DEPARTMENT OF
MINERALS AND ENERGY

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1973/95

MINERALIZATION IN THE VICTORIA RIVER REGION

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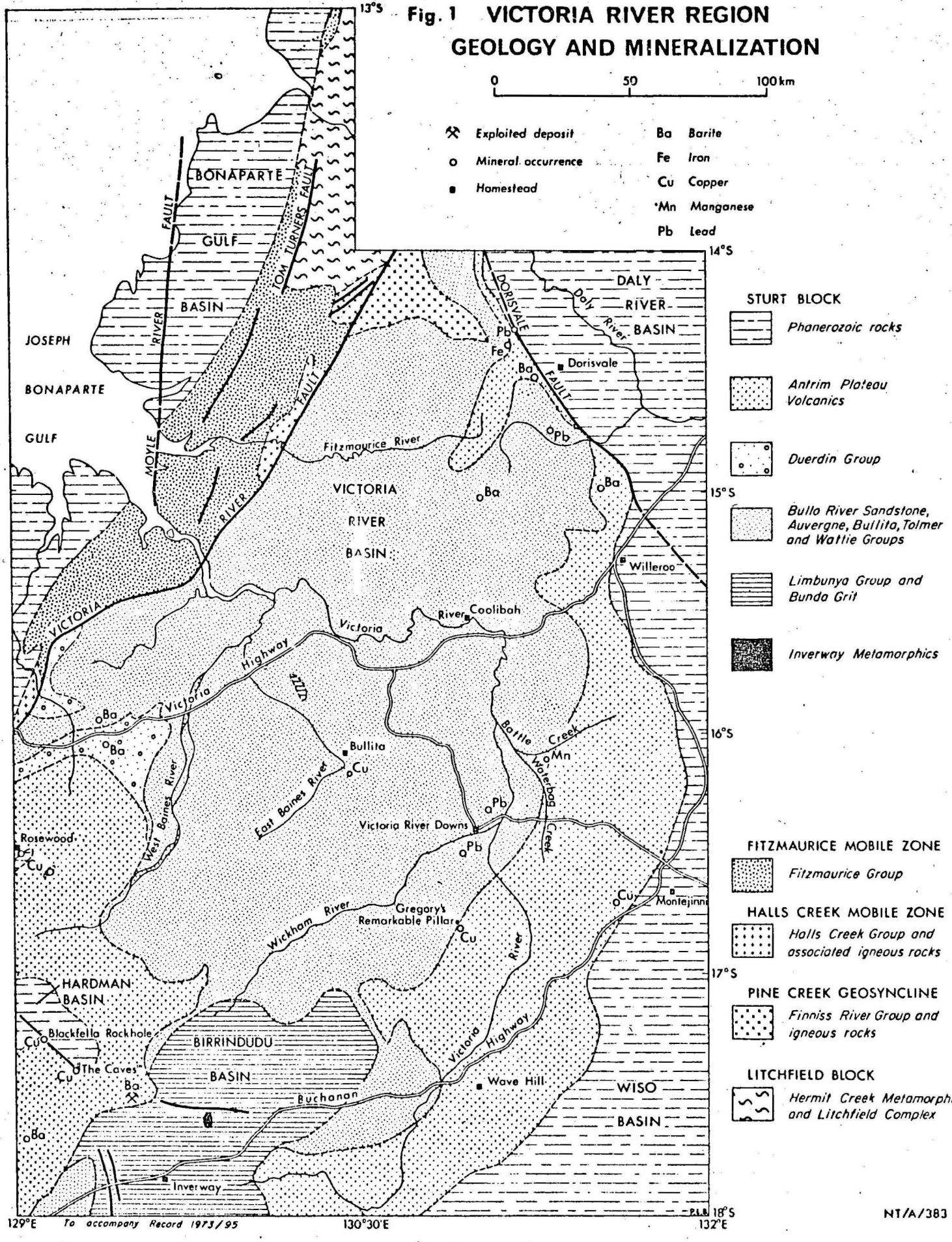
Two main tectonic units are recognizable in the Victoria River Region: the Fitzmaurice Mobile Zone occupied by metamorphic basement and overlying folded and faulted rocks, and the Sturt Block occupied by flat-lying and gently folded sedimentary rocks. The two units are separated by a major reverse fault, the Victoria River Fault, which merges with the Halls Creek Fault in the southwest, and possibly with the Giants Reef Fault in the north (Fig. 1).

