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GEOLOGICAL INVESTIGATIONS IN THE CAPE HORN - LYELL COMSTOCK - WEST SEDGWICK AREA

A Report for Gold Fields Exploration Pty. Limited

D of M A.O. D. DIR. - 6 JAN 1986 DEPT. OF MINES REF. No. 105/86 Registrar E & R.

P. Komyshan

October, 1985.

Distribution: G.F.E.L. Burnie (2 copies)
Mt. Lyell Office
Tasmanian Department of Mines
Gary Arnold - G.F.E.L. Canberra
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G.F.E.L. Report No.: T/85/10

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ABSTRACT

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Detailed geological mapping with an emphasis on structural interpretation was carried out during an 8-week period in the Cape Horn - Comstock - West Sedgwick area, immediately north of the main Mt. Lyell Mining field. This work followed from recommendations by G.O. Arnold after his major investigation in the North Lyell - Blow area earlier this year. Both the mapping philosophy used and the conclusions reached in this study agree quite closely with those of Arnold.

The Mt. Read Volcanics in this area are subdivided into two main units:

(1) **The Lyell Schists:** These comprise two main lithologies, viz:

  (a) basic to intermediate schists

  (b) felsic quartz sericite schists. These host all of the economic mineralisation at Lyell Comstock and Cape Horn.

(2) **Tyndall Group:** These overlie the Lyell Schists with apparent conformity and are less altered and cleaved than the Schists.

Arnold described two Devonian folding events. This study has identified a third fold phase. The three Devonian events documented by this work are:

(1) D_1 (Arnold's D_1), north-south trending fold axes.

(2) D_2, east-west trending fold axes. One major anticline is identified in the Comstock Valley and is defined by folding of the entire stratigraphy as well as a postulated fold in the Great Lyell Fault.

(3) D_3 (Arnold's D_2), north-west trending fold axes.

The Comstock "Chert" body, the largest of several enigmatic masses of intensely silicified rock which occur to the north-west and south-west of the Comstock Open Cut, is considered to be a wedge of silicified Owen Conglomerate enclosed by an imbricate thrust fault system sub-parallel to and west of the Great Lyell Fault.

This study has revealed that the mapped area has potential for four styles of economic mineralisation:

(1) High grade, North Lyell-style Cu-Ag ore on the south-east and west flanks of the Comstock "Chert".

(2) Au-Cu mineralisation adjacent to the Great Lyell Fault in the Queen Lyell area between Cape Horn and Comstock.

(3) A small deposit of secondarily enriched Cu-Au mineralisation just north of the Cape Horn open cut.

(4) Stand alone Au mineralisation within the Comstock "Chert".

Although several very small deposits of apparently volcanogenic massive base metal sulphides are known in the Tasman Crown and Lyell Comstock workings, there is little exploration potential for extensions to them. This is because the mineralised horizons are thin and must terminate at a shallow depth against the Great Lyell Fault.

The following work is recommended:

(1) Diamond drilling beneath the southern end of the Comstock "Chert" to test for North Lyell-style Cu-Ag mineralisation in the volcanics and gold values within the "Chert".

(2) Comprehensive gold assaying of drill core from the Queen Lyell area.

(3) Shallow follow-up drilling or costeaning north of Cape Horn to explore for extensions to the high grade Cu-Au mineralisation in the north face of the Cape Horn open cut.

A brief reconnaissance was made along the Great Lyell Fault in the Great Lyell area, south of the Blow. This work revealed an area of complex structure and strong alteration in the vicinity of the Copper Estates workings which is prospective for North Lyell-style Cu-Ag mineralisation.

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1. INTRODUCTION

This report outlines the results of six weeks of field work carried out in the Cape Horn, Lyell Comstock and West Sedgwick areas (see Figure 1).

1.1 Current Geological Interpretation

This work was carried out as a follow-up of Gary Arnold's mapping of the main Mt. Lyell Field undertaken earlier this year. Arnold (1985) envisaged the Mt. Read Volcanics were thrust over the younger Owen Conglomerate sequence along a north-south trending depositional hinge line or basin margin. He considers that the thrusting was accompanied by imbrication and folding of the Mt. Read-Owen contact and by large scale recumbent folding in the Owen Conglomerate. This deformation resulted in the "Haulage" unconformity. Subsequent Devonian deformation was recognized to include a phase of north trending folds (D_1) and a phase of northwest trending folds (D_2). At least one other phase of strong deformation predating D_2 is suggested, but not clarified.

Arnold considers that two phases of mineralisation are present at Mt. Lyell. Those are an early volcanogenic Cambrian mineralisation present as beds or boudins of massive laminated pyrite with or without Cu, Pb and Zn sulphides and later (possibly Devonian metamorphogenic) mineralisation located in the vicinity of the schist/conglomerate contact and forming high grade base metals and precious metals associated with the deposition of silica, barite and hematite.

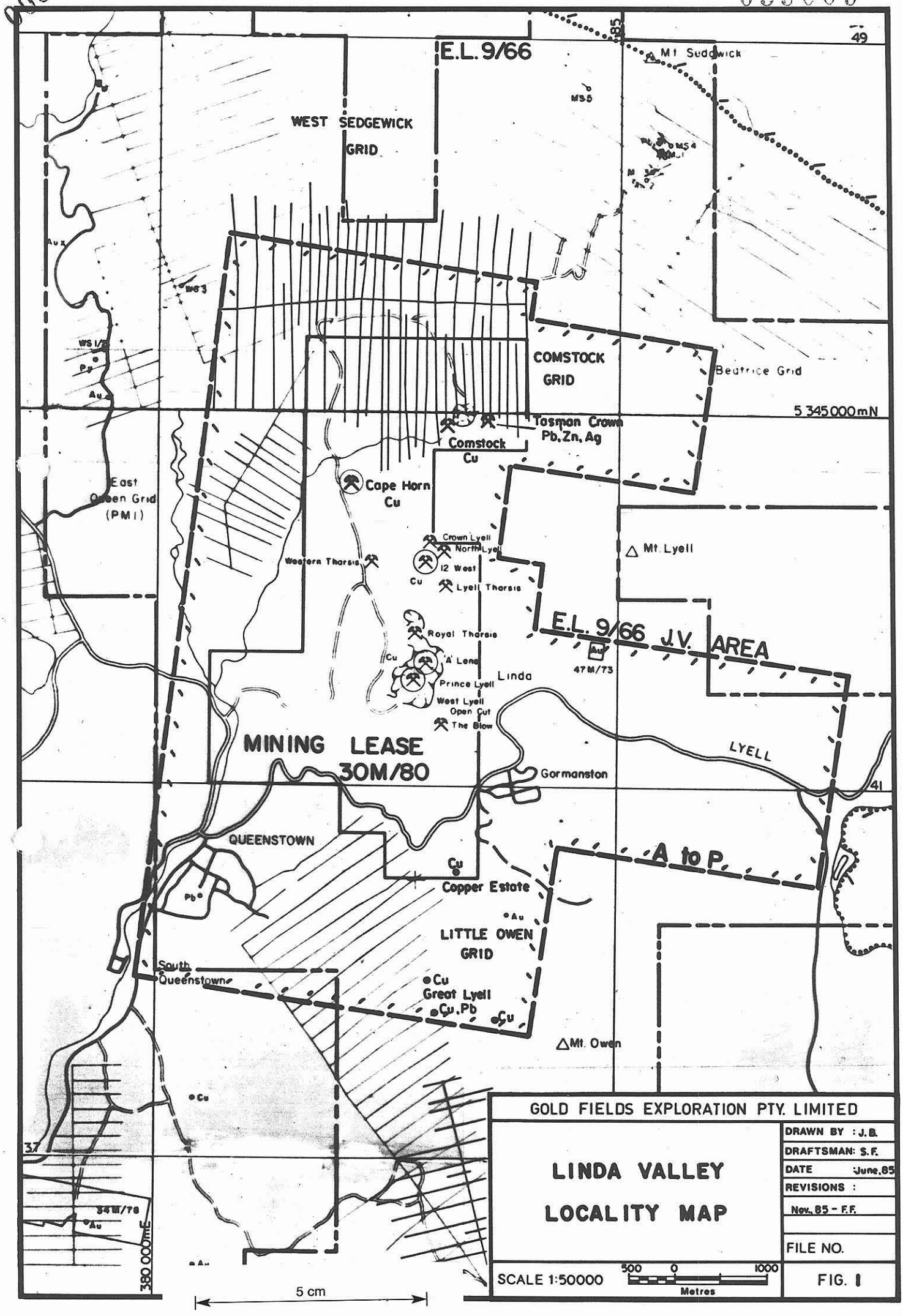
Arnold recommended that exploration at Mt. Lyell be concentrated on:

(a) locating zones of primary volcanogenic mineralisation, particularly beds and boudins of massive laminated pyrite (±Cu, Pb, Zn sulphides) and boudins of silica-pyrite;

(b) determining the position and orientation of the schist/conglomerate contact;

(c) outlining alteration along the schist/conglomerate contact, particularly hematite, barite and silica.

The mapping in the Cape Horn-Comstock-West Sedgwick area was carried out following these recommendations.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Mt Sedgwick
MS5
MS4
COMSTOCK GRID
Beatrice Grid
5 345 000mN
Tasman Crown Pb, Zn, Ag
Comstock Cu
Cape Horn Cu
East Queen Grid (PM1)
Crown Lyell
North Lyell
12 West
Cu
Lyell Thorsis
Western Thorsis
Mt. Lyell
Royal Thorsis
'A' Lens
Prince Lyell
West Lyell Open Cut
The Blow
Linda
47M/73
E.L. 9/66 J.V. AREA
MINING LEASE 30M/80
LYELL
Gormanston
QUEENSTOWN
Copper Estate
A to P
LITTLE OWEN GRID
South Queenstown
Great Lyell
Cu, Pb
Mt. Owen
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LINDA VALLEY
LOCALITY MAP
DRAWN BY : J.B.
DRAFTSMAN: S.F.
DATE June, 85
REVISIONS :
Nov., 85 - F.F.
FILE NO.
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FIG. 1

1.2 Previous Exploration and Mining History

The early work in the Mt. Lyell field is summarised by Arnold (1985). Details of earlier mining and exploration in the Comstock area are being compiled by Fergus FitzGerald in conjunction with this work, however a brief summary of this is given here.

Numerous mining companies explored the Mt. Lyell area on small mining leases following the discovery of the Blow at the end of the 19th century. Legacies from these companies remain with the names of exploration adits, shafts and workings in the Comstock area (see Figure 1). The most important workings are detailed below:

Lyell Comstock - These workings consisted of both open cut and underground development on four en echelon massive pyrite-chalcopyrite lenses (Reid, 1975). These workings later incorporated the Tasman Crown workings to allow access to lower levels. Production from the mine was first recorded in 1913, and continued until 1944. During this period a total of 1.34 million tonnes of ore was mined with recovery grades of 2.38% Cu, 5.23 g/t Ag and 0.67 g/t Au.

Tasman Crown - These workings which consist of adits and shafts, explored a small galena-pyrite body, a small bornite-pyrite body and the easternmost massive sulphide lens of the Lyell Comstock bodies. The workings were later incorporated within the main Lyell Comstock Mine.

Queen Lyell - The workings appear to consist of one adit driven to the schist/conglomerate contact, with little other underground development. Only minor copper mineralisation was encountered.

North Crown Lyell - These workings consist of three adits driven to the schist conglomerate contact. The schist/conglomerate contact was driven along from the lowest of these adits (No.3). Mineralisation, including bornite, is recorded on old mine plans. The North Crown Lyell Co. were extremely unlucky as it appears that their southernmost workings were developed to within metres of the Cape Horn orebody, discovered half a century later.

Cape Horn - This orebody, which was discovered in the mid 1960's, has produced 3.83 million tons of ore at 1.39% Cu, 3.3 g/t Ag and 0.42 g/t Au to June 1985, from both an open cut and underground development.

Extensive diamond drilling was carried out (during the 1960's and early 1970's) in the Comstock-Cape Horn area generally following up programs of geophysics and minor geochemistry.

Green (1971) mapped the Comstock to Cape Horn area as part of an honours project but appears to have concentrated on the mineralogy of the mineralisation. The geological maps presented with this report differ substantially from the geological interpretation shown in Green's thesis.

It should be noted that due to time constraints, no thin section work was carried out with this study. For this reason, conclusions reached about rock types and cleavage overprinting are based on visual examination of hand specimens and rock type, and descriptions are not too detailed.

Results from the current mapping program are presented on figures 2, 3, 4, 6 and 8, and sample assays and descriptions are presented in Appendix 1.

1.3 Acknowledgements

My thanks are due to Gold Fields Exploration Pty. Limited, in particular Lindsay Newnham, Paul Roberts and Fergus FitzGerald (G.F.E.L. Tasmania) for the opportunity and help with work on this project, and to Gary Arnold (G.F.E.L. Canberra) for providing the stimulus for the project. John Carswell and Peter Hills, (Renison Goldfields Consolidated, Mt. Lyell) also assisted with the compilation of some of the data.

2. STRATIGRAPHY

2.1 Introduction

The regional setting of the Mt. Lyell area has been discussed by numerous authors, e.g. Wade and Solomon (1958), Corbett et al. (1974), Williams et al. (1975), Corbett (1979) and Corbett (1981). The Comstock area occurs within the Mt. Read Volcanics, a 10-20 km wide, north-south trending belt of acid to intermediate volcanics extending through Western Tasmania. The belt is flanked to the east by Precambrian quartzites and schists and to the west by Cambrian sedimentary sequences containing ultramafic-mafic volcanic complexes (Corbett, 1979). The Mt. Read Volcanics, in the Comstock area, include a sequence of volcanic and sedimentary rocks, defined as the Tyndall Group, which according to Corbett et al. (1974) unconformably overlies the mineralised sequence of volcanics. This unconformity is discussed later in the report.

The Mt. Read Volcanics are overlain by Owen Conglomerate and its correlates of late Cambrian to Early Ordovician age, which consist of siliceous, Precambrian derived conglomerate and sandstone. Arnold (1985) and Corbett et al. (1974) describe this sequence as up to 1000m thick. They suggest that it was deposited in a graben-like basin, and that the present contact zone between the Volcanics and the Conglomerate approximates the margin of this basin.

An angular unconformity, known as the Haulage unconformity which is mapped in the Linda Valley area, separates the Owen Conglomerate from a thin overlying sequence of Owen-style siliclastics, the Pioneer Beds (Arnold 1985). This unconformity was not mapped at Comstock. However, from limited drill hole information, the Pioneer Beds appear to conformably overlie Owen Conglomerate and in turn are conformably overlain by Ordovician Gordon Limestone.

2.2 The Lyell Schists

The use of the term "Lyell schists", a non-stratigraphic term for the mineralised belt of Mt. Read Volcanics, used by earlier workers and by Arnold (1985), is continued in this report.

Overall, the major rock types in the area are intermediate in composition, in contrast to the predominance of more felsic volcanics to the south, in the area mapped by Arnold. Apart for Green (1971), it appears that earlier workers have made little attempt to subdivide units within the Lyell schists of the Comstock-Cape Horn area. Green's major subdivisions included intermediate lithic tuffs, felsic ignimbrites(?) and ignimbrites(?) with minor siltstones. Although the author agrees with these three broad rock groups, detailed mapping in this study shows major discrepancies in the location of these units on plan. Green postulated that the stratigraphy faces to the east, however it is suggested that no such assumption can be made due to the structural complexity of the area and the possibility of sequence repetition.

In this study four unit subdivisions have been proposed based on composition and weathered surface textures. These include two subdivisions similar to those mapped by Arnold, i.e. schists derived from felsic volcanics with siliceous pods and bands and chloritic mafic-intermediate volcanics and schists. The other two subdivisions are a less well defined intermediate schist with siliceous pods and a fine grained to mylonitic(?) strongly sericitised schist located in a zone adjacent to the Great Lyell Fault.

The more altered and deformed rocks close to the schist/conglomerate contact are gradually less deformed and less altered volcanics to the west towards the East Queen River. This enables some recognition of primary rock types which can be inferred closer to the Fault Zones. A short description of each rock type is given below:

2.2.1 **Chloritic Intermediate Schists**

The chloritic intermediate schists in the East Queen River area (as shown on Figure 2) appear to occur in two distinct zones separated by a felsic ignimbrite, a western and northern sequence.

2.2.1.1 Western Intermediate Volcanic Sequence

The westernmost intermediate volcanic sequence includes dacitic agglomerates and ignimbrites and chloritic andesitic crystal tuffs, crystal lithic tuffs, agglomerates and ignimbrites. No attempt has been made to subdivide these various rock types into separate units as this would have required detailed mapping in an area where very little significant mineralisation was observed.

Hematitc alteration which is not associated with silicification occurs within these western intermediate rocks. The most spectacular example of this alteration was mapped in a wide zone in the hanging wall of the Cape Horn orebody. Other minor zones of intense hematitic alteration were also observed away from known or observed sulphide mineralisation. Assays of this alteration type show low levels of base metals and barium, and only trace values of gold (<0.1 g/t), and it is not considered to be prospective.

The western intermediate schist unit appears to have an interfingering "stratigraphic" relationship with the quartz podded unit to the north of Cape Horn, however this outcrop pattern may be the result of three phases of folding as well as partial repetition of the sequence through faulting.

2.2.1.2 Northern Intermediate Volcanic Sequence

The northernmost intermediate volcanic unit consists predominantly of fine to medium grained andesitic crystal lithic tuffs with minor andesitic agglomerates. These rocks, which contain feldspar and minor ferromagnesian and quartz phenocrysts, are similarly strongly chloritically altered. Towards the east this unit becomes strongly sericitised and original textures are virtually obliterated.

