COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

RECORDS

1957, No.80

AIRBORNE SCINTILLOGRAPH SURVEY IN THE MOSQUITO CREEK REGION, NORTHERN TERRITORY, 1956

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ABSTRACT

During the period August to September, 1956, an Auster aircraft of the Bureau of Mineral Resources carried out a low-level airborne scintillograph survey in the Mosquito Creek region, south-east of Tennant Creek, in the Northern Territory.

An area of 220 square miles was surveyed, including three of the five areas selected by a regional geological mapping party of the Bureau of Mineral Resources, which was operating in the Davenport Range. Numerous anomalies of gamma-ray intensity were found; some of these were subsequently examined by ground parties, and three were recommended for further inspection.

Contours of gamma-ray intensity have been drawn, and these serve to indicate the general distribution of radioactivity over the areas surveyed. Both contours and anomalies appear on the map which is presented with this report.

It is considered that the likelihood of uranium mineralisation occurring in these areas is not great. However, it is considered that the evidence available justifies further ground radiometric survey before the areas can be dismissed from consideration.

1. INTRODUCTION

During the period August to September, 1956, a low-level airborne scintillograph survey was carried out by the Bureau of Mineral Resources in the Mosquito Creek region. This region lies south-east of Tennant Creek, in the Northern Territory. The areas surveyed are shown on Plate 1.

It is perhaps not strictly accurate to refer to this region as the Mosquito Creek region, as two of the areas surveyed lie far from Mosquito Creek, which runs through Area 2. However, this name was adopted for the survey programme as a whole, and will be retained.

Area 1, the largest of the three areas surveyed, lies on the eastern flank of the Murchison and Davenport Ranges. Areas 2 and 3 lie within the Davenport Range. These areas were numbered in order of priority for investigation, and are three of five areas selected by a regional geological mapping party of the Bureau of Mineral Resources which was operating in the Davenport Range during the period of the airborne survey. Time was not available to survey the remaining two smaller areas of lower priority.

K.G. Smith, leader of the geological party, considers that the anomalies found occur in rocks of the Hatches Creek Group (which may be equivalent in age to the Ashburton Sandstone) and the Warramunga Group. These formations occupy most of the areas surveyed, and are of Lower Proterozoic age (Smith, 1957). Prior to the survey, uranium minerals had been discovered at the Munadjee Prospect, south-east of the headwaters of Mosquito Creek. This prospect has been examined by Lord (1955, 1956).

The airborne survey was directed by D.F. Livingstone (geophysicist), assisted by J.E.F. Gardner (geophysicist), A. Crowder (draftsman), and K.A. Ashmore (driver). The Bureau's Auster aircraft, VH-RSS, was piloted and serviced by F/O A.H. Worley (T.A.A.).

2. EQUIPMENT

The scintillograph used consisted of a detector head and ratemeter, Austronic Engineering Laboratories type A.S.1, coupled to a Texas Instrument Incorporated dual-recording milliammeter of which only one channel was in use. Operation of the scintillograph was controlled and monitored in flight by a remote control unit.

The detecting element in the scintillograph consists of a thallium-activated sodium iodide crystal, cylindrical in shape, 4½ inches in diameter and 2 inches thick, mounted with its axis vertical. This is optically coupled to a photomultiplier tube, Dumont type 6364. Gamma radiation impinging on the crystal produces scintillations which are converted to electrical impulses in the photomultiplier. These electrical impulses are integrated in the ratemeter, whose output current, registered on a counting-rate meter, is proportional to the gamma radiation detected over the preceding short interval of time. The recording milliammeter, which is in series with the counting-rate meter, provides a continuous record of the gamma radiation detected, on which record the interpretation of results is based.

3. OPERATIONS

The technique of low-level airborne scintillograph survey has been discussed by Howard (1956) and Livingstone (1957). From these discussions it is seen that a certain flexibility of operating conditions is possible, to allow for differences in terrain and varying circumstances which affect aircraft safety and interpretation of the results.

The survey of Area 1, which is comparatively flat, was made from a height of 150 feet above ground level. At this height the lane scanned is about 360 feet wide; the flight-line spacing adopted, 6 per mile, gives a coverage of 40 per cent, which is regarded as giving an adequate sample. The survey of Areas 2 and 3, which are more difficult of aircraft access and more rugged, was made from a height of 200 feet. At this height the lane scanned is about 160 yards wide; the flight-line spacing adopted, 5 per mile, gives a coverage of 45 per cent, again an adequate sample despite the raising of the limit of detectability due to the increase in height. Wherever possible the aircraft speed was kept within the range of 75 to 80 m.p.h.

