U.S. DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY, PREPARED FOR

MINISTRY OF PETROLEUM AND MINERAL RESOURCES
DEPUTY MINISTRY FOR MINERAL RESOURCES

KINGDOM OF SAUDI ARABIA

OPEN-FILE REPORT USGS-OF-85-425
PLATE 1

Aerial photography 1956 and controlled mosaic 1959
Aero Service Corporation, Philadelphia, Penn., U.S.A.

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

TRUE NORTH

SCALE 1 : 100 000

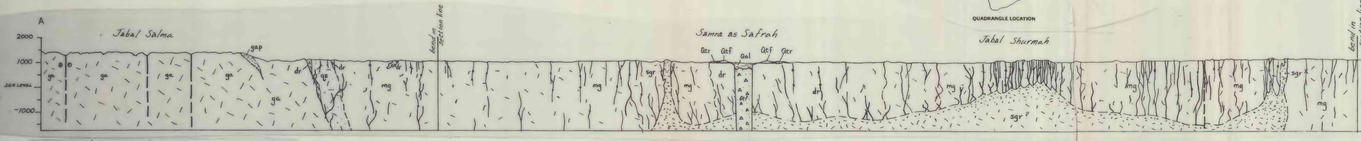
2 0 2 4 6 8 10 KILOMETERS

2 0 2 4 6 8 10 MILES

DATUM IS MEAN SEA LEVEL

Geology mapped by J. S. Pallister assisted by A. H. El Bazli, 1983

QUADRANGLE LOCATION

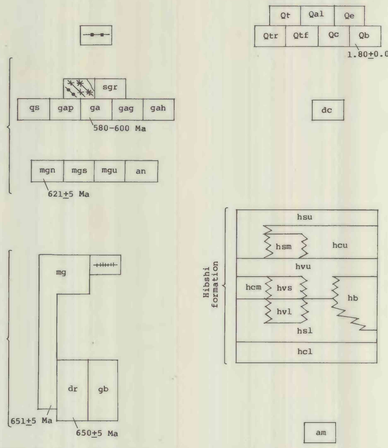


RECONNAISSANCE GEOLOGIC MAP OF THE HARRAT HUTAYMAH QUADRANGLE, SHEET 26/42 A, KINGDOM OF SAUDI ARABIA

by
John S. Pallister
1985

EXPLANATION

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

QUATERNARY VOLCANIC AND HYPABYSSAL ROCKS AND QUATERNARY SEDIMENTS

Qt TALUS--Unconsolidated angular rock fragments of boulder to cobble size forming angle-of-repose slopes along the northwest flank of Jibal Hibshi

Qal ALLUVIUM--Silt, sand, and gravel deposits along wadis, on pediments, and in alluvial fans; includes colluvium

Qe ELUVIUM--Eolian sand and silt; isolated terrain-trapped dune sand. Mostly in the east

Qtr REWORKED BASALTIC TUFF--Thin blanket and channel deposits of alluvially reworked basaltic tuff overlying basaltic tuff-ring deposits and adjacent country rock

Qtf BASALTIC TUFF-RING DEPOSITS--Poorly consolidated, bedded basaltic tephra deposits exposed as annular rings around magmatic or phreatomagmatic explosion craters. Consist of basaltic ash, cinder, and spatter with included blocks and bombs of olivine alkali basalt, and xenoliths of peridotite, diorite, and granitic rocks. Also contains xenocrysts of olivine, pyroxene, and amphibole

Qc BASALTIC CINDER AND SPATTER--Unconsolidated and agglutinated olivine alkali basaltic cinder, spatter, and bombs; includes rare granitic or dioritic xenoliths, generally lacks peridotite xenoliths. Forms cinder cones; aligned mostly along north trends in the northern part of the quadrangle

Qb OLIVINE ALKALI BASALT--Olivine-phyric basalt; nonvesicular or poorly vesicular, intergranular or intersertal; contains peridotite xenoliths; forms aa and minor pahoehoe flows spatially associated with cinder cones in the northern part of the quadrangle. Flow exposed below tuff-ring deposits at Harrat Hutaymah crater dated by whole-rock K-Ar at 1.80 ± 0.05 Ma

