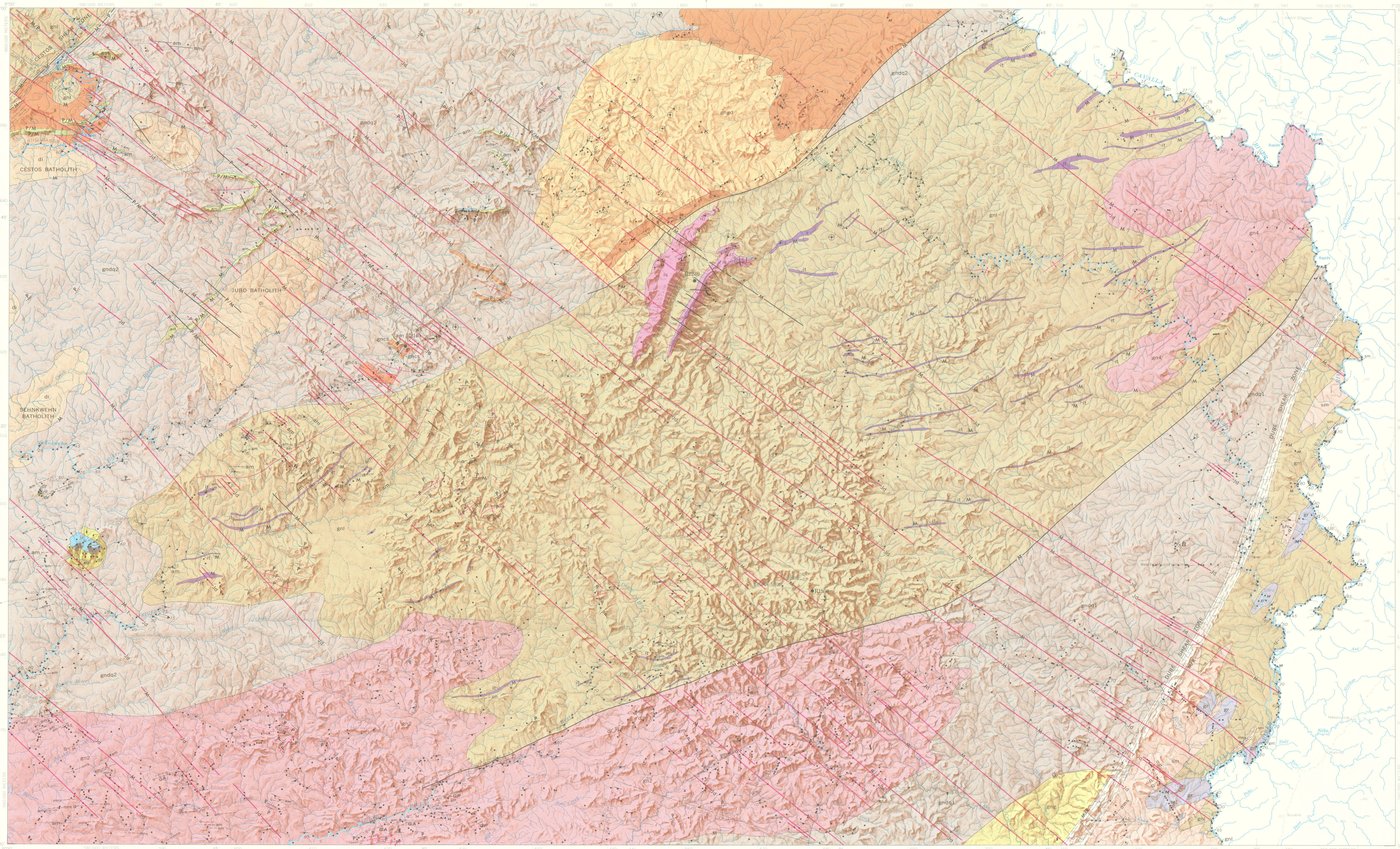
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

REPUBLIC OF LIBERIA
MINISTRY OF LANDS AND MINES
LIBERIAN GEOLOGICAL SURVEY



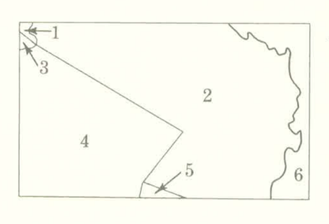
Base compiled by photo-planimetric methods from aerial photographs taken 1946, 1949, 1952-53, and 1968-69. Controlled from 1953 1:40,000-scale photomosaics by Aero Service Corporation
Hotines Rectified Skew Orthomorphic projection and rectangular coordinates