Flight lines were plotted during flight by the observer, using K-17 aerial photos. These lines were kept as straight as possible, and at right angles to the geological strike, though this was not always possible in Area 1. Anomalies which were deemed significant were re-flown wherever possible. The accuracy of positioning is considered to be of the order of 100 yards.

The response of the scintillograph to a standard flux of gamma radiation was determined before and after each survey flight by placing a standard radioactive source in a fixed position relative to the detecting element; this response is termed the "standard radiation level". The "instrumental background", resulting from cosmic radiation and radiation originating in the aircraft, was also determined before and after each survey flight, at an altitude of 2,000 feet above ground level.

Operations were severely restricted by gusty high winds, which persisted throughout the period of the survey, commencing at dawn and frequently rendering survey flying impracticable all day. When flying was possible, it was restricted to the late afternoon, resulting in flights of moderate duration only, averaging 2½ hours.

The day-to-day direction of the survey was based on the priority allotted to the selected areas, the available geological evidence, and the weather conditions. Although results were inspected as the survey progressed, they were not sufficiently important to modify the original programme to any great extent. Liaison with the regional geological party enabled the latter to examine some areas of higher radioactivity on the ground.

A total area of 220 square miles was surveyed.

4. INTERPRETATION PROCEDURE

The interpretation of results obtained in low-level airborne scintillograph surveys has been discussed by Howard (1956) and Livingstone (1957). Results obtained in this survey were interpreted in terms of anomalies and contours of gamma-ray intensity. This technique is discussed in detail in Livingstone's report, and is summarised here.

Anomalies were assessed by critical examination of the record of gamma-ray intensity. Where doubts existed as to the efficiency of altitude control, this inspection was carried out in conjunction with examination of aerial photos. Those anomalies which were then considered significant were plotted on sketch maps, on which the final maps are based.

Contours of gamma-ray intensity were established by application to the scintillograph record of an arbitrary contour interval, based on the standard radiation level. The instrumental background was taken as the zero contour.

5. DISCUSSION OF RESULTS

Area 1.

The difficulty of interpretation of results in Area 1 lay in the fact that the soil is fairly thick over most of the area, but there are numerous small outcrops, many of which represent bosses of granite, particularly along the north-eastern margin of the area. In these conditions, the pattern of general radioactivity is comparatively uniform, with a few broad areas higher in intensity than their surroundings, and several anomalies caused by these outcrops and minor topographical features may be expected.

This was found to be so, but the process of selective evaluation resulted in 46 anomalies being selected as worthy of further investigation on the ground (Plate 1). In the southern part of the area, many of the anomalies lie below the sandstone escarpment bounding the area in the south-west. Elsewhere, no definite pattern appears, though it would be possible to associate some anomalies into groups. This was done during the course of the survey, when the occurrence of anomalies, however minor, in groups was used as a basis for defining areas to be investigated by the geological party; only a few of these areas could be examined, and nothing of interest was found. The anomalies in the southern part of the area were examined by a carborne radiometric party under W.J. Langron, and three anomalies (Nos. 28, 29 and 32) were recommended for further investigation; the majority were of no interest (Langron, 1957).

As follow-up work in Area 1 was not completed by the end of the field season, it is possible that some of the anomalies not yet examined, and those selected for further investigation, may yet afford some results of interest.

Area 2.

In Area 2, a small group of six anomalies was found in the south-eastern corner of the area, which otherwise was radioactively featureless (Plate 1). These anomalies were examined by the carborne radiometric party, and were found to occur in sandstone near intrusive basic igneous rocks; nothing of interest was found (Langron, 1957).

Area 3.

In Area 3, nineteen anomalies were selected for further investigation (Plate 1) out of a much larger number, the majority of which were caused by topographical features. The concentration along the northern margin, at the foot of a ridge, and in the north-eastern corner of the area is interesting, but no follow-up evidence on this area was obtained.

6. CONCLUSIONS

The three areas surveyed were selected on geological evidence as the most favourable in the region. Of the 71 airborne anomalies which were found, 22 were investigated by a carborne radiometric party and three of these were recommended for further investigation (Langron, 1957).

