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NOTES ON GEOLOGICAL MAPPING IN THE

QUEENSTOWN AREA - TASMANIA

FEBRUARY-APRIL, 1986.

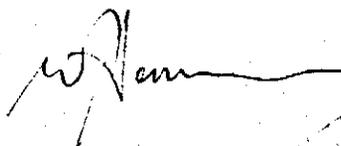
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A Report for Gold Fields Exploration Pty. Limited

by

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3	1:5000	Township	Structural Observations
4	1:5000	Township	Sample Locations
5	1:5000	Mine	Geological Interpretation
6	1:5000	Mine	Outcrop Geology
7	1:5000	Mine	Structural Observations
8	1:5000	Mine	Sample Locations

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1. INTRODUCTION

The geological mapping discussed herein was carried out on a contract basis by W. Herrmann during late summer 1986 at the request of Gold Fields Exploration Pty. Ltd.

The mapping project encompassed two more or less separate parts of the Mt. Lyell mining field at Queenstown, specifically:

- (A) The area from Glen Lyell and Philosopher Ridge southwards over Great Lyell to about Nasty Knob, and from Little Owen-Spur eastward to the Owen Conglomerate contact.
- (B) The Western Tharsis area to infill the gap between the previous mapping of Arnold (1985) and Komysan (1985) as far west as the Cape Horn Road.

Arnold (1985), on the basis of his mapping in the area from North Lyell to The Blow, discussed the significance of:

- i) "zones of primary volcanogenic mineralization, particularly beds and boudins of massive laminated pyrite ... and boudins of silica-pyrite";
- ii) The "position and orientation of the schist/conglomerate contact";
- and iii) "Alteration along the schist/conglomerate contact, particularly (of) hematite, barite and silica".

- with respect to exploration for high grade copper/gold/silver mineralization of the North Lyell type.

The work described in this report was undertaken in response to Arnold's recommendation that geological mapping, with emphasis on the above mentioned three parameters, should be extended southward and northward.

A secondary objective was sampling of "mineralized" outcrops and mullock dumps in the hope of identifying zones with gold mineralization potential. Overall, approximately 130 rock samples, generally 1-2 kg in weight, were collected and analysed for gold, silver, copper, lead, zinc and barium. Results are recorded as Appendix A.

Geological mapping was carried out at 1:5000 scale with field plotting onto transparent overlays on contoured orthophotomaps or enlarged colour aerial photographs, as available.

All rock descriptions and mineral identifications are based on mesoscopic (hand lens) examination. Samples (with sawn faces) of approximately eighty-five rock "type" specimens collected during the course of mapping (locations shown on Figures 4 and 8) have been submitted to Gold Fields office at Burnie.

An additional twenty-nine specimens, representative of selected rock geochemical samples (sample numbers are indicated by an * in the listing in Appendix A) have also been submitted to Gold Fields at Burnie.

All compass bearings are adjusted to AMG North; about 12° west of magnetic north.

2. SUMMARY

Geological mapping at 1:5000 scale in the Glen Lyell-Great Lyell and Western Tharsis areas has led to construction of geological interpretation plans which effectively complete the mapping coverage of the prospective Lyell Schists and adjacent schist-conglomerate contact.

In the Western Tharsis area it is apparent that a zone of disseminated pyrite mineralization in felsic schists, with significant concentration of silica-pyrite "heads" in the northern part, extends continuously from the West Lyell Open Cut to the North Lyell Fault. However, there does not appear to be significant hematite alteration developed at the fault contact.

In the Glen Lyell-Great Lyell area mapping has shown that the Lyell Schists extend southward to about the latitude of 5,340,000 N (Copper Estates) but the main Glen Lyell zone of disseminated pyrite mineralization fades out about 300 metres W of the Great Lyell Fault schist-conglomerate contact. Several small isolated zones of disseminated pyrite (\pm silica-pyrite "heads") in felsic schist occur in association with patchy or weak hematite alteration, adjacent to the schist-conglomerate contact at Karlson's Gap and Copper Estates. Neither occurrence can be considered very prospective; Karlson's Gap has apparently restricted extent and Copper Estates' has returned disappointingly low geochemical values.

There are no indications of significant pyrite mineralization or associated hematite alteration along the schist/volcanic-conglomerate contact south of Copper Estates.

Sampling of mullock dumps in the Great Lyell and Duke Lyell areas has led to rediscovery of significant grades of gold (and copper) mineralization associated with hematite disseminations and veinlets in chloritic and sericitic schists derived from alteration of volcanic lithologies. Further investigations of the distribution and character of this gold-hematite association is required to assess its prospectivity.

PART A : GLEN LYELL - GREAT LYELL AREA

(1:5000 TOWNSHIP SHEET; FIGURES 1-4)

3. LITHOTYPES AND STRATIGRAPHY

The geological setting and stratigraphy of this area has been discussed in detail by Corbett (1979). The lower slopes of Mt. Owen, in the eastern part of the mapped area, consist of coarse silicic clastic sediments called the Owen Conglomerate, of Late Cambrian-Early Ordovician age. The complex group of volcanics and meta-volcanics extending westward to Little Owen Spur and Glen Lyell all fall within Corbett's "Central Volcanic-Intrusive Sequence" of the Mt. Read Volcanics, considered to be of Mid-Late Cambrian age.

In the northern part of the area the volcanics have been extensively modified by low greenschist facies metamorphism subsequent to probable hydrothermal alteration and are collectively known as the "Lyell Schists".

During the course of this mapping project my general procedure has been to apply the four-fold subdivision evolved by Arnold and Komysan within the 'Lyell Schists', switching immediately to volcanic-clastic terminology wherever original textures are discernable. Often, the contact between schistose meta-volcanics and less altered volcanics is quite sharp, but in places the transition is almost imperceptible and, as a consequence, the boundaries drawn on Figure 1 should not be regarded too rigorously. All the rocks, excluding the Owen Conglomerate, are more or less intensely cleaved or foliated - a characteristic which often obscures volcanic fabrics and even bedding in ordinary outcrops.

The problem is increased by areas of intense surficial leaching and bleaching, mainly occurring in the volcanics and schists near the Owen Conglomerate contact, which effectively obliterates even the most fundamental compositional and textural characteristics.

However, in some of the creeks and gullies, where erosion has created smooth scoured exposures, original depositional structures and fabrics are startlingly revealed, providing peep holes through the obscuring processes of deformation and weathering. Frustration, however, is likely to occur as one attempts to map the often distinctive rock types beyond these water worn outcrops.

3.1 Central Volcanic-Intrusive Sequence

3.1.1 Dacitic Feldspar Porphyries (Ecd, Figure 1)

This compositional group occurs in a NNW trending belt immediately west of Great Lyell-Duke Lyell extending southward into the upper valley of Conglomerate Creek and in a more or less separate zone exposed in the Waterfall Gully (Moore Creek) and the gully draining southward from Karlson's Gap.

In the western belt, the typical appearance is massive and pale greenish grey (or pinkish grey when fresher) with small (1-2 mm) tabular or glomeroporphyritic whitish grey plagioclase phenocrysts sparsely distributed in a very fine felsic, possibly originally partly glassy, matrix. In fresher samples the matrix is often lightly dusted with fine ferromagnesian? and magnetite and these are detectably magnetic. Visible quartz occurs only rarely as small, rounded, inclusion packed "phenocrysts".

The fresher samples are mesoscopically similar to the rock on Nasty Knob. Corbett (1979) lists several analyses of this lithotype, giving silica contents in the dacite-rhyolite range and fairly high levels of potash (3.6-4.0% K_2O).

The rock in outcrop is generally massive with well developed fracture cleavage. Only in three localities (AMG 382400E/5339300N, 383100E/5338300N and 382700E/5338550N) have planar fabrics, thought to represent flow layering, been observed. In these instances, the banding runs roughly northerly,

parallel to the gross structural trend. It is likely that most of this western unit represents a sill like subvolcanic intrusive with boundaries slightly discordant to the layering in the overlying(?) bedded epiclastic group. In the southern part of the area mapped, the feldspar porphyry appears to close around the epiclastic units. Whilst this may represent a complex fold structure (there is evidence of small scale folding and transposition in the layered siltstones), it is probably an intrusive contact as there are indications of intrusive brecciation and "stopping" around the south western flank of the closure.

In the Waterfall Gully area the feldspar porphyries have a similar mineral constitution and are likewise weakly magnetic but are characterized by fine scale flow banding (Photograph N11). In this area the orientation of banding is dominantly (but not necessarily significantly) NNW to NNE with steep dips. Small scale fold structures (as in N11) are definitely cross cut by the superimposed WNW regional cleavage.



PHOTOGRAPH N.11

The fine banding and locally developed apparent auto brecciation textures (best exposed on weathered surfaces) are taken as indications of an extrusive origin.

In outcrops above the Lyell Highway, about 300m SW of The Blow turnoff, the rock has similar fine scale flow banding and overall composition (though deformation has obscured the feldspars) with the addition of about 2% of small (1 mm) rounded inclusion packed "phenocrysts" of clear quartz (e.g. WH62).

3.1.2 Felsic Pyroclastics (Ecf)

This is a rather mixed bag of lithotypes ranging from coarse volcanic breccias to fine ash or vitric tuffs. However, the coarser varieties are dominant in the area mapped.

In the several exposures in the Waterfall Gully, Great Lyell and Great Lyell West areas the rock types are medium to coarse volcanic breccias (fragment size 10-200 mm) of "pink and green blotchy" appearance consisting of a variety of felsic volcanic fragments contained in a more chloritic (or chloritized?) greenish-grey matrix as pictured in Photograph P10.



PHOTOGRAPH P.10

The fragments mainly consist of whitish to pink feldspar porphyry, generally of a more "siliceous" looking composition than the feldspar porphyries described in Section 3.1.1, although in the Great Lyell West area the fragments also include some dark green "andesitic" looking feldspar phyrlic varieties. Fragments are generally quite unsorted, highly irregular, angular or wispy in form and vary from closely crowded to sparsely distributed in proportion to the matrix. They are regarded as pyroclastic breccias, some probably deposited in a semi molten condition, though there is undoubtedly a transition to epiclastic rocks with which they are commonly associated in the field. As a general mapping rule, I have regarded the unsolved and unstratified breccias as pyroclastic and have used the epiclastic classification for those which show signs of stratification or are intimately interbedded with well layered shaley or silty sediments.

Along the crest of Little Owen Spur and near the Lyell Highway, at the western margin of the area mapped, there exists a coarse volcanic breccia of more felsic variety in that both clasts and the matrix supporting them are of felsic composition. The outcrops are universally rather leached and it is difficult to get a good look at the true composition but they appear to consist of large and small fragments of feldspar (quartz) porphyry in a grey siliceous matrix (WH74 is a relatively fresh example).

These rocks closely resemble and are an obvious precursor for the "podded and banded felsic schist" category of Arnold (1985).

Compare Photograph P25 (which I have mapped as volcanic breccia) from just north of the knoll on Little Owen Spur and Photograph P24 (which I regarded as typical "podded and banded felsic schist") from about 500m further north.

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PHOTOGRAPH P.25



PHOTOGRAPH P.24

The transition between these lithologies is imperceptible and clouded by surface leaching but I suspect that had I been prospecting northwards along Little Owen whilst mapping, the boundary would have appeared further north, around 5,340,000N.

3.1.3 Epiclastic Sediments (Ecef, Ecec)

There are two categories, based on fine and coarse grainings, which in the mapped area are nearly always intimately associated or interbedded. Individual units range from less than a metre to several tens of metres in thickness. The boundaries shown on Figure 1 reflect predominance of fine or coarse varieties as it is impractical to map out individual beds at this scale.

The finer lithologies consist of thinly laminated grey to green (and rarely black) shales, siltstones and fine sandstones. The coarser varieties are inclined to be massive with great variations in grain size from coarse sandstone to cobble conglomerate. Some beds display a crude grain size grading.

Photograph P21 pictures a sharp concordant contact between laminated green to dark grey siltstone/shale and (structurally) overlying pebbly, epiclastic sandstone. Cleavage is oblique to layering, approximately parallel to the marking pen.

The coarser epiclastics typically consist of rounded (and quite often flattened) clasts of pink to grey feldspar porphyry and dark, chloritic "flamé" like fragments rather sparsely distributed in an aggregate of feldspar, quartz, small lithic grains and murky sericite-chlorite. They are generally more or less chloritic in the matrix and I suspect the bulk composition might be intermediate rather than acid. There is an obvious compositional similarity with some of the rocks mapped as volcanic breccias. Compare, for instance,

013



PHOTOGRAPH P.21

specimens WH24 and WH36 (mapped as epiclastics interbedded with laminated siltstones) with WH20 and WH1 respectively (mapped as volcanic breccias).

The epiclastic suite occupies a semi continuous narrow NNW trending belt up to a few hundred metres wide extending from at least the Lyell Highway north of Little Owen Spur to the southern end of the spur. As mentioned the contact with the adjacent feldspar porphyry is locally discordant probably intrusive. Corbett (1979) shows the feldspar porphyry cutting through the epiclastic group at about 5,339,000N where I have a gap in the map.

More restricted occurrences occur in the creek exposures N and SE of the Great Lyell Shaft and also in very weathered outcrops near Karlson's Gap.

3.1.4 Mafic-Intermediate Volcanics (€cm)

These are restricted in recognizable form to a couple of small exposures north of the Lyell Highway at Glen Lyell in the far NW of the mapped area. Here the rocks consist of irregular, angular large and small fragments (to 300 mm) of dark chloritic material, probably originally a fine grained or glassy andesite or basalt, closely packed in a murky pale greenish grey matrix of sericite-chlorite(?). I regard them as andesitic volcanic breccias. A good example is represented in Photograph R2 (Specimen WH80 is from the same outcrop).



PHOTOGRAPH R.2

This lithotype is probably more widespread than meets the eye but, due to the readiness with which mafic assemblages can be transformed by low regional metamorphism, they have been disguised as chloritic schists. Indeed, the ordinary outcrops immediately adjacent to the exposure shown in Photograph R2 appears as mafic schists. The obvious fragmental fabric is barely discernible and would almost certainly be overlooked were it not for the smoothly scoured stream bed exposure.

3.1.5 Andesitic Intrusives (Eca)

These occur in a large (only partly delineated) area near the top of Little Owen Spur and as several small dyke or pipe? like bodies further northward along the Spur and in the Waterfall Gully-Karlson's Gap area. They are typically of massive, uniform composition forming blocky outcrops less affected by cleavage than most other rock types. The composition is of zoned, tabular phenocrysts of whitish to greenish grey plagioclase (1-5 mm, 20%) and short prisms of dark green pyroxene(?) (to 3 mm, 10-20%) closely crowded in a fine granular base of pinkish-greenish grey feldspar and quartz(?). Fresh samples are weakly magnetic. Apart from the variable development of cleavage, which tends to draw the chloritized ferromagnesian grains into wispy grains with planar preferred orientation but has less effect on the plagioclase phenocrysts, the composition is remarkably similar in the several occurrences. (Examples in the specimen collection are WH3, 5, 8, 25, 29, 60 and 81).

