TECHNICAL REPORT

OPEN FILE

EXPLORATION LICENCE NO. 1371 "BATTEN RANGE", N.T.

ANNUAL REPORT 1977

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1. INTRODUCTION

Exploration Licence No. 1371 "Batten Range" was applied for on August 16, 1976 to cover an area of McArthur Group sediments west of the Tawallah Fault. Also of interest in this area are the Scrutton Volcanics and lower formations of the Tawallah Group.

This region had previously been held under title by Carpentaria Exploration Co. Pty. Ltd. from 1968 to 1972. During that period a medium density stream sediment sampling survey was followed by soil lines and minor I.P. traverses with emphasis on the Amelia Dolomite. From later geochemical surveys and more detailed geological information in the McArthur area it was considered that a more detailed coverage of the Batten Range area would be required to ensure that no mineralisation was missed. The results of exploration in other areas had indicated that the Mallapunyah and Toogalinie Formations were also prospective for base metal mineralisation.

A number of areas within the Licence were selected for detailed stream sediment sampling. Geological work during the year was mainly limited to selecting the areas for sampling and follow-up of resulting anomalies.

Outcrops of Scrutton Volcanics, Yiyintyi Sandstone and Seigals Creek Volcanics (formerly known as Peters Creek Volcanics) were covered as potential hosts of uranium mineralisation. These units are in an equivalent stratigraphic position to and of the same general lithology as the host rocks of uranium mineralisation in the Westmoreland and Alligator River areas. Due to other priority work and difficult access the appropriate areas are still to be explored in detail for uranium.

2. LOCATION AND ACCESS

The "Batten Range" Exploration Licence is situated between the
2. LOCATION AND ACCESS (CONT.)

Limmam Bight and McArthur Rivers in the north-eastern part of the Northern Territory. The Licence which covers the northern-central area of the Bauhinia Downs 1:250 000 sheet is located 30 km west-north-west of Mimets McArthur River Camp and 60 km west of Borroloola. The Northern boundary is common with Exploration Licence No. 1372 "Tawallah Range" also held by Carpentaria Exploration Company Pty. Ltd.

Access is obtained from the sealed Borroloola beef road via Ryan's Bend and the graded roads to Nathan River and Bauhinia Downs cattle stations which pass through the centre of the Licence.

3. TENURE

Exploration Licence No. 1371 "Batten Range" was granted to Carpentaria Exploration Company Pty. Ltd. for a period of twelve months from November 30, 1976, with a minimum expenditure covenant of $25 000. The Licence covers an area of 1271 km².

4. PREVIOUS EXPLORATION

The area as part of the Bauhinia Downs 1:250 000 sheet was mapped by B.M.R. geologists during 1960-61.

4.1. C.E.C. Exploration

During 1961-62 a reconnaissance survey of the Bauhinia Downs-Rosie Creek area was carried out. In the region covered by the current Exploration Licence prospecting work including the drilling of one diamond drill hole at Johnson's Lead Prospect was completed. The best assay result obtained was 4.0% Pb over a 60 cm interval. Several other small lead prospects were also located in this area (Marlow 1963).

A stream sediment reconnaissance geochemical survey of the Amelia Dolomite was made during 1968 (Lord 1969). Following this, a
4. PREVIOUS EXPLORATION (CONT.)

Regional geochemical survey of the area west of the Tawallah Fault was made during 1969-70 (Harris, Bedford, Koerner, 1971). The area was covered by a stream sediment sampling programme with a sample density of up to 4.5 per square mile. A number of soil line traverses were sampled with particular emphasis on the Amelia Dolomite. Resulting geochemical anomalies were followed up by I.P. surveys and two areas were tested by rotary percussion drilling. No significant results were obtained from the drilling programme.

