وزارة الداخلية
مصلحة المساحة الجيولوجية الأمريكية
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

المملكة الليبية
وزارات الاقتصاد الوطني وشئون البترول والصناعة
KINGDOM OF LIBYA
MINISTRIES OF NATIONAL ECONOMY, PETROLEUM AFFAIRS, AND INDUSTRY

أبحاث جيولوجية مختلفة
جريطة رقم A ٣٥٠-I
MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-350 A

التفسير الجيولوجي

GEOLOGIC EXPLANATION

(Alternate spellings of names given in parentheses)

QUATERNARY

Qs — Sabkhah deposits
Saline deposits in undrained depressions

Q — Surficial deposits
Dunes, loess, sarir, alluvium, includes extensive coastal ridges of eolian calcarenite (Qarqarish Sandstone and equivalents), a veneer of fossiliferous limestone locally extending inland a few tens of kilometers, and, in coastal Cyrenaica, a boulder-bearing limestone. May be in part of Pliocene age

TERTIARY

Tpl — Pliocene deposits (Sahabi beds; Pliocene)
Clay, sand, gravel, and calcareous beds; of continental and shallow marine origins

Tmu — Upper Miocene rocks
Marl, limestone, gypsiferous shale, clay, calcareous sand, and conglomerate; of marine and continental origin

Tmm, Tmmc — Middle Miocene rocks (Miocene)
Tmm, in northern Cyrenaica, organic detrital limestone of the Maalegh Formation, and fossiliferous white sandy limestone and calcareous sandstone of the Benghazi Limestone; in the Sirte embayment, locally gypsiferous shale and very fossiliferous sandy limestone.
Tmmc, non-marine calcareous, marly, and sandy beds. Of Helvetian, and Tortonian Age; includes some Burdigalian Age (early Miocene)

Tml, Tmlc — Lower Miocene rocks
Tml, in northern Cyrenaica, the Beddahach Formation, a white fossiliferous detrital limestone that is earthy and marly above and more massive and locally dolomitic below. In the Sirte embayment, richly fossiliferous limestone, marl, and shale that in places grade downward and laterally into the Fortino Formation, a coarse sandy fossiliferous limestone.
Tmlc, near-shore or continental beds; the Fortino Formation in many places. Of Aquitanian and Burdigalian Age

To, Toc — Oligocene rocks (Oligocene)
To, in northern Cyrenaica, richly fossiliferous limestone, locally crystalline and massive; in the Sirte embayment, richly fossiliferous Greir Bu Hascisc Formation, chiefly a dolomitic coquina, a green shale having layers of soft limestone, and the Dur al Abd Formation of dolomite and limestone having intercalations of gypsiferous green clay, the lower part of Eocene age.
Toc, near-shore or continental deposits

Tc — Tertiary continental rocks
Lacustrine limestone of uncertain age, especially in the Fezzan; abundant interbeds of gypsum in the Hun (Jufrah) graben; and beds of unspecified character and age near the Egyptian border

Tv — Volcanic rocks
Extrusive rocks chiefly olivine basalt and phonolite; a few small intrusions of basalt and phonolite in Tripolitania; mostly of Tertiary age (post-Eocene), but may be in part of Quaternary age

Te, Teu, Tem, Tel — Eocene rocks (Eocene)
Te, in northern Cyrenaica, the Slonta, Derna, and Apollonia Formations, of nummulitic limestone, in part chalky, marly, and cherty; of early to late Eocene age. In the Tibesti foothills includes undifferentiated marine and non-marine beds, some perhaps of Paleocene age.
Teu, upper Eocene richly fossiliferous marine limestone, green shale, and gypsum of the Qararat al Jifah Member of the Wadi Thamit Formation. In central and southern Libya includes rocks of near-shore or continental origin. Of Lutetian and Priabonian Age.
Tem, middle Eocene fossiliferous chalk and marl having beds of chert, dolomite, and coquina; the Tmed al Ksour and the Al Gata Members of Wadi Thamit Formation. In central and southern Libya includes beds of near-shore or continental origin. Of Lutetian Age.
Tel, lower Eocene fossiliferous chalk and chalky marl locally including cherty limestone of the Bir Ziden, Bin Isa Chalk, Rouaga Chalk, and Flosculina Limestone Members of the Jabal Waddan Formation. South of Jabal Waddan includes shaly, marly, sandy, and gypsiferous beds of a near-shore and continental facies; the Gir Gypsum Member is a southern equivalent of the Bir Ziden and Bin Isa Members. Of Ypresian Age

Tp — Paleocene rocks (Paleocene)
Marl, limestone, and shale, locally fossiliferous, chalky, dolomitic, clayey, or gypsiferous; includes the Kheir Marl, Operculinoides Limestone, Gelta Chalk, Gheriat Limestone, and upper part of Zmam Formation which is of Late Cretaceous age

