U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

USGS OPEN-FILE REPORT 2006-1038
AGS OPEN-FILE REPORT 2006-1038
Version 2
USGS Afghanistan Project Product No. 072

AFGHAN GEOLOGICAL SURVEY
Prepared in cooperation with the U.S. Geological Survey and the Afghanistan Geodesy and Cartography Head Office
Under the auspices of the U.S. Agency for International Development and the U.S. Trade and Development Agency

GEOLOGIC AND MINERAL RESOURCE MAP OF AFGHANISTAN

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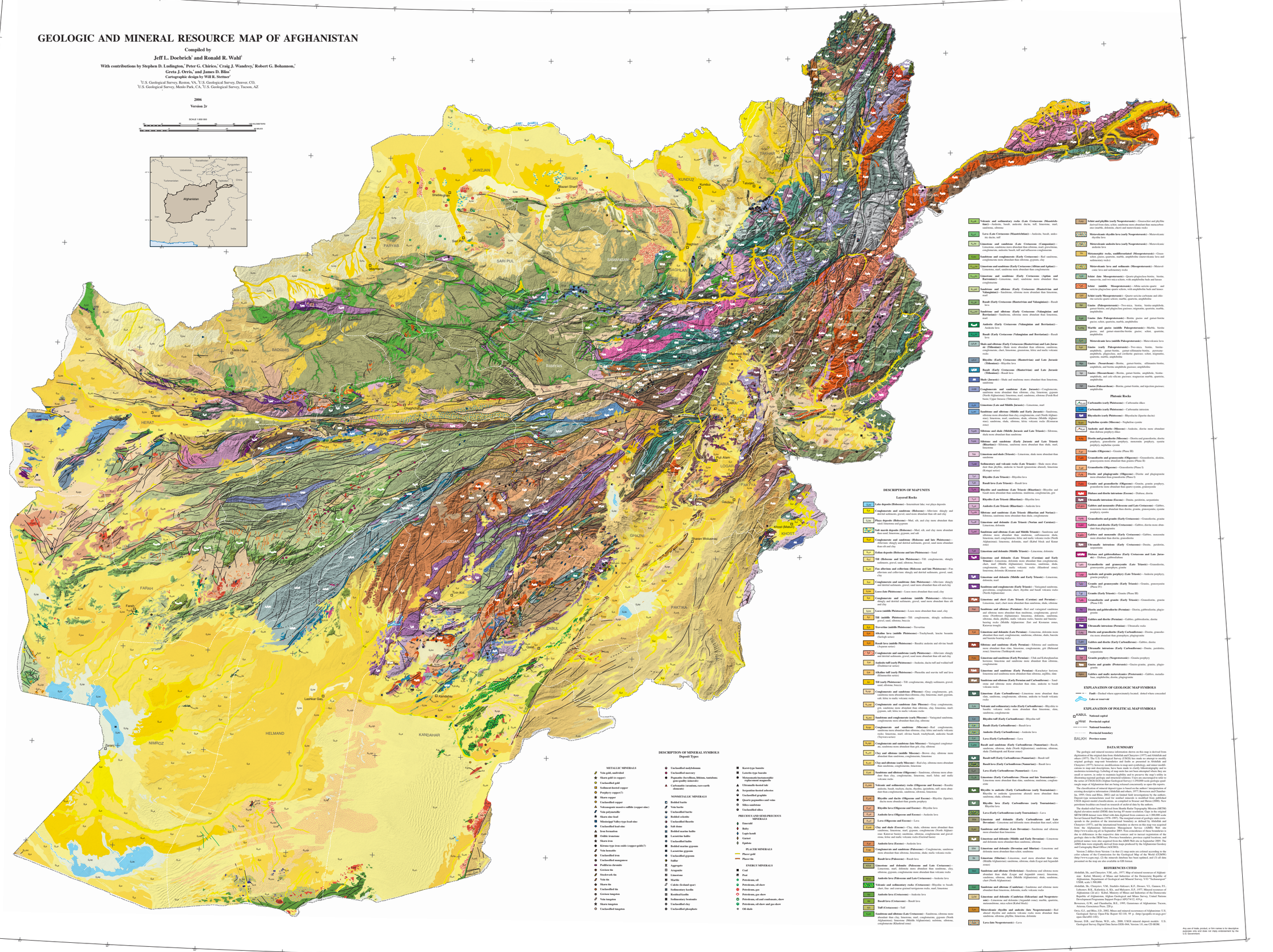
2006