PROTEROZOIC SEDIMENTARY AND VOLCANIC ROCKS AND METAMORPHIC EQUIVALENTS

dc SAMIRAH DACITE AND RHYOLITE--Gray to tan, porphyritic hornblende-biotite-plagioclase porphyritic dacite and plagioclase-sanidine porphyritic rhyolite. Forms ash-flows, lava-flows, and dikes in an annular belt along the east side of the Gusal pluton.

qs SALMA ALKALI-FELDSPAR QUARTZ SYENITE--Light-gray, medium- to fine-grained, allotriomorphic granular and locally granophyric, hornblende alkali-feldspar quartz syenite. Composed of microperthitic orthoclase and minor microcline, albite, quartz, hornblende, and trace biotite; color index 5-10. Forms border zone of the Salma pluton

gap SALMA ALKALI-FELDSPAR QUARTZ SYENITE GRANOPHYRE--Light-gray, fine-grained, porphyritic, biotite alkali-feldspar quartz syenite- or alkali-feldspar granite-granophyre; color index less than 5. Contains mm-scale phenocrysts of subhedral microperthitic orthoclase, subhedral to anhedral quartz, and subhedral to anhedral albite in a granophyric groundmass of microperthitic orthoclase and quartz and minor albite and quartz. Forms 10-100 m-scale dikes in the Salma alkali-feldspar granite in the southern part of the pluton and an irregular roof-carapace in the north

ga SALMA ALKALI-FELDSPAR GRANITE--Light-gray, medium- to coarse- grained, hypidiomorphic granular, biotite alkali-feldspar granite. Composed of subhedral perthitic orthoclase, subhedral quartz, and minor subhedral albite; color index less than 5. Forms resistant high country at Jabal Salma, where erosion along prominent northeast-trending joint system produces rugged topography

gag GUSAL ALKALI FELDSPAR GRANITE GRANOPHYRE-Pink to gray, alkali feldspar granite granophyre, alkali feldspar quartz syenite granophyre, and alaskitic alkali feldspar granite. The granophyre is alaskitic, hornblende and(or) biotite bearing, and commonly microcline or quartz and microcline porphyritic. Microcline phenocrysts locally perthitic; some optically transitional orthoclase-microcline. Granophyric and fine grained or allotriomorphic granular and fine grained. Locally peralkaline (acmite normative). Forms pluton northwest of Samirah village. Possible resurgent pluton related to Samirah dacite and rhyolite

gah HUDUB ALKALI-FELDSPAR GRANITE--Light-gray to pinkish-gray, massive, medium- to coarse-grained, allotriomorphic to hypidiomorphic granular, typically alaskitic, biotite-magnetite alkali-feldspar granite. Composed of subequal twinned albite, microcline (locally perthitic or microperthitic), and quartz; with minor magnetite, biotite, and trace muscovite. Magnetite typically weathered to limonitic pits; rock is crumbly. Forms circular pluton at Jabal Hudub. Intrudes Laban quartz diorite complex and Hibshi formation. Chilled border phase at contact with Hibshi formation is biotite-bearing alkali-feldspar granite porphyry

Murdama group

HIBSHI FORMATION

hsu Upper sandstone member--Green-gray, fine- to medium-grained, moderately sorted, angular to subangular, feldspathic or lithic wacke (graywacke). Matrix commonly recrystallized to a chlorite-rich greenschist assemblage. Contains mafic and felsic volcanic lithic fragments and sparse sandstone fragments. Commonly has plate cleavage. Similar to Murdama graywacke exposed in the basin south of the quadrangle

hsm Middle sandstone member--Repeated meter-scale interbedded green-gray sandstone and siltstone or claystone forming distinctive ridge and swale outcrop pattern. Sandstone is medium to fine grained, moderately sorted, angular to subangular, lithic and feldspathic wacke. Silt-sized matrix variably recrystallized to chlorite- or epidote- rich greenschist assemblage. Siltstones contain epidote, amphibole, and magnetite in addition to quartz and feldspar as clasts. Also contains thin chert (recrystallized water-laid tuff?) beds. Folded and block-faulted in the thrust sheet south of the Al Ghumrah fault

