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REPORT ON RUM JUNGLE URANIUM DEPOSITS

by

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CONFIDENTIAL

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INTRODUCTION

There are three areas so far discovered, each in a different state of development. They are: the East Finniss deposit, which has had a number of costeans and three shafts sunk on it by the present party; the Brown's mine deposit, which has an old shaft and many costeans sunk for copper around 1906; and the Mt. Fitch prospect which has two costeans and an 11 ft. shaft only, all old and some distance from the present area of interest.

The surface geology and geophysics of each of these, along with the regional survey, have been or are being described by the field party and will not be considered here. This report is to deal only with an assessment of the present position and recommendations for future work in the uranium prospects.

SUMMARY

1. The East Finniss deposit of disseminated uranium minerals needs little more work to be done on it before assessment of its content. Present estimates are:

Proven: 1 ton U_3O_8 equivalent
Probable: 10 tons ditto
Possible: 50 tons ditto,

of ore above 0.25% cut-off; but the estimate is dependent on assays not yet received.

2. The Brown's mine deposit can be adequately explored by three drives from the existing shaft, together with a deepening of the shaft. Present indications are fairly favourable.

3. The Mt. Fitch prospect, which looks most promising, can best be explored by a drilling programme outlined in the text: lacking drills a shaft-sinking programme is recommended.

4. Regional mapping should continue to concentrate on mapping the graphitic schists geologically and geophysically, and the geophysicist should also undertake radial traverses from the granite.

5. More equipment, radiometric and chemical, should be supplied to the field party to obviate the delay of several weeks in getting assays.

6. The possibilities of beneficiating the ore on the spot are briefly examined.

EAST FINNISS DEPOSIT

Subsurface Geology

No. 1 Shaft

The graphitic schists which gave high values at the surface cut out at about 12 ft., apparently in a tight fold, and are replaced by a felspathic rock showing only low counts. Efforts to find the schist again by deepening the shaft and by crosscutting have been unsuccessful, and the shaft was temporarily abandoned shortly before the writer's arrival.

No. 2 Shaft

The schists picked up at the surface were followed down by the inclined shaft, and at 31 ft. the shaft is still in schist. The dip of the schistosity is about 70°N, with local variations, and the strike has swung with depth from E-W to SE-NW. A number of sheers intersect the schist but without, so far, breaking the succession, and there are two fairly prominent joint planes. Quartz appears at 11 ft. on the south face, and from that point to 19 ft. forms part of the footwall. It carries only low values.

No. 3 Shaft

A third shaft was started on a very promising enriched zone in a costean, more or less along the strike from No. 1 Shaft, but at 8 ft. the schist was sheared out by a reverse fault striking N40E and hading 50°E. The drag indicates that the schist was on the downthrow side of the fault. This shaft was abandoned at 12 ft., with values steadily decreasing.

Costeans

Costeans between No. 1 and No. 2 shafts show one other high of encouraging strength, which can be traced for some 30 ft.

Costeans west of No. 2 shaft have encountered thick soil cover and have not been persevered with from considerations of cost.

Mineralization

Surface Mineralization

Mineralization of the graphitic schists at the surface is primarily malachite and pseudomalachite, with patches of torbernite and probably phosphouranylite and bright oxides. Even at the surface there are traces of copper sulphide mineralization. No significant uranium occurs outside the graphitic schists.

Subsurface Mineralization

The surface enrichment in bright oxides persists to a depth of 8-12 ft., below which there is an apparent zone of leaching. G-M readings drop, and there is no visible ore: autoradiographs might determine the distribution of values through this zone. Only one shaft (No. 2) has penetrated below the permanent water table, which there occurs about 23 ft. below the collar. A fairly abrupt change occurs there: within the next few feet G-M counts increase notably, and thin seams containing native copper, and chalcocite and chalcopyrite, are found. A uranium mineral here occurs as a fine dissemination through the schist. The local "highs" can be traced down dip along fairly well-defined zones, but the intervening sections are also mineralised. The association of disseminated uranium minerals with carbonaceous sediments is well known, e.g., kolm and oil shales in Sweden and elsewhere, and graphitic slates at Kenimekh, Central Asia; but the values appear to be higher here than are normally associated with such sediments, presumably because mineralization has been effected by emanation from the granite rather than simple deposition. The nature of the mineralization of carbonaceous slates such as this is not yet known: it may consist of minute specks of pitchblende or of a carburan mineral such as thucholite; the former is considered

more probable in this case. Whatever the mineral, the particle size is usually of the order of microns.

