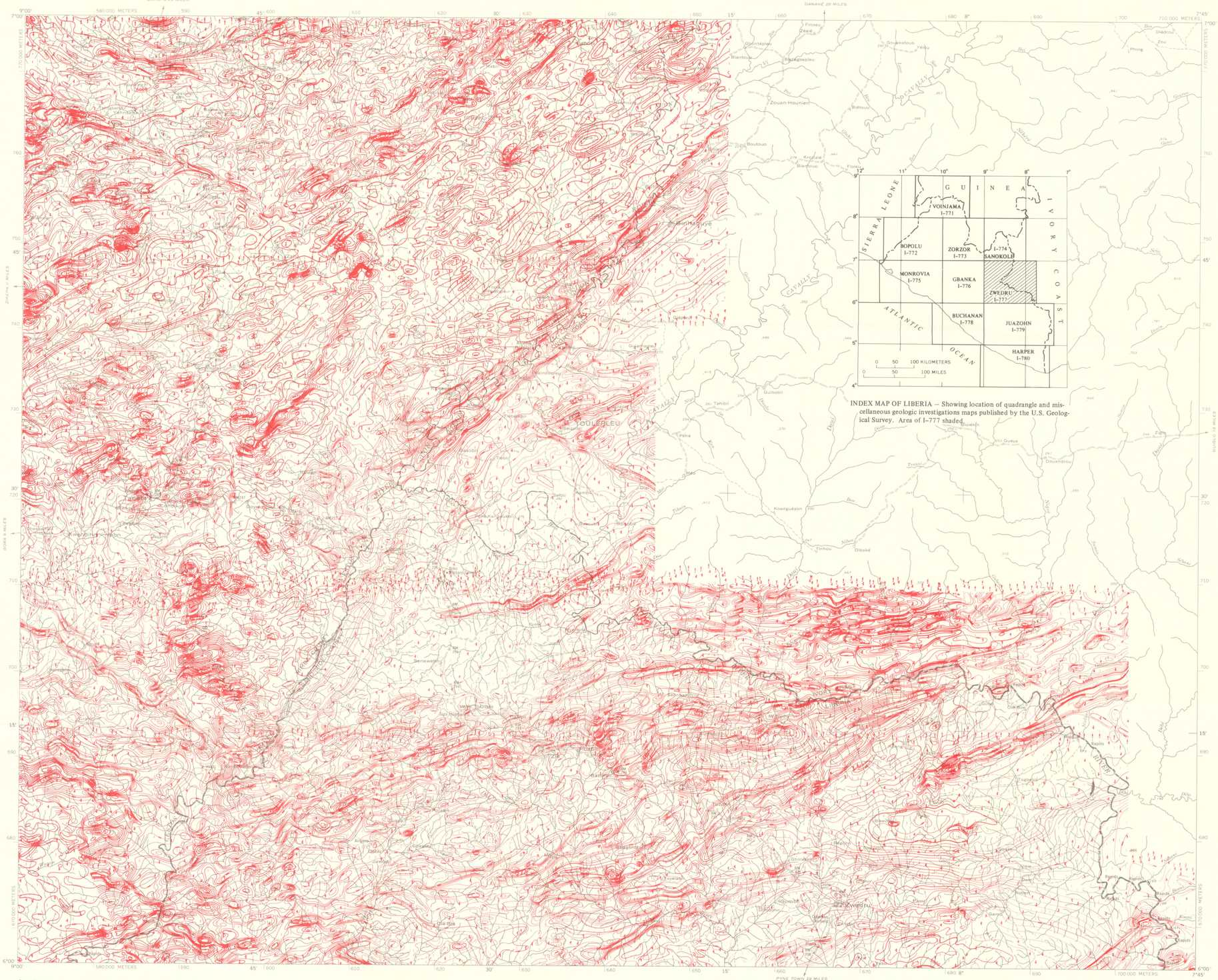
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

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



INDEX MAP OF LIBERIA — Showing location of quadrangle and miscellaneous geologic investigations maps published by the U.S. Geological Survey. Area of I-777 shaded.

