</u>
<u>9.0</u>	<u>12.0</u>	<u>12.80</u>	<u>"</u>	<u>Skarn</u>
<u>12.0</u>	<u>15.0</u>	<u>32.70</u>	<u>"</u>	<u>"</u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.12CO-ORDINATES: Northing: 101.0N Easting: 36.8EDEPTH DRILLED: 6.00m DATES DRILLED: 5 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>63.60</u>	<u><0.005</u>	<u>Magnetite</u>
<u>3.0</u>	<u>6.0</u>	<u>56.40</u>	<u><0.005</u>	<u>"</u>

HOLE NO: HM.13CO-ORDINATES: Northing: 101.40N Easting: 29.8EDEPTH DRILLED: 15.00m DATES DRILLED: 5 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>55.70</u>	<u>0.008</u>	<u>Magnetite</u>
<u>3.0</u>	<u>6.0</u>	<u>56.60</u>	<u><0.005</u>	<u>"</u>
<u>6.0</u>	<u>9.0</u>	<u>57.60</u>	<u>"</u>	<u>"</u>
<u>9.0</u>	<u>12.0</u>	<u>41.20</u>	<u>0.005</u>	<u>"</u>
<u>12.0</u>	<u>15.0</u>	<u>20.20</u>	<u><0.005</u>	<u>Fe Sst</u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989

Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME MAY - JUNE 1989

HOLE NO: HM.14CO-ORDINATES: Northing: 109.8N Easting: 22.3EDEPTH DRILLED: 15.00m DATES DRILLED: 5 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0	59.20	<0.005	Magnetite
3.0	6.0	60.80	"	"
6.0	9.0	47.60	"	"
9.0	12.0	27.50	"	Fe Sst
12.0	15.0	11.50	"	Sst

HOLE NO: HM.15CO-ORDINATES: Northing: 115.0N Easting: 27.0EDEPTH DRILLED: 15.00m DATES DRILLED: 6 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0	66.20	<0.005	Mag. Skarn
3.0	6.0	47.80	"	" "
6.0	9.0	39.70	"	" "
9.0	12.0	43.20	"	" "
12.0	15.0	36.30	"	" "

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989

Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

0077

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.16CO-ORDINATES: Northing: 128.5N Easting: 28.8EDEPTH DRILLED: 5.00m DATES DRILLED: 6 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>22.00</u>	<u><0.005</u>	<u>Sst</u>
<u>3.0</u>	<u>5.0</u>	<u>6.62</u>	<u><0.005</u>	<u>Sst</u>

HOLE NO: HM.16ACO-ORDINATES: Northing: 128.1N Easting: 27.1EDEPTH DRILLED: 10.00m DATES DRILLED: 6 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>26.70</u>	<u><0.005</u>	<u>Sst</u>
<u>3.0</u>	<u>6.0</u>	<u>3.15</u>	<u>"</u>	<u>"</u>
<u>6.0</u>	<u>9.0</u>	<u>12.60</u>	<u>"</u>	<u>"</u>
<u>9.0</u>	<u>10.0</u>	<u>15.50</u>	<u>0.006</u>	<u>Sst (Fe)</u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989

Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

EXPLORATION LICENCE 17/68HAMPSHIRE MAGNETITE SKARN ZONEPERCUSSION DRILLING PROGRAMMEMAY - JUNE 1989HOLE NO: HM.17CO-ORDINATES: Northing: 126.0N Easting: 25.0EDEPTH DRILLED: 9.00m DATES DRILLED: 7 June 1989

<u>DRILL INTERVAL (m)</u>		<u>ASSAYS</u>		<u>LITHOLOGY</u>
<u>From</u>	<u>To</u>	<u>Total Fe%</u>	<u>% W03</u>	
<u>0.0</u>	<u>3.0</u>	<u>45.40</u>	<u><0.005</u>	<u>Mag. Skarn</u>
<u>3.0</u>	<u>6.0</u>	<u>7.55</u>	<u>"</u>	<u>Sst</u>
<u>6.0</u>	<u>9.0</u>	<u>21.90</u>	<u>"</u>	<u>Sst (Fe)</u>

HOLE NO: HM.18CO-ORDINATES: Northing: 120.4N Easting: 16.6EDEPTH DRILLED: 3.00m DATES DRILLED: 7 June 1989

<u>DRILL INTERVAL (m)</u>		<u>ASSAYS</u>		<u>LITHOLOGY</u>
<u>From</u>	<u>To</u>	<u>Total Fe%</u>	<u>% W03</u>	
<u>0.0</u>	<u>3.0</u>	<u>55.90</u>	<u><0.005</u>	

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

0079

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.18ACO-ORDINATES: Northing: 120.4N Easting: 16.6EDEPTH DRILLED: 6.50m DATES DRILLED: 7 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>57.60</u>	<u><0.005</u>	<u>Magnetite</u>
<u>3.0</u>	<u>6.0</u>	<u>32.80</u>	<u>0.005</u>	<u>Fe Sst</u>
<u>6.0</u>	<u>6.50</u>	<u>38.40</u>	<u><0.005</u>	<u>Fe Sst</u>

HOLE NO: HM.19CO-ORDINATES: Northing: 117.6N Easting: 10.0EDEPTH DRILLED: 3.00m DATES DRILLED: 8 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>32.30</u>	<u>0.008</u>	<u>Fe Clay</u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

0000

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.19A

CO-ORDINATES: Northing: _____ Easting: _____

DEPTH DRILLED: 7.00m DATES DRILLED: 8 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0	-	-	Magnetite
3.0	6.0	59.60	<0.005	"
6.0	7.0	54.90	0.005	"

HOLE NO: HM.20CO-ORDINATES: Northing: 131.0N Easting: 81.1EDEPTH DRILLED: 12.00m DATES DRILLED: 9 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0			Mag. Skarn
3.0	6.0			Fe Sst
6.0	9.0			" "
9.0	12.0			" "

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

0081

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.21CO-ORDINATES: Northing: 133.4N Easting: 24.5EDEPTH DRILLED: 6.00m DATES DRILLED: 9 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0			Sst
3.0	6.0			Sst

HOLE NO: HM.22

CO-ORDINATES: Northing: _____ Easting: _____

DEPTH DRILLED: 12.00m DATES DRILLED: 12 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0			Fe Sst
3.0	6.0			Fe Sst
6.0	9.0			Sst
9.0	12.0			Sst

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989

Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

0950

425082

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.23

CO-ORDINATES: Northing: _____ Easting: _____

DEPTH DRILLED: 6.00m DATES DRILLED: 12 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0	_____	_____	Magnetite
3.0	6.0	_____	_____	Sst
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

HOLE NO: HM.24CO-ORDINATES: Northing: 140.0N Easting: 22.3EDEPTH DRILLED: 9.00m DATES DRILLED: 13 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0	_____	_____	Clay & Sst
3.0	6.0	_____	_____	Sst
6.0	9.0	_____	_____	Sst
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

0083

425083

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.25

CO-ORDINATES: Northing: 140.0N Easting: 17.0E

DEPTH DRILLED: 8.00m DATES DRILLED: 14 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u> </u>	<u> </u>	<u>Sst</u>
<u>3.0</u>	<u>6.0</u>	<u> </u>	<u> </u>	<u>Sst</u>
<u>6.0</u>	<u>8.0</u>	<u> </u>	<u> </u>	<u>Sst</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

HOLE NO: HM.26

CO-ORDINATES: Northing: Easting:

DEPTH DRILLED: 9.00m DATES DRILLED: 14 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u> </u>	<u> </u>	<u>Clay & Sst</u>
<u>3.0</u>	<u>6.0</u>	<u> </u>	<u> </u>	<u>Sst</u>
<u>6.0</u>	<u>9.0</u>	<u> </u>	<u> </u>	<u>Sst</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Assayed - Analabs - Report No 228.1.08.06298
 3rd July, 1989

Assay Method - Fe - 403 Det Limit 0.1%
 W03 - 403 Det Limit 0.005%

0084

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.27

CO-ORDINATES: Northing: _____ Easting: _____

DEPTH DRILLED: 9.00m DATES DRILLED: 14 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	_____	_____	<u>Clay/Sst</u>
<u>3.0</u>	<u>6.0</u>	_____	_____	<u>Sst</u>
<u>6.0</u>	<u>9.0</u>	_____	_____	<u>Sst</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

HOLE NO: HM.28CO-ORDINATES: Northing: 54.3N Easting: 37.4EDEPTH DRILLED: 3.00m DATES DRILLED: 14 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	_____	_____	<u>Fe</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989

Assay Method - Fe -- 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

0085

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.29CO-ORDINATES: Northing: 60.5N Easting: 29.7EDEPTH DRILLED: 15.0m DATES DRILLED: 15 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>58.60</u>	<u><0.005</u>	<u>Mag. Skarn</u>
<u>3.0</u>	<u>6.0</u>	<u>41.90</u>	<u>"</u>	<u>" "</u>
<u>6.0</u>	<u>9.0</u>	<u>31.30</u>	<u>"</u>	<u>" "</u>
<u>9.0</u>	<u>12.0</u>	<u>43.90</u>	<u>"</u>	<u>" "</u>
<u>12.0</u>	<u>15.0</u>	<u>30.50</u>	<u>"</u>	<u>" "</u>

HOLE NO: HM.30CO-ORDINATES: Northing: 75.2N Easting: 25.6EDEPTH DRILLED: 3.00m DATES DRILLED: 15 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>			<u>Mag. Skarn</u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

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EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.30ACO-ORDINATES: Northing: 75.0N Easting: 24.0EDEPTH DRILLED: 3.0m DATES DRILLED: 16 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0			Clay

HOLE NO: HM.31CO-ORDINATES: Northing: 67.7N Easting: 20.4EDEPTH DRILLED: 6.0m DATES DRILLED: 16 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
0.0	3.0			Clay
3.0	6.0			Fe & Clay

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

0087

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.32CO-ORDINATES: Northing: 15.0N Easting: 43.1EDEPTH DRILLED: 3.0m DATES DRILLED: 16 June 1989

<u>DRILL INTERVAL (m)</u>		<u>ASSAYS</u>		<u>LITHOLOGY</u>
<u>From</u>	<u>To</u>	<u>Total Fe%</u>	<u>% W03</u>	
<u>0.0</u>	<u>3.0</u>	<u> </u>	<u> </u>	<u>Clay</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

HOLE NO: HM.32ACO-ORDINATES: Northing: 10.0N Easting: 43.4EDEPTH DRILLED: 3.0m DATES DRILLED: 16 June 1989

<u>DRILL INTERVAL (m)</u>		<u>ASSAYS</u>		<u>LITHOLOGY</u>
<u>From</u>	<u>To</u>	<u>Total Fe%</u>	<u>% W03</u>	
<u>0.0</u>	<u>3.0</u>	<u> </u>	<u> </u>	<u>Clay</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989

Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.33CO-ORDINATES: Northing: 20.9N Easting: 41.5EDEPTH DRILLED: 11.0m DATES DRILLED: 16 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u>22.10</u>	<u>0.035</u>	<u>Clay</u>
<u>3.0</u>	<u>6.0</u>	<u>26.60</u>	<u>0.038</u>	<u>Clay</u>
<u>6.0</u>	<u>9.0</u>	<u>45.50</u>	<u>0.013</u>	<u>Mag. Skarn</u>
<u>9.0</u>	<u>11.0</u>	<u>58.50</u>	<u><0.005</u>	<u>" "</u>

HOLE NO: HM.34CO-ORDINATES: Northing: 23.8N Easting: 36.3EDEPTH DRILLED: 6.0m DATES DRILLED: 16 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>			<u>Clay</u>
<u>3.0</u>	<u>6.0</u>			<u>Clay</u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

0089

425089

0089

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.35CO-ORDINATES: Northing: 47.8N Easting: 54.2EDEPTH DRILLED: 9.0m DATES DRILLED: 16 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u> </u>	<u> </u>	<u>Magnetite</u>
<u>3.0</u>	<u>6.0</u>	<u> </u>	<u> </u>	<u>"</u>
<u>6.0</u>	<u>9.0</u>	<u> </u>	<u> </u>	<u>Mag. Skarn</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

HOLE NO: HM.36CO-ORDINATES: Northing: 47.7N Easting: 49.1EDEPTH DRILLED: 12.0m DATES DRILLED: 12 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u> </u>	<u> </u>	<u>Clay</u>
<u>3.0</u>	<u>6.0</u>	<u> </u>	<u> </u>	<u>Fe Clay</u>
<u>6.0</u>	<u>9.0</u>	<u> </u>	<u> </u>	<u>Magnetite</u>
<u>9.0</u>	<u>12.0</u>	<u> </u>	<u> </u>	<u>"</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.37CO-ORDINATES: Northing: 34.3N Easting: 39.8EDEPTH DRILLED: 4.0m DATES DRILLED: 13 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% WO ₃	
0.0	3.0			Clay & Sst
3.0	4.0			" "

HOLE NO: HM.37ACO-ORDINATES: Northing: 36.0N Easting: 38.1EDEPTH DRILLED: 8.50m DATES DRILLED: 13 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% WO ₃	
0.0	3.0			Clay & Sst
3.0	6.0			Magnetite
6.0	8.5			"

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
WO₃ - 403 Det Limit 0.005%

0091

425091

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.38

CO-ORDINATES: Northing: 25.4N Easting: 55.0E

DEPTH DRILLED: 2.0m DATES DRILLED: 14 June 1989

<u>DRILL INTERVAL (m)</u>		<u>ASSAYS</u>		<u>LITHOLOGY</u>
<u>From</u>	<u>To</u>	<u>Total Fe%</u>	<u>% W03</u>	
<u>0.0</u>	<u>2.0</u>	<u> </u>	<u> </u>	<u>No Sample</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

HOLE NO: HM.38A

CO-ORDINATES: Northing: 29.2N Easting: 54.0E

DEPTH DRILLED: 2.0m DATES DRILLED: 14 June 1989

<u>DRILL INTERVAL (m)</u>		<u>ASSAYS</u>		<u>LITHOLOGY</u>
<u>From</u>	<u>To</u>	<u>Total Fe%</u>	<u>% W03</u>	
<u>0.0</u>	<u>2.0</u>	<u> </u>	<u> </u>	<u>No Sample</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Assayed - Analabs - Report No 228.1.08.06298
 3rd July, 1989

Assay Method - Fe - 403 Det Limit 0.1%
 W03 - 403 Det Limit 0.005%

0098

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.38BCO-ORDINATES: Northing: 25.8N Easting: 52.6EDEPTH DRILLED: 13.0m DATES DRILLED: 14 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u> </u>	<u> </u>	<u>Clay</u>
<u>3.0</u>	<u>6.0</u>	<u> </u>	<u> </u>	<u>Mag. Skarn</u>
<u>6.0</u>	<u>9.0</u>	<u> </u>	<u> </u>	<u>" "</u>
<u>9.0</u>	<u>12.0</u>	<u> </u>	<u> </u>	<u>" "</u>
<u>12.0</u>	<u>13.0</u>	<u> </u>	<u> </u>	<u>" "</u>

HOLE NO: HM.39CO-ORDINATES: Northing: 34.4N Easting: 51.0EDEPTH DRILLED: 8.0m DATES DRILLED: 16 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u> </u>	<u> </u>	<u>Clay</u>
<u>3.0</u>	<u>6.0</u>	<u> </u>	<u> </u>	<u>Mag. Sst</u>
<u>6.0</u>	<u>8.0</u>	<u> </u>	<u> </u>	<u>Mag. Skarn</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.40CO-ORDINATES: Northing: 39.8N Easting: 56.2EDEPTH DRILLED: 9.0m DATES DRILLED: 15 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% WO ₃	
<u>0.0</u>	<u>3.0</u>	<u> </u>	<u> </u>	<u>Mag. Skarn</u>
<u>3.0</u>	<u>6.0</u>	<u> </u>	<u> </u>	<u>" "</u>
<u>6.0</u>	<u>9.0</u>	<u> </u>	<u> </u>	<u>" "</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

HOLE NO: HM.41CO-ORDINATES: Northing: 37.0N Easting: 70.5EDEPTH DRILLED: 9.0m DATES DRILLED: 15 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% WO ₃	
<u>0.0</u>	<u>3.0</u>	<u> </u>	<u> </u>	<u>Magnetite</u>
<u>3.0</u>	<u>6.0</u>	<u> </u>	<u> </u>	<u>Sst</u>
<u>6.0</u>	<u>9.0</u>	<u> </u>	<u> </u>	<u>Sst</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
WO₃ - 403 Det Limit 0.005%

0/89

EXPLORATION LICENCE 17/68

HAMPSHIRE MAGNETITE SKARN ZONE

PERCUSSION DRILLING PROGRAMME

MAY - JUNE 1989

HOLE NO: HM.42CO-ORDINATES: Northing: 48.2N Easting: 71.0EDEPTH DRILLED: 9.0m DATES DRILLED: 16 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u> </u>	<u> </u>	<u>Fe Sst</u>
<u>3.0</u>	<u>6.0</u>	<u> </u>	<u> </u>	<u>Sst</u>
<u>6.0</u>	<u>9.0</u>	<u> </u>	<u> </u>	<u>Sst</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

HOLE NO: HM.43CO-ORDINATES: Northing: 21.2N Easting: 68.6EDEPTH DRILLED: 6.0m DATES DRILLED: 16 June 1989

DRILL INTERVAL (m)		ASSAYS		LITHOLOGY
From	To	Total Fe%	% W03	
<u>0.0</u>	<u>3.0</u>	<u> </u>	<u> </u>	<u>Magnetite</u>
<u>3.0</u>	<u>6.0</u>	<u> </u>	<u> </u>	<u>"</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

EXPLORATION LICENCE 17/68HAMPSHIRE MAGNETITE SKARN ZONEPERCUSSION DRILLING PROGRAMMEMAY - JUNE 1989HOLE NO: HM.44CO-ORDINATES: Northing: 12.7N Easting: 66.5EDEPTH DRILLED: 14.0M DATES DRILLED: 16 June 1989

<u>DRILL INTERVAL (m)</u>		<u>ASSAYS</u>		<u>LITHOLOGY</u>
<u>From</u>	<u>To</u>	<u>Total Fe%</u>	<u>% W03</u>	
<u>0.0</u>	<u>3.0</u>	<u>-----</u>	<u>-----</u>	<u>Clay</u>
<u>3.0</u>	<u>6.0</u>	<u>-----</u>	<u>-----</u>	<u>Clay & Mag.</u>
<u>6.0</u>	<u>9.0</u>	<u>-----</u>	<u>-----</u>	<u>Mag. Skarn</u>
<u>9.0</u>	<u>12.0</u>	<u>-----</u>	<u>-----</u>	<u>" "</u>
<u>12.0</u>	<u>14.0</u>	<u>-----</u>	<u>-----</u>	<u>" "</u>

HOLE NO: -----CO-ORDINATES: Northing: ----- Easting: -----DEPTH DRILLED: ----- DATES DRILLED: -----

<u>DRILL INTERVAL (m)</u>		<u>ASSAYS</u>		<u>LITHOLOGY</u>
<u>From</u>	<u>To</u>	<u>Total Fe%</u>	<u>% W03</u>	
<u>-----</u>	<u>-----</u>	<u>-----</u>	<u>-----</u>	<u>-----</u>
<u>-----</u>	<u>-----</u>	<u>-----</u>	<u>-----</u>	<u>-----</u>
<u>-----</u>	<u>-----</u>	<u>-----</u>	<u>-----</u>	<u>-----</u>
<u>-----</u>	<u>-----</u>	<u>-----</u>	<u>-----</u>	<u>-----</u>
<u>-----</u>	<u>-----</u>	<u>-----</u>	<u>-----</u>	<u>-----</u>

Assayed - Analabs - Report No 228.1.08.06298
3rd July, 1989Assay Method - Fe - 403 Det Limit 0.1%
W03 - 403 Det Limit 0.005%

425096

TASMANIA MINES LIMITEDHAMPSHIRE MAGNETITE SKARN ZONE - E.L. 17/68AMG CO-ORDINATES - DRILLING PROGRAMME 1988/89

<u>Drill Hole No</u>	<u>Easting</u>	<u>Northing</u>	<u>Level</u>
HM.1	397879.608	5430299.732	486.874
HM.2	397862.831	5430327.571	487.426
HM.2A	397862.835	5430327.572	487.428
HM.3	397853.603	5430320.731	486.489
HM.3A	397851.441	5430320.830	486.255
HM.4	397868.106	5430333.710	488.282
HM.5	397863.407	5430337.301	488.185
HM.6	397864.936	5430347.238	488.482
HM.7	397858.195	5430344.791	487.891
HM.7A	397853.940	5430346.142	487.804
HM.8	397849.081	5430349.465	487.709
HM.9	397854.152	5430303.684	486.410
HM.10	397866.518	5430393.438	488.604
HM.10A	397863.364	5430394.636	488.602
HM.11	397873.271	5430377.563	489.288
HM.11A	397870.863	5430378.397	489.125
HM.12	397857.703	5430370.348	488.314
HM.13	397849.797	5430370.458	487.874
HM.14	397846.153	5430383.854	487.902
HM.15	397851.845	5430384.930	488.063
HM.16	397869.420	5430408.793	489.088
HM.16A	397866.261	5430409.929	489.023
HM.17	397860.772	5430402.566	488.320
HM.18	397852.656	5430395.407	487.945
HM.18A	397852.461	5430394.604	488.105
HM.19	397847.018	5430396.823	487.966
HM.19A	397847.232	5430395.716	487.960
HM.20	397855.772	5430408.566	488.320

HM.21	397862.542	5430414.028	487.562
HM.24	397867.963	5430420.216	489.163
HM.25	397856.146	5430419.607	488.650
HM.26	397863.365	5430435.907	488.611
HM.27	397860.147	5430447.419	488.318
HM.28	397853.099	5430332.243	487.074
HM.29	397849.303	5430341.385	487.250
HM.30	397850.146	5430355.970	487.803
HM.30A	397848.703	5430356.676	487.751
HM.31	397843.049	5430351.173	487.185
HM.32	397848.675	5430297.242	486.051
HM.32A	397848.751	5439291.120	485.942
HM.34	397844.141	5430303.119	486.153
HM.35	397867.448	5430319.599	487.381
HM.36	397859.795	5430315.659	486.726
HM.37	397852.660	5430311.701	486.416
HM.37A	397851.508	5430313.303	486.373
HM.38	397864.013	5430298.933	486.360
HM.38A	397866.097	5430300.835	486.611
HM.38B	397862.058	5430300.457	486.364
HM.39	397863.149	5430306.925	486.950
HM.40	397872.068	5430310.163	487.241
HM.41	397883.440	5430307.406	487.558
HM.42	397885.479	5430315.797	487.867
HM.43	397874.668	5430292.286	486.517
HM.44	397871.353	5430284.591	486.143

APPENDIX A2.4E.L. 17/68HAMPSHIRE MAGNETITE SKARN ZONEORE RESERVE CALCULATIONSINDICATED GEOLOGICAL RESERVES(Please refer to Plan N° 10/EX/EL) *Not in this report*

<u>Ore Block N°</u>	<u>Width</u> m	<u>Ore Zone</u> <u>Depth</u> m	<u>Strike</u> m	<u>Block</u> <u>Vol</u> m ³	<u>S.G.</u> <u>Factor</u>	<u>Block</u> <u>Tonnage</u> Tonnes
A	22.5	13.5	15	4,556	4.08	18,586
B	29.0	11.0	25	7,975	4.08	32,538
C	23.0	11.5	25	6,613	4.08	26,981
D	33.5	14.0	15	7,035	4.08	28,703
E	32.0	12.0	15	5,760	4.08	23,501
F	15.5	15.0	30	6,975	4.08	28,458
Av =	<u>25.9m</u>		<u>125m</u>		Total =	<u>158,769</u>

E.L. 17/68

HAMPSHIRE MAGNETITE SKARN ZONEFe GRADE CALCULATIONS

(NORTHERN SECTION)

<u>Block</u>	<u>Hole Nos</u> <u>Fe Intersections Used</u>	<u>Total</u> <u>Depth</u>	<u>Cumulative</u> <u>Fe x m</u>	<u>Average</u> <u>% Fe Grade</u>
A	1	13.5	647.595	47.97
B	9, 33	10.0	511.75	51.18
C	2, 2A, 3, 3A, 4, 5 & 6	46.0	2397.14	52.12
D	7, 7A, 14, 8, 29	48.5	2693.14	55.53
E	11, 11A, 12, 13	27.0	1493.16	55.30
F	14, 15, 17, 18, 18A	36.5	1796.46	49.22
<hr/>				
Average % Fe =				52.56%

HAMPSHIRE MAGNETITE SKARN

APPENDIX A3

Surface Rock Samples - Au Assays

EXPLORATION LICENCE 17/68LOCATION - HAMPSHIRE MAGNETITE SKARNSurface magnetite skarn samples - Assayed for Au and Ag

Total No of Samples = 20

Assayed - Department of Mines Laboratories 15/5/89

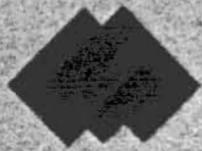
<u>Sample No</u>	<u>Req No</u>	<u>Au (g/t)</u>	<u>Ag (g/t)</u>
HM/G1	891538	<0.05	<5
2	39	"	<5
3	40	"	<5
4	41	"	8
5	42	"	7
6	43	"	8
7	44	"	7
8	45	"	8
9	46	"	8
10	47	"	8
11	48	"	7
12	49	"	8
13	50	<0.05	8
14	51	0.12	7
15	52	<0.05	8
16	53	"	7
17	54	"	8
18	55	"	9
19	56	"	<5
20	57	<0.05	<5

0102

CRL/C/2/90

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APPENDIX A4



BHP
Research &
New Technology

**CENTRAL
RESEARCH
LABORATORIES**

SHORTLAND, N.S.W.
AUSTRALIA

AN INVESTIGATION
OF THE POTENTIAL
FOR BENEFICIATION
OF THREE SAMPLES
OF TASMANIA
MINES MAGNETITE

by

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(Metallurgist)

and

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April, 1990

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SUMMARY

Preliminary testwork on a sample of Tasmania Mines "lump magnetite" showed that both wet drum magnetic separation and wet high intensity magnetic separation could be used to produce a concentrate with a grade of 65% Fe. However, in order to effect liberation of the magnetite, grinding to a topsize of approximately 0.1mm was required. Above this size, liberation was not significant, and little increase in iron grade resulted. It should also be noted that grinding liberated phosphorus and the product was extremely low in this undesirable element.

Testwork on the minus 3mm "magnetite fines" sample showed that it could not be easily upgraded by screening out low grade fractions at the "as received" size due to the relatively uniform chemistry with size. At the current grade of 64.8% Fe, the magnetite fines compare favourably with other Australian iron ores.

Mineralogical examination showed that the magnetite lump sample examined was a somewhat different ore type to the fines sample currently sold to BHP Steel. The "lump" contained finely dispersed gangue components, thus requiring grinding to liberate, whereas the "fines" sample was relatively pure magnetite with only a small amount of the gangue associated with the magnetite.

1. INTRODUCTION

A request was made to BHP Central Research Laboratories by the Slab and Plate Products Division (SPPD) Raw Materials Supply Department, on behalf of Tasmania Mines Limited, to conduct beneficiation testwork on three samples of magnetite ore. The testwork program was to determine low cost options for increasing the grade of the "as mined" magnetite lump, as well as the magnetite fines currently stockpiled.

Most of the iron ore tonnage mined in Australia, and hence most of the ore used in sinter plants within BHP, is classified as high grade hematite (typically greater than 62% Fe). With the current trend towards the use of higher grade (lower gangue) ores for use as sinter feed, this necessitates the use of concentrates (typically greater than 67% Fe) in the sinter plant iron ore feed, in order to meet the grade requirements.

From a comparison of hematite and magnetite based on their chemical composition, the theoretical Fe contents of hematite and magnetite are 70.0% and 72.4% respectively; magnetite being higher in Fe because of its lower oxidation state. As a consequence, an impure magnetite containing 3.3% gangue, can have the same Fe content as pure hematite. Thus when comparing hematite and magnetite ores, not only must the Fe grades be compared but the gangue levels must also be considered, since for two ores having the same iron content, the magnetite ore will have the higher gangue level, and this will affect sintering and blast furnace performance.

2. EXPERIMENTAL

2.1 Samples Tested

Three samples of magnetite ore were supplied by Tasmania Mines Limited in 20 litre drums for testwork as follows;

1. Magnetite Lump (minus 25mm, plus 6mm).
2. Upgraded Magnetite Lump (minus 25mm, plus 6mm). This material had been upgraded with a permanent magnet.
3. Magnetite Fines (-3mm).

