Note on Copper Possibilities - James Range

Central Australia

Records 1953/75

by

C J Sullivan

NOTE ON COPPER POSSIBILITIES - JAMES RANGE, CENTRAL AUSTRALIA.

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INTRODUCTION.

During the past three to five years small amounts of oxidized copper ore have been reported from various localities in the James Ranges to the west of Alice Springs. During a visit to Alice Springs in July of this year informationon these deposits was obtained from the Resident Geologist, A. D. M. Bell, and it is considered that potentially they may be of considerable importance and Bell has been instructed to investigate them further.

The deposits are briefly discussed in the monthly report by Bell dated 3rd July, 1953. In this report he states that the rocks to the west of Alice Springs, where limestones are developed only on a comparatively small scale, are not likely to contain ore deposits to the extent of those to the east of Alice Springs where extensive limestone deposits occur. This concept is discussed below.

GEOLOGY.

Very good aerial photographs exist of this area, but mapping carried out by G. F. Joklik in 1951 does not extend to the region under discussion.

As described by Bell the succession is as follows:

Ordovician shales, sandstones and limestones are conformably underlain by green and purple shales which are believed by Bell to be of Cambrian age. Girvanella have been found within limey bands in the shale. Beneath the green and purple shales are bands of limestone containing Collenia which are underlain by a considerable thickness of current bedded and arkosic sandstones which are believed by Bell to form the base of the Cambrian.

Apparently conformably underneath these formations

are considerable thicknesses of dolomitic Collenia limestones, including the Bitter Springs Formation. These beds are underlain by the Heavitree Quartzite.

Bell states that the copper which has been reported from Owen Springs and from several other localities all occurs within the green and purple shales immediately overlying the Collenia dolomite of the Cambrian. Since there is no evidence that igneous activity has affected these rocks, it seems likely to the present writer that this mineralization is of syngenetic origin. There is a very marked similarity between the stratigraphic succession in this area and that of the Belgian Congo where ore is associated with beds occurring close to Collenia limestone. The current bedded arkosic formations are quite similar to those found in Rhodesia and there is a world-wide association between arkosic sediments and syngenetic copper, uranium and other elements. Interestingly, Bell has reported the presence of nickel in what he regards as the same stratigraphic horizon to the east of Alice Springs. Copper-nickel association in the sediments not intruded by basic or acid igneous rocks again gives the same impression of syngenetic origin and is reminiscent of the association at Shinkolobwe.

The present author has not seen these deposits, but it is characteristic of syngenetic ore occurring in shales to be very inconspicuous under leaching conditions and he would like to have the opportunity to make a brief inspection of the area. Should this inspection lead to favourable results it is considered quite possible that this area should be investigated by the Bureau for the possible occurrence of extensive copper, cobalt and uranium deposits.

From a general geological point of view the conditions of sedimentation are quite similar to those of the Rhodesia-Katanga belt and are therefore interesting. Very probably only a weak mineralization occurs but it is the type of geological set-up in which some of the best deposits in the world are found.

Bell's monthly report referred to above was written

with the thought in mind that the copper in these beds was of epigenetic origin and that large epigenetic deposits might be localized by the thick limestone formations occurring to the east of Alice Springs. This view was also expressed to the writer verbally in Alice Springs.

It is considered, however, that there is no evidence of the existence of a post-Cambrian period of metallogenesis associated with orogenic and magmatic activity in Central Australia. Additionally, it is to be noted that copper deposits occurring in dolomitic and limey facies almost invariably show ample evidence of their existence at the surface. Surface enrichment rather than impovishment is the rule. Since virtually all these areas have been prospected, obvious signs of extensive copper mineralization would have been noted in the past. It is within the sandy and slatey formations that leaching takes place and important deposits occurring in these formations might easily escape unnoticed. The apparent occurrence of the copper in one stratigraphic position is considered to be of great importance in suggesting an anology with Rhodesia-Katanga.

Although it is not mentioned in his report Bell stated verbally that he had considered the possibility that these deposits were similar to those at Mansfield and in Rhodesia, but had tentatively rejected this view. In view of the importance of the Rhodesia-Katanga area, further investigation of the James Range deposits is well warranted. From verbal discussions with L. C. Noakes it seems possible that there is a correlation between the copper-bearing belts of the James Range and beds noted by him in the Jervois Range to the east of Alice Springs.

Canberra,

24th July, 1953.

COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

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INTRODUCTION

In accordance with the intention expressed in the above note, an inspection of a part of this area was made, mostly in companywith A.D.M. Bell, during the period 12th to 16th September, 1953.

The result of this inspection has been to confirm in the writers mind that this province is worth a good deal more investigation for bedded copper ores. Other valuable metals such as nickel and cobalt could also be present, although to date, only copper and traces of nickel have been found.

Mainly in the course of his search for underground water supplies, A.D.M. Bell has gathered a good deal of stratigraphical information about the province, building on the pioneer work of Madigan (1932) and the later work of Joklik (1951) carried out further to the east. The stratigraphic and general geological data given here have been supplied mainly by Bell.

EVIDENCE EXISTENCE OF ORE.

The writer inspected only the Jay Creek, Areonga and Owen Springs areas and his views are mainly derived from what he observed in these localities. However, Bell reported verbally that copper is also known to occur at several other localities and he has been instructed to compile these on a plan, together with what is known of the geology of the district.

Jay Creek

Bell reported large gossans from this area and these were inspected by the writer. It was found that limonitic rock, containing in places, up to 20 percent Fe, extends for some miles and apparently forms on the lower dolomite which is thought to be upper Proterozoic or Cambrian in age. The limonite is essentially not cellular but is massive, nodular, concretionary or botryoidal, showing in the writers opinion, that it has been transported in solution, not formed in situ. There are no signs of copper mineralization associated with these gossans and the writer does not anticipate that much copper will be found beneath them. It is just possible that these outcrops represent concretionary sedimentary iron ore, but it is considered far more likely that they are the oxidation product, in a neutralizing environment, of pyritic dolomite or dolomitic shales. The botryoidal limonite and the uneven distribution of ironpoint to this.

