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ANNUAL REPORT

3RD MARCH, 1995 - 2ND MARCH, 1996
EXPLORATION LICENCE NO. 44 / 94
MATHINNA, TASMANIA

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BESWICK C & D

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1. Lists of Figures, Maps and Appendices

- i) Appendix A - Report on Mathinna Goldfield by J.H. Gibson, Consulting and Contracting Geologist.
- ii) Appendix B - Petrographical report by J.H. Gibson, Consulting and Contracting Geologist.
- iii) Map No. 1 - 1:25,000 scale map of Mathinna, Tower Hill Goldfields with index of deposits.
- iv) Map No. 2 - Map of tenement showing three parts comprising tenement.

2. Tenement Information

The Tenement comprises three areas, each of 25 hectares, the total exploration licence area being designated as one square kilometre.

The tenement is in the land district of Cornwall, vicinity of Mathinna, municipality of Break O'Day. The areas comprising the tenement are described as follows:-

PART 1 - 25 ha

Commencing at the southeast corner at grid coordinates 573 800 metres E 5 406 820 metres N thence westerly to 573 310 metres E 5 406 920 metres N northerly to 573 420 metres E 5 407 400 metres N easterly to 573 910 metres E 5 407 300 metres N thence southerly to the point of commencement.

PART 2 - 25 ha

Commencing at the southeast corner at grid coordinate 574 840 metres E 5 405 440 metres N thence westerly to 574 450 metres E 5 405 510 metres N northerly to 574 570 metres E 5 406 120 metres N easterly to 574 970 metres E 5 406 030 metres N thence southerly to the point of commencement.

PART 3 - 25 ha

Commencing at the southeast corner at grid coordinate 573 320 metres E 5 404 000 metres N thence westerly to 574 870 metres E 5 404 070 metres N northerly to 574 980 metres E 5 404

620 metres N easterly to 575 420 metres E 5 404 540 metres N thence southerly to the point of commencement.

The tenement comprises both state forest and crown land.

3. Summary of Previous Exploration

This is the first year in which the licensees have held an exploration licence for the tenement and no previous exploration work has been carried out by the licensees on the tenement. No exploration licence has been in effect over the subject areas for a significant period of time.

4. Summary of Work Completed During the Report Period

- (i) Study of the area within which the three areas which comprise the tenement are located discloses that there is a major structural element stretching Lyndhurst to Mangana, which is most likely a series of faults with one ending and another starting at each field. One of these faults forms the riverbed of Dan's Rivulet. The three mines (Una 1, 2 and 3) above the start of Dan's Rivulet have their reefs trending parallel to the river's course. The ending of one and starting of another sets up special stress over a large area, and thus the secondary fractures (which the veins fill) should have set directions. The three mines present in each part of the tenement do not fit with this pattern, indicating a likelihood that they may have formed earlier and rotated with later movement.

The licensees engaged J.H. Gibson, consulting and contracting geologist of Bolten Point, New South Wales to carry out research and sampling work. His opinion was that mineralisation in the area appears to have come in five stages. In his opinion these stages appear to be controlled primarily by temperature, and as the temperature has dropped new minerals have formed. His assumption was that the mineralising phases ranged from 200-400 degrees Celsius, however a significant amount of

further work is required to verify this. His opinion as to the stages of mineralisation was as follows:-

- 450°C? - Stage 1 - Octahedral Pyrite
↓
300°C - Stage 2 - Massive Pyrite + Arsenopyrite ± Galena
↓
200°C - Stage 3 - Cubic Pyrite + Chalcopyrite
↓
-200°C - Stage 4 - Gold ± Pyrite ± Chalcopyrite
↓
20°C - Stage 5 - Present - undergoing weathering.

Two reports have been received from Mr. Gibson entitled "Report on Mathinna Goldfield" and "Appendix 1, Petrographical Report". Copies of those reports are annexed hereto and marked with the letters "A" and "B" respectively. Further work by J.H. Gibson throughout 1996 is anticipated by the licensees.

- (ii) The licensees have been working to attract a joint venture partner for development of the tenement specifically, negotiations have been conducted with two large Australian companies. Negotiations with one of those companies were conducted through 1994 prior to issue of the exploration licence 44 of 1994, and in anticipation of exploration works commencing in 1995. Those negotiations did not produce an agreement for that exploration work to be carried out.

Negotiations with a second company were carried out through 1995. To date those negotiations have not concluded with the joint venture agreement being reached however there is still some prospect of success.

The licensees will continue to actively seek a joint venture partner to development the tenement.

(iii) Surface sampling and samples from adits have been taken for analysis.

5. Details of Regional Surveys

The licensees have not conducted any regional surveys.

6. Details of Specific Surveys

Specific surveys of the Miner's Dream mine have been carried out. Please refer to Summary of Work Completed During the Report Period above.

7. Conclusions and Recommendations

No reliable or reasonable conclusions or recommendations can be drawn from the sampling and research work carried out by or on behalf of the licensees for the current reporting period. The licensees intend continuing to engage consultants or contractors to carry out further sampling and research work with a view to determining the prospects for mining the tenement.

8. Proposed Future Exploration

See conclusions and recommendations above.

9. Bibliographic References

Nil.

10. Appendices

Appendix A

Report on Mathinna Goldfield by J.H. Gibson, Consulting and Contracting Geologist.

Appendix B

Petrographical report by J.H. Gibson, Consulting and Contracting Geologist.

11. Maps of the Licence Area

Map No. 1 - 1:25,000 scale map of Mathinna, Tower Hill Goldfields with index of deposits.

Map No. 2 - Map of tenement showing three parts comprising tenement.

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REPORT ON MATHINNA GOLDFIELD

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Tuesday 12th of March 1995

Mines Visited:

- City of Hobart
- Miner's Dream
- Jubilee

Introduction

The Mathinna Goldfield lies towards the southern end of a 70 - 80km arcuate linear belt of gold fields in north east Tasmania, that strike approximately 150 to 140° grid from the Lyndhurst field in the north to Mangana in the south (Threader, 1967). These mines are found almost exclusively within quartzwacke units of the Ordovician/Silurian turbiditic Mathinna Beds, being part of the Melbourne-Mathinna terrane of Glen et al, 1992.

The Mathinna Beds are part of "a 12-15km thick slab of Ordovician to Middle Devonian Periods (500 million to 390 Million years) sedimentary sequences that was deposited as sediment upon the underlying Cambrian Period (570 to 500My) intraoceanic and fore-arc crust, and were progressively "stitched" (joined) to the western craton or rocks of the Delamerian Orogen by Early (405My) to Late Devonian Epochs (365My) Granitoids. The (*Melbourne-Mathinna*) [author's italics] terrane incorporates (1) the Ballarat and Melbourne terranes of Ferguson et. al (1986); (2) the east Tasmania terrane of Scheiber (1985) and Baillie *et al* (1989); and (3) The Bassian terrain of Stump et al. (1986) " *ibid*. Accretion of the of the Melbourne-Mathinna terrane commenced on the mainland during the late Silurian Epoch (415-405 My) during the Delamerian Orogen, and concluded within Tasmania during the Lachlan Orogen in the Middle Devonian Epoch (390-385 My). This being accomplished by sinistral movement along the Tamar Fault (*ibid*).

Structural Geology and Structural Control On Gold Mineralisation.