hcu Upper conglomerate member--Tan-weathering, matrix-supported cobble conglomerate. Mostly quartz diorite granophyre, quartz monzodiorite granophyre, and felsic rhyolite and dacite cobbles in a fine- to medium-grained lithic wacke matrix. Also contains sparse tonalite and tonalite gneiss, monzogranite aplite, lithic wacke, and quartzite cobbles. Crops out as a poorly exposed belt near Jabal Aba al Liqah, and as a discontinuous channel-fill deposit at Jibal Hibshi

hvu Upper volcanic member--Gray or tan, orange- or pink-weathering, plagioclase porphyritic dacitic to andesitic and sparse rhyolitic welded tuff and welded tuff breccia interbedded with subordinate air-fall and water-lain tuff and volcanic breccia, sandstone, and breccia. Lava flows common near top. Welded tuffs comprise multiple cooling units and commonly densely welded at bases with well-preserved eutaxitic structures. Mafic phenocrysts generally altered, but hornblende locally preserved. Tuffs partly to completely devitrified and variably recrystallized to zeolite or greenschist facies. Lithic fragments in both tuffs and interbedded sedimentary rocks are: dacitic volcanics or volcanic sandstone, minor mafic and intermediate volcanics, and sparse quartz diorite and tonalite fragments

hcm Middle conglomerate member--Gray to dark-green-gray and orange weathering, matrix- and clast-supported, pebble to boulder conglomerate. Contains mostly quartz diorite and tonalite clasts and subordinate granodiorite, quartz monzonite, monzonite gneiss, syenogranite gneiss, alkali feldspar granite granophyre, and andesite clasts. Conglomerate matrix medium- to coarse-grained lithic wacke containing tonalite, quartz diorite, diabase, and mafic and felsic volcanic lithic fragments in an epidote-rich recrystallized matrix

hvs Volcanic sandstone member--Gray-green and green to tan weathering, fissile and fracture-cleaved, moderately to well sorted, subangular to very angular, medium-grained, lithic wacke. Contains interbeds of lithic breccia, welded tuff, and water-laid tuff. Lithic fragments mostly dacitic volcanic rock and diorite. Matrix contains silt and devitrified volcanic ash. Thin dacite-cobble conglomerate at base

hb Basalt member--Dark-gray or green, fine-grained, intergranular clinopyroxene-plagioclase porphyritic basalt flows and subordinate diabase dikes. Metamorphosed to greenschist facies. Only exposed at Jabal Aba al Liqah. Locally interbedded with welded tuff of the upper volcanic member

hvl Lower volcanic member--Gray or tan, orange-weathering, plagioclase porphyritic, eutaxitic, dacitic welded tuff. Exposed only at the northeast end of Jibal Hibshi; pinches out to the northeast and not exposed south of the Al Ghumrah fault

hsl Lower sandstone member--Tan to gray or maroon, fine- to medium-grained, poorly to moderately sorted, angular to subangular arkose and lithic graywacke. Medium bedded; typically planar, but locally cross-bedded, and locally calcite cemented. Lithic fragments include: dacitic welded tuff, mafic volcanics, siltstone, and fine-grained tonalite or quartz diorite. Maroon and green siltstone, claystone, and shale interbeds common in the lower part. Raindrop imprints and ripple marks preserved in siltstone, claystone, and shale. Conglomerate locally interbedded with sandstone near the base

hcl Lower conglomerate member--Gray to dark-green-gray or orange, matrix- or clast-supported, moderately rounded, crudely bedded, arkose matrix, pebble to boulder conglomerate. Locally gradational into pebble breccia. Locally contains sandstone and siltstone at base and interbeds of medium- to coarse-grained arkose near the top. Dominated by quartz diorite, diorite, and tonalite clasts, also contains diabase, basalt, andesite and dacite fragments