2.2 Magnetite Lump

The two samples of lump ore provided for testwork had been screened into the minus 25mm, plus 6mm size fraction. It should be noted that at this topsize and with only a 20 litre drum sample, the material supplied may not have been representative of the larger lot size from which it was taken. One of the two lump samples had the non-magnetic material removed by the use of a permanent magnet by Tasmania Mines personnel, and was labelled as "upgraded".

The objective of the testwork was to recover the magnetite at the coarsest topsize possible, thereby minimising the milling cost; and for the grade to be suitable as a marketable product to BHP sinter plants. Preliminary tests were conducted by examining the possibility of upgrading the magnetite lump at the "as received" size by the rejection of the non-magnetic fraction.

The upgraded magnetite lump was then crushed in a laboratory jaw crusher to a top size of 8mm and the liberation characteristics of the ore were determined by assaying and mineralogical analysis.

The upgraded magnetite lump was then further reduced to a topsize of 1mm using a roll crusher and a direct comparison was made between dry and wet low intensity magnetic separation. Dry Roll Magnetic Separation, using a CARPCO, Inc. induced magnetic roll separator and Wet Drum Magnetic Separation, using a SALA MAGNETICS, Inc. single wet drum, were compared in terms of both grade and recovery of iron units.

The wet drum magnetic separator was used for the separation of the upgraded magnetite lump sample after the ore was further reduced to topsizes of minus 0.355mm and minus 0.125mm. These two finer topsizes were achieved by wet grinding in a ceramic ball mill, which minimises contamination of iron from media wear. The relationship between the reduction in top size and the grade and recovery of both magnetite and total iron units was investigated.

The SALA MAGNETICS wet drum low intensity magnetic separator was fed at 20% solids (by mass) via a calibrated vibratory feeder and metered water addition, at a solids feed rate of 460 g/min. A low pulp density was used as the laboratory scale wet drum magnetic separator is unable to handle high feed rates of a material with a high magnetic susceptibility without choking. The drum separator was operated with the concentrate and tailings fractions being separated concurrently. The products were dewatered, dried and weighed. The concentrate (CONC 1) was then repassed through the wet drum magnetic separator to produce a cleaned concentrate (CONC 2); this simulated a two stage beneficiation process. The concentrates and tails produced were then subsampled and assayed.

As a comparison to the grade of product that could be produced using a two stage wet drum magnetic separator, tests were also conducted using Wet High Intensity Magnetic Separation (WHIMS). WHIMS by comparison would involve a higher unit cost process due to a substantially higher capital cost.

2.3 Magnetite Fines

The "magnetite fines" sample supplied was sampled from an existing stockpile at the Tasmania Mines plant.

Size by size analysis of the sample was performed as well as both wet and dry sizings, to determine the possibility of a low cost upgrading of the fines by rejection of size fractions with lower iron grades.

3. RESULTS AND DISCUSSION

3.1 Magnetite Lump

3.1.1 Beneficiation of Lump at the "As Received" Size

The magnetite lump was screened and the sizing and chemical analyses are listed in Table 1. From an examination of the assays with size it is evident that the iron units, in terms of total iron and magnetite, are well distributed between the size fractions. Thus, it is not possible to upgrade the ore by screening the lump to reject any one size fraction and produce an acceptable grade ore.

The lump ore was then subjected to magnetic separation by passing a permanent magnet over the ore. It was determined that 3.7 percent of the material was non-magnetic at the lump size. Although the percentage of low grade material that could be rejected in this way is relatively low, and it could be achieved at a low cost by use of a cobbing magnet on a conveyor head drum, the grade of the lump remained unsatisfactory. Hence, the magnetite ore at the lump size received, offers no opportunity for beneficiation to an acceptable grade.

3.1.2 Lump Ore Characterisation

The lump ore was reduced to an 8mm topsize by crushing and the size distribution and corresponding assays are listed in Table 2. The reduction in topsize did not increase liberation significantly (i.e. by preferentially crushing the magnetite from the gangue ore) thus the assays with size still vary little between the various fractions. A sample was examined using optical microscopy for magnetite grain characteristics. The average magnetite particle size for good liberation was 0.1mm in diameter. Therefore fine grinding would be necessary to achieve this.

A polished section was also examined by scanning electron microscopy and X-ray microanalysis. This showed that the sample was composed of granular magnetite intergrown with a silicate gangue composed of andradite, diopside etc. (see Appendix 1).

Apart from the occasional trace levels of calcium, the magnetite is free of impurities, within detection limits, but does contain some very small inclusions. Only a relatively small percentage of the magnetite is oxidised to hematite.

3.1.3 Comparison of Wet and Dry Magnetic Separation

A sample of lump magnetite ore was reduced in topsize from 8mm to 1mm in order to make a direct comparison between wet and dry magnetic separation.

The conditions listed below in Table 3 were used to obtain the results shown in Table 4 for beneficiation using the dry induced roll magnetic separator.

TABLE 1. AS RECEIVED SIZE DISTRIBUTION TASMANIA MINES LUMP

Size (mm)	Weight (%)	Fe	Fe ₃ O ₄	SiO ₂	Al ₂ O ₃	TiO ₂	P	Mn	CaO	MgO	K ₂ O	Zn	Ignition
+16.0	28.4	38.8	48.0	24.0	3.09	0.22	0.013	0.46	11.40	5.33	0.18	0.033	-0.3
+10.0	51.4	39.5	48.9	23.6	2.98	0.20	0.015	0.43	11.10	5.33	0.19	0.032	-0.4
+6.4	15.7	41.1	51.8	22.4	2.87	0.19	0.012	0.42	10.60	5.02	0.17	0.036	-0.5
-6.4	4.5	44.1	51.6	19.9	2.56	0.19	0.014	0.55	9.22	4.40	0.14	0.038	-0.5
Calc Head	100	39.8	49.2	23.4	2.98	0.20	0.014	0.44	11.02	5.24	0.18	0.33	-0.4

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TABLE 2. SAMPLE CRUSHED TO MINUS 8mm SIZE DISTRIBUTION

Size (mm)	Weight (%)	Fe	Fe ₃ O ₄	SiO ₂	Al ₂ O ₃	TiO ₂	P	Mn	CaO	MgO	K ₂ O	Zn	Ignition
+4.000	31.1	34.4	42.9	27.4	3.72	0.22	0.014	0.45	12.60	6.11	0.28	0.027	-0.1
+2.000	26.2	36.1	44.1	26.4	3.28	0.20	0.013	0.43	12.50	5.86	0.21	0.031	-0.4
+1.000	9.6	38.1	46.8	24.7	3.19	0.19	0.016	0.43	11.90	5.48	0.19	0.031	-0.4
+0.500	9.9	43.9	55.5	20.1	2.72	0.22	0.010	0.41	9.68	4.49	0.15	0.036	-0.8
+0.250	6.4	46.2	59.4	18.5	2.46	0.22	0.009	0.39	9.00	4.16	0.13	0.040	-0.8
+0.125	5.6	43.2	55.2	20.8	2.25	0.22	0.010	0.39	10.10	4.97	0.12	0.035	-0.5
+0.063	5.8	33.5	40.8	28.5	2.27	0.17	0.016	0.42	13.40	7.02	0.14	0.028	0.3
+0.045	2.1	29.4	34.2	31.9	2.50	0.16	0.022	0.47	14.70	7.88	0.18	0.027	0.4
-0.045	3.3	31.4	37.8	29.5	3.17	0.19	0.030	0.52	13.40	6.89	0.23	0.028	1.2
Assay Head		39.5	49.3	23.6	3.07	0.20	0.013	0.39	11.10	5.28	0.2	0.033	-0.2

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TABLE 3. ROLL SEPARATOR SETTINGS

RUN	PASS	ROTOR SPEED	CURRENT SETTING (amps)
1	1	20	0.3
2	1	40	0.2
2	2	40	0.1

The first run gave a concentrate of 47.9% Fe with a recovery of 93.3% of the iron units; this was only a marginal upgrade from an original head grade of 39.5% Fe. The second run was carried out at a higher rotor speed in order to give increased selectivity between magnetic and non-magnetic materials by increasing the throw of the discharged non-magnetic material. Throughout the runs difficulty was experienced in operating the separator, because the magnetite tended to bridge between the roll and the nose block. This resulted in a decrease in the efficiency of separation. As a result of the difficulties experienced with bridging of the magnetite, the current was reduced to decrease the magnetic field strength. After the first pass of the second run the product produced was marginally higher in grade and recovery than the first run. The grade obtained was 48.3% Fe with 94.7% recovery of Fe. The product produced from the first pass was then repassed through the separator to clean the concentrate. This upgraded the concentrate to 51.5% Fe.

The wet drum magnetic separator results for comparison are listed in Table 5. The minus 1mm, concentrate produced after the first pass was 51.8% Fe. This was higher in grade than was possible with two passes using the dry roll separator. This is due to the increased efficiency of separation of the wet drum separator, compared to the dry roll separator, for a material with a high magnetic susceptibility. After the second pass a concentrate of 53.0% Fe was obtained. The recovery of the magnetite at a 1mm topsize was 94.7%. Although high recoveries resulted, beneficiation of the ore at a topsize of 1mm is not possible due to poor liberation; as a result the concentrate grade is relatively low. It was therefore decided to use the wet drum for magnetic separation and determine the grades and recoveries attainable at various topsizes.

3.1.4 Wet Drum Magnetic Separation with Decreasing Topsize

Samples of the magnetite ore were crushed to a topsize of 0.335mm and 0.125mm, and magnetically separated using the wet drum. The results are shown in Table 5 and compared to beneficiation at 1mm.

As the topsize was reduced from 1mm to 0.125mm the product grade increased from 53% to 65.5% Fe and similarly for the magnetite from 68.9% to 85.6%. This was achieved at very high recoveries; the iron recoveries were approximately 90 percent and the magnetite

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TABLE 4. DRY ROLL MAGNETIC SEPARATION

Feed Size (mm)	Product Type	Weight %	% Total Fe	Recovery of Fe (%)	SiO ₂	Al ₂ O ₃	TiO ₂	P	Mn	CaO	MgO	K ₂ O	Zn	Ignition
-1mm RUN 1	Conc 1	77.2	47.9	93.3	17.2	2.38	0.22	0.011	0.37	7.80	4.09	0.144	0.039	1.0
	Tail 1	22.8	11.3	6.6	44.2	5.24	0.13	0.022	0.50	21.15	9.31	0.389	0.014	-1.9
	Head	100.0	39.6	100.0										
-1mm RUN 2	Conc 2	65.7	51.5	86.1	14.6	2.11	0.22	0.010	0.35	6.53	3.53	0.120	0.040	1.5
	Tail 2	11.4	25.1	7.3	34.3	4.24	0.18	0.020	0.45	16.03	7.60	0.299	0.023	-0.7
	Tail 1	22.9	11.4	6.6	44.2	5.10	0.14	0.021	0.50	21.23	9.47	0.376	0.014	-1.8
	(Conc 1)	(77.1)	48.3	(94.7)	17.3	2.43	0.21	0.011	0.37	7.87	4.10	0.143	0.039	1.2
	Head	100.0	39.3	100.0										

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TABLE 5. WET DRUM MAGNETIC SEPARATION

Feed Size (mm)	Product Type	Weight %	% Total Fe	Recovery of Fe (%)	% Fe ₃ O ₄	Recovery of Fe ₃ O ₄	SiO ₂	Al ₂ O ₃	TiO ₂	P	Mn	CaO	MgO	K ₂ O	Zn	Ignition
-1mm	Conc 2	69.2	53.0	92.0	68.9	94.7	13.4	2.10	0.23	0.006	0.35	6.12	3.26	0.120	0.043	-1.3
	Tail 2	2.3	11.2	0.6	7.3	0.3	44.5	4.78	0.15	0.024	0.51	20.50	10.10	0.350	0.025	2.1
	Tail 1	28.5	10.4	7.4	8.8	5.0	45.2	4.98	0.13	0.025	0.52	21.27	9.90	0.385	0.016	-1.9
	(Conc 1)	(71.5)	51.8	(92.6)	67.6	(95.0)	14.2	2.17	0.22	0.008	0.35	6.49	3.41	0.116	0.041	1.5
	Head	100.0	39.9	100.0	50.4	100.0										
-0.355mm	Conc 2	59.0	62.0	89.7	81.4	93.9	6.7	1.41	0.24	0.004	0.32	2.95	1.71	0.057	0.049	-2.2
	Tail 2	3.3	13.9	1.1	13.2	0.9	42.1	5.32	0.17	0.026	0.50	18.80	9.37	0.410	0.034	2.2
	Tail 1	37.7	10.1	9.2	7.1	5.2	45.1	4.94	0.12	0.029	0.49	21.40	10.10	0.360	0.017	1.7
	(Conc 1)	(62.3)	59.7	(90.8)	78.1	(94.8)	8.5	1.64	0.25	0.004	0.33	3.77	2.09	0.075	0.048	-2.0
	Head	100.0	40.8	100.0	51.1	100.0										
-0.125mm	Conc 2	55.2	65.5	88.6	85.6	92.3	4.2	1.19	0.25	0.002	0.30	1.79	1.10	0.034	0.052	-2.7
	Tail 2	3.0	11.8	0.9	11.7	0.7	43.6	5.41	0.19	0.023	0.50	19.30	9.71	0.420	0.038	2.4
	Tail 1	41.8	10.3	10.5	8.6	7.0	44.9	5.05	0.14	0.029	0.49	21.10	10.20	0.370	0.017	1.7
	(Conc 1)	(58.2)	63.1	(89.5)	82.5	(93.0)	6.0	1.34	0.25	0.003	0.31	2.55	1.51	0.052	0.051	-2.3
	Head	100.0	40.8	100.0	51.2	100.0										

recoveries as expected were higher. This is represented graphically in Figures 1 and 2. Correspondingly, as the topsize was reduced there was a decrease in the level of the impurity elements in the concentrate due to the increased liberation and effective separation.

The concentrate produced at minus 0.125mm was 55 mass percent of the feed and assayed 65.5% Fe. The silica and alumina levels were 4.2% and 1.19% respectively, which compare favourably with other commercially available iron ores. The TiO_2 loading is relatively high at 0.25%. It should be noted that the phosphorus is liberated from the ore and less than 10% of the phosphorus in the head sample reports to the concentrate. The phosphorus levels are very low at 0.002% and this offers significant advantages to sinter plants in using such a low phosphorus ore in the blend. The concentrate contains 0.3% Mn and if used in significant quantities would reduce the amount of manganese alloying required in the steelmaking process, offering further possible price advantages.

The K_2O and zinc levels are relatively high, and these two metals lead to the build-up of deleterious deposits in the blast furnace. Hence sinter chemistry requirements places limitations on these elements, but at low mass fraction addition rates to the sinter feed, the presence of these undesirable elements are not seen as being likely to create significant restrictions on the use of this ore. However, when used in conjunction with other high zinc/ K_2O ores, the amount of Tasmania Mines ore that could be incorporated into any particular blend may be limited.

Overall, the concentrate would be an attractive component to the sinter plant feed.

3.1.5 WHIMS Testwork

Concurrently with the wet drum magnetic separation tests, samples were separated using wet high intensity magnetic separation (WHIMS) at topsizes of 1, 0.355, 0.125 and 0.045mm. The results are shown in Table 6. This work was undertaken to make a direct comparison between the separations obtained using WHIMS and wet drum magnetic separation. From a comparison of the results it is evident that the wet drum magnetic separation results were superior in terms of grade. Difficulty was experienced in operating the WHIMS unit due to the high magnetic susceptibility of the magnetite ore, resulting in the magnetite bridging across the separating matrix and significantly reducing the efficiency of separation.

3.2 Magnetite Fines

Wet and dry sieve sizings were performed on the "as received" minus 3mm fines. An analysis of each fraction of the dry sieve sizing was obtained and the results are listed in Table 7. From an examination of the assays with size, it is evident that the iron units, both in terms of total iron and magnetite, are well distributed between the fractions. The size fractions that are marginally lower in grade with respect to the calculated head only represent a small mass percent of the ore. Thus it is not possible to upgrade the ore by screening to reject any one size

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WET MAGNETIC SEPARATION

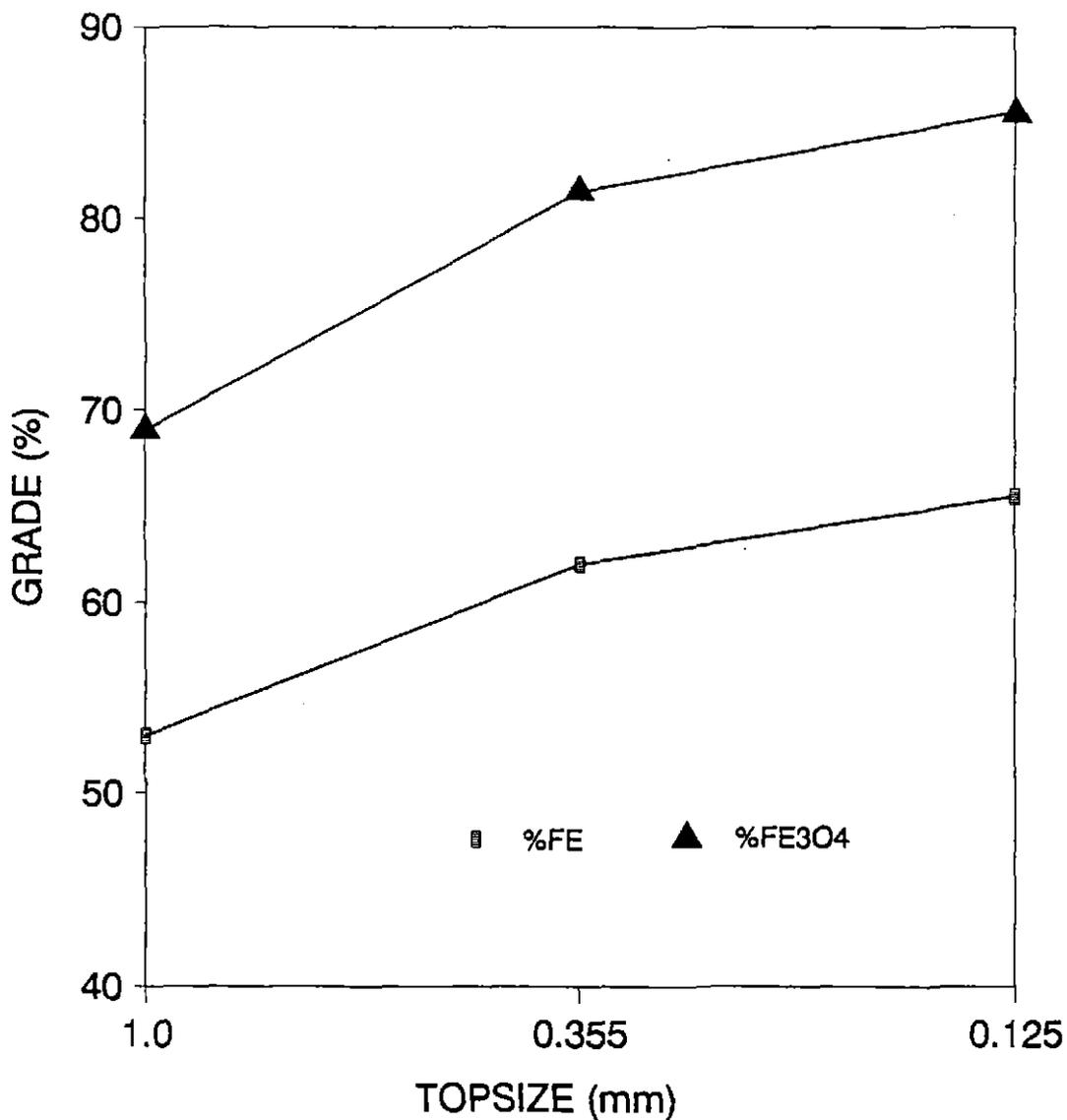


Figure 1. Concentrate grades at various top sizes.

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WET MAGNETIC SEPARATION

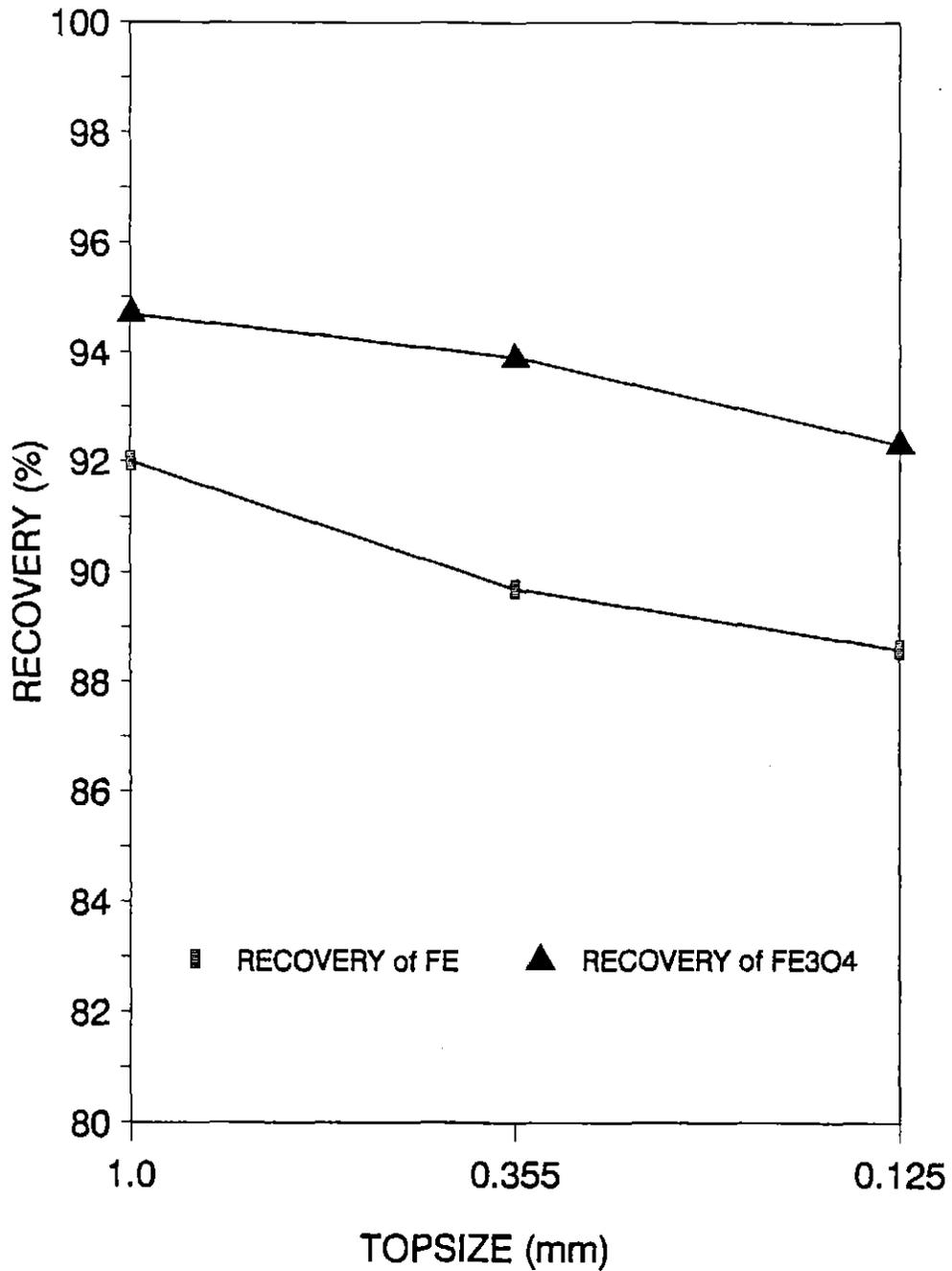


Figure 2. Recovery of Fe and Fe₃O₄ at various topsizes.

TABLE 6. WET HIGH INTENSITY MAGNETIC SEPARATION (WHIMS)

Feed Size (mm)	Product Type	Weight %	% Total Fe	Recovery of Fe (%)	% Fe ₃ O ₄	Recovery of Fe ₃ O ₄	SiO ₂	Al ₂ O ₃	TiO ₂	P	Mn	CaO	MgO	K ₂ O	Zn	Ignition
-1mm	+1amp	84.8	46.5	96.6			18.1	2.70	0.20	0.010	0.37	8.53	4.05	0.161	0.038	+1.0
	+6amp	11.2	10.2	2.8			46.4	4.37	0.12	0.007	0.50	20.90	10.62	0.357	0.020	-1.3
	-6amp	4.0	6.9	0.6			44.3	3.63	0.12	0.128	0.42	23.80	11.10	0.229	0.024	-4.0
	Total	100.0	40.8	100.0												
-0.355mm	+1amp	75.1	52.4	94.3	67.7	96.1	14.0	2.16	0.21	0.004	0.35	6.58	3.19	0.120	0.043	-1.4
	+6amp	7.6	11.3	2.1	7.9	1.1	45.2	5.03	0.12	0.004	0.50	20.50	9.91	0.400	0.018	1.1
	-6amp	17.3	8.7	3.6	8.4	2.8	45.1	4.78	0.15	0.057	0.47	21.90	10.60	0.330	0.023	2.5
	Total	100.0	41.7	100.0	52.9	100.0										
-0.125mm	+1amp	70.3	56.0	93.5	72.7	95.9	10.9	1.81	0.23	0.002	0.33	5.08	2.54	0.092	0.046	-2.0
	+6amp	6.8	12.8	2.1	10.7	1.4	44.1	5.50	0.14	0.004	0.52	19.60	9.23	0.490	0.019	0.8
	-6amp	22.9	8.2	4.5	6.3	2.7	45.9	4.67	0.13	0.046	0.46	22.50	10.80	0.300	0.018	2.0
	Total	100.0	42.1	100.0	53.3	100.0										
-0.045mm	+1amp	54.8	65.0	85.1			4.4	1.22	0.23	0.002	0.31	2.00	1.04	0.042	0.055	-2.4
	+6amp	2.8	18.9	1.3			39.6	6.73	0.17	0.003	0.53	16.60	6.92	0.766	0.024	0.7
	-6amp	42.4	13.5	13.6			45.4	4.90	0.16	0.030	0.54	21.90	10.50	0.350	0.016	0.7
	Total	100.0	41.9	100.0												

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TABLE 7. AS RECEIVED SIZE DISTRIBUTION AND GRADE OF MINUS 3MM FINES

Size (mm)	Dry Size Weight (%)	Wet Size Weight (%)	Fe	Fe ₃ O ₄	SiO ₂	Al ₂ O ₃	TiO ₂	P	Mn	CaO	MgO	K ₂ O	Zn	Ignition
+2.000	0.7	0.6	59.7	57.2	7.8	1.95	0.13	0.010	0.47	3.15	0.74	0.041	0.056	-0.4
+1.000	13.7	13.8	64.1	61.4	3.9	1.33	0.09	0.008	0.49	1.58	0.51	0.024	0.049	-1.1
+0.500	25.2	25.2	65.0	62.0	3.5	1.24	0.10	0.007	0.47	1.42	0.46	0.016	0.052	-1.1
+0.250	29.7	30.0	65.5	58.9	3.1	1.08	0.10	0.008	0.44	1.31	0.39	0.012	0.052	-1.0
+0.125	20.4	18.7	64.6	53.9	3.9	1.14	0.13	0.010	0.40	1.86	0.42	0.012	0.054	-1.1
+0.063	6.9	6.7	64.5	51.4	3.8	1.03	0.13	0.009	0.37	1.55	0.46	0.012	0.050	-1.0
+0.045	1.8	1.5	65.6	49.7	3.2	0.94	0.13	0.009	0.36	1.01	0.38	0.012	0.047	-0.9
-0.045	1.6	3.5	62.9	47.2	5.1	1.29	0.12	0.015	0.36	1.48	0.52	0.023	0.043	0.0
Calc Head	100	100	64.8	58.1	3.6	1.17	0.11	0.008	0.44	1.52	0.44	0.015	0.052	-1.0

fraction and produce a significant increase in grade. The magnetite fines would have some potential for upgrading, but this would require a reduction in topsize to liberate the remaining gangue from the magnetite.

The calculated head grade was 64.8% Fe, 3.6% SiO₂, and 1.17% Al₂O₃. This grade compares favourably with other Australian iron ores. One of the most notable characteristics of this ore that would make it attractive as a sinter feed is the very low phosphorus levels.