Synopsis of Previous Author's Investigations

Taheri and Findlay (1992) in their synopsis on published and unpublished reports, contend that

Mathinna Beds are folded around northwest trending axes with a southern plunge. These folds have an accompanying slaty cleavage that appears to be statistically axial planar (parallel to fold axes), but locally cleavage can cross the fold axes with an offset of as much as 25° to their axial surfaces. This would indicate a later deformational event. The development of cleavage would entail a horizontal shortening of the Mathinna Beds by as much as 70% and vertical uplift through folding of 50% (Kisch, 1991).

They contend a later deformational event, probably the one producing the cleavage deflection, has produced regional northeast trending mega-kinking with accompanying steeply dipping sinistral and dextral kink bands in the region of that kinking. This kinking event was in response to a northerly directed compression. The strike or trends of veins varies widely, and does not show any consistent relationship with fold axes, bedding or cleavage, but in the Dans Rivulet field, those veins trending NNE have the widest veins and the richest assays.

Quartz veining within the region is complex, with some early veining occurring at fold crests, while other thin veining follows the north east trending joints set, as well as other veins following cleavage. The mineralised veins as a rule tend to follow post-fold faults, with auriferous veining ranging from a few centimetres to 10 metres in thickness and 5 metres to over 300 metres in length. However the majority of veins are less than one metre wide and 30 to 60 metres long. An exception is the New Golden Gate mine.

The most extensive workings in the Tower Hill-Mathinna-Dans Rivulet area, indeed the NE Tasmania is the New golden Gate mine that worked veins within a shear zone called the "main slide" trending 327° dipping 70° to the south west. The mine worked six major sub-parallel auriferous reefs within a zone 12 metres wide and 580 metres deep. This is in sharp contrast to most veins within the area which were only worked to a depth of 30 to 60 metres.

The gold values of auriferous veins within the fields, is generally associated with minor sulphides that generally constitute less than 1% and rarely more than 2% of gangue. Pyrite and arsenopyrite are the primary sulphides with lesser amounts of galena, sphalerite and chalcopyrite. Gold occurs as grains within quartz and as inclusions within sulphides. This is confirmed by my earlier report on the Miner's Dream mine dated the 22nd of October 1994.

Generally the ore shoots worked within the Tower Hill-Mathinna- Dans Rivulet fields produced only small tonnages of ore (100 to 1,000 tonnes), with the exception of the New Golden Gate from which 60,000 to 80,000 tonnes of ore was produced. The New Golden Gate was also the richest mine (average of 26 grams per tonne) with a gold production of 7.2 tonnes of gold, or 87% of gold for the area in question.

Depositional Theories

Hills (1923) postulated that mineralisation was controlled by folding and related to a west-dipping thrust-fault, with lodes restricted to the crest and limbs of an anticline within an upper zone of thrusting. Hill's postulated thrust has never been found. Threader (1967) concluded that gold mineralisation was confined to shear zones, rather than folding and related to the emplacement of the surrounding granitoid bodies. Finally, Powell (1991) also contends a relationship with a postulated thrusting event.

Taheri and Findlay (1992) contend that mineralisation within "the Mangana-Alberton goldfields maybe caused by wrench (*strike-slip*) faulting." They base their idea on the following observations.

- "(1) the orientation of topographic lineaments between Mathinna and Mangana, the upper part of Dans Rivulet and Mathinna, and that formed by the Alberton Valley;
- (2) the consistently restricted orientations of known gold lodes; and
- (3) the offsets between the goldfields."

These authors further contend that "extensional jogs" or transtension zones (Ramsay and Huber, 1987), which are zones containing deformation between dextral(*displacement along a fault such that the opposite side of the fault appears displaced to the right*) en echelon (*over-lapping and staggered*) strike-slip faults have formed at the head of Dans Rivulet and Mathinna. They also explain the "-- Main slide at Mathinna may be interpreted as having formed as an extensional structure in such a system--". This is hard to imagine, as an "extensional structure in such a system" would be oriented east/west in the direction of least compression for dextral en echelon shearing.

INTERPRETATION - THIS REPORT

Two maps (figures 1 and 2) and a directional rose diagram figure 3, have been drawn using the Australian Map Grid references for the mines and trends of veins taken from Taheri and Findlay (1992) to explain my interpretation of the structural controls on mineralisation in operation within the Tower Hill-Mathinna-Dans Rivulet area.

Figure 1

This map includes the mines as detailed in Taheri and Findlay (1992) for the Tower Hill, Mathinna and Dans Rivulet Gold fields. The filled squares representing mines within the Dans Rivulet field and filled circles representing mines within the Mathinna-Tower Hill fields. Six trends are evident from this map, and are delineated by lines numbered 1 to 6. These trends are:

- 1 - 139° (NW/SE)
- 2 - 148° (NW/SE)
- 3 - 146° (NE/SW)
- 4 - 173° (N/S)
- 5 - 029° (NE/SW)
- 6 - 147° (NW/SE)

Figure 2

The figure 2 map includes those mines within the Mathinna and upper part of the Tower Hill goldfields. The filled circles represent mines generally, while filled squares representing the City of Hobart, Miner's Dream and the Jubilee mines. Seven trends are delineated in this map and are detailed below. The red lines through some mines represent the trend of veins worked within those mines (data from Taheri and Findlay, 1992).

- 1 - 132° (NW/SE)
- 2 - 117° (NW/SE)
- 3 - 139° (NW/SE)
- 4 - 181° (N)
- 5 - 184° (N)
- 6 - 183° (N)
- 7 - 180° (N)

Figure 3

Is a rose diagram of vein trends within the Tower Hill-Mathinna-Dans Rivulet goldfields. This was compiled by grouping the 89 vein trends from Taheri and Findlay, and are grouped from north into 10° increments. Each blue circle representing two vein trends, the scale line on due east indicating the number of veins grouped into each circle of the rose diagram. North is indicated as "N". The lines within the outer circle indicates the trends of veins within the Miner's Dream (No.1) the City of Hobart (2) and Jubilee mines (3). The following out side the last circle are:

- σ_1 = Direction of proposed extension veins.
- R_1 = Direction of proposed Riedel shear zones.
- R_2 = Direction of proposed Riedel Shear zones.
- Y = Direction of Y or en echelon fractures.
- GS = Direction of the "Main Slide" of the New Golden Gate Mine.

INTERPRETATION

In the opinion of the author, the interpretation of Taheri and Findlay is in part right, in that the mineralisation is the result of *strike-slip* faulting, and the Mathinna field is an extensional jog between en echelon fault segments. The difference expounded by the author is that the sense of movement of faulting appears to be sinistral (displacement along a fault such that, in plan view the side opposite the observer appears displaced to the left.).

If the fault was indeed dextral, the principal compression direction would be north/south and the direction of extension would be east west. If this was so the following preferred orientations would be noted between 145° en echelon faults (after Bartlett et al, 1981 Ramsay and Huber, 1987).

Y or en echelon zones after	= 145° (average) (dextral movement)
P fractures	= 130°
R1 Riedel zones of	= $160-165^{\circ}$ (dextral movement)
R2 " " "	= $040-045^{\circ}$ (sinistral movement)
Principal Compression direction	= 010°
Extension zones	= 100° (also direction of fault folds)
Conjugate dextral faulting	= 160° (dextral movement)
Conjugate sinistral faulting	= 040° (sinistral movement)

If on the other hand the en echelon faults were sinistral then the following would be true.

