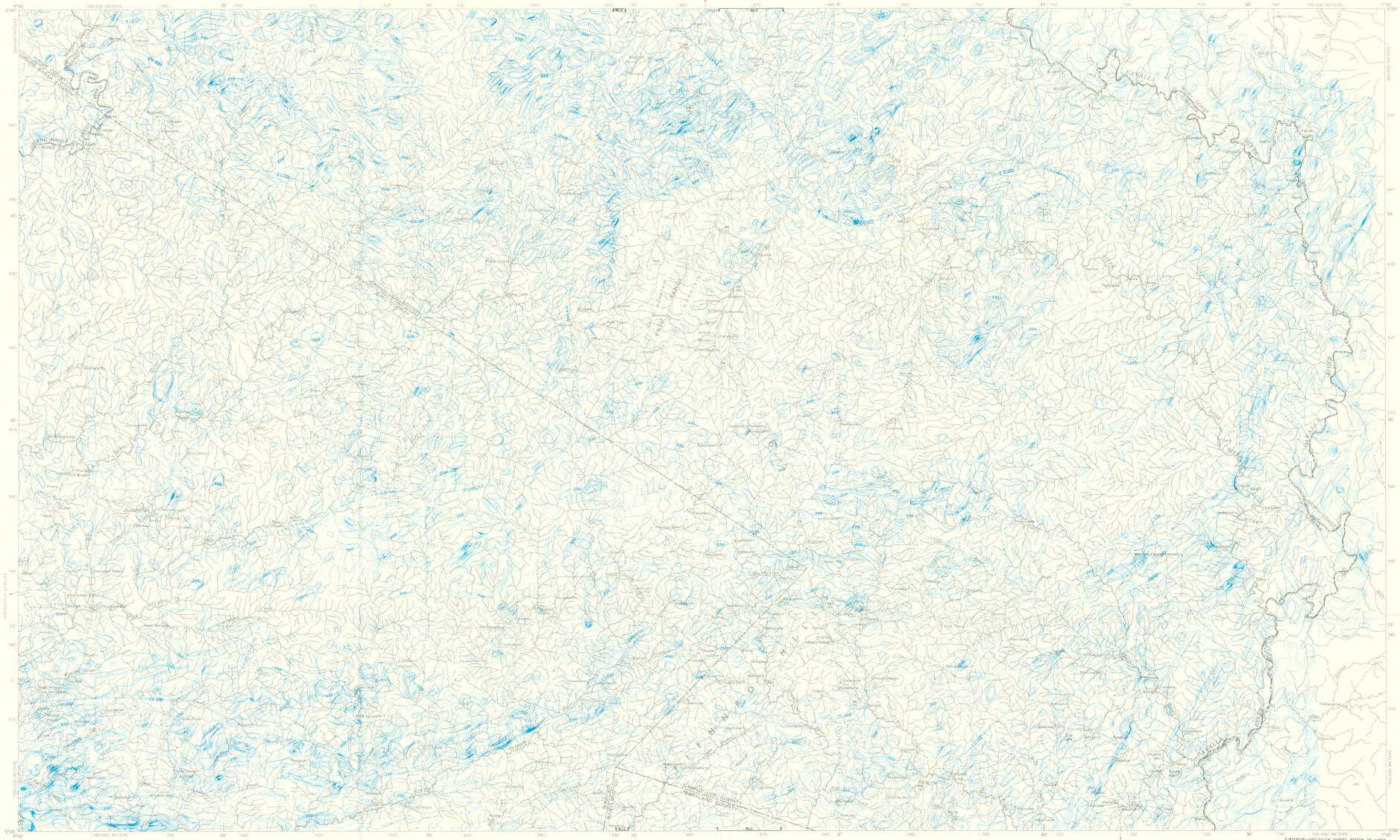
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

Prepared in cooperation with the
REPUBLIC OF LIBERIA
BUREAU OF NATURAL RESOURCES AND SURVEYS

FOLIO OF THE JUAZOHN QUADRANGLE, LIBERIA
MAP I-779-C



Coordinates based on Hotines rectified skew orthomorphic projection, U.S. Coast and Geodetic Survey, 1956

SCALE 1:250,000

5 0 5 10 15 20 25 30 KILOMETERS

5 0 5 10 15 20 MILES

1971 MAGNETIC DECLINATION VARIES FROM 13°20' WESTERLY FOR THE CENTER OF THE WEST EDGE TO 12°30' WESTERLY FOR THE CENTER OF THE EAST EDGE. MEAN ANNUAL CHANGE IS 0°06' EASTERLY