Version 2r

SCALE 1:850 000



DESCRIPTION OF MAP UNITS

Layered Rocks

Lake deposits (Holocene)—Intermittent lake; wet playa deposits

Conglomerate and sandstone (Holocene)—Alluvium; strongly and partial sediments, gravel, sand more abundant than silt and clay

Playa deposits (Holocene)—Mud, silt, and clay more abundant than sand; limestone and gypsum

Soft marsh deposits (Holocene)—Mud, silt, and clay more abundant than sand; limestone, gypsum, and salt

Conglomerate and sandstone (Holocene and late Pleistocene)—Alluvium; strongly and dertital sediments, gravel, sand more abundant than silt and clay

Eolian deposits (Holocene and late Pleistocene)—Sand

Till (Holocene and late Pleistocene)—Till: conglomerate, strongly sediments, gravel, sand, siltstone, breccia

Fan alluvium and colluvium (Holocene and late Pleistocene)—Fan alluvium and colluvium; strongly and dertital sediments, gravel, sand, clay

Conglomerate and sandstone (late Pleistocene)—Alluvium; strongly and dertital sediments, gravel, sand more abundant than silt and clay

Loess (late Pleistocene)—Loess more abundant than sand, clay

Conglomerate and sandstone (middle Pleistocene)—Alluvium; strongly and dertital sediments, gravel, sand more abundant than silt and clay

Loess (middle Pleistocene)—Loess more abundant than sand, clay

Till (middle Pleistocene)—Till: conglomerate, strongly sediments, gravel, sand, siltstone, breccia

Travertine (middle Pleistocene)—Travertine

Alkaline lava (middle Pleistocene)—Trachybasalt, leucite basanite (Sarkoghi series)

Basalt lava (middle Pleistocene)—Basaltic andesite and olivine basalt (Argosun series)

Conglomerate and sandstone (early Pleistocene)—Alluvium; strongly and dertital sediments, gravel, sand more abundant than silt and clay

Andesite tuff (early Pleistocene)—Andesite, dacite tuff and welded tuff (Dashtiarzar series)

Alkaline tuff (early Pleistocene)—Phonolite and nearcite tuff and lava (Khanneshin series)

Till (early Pleistocene)—Till: conglomerate, strongly sediments, gravel, sand, siltstone, breccia

Conglomerate and sandstone (Pliocene)—Gray conglomerate, grit, sandstone more abundant than siltstone, clay, limestone, marl; gypsum, salt; felsic to mafic volcanic rocks

Conglomerate and sandstone (late Pliocene)—Gray conglomerate, grit, sandstone more abundant than siltstone, clay, limestone, marl; gypsum, salt; felsic to mafic volcanic rocks

Sandstone and conglomerate (early Pliocene)—Variegated sandstone, conglomerate more abundant than clay, siltstone

Conglomerate and sandstone (Miocene)—Red conglomerate, sandstone more abundant than siltstone, clay; felsic and mafic volcanic rocks; limestone, marl, olivine basalt, trachybasalt, andesitic basalt (Taywara series)

Conglomerate and sandstone (late Miocene)—Variegated conglomerate, sandstone more abundant than grit, clay, siltstone

Clay and siltstone (middle Miocene)—Brown clay; siltstone more abundant than sandstone, conglomerate, limestone

Clay and siltstone (early Miocene)—Red clay; siltstone more abundant than sandstone, conglomerate, limestone

Sandstone and siltstone (Oligocene)—Sandstone, siltstone more abundant than clay; conglomerate, limestone; marl; felsic and mafic volcanic rocks

Volcanic and sedimentary rocks (Oligocene and Eocene)—Basaltic andesite, basalt, trachyte, dacite, rhyolite; sandstone, tuff; more abundant than conglomerate, sandstone, siltstone, limestone

Rhyolite and dacite (Oligocene and Eocene)—Rhyolite (lipparite), dacite; more abundant than granite porphyry