Detailed follow-up of geochemical anomalies continued during 1971 (Rawlins et al, 1972). This included soil sampling and I.P. surveys. During 1972 one diamond drill hole was drilled to test soil, rock chip and I.P. anomalies associated with the Amelia Dolomite south of the Tawallah Pocket area. No significant mineralisation was encountered, though the reporting of micro-fossils in the core stimulated a comprehensive B.M.R. sponsored field research study in the district and a Baas Becking Institute/C.E.C. sponsored investigation of microfossils of the H.Y.C. deposit. Following the detailed work on other anomalous areas it was concluded that they were not, or were unlikely to be, of economic significance.

4.2. Outside Exploration

A study of open file reports has indicated that during 1973-74 the western part of the area of interest was held as part of Exploration Licence No. 879 by C.R.A. Exploration Pty. Ltd. Work was concentrated on areas mapped as Billengarrah Formation by the B.M.R. which were re-mapped as Barney Creek Formation, Reward Dolomite and Lynott Formation. Stream and soil samples were taken but no significant base metal anomalous zones were found.

5. GEOLOGY

The majority of Exploration Licence No. 1371 "Batten Range" covers Carpentarian Scrutton Volcanics, Tawallah Group sediments and
5. GEOLOGY (CONT.)

volcanics and McArthur Group sediments. Lesser outcrops of Adelaidean Roper Group sediments and Cretaceous sandstone occur in this area.

A number of regional traverses across the Licence showed that the earlier mapping of the major units is essentially correct. Following the regional traversing the majority of the exploration has revolved around specific localised detailed geochemical surveys with mapping of geochemical anomalies and traverse lines. A summary of the geology is given below.

The oldest exposed rocks are the Scrutton Volcanics which consist of porphyritic dacite, rhyolites with interbedded siltstone, sandstone and chert (probable tuffs). Thin intermediate and basic volcanic units are less common. Several samples were submitted for petrological study and whole rock assays. All of the samples studied were classified as rhyodacites. Thin section identification of potash metasomatism of the rhyodacites was confirmed by the whole rock assays.

The Scrutton Volcanics are overlain by the Yiyintyi Sandstone of the Tawallah Group. Amygdaloidal basalts of the Seigals Creek Volcanics (formerly known as Peters Creek Volcanics) are situated between the Yiyintyi Sandstone and the Sly Creek Sandstone. Whole rock geochemistry and petrological descriptions indicate that the basalts have been potash metasomatised. The two volcanic sequences and Yiyintyi Sandstone are prospective for uranium. These units are in an equivalent stratigraphic position to and of the same general lithology as the host rocks of uranium mineralisation at Westmoreland and Alligator River.

The other main unit of interest within the Tawallah Group is the Wollogorang Formation. Fine grained dolomite, dolomitic siltstone and sandstone units outcrop poorly. Sandstone sequences of the Masterton Formation and Mulholland Sandstone form the top of the Tawallah Group.
5. GEOLOGY (CONT.)

The majority of the mapping and geochemical follow-up work has been associated with the shallow water carbonate rich lower McArthur Group sediments. In the Tawallah Ruins area the Mallapunyah Formation consists of purplish dolomite, dolarenite, sandy dolomite and sandstone. Chert nodules, cauliflower chert and chert plates commonly after gypsum are found in the dolomite units. Rare halite pseudomorphs occur in dolomitic siltstones. In the southern part of the Licence, the dolomite sections of the Mallapunyah Formation outcrop poorly.

Conformably overlying the Mallapunyah Formation the Amelia Dolomite consists of pale brown-grey, fine-grained dolomite, algal (stromatolites and algal mats), dolomite, intraclastic and oolitic dolomite. Chert is commonly developed as plates or nodules particularly in the algal units.

The sequence is overlain by the Tatoola Sandstone and Tooganinie Formation. The basal Leila Sandstone Member of the Tooganinie Formation has not been distinguished from the Tatoola Sandstone at this stage of exploration. Fine grained grey dolomite, dolarenite, intraclastic dolomite, dolomitic siltstone and algal dolomite are the main rock types present. Silicification of the algal dolomites is common. Minor chert breccia units occur near the top of the Tooganinie Formation.