3.3 Comparison of Magnetite Samples

The lump magnetite and the magnetite fines show quite different grade/size and liberation characteristics. Comments from Tasmania Mines personnel indicated that the lump ore should have been similar to the current minus 3mm fines shipments supplied to BHP Steel (see section 3.2), and hence it would not be expected that the lump would require such fine grinding to liberate the gangue components. CRL further examined the samples, in light of these comments, by comparing the two magnetite samples - lump ore crushed to a 1mm topsize and a sample of minus 3mm fines - using optical microscopy techniques.

Microscopy revealed that, as suspected, the two ores were texturally dissimilar. The lump contained fine intermixed gangue components, with the majority of particles containing locked gangue (particles that require comminution to release the gangue) with a liberation size of less than 0.1mm. The fines sample also contained some locked gangue particles, but the majority of particles examined contained no gangue components at all, being pure magnetite, i.e., the ore was obviously higher grade. Liberation size for the particles containing gangue in the fines sample was also approximately 0.1mm. Photographs 1 and 2 show the difference in texture of particles with locked gangue. Hence it is clearly demonstrated that differences in chemistry between the lump and fines sample is due to a difference in ore types. This may reflect on the representativity of the sample of lump ore sent to CRL for testwork.

3.4 Comparison of Tasmanian Mines Concentrate to Other Commercially Traded Iron Ores

In Table 8, a comparison is given of the grade of the concentrate produced from Tasmania Mines magnetite and that of other commercially traded iron ores, both from within Australia and also from overseas, that are currently used in Australian sintering feed ore blends.

TABLE 8. A COMPARISON OF TASMANIA MINES CONCENTRATE TO OTHER AUSTRALIAN AND OVERSEAS IRON ORES

Ore Name	Fe	Fe ₂ O ₃	Fe ₃ O ₄	SiO ₂	Al ₂ O ₃	P	MnO	CaO	MgO	S	K ₂ O	Zn	LOI	Type	Size
Carajas Sinter Feed	67.75			0.6	0.80	0.050	0.26	0.02	0.03	0.008	0.004		1.35	Sinter Feed	92%, -6.35mm 9%, -0.10mm
Mt Newman Fines	62.5	62.4	0.1	5.6	2.60	0.068	0.09	0.04	0.05	0.011	0.020	0.004	2.10	Sinter Feed	95%, -6.0mm 9%, -0.15mm
Kudremukh Concentrate	67.5			2.6	0.40	0.025	0.15	0.02	0.03	0.005	0.005		1.00	Pellet Feed	100%, -0.21mm 63.6%, -0.044mm
Samarco Concentrate	67			1.8	1.10	0.040	0.03	0.08	0.04	0.004	0.020	0.001	1.20	Pellet Feed	98.5%, -0.074mm
Carol Concentrate	65.9	68.1		4.6	0.15	0.008	0.13	0.43	0.30	0.004	0.003		0.26	Sinter Feed	97.2%, -0.85mm 8.9%, -0.075
Tasmanian Mines Concentrate	65.5			4.2	1.19	0.002	0.39	1.79	1.10		0.034	0.052	-2.70	Sinter Feed	100%, -0.125mm

4. CONCLUSIONS

Preliminary testwork on a sample of Tasmania Mines lump magnetite showed that the ore was amenable to beneficiation by magnetic separation. Both wet drum magnetic separation and wet high intensity magnetic separation could be used to produce a concentrate with a grade of 65% Fe. Wet drum magnetic separation would be favoured in terms of capital cost and ease of operation.

However, due to the ore texture of the magnetite, in order to effect liberation from the gangue, grinding to a topsize of approximately 0.1mm was required. Above this size, liberation was not significant, and little increase in iron grade could be obtained. It should be noted that grinding liberated phosphorus and the product was extremely low in this undesirable element.

It should be envisaged that a plant flowsheet would include cobbing at a lump size to remove the non-magnetic fraction followed by crushing and grinding to a topsize of approximately of 0.1mm. Magnetic separation would be undertaken using a two stage wet drum separator.

The minus 3mm magnetite fines sample could not be upgraded easily by screening out unwanted low grade size fractions as the chemistry was relatively uniform with size. At the current grade of 64.8% Fe, 3.6% SiO₂ and 1.17% Al₂O₃ the magnetite fines compare favourably with other Australian iron ores. It should also be noted that the phosphorus levels are very low.

Optical microscopy of the lump and fines samples indicated that the ore types appeared to be different. The lump ore had finely disseminated gangue whereas the minus 3mm fines sample was relatively pure with many particles containing no gangue constituents. This finding indicates either variability in ore type within the deposit or an unrepresentative sample of the lump ore from Tasmania Mines.

APPENDIX B - WOLLASTONITE INVESTIGATIONS

- APPENDIX B1 - ZETETIC - "A preliminary report on the
Wollastonite Creek Area: Nov. 1985
- APPENDIX B2 - Mineralogical - Petrological Studies
Wollastonite and Calc-Silicate drill samples
E.L. 17/68
W. Fander, C.M.S., Adelaide
- APPENDIX B3 - Surface rock samples - Analytical Results
- APPENDIX B4 - Wollastonite Percussion drilling programme
- Drill Logs/Assay Results
- APPENDIX B5 - Diamond drilling programme
DDMS19, 520
- APPENDIX B6 - Abermet/CMS. Bench test work results
- APPENDIX B7 - Department of Mines metallurgical test work
- Upgrading wollastonite sample
- APPENDIX B8 - Mineral Sands Consultancy Group
- Metallurgical upgrading of wollastonite
- APPENDIX B9 - Commodity review - wollastonite

WOLLASTONITE DEPOSIT - LIMESTONE CREEK

APPENDIX B1

ZETETIC - "A preliminary report on the
Wollastonite Creek area (EL 17/68)
November 1985.

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A PRELIMINARY REPORT ON THE
WOLLASTONITE CREEK AREA (EL 17/68)
FOR TASMINEX N.L.

By - ZETETIC
Consulting Economic Geologists
November, 1985

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TM 10(2)

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A PRELIMINARY REPORT
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WOLLASTONITE CREEK AREA
(EL 17/68)
FOR TASMINEX NL

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November 1985

CONTENTS

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2. LOCATION	1
3. PREVIOUS WORK	2
4. WORK COMPLETED, 1985	4
5. GEOLOGY OF THE WOLLASTONITE CREEK AREA	4
6. PROPOSED FUTURE WORK	7
7. CONCLUSIONS	8

FIGURES

<u>Figure No.</u>	<u>Zetetic Plan No.</u>	<u>Description</u>	<u>Plan Size</u>	<u>Scale</u>
✓ Fig. 1	ZET/85/100	Location Plan	A4	1:710,000
X - not necessary Fig. 2	TAS/85/201	Land Use	A3	1:15,000
Fig. 3 See Plan No 2/RL	TAS/85/202	Regional Geology	A3	1:15,000
Fig. 4 See Plan No 6/RL Plan No 7/RL	TAS/85/203	Geology of the Wollastonite Occurrences	A1	1:2,500
✓ Fig. 5	TAS/85/204	Schematic Cross- Section of the Wollastonite Creek Area	A4 (part)	Not to Scale
✓ Fig. 6	TAS/85/204	Schematic Long- Section of the Wollastonite Creek Area	A4 (part)	Not to Scale
Fig. 7 See plan 6/RL	TAS/85/205	Survey Data	A1	1:2,500
✓ Fig. 8	TAS/85/206	Pressure-Temp. Curve for Wollastonite Formation.	A4	Not to Scale

A3 and A4 plans with text

A1 plans in pockets at back of report

Fig. 8 forms part of Appendix A

APPENDICES

A The Properties and Uses of Wollastonite

B Wollastonite at Limestone Creek near Hampshire -
M.J. Longman.

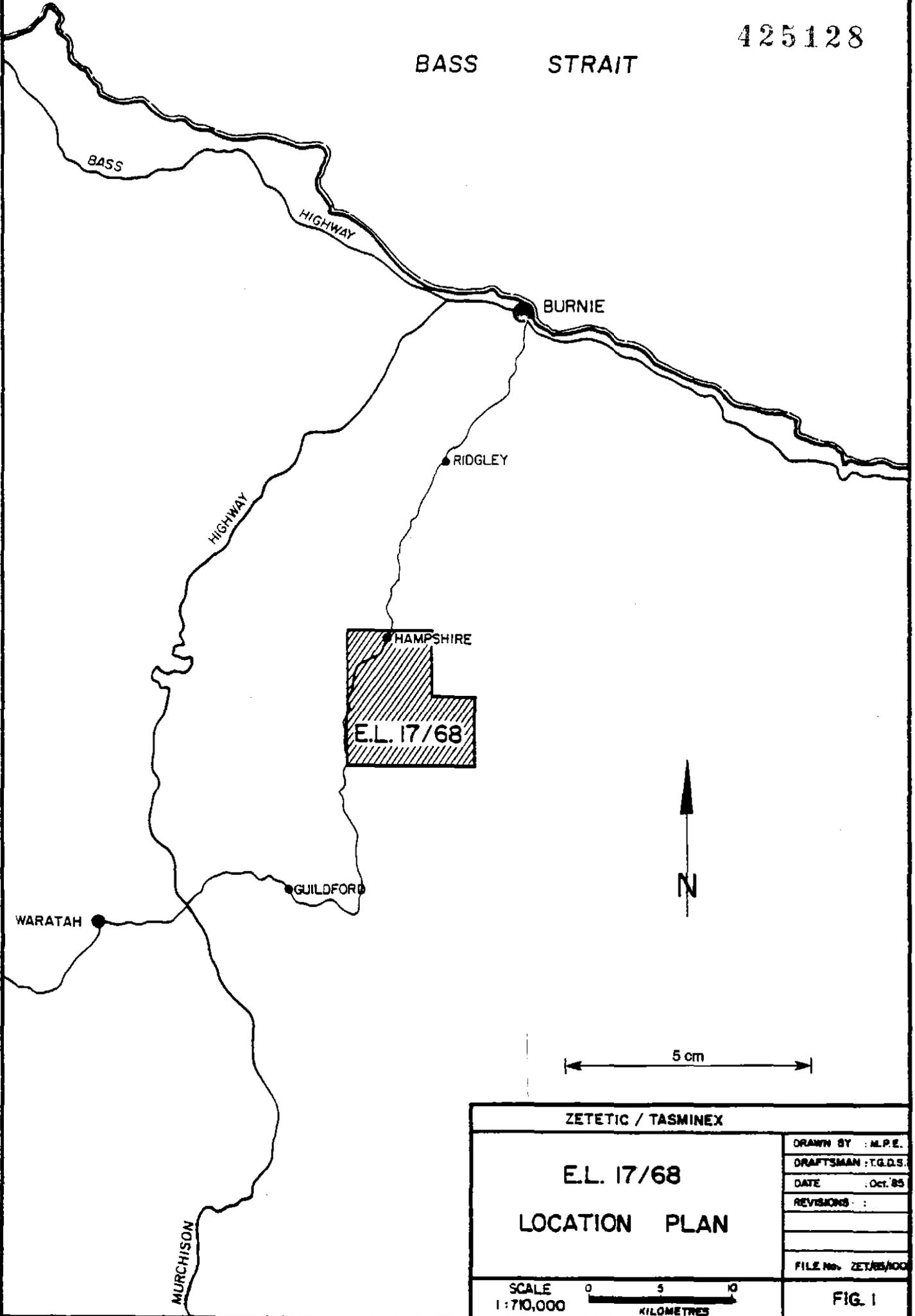
See Appx. B9 also.

See References

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BASS STRAIT



E.L. 17/68



5 cm

ZETETIC / TASMINEX													
E.L. 17/68													
LOCATION PLAN													
SCALE 1 : 710,000													
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">DRAWN BY : M.P.E.</td> <td style="width: 20%;"></td> </tr> <tr> <td>DRAFTSMAN : T.G.D.S.</td> <td></td> </tr> <tr> <td>DATE : Oct. '85</td> <td></td> </tr> <tr> <td>REVISIONS :</td> <td></td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td>FILE No. ZET/85/00</td> <td style="text-align: center;">FIG. 1</td> </tr> </table>		DRAWN BY : M.P.E.		DRAFTSMAN : T.G.D.S.		DATE : Oct. '85		REVISIONS :				FILE No. ZET/85/00	FIG. 1
DRAWN BY : M.P.E.													
DRAFTSMAN : T.G.D.S.													
DATE : Oct. '85													
REVISIONS :													
FILE No. ZET/85/00	FIG. 1												

1. INTRODUCTION

On 18th September, 1985, ZETETIC was commissioned by Mr. R. Boland, Director of Tasminex N.L., to undertake a brief preliminary assessment of known wollastonite occurrences at Wollastonite Creek, near Hampshire, within EL 17/68. Terms of reference were to produce a geological map of the area and to formulate an on-going exploration programme if this was considered worthwhile.

The work completed and the information gleaned therefrom is described in this document.

In brief, it is evident that the Wollastonite Creek mineralisation is worthy of more detailed appraisal and a work programme has therefore been proposed with an immediate objective of determining the likelihood of wollastonite occurring in economically viable amounts and grades. However, it is emphasised that as with most commercial minerals, a market for the product must be reasonably assured prior to large exploration expenditure.

2. LOCATION

The wollastonite occurrences under consideration are situated within the lower reaches of Wollastonite Creek, a tributary of the Emu River, on its eastern bank approximately 1 kilometre south of the Hampshire - Upper Natone road and about 3 kilometres south-east of Hampshire. The area lies within EL 17/68 of Tasminex N.L. (see Figure 1).

Access to the area is from the Hampshire - Upper Natone road, via an unsealed Forestry road (Cameron's Road) to informal tracks as shown on Figure 7.

The prospect is located mainly within a stand of euclayptus saplings surrounded by pine plantations and small areas of native bush or farmland (see Figure 2). The area forms part of an active forestry project managed by Associated Forest Holdings.

3. PREVIOUS WORK

Reid, in 1924, showed on his geological map large areas of limestone around the headwaters of Limestone Creek (now called Wollastonite Creek). Thomas and Henderson, in 1943, investigated this area for the possible production of wollastonite. Hughes, in 1950 and 1957, took some samples from Limestone Creek, but the most useful work was done by M.J. Longman, in 1960, at the request of Mr. A. Pearson of Ulverstone.

Hughes (1957) stated that, "Over much of the area limestone is not apparent, but an outcrop on the eastern bank of Limestone Creek, 60 chains south of the Natone Road bridge, shows a thinly bedded series of rocks in which may be seen five bands of limestone varying in thickness from three inches to three feet, contained in beds of hornfels and calc-silicate rocks. These beds strike at 160° and dip to the south-west at 15° . The thickness of the outcrop exposed is 25 feet. An analysis of the limestone taken from the various bands showed:-

	%
Acid Insoluble	8.4
CaO	51.0
MgO	0.4
Ignition Loss	38.0
Fe ₂ O ₃ + Al ₂ O ₃ + TiO ₂	1.6

"The siliceous portion of the outcrop showed:-

	%
Acid Insoluble	68.0
CaO	21.6
MgO	0.6
Ignition Loss	2.6
Fe ₂ O ₃ + Al ₂ O ₃ + TiO ₂	6.7

"This second analysis is of a representative sample taken across the silicate and calc-silicate beds and shows that the minerals are in the following proportions:-

	%	
Calcium Carbonate (CaCO ₃)	6	
Wollastonite (CaSiO ₃)	38	
Silica (SiO ₂)	48"

Longman (1961) undertook the most comprehensive assessment, to date, of this area. He carried out a detailed sampling programme (see table on Figure 4 for results of most relevance), geological mapping and some thin-section work.

In thin-section, Hughes noted the following minerals:-

Quartz
Wollastonite
Calcite
Pyrrhotite
Plagioclase
Diopside

Quartz and wollastonite tended to be dominant, forming 80 per cent of the rock in some cases. Hughes estimated the proportion of pyrrhotite to be between 5 and 10 per cent with the quantity of plagioclase, calcite and diopside usually being less than 5 per cent.

Hughes calculated that the average grade of the deposit was 30.3%, upgradable to 37.2% by rejecting the chert and dolomite bands, and that the amount available was approximately 1×10^6 tons.

Unfortunately, Hughes gave no basis for calculating this tonnage and did not explain the analytical results. Further, his 'isolated outcrops' samples were not shown on a plan and it was not mentioned whether his zero sampling level was at the bottom or top, stratigraphically, of the outcrops. It is presumed zero was the highest point of the outcrop sequence. It is also presumed that the grades quoted by Hughes are percentages of the total rock rather than a percentage of the acid insoluble fraction. Recent attempts to discover his methods of analysis, from the Department of Mines, Hobart, have not met with success.

Taking Hughes' results at face value, it is apparent that wollastonite grades exist at the lower end of the economic spectrum but can be readily upgraded by rejecting the lower grade chert bands, distinguished by a darker colour. This may have important economic consequences.

Since 1960/61. there appears to have been no detailed work carried out in the Wollastonite Creek area by either companies or government agencies.

4. WORK COMPLETED, 1985

Investigations at Wollastonite Creek were carried out during the period 4/10/85 to 30/10/85.

Work completed in the field was as follows:-

1. Regional mapping allied to aerial photographic interpretation set the Wollastonite Creek area in its geological context;
2. Detailed geological mapping of the Wollastonite Creek area;
3. Tape, compass and inclinometer traversing of forestry tracks in the area of wollastonite mineralisation;
4. Tape and compass traversing of part of Wollastonite Creek.

This report, and accompanying plans and sections, are the result of the above work.

5. GEOLOGY OF THE WOLLASTONITE CREEK AREA

The regional geology of EL 17/68 has already been adequately described in numerous previous Tasminex reports; however, the geology of the area surrounding Wollastonite Creek has been re-mapped and updated and is shown in Figure 3. In broad terms,

Ordovician age rocks were intruded by Devonian granites and, today, form inliers within the extensive Tertiary Basalt capping. The extensive limestones shown on some geological maps of the area do not exist rather the Gordon Limestone Transition Series is composed of a mixed sequence of fine quartzites (often described as cherts and often pyrrhotitic), hornfels, thin beds and lenses of limestone, occasional dolomites and calc-silicate rocks containing wollastonite. Before metamorphism this Transition Series was composed predominantly of sandstones and calcareous sandstones with intermittent minor limestones and formed a gradational sequence between the dominantly arenaceous Moina Sandstone and the dominantly calcareous Gordon Limestone sensu stricto.

The stratigraphy of the region may be summarised as follows:-

Tertiary		Basalt flows
Devonian		Granite intrusives
Silurian	Eldon Group	Sandstones, quartzites
	(Gordon Limestone	Essentially limestones
	(	with minor calcareous
	(	sandstones
	(
	(Transition Series	Calcareous sandstones,
	(	sandstones, siltstones,
	(	minor limestones.
	(	Where metamorphosed,
	(	quartzites, calc-silicate
Ordovician	(	hornfels
	(
	(Moina Sandstone	Sandstones, quartzites,
	(	siltstones, shales,
	(	slates and minor
	(	conglomerates
	(
	(Owen/Roland Conglomerate	Conglomerates and quartz
	(	sandstones
	- Unconformity -	
Cambrian	Undifferentiated	Greywackes, slates,
		quartzites, acidic
		lavas. etc.

Structurally, the most important feature for locating new shallow wollastonite deposits is the postulated Wollastonite Creek syncline shown on Figure 3 and schematically on Figure 5. It appears to be asymmetric with the western limb having generally steeper dips.

Faulting has not been proved but is suspected: Longman (1961) has noted post-Tertiary faulting on a NE-SW trend adjacent to Wollastonite Creek, but recent mapping did not confirm this. Further, there may be some structural control in a NNW-SSE direction as suggested by the drainage pattern of Wollastonite Creek itself.

The detailed geology of the known wollastonite deposits is shown on Figure 4. This plan is largely self-explanatory but a number of points are worth emphasising:-

- reconnaissance geological traversing along forestry tracks to the west of Wollastonite Creek did not reveal any outcrops except in the extreme south of the area mapped where the target rocks of the Transition Series were observed underlying the Tertiary Basalt capping.
- in the vicinity of outcrop 3 (three) there is a distinct swing in strike to the NE. The reasons for this are not known: it may be caused by a flexure on the eastern limb of the postulated Wollastonite Creek syncline or be a product of block faulting.
- the outcrops in Wollastonite Creek, either side of the granite boulder, are extremely weathered and unusually 'puggy' for this area; most other outcrops are hard, indurated and 'fresh' looking.
- the sub-basaltic boundary of the Transition Series meta-sediments as shown in Figure 4. may be further east. Its precise location depends on the thickness of the basalt and the relative erosional level of the pre-basalt topography. This should be tested by drilling as proposed in Section 6 of this report.

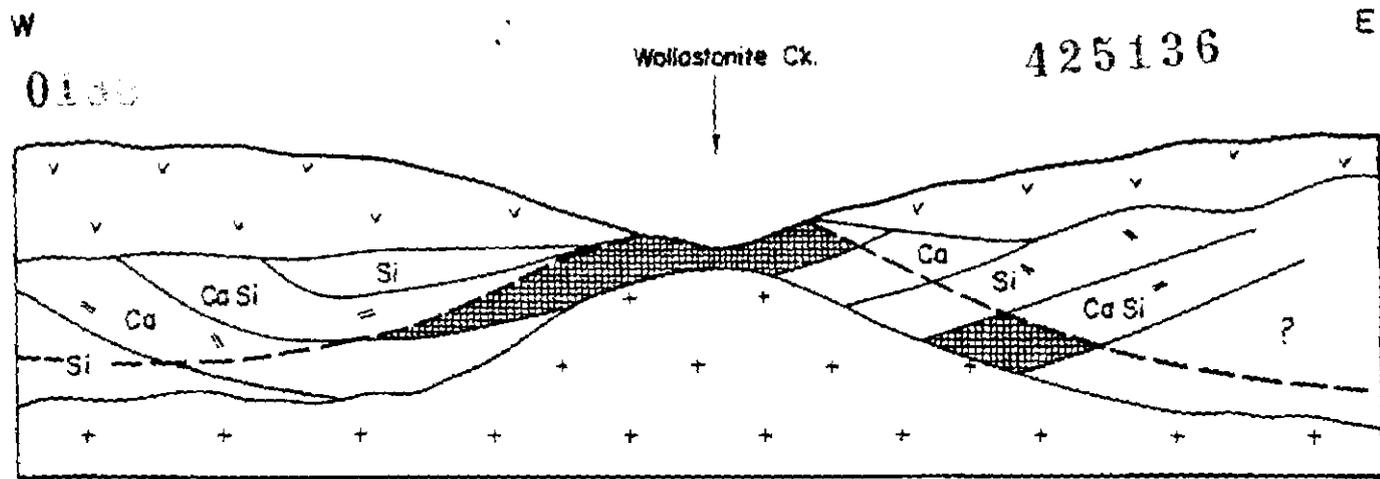
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- distribution of mineralisation will be governed by the parameters of the chemistry of the original rock type and temperature of subsequent metamorphism: where these are in balance, wollastonite will be formed. This is illustrated schematically in Figures 5 and 6.

6. PROPOSED FUTURE WORK

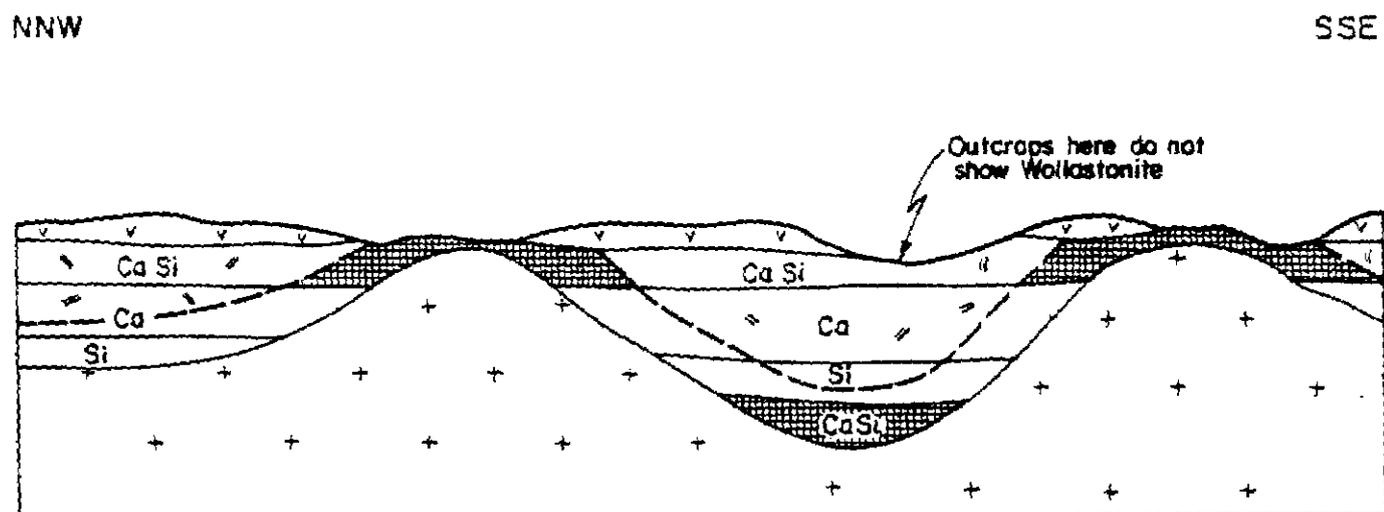
An exploration work programme is proposed as follows:

- Stage 1 Establish by bulk-sampling whether commercial end-user requirements can be met (i.e. suitability) ascertain whether a realistic potential market exists for the mined product (i.e. need) confirm a value/grade equation (i.e. profitability). It is understood that Tasminex is currently making investigations to these ends. Further, it should be checked that the area is not covered by a 'private minerals' title and that the forestry company is amenable to fair compensation for a proposed mining operation within their plantation area.
- Stage 2 Assuming the requirements of Stage 1 are successfully met, Tasminex should test the deposit by reconnaissance 'fence-line' percussion drilling of known surface mineralised areas (i.e. outcrop areas 1/2 and 4). This will establish the parameters of width, vertical extent and grade over a crucial area and it is proposed that 11 (eleven) vertical percussion holes are drilled at 40 m intervals on lines 240 m apart (see Figure 4). The depth of these holes will be controlled by depth to granite, depth of overburden and the vertical extent of the mineralisation: as a guide a relative level of 25 m beneath Wollastonite Creek should be used. For budget purposes, 450-500 m of drilling should be considered at an approximate cost of \$17,500. The objective of this drilling is to demonstrate 1×10^6 tonnes of wollastonite bearing rock. This can be achieved using the following indicative parameters:-



Schematic Cross-Section of Wollastonite Creek Area
To Illustrate Possible Distribution of Mineralisation

FIG. 5 (Not to scale)



Schematic Long Section of the Wollastonite Creek Area
To Illustrate Possible Distribution of Mineralisation

FIG. 6 (Not to scale)

LEGEND:

- v v Tertiary Basalt
- Gordon Limestone, Transition Series
- Ca - Limestone Unit
- Si - Sandstone Unit
- CaSi - Calcareous Sandstone or Siliceous Limestone Unit
- Area of wollastonite formation
- + + Granite
- Assumed limit of Thermal Metamorphic effects conducive to wollastonite formation

- assume strike length of 350 m (line 240N to outcrop area 2)
- assume deposit width of 120 m (that given if wollastonite is intersected in three adjacent holes on both lines):
- assume thickness of deposit is 10 m;
- assume SG of 2.5.

Failure to realise these parameters may give reason to review the project at this stage, but success would lead to further percussion drilling.

Stage 3

Further reconnaissance drilling is proposed aimed at achieving the following:-

- Extending the known mineralisation along strike to the south-east from outcrop area 2: two fence-lines of percussion drilling are proposed (lines 240s and 480s, see Figure 4) with hole-spacings of 40 m. The number of holes on each line and their depths will be determined by the results of Stage 2 drilling. For budgetary purposes, a further 500 m of drilling should be assumed. Successful intersections on these two proposed southern lines, and using the same criteria as above, would increase the potential tonnage by a further 1×10^6 tonnes.

Stage 4

Encouragement leads to infill drilling, metallurgical testwork and diamond drilling for geological control.

7. CONCLUSIONS

Work at Wollastonite Creek has reached only a very early stage; however, it is apparent that further expenditure is warran-

ted A genuine exploration target exists and providing commercial end-user criteria are met and a market can be established, reconnaissance percussion drilling must be carried out. It is stressed that no expenditure should be contemplated unless there is a reasonable assurance that a market for the product exists.