Previous interpretation from drill core suggests that the unit is gradational with, and possibly overlain by, a variably developed calcareous-tuffaceous sedimentary horizon. The best section of this calcareous sediment is seen as recrystalised fossiliferous limestone intersected in D.D.H. C50. Samples of this core were used by Jago et al. (1972) to date the sediments as late Middle Cambrian or upper Early Cambrian. However, the stratigraphic relationship of the sub-outcropping carbonate rocks to the predominantly outcropping andesitic volcanics is not clear due to a proposed thrust which occurs subparallel to the stratigraphic strike (see Section 3.3 and Figure 2).

Deposition of the calcareous sediment appears to have occurred during quiescence of the andesitic volcanism towards the "tops" of the sequence. Some coeval volcanism is indicated by outcrops of andesitic agglomerate which contains rounded weathered clasts of fine grained carbonate bearing tuffs. The carbonate horizon has been incorporated into the andesitic sequence on the geological map because of the indistinct boundary between these two lithologies.

Variable spotty to semi-pervasive hematite alteration occurs irregularly throughout the andesitic and carbonate bearing sequence. A zone of strong hematisation is exposed on the northern slopes of a prominent ridge, which extends ENE from the Lyell Comstock Mine. This hematitic zone, which also corresponds with a narrow zone of silicification and low angle cleavage, is considered to be an alteration halo related to a thrust fault (see Section 3.3). The more pervasive hematisation within the tuffaceous carbonates and andesitic tuffs, intersected in drill holes C64 and C68, is associated with low grade silver and base metal values.

The andesitic unit appears to be faulted out to the west, but may be equivalent to andesitic tuffs located to the north on the ridge between Agglomerate Hill and Zig-Zag Hill. It should be noted that the stratigraphic association of andesitic tuffs gradationally overlain by tuffaceous carbonate bearing sediments, overlain by Comstock Tuff seen in the Comstock Valley is very similar to that seen at Howards Anomaly further north.

2.2.2 **Quartz Podded and Banded Schists** Esq

The quartz podded and banded schist sequence appears to vary in thickness from 120m to less than 10m. The sequence is easily mapped in the Comstock area due to the compositional contrast with the surrounding intermediate volcanics.

Towards the west the rocks are predominantly rhyolitic ignimbrite



PLATE 1

Felsic quartz podded schist - originally an ignimbrite as shown by fiammé (darker colour). The S_2 cleavage is parallel to the pencil. Note kinking of this cleavage by S_3.



PLATE 2

Tectonic development of the podded character of the felsic quartz podded unit by S_2 cleavage overprinted on a banded tuff unit (S_2 is parallel to the pencil).

and minor agglomerate composed of feldspar and minor quartz phenocrysts, in a fine grained possibly vitric matrix. Fiammé are clearly identified. Sericitic alteration of feldspars becomes more pervasive towards the east. Also within this sequence very fine grained silicified tuffaceous sediments were recognised 100m east of an old ore pass near the East Queen River.

Within the East Queen River area the siliceous quartz podded unit does not appear to be significantly mineralised. However, closer to the Great Lyell Fault significant disseminated pyrite and pyritic bands associated with siliceous boudins occurs. In fact the main mineralisation at Lyell Comstock and Cape Horn appears to occur entirely within this unit. A feature of the increased deformation of the unit, closer to the Great Lyell Fault, is the development of the podded, and occasional banded character, of the unit and the almost total obliteration of original volcanic textures.

2.2.3 Intermediate Quartz-Podded Schists Esv

Flanking the quartz podded schist unit to the north and east (except near the "Comstock chert") is an andesitic to dacitic schist which contains quartz pods and bands. Boundaries of this unit could not be mapped with complete confidence due to its compositional and often textural similarity to the adjoining intermediate rocks.

The rocks are generally chloritic with abundant phenocrysts of felspar, minor quartz and rare ferromagnesians. Lithic clasts of siliceous rocks (lava?) and andesitic volcanics were also noted. Texturally the rocks appear to be agglomeratic, however a finely interbedded sequence of intermediate and acid tuffs could give similar textures when multiply and strongly deformed. A feature of the intermediate quartz podded schists is the presence of strong disseminated pyritic mineralisation in contrast to the adjoining chloritic intermediate volcanics.

2.2.4 Quartz-Sericite Schists

Sericite-quartz schists occur in a prominent zone, 20-100m wide, adjacent to the Great Lyell Fault extending north from Cape

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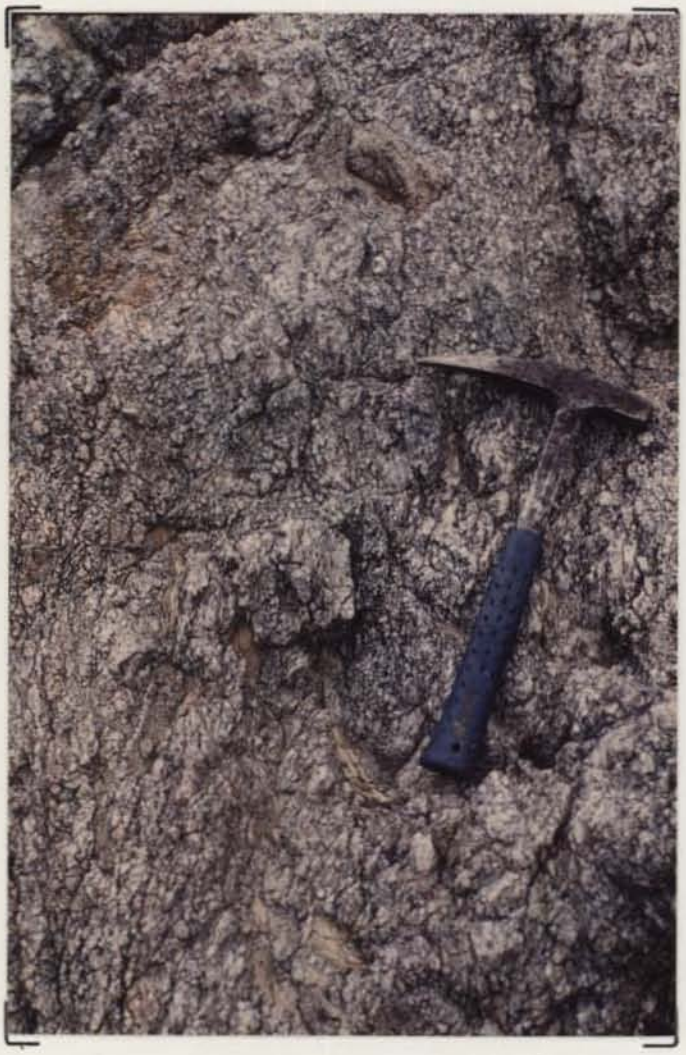

PLATE 3

Silicified felsic quartz podded schist - originally an ignimbrite or agglomerate as indicated by the cream coloured volcanic clasts and fiammé.



PLATE 4

Felsic quartz podded schist unit. The S_1 cleavage and bedding(?), sub-parallel to the base of the photograph is folded by a F_2 fold and cross cut by S_2 cleavage (parallel to the pencil).

Horn to the Lyell Comstock open cut. The unit is separated from the fault by a wedge of Comstock tuff further east beyond the open cut and this suggests that the schists may be semi-stratigraphic rather than simply the product of alteration and deformation.

The unit is pervasively sericitised and strongly cleaved with little or no remnant primary textures. Outcropping on a drill hole access road near Cape Horn are "rafts" up to 50 cms in diameter of siliceous pods (originally rhyolitic tuff or lava?) "floating" in a sericitic matrix.

Mineralisation in this unit is extensive as shown by:

(a) Pervasive disseminated pyritic mineralisation

(b) A large pyritic boudin (with minor base metal sulphides) outcropping in the Comstock Open Cut

(c) A siliceous body containing pyrite, chalcopyrite and chalcocite outcropping in the Cape Horn Open Cut

(d) Zones of copper mineralisation located in a number of drill holes in the Queen Lyell area

(e) Minor mineralisation in the North Crown Lyell adits.

It is suggested that this unit may have originally been a carbonate bearing tuff, similar to the rocks which occur to the north west of the Comstock open cut without the subsequent hydrothermal alteration and strong deformation.

2.3 Tyndall Group

2.3.1 The Unconformity at the Base of the Tyndall Group?

The Tyndall Group was defined by Corbett et al. (1974) as an unconformable Late Cambrian sequence of volcanic and sedimentary rocks which included the Jukes Formation, the Comstock Tuff and a fossiliferous limestone at the base of the group. The Jukes Formation and the Comstock Tuff are clearly mappable units distinct from the underlying volcanics. However the basal carbonate unit is not easily mapped as it has a gradational and interfingering relationship with the andesitic volcanic sequence.

As a consequence confusion has occurred in identifying and locating the basal Tyndall Group rocks particularly in Comstock diamond drill hole logs. This confusion has resulted in the development of the idea of an unconformity at the base of the Tyndall Group in the Comstock area.

The contact between the Tyndall Group and underlying volcanics has been recognised in a number of areas. Many descriptions of the original field work, however, do not describe an unconformity, e.g. Green (1971), Corbett (1979) and Corbett (1981). It is usually in the more general interpretative geological papers that the unconformity is stated clearly to exist.

No evidence for an unconformity at the base of the Tyndall Group could be found in surface outcrop or within diamond drill hole intersections during the current mapping program. It is considered that the commencement of deposition of the Comstock Tuff represents a change from andesitic volcanism to felsic volcanism and that the presence of carbonate indicates a hiatus in volcanism. The contact of the Comstock Tuff with the underlying rocks is probably disconformable in places, but not necessarily uncomformable.

A further complication in the Comstock area and not considered by other workers is that if the Comstock Tuff, which dips to the S.W., overlies the volcanics to the south, then the sequence is overturned. This structural complexity is discussed in the next section.

The inclusion of the carbonate unit in the Tyndall Group has created problems in defining the lower boundary of this sequence. The more readily mappable break marking the commencement of acid volcanism is suggested as a better lower boundary of the Tyndall Group.

2.3.2 Comstock Tuff

The Comstock Tuff is a "sequence of interbedded quartz, keratophyric tuffs, breccia, sandstone and shale" (Corbett et al., 1974). On Zig-Zag Hill it is interpreted to have a maximum thickness of 300-400m. The sequence appears to thin along strike in towards the Lyell Comstock mine area to approximately 150m. A thin wedge of Comstock Tuff also occurs in the West Sedgwick area.

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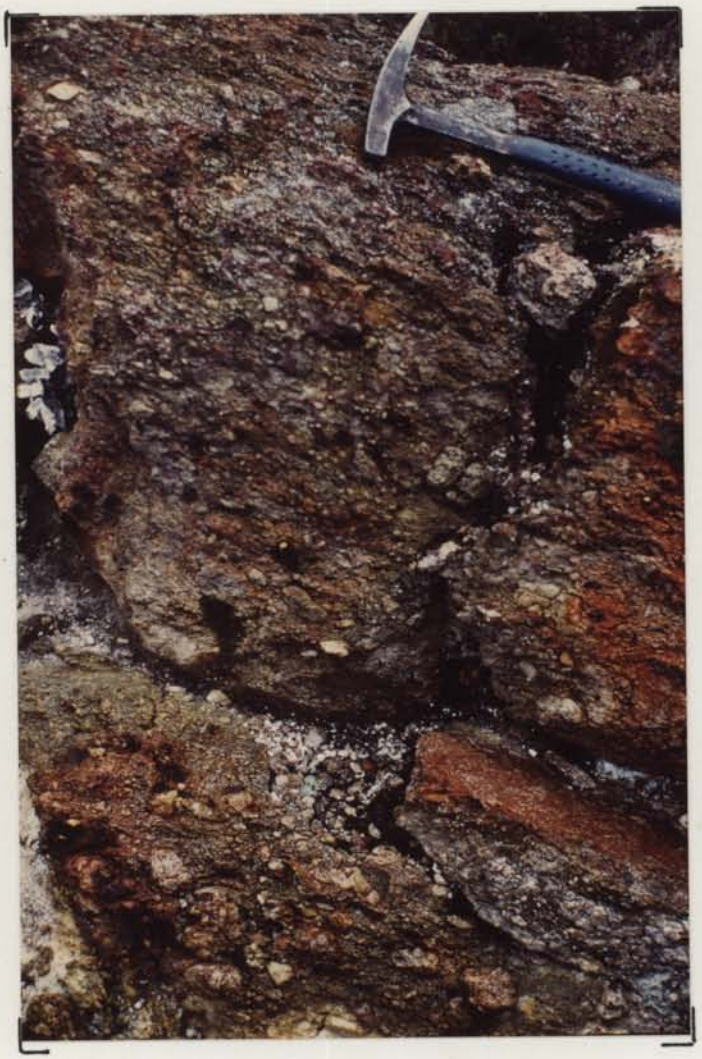

PLATE 5

Pyritic, partially hematitically altered quartz pebble conglomerate which is part of the "Comstock Chert" body. The strongly developed penetrative S_2 cleavage is parallel to the hammer handle.



PLATE 6

Silicified, brecciated "Comstock Chert" with hematitic veining and alteration.

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In the Lyell Comstock open cut, only minor sediment is present within the Comstock Tuff. The tuffs generally overlie a quartz phyric volcanic with a vitric to fine grained siliceous matrix. This rock, which is probably ignimbrite, has been described as a quartz porphyry in a number of drill hole intersections and underground workings. It is considered to be part of the Tyndall Group. A banded pyrite-galena boudin outcropping in the Lyell Comstock open cut occurs entirely within this quartz phyric rock. Dump samples near the shaft also indicate that the Tasman Crown workings and mineralisation may have been predominantly within this rock type.

2.3.3 Jukes Formation

This unit only outcrops on the western end of the Comstock Valley on the slopes of Zig-Zag Hill. Drill hole intersections of the Jukes Formation have also been obtained north of the Lyell Comstock open cut, adjacent to the Great Lyell Fault. The contact with the underlying Comstock Tuff appears to be a gradational one between an agglomerate containing volcanic and sedimentary clasts and dark green fiamme(?) and a volcaniclastic conglomerate.

Corbett (1981) describes a purple siltstone at the boundary between these two units. This was not observed during current work. Although the relationship of the Jukes Formation to rocks further east is not clear (as this boundary is covered by scree), drill hole intersections indicate a probable faulted contact.

2.4 Owen Conglomerate and the "Comstock Chert"

The distribution of Owen Conglomerate is shown in Figure 2. No attempt has been made in this report to subdivide this formation because of structural complications, particularly in the vicinity of the Great Lyell Fault. An example of this complication occurs at West Sedgwick where a steeply-dipping, grey, siliceous coarse cobble conglomerate is apparently thrust against a shallow dipping sequence of sandstones and conglomerates. Similarly a thrust fault is inferred to occur south east of the Lyell Comstock open cut where steeply dipping Owen Conglomerate and sandstone sits abruptly against a flat dipping red sandstone. An alternative less favoured explanation for this structure is a tight fold along the margin of the conglomerate.

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PLATE 7

Massive hematite-barite vein within the "Comstock Chert".

The major outcrops of "Comstock chert" are interpreted to be altered Owen Conglomerate. On the northern flanks of the longest "chert" body a strongly cleaved and mineralised (pyrite with rare galena and sphalerite) quartz pebble conglomerate identical to the Owen Conglomerate sequence is clearly recognised. A gradual increase in silicification occurs to the south within this outcrop until the original pebble textures are completely lost. The silicified rock has subsequently been brecciated and rehealed with hematite veining particularly in the central part of the body.

The bulk of this outcrop consists of massive recrystalised fine grained silica with no remnant primary textures. Bedding shown within the unit by earlier workers such as Solomon may have been from banded barite-hematite veins which are not considered to be primary. The lack of recognisable pebble textures in the majority of the "Comstock Chert" body suggests that most of the silicified body may have originally been a sandstone.

A group of outcropping "Comstock chert" bodies to the south of the Lyell Comstock open cut are extensively silicified with little evidence of original texture. They appear to form a moderate to steeply west dipping lens within volcanics which, from drilling information, wedges out at depth. This group of outcrops is tentatively correlated with the Owen Conglomerate sequence. However, it is possible that they might be silicified acid volcanics.

2.5 Pioneer Beds

The Pioneer Beds were not recognised within the mapped area however they have been intersected in a number of drill holes. It is suggested that the north side of Mt. Lyell into the Comstock Valley is predominantly a dip slope with the Owen Conglomerate sequence passing conformably up into Pioneer Beds then Gordon Limestone without an E-W fault as suggested by earlier workers. To the north of the Lyell Comstock open cut, in diamond drill hole C59, it is unclear whether the Pioneer Beds overlie the Jukes Formation or are faulted against it.

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2.6 Gordon Limestone

There are no limestone outcrops in the mapped area, however drill hole information indicates that limestone covered by Pleistocene moraine is extensive in the Comstock Valley probably forming the core of a syncline. Dump samples and old mine plans indicate that the Tasman Crown workings are located in Mt. Read Volcanics and not in Gordon Limestone as suggested by Brook (1984).

2.7 Pleistocene

Pleistocene glacial moraine and varved tills cover the central part of the Comstock Valley overlying the Gordon Limestone. Glacially derived material mixed with "house size" blocks of "Comstock chert", and boulders of Jurassic dolerite also occur just to the west of the Lyell Comstock open cut.

3. STRUCTURAL GEOLOGY

3.1 Introduction

Previous structural work in the Cape Horn-Comstock area has been carried out by Solomon (1964) and Cox (1981). However, this appears to have been peripheral to work in the Mt. Lyell area and the maps presented show little detail. Structural interpretations of the Mt. Lyell area prior to 1985 are well detailed by Arnold (1985) and these are not repeated here.