Rhyolite lava (Oligocene and Eocene)—Rhyolite lava

Andesite lava (Oligocene and Eocene)—Andesite lava

Lava (Oligocene and Eocene)—Lava

Clay and shale (Eocene)—Clay, shale, siltstone more abundant than sandstone, limestone; marl, gypsum, conglomerate (North Afghanistan: Kamrawa basin); sandstone, siltstone, conglomerate and gravel-stone, felsic and mafic volcanic rocks (Central basin)

Andesite lava (Eocene)—Andesite lava

Conglomerate and sandstone (Paleocene)—Conglomerate, sandstone more abundant than siltstone, limestone, shale; mafic volcanic rocks

Basalt lava (Paleocene)—Basalt lava

Limestone and dolomite (Paleocene and Late Cretaceous)—Limestone (marl), dolomite more abundant than sandstone, clay, siltstone, gypsum, conglomerate more abundant than volcanic rocks

Andesite lava (Cretaceous)—Andesite lava

Volcanic and sedimentary rocks (Cretaceous)—Rhyolite to basalt; chert, fine- and coarse-grained terrigenous rocks, marl, limestone

Basalt lava (Cretaceous)—Basalt lava

Tuff (Cretaceous)—Tuff

Sandstone and siltstone (Late Cretaceous)—Sandstone, siltstone more abundant than clay, limestone; marl, conglomerate, gypsum (North Afghanistan); limestone (Middle Afghanistan); siltstone, siltstone, conglomerate (Khoshtod zone)

Volcanic and sedimentary rocks (Late Cretaceous (Maastrichtian))—Andesite, basalt, andesitic dacite, tuff; limestone, marl, sandstone, siltstone

Lava (Late Cretaceous (Maastrichtian))—Andesite, basalt, andesitic dacite, tuff

Limestone and sandstone (Late Cretaceous (Campanian))—Limestone, sandstone more abundant than siltstone; marl, gravelstone, conglomerate; andesite basalt, tuff and tuffaceous conglomerate

Sandstone and conglomerate (Early Cretaceous)—Red sandstone, conglomerate more abundant than siltstone, gypsum, clay

Limestone and sandstone (Early Cretaceous (Albian and Aptian))—Limestone, marl, sandstone more abundant than conglomerate

Limestone and sandstone (Early Cretaceous (Aptian and Barremian))—Limestone, marl, sandstone more abundant than conglomerate

Sandstone and siltstone (Early Cretaceous (Hauterivian and Valanginian))—Sandstone, siltstone more abundant than limestone, marl

Basalt (Early Cretaceous (Hauterivian and Valanginian))—Basalt lava

Sandstone and siltstone (Early Cretaceous (Valanginian and Berriasian))—Sandstone, siltstone more abundant than limestone, marl

Andesite (Early Cretaceous (Valanginian and Berriasian))—Andesite lava

Basalt (Early Cretaceous (Valanginian and Berriasian))—Basalt lava

Shale and siltstone (Early Cretaceous (Hauterivian) and Late Jurassic (Tithonian))—Shale more abundant than siltstone, sandstone; conglomerate, chert, limestone, gneissose, felsic and mafic volcanic rocks

Rhyolite (Early Cretaceous (Hauterivian) and Late Jurassic (Tithonian))—Rhyolite lava

Basalt (Early Cretaceous (Hauterivian) and Late Jurassic (Tithonian))—Basalt lava

Shale (Jurassic)—Shale and mudstone more abundant than limestone, sandstone

Conglomerate and sandstone (Late Jurassic)—Conglomerate, sandstone more abundant than siltstone, clay, limestone; gypsum (North Afghanistan); limestone, marl, sandstone, siltstone (Farah Red basin; Upper Jurassic (Tithonian))

Limestone (Late and Middle Jurassic)—Limestone, marl

Sandstone and siltstone (Middle and Early Jurassic)—Sandstone, siltstone more abundant than clay, conglomerate, coal (North Afghanistan); limestone, marl, sandstone, shale, siltstone (Middle Afghanistan); sandstone, shale, siltstone, felsic volcanic rocks (Kermaran zone)

Siltstone and shale (Middle Jurassic and Late Triassic)—Siltstone, shale more abundant than sandstone

Siltstone and sandstone (Early Jurassic and Late Triassic (Rhaetian))—Siltstone, sandstone more abundant than shale, marl, limestone

