NORTHERN TERRITORY GEOLOGICAL SURVEY

Final Report for
EL's 73, 75-80, 341, 342, 451

Review of 1970 and 1971 Exploration on
Authorities to Prospect 2077 and 3071

At

VICTORIA RIVER DOWNS, NORTHERN TERRITORY, AUSTRALIA

OPEN FILE

CR 73/99A

HOOKER MINING COMPANY PTY. LTD.

AUSTRALASIAN MINERALS, INC.
Final Report for
El's 73, 75-80, 341, 342, 451

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Authorities to Prospect 2077 and 3071

At
Victoria River Downs, Northern Territory, Australia

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Hooker Mining Company Pty. Ltd.
Australasian Minerals, Inc.
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1:30,000-Scale Maps (112 total)

Stream Sediment Sample Location Numbers
Sheets 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

Lead Content -16+44 Mesh Fraction of Stream Sediments
Sheets 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

Lead Content -200 Mesh Fraction of Stream Sediments
Sheets 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

Copper Content -16+44 Mesh Fraction of Stream Sediments
Sheets 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

Copper Content -200 Mesh Fraction of Stream Sediments
Sheets 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19

Zinc Content -16+44 Mesh Fraction of Stream Sediments
Sheets 2, 8, 11, 12, 13, 14, 15, 16, 17, 18, 19

Zinc Content -200 Mesh Fraction of Stream Sediments
Sheets 2, 8, 11, 12, 13, 14, 15, 16, 17, 18, 19
INTRODUCTION

R. G. H. ALLEN

This two-part report with accompanying 1:30,000-scale maps summarizes the results of part of the exploration done by Hooker Mining Company Pty. Ltd. and Australasian Minerals, Inc. on Authorities to Prospect 2077 and 3071. These tenements are at Victoria River Downs in the Northern Territory of Australia.

The two companies formed the A. H. Venture in October, 1970, to explore several regions in northern Australia. At Victoria River Downs field work began in early September, 1970, and continued into middle November. In 1971, a caravan base camp was established, enabling work to be done from late April to the end of November. This report, which presents the results of 1970 and 1971, was prepared in 1972. From the information it contains, eighteen localities were selected for detailed mapping and sampling in 1972. Although induced polarization surveys were made at four of these localities, and percussion drilling was done at two of them, no significant base metal deposits were found.
The following professional staff of Australasian Minerals, Inc. participated in the exploration:

Mr. N. J. Cranley         geologist         1971, 1972
Mr. D. C. Speijers        geologist         1971, 1972
Mr. J. M. Treloar         geologist         1971, 1972
Dr. H. Schneider          geologist-in-charge of project 1970
Mr. C. A. Chapallaz       geologist-in-charge of project 1971, 1972

Part One of this report provides general information and Part Two is made up of reviews of twenty-one areas, each review written by the geologist who was responsible for the mapping and sampling of that particular area.
PART ONE
Authorities to Prospect 2077 and 2071 lie in the Victoria River District, in the northern part of the Northern Territory of Australia.

The 8,176 square miles are included in a rectangle bounded by latitudes 16°00'South and 17°10'South, and longitudes 130°00'East and 131°40'East, with the exception of the western part of Authority to Prospect 2077 and the area of Authority to Prospect 3071 extending north of the 16th parallel.

Victoria River Downs Station is the main centre and has three important outstations: Mt. Sanford, Pigeon Hole and Moolooloo. Other Homesteads of pastoral properties located within the two tenements include Bullita, Coolibah, Humbert River and Kidman Springs.

The Timber Creek Police Station and the store are on a 60-square-mile Government Reserve.

The boundary of the two Authorities to Prospect is shown on the location and access map (Diagram G - 1).
ACCESS

C. A. CHAPALLAZ

The principal road crossing the area links Top Springs to the Victoria Highway close to Timber Creek, via Victoria River Downs. It is a gravel road, impassable during the greatest part of the wet season.

(diagram G-1)
As the location and access map/shows, there are numerous station tracks going across the country, most of which are usually graded at the start of the dry season. Travelling by four-wheel-drive vehicle along these and cross-country permits one to cover most of the region.

Regions inaccessible except by foot, horse or helicopter include the sandstone plateaux and the very rugged terrain of the western half of Authority to Prospect 3071.

All the pastoral stations except Bullita have airstrips and Connellan Airways has regular air services from Kununurra, Katherine and Darwin.

CLIMATE

The climate is monsoonal, with a very long dry season during the winter from about April to November, and a short "wet". The rainfall decreases from the coast inland. Annual rainfall at Victoria River Downs ranges from about 15 inches to 30 inches, the greatest part
occurring during February and March. Temperature varies considerably between the winter months with minimums below 50°F and the beginning of the wet season, when the highest temperatures are recorded, usually well above 100°F.

Dominant winds are northwesterly during the wet season and southeasterly in winter.
TOPOGRAPHY

C.A. CHAPILLAZ

Relief in the Victoria River District is of low amplitude, characteristic of a very stable region that has not been affected by major orogenesis during its history.

The highest and roughest country is developed on the extensive sandstone and siltstone terrain near the western edge of the two Authorities to Prospect. Here elevations up to 390 metres above sea-level are attained. The Victoria River near Timber Creek is tidal and is the lowest point in the District.

The topography is controlled by the different lithologies and to a certain extent by folding and fracturing. Mesas are developed where resistant sandstones of the Jasper Gorge and Wondoan Hill Formation overlie horizontal to gently-dipping sedimentary rocks. In other places erosion has stripped these formations away to expose domes of Skull Creek Formation. Generally, the tops of the plateaus are covered by large blocks of orange sandstone incised by creeks following the joint system, forming deep gorges in some instances. In other cases a thin, residual, sandy soil has developed making a fairly smooth surface covered by scattered trees and spinifex. The tops
of the mesas generally stand about 100 to 150 metres above the ground level.

Hilly country is typical of the Skull Creek and Timber Creek Formation terrain. A terraced pattern occurs when dips are gentle, because these formations consist of thin, alternating resistant and nonresistant beds. Very little soil has formed over the dolomite formations, with the exception of calcrete development.

There is a marked lithological change between Bynoe and Skull Creek Formations. The soft siltstone and sandstone of the Bynoe erode easily to yield the red soils surrounding both the mesas and the dolomite and chert exposures of the top of the Skull Creek Formation.

In the Antrim Plateau Basalt belt, south and east of Victoria River Downs, extensive residual black soil plains spangled with basalt boulders separate smooth basalt hills.

The principal rivers cut across thick red silty alluvium flats.
Geologically, Authorities to Prospect 2077 and 3071 are located in the tectonically stable region usually referred to as the Sturt Block. This shelf or platform, over which generally shallow water sediments have been deposited is bounded by mobile belts.

Dolomite, siltstone, sandstone and minor shale are the typical sedimentary rocks of the Sturt Block. The only igneous activity recorded in the basin since the sedimentation started in Lower or Middle Proterozoic Time is the quiet outpouring of tholeitic basalt flows during the early Cambrian. The basement is not exposed within the two Authorities to Prospect and from magnetic data obtained during the 1971 airborne geophysical survey, it lies about 2000 metres below ground level around Victoria River Downs.

The Proterozoic sediments have suffered very little deformation and are gently warped into broad domes and basins. Zones of intense folding (monoclines and tight domal structures) are very localized, and are related to faulting in the basement. This environment contrasts with that of the mobile belts bounding the Sturt Block. These marly belts are characterized by rapid subsidence, which caused lateral facies changes during sedimentation, and are also characterized by strong faulting.
and folding, generally accompanied by metamorphism and igneous activity.

A regional geological map has been compiled at 1:1,000,000 scale and is produced here (Diagram G - 2).
TECTONIC SETTING AND STRUCTURE

The principal tectonic feature in the Victoria River District is the Sturt Block. It has acted as a relatively stable zone since sedimentation started in Lower Proterozoic time. The Sturt Block is surrounded by belts of more active sedimentation and deformation. These belts, or mobile zones, are:

1. To the west, the northeast-trending Fitzmaurice Mobile Zone, an extension of the Halls Creek Mobile Zone of the East Kimberleys.

2. The Pine Creek Geosyncline to the north-northeast.

3. The Warramunga Mobile Zone to the southeast.

The Proterozoic sedimentary rocks of the Sturt Block are covered by younger sequences deposited in structural and sedimentary basins: the Palaeozoic Rosewood and Hardman Basins to the west and the Cambrian and Cretaceous-filled Wiso Basin to the east. The different tectonic units are shown on Diagram G - 4.

The Proterozoic sedimentary rocks are generally only gently warped. More intense deformation has occurred along fault lines where monoclines and tight domal structures have formed. In these, dips up to 90° are not uncommon.
Domal structures form a belt extending from Burt Hill to just south of Mt. Warburton, where a complicated fold has developed at the intersection of two marked trend-lines (Area 1).

Other tight, faulted domes have been found few kilometres southeast of Humbert River Homestead (Area 21), south of the Humbert River (Area 3), near Jasper Gorge (Areas 10 and 19), and in several other localities.

Monoclinoes have developed in the Depot Pile region (Area 9), between the Humbert and Wickham Rivers (Area 3), and in the Bullita Region (Area 18 and 20).

Numerous small-scale structures associated with 'calcretisation' along joints or faults have formed where the rocks dip gently. These features have been called anticlinal ridges, as their elongated anticlinal shapes give rise to ridges. These linear ridges can be up to several kilometres long and up to a few metres wide. Their trend is not regular on a large scale, but it shows a relation with the larger folds to which these anticlinal ridges are associated. Anticlinal ridges are particularly numerous north of Victoria River Downs and in the western flank of the discontinuous anticline of Areas 5 and 6.

The prominent structural trends are northwest, north-northwest, and north-northeast.

The structural geology of the Sturt Block has been plotted on Diagram G - 2.
STRATIGRAPHY

C.A. CHAPALLAZ

Dolomites and siltstones of the middle and upper part of the Limbunya Group are the oldest outcropping rocks in Authorities to Prospect 2077 and 3071, and the Lower Cambrian Basalts are the youngest. The Archaean or Lower Proterozoic crystalline basement occurs only south-southeast of Limbunya Homestead and in the Halls Creek Mobile Zone.

Going northeast from the basement "high" near Limbunya Homestead, successively younger rocks are encountered, e.g. the Limbunya Group, then the Wattie Group and finally exposures of the Bullita and Auvergne Groups. However, rocks older than the Wattie Group are exposed in Authority to Prospect 3071 where faulting has produced steps on the basement surface.

Stratigraphic units of the Victoria River District are shown in Table I, accompanied by brief lithological descriptions.

Basement

The crystalline basement is not exposed inside the two Authorities to Prospect. Interpretation of magnetic data showed that near Victoria River Downs the irregular
<table>
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<th>Group</th>
<th>Formation, Thickness in metres</th>
<th>Lithology</th>
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</thead>
<tbody>
<tr>
<td>Cainozoic</td>
<td></td>
<td>Laterite, gravel, conglomerate, colluvium, sand, soil and alluvium.</td>
</tr>
<tr>
<td>Lower Cretaceous</td>
<td>Mullaman Beds</td>
<td>Claystone, siltstone and sandstone</td>
</tr>
<tr>
<td></td>
<td>Unconformity</td>
<td></td>
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<tr>
<td>Lower or Middle Cambrian</td>
<td>Montejinni Limestone</td>
<td>Limestone, calcareous mudstone, minor dolomite.</td>
</tr>
<tr>
<td></td>
<td>Unconformity</td>
<td></td>
</tr>
<tr>
<td>Lower Cambrian</td>
<td>Antrim Plateau Volcanics 300+</td>
<td>Basalt, agglomerate, minor sandstone, chert and limestone interbedded.</td>
</tr>
<tr>
<td></td>
<td>Unconformity</td>
<td></td>
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<tr>
<td>Duerdin Group</td>
<td></td>
<td>Basal tillite and conglomerate, sandstone, siltstone, minor dolomite</td>
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<tr>
<td></td>
<td>Unconformity</td>
<td></td>
</tr>
<tr>
<td>Auvergne Group</td>
<td>Shoal Reach Formation</td>
<td>Sandy and silty dolomite, minor siltstone and shale.</td>
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<td></td>
<td>Spencer Sandstone</td>
<td>Quartz sandstone, minor dolomitic sandstone.</td>
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<td></td>
<td>Lloyd Creek Formation</td>
<td>Oolitic and stomatolitic dolomite, siltstone.</td>
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<td></td>
<td>Pinkerton Sandstone 100</td>
<td>Massive quartz sandstone, siltstone minor shale.</td>
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<td></td>
<td>Saddle Creek Formation 150+</td>
<td>Basal quartz sandstone overlain by oolitic dolomite and shale.</td>
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<td></td>
<td>Angalaxxi Siltstone 230+</td>
<td>Siltstone, interbeds of fine sandstone, dolomite and shale.</td>
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<tr>
<td>Layer</td>
<td>Description</td>
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<tr>
<td>Jasper Gorge Sandstone 80</td>
<td>Massive and blocky quartz sandstone, minor siltstone, local basal conglomerate.</td>
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<tr>
<td>Stubb Formation 115-</td>
<td>Interbedded dark grey shale and siltstone, massive quartz sandstone interbeds near top.</td>
<td></td>
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<tr>
<td>Wondoan Hill Formation 145-</td>
<td>White claystone, brown sandstone, glauconitic and quartz-rich sandstone.</td>
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<td>Unconformity</td>
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<tr>
<td>Unconformity</td>
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<tr>
<td>Bullita Group</td>
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<td>Battle Creek Formation 80</td>
<td>Flaggy, red and grey dolomite; green siltstone and shale, blocky sandstone at top.</td>
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<td>Coarse quartz sandstone and grit, pebbly near base.</td>
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<td>Grey-green and red-purple siltstone, dolomitic sandstone and dolomite.</td>
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<td>Interbedded dolomite and dolomitic siltstone, minor dolomite and chert.</td>
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<tr>
<td>Supplejack Dolomite Member 9-12</td>
<td>Massive interbedded fine and coarse clastic dolomite, stromatolites near top.</td>
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<tr>
<td>Bardia Chert Member 30</td>
<td>Pink and red-brown chert, brecciated in part, at top of Formation.</td>
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<tr>
<td>Timber Creek Formation 200+</td>
<td>Interbedded fine-grained sandstone, dolomitic siltstone and dolomite.</td>
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<td>Wattie Group</td>
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<td>Seale Sandstone 100</td>
<td>Quartz sandstone</td>
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<tr>
<td>Gibbie Formation 25-75</td>
<td>Interbedded sandstone and siltstone, minor dolomite.</td>
<td></td>
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<tr>
<td>Formation</td>
<td>Description</td>
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<td>Neave Sandstone 1-21</td>
<td>Red quartz sandstone.</td>
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<td>Mt. Sanford Formation 50-250</td>
<td>Siltstone, interbedded with sandstone, minor fine-grained dolomite, chert and claystone.</td>
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<td>Hughie Sandstone 50-130</td>
<td>Quartz sandstone</td>
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<tr>
<td>Burtawurta Formation 18-38</td>
<td>Massive sandstone, siltstone</td>
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<tr>
<td>Wickham Formation 155</td>
<td>Quartz sandstone, laminated, with chert interbedded.</td>
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<tr>
<td><strong>Unconformity</strong></td>
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<tr>
<td>Limbunya Group</td>
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<tr>
<td>Killaloc Formation 60</td>
<td>Interbedded siltstone and dolomite, minor sandstone.</td>
<td></td>
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<tr>
<td>F-raynes Formation 130</td>
<td>Dolomite and silty dolomite, capped by chert.</td>
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<tr>
<td>Black Springs Dolomite</td>
<td>Grey dolomite, stromatolitic in places.</td>
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<tr>
<td>Blue Hole Formation 320</td>
<td>Pink to grey siltstone and dolomite.</td>
<td></td>
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<tr>
<td>Farquharson Sandstone 110</td>
<td>Fine- to medium-grained quartz sandstone.</td>
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<tr>
<td>Kunja Siltstone 60</td>
<td>Purple and green siltstone, dolomite.</td>
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<tr>
<td>Mallabah Dolomite 100</td>
<td>Grey to buff dolomite.</td>
<td></td>
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<tr>
<td>Amos Knob Formation 40-50</td>
<td>Dolomite, green siltstone, minor sandstone and shale.</td>
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<tr>
<td>Pear Tree Dolomite 105</td>
<td>Dolomite, dolarenite, capped by chert.</td>
<td></td>
</tr>
<tr>
<td>Margerey Formation 120+</td>
<td>Chert, claystone and dolomite. Stromatolitic in places.</td>
<td></td>
</tr>
<tr>
<td>Stirling Sandstone 105-120</td>
<td>White to brown sandstone, thin basal conglomerate.</td>
<td></td>
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<tr>
<td>Unconformity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basement</td>
<td>Halls Creek Group</td>
<td>Tightly-folded and metamorphosed geosynclinal sediments.</td>
</tr>
<tr>
<td></td>
<td>Inverway Metamorphics</td>
<td>Red-brown micaschist.</td>
</tr>
</tbody>
</table>

Thickness data from Bureau of Mineral Resources Mapping.
basement surface is about 2000m deep.

Archaean or Lower Proterozoic basement rocks are known to occur about 170 km southeast of Victoria River Downs, and in the East Kimberley Region of Western Australia.

There is a small dome of red-brown mica schists outcropping 35 km south-southeast of Limbunya Homestead. These schists are designated the Inverway Metamorphics by the Bureau of Mineral Resources. No information is available about this unit.

In the East Kimberley Region, geosynclinal sediments of the Halls Creek Group were deposited during the Archaean or Lower Proterozoic time. These have been tightly folded, slightly metamorphosed and intruded by basic sills and dykes. During a second stage of deformation, the sediments of the central part of the Halls Creek Mobile Zone have been invaded by granitic plutons and regionally metamorphosed to form the high-grade metamorphic rocks of the Lamboo Complex.

**Limbunya Group**

The Limbunya Group is particularly well exposed south of Limbunya, where a complete section can be examined. It consists of dolomite formations interbedded with sandstone, siltstone and shale units. The Group lies unconformably over the Inverway Metamorphics, and an
unconformity marks its top.

A description of the different formations checked and sampled during the field mapping is given below for each particular area of outcrop.

1. A window of possible Black Springs Dolomite occurs in the core of a large, faulted anticline around the intersection of latitude 16°42' South and longitude 130°19' East on the Waterloo 1:250,000 sheet. The following sequence is exposed from base to top:
   - Massive, thickly-bedded, silicified, white-grey and pink dolomite, showing very abundant stromatolites, laminae and patches of chert, and centimetre-thick interbeds of microbreccias.
   - Platy, grey, reddish or greenish, fine-grained, silty dolomite containing numerous small Col- lenia up to 3cm across.

The upper part of this sequence is covered by scree from an overhanging massive dissected chert. The latter probably belongs to the base of the Wickham Formation sandstones.

2. A monocline passes through Depot Pike on the Limbunya 1:250,000 sheet near the intersection of latitude 17°05' South and longitude 130°25' east. Erosion has exposed two formations of the Limbunya
Group at Depot Pile:

Fraynes Formation : Fissile siltstone with platy dolomite beds at top.

Black Springs Dolomite: Thin-bedded fine- to medium-grained dolomite with a few narrow silty bands. One thick bed of dark-weathering, medium-grained dolomite contains abundant stromatolite structures.

3. On the monocline northwest of Depot Pile, the Limbunya Group between the Pear Tree Dolomite and the Black Springs Dolomite has been mapped by the Bureau of Mineral Resources. No detailed mapping or stream sediment sampling has been carried out on these formations.

Wattie Group

Extensive outcrops of this group cover the southwestern corner of Authority to Prospect 3071 and the panhandle of Authority to Prospect 2077. The Wattie Group unconformably overlies the youngest dolomites of the Limbunya Group, and is very often capped by the transgressive Jasper Gorge Sandstone or the Antrim Plateau Basalts.

The soft, thinly-interbedded siltstones and sandstones form rounded hills, while the more resistant sandstone formations generate high ridges whose dips are steep. Good outcrops of the softer beds are generally found in cliffs beside rivers.
As no extensive mapping was carried out in this monotonous sequence and no published information is available about it, only brief lithological descriptions are given:

Seale Sandstone: Massive orange and white quartz sandstone, with asymmetrical ripple marks and cross-bedding.