Further ground radiometric and geological work is recommended in Area 1, and it is felt that the northern margin of Area 3 should be investigated. This work is not considered sufficiently important to warrant very high priority.

7. REFERENCES

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Lord, J.H., 1955 - Report on an inspection of a uranium prospect near Mosquito Creek, Northern Territory. Bur.Min.Resour.Aust., Records 1955/62

Lord, J.H., 1956 - Report on an inspection of the uranium discovery near Mosquito Creek, Northern Territory. Bur.Min.Resour.Aust., Records 1956/114

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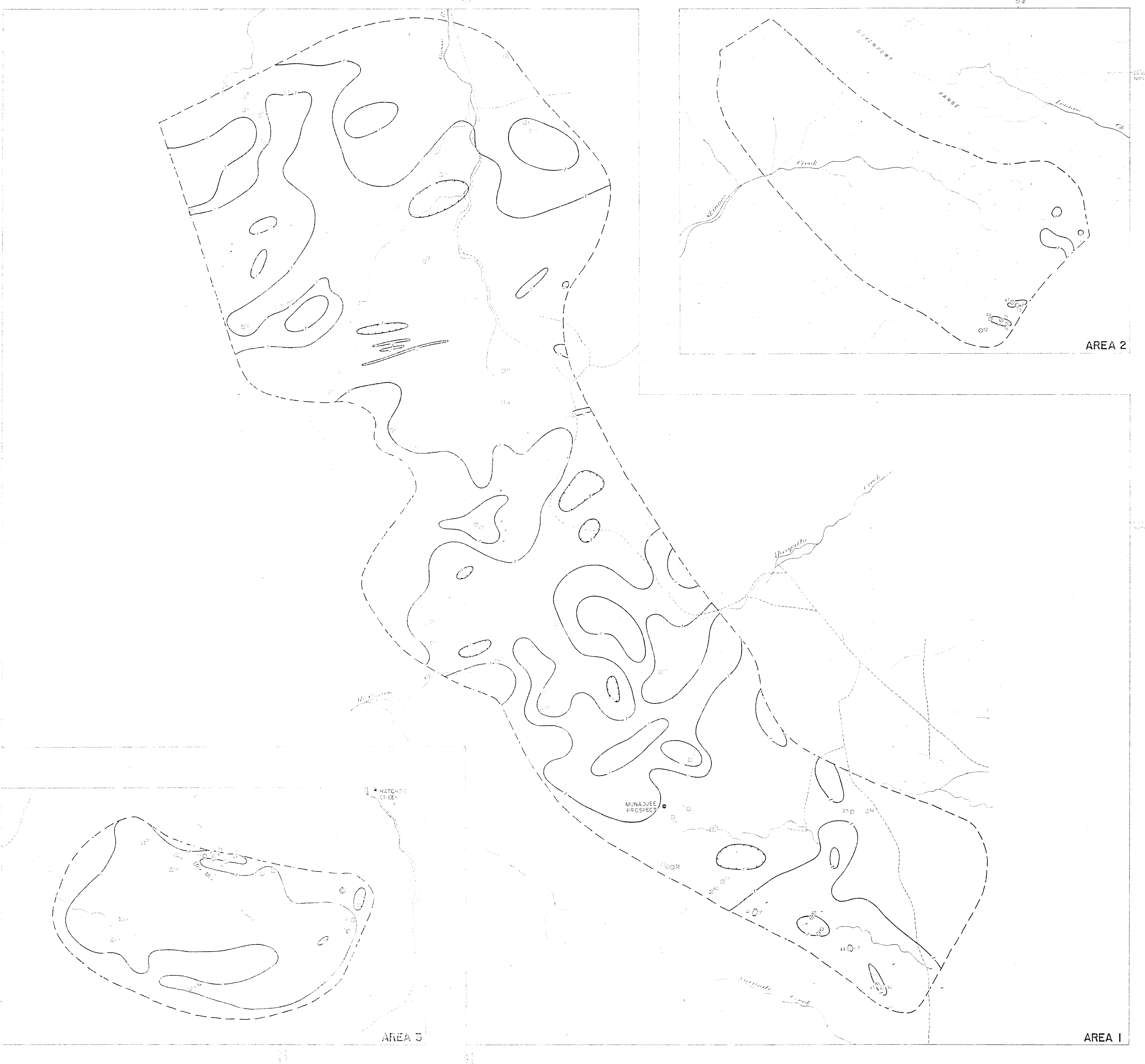
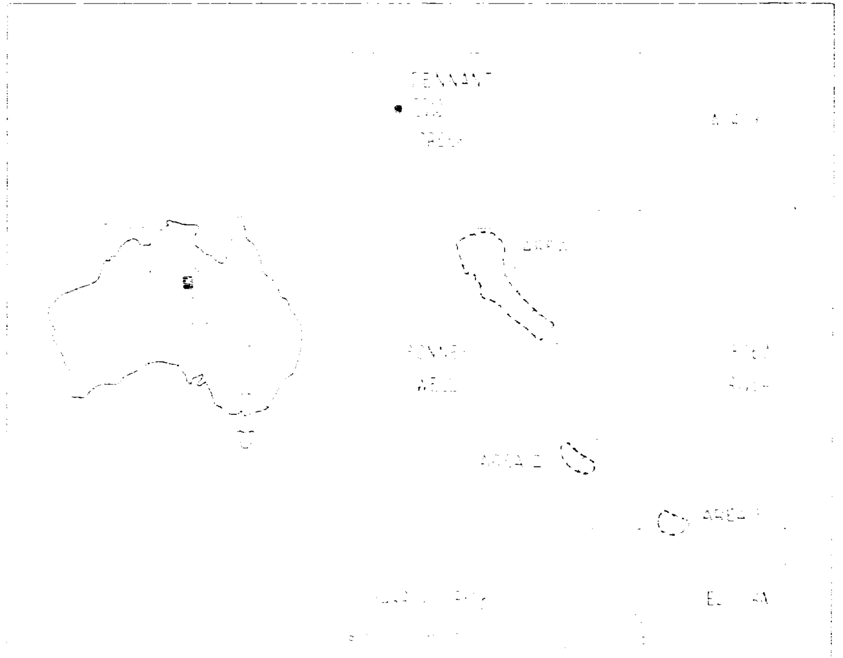