am GHUMRAH AMPHIBOLITE--Dark-green-gray to black plagioclase-hornblende porphyroblastic amphibolite and hornfels, and subordinate epidote-bearing quartzite, epidote-amphibole hornfels or quartzite, and epidote-garnet-quartz skarn. Amphibolite and plagioclase-hornblende hornfels probably metabasalt and metadiabase; quartzite and calc-silicates probably derived from interbedded sandstone and calcareous sandstone. Lineated and foliated, and isoclinally folded at small-scale. Occurs as roof-rock septum and metadiabase keel within the dioritic complex

PLUTONIC AND HYPABYSSAL ROCKS

Quaternary

MAFIC DIKES--Gray diabase dikes containing pyroxene xenocrysts and peridotite xenoliths. Known to occur only at Jabal Uraynibah. Probable feeder dikes for Harrat Hutaymah volcanics

Proterozoic

Younger plutonic series

DIKES AND QUARTZ VEINS--Red- or pink-weathering altered rhyolite or alkali feldspar granophyre dikes, and light-gray or tan to red-weathering altered dacite to andesite and rare trachyte dikes (dot-symbol); light- to dark-gray metabasalt and metadiabase dikes (X-symbol) associated with the Laban complex, but also intrude the Kilab monzogranite, Hibshi formation, and Shurmah ring dike. They commonly form northwest- or west-trending swarms; and red-weathering, vuggy quartz-limonite breccia dikes (star-symbol). Felsic and quartz-limonite breccia dikes originate mostly from younger plutonic series plutons. Quartz-limonite breccia dikes and veins probably intruded from Gusal alkali feldspar granite granophyre pluton; mineralized at Samirah gold prospect. Undifferentiated dikes shown as single lines

sgr SHURMAH ALKALI FELDSPAR GRANITE--Pinkish-gray to pink, fine-grained, allotriomorphic granular, graphic, or granophyric, alaskitic and biotite- or amphibole-bearing alkali-feldspar granite and orthoclase- (after sanidine?) quartz porphyritic alkali-feldspar granite (and rhyolite) porphyry. Orthoclase and quartz phenocrysts euhedral to subhedral; orthoclase pervasively sericitized. Locally contains minor sub-calcic amphibole. Color index less than 5. Forms a 10-100 m-wide, 15 X 27 km oval ring-dike around Jabal Shurmah and locally feeds thin (m-scale) easterly trending dikes at Jabal Shurmah. Peralkaline (acmite normative)

mgn NIMRIAH MONZOGRANITE--Pink, recessive weathering, biotite and hornblende-biotite monzogranite and granodiorite. Medium to coarse grained, hypidiomorphic to allotriomorphic granular. Forms pluton that intrudes upper sandstone member of the Hibshi formation southeast of Jibal Hibshi. Dated by U-Pb on zircon at 621 ± 5 Ma

mgs SHUWAYMAN MONZOGRANITE--Pale-orange, fine- to medium-grained, hypidiomorphic to allotriomorphic granular, biotite monzogranite, biotite quartz monzonite, and biotite granodiorite. Locally peraluminous (corundum normative) and locally contains trace muscovite. Part of a large pluton exposed in the southeast corner of the quadrangle. Intrudes the upper sandstone member of the Hibshi formation

mgu UBDAH MONZOGRANITE--Light-gray to pinkish-gray, massive, fine- to medium-grained, allotriomorphic to hypidiomorphic granular and locally granoblastic, biotite and hornblende-biotite monzogranite. Composed of microcline microperthite, zoned plagioclase, quartz, and minor biotite and hornblende. Forms irregularly exposed pluton in the northwestern part of the quadrangle. Intrudes Laban quartz diorite complex and partly covered by Quaternary volcanic rocks of Harrat Awaled and Harrat Hutaymah

an ANDESITE SILL--Gray to greenish-gray, fine-grained, intergranular, plagioclase, and hornblende-plagioclase porphyritic andesite. Hornblende typically pseudomorphed by uralite and chlorite or smectite and chlorite. Plagioclase saussuritized. Also contains minor Ti-Fe oxides and interstitial quartz. Groundmass variably altered to greenschist facies assemblage. Forms thick sill that intrudes upper volcanic member of Hibshi formation at northern end of Jibal Hibshi. Also forms thin sill (not shown) that intrudes lower conglomerate member of Hibshi