Gibbie Formation: Siltstones and brown-red platy sandstone with salt casts, few thin dolomitic beds.
Thin beds of fine-grained, beige to grey dolomite, locally silicified, containing chert nodules and stromatolites, with siltstone interbeds. Also several fine-grained dolomitic beds up to 1m thick.
Red purplish and green, more or less micaceous siltstones interbedded with coarse-grained sandstone beds and rare, fine-grained, beige dolomites.

Neave Sandstone: Red sandstone.

Mt. Sanford Formation: Interbedded siltstone and sandstone, minor dolomite and claystone. The siltstones are thinly-beded, green, white or purplish, very abundant towards the top with sandstone beds and discontinuous chert interbeds. The dolomites are fine-grained, grey to white, locally completely silicified with few bands of intraformational conglomerate. A few dolomitic beds up to 1.5m thick occur in the middle part of the formation.
Hughie Sandstone: Orange-brown, medium-grained, massive quartz sandstone.

Burtawurta Formation: Massive reddish sandstone and siltstone.

Wickham Formation: Orange to white quartz sandstone.

It appears that the Wattie Group is a uniform shallow-water sandstone and siltstones sequence, with very limited calcareous episodes of sedimentation, and gradual vertical changes.

No important lateral facies variations were noted, characterising the very uniform conditions that prevailed over huge areas during the sedimentation of the Wattie Group.

Bullita Group

The Bullita Group includes the three dolomite formations carrying disseminated base metal sulphides that have been mapped and sampled during 1970 and 1971.

The Group comprises five distinct formations, among which the two youngest are exposed in a curved belt joining Mt. Sandman (just north of Kidman Springs) to Mt. Fisher and Gregory's Remarkable Pillar. This is approximately the western edge of a spacious basin in which the Weener
Sandstone and Battle Creek Formation were deposited. It is likely that this basin extends northward as far as the southern-central part of the Fergusson River 1:250,000 sheet.

The Bynoe Formation occurs in the centre of the Authorities to Prospect, where it generally forms the gentle slopes beneath the sandstone that caps the mesas. It forms the red soil flats surrounding the Skull Creek exposures also. West of a curved line, going through Coolibah, Bullita and Humbert River Homesteads, the formation thins out and disappears and the Jasper Gorge Sandstone comes into direct contact with the Skull Creek and Timber Creek Formations.

The Bullita Group is of Middle to Upper Proterozoic age (Adelaideon)

Timber Creek Formation. -

The Timber Creek Formation is the basal unit of the Bullita Group, lying conformably over the Seale Sandstone.

It is predominantly siltstone, with minor amounts of sandstone, dolomite, dolomitic siltstone and shale.

The formation usually outcrops as smooth, rounded hills or in plateau slopes, with the terraced pattern not so well developed as in the Skull Creek Formation. Hard calcrete has very often developed over the more
calcareous parts of the Formation, across which the creeks have cut very sharply. Extensive spinifex, scattered scrubs and trees, and dark patches of turpentine trees characterize the vegetation growing over the Timber Creek Formation. The thin beds and small amount of dolomites distinguish it easily from the Skull Creek Formation, though the contact between the two formations is very gradual and often difficult to map.

The Timber Creek Formation has been investigated in the following regions:

1. In the centre of a dome west and southwest of Victoria River Downs (Areas 4, 5 and 6), from top to base:
   - Thick bed of cherty dolomite.
   - Thinly-interbedded, fine-grained sandstone and siltstones, 'calcrete' and fine-grained dolomites with chert nodules.

The above description could also represent the lowest part of the Skull Creek Formation, since the Seale Sandstone is not exposed and the contact between the Skull Creek and Timber Creek Formations is indistinct.

2. Along Gibbie Creek, Depot Creek and the Wickham
River, Areas 8 and 16. This is where the best sections of the Timber Creek Formation outcrop, including the boundary with the Skull Creek Formation. The following section has been found in all the parts of this area:

Skull Creek Formation, Basalts or Jasper Gorge Sandstone.

Interbedded siltstone, calcrete and thin, beige-yellow, fine-grained dolomite beds in increasing number towards the top.

Upper Marker: 2- to 3m-thick, massive, coarse-grained dolomite with a thin, chertified algal (?) development capping it.

Interbedded siltstone, calcrete and thin, fine-grained, beige-yellow dolomite beds, displaying silicified salt casts, small, red-orange siliceous blebs, and chert nodules.

Lower Marker: 5- to 10m-thick, massive dolomite bed, fine- to coarse-grained, with chert nodules, some stromatolites. At several places
disseminations of galena, pyrite chalcopyrite. A thin layer of red-brown haematitic dolomite at its top.

Reddish and purplish, cross-bedded sandstones and siltstones with salt casts; 'calcrete'; rare, beige-yellow, fine-grained thin dolomite beds containing chert nodules and sandy interbeds.

3. North and south of the Humbert River, Areas 3 and 4, from top to base:

Reddish siltstones with salt casts; calcrete; and thin, fine-grained dolomite beds with chert nodules.

Massive, grey, fine- to coarse-grained dolomite bed with a thin chertified algal (?) development capping it. This horizon corresponds to the Upper Marker of Areas 8 and 16.

Thinly-bedded siltstone, 'calcrete' and fine-grained dolomite with chert nodules. The siltstones are reddish, cross-bedded and contain salt casts.
4. Bullita region, Areas 11 and 18: from top to base:

Skull Creek Formation.

Thin cherty dolomites and siltstones.

2m-thick bed of fine-grained dolomite capped by a probable algal chert. Corresponds to the Upper Marker of Areas 8 and 16.

Siltstone, calcrete and fine-grained, cherty and silty dolomites.

6- to 7m-thick bed of fine- to medium-grained dolomite. Corresponds to the Lower Marker of Areas 8 and 16.

Siltstone, sandstone, with some bands and beds of fairly thick, fine-grained cherty dolomites.

5. Timber Creek region, Area 20.

The two marker beds found in most of the areas of Timber Creek Formation outcrops have not been recognised in the Timber Creek region. There the Timber Creek Formation consists of a sequence of
thinly-bedded mudstones, siltstones, fine-grained sandstone and fine-grained dolomite beds. Salt casts are frequent through the formation. The base of the formation is predominantly silty and the upper part dolomitic.

The investigations made in the Timber Creek Formation show that very similar conditions occurred over very large areas during deposition. Salt casts have been found in all the areas mapped, and the two marker beds could be traced for several tens of kilometres. Deposition of the Timber Creek Formation was predominantly in a shallow-water, lagoonal environment, with periods of complete evaporation of the sea-water and short episodes of carbonate deposition.

Skull Creek Formation -

The Skull Creek Formation is predominantly dolomitic, with a silty and dolomitic lower and upper part. The lithology of the Timber Creek Formation continues conformably upward into the Skull Creek Formation. The sandstone siltstone succession of the Bynoe Formation conformably overlies the Skull Creek Formation.

The alternation of hard dolomite beds with softer, thinly -bedded, silty layers controls the prominent terraced morphology characteristic of the Skull Creek Formation.
Vegetation is of the savannah type, with grass and scattered trees, with the exception of the Supplejack Dolomite Member that supports small, dense, bushy, dark-green trees.

An outstanding feature dividing the Skull Creek Formation is a dark-weathering, massive dolomite and dolarenite, 10 to 15m thick, stromatolitic at the top. It is called the Supplejack Dolomite Member. This member has been found in all the areas mapped and forms an ideal marker bed. It can be traced easily on aerial photographs and is distinguished on the ground by its dark colour, weathering and vegetation. On the Waterloo 1:250,000 sheet, the bed can be followed for about 60km without interruption, showing well the uniform facies of the Skull Creek Formation. No major variation of thickness affects the Supplejack Dolomite Member, and the parts of the Skull Creek above and below it do not display any major change in facies between Victoria River Downs, Gibbie Creek, Humbert River and Bullita. In the outcrops along the Victoria River, between Timber Creek and Coolibah stations, the Skull Creek Formation appears to contain more dolomite beds around the Supplejack Dolomite than south of this region.

Below the Supplejack Dolomite, the Skull Creek Formation consists of siltstone, 'calcrete' and thin beds of generally fine-grained dolomite, which increase in thickness and abundance upward in the sequence. Salt casts and cross-bedding show that the sedimentation conditions were similar to those of the Timber Creek Formation, with short periods
of more open water during which the dolomite beds were deposited.

The Supplejack Dolomite Member is a massive horizon of thickly-bedded dolomite and dolarenite, medium- to coarse-grained, in which small-scale current structures and thin intraformational conglomerates are apparent. The Member also contains some 5 to 10cm bands of yellow, fine-grained dolomite. Stromatolites have grown particularly well at the top and above the Supplejack Dolomite. From the uniformity of thickness and lithology of this dolomitic sequence, it can be assumed that the Sturt Block was uniformly covered by a relatively thin layer of water, in which chemical precipitation and later modification occurred, and that the conditions were favourable for algal growth.

The upper part of the Skull Creek Formation is a dolomitic sequence with siltstone and 'calcrete' increasing in amount upward. The dolomites are grey, medium- to coarse-grained and often stromatolitic near the Supplejack Dolomite. They become fine-grained and beige in thinner beds towards the top.

The Bardia Chert Member marks in many places the top of the Skull Creek Formation. It is a massive, thick, brecciated chert thought to be of diagenetic origin. It contains relics of both stromatolites and dolomite beds.

Galena mineralization has been found just above and below the Supplejack Dolomite Member, but generally not within.
the member itself.

Bynoe Formation -
Conformably following the Skull Creek is a thick sequence of sandstone and siltstone that outcrops only in the central northern part of the two Authorities to Prospect.

The Bynoe Formation has a basal part containing green and purplish micaceous siltstones and shales, with few sandstone and dolomite interbeds. The rest of the Formation consists of thinly-bedded sandstone and slightly micaceous siltstone with rare, fine-grained dolomitic bands.

Salt casts, ripple marks and cross-bedding found in the Bynoe Formation are indicative of deposition in very shallow water with periods of subaerial exposure.

Weaner Sandstone -
The Weaner Sandstone appears only in a restricted curved belt between Jasper Gorge and Gregory's Remarkable Pillar. It is a conformable, thin series of white to brown quartz sandstone and gritstone that thins out to the north. It probably disappears completely north of Jasper Gorge, because on Fergusson River 1:250,000 sheet area the equivalent of the Battle Creek Formation, the Banyan Formation, lies unconformably on the Bynoe Formation.
Battle Creek Formation

This is the youngest unit of the Bullita Group in the Victoria River Downs region and the third formation that carries sulphide disseminations. It occurs generally east of the Weaner Sandstone, in a spacious basin filled with Antrim Plateau Volcanics. The basin probably extends north as far as the centre of the Fergusson River 1:250,000 sheet area, where the dolomitic Banyan Formation terminates the Bullita Group.

The lower part of the Battle Creek Formation is a sequence of greenish and purplish siltstones interbedded with dark-brown, coarse-grained, glauconitic dolomite containing iron oxides and manganese stains.

At the middle of the Formation is a series of red-brown, iron-rich, stromatolitic dolomites and the top of the Formation is a sequence of brown-yellowish, massive sandstone. The Battle Creek Formation is unconformably covered by the Stubb or the Wondoan Hill Formation or the Antrim Plateau Volcanics. The relation between the Battle Creek Formation and the older sequences of the Bullita Group is shown on Diagram G - 3.

Wondoan Hill Formation

This unit usually forms extensive plateaus unconformably overlying the Rynoe Formation, Weaner Sandstone and Battle
DIAGRAM G—3
SCHEMATIC CROSS-SECTION OF THE BULLITA GROUP

W

Victoria River

E

Timber Creek Formation (?)

Horizontal Scale  1: 250,000
Vertical scale exaggerated

LEGEND

Antrim Plateau Basalts
Auvergne Group
Jasper Gorge Sandstone
Bullita Group
Battle Creek Formation
Weaner Sandstone
Bynoe Formation
Skull Creek Formation
Supplejack Dolomite Member
Creek Formation. It is best developed in the Jasper Gorge area, where it reaches its maximum thickness. The Wondoan Hill Formation is sandstone and glauconitic sandstone with minor claystone and siltstone.

Auvergne Group

Of this Group, only two formations occur within the properties: the Stubb Formation and the very widespread Jasper Gorge Sandstone. The Stubb Formation is a sequence of micaceous shales and siltstones, and sandstone. It is restricted to the northern boundary of Authority to Prospect 2077, on the slopes of the plateaus capped by Jasper Gorge Sandstone.

The Jasper Gorge Sandstone has a huge areal extent, almost always unconformably overlying sequences of the Bullita, Wattie or Limbunya Groups. This well-sorted quartz sandstone is orange, cross-beded and resistant to the erosion. Therefore, it is generally found capping mesas.

Antrim Plateau Volcanics

The only igneous activity in the Victoria River Basin is of Lower Cambrian age. It consists of tholeitic basalt flows that have uniformly spread over the whole region, in a large zone extending from the East Kimberley to the Barkly Tableland. The volcanics are up to 250m thick with agglomerate,
sandstone, chert and limestone interbedded with the individual flows. These are the youngest rocks occurring within Authority to Prospect 2077 and 3071.

Superficial deposits

Deposits of Tertiary and Quaternary age have formed extensively in many places. They are thin red soils restricted to the Bynoe Formation and other sandstone-siltstone units, black soil plains well developed over the volcanic material and in some areas over the dolomitic sequences. No extensive laterites have been found within the tenements.

Red silty alluvium and gravel are restricted to the vicinity of the largest rivers.

Of interest is the calcrete formed over particular beds of the Timber Creek and Skull Creek Formation. It is up to few metres thick, calcareous, siliceous, white to purplish with dolomitic elements. It has probably formed over slaty, carbonate-rich siltstone.
MINERALIZATION

C. A. CHAPALLAZ

Lead, zinc and copper minerals have been found in the dolomitic parts of the Timber Creek, Skull Creek and Battle Creek Formations. These metals occur generally as stratabound primary sulphides disseminated through the dolomite beds. No vein, lode or massive occurrence of base metals was discovered.

Barite mineralization is widespread through all the formations mapped. It consists of small pods, sometimes containing disseminations of copper minerals, and veinlets. The best barite mineralization is associated with the Skull Creek Formation.

1) Base metal mineralization

The most common types of base metal occurrences are described hereunder with references to areas and locality numbers.

Small barite lenses or veinlets contain pyrite and chalcopyrite disseminations. The grain size of the metallic minerals never exceeds few millimetres across, and analysis of representative samples of this material yielded up to several thousand parts per million copper. The areal extent of outcropping mineralization is never
greater than several square metres. Such occurrences have been found in the following localities:

Area 3: T73, T84, T89.
Area 4: T155 to T158
Area 14: Area 19: Area 21
Area 21: 21 - 1 & 21 - 3.

These are related to faults or joints, which have the same trend as the axial direction of the structure they are associated with.

The most common occurrence of base metal dissemination is in the coarse-grained dolomite or pink to white, thin calcite zones in dolomite beds. The mineralized beds are found just below or above the Supplejack Dolomite Member of the Skull Creek Formation and in a thick dolomite bed of the Timber Creek Formation designated the Lower Marker. The best mineralized areas of this type are described in detail hereunder.

a) 'Lower Marker' of the Timber Creek Formation:

In Areas 8 and 16, galena, pyrite and chalcopyrite have been found in a subhorizontal, thick, dolomite bed of the Timber Creek Formation referred in this report as 'Lower Marker'. The bed contains mineralization along Gibbie Creek, near the junction of Depot Creek and the Wickham River, and north of this point. The mineralized bed has been traced on the 1:30,000 scale geological
maps of Areas 8 and 16.

Along Gibbie Creek, isolated patches of galena are scattered through the bed.

Near the junction of Depot Creek and the Wickham River, the mineralization is restricted to a band of coarse-grained, white to grey dolomite up to 10cm thick. The band contains fresh patches (up to 1cm across) and elongated grains of galena only, probably averaging 30 to 40% galena over 10cm. The mineralized band is locally discontinuous, but can be followed in the same horizon for several kilometres.

At several localities, disseminated pyrite and chalcopyrite has been found near the base of the Lower Marker.

b) "Charlies' Prospect":

On Area 4, at location T 146, widespread disseminations of galena, sphalerite and pyrite occur in a gently-dipping, thick, coarse-grained, grey dolomite bed. The bed contains chert laminae, and appears to be just above the Supplejack Dolomite Member of the Skull Creek Formation. Galena and rare sphalerite grains are up to 1cm across.
The mineralized thickness is in the range of 1 to 2m, and probably contains several percent of galena. However, the mineralization could be traced laterally for only about 300m.

c) **Area 11:**

Small blebs of galena up to 1cm long have been found in a series of flat-lying, coarse-grained dolomite beds just underlying the Supplejack Dolomite Member of the Skull Creek Formation. The mineralization has very little lateral extension. It is found at locations S172, S193, S225, S229 and S230.

Pyrite and chalcopyrite grains also occur in the Skull Creek Formation in the same area, in small calcite veinlets or vugs within the dolomite itself.

d) **Battle Creek Formation, Area 14:**

Fairly extensive disseminations of pyrite, chalcopyrite and galena have been found at several localities in the Battle Creek Formation, east of the Victoria River. The mineralization is in a brown, fine-grained dolomite bed showing small barite veinlets and numerous iron-oxide pseudomorphs after pyrite. It is gently undulating and stromatolitic.
Other occurrences with only limited areal extent and of no economic importance are disseminations of pyrite and chalcopyrite or galena found at the following places:

Area 1: T55.
Area 4: T98, T148, T161.
Area 8: S45, S49 to S54, S58 to S60.
Area 10: S213, S214.
Area 11: S162, S163, S172, S181, S183, S188, S207, S208.
Area 14:
Area 15:
Area 19:
Area 20: C98, C127.

Of interest is a reported occurrence of pyrite and chalcopyrite in water hole No. 1024, Whitewater Billabong, on the Humbert River Pastoral Lease. The mineralization is near the contact between the Bynoe and Skull Creek Formations. It is described by the driller as being associated with chert. (See C.A. Chapallaz: "Visit to the Water Resources Branch, Darwin". June 25, 1971).

Three concordant zones of brown-yellowish limonitic material were found during the mapping of Areas 1, 8 and 12. The largest is 20 m by 3 m and contains veinlets of barite. No typical gossan texture is developed. Analysis of this material gave values of up to 150 ppm copper, 180 ppm lead,
30ppm zinc and iron in excess of 20%.

2) Non-metallic mineralization
Barite blebs, patches and veinlets are found in many lithologies. This mineralization occurs either as disseminated blebs or as joint and crack fillings. At some places brecciated chert is cemented by barite. No significant deposits of this mineral have been discovered in the Authorities to Prospect. The best barite shows are at the following locations:

Area 2: T49, T52.
Area 4: T149.
Area 5: S239.
Area 10: S154.

A massive vein of barite outcrops just outside Authority to prospect 3071, at location C199. The vein is up to 1.5m thick and about 800m long. Three smaller veins lie parallel to the main one.

Fluorite grains, up to 5mm across are associated with thin calcite veins and a thin band of coarsely-crystaline, manganese oxide-rich dolomite on Area 11. Some pale green fluorite grains have also been found in the massive barite vein of location C199.

3) Other known mineral occurrences
Galena, sphalerite, copper minerals and barite have been reported by H. Schneider following the 1970 field mapping
of a 500-square-mile area of dolomite north of Victoria River Downs. These showings are described by H. Schneider in his report of December 7, 1970.

Manganese stains and nodules have been reported around Battle Creek within a purple unit of the Battle Creek Formation. These showings were examined by Sampey Exploration Services in 1969.

No significant copper occurrences have been discovered in the Antrim Plateau Volcanics in the Authorities to Prospect.
STYLE OF FIELD OPERATION 1971.

C.A. CHAPALLAZ

The main item of the 1971 exploration was the continuation and completion of the reconnaissance started in 1970 over the Proterozoic dolomites of the Victoria River Basin.

Three formations, involving dolomites and limestones, carry disseminations of sulphide minerals within Authorities to Prospect 2077 and 3071. These formations have been investigated in a reconnaissance during the greatest part of the 1971 field season.