I regard these occurrences as probably intrusive and would coin the name Porphyritic Diorite to identify them. Corbett (1979) who gives detailed petrographic descriptions and chemical analyses, indicates that some of the [andesitic] units in the lower Conglomerate Creek area (west of Little Owen Spur) are probably lava flows.

3.2 "Lyell" Schists

In subdividing the more altered and foliated rocks of the Philosopher Ridge area I have followed the classifications based primarily on surface weathering textures and secondarily on composition which were developed by Arnold (1985) and Komysan (1985).

3.2.1 Felsic Schist with Siliceous Pods and Bands (Esf)

This is by far the dominant lithotype on Philosopher's Ridge with long "fingers" extending southwards to Conglomerate

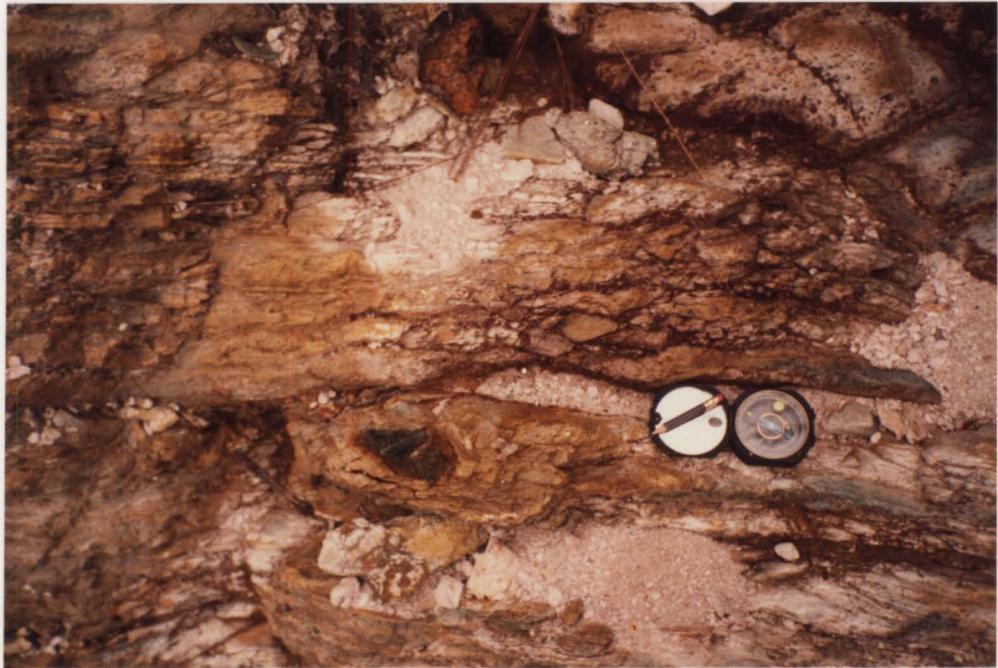
Creek and the northern end of Little Owen Spur. As Arnold (1985) has described, the rock is a quartz-sericite schist with prominent small pods and/or bands of siliceous material probably derived from felsic volcanics and having a characteristic rough, knobbly appearance in outcrops.

It is likely that the unmineralized examples of felsic schist (like those occurring on the E flank of Philosopher's Ridge) are simply derived from originally fragmental felsic pyroclastics. I also believe that the podded and banded character in some cases developed from the deformation related dismembering and small scale transposition of siliceous bands or beds in flow banded or layered felsic pyroclastics. An instance of this occurs around 382900E/5340400N where the contact between flow banded dacitic lava and podded felsic schists is more or less distinct and mappable. The contact appears to be "interfingering", and whilst it may represent complex small fold closures I favour the interpretation that it is a "deformation boundary", within the same fundamental rock type, but with more intense deformation on the northern side leading to disruption of original flow banding to give the podded appearance.

Furthermore it is apparent from a number of occurrences on the southern fringes of the disseminated pyrite zone that quartz-sericite alteration which accompanied pyrite mineralization tends to promote the development of the poddy texture.

A photographic example of this can be seen in Photograph N15.

Here a finely laminated green (chloritic) siltstone unit has suffered partial silicification and introduction of about 3% disseminated pyrite mineralization. It seems that the silicification has been selective, involving particular beds of siltstone, and patchy. In the silicified patch above and to the left of the compass, the silicified beds have behaved rigidly during deformation resulting in their fracturing and slight displacement along the plane of cleavage formation (which is parallel to the pencil lying on the

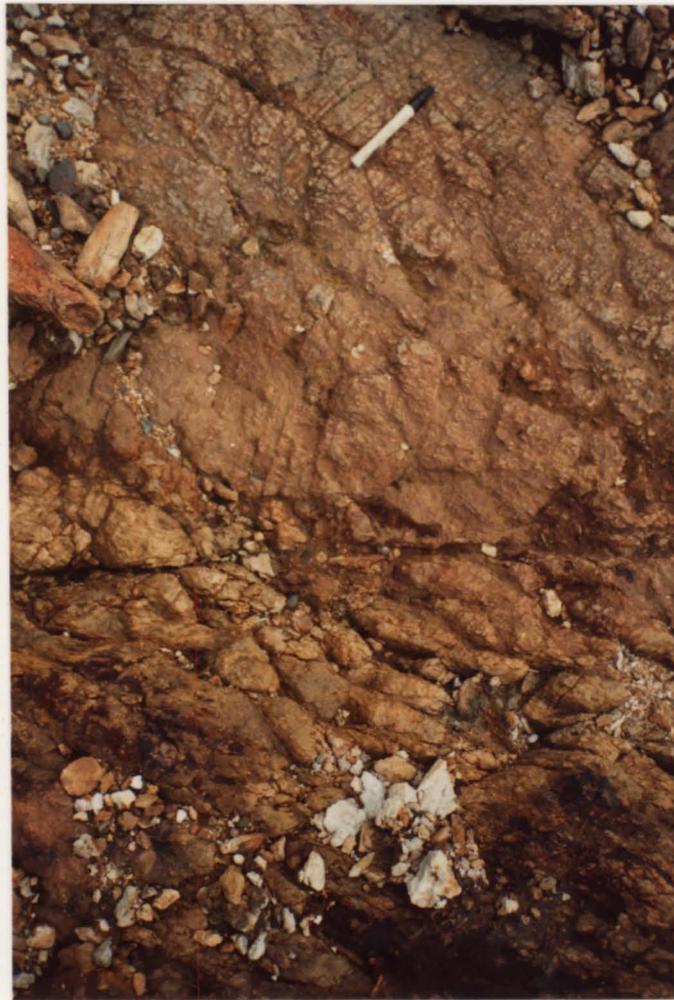


PHOTOGRAPH N.15

on the mirror of the compass). This represents incipient pod formation, the affected rock is quite siliceous and begins to resemble the felsic schist. Only the adjacent relict chloritic composition enables one to be confident that the precursor is of the laminated epiclastic siltstone unit.

Another example is depicted in Photograph P19.

In this exposure the rock in the upper part of the figure is of weakly silicified flow banded or finely bedded felsic to intermediate extrusive or pyroclastic carrying only about 1% disseminated pyrite. In the lower part it merges into more strongly (quartz-sericite) altered rock containing greater than 5% disseminated pyrite with a coarse podded fabric outlined by the (rhomboidal) intersection of fracture cleavage planes. There can be no question of a faulted contact; the fine layering in the upper part (which trends 045° and dips 75° to SE) can be faintly traced through the pods in the lower part. It appears that there is some particular mechanical characteristic of the altered and mineralized rock which favours the development of pods.



PHOTOGRAPH P.19

The point of this discourse is to suggest that the felsic schist with siliceous pods and bands may be derived not only from deformation of originally siliceous lavas and fragmental pyroclastics but also by deformation of other rocks which have previously undergone siliceous alteration and pyrite mineralization. Hence, the present boundaries of the felsic schist may in part be alteration boundaries, rather than depositional boundaries, and are therefore at least partly discordant. The narrow irregular zone of (in part strongly pyritic) felsic schist which appears to cut through the epiclastic sedimentary group in Conglomerate Creek at the northern end of Little Owen Spur would appear to be such a case. However, there is evidence to indicate that the rocks from which the mafic schists were derived were quite resistant to the silica-sericite-pyrite alteration, and the contacts against those may be more or less concordant.

I am prepared to admit that I have applied the felsic schist classification wherever the silica-sericite-pyrite compositional association is well developed without requiring too much emphasis on the distinctive podded surface texture (though quite often the two go "hand in glove"). Examples can be seen in the small lenses of pyritic felsic schist shown within mafic schist masses at 382100E/5340800N and a couple of hundred metres south of the Great Lyell Western Adits. I do not regard these as separate rock units but rather as small pods of silica-sericite-pyrite alteration within largely unaltered mafic rocks.

3.2.2 Mafic Schists (Gsm)

These are dark green, chlorite rich schists usually with fine smooth or splintery surface weathering textures succinctly described by Arnold (1985). The mafic schists occur in large elongate irregular masses and small lenses almost throughout the zone occupied by the felsic schist to which, however, they are quite subordinate in volume.

I concur with Arnold in suggesting that "much of the chloritic mafic schist is likely to [have] been lava and volcanoclastic of basaltic to andesitic composition". Obvious precursors amongst the "central volcanic sequence" are the mafic-intermediate volcanic breccias and perhaps related lavas already described in section 3.1.4, and also to perhaps a lesser extent the epiclastic sediment suite which are quite "green" and chloritic in the northern part of the belt, inexplicably somewhat less so at the southern end of the Little Owen Spur. The main lenses of mafic schist at Great Lyell Shaft and Great Lyell Western Adits are almost certainly derived from epiclastic sediments as I have indicated on Figure 1. In these cases the mafic schist is spatially associated with recognizably bedded epiclastic sediments and in some outcrops vague relicts of pebbly fabric can be observed.

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The narrow zone of mafic schist shown to run SSE from "the" Great Lyell through Duke Lyell and beyond appears to be derived from chloritic alteration within the feldspar porphyry unit and will be again mentioned in Section 5.

The distinctive porphyritic diorites (Andesitic Intrusives, Section 3.1.5) although compositionally perhaps comparable to some of the chloritic mafic schists appear to have successfully resisted the transformation. Although these rocks in some places have well developed cleavages and distinct planar foliation defined by chloritization and flattening of pyroxene(?) phenocrysts the characteristically zoned plagioclase phenocrysts have survived with only a moderate degree of flattening and linear extension (e.g. WH5). Specimen WH60 is texturally almost pristine and quite recognizable despite its location in Karlson's Gap within 30 metres of typical mafic schist and 100 metres of the Great Lyell Fault.

I believe that some of the narrow NW and W trending mafic schist bodies on Philosopher's Ridge were originally mafic dykes which are now partly dismembered and boudinaged by the main cleavage forming deformation event. These suspected dykes range in thickness from about 0.3 to 3 metres and appear to extend discontinuously up to at least 200 metres.



PHOTOGRAPH P.1

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Photograph P1 depicts a 400 mm wide dyke like body of fine chloritic schist (WH61) transecting relict igneous banding in felsic schist. The banding in the felsic schist is oriented 300° dipping $75^\circ W$ and the compass reads 310° . Principal cleavage in the dyke trends $295^\circ/85 S$ oblique to the dyke but there is a weaker cleavage parallel to the margin of the dyke and which follows the sinuosities of its course.

3.2.3 Intermediate Schists (Esi)

These are intermediate to the previously described felsic schists and mafic schists in that they possess the siliceous pods and/or bands giving the distinctive knobby outcrop surface yet have a green more or less chloritic schistose matrix. They have a similar mode of occurrence and distribution to the mafic schists usually enclosed within felsic schists but characteristically contain little disseminated pyrite even where the adjacent rocks are pyritic.

Arnold (1985) did not differentiate this sub-species in his mapping but did note that in some of the felsic schist "the matrix can be strongly chloritic". Since his primary diagnostic feature was surface texture I believe Arnold would include my intermediate schists with the felsic schist category.



PHOTOGRAPH R.3

Photograph R3 shows an outcrop within podded and banded intermediate schist at the north-western limit of mapping near 5341000N. The outcrop displays clear relict bedding with incipient small scale transposition of layering beginning to form pods. The broken specimen above the hammer head illustrates the rather chloritic nature of the rock.

It is suggested that precursor rocks for some of the podded intermediate schists were bedded epiclastic sediments.

3.2.4 Undifferentiated Schists (E_{su})

Arnold (1985) used this category for areas where poor outcrop and complex intercalation of mafic and felsic schists required painfully slow mapping to effect subdivision.

I have used the classification for those areas of schistose rocks which have been so severely weathered and bleached in outcrop as to make the original composition and fabric unrecognizable. They are reduced to pale grey, fine flakey sericitic or clayey foliated rock preserving only a prominent schistosity or cleavage. Their distribution in this area, is confined mainly to zones close to the contact with Owen Conglomerate and apart from the effect of pre-glacial supergene leaching as in the Gormanston area may relate to zones of particularly intense cleavage formation in zones close to the Great Lyell Fault.

3.3 Owen Conglomerate

The Owen Conglomerate occurs along the eastern boundary of the mapped area. The dominant lithology south of about 5339900N is coarse, whitish grey, siliceous pebble-cobble conglomerate with minor interbedded (sometimes crossbedded) quartz sandstone. The conglomerate is commonly massive and poorly bedded and particularly where dips are steep close to the volcanic/schist contacts the bedding appears to have been disrupted by local flattening and re-packing of the conglomerate clasts.

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In the Copper Estates and Karlson's Gap area, north of a structure named as the Owen Fault by Brooke (1984), the lithologies are mainly pinkish hematitic pebble conglomerate and interbedded pink sandstone with some major units of thinly bedded purplish hematitic siltstone and quartz sandstone. The hook like synclinal structure in Moores Creek above the Waterfall is outlined by an approximately 5 metres thick unit of grey bioturbated sandstone.

At the base of the exposed Owen Conglomerate, on the western wall of the upper part of the eastern branch of Conglomerate Creek, there occurs a thin (5 metres) unit of purplish siliceous pebbly conglomerate containing some pebbles of pink to purplish grey fine grained acid volcanic. This may represent the volcanolithic Jukes conglomerate which elsewhere is known to underly the Owen Conglomerate. A small outcrop of possibly related purplish pebbly sandstone with thin beds of detrital magnetite also occurs on the west flank of this (synclinal) structure at 383200E/5338250N. If these isolated outcrops represent a single bed (and due to the thick scrub and limited exposure I am by no means confident that they do), then the volcanic-conglomerate boundary here may be a folded depositional contact.