Algal dolomite, massive dolomite and siltstone have been mapped as Emmeregaga Dolomite by the B.M.R. in the western part of the area. The unit mapped as Billengarrah Formation consists mainly of chert and chert breccia with minor siltstone and dolomite. As mentioned in the previous section, later mapping by C.R.A. Exploration Pty. Ltd. subdivided this unit into the Barney Creek Formation, Reward Dolomite and Lynott Formation.

In the northern-central part of the area sandstone and siltstone of the Roper Group (Limmen Sandstone and Mainoru Formation) unconformably overlies the McArthur Group sediments.
5. GEOLOGY (CONT.)

Cretaceous sandstone caps the area mapped as Mallapunya Formation in the north-eastern corner of the Licence. In this area remnant pisolitic laterite outcrops are also found.

A number of outcrops of McArthur Group sediments have been strongly silicified and correct placement in the sequence is often difficult. This is also hindered in areas where remnant chert breccia (sandy matrix) covers the carbonate sequences. Chert breccia of this type is moderately common in the Tawallah Ruins area. The strong silicification and chert breccia development is probably due to the sequence being exposed to a number of major weathering cycles which converge towards the Gulf area.

The structure of the area is dominated by numerous faults. Major faults including the Tawallah Fault trend north to north-west. The Tawallah Group Sandstones are often strongly jointed. In general the sediments have dips less than 40° and often less than 20° with minor areas of stronger folding associated with the faulting.

6. GEOCHEMISTRY

6.1. Stream Sediment Geochemistry

6.1-1. Orientation Survey

The results of the earlier geochemical surveys carried out by C.E.C. Pty. Ltd. during 1969 and 1970-71 were studied. The sample locations for this earlier sampling are given in Drg Nos 11581, 11582. The majority of the sampling was concentrated on streams draining the Amelia Dolomite. Most of the anomalies were followed up but local experience indicates that a higher density of stream sediment sampling is needed to ensure optimum discrimination.

Prior to detailed stream sediment sampling an orientation survey was carried out on the "Batten Range" Exploration Licence and the
6. GEOCHEMISTRY (CONT.)

adjoining the "Tawallah Range" Exploration Licence. The conclusions made by Chief Geochemist L.Wall are applicable to both areas as listed below.

(1) The -80 mesh fraction is best for routine sampling.

(2) Where possible second order tributaries should be sampled.

(3) Analyse for base metals only.

(4) Collect three samples spaced 1 m apart at every twenty-fifth sample station to use as an estimate of how good or representative the individual routine samples are.

(5) In follow-up sampling it would be worthwhile to also analyse the -20 +40 mesh fraction and/or panned concentrates.

6.1-2. Detailed Stream Sediment Geochemistry

A total of 790 minus eighty mesh stream sediment samples were collected from "Batten Range" Exploration Licence. The sampling was concentrated in the area north of Tawallah Creek. Stream systems draining Tawallah Group and Roper Group sandstone sequences were not sampled. Depending on the suitability of the drainage system, the sample density varied up to 7.5 per km² in areas of interest.

All of the stream sediment samples were assayed for copper, lead and zinc. Sample locations and assay results are plotted on Drg Nos 19230-19241.

Anomalous lead values were obtained from a number of streams in the area 3 km north-west to 9 km north-north-west of Tawallah Ruins.
6. GEOCHEMISTRY (CONT.)