CRETACEOUS

Ku, Ks, Kct, Kuc — Upper Cretaceous rocks (Upper Cretaceous)
Ku, undifferentiated Upper Cretaceous rocks; limestone, marl, and marly limestone; fossiliferous and locally cherty; includes the Jardas (Gerdes) al Abid and Tocra Limestones of northern Cyrenaica; of Cenomanian to Maestrichtian Age.
Ks, rocks of Senonian Age; green shale, gypsum, limestone, and dolomite; in places fossiliferous, or detrital; includes the Socna Formation and the upper part of the Mizda Formation, both of the al Hamra Group.
Kct, rocks of Cenomanian and Turonian Age; dolomitic limestone, marl, shale, and gypsum; includes the lower part of the Mizda Formation of the al Hamra Group, the Gasr Tigrinna Formation, and the Garian Dolomite, Yafran (Jefren) Marl, and Ain Tobi Limestone of the Nefusa Group.
Kuc, near-shore or continental calcareous and sandy rocks of the Late Cretaceous(?) age west of the Jabal Haruj

Kk, Kn, Knm — Lower Cretaceous rocks (Lower Cretaceous)
Kk, sandstone, red shale, and conglomerate of the Kikla (Chicla) Formation, unconformably overlying dolomite, shale, and sandstone of the Kabaw (Cabao) Formation; present from the Tunisian border to the Garian area of Tripolitania.
Kn, Nubian Sandstone, continental sandstone, conglomerate, siltstone, and subordinate amounts of gray to purple clay and claystone; characteristically crossbedded; quartzite and silicified wood common; may include older beds.
Knm, lacustrine calcareous and cherty beds within the Nubian Sandstone east of the Jabal Eghei of southern Cyrenaica

JURASSIC

Jc, Ju, Jl — Jurassic rocks
Jc, rocks of the Continental Post Tassilian sequence; believed to be of Jurassic age.
Ju, Upper and Middle Jurassic rocks, chiefly sandstone, shale, and shaly limestone; present only at the base of the escarpment in Tripolitania from Tunisia to the Yafran area.
Jl, rocks of Liassic age, chiefly gypsum and anhydrite; present only in Tripolitania near Yafran and the Tunisian border

J̄R — Jurassic and Triassic rocks, undivided
Continental sandstone, conglomerate, siltstone, and some gray to purple clay and claystone; frequently termed the Continental Post Tassilian; distinguished with difficulty from the Nubian Sandstone; recognized only in the Fezzan. May include some beds of Permian age

TRIASSIC

R̄c, R̄u, R̄m — Triassic rocks
R̄c, rocks of the Continental Post Tassilian sequence; believed to be of Triassic and Permian(?) age.
R̄u, Upper Triassic and Lower Jurassic Bu Ghaylan Limestone and dolomitic limestone and its lateral equivalent the Bir al Ghanam Gypsum and anhydrite, and the underlying Bu Sheba (Bu Sceba) Formation of sandstone, conglomerate, green clay, and gypsum; present in Tripolitania in the al Watiyah-Bir al Ghanam-Bu Ghaylan area.
R̄m, Middle to Upper Triassic Azizia Formation of limestone and dolomitic limestone having some shale interbeds and chert, and a basal sandstone; and the underlying Ras Hamia Formation of red micaceous sandstone, red and green clay, and varicolored silt; present in Tripolitania near Azizia

CARBONIFEROUS

C, Cu, Cl — Carboniferous rocks
C, undifferentiated Carboniferous rocks, chiefly continental sandstone and siltstone; present in southern Cyrenaica.
Cu, Upper Carboniferous Dimbabah Formation, chiefly limestone rich in crinoids and other fossils, underlain by shale, and a lower member of limestone and marl; present in many parts of the Fezzan; of Namurian and Muscovian Age.
Cl, Lower Carboniferous rocks; in the Fezzan includes the Assedjefar Formation of silty shale containing fossil wood, the Dome of Collenia Beds containing marine algal fossils, the Mrar Formation of shale, siltstone, and sandstone, and basal beds of oolitic hematite near Brach; contact with the Devonian is uncertain; of shallow-marine or continental origin; in east-central Cyrenaica consists chiefly of sandy beds containing Lepidodendron. Of Tournaisian to Namurian Age

CD — Carboniferous or Upper Devonian rocks
In east-central Cyrenaica, chiefly sandstone

DEVONIAN

Du — Middle and Upper Devonian rocks
Includes in Brach-Adri-Awenat Wennin area the richly fossiliferous Awenat Wennin (Aouinet Ouenine) Formation of shale, siltstone, and sandstone; on east and west sides of the Marzuk basin chiefly plant-bearing sandstone and siltstone; in east-central Cyrenaica chiefly sandstone containing Spirophyton. Of Givetian to Famennian Age but may include Carboniferous beds of Strunian Age