The ferruginous beds are considered to be important only in so far as they indicate that to the writer that, during the deposition of the beds, conditions were suitable for the accumulation of sulphides. Payable bedded copper ores are generally low in pyrite content.

Areonga

Near Areonga Mission, an outpost of Hermannsburg, the noted native painter, Albert Namatjira, aided by his numerous relatives has gouged a few hundredweights of chalcocite and carbonate ore, mostly from the steep side of a gorge. Chalcocite occurs here in lumps and concretionary masses up to 1 lb. in

weight over a width of about 20 feet. The ore occurs in a highly fractured zone which lies on a known fault of major proportions. The ore occurs in a body of slumped and leached rock which appears to the writer to lie in a former channel of underground water circulation; possibly, it was a point from which, during a more pluvial period which is known to have occurred in Tertiary times, a spring issued from the hillside. It is reminiscent of the copper-bearing spring issuing from a similar valley side near Mufulira, Northern Rhodesia, which was what first drew attention to the possibilities of that large deposit. The outcrop of the copper-bearing arkose which is the Mufulira orebody, was almost completely leached of copper and looked most unattractive to the casual observer.

Chalcocite has also been mined by Namatjira from a second brecciated zone which crops out on the side of a steep hill some hundreds of feet from the first showing. It is considered probable that these deposits have been formed by deposition from circulating underground water and that their importance is to indicate that copper is present in the beds through which these waters have been circulating. The showings suggest too, that it might only be where such features as springs or unusually rapid erosion have occurred that obvious signs of copper mineralization might be found. Deeply eroded gorges and steep hillsides are suitable places for the occurrence of springs.

On the side of a long ridge, about 200 feet to the west of the gorge, the aborigines have made a cutting into a bed of claystone in which they found traces of copper carbonates as well as small amounts of chalcocite. Careful examination of this rock reveals the presence of very small maroon, purple and black dots of "limonite", arranged along the bedding plane, and the presence of copper together with the virtual absence of ferruginous gossan, suggest that these casts are remnants of copper minerals, possibly chalcocite. The appearance of this leached rock reminded the writer in a general way of surface showings of the Roan orebody in Rhodesia. But, although he feels it to be very likely that this bed at Areonga contains disseminated copper minerals, he is unable to predict that they are present in payable quantities.

The rock dotted with limonite casts was found also, some hundreds of feet further along the ridge, but there was insufficient time to follow it systematically.

The bed discussed above is part of an arkosic sequence lying above the upper dolomite described in the report of July 24th. The dolomite is rich in limonite in this locality. Arkoses are commonly associated with syngenetic copper ores, especially where, as in this locality they are strongly cross-bedded, and slumping is common. These features have been widely noted in Rhodesia by W.G. Garlick, Consulting Geologist, Rhodesian Selection Trust (Personal Communication). They were also observed at Mufulira by the writer.

Bell informs me that all of the copper showings in the district have been found to occur in or about the one stratigraphic position, a situation which is common to syngenetic ores and is thought to be of considerable significance. The ores are associated with shore-line facies.

Owen Springs

At Owen Springs thin layers of chalcocite as well as carbonates are found in a fine-grained sediment which is again part of the arkosic sequence. Traces of copper have apparently been known for years to occur in a small creek which parallels the strike of the sediments. This lateral creek runs into a large stream channel which has cut a deep gorge at right angles to the strike. It is thus possible that this exposure is due to unusually rapid erosion.

Only half a dozen pits, 1 to 3 feet deep, have been sunk in the bed of the stream over a length of perhaps 400 ft.

No attempt has been made to expose the width of the bed by costeaning, but it seems unlikely that it is more than 10 ft. However, coarser grained beds overlying the shale, appeared to the writer to show signs of having contained some copper.

In two of the pits, chalcocite ore which might assay 10 to 15 percent Cu has been found, but it appears to be confined to streaks only a few inches wide occurring along the bedding planes.

Disseminated chalcocite is also present in flakes and it is difficult to guess whether material of this type contains payable copper or not. In one specimen, a thin layer of chalcopyrite embedded in a wider band of chalcocite was observed. This seems to indicate that the chalcocite streaks, at least, are secondary.

In the Owen Springs deposit, certain types of "limonite" can be observed grading into chalcocite and into copper carbonates, from which they are being derived by leaching & oxidation. These could be used as a guide in searching for further ore.

SUMMARY AND RECOMMENDATIONS

The few skilled observers who have seen these deposits in the past have not been impressed by the small amounts of copper they have been able to observe in little cracks and partings. There are no fissures, gangue minerals or "lodes" in the conventional sense. No gossans are associated with the copper. As a result, the area has received little attention.

The writer has little doubt, however, that these are disseminated, bedded, essentially syngenetic, deposits which in Rhodesia-Katanga & elsewhere, produce big tonnages. As in Rhodesia, a desert period preceded the present sub-arid conditions and is now evidenced by fixed sand dunes. Preceding this was a wet period, during which lake deposits were accumulated. Arid conditions are especially suitable for deep leaching of copper, and the experience of Rhodesia (Sullivan, 1953) shows that under these conditions, copper disseminated in beds may be almost completely removed by leaching, leaving only barren-looking rock.

Copper may be found at the surface, only in recently and rapidly eroded areas.

It is considered that the district warrants a good deal of closer investigation as a possible source of copper, and perhaps of other valuable metals. The odds might be fairly long, but the prize could be very big.

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