Shaded relief geographic map available as map I-779-A

INTERNATIONAL BOUNDARY SHOWN ON THIS MAP IS NOT NECESSARILY AUTHORITATIVE

SCALE 1:250,000

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



ADMINISTRATIVE BOUNDARIES

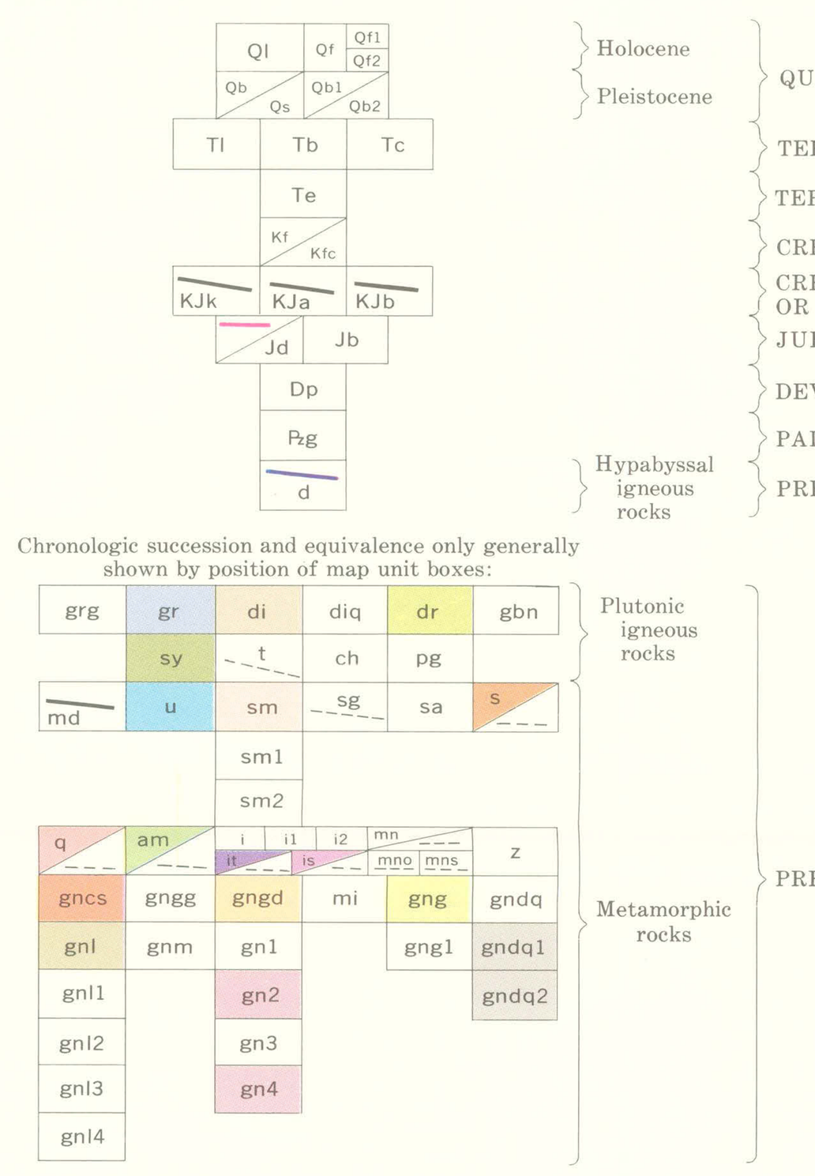
1—Nimba County, Liberia
2—Grand Jide County, Liberia
3—Grand Bassa County, Liberia
4—Sino County, Liberia
5—Maryland County, Liberia
6—Ivory Coast

Interior—Geological Survey, Reston, Va.—1977—G75240

EXPLANATION

Rock symbols in the correlation diagram are standard for all of Liberia. Only rock units present in this quadrangle are shown in color in the correlation diagram.

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

The names of igneous and metamorphic rocks are based on composition as follows:

Igneous rock	*Metamorphic rock*	*Percent potassium feldspar of total feldspar*	*Percent quartz in rock*
Granitic rocks, undivided	*Granite gneiss*	>10	>10
Granite	*Granite gneiss*	>50	>10
Granodiorite	*Granodiorite gneiss*	>10 and <50	>10
Dioritic rocks, undivided	*Diorite gneiss*	<10	
Quartz diorite	*Quartz diorite gneiss*	<10	>10
Diorite	*Diorite gneiss*	<10	<10

Metamorphic rocks classified according to this scheme are not necessarily igneous in origin. Leucocratic (light colored) and melanocratic (dark colored) are used for gneiss units of variable or complex composition for which mineralogic classification is not applicable.

Jd — DIABASE—Dark-gray, chiefly diabasic but locally gabbroic in texture. Consists primarily of calcic plagioclase and clinopyroxene with minor amounts of magnetite and ilmenite. Locally contains orthopyroxene. Forms dikes

d — DIABASE—Gray medium-grained dike rock composed mainly of calcic plagioclase and clinopyroxene

t — TRACHYTE—Reddish-brown fine-grained dike rock with phenocrysts of hornblende or clinopyroxene and a matrix of albite. Rock is commonly weathered, with plagioclase partly altered to clay

sy — SYENITE—Brownish-gray medium- to coarse-grained rock composed of orthoclase, aegirine, biotite, and magnetite. Locally pegmatitic

dr — DIORITIC ROCKS—Mainly melanocratic fine- to medium-grained diorite of plagioclase, hornblende, and diopside with minor biotite and magnetite. Also include quartz diorite, trondjhemite, gabbroic diorite, and locally gabbro

