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

84-378
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

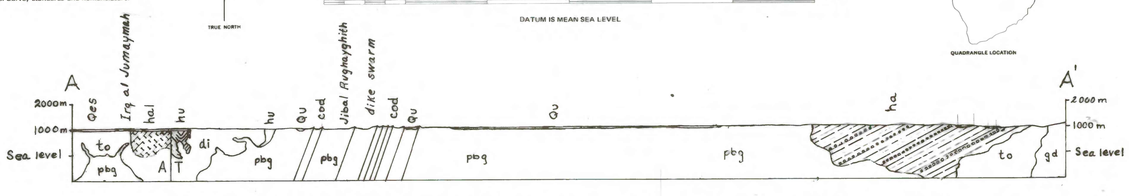
2 0 2 4 6 8 10 KILOMETERS

2 0 2 4 6 8 10 MILES

DATUM IS MEAN SEA LEVEL

Geology mapped in 1983

QUADRANGLE LOCATION



RECONNAISSANCE GEOLOGIC MAP OF THE JIBAL MATALLI QUADRANGLE, SHEET 27/40 D, KINGDOM OF SAUDI ARABIA

by
E. B. Ekren
1984

EXPLANATION

CORRELATION OF MAP UNITS

Qes	Qu

QUATERNARY

UNCONFORMITY

OЄru

ORDOVICIAN AND CAMBRIAN

UNCONFORMITY

gr	md	rhy	cod	du
			ragl/agl	
		ag	age	hbg
		bag	bgr	
			ma	ap
			pbg	
			gd	
			to	hag
		ha	hat	
			hac	
			hal	

PRECAMBRIAN (PROTEROZOIC)

UNCONFORMITY

di
hu

DESCRIPTION OF MAP UNITS

Qes EOLIAN SANDS OF IRQ AL JUMAYMAH OR GREAT NEFUD (QUATERNARY)--Quartz sand, fine- to medium-grained (mostly 0.25-0.5 mm), rounded to well-rounded with high sphericity; about 1 percent heavy minerals, no feldspar (D. J. Faulkender, oral commun., 1983). Dunes are semistabilized. Thickness, 0 to 100+ m

Qu UNDIFFERENTIATED ALLUVIUM (QUATERNARY)--Unconsolidated sheetflood and lag gravel with abundant admixtures of windblown sand. Gravel contains angular and subangular pebbles and cobbles of basaltic and granitic rocks derived from adjacent and subjacent bedrock. Thickness, 0 to 30 m

OЄru RAM AND UM SAHM SANDSTONES, UNDIVIDED (ORDOVICIAN AND CAMBRIAN)--Upper part exposed in adjacent quadrangle to the west consists of alternating beds of sandstone, siltstone, and mudstone (Ekren, 1984b); lower part is nearly entirely sandstone that occurs in alternating cosets of cross-stratified and flat-stratified beds. Sandstone is fine to coarse grained; brown, pale yellow brown, chocolate brown, and buff; some thin beds with abundant ferruginous and manganiferous(?) cement are nearly black; lower part contains numerous lenses of conglomeratic sandstone containing subrounded and rounded granules, pebbles, and sparse cobbles of white quartz

gr/md GRANOPHYRE AND MAFIC DIKES (PRECAMBRIAN)--Mostly composite dikes consisting of granophyre interiors with mafic dike selvages or granophyre with narrow mafic dikes cutting interior. Granophyre is mostly red or purple and consists of glomerophenocrysts of alkali feldspar to 1 cm and quartz to 6 mm in a micrographically intergrown groundmass of quartz and alkali feldspar. The associated mafic dikes contain as much as 50 percent mafic minerals consisting of altered clinopyroxene and hornblende; quartz occurs as interstitial grains and as phenocrysts to 3 mm with reaction rims of epidote, possibly after pyroxene; some rocks contain interstitial micrographic quartz and alkali feldspar. Where the mafic dikes predominate or where they occur without granophyre they are shown separately (md)

rhy RHYOLITE DIKES AND SILLS (PRECAMBRIAN)--Dikes and sills of rhyolite mapped only locally; brownish gray, black weathering; mostly with less than 5 percent phenocrysts of alkali feldspar to 5 mm and quartz to 2 mm in an aphanitic microcrystalline groundmass. In the southeastern part of the quadrangle, near Gariat Goormah, a thick rhyolite(?) sill contains 10 to 25 percent plagioclase phenocrysts to 1 cm, sparse quartz to 2 mm, and abundant tiny flakes of biotite in a silicic, flinty fracturing groundmass