At the current stage, there is an expectation of mineralisation grading 30-40% wollastonite and in the order of $1-2 \times 10^6$ tonnes. By comparison to overseas commercial wollastonite deposits, the grade at Wollastonite Creek seems to be lower than desirable. However, if the deposit can be cost-effectively upgraded by either selective mining or by processing techniques and commercial quality can be attained without prohibitive cost-penalties, then economic viability may still be achieved.

Given the extent of the so-called Transition Series of the Gordon Limestone, in proximity to the Devonian Granite, it would not be surprising if the wollastonite forming environment existed elsewhere in EL 17/68.

M.P. Everett

R.W.L. Shaw

for ZETETIC

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APPENDIX ATHE PROPERTIES AND USES OF WOLLASTONITEChemical Composition

Wollastonite, calcium metasilicate, can occur naturally, or be made synthetically, and has a theoretical composition of silica 51.7% and lime 48.3%, giving a chemical formula of CaSiO_3 or CaOSiO_2 . In nature there may be some substitution of iron, manganese or magnesium for calcium.

Wollastonite can be synthesised from its component oxides, or from hydrous gels via xonotlite, $\text{Ca}_6(\text{Si}_6\text{O}_{17})(\text{OH})_2$ which breaks down on heating to yield wollastonite.

Physical Properties

Crystal system	:	Wollastonite, Triclinic; Parawollastonite, Monoclinic.
Form and Habit	:	Bladed crystal masses; acicular.
Colour	:	Usually white; sometimes grey, cream, pale green, red or brown tinged. Streak, white. Sub-transparent to translucent.
Hardness	:	4.5 - 5.0 on Moh's scale.
S.G.	:	2.87 - 3.09 [2.8 - 2.9 in Dana].
Cleavage	:	(100) perfect; (001) and (102) good; (101) imperfect Fracture uneven. Brittle.
Lustre	:	Vitreous. on cleavage surfaces, pearly.
Inversion Temperature	:	Wollastonite - pseudowollastonite, $1.120^\circ \pm 10^\circ\text{C}$.
Melting Point	:	About $1,540^\circ\text{C}$.

Optical Properties

R.I.	:	Alpha 1.616, beta 1.629. gamma 1.631.
Birefringence	:	Weak.
Colour	:	Colourless in thin section.
Relief	:	Fairly high.

- Extinction : Parallel or almost parallel in longitudinal section; oblique in cross-section.
- Interference Figure : Biaxial negative, $2V = 38^\circ - 60^\circ$
- Dispersion : $r < v$, weak.

Properties Important for Commercial Use

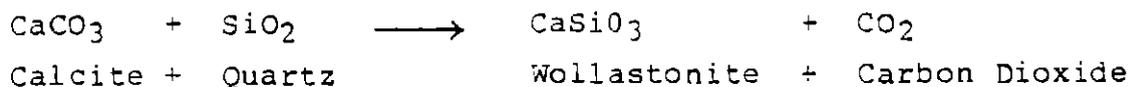
- Apparent density of loose material : 480 - 1.233 Kg/m³ according to grain size
- Solubility in water (neutral) : 0.0095g/100ml at 25°C.
- Coefficient of expansion : 6.5×10^{-6} mm/mm/°C.
- pH in 10% slurry : About 10.
- Brightness (99% - 325 mesh grade) : 92-96% (GE reflectance rating US)
- Chemical activity : Largely inert; decomposed by concentrated hydrochloric acid.

Fluorescence

Some crystals of wollastonite fluoresce in either short-wave or long-wave ultra-violet light, or in both, colours ranging from yellow-orange to pink-orange and more rarely a bluish-green. Specimens may also show deep red phosphorescence. Trials on Wollastonite Creek specimens failed to fluoresce or phosphoresce.

Paragenesis

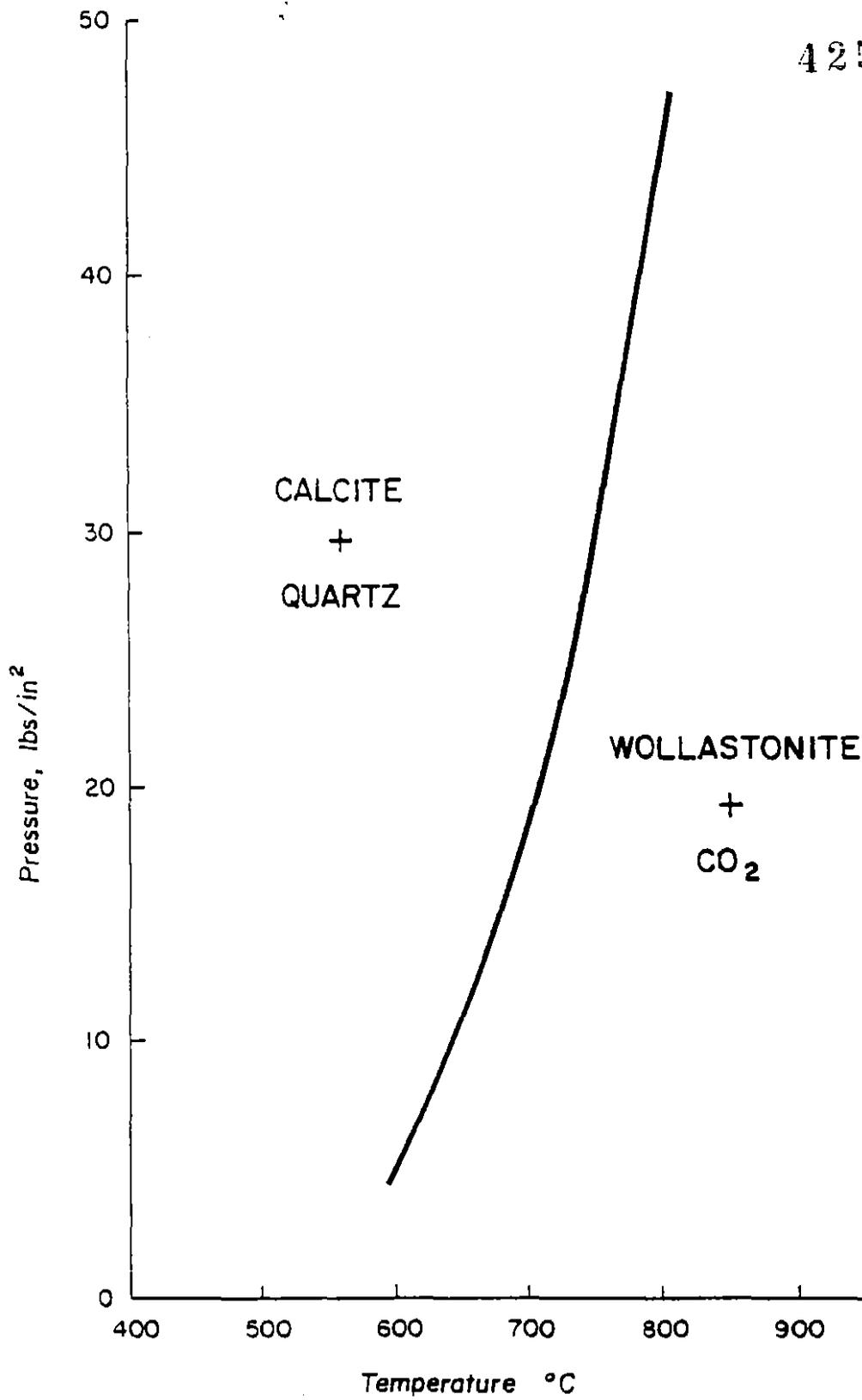
Wollastonite is a common mineral associated with contact metamorphic impure limestones; parawollastonite, although it may occur in the same paragenesis, is rarer. In most occurrences wollastonite occurs as a product of the reaction



The temperature at which wollastonite is formed depends on the conditions obtaining. At low temperatures, quartz and calcite form a stable assemblage but if the temperature rises to about

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ZETETIC / TASMINEX	
<p>$P_{CO_2} - T$ curve for the reaction $CaCO_3 + SiO_2 \rightleftharpoons CaSiO_3 + CO_2$ (after Harker, R.I. & Tuttle, O.F., 1956.)</p>	DRAWN BY : M.P.E.
	DRAFTSMAN : T.G.D.S.
	DATE : Oct. 85
	REVISIONS :
	FILE NO. Tol/85/204
FIG. 8	

500-600°C, the reaction (above) begins and proceeds to the right until the supply of calcite or quartz is exhausted, at a pressure of about 1 atmosphere. The carbon dioxide product, unless it escapes, will cause the pressure to increase and consequently the temperature needed for the required reaction will also increase to possibly 850-900°C (see Figure 8).

In the progressive metamorphism of siliceous dolomites the early stages of the sequence are talc - tremolite - diopside - forsterite - wollastonite - periclase - monticellite.

Commercial Uses of Wollastonite

There was virtually no exploration of this mineral until towards the end of the Second World War, and it was not marketed in any quantity until about 1950.

Production of the wollastonite is mainly consumed by the ceramic industry where it can be used to replace some traditional raw materials. Also, there are the advantages that wollastonite confers on the actual process of making ceramics (e.g. reduced firing times) together with the improved mechanical properties of articles made with wollastonite.

The paint industry also consumes wollastonite where it is used mainly in oil and water based flat paints for exteriors.

Wollastonite may be used in plastics and rubber, where it acts as a semi-reinforcing filler; in the manufacture of abrasives and of welding electrodes; and for insulation, as loose fill and as mineral wool.

Wollastonite has been investigated as a filler and as a coating material in the paper industry.

The above notes relate to those uses described in an Institute of Geological Sciences publication printed in 1970 (see References).

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More recent information (1981) suggests that the major use of wollastonite remains in the ceramic industry as a flux.

There appears to be no Australian production while the Australian consumption is estimated at 200 tonnes per annum. There is no synthetic production worldwide since costs are prohibitive.

The major consumers are as follows:

USA	90,000 tonnes p.a.
India	15,000 " "
Mexico	14,000 " "
Turkey	15,000 " "

The biggest wollastonite mine in the U.S.A. is in New York State, where there are 5×10^6 tonnes grading 59%. This deposit contains garnet as an impurity.

Prices (1981) are 120 Pounds Sterling bagged and dried in England and U.S. \$160 in North America; estimated price in Australia would be about A\$ 200 bagged and dried. There is no shortage of wollastonite on the world market.

The following are considered important criteria in assessing the economic value of a deposit of wollastonite (and most other commercial minerals):

- size of deposit: it is essential that 20 years supply at 50,000 tonnes p.a. is proved, i.e. 1×10^6 tonnes. Continuity of supply is important, especially to the Japanese market.
- ability to refine the product to the purity requirements of the end user.
- whiteness, particle size.
- mining economics: ability to mine, process and ship the product at the right price.

END
APPX B1

WOLLASTONITE DEPOSIT - LIMESTONE CREEK

APPENDIX B2

Mineralogical - Petrological Studies

Wollastonite and Calc Silicate drill samples - E.L. 17/68

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17th February, 1986.

MEMORANDUM

TO: N.Moony
FROM: C.Whitenead ✓
SUBJECT: WOLLASTONITE. E.L. 17/68

On the 13th February, 1986. eight samples of Kara drill core/rock outcrop representing potential Wollastonite material were forwarded to Wally Sander, C.M.S., Adelaide for mineralogical/petrological examination.

Preliminary details of the samples are as follows:-

<u>SAMPLE No.</u>	<u>TYPE</u>	<u>LOCATION</u>	<u>DOM No.</u>	<u>DEPTH</u>
WC 1	Core	Kara N. Mag Anomaly (N)	DOM 343	165.0 m
WC 2	Core	Kara N. Mag Anomaly (N)	DOM 343	157.34m
WC 3	Core	Location L.5	DOM 329	54.10m
WC 4	Core	Location L.5	DOM 334	81.10m
WC 5	Rock	Limestone Creek	-	-
WC 6	Rock	Limestone Creek	-	-
WC 7	Core	Kara N. Mag Anomaly (S)	DDH 288A	26.30m
WC 8	Core	Kara N. Mag Anomaly (S)	DOM 289	74.6 m

Spilts of each of the above are being chemically analysed by Amdel for SiO₂, TiO₂, Al₂O₃, MnO, MgO, CaO, Na₂O, K₂O, P₂O₅, LOI and Tertel Fe.

Representative samples of all the above remain at the Burnie Office.



39 Beulah Road
Norwood, S.A. 5067
Telephone 42 5659

Central Mineralogical Services

Mr. C.H. Whitehead
Tasmania Mines N.L.
P.O. Box 815
BURNIE / TAS. 7320

19th February, 1986

REPORT CMS 86/2/11

YOUR REFERENCE:	Letter dated 17.2.1986
DATE RECEIVED:	14th February, 1986
SAMPLE NOS.:	WC 1 - WC 8
SUBMITTED BY:	C.H. Whitehead
WORK REQUESTED:	Mineralogy

TASMANIA MINES N.L.
DISTRIBUTION

File No:

Order Code:

RECEIVED

1 FEB 1986

H.W. Fander
H.W. Fander, M. Sc.

P.L.

P.L.

Sh.

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REPORT CMS 86/2/11

Eight samples, WC 1 - WC 8, were received for mineralogical examination with special emphasis on the occurrence of wollastonite; thin-sections were prepared, and offcuts were subjected to carbonate stain tests.

- WC 1 (T.S. 55486) Calcite stain test positive.
This is calcite marble, containing small amounts of contact-metamorphic silicates and fine pyrrhotite. The original rock was a faintly bedded impure limestone.
- The rock consists of at least 98 % of well-crystallized, interlocking calcite patches; there are scattered small (mostly < 0.1 mm) flakes of talc, grains of diopside and colourless grossularite garnet, as thin streaks or stringers and occasional larger clusters, probably representing thin detrital quartz/clay laminations in the original rock.
- WC 2 (T.S. 55487) Calcite stain test positive.
This is a talcose calcite marble with relatively conspicuous but fine pyrrhotite.
- The rock consists dominantly (> 98 %) of interlocking crystals of calcite, with scattered small embedded talc flakes; there are more distinct, thin, deformed and folded bands consisting of fine talc intergrown with finely granular calcite and pyrrhotite. These represent original pyritic, argillaceous laminations in which the pyrite was very probably syngenetic. Since no other silicates were detected, the metamorphic grade of this rock appears to be lower than in WC 1.
- WC 3 (T.S. 55488) Calcite stain test positive in patches.
This is best termed a calc-silicate rock, and probably represents a calcareous sandstone or siltstone with more calcareous lenses and bands.
- The main silicates present are wollastonite, grossularite and vesuvianite, with minor diopside; both vesuvianite and grossularite have a dull greasy-yellow appearance in hand specimen, and the wollastonite is white. Vesuvianite tends to form relatively large poikiloblastic crystals (up to 5 mm in size), grossularite occurs as irregular, shapeless masses, and wollastonite forms masses of small matted/interlocking prismatic crystals.
- Finely granular diopside and calcite particles are interspersed and embedded in the other minerals; in addition, calcite forms more substantial granular masses with minor silicates. Wollastonite comprises about 50 % of the rock.
- WC 4 (T.S. 55489) Calcite stain test negative.
This is a calc-silicate rock, more specifically a wollastonite-diopside rock; carbonate is absent.
- The rock is composed of about 60 % wollastonite, 20 % diopside, and 20 % quartz and plagioclase. The wollastonite generally occurs as sheaves of prismatic to acicular crystals, full of inclusions of micro-granular diopside, ranging from < 10 μ to 250 μ across; individual

wollastonite crystals are up to 3 mm in length, but generally smaller. Small grains (averaging 100 μ) of quartz and labradorite are scattered throughout the rock.

Distributions and grainsizes of the minerals, particularly wollastonite, are variable; in places, wollastonite forms patches of matted crystals up to several millimetres across, essentially free of inclusions of other minerals.

It is not known whether diopside would be regarded as deleterious in a wollastonite product; there seems no mineralogical reason why it should not be acceptable, and this particular rock may well meet the required specifications. Copies of articles in "Industrial Minerals" (July 1975, August 1981) have previously been supplied to Mr. Moony and should be available at the Tasmania Mines office.

WC 5 (T.S. 55490) Calcite stain test negative.
This is a wollastonite-diopside rock, with small amounts of other minerals, including pyrrhotite.

The major component is wollastonite, comprising 65-70 % of the rock, as small matted prismatic crystals and occasional larger subradiating masses; some crystals are up to 1-2 mm long, but most are in the 0.1 - 0.3 mm range. Small aggregates of microgranular diopside are embedded in the wollastonite matrix; individual diopside grains range from 10-100 μ , and aggregates are mostly around 100-300 μ . Other minerals, present in amounts below 1 %, include granular sphene, pyrrhotite, and ultrafine carbonate (< 20 μ grains). The pyrrhotite occurs as scattered grains 10-200 μ across, mostly around 100 μ , and occasionally in veinlets (< 300 μ wide) with wollastonite and carbonate.

WC 6 (T.S. 55491) Calcite stain test positive in parts.
This calc-silicate rock consists dominantly of wollastonite and diopside, with lenses of calcite and scattered pyrrhotite.

Small matted wollastonite crystals and larger subradiating masses form the matrix for small aggregates of microgranular diopside, very similar to WC 5; the wollastonite is generally coarser (0.5 to 1 mm crystals are common) and diopside is less dispersed, being more confined to aggregates. Calcite lenses evidently comprise only a minor proportion of the rock (< 10 %). Wollastonite is about 70 %, diopside 25-30 %, and there are traces of pyrrhotite and sphene - both of these are scattered through the rock and cause the grey colour; pyrrhotite also occurs in concentrations adjacent to calcite lenses.

The photomicrograph (magnification = 30x) shows typical diopside aggregates in a general matrix of wollastonite, with small dark grains of sphene and pyrrhotite.

WC 7 (T.S. 55492) Calcite stain test positive.
This is a weakly diopsidic and talcose calcite-marble with conspicuous pyrrhotite.

The rock consists of > 95 % coarse interlocking plates of calcite; there are small clusters of microgranular diopside throughout, with parallel alignment which probably reflects original bedding. Bands of diopside and fine talc occur, with associated cloudy sphene. Pyrrhotite also tends to be concentrated in bands, as grains up to 300 μ in size, but is present elsewhere in the rock as well. Individual talc flakes and diopside grains seldom exceed 50 μ in size, though aggregates are larger.

WC 8

(T.S. 55493) Calcite stain test positive.

This is essentially a diopside-calcite-marble, with traces of carbonaceous matter and pyrrhotite.

Calcite is the major component, as coarse and fine interlocking crystals forming haphazard patches. Diopside occurs as poikiloblastic and granular crystals up to 1 mm across, and as distinctive aggregates of radiating needles; the diopside tends to occur in bands and lenses, and some is pigmented with carbonaceous matter.

Note:

Since wollastonite is relatively soft (for a silicate), with a Mohs hardness of $4\frac{1}{2}$ - 5, and is brittle, it is perhaps not always easy to distinguish from carbonate unless it is markedly fibrous. The carbonate stain test is a convenient, quick and easy way to identify calcite (and ankerite) and is useful in these particular rocks in determining the presence (and approximate) proportions of calcite/silicates. Wollastonite and diopside are generally colourless, other silicates are yellowish or greenish.

H.W. Fander, M.Sc.

WOLLASTONITE / CALC SILICATE ROCK SAMPLES.SAMPLE N° W.C. 1.

LOCATION. — KARA NORTH MAGNETITE ANOMALY.

ROCK TYPE — DRILL CORE.

DDH. N°. — DDH 343 , DEPTH 165.00m.

CMS REPORT 86/2/11 — MINERALOGY — CALCITE MARBLE.

WC 1

(T.S. 55486) Calcite stain test positive.

This is calcite marble, containing small amounts of contact-metamorphic silicates and fine pyrrhotite. The original rock was a faintly bedded impure limestone.

The rock consists of at least 98 % of well-crystallized, interlocking calcite patches; there are scattered small (mostly < 0.1 mm) flakes of talc, grains of diopside and colourless grossularite garnet, as thin streaks or stringers and occasional larger clusters, probably representing thin detrital quartz/clay laminations in the original rock.

CHEMICAL ANALYSIS.

(ANDEL - SPT 93/86)

SiO ₂	—	3.30
TiO ₂	—	< 0.01
Al ₂ O ₃	—	0.26
Fe ₂ O ₃	—	0.47
MnO	—	0.02
MgO	—	0.96
CaO	—	62.8
Na ₂ O	—	< 0.01
K ₂ O	—	< 0.05
P ₂ O ₅	—	< 0.01

WOLLASTONITE / CALC SILICATE ROCK SAMPLES.SAMPLE N° W.C. 2.

LOCATION — KARA NORTH MAGNETITE ANOMALY.

ROCK TYPE. — DRILL CORE.

DOH N°. — DOH. 343. DEPTH. 157.34m.

C.M.S. REPORT 86/2/11 — MINERALOGY — CALCITE MARBLE.

WC 2 (T.S. 55487) Calcite stain test positive.
This is a talcose calcite marble with relatively conspicuous but fine pyrrhotite.

The rock consists dominantly (> 98 %) of interlocking crystals of calcite, with scattered small embedded talc flakes; there are more distinct, thin, deformed and folded bands consisting of fine talc intergrown with finely granular calcite and pyrrhotite. These represent original pyritic, argillaceous laminations in which the pyrite was very probably syngenetic. Since no other silicates were detected, the metamorphic grade of this rock appears to be lower than in WC 1.

CHEMICAL ANALYSIS.

(ANDEL - SPT 93/86)

SiO ₂	-	2.56
TiO ₂	-	<0.01
Al ₂ O ₃	-	0.20
Fe ₂ O ₃	-	0.50
MnO	-	0.03
MgO	-	1.70
CaO	-	52.0
Na ₂ O	-	<0.01
K ₂ O	-	<0.05
P ₂ O ₅	-	<0.01
LOI	-	41.3.

WOLLASTONITE / CALC SILICATE ROCK SAMPLES.SAMPLE N° W.C. 3.

LOCATION — LOCATION. L. 5.

ROCK TYPE — DRILL CORE.

DDH. N° — DDH. 329 , DEPTH 54.10 m.

C.M.S. REPORT 86/2/11 — WOLLASTONITE 50%.

WC 3 (T.S. 55488) Calcite stain test positive in patches. This is best termed a calc-silicate rock, and probably represents a calcareous sandstone or siltstone with more calcareous lenses and bands.

The main silicates present are wollastonite, grossularite and vesuvianite, with minor diopside; both vesuvianite and grossularite have a dull greasy-yellow appearance in hand specimen, and the wollastonite is white. Vesuvianite tends to form relatively large poikiloblastic crystals (up to 5 mm in size), grossularite occurs as irregular, shapeless masses, and wollastonite forms masses of small matted/interlocking prismatic crystals.

Finely granular diopside and calcite particles are interspersed and embedded in the other minerals; in addition, calcite forms more substantial granular masses with minor silicates. Wollastonite comprises about 50 % of the rock.

CHEMICAL ANALYSIS.

(AMDEL SPT 93/86)

SiO ₂	-	33.6	CaO	-	45.4
TiO ₂	-	0.14	Na ₂ O	-	< 0.01
Al ₂ O ₃	-	2.48	K ₂ O	-	< 0.05
Fe ₂ O ₃	-	1.29	P ₂ O ₅	-	0.20
MnO	-	0.09	LOI	-	13.4
MgO	-	1.55			

WOLLASTONITE / CALC SILICATE ROCK SAMPLES.SAMPLE N° W.C. 4.

LOCATION — LOCATION L.S.
 ROCK TYPE — DRILL CORE.
 DDH. N° — DDH 334 DEPTH 81.10 m.

C.M.S. REPORT 86/2/11 — WOLLASTONITE 60%

4C 4 (T.S. 55489) Calcite stain test negative.
 This is a calc-silicate rock, more specifically a wollastonite-dioiside rock; carbonate is absent.

The rock is composed of about 60 % wollastonite, 20 % dioiside, and 20 % quartz and plagioclase. The wollastonite generally occurs as sneaves of prismatic to acicular crystals, full of inclusions of microgranular dioiside, ranging from $< 10 \mu$ to 250μ across; individual

wollastonite crystals are up to 3 mm in length, but generally smaller. Small grains (averaging 100μ) of quartz and labradorite are scattered throughout the rock.

Distributions and grainsizes of the minerals, particularly wollastonite, are variable; in places, wollastonite forms patches of matted crystals up to several millimetres across, essentially free of inclusions of other minerals.

It is not known whether dioiside would be regarded as deleterious in a wollastonite product; there seems no mineralogical reason why it should not be acceptable, and this particular rock may well meet the required specifications. Copies of articles in "Industrial Minerals" (July 1975, August 1981) have previously been supplied to Mr. Moony and should be available at the Tasmania Mines office.

CHEMICAL ANALYSIS.

ANDEL SPT 98/86.

SiO ₂ -	58.1	CaO -	31.8
TiO ₂ -	0.16	Na ₂ O -	0.04
Al ₂ O ₃ -	1.80	K ₂ O -	1.25
Fe ₂ O ₃ -	1.00	P ₂ O ₅ -	0.09
MnO -	0.06	LOI -	0.40.
MgO -	4.92		

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WOLLASTONITE /CALC SILICATE ROCK SAMPLES.

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SAMPLE N° W.C. 5.

LOCATION — LIMESTONE CREEK.

ROCK TYPE — GRAB SAMPLE - OUTCROP W.2
(C.H. WHITEHEAD)C.M.S. REPORT 86/2/11 - WOLLASTONITE 65-70%WC 5 (T.S. 55490) Calcite stain test negative.This is a wollastonite-diopside rock, with small amounts of other minerals, including pyrrhotite.

The major component is wollastonite, comprising 65-70 % of the rock, as small matted prismatic crystals and occasional larger subradiating masses; some crystals are up to 1-2 mm long, but most are in the 0.1 - 0.3 mm range. Small aggregates of microgranular diopside are embedded in the wollastonite matrix; individual diopside grains range from 10-100 μ , and aggregates are mostly around 100-300 μ . Other minerals, present in amounts below 1 %, include granular sphene, pyrrhotite, and ultrafine carbonate (< 20 μ grains). The pyrrhotite occurs as scattered grains 10-200 μ across, mostly around 100 μ , and occasionally in veinlets (< 300 μ wide) with wollastonite and carbonate.

CHEMICAL ANALYSIS

AMDEL SPT 93/86.

SiO ₂	-	50.5	CaO	-	40.1
TiO ₂	-	0.23	Na ₂ O	-	< 0.01
Al ₂ O ₃	-	1.47	K ₂ O	-	< 0.05
Fe ₂ O ₃	-	1.30	P ₂ O ₅	-	0.22
MnO	-	0.02	LOI	-	0.34.
MgO	-	4.08.			

WOLLASTONITE / CALC SILICATE ROCK SAMPLES.

0106

SAMPLE N° W.C. 6.

LOCATION - LIMESTONE CREEK.

ROCK TYPE - GRAB SAMPLE (N. MOUNT) - OUTCROP W. 2.

P.M.S. REPORT. 86/2/11. - WOLLASTONITE 70%.

WC 6 (T.S. 55491) Calcite stain test positive in parts. This calc-silicate rock consists dominantly of wollastonite and diopside, with lenses of calcite and scattered pyrrhotite.

Small melted wollastonite crystals and larger subradiating masses form the matrix for small aggregates of microgranular diopside, very similar to WC 5; the wollastonite is generally coarser (0.5 to 1 mm crystals are common) and diopside is less dispersed, being more confined to aggregates. Calcite lenses evidently comprise only a minor proportion of the rock (< 10 %). Wollastonite is about 70 %, diopside 25-30 %, and there are traces of pyrrhotite and sphene - both of these are scattered through the rock and cause the grey colour; pyrrhotite also occurs in concentrations adjacent to calcite lenses.

The photomicrograph (magnification = 30x) shows typical diopside aggregates in a general matrix of wollastonite, with small dark grains of sphene and pyrrhotite.

CHEMICAL ANALYSIS.

ANDEL. SPT. 93/86

SiO ₂ - 52.1	CaO - 39.8
TiO ₂ - 0.26	Na ₂ O - <0.01
Al ₂ O ₃ - 1.38	K ₂ O - <0.05
Fe ₂ O ₃ - 1.10	P ₂ O ₅ - 0.29
MnO - 0.02	LOI - 0.44.
MgO - 4.48	

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WOLLASTONITE / CALC SILICATE ROCK SAMPLES.SAMPLE N° W.C. 7.