di — DIORITE—Gray-green to dark-gray hornblende diorite. Hornblende averages 20-30 percent of rock, locally reaches 40 percent. Massive, forms rounded outcrops

gr — GRANITIC ROCKS, UNDIVIDED—Leucocratic medium- to coarse-grained rock of granodiorite to granite composition. Muscovite is dominant mica, and biotite may or may not be present. Tourmaline is common accessory mineral

u — ULTRAMAFIC ROCKS—Dark-green fine- to medium-grained rocks, including serpentinized dunite, serpentinite, and pyroxenite (augite or diopside and minor minerals). Magnetite composes up to 20 percent of some rocks, but is commonly less

mns — MANGANESE FORMATION, SILICATE FACIES—Dull black fine- to very fine grained finely laminated spessartinite or gondite. Minor minerals include goethite, hematite, and quartz. Clinopyroxene occurs in a few speciments. Equigranular quartz locally forms thin discontinuous laminations, veinlets, and irregular light-colored patches

mno — MANGANESE FORMATION, OXIDE FACIES—Black botryoidal dome-shaped stalagmitic masses with layers of psilomelane alternating with layers of radiating fibers of pyrolusite

is — IRON-FORMATION, SILICATE FACIES—Dark-colored fine- to medium-grained finely laminated schist containing chlorite or hornblend, quartz, plagioclase, and locally biotite, with minor magnetite. Varicolored fine-grained finely laminated quartzite is interbedded with the schist

it — IRON-FORMATION, OXIDE FACIES (ITABIRITE)—Dark-gray to brown very fine to medium-grained, finely laminated quartz-hematite-magnetite rock

am — AMPHIBOLITE—Black fine- to coarse-grained foliated to massive rock consisting of about equal amounts of plagioclase and hornblende. Quartz and garnet abundant locally

q — QUARTZITE—Light- to dark-colored fine- to medium-grained thin-bedded rock that is commonly greater than 90 percent quartz. Accessory minerals include hornblende, mica, garnet, graphite, or magnetite

s — SCHIST—In north-central part of quadrangle, schist is light- to dark-colored fine- to coarse-grained schist of biotite composition; rock is transitional from schist to gneiss. Sillimanite schist, quartzite, and amphibolite schist locally present. Along Cestos River schist is mainly pelitic, but also includes mica schist and hornblende schist

sm — MICA SCHIST—Leucocratic to melanocratic fine- to medium-grained plagioclase-quartz-muscovite-biotite schist with local sillimanite and minor tourmaline and garnet. Contains interbedded fine-grained equigranular quartzite, local managanese formation, and amphibolite units

gn2 — COMPOSITE GNEISS UNIT 2—Unit contains following rock types: (a) Melanocratic fine- to coarse-grained biotite-graphite quartz diorite gneiss; commonly banded. Contains sillimanite in westernmost part of unit. Garnets and graphite are common. (b) Magnetite-bearing biotite quartz diorite gneiss. (c) Clinopyroxene-hornblende quartz diorite gneiss. (d) Amphibolite. (e) Fine- to medium-grained quartzite beds with graphite, garnet, or hornblende. (f) Manganese formation. (g) Small quartz diorite bodies. (h) Metagabbro

gn4 — COMPOSITE GNEISS UNIT 4—Leucocratic medium- to coarse-grained diorite to granitic gneiss, migmatite, and small granitic bodies. Large outcrops are commonly migmatite. Pegmatites are abundant throughout unit

gnl — LEUCOCRATIC GNEISS—Light-colored fine- to medium-grained biotite quartz gneiss, and locally muscovite-bearing gneiss of granodiorite to granite composition. In central part of quadrangle unit contains quartz diorite, granodiorite, and unmapped areas of itabirite

gncs — CALC-SILICATE GNEISS—Pale- to dark-green fine-grained gneiss composed mainly of hornblende, plagioclase, and diopside with lesser quartz, hornblende, and microcline; minor epidote, garnet, sphene, and calcite. Locally hornblende and prehnite gneiss. Unit is banded, with bands a few metres thick having different mineral concentrations. Locally transitional into amphibolite

gndq1 — QUARTZ DIORITE GNEISS UNIT 1—Leucocratic to melanocratic fine- to coarse-grained hypidiomorphic granular biotite quartz diorite gneiss. Local interbedded schist. Migmatite is common. Small quartz diorite intrusives common. Local areas of small granite intrusives

gndq2 — QUARTZ DIORITE GNEISS UNIT 2—Dark-colored fine- to coarse-grained banded hornblende quartz diorite gneiss and leucocratic biotite quartz diorite gneiss. Local occurrences of gondite and schist. Abundant intercalated amphibolite

gng — GRANITIC GNEISS—Leucocratic fine- to coarse-grained weakly foliated gneiss with minor intercalated amphibolite

gngd — GRANODIORITE GNEISS—Leucocratic medium-grained hypidiomorphic biotite granodiorite gneiss. Foliation determined by sparse oriented biotite, locally by tabular quartz grains. Unit contains local occurrences of schist, amphibolite, and quartz diorite gneiss. Small granitic intrusive bodies present locally

Map symbols are standard for the geologic quadrangle maps of Liberia (I-771-D to I-780-D). Not all symbols are used on any one map.