In this area the results ranged up to 612 ppm Pb and with one sample assaying 2045 ppm Pb. Twenty samples assayed greater than 100 ppm Pb. Streams from the northern end of this area are also anomalous in zinc (up to 150 ppm). Elsewhere background zinc and copper values are associated with the lead anomalies. Follow-up of these anomalies has led to the discovery of cerussite mineralisation near the top of the Tooganinie Formation. Details of rock chip and soil samples taken from this area named the Mariner Lead Prospect and a discussion of the mineralisation are given in following sections of this report. Downstream from anomalies of 2045 ppm Pb and 612 ppm Pb, a sample from the main creek junction assayed 110 ppm Pb. An anomaly of 100 ppm Pb obtained during the 1969-70 less detailed survey from this location was not followed up at that time because it did not have an associated zinc anomaly although further sampling was suggested. This shows the effectiveness of the current detailed sampling programme.

Two anomalous lead values of 104 ppm and 140 ppm occur near the northern boundary of the Licence to the south of Tawallah Pocket. These stream anomalies still require field checking. No other significant lead values were obtained.

A number of anomalous copper results (80-218 ppm) were obtained for a group of streams draining the Scrutton Volcanics 5 km northeast of Tawallah Ruins. Minor disseminated pyrite and chalcopyrite(?) was observed in basic to intermediate volcanics. Three rock chip samples gave low assays of up to 180 ppm Cu, 80 ppm Pb and 193 ppm Zn (unrelated assays).

A 189 ppm Cu anomaly 2 km north of Tawallah Ruins is supported by weaker anomalous results of 79 ppm Cu and 83 ppm Cu. No copper mineralisation was observed in the area. A rock chip line adjacent to the main anomalous stream gave only moderate anomalies. Two consecutive 10 m chip samples of white chert, strongly weathered dolomitic siltstone and limonite rich material assayed 297 ppm Cu and 207 ppm Cu. Low assays were obtained for white chert breccia
6. GEOCHEMISTRY (CONT.)

in this area. No copper mineralisation has been found 5.5 km north of Tawallah Ruins where samples from two small creeks were anomalous in copper (83 ppm, 176 ppm).

High zinc values of 106-108 ppm occur along the northern boundary of the Licence south of Tawallah Pocket. The presence of laterite in this area may explain this zinc anomaly. Other than the zinc anomaly at the northern end of the Tawallah Ruins Pb Anomaly area a number of isolated zinc highs of 80-100 ppm were obtained. These anomalies had not been field checked by the time the first heavy storms of the Wet caused withdrawal from the area.

6.2. Soil Geochemistry

During the year 379 soil samples were collected from the Licence in the Tawallah Ruins area. Three major soil sampling traverses 500 m apart (T.R.1, T.R.2, T.R.3) were made across the Mallapunyah Formation, Amelia Dolomite, Tatoola Sandstone and Lower Tooganinnie Formation. For the eastern end of T.R.1, the sample interval was 10 m. A 50 m sample interval was used for the remainder of the traverses. Bedrock soil samples were taken from the eastern half of T.R.1 and T.R.2. Standard near-surface samples were taken for the rest of the lines because of access difficulties and auger breakdowns. The assay results show no significant difference between bedrock and surface soil samples.

Samples taken from over the Amelia Dolomite have a higher copper background of over 30 ppm and varying up to 110 ppm. One sample of soil developed on this unit assayed 220 ppm. Except for another high of 105 ppm Cu on T.R.2 over the Mallapunyah Formation the remainder of the samples assayed less than 30 ppm Cu. Zinc values are consistently low (< 35 ppm) over all the lines except for one value of 70 ppm on T.R.2. The lead results show a background of less than 30 ppm over the Mallapunyah Formation and Amelia Dolomite. Several samples from the lower Tooganinnie Formation assayed between 60 and 90 ppm Pb.
6. GEOCHEMISTRY (CONT.)