Dl — Lower and Middle Devonian rocks
Wan Kasa (Ouan Kasa) Formation, alternating shale and fine sandstone having marine fossils and fossil wood, and the underlying massive and crossbedded Tadrart Sandstone. Of Emsian and Couvinian Age; southwest of the Jabal Haruj includes some beds of Middle Devonian age

SILURIAN

S, Su, Sl — Silurian rocks
S, undifferentiated Silurian rocks southwest of the Jabal Haruj, chiefly sandstone and siltstone.
Su, Upper Silurian massive and crossbedded varicolored Acacus Sandstone including interbeds of gray to green shale; contains Harlania; of Ludlovian Age.
Sl, Lower Silurian thin-bedded gray and green sandy Tanezzuft Shale containing graptolites and other marine fossils; of Llandoverian and Ludlovian Age

ORDOVICIAN

Ou — Upper Ordovician rocks
Memouniat Formation, massive crossbedded sandstone weakly cemented by kaolinite. Provisionally assigned to Upper Ordovician; recognized west of Jabal Hasouna

Om — Middle Ordovician rocks
Includes Melez Chograne Formation, varicolored micaceous silty shale and fine sandstone, whose thickness and composition differ markedly in short distances, and underlying Haouaz Formation, arkosic and quartzitic fine argillaceous sandstone and siltstone. Provisionally assigned to Middle Ordovician; recognized west of Jabal Hasouna (Jabal Fezzan)

(Gargaf Group)

O€ — Ordovician and Cambrian rocks
Thick sequence of sandstone and shale, largely of continental origin; includes the crossbedded conglomeratic Eghei Sandstone in the Tibesti foothills

CAMBRIAN

€ — Cambrian(?) rocks
Hasouna Formation, medium to coarse sandstone, conglomeratic in lower part, commonly crossbedded and quartzitic; kaolinitic cement is common and distinctive; a few thin interbeds of silty and micaceous shale