It is possible, but in the writer's opinion unlikely, that a high-grade pitchblende seam may be the ultimate source of the values, as suggested by the presence of primary copper ores; the nearness of a granite intrusion differentiates it from the other carbonaceous sediment occurrences known to the writer.

The grade of the ore has not been determined owing to the lack of equipment on the spot to make approximate assays.

Controls

The only uranium mineralization is in the graphitic schists; but some graphitic schists are, on the surface at least, unmineralized, and no mineral or structural reason for this differentiation has yet been discovered.

No structural control within the schists has been found, and it seems probable that in view of the source of the mineral there may be no structural control as such, but that the control is purely chemical, based on the affinity for carbon which uranium is known to possess. This may be illustrated by the mineralization in No. 3 shaft, where copper follows the cleavage without respect of rock type, where as the uranium associated with it is only found in any quantity in the graphitic schists. If a pitchblende seam is found, however, it will presumably be subject to some structural control.

Mining Problems

The two chief problems in mining are the softness and shearing of the rock and dewatering. Close timbering will be necessary below the water table to prevent rock falls; dewatering at a fairly slow rate should be sufficient to keep down the seepage during the dry season. Conditions during the wet season are unknown to me.

Any shaft below about 30 ft., and all drives and crosscuts, must be very thoroughly ventilated to protect workers against the cumulative effect of radon poisoning.

Suggestions for future work

Short of opening up the whole deposit by a fairly intricate system of crosscuts from Nos. 1 and 2 shafts there is no way of proving the extent of the orebodies; soil cover is too heavy to allow of detailed mapping of the shears and folds which govern the schists. In these circumstances, it is recommended that No. 2 shaft be deepened for another 10-15 ft., that a drive be put in the east face, endeavouring to follow the zone of highest G-M values, and that a small drive be made on the west face for not more than 10 ft. A small cut on the North face would establish the width of useful ore.

Apart from the above suggestions, which should not take more than four weeks to carry out, it is recommended that underground work be stopped at East Finniss, as the other two areas remain to be opened up.

Diamond drilling would not be of much use here because of the soft character of the ground: practically no core would be recovered. However, a small cylindrical Geiger tube has been developed in USA for logging activity in drill holes, and if further work next year or later is contemplated, systematic churn drilling would provide a quick and fairly sure method of delimiting the orebody.

Estimated Ore Reserves

Only one assay has yet been notified to the party, and that was of a surface cut, so that extimates which follow are based on past experience of grade only.

Surface Deposits

There are several small areas on the surface which could be extracted by bulldozing, and which contain 1 - 2% U_3O_8. It is estimated that 1-2 tons U_3O_8 equivalent could be mined from these surface enrichments cheaply and quickly, with a possibility of up to a further 5 tons, if lower grade shoots

are also extracted.

Underground

The grade of the graphitic schists is estimated at 0.75-1% over at least 6 ft. It has been proved down to 31 ft., and a length of 30 ft. is considered conservative in the light of surface geology. From these figures it is estimated that about 10 tons U_3O_8 equivalent can be extracted as a minimum (the grade is increasing with depth) with a maximum possible tonnage from this body of 45-50 tons. There is a fair possibility that the other surface show over 30 ft. may develop at depth, in which case the possible tonnage could rise to the 100 ton mark, but this speculation has not been included in the estimates.

Already Extracted

In the dumps there is already lying ½-1 ton U_3O_8 in workable ore.

Summary

Proved ore:	1 ton U_3O_8 equivalent
Probable ore:	12 tons ditto
Possible ore:	50-55 tons ditto

Tailpiece

Peele, Mining Engineers' Handbook, 25, p. 27:

"To value mines of this kind is simply an attempt to discount the future and is therefore almost entirely a matter of personal judgment."

BROWN'S MINE DEPOSIT

There is only one shaft of any size in the area in which uranium "highs" are plotted: this is an old copper shaft some 25 ft. deep, vertical, and measuring 10 ft. by 4 ft. in cross section.

Dewatering is not yet completed, but I have requested Mr. Dyson to take G-M profiles of the lowest 8 ft., staging not being available over the whole depth. Spot checks reveal

that activity increases steadily in depth to a maximum of 18 times background. This is not in itself sufficient to arouse great hopes, but allowing for the fact that the shaft has been open and under water for the last 40 years, and that the surface may therefore be thoroughly leached, it is fairly encouraging.

