Aerial photography 1953, controlled mosaic 1955,
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

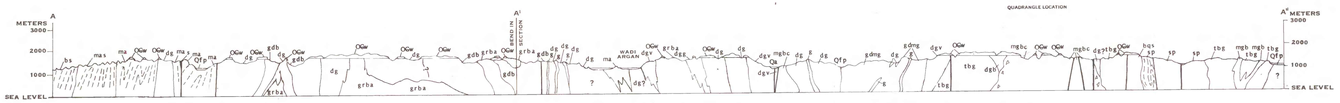
2 0 2 4 6 8 10 KILOMETERS

2 0 2 4 6 8 10 MILES

DATUM IS MEAN SEA LEVEL

Geology mapped in December 1978 and April and May 1979

QUADRANGLE LOCATION




# RECONNAISSANCE GEOLOGY OF THE WADI HABAWNAH QUADRANGLE, SHEET 17/44 A, KINGDOM OF SAUDI ARABIA

by
Edward G. Sable
1984

## EXPLANATION

### CORRELATION OF MAP UNITS

SEDIMENTS, AND SEDIMENTARY AND AND LAYERED ROCKS

| | | | | | |
|---|---|---|---|---|---|
| Qa | Qfp | Qdt | Qdl | Qsu | QUATERNARY — CENOZOIC |
| Qst | Qgp | | | | |
| Qgt | | | | | |

UNCONFORMITY

| | |
|---|---|
| OGw | ORDOVICIAN and CAMBRIAN — PALEOZOIC |

UNCONFORMITY

INTRUSIVE AND MIXED ROCKS

| | | | |
|---|---|---|---|
| rd | rf | ap | sap |
| agpa | sp | agm | spo |
| gdb | | | |
| mgbf | | | |
| grba | | | |
| mgb | mgbc | | |
| tbg | gdmg | | |
| dg | | | |

| | | | |
|---|---|---|---|
| Halaban group | bs | ? | ? |
| | mas | lg | bqs |
| | ma | ? | ? |

g — PRECAMBRIAN

dgv

dgg

## DESCRIPTION OF MAP UNITS

### CENOZOIC SEDIMENTS

ALLUVIUM AND COLLUVIUM

**Qa** — WADI ALLUVIUM--Sand, gravel, and silt along floodplains and channels of major wadis and their major tributaries

**Qfp** — FAN AND PEDIMENT DEPOSITS--Locally derived, unconsolidated, poorly sorted, generally angular clasts that are variable in shape, size, and composition; unit includes some alluvium and colluvium

**Qst** — SILT TERRACE DEPOSITS--Light-tan marly silt and silty marl, in part carbonaceous, containing interbedded minor lenses of sand and gravel; probably of eolian origin and in part deposited in lacustrine and alluvial environments

**Qgp** — GRAVEL PLAIN DEPOSITS--Brown to tan sand, silt, and gravel; unit includes minor eolian sand and silt; occurs generally at higher altitudes than Qgt but in part merges with Qgt

**Qgt** — GRAVEL TERRACE DEPOSITS--Brown to tan sand and gravel having clasts to small boulder size above and along present wadi flood plains

EOLIAN SAND AND DESERT REGOLITH--Mapped on basis of dominant sand dune morphology

**Qdt** — TRANVERSE DUNES--Buff to light-brown, fine- to very fine grained, well-rounded sand in low, discontinuous, crescentic to sinuous, northwest-trending dunes with south-facing slip-faces that trend nearly normal to the linear dunes; many partly covered by sparse vegetation and may be stabilized

**Qdl** — LINEAR DUNES--Sand similar to that in Qdt unit in low, narrow, straight southwest-trending dunes separated by areas of thin sheet sand and gravel plain or gravel terrace deposits

**Qsu** — UPLAND SAND DEPOSITS--Light-buff, medium- to very fine grained; unit occurs as fill of depressions in Wajid Sandstone surfaces; locally derived and mixed with colluvium and clasts of underlying bedrock

### PALEOZOIC SEDIMENTARY ROCKS

**OGw** — WAJID SANDSTONE--Gray to red, coarse-grained to pebbly, highly crossbedded quartz sandstone; iron oxides abundant at and above nearly planar base that rests with sharp angular unconformity on Precambrian units or on their weathered residuum; case-hardened surface and friable interior; basal beds locally conglomeratic; lower part of unit locally contains red-weathering siltstone and shale. Rare trace fossils consist of tracks, trails, and borings. Contains a few well-cemented fractures that weather to linear ridges ( )

### PRECAMBRIAN INTRUSIVE AND MINERALIZED ROCKS

**do** — MAFIC DIKES AND SILLS--Dark-gray to grayish-green aphanitic basalt, andesite, and greenstone; in part porphyritic with diabasic to trachytic texture; massive to schistose; probably represent two or three intrusive episodes; may be in part of Tertiary age. Attitude shown where known