Arnold considers that the structure of Mt. Lyell was developed initially by thrusting of the Mt. Read Volcanics over the Owen Conglomerate along a north-south trending depositional hinge line. Thrusting was accompanied by imbrication and folding of the Mt. Read/Owen contact and by large scale recumbent folding in the Owen Conglomerate. Strong deformation of altered Mt. Read Volcanics in the overthrust sheet is considered to have accompanied this event. Arnold also considers that the Haulage unconformity is a result of this thrusting event which occurred in the early Ordovician. Subsequent Devonian deformation included a north-south trending fold phase (D_1) and a northwest trending fold phase (D_2).

The basic sequence of structural development recognised by Arnold in the Mt. Lyell area is also recognised in the Cape Horn-Comstock area, however some additional features are recognised. In addition to thrusting along the Mt. Read/Owen contact, thrust faults entirely within the Owen Conglomerate and entirely within the Mt. Read Volcanics are also inferred. An additional deformational event is also postulated. This is represented by broad E-W folds with an E-W trending axial cleavage. This event postdates the D_1 event of Arnold (1985) and predates the predominant north-west trending event. Structural nomenclature requires the E-W trending event to be labelled as D_2 and the overprinting northwest trending folding and cleavage forming event as D_3. This D_3 event is equivalent to the second deformation phase of all earlier workers including Arnold (1985).

One of the features of the Cape Horn-Comstock area in contrast to the Mt. Lyell mine area is the spatial development of cleavage and the

lack of a pervasive overprint by the later NW trending cleavage. This has enabled the recognition of three major Devonian deformational events. It is suggested that this three phase deformation also applies to the Mt. Lyell area but that recognition of the E-W trending folding has been prevented by the intensity of the pervasive NW trending cleavage.

3.2 The Great Lyell Fault and Other Thrust Faults

The faulted contact between the Owen Conglomerate and the Mt. Read Volcanics (known as the Great Lyell Fault) in the southern part of the Cape Horn open cut strikes approximately north-south. Further north this strike gradually swings to the NE, a trend that is maintained to the Comstock Valley (see Figure 3). In detail, the contact appears to have minor perturbations which indicates that only weak subsequent folding of the structure has occurred compared to the extensive folding of the contact in the Mt. Lyell area.

In general this faulted contact dips to the west and north west at approximately 60-70° as indicated by drill intersections and mine plans. Mt. Lyell contour plans of the Owen/Mt. Read contact at CapeHorn show a regular dipping structure off-set by numerous small faults. However the more probable explanation is that the contact has been irregularly folded.

Old mine plans from Lyell Comstock indicate that the Mt. Read/Owen contact dips at 75° from the surface to the 460m level, then forms a "ledge" dipping at 33° down to the 375m level, then steepens again to 65° at the lowest level of the mine workings (263m level). The Tasman Crown base metal mineralisation sits above this contact "ledge" and hence the mineralisation appears to be faulted out by the shallow dipping Great Lyell fault.

North of the Tasman Crown shaft in the Comstock Valley the Great Lyell fault is covered by glacial moraine but it may have been intersected in diamond drill holes C50 and C59. D.D.H. C50, which was collared in Gordon Limestone, drilled south and intersected a faulted contact between the limestone and the Jukes Formation. D.D.H. C59, which was collared in Comstock Tuff, drilled north and intersected Jukes Formation with a possible faulted or conformable (i.e. ill-defined) contact with



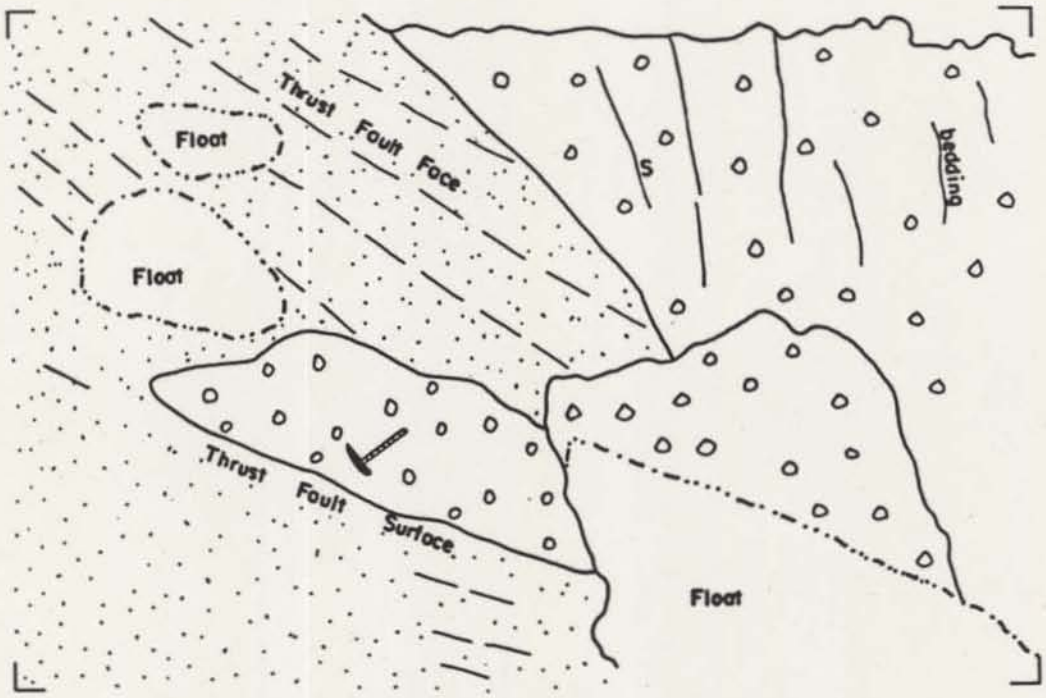

PLATE 8

Lake Margaret thrust fault surface at West Sedgwick. Grey coarse conglomerate to the right is thrust on pink flat dipping sandstone (bedding not visible in this photograph) on the left. Boulders in the foreground are dislodged blocks.

Pioneer Beds. It is suggested that in the Comstock area the Great Lyell Fault, which initially struck N-S and dipped west, was folded into an open, E-W trending D_2 syncline. This has resulted in the NE trending strike to the fault south of Lyell Comstock and an apparent NW trending strike to the north (see Figure 3).

The Owen Conglomerate/Mt. Read Volcanics contact in the West Sedgwick to Lake Margaret area appears to strike to the NW near Zig-Zag Hill then swings to the NNW near the Lake Margaret pipeline (see Figure 6). The contact is covered by scree along this mapped extent and hence no indication as to the dip of the structure could be obtained. No evidence of intense hematisation or silicification related to this contact were recognised in this area.

On the western slopes of the Sedgwick Plateau steeply dipping to vertical coarse cobble conglomerate is spectacularly thrust against flat dipping red sandstone. This structure is called the Lake Margaret Fault here (see Figure 6). A fault face is exposed in a number of places as a west dipping slab with a variable dip of 40-70°. The red sandstone to the east of the fault is folded over a narrow 5-10m zone adjacent to the fault with minor overturning of bedding. However, no recumbent folding was evident. The fault zone has minor silicification of the footwall and the hangingwall but only a trace of hematitic alteration.

A similar structure is inferred to the east of Lyell Comstock where steeply dipping Owen Conglomerate and sandstone with a NE strike sits abruptly against moderate north dipping and E-W striking sandstones and conglomerates. This contact is not exposed in the field.

3.3 Lyell Comstock Silicified Bodies and the Tasman Fault

In the Lyell Comstock area two zones of interpreted silicifed Owen Conglomerate occur within the Mt. Read Volcanics (see Figure 2). The southern most group of silicified bodies form a lens sub-parallel to the Great Lyell Fault. The bodies dip at an average of 60° to the NW, however one measurement of the dip of the contact is 30° NW. This group of silicified bodies outcrops on the south face of the Lyell Comstock open cut. Here the body, which is 1m wide, wedges out at depth against a steeply dipping fault zone.

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The largest silicified body is the "Comstock chert", and although this is irregular in shape it appears to be generally "triangular" in shape (see Figure 2). Scree and glacial debris prevent detailed mapping of the western contact of the body, however on the eastern margin the contact with the volcanics is "embayed" or multiply folded. The northern contact of the "Comstock chert" appears discordant to the volcanic stratigraphy. Drill hole and mine plan data indicate that the "Comstock chert" body continues at depth plunging at approximately 60-70° to the west.

The shape of the "Comstock chert" may be the result of folding of an initially irregularly shaped wedge of Owen Conglomerate/sandstone by the north-south trending D_1 deformation and subsequent folding in the axis of an east-west trending D_2 syncline. Silicification of the conglomerate is considered to have occurred in the early part of the D_2 event as D_2 cleavage postdates silicification. Later NW trending D_3 folds appear to have had little effect on the body.

The Lyell Comstock mine plans and sections show that the "Comstock chert" (or "quartzite" to use an earlier synonym) dips sub-parallel to the Great Lyell Fault and to the Lyell Comstock orebodies. Small outlying quartzite blocks or pods are shown in the hangingwall of the mineralisation (i.e. the footwall of the "Comstock chert"). These "quartzite" outliers may be either a fault breccia zone or silicified pods within the volcanics.

There is no information at present to show that the "Comstock chert" is connected to the Great Lyell Fault at depth. It is therefore suggested that these silicified bodies are wedges of Owen Conglomerate incorporated within a thrust fault, called here the Tasman Fault, which has in part thrust Mt. Read Volcanics against Mt. Read Volcanics sub-parallel to the stratigraphy and also sub-parallel to the Great Lyell Fault.

Clear recognition of this and other similar thrusts within the volcanics is almost impossible without the incorporation of a "foreign" rock type such as the Owen Conglomerate. However, the extension of the Tasman Fault further west has been inferred on the basis of the following facts:

(i) the line of overturned Comstock Tuff beds on the south side of the Comstock Valley

(ii) the narrow zone of silicification (1-2m) and broader zone of hematisation within the andesitic volcanics. This zone also corresponds to high base metal values in soil and rock chip samples

(iii) a corresponding zone of north-west trending, moderate to shallow, south-west dipping cleavages.

A similar example to the Tasman Fault (without the associated silicification) is seen on the western slopes of Mt.Owen, SW of Nasty Knob, where a fault-bound wedge of Owen Conglomerate occurs within the volcanics. This structure is also sub-parallel to the Great Lyell Fault.

The Tasman, Great Lyell and Lake Margaret Faults are all considered to have formed during the same deformation event.

3.4 Structure Within the Volcanics

The spatial development of cleavage in the Cape Horn-Lyell Comstock area has enabled the elucidation of at least three separate phases of deformation. The relative timing of these deformation events is established by the recognition of the overprinting relationships of cleavage and the geometry of the outcrops.

D_1 folding within the volcanics is difficult to recognise directly; however the apparent repetition of a felsic quartz podded unit in the Queen Lyell Area (see Figure 2) may be the result of this folding event. The prominent north-east trending cleavage, developed sub-parallel to the Great Lyell Fault between Lyell Comstock and Cape Horn, could be related to the early stage thrusting; it is more likely to be derived from D_1 folding. This cleavage (S_1) has been deformed by D_2 folds with minimal cleavage overprinting. To the west and north, strong overprinting by later (S_3) cleavage has prevented recognition of the D_1 cleavage.

In general, the D_1 cleavage is steeply dipping. However, in the Cape Horn area adjacent to the Great Lyell Fault, an unusual zone of flat dipping cleavage (see Figure 14) intersects the fault at a high angle. This zone may be large scale D_3 kink folding of the earlier S_1 cleavage. Alternatively this may be a zone of originally flat dipping, thrust-related cleavage which reflects "roll over" structure along the Owen/Mt. Read contact. Late stage movement on the fault is implied in both cases.

The D_2 event resulted in broad E-W trending folds reflected by a syncline in the Comstock Valley and an anticline over Mt. Lyell. The cleavage associated with this folding event (S_1) is developed primarily in the nose of the fold. Bedding, earlier S_1 cleavage, the Tasman Fault and the Great Lyell Fault are all clearly folded by this event. In the Mt. Lyell mine area the intensity of the later D_3 deformation and associated NW trending faulting have made the recognition of this D_2 event very difficult.

The D_3 deformation event in the Cape Horn to Comstock mine area is not as well developed as in the Mt. Lyell mine area. The S_3 cleavage in the vicinity of the Great Lyell Fault is rarely observed and only small scale folding of bedding is noted (see Figure 2). Further to the north-west and west, away from the Great Lyell Fault, the penetrative S_3 cleavage is dominant. Outcrop patterns also reveal low amplitude F_3 folds on the limits of earlier F_2 folds.

3.5 Later Stage Faulting

Numerous small faults, often associated with quartz veins, were recognised in the area. However only two north-west trending faults are considered to have significantly offset the Cambrian and Ordovician stratigraphy. These faults appear to vary from narrow zones of less than one metre with or without quartz veining, to wider (10-20m) zones of crushed and brecciated rock. A further north-west trending fault, is exposed as a very narrow zone in the Cape Horn open cut. Here steeply dipping Owen Conglomerate is faulted aginst gently dipping Owen Conglomerate. A parallel fault 100m to the south is recognised in the volcanics and may mark the southern limit of the Cape Horn orebody.

The North Lyell Fault, a major north-west trending structure in the Crown Lyell open cut, appears to continue to the west, following the Owen Conglomerate/Mt. Read Volcanics contact. The strike of this structure changes to E-W in the Anaconda area. It is suggested that this fault is either sub-parallel to the Great Lyell Fault in this area, or has in fact reactivated the Great Lyell Fault.

The E-W trending Sedgwick Fault forms the northern edge of the Comstock Valley. In the Zig-Zag Hill area it juxtaposes Owen Conglomerate to the north against Cambrian volcanics to the south. Apart from an outcrop of silicified fault breccia, this structure is generally not exposed.

The E-W trending Comstock Fault, on the south side of the Comstock Valley (that has been proposed by earlier workers) is not necessary to explain the presence of Gordon Limestone in the valley. The northern flanks of Mt. Lyell are a dip slope and, as indicated by diamond drilling in the Comstock Valley, the Owen Conglomerate sequence passes (possibly conformably) up into Pioneer Beds then to Gordon Limestone.

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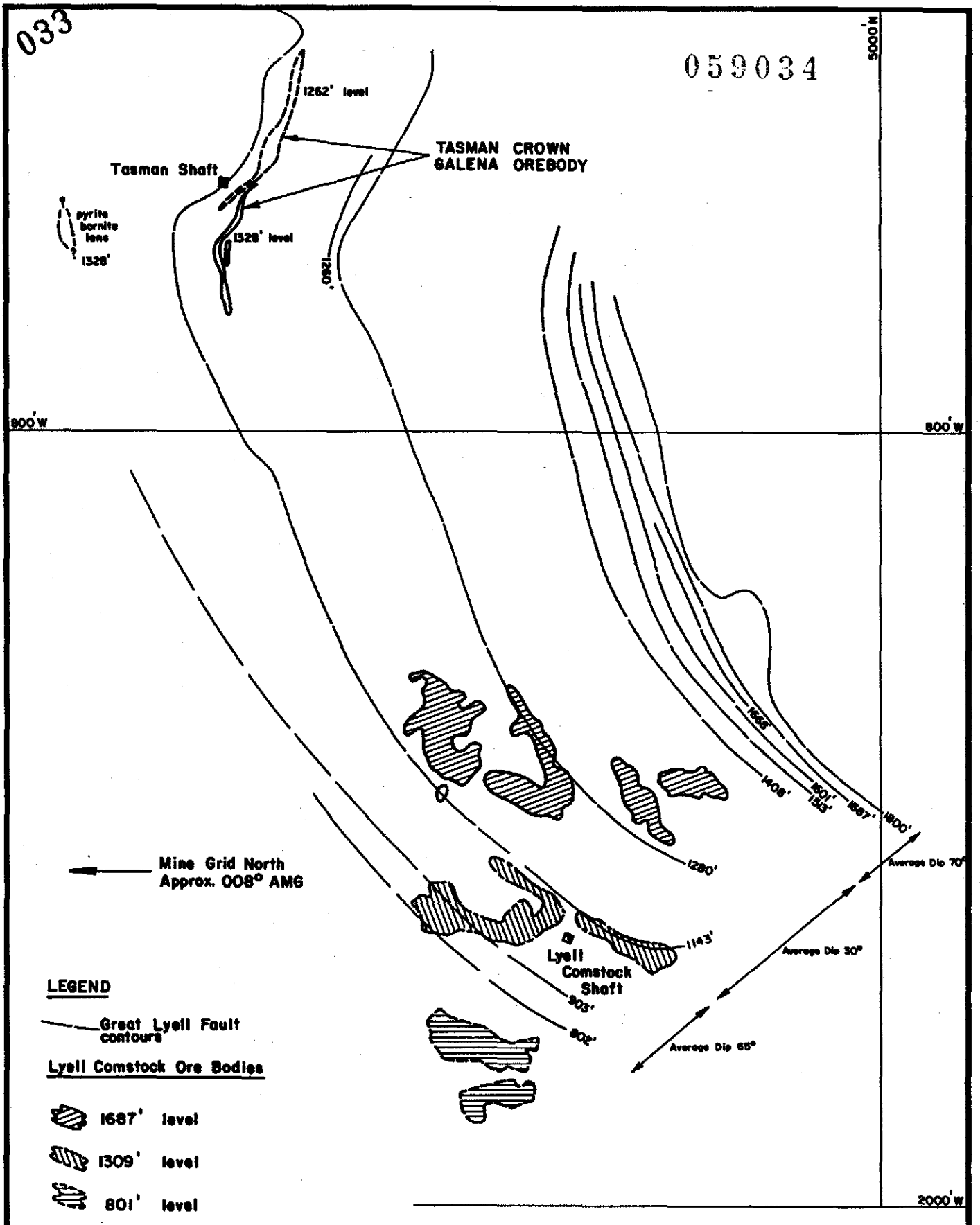

LEGEND

Great Lyell Fault contours

Lyell Comstock Ore Bodies

1687' level

1309' level

801' level

NOTE : Information derived from 1" to 100" mine plans, reduced to scale.

