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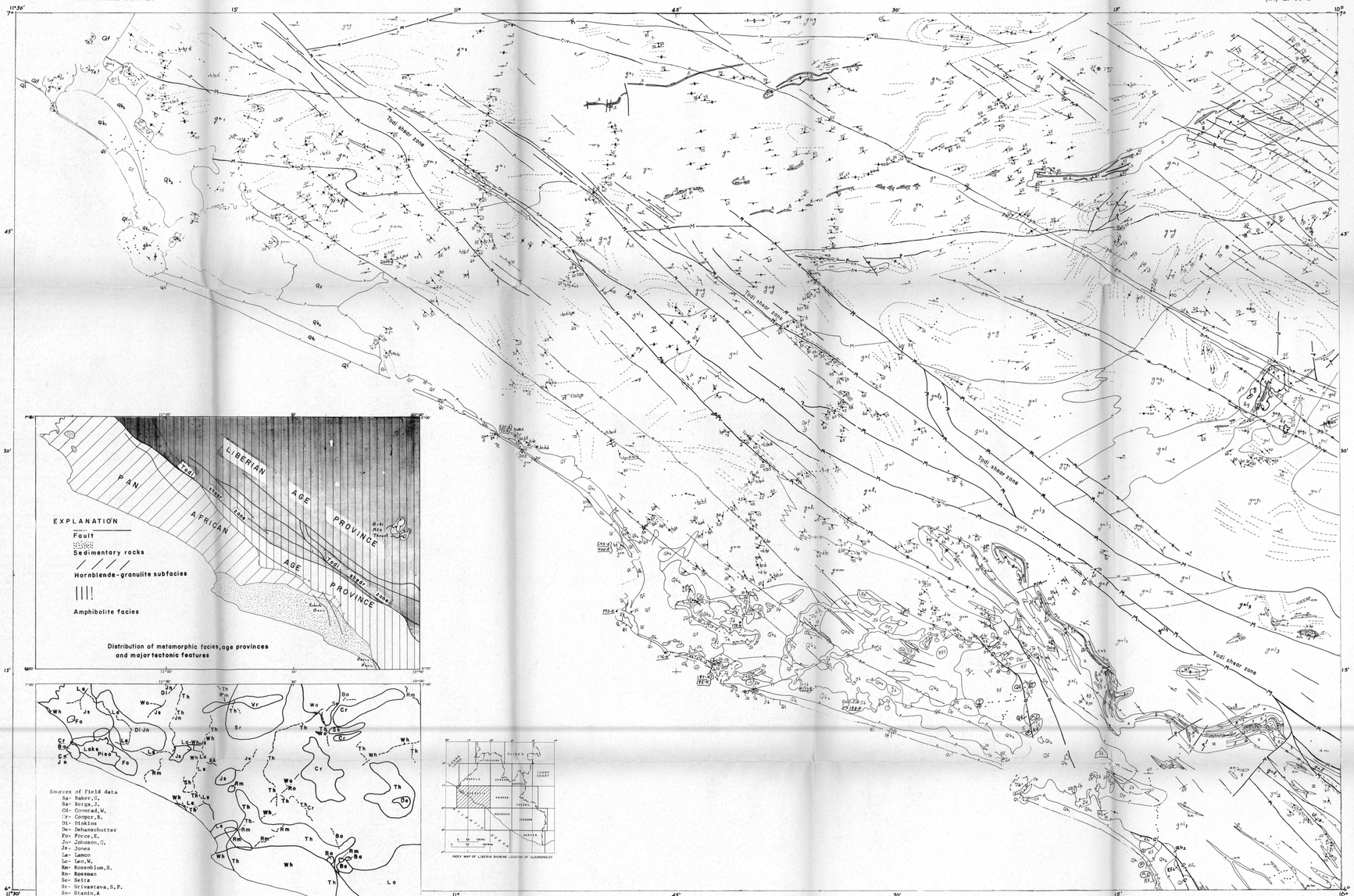

GEOLOGIC MAP OF THE MONROVIA QUADRANGLE, LIBERIA

by

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PREPARED BY THE U.S. GEOLOGICAL SURVEY AND THE LIBERIAN GEOLOGICAL SURVEY UNDER THE JOINT SPONSORSHIP OF THE GOVERNMENT OF LIBERIA AND THE AGENCY FOR INTERNATIONAL DEVELOPMENT, U.S. DEPARTMENT OF STATE

Compiled by photo-planimetric methods from aerial photographs taken 1968–69
The international boundary must not be considered authoritative
Form lines have no consistent interval and show only the general shape of terrain
Geographic graticule and rectangular grid based on Hotine's Rectified Skew Orthomorphic projection

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This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards or nomenclature.