This work, including prospecting, geological mapping and stream sediment sampling, started at the end of April from a centrally-located base camp, 8 miles west of Victoria River Downs Station, on the northern bank of the Wickham River. The first areas mapped were continuations of the Battle Creek and Skull Creek Formation exposures mapped in 1970 (see H. Schneider: "Mineralization of dolomitic sequences (Skull Creek Limestone) in the Victoria River Downs area, N.T., - Report on initial exploration", December 7, 1970). Particular attention was given to a belt of domal structures extending from Butt Hill to Mt. Warburton and the outcrops of Battle Creek Formation east of the Victoria River. The exploration then proceeded westward, over
large areas of outcropping Timber Creek and Skull Creek Formations along Gibbie Creek, Depot Creek, the Wickham River and the drainage basin of the Humbert River. Towards the end of the dry season, the base camp was moved to Timber Creek, making areas of interest around Bullita and in the Panhandle of Authority to Prospect 3071 more readily accessible.

The helicopter survey carried out by R. Allen in March and April, 1971 on the western part of Authorities to Prospect 2077 and 3071 showed that, apart from the dolomitie sequences exposed, there were large areas of outcropping sandstones and siltstones of the Wattie Group within the tenements. Important structural features in this group are probably due to faulting, and these warranted checking for mineralization before the renewal of Authority to Prospect 3071. This work has been done by helicopter during the month of November.

The basic technique used is geological mapping at 1:30,000 scale. This provides the basic knowledge for the interpretation of the stream sediment survey, the results of the prospecting, the airborne geophysical survey as well as for the regional study of the Proterozoic dolomite in the whole Victoria River Basin. Such a regional study is necessary because facies changes, reef structures and tectonic features can localize mineralization.
Prospecting was undertaken along with the mapping to locate outcropping mineralization and to aid in the interpretation of the geochemical data.

The stream sediment survey has been carried out in order to locate areas of anomalous base metal enrichment. Small creeks have been sampled, when practicable, in preference to large streams, in which dilution by material from barren areas obliterates signs of mineralization. The orientation work and subsequent sampling carried out during the 1970 field season proved the use of having the -16+44 mesh and -200 mesh fractions analysed. These two fractions give the best response to the type of mineralization sought. The samples were collected at 150m to 300m intervals in the smaller streams, but at about 300m intervals in the larger streams. The samples taken were sieved to 16 mesh on the spot, and analysed by atomic absorption spectrometry after perchloric acid attack. The analysis was done by Geochemical and Mineralogical Laboratories (N.T.) Pty. Ltd., in Darwin.

In the field, the stream sediment sample locations and the geological information have been plotted on transparent overlays on the 1:30,000 - scale aerial photographs.

After compilation of the maps of individual areas in the field, the data was plotted on 1:30,000 - scale base maps in Perth.
PART TWO
AREA 1

J.M. TRELOAR

Introduction

This area is 12 miles south-southwest of Victoria River Downs. The location, access, and general geology are shown on diagram 1 - 1. The country ranges from red soil plain where outcrop is less than 10% to gently undulating hills where outcrop is greater than 70%. Consequently, the streams are small and reflect the local geology.

The 1:30,000 - scale aerial photographic coverage is Victoria River Downs 1970,

run 2, photos 6226 and 6227.

run 3, photos 6217 to 6220.

Geology - Stratigraphy

Rocks ranging from Timber Creek Formation to middle Skull Creek Formation are exposed in the domal structure. Thinly interbedded sandstones and fine-grained dolomites with some chertification in the centre of
the dome are probably the upper beds of the Timber Creek Formation. Some barite, calcite and iron oxide veinlets and blebs occur in the dolomites.

<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skull Creek</td>
<td></td>
<td>Medium- to coarse-grained dolomites, which vary in siliceousness. Platy habit is developed in some laminated, sandy dolomites. Collenia structures up to 3m in diameter sometimes have chert and calcite veinlets following lamination outlines. These collenia-bearing dolomites are uniformly developed over large areas. They appear to have been matlike developments on the sea floor rather than reefs associated with abrupt changes in sedimentary facies.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chert horizons replacing dolomites become prominent. Barite and iron oxide in places are associated with brecciation of the somewhat vesicular chert.</td>
</tr>
<tr>
<td>Supplejack</td>
<td></td>
<td>A thick dolomite distinguished by its black weathering surface. It varies from fine- to coarse grained and from red to buff. Collenia structures are prominent.</td>
</tr>
<tr>
<td>Dolomite</td>
<td></td>
<td>Thin dolomites, dolomitic siltstones and sandstones. Chert laminae and nodules are common in the fine-grained dolomites. The dolomitic siltstones are laminated and some exhibit cross-bedding and scour-and fill structures. The sandstones have salt casts and ripple marks. Dolomite laminae bend smoothly around</td>
</tr>
<tr>
<td>Chert lenses indicating the chert has a syngetic origin.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thinly-interbedded fine-grained quartz sandstones, with salt casts and ripple marks, and fine-grained dolomites with chert laminae</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Some cherts that display collenia structures, partially silicified dolomite pods and lateral gradation into dolomite, appear to be structurally controlled and epigenetic in origin (locations T2 and T3).

Extensive outcrop permits beds to be traced throughout the area. No lateral facies changes were observed. There is a vertical change from a transitional terrestrial-marine facies to a marine facies.

**Geology - Structure**

The faulted, elongated dome trending southeast is contorted by a north-northeast fold and fault system. Joints and fractures in the brittle dolomites seem oriented by these major fold directions and the calcite and barite veining is similarly related. Anticlinal ridges on the red soil plain are also related to one or another of the main folds. Small folds on the limbs were also observed, but could be related to recent hill creep and erosion. The structures in this
area are extensions of those in areas 5 and 12.

Mineralization

Four areas of extensive barite impregnation were located. A thick epigenetic chert becoming more massive and brecciated near the nose of the fold (see Area 1-1) has concordant and discordant barite veinlets up to 8cm. wide, with accompanying calcite and iron oxides. The chert grades laterally into a thick, coarse-grained dolomite and is underlain by a similar bed, which is also cut by barite veinlets. Possible copper staining was recorded but no metallic minerals were observed (locations T3 and T4).

In area 1-2, there is a thick bed of grey and pink, fine-grained siliceous dolomite with numerous thin barite veinlets up to 1m long which follow joint directions. One vein 0.75m wide of powdery carbonate and iron oxides contains 58ppm copper, 62ppm lead and 8ppm zinc. Barite lacework on bedding planes was observed also. (location T29).

In Area 1-3, there is a grey, fine-grained dolomite with numerous chert laminae, especially near the base of the bed, where it has been brecciated and recemented with barite. This barite is especially well developed along 20m of the bed, but can be traced for at least one mile (location T38). This 2-metre-thick bed has been contorted at one point where iron occurs here over 10 metres. it contains 36 ppm copper, 98 ppm lead
32 ppm zinc, 20% iron and 5% manganese, and is similar to the iron oxide zones found in the other report areas (location T37).

Several hundred metres to the west there is a thick, mottled pink and light blue-grey siliceous dolomite with numerous calcite, barite and iron oxide veinlets in fractures which trend in many directions (T39).

No encouraging metallic mineralization was detected. Disseminated copper mineralization in vugs in coarse-grained dolomites and in barite smears was noted, and small iron oxide veinlets often with haematite psuedomorphs after pyrite were recorded.

**Geochemistry**

From a general study of the lead values, three anomalous areas are apparent. These appear to be structurally controlled.

**Anomalous Area 1 - 1**

The area is located in the southeastern corner of the fold. The streams intersect the structure generally at right angles so that any mineralized horizon should be evident. The stratigraphy consists of dolomites of varying degrees of silicification and texture interbedded with cherts and sandstones. The fold plunges up to 40° to the east. The southern limb dips up to 50° south, while the northern limb dips up to 30° north, but flattens out rapidly to a general dip.
of 15° north.

Mineralization detected in the area consisted of barite-calcite veinlets in a structurally-controlled epigenetic chert. Two streams running along this horizon have anomalous copper, lead and zinc values, but away from this area there are no anomalous values related to this horizon, so it appears that there is structural control of this mineralization. Although no mineralization was detected in horizons near the Supplejack Dolomite, the lead values indicate a slightly higher background value there.

The high values of 550 ppm lead, in the -16+44 mesh fraction, 66 ppm lead in the -200 mesh fraction and 60 ppm zinc in the -16+44 mesh fraction reflect probable galena and sphalerite mineralization in the chert. The other high values are sporadic and often do not correspond in different fractions. As there is no apparent pattern, it is inferred that the area has a higher background.

**Geophysics**

The electromagnetic (F400EM) anomalies over outcrop do not correspond with any topographic feature that could explain them, nor with the structural contortions. L.J. Starkey's anomaly 8, which has a moderate to strong conductivity ratio, follows the strike
of the beds in a highly faulted area. The other anomalies occur on the red soil plain and could correspond to saline water. Anomaly 8 correlates closely with very low frequency electromagnetic (KEM) anomalies, one of which has an anomaly depth of zero metres and is probably due to saline water, while the other has a depth of 60m. There are numerous other KEM anomalies over outcrop, and seven in the region of anomaly 8, but five of these have an anomaly depth of zero metres. As no mineralization could be seen, these five are attributed to saline water or other spurious responses. The areas of electromagnetic anomalies plotted by Starkey do not correlate with geological features evident on the air photos and both the F400 EM and KEM anomalies are best interpreted individually.

Starkey considers the F400 EM anomaly 8 important, even though of low intensity. As it corresponds with KEM anomalies and KEM anomalous zones, which according to him, could represent disseminated mineralization, this area warrants further investigation.

Anomalous Area 1 - 2

This is located in the northern part of the area. The relief is gentle, exposing about 30m of interbedded dolomites and dolomitic sandstones just above the Supplejack Dolomite. The less siliceous dolomites
occur as calcrete zones between the more resistant beds.

Mineralization is negligible and only barite veinlets with possible copper staining were found. There are numerous metal anomalies in the stream sediments. Three high lead values (1300, 1300 and 1800 ppm) in the -16+44 mesh fraction indicate that perhaps a horizon with galena occurs in this area. The sequence is flat-lying in the centre and the lack of outcrop hinders observation. Other high lead values (430 ppm and 230 ppm) also come from this flat-lying central area, so some degree of stratabound concentration seems likely. There are corresponding lead anomalies in the -200 mesh fraction, zinc anomalies in the -16+44 mesh fraction, and copper anomalies in the -16+44 mesh fraction.

The western area around the fault has some moderately anomalous lead values (290 and 230 ppm) in the -16+44 mesh fraction in a flat area with 75% soil cover. An area to the west of the fault zone is slightly anomalous in copper without corresponding lead and zinc anomalies. It seems related to some barite-copper mineralization associated with anticlinal ridges. The
fault does not seem to influence the stream sediment results to a marked degree, but perhaps closer spaced soil sampling might detect something.

Geophysics

The F400 EM anomalies over outcrop in the fault area are parallel to the fault, but are displaced a few hundred metres to the west, which indicates the fault dip westward. The anomalies are generally of low conductivity ratio and low intensity, but Starkey regards this anomaly pattern as important. The other F400 EM anomalies over outcrop do not appear related to structural or topographic features.

There are several KEM anomalies over outcrop in the fault area, but most of them are located in stream beds or have an anomaly depth of zero metres. They do not correlate closely with the F400 EM anomalies. Starkey's lines do not correlate with the mapped geology, but could be related to shallow ground water features.

Anomalous Area 1 - 3

This is to the extreme north of the area and is an extension of the faulted and folded zone to the south. The stratigraphy exposed is similar to area 1 - 2, but includes the chert horizon found on the nose of the fold in area 1 - 1.
The dolomites are generally coarser grained, have more barite-calcite veinlets and are mottled pink to blue-grey than elsewhere. These features seem to be related to low-amplitude, short-wavelength folding superimposed on the elongated dome.

The lead values in the -16+44 mesh fraction are almost all anomalous, but only a few values are very high (420, 380 and 250 ppm). These high values could relate to a single horizon. The lead, copper and zinc values in the two fractions analysed were also anomalous. The copper anomalies occur on the western side of the fault on the red soil plain, as in area 1 – 2.

Geophysics

The F400 EM anomalies are nearly parallel to the fault and are on its western side, indicating that the fault dips to the west. The anomalies on the eastern side are all on the red soil plain and cannot be correlated with structural or topographical features.

The KEM anomalies on the western side do not correspond with F400 EM anomalies, but occur in the same area. The calculated KEM anomaly depths are up to 40m. The lack of outcrop hinders the correlation of the anomalies with the geology. On the eastern side of the structure, the KEM anomalies correlate fairly well with
some F400 EM anomalies, but these are near fence lines on red soil plain, so interpretation is difficult. The two zones of possible disseminated mineralization are in red soil plain to the east of the structure at depths of 160m and 105m. The deeper one corresponds with an important F400 EM anomaly.

No basement structures were detected from the magnetics which indicate that the basement surface dips to the west at an average depth of 2160m.
Introduction

This area is 25 miles north of Victoria River Downs Station along the Timber Creek road. The relief is rugged where there are chert ridges, but all points are accessible by four-wheel-drive vehicle. The location, access and general geology are shown in diagram 2 - 1.

The 1:30,000 - scale aerial photographic coverage is Victoria River Downs 1970

run 1, photos 6254 to 6259
run 2, photos 6241 to 6247

Geology - Stratigraphy

Rocks of the Skull Creek Formation, ranging from just below the Supplejack Dolomite Member to the Bardia Chert Member, are exposed in an anticline. The Bynoe Formation is sporadically exposed on the adjacent red soil plain.
<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bynoe</td>
<td></td>
<td>Outcrop, less than 10%. Thinly interbedded green, yellow and red shaly siltstones, dolomitic sandstones and minor dolomites. They are soft, well cleaved, carbonate-rich sediments, deformed easily into anticlinal ridges.</td>
</tr>
<tr>
<td>Skull Creek</td>
<td></td>
<td>Fine- to coarse-grained dolomites and dolomitic siltstones; well cleaved, with some chert lenses. Up to 3m thick.</td>
</tr>
<tr>
<td></td>
<td>Bardia Chert</td>
<td>A thick-bedded, epigenetic chert, white to orange, in places brecciated and containing iron oxides and barite impregnations. It grades laterally into coarse-grained dolomite, and has remnant dolomite pods.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Siliceous, medium-grained dolomites and dolomitic sandstones, thick and massive, with collenia structures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chert varying from brecciated, coarse-grained orange-brown to fine-grained, bedded, white-orange, exhibits remnant dolomite pods.</td>
</tr>
<tr>
<td></td>
<td>Supplejack Dolomite</td>
<td>Thick, fine- to coarse-grained massive dolomites and dolomitic siltstones, with chert laminae and pods in most of the thinner beds. Some have collenia structures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chert, massive, banded, brecciated in places.</td>
</tr>
</tbody>
</table>
Outcrop in the anticlinal structure is greater than 70% so beds could be traced throughout the structure. No lateral facies change in the dolomites was detected. The epigenetic cherts showed lateral gradation into coarse-grained dolomites away from the areas of the most intense deformation, so it seems the cherts are tectonically controlled.

Geology - structure

An anticline trending 330° with the western limb dipping up to 15° and the eastern limb dipping up to 30° plunges up to 20° north. Fracture systems which parallel the fold axis have facilitated erosion, so that along the axis the chert has been eroded and the beds stratigraphically beneath it are exposed now.

A fault that has a 1.1 km long curvilinear, surface trace, and that displays little evidence of movement, has distorted the beds (see diagram 2 - 2). Neither brecciation nor mineralization was detected along the fault.

Mineralization

In the southern part of the area, the only mineralization observed was an iron-rich boulder with microcrystalline quartz stringers and small, black, translucent grains (location T42). A sample of it contained 112 ppm copper, 30 ppm lead, 360 ppm zinc, 24.5% iron and 5.5% manganese.
DIAGRAM 2-2
FAULT ON WESTERN FLANK OF ANTICLINE

LEGEND
- Dolomitic sandstone
- Dolomite
- Fault

EAST
WEST
10°
15°
80°
F
The source of the boulder is unknown.

In the northern half of the area, there is a 1km-long, epigenetic chert ridge trending 060° and following a photolineament. The ridge has apophyses into the gently-dipping dolomite sequence. The rock forming the ridge is brecciated and recemented with barite, calcite, iron oxides and possibly base metal sulphides (location T51). The mineralized material assayed 10ppm copper, 16ppm lead, 14 ppm zinc, 2.4% iron and 550 ppm manganese. Two vertically-dipping calcite-barite veins parallel this lineament and cut the dolomites (location T49 and T52). One is 150m long and up to 2m wide, the other is 200 m long and 30cm wide, but neither display base metal sulphides. About 1km north, there is an anticlinal ridge 40m long and 10m wide. Minute, disseminated grains of malachite and chalcopyrite occur in a coarse-grained, pink calcite rock in the centre of the ridge (Location T55). Numerous other ridges in the area have the same rock type but do not contain mineralization.

There is an iron-rich, brecciated, laminated chert horizon containing 28ppm copper, 88ppm lead, 84ppm zinc, 7.6% iron and 900ppm manganese in the centre of the anticline (location T47). It could be related to movement between more competent beds during folding. Other mineralization detected includes disseminated pyrite; haematite, pseudomorphic after pyrite; iron oxides and barite-calcite veinlets.
Geochemistry

In the southern half of the area, the streams drain only the chert horizon and the immediately underlying dolomites, so the sample results are excessively diluted by chert fragments.

Using a threshold value of 32 ppm lead for the -16+44 mesh fraction slightly anomalous values occur up to 1km upstream from the iron-rich boulder previously mentioned so prospecting for the source in this area is warranted. An area 2km north has anomalous values of up to 130 ppm lead but corresponding values of copper and zinc are low. Although prospecting detected nothing, these two anomalous areas are along strike, so perhaps there is a slightly mineralized horizon underneath the chert. This correlates with another slight anomaly 1km north along strike.

In the northern half of the area there are numerous distinct lead anomalies. Lead anomalies in the -200 mesh fraction and zinc from the -16+44 and -200 mesh fractions correspond with the higher lead values. No copper anomalies occur. The slight anomalies in streams draining the centre of the structure could be explained by the brecciated, laminated chert horizon. The lead values generally are less than 160 ppm with one high value of 360 ppm.
There is one lead value of 290 ppm in a short stream draining the fault with the curvilinear trace, but no surface mineralization was observed here.

On the western flank of the structure, there are some high lead values of 900 ppm, 800 ppm, 580 ppm and 430 ppm in the -16+44 mesh fraction. These are in a region characterized by lead values in excess of 200 ppm. There are corresponding lead anomalies in the -200 mesh fraction and zinc in the -16+44 and -200 mesh fractions. Around the epigenetic chert ridge and barite veins there are anomalous lead values of up to 280 ppm. These could be related to remobilization during the chertification of the linement. However, the streams on this western flank drain the same stratigraphic section and if there is a mineralized horizon, it could produce all the anomalies. There are no copper anomalies in the streams draining the anticlinal ridge in which malachite and chalcopryite were found, so this copper mineralization does not seem to be very extensive.

Geophysics

In the southern half of the area, there are many electromagnetic (F400 EM) anomalies and L. J. Starkey has defined four anomalous zones. However, joints, surface conductivity changes, relief changes and streams can explain almost all the anomalies. A definite zone of anomalies
parallels the boundary between the chert and the red soil plain where a conductivity change occurs. Another zone of anomalies follows the break in slope of the chert where underlying rocks become exposed. However, the anomalies around the iron-rich boulder could be worth investigation. The line of anomalies of moderate conductivity parallel to the fold axis could be related to a fault. Brecciation further north along the axis supports this contention.

In the northern half of the area, there are several anomalies with high conductivity ratios. Starkey's anomaly 6, in the area of the barite-calcite veins, seems related to the structure. Other anomalies in the area have high conductivity ratios but seem related to features like joints and anticlinal ridges. Further work is warranted in this area.

There is a zone of anomalies along the boundary, between the outcrop and the red soil plain. The anomalies in the centre of the structure cannot be correlated with observations made during prospecting or features on the aerial photographs. Some occur in areas of geochemical anomalies and warrant further investigation. The Bureau of Mineral Resources has mapped a large fault on the eastern side of the structure, where a large number of anomalies with moderate to strong conductivity ratios occur, however,
field observations did not detect the fault. These electromagnetic anomalies are related either to this fault or to the break in slope between the outcrop and red soil plain.

