PREPARED IN COOPERATION WITH THE
MINISTRIES OF INDUSTRY AND NATIONAL ECONOMY OF THE GOVERNMENT OF LIBYA
UNDER THE AUSPICES OF THE
AGENCY FOR INTERNATIONAL DEVELOPMENT, U.S. DEPARTMENT OF STATE

GEOLOGIC EXPLANATION

(Alternate spellings or names given in parentheses)

Symbol	Unit	Age
Qs	Sabkhah deposits	QUATERNARY
Q	Surficial deposits	QUATERNARY
Tpl	Pliocene deposits	QUATERNARY / TERTIARY
Tmu	Upper Miocene rocks	TERTIARY
Tmm, Tmmc	Middle Miocene rocks	TERTIARY
Tml, Tmlc	Lower Miocene rocks	TERTIARY
To, Toc	Oligocene rocks	TERTIARY
Tc	Tertiary continental rocks	TERTIARY
Tv	Volcanic rocks	TERTIARY
Tey, Tem, Tel	Eocene rocks	TERTIARY
Tp	Paleocene rocks	TERTIARY
Ku, Ks, Kus, Kcs	Upper Cretaceous rocks	CRETACEOUS
Kk, Kn, Kcn	Lower Cretaceous rocks	CRETACEOUS
Jc, Ju, Jl	Jurassic rocks	JURASSIC
JTr	Jurassic and Triassic rocks, undivided	JURASSIC / TRIASSIC
Tc, Tu, Tm	Triassic rocks	TRIASSIC
Cu, C, Cl	Carboniferous rocks	CARBONIFEROUS
CD	Carboniferous or Upper Devonian rocks	CARBONIFEROUS / DEVONIAN
Du	Middle and Upper Devonian rocks	DEVONIAN
Dl	Lower and Middle Devonian rocks	DEVONIAN
S, Su, Sl	Silurian rocks (Gargaf Group)	SILURIAN
Ou	Upper Ordovician rocks (Gargaf Group)	ORDOVICIAN
Om	Middle Ordovician rocks (Gargaf Group)	ORDOVICIAN
OC	Ordovician and Cambrian rocks (Gargaf Group)	ORDOVICIAN / CAMBRIAN
C	Cambrian(?) rocks (Gargaf Group)	CAMBRIAN
pC	Precambrian rocks	PRECAMBRIAN
g	Intrusive igneous rocks	PRECAMBRIAN

Sabkhah deposits
Saline deposits in undrained depressions

Surficial deposits
Dunes, loess, marir, alluvium, includes extensive coastal ridges of eolian calcarenite (Sporgitah 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

Pliocene deposits
Clay, sand, gravel, and calcareous beds; of continental and shallow marine origins

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

Middle Miocene rocks
Tmm, *in northern Cyrenaica, organic detrital limestone of the Mesleqh 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)*

Lower Miocene rocks
Tml, *in northern Cyrenaica, the Beddabach 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 Farlus Formation, a coarse sandy fossiliferous limestone*
Tlmc, *near-shore or continental beds; the Fortina Formation in many places. Of Aquitanian and Burdigalian Age*

Oligocene rocks
To, *in northern Cyrenaica, richly fossiliferous limestone, locally crystalline and massive; in the Sirte embayment, richly fossiliferous Geir Bu Hasira Formation, chiefly dolomitic capstone, a green shale having layers of soft limestone, and the Dur el Abd Formation of dolomite and limestone having intercalations of gypsiferous green clay, the lower part may be shaly. Of Chattian Age*
Toc, *near-shore or continental deposits*

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

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

Eocene rocks
Tey, *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 unfossiliferous marine and non-marine beds, some perhaps of Paleocene age.*
Tem, *upper Eocene richly fossiliferous marine limestone, green shale, and gypsum of the Qereat 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 capstone; the Tmed el Kuwar and the Al Getu Members of Wadi Thamit Formation. In central and southern Libya includes beds of near-shore or continental origin. Of Lutetian Age.*
Tel, *lower Eocene chalk, marl, and limestone, locally including cherty limestone of the Bir Zeden, Bin Ian Chalk, Ruaega Chalk, and Fluvialina 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 Zeden and Bin Ian Members. Of Ypresian Age*