Y fracture zone	= 145°
P fracture zone	= 160°
R1 fracture zone	= $130-125^{\circ}$ (sinistral movement)
R2 Fracture zone	= $070-165^{\circ}$ (dextral movement)
Principle direction of compression	= 100°
Principle direction of extension	= 010° (also direction of fault folds)
Conjugate dextral faulting	= 070° (dextral movement)
Conjugate sinistral faulting	= 130° (sinistral movement)

It can be seen from the above, a wide range of fractures can develop from en en echelon strike-slip faults making and if their sense of direction is unknown (and they are not from the information available), the sense of movement on the en echelon faults can not be ascertained from fault data.

The one thing that is definitive is the direction of extension and its products of fault folding and extension veins. While there is no mention of minor folding adjacent to the main line of fracture, figure 2 shows most of the mines within the Mathinna jog can be aligned in groups sub-parallel to the principle extension direction, σ^3 (0-10°).

As well as the foregoing, a view of Figure 1 of Taheri and Findlay (1992) shows the Upper Devonian to Lower Carboniferous granitoids within the region to have an apparent sinistral displacement. This displacement may be more apparent than real as the only place the proposed en echelon faults would cut the granitoids is between Warrentinna and Alberton and map definition is not good enough to define if any displacement exists.

Structures Pertaining to the City of Hobart, Miner's Dream and Jubilee Mines

City of Hobart Mine

The City of Hobart lies within the Mathinna extensional jog and its vein system is 005° dipping to the west. This would be in the direction of extension associated with sinistral en echelon faulting at 135-145°. Two small costeans within the property revealed two small extension veins measured at 005° dipping 65° east and 115° dipping 65° N/E. The first vein is in the direction of extension of first order deformation, the second appears to be a second order fracture in response to minor extension at right angles to the first episode.

A shaft was sunk to a depth of 201 metres and drivings of 152 metres. The first 36 metres of driving yielded 28 grames per tonne while the final 116 metres of driving gave poor results. Within the shaft, the first 100 metres of ore treated averaged 28 grames per tonne, extracted from a vein 90cm wide. Below 100 metres the vein became laminated and narrowed to 40cm wide, until at 177 metres the reef appears to be displaced by later faulting.

It would be difficult to predict an exploration program for this mine, but the best results should be expected along strike, while other major extensional features with a north - south trend could be encountered. East west costeans and geophysical methods would be the cheapest methods to employ at this site.

Miner's Dream Mine

The Miner's Dream mine is situated on the boundary of, or just outside the Mathinna extensional jog, but lies on the No. 2 trend of 117° shown in Figure 2. This trend lies close to what would be expected of a R; Riedel fracture zone (130-125°) in response to sinistral movement within the extensional jog between en echelon strike -slip faults bearing 145°.

This mine worked two veins, one trending 010° dipping 40 to 60° NE to SE, and the other 159° with a similar dip from a shaft 85 metres deep, and produced 12.2 kg of gold from veins of 10 cm to 4.8 metres wide. The veins were generally narrow and discontinues. The vein trending 010° could be an extensional vein in response to the extensional jog, while the other trend could be a P fracture of Bartlett et al (1981).

Apart from exploration along strike, exploration should be proceeded by a structural investigation.

Miner's Dream Adit

This mine is situated south east of the Miner's Dream Shaft, and was driven to intersect with the

the Miner's Dream shaft. The veins within this mine are stated as trending trend 110° , an unknown affinity. Within this mine a large shear zone was noted (trending 120° and dipping 50° to the north east) in the righthand adit running sub-parallel the trend 117° (Trend 2 of figure 2). Striations were noted in this shear that are horizontal indicating firstly that strike-slip movement had occurred and secondly that no tectonic tilt (*caused by later deformation*) has occurred since emplacement. Unfortunately no sense of the direction of movement was obtained.

Investigations of this prospect is well worth undertaking, even though previous values were low, as its width may indicate a bulk extractable asset. Once again a structural investigation of the surface and underground features would be judicious. This would ascertain if the shear sighted is continuous and contains values for bulk extraction across the width of the zone as gold was noted in mineral samples taken from both adits. Also there may be other similar zones parallel to or related to this shear.

Jubilee Mine

The Jubilee mine lies on, or close to the No. 3 trend in figure 2 representing a probable major en echelon fault zone. It has the following reefs:

- 1) **The Flat Reef** - trending 138° being generally parallel to cleavage, and it has a steep dip. This reef is probably an R₁ fracture, in which the fault made use of the inherent weakness of the cleavage within the rocks. This could explain the variance from 130° . The reef has been proven for 213 metres along strike with a width ranging from .3 to 1 metre. This excessive length over the average (30-40 metres) suggesting it is a major feature.
- 2) **Derby Reef** - Has a similar disposition to the Flat Reef with the vein varying from 1 to .15 metres. This vein has been worked to by a shaft to 79 metres.
- 3) **Eastern Reef** - trending 153° dipping 50 to 70° to the east was struck at the 49 metre level in the main shaft and has a maximum width of about 90cm and contains low gold values. This reef has the attitude of the main en echelon fractures but is unlikely to be one.
- 4) **City Reef** - trending 165° dipping 85° east and consists of narrow apparent barren veins over a zone of 7 metres of what appears to be a zone of breccia. Its association is unresolved.
- 5) **Other Shear Zones** - trending 040° and dipping 30 to 50° SE also of unknown origin, are within the area.

This property has the potential to contain bulk reserves. It would be advisable to structurally investigate the area in an endeavour to ascertain from surface evidence if the features seen contain distance as well as width before expenditure of capital on further exploration.

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Map of the Tower Hill- Mathinna-Dans Rivulet Goldfields