EXPLANATION

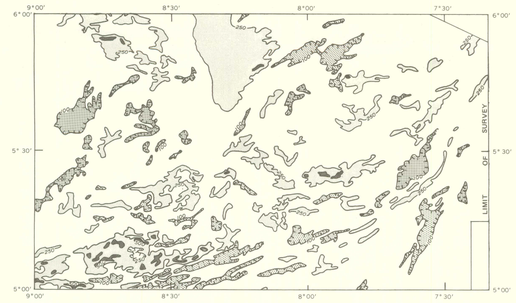
AEROradioACTIVITY CONTOURS — Showing aeroradioactivity in counts per second relative to arbitrary datum. Cosmic radiation component was removed. Hachured to indicate closed areas of lower aeroradioactivity. Contour interval 25 and 50 counts per second. Selected contour values shown in larger type

RLC

NOTE: North-south lineations, marked RLC on map, may be due to radiation level changes after rainfall

NOTE: For flight-path information see corresponding aeromagnetic map of the same quadrangle, Map I-779-B

Aeroradioactivity survey flown by Lockwood, Kessler, and Bartlet, Inc. at 150 meters above terrain, 1967–68. Flight-line spacing of 0.8 kilometers over land. Geophysical data reduced from original compilation at 1:40,000-scale by Lockwood, Kessler, and Bartlet, Inc., with minor modifications to improve legibility.



10 0 10 20 30 40 KILOMETERS

10 0 10 20 MILES

EXPLANATION

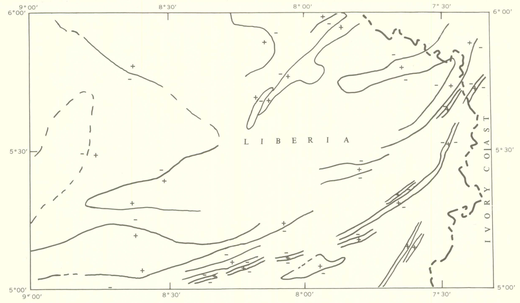
>500 COUNTS PER SECOND

250–500 COUNTS PER SECOND

100–250 COUNTS PER SECOND

<100 COUNTS PER SECOND

FIGURE 1. — Generalized aeroradioactivity map, Juazohn quadrangle.



10 0 10 20 30 40 KILOMETERS

10 0 10 20 MILES

EXPLANATION

GEOLOGIC CONTACT BASED ON RADIATION LEVEL AND MAGNETIC AMPLITUDE — Dashed where less certain

\+ indicates higher radiation, lower magnetic amplitude, and generally more felsic rock

\− indicates lower radiation, higher magnetic amplitude, and generally less felsic rock

FIGURE 2. — Suggested geologic contacts. Inferred from aeroradiometric and aeromagnetic data, Juazohn quadrangle.

INTERPRETATION

By John C. Behrendt, U.S. Geological Survey, and Cletus S. Wotorson, Liberian Geological Survey

INTRODUCTION

Aeromagnetic and total-count gamma radiation surveys were flown simultaneously over Liberia during the 1967–68 dry season. These geophysical surveys were designed to contribute to the geologic mapping program undertaken cooperatively by the Liberian Geological Survey and the U.S. Geological Survey under the auspices of the Liberian Government and the Agency for International Development, U.S. Department of State. The surveys were flown by Lockwood, Kessler, and Bartlett under contract to the Liberian Geological Survey. The geology of the Juazohn quadrangle has been mapped by Tysdal (in press) as part of the cooperative program

The entire country of Liberia is heavily forested, access is difficult, outcrops are sparse, and thick laterite is widespread. Accordingly, throughout large areas aeromagnetic and aeroradiometric surveys are the only feasible means of gathering virtually continuous data which can be related to near-surface geology, and they are useful in extrapolating geologic observations and in locating potential targets for mineral exploration.

The airborne surveys, which cover the entire country, required approximately 140,000 km of traverse, mostly along north-south lines 9.8 km apart over land and 4 km apart over the continental shelf. Continuous photography and Doppler navigation provided horizontal control; flight altitude was 150 m above mean terrain.

The geophysical data obtained from these airborne surveys are presented, by quadrangle, in these folios of 1:250,000-scale maps that show on separate sheets geographic, geologic, aeromagnetic, and total-count gamma radiation data for each of 10 quadrangles. The index map shows the locations of these quadrangles and their folio number designations. The aeromagnetic map of the Voinjama quadrangle (Wotorson and Behrendt, 1974) should be used in conjunction with this total-count gamma radiation map.