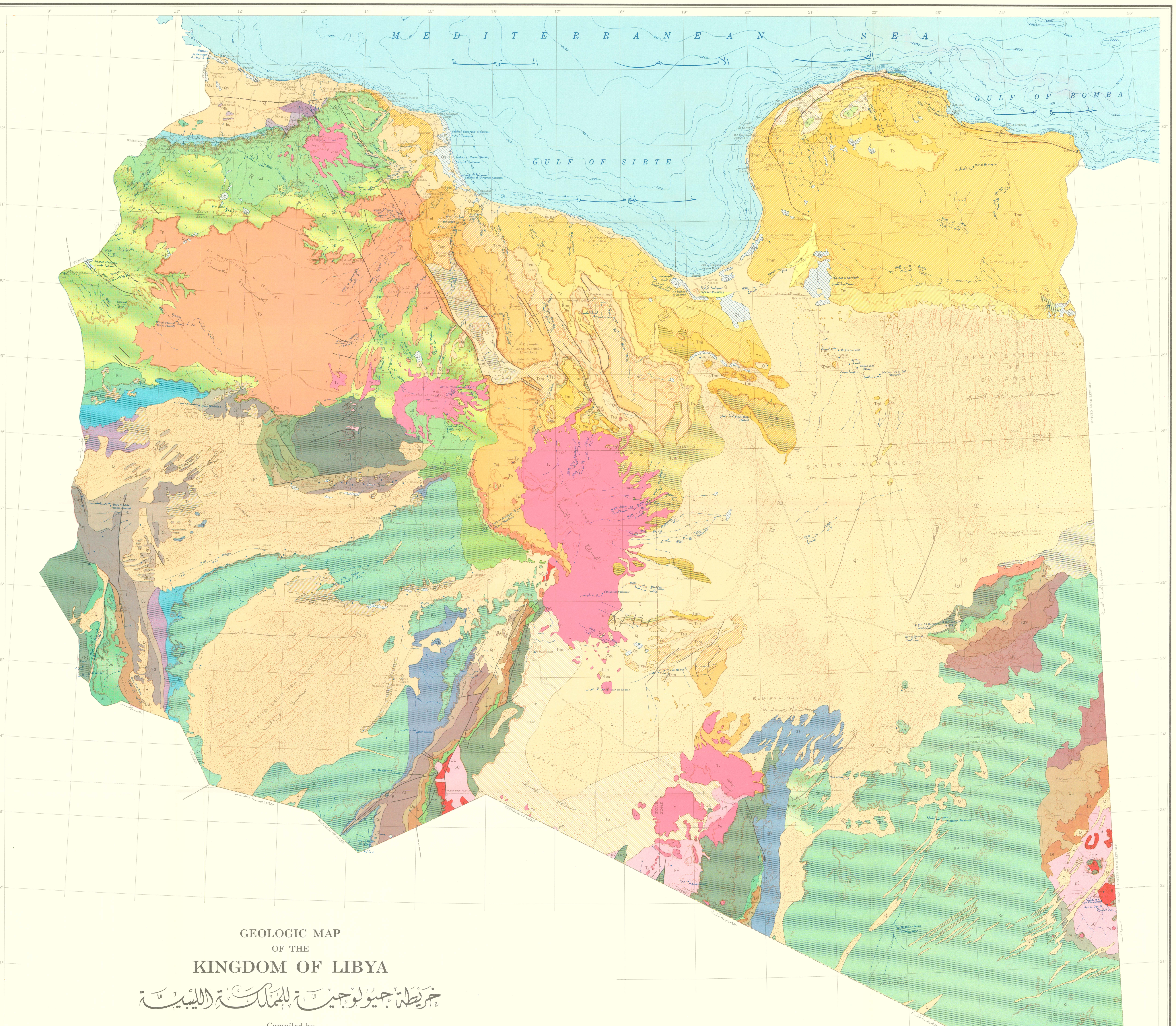
PRECAMBRIAN

p€ — Precambrian rocks
Metamorphic rocks including quartzite, phyllite, marble, schist, and gneiss

g — Intrusive igneous rocks
Includes granite, granodiorite, and diorite. Probably of Precambrian age; granite in Jabal Awenat area is of Paleozoic or younger age

Contact
Long dashes where uncertain, short dashes where gradational

Fault
Long dashes where uncertain, short dashes where concealed; U, upthrown side; D, downthrown side



GEOLOGIC MAP OF THE KINGDOM OF LIBYA

خريطة جيولوجية للمملكة الليبية

Compiled by
Louis C. Conant and Gus H. Goudarzi
جمعها
لويس كونَنت وغس غودرزي

Under the joint sponsorship of the Kingdom of Libya and the Agency for International Development, U.S. Department of State.

تحت رعاية المملكة الليبية
ووكالة التنمية الدولية التابعة لوزارة الخارجية الأمريكية

المقياس ١ : ٢٠٠٠٠٠٠
SCALE 1:2 000 000

25 0 25 50 75 100 125 150 175 200 KILOMETERS كيلومترات

25 0 25 50 75 100 125 150 175 200 MILES أميال

Lambert Conformal conic projection parallels 17° and 33°
Bathymetric and hypsographic data in meters.

1964
١٩٦٤

ان الحدود الدولية المبينة على هذه الخريطة لا تعتبر نهائية ولا ملزمة للحكومة الليبية
INTERNATIONAL BOUNDARIES AS ILLUSTRATED HEREIN ARE NEITHER FINAL NOR BINDING ON THE LIBYAN GOVERNMENT

SOURCES OF GEOLOGIC INFORMATION

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All the above information was modified as seemed necessary to fit the topography, to incorporate later information, and to reconcile discrepancies. In many places contacts and faults were projected on the basis of topography, examination of aerial photographs, or consultation with geologists. Several oil-company geologists assisted on areas of especial problems. P. F. Burollet, President of the Petroleum Exploration Society of Libya, and his associates in Compagnie des Petroles Total (Libye) gave much help, especially in the non-concession areas of southern Cyrenaica. The usage of "Lexique Stratigraphique International" has been followed so far as practicable, though most spellings have been anglicized in the same manner as the place names on the map.

مصادر المعلومات الجيولوجية

Prepared by the U.S. Geological Survey under the joint sponsorship of the Kingdom of Libya, Ministries of National Economy, Petroleum Affairs, and Industry, and the U.S. Department of State.

Base compiled 1959 to 1962 by Gus H. Goudarzi from U.S. Army Map Service P-501 and P-502 series 1:250,000; Carta Dimostrativa della Libia 1:400,000; Carte Aeronautique du Monde 1:1,000,000; U.S.A.F. World Aeronautical Charts 1:1,000,000; British M. D. R. 1:500,000 series; field exploration and ground-traverse data; and information supplied by oil concessionaires through the Petroleum Exploration Society of Libya. Bathymetric data interpolated from U.S. Navy Hydrographic Charts.

Geographic names on this map in general follow the transliteration system for Arabic of the United States Board on Geographic Names and of the United Kingdom Permanent Committee on Geographical Names.

This map is available from the Libyan Government, and from the U.S. Geological Survey, Washington 25, D.C., U.S.A.

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—G63276

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-350 A
أبحاث جيولوجية مختلفة
جريطة رقم A ٣٥٠-I