Letter symbol within contact, fault, or other structural symbol indicates source of information used in locating contact: M, aeromagnetic data; P, photointerpretation; R, near-surface radiometric data; G, gravity data; and P/M, combination source (predominant source given first). Segments without letter symbol were located by surface traverses. Break in line indicates change in source of information.

Where rock units are present only as marker beds within other formations, they are shown in black (see below) with the appropriate unit symbol.

Contact—Showing direction of dip where known

Fault—U, upthrown side; D, downthrown side; dip where known

Thrust fault—Sawteeth on upper plate

Fault zone or shear zone

Fault intruded by dike

Antiform—Showing trace of crestal plane and direction of plunge; degrees of dip and plunge given where known

Overturned antiform

Synform—Showing trace of trough plane and direction of plunge; degrees of dip and plunge given where known

Overturned synform

Strike and dip of axial plane of minor fold
- Inclined
- Vertical

Strike and dip of beds
- Inclined
- Vertical
- Horizontal

Strike and dip of foliation—Open symbol indicates foliation transecting earlier foliation or bedding; solid symbol indicates relation to bedding unknown
- Inclined, degree of dip given where known
- Vertical
- Horizontal

Strike and dip of parallel layering or bedding and foliation
- Inclined
- Vertical
- Horizontal

Strike of foliation, no dip determined

Strike and dip of joints
- Inclined
- Vertical
- Horizontal

Strike and dip of planar features determined from photointerpretation (P) or aeromagnetic data (M)—One, two, three, or four ticks indicate gentle, medium, steep, or vertical dip

Bearing and plunge of lineation formed by minor fold. Barbed arrow indicates crinkle axis or intersecting foliation; solid arrow indicates bearing and plunge of mineral lineation

Structural trend or lineation based on photointerpretation

Structural trend based on aeromagnetic data

Observed outcrop

Marker bed distinguished by rock symbol (q) or index mineral (AD)

Index minerals:

AD, andalusite	EN, enstatite	K, kyanite
AN, anthophyllite	EP, epidote	M, muscovite
AU, augite	EU, eulite	PY, pyrite
B, biotite	GA, garnet	PX, pyroxene
CL, chlorite	GP, graphite	S, sillimanite
CG, cummingtonite-grunerite	H, hornblende	ST, staurolite
D, diopside	HY, hypersthene	TA, tremolite-actinolite
	IL, ilmenite	

Sand, gravel, clay, or placer pit—B, barite; D, diamond; G, gold

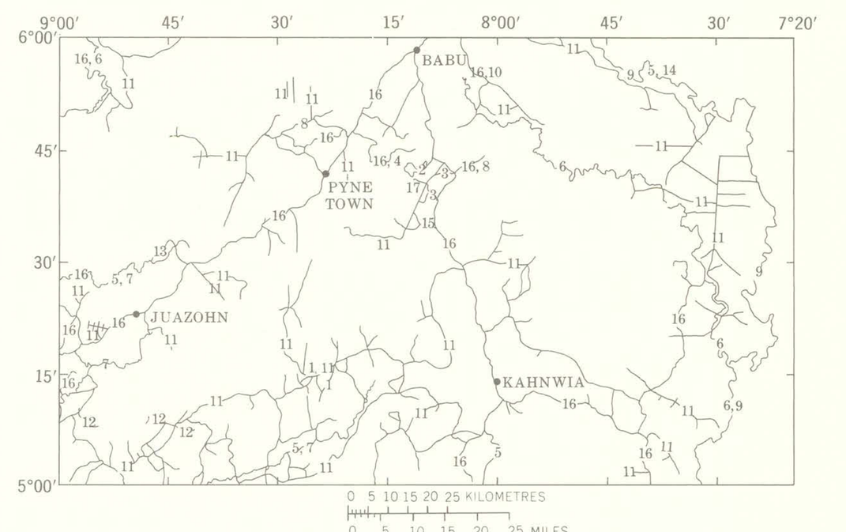
Mine or quarry—S, building stone or road metal; C, clay; I, iron

Prospect pit—B, barite; K, kyanite

Drill site for offshore well, abandoned

Fossil locality
- Invertebrate
- Plant

K2600 Radiometric age in millions of years—K, potassium-argon; R, rubidium-strontium; F, fission track. Reset age given in parentheses where applicable



SOURCES OF FIELD DATA

1. M. W. G. Baker (LGS)
2. G. O. Bachman (USGS)
3. Delimco (German-Liberian Mining Co.)
4. J. Dunbar (LGS)
5. R. L. Earhart (USGS)
6. P. T. Hayes (USGS)
7. T. D. Hessin (USGS)
8. J. N. Hoare (USGS)
9. Ivory Coast geologists
10. B. Micke (Peace Corps)
11. Wm. H. Muller Co.
12. E. Phillips (LGS)
13. T. Sherman (LGS)
14. G. C. Simmons (USGS)
15. T. P. Thayer (USGS)
16. R. G. Tysdal (USGS)
17. R. W. White (USGS)