GOLD FIELDS EXPLORATION PTY. LIMITED

Lyell Comstock – Tasman Crown

Ore Body Location relative to the Great Lyell Fault

DRAWN BY : P.K.

DRAFTSMAN: T.G.D.S.

DATE : Oct '85

REVISIONS :

FILE NO.

SCALE 1: 2500 (25 0 50 Metres)

FIG. 11

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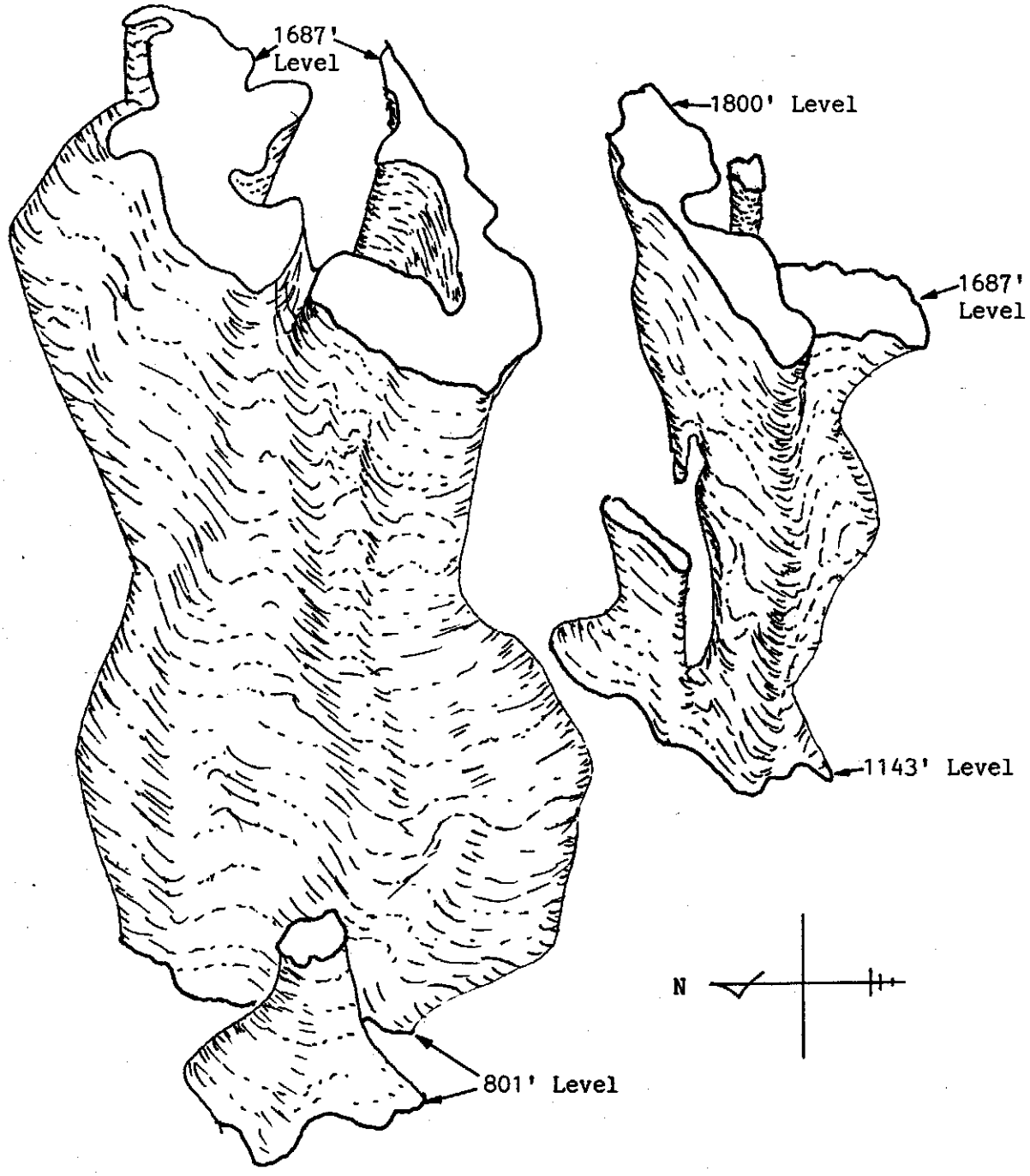

LYELL COMSTOCK ORE BODIES

Schematic representation of the ore body shape, looking vertically

(Derived from mine level plans)

Scale 1:1200

5 cm

Figure 12

4. MINERALISATION AND ALTERATION

4.1 Lyell Comstock Mine

Mineralisation in the Lyell Comstock area has been discussed by Wade (1957), Solomon (1964), Green (1971) and Reid (1975). The Lyell Comstock ore bodies yielded 1.34 million tons of 2.38% Cu, 0.67 g/t Au and 5.23 g/t Ag. The mineralisation has been described as occurring in four, en echelon north-east trending lenses dipping to the west. However when the mine plans are examined in detail, it appears that the ore lenses are not strictly en echelon nor do they trend north-easterly at depth. The two north-east trending lenses at the 514m level (as shown on Figure 2) merge to form a larger north trending lens parallel to cleavage at lower levels (Wade, 1957). The apparent en echelon character is shown in E-W section (see Figure 13). However, mine level plans show that the lenses merge out of section (see figure 12).

The ore consists mainly of disseminated pyrite and chalcopyrite with some bornite. Other minerals present include magnetite, hematite, molybdenite, galena, sphalerite, chalcocite, covellite, digenite, tennantite, mawsonite, betechtinite, stromeyerite and native gold.

The ore mineralisation appears to occur entirely within the felsic quartz sericite schists and is located approximately 30m from the overlying "quartzite" or "Comstock chert".

Little development work was carried out to the north or south of the known mineralisation as the exploration emphasis was placed on the search for further "en echelon" bodies.

The known mineralisation is located 50-100m to the south of an extensive zone of hematisation within the "Comstock chert". This zone, and elsewhere along the eastern contact between the volcanics and the "chert", would appear to be a logical place to look for North Lyell style mineralisation, i.e. high grade copper and precious metal orebodies associated with silicification and hematitic alteration in a "roll over" (siliceous rocks overlying volcanics) situation. This zone appears to have been little explored with only one small near surface adit (see Figure 2) and one underground horizontal drill hole (C27). This hole recorded

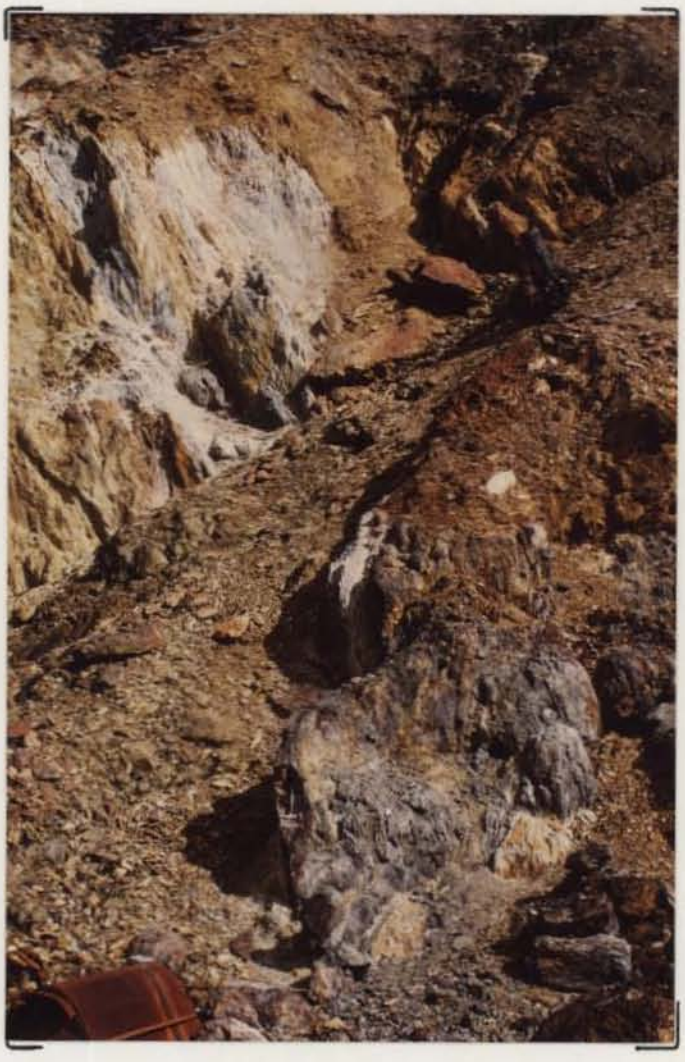

PLATE 9

Comstock Mullock Quarry - Boudinaged banded massive pyrite and galena lens within cleaved quartz phyric volcanic.



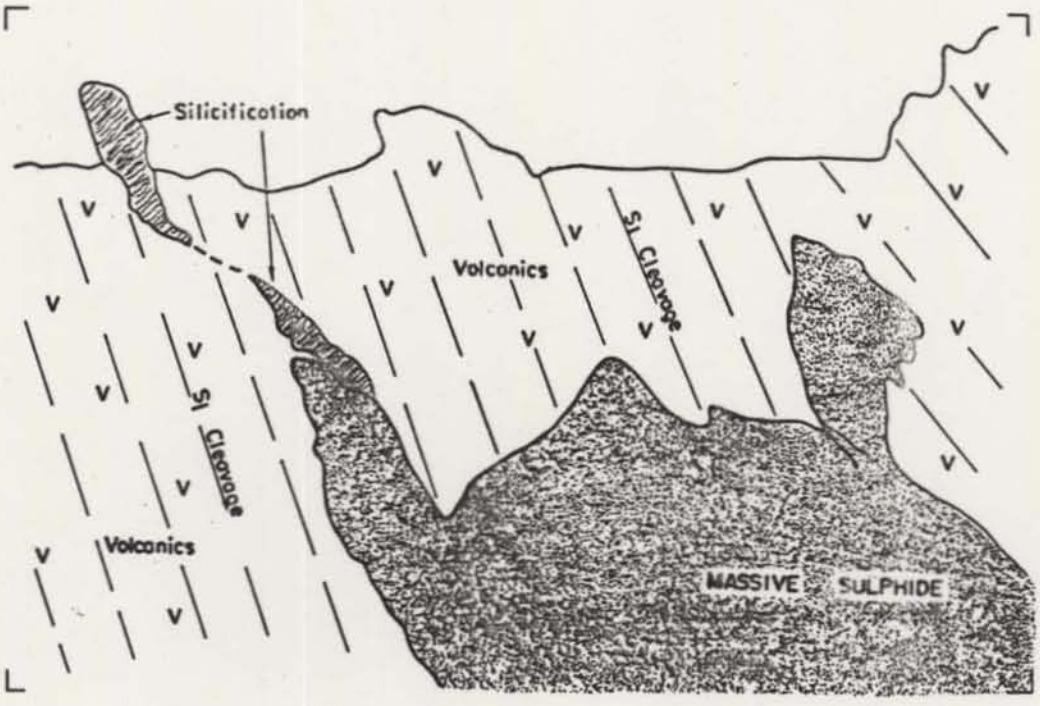

PLATE 10

Comstock Open Cut (looking South) - Relationship of silicified southern Comstock chert body to the southern Lyell Comstock massive sulphide lens. Note the banding in the sulphide is parallel to the S_1 cleavage in the volcanics.

pyrite and galena mineralisation in "quartzite" with "general low grade copper" (best assay was 10 ft. at 0.85% Cu within the "quartzite"). Apart from the No.5 adit, which passed through the chert body in the north (but did not intersect the hematitic zone) and an exploration drive on the No.2 (508m) level, no underground development has been carried out in this area.

Diamond drill testing of the chert body has been carried out along the northern part of the triangle-shaped silicified body. Drill holes C57, C56, C48 and C43 passed from volcanics through the "chert" body back into volcanics. Mel Jones reports encouraging gold values from this zone. Diamond drill holes C61 and C58 intersected the western or northern contact of the chert body and were completed in "chert". D.D.H. C61 also showed encouraging gold values along this contact.

As previously mentioned, the silicification and hematisation of the "Comstock chert" indicates the prospectivity for North Lyell style mineralisation. However, an important consideration for the occurrence of sulphide mineralisation may be the presence or absence of the felsic quartz podded unit. It appears that such mineralisation occurs entirely within this lithology in the Comstock area.

4.2 Tasman Crown and Crown Lyell Extended Mine

The main mineralisation in the Tasman Crown consists of a small copper lode and a small galena lode. The galena body is described as galena-sphalerite-pyrite lode, 7 feet wide, 40 feet deep and 110 feet in length with a quoted average value of 28% Pb, 20% Zn, 0.5% Cu, 500 g/t Ag and 0.3 g/t Au (Wade, 1957). This mineralisation (as seen on the dump) appears to be similar to the massive banded galena-sphalerite-pyrite mineralisation which outcrops in the Lyell Comstock mullock quarry.

A second lens or boudin in the quarry, 50m to the west, consists of the massive pyrite containing disseminated galena, sphalerite and chalcopyrite within sericite schists. This mineralisation may be equivalent to the poorly explored and poorly described copper lode in the Tasman Crown workings. The banded galena-pyrite body in the open cut appears

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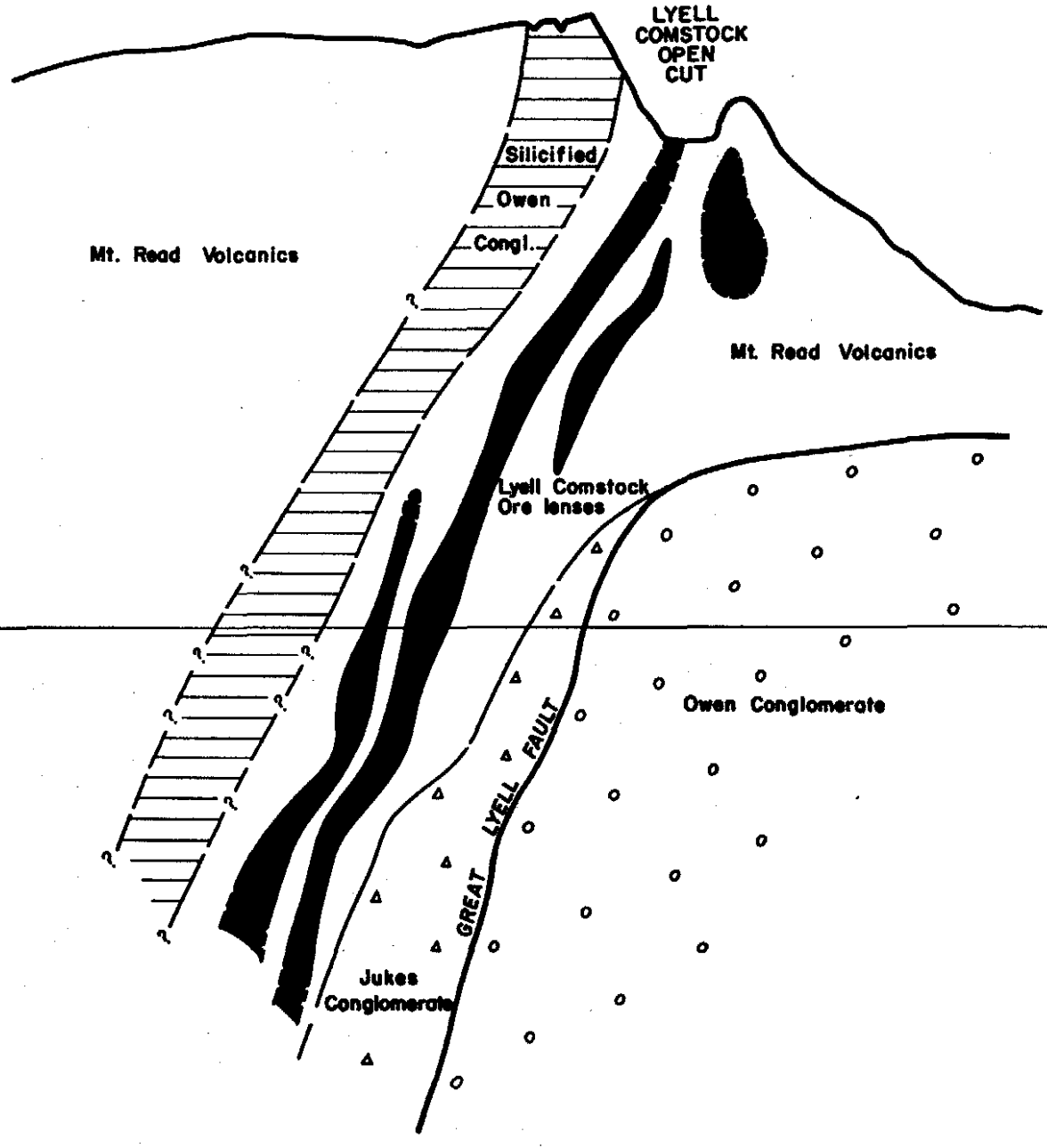
WEST

EAST



5 cm

GOLD FIELDS EXPLORATION PTY. LIMITED

Lyell Comstock

E-W Section

(adapted from Solomon 1964)

DRAWN BY : P.K.

DRAFTSMAN: T.G.D.S.

DATE : Oct. '85

REVISIONS :

FILE NO.