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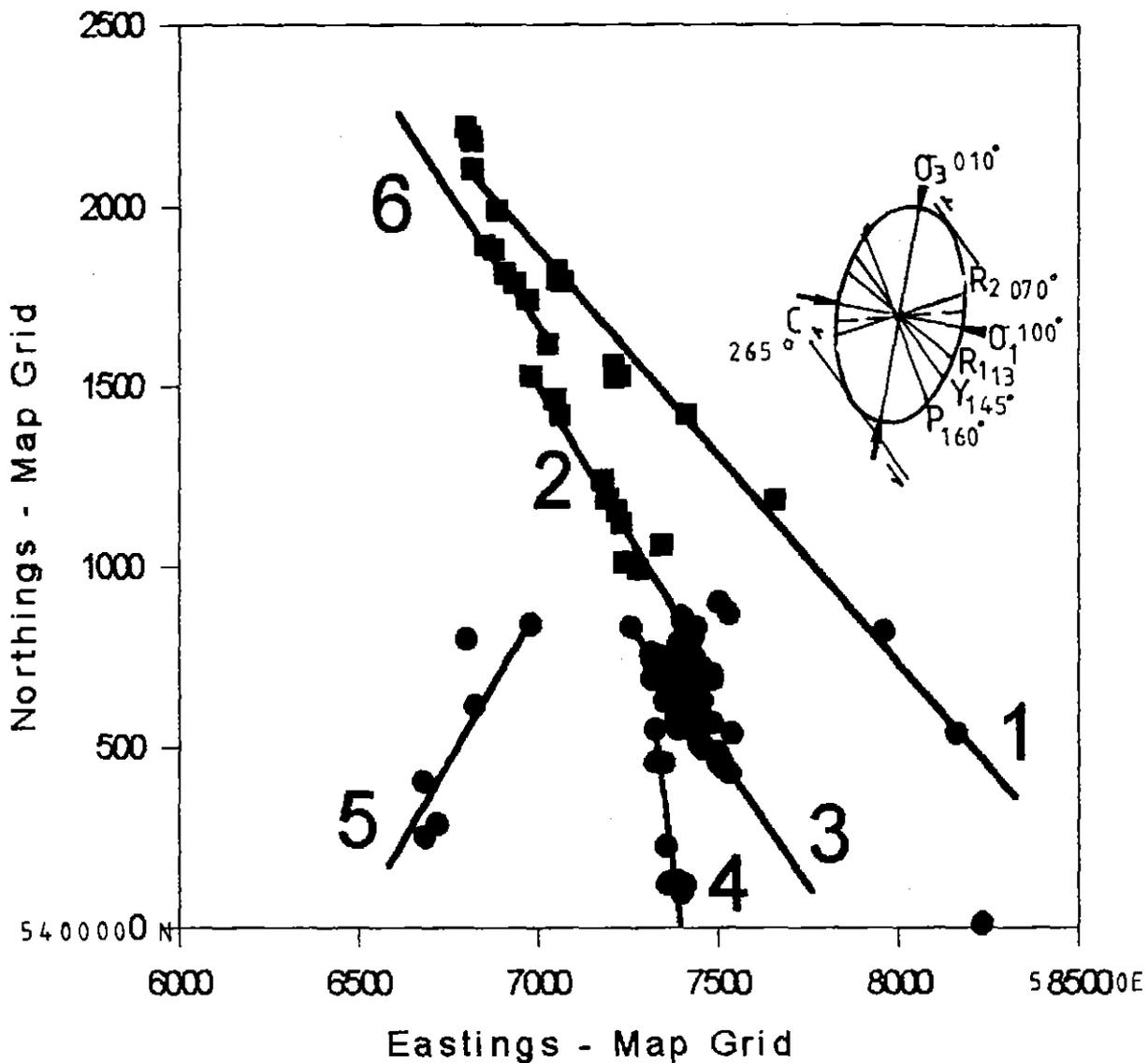


Figure 1:
Map of the Tower Hill-Mathinna-Dans Rivulet Goldfields.
Filled squares represent mine in the Dans Rivulet
area while filled circles represent mines in the
Tower Hill-Mathinna area.

Numbered lines represent possible trends deduced
from the map.

5 cm

Map of Mathinna - Part Tower Hill Goldfield

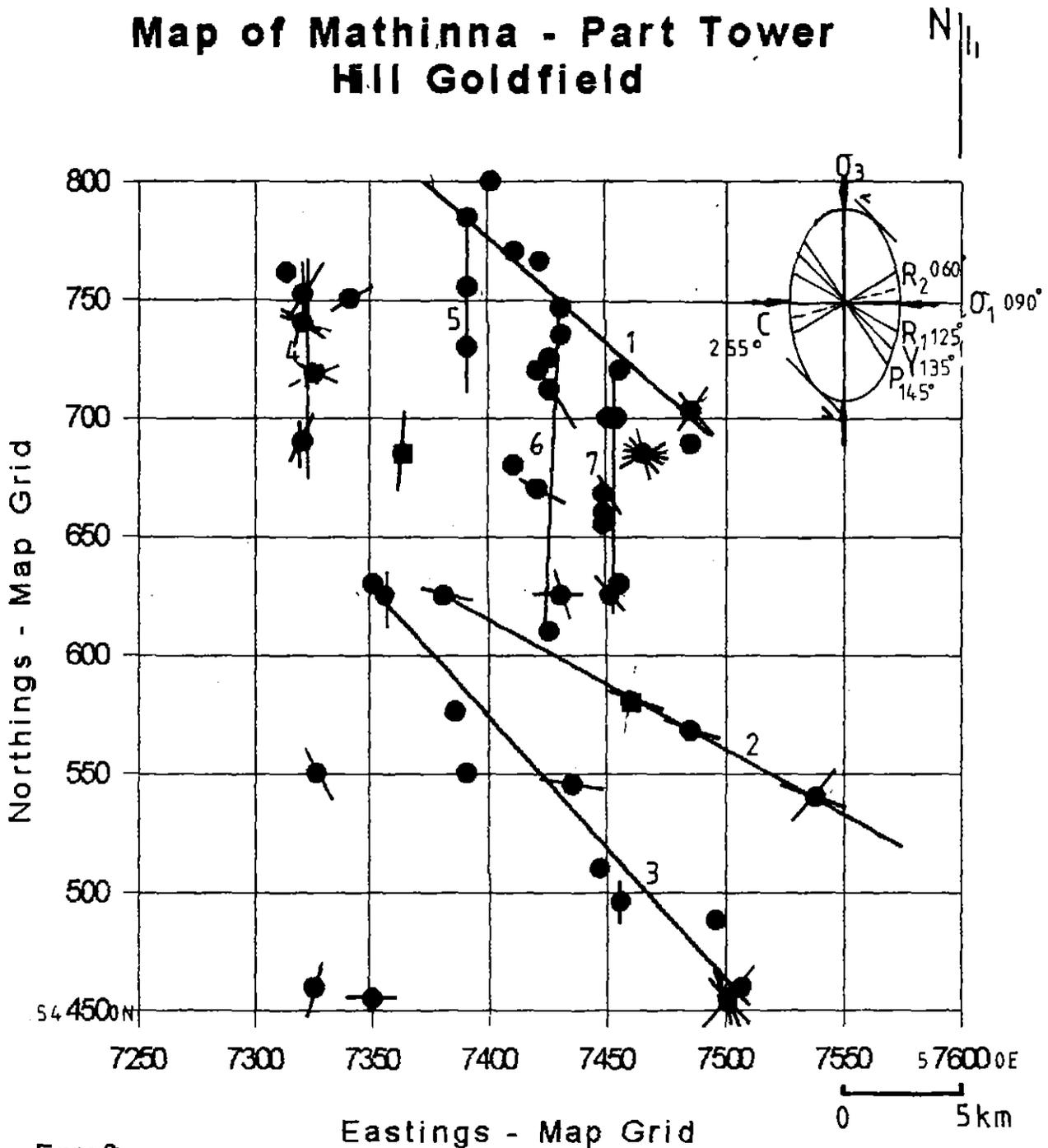
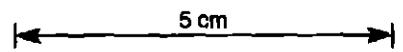


Figure 2
Map part of the Tower Hill and Mathinna goldfields.

Filled circles represent mines generally, filled squares represent mines this report.

Lines represent trends that are probable regional shear or fracture lines.