Limestone and shale (Triassic)—Limestone, shale more abundant than sandstone

Sedimentary and volcanic rocks (Late Triassic)—Shale more abundant than phyllite, andesite to basalt (gneissose altered); limestone (Kostagi series)

Rhyolite (Late Triassic)—Rhyolite lava

Basalt lava (Late Triassic)—Basalt lava

Rhyolite and sandstone (Late Triassic (Rhaetian))—Rhyolite and basalt more abundant than sandstone; sandstone, conglomerate, grit

Rhyolite (Late Triassic (Rhaetian))—Rhyolite lava

Andesite (Late Triassic (Rhaetian))—Andesite lava

Siltstone and sandstone (Late Triassic (Rhaetian and Norian))—Siltstone, sandstone more abundant than shale, conglomerate

Limestone and dolomite (Late Triassic (Norian and Carnian))—Limestone, dolomite

Sandstone and siltstone (Late and Middle Triassic)—Sandstone and siltstone more abundant than sandstone; carbonaceous shale, limestone; marl, conglomerate; felsic and mafic volcanic rocks (North Afghanistan); limestone, dolomite, marl (Kabul block and Kotar zone)

Limestone and dolomite (Middle Triassic)—Limestone, dolomite

Limestone and dolomite (Late Triassic (Carnian) and Early Triassic)—Limestone, dolomite more abundant than conglomerate, chert, marl (Middle Afghanistan); limestone, sandstone, shale, conglomerate, chert, mafic volcanic rocks (Khoshtod zone); limestone, dolomite (Kermaran zone)

Limestone and dolomite (Middle and Early Triassic)—Limestone, dolomite, marl

Sandstone and conglomerate (Early Triassic)—Variegated sandstone, gneissose, conglomerate, chert; rhyolite and basalt volcanic rocks (North Afghanistan)

Limestone and chert (Late Triassic (Carnian) and Permian)—Limestone, marl, chert more abundant than sandstone, shale, siltstone

Sandstone and siltstone (Permian)—Red and variegated sandstone and siltstone more abundant than sandstone, conglomerate, gravel-stone (Northeast Afghanistan); limestone, dolomite, sandstone, siltstone, shale, chert (Kabul block); marl, limestone, sandstone, basaltic hearing rocks (Middle Afghanistan: Zard and Kermaran zones, Katawaz trough)

Limestone and dolomite (Late Permian)—Limestone, dolomite more abundant than sandstone, siltstone, shale, basaltic and basaltic-bearing rocks

Siltstone and sandstone (Early Permian)—Siltstone and sandstone more abundant than slate, limestone, conglomerate, grit (Helmand zone); limestone (Tashkorgoh zone)

Limestone and sandstone (Early Permian)—Ulah and Kohsefpanelan horizons; limestone and sandstone more abundant than siltstone, conglomerate

Limestone and sandstone (Early Permian)—Karachatv horizon; limestone and sandstone more abundant than siltstone, argillite, slate

Sandstone and siltstone (Early Permian and Carboniferous)—Sandstone and siltstone more abundant than slate, andesite to basalt volcanic rocks

Limestone (Late Carboniferous)—Limestone more abundant than slate, sandstone, conglomerate, siltstone, andesite to basalt volcanic rocks

Volcanic and sedimentary rocks (Early Carboniferous)—Rhyolite to basalt; volcanic rocks more abundant than limestone, slate, sandstone, conglomerate

Rhyolite tuff (Early Carboniferous)—Rhyolite tuff

Basalt (Early Carboniferous)—Basalt lava

Andesite (Early Carboniferous)—Andesite lava

Lava (Early Carboniferous)—Lava

Basalt and sandstone (Early Carboniferous (Namurian))—Basalt, sandstone, siltstone, shale (North Afghanistan); sandstone, siltstone, shale (Tashkorgoh and Kotar zones)

Basalt tuff (Early Carboniferous (Namurian))—Basalt tuff

Basalt lava (Early Carboniferous (Namurian))—Basalt lava

Lava (Early Carboniferous (Namurian))—Lava

Limestone (Early Carboniferous (Visean and late Tournaisian))—Limestone, sandstone, siltstone, shale, conglomerate, sandstone, conglomerate

Rhyolite to andesite (Early Carboniferous (early Tournaisian))—Rhyolite to andesite (gneissose altered) more abundant than limestone, shale, siltstone

