COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

1961/42

THE OCCURRENCES OF LEAD NEAR BOX HOLE BORE, CENTRAL AUSTRALIA.

by

D.R.Woolley and K.A.Rochow.

THE OCCURRENCE OF LEAD NEAR BOX HOLE BORE, CENTRAL AUSTRALIA

by

D.R. Woolley and K.A. Rochow.

RECORDS 1961/42

CONTENTS

SUMMARY

Lead mineralisation (mainly galena) occurs near Box Hole Bore, 160 miles north-east of Alice Springs, in lenses in Upper Cambrian dolomites of the Arrinthrunga Formation. The lenses are restricted to two horizons; the main lens averages 20 feet in thickness, and extends for about 8,000 feet along the strike. Mineralisation exposed at the surface is lenticular, and has been considerably affected by leaching; hence a worthwhile estimate of tonnage and grade is not possible without sub-surface data. Results of drilling by Enterprise Exploration Pty. Ltd. are not yet available.

INTRODUCTION

Specimens of galena in limestone have been collected by stockmen and natives for some time from various localities in the vicinity of Ooratippra Station, about 180 miles north-east of Alice Springs, (Fig. 1).

W.H. King obtained an authority to prospect over one of these localities in January, 1960, and the area is at present (August, 1960) under option to Enterprise Exploration Pty. Ltd. The prospect was inspected by the authors in May, 1960, and again by Rochow in July, 1960. Some drilling has been carried out since the inspections were made, but the results are not available.

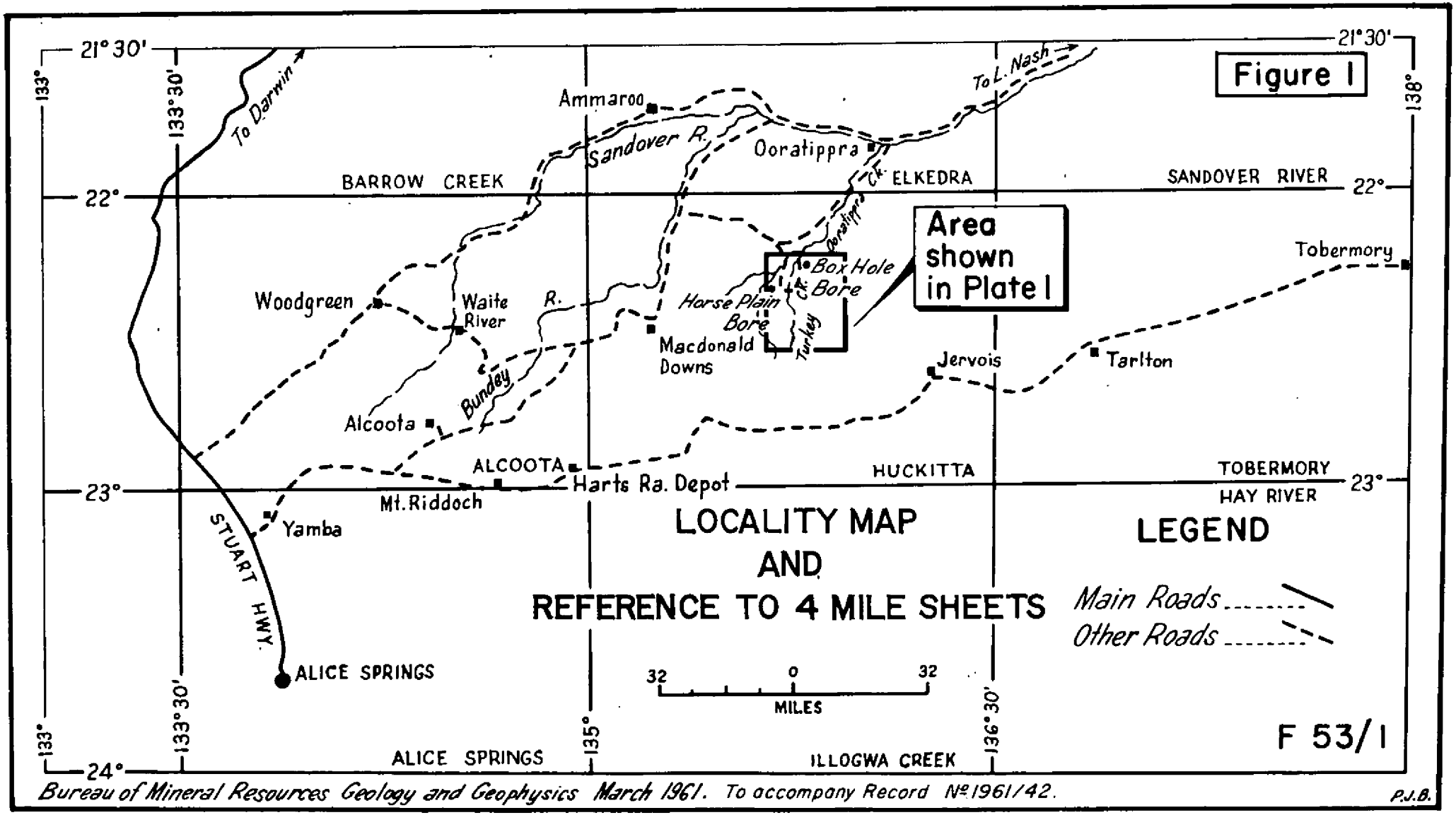
The occurrence consists of galena-bearing silicified lenses of Cambrian carbonate sediments, and is situated approximately three miles south of Box Hole Bore, 230 miles by road from Alice Springs. Access is by formed earth roads, and potable water is available at Box Hole Bore and at Horse Plain Bore, approximately six miles to the south-west.