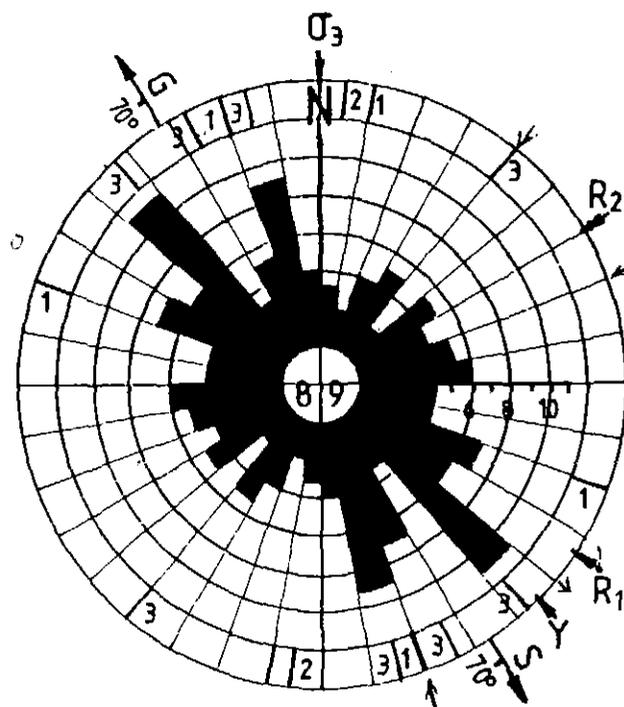


Figure 3:
Rose diagram of vein trends for the Tower Hill-Mathinna-Dans Rivulet goldfields.

5 cm

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Appendix 1

PETROGRAPHICAL REPORT

MINER'S DREAM TUNNEL - MATHINNA GOLDFIELD, TASMANIA.
22th October 1994.

Samples

Two chip samples were taken from the reefs of the left-hand (Sample 1) and right-hand (Sample 2) crosscuts of the above mentioned mine. These samples were first crushed in a 12cm jaw crusher then in a Tammam Mill, until all the sample passed through a 0.5mm sieve. The samples were then reduced in volume by "panning off" in a gold pan most of the lighter fraction. From this residue, that fraction with a specific gravity (S.G.) greater than 2.80 was separated by settling the heavier fraction through a liquid of 2.80 S.G. The final separate was then set in resin blocks which were polished for reflected light microscopy.

SAMPLE NO. 1

Hand Specimen

The in hand specimen, the gangue consists of white quartz with traces of what appears to be carbonaceous wall-rock on one side. To the naked eye pyrite and other unidentified sulphides were noted. The bulk of these sulphides appeared to be primarily associated with the wall rock selvage as sulphide grains were scarce and randomly distributed through the rest of the specimen. With the aid of a 10X glass the identifiable sulphides consists of euhedral cubic pyrite associated with some anhedral arsenopyrite. Sulphides in total are estimated to be less than 1% of the rock by volume.

Microscopy

General

Sulphide and oxide minerals identified in order of abundance were:

- Pyrite
- Arsenopyrite
- Chalcopyrite
- Galena
- Pyrrhotite
- Secondary Hematite and Limonite
- Sphalerite(single grain)
- Gold (single grain)

Pyrite

There appears to be three crystal structures of pyrite.

1) Euhedral Octahedra

Some of these crystals have been shattered by late tectonic movement, with occasional grains having their centres selectively dissolved and replaced by late quartz in a similar manner to atoll structure. These crystal do not appear to have any inclusions apart from the fore-mentioned quartz.

2) Anhedraal Masses Intergrown with Arsenopyrite

In some instances these masses are banded with the boundaries appearing to be mutually penetrative, suggesting that they developed within the same petrographic stage.

3) Euhedral Cubes

These cubes also have been fractured by late stage tectonism, but not to the same degree as the octahedra. Downward percolating meteoric water has made use of these unfilled fractures to oxidise the pyrite to limonite. These crystals were seen enclosing small crystals of euhedral arsenopyrite and blebs of pyrrhotite.

The experiments of Murowchick and Barnes (1987) showed that "Growth temperature and degree of supersaturation have profound effects on the morphologies of hydrothermally grown pyrite crystals. --low degrees of super-saturation produced lightly striated cubes with small octahedral faces whereas higher degrees of supersaturation resulted in the formation of rough cubes, increased development of the octahedral form---." These authors also state that the octahedral shape may "delineate zones of high supersaturation of hydrothermal fluids, and hence zones of potential mineralisation." It appears that the octahedral pyrite formed from fluids that were hotter and/or had a high degree of super saturation.

Arsenopyrite

There are two varieties of arsenopyrite.

Massive and Intergrown with Pyrite

When viewed at higher power, the arsenopyrite bands appear as a mass of intergrown small crystals that run the whole gambit from euhedral to anhedraal grains.

Fractured Euhedral Grains

The second variety consisted of fractured grains, fractured as a result of mineral extraction and appear to have no affiliation with massive pyrite.

Galena

There appears to be only one variety of galena, this consisting of small subhedral cubic cleavage blocks or subhedral crystals within the concentrate. Some galena grains appear to be partly replaced by chalcopyrite.

Pyrrhotite

Small anhedraal grains of pyrrhotite grains were noted in the concentrate, occurring as independent grains and occasionally as blebs or inclusions within pyrite.

Hematite

Secondary anhedraal limonite is seen occasionally replacing both pyrite (see pyrite) and arsenopyrite. One grain of anhedraal colloform limonite was noted.

Sphalerite

Sphalerite was only seen as one small anhedral grain and no affiliation could be gauged.

Gold

Only one small anhedral grain was note. This grain was irregularly shaped and could have been filling a void, possibly within quartz.

SAMPLE NO.2

The quartz in situ is blue/grey in colour and appears to be replacing the wall-rock. The face was damp from seepage and covered by small crystals of gypsum, formed from the weathering of sulphides and wall-rock. The quartz was tough and therefore dense, but sulphides were visible in the fresh faces of the specimen in torch light. When cleaned and viewed under a 10X glass both pyrite and arsenopyrite were noted. Sulphides are estimated to be less than 2% of the rock by volume.

Microscopy**General**

Sulphide and oxide minerals identified in order of abundance:

- Arsenopyrite
- Pyrite
- Chalcopyrite
- Pyrrhotite
- Hematite & Limonite
- Galena
- Covellite
- Gold

Arsenopyrite

The arsenopyrite is similar to that examined in Sample 1. One large fractured octahedra of pyrite has later formed arsenopyrite filling its fractures.

Pyrite

Pyrite was again similar to sample 1.

The large euhedral grains of cubic pyrite show a high degree of fracturing.

Chalcopyrite

As for Sample 1, some grains of chalcopyrite were again observed replacing galena.

Hematite

As in Sample 1, hematite was a secondary mineral replacing mainly pyrite along fractures.

Galena

The occasional galena grains were similar in number and appearance to those observed in Sample 1.

Covellite

Covellite was observed rimming a grain of chalcopyrite as a result of secondary replacement of the chalcopyrite.

Gold

Three small inclusions of gold were noted. These grains, unlike Sample 1, were noted filling fractures within arsenopyrite grains.

PARAGENESIS

It is inappropriate to suggest a definitive paragenesis on the basis of these two samples, but a definite trend was observed.

Stage 1

The crystallisation of octahedral pyrite in zones of increased temperature that were super-saturated in pyrite precursors as suggested by Murowchick & Barnes (1987). That the formation of octahedral pyrite preceded the massive phase is evident as massive arsenopyrite fills fractures in a large fractured remnant of octahedral pyrite.