As a follow-up of stream sediment highs in the Tawallah Ruins Pb anomaly area, T.R.3 was extended to give a complete coverage of the Tooganinie Formation. Two additional lines 500 m apart (T.R.4, T.R.5) were also sampled. For this sampling a 25 m interval was used. The geology and Pb results of these traverses over the Mariner Lead Prospect area are plotted on Drg No. 11572. The lead results show anomalous zones of 100 ppm Pb up to 732 ppm Pb over 300 m to 500 m width. The single peak of 160 ppm Pb (sample number 384737) on the eastern end of T.R.3 extended represents a stream sediment anomaly. The sample was taken on the flood-out of the small creek giving the strongest stream sediment anomalies. The only significant copper and zinc results are from two adjacent samples on T.R.3 over the major fault at the top of the Tooganinie Formation which assayed 134 ppm Cu and 139 ppm Zn.

6.3. Rock Chip Geochemistry

The majority of the 93 rock chip samples were taken from the Mariner Lead Prospect. Details of this sampling are given in a separate section. Several of the samples taken as follow-up of stream sediment anomalies have already been discussed. The only other significant result is 1650 ppm Cu, 55 ppm Pb and 14 ppm Zn for a dolomite horizon containing minor disseminated chalcopyrite of the Tooganinie Formation below the anomalous lead horizons 200 m north of T.R.5.

Assays for a suite of 20 samples of Scrutton Volcanics ranged up to 10 ppm Cu, 15 ppm Pb, 75 ppm Zn, 30 ppm Co and less than 1.5 ppm U. Whole rock analyses show that the volcanics have been potash metasomatised. These samples were taken adjacent to the track to Tawallah Pocket 4 km north of the region which gave stream sediment copper anomalies. Three rock chip samples of intermediate to basic volcanics from this area assayed up to 180 ppm Cu, 80 ppm Pb and 193 ppm Zn (unrelated assays).
6. GEOCHEMISTRY (CONT.)

6.3-1. Mariner Lead Prospect

Rock chip samples were taken from three lines to check stream sediment anomalies. The samples consisted of a number of chips generally grouped over 10 m intervals. A number of individual rock chip samples were also assayed. Location of the rock chip samples are given on Drg No. 19242. Details of the three rock chip lines are shown on sketch map (Drg No. 11577).

A rock chip line (QX.20447 - QX.20457) 3 km north-west of Tawallah Ruins over dolomite, brecciated algal chert and weathered chert breccia assayed from 935 ppm Pb to 8300 ppm Pb. The copper and zinc assays ranged up to 390 ppm and 421 ppm respectively. Two selected samples (QX.20445, 20446) from this area containing cerussite assayed 1050 ppm Cu, 11.9% Pb, 1340 ppm Zn and 384 ppm Cu, 8.9% Pb and 285 ppm Zn. The later sample is from a 0.5 m thick weathered, brecciated algal horizon.

A sample of algal chert 6 km north-north-west of Tawallah Ruins assayed 1.5% Pb. The algal chert is only exposed over an area 20 m x 15 m. A rock chip line QX.20459 - 20474 mainly covered a younger chert and sand breccia capping the algal chert and minor algal chert rubble. The best assay result obtained is 2450 ppm Pb (9 ppm Cu, 3 ppm Zn). The assays confirm that the chert and sand breccia is not the source of the stream sediment lead anomaly.

Rock chip line QX.20480 - 20489 was sampled to test the stream sediment anomaly (368 ppm Pb, 150 ppm Zn) at the northern end of this area. White chert and sand breccia, banded chert, silicified siltstone and minor possible algal chert boulders were sampled. Low assay results of up to 430 ppm Pb and 65 ppm Zn were obtained. Spectrographic scan analyses of two samples containing cerussite are given in Appendix I.

7. MINERALISATION
7. MINERALISATION (CONT.)

7.1. Mariner Lead Prospect

Cerussite mineralisation occurs within dolomite, brecciated algal chert and chert breccia units near the top of the Tooganinie Formation in an area 3 km north-west to 9 km north-north-west of Tawallah Ruins. The mineralisation was found by following up stream sediment anomalies resulting from the current detailed sampling programme. The only certain method for identifying the lead mineralisation is by using the HNO₂/KI test.