EXPLANATION

Correlation of Map Units

Ql / Qf		Holocene	Quaternary
Qb1 / Qb2		Pleistocene (?)	Quaternary
Te			Tertiary
Kf / Kfc		Cretaceous	
Jd	Jb	Jurassic	
Dp		Devonian (?)	
Pg		Paleozoic (?)	

Stratigraphic succession not implied for the following units

gbn					Plutonic igneous rocks	Precambrian
s					Metamorphic rocks	Precambrian
q	am	it	mn	z	Metamorphic rocks	Precambrian
gnq1 / gnq2					Metamorphic rocks	Precambrian
gnl / gnl1 gnl3	gnm	gn1 / gn2			Metamorphic rocks	Precambrian

Description of Map Units

Ql Lagoonal and beach deposits--modern beach deposits including longshore bars

Qf Fluvial and deltaic deposits--buff silt and sand deposits underlie terrain of very low relief along the coast; probably includes some beach sands

Qb1 Beach deposits unit 1—raised beach ridges, up to about 6 meters above sea level, consisting of brown sand

Qb2 Beach deposits unit 2-- nearly pure white quartz sand averanging one meter in thickness, forming large savannahs

Qs Silt--brown to yellowish brown silt with iron-stained clay concretions.

Te Edina Sandstone--white to light brown, coarse- to medium-grained gritty sandstone, generally less than a few meters thick

Kf Farmington River Formation--brown to drab green, nearly massive sandstone consisting of poorly to moderately well-sorted, subangular to subrounded clasts of quartz (25-40%), feldspar (30-25%), mafic minerals (10-20%), lithic fragments (2-15%), in a matrix of quartz, mica, clay, chlorite and calcite (5-35%). Fragments of gastropod and pelecypod shells and carbonatized plant debris present locally

Kfc Farmington River Formation conglomerate--contains well-rounded lithic fragments of all older rock types in a sandy matrix.

Jb Basalt, probably flow rock, dark gray, fine-grained, locally amygdaloidal; contains calcic plagioclase, clinopyroxene, magnetite and ilmenite; sometimes contains small amounts of olivine

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 ortnopyroxene; occurs chiefly as dikes but also forms large sill-like bodies in the coastal area near Monrovia

Dp Paynesville Sandstone--light-colored, fine- to medium-grained, well-rounded and well-sorted, crossbedded quartz sandstone; subordinate crossbedded reddish-brown siltstone and shale occur along the highway near the ELWA junction and on the highway north of Paynesville

Pg Gibi Mountain Formation (new name)--Basalt conglomerate with gneiss bouldem in arkosic matrix; medial sandstone or arkosic wake consists of medium-to coarse-grained, fairly well sorted, subangular to subrounded quartz and feldspar in sericite-quartz-chlorite matrix (5-35%); upper member consists of shale and mudstone with thin lenses of gritty arkosic wake

gbn Norite--dark reddish-gray, medium- to coarse-grained, hypersthene-augite norite with some gabbro on northern borders; coronas of actinolitic hornblende and garnet commonly rim pyroxenes

s Schist, undivided--kyanite-bearing quartz-muscovite, biotite-quartz-muscovite and graphitic schist in Goe-Fantro Ranges and their northwest extension

q Quartzite--pure to kyanite- and muscovite-bearing quartzite in Goe-Fantro Ranges and their northwest extension; pure to slightly micaceous quartzite that displays only cataclastic textures at Gibi Mountain, including thin lenses of graphitic mylonite schist at base of unit

am Amphibolite--dark gray, medium-grained, schistose to nearly massive rock consisting of approximately equal amounts of plagioclase and hornblende; locally contains thin lenses of granitic material; rocks in melanocratic gneiss (gnm) and leucocratic gneiss unit 1 (gnl$_1$) commonly contain up to 10% sphene and apatite; rocks in melanocratic gneiss (gnm) commonly contain two generations of hornblende, one in equilibrium with pyroxene and another retrogressive after pyroxene

it Itabirite--medium to dark gray, finely laminated, commonly schistose quartz-hematite-magnetite rock; specularite is abundant in the Goe-Fantro Ranges and their northwest extension

mn Manganese formation--dark gray to black, medium-grained quartz-garnet rock impregnated with sooty black manganese oxide; contains some graphite

z Composite unit z--comprises rock units typically associated with itabirite that are too small to be mapped separately; includes 1) iron-rich schist, quartzite, kyanite-muscovite quartzite, amphibolite, itabirite, graphite-quartz-muscovite schist, quartz-garnet rock, and banded leucocratic gneiss in the Goe-Fantro Ranges and their northwest extension; and 2) quartz-muscovite schist, biotite-bearing quartzite, quartzite, amphibole-biotite schist, silicate-bearing itabirite, sillimanite-bearing quartzite and banded muscovite- and biotite-bearing leucocratic gneiss in the Bong Range

