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NOTES ON INSPECTION OF URANIUM MINES AND PROSPECTS NORTHERN AUSTRALIA.

It was thought that an examination of uranium mines and prospects in other parts of Australia would lead to a better appreciation and understanding of Tasmanian prospects. A comparison may be made by approaching the problem from the points of source rocks, host rocks and channel ways.

Source Rocks. Although the distance of the deposits in Northern Australia from granite varies from ½ mile to several miles, nowhere is this source very far away. At Rum Jungle the uranium bearing sediments occupy an embayment, caused by faulting, in a large granite mass; at Mary Kathleen the deposits lie between a massive granite and granitised sediments; the South Alligator Deposits are laterally 2 to 5 miles from granite but doubtless it is closer vertically. All the granites belong to the Proterozoic and south of Pine Creek uranium minerals have been found in the granite itself. in Tasmania, the granite is Devonian but as the uranium minerals have been found in this granite itself and there is no known Pre-Cambrian granite here, then the source is doubtless the common Tasmanian granite of Devonian Age. Condon and Walpole (1) believe the uranium is syngenetic in origin but even they say the granites play no part in the origin of most of the deposits.

Host Rocks. The principal host rock type is a shale which may grade either way into a slate or siltstone. In the Northern Territory these rocks belong to the Brock Creek Group of the Lower Proterozoic and at Mary Kathleen the host rock is also in the Lower Proterozoic. But as well as being a shale, the interesting point noticed was that the most favourable shale is a black graphitic variety. Whether the carbonaceous matter has a chemical action in the precipitation of uranium minerals has not been fully established but it does seem more than a coincidence that at the two best mines, Rum Jungle and El Sharana uranium minerals are found on the walls of a shale of this type. Condon and Walpole,(1) in considering the uranium minerals precipitated on the edge of the continental shelf, say the presence of a silicified limestone breccia is necessary. Whether this theory is correct or not, the principal host rock noted during this visit was a shale or siltstone usually associated with a sandstone type of rock into which some secondary uranium minerals had penetrated. Thus at Adelaide River the host rock is a shale between two sandstone beds; in the South Alligator deposits, the shale host is at an unconformity with Upper Proterozoic grits and conglomerates; at Rum Jungle the shales are near a limestone boundary and there the presence of limestone is considered necessary for the deposition of the uranium.

Channel Ways. Either faults or shear zones are associated with all the deposits and these have formed the pathways for the mineralizing solutions. In most mines and major prospects the fault pattern has been worked out fairly thoroughly. At Adelaide River, mineralization has occurred

along several fault planes and the ore is obtained from an area where one fault plane traverses shale beds. In the South Alligator prospects uranium is deposited not only adjacent to a major fault plane, but also close to an Upper Proterozoic unconformity. At Rum Jungle there are a whole series of faults in the mineralised area. At Mary Kathleen not only have many faults been mapped but uranium mineralization has been intensified along two sets of joint planes.

Type of Mineralization. In almost every instance the primary uranium mineral found has been pitchblende, ranging from microscopic amounts at most prospects (and incidentally at Rum Jungle and Mary Kathleen) to pieces weighing up to one ton at El Sharana. Pitchblende is usually massive and heavy but at Adelaide River it is powdery and at El Sharana tends to be crystalline. For a primary mineral, pitchblende occurs surprisingly close to the surface, well up in the oxidised zone of other minerals and sometimes even to within a foot or two of the surface. When exposed to the air, pitchblende oxidises rapidly and haloes of minerals such as carnotite, gummite and the ochres form round cores of pitchblende. Beautiful samples showing this can be seen at the Palette Workings at South Alligator. Torbernite is fairly common, and is the normal oxidised mineral at George Creek Prospect. An unusual mineral, well developed in cracks and joints at El Sharana, is kasolite, a silicate of lead and uranium.

Associated Minerals. As may be expected, the ubiquitous pyrite is the most commonly associated mineral; but copper is usually a good indication except in the Mt. Isa - Conclurry Field where copper and uranium minerals are found in different prospects. Lead is often present but at Rum Jungle it is considered a different generation from uranium and copper. Quartz is not common. A curious association occurs at Mary Kathleen where the uranium is localised in a garnet rock and associated with rare earth minerals orthite (or allanite) and a newly discovered one, stillwellite, a boro-silicate of lanthanum etc.

Surface Indications. In all instances, uranium mineralization has been located instrumentally, geiger counter, or scintillometer, for seldom can any uranium mineral be located in outcrop. The oxidised minerals grow quickly but they are usually fairly frail and soluble so that rain washes them away just as easily. In old workings secondary minerals often form on the walls.

Comparisons in Tasmania. As applied to prospecting for uranium in Tasmania this visit has established two facts.
1. In Northern Australia, although uranium has been found in granite, no major development has been undertaken in these rocks and it is a general opinion that the uranium mineralization found in shears and joints in the granite shows no continuity of size or grade.
2. No spectacular outcrop showing uranium minerals led prospectors and geologists to the discovery of any of the mines and prospects; but by patient gridding by scintillometer and geiger counter. The secondary uranium minerals form easily and quickly and migrate from the primary ore but they are easily washed away and although in some instances were found in old workings they rarely can be seen in outcrop. The

uranium minerals at Mary Kathleen are associated with very characteristic outcrops of rare earth minerals, but that association, until recently was not recognised, and the area had been well prospected for other minerals before the uranium was discovered by geiger counter.

Prospecting in Tasmania. In the past too much attention has been paid to the granite areas, in the search for uranium. This is because:

1. The first uranium mineralization in Tasmania was found in granite at Royal George.
2. All subsequent uranium has been found in granite at Rossarden, Blue Tier and Heemskirk.
3. The airborne scintillometer shows most of the anomolies over granite areas.

Now it may be that commercial quantities of uranium will be found in granite in Tasmania. But for future prospecting I would urge a search in sedimentary rocks adjacent to granite. If an anomaly has been indicated by air-borne scintillograph, so much the better. From analogy with the host rocks of Northern Australia it would seem that black shales or slates, possibly in association with limestone, should be present. Two areas that are worthy of further prospecting are to the east of the Heemskirk granite and east of Tullah.

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(1) Bureau of Mineral Resources Records 1955/56.