The geology of the Victoria River Region has been described by Sweet, Pontifex, & Morgan (in press), Sweet, Mendum, Morgan, & Pontifex (in press), and Sweet, Mendum, Bultitude, & Morgan (in press).

FITZMAURICE MOBILE ZONE (Table 1)

Basement rocks include granite, acid volcanics, and metasediments of the Pine Creek Geosyncline (Walpole et al., 1968) in the northeast, and the rocks of the Halls Creek Mobile Zone (Traves, 1955; Dow & Gemuts, 1969) in the southwest. Overlying Lower Proterozoic and Archaean rocks with marked angular unconformity are quartz sandstone, siltstone, and shale of the Fitzmaurice Group which have been correlated (Pontifex & Sweet, 1972) with the Carr Boyd Group, of Adelaidean age, also to the southwest in the Halls Creek Mobile Zone (Plumb & Veevers, 1971). The Fitzmaurice Group is thus believed to be of Adelaidean age, using the term in the sense proposed by Dunn, Plumb, & Roberts (1966), and is much younger than

Fig. 1 VICTORIA RIVER REGION GEOLOGY AND MINERALIZATION



To accompany Record 1973/95

NT/A/383

TABLE 1: Summary of stratigraphy of the Fitzmaurice Mobile Zone

AGE		UNIT		
Adelaidean		FITZMAURICE GROUP (3600+ m of sandstone, siltstone, shale; minor conglomerate)		
		UNCONFORMITY		
Carpentarian	Halls Creek Mobile Zone	Bow River Granite Whitewater Volcanics	Pine Creek Geosyncline	Allia Creek Granite Soldiers Creek Granite Koolendong Granite Ti-Tree Granophyre
Lower Proterozoic and Archaean	Halls Creek Mobile Zone	Halls Creek Group	Pine Creek Geosyncline	Chilling Sandstone Finniss River Group UNCONFORMITY Hermit Creek Metamorphics and Litchfield Complex

previously thought by Walpole et al (1968) who assigned it to the Lower Proterozoic Chilling Sandstone.

Although Brown (1895) reported traces of gold mineralization in quartz veins cutting rocks of the Fitzmaurice Group, no mineralization is known in either the basement rocks or sedimentary cover of the Fitzmaurice Mobile Zone. However, prospecting of the basement rock inliers of Pine Creek Geosyncline granites and sediments may reveal at least minor tin and gold mineralization.

STURT BLOCK (Table 2)

A sequence totalling about 5300 m makes up the Sturt Block, and has been subdivided into six major units (Table 2). The sequence from the Wattie Group through to the Bullo River Sandstone was deposited in the Victoria River Basin, and the Limbunya Group and Duerdin Group in older (Birrindudu) and younger (unnamed) basins, respectively. The whole sequence reflects the stable platform (Sturt Block) environment in which it was laid down. Most of the sediments were laid down in shallow marine and paralic environments, although some indicate moderately deep water, and others non-marine conditions. Considering its time span of perhaps 800 or more million years, the sequence is very thin, and far more time is probably represented by at least six regional unconformities than by sedimentation.