LOCATION — KARA NORTH MAGNETITE ANOMALY.
 ROCK TYPE — DRILL CORE.
 DDH. N° — D. 288A - DEPTH 26.30m.

C.M.S. REPORT - 86/2/11 - CALCITE MARBLE.

WC 7 (T.S. 55492) Calcite stain test positive.
 This is a weakly diopsidic and talcose calcite-marble with conspicuous pyrrhotite.

The rock consists of > 95 % coarse interlocking plates of calcite; there are small clusters of microgranular diopside throughout, with parallel alignment which probably reflects original bedding. Bands of diopside and fine talc occur, with associated cloudy sphene. Pyrrhotite also tends to be concentrated in bands, as grains up to 300 μ in size, but is present elsewhere in the rock as well. Individual talc flakes and diopside grains seldom exceed 50 μ in size, though aggregates are larger.

CHEMICAL ANALYSIS.

AMDEL. SPT. 93/86.

SiO ₂	-	6.85	CaO	-	48.6
TiO ₂	-	0.04	Na ₂ O	-	< 0.01
Al ₂ O ₃	-	1.26	K ₂ O	-	0.68
Fe ₂ O ₃	-	0.74	P ₂ O ₅	-	< 0.01.
MnO.	-	0.02	LOI	-	36.8.
MgO	-	3.50			

0153

425158

WOLLASTONITE / CALC SILICATE ROCK SAMPLESSAMPLE NO W.C. 8.

LOCATION — KARA. NORTH MAGNETITE ANOMALY.

ROCK TYPE. — DRILL CORE.

DDH. N°. — DDH. 289 , DEPTH. 74.6m.

C.M.S. REPORT - 86/2/11.

DIOPSIDE - CALCITE MARBLE.LC 3

(T.S. 55493) Calcite stain test positive.

This is essentially a diopside-calcite-marble, with traces of carbonaceous matter and pyrrhotite.

Calcite is the major component, as coarse and fine interlocking crystals forming haphazard patches. Diopside occurs as poikiloblastic and granular crystals up to 1 mm across, and as distinctive aggregates of radiating needles; the diopside tends to occur in bands and lenses, and some is pigmented with carbonaceous matter.

CHEMICAL ANALYSIS.

AMDEL SPT. 93/86.

SiO ₂ -	27.4	CaO -	39.4
TiO ₂ -	0.05	Na ₂ O -	< 0.01
Al ₂ O ₃ -	0.76	K ₂ O -	< 0.05
Fe ₂ O ₃ -	0.45	P ₂ O ₅ -	< 0.01
MnO -	0.03	LOI -	21.3
MgO -	9.05		

WOLLASTONITE DEPOSIT - LIMESTONE CREEK

APPENDIX B3

Surface Rock Samples - Analytical Results

LIMESTONE CREEK - WOLLASTONITE INVESTIGATIONSSURFACE ROCK SAMPLES - ASSAY RESULTS

<u>SAMPLE NO.</u>	<u>ANALYSIS</u>	<u>ASSAYS</u>				<u>CALCULATED</u>
		<u>CaO%</u>	<u>MgO%</u>	<u>SiO₂%</u>	<u>CO₂%</u>	<u>CaSiO₃</u>
LST/10	62438	15.00	2.75	61.0	0.60	29.52
LST/11	62439	14.50	2.90	57.5	1.00	27.45
LST/12	62440	24.50	3.00	53.5	0.75	48.75
LST/13	62441	16.50	2.95	59.0	0.65	32.42
LST/14	62442	17.50	2.75	58.0	0.70	34.39
LST/15	62443	21.00	2.60	59.0	0.55	42.05
LST/16	62444	20.50	3.00	62.5	0.65	40.70
LST/17	62445	15.50	3.00	60.0	0.55	30.66
LST/18	62446	17.50	2.70	62.5	0.55	34.80
LST/19	62447	32.00	3.25	57.5	2.35	60.07
LST/20	62448	19.50	3.15	57.0	0.36	37.46

REFERENCE PLANT #118T.

WOLLASTONITE DEPOSIT - LIMESTONE CREEKAPPENDIX B4

Wollastonite Percussion drilling programme. Hole Nos WL1 to WL9.

- Drill Logs/Assay Results

APPENDIX NO 1BLIMESTONE CREEK WOLLASTONITE INVESTIGATIONS

Air-track Drill Samples W L 1 to W L 9
Assay Results CaO, MgO, SiO₂

425166

LOCATION - LIMESTONE CREEK - E.L. 17/68.

DEPTH DRILLED (m) = 11.0m

0158 (WOLLASTONITE OCCURRENCES)

DATE DRILLED = 3rd FEB. 1987

GRID COORDINATES

NORTHING - REF. PLAN. NO 4187

ASSAYED BY = AMDEL

EASTING - 1590m N.

ASSAY DATE =

R.L. - 563m E.

ASSAY REPORT NO = AC-2851/87

DRILL ASSAY RECORD

DEPTH(m)		INTERVAL (m)	ASSAYS		
FROM	TO		CaO %	MgO %	SO ₂ %
0	1	1	37.5	3.60	44.4
1	2	1	38.0	2.85	43.3
2	3	1	39.4	3.60	35.7
5	6	1	36.3	3.25	42.2
6	7	1	40.6	2.25	38.1
7	8	1	35.5	2.80	45.7
8	9	1	38.6	2.20	41.1
10	11	1	35.9	2.50	50.0

LOCATION - LIMESTONE CREEK - EL. 17/68.

425167
DEPTH DRILLED (m) = 24.0m

0101
(NOLLASTONITE OCCURRENCES).

DATE DRILLED = 15 FEB. 1987.

GRID COORDINATES

NORTHING - REF. PLAN N° 4187

ASSAYED BY = AMDEL

EASTING - 1586m N.

ASSAY DATE =

R.L. - 533.5m E.

ASSAY REPORT N° = RC. 2874187

DRILL ASSAY RECORD

DEPTH(m)		INTERVAL (m)	ASSAYS		
FROM	TO		CaO %	MgO %	SiO ₂ %
0	1	1	40.1	4.10	45.1
1	2	1	36.6	3.35	43.4
2	3	1	27.8	3.35	44.8
3	4	1	42.6	4.55	35.4
5	6	1	39.0	3.70	41.0
6	7	1	31.1	3.35	49.1
7	8	1	38.8	2.70	42.0
8	9	1	36.3	3.20	41.9
9	10	1	39.1	2.60	40.9
10	11	1	45.4	2.25	29.7
11	12	1	34.2	3.10	47.2
12	13	1	31.7	2.95	48.3
13	14	1	36.5	2.60	43.3
14	15	1	37.5	2.50	37.5
15	16	1	36.0	2.60	42.4

425169

LOCATION - LIMESTONE CREEK - E.L 17/68
(NOLLASTONITE OCCURRENCES)

DEPTH DRILLED (m) = 32.0m

DATE DRILLED = 7th FEB. 1987

GRID COORDINATES

NORTHING - REF. PLAN. 1487

ASSAYED BY = AMDEL

EASTING - 1578 m. N.

ASSAY DATE =

R.L - 517 m E.

ASSAY REPORT NO = AC 2874/87

DRILL ASSAY RECORD

DEPTH (m)		INTERVAL (m)	ASSAYS		
FROM	TO		CaO %	MgO %	SiO ₂ %
0	3	3	4.50	2.85	50.7
3	6	3	23.4	4.65	47.9
6	9	3	38.3	2.85	44.4
9	12	3	32.3	3.10	49.1
12	15	3	29.4	2.85	46.2
15	18	3	31.0	3.25	47.2
18	21	3	30.8	2.90	47.8
21	24	3	28.7	3.70	48.0
24	27	3	27.5	3.10	57.2
27	30	3	23.9	4.85	48.6
30	32	2	21.9	6.60	46.6

013

WOLLASTONITE DEPOSIT - LIMESTONE CREEK

APPENDIX B5

Diamond Drilling Programme

DDMS19

DDMS20

LOCATION - LIMESTONE CREEK - E.L. 17/68.

DEPTH DRILLED (m) = 200.00m

0174 (WOLLASTONITE OCCURRENCES)

DATE DRILLED = FEB/MAY 1987

GRID COORDINATES

REF PLAN H/ET

NORTHING - 641523m NORTH

ASSAYED BY = ANALABS

EASTING - 400517m EAST

ASSAY DATE = 10th SEPT 1987

R.L - -

ASSAY REPORT NO = J366E

DRILL ASSAY RECORD

DEPTH(m)		INTERVAL	ASSAYS				CALCULATED
FROM (m)	TO (m)	(m) SAMPLE N°	CaO %	MgO %	SiO ₂ %	CO ₂ %	CaSiO ₃
3.05	4	373	31.50	2.35	49.5	2.50	58.62
4	5	374	40.00	1.60	40.0	10.80	52.48
5	6	375	35.50	2.05	42.5	9.20	49.30
6	7	376	31.50	2.10	49.5	1.85	60.38
7	8	377	42.50	1.40	31.5	20.00	35.21
8	9	378	35.50	2.32	45.0	9.80	47.64
9	10	379	34.50	2.00	48.5	4.80	58.83
10	11	380	32.50	2.10	52.0	2.10	61.83
11	11.61	381	31.50	2.00	51.5	4.00	58.21
11.61	12.21	382	13.50	1.90	60.0	0.34	26.66
12.21	12.81	383	41.40	2.05	40.5	13.20	30.13
12.81	13.35	384	35.00	1.85	46.0	7.80	51.89
13.35	14.12	385	33.00	2.15	51.5	5.00	35.20
14.12	15.17	386	32.50	2.05	52.0	5.60	52.61
15.17	16	387	36.50	2.10	49.5	4.00	65.25
16	17	388	34.00	2.00	47.5	4.40	58.83

DRILL HOLE N° - DDH.
425175 519

LOCATION - LIMESTONE CREEK - E.L. 17/68
0111 (NOLLASTONITE OCCURRENCES)

DEPTH DRILLED (m) = 200.00m

GRID COORDINATES

NORTHING - REF. PLAN. 4/87
1583m N
EASTING - 517m E
R.L. -

DATE DRILLED = FEB/MAY. 1987

ASSAYED BY = ANBLABS

ASSAY DATE = 10th SEPT. 1987

ASSAY NUMBER = 53668

DRILL ASSAY RECORD

DEPTH (m)		INTERIAL	ASSAYS				CALCULATED CaSiO ₃
FROM (m)	TO (m)	(m) SAMPLE N°	CaO %	MgO %	SiO ₂ %	CO ₂ %	
17	18	390	31.0	2.00	48.5	3.50	55.00
18	19	391	31.0	2.05	49.0	4.20	53.13
19	20	391	28.0	2.00	53.0	3.00	50.13
20	21	392	32.0	2.55	47.5	6.40	49.40
21	22	393	33.0	1.95	46.5	6.60	50.96
22	23	394	27.5	1.95	53.0	4.80	44.33
23	24	395	27.5	1.95	52.5	5.60	42.15
24	25	396	30.0	2.05	49.5	2.05	56.76
25	26	397	28.5	1.95	47.0	5.00	45.88
26	27	398	31.0	2.05	48.0	5.60	49.40
27	28.30	399	28.5	2.15	52.5	2.70	51.90

DRILL HOLE N° - DDM

425176

520

LOCATION - LIMESTONE CREEK - E.L. 17/68.

DEPTH DRILLED (m) = 200.00m

(NOLLASTONITE OCCURRENCES).

0175

DATE DRILLED = MAY/AUG 1987.

GRID COORDINATES

NORTHING - 541 898 m N

ASSAYED BY = ANALABS.

EASTING - 400439 m E.

ASSAY DATE = 10th SEPT 1987.

R.L. -

ASSAY REPORT N° = 53668.

DRILL ASSAY RECORD

DEPTH (m)		INTERVAL	ASSAYS				CALCULATED
FROM (m)	TO (m)	(m) SAMPLE N°	CaO %	MgO %	SiO ₂ %	CO ₂ %	Ca SiO ₃
2	3	400	29.50	2.65	49.0	4.20	50.01
3	4	401	43.50	3.25	39.5	14.00	53.24
4.35	5.0	402	44.00	2.95	39.0	15.20	57.16
5	6	403	47.00	3.55	35.0	18.50	48.68
6	7	404	46.00	3.75	33.5	19.50	43.91
7	8	405	46.00	3.25	31.5	16.60	51.58
8	9	406	38.50	2.70	38.0	13.20	44.95
9	10	407	31.50	2.35	44.0	7.60	45.26
10	11	408	44.00	2.60	34.0	17.00	46.61
11	12	409	47.00	2.80	35.0	18.20	49.30
12	13	410	36.00	3.80	56.0	0.60	73.02
13	14	411	26.00	2.55	56.0	4.40	42.26
14	15	412	21.50	2.30	55.5	3.80	34.49
15	16	413	42.50	2.75	36.5	18.80	46.40
16	17	414	43.00	3.00	38.0	14.20	51.58
17	18	415	35.50	2.15	50.5	3.65	63.90

LOCATION - LIMESTONE CREEK - E.L. 17/68.

DEPTH DRILLED (m) = 200.00m

01. (NOLLASTONITE OCCURRENCES).

DATE DRILLED = MAY/AUG. 1967

GRID COORDINATES

REF. PLAN. N° 4187

NORTHING -

1896 m N.

ASSAYED BY = ANALABS.

EASTING -

439 m E.

ASSAY DATE = 10th SEPT 1967

R.L. -

ASSAY REPORT N° = 53668.

DRILL ASSAY RECORD

DEPTH (m)		INTERVAL	ASSAYS				CALCULATED CaSiO ₃
FROM (m)	TO (m)	(m) SAMPLE NO°	CaO %	MgO %	SiO ₂ %	CO ₂ %	
18	19	62416	41.00	1.90	40.0	12.20	57.16
19	20	47	33.50	2.75	49.0	3.45	60.28
20	21	418	38.00	1.80	37.5	13.40	43.29
21	22	419	44.50	2.25	34.0	15.40	57.58
22	23	420	38.00	2.80	43.5	8.60	56.03
23	24	421	35.50	2.35	47.0	6.60	56.14
24	25	422	38.50	1.95	40.5	11.00	50.75
25	26	423	43.50	2.20	31.5	16.40	46.81
26	27	424	37.00	2.45	42.5	8.60	53.96
27	28	425	31.50	2.50	48.0	5.60	50.44
28	29	426	35.00	2.45	44.5	8.40	50.36
29	30	427	31.00	2.45	47.5	5.40	49.92
30	31	428	32.50	2.35	46.5	5.80	51.99
31	32	429	32.00	2.50	45.0	5.00	53.13
32	33	430	33.00	2.35	48.0	7.00	48.92
33	34	431	30.50	3.15	48.0	7.20	44.22

01/79

WOLLASTONITE DEPOSIT - LIMESTONE CREEK

APPENDIX B6

Abermet/CMS - Bench test work results

0180

425180

Aberfoyle Resources Limited

Incorporated in Victoria

TECHNICAL SERVICES DIVISION

39 River Road
Wivenhoe
Tasmania 7320
Australia
PO Box 952
Burnie
Tasmania 7320
Telephone: (004) 31 6333
Facsimile: (004) 31 6896
Telex: AA59061

FILE NO: 50.6.4

4th April, 1986

Mr. N. E-Moony,
Tasmanian Mines N.L.,
P.O. Box 315,
BURNIE, TAS. 7320

Dear Nick,

Tasmanian Mines O/N 5758 - Wollastonite Sample

Dry sample received 1/4/86

Total Weight - 11689 grams

Wet Screen at 38 microns

	<u>Wt(g)</u>	<u>Wt(%)</u>
+38	8073	69.1
-38	31616	30.9
Total	11689	

- 38 fraction then passed through Rapid dry magnetic separator.

<u>1.0 amp</u>	Ferro	Mag 1(4mm)	Mag 2(3mm)	Non-Mags
Wt (g)	0.3	2.9	6.3	231.6
Wt (%)	0.1	1.2	2.3	95.9
<u>1.5 amp</u>				
Wt (g)	0.4	4.5	23.7	230.5
Wt (%)	0.1	1.7	9.2	39.0
<u>2.4 amp</u>				
Wt (g)	0.3	10.6	184.3	344.1
Wt (%)	0.2	2.0	34.2	63.6

-38 fraction still retained at Abermet in wet state. Unable to settle.

Yours sincerely,



Kevin Gibbs,
Laboratory Supervisor.

0183
Aberfoyle Resources Limited

Incorporated in Victoria

TECHNICAL SERVICES DIVISION

39 River Road
Wivenhoe
Tasmania 7320
Australia
PO Box 952
Burnie
Tasmania 7320
Telephone: (004) 31 6333
Facsimile: (004) 31 6896
Telex: AA59061

FILE NO: 30.6.4

3rd June, 1986

Mr. N. E-Moony,
Tasmania Mines N.L.,
P.O. Box 815,
BURNIE. TAS. 7320

Dear Nick,

Re: Wollastonite Testwork - O/N 6109

Testwork on wollastonite to enable you to identify diopside has been finalised and the results are shown herewith.

As requested the material was sized and fractions submitted for magnesium analysis.

Results obtained were as follows :

Sieve Size (microns)	%Wt	%Mg	%Dist.
+300	11.3	2.90	13.9
+150	28.7	2.65	32.3
+ 75	14.0	2.60	15.5
+ 38	8.9	2.20	8.3
- 38	37.1	1.90	30.0
Head (Calc.)	100.0	2.35	100.0

Testwork was conducted on crushed material previously submitted on the 1/4/86.

This was supplied for magnetic separator testwork which was completed on O/N 5758.

Trust this is to your satisfaction and finds you well.

Yours sincerely,



G. C. Tapp,
Technical Officer.



0182

SIZING SHEET - 1

Project No. 6109
Date 8/5/86

Lab. No. 86/62

Testwork by KG
Checked by
Sieve Set No.
Cyclosizer No.

Sample Ref. and Description WOLLASTONITE

Original wt. 144.12 g
Wet sieve o/s wt. 137.9 g %
Sieved wt. loss 0.02 g %
* -38 μm collected 6.66 g
* -2/-5 μm collected

SIEVE DATA:
BS410 standard
Round 200mm
Woven wire
Stainless steel
Square aperture

DECANT DATA:
Settling height mm
Settling time min
Water temp. °C
Dispersant(s)
No. of decant

+38 μm SIZING BY:-
Hand wet sieving (Pretreatment)
Ro - Tap dry sieving min

CYCLOSIZER DATA:
Run time 20 minutes
Water temperature °C
Rotameter 185mm

s.g. of dry solids
-38 μm SIZING BY:-
Decant/Cyclosizer

CMS No.	Sieve Size (Microns)	Z	% Wt.	dg	Units	DIST
				Mg		
	+ 850					
	- 850 + 600					
	- 600 + 425					
<u>3292</u>	- 425 + 300	<u>16.28</u>	<u>11.3</u>	<u>2.90</u>	<u>47.21</u>	<u>13.9</u>
	- 300 + 212					
<u>3293</u>	- 212 + 150	<u>41.36</u>	<u>28.7</u>	<u>2.65</u>	<u>109.60</u>	<u>32.3</u>
	- 150 + 106					
<u>3294</u>	- 106 + 75	<u>20.17</u>	<u>14.0</u>	<u>2.60</u>	<u>52.44</u>	<u>15.5</u>
	- 75 + 53					
<u>3295</u>	- 53 + 38	<u>12.82</u>	<u>8.9</u>	<u>2.20</u>	<u>38.20</u>	<u>8.3</u>
<u>3296</u>	+ (CS1) - 38	<u>53.47</u>	<u>37.1</u>	<u>1.90</u>	<u>101.59</u>	<u>30.0</u>
	(CS2)					
	(CS3)					
	(CS4)					
	(CS5)					
	(CS6)					
	(CS7)					
	Calculated Head	<u>144.10</u>	100.0	<u>2.35</u>	<u>339.04</u>	<u>100.0</u>
	Assay Head					

A16920

* Where Applicable † CS = Cyclosizer Spigot

N.B. Sub-sieve (-38 μm) sizes are based on cassiterite of s.g. = 7.1

Remarks 3296 - J.8

018.

WOLLASTONITE DEPOSIT - LIMESTONE CREEKAPPENDIX B7

Department of Mines metallurgical test work

- Upgrading wollastonite

4TH July 1988

0184

R886TASMANIA MINES - WOLLASTONITE CONCENTRATIONIntroduction:

Tasmania Mines requested that experimental work be undertaken on a low grade sample of Wollastonite (from their Kara deposit) to produce a Wollastonite concentrate for commercial evaluation.

Object:

To produce a quantity of high grade Wollastonite.

Sample:

The sample submitted Reg. No 880509 consisted of approximately 25 kilograms of pieces of Wollastonite ore ranging from about 5mm to 25mm in size.

Method:

1. The as received ore was jaw crushed to -4mm, mixed, then riffled to produce:
 - (a) A head sample for chemical analysis.
 - (b) 10X1 kilogram samples for test work.
2. Each of the 1 kilogram test samples were separately ground in a laboratory ball mill at forty percent solids for 25 minutes. Any + 600µm material remaining was reduced to -600µm by mortar and pestle.
3. One kilogram of ground ore was wet then dry screened to provide a description of grind.
4. Two of the one kilogram ball mill ground samples were combined (test N1) and fed to a Jones Wet Magnetic Separator using the following conditions.
 - (a) Maximum magnetic strength (i.e. 40 amp current)
 - (b) Feed rate 250g/minute
 - (c) Wash water 3 litres/minute
5. The Jones magnetic product was fed to a Davis Tube for ball mill iron removal.
6. The Jones Non magnetic product was subjected to calcite froth flotation in a Denver laboratory flotation cell using the following reagents and conditions.

(a) Sodium carbonate (Regulator)	0.6 kg/tonne
(b) Oleic acid (Collection)	3.3 kg/tonne
(c) Aero frother 77 (Frother)	
(d) Flotation time	5 minutes
(e) Cleaner Flotation time	5 minutes

7. The flotation tailing product (Wollastonite concentrate) was subjected to silica froth flotation in a Denver laboratory flotation cell using the following conditions and reagents.

(a) Aeromine 3037 (Collector)	4 kg/tonne
(b) Fuel Oil (Collector)	1.5 kg/tonne
(c) Aerofrother 77 (Frother)	
(d) Flotation Time	5 minutes
(e) Cleaner Flotation Time	5 minutes

8. Except for the Davis Tube magnetics or ball mill iron product, all N1 products were assayed for Loss on Ignition, CaO, MgO, Fe₂O₃, Al₂O₃, and SiO₂.

9. A further Jones Magnetic separation test was performed on 6 kilograms of sample with the non magnetic product being subjected to rougher calcite froth flotation only. All conditions used were those as previously described. This test was termed N2 and only the rougher flotation tail or Wollastonite concentrate was analysed.

10. Portion of the products of Test N1 and the ball mill (description of grind) particle size analysis were submitted along with chemical analysis to Mineralogist R.S. Bottrill for examination.

Appendix 1 is a copy of his evaluation of those products.

Results Obtained

1. Head Sample analysis

Percent L.O.I.	9.0
Percent CaO	39.5
Percent SiO ₂	41.4
Percent MgO	3.5
Percent Fe ₂ O ₃	1.3
Percent Al ₂ O ₃	(2.3)
Calc. % Wollastonite	42.0

0135

- 3 -

2. Sizing Analyses - 25 Minute Ball Mill Grind.

<u>Particle</u> <u>Size</u> <u>µm</u>	<u>Percent</u> <u>Mass</u>	<u>Cumulative</u> <u>Percent</u> <u>Mass</u>
-4000 + 2360	0.4	0.4
-2360 + 1180	0.1	0.5
-1180 + 600	0.1	0.6
- 600 + 300	0.1	0.7
- 300 + 150	2.7	3.4
- 150 + 75	3.7	7.1
- 75 + 38	0.3	7.4
(- 38)	(92.6)	(100.0)
C/S 1	19.8	27.2
C/S 2	21.6	48.8
C/S 3	12.8	61.6
C/S 4	13.2	74.8
C/S 5	6.0	80.8
O/F	(19.2)	100.0
Head	<u>100.0</u>	<u>-</u>

C/S at 24°C.

0
1
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5
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3. Overall Results Test N1

Product	% Mass	% LOI	% CaO	% SiO ₂	% MgO	% Fe ₂ O ₃	% Al ₂ O ₃	% CaCO ₃ from L.O.I.
+ 600 μm	0.6	-	-	-	-	-	-	-
Davis tube M/A (Tramp iron)	0.3	-	-	-	-	-	-	-
Davis tube Non Mag	4.6	3.5	29.7	44.5	7.3	10.1	3.5	8.0
=Jones Magnetics Diopside, Augite etc	4.9	3.5	29.7	-	-	-	-	-
Jones M/S Washings =Middlings	11.1	5.4	37.9	45.1	5.5	1.5	2.7	12.3
Cleaner FC (Calcite Conc)	23.7	25.5	44.2	21.0	3.5	0.9	1.5	58.0
Cleaner FT (Middling)	7.9	1.2	36.7	49.5	5.6	1.5	2.7	2.7
Rougher FC (mainly cal) =Sum of CFC & CFT above	31.6	(19.4)	(42.3)	(28.1)	(4.0)	(1.1)	(1.8)	(44.1)
Rougher FT (Wollastonite Conc)	51.8	0.62	41.1	52.1	2.7	0.8	2.4	1.4
Jones Non Mags =Sum of FC & FT above	83.4	(7.7)	(41.6)	(43.0)	(3.2)	(0.9)	(2.2)	(17.5)
Calc: H/D	100.0	(7.2)	(40.2)	(42.9)	(3.6)	(1.4)	(2.3)	(16.4)
Head assays	-	9.0	39.5	41.4	3.5	1.3	-	(20.5)

425187

The calculated Wollastonite content of the Rougher FT (Wollastonite concentrate was found to be approximately 70.5 percent in a mass of 51.8 percent overall.

4. Silica Flotation of Rougher FT (Wollastonite Conc.)

Product	% Mass	% L.O.I.	% CaO	% SiO ₂	% MgO	% Fe ₂ O ₃	% Al ₂ O ₃
CFC	34.3	0.77	41.7	51.8	2.2	0.90	2.2
CFT	2.4	0.75	39.8	51.5	3.5	0.87	3.1
FLC	36.7	(0.77)	(41.6)	(51.8)	(2.3)	(0.90)	(2.3)
FlT	15.1	0.70	39.9	51.3	3.5	0.70	2.3
FT	51.8	(0.75)	(41.1)	(51.6)	(2.6)	(0.84)	(2.3)

Whilst it is readily apparent that the Wollastonite concentrate contains an excess of SiO₂, conventional silica flotation did not achieve any SiO₂ removal or concentration.

0139

5. Overall Results Test N2.

Product	% Mass	% L.O.I.	% CaO	% SiO ₂	% MgO	% Fe ₂ O ₃	% Al ₂ O ₃
FlT (Wollastonite Conc)	55.0	0.9	40.8	51.9	2.8	0.9	2.3
FlC (Calcite Conc)	29.1	-	-	-	-	-	-
Jones M/S N	84.1	-	-	-	-	-	-
Jones M/S W (washings)	11.8	-	-	-	-	-	-
Jones M/S M/A	4.1	-	-	-	-	-	-
Head	100.0	-	-	-	-	-	-

The yield and chemical composition of the Wollastonite product from test N2 was very similar to that of test N1. Test N2 was only performed such that a quantity of Wollastonite concentrate would be available for commercial evaluation.

6. Fusion Point Determination of Concentrate.

The fusion point of the test N2 Wollastonite concentrate was found to be 1400°C. The softening point was found to be 1280°C.

425189

7. Firing Tests of N2 Concentration

Small test pieces were made (using the Wollastonite Concentrate) and fired in an electric furnace for six hours at 1000°C. The surfaces of the fired test pieces showed a slight pink tinge probably due to the oxidation of the contained iron (0.9% Fe₂O₃). Superficial fritting occurred and the test pieces were quite fragile.

Conclusion

This investigation has shown that it is possible to upgrade this ore containing 42% Wollastonite to a concentrate containing 70% Wollastonite by means of wet magnetic separation and flotation. The Company has been supplied with a sample of concentrate for market evaluation. When the results of this evaluation are known some discussion should ensue on whether further test work should be undertaken.