SCALE 1: 0 100 200 ft / 0 20 40 60 m

FIG. 13

to occur entirely within a quartz phyric unit which has been correlated with the Tyndall Group. The presence of narrow beds of fine grained sediments on the hangingwall and footwall of the mineralisation appear to support Arnold's (1985) argument for syngenetic mineralisation.

4.3 Cape Horn Mine

The mineralisation at Cape Horn is described by Green (1971) and Reid (1975). It consists of a north trending west dipping lens of pyrite and chalcopyrite approximately 150m in length with a maximum width of 50m. Accessory minerals include hematite, molybdenite, tennantite, rutile, galena, sphalerite and gold. Up to July 1985 the orebody has produced 3.83 million tons of ore at 1.39% Cu, 3.3 g/t Ag and 0.42 g/t Au.

The orebody lies about 50-80m west of and is sub-parallel to the Great Lyell Fault. Although the ore body is not exposed in the open cut, it occurs within the felsic quartz podded and banded schist (J. Carswell pers. comm.).

During this mapping program a 4m thick silicified body containing pyrite, chalcopyrite and chalcocite was located in a recently exposed portion of the Cape Horn open cut. This body is flat dipping and sub-parallel to the local cleavage. The body is exposed for a length of approximately 15m in the open cut, and it appears to intersect the Great Lyell Fault at a high angle. Scree, approximately 1m thick, covers most of the surface outcrop. Two rock chip samples taken from across this zone assayed at 3.4% Cu and 5.8% Cu with 1 g/t Au. This zone, which has not previously been recognised or intersected in drilling, may extend north for about 100m and could contain a small tonnage of high grade ore amenable to open cut mining. Naturally the extent and grade of mineralisation would have to be proved either by exposing the outcrop along strike from the open cut by bulldozing or by shallow percussion drilling along the existing 4WD track.

4.4 Cape Horn to Lyell Comstock (Queen Lyell Area)

Disseminated pyrite, chalcopyrite and minor base metal mineralisation appers to occur in a 50-100m wide zone adjacent to the Great Lyell

Fault between Cape Horn and Lyell Comstock. Consistent mineralisation is recorded in all of the North Crown Lyell adits, and in most of the holes drilled into this zone. However, surface geophysics and subsequent drilling have shown that it is unlikely that any substantial massive sulphide body occurs in this area.

No hematite-barite or silica alteration was recognised along the entire zone from Cape Horn to Lyell Comstock.

Anomalous rock chip samples containing gold have been collected in this area however, indicating that potential for a low grade copper with significant gold mineralisation (2 to 3 g/t Au) may exist within this zone.

4.5 Other Areas

Disseminated pyrite mineralisation and quartz pyrite boudins occur throughout the quartz podded unit up to 600m away from the Great Lyell Fault. The andesitic quartz podded schist also contains disseminated pyrite but without significant base or precious metal values. Neither of these mineralisations appears to be economically significant.

A zone of Pb, Zn and Ag soil and rock chip anomalies extends to the WNW from the Lyell Comstock Mine, and is spatially associated with hematitic alteration within the andesitic pyroclastics. This zone may represent syngenetic mineralisation similar to that in the Tasman Crown Mine and the Lyell Comstock mullock quarry. If so, then this potentially mineralised "stratigraphic" horizon has been tested by D.D.H.s C64 and C68. Both drill holes intersected low grade base metal values and silver mineralisation over a wide zone. However, if this base metal mineralisation is structurally related to the Tasman Fault, then the above drill holes may not have intersected this inferred south dipping structure.

4.6 Timing of the Mineralisation

Arnold (1983) outlined evidence for the occurrence of both syngenetic mineralisation and hydrothermal mineralisation in the Mt. Lyell area.

His arguments apply equally to the Lyell Comstock-Cape Horn area. Mineralisation in the area could be either syngenetic Cambrian, syn-thrusting, i.e. Ordovician (less likely) or Devonian. There are several styles of mineralisation (as previously described) and the age for one particular type may not be the same for another.

(1) Syngenetic origin for the massive banded galena-pyrite mineralisation in the Lyell Comstock mullock quarry is indicated by the presence of fine grained sediments on the footwall and hanging-wall. Cox (1981) recognised colloform textures within this body, which also indicates a syngenetic origin.

(2) Banding within the massive sulphide at Lyell Comstock has been quoted as an example of exhalative mineralisation. However, in the main Lyell Comstock open cut the banding is not parallel to the sulphide/schist contact but is parallel to the S_1 cleavage which cuts across this contact. This evidence does not negate syngenetic mineralisation but implies that this particular style of mineralisation merely occurred pre-D_2.

(3) The massive sulphide mineralisation at Lyell Comstock and Cape Horn and smaller pyrite boudins occur within the quartz podded schist. However, the mineralisation only occurs along a strong sericite alteration zone which is sub-parallel to the Great Lyell Fault. The alteration and the mineralisation are not persistent along the strike of the quartz podded unit to the north-west. This implies that the mineralisation and alteration are related to the Great Lyell Fault and not directly to the stratigraphy. This argument is a little confused by the lack of significant alteration on the Tyndall Group adjacent to the Great Lyell Fault.

(4) Successive silicification and hematisation phases within the "Comstock Chert" are pre-D_2 but post-D_1. This is indicated by the strongly developed S_2 cleavage crosscutting the silicification which had previously obliterated S_1.

(5) Disseminated pyrite and galena mineralisation in Owen Conglomerate in the Lyell Comstock area indicates post-Owen mineralisation.

(6) Chalcocite after chalcopyrite veins crosscut the silicification and pyritic mineralisation within the Cape Horn open cut indicating a late stage phase of mineralisation postdating silicification.

In summary, arguments exist for at least two phases of mineralisation in the Lyell Comstock-Cape Horn area. The first phase is probably Cambrian and comprises syngenetic massive pyrite and base metal mineralisation. The second phase of base metal mineralisation is associated with silicification and hematitic alteration and is probably post-Owen Conglomerate and pre-D_2.

5. GREAT LYELL AREA

Three days were spent working in this area, immediately south of the Mt. Lyell Mine. Two of these days involved detailed mapping in the Copper Estates area and the third was spent on reconnaissance looking at the nature of the Mt. Read Volcanics/Owen Conglomerate contact as well as the main mineralised occurrences. Results from this mapping are presented on Figure 8.

Previous work in the Great Lyell area has included mapping of the Mt. Read Volcanics/Owen Conglomerate contact by Solomon and Wade (1954) on a scale of 1" to 100 ft. This work is superb in detail, and probably difficult to surpass. However, the volcanics, although mapped, have not been differentiated nor has the late stage faulting been separated from the Great Lyell Fault. Corbett's (1979) subdivision of the volcanics appears, from my reconnaissance in the Great Lyell Area, to be essentially correct. However, the complexity of the geological detail cannot be resolved without mapping directly onto large scale aerial photography.

The volcanic rocks in the area varied from felsic quartz podded schists, sericite quartz schists and mafic schists seen in the Lyell Schists of the Comstock area to rhyolitic ignimbrites, agglomerates and lavas similar to those seen on Whip Spur. Only in the Copper Estates area was any attempt made to differentiate between units.

A number of features highlight the Copper Estates area as being of exploration interest:

(1) Massive sulphide mineralisation elsewhere on the Mine Lease generally occurs within the felsic quartz podded schist. At the Copper Estates, a pyritic felsic quartz podded unit occurs sub-parallel to a zone of faulting related to the Great Lyell Fault.

(2) The above complex fault zone extends from Karlson's Gap to 100m south of the waterfall and is extensively hematised. This hematitic alteration, which is most intense in the fault zone, is also extensive in the Owen sandstone and shale unit adjacent to the fault.

(3) The area is structurally complex as highlighted by "outliers" of Owen Conglomerate within volcanics; e.g. an outcrop of sericitised pyritic

Owen Conglomerate occurs at the base of the waterfall in Moores Creek.

(4) An isolated outcrop of massive pyrite occurs in close proximity to the Great Lyell Fault near Karlson's Gap.

A less positive feature is the apparent lack of any significant gradient array I.P. response over this area.

Workings at the Copper Estates consist of minor trenches and two small adits which were driven through a narrow zone of Lyell Schists into hematitic Owen shale. Mineralisation was limited to minor disseminated pyrite within the schists. A third adit, as shown on Solomon and Wade's plans, was not seen.

Apart from mineralisation on the dump at the Great Lyell shaft, the rest of the area examined showed a notable lack of hematitic alteration. The pervasive sericitic alteration typical of the Mt. Lyell area diminshes rapidly to the south of the Copper Estates.

Extensive leaching of sulphides from the volcanics has occurred and examination of mineralisation away from the Copper Estates was restricted to dump samples. Such samples from all of the Great Lyell adits, Duke Lyell and an adit 1 km to the south-east of Duke Lyell all show extensive chloritic alteration with disseminated pyrite and minor chalcopyrite mineralisation in what was probably a felsic ignimbrite or crystal lithic tuff. The appearance of this mineralisation is similar to that seen in a chloritic agglomerate and tuff flanking the eastern side of Nasty Knob. Only at the Great Lyell Shaft was massive sulphide mineralisation located on the dump. Here the mineralisation occurs as massive pyrite; pyrite associated with quartz, barite and minor hematite veining; and hematite-pyrite-chalcopyrite with minor barite and galena.

The geology of the Copper Estates-Great Lyell area shows some of the features typical of the mineralisation at Mt. Lyell. The decrease in sericite alteration to the south indicates that this area may be peripheral to the Mt. Lyell system, but does not necessarily reduce the prospectivity of the area. The relationship of structure to the known and other possible mineralisation needs to be looked at in detail to enable a full assessment of the area's exploration potential. In particular, it is not immediately apparent which

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sections of the Mt. Read Volcanics/Owen Conglomerate contact are related to the Great Lyell Fault or to late stage faulting.

6. CONCLUSIONS AND RECOMMENDATIONS

Several styles of potentially economic mineralisation have been identified in the Cape Horn-Comstock area and specific zones are outlined for further investigation. These are:

(1) North Lyell Type High Grade Cu-Ag Mineralisation: The eastern contact between the "Comstock Chert" body and the hematite altered volcanics offer the best target especially if felsic quartz-podded schists occur here. This area should be drill tested. A similar style of copper mineralisation may occur along the Great Lyell Fault zone in the Anaconda area. A detailed compilation of existing data here should be made.

(2) Moderate Cu with Significant Au Mineralisation: The Queen Lyell area, adjacent to the Great Lyell Fault, between Cape Horn and Lyell Comstock contains moderate grades of disseminated copper mineralisation (up to 1.8% Cu) with initial tests for gold giving encouraging results (up to 0.8 g/t Au). Comprehensive gold assaying is required prior to further drilling.

(3) Secondary Enriched Cu Mineralisation: A small flat-lying body of high grade copper (up to 5.8% Cu) with associated gold (up to 1 g/t Au) has been exposed by a slip in the north face of the Cape Horn open cut. This mineralisation may extend beneath scree cover and warrants further investigation.

(4) Stand Alone Au Mineralisation: Sampling of parts of the "Comstock Chert" body has given encouraging gold assays (up to 0.9 g/t Au). Additional sampling and possible drilling should be carried out here.

The current investigations have also indicated that little potential exists for the following economic mineral occurrences:

(1) Polymetallic Massive Sulphide Mineralisation: Possible extensions to the small sulphide bodies exposed in the Tasman Crown workings and the Lyell Comstock mullock quarry appear to be quite restricted at depth because of the inferred shallow dip of the Great Lyell Fault here. There is little evidence to indicate that similar larger bodies occur elsewhere in the area.

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(2) Copper Mineralisation Along the Great Lyell Fault: A lack of significant alteration and mineralisation associated with the Great Lyell Fault north of the Tasman Crown workings along the Comstock Valley and in the West Sedgwick area severely downgrades exploration interest here.

(3) Other Mineralisation Away from the Great Lyell Fault: The detailed mapping and geochemical sampling over the Cape Horn-Comstock area has not identified potential for other significant mineralisation.

A brief geological reconnaissance in the Copper Estates-Great Lyell area south of the main Mt. Lyell Mining area has recognised significant exploration potential here. In particular the intensity of alteration and degree of structural complexity in the Copper Estates area is encouraging. Similarly, significant gold and copper values were obtined from dump sampling in the Great Lyell-Duke Lyell area. It is recommended that a detailed mapping and sampling program be carried out here in conjunction with a comprehensive reapparisal of the existing exploration data.

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APPENDIX

ROCK SAMPLE DESCRIPTIONS AND ASSAY RESULTS

GOLD FIELDS EXPLORATION PTY. LTD. **SAMPLE RECORD AND ANALYTICAL DATA SHEET** COLLECTED BY: D. KOMYSHAN 050

PROJECT: LINDA PROSPECT: CAPE HORN/LOMSTOCK SAMPLE STORAGE REQ'D: LABORATORY: ANALABS DATE DISPATCHED:

1:250.000 SHEET: TYPE OF SAMPLE: ROCK SAMPLE PREP. REQ'D: ANALYSIS REQ'D: DATE RECEIVED: SEPT '85

A19962

SAMPLE NUMBER	LOCATION		DESCRIPTION	ANALYSES Au	Ag	Cu	Pb	Zn	Ba	As		
T1001		o/c	sericitic schist c̄ pods of hematite	0.041	0.1	128	19	12	290	<2		
T1002		o/c	chloritised silicified and. vit. cryt. tuff dis py 5-10% hm(bor)	0.009	<0.1	438	1	184	2150	<2		
T1004		o/c	quartz ser. schist (sil'd) + massive py	0.030	0.5	137	<1	9	1910	<2		
T1005		o/c	quartz ser. schist py 5-15%	<0.008	0.9	141	5	6	175	<2		
T1006		o/c	manganiferous sericite schist	0.049	0.3	108	18	5	180	8		
T1007		o/c	10cm wide massive pyrite	0.213	4	6800	14	310	150	<2		
T1008		o/c	part chl'd quart ser. schist c.g. py 10-30%	0.037	0.4	1200	<1	35	1480	<2		
T1009		o/c	1m wide massive pyrite boudin	0.013	2.4	910	<1	6	1530	6		
T1010		o/c	1m wide " " "	0.074	1.4	720	<1	10	3800	9		
T1011		o/c	hematitic sericite schist	0.40	<0.1	430	40	49	170	<2		
T1012		o/c	sericitic quartz schist (chl) c̄ pods gn & dis. gn, py, cpy	0.057	<0.1	54	40	250	260	<2		
T1013		o/c	10cm wide gossan zone - part banded c̄ host rock	0.789	23.0	1900	195	92	290	592		
T1014		o/c	quartz sericite schist c̄ 5-20% dis py	0.109	1.4	34	2	9	1460	<2		
T1002		o/c	sericitic schist c̄ pyrite 1-10%, Mn, Fe oxides	0.465	0.5	170	49	11	881	9		
T1015		o/c	siliceous quartz sericite schist c̄ 20-30% py	0.071	0.4	420	12	27	185	50		
T1016		o/c	sericite schist c̄ 10-50% py, barite veins & pods	0.213	1.9	430	<1	17	6.35%	13		
T1017		o/c	pyrite silica boudin	0.131	7.4	950	13	30	235	<2		
T1018		o/c	quartz pyrite pod	0.194	4.9	134	6	9	1890	<2		
T1019		o/c	pyrite, sericite, barite? lens 20cm wide	0.557	4.3	102	20	22	245	12		
T1020		o/c	hematitic pods & veins%, chloritic quartz ser schist	0.611	0.2	19	162	740	165	<2		
T1021		o/c	40cms quartz pyrite zone	0.025	5.0	350	38	6	195	<2		

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GOLD FIELDS EXPLORATION PTY. LTD. **SAMPLE RECORD AND ANALYTICAL DATA SHEET**

COLLECTED BY: P. KOMYSHAN

PROJECT: LINDA | PROSPECT: CAPE HORN/COMSTOCK | SAMPLE STORAGE REQ'D: | LABORATORY: ANALABS | DATE DISPATCHED:

1:250.000 SHEET: | TYPE OF SAMPLE: ROCK | SAMPLE PREP. REQ'D: | ANALYSIS REQ'D: | DATE RECEIVED: SEPT '85

A1996

SAMPLE NUMBER	LOCATION		DESCRIPTION	ANALYSES								
				Au	Ag	Cu	Pb	Zn	Ba	As		
T1022			o/c pyrite, quartz boudin	0.039	2.7	290	3	25	300	9		
T1023			o/c 10m chip sample of pyritic 20-40% sericite schist	0.26	2.2	84	26	540	1730	6		
T1024			o/c 5m zone of pyritic 20-40% sericite schist	0.067	6.7	640	4	250	2140	14		
T1025			o/c silicified quartz pyrite (40%) rock	0.055	2.3	390	5	17	85	6		
T1026			o/c sericite schist, hematite 5%	0.021	4.4	116	1750	1000	2270	153		
T1027			o/c 1m wide pyrite quartz boudin	0.054	4.8	68	26	112	835	<2		
T1028			o/c hematitic (very) Owen Conglomerate, sil pebbles Sulphur shattered	0.013	0.3	10	31	42	1.87%	<2		
T1029A			o/c " Comstock Chert	0.035	13.7	48	55	60	1640	<2		
T1029B			o/c hematitic f.g. tuff.	0.014	<0.1	45	10	310	280	<2		
T1030			o/c chloritic, sericite, quartz schist ~ py minor flourite, barite, hematite	<0.008	0.7	150	101	320	180	5		
T1031			o/c pyritic chlorite sericite schist	0.133	0.6	610	7	93	270	<2		
T1032			o/c hematite pyrite vein in mafic schists	0.046	4.2	660	30	390	10	<2		
T1033			o/c pyritic zone in mafic schists	0.151	1.6	5100	106	290	350	<2		
T1034			o/c pyritic (20%) quartz ser schist (chip sample over 10m)	<0.008	0.2	80	6	20	580	<2		
T1035			o/c pyritic (10-20%) " " "	0.037	0.5	410	3	9	2670	<2		
T1036			o/c hematitic andesitic crystal tuff	<0.008	<0.1	410	60	97	740	<2		
T1037			o/c hematitic sericite schist	0.086	5.5	930	100	131	750	10		
T1038			o/c Manganiferous zone in chlorite sericite schist	<0.008	<0.1	1770	56	36	1700	<2		055054
T1039			o/c quartz sericite schist, ~ hematite, pyrite 5-10%	<0.008	0.2	18	79	16	790	<2		
T1040			o/c pyrite (10-20%) quartz boudin.	0.021	0.3	53	16	11	440	4		
T1041			o/c sericite schist ~ f.g. pyrite up to 40%	0.038	2.7	930	16	23	2070	<2		

GOLD FIELDS EXPLORATION PTY. LTD. **SAMPLE RECORD AND ANALYTICAL DATA SHEET**

COLLECTED BY: P. KOMYSH 055

PROJECT: LINDA PROSPECT: COMSTOCK SAMPLE STORAGE REQ'D: LABORATORY: ANALABS DATE DISPATCHED:

1:250.000 SHEET: TYPE OF SAMPLE: ROCK SAMPLE PREP. REQ'D: ANALYSIS REQ'D: DATE RECEIVED: SEPT '85

A1996.