To date the main mineralisation found occurs 3 km north-west of Tawallah Ruins. In this region dolomite and brecciated algal dolomite beds dip 15° to 20°W. Lead mineralisation is also found in an overlying heavily weathered chert breccia. Rock chip samples assayed up to 11.9% Pb with 10 m chip samples over this sequence (total length of rock chip line sampled 120 m) ranging from 935 ppm Pb to 8300 ppm Pb. A 0.5 m thick weathered, brecciated algal chert unit returned an assay of 8.95% Pb. Outcrop in this area is poor and soil sampling has indicated an anomalous zone 300 m to 500 m wide. The cerussite mineralisation observed occurs on the western end of this soil anomaly. The true thickness of the mineralisation is not known. The main area of mineralisation is bounded to the west by a major fault which has uplifted Tawallah Group sediments against the Tooganinie Formation.

A small algal chert outcrop 6 km north-north-west of Tawallah Ruins assayed 1.5% Pb. The surrounding area is covered by chert scree and a capping of a younger chert breccia with a sandy matrix. The stream sediment data indicates an anomalous zone of 6.5 km strike length. The southern end of this zone is still open. A petrological description of this algal chert is given in Appendix II.

7.2. Johnson's Lead Prospect

Johnson's Lead Prospect is located on the southern side of the Bauhinia Downs road 2 km west of the Nathan River station turn-off.
7. MINERALISATION (CONT.)

A brief visit to this area was made to clarify details given in previous company reports (Marlow 1963). The surface indications and drilling results show that the lead and associated copper mineralisation is confined to a shear zone cutting a dolomite sequence of the Toogalinie Formation. The mineralisation is confined to an area 200 m x 70 m. The best assay results from one diamond drill hole are 0.6 m of 0.2% Cu, 4.0% Pb and 0.75 m of 0.2% Cu, 3.0% Pb. Both copper and lead rich surface and shallow pit samples are probably due to supergene enrichment.

7.3. Great Scott Prospect

The Great Scott Prospect is located approximately 16 km east of Bawhinia Downs Homestead. Details of this prospect are taken from C.E.C. Technical Report No. 230 by R.J. Rawlins et al. This prospect was located by following up stream sediment anomalies with soil lines. Coarsely crystalline galena and sparse chalcopyrite specks occur within algal dolomite of the Toogalinie Formation. The main mineralised bed is of collenia dolomite about 1-2 m thick. Prospecting along strike showed that lead mineralisation occurred over 2 km. The best rock chip assays obtained were 0.30% Cu, 0.10% Pb, 0.29% Zn and 0.00% Cu, 0.4% Pb and 0.23% Zn. No real I.P. anomalies were obtained over the surface mineralisation and it was concluded that the mineralisation would be of no greater grade at depth.
REFERENCES


APPENDIX 1

MARINER LEAD PROSPECT - SPECTROGRAPHIC SCAN RESULTS
APPENDIX I

SPECTRO-CHEMICAL ANALYSIS REPORT

Samples QX.20525
QX.20526

Location Mariner Pb Prospect, Batten E.I.

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ND Not Detected
* SPECTROGRAPHIC ANALYSIS - SEMI QUANTITATIVE
Other results checked and assayed by A.A.S.
APPENDIX II

Petrological Reports.

Note: GX.20439 only refers to this report.

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OBJECTIVE

To examine specimens QX20431 to QX20439 submitted by J.A. Nenke.

RESULTS

QX20431

A highly siliceous rock. The thin section consists of fine to medium grained quartz. The fine grained quartz is chert. The subordinate coarser grained quartz (~0.25 mm) has formed by recrystallization of chert. A broad layering is seen which corresponds to variation in thickness and grain size of the chert layers. No other silicate minerals were identified apart from trace muscovite.