(P.L. James)
Chief Chemist & Metallurgist

Metallurgist
K. Austin

K. Austin
.....

DEPARTMENT OF MINES



Head Office

Gordons Hill Road,
P.O. Box 56,
ROSNY PARK 7018Enquiries R.S. Bottrill
Phone 30 8359
Your ref:
Our file RSB(2):JHAPPENDIX 1Mr P. James,
Chief Chemist & Metallurgist,
Department of Mines,
LAUNCESTONR886 - WOLLASTONITE PRODUCTS, KARA

Sixteen products from metallurgical tests on wollastonite ores from the Kara area were submitted for determination of their mineralogical constitution. Sample details are summarised in Table 1.

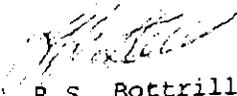
The samples were all run on the X-ray diffractometer, calibrated externally with pure and weighed mixes of minerals similar to the constituent phases (calcite, wollastonite, diopside and feldspar). Calibration was difficult due to the mixture of several minerals with complex X-ray patterns and indefinite compositions. The results are shown in Table 1.

The measured whole-rock analyses (Table 2, by XRF) were used to estimate compositions for constituent phases (Table 3) and thus calculate the expected whole-rock composition (Table 4). The measured and calculated compositions are not in particularly good agreement: CaO, SiO₂ and CO₂ are generally comparable (A2 would be better if an iron-bearing phase could have been measured) but the minor components Al₂O₃, MgO and Fe₂O₃ correlate poorly. This suggests that the calibrating samples may have been inappropriate in composition for these products, and/or the minerals have greater compositional variability than expected. The results in Table 1 are thus more precise than accurate and may only be taken to indicate relative compositional trends.

The XRF analyses (Table 2) were converted into mineralogical constitutions (Table 5) using the estimated mineral compositions in Table 3. These figures may be more accurate than those in Table 1 but should still be used with caution as accurate mineral compositions are not available. Quartz and haematite were not detected but are represented in Table 5 to indicate excess silica and Fe₂O₃ from the calculations, which could be corrected to zero by manipulation of mineral compositions. Na and K in the XRF analyses could indicate some albite and alkali feldspars.

2.

The calculated mineralogy of the feed (A1 in Table 5) is about 42% wollastonite, 23% diopside, 20% calcite and 9% feldspar. This indicates a little more diopside than expected from preliminary studies (see my previous memoranda of November 1985 and February 1988). The ore samples examined to date indicate ranges in mineralogy of about: 30-70% wollastonite, 5-60% calcite, 1-20% diopside, 2-40% feldspar and 1-2% sulphides. The ore is obviously very variable and more selective mining may be necessary to maximise the wollastonite in the feed.


R.S. Bottrill
MINERALOGIST/PETROLOGIST

Encl.

Table 1. Mineral Constitution by XRD (Wt. %, semi-quantitative), and sample descriptions.

No.	Description	Woll. *	Di	Calcite	Fsp
A1	Head	-	-	-	-
A2	Jones M/S. M/A	65	30	4	1
A3	1st M/S test, +600	81	17	1	1
A5	Jones washings	69	18	12	1
A6	CFC (Calcite Con)	19	11	68	2
A7	CFT (Middling)	76	18	4	2
A8	FT (Woll. Con)	92	7	0	1
A9	C/S 1	74	13	11	2
A10	C/S 2	79	7	13	1
A11	C/S 3	77	10	12	1
A12	C/S 4	79	10	10	1
A13	C/S 5	77	9	13	1
A14	-4000+150 μ m	83	11	5	1
A15	-150+38 μ m	83	10	6	1
A17	F1T	91	8	0	1
A18	F2T	92	5	1	2
A19	F2C	94	4	0	2

*Abbreviations in table 6.

Table 2: Whole rock analyses -XRF (Wt. %).

No.	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	CO ₂	SO ₃	total
A1	41.44	2.30	1.32	3.47	39.51	8.97	0.10	97.11
A2	44.51	3.47	10.06	7.27	29.67	3.52	1.12	99.62
A5	45.05	2.71	1.49	5.47	37.90	5.35	0.08	98.05
A6	20.96	1.46	0.90	3.53	44.24	25.51	0.02	96.62
A7	49.47	2.64	1.52	5.61	36.72	1.23	0.04	97.28
A8	52.08	2.37	0.78	2.57	41.14	0.62	0.03	99.69

Table 3. Estimated Mineral Compositions (Wt. %)

No	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	CO ₂	SO ₃	total
Woll.	51.7	0	0	0	48.3	0	0	100
Di	53	2.5	3.6	15	25.9	0	0	100
Calcite	0	0	0	0	56	44	0	100
Fsp (An)	64.8	18.3	0	0	17	0	0	100.1
Qtz	100	0	0	0	0	0	0	100
Po	0	0	90.7	0	0	0	91.2	181.9

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- 4 -

Table 4: Whole rock analyses calculated from Table 1.

No.	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	CO ₂	total
A2	50.15	0.93	1.08	4.50	41.58	1.76	100
A3	51.54	0.61	0.61	2.55	44.26	0.44	100
A5	45.86	0.63	0.65	2.70	44.88	5.28	100
A6	16.95	0.64	0.40	1.65	50.45	29.92	100
A7	50.13	0.82	0.65	2.70	43.95	1.76	100
A8	51.92	0.36	0.25	1.05	46.42	0.00	100

Table 5: Calculated mineral constitution (from Table 2).

No.	Woll	Di	Calcite	Fsp(An)	Qtz	Po	Hem	Total
A1	42.46	23.1	20.4	9.4	1.13	0.11	0.39	97.02
A2	21.61	48.5	8.0	12.3	-0.35	1.23	7.20	98.51
A5	41.34	36.5	12.2	9.8	-2.02	0.09	0.10	97.97
A6	10.01	23.5	58.0	4.8	0.22	0.02	0.03	96.57
A7	49.40	37.4	2.8	9.6	-2.11	0.04	0.13	97.26
A8	70.45	17.8	1.4	10.5	-0.59	0.03	0.11	99.73

Table 6: Abbreviations

Woll.	Wollastonite (CaSiO ₃)
Di	Diopside (CaMgSi ₂ O ₆)
Fsp (An)	Feldspar (anorthite) (CaAl ₂ Si ₂ O ₈)
Qtz	Quartz (SiO ₂)
Pn	Pyrrhotite (FeS)

WOLLASTONITE DEPOSIT - LIMESTONE CREEK

APPENDIX BB

Mineral Sands Consultancy Group

Metallurgical upgrading of wollastonite

SUMMARY REPORT
ON
PRELIMINARY TESTS
RE. UPGRADING OF WOLLASTONITE ORE

FOR
TASMANIA MINES LIMITED

BY
THE MINERAL SANDS CONSULTANCY



N. DAWSON.
SEPTEMBER 1988

CONTENTS

	Page No.
1. INTRODUCTION	1
2. TEST PROGRAMME	1
2.1 Crushings	1
2.2 Wet Magnetic Separation	1
2.3 Flotation Tests	3
2.4 Additional Magnetic Tests	4
3. DISCUSSION OF RESULTS	4
3.1 Positive Results	4
3.2 Negative Results	4
4. RECOMMENDATIONS	5

APPENDICES

I	Previous Data
II	Mineralogical Assays
III	WHIMS Tests Data
IV	Float Test Data

1. INTRODUCTION

As a follow on to discussions with Mr. C. Whitehead of Tasmanian Mines Limited a 5 Kg sample of Wollastonite Ore was submitted for Upgrading Tests.

The objective was to produce a high grade, +90%, Wollastonite Concentrate. A number of techniques were discussed ie fine grinding, magnetic separation, flotation etc. as being applicable to achieving the production of a concentrate.

The following describes the tests conducted and the resultant data is discussed.

2. TEST PROGRAMME

Previous Mineralogical Studies by the Department of Mines in Tasmania (refer Appendix I) showed that on two out of three of the ore samples examined, the Wollastonite and in particular the Calcite contaminant had average grain sizes 800 and 350 micron respectively. On the third ore sample all minerals were stated to have an average grain size of 50 micron.

Hence, these preliminary tests were aimed at assessing the possibility of producing a Wollastonite Concentrate by utilizing a grind coarser than the 20 microns expressed in the initial Mineralogical work.

The Test Programme, as conducted, is described in the enclosed diagram - refer Fig. 1 , Page 2 .

2.1 Crushings

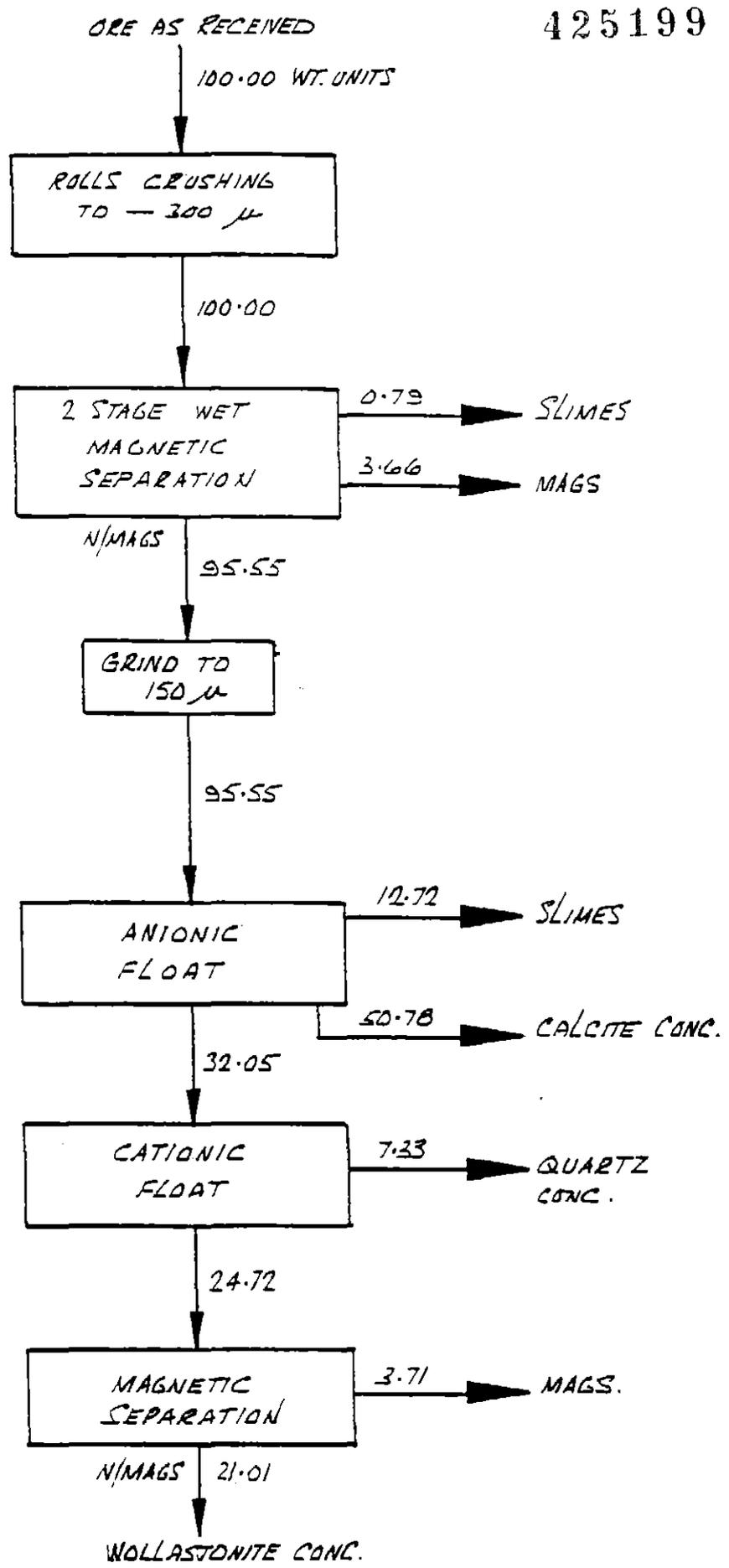
An initial crush to 100% - 300 micron was done by Fox-Anamet Laboratories in Sydney.

2.2 Wet Magnetic Separations

The - 300 micron material was passed through a Wet High Intensity Magnetic Separator (W.H.I.M.S.)

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LABORATORY TREATMENT FLOWSHEET - FIG. 1

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The non-mags from the 1st Stage was repassed through a 2nd Stage. The 2nd Stage WHIMS non-mags represented 95.55% by WT of the original feed. Refer to Appendix III for WHIMS Test data.

This 2 pass WHIMS step reduced the Total Fe as Fe_2O_3 from 0.79 in the feed to 0.186% in the 2nd pass WHIMS non-mags. This Fe level is within the Product specification as given - refer to Appendix I.

2.3 Flotation Tests

The 2nd Stage WHIMS non-mags was forwarded to Amdel for flotation tests.

This step was adopted as a follow on to Mineralogical assessment of the WHIMS non-mags by W. Fander - refer to Appendix II . This assessment advised that the Calcite content of WHIMS non-mags was 70% with Wollastonite content being 30% (maximum).

Amdel utilized a two stage Flotation Approach. The WHIMS non-mags was ground to 100% minus 150 micron. An Anionic Float was used to reject the Calcite followed by a Cationic Float to reject the Silica/Quartz..

The aim was for the Cationic Float Sinks to be enriched in Wollastonite.

These Flotation tests produced a Wollastonite concentrate which by Amdel's assessment contained 57.56% Wollastonite and 70% Wollastonite by W. Fander's examination.

The main contaminant in the Flotation concentrate was diopside.

Amdel's Test Report is enclosed in Appendix IV.

0390

2.4 Additional Magnetic Separation Tests

In an attempt to reduce the diopside content of the Float Conc. further Magnetic separation tests were done. The small size of samples available, at this stage of the test programme restricted these separations to dry magnetic.

Although a 15% Weight take to magnetics was made the resultant "non-mags" from the Float Conc. still contained 20-25% diopside - refer to Mineralogical Report in Appendix II.

3. DISCUSSION OF RESULTS

The results obtained from this work showed some potential for the upgrading of Wollastonite contents in the ore sample submitted. In particular

3.1 Positive Results Obtained.

- a. Significant reduction in Fe levels by Wet Magnetic Separations.
- b. Promising rejections of Calcite and Quartz by Flotation technique even at a relatively coarse (150 micron) grind.

3.2 Negative Results Obtained.

At the 150 micron grind composites of diopside mineral are still present in the Wollastonite concentrate. These could not be significantly reduced by Magnetic separations.

Grinding finer, for diopside liberation, in particular, is clearly necessary.

425202

Based on the above observations a conceptual treatment flowsheet is described in Fig. 2, Page 6 . This flowsheet requires further development.

4. RECOMMENDATIONS

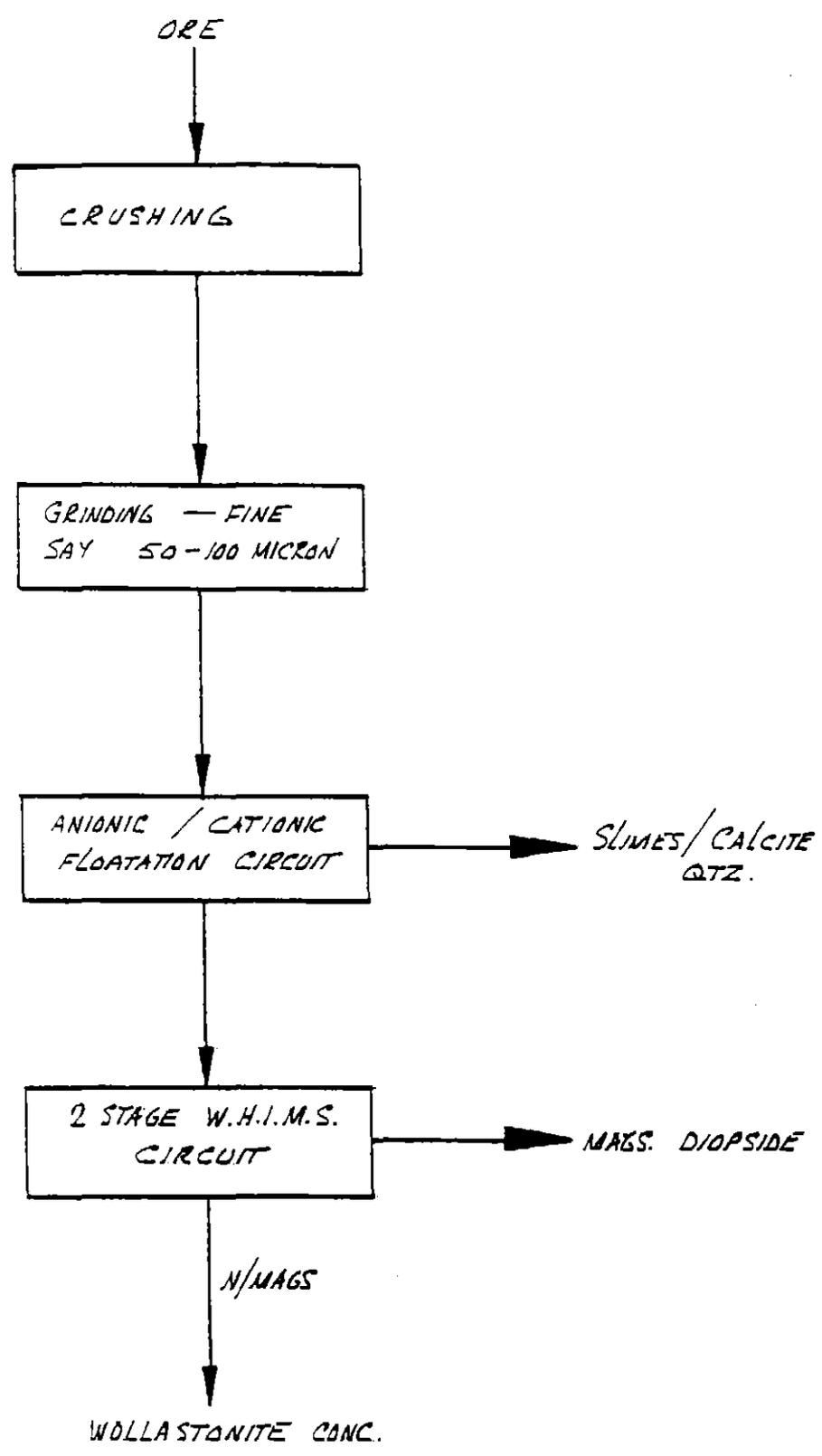
Although the work conducted did not produce a +90% Wollastonite Conc. some of the results obtained were promising.

Provided Market conditions warrant, and assuming significant tonnages of ore exist, then further Metallurgical work should be directed towards

- a. Conducting a number of grinds to various micron sizes and conducting WHIMS separations to assess the coarsest grind which will allow the majority of the diopside to be rejected by WHIMS.
- b. Once a. is established, then to conduct Flotation at this grind, and proceed to use WHIMS on Float Conc.

This work should be conducted at Amdel in Adelaide with the final WHIMS tests done by Readings in Lismore.

425203



CONCEPTUAL TREATMENT FLOWSHEET — FIG. 2.

0204

APPENDIX I

Previous Data

TASMANIA MINES LIMITED

425205

(Incorporated in Tasmania)

Registered Office:
J. FRENCH LING & COMPANY
PO. Box 844
BURNIE, TAS 7320
Phone (004) 31 2911

Exploration Office: 13 MARINE TERRACE,
BURNIE
PO. Box 815,
Burnie, Tas., Aust. 7320
Voca-Fax (004) 31 8027
Phone (004) 31 2277

Our Reference:

Mine Office: KARA ROAD,
HAMPSHIRE, TAS.
Phone (004) 31 6288
(Fax) 318952

Address All Correspondence to
Exploration Office.

3rd May, 1988.

Fax. No.: 07 349 0019

Neil Dawson,
H & W Investments Pty. Ltd.,
10 Dolphin Street,
Gregory,
QUEENSLAND 4019.

Dear Neil,

RE: WOLLASTONITE MATERIAL, SEPERATION TESTS.

We thank you for your fax. letter re costs for "Preliminary Tests on Wollastonite Material". This programme and estimated expenditures are satisfactory and we ask you to proceed with co-ordinating the programme. Our Order No. for the work is 2794.

The plus 5kg sample of wollastonite was air-freighted to Steve Raynor at Fox-Amamet on the 2nd May 1988.

As requested specification requirements of wollastonite products are itemised overleaf (Table 1.), and a copy of a Dept. Of Mines mineralogical study of Tasmania Mines Limited wollastonite is also attached.

Yours sincerely,

J. H. Whitehead.

0296

Table No. 1.

TYPICAL SPECIFICATIONS FOR WOLLASTONITE CURRENTLY SOLD IN U.K./EUROPEAN MARKET.

SiO ₂	-	51.80%
Ca	-	44.50%
Al ₂ O ₃	-	0.44%
Fe ₂ O ₃	-	0.22% (Max. 0.3%)
TiO ₂	-	Max. 0.05%
MnO	-	Max. 0.01%
MgO	-	0.56%
Na ₂ O	-	0.10%
K ₂ O	-	0.10%
Loss on Ign.	-	2.20%

Typical Mineral Composition:-

Wollastonite	90%
Quartz	4%
Calcite	1%
Other Silicates	2%

U.S.A. CHEMICAL ANALYSES OF U.S. WOLLASTONITE DEPOSITS.

	<u>Willsboro (NY)</u>	<u>Lewis (NY)</u>	<u>Custer County Idaho</u>
SiO ₂	48.73	45.90	50.47
CaO	39.84	39.07	45.99
Al ₂ O ₃	3.14	4.34	0.45
FeO	6.63	6.77	0.10
MgO	3.63	3.75	1.17
MnO	0.96	0.96	-
CO ₂	-	-	0.69
<u>TOTAL</u>	100.93	100.81	99.03

FEB 15 '88 12:15 DEPT OF MINES LONDON

425207

P.1/2

①

NOTE: ALL CORRESPONDENCE TO BE ADDRESSED TO THE DIRECTOR OF MINES

0333

12/16 1988



COPY

DEPARTMENT OF MINES

FAX (002) 44 2117
TELEFAX NO. 44276
TELEPHONE 30 4033
WHEN TELEPHONING OR
CALLING ASK FOR

CORDON'S HILL RD
P.O. BOX 16
ROSEY PARK
TASMANIA 7815

R. Bottrill EXT. NO. 8359

DX 70401

*For Information of
Cliff Whitehead*

[Handwritten signature]

12 FEB 1988

Mr P. James,
Chief Chemist & Metallurgist,
LAUNCESTON

WOLLASTONITE

Two samples of Wollastonite ore from the Kara area were submitted for assessment of grain size and locking characteristics. Sample details and a mineralogical summary are shown on Table 1.

Sample 400326 is particularly inhomogeneous in grain size and mineral distribution; sample 400325 may be more representative of normal ore. The wollastonite is usually poikiloblastic (i.e. sieve-textured with fine inclusions) predominantly containing calcite and diopside, with less common pyrrhotite, feldspars, etc. The wollastonite averages about 0.2 mm in size, with inclusions from 0.01-0.3 mm, commonly very irregular in shape, and sometimes comprising up to 30% of the volume of grains. The wollastonite is elongate to fibrous, but grain boundaries are typically very irregular to amoeboid. It is estimated that to produce a product of >90% wollastonite, the ore would require grinding to about 20 microns or less.

[Handwritten signature]

R. Bottrill;
MINERALOGIST/PETROLOGIST

Encl.

0208

COPY

TABLE 1: MINERALOGY OF WOLLASTONITE CRES (QUALITATIVE)

Sample	Mineral	Approx %	Size range (µm)	Avg. size (µm)
400325 (Longmans W2)	Wollastonite	50	200-1000	600
	Calcite	30	100-1000	400
	Diopside	5	10-200	100
	Feldspars*	2	20-200	100
	Pyrrhocite	1	20-200	100
	Others*	1	10-100	50
400326A (Hole 520)	Wollastonite	30	200-1000	1000
	Calcite	60	100-600	300
	Diopside	5	10-100	100
	Feldspars*	5	20-100	100
	Sulphides*	1	10-200	100
	Others*	1	10-100	50
400326B (Hole 520)	Quartz	30	10-200	50
	Wollastonite	20	10-100	50
	Calcite	5	10-100	50
	Diopside	<1	10-50	20
	Feldspars*	40	2-50	10
	Sulphides*	2	10-200	50
	Others*	1	10-100	50

* Others include sphene, leucosane, zircon, epidote and apatites.
 Sulphides include pyrrhocite, pyrite and rare chalcopyrite.
 Feldspars include plagioclase and potass feldspars.

03-71

APPENDIX III

WHIMS Tests Data

READINGS OF LISMORE PTY LTD
8 COOK STREET
SOUTH LISMORE
N.S.W. 2480

FACSIMILE SHEET

TELEPHONE: (066) 21 7451
TELEX: 166158 READG
FAX: (066) 21 9384

CLIENT FILE: H & N INVESTMENTS

TO: NOLA HINES NUMBER: 07-8411665

FROM: EUGENE DARDENGO DATE: 31/5/88

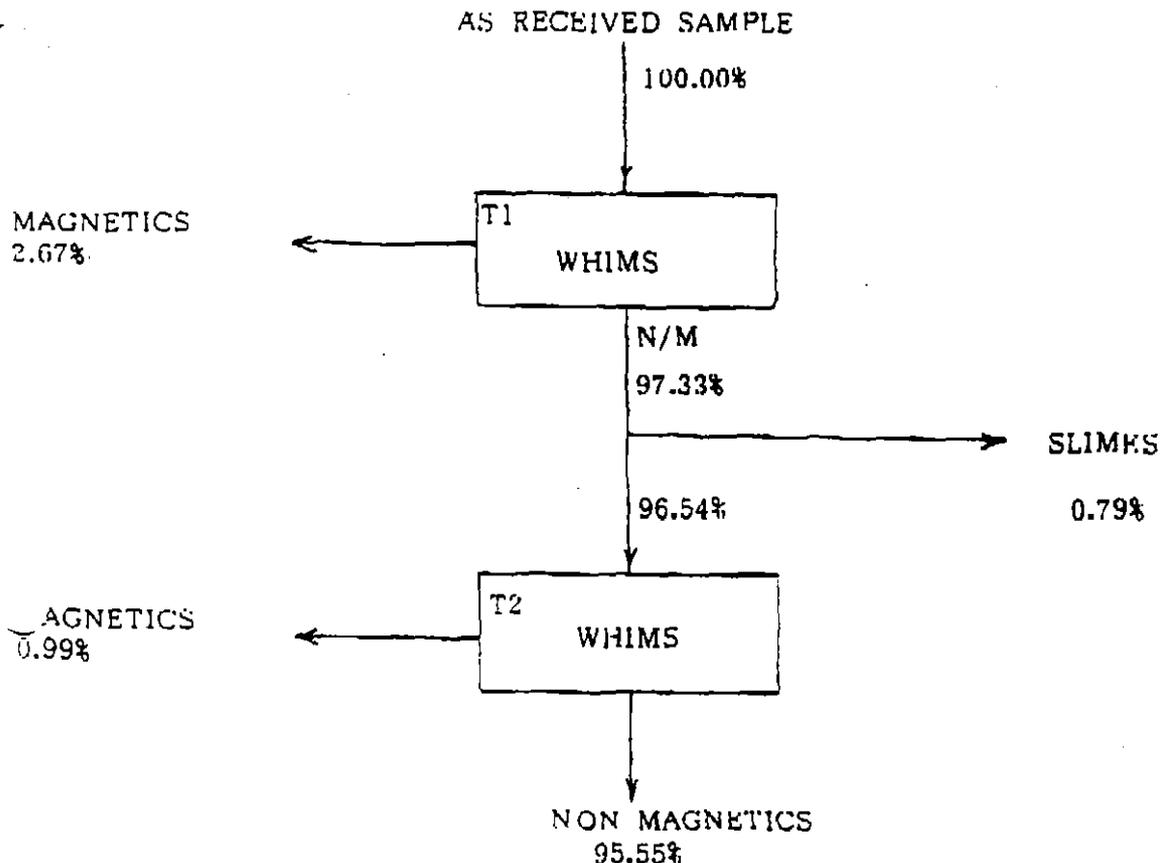
REF NO: RL 2650 TOTAL OF PAGES INCLUDING THIS ONE.

PLEASE CALL IF ANY PAGES NOT RECEIVED.

MESSAGE:

RE: WOLLASTONITE SAMPLE

The sample received by Readings, after consultation with Neil Dawson was processed thru a Readings WHIMS with the objective of attaining maximum extraction of magnetics. This was done by retreating the non magnetics. The testwork procedure can be seen below, along with percent weights obtained around this circuit.



Samples of head feed and final non magnetics have been sent for chemical assays - Total Fe. Also have sent the non magnetics for mineralogy. To date, no assays are available.