**qz** — QUARTZ CONCENTRATION--Milky white, light-gray and light-greenish iron-oxide-stained quartz, irregular to circular in plan view or as stockwork of abundant veins. Mapped only in Ghezm pluton

**ep** — QUARTZ-EPIDOTE ROCK--Irregularly shaped concentration of fine-grained quartz-epidote rock in granite, locally with magnetite. Occurs in many places, mapped only in Najran pluton

**do** — FELSIC TO INTERMEDIATE COMPOSITION DIKES AND SILLS--Reddish-gray to medium-dark-gray, flinty, cryptocrystalline to fine grained, commonly porphyritic, massive to cleaved rhyolite and dacite. Attitude shown where known

**sgc** — COARSE-GRAINED BIOTITE SYENOGRANITE--Very leucocratic, pale to moderate red, coarse- to medium-grained, allotriomorphic, in part porphyritic; mostly structureless but locally sheared and cataclastized; locally anomalous tin and molybdenum content. Posttectonic

**rf** — RHYOLITE-DACITE FELS--Reddish- to dark-gray aphanitic, flinty, having conchoidal fracture, porphyritic; in places contains biotite and sodic amphiboles riebeckite and arfvedsonite; microcrystalline quartzofeldspathic groundmass with small phenocrysts or phenoclasts of plagioclase, potassium feldspar, and locally quartz; in part granophyric. Probably related to intrusion of granites of the Najran and Ya'arah plutons, in part as hypabyssal intrusive facies, in part as alteration product of pre-existing metavolcanic flow rocks (ma) and dioritic rocks (dg)

**rd** — RHYOLITE OR DACITE--Gray, weathers rust-colored; quartzofeldspathic microcrystalline groundmass having plagioclase and potassium feldspar phenocrysts; quartz-veined, iron-oxide stained. Exposed in three small bodies along western boundary of quadrangle; interpreted to be of hypabyssal origin but may be boudined felsic tuff

**ap** — APLITE--Gray to pink, with microcrystalline saccharoidal texture of quartzofeldspathic groundmass with sparse phenocrysts of potassium feldspar; of monzogranite composition. Mappable dikes cut granite of Najran pluton

**sap** — SYENOGRANITE APLITE--Gray to pink, weathers light brown, contains biotite and sodic amphibole; aphanitic to fine grained. Mapped in large dike which crosses rocks deformed by Walih pluton; believed related to perthite granite of Ya'arah pluton

**agpa** — SODIC AMPHIBOLE PERTHITE GRANITE--Distinctive major granite unit, primarily perthite granite with alkali granite facies; leucocratic to submesocratic; brownish gray, olive gray, and locally pale red to reddish brown; medium to coarse grained; massive and structurally isotropic to weakly foliate except for cataclasite and augen gneiss along zones of shear; minerals include highly perthitic microcline, weakly strained quartz, biotite, hornblende,ferrohastingsite, and sodic amphiboles including arfvedsonite and riebeckite, and minor clinopyroxene. Posttectonic or late tectonic in Najran and Ya'arah plutons, but appears syntectonic in A'sud pluton

**sp** — PYROXENE SYENITE--Gray to yellowish-gray clinopyroxene alkali-feldspar syenite and leucocratic alkali-feldspar granite, mostly fine-grained, with seriate texture; contains colorless and olive-green pyroxene, magnetite, minor biotite, plagioclase, orthoclase, blasts or phenocrysts of perthitic microcline, and secondary bluish-green to green amphibole. in Eargairth and Shubaruk stocks; may be coveal with and related to rocks of agpa

**agm** — MAGNETITE ALKALI-FELDSPAR GRANITE--Gray to yellowish-gray, leucocratic, generally fine-grained, with seriate texture; magnetite associated with hornblende and biotite; groundmass largely of microcline and quartz having blasts or phenocrysts of perthitic microcline and quartz. May be coeval with and related to rocks of agpa

**spo** — PYROXENE OLIVINE SYENITE--Dark-olive, gabbroic in appearance, fine- to medium-grained; unaltered; mafic minerals are olive-green to light-green clinopyroxene, fayalite, and secondary blue-green to light-green amphibole; seriate-textured with microcline, perthitic orthoclase(?) rimmed by albite and calcic plagioclase. Mapped in two small bodies in or near Eargairth and Shubaruk stocks; may be coeval with and related to rocks of agpa

**gdb** — BIOTITE GABBRO AND DIORITE--Gray to dark-gray, fine- to coarse-grained, allotriomorphic, generally unaltered; gabbro contains olivine, augite, and commonly large glomerocrysts of biotite, magnetite, and kaersutite; diorite contains hornblende, augite, and biotite. Occurs mostly in area of the Zilm plutonic complex

**mgbf** — FINE-GRAINED BIOTITE MONZOGRANITE--Grayish-pink to reddish-orange leucocratic, fine- to medium-grained, with seriate texture to distinctly bimodal-i-sized quartz and microcline; mostly foliate and in part gneissic. Mapped in Thar and Walih plutons