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

Upper Cretaceous rocks
Ku, *undifferentiated Upper Cretaceous rocks; limestone, marl, and marly limestone; fossiliferous and locally cherty; includes the Jordan (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 detrital; includes the Sawn Formation and the upper part of the Minde Formation, both of the el Hamra Group.*
Kcs, *rocks of Cenomanian Age; limestone, dolomite, calcareous green shale, and gypsum; includes the lower part of the Minde Formation of the el Hamra Group, the Gasr Tigrinna Formation, and the Garian Dolomite, Tufrah (Jefren) Marl, and Ain Tobi Limestone of the Nefusa Group.*
Kus, *near-shore or continental calcareous and sandy rocks of the Late Cretaceous(?) age west of the Jabal Hora*

Lower Cretaceous rocks
Kk, *sandstone, red shale, and conglomerate, of the Kikla (Chicla) Formation, unconformably overlying dolomite, shale, and sandstone of the Kidmet (Ghoma) 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.*
Kcn, *lacustrine calcareous and cherty beds within the Nubian Sandstone east of the Jabal Eghei of southern Cyrenaica*

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*

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 south. May include some beds of Permian age

Triassic rocks
Tc, *rocks of the Continental Post Tassilian sequence; believed to be of Triassic and Permian(?) age.*
Tu, *Upper Triassic and Lower Jurassic Ba Ghajjen Limestone and dolomite limestone and its lateral equivalent the Bir el Ghanem Gypsum and anhydrite, and the underlying Ba Shebb (Ba Sebb) Formation of sandstone, conglomerate, green clay, and gypsum; present in Tripolitania in the el Wahjah-Bir el Ghanem-Ba Ghajjen area.*
Tm, *Middle to Upper Triassic Azizia Formation of limestone and dolomitic limestone having some shale interbeds and chert, and a basal sandstone; and the underlying Ben Ghanis Formation of red micaceous sandstone, red and green clay, and varicolored silt; present in Tripolitania near Azizia*

Carboniferous rocks
C, *undifferentiated Carboniferous rocks, chiefly continental sandstone and siltstone; present in southern Cyrenaica.*
Cu, *Upper Carboniferous Dimbobeh 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 Westphalian Age*
Cl, *Lower Carboniferous rocks; in the Fezzan includes the Assaiglia Formation of silty shale containing fossil wood, the Dame 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*

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

Middle and Upper Devonian rocks
Includes in Brach-Adri-Awenat Wennin area the richly fossiliferous Awenat Wennin (Awainet Ouenine) Formation of shale, siltstone, and sandstone; on east and west sides of the Murzuk 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

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 Hora; includes some beds of Middle Devonian age

Silurian rocks
S, *undifferentiated Silurian rocks southwest of the Jabal Hora; chiefly sandstone and siltstone*
Su, *Upper Silurian massive and crossbedded varicolored Acacus Sandstone and its lateral equivalent the Tanezzuft Shale containing graptolites and other marine fossils; of Ludlovician and Ludlovian Age*
Sl, *Lower Silurian thin-bedded gray and green sandy Tanezzuft Shale containing graptolites and other marine fossils; of Llandoverian and Ludlovian Age*

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

Middle Ordovician rocks
Includes Melez Chagrene Formation, varicolored micaceous silty shale and fine sandstone, whose thickness and composition differ markedly in short distances, and underlying Hassaua Formation, orthoquartzite fine-argillaceous sandstone and siltstone. Provisionally assigned to Middle Ordovician; recognized west of Jabal Hasawna (Jabal Fezzan)

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(?) rocks
Hassouna 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 rocks
Metamorphic rocks including quartzite, phyllite, marble, schist, and gneiss

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