To the north, the volcanic /schist-conglomerate contact is irregular on a grand scale with large fang-like ridges of resistant conglomerate projecting out into the volcanic sequence. It is generally possible to pin down the contact position to within a few metres but often difficult to observe the true nature of the contact. However, at most localities, it appears to be faulted and the apparent truncation of bedding within the conglomerate in some areas would support this conclusion. Some contacts, such as those exposed in the bed of upper Conglomerate Creek at 383180E and 383390E and the E-W structure at 5339600N, are measurable, sharp fault planes with narrow zones of brecciation and parallel shearing or jointing in the immediate wall rocks.

Since my mapping of the Owen Conglomerate has been confined more or less to the contact zone I have not attempted a stratigraphic subdivision. However based on Arnold's (1985, p.10) restatement of "traditional" Owen stratigraphy I would suspect that all the

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rocks south of the Owen Fault (at least at the elevation of the contact) would belong to the "Lower Owen Conglomerate" and that the finer hematitic conglomerates etc. or the Moores Creek-Karlson's Gap area would be "Middle Owen Conglomerate".

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4. STRUCTURE4.1 Volcanic/Schist-Conglomerate Contacts

The form of the contact between the volcanic/schist and Owen Conglomerate, as mentioned above, appears to be controlled by fault structures.

In the zone between Karlson's Gap and the upper valley of Conglomerate Creek (eastern branch) the contact appears to represent the continuation of the phenomenal Great Lyell (Thrust) Fault discussed in detail by Arnold (1985). Segments of the Great Lyell Fault trend N to NW with steep ($>20^\circ$) dips to the W and SW and are offset by W to NW trending crossfaults also with steep usually southerly dips. In this area I could find no good evidence for the fold closures around the noses of the conglomerate projections. Admittedly there is a S plunging synclinal structure within the finger of Owen Conglomerate occupying the ridge just east of Great Lyell-Duke Lyell, but the axis runs off the eastern side about half way up the finger.

The next cusp of conglomerate to the E also has a faint synclinal structure which however appears to plunge N and, moreover, an EW trending fault within conglomerate is quite evident at the head of the gully to the E. The next two W to NW trending faults, shown to the S of here, could also I suspect, from the airphoto expression, be proven if followed up the gullies to the E.

At Karlson's Gap the schist-conglomerate contact is involved in a right angle bend which appears to be due to strike slip movement on a WNW trending fault (which coincides with the axis of an open anticlinal fold) and has caused local development of an anticlinal fold in the northern block. The small triangle of pyritic felsic schist preserved in the corner just above the car park appears to sit against a splay of the same cross fault.

A similar situation may occur at Copper Estates where an embayment of the schist-conglomerate contact is associated with a hingeless NW to WNW trending asymmetric "synclinal" structure. Notice that the bedding on the northern limb of the axis is essentially undisturbed and consistent with orientations over the Long Ridge toward the Gap.

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24.

The S wall of the Waterfall exposes a tight upright N trending syncline/anticline drag fold in the thinly bedded hematitic siltstones and slates (which is not shown on the map because I was never there at the right time to measure the orientation). This would appear analogous to the small north trending anticline shown just east of Karlson's Gap.

The Copper Estates embayment includes a large lensoidal body of pebbly Owen Conglomerate (which lithologically could be correlated with the band of Owen Conglomerate immediately to the E) entirely surrounded by sheared pyritic felsic schist. Several similar bodies of conglomerate and pink sandstone (down to about 300 mm length) occupy the faulted contact between the felsic schist and the flow banded dacites/intrusive porphyritic diorite to the W.



PHOTOGRAPH N.9

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Photograph N9 depicts such a small lens and discontinuous band of pink sandstone enclosed by sheared schists.

These may represent imbricated slivers of the Great Lyell Fault. The presence of deformed sandstone dykes in adjacent banded dacite indicates the relatively unlithified condition of the siliclastics at the time of emplacement. The incipient transposition of the dykes along cleavage planes suggests intrusion prior to the main cleavage forming deformation event (Devonian D2 of Arnold, 1985).



PHOTOGRAPH N.10: Showing irregular (transposed) pink sandstone dyke in cleaved dacitic lava. Copper Estates area.

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PHOTOGRAPH P.26 Showing another occurrence of apparently pre cleavage pink sandstone dyke within leached schists, 400m south of the Blow.

A possible exception to the fault controlled volcanic-conglomerate contacts may occur in the far southern cusp of conglomerate shown on Figure 1. The internal structure of this spur involves an open asymmetric largely hingeless syncline. At the southern edge of the map the two limbs of the syncline come together without any trace of a hinge, as in a giant "kink". At the northern nose however, and to the S near Nasty Knob bedding orientations can be found which indicate a gradual bending of layering in towards the hinge. At any rate, the strike of the contact closely follows bedding orientations in the adjacent conglomerates and, as has been mentioned in Section 3.3, these occur at three points along the contact, purplish (volcanolithic) pebbly sandstones which possibly outline a

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single bed implying that the contact with the volcanics could be conformable and depositional. My main reservation lies in the fact that I have been unable to observe this part of the contact in the third (vertical) dimension.

I had hoped to elucidate the structure of the entire area by mapping "futher back" into the Owen Conglomerates but shortage of time and mountaineering confidence prevented this pursuit of the problem.

4.2 Structure of the Volcanics and Schists

The most prominent and almost ubiquitous structure within the volcanics and schists is a strong north westerly cleavage. Spaced fracture cleavage occurs in the fresher volcanics grading to slaty cleavage and micaceous foliation in the more altered/metamorphosed schists. Without the benefit of statistical treatment I would say that there is a prominent concentration of orientations around about 320° with occasional anomalous orientations out to about 260° and 0° . Dips of cleavage are always steep in either direction but favouring the SW.

In some places near the schist-conglomerate contact, as in the area of Karlson's Gap and the embayment E of Great Lyell Shaft, the cleavage orientations are systematically nearly E-W, subparalleling the trend of transverse faults which offset the Great Lyell Fault contact.

Generally speaking, cleavage within the volcanics is sympathetic to that within the schists and overall they are parallel to the S_2 trends of Arnold (1985). In places, most notably in coarse fragmental felsic pyroclastics and their (largely) derivative felsic podded schists, there are two cleavages, usually having azimuths within about 30° of each other and of which the mean is roughly NW. I have not been able to convince myself that these are separate cleavages, one over the other, but consider them to be a reflection of the poddy/fragmental rock type with the cleavage planes forced to refract around hard, deformation resistant particles, forming a rhomboidal pattern.

Some of the fine grained slaty epiclastic sediments possess planar "parting" parallel to bedding but this (in field pers. comm. with Gary Arnold) was dismissed as a bedding fissility.

Within the epiclastic suite bedding trends are nearly all in the range 330° - 350° , which parallels the gross distribution of major rock units. No large scale fold closures have been mapped out. Within the thinly laminated siltstone units small scale folds (10 cm to 1m amplitude) are relatively common. They are often tightly pressed, sometimes to the point of partial transposition of layering, with moderate to steep plunges to both N and S in different but not widely separate localities. In these cases, axial directions of the folds more or less sub parallel the intersection of layering and cleavage and by analogy with Arnold (1985) would be of D_2 generation. The opposing plunges might imply interference with an earlier generation of folds for which I have no other evidence.

On the other hand small fold closures have not been recognized to affect major lithological boundaries. In some places where tight folding occurs within laminated siltstones, adjacent contacts with more massive coarser epiclastic units are not folded and follow the approximate NNW trend. The small folds appear to be tectonic, related to (S_2) cleavage but intraformation, as if the laminated siltstones have crumpled under the strain imposed by adjacent coarser and more massive units.

The epiclastic sediments are commonly crudely graded but due to the apparent mixed debris flow type origin of some of the units I have regarded grain size grading with caution. Nevertheless, at two locations (382000E/5340630N and 382440E/5340120N) I have measured bedding surfaces which I believe indicate younging to the west. Another very doubtful facing indicating younging to the E, was recorded at 382250E/5340730N. The former two accord with Corbett's (1979) mapping, the recorded westerly facings on the E flank of Little Owen Spur and easterly facings on the W flank implying (though he could not recognize stratigraphic equivalence) that Little Owen occupies the core of a large synclinal structure. If so, the predominant NNW bedding orientations suggest that the structure could

be of more northerly orientation than the NW trending cleavage, perhaps related to Arnold's (1985) D₁ deformation.

Other than this I have no evidence for defining fold phases within the volcanic/schist sequence. Distribution of major rock units and (non contorted) bedding surfaces display a predominant NNW trend, very steep, mostly westerly dips and a consistent bedding/cleavage relationship.

5. MINERALIZATION

(N.B.) *The notes in this section were written prior to availability of complete analytical results for samples T2796-2803. All sample locations are plotted on Figure 4.

5.1 Disseminated Pyrite Mineralization in Quartz-Sericite Schists

Disseminated pyrite mineralization within quartz-sericite schists is the most noticeable and widespread type recognized in the area. It typically consists simply of fine specks and blebs of pyrite, in the range 2-30%, disseminated within foliated quartz-sericite schist. There are commonly very local variations in pyrite content with wispy, discontinuous lenses of higher concentrations paralleling the foliation in schists containing about 5-10% background disseminated pyrite. Zones containing greater than 5% (mesoscopically estimated) pyrite occupy the greater part of the Glen Lyell area extending from Conglomerate Creek adjacent to the N end of Little Owen Spur to the crest of Philosopher's Ridge, and also several smaller occurrences near Karlson's Gap and Copper Estates, as indicated by the dotted area of Figure 1. Since Figure 1 is an interpretation I have "dotted in" areas of no outcrop lying amongst pyritic outcrops. Some outcrops in the Glen Lyell area N of the Lyell Highway are rather leached but one can generally observe weathered out cavities or boxworks after pyrite(?). An unfortunate coincidence exists with the boundary between my mapping and that of Gary Arnold (1985) and the apparent boundary of the disseminated pyrite. I am not sure if Gary's map (Figure 1, 1985) is "interpretative" with respect to pyrite leaching/outcrop gaps as mine is. If so, there appears to be a separation between the Glen Lyell pyrite zone and the major zone extending southwards from Prince Lyell.

It is clear that disseminated pyrite mineralization occurs mainly within the felsic podded and banded schist lithology and to that extent may be largely stratabound. However, as discussed in Section 3.2.1, disseminated pyrite mineralization, nearly always accompanied by silica-sericite alteration, occurs within other rock types and appears to cut across lithological boundaries.

Background geochemical values for the podded quartz-sericite schists with 5-10% disseminated pyrite appear to occupy a wide range as follows:

Au	<0.01-0.80 g/t
Ag	<1-10 g/t
Cu	20-1000 ppm
Pb, Zn	Generally <200 ppm but occasionally up to 800 (e.g. T2760, 820 ppm Pb, 6 ppm Zn)
Ba	0.05 to 2 or 3%

Results from "culvert sampling" of the section of the Lyell Highway cutting through the disseminated pyrite zone (data supplied by F. FitzGerald, Goldfields, Burnie) indicate a maximum value of 0.367 g/t Au (over 6m) with values in three separate zones over about a 250m section averaging

0.22 g/t Au	over 56m
0.15 g/t Au	over 28m
0.12 g/t Au	over 86m

On the basis of about 8 rock geochemical samples (T2728, 2741, 2764, 2767, 2769, 2786, 2787, 2789) of other rocks with superimposed quartz-sericite-pyrite mineralization it appears that they have about the same ranges of precious, base and barium metals as those quoted above. However, there is slender evidence that rocks at the fringes of superimposed pyrite mineralization are slightly anomalous in lead and zinc. For example T2729 from near the southern fringe of the pyrite zone contains 1600 ppm Pb and 6800 ppm Zn. Another example can be seen in the results from T2785, T2786. The latter, from a small (20 x 2m) pod of sericitic schist with 5% pyrite occurring within mafic schists, contains 580 ppm Cu, 740 ppm Pb, 1560 ppm Zn. Sample T785, of mafic schist within about 100 mm of the margin of the sericitic pod, contains by contrast 66 ppm Cu, 3440 ppm Pb and 6000 ppm Zn.

In general, the boundaries of the disseminated pyrite zone are quite mappable. This is particularly notable where pyritic quartz-sericite schists contact mafic schists; the latter rarely contain

significant pyrite and the coincident pyritic/lithological boundary can be "knife" sharp.

This situation is illustrated in Photograph P6.



PHOTOGRAPH P.6

Here, a quite unmineralized narrow dyke of mafic schist (dark outcrop at hammer and beyond to the right) is enclosed by poddy, quartz-sericite schist containing 5-10% pyrite (light grey in foreground outcrops). The dyke is partly discontinuous and boudinaged, obviously of pre-cleavage forming deformation age. The absence of pyrite in the "dyke" gives a strong suggestion of post pyrite mineralization intrusion. If it could be assumed that the dyke(s) are of similar age to the larger bodies of mafic schist which appear to form part of the (meta) volcanic sequence (and which are typically devoid of

significant pyrite) it could be implied that disseminated pyrite mineralization is synvolcanic. Furthermore, the juxtaposition of such pyritic-sericitic and mafic compositions (which I would think an unlikely "equilibrium" assemblage) must have implications for the physico-chemical conditions and durations of subsequent deformation events.

5.2 Silica-Pyrite "Heads", Pyritic "Beds" and Quartz-Barite-Pyrite "Veins" in Quartz-Sericite Schists

As mentioned pyrite contact^{ga} within the greater disseminated pyrite zone, varies widely. Pyrite concentrations up to 50 or 60% in association with quartz + sericite and barite occur in narrow lenses or pods parallel to foliation some of which resemble the laminated massive pyrite "beds" discussed by Arnold (1985). Due to the relatively few road cuttings and other clear exposures in this area, such "beds" are not prominent but I suspect they probably do occur with reasonable frequency within the larger disseminated pyrite zone. Geochemical results suggest that these high pyrite concentrations are associated with metal values of similar ranges to those quoted for the host rocks (Section 5.1); possibly with about two-fold enrichment in gold and copper relative to their immediate wall rocks (example:T2753, T2754).

Silica-pyrite "heads" as described by Arnold (1985), however, are not abundant in this area. Only four outcrops which could belong to this category were encountered and sampled (T2705, 2738, 2761, 2782). These show "ordinary" base metal and barite values but greatly disparate gold values; the first and last containing <0.01 and 0.05 g/t Au respectively, and the middle two 0.30 and 1.1 g/t Au respectively.

Coarse crystalline masses and large veins of pyrite-barite-quartz are common and appear to be particularly abundant in the western half of the Glen Lyell disseminated pyrite zone. Such veins and breccia fillings commonly cross cut the NW foliation and instances of both foliated and non-foliated mineralization have been observed.

