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Resource and radioactivity survey in the Ellsworth Mountains

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During the 1979–80 field season, radiometric survey operations were mostly limited to the Ellsworth Mountain area. The only exception was a brief attempt to detect radioactive fallout on the sea ice at McMurdo Station. The fallout measurements were made in an effort to detect a supposed nuclear bomb test off the South African coast. No fission products were found. The gamma-ray spectrometer used for the survey was a Geometrics GR-800 with a total sodium iodide (NaI (Tl)) detector volume of 8,390 cubic centimeters (512 cubic inches) (Zeller and Dreschhoff 1979). The equipment had not been modified since the previous year and it functioned without interruption throughout the survey flights.

Actual field measurements were begun on 14 December 1979 from the Ellsworth Mountains Camp and were completed on 19 December 1979. The field area was located in the Ellsworth Mountains and included both the Sentinel and Heritage Ranges. It encompassed an area roughly 300 kilometers in length and 80 kilometers in width. Outcrops were limited in the region, which receives over 50 centimeters of snow each year; generally they were confined to steep slopes, ridge crests, and a few areas where high winds tend to sweep rock surfaces free of snow. A few small dry valleys exist in the Heritage Range, but they are of very limited aerial extent.

Most of the rocks surveyed were sediments, but several limited outcrops of basic igneous rocks were also examined. The sediments range in age from Precambrian to Permian. The airborne survey track was flown mainly over Precambrian and Lower Paleozoic sediments because these outcrops were most readily accessible from the camp location. Two flights did go over Upper Paleozoic sediments, but in both cases the outcrops were near the limit of the helicopter range from the camp. The Precambrian and Cambrian sediments consist of marbles, contorted argillites, phyllites, sandstones, and shales, with a few breccia bodies associated with the marbles at the south end of the Heritage Range. The Devonian rocks also show low-grade metamorphism and are tightly folded in many areas. Quartzite is by far the most common rock type, but some localities have fairly extensive interbedding of phyllites and a few areas show nearly unmetamorphosed sandstones and shales. Sedimentary structures showing evidence of shallow water deposition are common. The Permian rocks are mainly dark conglomerates, siltstones, and graywackes; they also appear to have been deposited under shallow water conditions in many portions of the sedimentary sequence. Some thin coal beds are also present.

No significant concentrations of radioactive elements were found in any of the rocks covered by the flight path. A number of landings were made for ground checking at outcrops that appeared to have some geologic interest, but no significant radioactive anomalies were detected. Computer evaluation of all of the radiometric survey data from flights in the Ellsworth Mountains is in progress.

Almost all of the rocks exposed in the Ellsworth Mountains show evidence of low-grade metamorphism. It appears that this metamorphism proceeded under relatively dry conditions and that the uranium remained essentially immobile during the metamorphic process. For this reason, the entire area apparently has a higher than average uranium:thorium ratio. This condition probably reflects the fact that the uranium in the sediments is primary and has remained in refractory accessory minerals that are almost completely insoluble.

The project is a continuing joint research effort of the University of Kansas and the West German Federal Institute of Geosciences and Resources represented by Volker Thoste and Klaus Bulla. This research was supported in part by National Science Foundation grant DPP 77-21504.

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