Stage 2

It would appear that massive pyrite and arsenopyrite formed next. These sulphides are mutually associated and no other sulphides are seen intimately associated with, or enclosing by either. The inter-banding of pyrite and arsenopyrite, reflects fluctuations in the physio-chemical environment of the time. Although there are no physical indications, galena was probably deposited within this stage.

Stage 3

Chalcopyrite and cubic pyrite appears after stage 2. As chalcopyrite occasionally replaces galena, the galena must have preceded chalcopyrite. Cubic pyrite is also observed enclosing early formed euhedral arsenopyrite, and chalcopyrite so must post date these minerals. The experiments of Murowchick and Barnes (1987) supports the contention that cubic pyrite forms at temperatures and degrees of saturation below that required for octahedral pyrite, thus further substantiating the contention that pyrite formed from a waning hydrothermal episode. The pyrrhotite blebs would be unconverted precursor mono-sulphides, as pyrrhotite is the recognised precursor mineral of pyrite in temperatures above 181°C (Schoonen & Barnes, 1991).

Stage 4

Gold probably appears at this stage as it is observed filling fractures within earlier formed arsenopyrite of stage 2 and cubic pyrite of stage 3. The gold forming within the quartz would result from destabilisation of hydrothermal fluids as a result of the reduction of carbon in the surrounding country rocks. Those occurring within arsenopyrite grains could be as a result of reduction of the arsenopyrite in lieu of carbon.

Stage 5

Weathering of sulphides by meteoric water to form covellite, hematite and limonite.

PHOTOMICROGRAPHS

(All photomicrographs were taken with reflected light through air as a medium.)

RIGHTHAND DRIVE

Photomicrograph 1 (Magnification 206X)

Stage 4 gold (Au) the butter yellow mineral, filling fractures and voids in and around stage 2 arsenopyrite (asp), the silver mineral. The dark grains are quartz gangue (G). As the gold fills voids within arsenopyrite, it must be a later product of the paragenesis.

Photomicrograph 2 (Magnification 206X)

In the centre of the picture is a grain of stage 2 mixed massive pyrite (py), and arsenopyrite (asp). The lower section of this grain is stage 3 pyrite (light silver/yellow) and the upper section is stage 2 arsenopyrite (silver). Surrounding the central grain are smaller grains of both pyrite and arsenopyrite. The boundary between the massive pyrite and massive arsenopyrite in the central grain consists of fine grained arsenopyrite that covers the full gambit between euhedral to anhedral crystals.

Photomicrograph 3 (Magnification 515X)

Central to the picture is a grain of stage 3 chalcopyrite (cc) which is yellow green in colour, the silver/grey mineral in the upper left corner is stage 2 galena (gn) and the silver mineral in the lower right is stage 2 arsenopyrite(asp). The blue mineral edging the chalcopyrite is stage 5 covellite (cv), a secondary mineral formed by the breakdown of the chalcopyrite within the present weathering profile.

LEFTHAND DRIVE

Photomicrograph 4 (Magnification 206X)

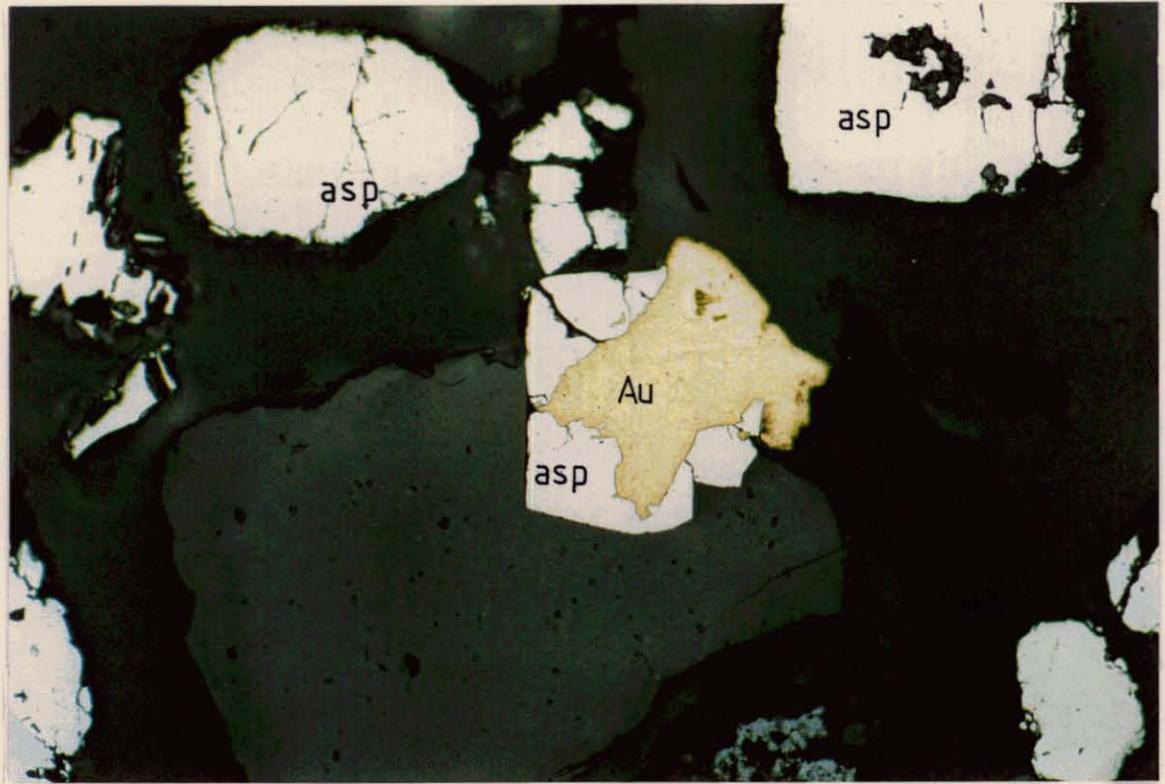
All the silver grains within the field of view are stage 2 arsenopyrite (asp) while the butter yellow grain is stage 4 gold (Au). The rounded shape of the grain's boundaries tends to suggest that the grain is void-fill within quartz gangue. This is unlike the straighter sides of the gold grain occurring in microphotograph 1 that fills voids around and within arsenopyrite grains.

Photomicrograph 5 (Magnification 206X)