gng Granitic gneiss--light-colored, medium-grained, banded, biotite-bearing gneiss; predominately granodiorite, but ranging in composition from granite to granodiorite; magnetic and aerial photographic trends are parallel to regional structural trends; contains less amphibolite than adjacent units

gng$_1$ Granitic gneiss unit 1-- chiefly biotite-bearing gneiss like granitic gneiss (gng) but ranges from banded to massive in short distances, and magnetic and aerial photographic trends are irregular and do not follow regional trends

gnl Leucocratic gneiss--light-colored, medium-grained, commonly banded, biotite-bearing granitic to quartz dioritic gneiss; appears to contain more amphibolite than adjacent gng$_1$; characterized by closely spaced moderate magnetic anomalies; structural trends are more uniform and continuous than in adjacent gng$_1$ and gnl$_1$

gnl$_1$ Leucocratic gneiss unit 1--similar to leucocratic gneiss (gnl) lithologically; contains some syenite gneiss on the south side of the Goe Range; contains more amphibolite than other leucocratic gneiss units.

gnl$_3$ Leucocratic gneiss unit 3-- rocks are similar to leucocratic gneiss(gnl) but structural trends are less regular and magnetic anomalies are more subdued

gnm Melanocratic gneiss-- this unit includes varying proportions of: dark-colored hyperstene-diopside-hornblende-plagioclase-biotite gneiss with varying amounts of pyroxenes and hornblende amphibolites with and without pyroxenes; granitic gneiss with and without pyroxenes; sillimanite-hyperstuene-garnet-two mica gneiss; only very acid rocks, which are subordinate, are light colored

gn$_1$ Composite gneiss unit 1-- this unit is typically associated with itabirite and composite unit z rocks and includes: light-colored, medium-grained, layered, biotite-rich granitic gneiss; medium-colored, medium-grained, hornblende-bearing granodiorite to diorite gneiss; contains more amphibolite than adjacent units, especially on the south side of the Bong Range near the quadrangle boundary; west of the Todi shear zone melanocratic and leucocratic rocks commonly contain diopside and/or hypersthene; contains thin beds of quartzite, hematite-magnetite-bearing quartzite and itabirite west of the Lofa River

gn$_2$ Composite gneiss unit 2--this unit consists of nearly equal amounts of amphibolite and biotite- and/or muscovite-bearing granitic gneiss; to the east in the Ghanka quadrangle the unit is primarily amphibolite

MAP SYMBOLS

Field data are shown by conventional symbols; other data sources are indicated by letter symbols adjacent to structure symbols, or at limit of line segment to which the symbol applies: M, aeromagnetic data; P, photo interpretation; R, radiometric data

- Contact
- Fault--U, upthrown side; D, downthrown side
- Thrust fault--sawteeth on upper plate
- Fault zone or shear zone
- Fault intruded by dike
- Anticline--showing trace of crestal plane and direction of plunge
- Overturned anticline
- Synform--showing trace of trough plane and direction of plunge
- Overturned synform
- Strike and dip of axial plane of fold: Inclined; Vertical
- Strike and dip of beds: Inclined; Horizontal; Vertical
- Strike and dip of foliation--open symbol indicates foliation transecting earlier foliation or bedding; solid symbol indicates relation to bedding unknown: Inclined; Horizontal; Vertical
- Strike and dip of parallel foliation and bedding: Inclined; Horizontal; Vertical
- Strike of foliation, no dip determined
- Strike and dip of joints: Inclined; Horizontal; Vertical
- Strike and dip of planar features determined from photo interpretation (P) or aeromagnetic data (M)--one, two, or three ticks indicate gentle, medium, or steep dip
- Bearing and plunge of lineation--barbed arrow indicates crinkle axis or intersecting foliations; solid arrow indicates mineral lineation
- Structural trend based on photo interpretation
- Structural trend based on magnetics
- Observed outcrop
- Marker bed distinguished by rock symbol or index mineral

Index minerals:

ad	andalusite	en	enstatite	k	kyanite
an	anthophyllite	ep	epidote	m	muscovite
au	augite	ol	olivine		
b	biotite	ga	garnet	py	pyrite
		gr	graphite	py	pyroxene
cl	clorite				
cg	cummingtonite-grunerite	h	hornblende	s	sillimanite
		hy	hypersthene	st	staurolite
d	diopside	il	ilmenite	ta	tremolite-actinolite

- Fossil locality: Invertebrate; Plant
- Radiometric age in m. y.
- Boundary between radiometrically determined age provinces--Pan-African, 500-700 m. y.; Rhuenan, 1600-2000 m. y.; Liberian, 2700-3500 m. y.
- Sand, gravel, clay, or placer pit--B, barite; D, diamond; G, gold
- Mine or quarry--B, building stone or road metal; C, clay; I, iron
- Prospect pit--B, barite; K, kyanite