LOCATION DIAGRAM

WITH REFERENCE TO AUSTRALIAN 4 MILE MILITARY MAP SERIES



COMPILED AND DRAWN BY GEOPHYSICAL SECTION
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
DEPARTMENT OF NATIONAL DEVELOPMENT, MELBOURNE

NORTHERN TERRITORY

MOSQUITO CREEK REGION

ANOMALIES AND CONTOURS OF GAMMA-RAY INTENSITY

DETERMINED BY AIRBORNE SCINTILLOGRAPH

AUG - SEPT 1956

SCALE

MILES

LEGEND

RADIOMETRIC DATA

Anomaly and number thereof [illegible]

[illegible]

TOPOGRAPHICAL DATA

[illegible]

MAP DATA

PROJECTION [illegible]

DETAIL [illegible]

RELIABILITY [illegible]

EXPLANATORY NOTES

The airborne scintillograph records continuously the intensity of gamma radiation from the ground over which the aircraft flies. This radiation is due to the presence of the naturally occurring radioactive elements, uranium and thorium, and their decay products and to a lesser extent potassium.

The scintillograph was carried in an Auster aircraft which was flown at an average altitude of 175 feet above the ground. The scintillograph effectively scanned a strip of ground approximately 140 yards wide. The recorded gamma-ray intensity therefore represents the average intensity within a radius of 70 yards of the aircraft. The areas were surveyed systematically with flight lines about one [illegible]

The gamma-ray intensity over an area may show considerable variations, depending on the geology and topography of the area. Anomalies of gamma-ray intensity have been plotted on the map where the intensity shows a significant and localised increase. The positioning of these anomalies is considered to be accurate to within [illegible] yards. Contours have also been drawn on the map to represent the general distribution of gamma-ray intensity. These radiation levels are multiples of an arbitrary unit.

The higher intensities recorded by the scintillograph are not necessarily due to the presence of uranium deposits. Many of the higher intensities may be due to outcrops of igneous rocks, particularly granite, which contain a slightly higher concentration of the radioactive elements, uranium, thorium and potassium, than other rocks. No claim is made that all, or even any, of the higher intensities correspond to uranium deposits of economic significance, but it is possible that some do.

It should be noted that it is virtually only the radioactivity of the surface of the ground that has been recorded because the radiation from any buried deposit is substantially reduced by a few inches of soil or rock cover.

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