REPORT NO. 553

MINES BRANCH
A PHOTOCOLOGICAL INTERPRETATION OF TWO
AREAS IN THE NORTHERN TERRITORY

1) VICTORIA RIVER BASIN

THIS MAP IS NOT TO BE
REMOVED OR DESTROYED

OPEN FILE

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INTRODUCTION

A literature search and photogeological interpretation of areas covering 6925 sq. km of the Northern Territory were commissioned by North Coast Mining Limited. The literature searches were carried out over the two areas, designated Helen Springs and the Victoria River Basin, in November and December, 1970 and the results are contained in Reports No.'s 60 and 61. This report describes the results of the photogeological studies mainly in relation to the mineral potential of both areas.

Two sets of black and white aerial photographs, 24 x 24 cms. at the approximate scale of 1:83330 were used in this photogeological investigation, together with geological maps of the two areas at scales of 1:250,000 and one set of old uncontrolled photomosaics of the Victoria River Basin at 1:63,360 scale.

An uncontrolled photomosaic, at photo scale, covering the Victoria River Basin area was hand-mounted and subsequently cut into two sheets; the technique used in mounting the photomosaic was such that only every other photograph was laid down, the alternate photographs providing stereoscopic coverage. The photogeological interpretation was later carried out on transparent overlays to the mosaic sheets and is presented as enclosures with this report as a set of two coloured maps at approximately 1:83330 scale together with the master transparencies.

In general the Victoria River Basin region is quite mountainous, with deep and wide valleys, and some difficulty was experienced in mounting the uncontrolled photomosaic; inaccuracies due to distortion were, however, minimised by using only the central part of each photograph.

The photogeological interpretation of the Helen Springs area was carried out by annotating transparent overlays to alternate photographs. The annotated
templates were then hand-mounted together by the radial line method and the resulting coloured map at 1:83330 scale is presented in this report together with the master transparency.

Morphologically the Helen Springs area is rugged, though considerably less so than the Victoria River Basin. In general it has lower elevations.

The aerial photographs were of good quality and the consistency of the tonal contrast displayed on the photographs facilitated the interpretation. The geological maps at 1:250,000 scale covering both areas are generally good and consequently the principal aim of the photo-interpretation was to map in detail structural characteristics and features and to delimit tonal variations which may relate to structural or mineralised features.

Field inspection of these anomalous areas is considered essential.

II

VICTORIA RIVER BASIN

Three major groups of Proterozoic rock formations outcrop in this area, namely the Fitzmaurice Group in the northwest, the Bullita Group in the southeast and the Auvergne Group which covers the remaining part of the area. The latter is in turn covered by scattered mesas of Cambrian Antrim Plateau Volcanics and associated sediments, Lower Cretaceous Mullaman Beds and Cainozoic deposits. Only these principal rock formations are shown on the enclosed maps as more lithological subdivisions would only have complicated the structural picture and its interpretation. The same is valid for the Cainozoic cover sediments. Significant marker beds within the three main groups were mapped in order to complete the structural picture of this region.

The Fitzmaurice Group is separated from the underlying Auvergne Group by the Victoria River Fault which, in this area, strikes northeast-southwest and which is covered at the surface by recent sediments. Although no direct
evidence is available, probably this tectonic structure would be better represented by a low angle thrust. This hypothesis would also explain the high degree of folding and faulting parallel to the Victoria River Fault in the Fitzmaurice and Auvergne Group rocks near the thrust; it is reasonable to assume that compressional forces from the northwest caused these tectonic features. Tectonic structures striking northwesterly would thus result from tensional stresses released when the compressional phase had died out. Further evidence of compressional movements, not only from the northwest, but also from the north, is provided by three other thrust-like features respectively in the centre-west, centre-north, and northeastern part of the area: the first thrust is marked as an almost rectilinear fault immediately to the west of the monoclinal axis; the second as a complex of faults resulting in a semicircular pattern; the third as a curved fault.

The areas in the immediate surroundings of the thrust-like features have similar structural characteristics, namely steeper dips in the overthrusted block, low or sub-horizontal dips in the underthrusted block, and folds parallel or sub-parallel to the thrust front.

The main tectonic structures in the Auvergne Group are restricted to the vicinity of the thrust-like features described above. Exceptions are represented by the intense fracturing in the Jasper Gorge Sandstone and by the graben-like feature occurring in the same rock formation in the south-eastern part of the area.

With the exception of some outcrops of Angalarri Siltstone, the rock formations underlying and overlying the Jasper Gorge Sandstone are devoid of such an intense fracture pattern. The fracturing present in some outcrops of Angalarri Siltstone is obviously only inherited from the Jasper Gorge Sandstone as a result of compaction effects over a long period of time, and hence is not in any way related to deep-seated fractures. The fact that much of the intense fracturing is confined to the Jasper Gorge Sandstone can be explained by its
competent nature, (although other rock formations have the same competent character) though a more reasonable explanation is that, after diagenesis, a very active period of "high speed" deformations of a particular wave-length here resulted in the present fracturing probably along pre-existing zones of weakness in the Jasper Gorge Sandstone.

The graben-like structure is several tens of kilometres long in the study area and apparently continues outside it. It strikes north-northwest and results from tensional stresses which apparently post-dated the fracturing of the Jasper Gorge Sandstone. It could well be associated with the extrusion of the volcanic rocks whose relics are present in the eastern part of the area.

Apart from localised deviations, the general dip of the Auvergne Group is gently to the northwest indicating that the maximum values of the epeirogenetic movements occurred in the southeast, outside the area of study.