REGIONAL GEOLOGY

The area, which is part of the Huckitta 4-mile Sheet area, has been mapped in detailed reconnaissance by geologists of the Bureau of Mineral Resources (Smith et al., 1960), and the stratigraphic nomenclature proposed by them is used in this report.

A generalised section in the Box Hole Area is, in descending order :

DEVONIAN	DULCIE SANDSTONE
UNCONFORMITY	
UPPER CAMBRIAN to LOWER ORDOVICIAN	TOMAHAWK BEDS (SANDSTONE)
(?)UNCONFORMITY	
UPPER CAMBRIAN	ARRINTHRUNGA FORMATION Limestone, Dolomite, Siltstone, with Eurowie Sandstone Member.



Bureau of Mineral Resources Geology and Geophysics March 1961. To accompany Record №1961/42.

P.J.B.

Outcrops of the Arrinthrunga Formation are widespread in the vicinity of the Box Hole Bore, and extend for many miles to the north and east. To the south and west, the Arrinthrunga Formation is overlain by sandstone of the Tomahawk Beds of Cambrian to Ordovician age. The contact between these two formations was considered to be conformable by Smith et al., (1960), but a detailed examination of the air photos suggests than an unconformity may be present. The contact was not examined in the field by the present authors.

The Arrinthrunga Formation consists mainly of limestone and dolomite with abundant algal structures and some oolitic beds. Fine-grained, creamy brown, laminated siltstone is interbedded with the limestone and dolomite. The siltstone does not form prominent outcrops, but is well exposed in a pit about eight feet deep immediately above the mineralised bed.

The carbonate rocks are generally grey, cream, and brown. In the Box Hole area, the majority of the beds are from three inches to one foot thick, but they become thicker (commonly more than two feet) near the top of the formation. The proportion of siltstone appears to be lower near the top of the formation.

In the immediate vicinity of the prospect, the outcrops are mainly thin-bedded, fine-grained, cream or pale grey dolomites and limestones. Algal structures are common immediately below the mineralised beds. Silicification, ranging from slight to intense, is present in these beds, and barite occurs sporadically through the section in irregular nodules up to 2" long. Areas of no outcrop appear to represent calcareous siltstones, which have been exposed in prospecting pits.