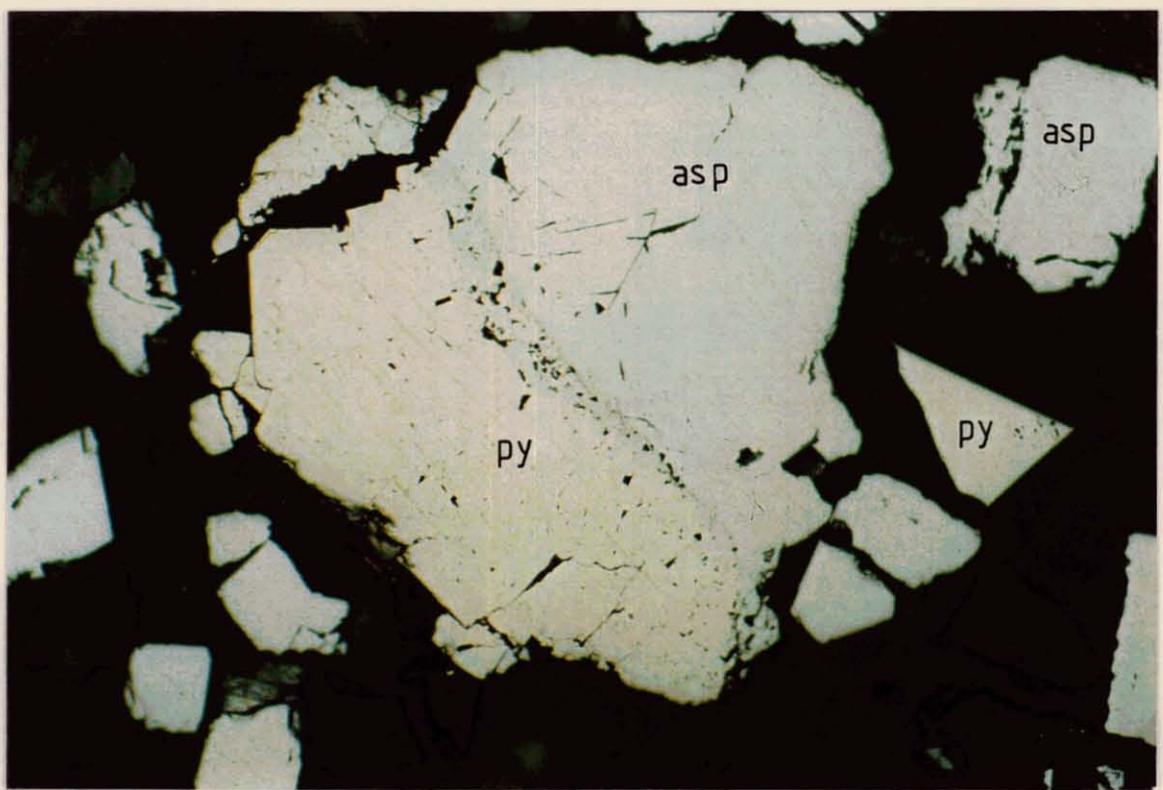
All the silver grains within the field of view are pyrite (py), the silver colouring a result of being slightly over exposed. The half dozen grains within the centre to upper centre are early formed stage 1 octahedral pyrites. These grains are highly fractured especially within their centres, the fractures generally being filled with late formed quartz, indicating that these fractures are a product of tectonism, and not a product of the extraction of the grains from the gangue.

Photomicrograph 6 (Magnification 206X)

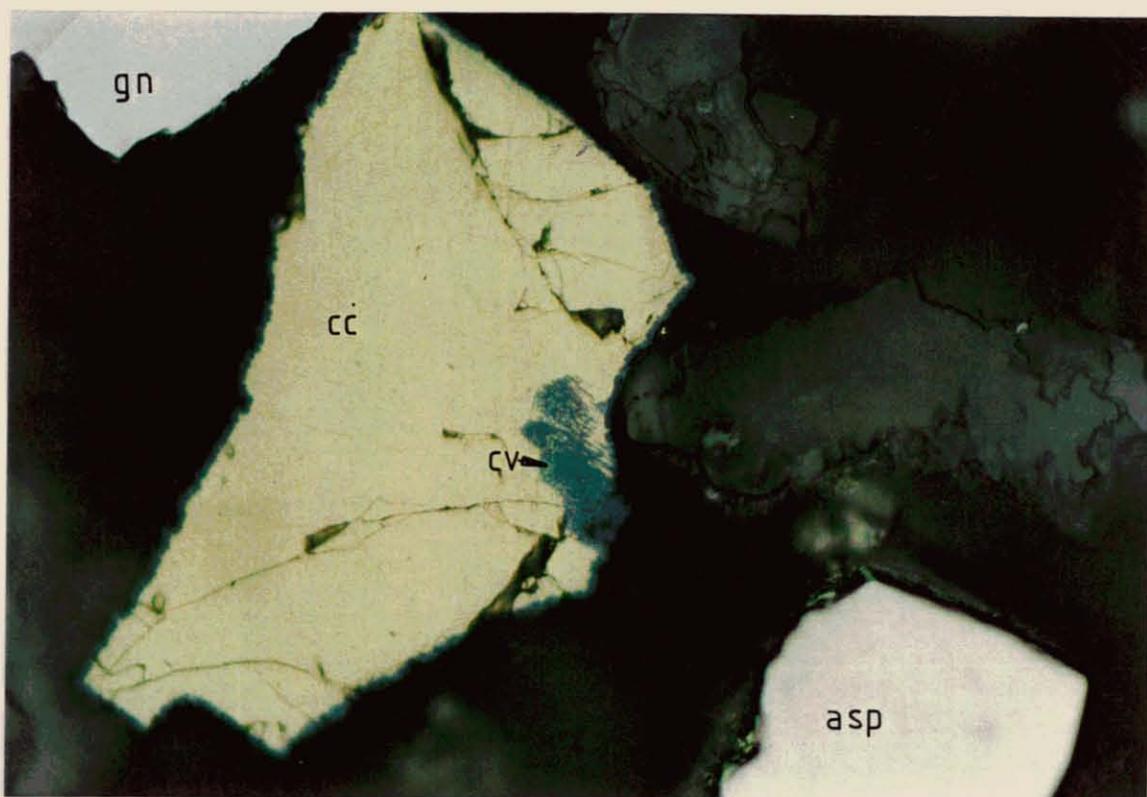
The large central grain is part of a large stage 1 octahedral grain of pyrite that has been fractured by a tectonic event between the ends of stage 1 and stage 2. The fractures within this grain (silver/yellow) are filled with stage 2 arsenopyrite (silver). The colour contrasts between the minerals are slight, probably as a result of increased iron within the arsenopyrite, making distinction difficult.



