MAR 19690041: MARGUERITE RIVER

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Mr. Ronald L. Haxby,
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Re: Airborne radiometric survey, Marguerite River area, Alberta

Dear Ron:

I have examined all of the geophysical data from the above survey and have also studied the following references:

1. GSC Map 16-1961, Firebag River area, Alberta and Saskatchewan, scale 1 inch to 4 miles, and descriptive notes.

2. GSC Aeromagnetic Series Maps 468G, 469G, 463G and 462G, entitled Richardson River, Robert Creek, Reid Creek and Marguerite River, Alberta, respectively, scale 1 inch to 1 mile.

The following is a brief summary of my conclusions; a full report and anomaly descriptions can be provided at a later date if required.

ECONOMIC POSSIBILITIES

Despite a particularly favourable geological setting, the airborne radiometric results are discouraging. Only 11 widely scattered anomalies show uranium values that exceed the local noise envelope, and these only marginally so. The factors which apparently contribute to the surprisingly low uranium values in the area are set out later in this report.

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Only two anomalies can be regarded as having sufficient amplitude to represent reliable targets for further investigation: these form parts of what Seigel Associates refer to as Zones 1 and 2.

The strongest peak in Zone 1 is referred to as Anomaly C and falls on Line 21. Uranium amplitude here is approximately 15 c.p.s., against a background level of about 35 c.p.s. and a noise envelope of about 15 c.p.s. peak to peak. That this should be regarded as a significant anomaly attests to the low uranium values elsewhere in the area. A thorium amplitude of approximately 10 c.p.s. on this anomaly implies a U/Th ratio of about 1.5, rather low for most uranium deposits in the area. On the other hand, there appears to be in the uranium channel an over-compensation for the effects of Compton scattering from the higher energy levels. This is shown up, as stated later, by sympathetic variations of opposite sign on the thorium and uranium channels, of approximately equal value in c.p.s. With this in mind, a true U/Th ratio could be as high as 2.5, still rather low to be considered a prime target.

The strongest peak in Zone 2 is Anomaly A on Line 30. This is the highest uranium anomaly in the area. Peaking at about 23 c.p.s. over a local background of approximately 30 and a noise envelope of about 15 c.p.s. peak to peak, this anomaly may be considered fairly reliable. Thorium amplitude is locally low at about 9 c.p.s.; elevation is about 230 feet as compared with 200 feet on the former anomaly. Bearing in mind the over-compensation mentioned above and taking into account the height change, we could be dealing with a uranium anomaly of about 40 c.p.s., giving a U/Th ratio of more than 4. This is fairly close to the ratios experienced over some of the more important deposits elsewhere in the area.

A weak indication of the first anomaly is seen on Line 22, suggesting a strike length of more than 1000 feet. The anomaly in Zone 2 is probably shorter, as there is no sign of it on adjacent lines.

Both anomalies fall near the postulated contact between banded gneisses and migmatites to the west, and granites and granite-gneisses to the east. These two units form part of a sequence of folded gneissic rocks of either late Archaean or early Proterozoic age that underlie most of the survey area. Near the anomalies the country rocks, probably of sedimentary origin, are characterized by a broad, magnetic low, of about 100 gamma amplitude. This probably represents the white-weathering gneiss, low in mafic minerals, strongly chloritized and very low in magnetite. Eastward, as the magnetic level increases, the transition to the dark-weathering gneiss, containing abundant biotite and some magnetite may be expected. Zone 2 is probably underlain by the latter member, rather than the granite gneiss which is mapped in its vicinity.

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Both anomalies occur near the elbow of a major fold that changes the strikes of the country rocks from west-northwest to north-south in the vicinity of the Marguerite River.

Rocks of similar types east and north of the Athabasca Basin have been found to contain uranium deposits of various kinds: pitchblende veins (Beaverlodge, Wollaston Lake); uraninite mineralization in pegmatites (Charlebois Lake, Kasba Lake); and secondary deposits of autunite, etc. in detrital material on the basement surface. Only the first-mentioned deposits have so far been commercial.

Several other uranium anomalies of 15 - 20 c.p.s. above local background occur elsewhere in the area. None of them exhibit characteristics as favourable as the two mentioned above. If however it is decided to investigate the area further, these additional anomalies might also warrant attention. The more favourable ones are as follows:

Line 22, Anomaly B (this anomaly occurs near Fiducial 5136 at the north of the area; it was not picked by Seigel).

Line 50, Anomaly A

Line 62, Anomalies C and D

Line 66, Anomaly A

Line 90, Anomaly A

All of these anomalies with the exception of Line 62, Anomalies C and D appear to lie in very much the same geological environment as those in Zones 1 and 2.