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and the
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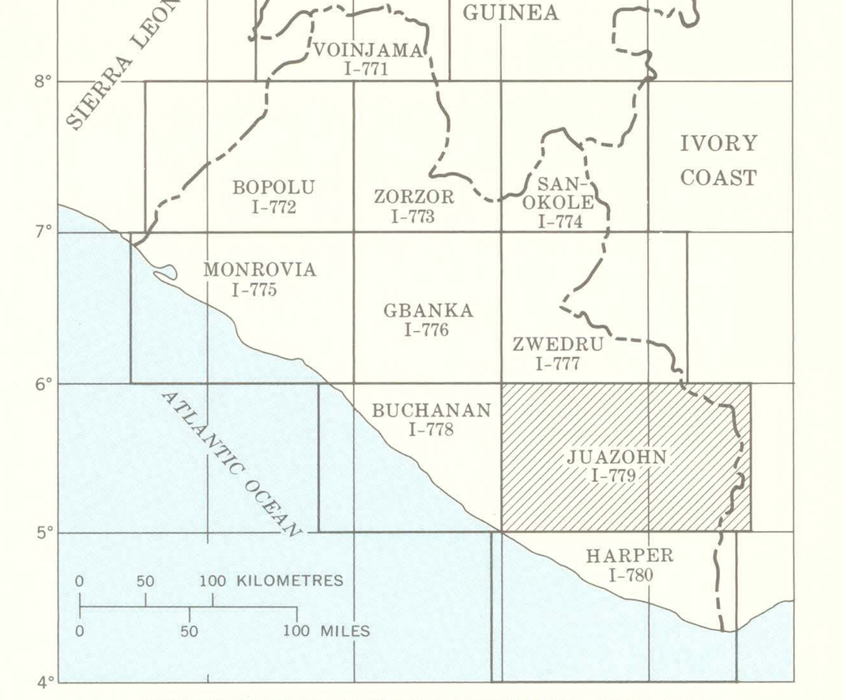
U.S. DEPARTMENT OF STATE



INDEX MAP OF LIBERIA SHOWING LOCATION OF QUADRANGLES IN THIS SERIES

INTRODUCTION

Liberia was mapped by geologic and geophysical methods during the period 1965 to 1972 as part of a program undertaken cooperatively by the Liberian Geological Survey (LGS) and the U.S. Geological Survey (USGS), under the sponsorship of the Government of Liberia and the Agency for International Development, U.S. Department of State. The resulting geologic and geophysical maps are published in 10 folios, each covering one quadrangle (see index map). The Juazohn quadrangle was systematically mapped by the author from December 1970 to June 1972. Field data provided by private companies and other members of the LGS—USGS project were used in map compilation and are hereby acknowledged.

The topography of the Juazohn quadrangle is hilly and ranges mostly from 75 to 200 m above sea level. The hilly area in the north-central part, however, is higher and culminates in Jide Mountain at more than 800 m altitude. Much of the low-lying eastern and western thirds of the quadrangle contain thick laterite and few outcrops. Saprolite was observed in many roadcuts. Traverses were made along trails, the two main roads, many short logging roads, and in rubber boats, on the Cavalla, Dube, Grand Cess, Dugbe, Sehnkwehn, and Sino Rivers.

Mineral-exploration data of the Muller Company (unpub. data, 1968, 1969, 1970, 1971; van Griethuysen, 1970) were used extensively. Total-intensity aeromagnetic (Wotorson and Behrendt, 1974) and radiometric maps (Behrendt and Wotorson, 1974b) were used to distinguish and delineate map units.

ROCKS

The Juazohn quadrangle forms part of the Guinean Shield of West Africa and is composed mainly of quartz diorite gneiss and lesser schist, amphibolite, iron-formation, and igneous rocks. Some of the rocks belong to the Eburnean (2,000 m.y.) metamorphic age province, but other rocks are transitional in age between the Eburnean and Liberian (2,700 m.y.) age provinces (White and Leo, 1970; Hurley and others, 1971). Rock units are described in a sequence according to rock type, the order of which has no stratigraphic significance. Surficial and residual deposits, which commonly obscure bedrock, are not mapped separately.

METAMORPHIC ROCKS

Metamorphic rocks are classified according to the ratio of potassium feldspar to total feldspar (see map explanation), following igneous-rock terminology, with appropriate modifiers. An igneous origin is not necessarily implied. Rocks that do not fit this scheme are given descriptive names (for example, amphibolite).

Granodiorite gneiss

The granodiorite gneiss unit (gngd) consists mainly of moderately dipping gneiss of granodiorite composition, but the unit contains minor schist and amphibolite. In the northern part, the unit is characterized by linear magnetic highs and lows (see Wotorson and Behrendt, 1974). Southward, the pattern becomes more diffuse, broad, and flat, a pattern more typical of igneous bodies. It contains local radiometric highs (see Behrendt and Wotorson, 1974b) in the western part, which are caused by small granitic intrusive bodies as much as 2 km across. Some granites are clearly discordant to the country rock, but elsewhere discordance is not obvious, and there is a gradual change from granodiorite gneiss to intricately folded granodiorite gneiss, locally containing pegmatites, to granite.