Rhyolite lava (Early Carboniferous (early Tournaisian))—Rhyolite lava

Andesite lava (Early Carboniferous (early Tournaisian))—Andesite lava

Lava (Early Carboniferous (early Tournaisian))—Lava

Limestone and dolomite (Early Carboniferous and Late Devonian)—Limestone more abundant than marl, schist

Sandstone and siltstone (Late Devonian)—Sandstone and siltstone more abundant than limestone

Limestone and dolomite (Middle and Early Devonian)—Limestone and dolomite more abundant than sandstone, siltstone

Sandstone and shale (Devonian and Silurian)—Limestone and dolomite more abundant than schist, sandstone

Limestone (Silurian)—Limestone, marl more abundant than slate (Middle Afghanistan); sandstone, siltstone, shale (Logar and Aryandab zones)

Sandstone and siltstone (Ordovician)—Sandstone and siltstone more abundant than shale (Logar and Aryandab zones); limestone, sandstone, siltstone, shale (Middle Afghanistan); shale, sandstone, chert (North Afghanistan)

Sandstone and siltstone (Cambrian)—Sandstone and siltstone more abundant than limestone, dolomite, mafic volcanic rocks

Limestone and dolomite (Cambrian (Edicarian) and Neoproterozoic)—Limestone and dolomite (Aryandab zone); marble, quartzite, metasandstone, meta schist (Kabul block)

Metavolcanic rhyolite and andesite (late Neoproterozoic)—Red alkali rhyolite and andesite volcanic rocks more abundant than sandstone, siltstone, phyllite; limestone, dolomite

Lava (late Neoproterozoic)—Lava

Schist and phyllite (early Neoproterozoic)—Greenschist and phyllite more abundant than marble; metasandstone, metasiltstone more abundant than marble, dolomite, chert; and metavolcanic rocks

Metavolcanic rhyolite lava (early Neoproterozoic)—Metavolcanic rhyolite lava

Metavolcanic andesite lava (early Neoproterozoic)—Metavolcanic andesite lava

Metamorphic rocks, undifferentiated (Mesoproterozoic)—Gneiss, schist, gneiss, quartzite, marble, amphibolite (metavolcanic lava and sedimentary rocks)

Metavolcanic lava and sediments (Mesoproterozoic)—Metavolcanic lava and sedimentary rocks

Schist (late Mesoproterozoic)—Quartz-plagioclase-biotite, biotite, muscovite, and two-mica schists, with amphibolite beds and lenses

Schist (middle Mesoproterozoic)—Albite-sericite-quartz and sericite-plagioclase-quartz schists, with amphibolite beds and lenses

Schist (early Mesoproterozoic)—Quartz-sericite-carbonate and chlorite-sericite-quartz schists; marble, quartzite, amphibolite

Gneiss (Paleoproterozoic)—Two-mica, biotite, biotite-amphibole, garnet-biotite, and plagioclase gneisses; migmatite, quartzite, marble, amphibolite

Gneiss (late Paleoproterozoic)—Biotite gneiss and garnet-biotite gneiss; schist, quartzite, marble, amphibolite

Marble and gneiss (middle Paleoproterozoic)—Marble, biotite gneiss, and garnet-muscovite-biotite gneiss; schist, quartzite, amphibolite

Metavolcanic lava (middle Paleoproterozoic)—Metavolcanic lava

Gneiss (early Paleoproterozoic)—Two-mica, biotite, biotite-amphibole, garnet-biotite, garnet-sillimanite-biotite, pyroxene-amphibole, plagioclase, and cordierite gneisses; schist, migmatite, quartzite, marble, amphibolite

Gneiss (Neoarchean)—Biotite, garnet-biotite, sillimanite-biotite, amphibole, and biotite-amphibole gneisses; amphibolite

Gneiss (Mesoarchean)—Biotite, garnet-biotite, amphibole, biotite-amphibole, and calc-silicate gneisses; magnesite marble, quartzite, amphibolite

Gneiss (Paleoarchean)—Biotite, garnet-biotite, and injection gneisses; amphibolite

Plutonic Rocks

Carbonatite (early Pleistocene)—Carbonatite dikes

Carbonatite (early Pleistocene)—Carbonatite intrusion

Rhyolite (early Pleistocene)—Rhyolite (lipparite-dacite)