Lead mineralization is widespread. It consists mostly of cerussite and galena. Minor anglesite was noted. Cerussite and anglesite have formed by alteration of galena. Often the cerussite forms elongate, irregular shaped bodies lying parallel to the layering of the chert. The secondary quartz commonly protrudes into the cerussite as subhedral to euhedral crystals. Elsewhere cerussite is present as widely scattered, shapeless grains <20 μm to at least 2 mm size. There seems little doubt that most of the cerussite (and anglesite) has formed from galena. Many areas of cerussite carry similarly shaped cores of galena. Also, thin concentric zones of fine opaque matter in the cerussite reflect the progressive oxidation stages of the galena.

Several areas of galena show concentric alteration to chalcocite and covellite, viz. PbS → Cu₂S → CuS. However many cerussite grains carry small relics of galena with no sign of copper sulphides. Elsewhere, small isolated chalcocite and covellite grains lie in the cerussite. No chalcopyrite or pyrite was seen.

QX20432

A chert. Considerable dislocation has occurred. Recrystallized chert is the most abundant non-sulphide component. Cerussite is widespread and varies in form from small shapeless grains <20 μm up to large irregular vein like masses undoubtedly derived from primary galena (see QX20431). The section contains
two subhedral galena crystals about 6 mm in size which show peripheral alteration to cerussite.

In this specimen no secondary copper minerals were found except for isolated specks of chalcocite and covellite. Galena has altered to cerussite directly. A little goethite indicates the presence of minor pyrite originally.

QX20433

A chert in which fine grained galena is distributed throughout the matrix. This suggests that the finest cerussite represents the in situ replacement of galena. Recrystallization of chert is pervasive and there has been limited collapse as shown by small angular chert fragments "floating" in the recrystallized quartz matrix.

In polished section much of the original galena remains and a few anhedral to subhedral pyrite crystals up to 30 µm size were noted in association with galena. Negligible amounts of chalcocite and covellite were seen. A trace of sphalerite is present.

QX20434

This specimen is very similar to QX20433. However bedding is more accentuated and only minor disruption has occurred. Again, much of the recrystallized quartz lies approximately parallel to the layering as does the accompanying galena and cerussite (see QX20431). A large vein of galena, cerussite and barite traverses the bedding. Minor barite is scattered throughout the specimen. It tends to have a layered disposition. One particular layer carries significant barite (2-5% vol.) as well as galena, cerussite and malachite. One grain of malachite has a limonite core which, judging by its shape, was originally a copper-iron sulphide. In places, barite shows a close spatial relationship with malachite.

In polished section coarse grained galena relicts are enclosed by variously zoned alteration haloes of chalcocite. In turn, the chalcocite is altering to malachite.

QX20435

Similar to the above specimens. Considerable recrystallization and collapse of chert has taken place. Elsewhere the chert beds are crenulated. This form of chert can abut sharply against recrystallized material. One possibility is that this material has a detrital component such as clay which modified its recrystallization behaviour. Cerussite is abundant and most likely derived from primary galena. Small areas of limonite represent original pyrite. In one case a thin "layer" of galena and secondary quartz can be followed across the section. The galena-quartz layer seldom exceeds 0.2 mm in thickness. Locally however isolated, small projections of quartz and galena "intrude" into the enclosing chert beds and this is consistent with the discordant occurrences of secondary quartz noted in the previous specimens. Galena shows some oxidation to cerussite. At high magnifications the secondary quartz in contact with the galena bodies is subhedral to euhedral - a feature not readily seen at x30 magnifications. Fluid inclusions are not abundant or particularly concentrated in the secondary quartz. Translucent brown inclusions may be kerogen.
The hand specimen is a layered cherty rock varying from yellow-white to pink-brown in colour. In places the hand specimen is grey-blue in colour due to fine disseminations of galena. Individual flecks of galena seldom exceed 1 mm size and they lie parallel to the layering.