Granitic gneiss

The granitic gneiss (gng) is mainly the composition of granodiorite, but the unit locally ranges from quartz diorite to granite. It contains minor intercalated amphibolite. The unit is distinguished on the basis of outcrops in the Harper quadrangle (Brock and others, 1977), where it has a distinct magnetic pattern. The pattern is less prominent in the Juazohn quadrangle, and the boundaries are thus less certain.

Quartz diorite gneiss

The quartz diorite gneiss is divided into two units. Unit 1 (gndq1) is immediately west of the Dube shear zone and is characterized by few outcrops and hilly topography. Biotite quartz diorite is the dominant rock type, but migmatitic rocks are also common. Quartzite was noted at two localities, and small dioritic to granitic bodies occur locally. Contacts of these small igneous bodies are not exposed.

Unit 2 (gndq2) underlies a large area. From the Sino River to the Sehnkwehn River and northwest to the Cestos batholith, it is chiefly banded hornblende-bearing quartz diorite gneiss, although biotite gneiss is also present. Northwest of the southeast-flowing length of the Sehnkwehn River, however, hornblende commonly constitutes 20 to 35 percent of the rock. In the central part of the area underlain by unit 2, the dominance of hornblende decreases, and in the northern part, biotite becomes the chief mafic mineral, commonly constituting 10 to 20 percent of the rock. Schist is locally interbedded with the gneiss. Gondite and fine-grained quartzite are present locally, and a small pyroxenitic body (u) is present north of Tibowehn. Amphibolite, which is common in map unit gndq2, is locally tens of metres thick, weathers in relief, and in places defines large-scale structures easily seen on aerial photographs.

Leucocratic gneiss

Leucocratic gneiss (gnl), with minor associated schist, crops out east of the Dube shear zone and consists predominantly of banded biotite quartz diorite. Muscovite gneiss of granodiorite to granite composition is present locally. Quartz commonly constitutes 20 to 30 percent of the gneisses but may reach 50 percent.

The large area of leucocratic gneiss in the central part of the quadrangle is composed of a variety of rocks, but the widespread presence of itabirite characterizes it as an itabirite province. In much of the province, rocks are mainly leucocratic biotite quartz diorite gneiss and biotite granodiorite gneiss. In the Juazohn area, hornblende quartz diorite is also present, along with minor amphibolite. Granitic intrusive rocks form hills in the Kahnwia area, and in some places, these rocks clearly crosscut the gneissic country rock. In the hilly southwestern part near Wudekehn, granite and quartz diorite intrusive bodies were noted by the Muller Company (unpub. data, 1970) along with abundant migmatites.

Leucocratic gneiss along the Cestos River commonly contains both biotite and lesser muscovite, and the gneiss ranges from granodiorite to granite in composition. Pegmatites with muscovite are abundant.

Calc-silicate gneiss

Calc-silicate gneiss (gncs) occurs southwest of Pyne Town and forms resistant outcrops and low rounded hills. In one area, centimetre-thick bands of calc-silicate gneiss alternate with hornblende-rich calc-silicate gneiss layers. The rock is transitional into amphibolite by a gradual increase in content of hornblende. This unit is not characterized by distinctive magnetic or radiometric patterns.

Composite gneiss

Composite gneiss is separated into two units in this quadrangle on the basis of distribution of graphite. However, other rock types, as noted, are typical of each unit.

Composite gneiss unit 2 (gn2) has graphite-bearing biotite quartz diorite gneiss as its prominent rock type. In the western part of the unit, graphitic rocks form 10 long parallel bands in which graphite commonly makes up about 5 percent of the rock. Narrow linear magnetic anomalies are associated locally with magnetite-bearing quartz diorite gneiss and magnetite-bearing migmatites (Muller Company, unpub. data, 1969). Clinopyroxene-bearing hornblende quartz diorite gneiss occurs locally along the Dugbe River, and metamorphosed ultramafic rocks were reported by the Muller Company (unpub. data, 1970). Quartzite and amphibolite occur throughout the belt and are associated locally with manganese formation. Many small poorly foliated to massive quartz diorite bodies crop out in the eastern end of the unit. High-amplitude radiometric anomalies in the southwestern part of the unit appear to crosscut the regional stratigraphic and structural patterns. Limited data suggest that these are caused by small granitic intrusive bodies.

Composite gneiss unit 4 (gn4) is characterized by low topographic relief and an abundance of dioritic to granitic gneiss, migmatite, pegmatite, and small granitic bodies. Large outcrops are generally migmatitic. Similar rocks with the same broad uniform magnetic pattern occur along strike in the Ivory Coast (Bos, 1964). Bos also described a large granite body about 9 km northeast of the Cavalla River and speculated that the assemblage of rocks reflects an unexposed granite massif. The magnetic pattern is certainly similar to those of the batholiths in the western part of the quadrangle, thus lending support to Bos' interpretation.