These, I suspect, are of similar form and association to Arnold's (1985, p.28) syn D₂ coarse grained segregations and veins in the relative proportions of the principal constituents pyrite, quartz and barite. In a few cases, coarse specular hematite or minor chalcopyrite has been observed in this association. The rock chip analyses show the following ranges:

Au	:	0.1-1.10 g/t (with estimated average over 0.5)
Ag	:	1-80 (average about 20)
Cu	:	<100 ppm to about 5%
Pb, Zn	:	generally <100 ppm, occasionally to 500; Zn 4760 ppm in T2783
Ba	:	generally >1%, up to 50%

They appear to be quite erratic and discontinuous in distribution and apart from interesting Au-Cu values present an unattractive (difficult) exploration target.

5.3 Hematite (+ Silica, Barite) Alteration at Conglomerate Contacts

One of the fundamental mapping parameters handed down by Arnold (1985) was the delineation of hematite-silica-barite alteration along the schist/volcanics-conglomerate contact. This, he suggested, would be most likely developed where schists with high pyrite content occurred adjacent to "overhanging" parts of the Great Lyell Fault schist-conglomerate contact.

I regret to report that, along the conglomerate contacts S of Copper Estates, I have not observed a skerrick of hematite alteration nor significant sulphide mineralization.

Patchy disseminated pyrite mineralization, of around 3-5% Py and very locally to 20% Py, occurs in the quartz-sericite schists of the apparently fault bounded embayment in the conglomerate contact at Copper Estates. Weak and patchy hematite mineralization occurs in the adjacent locally strongly sheared, flattened and foliated conglomerate/sandstone/siltstone of the Owen formation although it is difficult to assess the true extent of "alteration" due to the fact that the sediments here appear to be locally anomalous in hematite.

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However geochemical results indicate that the pyritic schists at Copper Estates are anomalously low in most metals, relative to the background values for similar rocks in the Glen Lyell area. Maximum values recorded were: 0.01 g/t Au, 1 g/t Ag, 220 ppm Cu, 215 ppm Pb, 150 ppm Zn and 2380 ppm Ba. Geochemical results for hematite bearing rocks from the conglomerate contact were equally disappointing. Komyschan (1985) was able to do considerably better at Copper Estates with results of up to 0.07 g/t Au and 27 g/t Ag in pyritic quartz-sericite schists and a maximum of 0.028 g/t Au in hematitic conglomerate. Komyschan also recorded a sample (T1241) of an outcrop of "masive banded pyrite" near the contact just west of Copper Estates which analysed at 0.143 g/t Au, 0.28% Cu and 11.76% Ba. I have been unable to relocate this outcrop. Several small lenses of felsic schist with patchy disseminated pyrite to 5% occur amongst a number of small prospecting pits and adits south east of Copper Estates adjacent to the Owen Fault (zone). Geochemical results from this area were also low, and no hematite alteration was observed.

The best development of hematite alteration occurs near Karlson's Gap about 200m SE of the Blow turn off. Here, a small zone of pyritic felsic schist abuts the conglomerate with a quite irregular almost interfingering contact which I believe may be due to tectonic "intrusion" of soft sericitic schists along fractures in the conglomeratic sandstone. Massive compact dark purplish grey hematite with minor barite occurs in several small (up to 5m) patches and pods within both the schist and adjacent conglomerate-sandstone. Precious and base metal contents of this material are low; about 5% Ba was recorded in one sample. A sample of the pyritic quartz-sericite schist with small silica-pyrite boudins ("heads") was found to contain 0.7 g/t Au, 9 g/t Ag and 750 ppm Cu. A sample of massive 60% "bedded" pyrite from the entrance of the prospect adit at the SW end of the pyritic schist exposure analysed 0.7 g/t Au, 54 g/t Ag and 1480 ppm Cu. This occurrence appears to exhibit at least two of Arnold's three parameters (I am not sure of the orientation of the contact) although developed on a rather puny scale if the outcrop exposure can be taken as a firm indication. A dump, presumably from an old adit driven southwards?, is located just below the highway opposite this occurrence, and consists largely

of hematite material. If this adit(?) has intersected the contact at about the level of the dump a vertical extent of about 60m is implied. Further extensions could occur along the contact to the east under the area now covered by glacial sediments.

An additional small occurrence of pyritic schist with small (to 1m) silica-pyrite "heads" is located adjacent to the conglomerate contact about 150m W of the above locality. There is no apparent hematite alteration and a sample of the "heads" indicated paradoxically low (<0.01 g/t) levels of Au and other metals.

5.4 Quartz-Chlorite-Carbonate-Feldspar Veins

These veins are quite common particularly in the mafic rock types, schist and volcanic alike. They usually take the form of large and small discontinuous, sometimes en echelon tension gash fillings and are possibly equivalent in age and origin to the quartz-pyrite-barite veins described from the disseminated pyrite zone in Section 5.2. Quartz is nearly always the dominant mineral and most occurrences look "hungry". I was only tempted to sample one such system of veins in T2757. These were irregular lenticular veins of quartz-chlorite with considerable chalcopryrite, pyrite, hematite and possible chalcocite, exposed in the walls of a short adit near the end of Philosopher's Ridge. The (high graded) sample reported at 0.44 g/t Au, 9 g/t Ag, 3.51% Cu.

5.5 Hematite-Pyrite Veinlets and Disseminations in Chloritic Schists

This category of mineralization is mainly confined to the Great Lyell-Duke Lyell area and a cluster of small workings, on the E slope of Little Owen Spur, called Great Lyell Adits (Brophy, 1977). Geological exposure in the area is scant and most of the observations of mineralization have been made from examination of mullock dumps and prospecting pits.

This style of mineralization is in most cases quite unspectacular. The host rock consists of dark, fine grained chloritic schist with or without up to a few per cent of disseminated pyrite (often as relatively coarse [1 mm] cubes) and with or without minor fine veinlets or blebs of hematite and/or chalcopyrite. The total content of sulphides plus hematite rarely exceeds 5%, but there is an association with anomalous gold and copper and an obvious (positive) correlation between hematite and gold.

A "mullock by mullock" description might be the least confusing approach.

- (1) At the Great Lyell Adits (E Little Owen), the country rocks are a mixture of medium to coarse rather green epiclastics and lithic pyroclastics with "zones" of dark chloritic mafic schist which I interpreted to represent "chloritized" versions of the above or areas of intense cleavage development with destruction of primary textures. I cannot rule out the possibility of a separate mafic rock unit but conversely have no evidence for it. The boundaries of the chloritic zones are quite unmappable and the boundaries shown on Figure 1 are fairly imaginative. Material on the mullock dumps of the three northern adits consists mainly of fine dark chloritic schist (e.g. T2788, 2790) with subordinate (10-20% proportion) pinkish grey quartz sericite schist (e.g. T2787). The latter is similar in appearance to pyritic quartz-sericite schist form anywhere within the Glen Lyell disseminated pyrite zone, but is obviously of restricted occurrence here, and carries gold values of 0.05 g/t or less and low values of other metals except barium which is around 2000-3000 ppm. The dominant chloritic schist almost ubiquitously carries a few per cent disseminated pyrite (e.g. T2790) less than 0.2 g/t Au and low other metals. Chloritic schist with minor disseminated pyrite AND fine veinlets of hematite and/or pyrite are rare (constituting less than 5% of dump material at the main adits). Examples of the latter include samples T2788 and T2791 which contain 3.4 and 2.4 g/t Au respectively with 0.645% and 0.176% Cu respectively. Samples

T2776 and T2777 from small prospecting pits a couple of hundred metres to the south contain no hematite, patchy pyrite and low metal values.

- (2) About 500 metres SW of the principal adits, in the vicinity of the big pine tree, is a cluster of workings including a shaft and apparently two adits (Little Owen area of Brophy, 1977). Samples T2771-75 are from this area.

The shaft appears to have been developed on a system of gossanous quartz veins which contain 0.3 g/t Au and moderately anomalous base metals and barite at the surface. A sample of fresh quartz vein with traces of chlorite and 1-2% disseminated chalcopyrite from the dump (T2772) assayed at 0.43% Cu with low everything else. The fine grained chloritic schist host rock to the veins carries a trace (<0.5%) disseminated pyrite and low metal values. However, a few metres to the north the mullock dump at an adit consists of chloritic rocks with some blebs and fine veinlets of pyrite-galena-sphalerite-chalcopyrite. Sample T2774, of this type reported a surprising result of 4.2 g.t Au, 92 g/t Ag, 0.7% Cu, 7.15% Pb, 6.94% Zn and 3.75% Ba. There are some larger (to 50 mm) veins of barite amongst the mullock but these appear and were analysed (T2775) to be essentially barren of precious and base metals. However, there is slender evidence in mullock specimen WH76, that the base (precious?) metal mineralization occurs at the selvedges of barite veins within the chloritic host rock. In such size restricted material I have had difficulty in assessing the age relationship between veins and rock schistosity but would probably take a punt on the barren barite veins slightly post dating or accompanying sulphide veinlets and both sets post dating the cleavage forming deformation.

Brophy (1977) makes a one paragraph reference to the above workings (P.40) noting minor "baryte mineralization" within "strongly hematitic lavas". I missed the hematite (it was a fairly gloomy day of rain) but, in view of the emerging gold-hematite association, Brophy's comment is worth remembering.

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- (3) At the Great Lyell Shaft on the E branch of Upper Conglomerate Creek most of the dump material is chloritic schist, some weakly silicified mafic schist and considerable grey-pink quartz-sericite with variable (0-5% total) disseminated pyrite and hematite. Close to the collar of the ancient shaft is scattered some more spectacular material including lumps of near, massive compact blue hematite with up to 30% intergrown pyrite and traces of chalcopryrite and barite. Sample T2766 of this type was found to contain 0.92 g/t Au, 6 g/t Ag and 0.52% Cu. Also present is near massive pyrite with minor hematite, barite and quartz(?) (e.g. sample T2768) which reported at 0.7 g.t Au, 7 g/t Ag, 0.057% Cu and 7.0% Ba. The key for this style of mineralization I believe lies in the rare specimen No. T2767 (in Goldfields' collection) which consists of pinkish grey quartz sericite schist with distinct veins to 10 mm width, of hematite-pyrite. The veins constituted less than about 10% of the sample analysed which reported 0.16 g/t Au, 1 g/t Ag and 0.06% Cu. The veins in the specimen, T2767, are branching, partly semiconcordant with schistosity and partly cross cutting. The latter are somewhat irregular, almost wavy, perhaps even folded but under the hand lens I cannot detect any clear evidence of cleavage in the hematite-pyrite which appears quite crystalline with grain size up to 2 or 3 mm.

Brophy (1977, P.37) discussed the macroscopic and microscopic characteristics of this mineralization. He refers to "primary" layering of massive hematite and pyrite "bands" faintly implying syngenetic mineralization. He records that "post depositional" folding or deformation structures could not be observed in hand specimens. Further on (P.42) Brophy compares this type of mineralization with magnetite-hematite lenses associated with the Prince Lyell and Royal Tharsis disseminated pyrite-chalcopryrite ore bodies and speculates on the prospectivity of Great Lyell. He mentions the possibility of similarity with veinlet magnetite-pyrite-chalcopryrite mineralization of Prince Darwin and Jukes Proprietary, but considers this improbable.

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I have made a brief inspection of diamond drill core of holes G.L.1 and G.L.2 (plotted on Figure 1). Mineralized sections of this core (circa late 1950's?) were originally mechanically "split" or "cracked" for analytical sampling. The foliation cuts core axis at about 45° and in consequence the mineralized sections are largely reduced to small slices and fragments which reveal little of the form of mineralization. Subsequent sampling of the core to obtain gold analyses (data supplied by F. FitzGerald) appears to have been done on a core box by core box basis. In the "uncracked" core one can see short sections of about 70-100 mm of $\frac{1}{2}$ core, usually two to each 4 ft. row of core tray, which I assume to be the intervals sampled for gold. There are five rows per box; i.e. 20 ft. of core, so the gold assays probably represent analysis of about 10% of the core.

In G.L.2 (passing more or less under Great Lyell Shaft) the whole core in the upper part of the hole is fine grained to dark green grey chlorite sericite "schist" of nondescript unmineralized appearance. From 208'10" to 313' the core is "cracked". Recovery appears low; this interval occupies only 68' of core tray space. The rock consists of pale pinkish quartz-sericite schist (quite similar to the host in T2767) with nearly ubiquitous disseminated pyrite in the range 1-10% with occasional "massive" zones of up to 30% pyrite over short sections of a few centimetres. Disseminated hematite is also widespread as small blebs lying flat on the foliation or irregular slugs and veinlets. Hematite content varies 0-5%, averaging about 2%. There is a weak negative correlation between pyrite and hematite although the two commonly occur in close association. Given the broken nature of the core I could not confidently determine relative age relationships between the various forms of mineralization and deformation. Contacts with dark chloritic rocks above and below this interval would seem to be quite sharp, although there is patchy pink sericitization(?) associated with 1-2% hematite (but no pyrite) in the interval 313-337'. The interval 337'-413' is a grey-greenish grey-

pinkish grey fragmental (meta) volcanic resembling the pink and green fragmental volcanic breccia exposed in the creek just upstream from the shaft (and pictured in Photograph P.10, Section 3.1.2).

In comparing the G.L.2 gold analyses it is quite clear that the anomalous zone 264'-337' (\bar{x} = 0.33 g/t Au) can be broadly correlated with the zone of pink quartz-sericite schist and pyrite-hematite mineralization.

G.L.1 was drilled on section about 50m N of G.L.2. The same system of gold sampling appears to have been used. Maximum value is 0.182 g/t Au for the interval 356'-386'. I had a quick look through this core in an attempt to reconcile available gold results with lithotypes.

Sample No. G.L.106, 174'(?)-192' reports at 0.133 g/t Au. The sampled sections from this interval include four pieces of nondescript grey "schist" and two pieces of the same with 30% (by volume) of quartz-chlorite-carbonate-pink feldspar veins. I suspect the gold is in the veins as there is nothing distinctive about the host rock.

Sample No. G.L.115, 256'-386', 0.182 g/t Au, lithology is mid grey fine grained sericite-chlorite schist with distinctive small pink felsic flattened fragments and crystals; minute traces of <1% pyrite and possibly chalcopyrite in fine veinlets. Extensive patches of pink bleaching which do not appear mineralized, although some of the fine veinlets have narrow bleached envelopes.

Sample G.L.116, 386'-411', 0.142 g/t Au. Gold samples taken mostly from segments of pinkish bleached feldspar phyric massive grey rock (\approx dioritic feldspar porphyry?). No visible sulphides or hematite.

In the interval 413'-585' the core is of pale pinkish grey sericitic schist, (not necessarily a different precursor to above but with superimposed sericitic alteration), containing about 2% disseminated pyrite. This zone ranged about 0.02 to 0.08 g/t Au which is an order of magnitude lower than G.L.115 and G.L.116, and yet the rock resembles the more anomalous section in G.L.2 except for the absence of hematite.