SAMPLE NUMBER	LOCATION		DESCRIPTION	ANALYSES								
				Au	Ag	Cu	Pb	Zn	Ba	As		
T1042			o/c manganiferous sericite schist ē 10-20% py, calcite?	0.185	1.0	4200	2	139	4030	<2		
T1043			o/c " " " ē pyrite	0.423	3.7	1.36%	40	38	800	79		
T1044			o/c 4m "bed" of quartz pyrite and bornite as vein & dis.	1.044	4.2	5.8%	<1	110	800	195		
T1045			o/c sericite pyrite schist ē malachite and chalcocite?	0.356	1.4	1.8%	<1	10	1300	<2		
T1046			o/c hematitic "Owen" sandstone (from G.L.F.)	0.066	<0.01	63	145	29	370	<2		
T1047			o/c hematitic sericite schist	<0.008	<0.01	820	61	128	570	<2		
T1048			o/c andesitic, sericitic crystal tuff, part hm, Manq. st.	<0.008	4.8	61	890	490	720	<2		
T1049			o/c mafic tuff, (xlt) ē siliceous pods & lim. podo after pyrite	<0.008	0.1	350	25	260	360	24		
T1050			o/c sericite quartz schist ē vfg dis py 5-10%	0.008	2.7	21	730	330	790	46		
T1051			o/c andesitic crystal lithic tuff ē limonitic vugs after py (hm)	<0.008	<0.01	145	35	250	280	13		
T1052			o/c rhyolitic ignimbrite, lim. st. after py	<0.008	<0.01	26	55	76	350	8		
T1053			o/c " " dis. v.f.g. py (5%)	0.020	<0.01	10	<1	6	650	20		
T1054			o/c andesitic crystal lithic tuff, lim. st. after py	<0.008	6.5	178	44	300	170	45		
T1055			o/c sericite schist ē py 5-10%	0.004	<0.1	44	54	40	1600	3		
T1056			o/c quartz sericite schist ē py 5-20%	0.114	<0.1	17	67	18	320	14		
T1057			o/c phreatically hematitic mafic tuff	0.087	<0.1	18	195	23	160	7		
T1058			o/c " " " "	0.060	<0.1	53	30	16	170	<2		055
T1059			o/c siliceous pyrite, chlorite rock (within mafic tuffs)	<0.008	15.5	25	2150	450	1.35%	140		055
T1060			o/c siliceous hematitic breccia (" " ")	<0.008	8.0	210	230	70	390	460		055
T1061			o/c sericite schist ē pyrite & hematite	<0.008	<0.5	30	25	<5	890	120		055
T1062			o/c manganiferous andesitic tuff.	<0.008	0.5	250	210	1980	1.16%	120		

GOLD FIELDS EXPLORATION PTY. LTD. **SAMPLE RECORD AND ANALYTICAL DATA SHEET**

PROJECT: LINDA PROSPECT: COMSTOCK SAMPLE STORAGE REQ'D: LABORATORY: ANALABS COLLECTED BY: P. KOMYSH 056

250.000 SHEET: TYPE OF SAMPLE: ROCK SAMPLE PREP. REQ'D: ANALYSIS REQ'D: DATE RECEIVED: OCT '85 DATE DISPATCHED:

A19962

SAMPLE NUMBER	LOCATION		DESCRIPTION	ANALYSES								
				Au	Ag	Cu	Pb	Zn	Ba	As		
T1063			o/c silicified hematitic andesitic volcanoclastic ± chalky pods	<0.008	2.5	20	495	480	7800	15		
T1064			o/c quartz paddell sericite schist py 5-30%	<0.008	0.5	115	45	10	3600	7		
T1065			o/c f.g. pink siliceous rock ± spots magnetite	<0.008	3.5	350	4450	550	3250	15		
T1066			o/c chloritised Owen Cong. ± py, gn, cpy	0.092	25.0	800	3840	7200	5280	15		
T1067			o/c hematitic & sil'd Owen cong	<0.008	0.5	275	115	320	40	85		
T1068			o/c limonitic/hematite zone in Comstock "Chert"	<0.008	1.0	1235	730	390	960	85		
T1069			o/c Massive vein of hematite, barite, qtz in " "	<0.008	0.5	55	315	<5	4.73%	45		
T1070			o/c sericite quartz schist disc py 10-40%	<0.008	<0.5	130	20	<5	1.33%	15		
T1071			o/c gossanous breccia of "chert" ± hematite & volc. frag.	0.025	225	2325	2925	2230	10.87%	40		
T1072			o/c hematitic andesitic crystal tuff	<0.008	2.0	375	3350	25	1350	20		
T1073			o/c green sericite schist (batchelorite?)	0.217	116	550	450	15	3950	15		
T1074			o/c hematitic Owen grit (Comstock chert)	<0.008	1.0	85	35	30	1350	55		
T1075			o/c pyritic 20-40% silica rock (" ")	<0.008	4.0	210	110	95	2.81%	75		
T1076			o/c silica pyrite boudin	<0.008	5.5	85	5	60	8.77%	30		
T1077			o/c hematitic alteration in Comstock chert	<0.008	3.5	70	35	60	1.58%	85		
T1078			o/c sericite & sericitised mafic schist ± green staining	<0.008	1.5	65	120	455	460	30		
T1079			o/c very hematitic sil'd mafic tuff ± stringer % cpy?	<0.008	<0.5	115	40	360	1700	6		
T1080			o/c silica pyrite boudin	<0.008	5.5	195	130	25	2.87%	30		056
T1081			o/c pyritic quartz sericite schist	<0.008	2.0	70	120	<5	2150	15		056
T1082			(comp sample) silica pyrite rock (20-30% py)	<0.008	1.5	220	15	<5	370	35		056
T1083			o/c mafic tuff ± disc py 20%	<0.008	1.0	80	80	590	1050	9		056

GOLD FIELDS EXPLORATION PTY. LTD. — **SAMPLE RECORD AND ANALYTICAL DATA SHEET**

COLLECTED BY: P. Komys 85

PROJECT: LINDA | PROSPECT: COMSTOCK | SAMPLE STORAGE REQ'D: | LABORATORY: ANALABS | DATE DISPATCHED:

1:250.000 SHEET: | TYPE OF SAMPLE: | SAMPLE PREP. REQ'D: | ANALYSIS REQ'D: | DATE RECEIVED: OCT '85

A1996

SAMPLE NUMBER	LOCATION	DESCRIPTION	ANALYSES								
			Au	Ag	Cu	Pb	Zn	Ba	As		
T1084		o/c sericite pyrite (10-40%) schist ± black Mn ? stain	<0.008	2.5	0.98%	35	<5	1600	20		
T1085		o/c pyrite (20-40%) sericite schist ± black min.	<0.008	3.5	3235	120	<5	2950	3		
T1086		o/c pyrite (20-60%) sericite schist ± " "	<0.008	4.0	925	60	<5	2450	10		
T1087		o/c pyritic andesitic qtzt porphyritic tuff ± hematite veins	<0.008	1.0	90	125	10	1450	35		
T1088		o/c siliceous pyritic (5-20%) q-py-hm pods in q.s. schist	<0.008	<0.5	45	<5	<5	190	8		
T1089		o/c pyritic (20%) andesitic tuff	<0.008	0.5	30	<5	90	780	4		
T1090		o/c dacitic ignimbrite ± hematite and minor py 1-5%	<0.008	<0.5	25	90	<5	930	25		
T1091		o/c pyritic (5-20%) pyritic quartz podded sericite schist	<0.008	<0.5	175	15	<5	120	10		
T1092		o/c pyritic (5%) part si'd andesitic tuff	<0.008	2.0	190	565	<5	610	75		
T1093		(dump sample) hematitic chloritic mafic schist ± py (5-10%)	0.033	4.5	1.01%	30	1030	120	8		
T1094		o/c pyritic 20-40% quartz sericite schist	<0.008	8.0	255	50	<5	1150	25		
T1095		o/c pyritic hematitic min. in narrow si'd zone adjacent to quartz vein	<0.008	9.0	235	895	545	370	35		
T1096		o/c hematitic mafic tuff	<0.008	1.0	235	320	1080	370	15		
T1097		(dump sample) pyrite, hematite, chalcopyrite, quartz vein	<0.008	13.5	220	410	155	60	55		
T1098		o/c pyritic min in si'd quartz podded ser schist	<0.008	3.0	225	50	<5	1500	15		
T1099		o/c sericite schist ± disp py 5-20%, gn 5-10%	<0.008	5.0	5785	160	<5	1050	120		
T1100		o/c banded galena pyrite (sph) - massive	0.025	243	2050	14.33%	24.13%	910	1000		
											0390
T1201		o/c weathered calcocite, malachite ± gn, py lens	0.032	163	16.94%	6.72%	14.14%	320	290		0503
T1202		o/c massive pyrite boulder	0.032	81	625	5.90%	6.12%	2.75%	1150		
T1203		o/c gossanous zone adjacent to massive py	0.092	54	3625	8.37%	1050	5.75%	2750		

GOLD FIELDS EXPLORATION PTY. LTD. [redacted] **SAMPLE RECORD AND ANALYTICAL [redacted]ATA SHEET**

COLLECTED BY: P. Konyshev 058

PROJECT: WNDA PROSPECT: COMSTOCK / GREAT LYELL SAMPLE STORAGE REQ'D: LABORATORY: ANALABS DATE DISPATCHED:

1:250.000 SHEET: TYPE OF SAMPLE: ROCK SAMPLE PREP. REQ'D: ANALYSIS REQ'D: DATE RECEIVED: OCT '85

A19962

SAMPLE NUMBER	LOCATION		DESCRIPTION	ANALYSES								
				Au	Ag	Cu	Pb	Zn	Ba	As		
T1204			o/c quartz, muscovite porphyritic crystals in v.f. groundmass	<0.008	1.0	245	2050	253	780	20		
T1205			o/c quartz mica phyric porphyry or xt?	<0.008	0.5	620	260	570	1250	35		
T1206			o/c andesitic x-tuff ± pods qtz and gossanous veins	<0.008	1.5	885	1350	1130	4850	30		
T1207			o/c gossanous pyrite sericite schist ± minor qtz	<0.008	3.0	210	410	180	2900	190		
T1208			o/c pyritic (20-30%) sericite schist ± veins sph qtz	0.125	8	175	1.87%	3050	480	120		
T1209			(dump) massive pyrite ± minor galena (Tasman Crown)	0.558	301	475	0.91%	1600	4.08%	200		
T1210			(dump) banded galena ± minor py (Tasman Crown)	0.233	261	1050	18.00%	20.31%	2.67%	250		
T1211			o/c very hematitic mafic tuff	<0.008	1.5	315	1350	310	1550	30		
T1212			o/c silicified andesitic x-tuff ± dis py	<0.008	0.5	20	70	10	1000	30		
T1213			o/c pyritic (5-10%) dacitic x-tuff ± dark bands	<0.008	1.5	65	40	<5	1550	25		
T1214			o/c andesitic x-lithic tuff dis py 1-3%	<0.008	1.5	15	160	130	680	8		
T1215			o/c limonitic ?matrix of cobbles & veins in Arden Congl.	<0.008	1.5	<5	5	10	2350	3		
T1216			o/c pyritic 5-10% ser'd dacitic crystal tuff	<0.008	2.0	65	15	5	1700	25		
T1217			o/c quartz ser schist ± dis py 20-30%	0.133	1.0	110	65	5	1250	<2		
T1218			o/c ser, qtz schist, dis py 10-20%	0.067	0.5	360	150	35	827	<2		
T1219			o/c chl ser schist dis py 10-20%	0.050	3.5	260	560	175	1310	<2		
T1220			o/c chl. ser. qtz schist ± dis py 10% hm, magnetite, cpy (chalcocite?)	0.194	0.5	1800	65	65	2020	<2		
T1221			o/c limonitic manganiferous schist on G.L.F.	<0.008	<0.5	735	205	240	1180	<2		
T1222			o/c " " " " "	<0.008	0.5	165	55	10	397	<2		
T1223			o/c sericitic quartz schist 5-15% py Mn stained	0.044	<0.5	1050	40	10	1460	<2		
T1224			o/c quartz psammitic schist dis py 5-10%	0.035	<0.5	550	5	<5	1230	<2		

058 059 060

GOLD FIELDS EXPLORATION PTY. LTD. **SAMPLE RECORD AND ANALYTICAL DATA SHEET** COLLECTED BY: P. Komyshan 059

PROJECT: LINDA PROSPECT: COMSTOCK / GREAT LYELL SAMPLE STORAGE REQ'D: LABORATORY: ANALABS DATE DISPATCHED:

1:250,000 SHEET: TYPE OF SAMPLE: SAMPLE PREP. REQ'D: ANALYSIS REQ'D: DATE RECEIVED: OCT '85

A1996

SAMPLE NUMBER	LOCATION		DESCRIPTION	ANALYSES Au	Ag	Cu	Pb	Zn	Ba	As		
T1225			o/c hematitic Owen conglomerate	0.028	<0.5	10	45	5	192	<2		
T1226			o/c " " sandstone	0.014	<0.5	15	565	5	2760	24		
T1227			o/c " " sandstone and shale	0.010	0.5	15	220	5	2510	<2		
T1228			o/c quartz podded schist c̄ dis py 20%	0.023	0.5	50	35	5	2140	<2		
T1229			o/c sericite, pyrite 30-60% schist minor hm	0.030	27	575	225	15	980	157		
T1230			o/c hematitic Owen conglomerate	0.023	0.5	15	135	5	1720	<2		
T1231			o/c pyritic 20-30% sericite schist	0.061	0.5	580	70	5	2930	25		
T1232			o/c pyritic 5-20% ser'd Owen conglomerate blk min.? (gn)	0.029	<0.5	30	10	35	878	7		
T1233			o/c pyritic 5% quartz podded ser. schist	0.009	0.5	10	60	5	717	<2		
T1234			o/c pyritic 5% quartz podded schist (leached)	<0.008	<0.5	10	75	10	641	<2		
T1235			dump sample; slightly hematitic sil'd mafic schist	<0.008	<0.5	5	30	10	613	<2		
T1236			o/c quartz podded schist py 5-10%, hematite	<0.008	0.5	10	120	150	1730	22		
T1237			o/c pyritic 20-30% qtz ser → ser qtz schist	0.070	<0.5	230	35	70	712	96		
T1238			dump; hematitic Owen shale	0.008	<0.5	10	60	10	1080	<2		
T1239			o/c pyritic Owen sandstone	0.036	6.0	830	160	10	640	2		
T1240			dump; chloritic pyritic mafic schist gn?	0.023	0.5	200	30	20	897	<2		
T1241			o/c massive banded pyrite	0.143	74	2800	5	65	11.76%	1170		059059
T1242			dump; Great Lyell shaft · hematite, pyrite chalcopyrite	1.056	6.5	7700	30	40	8350	<2		
T1243			" " " " massive pyrite c̄ minor barite	0.084	5.5	600	<5	20	8.93%	<2		
T1244			" " " " barite? sericite, pyrite 5%	0.220	1.0	150	135	315	3.38%	<2		
T1245			" chloritic tuff c̄ phenocryst q, veinlet hm dis py 1%	0.025	1.5	50	540	615	781	<2		