The thickness of the Arrinthrunga Formation has not been measured in the Box Hole area, but is thought to be about 2,000 feet.

The Eurowie Sandstone Member, within the Arrinthrunga Formation, has been used as a marker unit. It is a medium-grained, medium-bedded, rather poorly sorted sandstone, which is generally pale brown. Dips are very irregular in this member, and it commonly contains pseudomorphs after halite. The thickness of the Eurowie Sandstone Member is not known precisely, but is probably about 100 feet in the Box Hole area.

The lead-bearing beds appear to be 300 to 400 feet above the top of the Eurowie Sandstone Member. The complete interval has not been measured; two partial sections measured up to the mineralised beds are shown in the Appendix.

STRUCTURE

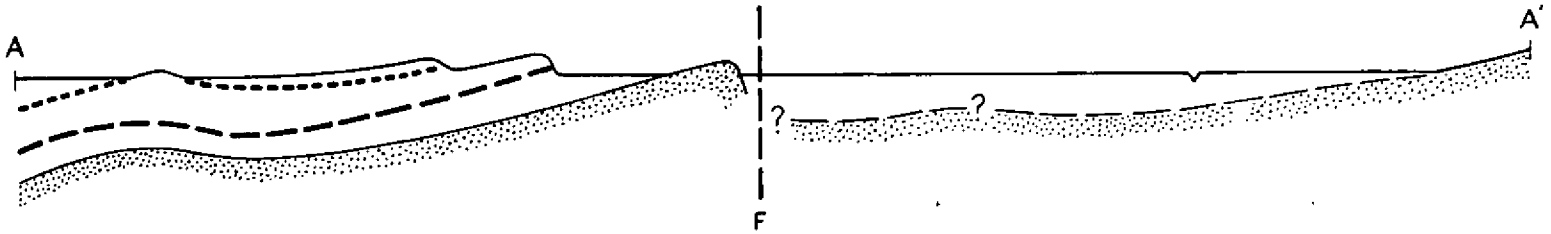
(a) Regional

The regional structural pattern is fairly simple, as the sediments of the Arrinthrunga Formation, including the Eurowie Sandstone Member, dip gently to the south-west. To the east there are some faults, probably of small displacement, but extending for some miles, and generally trending north to north-east.

(b) In the Vicinity of the Mineralisation.

The lead-bearing horizons crop out along part of the eastern flank of a north-trending ridge which rises about 100 feet above the surrounding plain. The geological structure

FIG. 2



LEGEND

- DOLOMITE
- SANDSTONE
- MAIN (LOWER) ORE BEARING HORIZON
- UPPER ORE BEARING HORIZON

SCALE

0 3000' 6000' 9000'

PROBABLE SECTION THROUGH A A', PLATE I

Bureau of Mineral Resources Geology & Geophysics March 1961 *To accompany Record No 1961/42.* F 53/11/1 EJ

of the sediments in this ridge is a shallow syncline whose axis trends approximately north-south. The limbs of the syncline dip at 10°-20°. This structure, which is closed at the northern end, can be traced southward for about 4 miles, where it is lost under alluvium. A cross-fold, with which a slight change in strike of the synclinal axis appears to be associated, has created a constriction of the syncline, about halfway along its exposed length. Lead mineralisation occurs mainly south of this constriction.

The southern part of the syncline is bounded on the east by a monoclinal structure, which dies out completely to the north, and appears to pass southward into a fault which truncates the mineralised zone. Some of the beds on the western side of the fault have been folded into small south-pitching anticlines, whose attitude indicates that the eastern block was down-thrown (Plate 1). The distribution of the Eurowie Sandstone Member, which occurs stratigraphically below the ore bearing horizon, also indicates that the eastern block was down-thrown (Fig. 2). However, the movement appears to be small, and it is doubtful if much of the ore bearing horizon occurs below ground level east of this fault.