A costean on the west side of the shaft shows a useful "high" for at least 30 ft. along the strike, and there is also a "high" recorded on the east side of the shaft.

The shaft has been sunk in highly contorted graphitic schists. Surface mineralization is somewhat similar to that at East Finniss, though cerussite and pyromorphite are associated with the malachite, and uranium is only represented by some rather doubtful bright oxides. No torbernite has been seen. Occasional traces of malachite remain in the shaft; uranium mineralization at depth will probably prove to be of the same type as East Finniss, though probably not so rich.

Suggestions for future work

It is suggested that the shaft be deepened by 10-15 ft., and that drives to east and west from the bottom of the shaft be made, up to 30 ft. in length or until the ore cuts out, as indicated by the G-M readings. A crosscut north from the north face of the shaft would serve the double purpose of determining the width of mineralized graphitic schist and establishing if the band of silicified and ferruginized schist which shows a "high" on the surface is usefully mineralized. Further costeaning is unnecessary.

Ore Reserves

Not enough work has yet been done to make any estimate of ore reserves or even to decide whether or not whether the deposit should be proceeded with; but any

of the cuts outlined above will decide the latter point.

MT. FITCH PROSPECT

Suggestions for future work

As the Mt. Fitch prospect appears to be in harder rock than East Finniss it is considered that diamond drilling might be of use. If a drill crew can be obtained it is recommended that a grid of drill holes be laid down covering the belt of "highs" in the north-west of the area. If the drill holes were inclined at, say, 30° to the vertical, against the dip, time and depth would be saved. It should not be necessary to put any hole down further than about 40 ft. vertical depth.

If no diamond drill is available it is suggested that shafts be put down on the "high" situated 450 ft. north and 100 ft. west of base, and on that some 400 ft. NW of this. If ore is met down dip it should be driven on towards the other shaft. This is a much more expensive programme than that of drilling, and not as satisfactory.

The small local "highs" in the south of the area do not appear to me to be worth investigation.

MINERAL DRESSING

Unless vein pitchblende is found it will be impossible to beneficiate the ore by mechanical means, and it would seem that an acid leach after crushing would recover the metal values; uranium could then be recovered by precipitation with excess sodium carbonate.

Brown's workings seems to be the logical spot to erect a small leaching plant, because it is on a slope and above the summer flooding level of the East Finniss River; it is also central and not far from the railway. A good supply of water is assured even during the dry season from a pool in the river over half a mile long and of good depth. Samples of water have been taken for analyses of purity. The

water supply is sufficient to cope with a shaking table in case vein pitchblende is found.

The present road is only passable during the dry season, but an all-weather road could be constructed from the railway at a not prohibitive cost.

REGIONAL GEOLOGY AND GEOPHYSICS

It seems to be fairly well established that the graphite schists contain all the values; and it is therefore recommended that regional mapping continue to be concentrated on these schists and their immediate associates, reserving the rest of the area for a more specious future.

Geophysical prospecting should consist of (1) following up the geological work on the schists, and (II) making rapid radial traverses outwards from the granite on its western side, and paying particular attention to the valleys - although it is realised that little good is to be expected of this because of the soil covering and the unlikelihood of favourable rocks outcropping. Gossans may be a help, however.

OTHER RECOMMENDATIONS

1. That arrangements be made to enable rough radiometric assays to be undertaken in the field by supplying a counter with a pulse counter attachment, together with a convertor set to enable it to be used off car batteries, or with a small portable generator. The unavoidable delay in receiving assays from Melbourne means a very considerable hold up in the direction of work, and may well lead to waste of money in continuing work not economically justifiable. Standard pulps and a balance are also required, of course.

2. That material for a rough chemical assay be forwarded to Rum Jungle, and Mr. Debnam be seconded thither either to undertake the work himself or to instruct a field assistant in it. This proposal is in some sense an

alternative to (1) above.

3. That the taking of autoradiographs be adopted as standard procedure in the field.

4. That any radiometric assays made in the laboratory should be backed by chemical assay: in ores of this sort which are not in radioactive equilibrium and are also subject to differential leaching, the radiometric assay may be wrong by as much as 50%, and, however carefully conducted, are only useful as a very rough guide to grade, which could as easily be made in the field.

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Rum Jungle,
20th July, 1950.