Starkey's anomaly 3, has a strong conductivity ratio but is on the flood plain of Surprise Creek and could represent saline water. The anomalies further north are mainly on red soil plain, and correlate with water holes, anticlinal ridges and rivers.

No basement structures were observed from the magnetics. The basement dips gently to the northeast at an average of 6400 feet below the surface.
Introduction

This area is located 13 miles west of Humbert River Station along the Humbert River - Bullita trail, which is the only access. The relief is rugged, but it is possible to travel throughout the area by four-wheel-drive vehicle. The location, access and general geology are shown on diagram 3 - 1.

The 1:30,000 - scale aerial photographic coverage is Humbert River 1971.

run 3, photos 2275 to 2278
run 4, photos 2433 to 2438
run 5, photos 2584 to 2586.

Geology - Stratigraphy

Rocks ranging from the Gibbie Formation of the Wattie Group to the Jasper Gorge Sandstone of the Auvergne Group are exposed. Outcrop is generally greater than 60%. There are no large red soil plains. No lateral facies changes were observed, but a vertical change
DIAGRAM 3-1
LOCATION, ACCESS AND GENERAL GEOLOGY

LEGEND

AUVERGNE GROUP
- Jasper Gorge Sandstone
- Stubb Formation
- Wondoom Hill Formation

BULLITA GROUP
- Bynoe Formation
- Skull Creek Formation
- Bardia Chert Member
- Supplejack Dolomite Member
- Timber Creek Formation

WATTIE GROUP
- Seale Sandstone
- Gibbie Formation

SCALE 1:250,000

Fault
Fold
Track
River, creek
Area covered

Southern Monoclinal Structure

Jasper Gorge Sandstone
Timber Creek Formation
Seale Sandstone
Timber Creek Formation

Domal Structure

Jasper Gorge Sandstone
Timber Creek Formation
Gibbie Creek Formation
Timber Creek Formation

Domal Structure

Skull Creek Formation
Skull Creek Formation
Humbert River
occurs from transitional terrestrial-marine facies to marine facies.

<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasper Gorge Sandstone</td>
<td></td>
<td>Thick, quartz-rich sandstone varying from a soft, coarse-grained sandstone, with cross-bedding and ripple marks, to a hard, fine- to medium-grained sandstone.</td>
</tr>
<tr>
<td>Stubb</td>
<td></td>
<td>Manganiferous sandstone and red brown silty sandstone. The unconformity with Skull Creek Formation is covered by scree, but a difference in dip is observed.</td>
</tr>
<tr>
<td>Skull Creek</td>
<td>Supplejack Dolomite</td>
<td>A fine- to coarse-grained dolomite with lenses of thin, coarse-grained barite and calcite. Red-brown to buff, but with a black weathered surface. Vugs containing haematite-stained dolomite crystals and white powdery material. Collenia structures range up to 3m in diameter often with calcite veinlets following the outlines. Dolomites become sandy and laminated, some have cherty lenses following collenia structures. They are massive beds up to 2m thick, some show cross-bedding.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thin, fine-grained, grey dolomites with chert laminae and fewer collenia structures, interbedded with quartz sandstones with ripple marks and salt casts.</td>
</tr>
</tbody>
</table>
### Timber Creek

<table>
<thead>
<tr>
<th>Thinly-interbedded sandstones and dolomites. The quartz sandstones have salt casts generally about 3mm across and asymmetrical ripple marks. The dolomites are grey, fine-grained and with either thin, pink, ropy chert and calcite laminae, or thicker lenses of dull, coarse chert.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>There is a four-foot-thick marker horizon of dark grey, coarse-grained dolomite, half replaced by veins of blue vesicular chert. These veins follow stromatolite structures and a sample contained 10ppm copper, 14ppm lead and 8ppm zinc.</th>
</tr>
</thead>
</table>

### Seale Sandstone

<table>
<thead>
<tr>
<th>Thick, massive, orange and white quartz sandstone of varying texture and compactness, with asymmetrical ripple marks and cross-bedding.</th>
</tr>
</thead>
</table>

### Gibbie

<table>
<thead>
<tr>
<th>Thinly-bedded, red-brown dolomitic sandstones and pale green, well-cleaved, micaceous siltstones with thin dolomite beds. Carbonate crystals up to 2mm long occur with smaller mica and quartz grains in the sandstone. An epigenetic chert has replaced some of the beds in the centre of the southern anticlinal structures.</th>
</tr>
</thead>
</table>

### Geology - Structure

There are two narrow, tight, elongated domes trending 135° in an otherwise gently-dipping area (see cross-section diagram 3-1.) Near the centre of the northern dome on the northern limb beds are overturned, but 1km from the axis the beds...
20°. Joints are parallel to, and perpendicular to, the axis of the northern dome. Anticlinal ridges trend in many directions. The southern dome has limbs dipping 35°, with closures plunging 20° southeast and 50° northwest. Large joints and faults extend parallel to the axis for 5km. The anticlinal ridge system has members parallel to, and perpendicular to, the axis.

There is a monocline or fault structure in the extreme south of the area, trending 345°. (see cross-section diagram 3-1). The beds of this structure dip up to 80° east.

**Mineralization**

Three small barite-calcite pods without associated metallic mineralization occur near the axis of the northern structure. The largest is a 5m by 10m irregular pod, occurring in a fine-to-coarse-grained, chertified dolomite (location T73). The other two are 2m by 3m pods, one occurring along a small fault and the other in a thin, fine-grained sandstone bed (location T84 and T89). The control of this mineralization is obscure.

On the southern limb of the southern dome, there are small, discontinuous barite veinlets controlled by joints in the sandstone (location T125). These barite veinlets also have no associated metallic mineralization.
Below the Supplejack Dolomite Member, there are several 1m-thick, grey, fine-grained dolomites. These contain red silica pods up to 12cm long, which enclose barite pods. The barite often contains 1mm-sized grains of chalcopyrite altering to malachite.

Generally, there is negligible mineralization, especially in undeformed areas.

Geochemistry

The area with the barite pods has a slightly higher background content of lead, perhaps reflecting the more intense deformation there. Apart from this, there are no interesting results in lead and copper in either sediment fraction.

There is a zinc anomaly in the -16+44 mesh fraction, with values of 62, 50, 50 and 46 ppm. No corresponding zinc anomalies in the -200 mesh fraction, lead anomalies or copper anomalies occur. No explanation for the zinc anomaly was observed in the field.

Conclusions

The Timber Creek Formation, Seale Sandstone and Gâbbie Formation in this area are barren formations relative
to the Skull Creek Formation, which exhibits higher background values for lead, zinc and copper. In the southern part of the area, the high content of sand in streams may have masked any anomalies, but, in general, the area is unprospective.
INTRODUCTION

This area is located 25 miles northwest of Humbert River Station and covers 225 square miles on both sides of the Bullita trail. Access from the trail into most points in the area is possible by four-wheel-drive vehicle. To prospect and sample the East Baines River area, a rough track was made alongside the river from Bullita Station. The location, access and general geology is shown on diagram 4 - 1.

The 1:30,000 - scale aerial photographic coverage is Humbert River 1971

run 1, photos 2123 to 2130
run 2, photos 2152 to 2158
run 3, photos 2269 to 2274
run 4, photos 2426 to 2432
run 5, photos 2576 to 2584
run 6, photo 2215.

GEOLOGY - STRATIGRAPHY

Rocks ranging from the Gibbie Formation to the Jasper Gorge Sandstone are exposed. Outcrop is generally greater that 60% except on the red soil plain in the central north of the area, where outcrop is less than 10%.
DIAGRAM 4-1a
CROSS-SECTIONS A-B AND C-D
No lateral facies changes were detected.

<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasper Gorge Sandstone</td>
<td></td>
<td>White and orange, quartz sandstone varying in texture and compactness, with cross-bedding and ripple marks.</td>
</tr>
<tr>
<td>Bynoe</td>
<td></td>
<td>Thin, interbedded, green, yellow and red shaly siltstones, dolomitic sandstones and minor dolomites. These are soft, well-cleaved, carbonate-rich sediments.</td>
</tr>
<tr>
<td>Skull Creek</td>
<td></td>
<td>Interbedded dolomites, silty dolomites, minor sandstone and chert. Beds in the upper part of the formation are thick, medium-to coarse-grained dolomites, often with collenia structures. They contain coarse-grained, conformable lenses of calcite and barite. They vary in colour from red-brown to off-white. Vugs with haematite-stained carbonate crystals and white powder occur sporadically. Some silty dolomites are laminated and contain chert lenses. Others are soft and massive. Platy habit is often developed in the thinner beds.</td>
</tr>
<tr>
<td>Supplejack Dolomite</td>
<td></td>
<td>A marker horizon in the lower part of the sequence. Medium-to coarse-grained, red to buff dolomite with collenia structures up to 3m in diameter. Calcite stringers often follow the collenia outlines.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chert, red to white, banded, sporadic brecciation with iron oxide staining</td>
</tr>
</tbody>
</table>
### Geology - Structure

The elongated dome of area 3 continues northward and gradually dies out. It is faulted, contoured, and the trend of the axis changes from $310^\circ$ to $270^\circ$ and then back to $310^\circ$. Another elongated dome in the northeast trends $030^\circ$ and plunges $30^\circ$ at both ends. It is faulted by a large, chertified, transcurrent fault zone at the south end. A similar fault zone to the west is also chertified. These two fault zones are colinear and trend $120^\circ$. Other faults
in the area are smaller and are either normal or transcurrent faults.

The joint and anticlinal ridge systems are either parallel, perpendicular or form a conjugate set to the dome axes.

Mineralization

Several concordant barite veins up to 20m long and 1m thick occur at the base of a chert band that follows the large transcurrent fault (location T149, diagram 4 - 2). The steeply-dipping chert grades into a coarse-grained, cherty dolomite as the beds are traced out of the fault zone. The veins contain some calcite and iron oxides but no metallic mineralization was detected.

Some grey, fine-grained dolomites have small red silica pods. Within these pods are barite and calcite blebs that in places contain chalcopyrite grains up to 1mm square, (location T94). The dolomites are four-foot-thick beds with dolomite extensive chert laminae. They occur below the Supplejack Dolomite Member. The mineralization appears related to the purity of these dolomites.

Coarse-grained concordant lenses of calcite and barite in medium- to coarse-grained dolomites often contain copper minerals or galena (locations T155, 156, 157 & 158). Chalcopyrite, malachite and chalcocite also occur in vugs filled with coarse-grained iron-stained dolomite crystals and calcite or barite. This mode of occurrence is restricted to the thick dolomite beds above the Supplejack
Dolomite.

The most extensive galena mineralization is in a coarse-grained cherty dolomite at "Charlie's Lead Prospect" (location T146). Galena crystals up to 1cm across are disseminated throughout medium- to coarse-grained dolomites along a prominent vertical joint face trending 110°. About 100m north of the joint face, the cherty dolomite horizon forms a dip slope with galena crystals disseminated on the surface. There is a relatively barren, thin, dolomite bed with collenia overlying the mineralized horizon. Sphalerite, chalcopyrite, malachite and pyrite grains accompany the galena mineralization, but are generally restricted to barite- and calcite-filled vugs. The joint system could have facilitated the chertification and mineralization.

Single galena crystals up to 1cm across have been found in a flat-lying, sandy dolomite (location T98), a contorted blue-grey dolomitic sandstone (location T148) and a coarse-grained, pink, calcite rock (location T161). Iron oxide veinlets occur in some dolomites as fracture fillings.

Geochemistry

Several areas with anomalous lead values have been delineated. A correlation of these lead values with those of zinc and copper reveals a zoning in which lead, zinc and slight copper anomalies occur below the Supplejack Dolomite and lead, copper and slight zinc anomalies occur above the Supplejack Dolomite.
In area 4 - 1, galena and chalcopyrite was found in gently
dipping beds below the Supplejack Dolomite (locations,
T96 and 98). Moderate lead, zinc and slight copper
anomalies occur in streams which drain this part of the
sequence. These anomalies are related to the visible
mineralization. Streams west of "Charlie's Lead Prospect"
have slight lead, zinc and copper anomalies probably
related to the vertical joint. To the north, two moderate
lead and zinc anomalies occur below the Supplejack Dolomite
and are probably related to these mineralized horizons,
though field observations did not detect disseminated
sulphides.

In Area 4 - 2, the streams draining the fault zone have
erratically high lead and zinc values. Several anomaly
patterns reflect higher background values for metals
in particular horizons or correlate with observed sulphide
dissemination. For example, the small stream draining the
area where disseminated galena was detected (location T148)
contains 160ppm lead in the -16+44 fraction. Some streams
have anomalous values outside the fault zone and erratic
anomalous values along and past the fault. The eastern
area with lead values of 320, 260 and 200 ppm warrants
further prospecting.

Area 4 - 3 has high lead and zinc values with slightly
higher copper values in streams draining the western limb of
the structure. A horizon of higher background values could
produce the anomalies, although prospecting detected only
iron oxide veinlets. Lead values of 160 ppm and zinc values of 140 ppm encourage further work in this strongly contorted area.

Area 4 - 4, incorporates the zone of lead and copper anomalies above the Supplejack Dolomite. Lead values up to 1400 ppm copper values up to 66 ppm delineate a high background horizon immediately above the Supplejack Dolomite. Galena and chalcopyrite disseminations detected in the beds have been found in other areas to be slightly concentrated in a band just above the Supplejack Dolomite. The copper occurs in coarsely crystalline silica, barite and dolomite lenses. These seem to have formed no earlier than during late-stage diagenesis. The reason for their restriction to these horizons is obscure.

The galena both above and below the Supplejack Dolomite Member has a mode of occurrence consistent with syngenesis.
Introduction

This 18-square-mile area is located about 6 miles southwest of Victoria River Downs Homestead. The Victoria River Downs - Humbert River road follows the river through the northern part of the area. Most points away from this road can be reached by four-wheel-drive vehicle. The location, access and general geology are shown in diagram 5 - 1.

The 1:30,000 - scale aerial photographic coverage is Victoria River Downs 1970:

run 2, photo 6231
run 3, photos 6213 to 6215
run 4, photos 6173 to 6176

Geology - Stratigraphy

The main formation exposed is the Skull Creek Formation. Its lithologies are dolomite and siltstone with very minor sandstone. The Timber Creek Formation is exposed in the central part of the area.
DIAGRAM 5-3
IDEALISED SECTION ACROSS DOMAL STRUCTURE

LEGEND

- Calcrete
- Dolomite - siltstone - calcrite
- Supplejack Dolomite
- Dolomite - siltstone - calcrite
- Chert-banded dolomite
- Silty-calcrete with thin dolomites
- Reddish sandstone

HORIZONTAL SCALE 1:30,000
\( \frac{V}{H} \approx 8 \)
<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skull Creek</td>
<td></td>
<td>Exposed over a large area. Thickness unknown, possibly represents weathering of some 200m of carbonate and siltstone sediments. Silty and siliceous in places. Pinkish iron and/or manganese-stained patches common. Thin sandstone bed at base.</td>
</tr>
<tr>
<td></td>
<td>Resistant dolomite, commonly silicified and containing chert nodules, interbedded with slightly thicker siltstone-calcrete beds that probably represent thinly-bedded siltstone and dolomite or limestone, with carbonates predominant. No sandstone. Thickness 100m to 130m.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supplejack Dolomite</td>
<td>Coarse-grained dolomite with dark weathering surface. Notably rich in &quot;collenia&quot; structures (diagram 5 - 2) Thickness 6m to 20m.</td>
</tr>
<tr>
<td></td>
<td>Thin, resistant dolomite beds, generally about 50cm thick with chert nodules. Thicker siltstone-calcrete beds than above Supplejack Member. Boundary between Skull Creek and Timber Creek Formation lies in this interval. Thickness 150m to 200m.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thick bed with two zones of intense chertification having individual chert bands up to 10cm wide, which are roughly conformable with bedding. Some limonitic encrustations associated with chert. Thickness about 20m.</td>
<td></td>
</tr>
</tbody>
</table>
DIAGRAM 5-2
COLLENIA STRUCTURES IN SUPPLEJACK DOLOMITE

PLAN

SECTION

SCALE 1 inch = 4 feet
Timber Creek

Silty calcrite is probably weathered equivalent of thin-beded siltstones and dolomites. Irregularly-spaced, resistant beds of silicified dolomite up to 2m thick typified by bands, nodules and flaky stringers of iron-rich chert. Several sandstone beds, each less than 1m thick, present in lower part of sequence. Thickness approximately 70m.

Medium-grained, platy. Abundant salt casts (up to lcm across) ripple marks and cross-bedding. Thickness at least 2m.

In the southern part of the area, large masses of chert are exposed. These often cover the tops of low hills and form ridges and long slopes. The strikes of the bedding and jointing are not consistent over a large area.

The chert does not appear to be conformable. Most likely it is of tectonic origin since its occurrence in other areas on Victoria River Downs appears to be restricted to regions of large scale deformation, e.g. west of Kidman Springs.

**Geology - Structure**

The area of this report represents the southern half of a dome that crosses the Wickham River. It is elongated northward, the length being about twice the width. The axis of the structure trends about 165°. On the eastern limb the beds dip generally about 35° east with a variation from 20° to 55°. The western limb has more gentle dips, averaging about 15° west, but varying from 0° to about 30°, discounting smaller-scale contortions.
The long axis of the structure is marked by a definite lineament. Along it, brecciation is seen in places. Parallel, tree-marked lineaments exist about 500m to the west and 300m to the east but their origins are difficult to determine; possibly they mark two shear zones.

Anticlinal ridges are features of the area (diagram 5 - 4). They vary from 5m to over 1.5km in length and their width ranges from 2m to 7m, with a few up to 20m wide. The limbs dip outward from the axis at 40° to 60°, although, in places they dip vertically. The cores of these anticlinal structures are composed of silty calcrete and the limbs may or may not be capped with thin beds of dolomite, sandstone or chert. Anticlinal ridges are rarely seen where there are thicker dolomite beds. The synclinal structures between the ridges appear to be gentler with much greater apical angles than the anticlines and with lesser brecciation along their axes. The ridges can intersect, although in a particular area one orientation usually predominates. No attempt has been made to analyse the trends of these ridges over a large area, although such a study could prove useful. The silicified dolomite beds are much more competent than the calcrete and siltstone, hence the latter are generally contorted and show few remnant bedding structures, while the silicified dolomites remain relatively unscathed, and show ripple marks and cross-bedding.

Mineralization

Most of the dolomites have some minor mineralization. This
DIAGRAM 5-4
CROSS-SECTION OF ANTICLINAL RIDGE STRUCTURE

Shearing effect in axial area

Dolomite cap

Calcite and siltstone core (greater deformation)

SCALE

10 Feet
includes barite pods scattered through the beds, as well as oxidized, iron-rich veinlets sometimes associated with barite and commonly showing pyrite psuedomorphs (location S246). At one anticlinal ridge (location S248) these barite pods become more abundant, sometimes breaking into small veinlets and fracture fillings up to 1cm wide. Occasional specks of malachite may be found in iron-rich cavity fillings (location S249).

Another form of mineralization is associated with chert masses that are probably of tectonic origin (locations S241 S242, S243, S250 and possibly S239). Iron-rich encrustations and gossanous-looking limonites accompany these. Small amounts of galena have been found within the cherts (location S241). Barite veins up to 30cm wide are abundant. These veins are brecciated and have a limonitic matrix along the axis of the major dome. The barite occurrences at location S239 is the largest seen in this area with small pods distributed over a length of 250m and width of 15m. It is wholly contained within a cherty dolomite bed.

Another occurrence (location S247), which may not fit into either category, is a lens-shaped zone of iron oxides within a dolomite bed. This lens is about 10m long and up to 1m thick. It contains limonite and haematite with a little chert.

The largest mineralized area encloses locations S241, S242 and S243. It extends for several hundred yards.
Geochemistry

271 stream sediment samples were taken in the 1971 field season and 97 were taken during 1970. Copper, lead and zinc were analysed in the -16+44 mesh and -200 mesh fractions. Analyses for iron and manganese were made where results exceeded 60ppm.

The sample interval was generally around 250m on streams up to 1.5km long but larger streams were sampled at intervals of 330m to 400m. Emphasis was placed on the smaller streams during the sample collection.