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°00' 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

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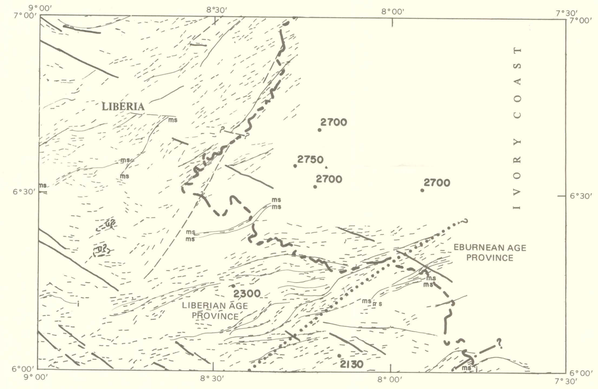
EXPLANATION

MAGNETIC CONTOURS — Showing total intensity magnetic field of the earth in gammas relative to arbitrary datum. Regional magnetic gradient not removed. Hachured to indicate closed areas of lower magnetic intensity. Contour intervals are 10, 50, 250, and 1,000 gammas. Selected contour values shown in larger type

FLIGHT PATH

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



EXPLANATION

TREND DIRECTION OF SHORT WAVELENGTH MAGNETIC ANOMALIES — Assumed to be associated with near-surface geology and interpreted as indicative of rock foliation directions.

LOCATION OF LONG LINEAR MAGNETIC ANOMALIES — Interpreted as being caused by diabase dikes

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SIGNIFICANT CHANGE IN MAGNETIC AND (OR) RADIOMETRIC CONTOURS — Inferred to be a geologic boundary of unspecified origin or type. Queried where location uncertain

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POSSIBLE FAULT — Suggested by linear change in magnetic or radiometric contour

LINEAR MAGNETIC ANOMALIES — Caused by magnetization contrasts interpreted as geologic structures that may include folds, faults, and contacts

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MAGNETICALLY DETERMINED LINEAR STRUCTURE — Inferred to be locally associated with magnetic metasedimentary rocks including schist, quartzite, amphibolites, iron-formation, paragneiss, and migmatite. May include folds, faults, and contacts

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MAGNETICALLY DETERMINED LINEAR STRUCTURE — With anomaly greater than 1,000 gammas interpreted as being caused by magnatite iron-formation. May include folds, faults, and contacts

NONLINEAR MAGNETIC ANOMALY IN THE RANGE OF –1000 TO –2000 GAMMAS — Interpreted as possible mafic or ultramafic intrusion. Queried where uncertain

•2700
RADIOMETRIC AGE DETERMINATION — In m.y. from Hurley and others (1971)

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INFERRED BOUNDARY SEPARATING AGE PROVINCES — Queried where uncertain

FIGURE 1. — Tectonic map, Zwedru quadrangle. Construction is based primarily on magnetic data.

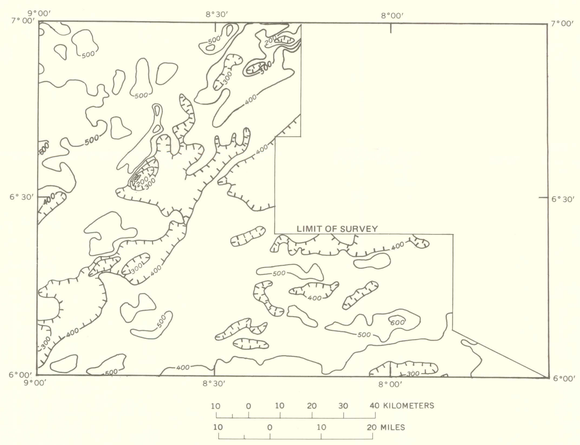

FIGURE 2. — Residual total magnetic intensity map. Compiled by removing the main earth from the map and smoothing to generalized short wavelength anomalies. G. Andreasen and P. Zabel assisted in computer processing. Hachures indicate closed areas of lower magnetic intensity. Contour interval 100 gammas, except for areas of extreme anomaly.