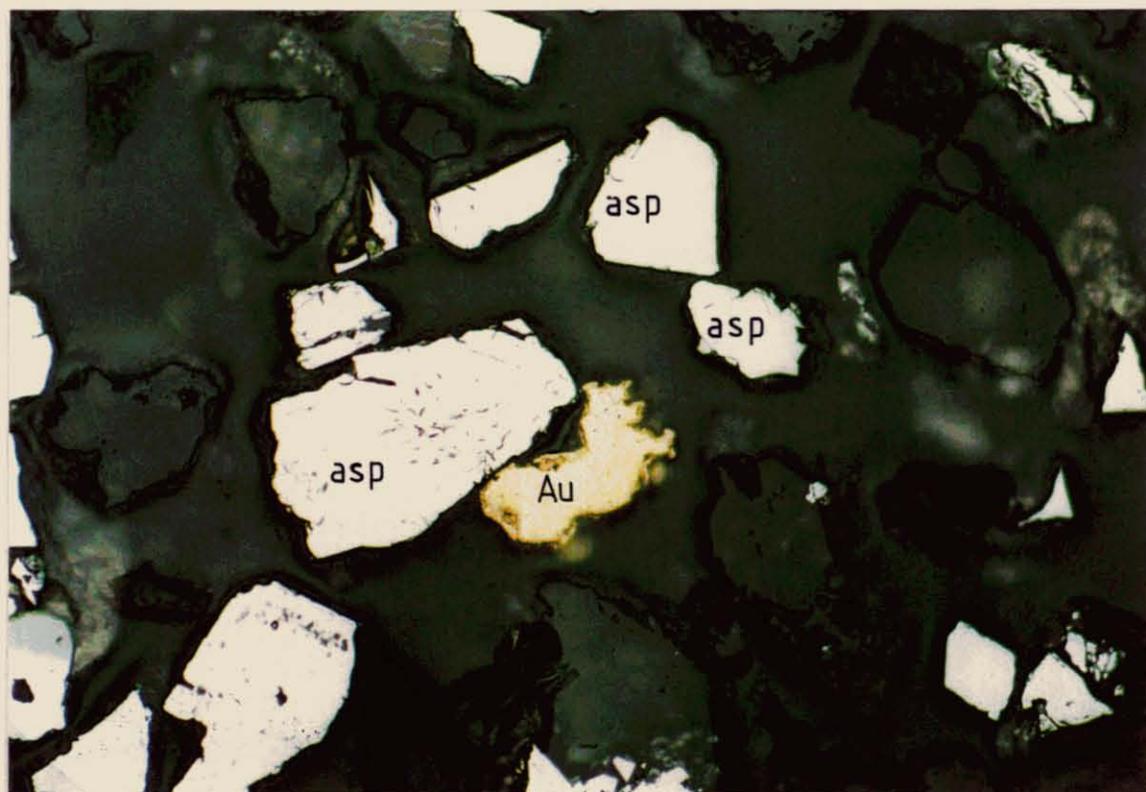
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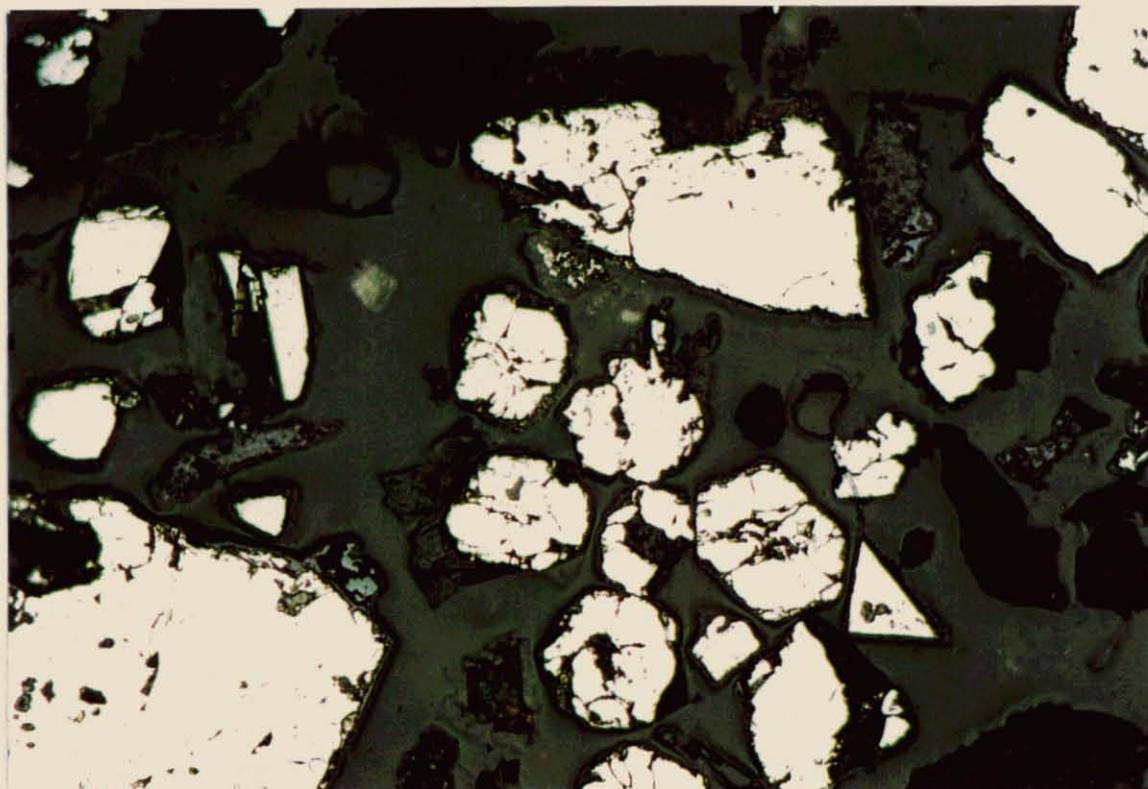
2



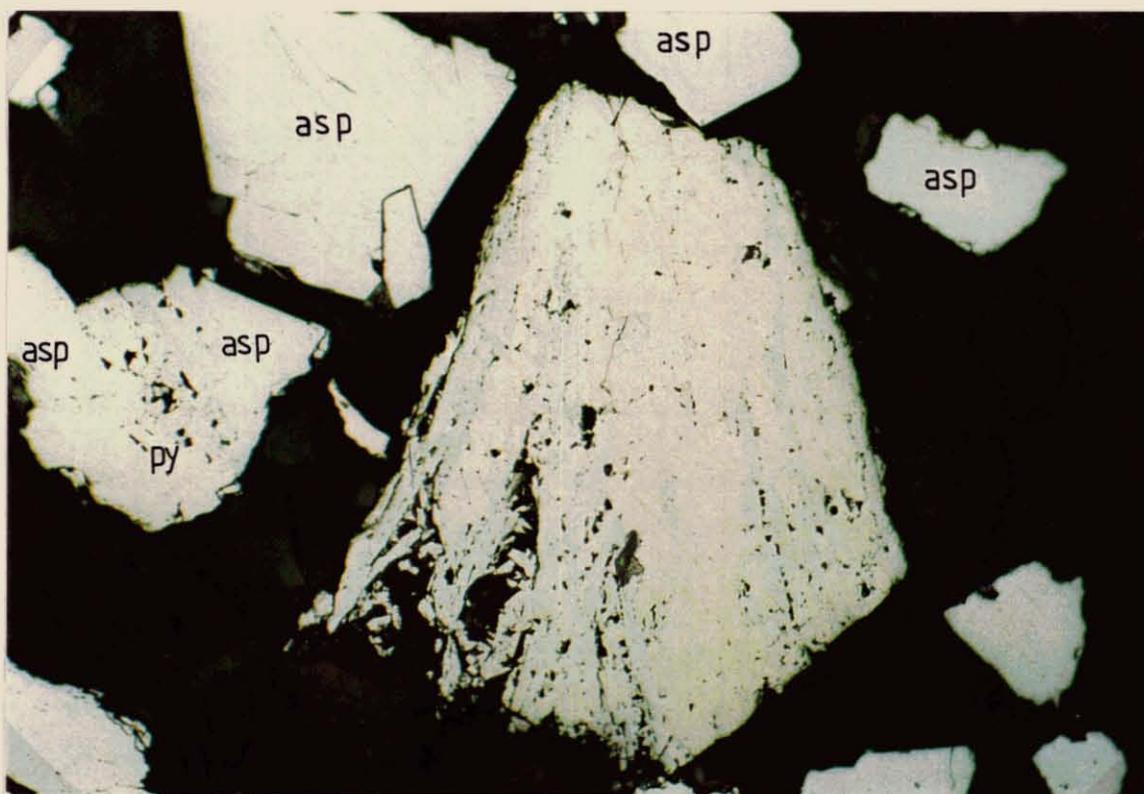
3



4



5



6

