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No. 159

Field Investigation
of Airborne
Radioactivity Anomalies in
Marquette County, Michigan

Trace Elements Memorandum Report 159

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

TEM 159



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

AEC 77/1

AUG 16 1950

Dr. Phillip L. Merritt, Assistant Manager
Raw Materials Operations
U. S. Atomic Energy Commission
P. O. Box 30, Ansonia Station
New York 23, New York

Dear Phil:

Transmitted herewith for your information and files are 5 copies of Trace Elements Memorandum Report 159, "Field investigation of airborne radioactivity anomalies in Marquette County, Michigan" by Harold L. James, August 1950.

It should be noted that the radioactivity anomalies shown on fig. 2, Radioactivity anomalies in the vicinity of Republic, Marquette County, Michigan, are defined on a different basis than those shown on the formal release entitled "Airborne radioactivity survey of parts of Marquette, Dickinson, and Baraga Counties, Michigan." Referring to the anomalies shown on fig. 2, the various ranks of anomalies were differentiated on the basis of a step-like increase in recorded radiation intensity above the minimum intensity recorded over Lake Superior, north of the area surveyed. No distinction between anomalies was made on the basis of sharpness or duration of the anomaly; the distinction was made solely on the level of radiation intensity regardless of the distance over which such intensity occurred. Thus, the "broad" anomalies shown on fig. 2 reflect the radiation intensity due to broad lithologic units.

Referring to the anomalies shown on the formal release, the anomalies were defined on the basis of a sharp rise and fall of radiation intensity over a short distance or time interval. These anomalies reflect a more localized source area for the observed radiation intensity and might indicate significant concentrations of radioactive materials.

Other copies of this report are being distributed as shown on the attached distribution sheet.

Sincerely yours,

Esper S. Larsen, 3d
Acting Chief Geologist

Enclosures 5

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U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

FIELD INVESTIGATION OF AIRBORNE RADIOACTIVITY ANOMALIES

IN

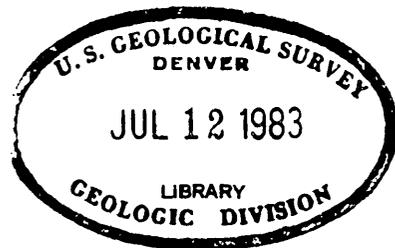
MARQUETTE COUNTY, MICHIGAN

by

Harold L. James

August 1950

Trace Elements Memorandum Report 159



USGS-TEMR-159
Consisting of 5 pages
and 3 figures
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FIELD INVESTIGATION OF AIRBORNE RADIOACTIVITY ANOMALIES IN MARQUETTE
COUNTY, MICHIGAN

By Harold L. James

Abstract

The broad radioactivity anomalies recorded by the airborne detector in the vicinity of Republic, Marquette County, Michigan, coincide rather closely with parts of a granitic complex chiefly of Archean age. Ground examination of the rock in these areas of high radioactivity shows that the granitic rock typically yields two to four times the normal background activity. Fissures, shear zones, veins, and pegmatites were tested carefully. None exhibited activity higher than that of the adjacent granitic rock.

It is significant that the zones of more-than-average radioactivity are related to the larger elements of the geology -- in fact, the information will be of considerable value in reconsideration of some of the regional problems.

Introduction

The airborne detector recorded broad zones of high radioactivity, as much as 5 times the background activity, in areas north, northwest, and west of the town of Republic, Marquette County, Michigan. The highs were particularly pronounced in T. 47 N., R. 29 W., in T. 47 N., R. 30 W., and in T. 46 N., R. 29 W.

This memorandum is designed to give some information regarding the geology, topography, and accessibility of this area. Three days were spent on field work.

General geology

The outlines of the general geology are shown on Fig. 1. The rocks of the Marquette and Republic troughs consist of sedimentary rocks -- quartzite, iron-formation, and slate -- now rather highly metamorphosed and deformed. The troughs are downfolded or down-faulted blocks between areas of crystalline rocks. The crystalline rocks consist chiefly of granite and granite gneiss of probable pre-Huronian (Archean) age, but a younger, post-Huronian granite is locally present.

Comparison of the general geologic map (Fig. 1) and the radioactivity anomaly map (Fig. 2) shows a strong degree of coincidence between parts of the crystalline areas and the broad radioactivity anomalies. The area in T. 47 N., R. 30 W., indicated on Fig. 1, was investigated in some detail, and brief examination was made of the area immediately north of Republic.

Area of the detail map, in T. 47 N., R. 30 W.

Fig. 3 is a sketch map of this area, compiled from airplane photographs. Two days were spent in field examination, with particular attention being paid to the "Anomaly Rank 5" and "Anomaly Rank 4"

areas indicated on the radioactivity anomaly map (Fig. 2).

The area is reasonably accessible at the present time by two logging trails, one leading to Saari's Camp in sec. 9 and the other to Ferley's Camp in sec. 23. Both trails have been put in within the last year or so; consequently neither are shown as yet on any available map, nor do they appear on our air photos which are now 11 years old.

Topographically, the area is rough, but the local relief does not exceed 100 feet. The eastern two-thirds of the area, underlain by crystalline rocks, contains many outcrops. These are typically separated by swamps.

As can be seen from the scattered observations on foliation, the crystalline area is the west end of a structural dome, the strike swinging from N. 45°E. in the north to N. 70°W. in the south. In general, the border areas of this dome appear to be underlain chiefly by granite gneiss (strongly foliated, medium grained, pink) and by schist that is interleaved with massive pegmatite layers as much as 150 feet thick. The schist consists mostly of quartz and mica and is well banded. The pegmatite consists of large chalky white feldspars and quartz. The feldspars are commonly as much as a foot in length. The "porphyritic gray granite" located in sec. 23 is a massive rock characterized by large euhedral microcline crystals 1/2 inch to 4 inches in length. This rock appears to form the core of the dome in this area. The post-Huronian granite (ygr¹)

is a non-foliated, fine- to medium-grained rock.

The outcrops shown on Fig. 3 were tested with a Geiger Counter (Beta Gamma Survey meter, Serial No. 262, manufactured by EL-Tronics, Inc.). The normal background activity, as read on the MR/Hour with the instrument set on the most sensitive (0.2) range, is generally 1 to 2. On all the outcrops of granitic rock (younger granite, pegmatite, gneiss, and porphyritic granite) the radioactivity is two to four times this background value. Veins, fissures, pegmatites, and shear zones were tested carefully but none yielded activity appreciably higher than that of the rock mass. A 50-foot metadiabase dike, trending about N-S, was located in the NE $\frac{1}{4}$ sec. 23. The activity of this rock (tested in several places) was very distinctly lower than that of the adjacent granite; in fact, it was very close to normal background activity.

The highest radioactivity recorded by the airborne detector was in the eastern part of sec. 15. Examination showed a broad morainal tract studded with huge boulders. No outcrops could be discovered.

Area north of Republic

Outcrops are numerous in the area immediately north of Republic, and those adjacent to highway M-95 were tested. The rock near the south boundary of the crystalline mass with the Huronian is granite gneiss; farther north the rock is a porphyritic gray granite. The radioactivity of these rocks, like that of the granitic rocks to the

west, was typically two to three times the background activity.

Conclusions

The broad radioactivity anomalies recorded by the airborne detector are mass effects caused by granitic rocks. Ground examination in the areas of most pronounced anomalies did not reveal any concentrated activity; all of the several granitic rock types yield similar activity. Such activity is typically two to four times background activity in the area as a whole. No unusually high readings were obtained over fissures, veins, pegmatites, or shear zones.

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