cod COMENDITE DIKES OF JIBAL RUGHAYGHITH DIKE SWARM (PRECAMBRIAN)--Comendite dikes; gray and pink gray with less than 5 percent small phenocrysts of alkali feldspar and quartz in a microgranular and micrographic groundmass composed of quartz, alkali feldspar, and 10 percent or more tiny aegerine-augite and (or) oxidized sodic amphibole, probably arfvedsonite; locally, with abundant spherules about 3 mm in diameter formed of radiating crystallite needles of pyroxene. Fresh rock without spherules has a distinctive salt-and-pepper appearance

du DIKES, UNDIFFERENTIATED (PRECAMBRIAN)--Mostly aphyric dikes of basaltic composition, but including black-weathering dikes of intermediate and rhyolite composition

ragl/agl LATE ALKALI FELDSPAR GRANITE (PRECAMBRIAN)--Pink and red, amphibole-rich granite; large mass in the southwestern part is homogeneous, and three chemical analyses show that it is peralkaline throughout. It contains 20 to 40 percent quartz and 50 to 70 percent alkali feldspar as perthite, microcline, and late interstitial albite; commonly contains as much as 10 percent green amphibole (either arfvedsonite or kataphorite) that is pleochroic from dark green or dark gray to black and is virtually uniaxial; aegerine-augite is ubiquitous but modally insignificant; zircon is an abundant accessory and so is elpidite -- $Na_2ZrSi_6O_{15} \cdot 3H_2O$ (microprobe and X-ray analysis by D. B. Stoeser, oral commun., 1983). The mass in the southeastern part is very similar but contains arfvedsonite or kataphorite only around the peripheries; microprobe analysis by D. B. Stoeser (oral commun., 1983) showed that the interior contains ferroedenite; allanite is a fairly common accessory. A red granite zone (ragl) was mapped separately; this rock contains common hornblende or ferroedenite, and a single chemical analysis shows it to be peraluminous

ag ALKALI FELDSPAR GRANITE (PRECAMBRIAN)--Pink and orange-pink, medium-grained granite apparently closely related to the alkali feldspar granite that is extensive in the acjacent Jibal al Misma quadrangle to the west where the principal amphibole is kataphorite or arfvedsonite (Ekren, 1984b). A single thin section from an outcrop in the western part of this quadrangle shows 27 percent quartz, 70 percent alkali feldspar, and 3 percent oxidized mafics of indeterminate ancestry. Large mass along the eastern border contains sodic amphibole up to 1 cm long and quartz in composite grains as large as 8 mm

hbg HORNBLENDE GRANITE (PRECAMBRIAN)--Pink syenogranite; grades locally to pink alkali feldspar granite with sodic amphibole; contains about 17 to 37 percent quartz, 45 to 60 percent alkali feldspar, 2 to 24 percent plagioclase, and 2 to about 5 percent hornblende

bag BIOTITE-ALKALI FELDSPAR GRANITE (PRECAMBRIAN)--Pink, brown-weathering, medium-grained granite; contains 59 percent microcline and perthite, 25 to 31 percent quartz, 1 to 4 percent interstitial albite, and 2 to 4 percent chloritized and oxidized biotite; locally contains sparse oxidized amphibole

bgr BIOTITE GRANOPHYRE (PRECAMBRIAN)--Pink, brown-weathering porphyritic, with glomerophenocrysts of alkali feldspar, single phenocrysts of plagioclase, both as large as 1 cm; and slightly resorbed quartz to 4 or 6 mm in a micrographically intergrown groundmass of quartz and alkali feldspar. Chloritized biotite is the chief mafic mineral but sparse oxidized hornblende or, locally, arfvedsonite or kataphorite is present. At Jibal Matalli the phenocrysts vary from mostly alkali feldspar to mostly plagioclase.

ap BIOTITE APLITE (PRECAMBRIAN)--Pink, pale-brown-weathering aplite. Mostly monzogranite, but fine grained; somewhat porphyritic with a few euhedral alkali feldspar or plagioclase phenocrysts as long as 6 mm in a sugary textured groundmass of quartz, alkali feldspar, and plagioclase. Texturally resembles a fine-grained, well-sorted arkosic sandstone; locally contains fairly abundant tiny flakes of biotite. Intrudes granodiorite and pink biotite-granite of the mixed assemblage, and pink biotite granite of Jabal Routh, where the aplite is porphyritic

ma MIXED ASSEMBLAGE ROCKS (PRECAMBRIAN)--Chiefly gray, biotite-rich, fine- to medium-grained granodiorite that probably intrudes masses of pink biotite-granite (see below); fine-grained aplite containing variable amounts of biotite as tiny flakes is widespread. Locally, with numerous small pendants of metasedimentary and volcanic rocks probably derived from the Hadn formation; commonly, with numerous veins of buff quartz that are mostly less than 1 m wide and that weather to angular fragments