TABLE 2: Summary of the stratigraphy of the Sturt Block, Victoria River region

AGE	UNIT	MAXIMUM THICKNESS (m)	LITHOLOGY
ADELAIDEAN OR CAMBRIAN	ANTRIM PLATEAU VOLCANICS	300+	Basalt; minor agglomerate, sandstone, chert, limestone
	UNCONFORMITY		
ADELAIDEAN	DUERDIN GROUP	300	Tillite, sandstone, conglomerate, siltstone, shale, dolomite
	UNCONFORMITY		
	BULLO RIVER SANDSTONE	300	Sandstone, conglomerate
	UNCONFORMITY(?)		
	AUVERGNE GROUP	1000	Sandstone, siltstone, dolomite, shale
	UNCONFORMITY		
	WONDOAN HILL FORMATION	145	Sandstone, siltstone, mudstone
	UNCONFORMITY		
ADELAIDEAN (?)	BULLITA GROUP	700	Dolomite, siltstone, chert; minor sandstone
	WATTIE GROUP	400	Sandstone, siltstone; minor dolomite, claystone
	UNCONFORMITY		
CARPENTARIAN OR ADELAIDEAN	LIMBUNYA GROUP	1500+	Dolomite, siltstone, sandstone, shale, chert
	UNCONFORMITY		
CARPENTARIAN	BUNDA GRIT	1200+	Sandstone, grit; minor chert
	UNCONFORMITY		
ARCHAEAN OR LOWER PROTEROZOIC	INVERWAY METAMORPHICS	-	Schist

Apart from the Antrim Plateau Volcanics, of uppermost Proterozoic or Cambrian age, no definite evidence of volcanic activity has been observed, although some tuff-like rocks have been recorded by Sweet, Mendum, Bultitude, & Morgan (in press) in the Wattie Group.

Except for the Bunda Grit, which is strongly folded, rocks of the Sturt Block are only gently folded or warped over large areas, and some Auvergne Group and younger rocks are virtually flat-lying. Faults are common, although displacements are generally small - about a few hundred metres. Many of the faults are monoclines in which the limbs have separated, probably indicating minor movements in a rigid basement with corresponding flexure and breakage in the cover.

MINERALIZATION

Mineralization in the basin consists of several minor occurrences of lead, zinc, copper, and manganese minerals associated with carbonate units, iron in laterites and older weathering surfaces, and barite veins throughout the sequence (Fig. 1).

Lead and zinc: Small aggregates of galena crystals occur in fine and medium crystalline dolomite of the Bullita Group, particularly in the Skull Creek and Banyan Formations.

The lead was probably incorporated with carbonates during sedimentation, and slightly concentrated during recrystallization. The probability of finding large stratiform bodies seems small, but concentrations could possibly be found in structurally favourable localities. One such locality could be the Dorisvale Fault which forms the western margin of the Daly River Basin, where Euralba Mining N.L. (1971) have found anomalous lead and zinc contents in ferruginous rocks along the fault-zone 30 km northwest of Dorisvale homestead.

Australasian Minerals Incorporated carried out an intensive survey of the Bullita Group on Victoria River Downs Station, but despite the discovery of many minor galena occurrences, no economic deposits were found. Rock-chip sampling by Sweet, Mendum, Bultitude & Morgan (in press) showed that the Supplejack Dolomite Member contains slightly higher lead values than the remainder of the host formation, the Skull Creek Formation.

The Limbunya Group, a dolomite, shale, and sandstone sequence, has not been explored for base metals. However, because of its possible equivalence with the McArthur Group (Plumb & Derrick, this volume), the Limbunya Group warrants exploration for base metals.

Copper: The lavas of the Antrim Plateau Volcanics contain traces of native copper either as sparse disseminations in massive basalt or as amygdale and geode infillings in vesicular flow tops. Malachite, azurite, chalcocite, and chrysocolla are associated with the native copper in amygdales and geodes. Assays of samples taken from a single boulder of massive basalt 2 km southeast of Gregory's Remarkable Pillar have yielded up to 0.38 percent copper. Specimens of native copper up to about 30 cm across and several kilograms in weight have been found in places - for example, on Willeroo Station, southwest of Katherine. These were probably geode infillings, and have been exposed by erosion of the enclosing, extensively altered, relatively soft, vesicular basalt.