This map shows variations in the natural energy spectrum >0.05 mev (million electron volts). The data have been normalized to an altitude of 220 m above terrain, and the cosmic background was removed by utilizing calibration data obtained over the Atlantic Ocean. The contoured data were adjusted to base-level datums obtained from the east-west control lines. The radioactivity detector used in this survey consisted of three thallium-activated sodium iodide crystals, each 12 cm in diameter and 5 cm thick. The original data were contoured at intervals of 25 and 50 cps (counts per second) referred to 180 cps equivalent to 1 μr/hr.

The gamma radiation generally detected in airborne surveys is that produced by the naturally occurring isotopes of K-40 and the U and Th decay series. Only those isotopes in the uppermost 20–30 cm of rock or soil at the earth's surface can be measured by airborne methods. The distribution of these isotopes is dependent on original bedrock composition modified by the geologic processes of weathering, solution, and erosion. Comparison of gamma radiation data and K_2O analysis for various rock types (Behrendt and Wotorson, 1971) shows that granitic rocks have a high variability in K and in radiation level, ranging from 2 to 5 percent K_2O and from 100 to >500 cps, respectively. Iron-formation, granulite, and other mafic rocks range from 0–1.5 percent K_2O and from 25–200 cps. In general all of the area above 250 cps is granitic terrane, as well as most areas between 100 and 250 cps.

Figure 1 shows the generalized radiation level for the data in this quadrangle. Figure 2 is a map showing possible geologic contacts inferred from the radioactivity and magnetic data.

GEOLOGY

The geology of the Juazohn quadrangle is less well known than that of western Liberia. Unpublished data made available by the Muller Company, of the Netherlands, suggest that the rocks in some areas of the quadrangle consist of a series of migmatite, metabasalt, granite, and some pegmatites. The approximate boundary separating the Liberian (about 2,700 m.y.) and Eburnean (about 2,000 m.y.) age provinces (Hurley and others, 1971) crosses the quadrangle from southwest to northeast in the western part of the quadrangle, but its exact location is not known. The east-northeast geologic trend in the western part of the quadrangle changes to dominantly northeast in the eastern part; this change suggests two tectonic histories. The Eburnean age province, which probably includes most of the rocks in the quadrangle, especially those in the eastern part, consists of isoclinally folded metasedimentary rocks, migmatite, metabasalt, and granite. The Liberian age province is predominantly granite gneiss and associated amphibole-pyroxenite, and some granitized metabasalt, migmatite, and anatectic granite. A zone of diabase dikes (Behrendt and Wotorson, in press) crosses Liberia from Ivory Coast to Sierra Leone parallel to the coast. A presumably mafic(?) intrusion has been identified near Juazohn on the basis of the magnetic and radiometric maps and gravity data. Preliminary investigation indicates anomalous amounts of nickel and cobalt in laterite (H. Cruijs, oral commun., 1969).

RADIOACTIVITY INTERPRETATION

The break within the Eburnean province noted in the magnetic map (Wotorson and Behrendt, 1974) is well shown on the total-count gamma radiation map and probably represents the western limit of the isoclinally folded metasedimentary rocks. The linear trends of the radioactivity map agree with those of the tectonic map (Wotorson and Behrendt, 1974, fig. 1) which was compiled by interpretation of the magnetic data. The area generally has a low radiation level as compared with the rest of Liberia. Several trends of prominent positive anomalies greater than 250 cps (fig. 1) are in all probability related to granitic rocks. The patterns in the eastern part of the quadrangle are similar to those that might be expected from isoclinally folded rocks of varying composition. The repeated radiometric highs and lows were used with the magnetic data to show the contacts between the more felsic and less felsic rocks on figure 2. Careful scrutiny of the radiometric and magnetic data reveals many additional contacts which might be used to compile a geologic map when more field geologic information becomes available.

Several anomalies are more than 500 cps, and some are more than 700 cps (fig. 1); some of these anomalies may be economically important and should be investigated. The very low radiation level in the western part of the quadrangle (fig. 1) is not easily explained; we interpret the area to be a mafic terrane because of the numerous magnetic anomalies in the area (Wotorson and Behrendt, 1974). The magnetic anomaly and moderate amplitude radiation anomaly over the mafic(?) intrusion west of Juazohn show a good correlation.

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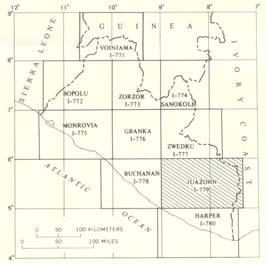

INDEX MAP OF LIBERIA — Showing location of quadrangles and miscellaneous geologic investigation maps published by the U.S. Geological Survey. Area of I-779 shaded.

TOTAL-COUNT GAMMA RADIATION MAP OF THE JUAZOHN QUADRANGLE, LIBERIA

By
John C. Behrendt and Cletus S. Wotorson
1974

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