Access to Zones 1 and 2 might be possible via a small lake lying within 1½ miles of the anomalies. The lake itself is situated one mile south of a sharp bend in the Marguerite River which is approximately 80 miles north-northeast of Fort McMurray.

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SOME TECHNICAL CONSIDERATIONS

As stated earlier, for an area underlain by these particular rock types, the uranium levels recorded are disappointingly low. There are two obvious reasons for this, one geologic and the other instrumental.

Firstly, despite the relatively large number of outcrops shown on Map No. 15-1961, the area is described as "almost entirely covered with apparently thick drift". The large thickness is indicated by the deep gullies cut by most of the rivers. Eskers show up in the area as topographic lows, apparently formed by river action. The Precambrian surface was obviously deeply eroded before most of the glacial deposition, because outcrops are exposed on small hills and ridges throughout the area. Virtually all of these features, which give rise to local decreases of 50 to 100 feet in flight elevation of the survey aircraft, result in "broad band" radiometric anomalies. Most of the uranium anomalies also coincide with outcrop areas occurring as hills and ridges. A rough estimate based on the radio altimeter profiles suggests that outcrop is exposed thus over less than 5% of the area. Elsewhere, the absence of radiometric anomalies suggests thick, transported overburden, as anomalies are virtually absent.

The airborne radiometric survey therefore apparently sampled a very small portion of the total area. In other areas flanking the Athabasca Basin, overburden is frequently light, and large areas of boulders carry reasonably accurate signatures of the rocks underlying them.

Instrumentally, we have a number of factors that contribute to downgrade the size and reliability of the anomalies:

1. By most accepted standards the combination of crystal volume, flight elevation and speed used on this survey is such as to minimize the chances of detecting the smaller uranium deposits. In this case the crystal volume was approximately 315 cu.ins; flying height was nominally 150 to 250 feet but in practice varied mainly between 200 and 300 feet; and the flying speed was approximately 160 m.p.h. By contrast elsewhere in the area combinations of 600 cu.ins, 100 - 150 feet elevations and 100 - 120 m.p.h. were being used. The result of this choice of survey parameters was to reduce the count rate on all channels and to reduce more strongly the anomalies from sources of restricted areal extent.

2. To compensate for the above factors, increased integrating time is often used. This has the effect of reducing resolution but enhancing the anomalies relative to the local noise envelope. In this survey however a one second time constant was used, resulting in the unfortunately low count

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rates on all but the "broad band" channel. A frequently used criterion is that a signal can only be considered reliable if it provides 50 counts during the integration interval. In this case neither the thorium nor the uranium channels recorded levels as high as 50 counts per second except at the peaks of a few anomalies. The low count rate is responsible for most of the noise envelope on the three threshold channels.

3. The method used in the GIS A-4 spectrometer for isolating thorium, uranium and potassium levels, is to correct the signals at the lower energy levels by subtracting a proportion of the energy recorded at the higher energy levels. This process, called "stripping" or "subtraction", is performed empirically, and is checked at least twice daily by bringing pure uranium and pure thorium sources near the spectrometer crystal. Despite these calibrations some obvious over-compensation has occurred, as throughout the survey data virtually all thorium anomalies are accompanied by sympathetic uranium anomalies of opposite sign and roughly equal size in c.p.s. The result of this is to subdue uranium anomalies which are accompanied by thorium anomalies, and to introduce uranium anomalies where there is a local absence of thorium. Examples of both of these are abundant on the survey records.

Despite these factors and others of less importance, it is considered that the survey was carried out in a manner such as to detect any major uranium occurrence coinciding with an outcrop area. The heavy drift cover is a problem that cannot be solved geophysically but might be amenable to a geochemical approach.

SUMMARY

Two anomalies with some evidence of reliability occur in Zones 1 and 2 in the western part of the survey area. Strike length of the anomalies is unknown as it is affected by outcrop exposure. Probable limits of exposure length are 1250 and 750 feet for Zones 1 and 2 respectively. Widths are of the order of a few hundred feet in each case. These two zones may be accessible by aircraft via a small lake within 1¼ miles of the anomalies.

The two anomalous areas may represent locally radioactive pegmatite zones, probably containing syngenetic uraninite; or they could represent zones of

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pitchblende veining, probably accompanied by minor sulphides. The rather low apparent U/Th ratio would tend to support the former alternative. Neither volume nor concentration appears to be high, but ground work would be needed to verify this. The survey was not carried out in such a way as to provide reliable data for quantitative interpretation.

Elsewhere in the area there are approximately six other anomalies of possible significance; these should be studied only if further investigation is done in Zones 1 and 2 with favourable results.

Please let me know if you require any further information. I shall hold the data until I hear from you.

Yours sincerely,

Norman R. Paterson