Schist and quartzite

Mica schist (sm) underlies hilly topography southeast of the Dube shear zone and contains an abundance of muscovite and minor tourmaline. Quartzite (q) is commonly interbedded with schist and locally contains garnet, pyrite, or hornblende as accessory minerals. Manganese formation is locally associated with quartzite. A few thin amphibolite units were also noted.

Schist (s) east of Babu is composed mainly of biotite quartz diorite and is best termed schist-gneiss. Quartzite (q), sillimanite schist, and amphibolite are also present. Isolated areas of similar rocks to the southwest in the granodiorite gneiss unit (gngd) are probably remnants of the schist unit east of Babu.

Schist along the Cestos River is partly pelitic and locally contains sillimanite and muscovite. It is a continuation of the belt of pelitic rocks extending from the Buchanan quadrangle (Tysdal, 1977) northeastward into the Zwedru quadrangle (compare Force and Beikman, 1977).

Amphibolite

Amphibolite (am) is composed of about equal parts hornblende and plagioclase and commonly contains minor garnet. Clinopyroxene is a common accessory mineral in some amphibolite. Most of the amphibolite forms discontinuous tabular bodies that are too thin to map and are shown only as marker beds, but some of them are mappable units hundreds of metres thick. Many of the amphibolite bodies form ridges and have a negative magnetic anomaly of 100 to 300 gammas (see Wotorson and Behrendt, 1974).

Iron-formation

Iron-formation is represented by both oxide- and silicate-facies rocks. Itabirite (oxide facies) (it) is composed of magnetite (locally hematite), quartz, and minor iron silicate minerals. The magnetite content is commonly less than 25 percent of the rock, except in Jide Mountain where it reaches about 40 percent. It commonly forms linear bands marked by negative magnetic anomalies.

Iron silicate rocks (is) commonly flank the itabirite. In Jide Mountain they are composed of quartz-chlorite schist; in Ghi Mountain the iron silicate rocks are quartz-hornblende schist. Quartzite is commonly interbedded with these rocks.

Manganese formation

Metasedimentary manganese formations (mno, mns), shown on the map as marker beds, are composed mainly of spessartite with minor quartz and iron oxide. They are resistant to erosion and commonly form steep-sided ridges.

IGNEOUS ROCKS

Mappable igneous rocks make up only a small part of the quadrangle. Diabase dikes are the most abundant and trend northwestward across the quadrangle.

Granitic rocks

Granitic bodies (gr) east of the Dube shear zone are granodiorite to granite in composition, and they contain muscovite as the dominant mica. Some granites are rich in apatite and tourmaline. Coarse-grained hydrothermal veins with graphic texture and booklets of muscovite are associated with the granitic rocks (Muller Company, unpub. data, 1971). Granite pegmatites are common and contain abundant muscovite and lesser tourmaline and apatite.

Diorite

Hornblende diorite (di) underlies areas characterized by few outcrops and low-lying topography. It forms the Cestos and Sehnkwehn batholiths (Tysdal, 1977) and the Jubo batholith, herein named for the river that flows across it. The batholiths have a broad flat magnetic pattern. An area of similar magnetic expression is northeast of the Cestos batholith and is assumed to represent another diorite body.

Dioritic rocks

Intrusive dioritic rocks (dr) crop out adjacent to the ultramafic bodies near Juazohn, form massive rounded outcrops, and contain inclusions of the nearby ultramafic rocks. Mafic pegmatites are locally associated with the diorite.

Ultramafic rocks

Ultramafic (u) and associated rocks have intruded the country rock at Taju Hill southwest of Juazohn. The ultramafic rocks include pyroxenite (augite and (or) diopside), serpentinized dunite, and serpentinite (Muller Company, unpub. data, 1970). A gravity anomaly of +40 milligals (Behrendt and Wotorson, 1974) and an aeromagnetic anomaly of -1,500 gammas mark the intrusive.

Syenite and trachyte

Aegirine syenite (sy) forms a resistant knoll on the southern flank of Taju Hill within the dioritic rocks of the Juazohn ultramafic complex. The syenite is locally gradational into granodiorite, both within and marginal to the syenite body, and drill cores show that it has been intruded by pegmatitic syenite (Muller Company, unpub. data, 1970).

Sodic trachyte dikes (t) 1 to 5 m thick locally crosscut gneisses in the Juazohn region and are probably related to the syenitic rocks.

Diabase

A swarm of diabase dikes (Jd) trends northwest across the quadrangle; the dikes form linear ridges that are commonly 10 to 30 m high. Most of the dikes are steeply dipping. Field observations demonstrate that some are intruded along faults, and many others are believed to occupy faults. A linear negative magnetic anomaly typically characterizes the diabase. The dikes are Early Jurassic in age (Grommé and Dalrymple, 1972).

A single north-trending dike (d) in the northeastern part of the quadrangle crosses the Cavalla River north of Drubo. It is diabasic, like the northwest-trending dikes, but its aberrent trend suggests the possibility of a different age.

METAMORPHISM

The greenschist facies of metamorphism is thought to be represented by the iron-formation of Jide Mountain, although the plagioclase composition of these chloritic rocks is unknown. Most of the rocks in the quadrangle, however, are of the amphibolite facies. The upper amphibolite facies is reached in the southwesternmost part of the quadrangle where sillimanite gneisses and clinopyroxene-bearing mafic rocks occur.