The western limb of the syncline is truncated for its exposed length by a narrow zone of steep reversed dips, ~~which~~ This zone is approximately parallel to the synclinal axis (Plate 1). This zone of steep dips marks a reversal from the easterly dips of the syncline, to the regional westerly dip which extends west to Turkey Creek and beyond. Within this zone there appears to be some fairly tight minor folding, with dips ranging up to 70°. At the northern end of this zone the structure is monoclinal, with a displacement of about 20 feet (west side down), but outcrop over the remainder of the zone is too poor to allow an accurate determination.

The western zone of steep reverse dips is close to the synclinal axis (Plate 1) preventing exposure of the main mineralised horizon on the western flank of the syncline. If the mineralisation which crops out on the eastern flank of the syncline persists down dip, it should occur at depth west of the zone of steep reversed dips (Fig. 2).

OCCURRENCE OF LEAD

(a) Mineralisation.

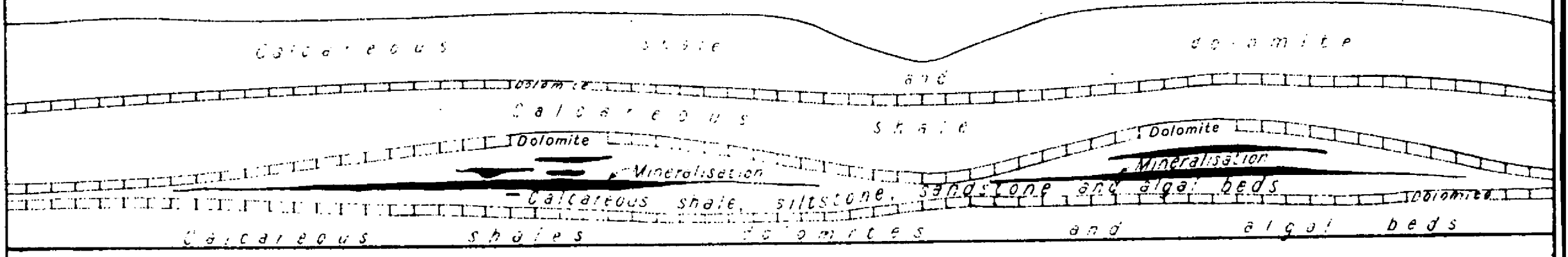
The mineralisation is in the form of abundant disseminated cubes of galena ranging from about $\frac{1}{8}$" to 1" in size, with some irregular crystal aggregates up to 3" long, and occurs within lenses of silicified carbonate rock. Silicification generally prevents the differentiation of dolomite and limestone by the acid test, but the algal and oolitic structures present suggest that some at least of the host rock was originally limestone. The mineralised zone is exposed for a distance of almost two miles along the eastern flank of the southern part of the syncline. Barite is commonly associated with the galena.

The main mineralised bed varies greatly in thickness, and maintains a position between two dolomite beds, which have been recognised wherever outcrops occur within this two-mile belt. The dips of the lead-bearing bed range from 5° to 15°W.

Fig 3

SECTION THROUGH ORE SEQUENCE

(GENERALISED, AND PROJECTED TO LINE B B' ON PLATE I)



Scale

Horizontal Scale : 1000 feet to 1 inch Approx.

Vertical Scale : 100 feet to 1 inch Approx

Bureau of Mineral Resources March 1961

To accompany Record No. 1961/42

F 55/11/2

The mineralisation pinches out completely near the centre of the belt, thus forming two main lenses, and the enveloping dolomite beds approach to within a few feet of each other at this point (Fig.3).

Cavities are very common, and are in many places the only indication of mineralisation in surface exposures; some have cubic outlines, but the majority have no regular shape or are roughly hemispherical. In some places it is difficult to distinguish between pitting due to weathering and cavities formed by the leaching of galena. Cerussite is commonly found in the cavities, presumably formed by oxidation of galena in situ. However, some cerussite occurs in the dolomite matrix between the cavities.