INTERPRETATION

By Cletus S. Wotorson, Liberian Geological Survey, and John C. Behrendt, U. S. 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 Zwedru quadrangle has been mapped by Force and Beikman (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 0.8 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. Temporal variations in the magnetic field measured with a fluxgate magnetometer were removed by adjustment at crossings of east-west control lines. Varied contour intervals of 10, 50, 250, and 1,000 gammas were used, depending on horizontal gradient.

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 total-count gamma radiation map of the Zwedru quadrangle (Wotorson and Behrendt, 1974) should be used in conjunction with this aeromagnetic map.

Figure 1 shows the tectonic interpretation for the area covered by this map. The interpretation is based primarily on aeromagnetic data, but partly on aeroradiometric data and readily available geologic information (White and Leo, 1969; Liberian Geol. Survey, unpub. data).

Figure 2 shows part of the residual total magnetic intensity map of Liberia obtained by digitizing the data from the map area on a 1-minute grid, tying to an absolute survey (Lowrie and Escowitz, 1969) by a constant of +25,980±35 gammas, and removing Cain's "Field G" (Cain and others, 1965).

GEOLOGY

The western part of the Zwedru quadrangle is in the Liberian age province (about 2,700 m.y.) and the southeastern part is in the Eburnean age province (about 2,000 m.y.) as outlined by Hurley, Leo, White, and Fairbairn (1971). The geology is not well known, but rock types known in the quadrangle are granite gneiss, granite, quartzite, amphibolite, and migmatite. Most of the available geologic information is from unpublished reports of the Muller Company, of the Netherlands, which is exploring part of the area under a concession agreement with the Liberian Government. The northwest-trending diabase dikes shown in figure 1 are part of the central dike zone that crosses Liberia from Ivory Coast to Sierra Leone (White and Leo, 1969).

AEROMAGNETIC INTERPRETATION

The predominant northeast-trending magnetic lineation typical of the Liberian age province is present in the northwestern part of the quadrangle (fig. 1). It is separated from the east-northeast lineation in the southeastern part of the quadrangle by an area near the center of the quadrangle that has a smooth field, few anomalies, and no conspicuous lineation. Diabase dikes strike northwest across the quadrangle. The residual map (fig. 2) shows a negative anomaly that extends from the southwest corner to the northeast corner of the quadrangle, and a positive anomaly (indicative of less magnetic rock) over the central smooth area. Examination of observed profiles in the central area shows very smooth magnetic and radiometric fields that are suggestive of a thick section of metasedimentary rock (for example, quartzite) or granite.

Several 1,000–2000-gamma anomalies southeast of Tapeta suggest mafic or ultramafic intrusions that are similar to other intrusions present in the northwest-trending diabase dike zone in Liberia. Another possible explanation is iron-formation. These anomalies should be investigated for possible economic deposits. An inferred north-northeast-trending fault(?) crosses the center of the quadrangle (fig. 1) and may control the course of the Nuon and Cestos Rivers.

The residual map (fig. 2) shows positive and negative anomalies, 20–30 km in width and 100–200 gammas in amplitude, that are part of a regional pattern extending across Liberia into Ivory Coast. Magnetic surveys over the Guyana Shield in South America show a similar pattern (Strangway and Vogt, 1970) as might be expected if the rocks originated during the Precambrian before the separation of Africa and South America in Mesozoic time.

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AEROMAGNETIC MAP OF THE ZWEDRU QUADRANGLE, LIBERIA

By

Cletus S. Wotorson and John C. Behrendt

1974

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