Nepheline syenite (Miocene)—Nepheline syenite

Andesite and diorite (Miocene)—Andesite, diorite more abundant than diabase porphyry dikes

Diorite and granodiorite (Miocene)—Diorite and granodiorite, diorite porphyry, granodiorite porphyry, monzonite porphyry, syenite porphyry, nepheline syenite

Granite (Oligocene)—Granite (Phase III)

Granodiorite and granosyenite (Oligocene)—Granodiorite, alaskite, granosyenite more abundant than granite (Phase II)

Granodiorite (Oligocene)—Granodiorite (Phase I)

Diorite and plagiogranite (Oligocene)—Diorite and plagiogranite more abundant than granodiorite (Phase I)

Granite and granodiorite (Oligocene)—Granite, granite porphyry, granodiorite more abundant than quartz syenite, granosyenite

Diabase and diorite intrusion (Eocene)—Diabase, diorite

Ultramafic intrusion (Eocene)—Dunite, peridotite, serpentinite

Gabbro and monzonite (Paleocene and Late Cretaceous)—Gabbro, monzonite more abundant than diorite, granite, granosyenite, syenite porphyry, syenite

Granodiorite and granite (Early Cretaceous)—Granodiorite, granite

Gabbro and diorite (Early Cretaceous)—Gabbro, diorite more abundant than plagiogranite

Gabbro and monzonite (Early Cretaceous)—Gabbro, monzonite more abundant than diorite, granodiorite

Ultramafic intrusion (Early Cretaceous)—Dunite, peridotite, serpentinite

Diabase and gabbrodiabase (Early Cretaceous and Late Jurassic)—Diabase, gabbrodiabase

Granodiorite and granosyenite (Late Triassic)—Granodiorite, granosyenite, granophyre, granite

Andesite and granite porphyry (Late Triassic)—Andesite porphyry, granite porphyry

Granite and granosyenite (Early Triassic)—Granite, granosyenite (Phase IV)

Granite (Early Triassic)—Granite (Phase III)

Granodiorite and granite (Early Triassic)—Granodiorite, granite (Phase I-II)

Diorite and gabbrodiorite (Permian)—Diorite, gabbrodiorite, plagiogranite

Gabbro and diorite (Permian)—Gabbro, gabbrodiorite, diorite

Ultramafic intrusion (Permian)—Ultramafic rocks

Diorite and granodiorite (Early Carboniferous)—Diorite, granodiorite more abundant than granophyre, plagiogranite

Gabbro and diorite (Early Carboniferous)—Gabbro, diorite

Ultramafic intrusion (Early Carboniferous)—Dunite, peridotite, serpentinite

Granite porphyry (Neoproterozoic)—Granite porphyry

Gneiss and granite (Proterozoic)—Gneiss-granite, gneiss, plagiogranite

Gabbro and mafic metavolcanics (Proterozoic)—Gabbro, metadiabase, amphibolite, diorite, plagiogranite

DESCRIPTION OF MINERAL SYMBOLS

Deposit Types

METALLIC MINERALS

- Vein gold, undivided
- Skarn gold (± copper)
- Unclassified gold
- Sediment-hosted copper
- Porphyry copper(?)
- Skarn copper
- Unclassified copper
- Volcanogenic massive-sulfide (copper-zinc)
- Vein polymetallic
- Skarn zinc-lead
- Mississippi Valley-type lead-zinc
- Unclassified lead-zinc
- Iron formation
- Oolitic ironstone
- Skarn iron
- Kiruna-type iron oxide (copper-gold(?))
- Vein hematite
- Unclassified iron
- Unclassified manganese
- Podiform chromite
- Cassiterite tin
- Stockwork tin
- Vein tin
- Skarn tin
- Unclassified tin
- Cassiterite tungsten
- Vein tungsten
- Skarn tungsten
- Unclassified tungsten
- Unclassified molybdenum
- Unclassified mercury
- Pegmatite (beryllium, lithium, tantalum; gem-quality minerals)
- Carbonatite (carnotite, rare-earth elements)