pbg PINK BIOTITE GRANITE (PRECAMBRIAN)--Pink monzogranite with average grain size varying from 4 to 5 mm to as much as 8 mm. In most localities contains a few grains of quartz as large as 1 cm, and a few alkali feldspar as large as 1.2 cm. Typically, 35 percent quartz, 35 percent alkali feldspar (orthoclase and perthite) and 25 to 30 percent plagioclase. Biotite varies from less than 1 percent to as much as 5 percent. Weakly jointed and weathers to massive, rounded outcrops

gd GRANODIORITE (PRECAMBRIAN)--Light-pinkish-gray, medium-grained granodiorite; a single thin section along the southern border contained 22 percent quartz, 21 percent alkali feldspar, 47 percent plagioclase, and 10 percent altered mafic that appears to be mostly after biotite; well jointed, locally sheared. This granodiorite is intruded by the pink biotite-granite

to TONALITE (PRECAMBRIAN)--Gray; quartz content varies from 25 percent in the tonalite exposed in the west-central part of the quadrangle to as much as 52 percent in the southeastern part; contains 41 to 70 percent plagioclase, less than 3 percent alkali feldspar, and from 3 to 17 percent propylitized mafic minerals that appear to be after both biotite and hornblende. In both localities the tonalite intrudes Hadn formation

HADN FORMATION (PRECAMBRIAN)

hat Ash-flow tuffs--Gray to pink-gray, flinty-fracturing; flattened pumice lapilli that are darker than the enclosing matrix. Shards are well preserved; contains 15 to as much as 25 percent small phenocrysts; typically, contains subequal alkali feldspar and quartz, both as large as 3 mm; mafic minerals are sparse and completely oxidized; locally, contains sparse plagioclase

hac Conglomerate--Dark-gray conglomerate lenses; unstratified except near top where rock grades abruptly into sandstone. Consists of unsorted boulders, cobbles, pebbles, and granules in a fine- to coarse-grained sandstone matrix. Boulder-sized fragments are well rounded; pebble sized are angular to subangular, intermediate sized are gradational in rounding between the two extremes. Clasts consist of about 70 percent volcanic rocks ranging in composition from rhyolite to basalt, and 30 percent granitic rocks ranging in composition from tonalite to syenogranite. Lenses are as thick as 100 m

hal Limestone and marble--Limestone; dark gray and black, dense, weathers blue and gray; mostly metamorphosed to white marble. Thin-bedded and not crenulated

ha Hadn formation, undivided--Rocks in the southeastern part are principally gray, thin-bedded, evenly stratified sandstone, siltstone, and mudstone. Rocks in the northwestern part tend to be purple-gray and dark-purplish-gray, more argillaceous, and with a few thin beds of limestone. Rocks in both areas contain lenses of rhyolitic ash-flow tuff and conglomerate. Thin lenses black or green of basalt are common in both areas but tend to be more abundant in the northwest. Thickness, 3,000+ m

hag HADN FORMATION AND GRANITIC ROCKS, UNDIVIDED (PRECAMBRIAN)--Mixture of Hadn formation and variegated granitic rocks in an area of extremely poor exposures

di DIORITE (PRECAMBRIAN)--Gray to green-gray, medium-grained, weakly foliated, weakly propylitized diorite. Rocks in the two localities contain 8 to 13 percent quartz, 62 to 65 percent plagioclase, 20 percent hornblende, and 5 percent biotite

hu HULAYFAH GROUP (PRECAMBRIAN)--Dark-green, green-gray, and black basalt; mostly dense greenstone or greenschist facies; intruded locally by dark-green, fine- to medium-grained diabase and pink aphanitic rhyolite. Thickness, at least several hundred meters

SYMBOLS

CONTACT--Approximately located; queried where uncertain

FAULT--Inferred and concealed; arrows show relative horizontal movement; bar and ball on downthrown side; in section, T = toward, A = away from observer

SYNCLINE--Showing approximate location of axial trace; queried where uncertain

STRIKE AND DIP OF BEDDING

- Inclined, showing dip
- Inclined, showing direction of dip
- Vertical
- Distorted, steeply dipping

VERTICAL JOINT

IGNEOUS DIKE--Showing dip

SAMPLE LOCALITY--Showing sample number

Prefix 203, E. B. Ekren
Prefix 128, D. B. Stoeser
Prefix 155, J. S. Stuckless
Prefix E, J. E. Elliott

Note the prefix may be left off in areas where space is limited; prefix is the same as nearby samples. Also at some outcrops, sample numbers are shown by bedding symbols or other point symbols indicating station locality

VILLAGE AND FARMING AREA