Numerous small uneconomic deposits of malachite, chalcocite, azurite, and chrysocolla have been found in vesicular parts of flows, in an agglomerate layer near the top of the volcanic sequence, and in basal beds of limestone units overlying the Antrim Plateau Volcanics. The richest concentrations reported are southeast of Blackfella Rockhole (in the area locally known as "The Caves") and along the "Rosewood Wall" (in Western Australia), and are associated with faults in the volcanics and related monoclines in the limestone. There can be little

doubt that these deposits are related directly or indirectly to the lavas of the Antrim Plateau Volcanics; the copper was probably leached from the highly vesicular, relatively porous flow tops by hydrothermal solutions, groundwater or both, and deposited as disseminations and as concentrations in and adjacent to faults, fractures, and joints in the volcanics, and also as disseminations along bedding in the basal part of the overlying limestone.

The Antrim Plateau Volcanics in the Victoria River district and the adjoining East Kimberley region of Western Australia have been examined for copper mineralization by several companies, particularly Metals Exploration N.L., Sampey Exploration Services, and Australasian Minerals Incorporated. A geochemical survey based on stream-sediment sampling has been carried out in the area by Metals Exploration N.L. Areas with anomalously high copper values were then investigated by induced polarization. Airborne electromagnetic, magnetic, and radiometric surveys covering Victoria River Downs and part of Rosewood stations were undertaken by Australasian Minerals Incorporated in 1971. The surveys were followed by a program of rotary percussion drilling. However, no significant concentrations of copper were found.

Very small (0.5 mm) grains of chalcopyrite are disseminated in a 0.5 m bed of dolomitic sandstone near the top of the Bynoe Formation south of Bullita homestead, and malachite stains follow joints in the formation near Coolibah homestead, but no significant concentrations of copper minerals are known. Chip samples taken by Sweet, Mendum, Bultitude, & Morgan (in press) showed values of less than 100 ppm copper over 15 m stratigraphic intervals.

Manganese: The Battle Creek Formation contains reddish-brown coarsely crystalline dolomite beds which assay 0.1 to 1.0 percent manganese. Between Battle and Waterbag Creeks concentrations of up to 9 percent manganese occur, mostly as pyrolusite filling joints, but mineralization is patchy.

Iron: Ferruginous laterites cap mesas throughout the region, and represent remnants of a Tertiary weathering surface (Hays, 1967). Fe_2O_3 rarely exceeds 50 percent, and Al_2O_3 20 percent (Sweet, Mendum, Morgan, & Pontifex, in press). More prospective for iron are ferruginous crusts of Precambrian age developed on the Bynoe and Waterbag Creek Formations southwest and northwest of Dorisvale homestead, respectively. They were first recorded by Sweet et al. (op. cit.), and some have been tested by Euralba Mining N.L. (1971), who have

shown the existence of several millions of tonnes of ore assaying 40 to 60 percent Fe_2O_3.

Barite: Barite is the only mineral which has been produced from the Victoria River region in commercial quantities. The only recorded production was from June to September, 1971, when about 9000 tonnes of ore yielded about 6700 tonnes of barite*, all from the Inverway deposit worked by South Australian Barytes Ltd. This deposit consists of two vertical veins 1.5 to 3 m wide, and totalling more than 4 km in length, in flat-lying basalt of the Antrim Plateau Volcanics.

Two veins of barite, 300 to 600 m long and 1 to 5 m thick, have been found southwest of Dorisvale homestead (Shields, 1969); they have been tested by exploration companies, but no mining has been carried out. The deposits occur as vertical infillings of joints or faults in basal flat-lying sandstone of the Antrim Plateau Volcanics.

Many veins of barite up to a few tens of metres in length intersect Precambrian rocks, particularly those of the lower part of the Auvergne Group (Angalarri Siltstone) and Bullita Group (Bynoe Formation). Veinlets 0.5 to 2 mm thick cut Angalarri Siltstone, and barite also forms sparse cement in sandstone of

*Figures from Mines Branch, Department of the Northern Territory, Darwin.

the Wattie Group. In the absence of known igneous or hydrothermal activity, it is suggested that many of the barite veins may have been derived, at comparatively low temperatures, from barium-rich sediments.

Both the larger barite deposits (Inverway and Dorisvale) lie within the Antrim Plateau Volcanics, and it is possible that they are genetically related to the Volcanics. In the Dorisvale area, however, extensive outcrops of Bynoe Formation are also known to carry barite, and this formation could be the source of barium locally.

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