In thin section there seems little doubt that the rock is a chert which has undergone incipient recrystallization. The recrystallized quartz occurs as anhedral grains up to 0.3 mm size and commonly aggregates of this quartz are elongate and oriented parallel to the bedding. In places chalcedonic quartz areas occur similar to those noted in the chert nodules from the H.Y.C. deposit. These extend across the section and in one case coarse grained barite accompanies the chalcedony. The chalcedony is developed also on a very small scale and is not readily apparent. Small centres are found within the very fine grained chert matrix. Abundant small crystals of apatite generally about 10 µm size but do reach 30 µm lie along the bedding contacts of chert layers.

Pyrite is locally abundant as anhedral grains (~0.1 mm). Several small chalcopyrite grains were also found. Pyrite explains the limonite content of these rocks.

A cherty rock in which the quartz shows a variety of occurrences. The most abundant consists of quite thick layers of cherty quartz in which (?)recrystallization has led to the development of small anhedral to subhedral quartz prisms (about 0.05 mm size) that appear to form two populations, each of which have the quartz C-axis diametrically opposed but oblique to the bedding direction.

Possibly this could be stress control of the quartz during crystallization. Vague layers in the chert show the development to different extent. A little K-feldspar is included in this rock and it may be detrital in origin. It could be authigenic. Very fine chert layers also occur and these could be degradational into the above type. In some areas the degree of recrystallization is quite advanced and resembles fine grained quartz-rich rocks from the 1100 Orebody at Mount Isa. These have been interpreted as recrystallized cherts. A third quartz form consists of coarsely crystalline vein quartz which traverses the rock both conformably and disconformably. This quartz appears to be the youngest form and it transects the copper-bearing quartz layers.

The chalcopyrite is restricted to the second type of quartz. It occurs as apparently anhedral to subhedral grains generally about 50 µm size. The largest noted measured 80 x 184 µm size. Some of the more cubic grains appear to be tetragonal sphenoidal crystals. A few poorly developed pyrite crystals accompany the chalcopyrite. These cupriferous layers are only a few millimetres thick but chalcopyrite comprises up to 5% vol. of the layers. Minor barite accompanies the chalcopyrite. Pyrite is replaced by goethite and chalcopyrite by covellite and chalcocite.
A similar rock to QX20437 again with fine grained chalcopyrite. Once again the development of prismatic quartz is evident. Rounded pockets of chalcedonic quartz are found in this quartz but these areas do not contain chalcopyrite. Some oxidation of chalcopyrite to chalcocite and covellite has happened. Minor pyrite is present and oxidizing to goethite. Small grains of K-feldspar are scattered throughout this chert and their rhombohedral shape indicates adularia. The chalcedonic areas are free of K-feldspar. A few crystals of pyrite report.

Texturally, this is a slightly different rock from those described above. It is mostly a layered microcrystalline chert of average grain size between 5 and 10 μm. This type of chert constitutes some areas of QX20434 and QX20435 and it forms dislocated "fragments" in several other sections. Fine patchy chalcedonic quartz is distributed irregularly throughout. Deformation is shown by the contorted bedding arrangement and the "open spaces" formed by dislocation are occupied by the recrystallized quartz. In QX20439 minor cerussite lies in the recrystallized quartz.

The particular specimen has been quite strongly dislocated as shown by bedding attitudes. It appears that deformation has occurred with cementation (after injection) of a mesh of partly crystalline quartz material. Also, incipient recrystallization of chert perhaps related to the injected material may also have happened. Finally, late stage fracture veinlets of quartz traverse the slide and there is a suggestion of structural control. As a rule this quartz is coarsely crystalline and resembles that found in QX20438.

cc. Operations Manager/File
Carpentaria Exploration Company Pty. Ltd.

EL No 1371 Batten Range
EL No 1372 Tawallah Range

Location Map

Revision: SCA 1:1000000

GEO: J. N.
DRAFT: L. L.
CHECKED:
DATE: November 1977
MICROFILMED:
ROLL No:
MINING FIELD OR DISTRICT: McArthur River

DARWIN
A L I C E  S P R I N G S