This area lends itself well to graphical analyses of the stream sediment data because of the homogeneity of its lithologies and its restricted drainage system. In other words, the area can be regarded as several drainage basins, the streams of which do not carry in sediment from outside regions of different lithologies.

Zinc (fine and coarse fractions) and copper (fine fraction) show no interpretable deviation from lognormality.

A cumulative frequency plot of lead values in the coarse fraction on log-probability paper displays 3 distinct linear trends with breaks of slope at 26ppm and 210ppm. This could represent three populations. The lowest population would be a background distribution and the highest values may be due to sporadic galena grains in the
sediments. The middle population covers 47% of the values. The upper part of this population, 70 to 210 ppm only, was plotted to avoid most of the influence from background. Values above 210 ppm the third population, representing 20% of the total and belonging to a different graphical trend, were plotted separately.

The 70 to 210ppm values as well as some of the higher values would appear to be derived from a horizon about 60m above the Supplejack Dolomite Member (diagram 5-5).

The high lead values near the centre of the dome, which range from 140ppm to 620ppm are derived from a position equivalent to the mineralized horizon that is just below the Supplejack Member on Bullita Station. However, the likelihood that this is only a residual accumulation of lead mineral grains from the first horizon should also be considered.

The copper values in the -16+44 mesh fraction show only two real trends. The one that could be considered anomalous represents only 3% of the total number of samples, those from 35 to 100ppm. Some of these values appear to be derived from the proposed anomalous lead horizon.

A few high copper and lead values in the south and south-east of the area occur in a calcrete-siltstone sequence which is marked with anticlinal ridge structures.
Useful background and threshold values have been estimated for the area as follows:

<table>
<thead>
<tr>
<th>Element</th>
<th>Fraction</th>
<th>Background (ppm)</th>
<th>Threshold (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu</td>
<td>-16 + 44</td>
<td>15</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>-200</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Pb</td>
<td>-16 + 44</td>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>-200</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td>Zn</td>
<td>-16 + 44</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-200</td>
<td>15</td>
<td>-</td>
</tr>
</tbody>
</table>

**Geophysics - Magnetics**

An airborne magnetic and electromagnetic geophysical survey covered this area. (see Report by L.J. Starkey 1971).

A basement contour plan was prepared from the magnetic data. This revealed one fault running under the southern extension of the dome and another, outside the area of this report, under the most northern portion of the dome. The area between is interpreted as an uplift to the extent of 500 feet. It is possible that this dome and others in line with it were originally parts of one large anticlinal structure that was separated into domes by such basement movements.

**Geophysics - F400 Electromagnetics**

The density of electromagnetic anomalies in this area
is rather low compared with other areas, but some correlations can be made with geological data. Trends between anomalies on adjacent flight lines have been plotted in the hope of revealing some patterns (diagram 5-6).

The most obvious pattern is a grouping of trends around $330^\circ$. It is possible that these anomalies result from saline waters along second-order fractures related to the inferred basement fault.

Short trends, such as numbers 4 and 11, lie parallel to the strike of the bedding, and number 11 in particular may be interesting, since it is almost coincident with two areas in which scattered mineralization is found. Trends numbers 16, 21 and possibly 19 lie along anticlinal ridges, with number 16 by far the most prominent.

There are several isolated electromagnetic anomalies that are difficult to explain. They occur mainly on hilltops and hillsides and it is possible they have some association with mineralization, since small pyrite veinlets, and possibly chalcopyrite, are found nearby (e.g. near trend number 5). They may also be due to sharp changes in topography which result in sudden variation in the distance of the airborne geophysical instruments above the ground.

No interesting correlation with geochemical anomalies can be made except in the case of trend number 11. Lead
mineralization is known in this locality and corresponding stream sediment anomalies are present.
**AREA 6**

**D.C. SPEIJERS**

**Introduction**

This 40-square-mile area is located 6 miles west of Victoria River Downs Homestead and extends 10 miles north of the river. The location, access and general geology are shown on diagram 6 - 1.

Several tracks around the area provide reasonable access. In the south there is the Old Gordon Homestead track and in the west and north an old track going to Station Hill and then continuing to the Victoria River Downs - Timber Creek Road.

The 1:30,000 scale aerial photographic coverage is,

Victoria River Downs, 1970:

- run 2 photos 6234 to 6238
- run 3 photos 6208 to 6213
- run 4 photos 6176 to 6178

**Geology - Stratigraphy**

<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bynoe</td>
<td></td>
<td>Fine-grained, platy sandstone and siltstone with several bands of medium-grained sandstone towards the base (location S2620)</td>
</tr>
</tbody>
</table>
Exposed over a large area. Indeterminate thickness but possibly represents weathering of several hundred feet of carbonate and siltstone sediments. Silty and siliceous in places. Pink iron- and/or manganese stained patches common. Thin sandstone bed at base.

<table>
<thead>
<tr>
<th>Skull Creek</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistant dolomite beds, commonly silicified and with chert nodules. Slightly thicker interbeds of a siltstone-calcrete composition probably representing thinly-bedded siltstone and dolomite or limestone with carbonates predominant. No sandstone. Thickness 100m to 130m.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supplejack Dolomite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse-grained dolomite with dark weathering surface. Notably rich in &quot;collenia&quot; structures. Thickness 6m to 20m.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Timber Creek</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thin, resistant dolomite beds, generally 50cm thick, with chert nodules. Thicker siltstone-calcrete beds than before. Boundary between Skull Creek and Timber Creek Formations lies in this interval. Thickness, 150m to 200m.</td>
</tr>
</tbody>
</table>

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Thick bed with two zones of intense chertification having individual chert bands up to 10cm wide and roughly comformable with bedding. Some limonitic encrustations associated with chert. Thickness about 20m.</td>
</tr>
</tbody>
</table>

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Silty calcrete is probably weathered equivalent of thin-bedded siltstones and dolomites. Irregularly-spaced, resistant beds of silicified dolomite up to 2m thick. Typified by bands, nodules, and flaky stringers of iron-rich chert. Several sandstone beds, each less than 1m thick present in lower part of sequence. Thickness approximately 70m.</td>
</tr>
</tbody>
</table>
Geology - Structure

Two domes occupy most of the area. The core and western flank of a large, elongated dome is shown on run 3, photos 6210 to 6212. The southern portion of this dome was discussed in the report on area 5. The axis trends more northward than in area 5, and plunges northward about 10°. Dips just to the east of the core are steep at 45° to 70°, while, on the western limb, they vary from 15° (location S2615) to 35° (location S3470X) then 5° to 10° (location S2622). The Bynoe Formation shows only a slight westerly dip.

The second dome appears on run 3, photo 6208. This is elongated along 170°, is partially closed to the south and is open to the north. The eastern flank dips 25° to 30° while the western flank is again less steep at 5° to 15°. The axial trend of the structure appears to curve slightly, convex to the northeast, but it is not as well defined topographically as that of the southern dome.

Anticlinal ridges are especially common in the western part of the area. They are developed in both the upper and lower parts of the Skull Creek Formation and can be followed across different lithologies. They are better defined in the Skull Creek Formation, due to the presence of silicified dolomite.
bands. The limbs vary greatly in dip from 10° to 70° even along a single anticlinal ridge. Closures rarely plunge greater than 15°. The character of these ridges may vary from a short criss-cross variety (location S2624) to one 5km long and up to 12m wide (location S2611). The major axial trend averages about 060° while a few long ridges trend almost at right angles at 160°. In one place (location S2612) a now-brecciated, silicified calcrete material has been exuded up joints within a silicified dolomite.

Mineralization

Obvious mineralization is poor and scattered. Blebs or small veins of barite are found at locations S2375X, S2376X, S2625, S2371X, S2616, S2626, S2627 and S2612 in dolomite. These veins are up to 4cm wide. Pink calcite veins up to 1cm wide, containing some pyrite, were found within dolomite at S2613.

Geochemistry

235 stream samples were taken on this area during 1971 and 50 samples were taken during 1970. Lead, zinc and copper were analysed in the -16+44 and -200 mesh fraction. Iron and manganese were analysed in samples exceeding 60ppm lead, zinc or copper.

Sampling intervals were around 250m for small streams but from
330m to 480m in larger ones. The Sampling density was not as great in Area 5, so further sampling could be advantageous in checking conclusions made from the present data.

Lead values above 90ppm in the coarse fraction and above 18ppm in the fine fraction were plotted and compared with the geology. On this basis, the proposed horizon generating high lead values in the stream sediments in area 5 has been extended into this area, and its approximate location has been plotted. It is noteworthy that the lead values of the fine fraction define the horizon more closely than those of the coarse fraction.

Copper values in both fractions correlate reasonably well with this horizon.

A stream near the centre of photo 2635, run 3, gave somewhat anomalous lead and copper values. Because this stream cuts through a system of anticlinal ridges, these should be checked for mineralization.

Geophysics - Magnetics

The basement contour plan prepared from the magnetic data shows a fault crossing the dome. There is a basement "high" to the south. Movement along this fault may explain the presence of the dome and the twisting of the major structural axis through the area. There is a basement "low" just north of the fault, and a broad southeast-trending "low" just east of the area.
In the correlation of the electromagnetic anomalies with the geology, those occurring over alluvial or black soil plains are disregarded since there is a likelihood that these anomalies are due to saline water. Fourteen anomalies have been correlated with the geology in this area.

1) This anomaly lies mainly over dolomite outcrop. It is oriented at a large angle with the strike of the bedding and possibly corresponds to a joint, not revealed on the aerial photograph. The anomaly crosses an outcrop the Supplejack Dolomite Member and extends under alluvium near the river. There is no correlation with geochemical data.

2) This is a low-order anomaly over outcrops of dolomite just north of anomaly 1. The trend of the anomaly is parallel to a small fault, which extends for at least a mile and passes through the northwestern edge of the anomaly. Small amounts of barite in veins less than lcm wide have been found in some dolomite beds. There is no correlation with geochemical data.

3) This anomaly occurs over the same sequence as anomalies 1 and 2. The southern portion of the anomaly may be related/Blacksoil development, but the northern section correlates with high lead values in the stream sediments, although these are at least partially derived from higher in the sequence, away from the anomaly.
(4) This anomaly occurs partially over dolomite outcrop and partially over alluvium. The anomaly crosses an anticlinal ridge with small amounts of barite in its core.

An indistinct airphoto lineation is sub-parallel to the anomaly trend and some slightly anomalous lead and copper values occur in the vicinity.

(5) This anomaly lies over relatively poorly outcropping dolomite, siltstone and calcrete containing some scattered, small anticlinal ridges and a major one 3km long. The anomaly is centred on this large anticlinal ridge. However, the anomaly is of low order, broad and in a low-lying area of some soil. These suggest that it may be due to saline water accumulation in the soil. There is no correlation with geochemical data.

(6) This strong anomaly lies near the edge of a black soil area, but is centred over dolomite outcrop. Some rather indistinct lineaments seen on the aerial photograph probably represent anticlinal ridges. There is no correlation with geochemical data.

(7) This is an exceptionally strong anomaly with a maximum conductivity ratio of 2.1. It lies over an area of calcrete outcrop and soil. A distinct lineament, which probably represents a fault structure, is intersected by an anticlinal ridge at the anomaly site. It also
coincides with the horizon that generates anomalous lead values in the stream sediment.

(8) This anomaly lies over an area of soil with rather poor dolomite and calcrite outcrop, which is crossed by two sets of anticlinal ridges. The major ridge is parallel to one of the anomaly trends. No geochemical data is available near this small area.

(9) Dolomite outcrop in this area is minimal with calcrite predominating, mainly in anticlinal ridges intersecting the anomaly axis at 45°. This axis runs sub-parallel to a stream channel 400 yards to the west and hence, parallel subsurface water channels along joints or faults should be considered as a source. This anomaly coincides with the horizon that generates anomalous lead values in the stream sediment.

(10) This anomaly lies in an area of scattered dolomite and calcrite outcrops marked by many anticlinal ridges. The axis of the anomaly passes through the point of intersection of two or possibly three major lineaments. However, the conductivity ratio of 0.5 may be too low to represent significant mineralization. There is no correlation with geochemical data.

(11) This is a moderate anomaly over dolomite outcrop and some soil. The anomaly trend crosses the horizon generating anomalous lead values in stream sediment.
(12) The anomaly lies over calcrete, dolomite and soil and its trend is parallel to the strike of the bedding. There is no correlation with geochemical data.

(13) This anomaly lies over solid dolomite outcrop and coincides with anomalous lead values in a stream. However, steep topography in this area should be considered as a source since the conductivity ratios are not very great.

(14) This anomaly occurs over dolomite outcrop with some calcrete and almost directly on the horizon generating anomalous lead values in stream sediments.
AREA 7

D.C. SPEIJERS

Introduction

This 50-square-mile area extends south from Gregory's Remarkable Pillar, for 7 miles on both sides of Gordon Creek. The location, access and general geology are shown in diagram 7 - 1. A track from Victoria River Downs Homestead is followed 23 miles to Gregory's Remarkable Pillar, from whence it follows the eastern bank of Gordon Creek through the centre of the area. The eastern part of the area is readily accessible by four-wheel-drive vehicle from this track and the western part may be reached in a vehicle. The creek crossing is difficult to make and cross-country driving is rough.

The 1:80,000 - scale aerial photographic coverage is Victoria River Downs 1967

run 7, photos 51 to 57
run 8, photos 166 to 176.

Geology - Stratigraphy

<table>
<thead>
<tr>
<th>Formation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antrim Plateau Basalts</td>
<td>Cambrian basalt flows with interbedded sands.</td>
</tr>
</tbody>
</table>
FIGURE 7-1
LOCATION, ACCESS AND GENERAL GEOLOGY

To VRD.

Gregory's Remarkable Pillar

To Mt Sanford

LEGEND

Alluvium
Terrace Deposits
Silty Residual Soil
Black Residual Soil
Antrim Plateau Volcanics
Jasper Gorge Sandstone
Wondoan Hill Formation
Battle Creek Formation
Unnamed Formation
Bynoe Formation
Timber Creek Formation
Geological boundary
Fault, joint
Creek
Track
Dip

SCALE 1:250,000

Compiled from Victoria River Downs
1:250,000 Geological Sheet

NOTE: This area is outside the 1:30,000 sheet areas.

V.R.D. Sheet
<table>
<thead>
<tr>
<th>Jasper Gorge Sandstone</th>
<th>Ferruginous quartz sandstone.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unnamed</td>
<td>Sandstones and siltstones similar to Bynoe Formation. About 20m exposed (location S25).</td>
</tr>
<tr>
<td>Battle Creek</td>
<td>Siltstones, limestones and dolomites with the latter two less silicified than the dolomites of the Skull Creek Formation. Chert ridges are a feature (location S13, S15, S16). Contains a thick bed of coarse-grained, dark weathering dolomite.</td>
</tr>
</tbody>
</table>

Geology - Structure

On a broad scale the Proterozoic limestone, dolomites and siltstones dip gently to the north but minor structures make dip measurements difficult.

In the Battle Creek Formation, on the west side of Gordon Creek (location S20), there is a 2-mile-long dome with a distinct, north trending axis. Dips are up to 40° east and 25° west on the limbs.

Two small-scale structure types warrant mention:
1. Anticlinal ridges, which are abundantly distributed, vary in orientation, but are semi-parallel or at right angles to each other. Massive chert occurs in the core of some larger ridges, (locations S13 S15 and S16) and may represent silicified beds. These chert cores trend 075° to 085°. (diagram 7-2).
DIAGRAM 7-2
SILICIFIED ANTICLINAL RIDGE

Barite mineralisation in dolomite bed as small veins and fracture fillings

Chert zone

Interbedded dolomite, siltstone and calcite
2. Undulatory dome and basin patterns in the dolomite bands. These never exceed about 10m in diameter (location S3).

Mineralization

Little mineralization was found. Throughout the area, barite can be seen in small veins and fracture fillings up to a few centimeters wide around the chert within the dolomite on the limbs of anticlinal ridges. Pink calcite veins up to 5mm wide occur in the small domal structures at location S3.
Introduction

The area is located about 28 miles southwest of Victoria River Downs Homestead. It is bounded in the north and the west by the Wickham River and Depot Creek, in the east by a sandstone plateau that begins just east of Gibbie Creek, and in the south by a basalt plateau near Paper Bark Yard. The location, access and general geology are shown on diagram 8 - 1.

Access to most of the area is from the Mt. Sanford track, but some parts can only be reached on foot. The region near Depot Creek is best approached by following the track along the north side of the Wickham River to a point eight miles upstream from its junction with Depot Creek. Here the river can be crossed by vehicle. By proceeding south and crossing Depot Creek, the northwestern part of the area is reached.

The 1:30,000 - scale aerial photographic coverage is Humbert River 1971

run 5, photos 2598 to 2600
run 6, photos 2195 to 2202
run 7, photos 2314 to 2320
run 8, photos 2470 to 2479
run 9, photos 2365 to 2373
run 10, photos 2519 to 2521.
DIAGRAM 8-1
LOCATION, ACCESS AND GENERAL GEOLOGY

LEGEND

- Quaternary Alluvium
- Terrace Deposits
- Cainozoic Beds
- Antrim Plateau Basalts
- Jasper Gorge Sandstone
- Bynoe Formation
- Skull Creek Formation
- Supplejack Dolomite Member
- Timber Creek Formation
- Skae Sandstone
- Gibbie Formation

Geological boundary

Creek
Track
Yard
Area boundary

SCALE 1:250,000
5 miles 0 5

Compiled from Victoria River Downs
1:250,000 Geological Sheet

N
## Geology - Stratigraphy

<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antrim Plateau</td>
<td></td>
<td>Cambrian basalts. Tops of several flows markedly vesicular. Interbedded sandstone as at Mt. Hodgson.</td>
</tr>
<tr>
<td>Volcanics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jasper Gorge Sandstone</td>
<td></td>
<td>Capping broad plateau. Ferruginous quartz sandstone with large-scale cross-bedding; grit and pebble deposits mark stream channels.</td>
</tr>
<tr>
<td>Skull Creek</td>
<td></td>
<td>Dolomites displaying ripple marks and cross-bedding (location SI19). These increase in thickness at the expense of silty interbeds until the latter become insignificant.</td>
</tr>
<tr>
<td></td>
<td>Supplejack Dolomite</td>
<td>Dark-weathering, coarse-grained massive dolomite containing abundant stromatolites. Up to 7m thick.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continuous, fine- to medium-grained dolomite beds.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Three massive chert beds (location S108) with interbedded dolomites and siltstones.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Silty dolomite beds with interbedded siltstone and calcrete. The dolomite beds become increasingly thin downward in the sequence.</td>
</tr>
<tr>
<td>Timber Creek</td>
<td></td>
<td>Most dolomites fine- to medium-grained, significantly silty, with ripple marks (location S78 and current bedding (location S70).</td>
</tr>
</tbody>
</table>
Dolomite beds, which decrease in thickness at successively lower horizons in the sequence. Chert common as nodules and reddish material lining calcite pseudomorphs of halite (location S107). Inter-beds of decomposed siltstone, brecciated and recemented limestone, dolomite and chert. Cement is calcareous and siliceous and exudes along joints and fractures (location S65). Three prominent markers exist.

a. Porous, coarse-grained dolomite, capped by algal chert. Dolomite is iron-stained and pores are lined with chalcedony. Thickness is 2m.

b. Silty dolomite bed 7m thick producing a conspicuous cliff. There are patches of intense iron-staining and also unusual maroon-coloured lensoidal shapes up to 5cm long (location S82)

c. Bed of ferroan dolomite: dark reddish-brown and composed of dolomite with about 20% finely disseminated haematite.

Consistently 30cm thick over several miles.

Mainly siltstone with minor sandstones as well as silty dolomites and limestones that are silicified and form relatively narrow bands less than 1m thick.

| Seale Sandstone | Mainly quartz sandstone with some siltstones. |

Geology - Structure

On a broad scale the three lower formations all dip about
5° northeast, although there are local minor contortions (at location S118 the beds dip 10° to 15° northwest, while in other localities they are virtually flat-lying). A small basin at location S47 is elongated northeast and its limbs dip up to 35°. Another poorly-exposed structure appears at location S80, where the beds dip at 30° to 40° northwest. The only other major bedding contortions are associated with shear zones, such as those at locations S96 and S48.