The lead minerals are found in silicified carbonate rocks of the following type, in decreasing order of intensity of mineralisation:

a) Massive: Mostly random distribution of galena in rock which has no internal structure.

b) Massive thinly laminated: Galena commonly concentrated along lamination planes.

c) Intraformational breccia: Distribution apparently random, with some cubes of galena transgressing the boundaries of breccia fragments.

d) Algal: Random distribution of galena.

Few of the individual mineralised lenses extend for more than 100 feet along the strike, but the mineralised zone as a whole crops out for a total length of 8,000 feet, and is confined to a single sedimentary unit whose average thickness is about 20 feet.

This unit may contain several lead-bearing lenses in any particular section, but most commonly there is only one. The individual lenses seldom exceed two feet in thickness. At the northern and southern extremities of the mineralised zone, the lead-bearing bed appears to thicken to 60 to 70 feet. As the actual thickness of the lead-bearing lenses does not increase in proportion, this results in a decrease in the overall grade of the zone.

Another mineralised zone is present 130 feet stratigraphically above the main zone. The host rocks of this sequence are similar to those of the main zone, but this upper sequence has only been traced for a few hundred feet along the strike, and it has an average thickness of less than five feet.

As there are many sections of the Arrinthrunga Formation which contain similar lithological assemblages that are not mineralised, lithology alone is not a useful guide for prospecting. However, most of the galena occurrences appear to be associated with extreme silicification.

Rare cubes of galena have been found sporadically distributed in the algal beds immediately below the main mineralised bed, but nearly all the mineralisation occurs in the non-algal beds.

The lead occurrences in this area are therefore thought to be syngenetic in the sense that the lead was introduced into the sediments at the time of their deposition, but a certain amount of mobilisation and redistribution may have taken place.

The presence of algae in the succession indicates that deposition took place largely in clear, shallow water, but the algae were not necessarily directly responsible for the precipitation of the lead.

(b) Size and Grade of the Deposit.

No reliable estimate of tonnage and grade can be given without subsurface investigation. The length of the mineralised zone as seen in the outcrop is about 8,000 feet, and the aggregate thickness of mineralised lenses within the zone ranges from 0 to 10 feet. If mineralisation of the same dimensions persists down dip it could constitute a major deposit; diamond drilling is required to establish reserves.

The grade of the deposit is similarly in doubt; it is difficult even to establish the grade of surface mineralisation because of leaching. Box-works occur throughout, but there is little development of secondary lead minerals; thus surface samples might be expected to return low values. A surface sample obtained by the authors assayed 4.5% Pb, and a sample of hand-picked ore, assayed for W.H. King by Broken Hill Associated Smelters, Port Pirie, gave the following results:

Pb	66.1%
Au	nil
Ag	1 oz. 18.4 dwt. per ton
Bi	0.43%

(c) Possible Extensions

As the stratigraphic position of the mineralised horizon has been approximately established it should be possible to check this part of the sedimentary sequence in other areas in an endeavour to find similar deposits. During the present investigation an attempt was made to do this in an area to the south-east of Box Hole, but time did not permit a search in more than one locality.

A section through the Arrinthrunga Formation, between the Eurowie Sandstone Member and the overlying Cambro-Ordovician sandstone, was examined about 5 miles south-east of the Box Hole deposit. Using aerial photos, the beds containing the lead mineralisation at Box Hole were traced to the vicinity of this section, but unfortunately the critical part of the area is mostly covered by alluvium. However, lead-bearing beds are commonly strongly silicified and crop out prominently, so that the absence of such outcrops suggests little or no mineralisation. Unsilicified thin-bedded dolomites and some fine-grained siltstones appeared generally similar to those at Box Hole, but no traces of lead were found. The upper part of this section contains massive thick-bedded limestones and dolomites, with many algal beds and some oolitic beds. The stratigraphic interval between the Eurowie Member and the Cambro-Ordovician sandstone is apparently much greater in this area than at Box Hole.