NONMETALLIC MINERALS

- Bedded barite
- Vein barite
- Unclassified barite
- Bedded celestite
- Unclassified fluorite
- Salt dome
- Bedded marine halite
- Lacustrine halite
- Unclassified halite
- Bedded marine gypsum
- Lacustrine gypsum
- Unclassified gypsum
- Sulfur
- Aggregate
- Aragonite
- Limestone
- Marble
- Calcite (Iceland spar)
- Sedimentary kaolin
- Residual kaolin
- Sedimentary bentonite
- Unclassified clay
- Unclassified phosphate
- Karst-type bauxite
- Lateritic-type bauxite
- Metamorphic/metamorphic replacement magnesite
- Ultramafic-hosted talc
- Serpentinite-hosted asbestos
- Unclassified graphite
- Quartz pegmatites and veins
- Silica sandstone
- Unclassified silica

PRECIOUS AND SEMI-PRECIOUS MINERALS

- Emerald
- Ruby
- Lapis lazuli
- Garnet
- Epidote

PLACER MINERALS

- Placer gold
- Placer tin

ENERGY MINERALS

- Coal
- Peat
- Petroleum, oil
- Petroleum, oil show
- Petroleum, gas
- Petroleum, gas show
- Petroleum, oil and condensate, show
- Petroleum, oil show and gas show
- Oil shale

EXPLANATION OF GEOLOGIC MAP SYMBOLS

Fault—Dashed where approximately located, dotted where concealed

Lake or reservoir

EXPLANATION OF POLITICAL MAP SYMBOLS

KABUL **National capital**

Hirat **Provincial capital**

National boundary

Provincial boundary

BALKH **Province name**

DATA SUMMARY

The geologic and mineral resource information shown on this map is derived from published and unpublished maps and reports of the Afghan Geological and Mineral Survey (AGMS) and others (1977). The U.S. Geological Survey (USGS) has made no attempt to modify original geologic map-unit boundaries and faults as presented in Abdullah and Chaterjee (1977); however, modifications to map-unit symbology, and minor modifications to map-unit descriptions, have been made to clarify lithostratigraphy and to accommodate digital formats. The USGS has made minor modifications to map-unit names, small or narrow, in order to maintain legibility and to preserve the map's utility in illustrating regional geologic and structural relations. Users are encouraged to refer to the series of USGS-AGS (Afghan Geological Survey) 1:250,000-scale geologic quadrangle maps of Afghanistan that are being released concurrently as open-file reports.

The classification of mineral deposit types is based on the authors' interpretation of existing descriptive information (Abdullah and others, 1977; Bowersox and Chamberlain, 1978; Peters and others, 1978; Orris and Bliss, 1992; Bowersox and others, 1995). Deposit-type nomenclature used for unalloyed minerals is modified from published USGS deposit-model classifications, as compiled in Stoser and Heras (2000). Nonprofitable localities are based on research of archival data by the authors.

The shaded relief base is derived from Shuttle Radar Topography Mission (SRTM) 30-meter digital data (Farr and Kobrick, 2000). Elevation data for the SRTM DEM (SRTM DEM dataset were filled with data digitized from contours on 1:250,000-scale Soviet General Staff Sheets) (1978–1987). The nearsigned extent of geologic units corresponds to the position of the international boundary as defined by Abdullah and Chatterjee (1977), and the international boundary as shown on this map was acquired from the Office of International Boundaries, Geographer, U.S. Department of State (http://www.state.org) on September 2003. Non-coincidence of these boundaries is due to differences in the respective data sources and to inexact registration of the geologic data to the DEM base. Previous boundaries, previous capital locations, and political names were also acquired from the ARMS Web site in September 2005. The ARMS data were originally digital maps produced by the Afghanistan Geodesy and Cartography Head Office (AGCHO).

Version 2 differs from Version 1 in that (1) map units are colored according to the color scheme of the Commission for the Geological Map of the World (CGMW) (http://www.ccgm.org), (2) the mineralo database has been updated, and (3) all data presented on the map are also available as GIS format.

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Base from Shuttle Radar Topography Mission (SRTM) 30-meter digital data
Global Land One-kilometer Base from AMS Web site (http://www.nlt.org/) as digitized in September 2002

Transverse Mercator projection, WGS 84 Datum; scale factor 0.9996; longitude of central meridian 66°30′ E.; latitude of origin 34°30′ N.

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