Older plutonic series and Klab batholith

mg KILAB MONZOGRANITE--Batholith composed mostly of light-gray to pinkish-gray, massive to weakly foliated, medium-grained, allotriomorphic granular to granoblastic biotite, and hornblende-biotite monzogranite. Composed of microcline or microcline perthite, zoned plagioclase (commonly with saussuritized cores), variably recrystallized quartz, green hornblende and(or) biotite, and minor titanite. Locally plagioclase- or microcline porphyritic. Color index typically about 5, but locally less than 5. Variation in grain size (from fine- to coarse-grained) and in degree of deformation and recrystallization (weak to moderate) present within batholith. Also contains minor biotite-bearing alkali feldspar granite or granophyre, biotite syenogranite, muscovite-bearing peraluminous syenogranite, biotite-hornblende quartz monzonite, and biotite-hornblende granodiorite. Contains sparse, centimeter- to meter-scale, bull quartz or quartz-feldspar pegmatite veins and pods associated in one case with a small zone of peraluminous zinwaldite(?) granite. Batholith weathers to a low-relief grus-covered plain with a few resistant knobs, as at Jabal al Ramrah

GRANODIORITE DIKES--Alaskitic biotite granodiorite aplite and pegmatite dikes that intrude Al Ghumrah amphibolite and Laban quartz diorite complex

dr LABAN DIORITIC COMPLEX--Intrusive complex consisting of variably deformed and metamorphosed biotite quartz diorite, biotite and(or) hornblende diorite and tonalite, hornblende and pyroxene gabbro and monzogabbro, and subordinate granodiorite. Mafic minerals commonly converted to aggregates of chlorite and(or) uralite. Mostly metamorphosed at amphibolite facies; locally metamorphism produced banded dioritic gneiss. Includes amphibolite roof-rock septa near Uzaym; intruded by Ubdah, Hudub, Shurmah, and Kilab plutonic rocks and overlain by the Hibshi formation

gb GABBRO--Dark-gray to black olivine-clinopyroxene gabbro and melagabbro or plagioclase wehrlite, hornblende-olivine-clinopyroxene gabbro, clinopyroxene gabbro, and hornblende gabbro. Fine to coarse grained, hypidiomorphic or cumulus. Melagabbro and wehrlite serpentinized. Forms small plutons within Laban complex. Forms prominant plutons at Jabal Uraynibah and in Wadi Aba al Kurush. Smaller and less distinct gabbro bodies also occur in Laban complex

SYMBOLS

CONTACT--Dashed where inferred; dotted where concealed

FAULT--Showing dip; dashed where inferred; dotted where concealed; arrows indicate relative motion

THRUST FAULT--Showing dip; dashed where inferred; dotted where concealed; Sawteeth on upper plate

SYNCLINE--Showing troughline and direction of plunge

LINEATION--Showing direction and plunge

STRIKE AND DIP OF BEDS

Vertical

Inclined

STRIKE AND DIP OF CUMULUS LAYERING

Inclined

STRIKE AND DIP OF FOLIATION OR SCHISTOSITY

Vertical

Inclined

STRIKE AND DIP OF DIKES--Letter indicates rock type (a = aplite, r = rhyolite, p = pegmetite)

Vertical

Inclined

STRIKE AND DIP OF JOINTS

Vertical (primary)

Vertical (secondary)

Inclined (primary)

Inclined (secondary)

QUARTZ VEIN OR POD

U-Pb ZIRCON SAMPLE LOCALITY--Showing date

K-AR WHOLE-ROCK SAMPLE LOCALITY AND DATE

ANCIENT MINE--MODS 01264 (quartz-hematite veins, gold)