The laterised Mullaman beds outcrop in the centre-north and northeastern parts of the area and represent erosional relics of a much more extensive cover; they are horizontal or sub-horizontal and do not show any structural characteristics.

Bullita Group beds outcrop on the walls of the deep canyons present in the southeastern corner of the area as a result of active erosion along rivers and fracture systems cutting through the Auvergne Group. The limited outcrop area does not allow an evaluation of the structural characteristics of this Group.

The photogeological study has revealed several areas of interest which should be checked in the field; these are located on Enclosure I. All but the one

*"High speed" deformations, as opposed to "low speed" deformations which give rise to large fractures and folds.
in the northeast have the same characteristics and are located in topographic "lows" as windows in the Cainozoic cover. The largest one in the centre-south of Sheet 1 was revealed by the analysis of the old photomosaics at 1:63360 scale and is not visible in the new photography; this indicates that at least at this location erosional processes are not active any more and deposition is taking place instead.

These anomalous areas have the same photographic characteristics and appear to be the peneplained expression of a folded alternation of light and dark beds or groups of beds. Field evidence is required to ascertain their nature but they could represent areas of the metamorphic basement, Archean or Lower Proterozoic in age. If this is the case, as these anomalous areas are present in the Auvergne and the Bullita Groups, the Bullita Group and the lower member of the Auvergne Group (Jasper Gorge Sandstone) cannot be present northwest of a line running approximately along the Angalarri River to Mairanyi and from Mairanyi to Ring Lagoon on the Baines River. The absence of these rocks may be attributed to one of two causes. Either strong faulting along the main course of the Angalarri River (which is indicated by the morphology) caused the uplift of the block in the northwest thereby preventing deposition, or the Jasper Gorge Sandstone was eroded away. Additional evidence that this formation is absent in the northwest is provided by the decreased intensity of fractures in this area.

The anomalous area in the northeast has been interpreted as a dyke-like feature which should also be checked in the field.

No significant mineral occurrences have been reported in the area, but interesting geochemical and geophysical anomalies have been located to the north of it (Durack Mines Limited Prospect, Southern Miner, Vol. 1 No. 41, December 7th, 1970). Durack Mines Limited has budgeted A$400,000 for exploration expenditure in that area during 1971. The reported occurrences in the Durack
prospect consist of uranium mineralisation in laterites and granites, exotic limonitic deposits associated with black shale and pyritic quartz-sandstone cobbles, base metals mineralisation, and possible buried volcanic plugs of a kimberlitic nature which were located during an airborne magnetometer survey. As the geological environment at the Durack Prospect to the east of the Victoria River Fault does not differ from that of the study area, it is reasonable to assume that comparable occurrences could be found here if geochemical and geophysical surveys are carried out over favourable targets.

The first areas to be tested are those ones containing and surrounding the major tectonic dislocations, especially the two suspected overthrusts in the centre-north and northeast and the graben-type structure in the east and southeast.

If it is proved that the Archean basement penetrates the cover rocks, these Precambrian areas and their immediate surroundings should be made the object of a magnetometric survey to check the possible presence in their vicinity of granitic intrusions or volcanic plugs.

The laterites overlying the Mullaman beds should be surveyed radiometrically to ascertain the presence of radio-active mineralisation.

Outcrops of Angalarri Siltstone and especially its shaly horizons should be geochemically surveyed to test for sulphides other than pyrite as copper values in the range of 300-400 p.p.m. have been encountered to the north of the study area. For the same reason the geochemical survey should be extended over any pyritic sandstones of the Auvergne Group.

Further conclusions given in Report No. 61 are still valid.

III

HELEN SPRINGS

The photogeological study of the Helen Springs area has broadly confirmed the validity of the conclusions given in our Report No. 60 of December 7th, 1970,
namely that although prospects for mineralisation are not good, some prospecting should be undertaken in the area.

The rock formations outcropping in the area range in age from Precambrian to Cainozoic and several hiatuses are present. A detailed lithological description of these rock formations has already been given in the report mentioned above. The most important tectonic features are concentrated in the central and eastern parts of the area and consist of large faults with azimuths ranging between north northwest and north northeast and affecting mostly the rocks of Proterozoic age. The few faults intersecting the Palaeozoic and Mesozoic rocks are interpreted as the surface expressions of deep-seated tectonic features; we may therefore conclude that apart from re-juvenation of the existing tectonic features, no major orogenic movements have subsequently affected this area.

Analysis of the photogeological map reveals that the most intense fracture patterns are always associated with the most tectonically disturbed zones in the east and centre-north of the area; these two areas could have mineral potential and consequently should be investigated in the field. In Report No. 60, it was suggested that the Helen Springs area could be located in a mobile zone; this hypothesis is strongly supported by the fact that this area is related to a "high" in the gravity pattern and corresponds to the most intensely faulted and fractured region. Most of the areas to be checked in the field lie within or near this tectonically dislocated belt and in the same lithological environment as the known manganese mineralised areas. They were selected because of their close relationship with, and similar photographic characteristics to, the known mineralised zones. Field inspection of these anomalous areas could reveal more manganese mineralisation.

Tonal photographic anomalies which could be caused by hydrothermal activity were also found in the basalt covered areas which, together with associated Palaeozoic sedimentary rocks, should be geochemically tested to prove if any copper mineralisation is present. The Helen Springs Volcanics are the
equivalent of the Antrim Plateau Volcanics which, in certain areas, contain copper mineralisation. The sedimentary rocks overlying and underlying the basalt, namely the Palaeozoic Gum Ridge Formation and the basal sandstone and breccia, should also be the object of a geochemical survey for copper as the possibility exists that leaching of the basalts may have secondarily enriched these sediments.