GOLD FIELDS EXPLORATION PTY. LTD. **SAMPLE RECORD AND ANALYTICAL DATA SHEET** COLLECTED BY: D. Kompsey

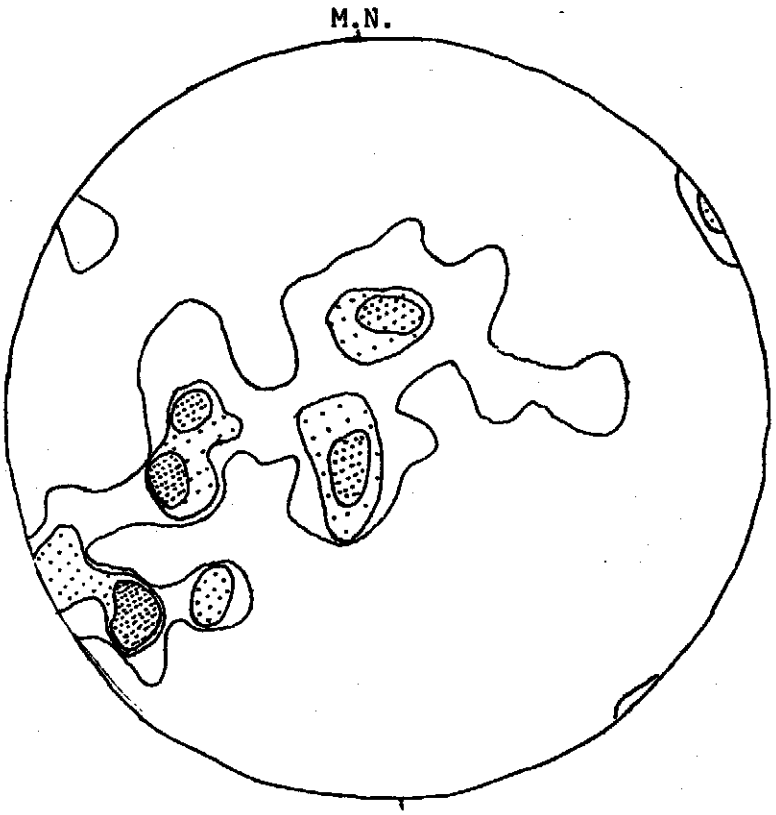
PROJECT: LINDA PROSPECT: COMSTOCK / GREAT LYELL SAMPLE STORAGE REQ'D: LABORATORY: ANALABS DATE DISPATCHED:

1:250.000 SHEET: TYPE OF SAMPLE: ROCK SAMPLE PREP. REQ'D: ANALYSIS REQ'D: DATE RECEIVED: OCT '85

A1996

SAMPLE NUMBER	LOCATION		DESCRIPTION	ANALYSES Au	Ag	Cu	Pb	Zn	Ba	As		
T1246			o/c chloritic rhyolitic-dacitic agglomerate	0.026	<0.5	70	380	175	803	<2		
T1247			o/c hematitic ser'd volcanoclastic (Jukes?)	0.011	<0.5	5	20	45	1290	<2		
T1248			flt hematitic ignimbrite (vicinity Duke Lyell)	0.015	<0.5	10	385	70	482	<2		
T1249			o/c? poorous gossan on brn soil " " "	0.009	<0.5	160	1050	2700	1.53%	<2		
T1250			dump; chloritic pyritic 5-10% siliceous rock (Duke Lyell ignimbrite?)	0.174	<0.5	8050	155	245	180	30		
T1251			dump; chloritic pyritic 5% ignimbrite? sw them Great Lyell shaft	0.143	1.5	6000	300	115	721	<2		
T1252			dump; " " 20% " adit below shaft	0.145	<0.5	4900	145	100	847	7		
T1253			dump; " " 5-10% siliceous dacitic tuff (gn, hm, cpy)	3.716	1.5	5850	1650	300	828	<2		
T1254			dump; " siliceous dacitic ignimbrite? disp. 5-10%	0.627	0.5	730	80	135	2160	<2		
T1255			o/c; hematitic mafic schist - Lyell Comstock H.W	0.040	<0.5	25	115	15	9740	<2		
T1256			o/c part sil'd Owen sandstone - Lake Margaret Fault	0.010	<0.5	80	10	<5	81	<2		

059060



Cleavage Cape Horn Open Cut

35 pts., Contours 1, 2, 3

Figure 14

6500

LEGEND

QUATERNARY
- Qt — Recent talus
- Qm — Pleistocene moraine

JURASSIC
- Jdl — Dolerite

PERMIAN
- Pt — Tillite

SILURIAN – EARLY DEVONIAN
- S-D — Eldon Group, undifferentiated sedimentary rocks

ORDOVICIAN
- Ogl — Gordon Limestone
- Oop — Pioneer Beds

LATE CAMBRIAN – EARLY ORDOVICIAN
- COos — Owen Conglomerate, predominantly red hematitic sandstone, minor conglomerates and shales
- COoc — Owen Conglomerate, predominantly grey siliceous conglomerates and sandstones

CAMBRIAN

Mt. Read Volcanics – Tyndall Group
- Etj — Jukes Breccia: volcanic breccias and conglomerates
- Etc — Comstock Tuff: tuffs, agglomerates (a), lavas (v) and minor siliceous sediments; q-quartz and quartz mica porphyry
- Ets — Siliceous tuffaceous fine grained sediments

Mt. Read Volcanics: Lyell Schists
- Csf — Felsic Schist: quartz podded and banded sericitic felsic volcanics including ignimbrites (f) and agglomerates (a)
- Csi — Intermediate Schist: chloritic volcanics with quartz pods and bands
- Csm — Intermediate – Mafic Schist: chloritic volcanics including tuffs, agglomerates (a) and ignimbrites (f); (c) Carbonate in matrix or interbedded with tuffs (ct) or as limestone units
- Csq — Quartz Sericite Schist: original lithology uncertain
- Csu — Undifferentiated Felsic and Mafic Schists
- Css — Siliceous Body: original lithology uncertain
- Cu — Undifferentiated volcanics

ALTERATION AND MINERALISATION
- Zone of intense silicification
- Zone of intense hematitic alteration
- Zone of intense silicification and hematitic alteration
- Zone of pervasive pyritic mineralisation (>5% py)
- gn — Galena present (>2% gn)
- Massive sulphide mineralisation

LITHOLOGICAL BOUNDARIES
- Position accurate
- Position approximate
- Position inferred
- Unconformity
- Possible unconformity

FAULTS
- Position accurate, dip of fault plane
- Position approximate
- Position inferred

STRUCTURE
- Strike and dip of bedding
- Strike and dip of cleavage
- Trace of anticline
- Trace of syncline

PROSPECTS AND WORKINGS
- Trench or costean
- Adits, drives and crosscuts
- Shaft
- Open cut

Glacial Moraine overlying Gordon Limestone

Glacial Moraine overlying Tyndall Group rocks

Jukes Formation / Gordon Limestone Contact

Great Lyell Fault

Comstock Tuff

Glacial Moraine overlying Volcanics

Qm Glacial Moraine with large blocks of Comstock Chert

Tasman Crown Pyrite and Agnew Lode

Steeply dipping Conglomerates and Sandstone

Steeply dipping Conglomerate

Flat dipping Conglomerate

Flat dipping Sandstone

Steeply dipping Beds

Conglomerate

Undifferentiated Volcanics

Zone where the Great Lyell Fault and North Lyell Fault are sub-parallel

North Lyell Fault

Lyell Fault

Fault or possible fold axis

M.L. 30M/80

E.L. 9/66

A TO P BOUNDARY

Queen River

Zeehan Highway

059062

SHEET INDEX

YOLANDE	MARGARET	BEATRICE
DIAMOND	M.96	LYELL
AIRPORT	TOWNSHIP	PRINCESS

GRID CONVERGENCE 0°06'

GRID MAGNETIC ANGLE 13°

The relationship between True North Grid North and Magnetic North is correct at the centre of the sheet but will vary across the sheet. Annual change is 00° 03' E and Easterly.

5 cm

Kownshan Report

GOLD FIELDS EXPLORATION PTY. LIMITED

MT LYELL AREA
MINE SHEET
GEOLOGICAL INTERPRETATION

DRAWN BY T.G.D.S.
DRAFTSMAN P.K.
DATE Dec. 1985
REVISIONS

6500

86-2519

FILE NO.

SCALE 1:5000

METRES

FIG. 2

6501



STRUCTURAL INTERPRETATION LEGEND

BEDDING

- S_0 with dip and facing
- S_0 overturned
- S_0 dip unknown

CLEAVAGE

- S_1 shallow dip
- S_2 steep dip
- S_3 vertical dip

FAULTS

- Thrust Fault (Great Lyell Fault age)
- Thrust Fault with dip
- Fault, (post Great Lyell Fault)
- Fault with dip

FOLDS

- Major anticlinal axis
- Major synclinal axis
- Minor fold axis with plunge

059063

SHEET INDEX

YOLANDE	MARGARET	BEATRICE
DIAMOND	MINE	LYELL
AIRPORT	TOWNSHIP	PRINCESS

5 cm

GRID CONVERGENCE 0°38'

GRID MAGNETIC ANGLE 12°

The relationship between True North and Magnetic North is shown diagrammatically. Magnetic value is correct for 1980. Annual change is 0°.10' to 0°.15' Easterly.

GOLD FIELDS EXPLORATION PTY. LIMITED

MT. LYELL AREA

MINE SHEET

STRUCTURAL INTERPRETATION

86-2519 6501

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DRAFTSMAN	P.K.
DATE	Dec. 1985
REVISIONS	
FILE NO.	

SCALE 1:5000 — 100 50 0 50 100 150 200 METRES

FIG. 3

6502



LEGEND

- Bedding.
- Bedding overturned.
- Cleavage undifferentiated.
- Cleavage differentiated.

059064

SHEET INDEX

YOLANDE	MARGARET	BEATRICE
DIAMOND	MINE	LYELL
AIRPORT	TOWNSHIP	PRINCESS

5 cm

GRID CONVERGENCE 0°30'

GRID MAGNETIC ANGLE 12°

The relationship between True North Grid North and Magnetic North is shown diagrammatically. Magnetic value is correct for 1980. Annual change is 0°10' in mid Easterly

GOLD FIELDS EXPLORATION PTY. LIMITED

MT. LYELL AREA

MINE SHEET

STRUCTURAL DATA

6502

DRAWN BY	T.G.D.S.
DRAFTSMAN	P.K.
DATE	Dec. 1985
REVISIONS	
FILE NO.	

SCALE 1:5000 — 100 50 0 50 100 150 200 METRES

FIG. 4

86-2519

6503



059065

SHEET INDEX

YOLANDE	MARGARET	BEATRICE
DIAMOND	MINE	LYELL
AIRPORT	TOWNSHIP	PRINCESS

5 cm

GRID CONVERGENCE 0°00'

GRID MAGNETIC ANGLE 12°

The relationship between True North Grid North and Magnetic North is shown diagrammatically. Magnetic value is correct for 1980. Annual change is 0° 10' 0 mins Easterly.

86-2519

GOLD FIELDS EXPLORATION PTY. LIMITED

MT. LYELL AREA

MINE SHEET

ROCK & SOIL GEOCHEMISTRY

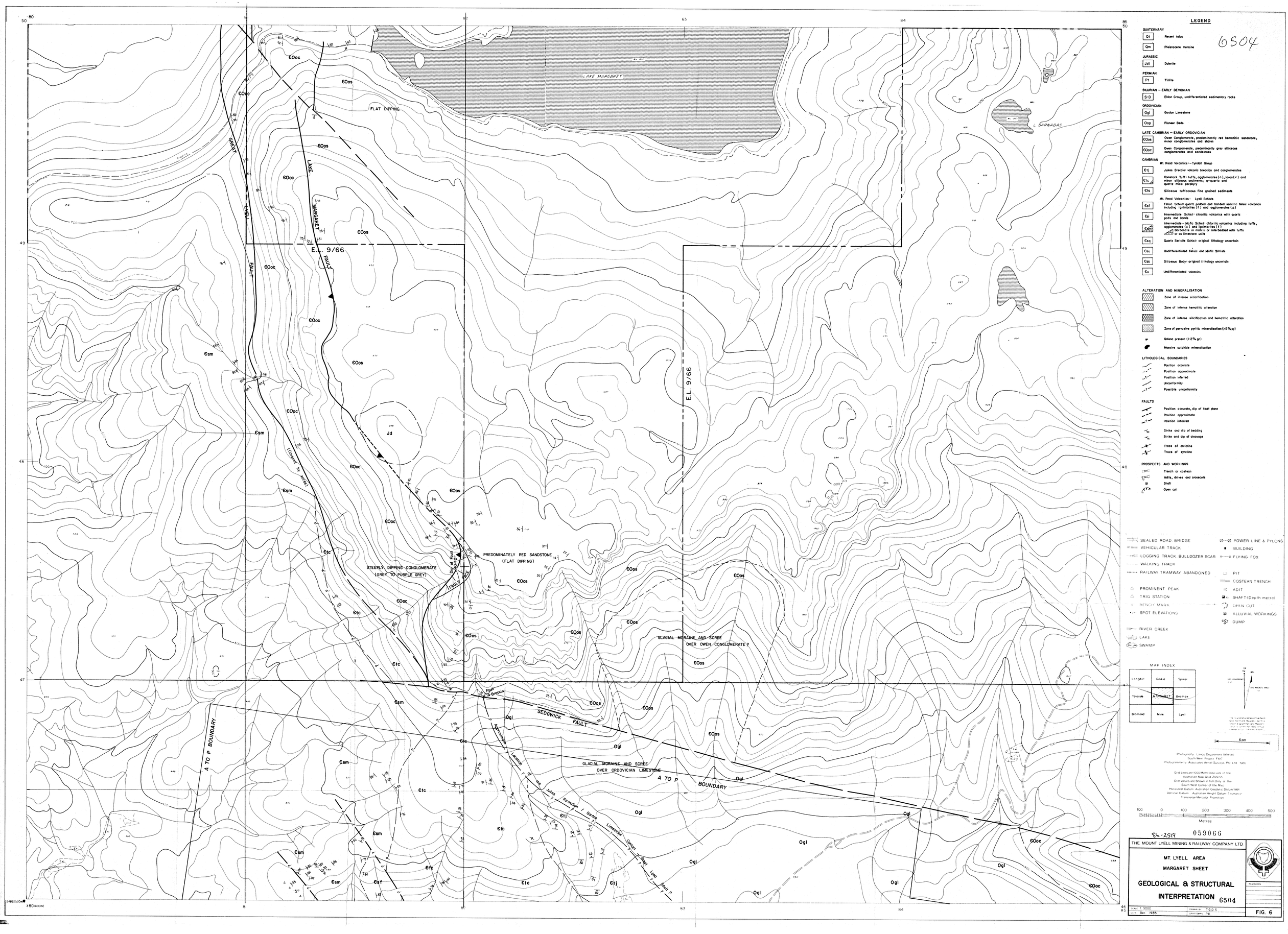
SAMPLE LOCATIONS

6503

DRAWN BY	T.G.D.S.
DRAFTSMAN	P.K.
DATE	Dec. 1985
REVISIONS	
FILE NO.	

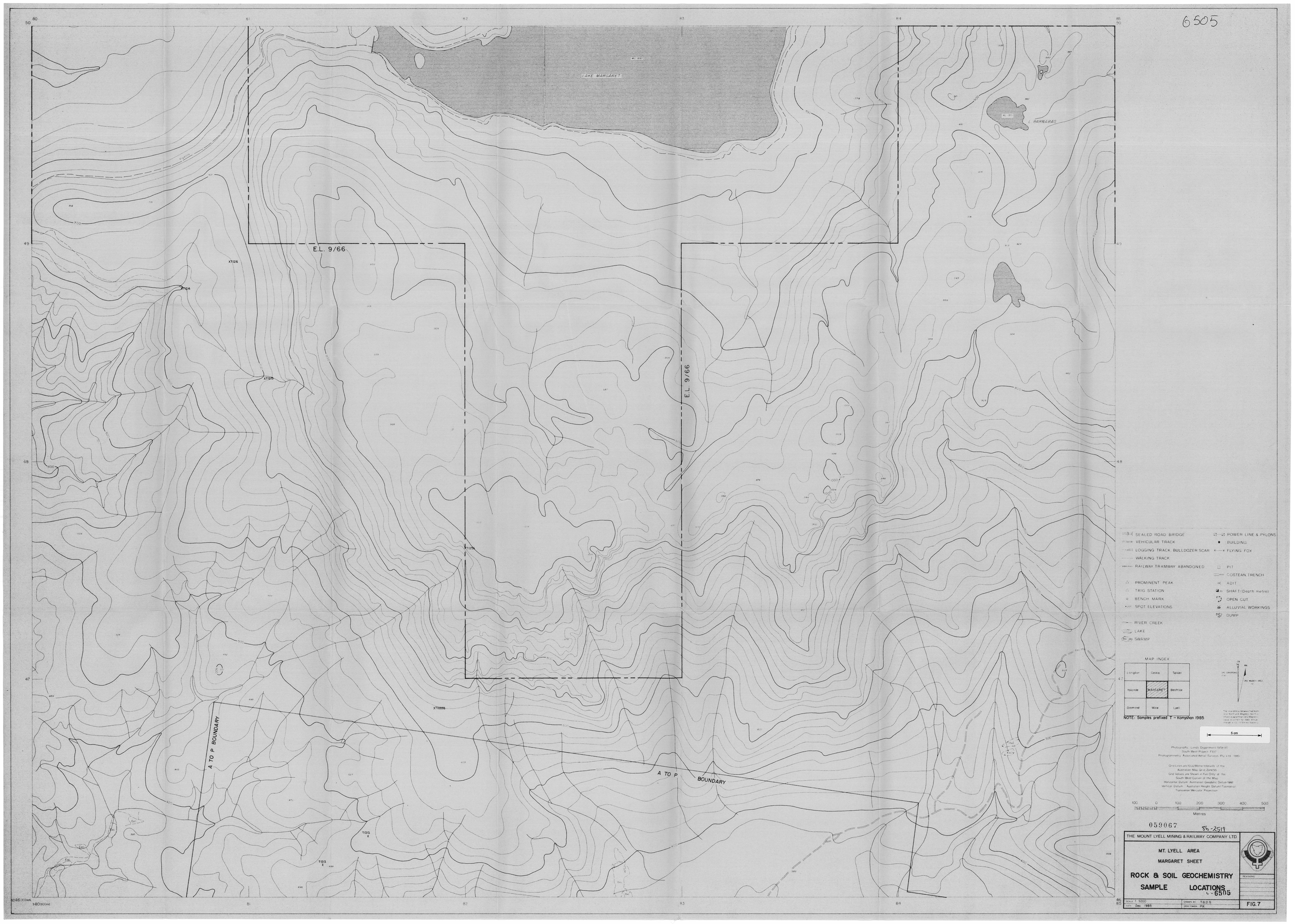
SCALE 1:5000 — 100 50 0 50 100 150 200 METRES