Regards,

Eugene

E. DARDENGO
PROJECT METALLURGIST

Australian Laboratory Services Pty. Ltd.

CONSULTING ANALYTICAL CHEMISTS LABORATORY REPORT

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10 Drew Street, Charters Towers, Q. 4870
Phone (077) 87 4155 Fax (077) 87 4220
Bendigo Laboratory
127A Victoria Street, East Melbourne, Vic. 3156
Phone (054) 48 1390 Fax (054) 48 1383

Geelong Head Office and Laboratory
22 Grand Street, Geelong, Q. 3203
P.O. Box 99, Geelong Post Office 3207
Phone (07) 382 8877 Telex AL88V
Fax (07) 382 8108

South Coast and Laboratory
18 Boscawen Road, Boyanba, N.S.W.
Phone (081) 272 2300 Fax (081) 272
Tweed Heads Laboratory
21 Brimage Street, Tweed Heads, N.S.W.
Phone (077) 29 8105 Fax (077) 292

0214
Client: READING OF LISMORE PTY. LTD.
Address: P.O. Box 161
LISMORE N.S.W. 2480

Page 1 of 1

Batch Number: E249

Method: NP 1000 HARDENCO

No of Samples: 4
Date Received: 30.05.88
Date Completed: 05.06.88

Sample No: 602702 Sample type: WOLLASTONITE

SAMPLE NUMBER	Element Unit Method	Fe2O3				
2907 H.F.EED		0.79				
2907 H.F.EED		0.90				
2907 TEST 2		0.106				
2907 TEST 3		0.181				
Time						

NOTIFIED WOLFS WILL BE DUMPED ON 30/11/88 AND SPLITS KIP ANY ON 30/08/88

The Laboratory is registered by the National Association of Testing Authorities, Australia. The test required herein have been performed in accordance with the terms of this contract and the Department's Accredited Test Method.

Signatory: *[Signature]*

0212

APPENDIX II

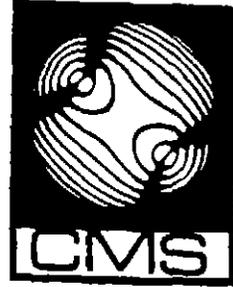
Mineralogical Assays

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081

Central Mineralogical Services



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International: Telephone + 618 425659 Fax + 618 363 1820

Mr. N. Dawson
Metallurgical Consultant
The Mineral Sands Consultancy
Suite 3
Sunnybank Woods Shopping Centre
218, Padstow Road
EIGHT MILE PLAINS / QLD. 4123

9th September, 1988

REPORT CMS 88/9/10

YOUR REFERENCE:	Purchase Order No. 262
DATE RECEIVED:	5th September, 1988
SAMPLE NOS.:	"Wollastonite"
SUBMITTED BY:	N. Dawson
WORK REQUESTED:	Mineralogy

H. W. Fander.
H.W. Fander, M. Sc.

MINERALOGICAL ANALYSIS
OF N/MAGS EX FLOAT CONC.

0211

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

IDENTIFICATION

Job No. CMS 88/9/10 Date Received: 5.9.1988

Reference Purchase Order No. 262

Sample No. "Wollastonite"

Nature of Sample: Float Con. Non-Mags.

DESCRIPTION

SECTION No.

a. Hand Specimen:

b. Microscopic:

A portion of the sample was mounted in an R.I. oil of 1.63 and microscopically examined.

The sample consists of approximately 65 % wollastonite, 25 % diopside, 7-10 % carbonate and 2-3 % quartz.

Almost all the carbonate occurs as 5-30 um inclusions in wollastonite and diopside; some of the quartz is free, as single grains and fine-grained aggregates, and some forms small inclusions in wollastonite.

Diopside is present as very irregular grains, and about half is composite with wollastonite in varying proportions; half occurs as free grains in the 10 um to 120 um range, mostly around 50 um.

About 50 % of the wollastonite is free or substantially free (i.e. with only a few small inclusions of quartz and/or carbonate); the remainder contains substantial numbers of inclusions or forms composites, generally texturally complex, with diopside.

The diopside is a colourless, very low-Fe variety, and is very probably non-magnetic.

A small trace of pyrite occurs as fine inclusions in the silicates.

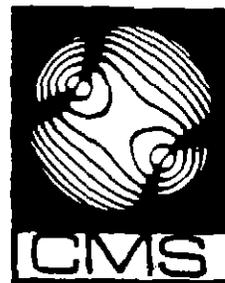
H.W. Fander, M. Sc.

023

425215

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Mr. N. Dawson
H. & N. Investments Pty. Ltd.
The Mineral Sands Consultancy
Suite R
Sunnybank Woods Shopping Centre
319, Padstow Road
EIGHT MILE PLAINS / QLD. 4123

15th July, 1988

REPORT CMS 88/7/14

YOUR REFERENCE: Order No. 129
Facsimile Message 12.7.1988

DATE RECEIVED: 13th July, 1988 (sample)

SAMPLE NOS.: "Wollastonite"

SUBMITTED BY: N. Dawson

WORK REQUESTED: Mineralogy

H. W. Fander
H.W. Fander, M. Sc.

MINERALOGICAL ANALYSIS OF
FLOAT CONC.

0216

CENTRAL MINERALOGICAL SERVICES

425216

Date 15th July, 1988

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

No. CMS 88/7/14 Date Received: 13.7.1988

P.O. No. 129

Sample No. "Wollastonite"

Type of Sample: Flotation Concentrate

DESCRIPTION SECTION No.

Send Specimen:

IDENTIFICATION

Microscopic:

The sample was examined as received, using specific immersion oils.

Mineral percentages are difficult to determine with accuracy because of the very different shapes of the mineral constituents, but approximate percentages are as follows:

- Free wollastonite - 70 %; clean, thin crystals and needles.
- Free diopside - 20 %; granular, often with minute opaque inclusions.
- Free quartz - 1-2 %; clear grains and cloudy masses full of inclusions.
- Composites - 8-10 %; mainly diopside, with carbonate, quartz, wollastonite.
- Sulphides - Trace

The presence of diopside in this sample, and its absence in the previous sample (CMS 88/5/30), suggest that it is weakly magnetic, presumably due to the inclusions; the cloudy masses of quartz may well be magnetic also.

H.W. Fander, M. Sc.

425217

0217



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Mr. E. Dardengo
Metallurgist
Readings of Lismore Pty. Ltd.
P.O. Box 161
LISMORE / N.S.W. 2480

31st May, 1988

REPORT CMS 88/5/30

YOUR REFERENCE:	Order No. 662710
DATE RECEIVED:	30th May, 1988
SAMPLE NOS.:	"Wollastonite"
SUBMITTED BY:	E. Dardengo
WORK REQUESTED:	Mineralogy

H.W. Fander, M. Sc.

MINERALOGICAL ANALYSIS
OF W.H.M.S. NON-MAGS.

CENTRAL MINERALOGICAL SERVICES

Date 31st May, 1988

0218
SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

IDENTIFICATION

Job No. CMS 88/5/30 Date Received: 30.5.1988

Reference Order No. 662710

Sample No. "Wollastonite"

Nature of Sample: _____

DESCRIPTION **SECTION No.**

a. Hand Specimen:

b. Microscopic:

Representative portions of material were mounted on slides, using different refractive index oils; the material is unsized, and grain sizes ranged from 1 um up to 300 um - thus quantitative estimates were not possible, and figures given are only approximate.

The sample consists of at least 70 % calcite, and no more than 30 % wollastonite, with a trace to 1 % of sulphides; the minerals are dominantly free, but there are calcite-wollastonite composites.

In order to make a more accurate estimate of the minerals present, a portion of the sample was treated with HCl to remove calcite; however, wollastonite is also somewhat soluble and thus calcite could not be dissolved without the danger of losing some wollastonite. The SGs of the two minerals are fairly close also, and clean separations on that basis would be questionable. Quantitative XRD or DTA/TGA may be more successful in providing more accurate data, and CO₂ assays could be used to calculate the amount of calcite present, with wollastonite obtained by difference (this only applies to this particular sample, which consists essentially only of two minerals).

The sulphides are fine-grained (1-100 um, mostly < 50 um) and are free and also occur as inclusions in calcite; they consist of pyrite, sphalerite, possible chalcopyrite and galena.

H.W. Fander, M. Sc.

0218

APPENDIX IV

Float Test Data

technology and enterprise

0220

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International Operations Group
(Incorporated in S.A.)
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Address all correspondence to:
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Eastwood, S.A. 5063,
Australia

425220

Telex: AA82725
Facsimile: (08) 352 8243

26 July 1988

OD 3/0/0-06749

Mr. N. Dawson
Consultant
The Mineral Sands Consultancy
Suite 3, Sunnybank Woods Shopping Centre
218 Padstow Road
Eight Mile Plains
BRISBANE Qld 4123

REPORT NO. 06749/88

YOUR REFERENCE: Purchase Order No. 242

MATERIAL: Wollastonite Ore

IDENTIFICATION: 2907 Test 2 N/Mags

LOCATION: Tasmania

WORK REQUIRED: Flotation testing.

Investigation and Report by: *J.W.* I.W. McPheat

General Manager, International Operations Group: Peter M. Cameron

Sydney, Melbourne, Perth, Canberra, Darwin, Townsville. Represented world-wide.

SUMMARY

A single flotation test was carried out on a sample of wollastonite ore which had been treated by magnetic separation to remove iron-bearing minerals.

The test procedure employed anionic flotation to remove calcite, followed by cationic flotation to remove quartz and some silicate minerals.

The wollastonite contents of the flotation products were calculated from CO_2 and acid soluble calcium assays. Although the precision of this technique needs to be verified for the ore sample tested, the results indicate that the sample was upgraded from a feed grade of 22% wollastonite to a concentrate grade of 57% wollastonite, for a wollastonite recovery of 66%.

0233

FLOTATION OF WOLLASTONITE ORE1. INTRODUCTION

A sample of wollastonite ore was received for testing. This sample had previously been treated by magnetic separation to remove iron bearing minerals.

At the time of testing, little was known about the mineralogical composition of the sample, but it was assumed that the major gangue minerals present were calcite and quartz. The validity of this assumption was not confirmed because of the client's doubts concerning the representivity of the ore sample.

The client requested that a single preliminary test be undertaken to examine the flotation response of the sample using a feed grind of 100% passing 150 μm .

2. FLOTATION TESTING

On the basis of the above assumed mineralogical composition a flotation test was undertaken using a 1000 g feed charge stage ground to the requested size. The ground material was deslimed, using a 50 mm dia cyclone.

Grinding and flotation were carried out using distilled water. Adelaide mains water was used for the desliming, and the deslimed material was washed three times on a vacuum filter with distilled water.

2.1 Anionic Flotation

Anionic flotation was carried out without pH adjustment. The pulp was conditioned with sodium silicate to depress wollastonite and then with calcium chloride to activate quartz.

Five stages of rougher flotation were carried out using an anionic collector¹ based on Acintol FA-1 (tall oil fatty acids).

2.2 Cationic Flotation

Cationic flotation was undertaken on the anionic flotation tailing to remove quartz and some silicate minerals as the froth product.

The pH of the anionic tailing was adjusted to 4 using sulphuric acid and three stages of rougher flotation carried out using the collector Flotigam (C12 coconut fatty amine acetate).

The flotation conditions are given in Table 1.

¹ The composition of the collector is given in Appendix A.

022
The test products were assayed for acid soluble Ca and for CO₂. The results are shown in Appendix B.

The wollastonite and calcite concentrations were calculated assuming that calcite was the only carbonate mineral present, that wollastonite is acid soluble and that wollastonite and calcite were the only acid soluble calcium minerals present.

The flotation test results are shown in Table 2. Based on the assumptions stipulated above, the flotation feed (before desliming) contained 22.5% wollastonite and 42.9% calcite. The wollastonite concentrate (cationic tailing) contained 57.6% wollastonite and the corresponding wollastonite recovery was 66.3%.

Calcite removal by anionic flotation was good.

It should be noted that the wollastonite content of the Anionic Rougher Concentrate 1 and 2, calculated from the CO₂ and acid soluble Ca assays, was -12.3%. It is evident from this result that the analytical procedures used and the assumptions made concerning the mineralogical composition of the ore need to be verified.

Until a confirmed analytical technique for wollastonite determination is available the accuracy of the results presented in this report cannot be stipulated and the results should be used with caution.

APPENDIX ACOMPOSITION OF ANIONIC COLLECTOR

The anionic collector had the following composition:

	<u>Weight %</u>
Acintol PA-1 (tall oil fatty acid)	58.2
Distillate (extender)	38.8
Terric X-10* (emulsifier)	3.0

The above mixture was diluted with distilled water to produce an emulsion containing 5% w/v of the above constituents.

* Octyl phenol ethoxylate.

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APPENDIX B

ASSAY OF FLOTATION PRODUCTS

Product	Assay, %	
	Ca (acid sol)	CO ₂
Cationic Ro Tail	20.3	0.48
Cationic Ro Conc 2 + 3	11.1	0.09
Cationic Ro Conc 1	10.8	0.21
Anionic Ro Conc 4 + 5	11.6	5.8
Anionic Ro Conc 3	28.0	27.3
Anionic Ro Conc 1 + 2	30.0	37.6
Slimes	25.1	20.3

0226

TABLE 1: CONDITIONS FOR WOLLASTONITE FLOTATION TEST 1

Condit.	Time, min		pH	REAGENT ADDITION, kg/t				
	Flotation			MIBC	SODIUM SILICATE	CALCIUM CHLORIDE	ANIONIC COLLECTOR	FLOTIGAM CA	H2SO4
Anionic Flotation	2		9.6					
	1				1			
Rougher 1	3	3	9.3			0.5		
Rougher 2	3	2	9.0				0.5	
Rougher 3	3	1-1/2	8.7				0.25	
Rougher 4	3	1	8.5				0.25	
Rougher 5	3	1	8.3				0.25	
Cationic Flotation								
Rougher 1	3	3	5.0	0.075				
Rougher 2	3	3	5.0				0.025	2.3
Rougher 3	3	3	5.0				0.025	0.7
							0.025	nr *

* Not recorded

425226

0234

TABLE 2: RESULTS OF WOLLASTONITE FLOTATION TEST 1

Product	Weight %		Assay				Distribution, %			
			WOLL %		CALC %		WOLL		CALC	
	Product	Cum.	Product	Cum.	Product	Cum.	Product	Cum.	Product	Cum.
Cat Ro Tail	25.88	25.88	57.56	57.56	1.09	1.09	66.29	66.29	0.66	0.66
Cat Ro Conc 2+3	5.41	31.29	31.93	53.13	0.20	0.94	7.68	73.97	0.03	0.68
Cat Ro Conc 1	2.26	33.55	30.74	51.62	0.48	0.91	3.09	77.07	0.03	0.71
An Ro Conc 4+5	8.80	42.35	18.31	44.70	13.19	3.46	7.17	84.23	2.71	3.42
An Ro Conc 3	10.91	53.25	9.10	37.41	62.09	15.46	4.42	88.65	15.80	19.21
An Ro Conc 1+2	33.44	86.69	0.00*	22.98	85.20	42.36	0.00	88.65	66.46	35.67
Slimes	13.31	100.00	19.17	22.47	46.17	42.87	11.35	100.00	14.33	100.00

* Calculated wollastonite assay was -12.3%

File name: UNT01.REP

**THE AMDEL GROUP
HAS BRANCHES AND AGENTS
THROUGHOUT AUSTRALIA AND
THE SOUTH PACIFIC REGION**

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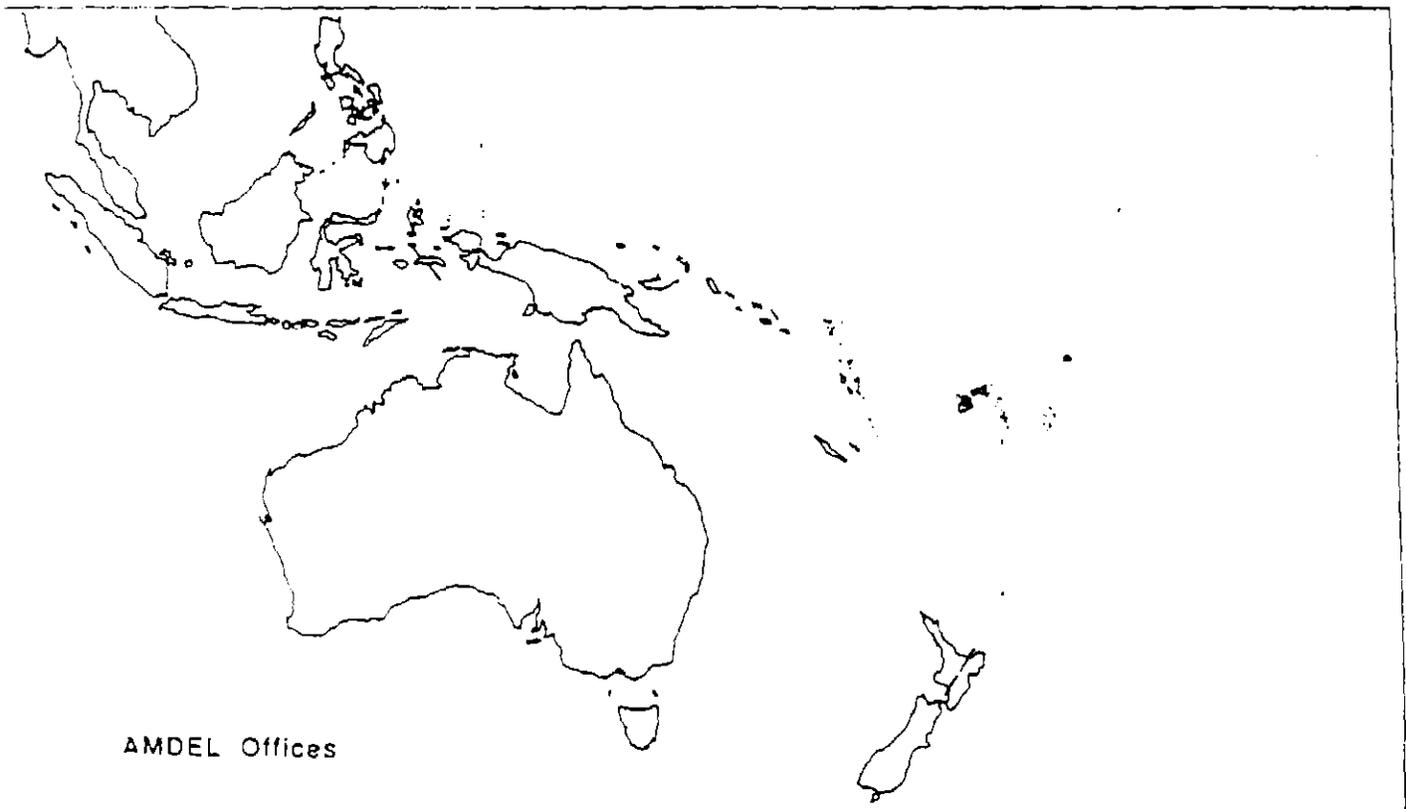
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AMDEL Offices

0824

425229

WOLLASTONITE DEPOSIT - LIMESTONE CREEK

APPENDIX B9

Commodity review - wollastonite

TASMANIA MINES LIMITEDCOMMODITY REVIEW - WOLLASTONITEAUGUST 1990

1. Introduction
2. Mineralogy
3. Physical Properties
4. Uses
5. Known Deposits
6. Mining and Processing
7. Consumption - Production
8. Synthetic Wollastonite
9. Prices - Specifications
10. References

023.

1. INTRODUCTION

1. Wollastonite is used extensively as a filling and reinforcing agent in plastic, paint, ceramics and tiles, and as a partial substitute for both fibreglass and asbestos.
2. No wollastonite is currently produced in Australia. All local consumption uses imported products, which sell for around \$550-650/tonne.
3. Wollastonite (CaSiO_3) is ideally composed of 48.3% CaO and 51.7% SiO_2 . It is a triclinic mineral found in contact metamorphic limestones, usually in the form of clearable masses.
4. Wollastonite was named after the English chemist William Wollaston (1766 - 1828).

0238

2. MINERALOGY

1. Pure wollastonite, CaSiO_3 , has the composition of 48.3% CaO and 51.7% SiO_2 and is a triclinic mineral.
2. Natural wollastonite takes into solution the metasilicates of manganese, magnesium, iron and strontium.
3. Commodity associated minerals are garnet, diopside, epidote, calcite and quartz.
4. S.G. of 2.8 to 3.0.
Hardness of 4.5 to 5.
5. When pure, it has a brilliant white colour, but with impurities may be tinged greyish or brownish.
6. Lustre is vitreous to pearly.
7. Wollastonite is usually massive to fibrous.
8. Melting point is about 1540°C .
9. Occurs in coarse bladed masses, rarely showing good crystal form. It is usually acicular or fibrous. Its unique property is its cleavage, crushed wollastonite tending to be needle shaped imparting a high strength. Fiber lengths are commonly in ratio of 7-8:1 length to diameter.
10. Some crystals of wollastonite fluoresce under U.V. light, colours ranging from yellow-orange to pink-orange.
11. Brightness is a significant property, especially in the paint industry. Material, 99% pure, with a size of -325 mesh has a General Electric reflectance rating of 92% to 96%.

0231

3. PHYSICAL PROPERTIES

BRIGHTNESS:	90% (compared to MgO)
OIL ABSORPTION:	351bs/1001bs
HARDNESS:	4.5
SPECIFIC GRAVITY:	2.9
DENSITY:	241bs/solid gallon
CO-EFFICIENT OF EXPANSION:	5×10^{-6} mm/mm/°C
PH OF 10% SLURRY:	9.9
SOLUBILITY IN WATER:	0.0095g/100cc
CHEMICAL ACTIVITY:	Largely inert, except concentrated acids
REFRACTIVE INDEX:	1.63
MELTING POINT:	1540°C

4. USES

1. Wollastonite is used extensively as a filling and reinforcing agent in plastic, paint, ceramics and tiles, and as a partial substitute for both fibreglass and asbestos.
2. The prime use of wollastonite is in the manufacture of plastic, where the inert acicular fibres are a valuable reinforcing material and provide excellent resistance to heat.
3. In paint (house paints, etc) wollastonite is used as a pH stabiliser to prevent can and lid corrosion and to keep the pigments in suspension. The incorporation of wollastonite in exterior paints gives greater weathering resistance and provides a lower oil absorption. In latent paints it increases brightness and
4. In ceramic use, wollastonite improves the mechanical properties of ceramic ware and reduces warping or cracking of rapidly fired materials. These are especially stronger with the inclusion of wollastonite. This is because wollastonite contains virtually no moisture, and so can reduce thermal expansion and cracking associated with moisture in ceramics.

As wollastonite contains both Ca and Si, traditional raw materials (flint, quartz, sand), can be wholly or at least partially replaced by just *one mineral*.

Shrinkage is minimised by the acicular nature of wollastonite particles, and tiles containing 55% wollastonite have been shown to have a firing shrinkage as low as 0.1% to 0.2%.

5. Minor uses of wollastonite are in the manufacture of flaxes, match heads, abrasives and metal casting plastics.

As an abrasive, wollastonite is used in making wheels, stones and industrial pumice.

0235

6. In U.S.A., ceramic industry was the largest user of wollastonite, with about 50% used in manufacturing tiles, 10-20% for plastics and glazes, 30% in paint industry.
7. In Germany, Denmark and Finland, the ceramic industry is the sole consumer, whereas in Italy, the paint industry is the exclusive user.
8. In Mexico, production goes into the ceramic industry, and small amounts into manufacturing mineral wool.
9. Ornamental wollastonite, used as decorative rock, and in crushed form for terrazo and roofing material is produced in California, Mexico and S.W. Africa.

5. KNOWN DEPOSITS

1. U.S.A. is largest producer and consumer of wollastonite. (Approx 75% worlds output). Currently most of the U.S.A. supply comes from New York State and California.
2. Deposit near New York - WILLSBORO - has reserves in excess of 10 million tonnes of 55-65% wollastonite.
3. A number of small occurrences are worked in California e.g. Little & Big Maria Mountains of Riverside Co, and in Panamint Range of Inyo Co, both in California.
4. Elsewhere wollastonite is produced from mines in Mexico, central Asia (U.S.S.R.), SW Finland, Kenya and Namibia, Finland. Small quantities have been produced in India, U.S.S.R., New Zealand, Sudan, S Africa and SW Africa.
5. World reserves of proven wollastonite bearing rocks exceed 90 million tonnes, with probable reserves being 270+ million tonnes.

UNITED STATES (New York State and California)A. NEW YORK STATE

- Wollastonite is found on W side of Lake Chaplain near WILLSBORO.
- Found in contact metamorphosed limestones and metasomatised sediments, approx 6 miles long + 1/4 mile wide.
- 3 main deposits - WILLSBORO. LEWIS and DEERHEAD.

0238

- PROVEN resources are in excess of 10 million tons containing 55-65% wollastonite.
- Largest wollastonite band is between 30-75 feet, interbedded with garnet and diopside, both of which are ficklely magnetic and separated from wollastonite by magnetic separation.
- Typical analysis of the Willsboro deposit would be:-

SiO ₂	-	47.7%	CaO	-	37.8%
Al ₂ O ₃	-	3.1%	FeO	-	6.6%
MgO	-	3.67%	MnO	-	1.2%

B. CALIFORNIA

- Produced from Little and Big Maria Mountains, 20 NW of Blythe.
- Wollastonite is found as high grade pods in Palaeozoic crystalline limestone.
- Ore is high in magnesium and iron.
- Ore is mined by Chas Pfizer and Co, milled at Victorville, beneficiated and ground to a -200 mesh product, sold under trade name Wolcon and sold to the ceramic industry.
- High grade wollastonite is mined in the Panamint Range, just outside Death Valley National Monument.
- Occurs in a calc-silicate environment, and reserves are large and wollastonite both fine ground and acicular.
- Deposit is operated by American Non Metallics Inc., and material is marketed in two grades - a ceramic grade called CART-O-LITE of minus 200 mesh and a paint grade of minus 325 mesh called ANOMITE.

0200

- Other Californian wollastonite occurrences:-
 - RANDBURG - Reserves 12 million tons
 - Warm Springs Canyon - INYO Co
 - Hunter Mountain, near Darwin.

C. ARIZONA

Wollastonite is found at:-

- Mineral Hill area of Sierrita Mountains, Pima Co
- Tank Pass, near Salome, Yuma Co
- Tombstone District, Cochise Co

D. NEVADA

At Yerington in Lyon County.

MEXICO

- Extensive deposits exist in the States of CHIAPAS and ZACATECAS where wollastonite was first mined during the 1950's.
- The "SANTA Fe" deposit in CHIAPAS is unusually pure, and free of garnet and calcite. It is 300ft thick, elliptical being 1400ft long and 400ft wide. Associated minerals total less than 1%, and the wollastonite is brilliant white and typical acicular cleavage. Most of output is consumed by the domestic ceramics industry.
- In La Blanca District, Zacatecas, Wollastonna de Mexico produces wollastonite from irregular tabuclar bodies about 8" thick. A very pure and white wollastonite is found

6. MINING AND PROCESSING

(see E.A. ELEVATORSKI)

1. At Willsboro, NY, wollastonite is mined by open stope methods (30ft wide varying from 15ft lower level to 80ft at surface).
2. Lump ore is beneficiated dry.
3. Beneficiated wollastonite is ground to four product sizes in pebble mills, and a fibrous product produced in an attrition mill. Finished products are sold under trade name CAB-O-LITE.
4. At LAPPEERANTA, FINLAND, open pit selective mining is necessary as wollastonite occurs in thin bands up to 1m in thickness. After primary and secondary crushing, a 2-stage flotation process is employed. Both calcite and other silicate minerals are removed. After drying, flotation concentrates are ground in a pebble mill to produce to principal grades, one - 50 mesh and the other - 200 mesh.

Concentrates are composed of:-

SiO ₂	51-53%
CaO	43-45%
Al ₂ O ₃	0.5%
Fe ₂ O ₃	0.2%
MgO	0.3%

0240

7. CONSUMPTION/PRODUCTION

1. Consumption of wollastonite appears to be around 115,000 tonnes/year. Up from 90,000 in 1974.

2. Main produces are the:-

U.S.A., Finland and India.