In searching for additional deposits it is logical to first prospect the beds in which mineralisation occurs at Box Hole, but until more is known of the origin of the lead or of the critical environment in which deposition took place, there seems no reasonable basis for excluding other parts of the Arrinthrunga Formation, or other dolomitic formations to the east.

REFERENCE

SMITH, K.G., VINE R.R., and WOOLLEY, D.R., 1960: Geology of the Huckitta Area, Second Progress Report. Bur.Min.Resour.Aust. Rec. 1960/66.(unpubl.)

APPENDIX

(a) Section 1. (Plate 1) (In descending order).

5	feet	Limestone, silicified, with boxworks after galena;
6	"	Dolomite, flaggy;
½	"	Dolomite, flaggy, medium-grained, buff;
6	"	No outcrops;
5	"	Dolomite, flaggy, coarse, buff - some algae;
6	"	No outcrops;
½	"	Dolomite, coarse;
3	"	Dolomite, flaggy, buff, medium-to coarse-grained;
2	"	No outcrops
3	"	Dolomite, flaggy, medium-grained, buff;
3	"	No outcrops;
1	"	Dolomite, coarse-grained, buff;
5	"	No outcrops;
1	"	Dolomite, coarse-grained, buff;
3	"	No outcrops;
3	"	Dolomite, coarse-grained, buff;
30	"	No outcrops;
1	"	Dolomite, medium-grained, reddish buff;
13	"	No outcrops;
2	"	Siltstone, laminated, brown;
26	"	No outcrops;
2	"	Dolomite, medium-grained, thin-bedded, cross-bedded;
92	"	No outcrops;
3	"	Dolomite, thin-bedded, buff, alternating fine-and medium-grained beds;
16	"	No outcrops;
3	"	Sandstone, medium-grained, cross-bedded, dull red.
241	feet	

Dolomite underlying. Poor outcrops and steep dips.

(b) Section 2. (Plate 1)

1½	feet	Dolomite, medium-grained, medium-bedded, with algal
6	"	No outcrops; lenses;
5	"	Dolomite, coarse, crystalline, medium-bedded, brown to grey;
2	"	No outcrops;
1½	"	Dolomite, brown, medium-bedded, algal;
6	"	No outcrops;
1	"	Dolomite, crystalline, medium-grained, thin-bedded;
10	"	No outcrops;
4	"	Dolomite, medium-grained, thin to medium-bedded pinkish brown, with sandy laminae;
6	"	No outcrops;
2	"	Sandstone, fine-grained, soft, friable, yellow;
13	"	Siltstone, shaly, buff and grey;
4	"	Dolomite, fine-grained, medium-bedded, algal, pink & brown;
25	"	Siltstone, laminated, micaceous, green;
5	"	Sandstone, thin to medium-bedded, calcareous, brown;
10	"	Shale and siltstone, calcareous thin-bedded and laminated.
102	feet	

Underlying beds (dolomite) have irregular, steep dips.

Poor outcrops.

GEOLOGICAL MAP OF BOX HOLE AREA

PLATE I

Scale 1 0 1 2 Miles

Qa

Box Hole

€ua

€ua (e)

Ooratippra Creek

Horse Plain Bore

Turkey Creek

Yard

B

B'

A

A'

?F

€-O

Tomahawk Creek

Tomahawk Yard

REFERENCE

- Qa — Alluvium
- €-O — Tomahawk Beds
- €ua — Arrinthrunga Formation
- €ua(e) — Eurowie Sandstone
- 10 — Strike and dip of strata
- Trend of strata with prevailing dip
- ..... Line of steep dips
- —?— Inferred fault
- Anticline
- Syncline
- Mineralisation
- S (1) — Measured section
- A — A' Line of cross-section
- Vehicle track
- Wind pump

Bureau of Mineral Resources Geology & Geophysics March 1961. To Accompany Records Nº 1961/42

F 53/11/3 EJ