- (4) At the Great Lyell Workings (200m S of Great Lyell Shaft) dump material consisting of chloritic schist with 2-3% disseminated blebs and veinlets of pyrite and chalcopyrite gave analyses of less than 0.2 g/t Au and copper in the range 0.26-0.88%. Again, no hematite was observed.

Komyshan (1985) reports several samples of pyritic, chloritic schist (presumably without hematite) from the Great Lyell - Duke Lyell area which assayed in the range 0.14-0.17 g/t Au and 0.49-0.8% Cu.

A general conclusion from these collective results is that gold grades over about 0.3 g/t in the Great Lyell area are associated with veinlet or disseminated hematite mineralization occurring in chloritic schists, chloritic schists with low disseminated pyrite and sericitic or sericitized schists with significant disseminated pyrite. The unifying factor seems to be presence of hematite.

- (5) On the western slope of the ridge about 400m SSE of Duke Lyell there are a number of small pits and associated mullock dumps, developed on variable chloritic schist with minor (<1%) disseminated pyrite. A sample from one of these mullock dumps (T.2798) has returned an analysis of 1.5 g/t Au (F. FitzGerald, pers. comm.). Specimens W.H.84, W.H.85 from about 50m E of that occurrence are also dark green chloritic rocks but also have sparsely distributed pinkish grey grains texturally resembling altered feldspar phenocrysts.

Texturally the rocks, especially W.H.84, are closely similar to the dacitic feldspar porphyry intrusive (or extrusive?) which occupies large areas to the E and W. I suspect that these dark chloritic rocks, the low pyritic rocks of the prospect pits and possibly the poorly exposed chloritic rocks of Duke Lyell-Great Lyell are chloritized feldspar porphyry. Small scale, apparently fracture or cleavage controlled, chloritic alteration which is mesoscopically identical to W.H.84 can be observed in W.H.16 from minor outcrops about 200m to the E. The boundary of this "zone of chloritization" within feldspar porphyry as shown on Figure 1 is based on too few exposures and may in fact be

045

of far lesser extent. However, the rediscovery of mullock dumps carrying (high graded) copper to 0.88% and gold averaging just under 0.2 g/t with a single value of 1.5 g/t recommends this area as a second rate target which may warrant follow up as knowledge of the gold distribution and mineralization of the area evolves.

- (6) Of possible significance in terms of peripheral or zonal alteration/mineralization systems are the recorded occurrences of silicified feldspar porphyry with minor disseminated pyrite-galena-sphalerite mineralization (Samples T.2723, T.2798 with anomalous Pb-Zn but low gold) just W of the southern extension of the inferred zone of chloritization.

PART B : WESTERN THARSIS AREA

(1:5000 MINE SHEET; FIGURES 5-8)

6. LITHOTYPES AND STRATIGRAPHY

The general geological setting is akin to that outlined for the Glen Lyell-Great Lyell Area. Rocks of the Owen Conglomerate association in the E are in faulted contact with mineralized, deformed and metamorphosed volcanics considered to correlate with the central volcanic-intrusive sequence of the Mt. Read Volcanics of Corbett (1979). In the approximately 1 km wide zone W of the conglomerate contact the volcanics are strongly cleaved and metamorphosed to schists of felsic and mafic volcanic derivation, collectively known as the Lyell Schists. To the W of the Lyell Schists deformation and alteration appear less intense allowing recognition of primary volcanic textural features.

6.1 Epiclastic Rocks

In the area covered by this mapping project, rocks with reasonably preserved primary depositional and textural features (apart from the Owen Conglomerate) are confined to the western margin N of the No.1 Shaft. At this longitude, the outcrops are almost universally strongly weathered and commonly heavily leached at the surface, mostly presenting smooth, uniformly pale greenish or grey, soft clayey exposures which can perhaps best be categorized as weathered chloritic schists. However, at several localities just N of No.1 Shaft and along the Cape Horn Road there are (slightly less weathered?) exposures in which fragmental fabric, grain size variations and sedimentary bedding can be discerned. Grain size varies from fairly thin bedded siltstone through medium sandstone to pebbly volcanolithic conglomerate. Compositions would tend to intermediate rather than acid although feldspar and lesser quartz grains are prominent constituents.

047

I consider these to be epiclastic sediments; as a group essentially similar to the epiclastic suite exposed along the E flank of Little Owen Spur (Section 3.1.3) and quite possibly their stratigraphic equivalents.

6.2 Lyell Schists

In the Western Tharsis area I have had no qualms about applying the same four fold subdivision of Lyell Schists as used and described for the Glen Lyell-Great Lyell area (Part A of this report).

The felsic podded and banded schist is by far the dominant rock type with numerous elongate bodies (from only a few metres to several hundred metres in length) of the typical fine textured mafic schist.

Apart from a few narrow branching dyke like bodies near 5343000N just W of Tharsis Ridge most of the mafic schist occurs as small pods or lenses or in larger elongate somewhat irregular masses leaving few clues as to their pre-deformational form. Extensive boudinage of originally coherent beds or flows seems likely. The interpretative map shown in Figure 5 covers considerable areas of non-exposure and mini dumps. In most cases I have extrapolated through these with felsic schist and it is almost certain that unexposed bodies of mafic schist lie within the areas interpreted as felsic schist on Figure 5.

The intermediate chloritic podded schist rock type has a very limited distribution and is mainly used on Figure 5 to designate pods within the felsic schists of anomalous matrix chlorite content which are usually coincident with zones of low pyrite content.

As before, the undifferentiated schist category has been used to signify areas of extreme weathering and/or leaching in which the original rock type is uncertain. I suspect that most of the area shown as E_{su} represents epiclastic sediments.

Although the distribution and abundance of lithotypes accords well with the mapping of Arnold (1985), there appears to be a disparity

048

with that of Komyshan (1985) whose map shows a dominance of mafic schist with relatively minor felsic schist.

7. STRUCTURE

The structure of the schist-conglomerate contacts in the Tharsis Ridge and North Lyell areas has been fully discussed by Arnold (1985). I have not repeated that work and the Conglomerate boundaries shown on Figure 5 are directly attributable to Arnold and Komysan (both 1985).

Internal structure of the Lyell Schists in this area is completely dominated by a single NW trending and steeply to vertically dipping schistosity or cleavage which by orientation seems to accord with Arnold's principal (S_2) cleavage.

The twin sets of cleavages often observed within the podded schist varieties appears to relate to refraction or bending of foliation planes around hard deformation resistant pods and fragments. Only one possible instance of a cleavage overprinting relationship was observed; this occurs on the Cape Horn Road at about 5343520N amongst weathered, foliated epiclastic sandstone and conglomerate, in which a steeply dipping cleavage oriented at 295° appears to be crenulated by a similarly steeply dipping cleavage trending 320° .

Only two occurrences of measurable sedimentary layering were discovered within the epiclastic suite. One, at the southern end near No.1 Shaft gave a dip 75° to the E and the second about 600m to the N indicated a dip of 55° to NNE but no facings were obtained.

The contact between felsic schists and undifferentiated schists ex-epiclastics is locally well defined but generally rather vague due to lack of outcrop or effect of surface leaching but the general trend is northerly.

8. MINERALIZATION

(N.B.) *The notes in this section were written prior to availability of analytical results for rock samples T.2804-2830.

8.1 Disseminated Pyrite and Silica-Pyrite Heads in Felsic Schists

Disseminated pyrite mineralization ranging from about 5% to 15 or 20% pyrite occurs as a broad continuous zone, in felsic schist, extending northwards from the West Lyell Open Cut to the North Lyell Fault (with the usual assumptions for areas of no outcrop).

The western margin of the pyritic zone is quite sharp and mappable and most faithfully reflects the trend of the western boundary of the felsic schist unit, occurring always within about 50-100m of that boundary. The pyrite content diminishes very suddenly from 5-10% (sometimes partly oxidized) to virtually zero over an interval of a metre or two. The composition and texture of the felsic schist appears identical on both sides of the boundary. There does not appear to be any evidence of a faulted contact. It looks stratigraphic but intraformational. Nevertheless it must be stated that the western boundary of pyrite mineralization approximates the 400m R.L. contour and that the rocks a short distance (sometimes only a few metres) downhill from the boundary are generally somewhat leached. I do reserve some doubts that it may be a leaching boundary. It may be coincidental that the boundary of leached (undifferentiated) schists north of Karlson's Gap occurs near the 400m contour.

Apart from a small barren area just W and NW of Tharsis Ridge, the pyritic zone appears to be continuous right across to the Crown Lyell Open Cut.

Within the disseminated zone, there are numerous small pods and bands of near massive granular pyrite mostly too small to show on the plan. Two large massive pyrite pods of up to about 80% pyrite and 5m length occur near 382470E/5343230N. There appears to be a concentration of such massive bands or pods from this locality northwards along the bulldozed tracks and westwards down the gully but this might be a reflection of better geological exposure as these pyrite rich rocks do not ordinarily form prominent outcrops.

051

The converse is true with silica-pyrite "heads" and these, of all sizes up to about 40m diameter, occur in unusual abundance in the Western Tharsis area (W and NW of the northern end of Tharsis Ridge) whilst they seem virtually absent S of about 534300N. The larger silica-pyrite heads are usually partly oxidized in outcrop but the general range of pyrite content seems to be about 5-20%. They usually occur enclosed within pyritic felsic schist.

A number of possible exceptions to this rule occur at 382750E/5343450N where several moderate to large (5-20 metres) rounded, knobbly surfaced "heads" of pinkish white silica without trace of pyrite occur within mafic schist. I am quite uncertain as to their affinity; their characteristic knobbly surface appearance is strongly suggestive of silicified (Owen) Conglomerate.

The zone of silica-pyrite heads at Western Tharsis is covered to the N by dump material but a small outcrop on the N side of the dump "tail" suggests that the silica-pyrite head zone could extend up to the North Lyell Fault as it does on the northern side of the Crown Open Cut.

The North Lyell Fault dips to the S and is interpreted as a younger structure than the Great Lyell Fault (Arnold, 1985), so this juxtaposition may not constitute a favourable site for North Lyell style mineralization. There does not appear to be any obvious hematite mineralization of the Owen Conglomerate in the cliffs above the contact zone.

8.2 Disseminated and Veinlet Hematite in Schists

This style of mineralization has been observed in two situations:

- (1) as disseminated hematite to about 2% in podded felsic schist at 382300E/5343670N.
- (2) as disseminations and minor veinlets in podded intermediate-mafic schists at a location about 150m S of the above and also in a more widespread area about 200m W of the northern half of Tharsis Ridge.

052

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It will be interesting to note assay values when available for sample numbers T.2805, 2809, 2812, 2816 and 2830 in the light of the anomalous gold-hematite association apparent at Great Lyell. However, on the negative side, Komysan (1985, p.6) notes the occurrence of "hematite alteration which is not associated with silicification" within chloritic schists in the hanging wall of the Cape Horn orebody and elsewhere. He reports analyses low in base metals, barium and gold and concludes the mineralization type to be unprospective.

9. REFERENCES

- Arnold, G.O., 1985: Mt. Lyell 1985: An Exploration Perspective (Report to Gold Fields Exploration Pty. Limited).
- Brook, W., 1984: Geological Compilation of Mt. Lyell Mine Lease and Buffer Zone (1:10,000 scale plan, Gold Fields Exploration Pty. Limited).
- Brophy, P., 1977: Geology and Mineralization of the Great Lyell Area, Tasmania (M.Sc. thesis, Faculty of Science, James Cook University, Queensland).
- Corbett, K.D., 1979: Stratigraphy, Correlation and Evolution of the Mt. Read Volcanics in the Queenstown, Jukes-Darwn and Mt. Sedgwick Areas (Geological Survey Bull.58, Department of Mines, Tasmania).
- Komyshan, P., 1985: Geological Investigations in the Cape Horn-Lyell Comstock-West Sedgwick Area (Report to Gold Fields Exploration Pty. Limited).

10. APPENDICES10.1 Appendix A

Sample Record and Analytical Data Sheet.

GOLD FIELDS EXPLORATION PTY. LTD.

SAMPLE RECORD AND ANALYTICAL DATA SHEET

COLLECTED BY: W. HEERMAN

PROJECT: LINDA.

PROSPECT: COPPER ESTATES - LITTLEWATER AREA

LABORATORY: AMDEL

DATE DISPATCHED: MARCH '86

1:250,000 SHEET: SK 55-5

TYPE OF SAMPLE: ROCK CHIP, SAMPLE PREP. REQ'D:

ANALYSIS REQ'D:

DATE RECEIVED:

A19

001056

SAMPLE NUMBER	LOCATION	DESCRIPTION	ANALYSES					
			Au	Ag	Cu	Pb	Zn	Ba
T 2701		Over Conf + st. ± patchy hematite alt. + brass	<0.01	<1	18	36	5	100
T 2702		Massive hematite (barite) pod in pink Ov. Sch	<0.01	<1	27	160	13	4.96%
T 2703		Podded Qtz-ser schist 1-15% dia. pyrite	0.30	9	350	190	24	9900
T 2704		Recryst. bands pyrite - Qtz ≈ 60% Py.	0.70	54	1480	355	27	750
T 2705		Silica-pyrite banding in py-ser. schist.	<0.01	3	210	90	10	370
T 2706	Copper Estates	Patchy hematite alteration in Over Conf.	<0.01	1	41	255	6	730
T 2707		heminated "Qtzite" - Mylonite? ex Over Conf.	(FOR TWIN SECTION) (ABANDONED)					
T 2708		Podded Qtz-ser. schist. ≈ 5% Py. Possible Malachite?	<0.01	<1	60	12	18	500
T 2709		Foliated purple congl. - st. ± patchy Hematite Alt.	<0.01	1	33	450	8	1380
T 2710		Podded Qtz-ser schist ± patchy pyrite; 2-10%	<0.01	1	160	215	150	2380
T 2711		Pebble/Podded Qtz-ser (ch) schist; 2-5% Py.	<0.01	<1	220	40	110	690
T 2712		Podded Qtz-ser schist 5-20% Py.	<0.01	<1	200	58	47	640
T 2713		Massive foliated Hematite (Copper Estates Dump)	<0.01	1	41	185	6	9600
T 2714		* Foliated pale green schist ± fuchsite? Chromite	0.12	<1	20	32	3440	910
T 2715		* Grey Qtzite ± 2% detrital Chromite?	<0.01	"	29	58	48	25
T 2716		* hematite saturated (40%) schist or phyllite	"	"	310	170	185	160
T 2717		Podded Qtz-ser schist ± 2-4% dia. Py	"	"	28	74	21	570
T 2718		Siliceous fault breccia in Over Cf. Patchy fest	"	"	28	26	8	85
T 2719		Earthy limonitic Pseudogossan? Adj. Lake Lyell	"	"	110	7100	2740	1.08%
T 2720		Banded chl./qtz-ser. schist? ± Py, Cr, Mn, Fe	"	"	455	32	84	3360

* DENOTES OFFICUT OF SAMPLE XELIMEN RETAINED BY GOLDFIELDS, BUANIE.