Severe distortions may take place within the softer and more thinly-bedded strata between dolomite beds and sometimes there are small undulations in the dolomite beds themselves (location S70). In such places, calcareous breccias may be injected along fractures and joints.

Anticlinal ridges are not as common as in other areas. The majority of them trend between 060° and 085° but some trend around 150° and others in various directions.

Pronounced lineaments appearing on airphotos (location S73) are often not well marked on the ground. They are probably faults with very little movement or joints.

An analysis of these lineaments over this area, reveals three maxima at approximately 55°, 130° and 165° (see diagram 8 - 4).
Mineralization

Mineralization is generally widespread, but in low concentrations.

One of the major occurrences is that of pyrite and chalcopyrite in calcite and barite pods encased in red chert. This chert often takes the form of salt casts within beds of fine-grained dolomite, which may contain nodular chert also. The principal such bed is exposed at locations S45, S49, S50, S51, S52, S53, S54, S58, S59 and S60. Not all these localities show significant copper, but one specimen contained 7800 ppm. Other similar beds contain copper, but analyses showed much lower contents and the mineralization has a more limited lateral extent (location S107).

Calcite and especially barite blebs and veinlets in places contain visible pyrite and chalcopyrite (locations S110, S111, S112 and S114).

Possibly the most widespread, although patchy, occurrence of copper-iron sulphides is in the lower part of a thick silty dolomite bed in the upper part of the Timber Creek Formation (locations S90, S65 and S101). Here chalcopyrite grains up to 3 mm across are found in a coarse-grained, non-cherty dolomite with no associated calcite or barite.

Isolated, insignificant copper occurrences are at locations S33, S34, S40, S124 and S125.
Galena was found in much higher concentrations, although in fewer localities. The thick dolomite bed at locations S65, S40 and S101 contains a thin band of coarse-grained dolomite with galena blebs up to 1cm across. This galena is distributed over a maximum width of 10cm. Isolated blebs of galena are found in the Skull Creek Formation in the vicinity of location S123 also.

Although numerous anomalous zinc values appear in the stream sediment analyses, sphalerite was recorded only at S90, where it is a fine-grained mass with galena.

A zone of intense iron-manganese oxides was found at location S75, forming the matrix in a chert breccia. The outcrop measures only 10m by 1m.

Calcite and barite occur throughout the area as blebs and small veinlets in dolomite beds, but no large veins have been recorded.

**Geochemistry**

1442 stream sediment samples were taken on this area. Copper, lead and zinc were analysed in the -16+44 and -200 mesh fractions. Where results exceeded 60 ppm, analyses for iron and manganese were undertaken.

In streams up to 2km long the sampling interval was 250m but in the larger streams intervals of up to 500m
were used.

The zinc values in the coarse fraction fall into two main categories. About 30% of the values lie between 75 ppm and 400 ppm but these are almost certainly related to material derived from the Antrim Plateau Basalts. Another 20% of the values probably have a similar origin, but occur where dilution by material derived from the Jasper Gorge Sandstone has taken place.

There are only two places where the anomalies cannot be directly related to basalt. These are three miles north of Paper Bark Yard, but the latter could be due to a small amount of basalt undetected on the aerial photograph. It should be noted that anomalous zinc values persist for several miles even in large streams.

The distribution of the lead values above 30 ppm in the coarse fraction matches very closely the distribution of the high zinc values. Hence the same basalt source is proposed for them. High lead values also coincide with the high zinc values in the area southwest of Mt. Hodgson. As these originate from just below the Supplejack Dolomite Member, this area should be checked for galena. Galena has been found in a similar stratigraphic position on Bullita Station.

The high copper values in the coarse fraction correlate well with the basalt outcrops except in the area southwest of Mt. Hodgson where they can be explained by the high background values of the Skull Creek Formation. One group
of high values in the lower Timber Creek Formation near Depot Creek cannot be explained by drainage from the basalt. Although no mineralization has been found, these values may correlate with small chalcopyrite occurrences in the dolomite. This is the case at some places around Gibbie Creek.

Copper, lead and zinc in the fine fractions yield little information except that the zinc in the fine fraction tends to follow the pattern of the zinc in the coarse fraction.
AREA 9

D.C. SPEIJERS

Introduction

This 8-square-mile area lies directly west of Depot Pile Yard. It is a window of dolomite and siltstone. The location, access and general geology are shown in diagram 9-1. Access may be gained by driving through a gorge along Depot Creek and then most of the area can be reached by four-wheel-drive vehicle.

The 1:30,000 - scale aerial photographic coverage is Humbert River 1971 run 3, photos 2299 to 2303.

Geology - Stratigraphy

<table>
<thead>
<tr>
<th>Formation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laterite</td>
<td>Formed over siltstone outcrop on some hilltops in the south of the area (location SI34)</td>
</tr>
<tr>
<td>Jasper Gorge Sandstone</td>
<td>Coarse-grained, ferruginous sandstone.</td>
</tr>
<tr>
<td>Wickham</td>
<td>Quartzite. Probably an original sedimentary quartzite.</td>
</tr>
<tr>
<td>Fraynes</td>
<td>Fissile siltstones with platy dolomite bed at top.</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>Black Springs Dolomite</td>
<td>Almost continuous, thin-bedded dolomite with a few narrow silty bands. One thick bed of dark-weathering, medium-grained dolomite with abundant stromatolite structures (location S140). Pink and white banded, fine- to medium-grained dolomites are present (location S129) as well as calcite vugs and veinlets. Yellowish calcrite-like material invades fractures and bedding planes of the dolomite in some places, especially near the monocline (location S137).</td>
</tr>
</tbody>
</table>

**Geology - Structure**

The dominant structural feature is the monocline bordering the area on the east. (Diagram 9-2) The axis of this fold trends northwest and the western limb is higher than the eastern one. The axial plane dips about 80° east and lies within brecciated chert. This brecciation may be caused by movement along a silicified fault zone. The Black Springs Dolomite is flat-lying except near the monocline, where it dips up to 60° east. Further to the west of the monocline, the strata dips up to 15° west, producing a gentle dome closed in the north and probably also in the south, although the dips are very shallow or flat there.

Anticlinal ridges commonly trend 065° with some at 150°.
DIAGRAM 9 - 2a.
CROSS-SECTION A - B

Monoclinal axis and zone of brecciation

A
Chert
Fraynes Formation

B
Sandstone
Quartzite
Chert
Dolomite
Sandstone
Small-scale domal and basinal structures are associated with ridges. They are 10 to 200 metres across, but dips rarely exceed 10°.

Mineralization

No base metal mineralization was observed. Within the dolomite there are only scattered calcite and barite vugs and veinlets associated with occasional patches of haematite.

Geochemistry

100 stream sediment samples were analysed for copper, lead and zinc in both the -16+44 and -200 mesh fractions. The coarse fraction showed several anomalous lead values in streams draining the Black Springs Dolomite. There is insufficient information to determine whether these values are derived from a single horizon or from some other distribution of lead. The coarse fraction also showed anomalous copper values which correlate well with the lead values. Some lower copper and lead values appear to derive from the lowest part of the Fraynes Formation.

Zinc values in both size fractions as well as copper and lead values in the fine fraction showed no distinct anomalies.
Background and threshold values were estimated. Where two figures appear the first refers to the Fraynes Formation and the second to the Black Springs Dolomite.

<table>
<thead>
<tr>
<th>Element</th>
<th>Fraction</th>
<th>Background (ppm)</th>
<th>Threshold (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu</td>
<td>-200</td>
<td>14</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>-16 + 44</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Pb</td>
<td>-200</td>
<td>14, 22</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>-16 + 44</td>
<td>20, 26</td>
<td>50</td>
</tr>
<tr>
<td>Zn</td>
<td>-200</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-16 + 44</td>
<td>18</td>
<td>-</td>
</tr>
</tbody>
</table>
AREA 10

D. C. SPEIJERS

Introduction

The four-square-mile area is located along a tributary to Jasper Creek near the western end of Jasper Gorge. Access is difficult. From the Jasper Gorge road, a graded track leads to a yard half a mile away. From this yard a four-wheel-drive vehicle track follows a creek upstream into the area. The location, access and general geology is shown in diagram 10 - 1.

The 1:30,000 - scale aerial photographic coverage is Humbert River 1971 run 8, photos 2500 to 2504.

Geology - Stratigraphy

<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skull Creek</td>
<td>Bardia Chert</td>
<td>Thickly-bedded chert (location S231). Not conformable with dolomite, which it has replaced in places. Follows along joints and fractures in the dolomite beneath. Up to 15m thick.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dolomite with some thin, silty laminae. Poorly exposed. Some chert as nodules and silty pods. Mainly fine-grained but there are a few coarse-grained beds, including Supplejack Dolomite Member. Silicification in-</td>
</tr>
</tbody>
</table>
DIAGRAM 10-1
LOCATION, ACCESS AND GENERAL GEOLOGY

LEGEND

Lateite (?)
Residual Silty Soils
Jasper Gorge Sandstone
Stubbs Formation
Wandoan Hill Formation
Bynoe Formation
Skull Creek Formation
Supplejack Dolomite Member
Bardia Chert Member

Geological boundary
Creek
Road
Yard
Area boundary

SCALE 1:250,000

To Timber Creek
To V.R.O.
Jasper Creek

N
creases as the Bardia chert is approached. Thickness up to 100m.

Geology - Structure

The area contains three small tight domes, somewhat elongated and aligned on a trend of about 035°. On all three domes, the dips are greatest on the north and northeast flanks (up to 70° or more) and least on the south and southwest flanks (generally 15° to 30°). Anticlinal ridges are common near location S153. These usually trend 070°.

Mineralization

Barite is the most common mineralization. It occurs mainly in the chert of the central dome where it forms veins up to 15cm wide and fills fractures and joints (location S154). Scattered small patches of pyrite and/or chalcopyrite occur in the coarser dolomite bands (location S213, S214). There are a few occurrences of pyrite and quartz crystals in thin fracture fillings (location S215).

Veins of very coarse-grained calcite up to 30cm wide are not uncommon in the dolomite (location S215).
Geochemistry

Forty-three stream sediment samples were collected and analysed for copper, lead and zinc in the -16+44 and -200 mesh fractions. The fine fraction results revealed very little, but some analyses of the coarse fraction were anomalous.

Rough estimates of background and threshold were made:

<table>
<thead>
<tr>
<th>Element</th>
<th>Fraction</th>
<th>Background (ppm)</th>
<th>Threshold (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu</td>
<td>-200</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-16 + 44</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Pb</td>
<td>-200</td>
<td>15</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>-16 + 44</td>
<td>15</td>
<td>40</td>
</tr>
<tr>
<td>Zn</td>
<td>-200</td>
<td>14</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-16 + 44</td>
<td>10</td>
<td>40</td>
</tr>
</tbody>
</table>

The lead values were highest and usually corresponded with high zinc values as well as high copper in some cases, e.g. the -16 + 44 mesh fraction of sample S4720 gave 2000 ppm lead, 740 ppm zinc and 180 ppm copper. It is thought that such high values could correspond with a mineralized horizon possibly just below the Supplejack Dolomite Member, as in the Spring Creek area on Bullita Station.

The anomalous base metal concentration in sediment samples does not seem to correlate with the best areas of barite mineralization, nor with any of the recognised disseminations of pyrite or chalcopyrite.
Introduction

This 150-square-mile area lies directly west of Bullita Station. It is bounded by the East Baines River in the north, east and southeast and by a sandstone plateau in the west. Access is by a track directly from Bullita to Spring Creek or by a graded track heading west from a point half-way along the Bullita-Timber Creek track. This graded track proceeds 25 miles to the East Baines River, crosses it, and follows it south to Spring Creek. It follows Spring Creek upstream to meet the track from Bullita. The location, access and general geology are shown on diagram 11-1 and 11-1a.

The 1:30,000 - scale aerial photographic coverage is Humbert River 1971

run 1, photos 2131 to 2139
run 2, photos 2142 to 2148
run 3, photos 2261 to 2264

Additional 1:80,000 - scale aerial photographs used were Waterloo 1967

run 1, photos 85, 87
run 2, photo 165.
LEGEND

- Quaternary Alluvium
- Residual Silty Soil
- Jasper Gorge Sandstone
- Wondoan Hill Formation
- Bynoe Formation
- Skull Creek Formation
- Bardia Chert Member
- Supplejack Dolomite Member
- Timber Creek Formation
- Seale Sandstone
- Gibbie Formation
## Geology - Stratigraphy

<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasper Gorge Sandstone</td>
<td></td>
<td>Ferruginous, coarse-grained quartz sandstone with large-scale current bedding and scour-and-fill structures.</td>
</tr>
<tr>
<td>Bynoe</td>
<td></td>
<td>Limited occurrence. Mainly siltstone with some fine-grained sandstone. A few dolomite beds near the base. All thinly interbedded.</td>
</tr>
<tr>
<td>Skull Creek</td>
<td></td>
<td>Thin beds of cherty, fine-grained dolomite with thick silty interbeds.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Light grey, fine- to coarse-grained, massive, non-cherty dolomite separated by thin, silty, carbonate beds (locations S187, S188, S189, S222)</td>
</tr>
<tr>
<td>Supplejack Dolomite</td>
<td></td>
<td>Dark-weathering, massive, coarse-grained dolomite with abundant stromatolite structures. Up to 15m thick (locations S168, S164, S191 S207 etc.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The silt content of the beds gradually increases down the sequence (location S207) until, at location S181, thin, fine-grained dolomites are interbedded with silty carbonate beds of equal thickness. Further down the sequence, the silty interbeds are suddenly reduced to laminations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thick bed of fine and coarse banded dolomite with a heavy chert content (locations S181, S183). Further down the sequence some thin cherty dolomites and siltstones occur.</td>
</tr>
<tr>
<td>Location</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Timber Creek</td>
<td>A 2m-thick bed of fine-grained dolomite capped by a probable algal chert (locations S197, S179 and S180). Below this are 20m to 25m of thin dolomites, siltstones and silty dolomites.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A 2m-thick bed of fine-grained dolomite with about 40% chert and abundant stromatolite structures (locations S197, S198)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>About 30m of 30cm to 1m beds of fine-grained cherty and silty dolomites, siltstones and calcrite.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6m to 7m-thick bed of fine- to medium-grained dolomite (location S200)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Silty sequence with thin sandstone laminae and sandy dolomite (location S216). Several beds of dolomite and silty dolomite (up to 1m thick) occur higher in this sequence (location S199)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Band of almost continuous, fine-grained cherty dolomites, about 15m thick. Underlain by 65m of thin fine-grained, cherty dolomite interbedded with thicker dolomite siltstone.</td>
<td></td>
</tr>
<tr>
<td>Seale Sandstone</td>
<td>Massive, fine-grained sandstone, somewhat porous and ripple marked.</td>
<td></td>
</tr>
<tr>
<td>Gibbie</td>
<td>Mainly siltstone and fine-grained, platy, sandstone with a few thin beds of fine-grained dolomite, generally less than 30cm thick. Platy sandstone contains salt casts, ripple marks and is often quite porous. A bed of cherty dolomite 50cm thick may serve as a marker in the higher part of the sequence.</td>
<td></td>
</tr>
</tbody>
</table>
Geology - Structure

The area forms part of the western limb of a very broad syncline or basin, and the regional dips are of the order of 2 or 3 degrees east to south-east. Local variations may produce dips of up to 10°.

A north-trending monocline in the western part of the area displays dips of up to 55° east. The Seale Sandstone and Gibbie Formation are exposed to the west of the fold axis but Timber Creek Formation is eroded.

Anticlinal ridges are relatively uncommon in this area. They generally trend around 075°. Lineaments can be traced on the airphotos for several miles and these are thought to be mainly joints or fractures, although evidence on the ground is difficult to obtain.

Mineralization

Galena in small blebs up to 1cm long is found in calcite veinlets within a thin band of cherty dolomite beneath the Supplejack Dolomite Member at location S172, but this occurrence has no areal extent. A similar find in a similar stratigraphic position is at location S193, where galena occurs in a number of beds, but again over a small area. Further prospecting in equivalent horizons revealed patches of galena at locations S225, S229 and S230, all in coarse-grained dolomites just below the Supplejack.
A traverse along a major lineament on airphoto 2132, run 3 uncovered blebs of galena at locations S225 and S230, a few grains of fluorite up to 5mm long in small calcite veins within a coarse-and fine-banded dolomite and a thin band of coarsely-crystalline, manganese oxide-rich dolomite.

Isolated patches of pyrite and/or chalcopyrite occur at locations, S162, S163, S181, S183, S188, S207 and S208, all of which are in the Skull Creek Formation. These grains are up to 3mm across in small calcite veinlets or vugs or within the dolomite itself. Barite occurs only occasionally in small vugs in siltstones and dolomites. Calcite veins are usually restricted to widths of a few millimetres, but veins up to 4cm wide have been found (location S175).

A ferruginous brecciated chert zone trending about 330° occurs at S124.

**Geochemistry**

444 Stream sediment samples were collected on this area and analysed for copper, lead and zinc in both -16+44 and -200 mesh fractions. Where any value exceeded 60ppm, further analyses for iron and manganese were done.

One of the most important correlations on this area is between the lead values in the coarse fraction and galena
mineralization in strata just below the Supplejack Dolomite Member. Sampling in areas where galena was not found indicates potential mineralization in similar stratigraphic horizons at several places. Further anomalous lead values occur along a large stream, four miles west-southwest of Bullita Homestead which drains strata above the Supplejack. Isolated high lead values occur in approximately the same stratigraphic position elsewhere.

Zinc values above 50ppm in both fractions correlate with the high lead values derived from below the Supplejack, while the copper values above 20ppm in the coarse fraction correspond well with the high lead values derived from strata above the Supplejack.

Thus, it seems there is a lead-zinc concentration below the Supplejack and a lead-copper concentration at some distance above it.
AREA 12

N.J. CRANLEY

Introduction

This area is situated 2 miles to the east of McCullaghs yard. A track leads into the area from the yard. A four-wheel-drive vehicle can be driven across country to points off this track. The location, access and general geology are shown in diagram 12 - 1.

The 1:30,000 scale aerial photographic coverage is Victoria River Downs 1970

run 1, photo 6273
run 2, photo 6228

Geology - Stratigraphy

The rocks are part of the Skull Creek Formation, a detailed lithology of which is given over leaf.
<table>
<thead>
<tr>
<th>Formation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skull Creek</td>
<td>Siltstone: brown, highly siliceous, grades into sandstone.</td>
</tr>
<tr>
<td></td>
<td>Sandstone: brown to yellow, fractures into flat plates, contains salt casts, ripple marks.</td>
</tr>
<tr>
<td></td>
<td>Chert: often with a limonitic capping, as long ridges associated with the major structures, interbedded with dolomite.</td>
</tr>
<tr>
<td></td>
<td>Calcrete: 'brecciated', pink-brown-green-white, highly contorted, associated with anticlinal ridges.</td>
</tr>
<tr>
<td></td>
<td>Dolomite: white-pink, medium-to coarse-grained, siliceous, associated with major structures.</td>
</tr>
</tbody>
</table>

**Geology - Structure**

These structures are present:

1. Small anticlinal ridges, 3 to 7m wide, ½ to 1km long, generally trending east with small ridges intersecting at 90°, 60° and 30°. Where bedded rocks are involved the flanks of the ridge exhibit steep dips and are often contorted.

2. A large dome with gently inclined beds around the periphery and two roughly parallel ridges trending east. On the southern part of the dome, a radially
arranged ridge system emanates from a small hill.

3. A long anticlinal ridge trending north, which has the form of an elongated dome plunging both to the north and to the south. The main joints trend 30°, 60° and 345°.

Mineralization

Three types of mineralization were observed;

1. Barite veins and blebs: Blebs are common in the dolomites, associated with the domes. At one place there is a barite vein, 30cm wide, which was traced intermittently for 4m.

2. Galena: Only small grains (5mm x 5mm) were observed in the dolomites of the domes.

3. "Gossan": This is a limonitic lens with an areal extent of 20m x 3m. Assays of chip samples revealed 15ppm copper, 125ppm lead, 30ppm zinc and iron in excess of 20% (location N23)

Geochemistry

Copper, lead and zinc were analysed in both the -1644 and -200 mesh fractions. Copper and zinc showed only
background values in both fractions, so these are not used in correlation with the other data.