FIG. 5



LEGEND
6504
QUATERNARY
Qt Recent talus
Qm Pleistocene moraine
JURASSIC
Jdl Dolerite
PERMIAN
Pt Tillite
SILURIAN – EARLY DEVONIAN
S-D Eldon Group, undifferentiated sedimentary rocks
ORDOVICIAN
Ogl Gordon Limestone
Oop Pioneer Beds
LATE CAMBRIAN – EARLY ORDOVICIAN
ЄOos Owen Conglomerate, predominantly red hematitic sandstone, minor conglomerates and shales
ЄOoc Owen Conglomerate, predominantly grey siliceous conglomerates and sandstones
CAMBRIAN
Mt. Read Volcanics: – Tyndall Group
Єtj Jukes Breccia: volcanic breccias and conglomerates
Єtc Comstock Tuff: tuffs, agglomerates (Δ), lavas (V) and minor siliceous sediments; q-quartz and quartz mica porphyry
Єts Siliceous tuffaceous fine grained sediments
Mt. Read Volcanics: Lyell Schists
Єsf Felsic Schist: quartz podded and banded sericitic felsic volcanics including ignimbrites (f) and agglomerates (Δ)
Єsi Intermediate Schist: chloritic volcanics with quartz pods and bands
Єsm Intermediate – Mafic Schist: chloritic volcanics including tuffs, agglomerates (Δ) and ignimbrites (f) Carbonate in matrix or interbedded with tuffs or as limestone units
Єsq Quartz Sericite Schist: original lithology uncertain
Єsu Undifferentiated Felsic and Mafic Schists
Єss Siliceous Body: original lithology uncertain
Єu Undifferentiated volcanics
ALTERATION AND MINERALISATION
Zone of intense silicification
Zone of intense hematitic alteration
Zone of intense silicification and hematitic alteration
Zone of pervasive pyritic mineralisation (>5% py)
gn Galena present (>2% gn)
Massive sulphide mineralisation
LITHOLOGICAL BOUNDARIES
Position accurate
Position approximate
Position inferred
Unconformity
Possible unconformity
FAULTS
Position accurate, dip of fault plane
Position approximate
Position inferred
Strike and dip of bedding
Strike and dip of cleavage
Trace of anticline
Trace of syncline
PROSPECTS AND WORKINGS
Trench or costean
Adits, drives and crosscuts
Shaft
Open cut
SEALED ROAD BRIDGE
VEHICULAR TRACK
LOGGING TRACK, BULLDOZER SCAR
WALKING TRACK
RAILWAY TRAMWAY ABANDONED
PROMINENT PEAK
TRIG STATION
BENCH MARK
SPOT ELEVATIONS
RIVER CREEK
LAKE
SWAMP
POWER LINE & PYLONS
BUILDING
FLYING FOX
PIT
COSTEAN TRENCH
ADIT
SHAFT (Depth metre)
OPEN CUT
ALLUVIAL WORKINGS
DUMP
MAP INDEX
Langdon
Geikie
Spicer
Yolande
MARGARET
Beatrice
Diamond
Mine
Lyell
5 cm
Photography: Lands Department 1976-80
South West Project F617
Photogrammetry: Associated Aerial Surveys Pty. Ltd. 1980
Grid Lines are 1000 Metre Intervals of the Australian Map Grid Zone 55
Grid Values are Shown in Full Only at the South West Corner of the Map
Horizontal Datum: Australian Geodetic Datum 1966
Vertical Datum: Australian Height Datum (Tasmania)
Transverse Mercator Projection
100 0 100 200 300 400 500
Metres
86-2519
059066
THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.
MT. LYELL AREA
MARGARET SHEET
GEOLOGICAL & STRUCTURAL INTERPRETATION
6504
REVISIONS
SCALE 1:5000
DATE Dec. 1985
DRAWN BY T.G.D.S.
DRAFTSMAN P.K.
FIG. 6
LAKE MARGARET
FLAT DIPPING
GREAT LYELL FAULT
LAKE MARGARET FAULT
E.L. 9/66
E.L. 9/66
(Covered by scree)
STEEPLY DIPPING CONGLOMERATE (GREY TO PURPLE GREY)
PREDOMINATELY RED SANDSTONE (FLAT DIPPING)
GLACIAL MORAINE AND SCREE OVER OWEN CONGLOMERATE ?
SEDGWICK FAULT
GLACIAL MORAINE AND SCREE OVER ORDOVICIAN LIMESTONE
A TO P BOUNDARY
A TO P BOUNDARY
Approximate Location of the Jukes Formation / Gordon Limestone Contact
Great Lyell Fault ?
L. BARNABAS

6505



059067 86-2519

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

MT. LYELL AREA

MARGARET SHEET

ROCK & SOIL GEOCHEMISTRY

SAMPLE LOCATIONS

6505

SCALE 1:5000 | DRAWN BY T.G.D.S.

DATE Dec. 1985 | DRAFTSMAN P.K.

REVISIONS

FIG. 7

6506

M.L. 30M/80

M.L. 30M/80

A TO P BOUNDARY

E.L. 9/66

A TO P BOUNDARY

E.L. 9/66

GREAT LYELL FAULT STRUCTURES

UNDIFFERENTIATED MT READ VOLCANICS

UNDIFFERENTIATED MT READ VOLCANICS

Mt Lyell Mine

QUEENSTOWN

GORMANSTON

THE BLOW

HIGHWAY

LYELL HIGHWAY

ZEEHAN HIGHWAY

Queen River

Gaffney Creek

Macquarie Harbour

Mossman pyrite boodin

LEGEND

QUATERNARY
- Qt — Recent talus
- Qm — Pleistocene moraine

JURASSIC
- Jdl — Dolerite

PERMIAN
- Pt — Tillite

SILURIAN – EARLY DEVONIAN
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- Trace of syncline

PROSPECTS AND WORKINGS
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- Adits, drives and crosscuts
- Shaft
- Open cut

- SEALED ROAD BRIDGE
- VEHICULAR TRACK
- LOGGING TRACK BULLDOZER SCAR
- WALKING TRACK
- RAILWAY TRAMWAY ABANDONED
- PROMINENT PEAK
- TRIG STATION
- BENCH MARK
- SPOT ELEVATIONS
- RIVER CREEK
- LAKE
- SWAMP
- POWER LINE & PYLONS
- BUILDING
- FLYING FOX
- PIT
- COSTEAN TRENCH
- ADIT
- SHAFT (Depth metre)
- OPEN CUT
- ALLUVIAL WORKINGS
- DUMP

MAP INDEX

Dismaid	Mine	Lyell
Airport	Townships	Princess
Lynchford	Owen	Tullah

5 cm

Photography: Lands Department 1979-80
South West Project 1970
Photogrammetry: Associated Aerial Surveys Pty Ltd 1980

Grid Lines are 1000 Metre Intervals of the Australian Map Grid Zone55
Grid Values are Shown in Full Only at the South West Corner of the Map
Horizontal Datum: Australian Geodetic Datum 1966
Vertical Datum: Australian Height Datum (Tasmania)
Transverse Mercator Projection

100 0 100 200 300 400 500
Metres

059068 86-2519

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

MT. LYELL AREA

TOWNSHIP SHEET

GEOLOGICAL INTERPRETATION

6506

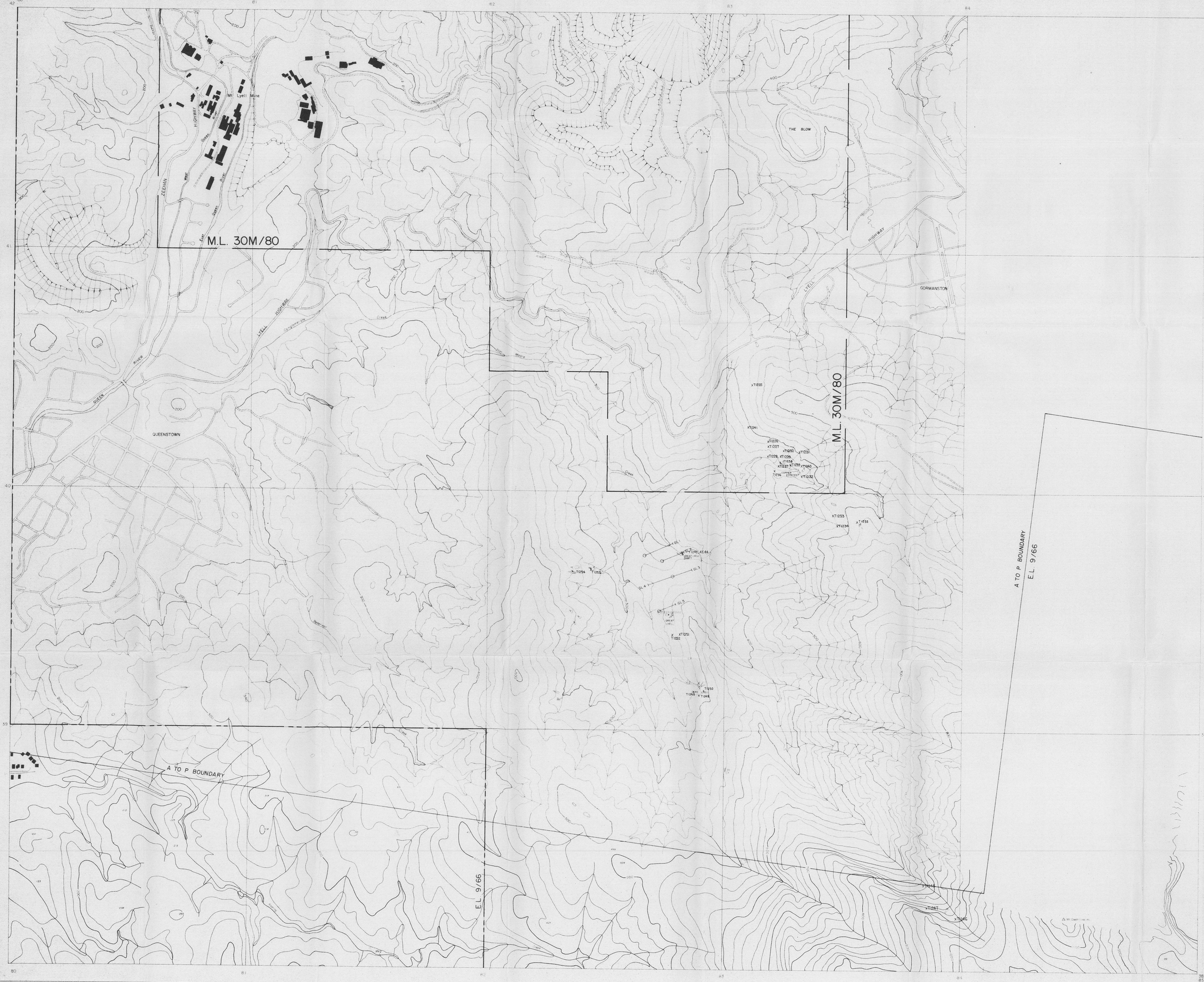
SCALE 1:5000 DRAWN BY T.G.D.S

DATE Dec. 1985 DRAUGHTSMAN P.K.

REVISIONS

FIG. 8

6507



SEALED ROAD BRIDGE
VEHICULAR TRACK
LOGGING TRACK, BULLDOZER SCAR
WALKING TRACK
RAILWAY TRAMWAY ABANDONED
PROMINENT PEAK
TRIG STATION
BENCH MARK
SPOT ELEVATIONS
RIVER CREEK
LAKE
SWAMP
POWER LINE & PYLONS
BUILDING
FLYING FOX
PIT
COSTEAN TRENCH
ADIT
SHAFT (Depth metre)
OPEN CUT
ALLUVIAL WORKINGS
DUMP

MAP INDEX

Diamond	Mine	Lyell
Airport	TOWNSHIP	Princess
Lyndhurst	Owen	Tyndall

5 cm

Photography: Lands Department 1979-80
South West Project F407
Photogrammetry: Associated Aerial Surveys Pty. Ltd. 1980

Grid Lines are 1000 Metre Intervals of the Australian Map Grid Zone 55
Grid Values are Shown in Full Only at the South West Corner of the Map
Horizontal Datum: Australian Geodetic Datum 1966
Vertical Datum: Australian Height Datum (Tasmania)
Transverse Mercator Projection

100 0 100 200 300 400 500
Metres

059069 86-2519

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

MT. LYELL AREA
TOWNSHIP SHEET

ROCK & SOIL GEOCHEMISTRY SAMPLE LOCATIONS

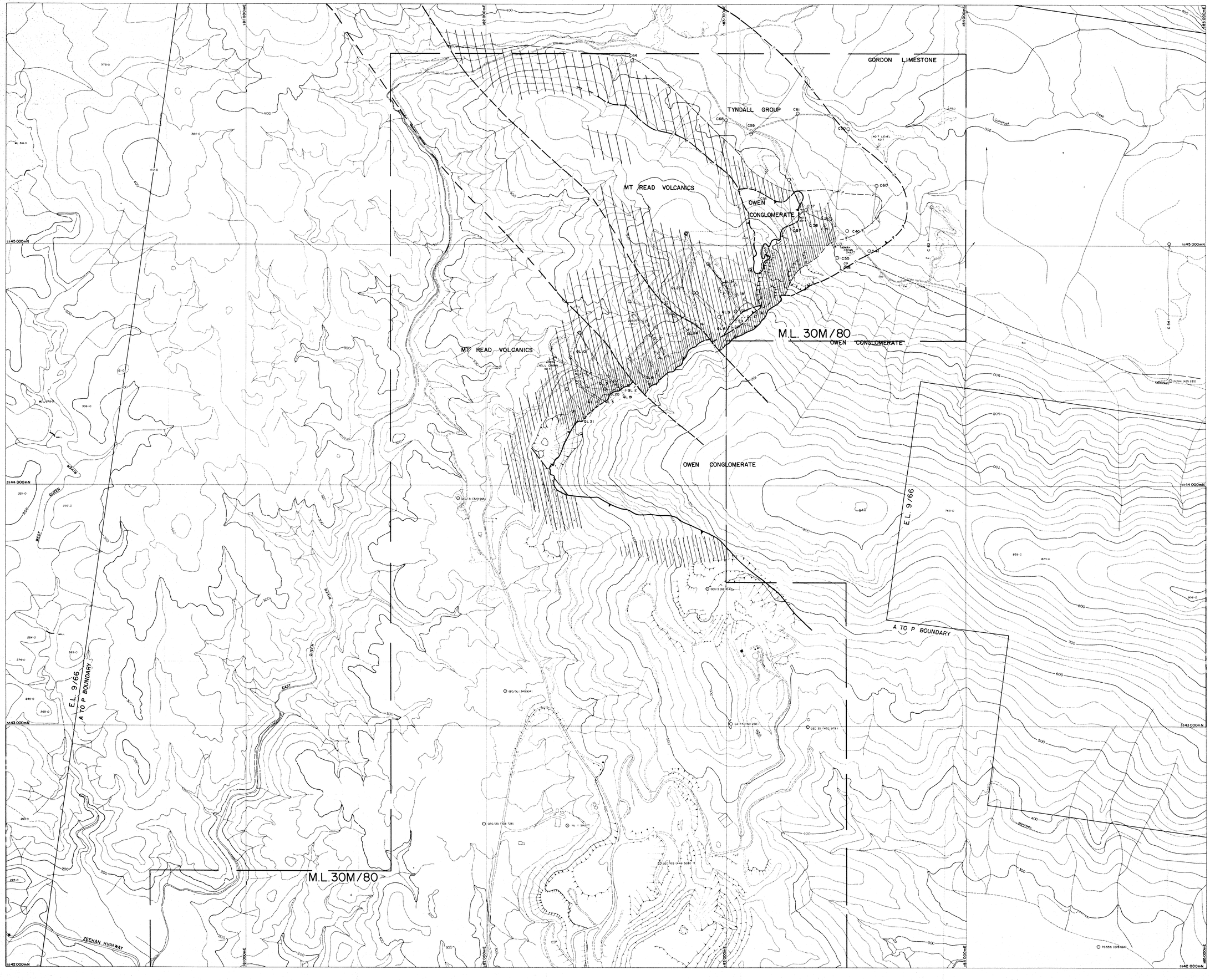
6507

SCALE 1:5000 | DRAWN BY T.G.D.S.
DATE Dec. 1985 | DRAFTSMAN P.K.

REVISIONS

FIG. 9

6508.



SERICITE ALTERATION

Pervasive serite alteration and penetrative cleavage development — no original textures.

Moderate to strong sericite alteration. Strong cleavage development.

Moderate sericite alteration.

5 cm

SHEET INDEX

YOLANDE	MARGARET	BEATRICE
DIAMOND	MINE	LYELL
AIRPORT	TOWNSHIP	PRINCESS

GN
TN
MN
GRID CONVERGENCE 0°00'
GRID MAGNETIC ANGLE 13°

The relationship between True North Grid North and Magnetic North is shown diagrammatically. Magnetic value is derived for GRID. Annual change is 0°0'19 Annual Easterly.

059070

86-2519

GOLD FIELDS EXPLORATION PTY. LIMITED

MT. LYELL AREA
MINE SHEET

SERICITE ALTERATION

6508

DRAWN BY	T.G.D.S.
DRAFTSMAN	P.K.
DATE	Dec. 1985
REVISIONS	
FILE NO.	

SCALE 1:5000 — METRES

FIG. 10