GOLD FIELDS EXPLORATION PTY. LTD.

SAMPLE RECORD AND ANALYTICAL DATA SHEET

COLLECTED BY: W. KERRMAN

PROJECT: LINDA

PROSPECT: TOWNSHIP SHEET 115000 SAMPLE STORAGE REQ'D:

LABORATORY: AMDEL

DATE DISPATCHED: MAR 21 1958

1:250,000 SHEET: SK-55.5

TYPE OF SAMPLE: ROCK CHIP

SAMPLE PREP. REQ'D:

ANALYSIS REQ'D:

DATE RECEIVED:

1958

SAMPLE NUMBER	LOCATION	DESCRIPTION	ANALYSES						
			Au	Ag	Cu	Pb	Zn	Ba	Mo
T2721	Atlyell West Hill	Dr. chloritic fg. mafic schist 2-5% diss. cubic Py.	1.50	1	1660	70	480	930	
T2722		Purplish-Black ch. hematitic slate 10% diss Py.	1.00	10	2.30%	410	470	1960	
T2723		* Silicified/sericitized fs. porphyry ± minor Py, gal	<0.01	3	395	1.06%	4180	1580	
T2724		fg. chloritic schist ± small sparse qtz "eyes"	<0.01	1	98	155	345	1300	
T2725	Copper Estate	* Polished qtz - var schist ± 2-5% diss. pyrite	0.01	<1	24	36	19	930	
T2726		Clvd. fs. porphyry ± weak "jarsite" stain.	<0.01	<1	42	38	74	690	
T2727		Sericitic schist ± 2-5% Pyrite (small pod)	0.06	4	160	115	125	1100	
T2728		Silic-sericitic schist ± 2-15% Pyrite	0.09	6	150	160	380	2.59%	
T2729		* Seric-chlorite pods in var. py. sch. ± 2% Py; upto 1/100"	0.03	1	110	1600	6800	840	2
T2730		50 mm Barite vein ± 10% Pyrite.	0.09	<1	190	66	29	18.6%	
T2731		Massive granular Pyrite in 50mm vein.	0.28	20	94	82	24	2.15%	
T2732		Py/Cpy/Cc/Ba/Qty/Chl. vein in mafic schist.	1.10	33	450%	92	185	1.32%	
T2733		Massive Py (60%) Cpy (10%) Qty (30%) Vein 100mm	0.12	78	6100	540	580	1.03%	
T2734		Irregular Pod/Vein 60% Py + Qty + Barite. 150mm	0.28	3	280	110	11	2.41%	
T2735		Qty-barite schist Av. 5% Py. (Photo N13)	0.12	<1	235	54	18	1740	
T2736		Irregular Vein upto 150mm. Py 50% Ba 20% Qty 30%	0.30	1	235	24	5	20.5%	
T2737		Partially sericitized mafic schist? Trace Py, Ba?	0.01	<1	45	445	210	6800	
T2738		Large sheet (3m) Py 40% Ba ~10% Qty 50%	0.30	1	78	94	20	2820	Si
T2739		fg. Mafic Schist ~0.5% Pyrite disse.	0.09	<1	435	84	275	630	
T2740		Vein 30-50mm // chq. alt. gr. slt. Ba 50% Py 30% + Qty	0.88	2	440	72	5	11.0%	

001057

GOLD FIELDS EXPLORATION PTY. LTD.

SAMPLE RECORD AND ANALYTICAL DATA SHEET

COLLECTED BY: W. KERRMANN

PROJECT: LINDA.

PROSPECT: TOWNSHIP SHEET 1:5000 SAMPLE STORAGE REQ'D:

LABORATORY: AMDEL

DATE DISPATCHED: MARCH '86

1:250,000 SHEET: SK 55-5

TYPE OF SAMPLE: ROCK CHIP SAMPLE PREP. REQ'D:

ANALYSIS REQ'D:

DATE RECEIVED:

A15

001058

SAMPLE NUMBER	LOCATION	DESCRIPTION	ANALYSES					
			Au	Ag	Cu	Pb	Zn	Ba
T2741		Schistified/sericitized laminated gn. slt/epidote 2-5/P	0.01	1	750	34	27	3000
T2742		Felsic-int podded schist ± 3% disse. Py.	0.04	<1	120	78	48	7100
T2743		Irregular veins/veinlets ± 50% Ba, 30% Py + Qtz	0.92	5	340	1780	62	17.2%
T2744		P+B Qtz-ser Schist ± 2-10% Py (Host Rock for T2743)	0.12	<1	105	32	16	8150
T2745		Cavernous goethite limonite cemented Breccia.	0.05	6	830	4180	449	9500
T2746		* 0.5 x 1.5 m Lens: Ba 60% Py 15%, Qtz, 20%; Cpy, Hm.	0.88	3	2020	270	8	22.3%
T2747		Podded "Qtz-ser Schist" ± 2-10% Pyrite	0.16	<1	68	40	5	6700
T2748	(Mullach)	Massive (vein?) Barite; traces Py, Cpy, Hm, chl.	0.96	9	1280	435	250	41.6%
T2749		(Mullach) Silicified mafic schist; 5% Py, 1% Hm. Ba 2%	0.20	1	530	290	890	1.56%
T2750		* 5 x 2 m zone Hm-ser alt. in podded felsic schist	0.06	<1	29	140	7	3440
T2751		* < 50 mm vein Barite + spec. Hm in mafic schist	0.14	1	130	255	455	26.0%
T2752		Podded + Banded Qtz-ser Schist 5-10% Pyrite	0.78	3	710	860	18	1.68%
T2753		10 cm. Pyritic (40%) Band in Qtz-ser schist	0.42	1	475	185	22	1.17%
T2754		Qtz-ser Schist, 5-15% Py (host to T2753)	0.24	1	930	105	7	1.40%
T2755		(Mullach) Qtz-chl vein, cpy + Hm < 2%	0.12	1	1000	150	210	7900
T2756		* (Mullach) Silicified Mafic Schist Py 10%, Tr Cpy, Hm.	0.20	2	3360	345	170	1.18%
T2757		Qtz-chl Veins ± Cpy, Py, Hm, Cc. Srt. 4% Cu.	0.44	9	3.51%	310	600	210
T2758		5 cm. Sericitic band // chry. in Inters. Schist 5/P.	0.09	3	2400	530	22	1880
T2759		Near massive Pyrite (50%) with Qtz, milled Barite	0.46	3	770	250	33	5.70%
T2760		Silica-sericite Schist av. 5% disse. Pyrite.	0.08	<1	105	820	6	1.40%

GOLD FIELDS EXPLORATION PTY. LTD.

SAMPLE RECORD AND ANALYTICAL DATA SHEET

COLLECTED BY: W. KERNMANN

PROJECT: LINDA.

PROSPECT: TOWNSHIP SHEET ¹¹⁵⁰⁰⁰

SAMPLE STORAGE REQ'D:

LABORATORY: AMDEL

DATE DISPATCHED: MARCH '86

1:250,000 SHEET: SK 555

TYPE OF SAMPLE: ROCK CHIP

SAMPLE PREP. REQ'D:

ANALYSIS REQ'D:

DATE RECEIVED:

0.10

SAMPLE NUMBER	LOCATION	DESCRIPTION	ANALYSES					
			Au	Ag	Cu	Pb	Zn	Ba
T2761		20x5 m. zone of 10-50% (Si-15%) Py in Q-schist.	1.10	1	195	120	5	7600
T2762		1 m. zone (crosscutting) Ba 40% Py 40% in silic. mafic	0.20	1	560	105	18	17.2%
T2763		* Partially silicified? mafic schist, 2-3% Py	0.14	<1	290	70	105	2080
T2764		Sil-ser alteration ± 5-10% Py in lam. Green Slst.	0.36	1	1500	240	62	5700
T2765		Weakly silicified mafic schist, tr. Py, Cpy ± Hem 2%	0.12	2	1000	98	520	2.29%
T2766	Atlyell Shaft, Mullloch	* Massive compact Hematite ± Py 30% Cpy ~5%	0.92	6	5150	165	27	5650
T2767	"	* Sil-ser alt. schist? ± stringers Hem, Py, chl, cpy?	0.16	1	630	200	27	3140
T2768	"	* Massive compact granular Pyrite 70%. Qtz, chl, Ba?	0.70	7	570	58	28	7.00%
T2769	(P23)	* Pods ser Akti ± 5-10% disseminated Py in Intern. Epidote Gf.	0.04	4	88	570	17	940
T2770		Irregular stringers Mn-Fe oxides (5-20mm) in ph. sil/ser sch.	<0.01	1	54	1060	800	2140
T2771	Pine Tree workings	Mullloch F.g. chlorite ("mafic") schist < 0.5% disse. Py.	<0.01	<1	250	94	630	580
T2772	"	Qtz veins, traces chlorite, 100% disse. Cpy.	0.02	1	4280	58	80	25
T2773	"	Bn-Blk stained qtz + spongy garnet on qtz veins	0.30	3	760	1320	345	6.15%
T2774	Mullloch	* Chl. schist ± blebs/stringers Py, cpy, gal, sp. 3%	4.20	92	6950	7.15%	694%	3.75%
T2775	"	Barite-Qtz veins to 50mm, essentially barren.	0.01	1	210	42	36	53.5%
T2776		Patchy strong sil/ser alt. ± 5% Py in frag. mafic sch.	0.01	1	40	82	82	1560
T2777		f.g. mafic schist, essentially unmineralized.	<0.01	<1	155	56	320	1640
T2778		Patchy reddish (Hem?) stain in wd. schist?	0.01	1	155	800	810	590
T2779		Flinted, weakly ser alt. siliceous patchy Congl.	<0.01	<1	19	170	27	1100
T2780		Massive spec. Hematite as pods in Q-s schist	<0.01	<1	49	180	2	7500

001059

GOLD FIELDS EXPLORATION PTY. LTD.

SAMPLE RECORD AND ANALYTICAL DATA SHEET

COLLECTED BY: W. HERDMANN

PROJECT: LINDA

PROSPECT: TOWNHIP SHEET

SAMPLE STORAGE REQ'D:

LABORATORY: AMDEL

DATE DISPATCHED: MARCH '66

1:250,000 SHEET: SK 55-8

TYPE OF SAMPLE: 45000

SAMPLE PREP. REQ'D:

ANALYSIS REQ'D:

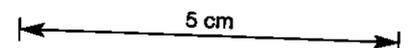
DATE RECEIVED:

A15

061

001064

SAMPLE NUMBER	LOCATION		DESCRIPTION	ANALYSES					
				Au	Ag	Cu	Pb	Zn	Ba
T2801		Offcut W146	Sericitized mafic schist - traces Hem, cpy, py.	<0.01	<1	140	58	39	980
T2802		Clearly pl.	Ironstone, surficial deposit at springs.	<0.01	<1	230	170	48	290
T2803		"	Silica-sericite altered fragmental mafic vs. 5-10% py.	0.06	1	290	50	27	1320
T2804	1:5000 Mine Sheet	(Thursis)	(Thin) massive pyrite lenses (2 m x 0.2 m) 80% py.	0.38	28	2560	1360	1.55%	3120
T2805	"	"	Podded chloritic (sericitic) schist ± 1/2 dia. Hem.	0.01	<1	135	50	90	840
T2806	"	"	Near massive pyrite pod in Q-ter sch. 60% py 20% Ba	0.34	7	1100	90	10	960%
T2807	"	"	Near massive granular-crystalline pyrite in Q-ter sch. 60% py.	0.44	1	950	10	9	460
T2808	"	"	Sm. wide zone 20-50% py in Q-ter schists.	0.22	1	380	52	14	190
T2809	"	*	Podded Q-ter schist ± patchy 2% dissemin Hem.	0.14	<1	120	52	12	1440
T2810	"	Mullbach	Qtz vein material ± variable cpy/py. est: 3% Cu	1.60	7	8.02%	74	11	1.40%
T2811	"	"	Pyritic Qtz-sericite schist ~ 10% py.	0.12	1	4220	28	9	1.10%
T2812	"	*	Chloritic schist ± dissemin py; stringers of qtz, py, hem, etc.	0.01	<1	1220	18	225	220
T2813	"	"	2m. zone pyritic zone in py-qtz-ser sch. ~ 30% py	0.24	<1	850	22	7	1.20%
T2814	"	*	Massive compact sulphides-silica (10% cpy) in small lens.	3.10	15	5.20%	80	9	830
T2815	"	"	Pyritic (20-50%) Si-ser all. zones in mafic schist	0.42	3	1340	120	9	3.75%
T2816	"	*	Esf. ± purplish hematite? stain + 1-2% py.	0.04	1	205	46	17	900
T2817	"	"	Massive granular py 80% Qtz 20% Pod (0.2 x 1.0 m)	0.40	<1	940	24	6	1.40%
T2818	"	"	Massive granular py 80% Qtz 20% Pod (0.4 x 1 m)	0.18	<1	850	6	8	270
T2819	"	"	Esf. ~ 10% py host rock to T2818.	0.14	<1	185	26	4	1260
T2820	"	"	Massive pyrite pod (80% py) (5 m x 2 m)	0.14	<1	170	40	9	440



GOLD FIELDS EXPLORATION PTY. LTD.