The lead values in the coarse fraction are used for correlation since anomalous values in the coarse fraction are reflected in the fine fraction, and no fine fraction anomalies occur without corresponding coarse fraction anomalies.

For interpretation of results, background and threshold values for the coarse lead fraction have been taken to be:

- background : 25 ppm
- threshold : 60 ppm

The fine fraction limits have been put at:

- background : 20 ppm
- threshold : 50 ppm

Due to the gentle grade of the streams and the coarseness and density of the lead minerals, the mobility of the mineralized grains has been restricted to less than 4 km.

Each of the six streams will be considered separately, the area being divided into two sections:

a) Northern half of the dome.

b) Southern half of the dome.
a) Four streams were found to have anomalous lead values. Stream (A) shows the highest consistent values, which range from 74 to 620 ppm. Most of these values are between 200 and 350 ppm, although there is no classic pattern in the gradation of the values. The highest values are grouped close to the source of the stream where outcrop accounts for more than 60% of the area. Stream (B) again shows consistent values, the spread being more uniform than stream (A), but of a lower average value. The Stream (C) values are fairly consistent. Again the anomalous results occur only towards the source of the stream.

The results of Stream (D) are reasonably uniform, although no definite pattern is apparent.

b) Streams (E) and (F) show a more consistent decrease in lead values downstream. These streams are parallel to the axis of the anticlinal ridge.

Interpretation

Two sources of mineralization are possible:

a) anticlinal ridges,

b) stratabound mineralization in a particular bed,

a) These ridges strike east and, except in two cases, strike normal to the direction of the streams. The ridges form the highest part of the dome, so sediment from here will be carried down the streams. The
lead values in the coarse fraction do not decrease uniformly down the stream. The anomalous values are close to the ridges, so these must be considered a possible source for the lead anomalies.

b) It is considered more likely that the mineralization is confined to a set of dolomite beds. This is indicated by the grouping of the values along the streams. This seems evident between the two brown lines shown on the map where stream sediment values have been recorded at 200 to 230 ppm in four of the streams around the dome. The spread of values could be due to the fact that the beds are dipping outwards at 35° so that, in some cases, dip slopes would be exposed for some distance.

Geophysics

Three geophysical techniques were used over this area;

1) Magnetic
2) Electromagnetic (F400 EM)
3) Very low frequency electromagnetic (KEM)

1. Unfortunately, little useful information pertaining to conduits for mineralization can be gained from the Depth-to-basement contours. It appears from these data that the basement dips towards the northwest, but does not seem related to any of the structural elements described in this report.
2. Of the 1,400 EM anomalies, only two coincide with structural features, these being close to, or on one of, the anticlinal ridges. The other anomalies are situated on or around known water courses which, probably, would affect the conductivities recorded. Three of these anomalies were checked in the field and in each case these were centred around marshy areas, although the anomaly to the north of the dome coincided with dolomite beds with small disseminations of galena.

3. Many KEM anomalies were recorded in this area, their general trend being northeast. Only one anomaly corresponded with a major structural feature, this being one of the anticlinal ridges. However, many of the small anticlinal ridges are roughly aligned with the anomalies. 75% of the anomalies occur on red soil plain which, in general, has only about 30 to 40% outcrop consisting mainly of calcrete and fine-grained dolomite. West of the dome, the area consists dominantly of red soil with minor black soil pods with calcrete anticlinal ridges striking in three dominant directions: east, southeast and northeast.

The only correlation observed is that the KEM anomalies in a few cases tend to follow the calcrete anticlinal ridges. The only mineralization in the area is a barite vein (location No. 13), but no correspondence with geophysics can be observed.
AREA 13

N.J. CRANLEY

Introduction

This area is approximately 9 miles north of Victoria
River Downs Station. The location, access and general
geology are shown on diagram 13 - 1.

The 1:30,000 - scale aerial photographic coverage is
Victoria River Downs 1970

run 2, photos 6238 to 6240
run 3, photos 6205 to 6207

Geology - Stratigraphy

Three formations are present:

(a) Jasper Gorge Sandstone
(b) Bynoe Formation
(c) Skull Creek Dolomites,
    consisting of coarse-
    grained dolomites, chert
    lenses, and ridges and
    irregular bands of calcrete.
Geology - Structure

In the south, the beds are dominantly flat-lying dolomites and limestone, whereas in the north, massive chert is found with little or no bedding discernable. Also in the north, there is a prominent fault which appears to have displaced the chert in a downward direction.

Joints in both dolomite and chert were recorded, and are reproduced below.

<table>
<thead>
<tr>
<th>Dolomite</th>
<th>Chert</th>
</tr>
</thead>
<tbody>
<tr>
<td>330°</td>
<td>150°</td>
</tr>
<tr>
<td>240°</td>
<td>200°</td>
</tr>
<tr>
<td>300°</td>
<td>070°</td>
</tr>
</tbody>
</table>

Mineralization

Barite veins and blebs are the main mineralization. Some veins are up to 10cm thick. The mineralization is confined to the dolomites and is prevalent around the Colenia beds.

Geochemistry

Only 2 streams showed anomalous stream sediment results, these being for lead in the -16+44 and -200 mesh fractions. Background and threshold values have been taken
to be (for -16+ 44 fraction):

background : 20 ppm
threshold : 60 ppm

Due to the gentle gradient of the streams and the density of the secondary lead mineral grains, mobility will be limited, especially since most of the anomalous values are located in small streams.

The streams at the southern edge of the area have only three anomalous values in the coarse fraction with only two corresponding anomalous values in the fine fraction. These are in a small stream draining hills of flat-lying siliceous dolomite.

Geophysics

The F400 electromagnetic anomalies are plotted on sheet 2B. All anomalies occur over areas of dolomitic outcrop. However, the conductivity ratios range between 0.6 to 0.9, indicating a moderate conductor. These values could be related to saline water.
AREA 14

N.J. CRANLEY

Introduction

This report covers the geological mapping and sampling of the area covered by the 1970 1:30,000 - scale map sheets 2, 4 and 6. This 150-square-mile area is situated east of the Victoria River and north of Victoria River Downs. The location, access and general geology are shown in diagram 14 - 1.

The 1:30,000 - scale aerial photographic coverage is Victoria River Downs 1970

run 7, photos 6101 to 6112
run 8, photos 6090 to 6100

Geology - Stratigraphy

<table>
<thead>
<tr>
<th>Formation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antrim Plateau Volcanics</td>
<td>Fine- to medium-grained basalts. Weathered in places, some medium-grained volcanic material with laths of feldspar.</td>
</tr>
<tr>
<td>Battle Creek</td>
<td>Fine- to coarse-grained, yellow dolomites, Highly contorted beds or flat beds associated with ridges and scarps. Cavities filled by barite or iron-stained dolomite. Blue-green micaceous shales below the dolomite beds.</td>
</tr>
</tbody>
</table>
Geology - Structure

Only one fault was observed in the area. This is on Sheet 2 in the Battle Creek Formation. Other faults have been mapped by Bureau of Mineral Resources, but there is little evidence for them in the field.

All beds are flat- to slightly-inclined. Some anticlinal ridges have axes that trend parallel with the scarps. These scarps mark the edges of the outcrops of the more resistant beds.

Mineralization

Fairly extensive disseminations of chalcopyrite, pyrite and galena are found in the fine- to medium-grained dolomites. Little mineralization was found along the major fault. The main mineralization is associated with the scarps and isolated beds.

The galena occurs as grey, weathered crystals on the rock surface or as small disseminations throughout the rock. Generally, where the beds are well exposed, these galena crystals are found along a particular bedding
plane surface.

Geochemistry

Since two distinct formations of sedimentary rocks are present, a separate geochemical analysis is needed for each. The Bynoe Formation is characterized by low metal values in the stream sediments, whereas the Battle Creek Formation yields highly anomalous values. For this reason sheets 4 and 6, which do not have exposures of the Battle Creek Formation, will not be discussed as regards possible mineralization.

Sheet 2 contains all the anomalous values found in Area 3. The long belt of dolomites of the Battle Creek Formation shows consistent high lead and copper values in both the -16+44 and -200 mesh fractions. Most streams sampled are either washes or streams less than 1 mile long. Therefore, mechanical mobility is considered minor, with a possible maximum distance of travel of about 100m.

The background and threshold values for the three elements in the Battle Creek Formation are as follows:

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Cu (ppm)</th>
<th>Pb (ppm)</th>
<th>Zn (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-16+44</td>
<td>-200</td>
<td>-16+44</td>
</tr>
<tr>
<td>background</td>
<td>35</td>
<td>16</td>
<td>35</td>
</tr>
<tr>
<td>threshold</td>
<td>65</td>
<td>34</td>
<td>70</td>
</tr>
</tbody>
</table>
Considering the anomalous lead values in relation to the geology, a few conclusions can be drawn.

1. All anomalous results occur in areas of dolomitic outcrop.

2. Most anomalous values are concentrated along scarps and are fairly consistent in value.

3. In the longer streams, there seems to be a gradation from high values to low values proceeding downstream.

As discussed, the mineralization is fairly extensive and, in general, there is a fair correlation between its distribution and the lead and copper anomalies. Galena is the most extensive base metal mineral. Its occurrences correspond well with the sites of stream sediment anomalies.

Little correlation was observed between the distribution of chalcopyrite and the anomalous copper values. This could indicate a relatively high copper background in this formation. As found in the other report areas, the zinc values are generally anomalous where the corresponding copper and lead values are anomalous.

The most likely explanation of these results is that the
mineralization is confined to a particular bed or series of beds. The likelihood of this mineralization being structurally controlled seems rather remote because most of the mineralization and anomalous stream sediment values occur away from the major structures.
AREA 15

N.J. CRANLEY

Introduction

This area is along Peter Creek, to the west of Humbert River Station. The location, access and general geology are shown in diagram 15 - 1. The 1:30,000 - scale aerial photographic coverage is Humbert River 1971 run 5, photos 2583 
run 6, photos 2212 to 2214 
run 7, photos 2329, 2330 and 2338 
run 8, photos 2485 and 2486.

Geology - Stratigraphy

<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasper Gorge</td>
<td>Massive, flat-lying. Inter-bedded chert at base.</td>
<td></td>
</tr>
<tr>
<td>Sandstone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skull Creek</td>
<td>Fine- to coarse-grained dolomite. 3- to 12-meter-thick beds dipping 0° to 10°.</td>
<td></td>
</tr>
<tr>
<td>Supplejack</td>
<td>Grey-black coarse-grained 10- to 12-meter-thick bed that weathers to produce blocky fragments and that shows yellow etch marks on surface. Also white, fine-grained calcite interbedded with dolomite</td>
<td></td>
</tr>
<tr>
<td>Dolomite</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
LEGEND
- Jasper Gorge Sandstone
- Bynoe Formation
- Skull Creek
- Supplejack Dolomite

SCALE
1:250,000

Area sampled
Joints
Fault

Compiled from B.M.R. 1:250,000 geological map sheet Victoria River Downs
Geology - Structure

Little deformation appears to have occurred in this area, as most beds are flat or only gently inclined to the southeast. Photogeological interpretation shows a series of lineaments trending northwest, which probably represent major joints. Jointing is very prominent and almost all the streams tend to follow the major joint directions.

Mineralization

Only occasional crystals of barite and a small zone of chalcopyrite blebs in coarse-grained dolomite were found. This zone of mineralization trends for approximately 1 metre and occurs only in one bed.

Geochemistry

No anomalous values were obtained in the 253 samples collected.
AREA 16

N.J. CRANLEY

Introduction

This area is north and west of the junction of the Wickham River and Depot Creek. The location, access and general geology are shown on diagram 16 - 1.

The 1:30,000 - scale aerial photographic coverage is Humbert River 1971

run 3, photos 2282 to 2287
run 4, photos 2441 to 2447
run 5, photos 2592, 2596 & 2597
run 6, photos 2202 to 2205
run 7, photos 2321 to 2324
run 8, photos 2478 to 2481

Geology - Stratigraphy

<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasper Gorge</td>
<td></td>
<td>Red to dark red siliceous sandstone. As elevated plateaus.</td>
</tr>
<tr>
<td>Skull Creek</td>
<td></td>
<td>Fine- to coarse-grained dolomites. Some show elongate clasts usually in an irregular network, or yellow 'hieroglyphic' etchings on surface.</td>
</tr>
</tbody>
</table>
A particularly well-exposed section was observed between the Antrim Plateau Volcanics and the Timber Creek Formation. It is reproduced on Diagram 16 - 2.

Geology - Structure

The most prominent structural element in this area appears to be an extended anticlinal ridge, 10 to 12 m high, trending southeast. Dips of 30° to 40° are common along the flanks and at one location a good section was observed with the bedding continuous across the axis of the fold. This disagrees with the Bureau of Mineral Resources 1:250,000 scale geological sheet, which records this anticlinal ridge as a fault.
DIAGRAM 16 - 2
SECTION OF ANTRIM BASALTS AND TIMBER CREEK FORMATION

ANALYSIS

<table>
<thead>
<tr>
<th></th>
<th>Cu</th>
<th>Pb</th>
<th>Zn</th>
</tr>
</thead>
<tbody>
<tr>
<td>N85</td>
<td>58</td>
<td>18</td>
<td>64</td>
</tr>
<tr>
<td>N86</td>
<td>16</td>
<td>100</td>
<td>10</td>
</tr>
</tbody>
</table>
Faulting is prominent, the movement in all cases being of the normal or reverse type with displacements up to 20m.

There are two major joint directions at 150° and 120°. The Timber Creek Formation is well defined by the thinly-bedded dolomite bands and change in vegetation. Both the Skull Creek and Timber Creek Formations dip northeast at 10° to 15° in contrast to the Jasper Gorge Sandstone, which is flat.

Mineralization

The main mineralization is confined to two thin bands, approximately 3 m apart, situated in beds near the upper part of the Timber Creek Formation. The host rock is coarse-grained, black dolomite containing a thin band of galena towards the top of the bed and a thin, disseminated band of chalcopyrite at the bottom of the bed. These bands were found to be fairly continuous from the north side of the Wickham River through to Depot Creek and into Area 8.

Small veinlets of galena in these bands were observed. These range from 2 to 4mm wide and are up to 10mm long. The chalcopyrite, however, occurs as small disseminations and no banding is visible. Small galena crystals, similar to ones found around Area 14 and at the Colt Prospect are found on the rock faces. These are grey, generally weathered and up to 1cm across.
Further southwest, small, disseminated grains of pyrite and chalcopyrite are found in a conglomeritic, coarsely-veined, fine-grained dolomite bed, which extends for approximately 3/4 km. The chalcopyrite occurs only in coarse dolomite veins as small blebs 1 mm across. In addition there are small showings of malachite in calcite veins, which show ferruginous staining in places. In some specimens small green crystals were observed, but generally the malachite forms a fine powdery film.

Geochemistry

The lead, zinc and copper background and threshold values in the stream sediment samples were found to be as follows:

<table>
<thead>
<tr>
<th></th>
<th>-16+44 mesh</th>
<th>background 8 ppm</th>
<th>threshold 20 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>-200 mesh</td>
<td>background 8 ppm</td>
<td>threshold 20 ppm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>-16+44 mesh</th>
<th>background 15 ppm</th>
<th>threshold 25 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>-200 mesh</td>
<td>background 16 ppm</td>
<td>threshold 24 ppm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>-16+44 mesh</th>
<th>background 17 ppm</th>
<th>threshold 27 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc</td>
<td>-200 mesh</td>
<td>background 16 ppm</td>
<td>threshold 24 ppm</td>
</tr>
</tbody>
</table>

Anomalous values obtained near the junction of the Wickham River and Depot Creek correspond well with observed mineralization. High values (60-450 ppm) recorded around two basalt hills, but according to Hawkes & Webb (p. 376) these represent background values for mafic material,
such as basalt.

At the junction of the Wickham River and Depot Creek, anomalous lead and zinc values have been recorded, the lead values reaching 90 ppm and the zinc 34 ppm. The copper values in the -16+44 and -200 mesh fractions correlate well with the lead in the -16+44 fraction, especially with regard to the mineralized band where chalcopyrite has been found. However, the individual values for the copper are less than those for lead.

The Timber Creek Formation differs from the Skull Creek in that there is more shale and siltstone present. This seems to have the effect of diluting the sample with respect to base metals, especially since the siltstones and shales appear to be barren of mineralization in this region.

No correlation of geochemical anomalies with structure was observed even though some large-scale structures are present. All geochemical anomalies occur around beds which are generally flat or slightly inclined.
<table>
<thead>
<tr>
<th>SAMPLE No</th>
<th>Cu</th>
<th>Pb</th>
<th>Zn</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>N 74</td>
<td>290</td>
<td>16</td>
<td>4</td>
<td>White to pink dolomite with small green blebs.</td>
</tr>
<tr>
<td>N 79</td>
<td>78</td>
<td>28</td>
<td>6</td>
<td>Fine-grained, white dolomite with malachite staining.</td>
</tr>
<tr>
<td>N 80</td>
<td>680</td>
<td>44</td>
<td>18</td>
<td>Chalcopyrite and malachite in coarse-grained, white dolomite.</td>
</tr>
<tr>
<td>N 81</td>
<td>840</td>
<td>30</td>
<td>20</td>
<td>Chalcopyrite and malachite in coarse-grained, white dolomite.</td>
</tr>
<tr>
<td>N 82</td>
<td>200</td>
<td>30</td>
<td>10</td>
<td>Chalcopyrite and malachite in coarse-grained, white dolomite.</td>
</tr>
<tr>
<td>N 85</td>
<td>58</td>
<td>18</td>
<td>64</td>
<td>Dark brown, fissile, ripple marked shale.</td>
</tr>
<tr>
<td>N 86</td>
<td>16</td>
<td>100</td>
<td>10</td>
<td>Chip samples across dolomite at base of basalt.</td>
</tr>
<tr>
<td>N 87</td>
<td>1400</td>
<td>24</td>
<td>8</td>
<td>White, fine-grained dolomite with small grains of malachite (overliesblack, coarse-grained dolomite in chert).</td>
</tr>
<tr>
<td>N 89</td>
<td>10</td>
<td>&gt;1%</td>
<td>140</td>
<td>White, coarse-grained dolomite with small veinlets of galena</td>
</tr>
<tr>
<td>N 90</td>
<td>540</td>
<td>44</td>
<td>6</td>
<td>Dolomite with calcite veins containing chalcopyrite or pyrite; dominantly fine-grained and mottled.</td>
</tr>
<tr>
<td>N 91</td>
<td>110</td>
<td>20</td>
<td>8</td>
<td>Dolomite with red calcite veins containing chalcopyrite or pyrite; dominantly fine-grained.</td>
</tr>
<tr>
<td>N 92</td>
<td>210</td>
<td>18</td>
<td>6</td>
<td>Black mineralization (chalcopyrite and malachite in mottled dolomite, mineralization occurring only in calcite veins (band lm thick).</td>
</tr>
<tr>
<td>N 94</td>
<td>150</td>
<td>22</td>
<td>8</td>
<td>Fine-grained, dolomite-cholecalcite bands with malachite.</td>
</tr>
<tr>
<td>N 96</td>
<td>36</td>
<td>76</td>
<td>36</td>
<td>White, coarse-grained dolomite with galena, chalcopyrite.</td>
</tr>
<tr>
<td>N 97</td>
<td>400</td>
<td>280</td>
<td>20</td>
<td>White, coarse-grained dolomite with galena, chalcopyrite.</td>
</tr>
</tbody>
</table>
AREA 17

K.J. CRANLEY

Introduction

This area is situated to the north of Mt. Sanford Outstation and encloses an area of approximately 30 square miles. The location, access and general geology is shown on Fig. 17 - 1.