3. Australian Mines Review 1984.

<u>COUNTRY</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
Finland	10,576	8,782	13,690	14,962	15,402
Kenya	200	--	--	--	--
Mexico	11,892	20,905	14,602	15,599	--
U.S.A.	63,000	76,000	87,000	86,000	83,000
India	3,794	5,790	15,915	20,724	16,557

4. Commercial Specifications

Products in the U.S.A. are classed as:-

"Milled Grades" (200, -325 and -400 mesh, and -10um)

"Attrition Grades" (@ 20:1 length/diameter product)

5. In trade, the USA and Finland consume 80-90% of their respective production, with the remainder export to Denmark, Germany, Italy, Great Britain and Canada.

B. SYNTHETIC WOLLASTONITE

1. Varieties of synthetic wollastonite are made in USA and Europe (Denmark, Italy, Germany) and USSR.
2. Synthetic forms do not have the acicular crystal structure of the natural mineral, and are also more absorbent.
3. A synthetic variety "SYNOPAL" is made in Denmark from chalk, sand and dolomite.

In Italy "wollonita" is made from silica, chalk, sand and dolomite. This is used as a road material, an abrasive and in ceramics.

4. In the USA, synthetic wollastonite is manufactured in "silene" (Pittsburg Plate Glass Company) and as "Micro Gel" (Manville Products Corporation).
5. Synthetic varieties cost around twice that of the natural product.

034

9. PRICES/SPECIFICATIONS

1. Prices in 1981 of the milled grades were 2-5 cents (US) per pound (i.e. \$US40-100 per tonne) and 7 cents per lb (\$150 per tonne) for attrition grade.
2. In Australia (1988) processed wollastonite, known as "KEMOLIT" sells for \$A550-650 per tonne. The wollastonite is imported from either India or the USA.
3. Generally specifications for wollastonite conform to the demand of the consumer.

In USA, wollastonite under trade name Cal-O-Lite is provided in the following grades.

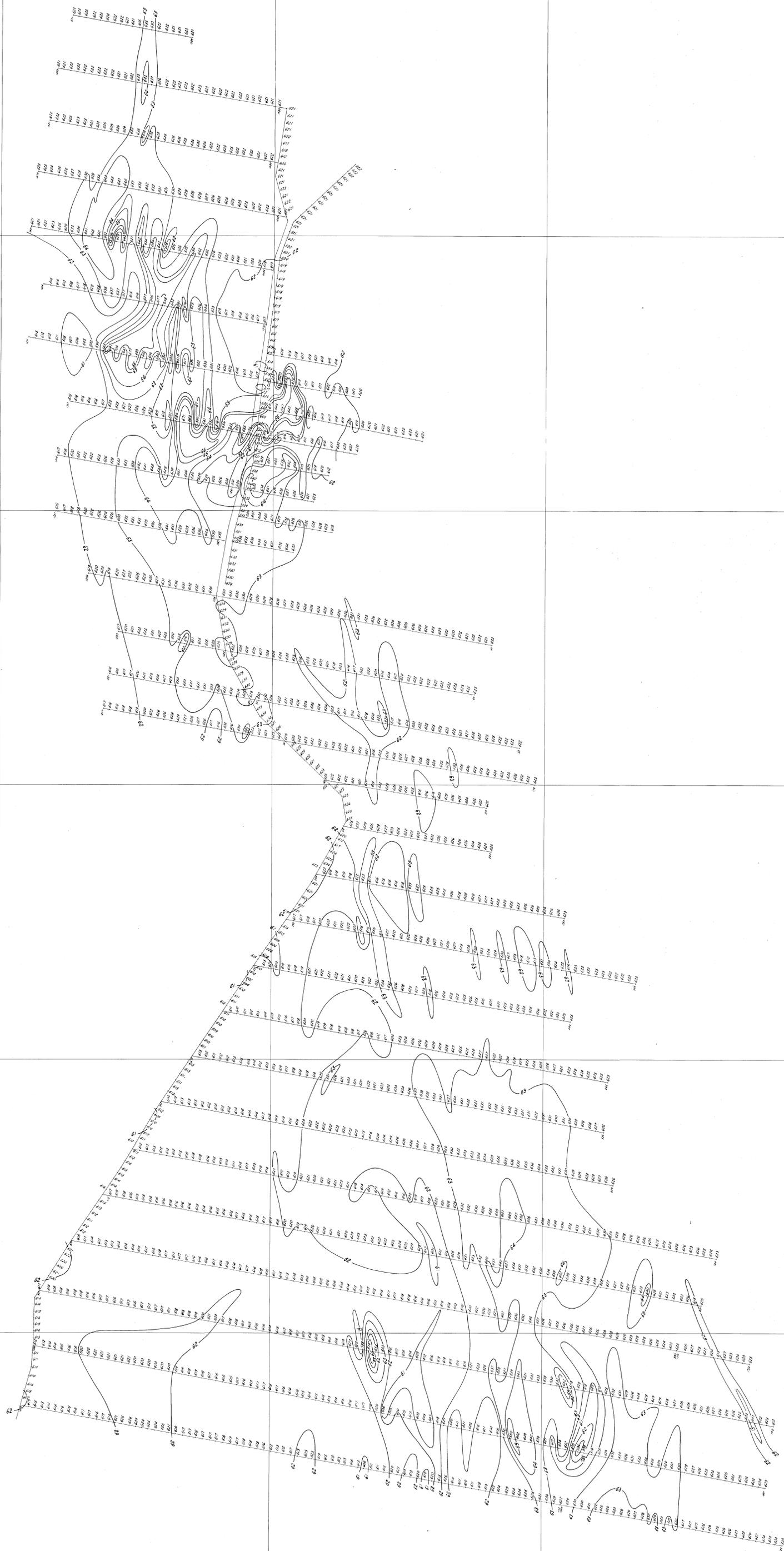
<u>QUALITY</u>	<u>GRADE</u>	<u>Av PARTICLE SIZE u</u>
Paint	P-1 (medium)	11
	P-4 (fine)	7
Ceramic	C-1 (medium)	16
	C-6 (coarse)	23
	C-101 (all purpose)	500
Caulhing	F-1	32
	FF-1	25

4. Primarily, wollastonite is sold in two grades, one for the ceramic industry and one for the paint industry. CAB-O-LITE is sold in 50lb bags or bulk.
5. In February 1975, nominal per ton prices for wollastonite were:-
 - \$44 per ton - for fine, paint grade, bags, calots ex-warehouse
 - \$44 per ton - for medium, paint grade, bags, calots ex-warehouse

10. REFERENCES

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- Longman M.J. 1962 - Wollastonite at Limestone Creek near Hampshire. Tech. Report Department of Mines Tas. 6:10-15
- Industrial Minerals August 1981 - Wollastonite "Production and Consumption Continue to Climb".
- R.B. Ladoo 1960 - Industrial Minerals and Rock "Wollastonite"
- J.G. Broughton 1944 - Occurrences and uses of Wollastonite from Willsboro. NY Mining Tech. (July 1944) 8, 1-8.
- Burhham K.D. & Wainer E. - Potential uses of wet processed wollastonite Society of Mining Engineers USA - March 1965

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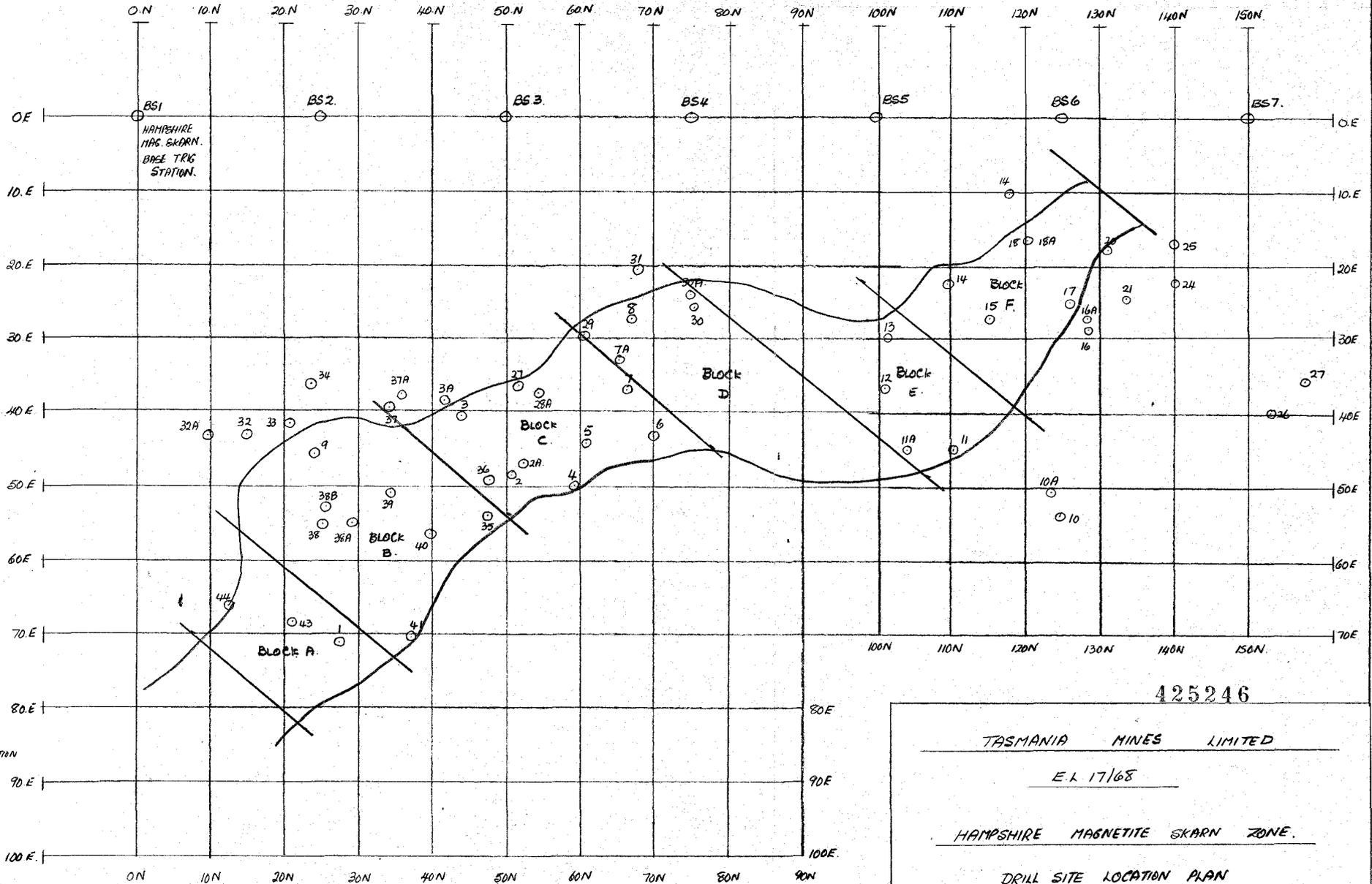
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- LEGEND
- > 66,000 Gammas
 - 65 - 66
 - 64 - 65
 - 63 - 64
 - 62 - 63
 - 61 - 62
 - 60 - 61
 - < 60

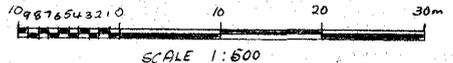
TASMANIA MINES LIMITED
 KARA TUNGSTEN PROJECT, TASMANIA
 GROUND MAGNETITE SURVEY
 HAMPSHIRE MAGNETITE SKARN

9941

HAMPSHIRE MAGNETITE SKARN.



42
 O = PERCUSSION
 DRILL SITE LOCATION
 + DRILL HOLE NO



5 cm

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TASMANIA MINES LIMITED

E.L. 17/68

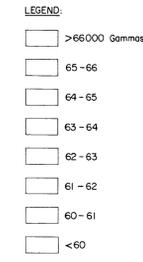
HAMPSHIRE MAGNETITE SKARN ZONE.

DRILL SITE LOCATION PLAN

SCALE 1:500

DATE AUG. 1989

PLAN NO
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5 cm

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TASMANIA MINES LIMITED
KARA TUNGSTEN PROJECT, TASMANIA
LOUDWATER CK./HAMPSHIRE MAG. ANOM.
GROUND MAGNETICS

5563

TASMANIA MINES LTD.
EXPLORATION LICENCE 17/68

133215

WOLLASTONITE DEPOSITS - LIMESTONE CREEK

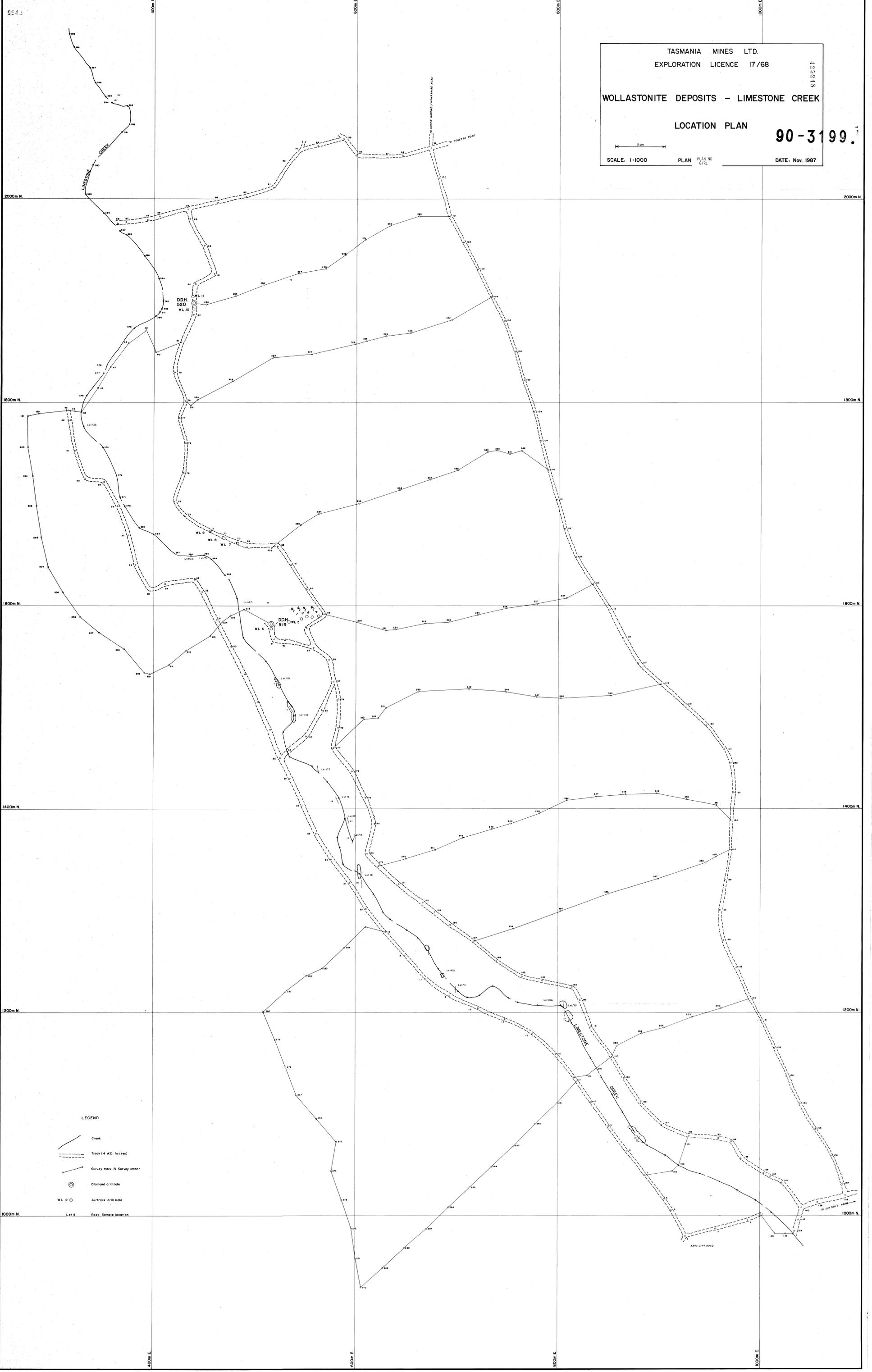
LOCATION PLAN

90-3199

SCALE: 1:1000

PLAN PLAN NO 6/RL

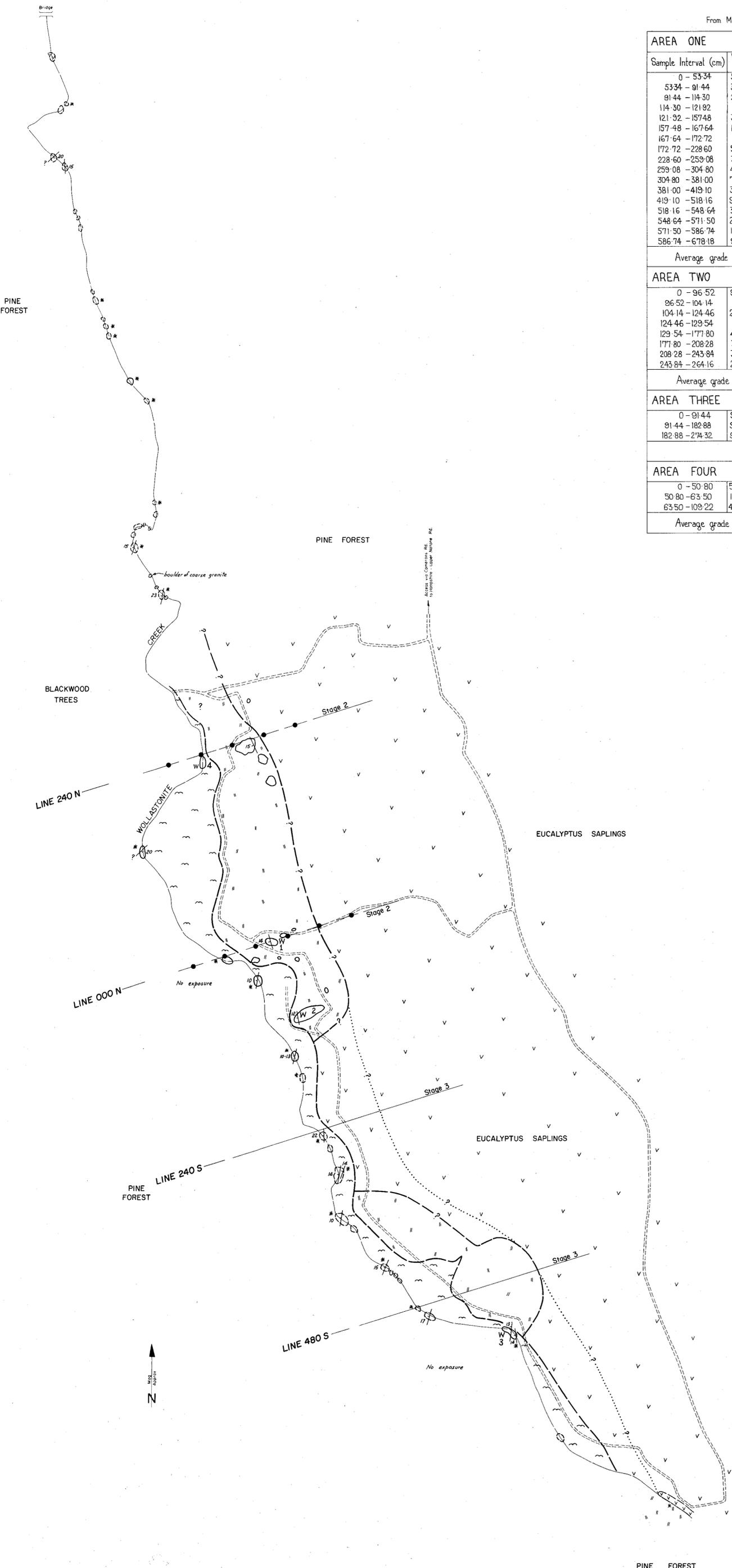
DATE: Nov. 1987



LEGEND

- Creek
- Track (4 W.D. Access)
- Survey track & Survey station
- Diamond drill hole
- Airtrack drill hole
- Rock Sample location

AREA ONE			
Sample Interval (cm)	Width (cm)	Wollastonite Ca Co ₂ %	Lithotype
0 - 53.34	53.34	32.7	Hornfels containing wollastonite.
53.34 - 91.44	38.10	5.6	Banded chert.
91.44 - 114.30	22.86	45.6	Hornfels composed dominantly of wollastonite.
114.30 - 121.92	7.62	—	No sample. Badly weathered limestone.
121.92 - 157.48	35.56	33.6	Hornfels with wollastonite.
157.48 - 167.64	10.16	13.4	Banded chert.
167.64 - 172.72	5.08	9.8	Impure limestone.
172.72 - 228.60	55.88	53.1	Hornfels with small lenses of limestone.
228.60 - 259.08	30.48	4.3	Banded chert.
259.08 - 304.80	45.72	42.6	Hornfels composed dominantly of wollastonite.
304.80 - 381.00	76.20	25.3	Hornfels containing wollastonite.
381.00 - 419.10	38.10	14.2	Alternating bands of chert containing wollastonite (?).
419.10 - 518.16	99.06	44.5	Alternating bands of hornfels, chert and limestone.
518.16 - 548.64	30.48	27.7	Chert bands containing wollastonite (poorly bedded).
548.64 - 571.50	22.86	31.3	Limestone and wollastonite hornfels.
571.50 - 586.74	15.24	20.6	Alternating bands of chert and hornfels.
586.74 - 678.18	91.44	20.8	Limestone and wollastonite hornfels.
Average grade 31.5%. Grade rejecting chert bands 34.1%			
AREA TWO			
Sample Interval (cm)	Width (cm)	Wollastonite Ca Co ₂ %	Lithotype
0 - 96.52	96.52	60.0	Wollastonite hornfels.
96.52 - 104.14	7.62	10.2	Banded chert.
104.14 - 124.46	20.32	64.8	Wollastonite hornfels.
124.46 - 129.54	5.08	14.8	Banded chert.
129.54 - 177.80	48.26	46.3	Wollastonite hornfels with limestone lenses.
177.80 - 208.28	30.48	2.9	Banded chert.
208.28 - 243.84	35.56	18.8	Limestone with wollastonite hornfels.
243.84 - 264.16	20.32	10.4	Banded chert.
Average grade 42.5%. Grade rejecting chert bands 52.0%			
AREA THREE			
Sample Interval (cm)	Width (cm)	Wollastonite Ca Co ₂ %	Lithotype
0 - 91.44	91.44	12.1	Banded chert containing wollastonite.
91.44 - 182.88	91.44	16.3	Banded chert containing wollastonite.
182.88 - 274.32	91.44	24.5	Banded chert containing wollastonite.
Average grade 17.6%			
AREA FOUR			
Sample Interval (cm)	Width (cm)	Wollastonite Ca Co ₂ %	Lithotype
0 - 50.80	50.80	53.9	Wollastonite hornfels with limestone lenses.
50.80 - 63.50	12.70	9.2	Chert bands.
63.50 - 109.22	45.72	49.0	Wollastonite hornfels with limestone lenses.
Average grade 46.5%. Grade rejecting chert bands 52.0%			



- LEGEND:**
- Recent Alluvium
 - Tertiary Basalt
 - Gordon Limestone (Transition Series) [Calc-silicates, re-crystallised f/s., quartzites (cherts), hornfels.]
 - Inferred Surface Geological Boundary
 - Inferred Surface Geological Boundary (doubtful).
 - Postulated sub-outcrop of Gordon Limestone (Transition Series) beneath Tertiary Basalt and basaltic scree.
 - Dip and Strike.
 - Dip and Strike approximate or validity of outcrop doubtful.
 - Outcrop.
 - Outcrop, Wollastonite observed in field.
 - Outcrop number; 1-4 equals Longman's (1961) outcrop areas.
 - Outcrop, specimen collected.
 - Access tracks.
 - Proposed drill holes (Stage 2)
 - Proposed stage 3 drill holes (holes not shown).

90-3199

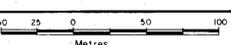
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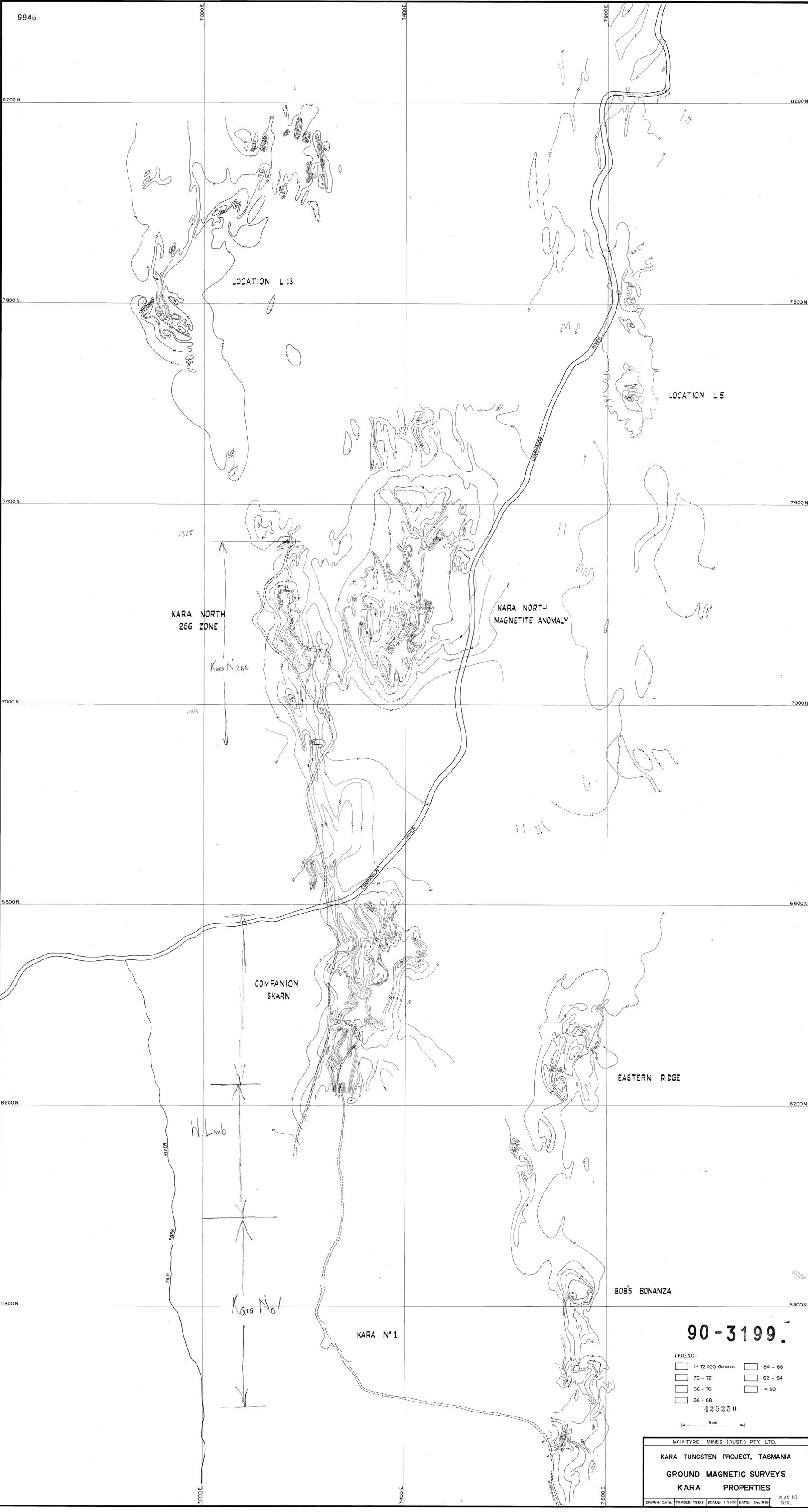
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TASMANIA MINES LIMITED	
E.L. 17/68 WOLLASTONITE CREEK	
DRAWN BY : M.P.E.	DRAFTSMAN : T.G.D.S.
DATE : Oct. 1985	REVISIONS :
FILE NO.	PLAN NO 7/RL

GEOLOGICAL INTERPRETATION

SCALE: 1:2500



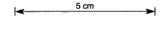


90-3199

LEGEND:

[Symbol]	> 72 000 Gammas	[Symbol]	64 - 66
[Symbol]	70 - 72	[Symbol]	62 - 64
[Symbol]	68 - 70	[Symbol]	< 60
[Symbol]	66 - 68		

425250



McINTYRE MINES (AUST.) PTY. LTD.
 KARA TUNGSTEN PROJECT, TASMANIA
 GROUND MAGNETIC SURVEYS
 KARA PROPERTIES

DRAWN: CHW TRACED: TG.D.S. SCALE: 1:2500 DATE: Dec 1983 PLAN NO: 8/RL