STRUCTURE

The quadrangle can be divided into three northeast-trending structural provinces. In the central part of the quadrangle, the itabirite province has gently to moderately dipping rocks in addition to local areas of steeply dipping rocks. In the adjoining province to the southeast, south of a major fault, the rocks dip steeply in isoclinal folds. In the northwest province, broad open folds are prominent, although isoclinal folds also occur.

Within this latter province is a zone of subtle northwest-trending structures that extend from the northwest corner of the quadrangle across the quartz diorite gneiss unit (gndq2). The width of the zone is uncertain, but along the Babu-Juazohn road it must extend at least from about Pyne Town to about 20 km southwestward. It is marked by the greatest density of diabase dikes and by both northeast- and northwest-trending structural features.

Unconformities

An unconformity separates the iron-formation of Jide Mountain from the underlying gneisses, according to J. Stobernack (oral commun., 1968, *in* White and Leo, 1969, p. 13). Stobernack's mapping, on which the map pattern of Jide Mountain is based (German-Liberian Mining Co., unpub. data, 1971), shows a tight syncline along most of the backbone of the mountain and a shallow syncline at the northeastern end. Along this same trend, northeast of the mountain, itabirite dips 15° S., reflecting the low dips of rocks over much of the area northeast of the Putu Range. Thus all these low-dipping rocks may uncomformably overlie older rocks.

Folds

Isoclinal folds characterize the rocks southeast of the itabirite province. Most of the fold limbs dip south or southeast, parallel to the foliation, but some are vertical and a very few dip north.

In the northeastern half of the itabirite province, anticlines and synclines trend southwest and locally west. Dips on the flanks of these folds are commonly at moderate angles, but some limbs do dip steeply. The itabirite lenses in the northeastern part of the quadrangle occur within both tight, steeply dipping synclinal limbs and more open folds.

Folds in the southwestern part of the itabirite province are broad and open. On aerial photographs, some of them reveal a swirly pattern characteristic of plastic deformation. In areas of swirly folds, itabirite occurs in short discontinuous lenses; elsewhere it forms long lenses. In general, areas of swirly folds show prominent topographic relief and crosscutting high radiometric patterns.

Major broad open folds with axes that strike northwest to west occur in the structural province northwest of the itabirite province. The Muller Company (unpub. data, 1969) found isoclinal folding in rocks northwest of the itabirite province, but only open folds are prominent on aerial photographs. One of these is immediately south of Pyne Town and is unusual in that its northeastern limb contains an isoclinal recumbent fold, its axis striking about parallel to that of the major open fold.

Faults

Four major northeast-trending faults cut the quadrangle, and three of the four are marked by wide zones of shearing. The Dube shear zone, named after its exposure along the Dube River, is a vertical structure marked by strong linearity on the magnetic and radiometric maps (see Behrendt and Wotorson, 1974b, and Wotorson and Behrendt, 1974). The bouguer gravity map (Behrendt and Wotorson, 1974a) shows a negative anomaly southeast of the shear zone and a positive correlation with rocks to the northwest. Brock and others (1977) noted evidence for left-lateral strike-slip movement along the shear zone in the Harper quadrangle.

The fault forming the southeast margin of the itabirite province marks strong magnetic and topographic contrasts and forms the contact between unit gnl and other units. Shearing was noted only in a few places along this fault. A low-angle fault near the northwest margin of the itabirite province is marked by a wide zone of shearing. Its continuation southwestward beyond the Putu Range is uncertain. The Cestos shear zone described by Tysdal (1977) cuts across the northwesternmost corner of the quadrangle.

Northwest-trending faults locally cut the northeast-trending faults and are emphasized by the diabase that has intruded some of them. Shearing has been observed in some of the gneisses adjacent to the diabase dikes, and the strike of foliation locally changes from the regional northeast trend to northwest adjacent to the diabase. In the northwesternmost part of the quadrangle and in the adjacent Buchanan quadrangle (Tysdal, 1977), lateral movement is evident along some of the faults. Locally, magnetic patterns trending normal to the faults are abruptly truncated.

AGE PROVINCES

Three whole-rock Rb-Sr ages of rocks in the quadrangle were determined by Hurley and others (1971) and were described in geologic context by White and Leo (1969-1970). Two of these (1950 m.y. and 2140 m.y.) are for intrusive granitic bodies and postdate regional metamorphism. The third (2,230 m.y.) is from a gneiss in the Jide Mountain. A 2,070 m.y. (Eburnean) date was yielded by graphitic rocks of unit gn2 near Greenville, 1 km south of the quadrangle boundary (Hurley and others, 1971; and White and Leo, 1969-1970).

MINERAL RESOURCES

Gold is common in placer deposits of gn2 and molybdenum is locally present in the same gneiss unit (Muller Company, unpub. data, 1971). Itabirite occurances are being explored in Jide Mountain by the German—Liberian Mining Company.

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GEOLOGIC MAP OF THE JUAZOHN QUADRANGLE, LIBERIA

By
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1977

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