The 1:30,000 - scale aerial photographic coverage is Humbert River, 1971

run 4, photo  2453
run 5, photo  2605
run 6, photo  2192
run 7, photos 2309 to 2311

Geology - Stratigraphy

<table>
<thead>
<tr>
<th>Formation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seale Sandstone</td>
<td>Light-coloured, siliceous sandstone</td>
</tr>
<tr>
<td>Gibbie</td>
<td>Interbedded sandstone and siltstone</td>
</tr>
<tr>
<td>Neave Sandstone</td>
<td>Red sandstone, capping hills.</td>
</tr>
<tr>
<td>Mt. Sanford</td>
<td>Red-white calcrite interbedded with 1m-thick dolomite bands and siltstone.</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Hughie Sandstone</td>
<td>Light coloured sandstone</td>
</tr>
<tr>
<td>Burtawurta</td>
<td>Red to dark red sandstone, very massive, forms high ridges.</td>
</tr>
<tr>
<td>Wickham</td>
<td>Sandstone.</td>
</tr>
</tbody>
</table>

Dolomite beds are restricted to the Mt. Sanford Formation. They commonly are interbedded with chert. This chert forms a band above the dolomite and in many cases shows green staining, but this is believed to be of biological origin.

**Geology - Structure**

The most prominent structure is a dome of sandstone in the centre of the area. The outer baḥi (Burtawurta Formation) dips at about 30° and is approximately 700m thick. The anticlinal axis trends roughly northeast and shows the best development on the southern flank.

**Mineralization**

No mineralization was encountered, the only favourable formation for mineralization being the Mt. Sanford Formation with the sequence of fine-grained dolomites, calcrite
and chert.

Geochemistry

No anomalous stream sediment values were recorded, 198 stream sediment samples being taken.
Introduction

The area covered in this report is to the north, northwest and the northeast of Bullita Station. It is bordered by the Baines River to the west, the sandstone plateau to the east, and extends northwards to the boundary of Authority to Prospect 3071. Access to some parts of the area is difficult, but can be reached by four-wheel-drive vehicle. The location, access and general geology is shown on diagram 18 - 1.

The 1:30,000 - scale photo coverage is Humbert River, 1971

run 1, photo 2140
run 2, photo 2141
run 3, photos 2257 to 2260
run 4, photos 2415 to 2420
run 5, photos 2254, 2566 to 2573
run 6, photos 2229 to 2234
run 7, photo 2349
<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasper Gorge</td>
<td></td>
<td>Massive, jointed.</td>
</tr>
<tr>
<td>Sandstone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wondoan Hill</td>
<td></td>
<td>Green siltstone, shale and interbedded sandstone.</td>
</tr>
<tr>
<td>Bynoe</td>
<td></td>
<td>Multicoloured shales, siltstone silty dolomites. Beds 30 to 50cm thick, fissile.</td>
</tr>
<tr>
<td>Skull Creek</td>
<td></td>
<td>Fine- to coarse-grained dolomites, interbedded chert and dolomite and a thick sequence of chert. Dolomite beds are often up to 11 to 16m, displaying fresh grey, grey-black or white sequences.</td>
</tr>
<tr>
<td></td>
<td>Supplejack</td>
<td>Top: Grey, fine-grained, siliceous dolomites occurring as massive tabular blocks.</td>
</tr>
<tr>
<td></td>
<td>Dolomite</td>
<td>Black, coarse-to very coarse-grained dolomite, some bands interbedded with brown to dark-brown chert.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bottom: Fine- to coarse-grained white dolomite, showing veinlets of calcite and purple-white vugs.</td>
</tr>
<tr>
<td>Bardia Chert</td>
<td></td>
<td>Massive sequences of yellow-red and yellow chert with interbeds of sandstone.</td>
</tr>
<tr>
<td>Timber Creek</td>
<td></td>
<td>Well-exposed sequence of siltstone, sandstone, shales and fine-grained dolomites.</td>
</tr>
</tbody>
</table>
The dolomites in general are silicified. There are relatively few bands of pure dolomite. Coiling structures up to 12 cm across occur.

Dolomite anticlinal ridges were noted, the fine-grained dolomite beds overlying massive contorted calcite.

Geology - Structure

A major structure running approximately north on the eastern side of the area is a monocline dipping steeply to the west. In places, beds dip vertically but flatten out towards the sandstone plateau to the east. Good sections were observed (Section A-B) along the creeks cutting the structure. Siliceous dolomite dominates the western flank while shales, silty dolomites and calcite dominate the eastern flank.

East of the monocline is a gently-dipping anticline with dips of 5 to 10° on both flanks. Its axis trends parallel to that of the monocline.

Anticlinal ridges were observed to the east of the monocline. These have two major directions: 120° and 150°.

Mineralization

No mineralization was encountered, although rock samples were taken across contacts between formations at well-
exposed sections.

Geochemistry

The most meaningful anomalies observed are of lead in the -16+44 fraction where consistent high values have been obtained. Both copper and zinc anomalies correspond well with the lead values, but the individual copper and zinc values are not as high.

Background and Threshold values are tabulated below:

<table>
<thead>
<tr>
<th>Element</th>
<th>Fraction</th>
<th>Background (ppm)</th>
<th>Threshold (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pb</td>
<td>-16 + 44</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Pb</td>
<td>-200</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>Cu</td>
<td>-16 + 44</td>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td>Cu</td>
<td>-200</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Zn</td>
<td>-16 + 44</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Zn</td>
<td>-200</td>
<td>10</td>
<td>25</td>
</tr>
</tbody>
</table>

Due to the gentle grade of the streams and the shallow nature of the stream channels, mechanical mobility will be restricted to within 0.5 km.

Several areas of interest have been delineated, both below and above the Supplejack Dolomite.
1. Below the Supplejack Member: Consistent, high lead values between 38 and 230 ppm have been recorded, one set of results ranging between 170 to 230 ppm. All are situated at approximately the same distance below the Supplejack Member. In general the stream sediments do not show a general decrease natural gradient from high to low lead values, but are consistent.

2. Above the Supplejack Member: Three areas of anomalous lead values have been delineated,

a) To the west of the monocline, consistent, high values are present which seem to form a belt running parallel to the axis of the monocline. A rough contouring of the results in the northern part of the sheet delineates this belt well. Several anticlinal ridges are parallel to this belt of anomalous values. One anticlinal ridge follows a stream containing high stream sediment results.

b) One mile east of the monocline a small anomalous area has lead values in the -16-44 mesh fraction of between 36 - 140 ppm. Again these values delineate a belt striking parallel to the axis of the monocline.

c) East of the Jasper Gorge road comparatively high results were recorded. Some of these are the highest results in Area 18.
They range from 14 to 900 ppm lead. In general these correlate with structure, especially joint systems and anticlinal ridges. It is interesting to note that the highly anomalous values occur in areas of reasonably dense vegetation, where water is more abundant. A five-mile-long, north-striking bed can be inferred to pass through the sites of the anomalous stream sediments.

Two explanations are possible;

a) Mineralization is confined to either joint systems or anticlinal ridges.

b) Mineralization is confined to a particular bed. Due to the deformation in the western part of the area, it is not possible to tell whether the inferred bed is the same as the one on the western side of the monocline.
Introduction

This area is 12 miles north of Jasper Gorge along the Timber Creek Road. It is not in Authorities to Prospect 2077 or 3071. The location, access and general geology are shown on diagram 19 - 1.

The 1:80,000 - scale aerial photographic coverage is as follows: Delamere 1967

run 8, photo 18

Geology - Stratigraphy

The elongated domal structure exposes rocks of the Timber Creek Formation and Skull Creek Formation.

<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skull Creek</td>
<td></td>
<td>Thick, medium- to coarse-grained dolomites. Collenia structures prominent in some dolomites, others are laminated and platy and habit is well developed.</td>
</tr>
<tr>
<td>Supplejack Dolomite</td>
<td>Thick, coarse-grained dolomite with col lenia structures up to 3m in diameter.</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fine- to medium-grained sil icous dolomites, with sandy chert laminae, interbedded with thinly-bedded sandstones, cherts and fine-grained, pure dolomites.</td>
<td></td>
</tr>
<tr>
<td>Timber Creek</td>
<td>Thin interbeds of sandstones, dolomitic siltstones and dolomites. Some chertification has occurred.</td>
<td></td>
</tr>
</tbody>
</table>

**Geology - Structure**

A window in the sandstone plateau has exposed three domes trending 120° for 7 km. They are 1 km wide and are faulted and contorted (see cross section diagram 19-1). The limbs dip about 35° to the northeast and southwest with the closures plunging 40°. Faulting in the central and northwestern domes has exposed steeply-dipping beds of the Timber Creek Formation. A discordant fault breccia of recrystallized cherty dolomite has been formed along the faults. Strong jointing parallel to the axis has been found.

**Mineralization**

In the southeastern dome disseminated galena and chalcopyrite was found. The galena crystals, up to 0.5 cm
DIAGRAM 19-1
LOCATION, ACCESS AND GENERAL GEOLOGY

SCALE 1:80,000

LEGEND
- Prominent marker sequence of dolomites
- Timber Creek Formation
- Fault
- Fold axis
- Cu. Mineralisation locality

SECTION A-B

SECTION C-D
across, occur in thin, discontinuous veinlets of yellow and brown iron oxides which follow joints or collenia outlines in a thin, coarse-grained dolomite. The chalcopyrite grains, up to 1mm across, occurred in coarse-grained dolomite which has sandy chert laminae. This horizon is interbedded with dolomites, sandstones and cherts. It can be traced throughout the area and consistently contains chalcopyrite. No galena was found in the central and north western domes.

Conclusions

Sporadic mineralization, with a similar mode of occurrence to mineralization found in other areas, was detected in this strongly faulted area. No stream sediment samples were taken but outcrop was greater than 80%, enabling detailed prospecting, which detected nothing encouraging.
**Introduction**

Prospecting, geological mapping and stream sediment sampling have been carried out on the 407-square-mile panhandle of Authority to Prospect 3071. This is the part of Authority to Prospect 3071 north of latitude 16° South and within the 1:250,000 scale Auvergne and Delamere map-areas. The location, access and geology are shown on diagram 20-1.

Due to the weather and the lack of access, the Victoria River Downs helicopter was used for about 1.2 hours.

Aerial Photographic coverage at 1:80,000 scale is provided by

- Delamere run 5, photos 51 to 62
- run 6, photo 225
- run 8, photos 16 to 18

- Auvergne run 6, photos 221 to 223
- run 7, photo 165
- run 8, photo 65

Detailed geological traverses have been undertaken along the Victoria River in the best exposures of the Timber Creek and Skull Creek Formations. No stream sediment sampling was carried out in this region, as the target
formations only outcrop sporadically in the slopes of plateaus capped by sandstone.

Elsewhere, sampling and geological mapping was carried out at 1:80,000 scale.

Geology

The area is located relatively close to the western edge of the Victoria River Basin, and contains generally gently-dipping exposures of the Timber Creek, Skull Creek and Bynoe Formations and Jasper Gorge Sandstone.

Written geological information can be obtained from Bureau of Mineral Resources Records Nos. 1968/117 and 1970/3, covering, respectively, the Auvergne and Delamere 1:250,000 sheets.

Geology - Stratigraphy

An outline of the stratigraphy is given below. For more detailed information, the two abovementioned publications should be referred to.

<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasper Gorge Sandstone</td>
<td></td>
<td>Massive, white to orange, quartz sandstone</td>
</tr>
<tr>
<td>Location</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Wondoan Hill</td>
<td>Glaucobitic sandstone, siltstone and shales.</td>
<td></td>
</tr>
<tr>
<td>Bynoe</td>
<td>Green to purplish micaceous siltstones and shales; fine-grained, ripple-marked sandstones; minor dolomitic beds.</td>
<td></td>
</tr>
<tr>
<td>Skull Creek</td>
<td><strong>Bardia Chert</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Massive, brecciated, red-brown chert found only west of Mt. Dempsey, capping small hills. Thickness greater than 5m.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interbedded fine-grained, beige dolomite, &quot;calcrete&quot; and grey detrital stromatolitic dolomite. The uppermost part of the formation never outcrops well. It probably consists of a succession of siltstone, calcareous siltstone, possibly sandstone.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beige, platy, fine-grained dolomitic siltstones interbedded with massive, grey, dolomitic beds, containing chert laminae. Some fine layers of intraformational conglomerate. Thickness greater than 30m.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Massive, dark-grey, fine-to medium-grained dolomite with some stromatolites. About 15m thick.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interbedded grey detrital dolomite and platy dolomitic siltstone. Some beds are coarse, pink in colour and contain stromatolites. Thickness greater than 40m.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Massive, dark-grey dolomite, coarse-grained, stromatolitic. Very similar to the Supplejack Dolomite around Victoria River Downs. About 15m thick.</td>
<td></td>
</tr>
</tbody>
</table>
Massive, grey, fine- to coarse-grained dolomite, containing numerous chert nodules and laminae. Thickness greater than 30m.

Timber Creek

Forms the slope of the sandstone mesas around Timber Creek. Thinly-bedded mudstones, siltstones, dolomitic siltstones, fine- to medium-grained sandstones and minor dolomite beds. The mudstones and siltstones are similar to those occurring at the base of the Bynoe Formation and are red-brown, chocolate or greenish, are slightly micaceous and contain halite casts and mudcracks. The sandstones are generally fine-grained, cross-bedded, and whitish to purplish. The dolomite occurs as rare, thin, beige, fine-grained beds up to 20cm thick. These sometimes contain chert nodules. No coarse-grained dolomitic material was found. Thickness greater than 100m.

Geology - Structure

The only outstanding structure of the panhandle area is a monocline trending 315°, in which dips range up to 60° southwest. This feature dies out in both directions and is not directly connected with the curved monocline of Bullita. The main directions of faulting and jointing are 040° and 270°. A massive red-orange brecciated chert has been found associated with some fracture zones in the vicinity of Mt. Dempsey.
Along the Victoria River, the regional dip in the sediments of the Bullita Group is a few degrees to the east-northeast. In the same area, the jointing in the Jasper Gorge Sandstone trends 330°.

Mineralization

Copper minerals, galena and barite were found during the prospecting and geological mapping.

Small patches of malachite and cuprite occur at locations C98 and C127, in a 30cm-thick bed of massive, grey, coarse-grained dolomite. The patches are elongated, up to 1cm long and a few millimetres thick. These are in a bed containing chert laminae. This bed is above the second massive dark-grey dolomitic bed of the Skull Creek Formation, overlooking the Victoria River. The best showings grade laterally into sparse disseminations of copper minerals.

One grain of galena was discovered at location C193 in a pink, coarse-grained calcite veinlet. This is within a coarse-grained, grey, detrital dolomite, containing chert laminae.

Small aggregates of barite occur in the Timber Creek and Skull Creek Formations, but no vein type occurrence was found.
A massive vein of barite occurs at location C199, outside Authority to Prospect 3071. It is about 800m long and varies in thickness up to 1m. A few millimeter-sized grains of pale green fluorite are scattered through the coarsely crystalline barite, but traces of base metals were not recorded. Three smaller veins up to 30cm thick run parallel to the main occurrence, and trend northwest.
Introduction

Prospecting, geological mapping and stream sediment sampling has been carried out on two domal structures located northeast of Humbert River Homestead.

The access into the area is provided by recently-graded station tracks, shown with geology on diagram 21-1.

The 1:30,000 – scale aerial photographic coverage is Humbert River 1971

- run 8, photos 2487 to 2489
- run 9, photos 2354 to 2358
- run 10, photos 2509 to 2512
- run 11, photos 2536 to 2539

Geology

The area is surrounded by siltstone and sandstone mesas of the Bynoe Formation and Jasper Gorge Sandstone, in which the two domal structures form a window of outcropping dolomites of the Skull Creek Formation.
Airphoto interpretation has been combined with the field observations to prepare a 1:30,000 - scale geological map, on which mineral occurrences and geochemical anomaly sites have been plotted.

**Geology - Stratigraphy**

The stratigraphic section in the area is the following

<table>
<thead>
<tr>
<th>Formation</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jasper Gorge Sandstone</td>
<td></td>
<td>Pure, well-sorted quartz sandstone, with large-scale cross-bedding, rare ripple marks. Thickness greater than 3m.</td>
</tr>
<tr>
<td>Bynoe</td>
<td></td>
<td>Grey-green and purplish micaceous siltstone; micaceous, fine-grained, dolomitic sandstone; and rare beds of fine-grained dolomite. Mudcracks, cross-bedding and salt casts are common. Thickness greater than 60m.</td>
</tr>
<tr>
<td>Skull Creek</td>
<td></td>
<td>Calcrete and white and purplish siltstones interbedded with very rare, beige-yellow dolomite beds. (The Skull Creek Formation from the Supplejack Dolomite Member to the top of the Formation is about 70m thick.) In the southeastern dome, a few metres of thick, massive chert occurs in the middle and upper part of the Upper Skull Creek Formation. The chert overlies a few, thick, grey, detrital dolomite beds, very rich in chert laminae and nodules.</td>
</tr>
<tr>
<td>Supplejack Dolomite</td>
<td><strong>Calcrete and thin beds of beige-yellow, fine-grained dolomite.</strong></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Platy, grey, fine detrital dolomite with very little calcrete.</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Massive, dark-grey (black on aerial photograph) detrital dolomite, thickly bedded, showing numerous stromatolites near the top. The rock is fine- to medium-grained, grey to purplish, with few beige-yellow bands of fine dolomite up to 20cm thick displaying thin, contorted concentrations of coarse material, also some thin layers of intraformational conglomerate. Thickness 10 to 15m.</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Thick beds of grey detrital or brecciated dolomite containing abundant chert nodules and laminae, interbedded with few thin calcrete layers. About 5m thick.</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Thick beds of yellow-beige, fine-grained dolomite with few calcrete bands. About 20m thick.</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Interbedded calcrete, siltstone and thin beds of yellow-beige, fine-grained dolomite. About 50m thick.</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Cross-bedded, purplish and whitish siltstones containing salt casts with few interbedded calcrete beds. Possibly upper Timber Creek Formation. Unknown thickness.</strong></td>
<td></td>
</tr>
</tbody>
</table>
In the faulted part of the southeastern dome, a thin, irregular algal bed was found. The organisms are of the same type as those found in the upper part of the Timber Creek Formation along Gibbie Creek. In the same area, three different thin short "beds" occur, probably representing fault planes. As no mineralization is related to these local structural complications, no further time was spent in this locality.

The term "calcrete" has been used here to describe a weathering product, probably of calcareous siltstone.

Geology - Structure

Both structures in the area are faulted domes, the southeastern one being symmetrical, with a gently-dipping, undulating, southwestern flank, and a steeply-dipping northeastern flank on which the dips range up to $90^\circ$.

The main faulting has a general trend of $315^\circ$. The fault planes appear to dip vertically. It has a possible vertical throw of up to 50m in the northwestern structure.

Few anticlinal ridges occur where the part of the sequence containing calcrete dips flatly.
Mineralization

Although exposures are very good in the area, very little mineralization was found despite numerous traverses and checking of faults.

The best non-metallic mineralization in the area is small barite veins and blebs in dolomite or chert. The veinlets are up to 2 cm thick and up to 20 cm long. One lens of barite located in the northwestern extension of the western dome (location 21 - 1) contains fine disseminations of pyrite and chalcopyrite. A representative sample of the 1-to-2-square-metre outcrop area yielded 1000 ppm copper. A similar, but smaller, occurrence has been found at location 21 - 3.

Small patches and veinlets of iron oxide occur in the uppermost part of the Supplejack Dolomite. No other metallic mineralization was discovered.

Geochemistry

138 Stream sediment samples have been taken in the area, and the -16+44 and -200 mesh fractions have been analysed for lead, zinc and copper. The results have been plotted at 1:30,000 scale.
The geochemical survey has outlined three areas of interest:

Area 21-4: Lead values up to 560 ppm in the -16+44 mesh fraction occur very consistently along the creek, supported by copper values in the -200 mesh fraction, slightly higher than threshold. As no anomalies occur in the adjoining creeks, it appears that the mineralization must be of a small extent. It could be related to a locally mineralized bed in the vicinity of the contact between the Skull Creek and Bynoe Formations.

A single copper anomaly occurs at location 21-5. As there is neither mineralization in this locality, nor supporting anomalies in adjoining creeks, this anomaly could be due to a heterogeneity in the sampling.

Many lead and zinc anomalies occur in the drainage system of the northwestern dome (locality 21-2). The highest lead content in the coarse fraction is 310 ppm. These anomalous values are probably caused by disseminated galena and sphalerite around the middle of the Skull Creek Formation. However, no traces of these two minerals were found during the field mapping.
Conclusion

The faulted domal structures examined are of little economic interest. Only a little barite and copper mineralization was discovered during the field mapping, and the geochemical survey has outlined three anomalous areas, two of which warrant field checking.