SAMPLE RECORD AND ANALYTICAL DATA SHEET

COLLECTED BY: *W. A. ...*
 DATE DISPATCHED: MARCH 86
 DATE RECEIVED:
 A1

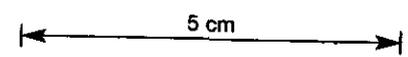
PROJECT: LINDA
 1:250,000 SHEET: SK 55-5

PROSPECT: 1:5000 TOWNSHIP SHEET.
 TYPE OF SAMPLE:

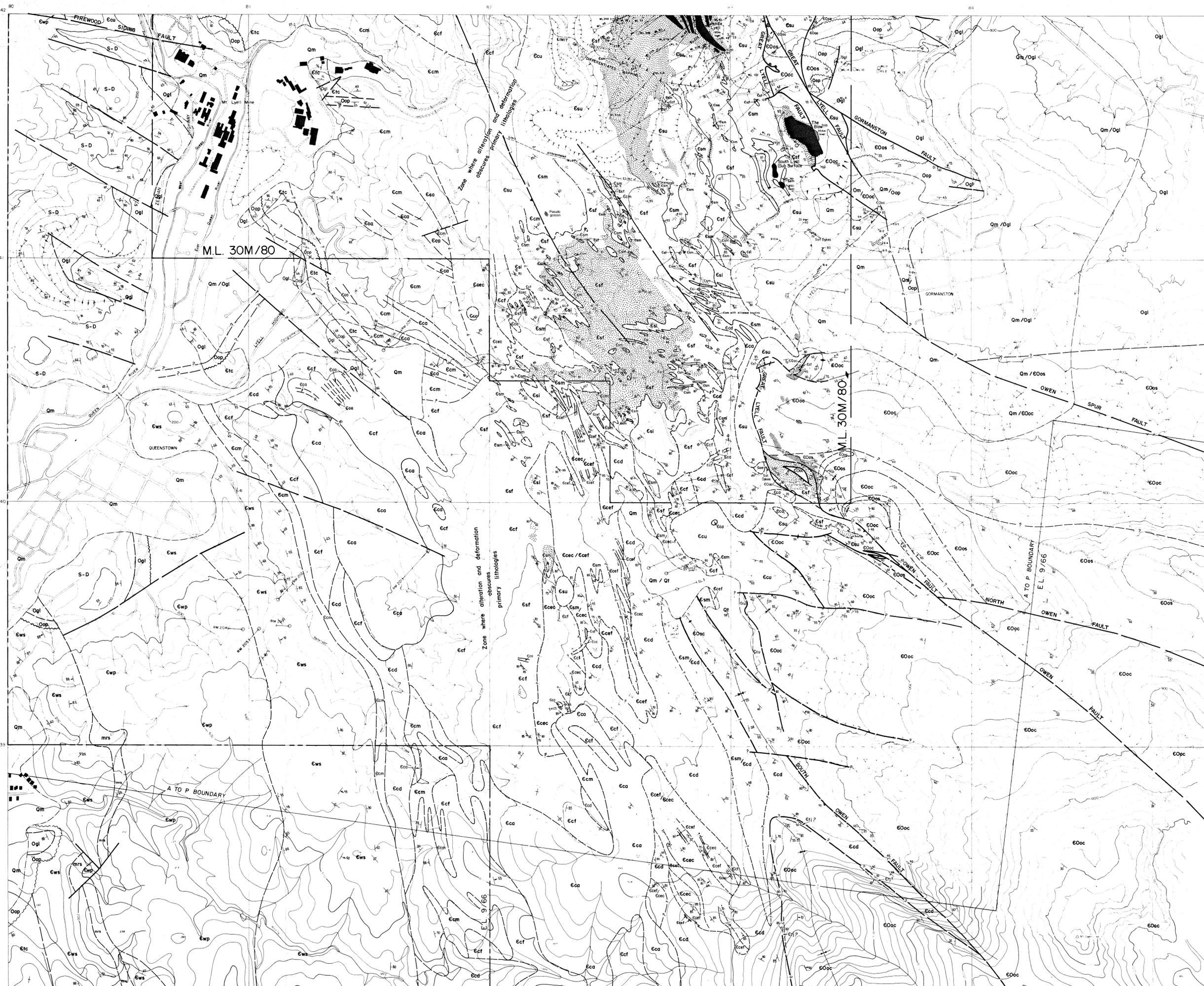
SAMPLE STORAGE REQ'D:
 SAMPLE PREP. REQ'D:

LABORATORY: HDEL
 ANALYSIS REQ'D:

SAMPLE NUMBER	LOCATION	DESCRIPTION	ANALYSES					
			Au	Ag	Cu	Pb	Zn	Ba
T2781	Mullock	Weakly pyritic Q-ser schist (1-2% Py)	0.01	1	48	190	365	1420
T2782		Silicified felsic schist $\epsilon = 30\%$ diss. Py.	0.05	<1	405	210	11	1300
T2783		Massive crystalline Barite; 10% Py s/ Hem.	0.30	15	5.20%	76	4760	47.1%
T2784		Heavy (40mm) Botryoidal Mn Oxides on joint	<0.01	7	455	2060	600	1640
T2785		Pyritic mafic schist (3% Py) adjacent to ^(100mm) pod	<0.01	3	66	3440	6000	6700
T2786		Sericitic schist $\epsilon \sim 5\%$ Py. Pod 2 x 20mm	0.14	9	580	740	1560	4140
T2787	Ct. Lyell Mt. Mullock *	Qtz-sericitic Schist $\epsilon = 5-10\%$ diss Pyrite	0.05	1	24	94	18	2900
T2788	" *	Chloritic Schist ϵ stringers Hem + Py $\approx 3\%$	3.40	2	6450	94	460	2780
T2789	"	Qtz-sericitic Schist $\epsilon = 3\%$ Pyrite	0.02	1	18	74	21	1980
T2790	" *	Chloritic Schist 1-5% diss. Pyrite	0.14	1	94	105	420	420
T2791	"	Chloritic Schist ϵ stringers Hem + Pyrite $\approx 3\%$	2.40	1	1760	195	670	360
T2792	"	Chloritic Schist $\epsilon = 2-4\%$ diss. Py.	0.16	1	240	145	315	1280
T2793	(west Lyell)	" * Chl-ser? schist ϵ white Qtz-lens Vms; 1% Py	<0.01	<1	47	40	475	310
T2794	" *	Chloritic Schist ϵ v. diss/stringers Cpy, lens Py.	0.09	1	2640	48	150	360
T2795	"	Chloritic Schist ϵ Cpy 2%, Py 1%	0.18	5	8800	170	115	570
T2796	" *	Sericitized, leucocratic Hem st. fr. Porph or felsic tuff?	0.01	<1	78	42	1680	370
T2797	" *	Silicified? f. porph ϵ diss. qtz, Py, sp, to 1%	<0.01	2	33	3520	1940	660
T2798	Mullock *	f.g. dark chloritic schist $\epsilon < 1\%$ Pyrite diss.	1.50	3	680	145	485	55
T2799	Mullock *	f.g. chloritic schist $\epsilon < 1\%$ c. cubic diss. Py.	<0.01	<1	80	66	340	65
T2800	offcut with 71	Fr-Qtz porph, felsic par. $\epsilon < 1\%$ diss. qtz, sp, Py.	<0.01	1	27	3180	870	3200



001062



LEGEND

QUATERNARY
 Q1 Recent talus
 Qm Pleistocene moraine

JURASSIC
 Jdl Dolerite

PERMIAN
 P1 Tiltite

SILURIAN - EARLY DEVONIAN
 S-D Eldon Group: undifferentiated sedimentary rocks

ORDOVICIAN
 Ogl Gordon Limestone
 Oop Pioneer Beds

LATE CAMBRIAN - EARLY ORDOVICIAN
 EOos Owen Conglomerate: predominantly hematitic sandstone and shale
 EOoc Owen Conglomerate: interbedded siliceous conglomerate and sandstone with minor shale, often hematitic

CAMBRIAN
 Mt. Read Volcanics - Tyndall Group
 Jules Breccia (and Dara Conglomerate): volcanic breccia and conglomerates
 Ctc Comstock Tuff: felsic tuffs, agglomerates, lavas and minor quartz-muscovite porphyry
 Cts Turfaceous fine grained sediments: including pelitic calcareous sediment and fossiliferous limestone lens
 Mt. Read Volcanics - Lyell Schists
 Esf Felsic Schist: quartz pebbled and banded sericitic schists principally derived from felsic volcanics
 Csi Intermediate Schist: chloritic schists with quartz pods and bands intermediate between Csf and Csm
 Csm Mafic Schist: schistose schists derived from mafic-intermediate volcanics and intrusives
 Esu Undifferentiated Schist: felsic to mafic, often unrecognizable due to intense leaching and weathering
 Mt. Read Volcanics - Central Sequence
 Ecef Fine-Grained Epilastics: predominantly shales and siltstones, minor sandstones
 Ecec Coarse-Grained Epilastics: predominantly mass debris deposits and volcanic conglomerates, minor shales and siltstones
 Ecf Felsic Pyroclastics: ignimbrites, tuffs and agglomerates
 Rhyolitic Lavas: often flow banded, quartz-phyric, minor associated pyroclastics
 Ecd Dacitic-Rhyolitic Lavas: often endogenous domes with breccias, some sub-volcanic intrusives
 Eca Andesitic Intrusives: minor lavas and breccias
 Ecm Mafic-Intermediate Volcanics: pyroclastic tuffs, agglomerates and lavas
 Ecu Undifferentiated Volcanics: mostly unrecognizable pyroclastics and epilastics due to intense leaching and weathering
 Mt. Read Volcanics - Western Sequence (O'town Pyroclastics)
 Cwf Felsic Pyroclastics: ignimbrites, tuffs and agglomerates
 Cwm Mafic-Intermediate Volcanics: predominantly intrusives, minor lavas and breccia tuffs
 Ews Sediments: interbedded vitric tuffs, shales, sandstones and greywackes, dominantly marine sequence, including Miners Ridge Sandstone (mrs)
 Ewp Quartz-Feldspar Porphyry: mostly high level intrusives

ALTERATION AND MINERALISATION
 Intense hematite - (silica-barite) alteration eg North Lyell and Comstock "Ore" bodies
 Silica: large and small pods or bands of silica-pyrite with Lyell Schists, pyrite content 0-20%, boundaries approximate
 Banded beds of massive pyrite, observed and inferred, boundaries approximate
 Disseminated sulphides exceeding 5%, mostly pyrite, minor chalcocopyrite and bornite
 Massive sulphide, copper (gold, silver) orebodies showing level of projection
 Galena present

PROSPECTS AND WORKINGS
 Trench or coater Adit Shaft
 Alluvial workings
 Open cut Waste dump
 Surface exploration diamond drill hole
 NB: not of holes shown in areas of dense drilling, now mined out

SYMBOLS
 --- Lithological boundary - position accurate, approximate or inferred
 --- Unconformity - definite or inferred
 --- Fault: - position accurate, approximate or inferred, teeth indicate dip of fault plane
 --- Cover: - showing limit of significant glacial moraine or scree cover
 --- Bedding: - showing strike and dip
 --- Bedding: - showing facing direction
 --- Cleavage: - showing strike and dip
 --- Cleavage: - showing differentiated phase
 --- Anticline: - showing axial trend
 --- Syncline: - showing axial trend

SOURCE GEOLOGICAL DATA

ML	GA	P. BROPHY 1977
		K.D. CORBETT 1978
		G.O. ARNOLD 1985
		W. HERRMANN 1986
PB/KC	WH	MT. LYELL miscellaneous mapping

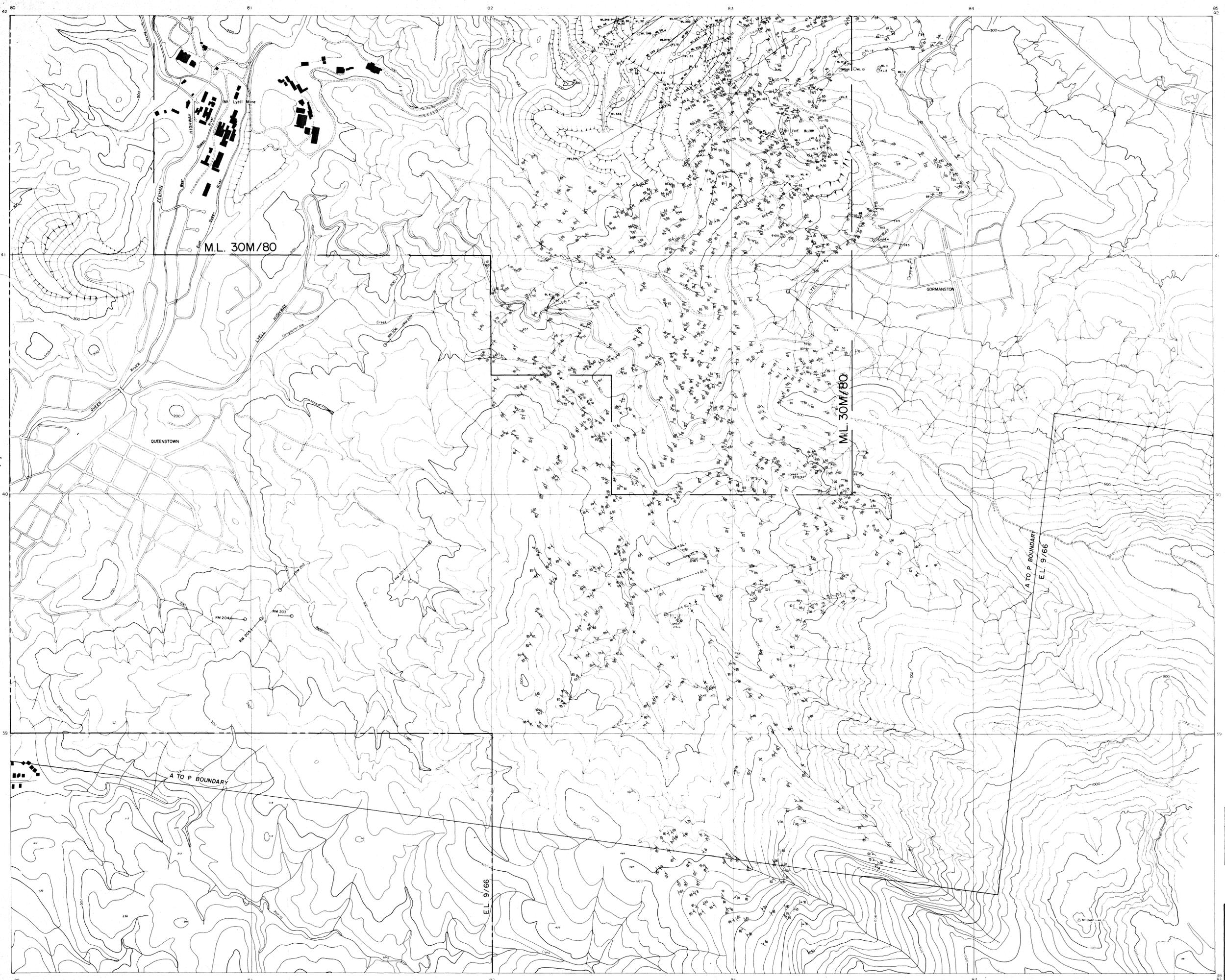
SHEET INDEX

Diamond	Mine	Lyell
Airport	Township	Process
Lynchford	Owen	Tyff

001063
GOLD FIELDS EXPLORATION PTY LIMITED
MT LYELL AREA
TOWNSHIP SHEET
GEOLOGICAL INTERPRETATION

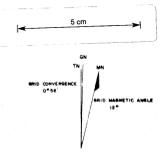
DRAWN BY: J.G.F.
DRAFTSMAN: T.G.D.S.
DATE: May 1986
REVISIONS:
FILE NO.:

SCALE 1:5000
 5cm
 FIG. 1



SHEET INDEX

Diamond	Mine	Well
Airport	Township	Princess
Lynchford	Dam	Taft



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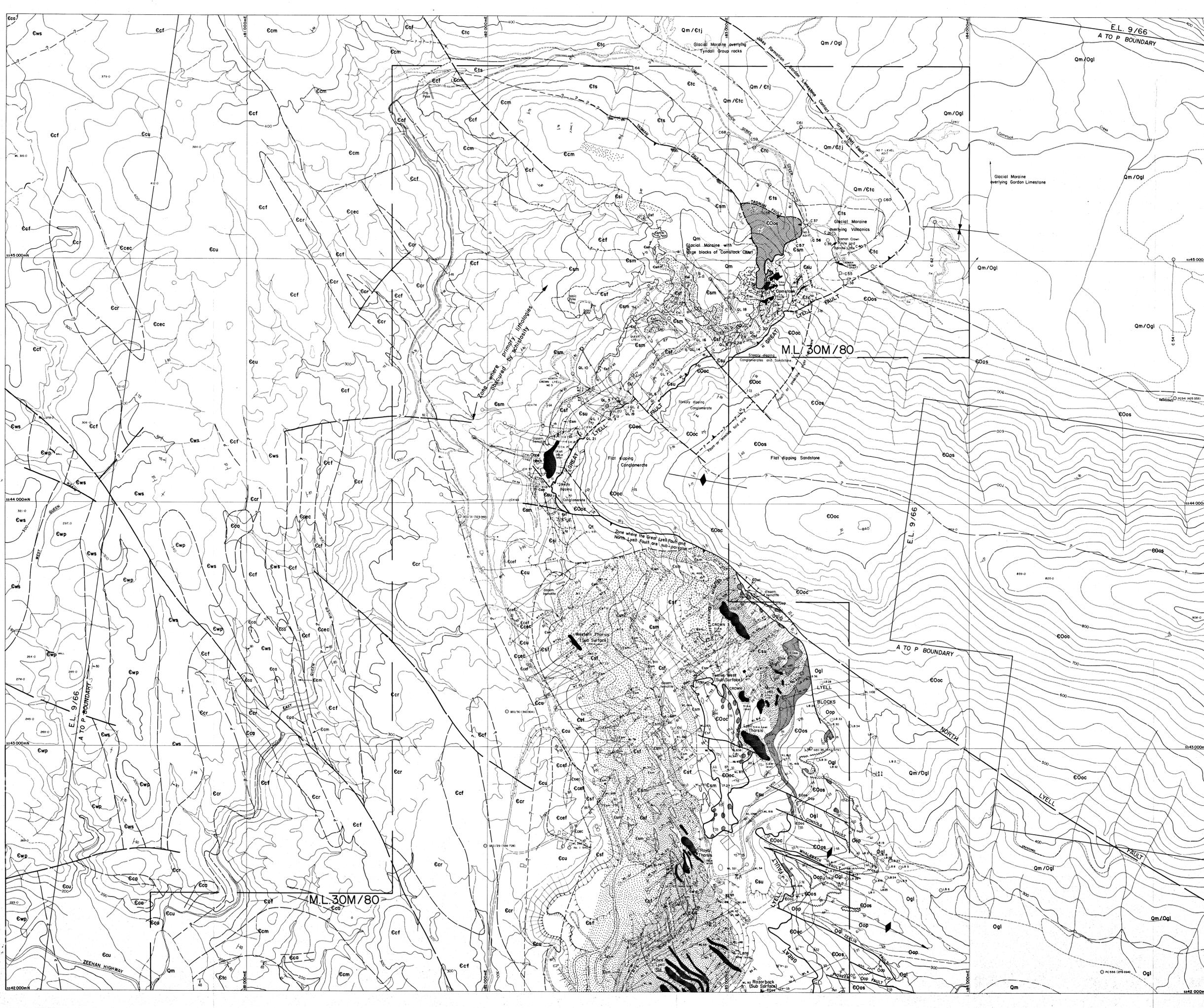
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GOLD FIELDS EXPLORATION PTY LIMITED

MT LYELL AREA	DRAWN BY FGF
TOWNSHIP SHEET	DRAFTSMAN TGD
	DATE May 1986
	REVISIONS
	FILE NO.

SCALE 1:5000

FIG 3



LEGEND

QUATERNARY
 Q1 Recent talus
 Qm Pleistocene moraine

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 Jdl Dolerite

PERMIAN
 Pt Tillite

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 * Galena present

PROSPECTS AND WORKINGS
 Trench or coaction Adit Shaft
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 Open cut Waste dump
 Surface exploration diamond drill hole
 NB: not all holes shown in areas of dense drilling, now mined out

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 - Bedding: - showing facing direction  
 - Cleavage: - showing strike and dip  
 - Cleavage: - showing differentiated phase  
 - Anticline: - showing axial trend  
 - Syncline: - showing axial trend

**SOURCE GEOLOGICAL DATA**

|      |                                 |
|------|---------------------------------|
| P.K. | K.D. CORBETT 1981               |
| K.C. | G.O. ARNOLD 1985                |
| M.L. | P. KOMYSHAN 1985                |
| M.L. | W. HERRMANN 1986                |
|      | MT. LVELL miscellaneous mapping |

6438

**SHEET INDEX**

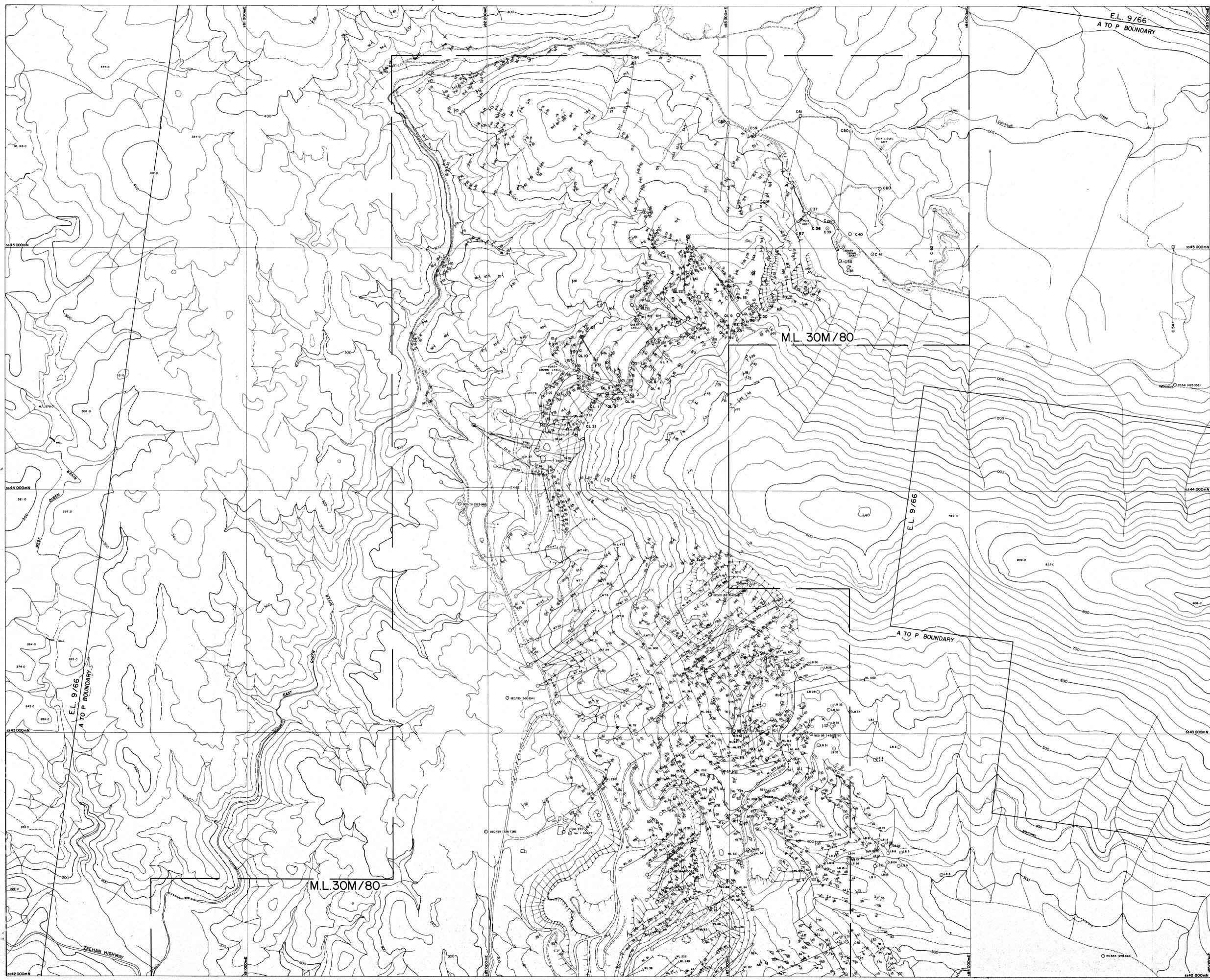
|         |          |          |
|---------|----------|----------|
| VILLAGE | MARGARET | BEATRICE |
| DANING  |          | LVELL    |
| AIRPORT | TOWNSHIP | PRINCES  |

**86-2579 001067**  
**GOLD FIELDS EXPLORATION PTY LIMITED**  
**MT. LVELL AREA**  
**MINE SHEET**  
**GEOLOGICAL INTERPRETATION**

DRAWN BY F.G.F.  
 DRAFTSMAN T.G.D.  
 DATE May 1986  
 REVISIONS  
 FILE NO.

SCALE 1:5000  
 METRES  
 FIG. 5





- LEGEND**
- Bedding.
  - Bedding overturned.
  - Cleavage undifferentiated.
  - Cleavage differentiated.

**SHEET INDEX**

|         |          |          |
|---------|----------|----------|
| YOLANDE | MARGARET | BEATRICE |
| DARWIN  | LYELL    | PRINCESS |
| AIRPORT | TOWNSHIP | PRINCESS |



6440

86-2579 001009

**GOLD FIELDS EXPLORATION PTY LIMITED**

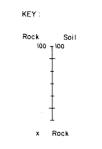
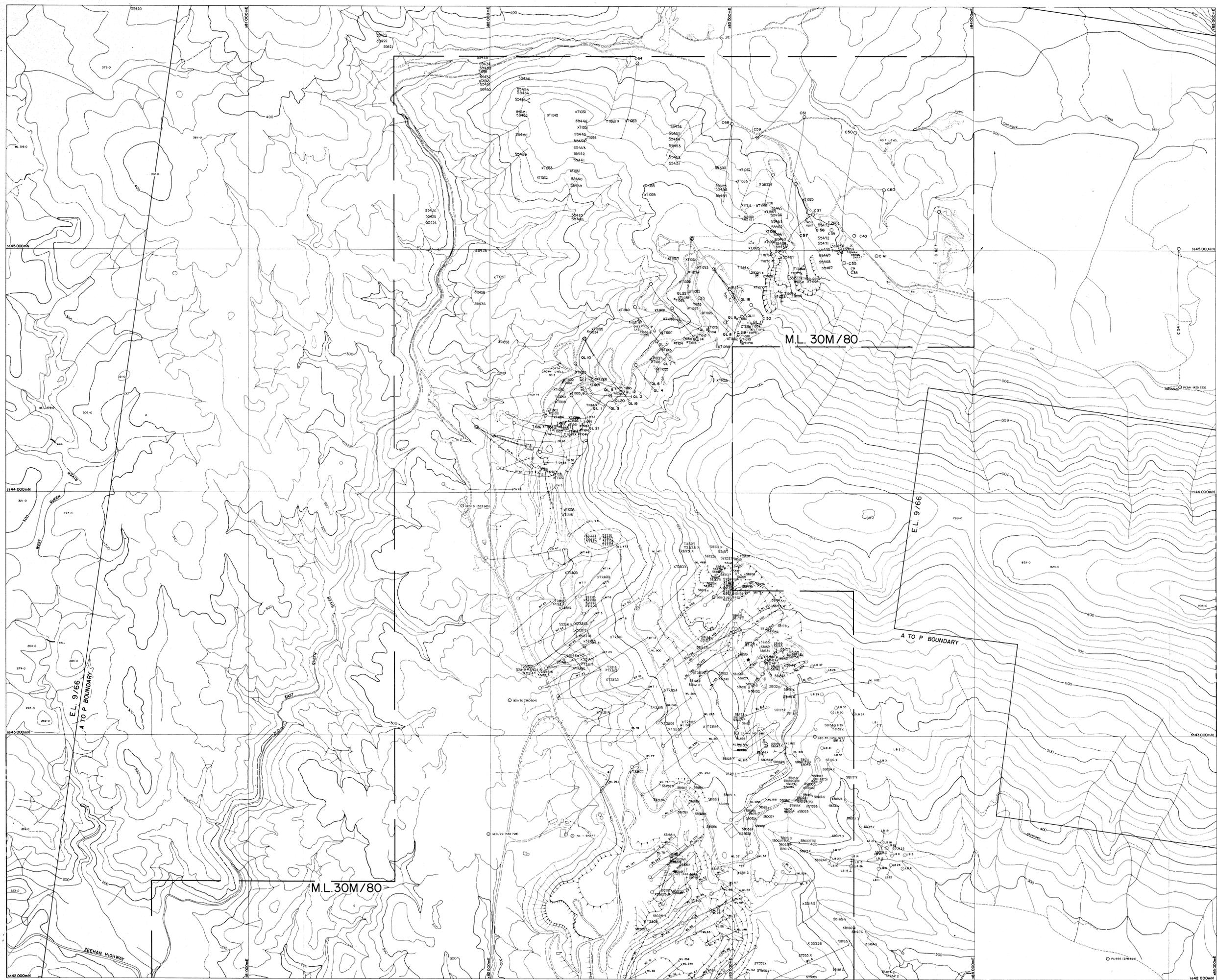
**MT. LYELL AREA**  
**MINE SHEET**

**STRUCTURAL DATA**

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DRAFTSMAN: T.G.D.S.  
DATE: May 1986  
REVISIONS:  
FILE NO.

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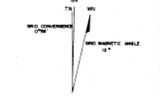
**FIG. 7**



- SOURCE OF GEOCHEMICAL DATA**
1. COMSTOCK GRID SAMPLES - MT. LYELL 1981
  2. SAMPLES N57901-58226 ARNOLD, 1985
  3. SAMPLES T1001-1256, KOMYSHAN, 1985
  4. SAMPLES T2701-2830, HERRMANN, 1986

6441

| SHEET INDEX |          |          |          |
|-------------|----------|----------|----------|
| 100-100     | MARGARET | BEATRICE |          |
| 100-100     | DAMROD   | LYELL    |          |
| 100-100     | AIRPORT  | TOWNSHIP | PRINCESS |



85-2519 001070

**GOLD FIELDS EXPLORATION PTY LIMITED**

**MT. LYELL AREA**  
**MINE SHEET**

**ROCK & SOIL GEOCHEMISTRY**  
**SAMPLE LOCATIONS**

SCALE 1:5000 METRES

DRAWN BY F.G.F.  
 DRAFTSMAN T.G.D.S.  
 DATE May 1986  
 REVISIONS  
 FILE NO.

**FIG. 8**