**grba** — BIOTITE-AMPHIBOLE GRANITE--Pink to reddish-orange, fine- to coarse-grained, foliated to massive, leucocratic to subleucocratic syenogranite and monzogranite with minor alkali-feldspar granite; characteristic minerals are perthitic microcline, olive-brown to yellow biotite, probable ferrohastingsite, and more rarely hornblende and unidentified amphibole, minor clinopyroxene, and variably strained quartz

**mgb** — BIOTITE MONZOGRANITE--Pink to reddish-orange, leucocratic, fine- to medium-grained, generally foliate; with biotite, weakly perthitic to perthitic microcline, strained quartz, locally minor hornblende, and unidentified amphiboles; generally variable-textured

**mgbc** — COARSE-GRAINED BIOTITE MONZOGRANITE--Pink, reddish, and orange, leucocratic, coarse- to medium-grained with seriate to very seriate texture, weakly to strongly foliate, at least in part polymetamorphosed; contains septa of older rocks; in part migmatitic; includes minor syenogranite. Minerals include biotite, hornblende, and minor clinopyroxene; microcline as partial replacement of plagioclase and as large porphyroblasts; quartz highly strained; with locally abundant magnetite and red spinel. Interpreted to be syntectonic

**g** — GRANITE, UNDIVIDED--Pink, reddish, and orange, very fine to medium-grained, generally foliate monzogranite to syenogranite as lenses, pod-like bodies, folded tabular bodies, and dikes. Located mostly by aircraft surveillance and aerial photograph interpretation

**tbg** — BIOTITE TONALITE GNEISS--Ranges from quartz diorite to granodiorite; medium-light-gray to medium-dark-gray, fine- to medium-grained equigranular with plutonic subdiabasic texture and "salt and pepper" appearance; mildly to strongly foliate; mineral banding common; contains biotite and lesser hornblende having clinopyroxene cores, zoned plagioclase, strained quartz, and scattered microcline porphyroblasts

**gdmg** — GRANODIORITE GNEISS AND MONZOGRANITE, UNDIVIDED--Largely granodiorite gneiss, gray to pink, fine- to medium-grained, mesocratic with color index of 15 to 25, foliate, with seriate plutonic texture and microcline as porphyroblasts and replacements of plagioclase; in part migmatitic. Interlensed and gradational with granite; appears transitional with coarse-grained biotite monzogranite of unit mgbc and tonalite and granodiorite of unit tbg

**dg** — METADIORITE AND METAGABBRO--Medium- to medium-dark-gray, mesocratic to melanocratic, fine- to medium-grained to rarely coarse grained, with dibasic texture; contains green hornblende, brown biotite in part altered to chlorite, and commonly saussuritized plagioclase; generally weakly foliate. Forms a widespread unit that has been affected by later granite plutonism

**dgg** — MIXED DIORITIC, GABBROIC, AND GRANITIC GNEISSIC ROCK--Mafic country rock of metadiorite like that described for metadiorite-metagabbro unit dg, which ranges to tonalite in generally migmatitic terrane; invaded and altered largely by monzogranite like that in units mgb and mgbc, which occurs as lit-par-lit stringers, lenses, irregular to tabular concordant and discordant bodies, agmatite, and ptygmatic folds; microcline porphyroblasts and replacement of plagioclase common. Discrete granite bodies (g) shown where map scale permits. In A'ashiba gneiss complex some of mixed tonalitic and granitic rock mapped as tbg and gdmg

**dgv** — METADIORITE, METAGABBRO, AND VOLCANIC FLOW ROCK, UNDIVIDED--Mostly intrusive country rock of unit dg with large septa and inclusions of meta-andesite and metabasalt similar to unit ma

### PRECAMBRIAN LAYERED ROCKS

HALABAN GROUP

**bs** — BIOTITE SCHIST--Generally subleucocratic gray to tan metamorphosed pelitic and psammitic dacitic volcaniclastic and epiclastic rock containing few interlayered andesitic flow rocks; includes biotite-quartz-garnet schist, tuffaceous metagraywacke, lapilli metatuff, gray to variegated slate and argillite, distinctive, poorly resistant graphitic slate and phyllite, and minor dark-gray graphitic marble and dolostone

**mas** — META-ANDESITE AND SCHIST--Interlayered volcaniclastic, epiclastic, and metavolcanic flow rock similar to units bs and ma

**ma** — META-ANDESITE--Dominantly medium-dark- to dark-greenish-gray andesitic to basaltic metavolcanic flow rock; dense, aphanitic, locally a flow breccia; massive to cleaved, in part amygdaloidal, locally porphyritic, few pillow structures present; interlayered with dark-greenish amphibolitic schist and minor volcaniclastic and epiclastic rock similar to unit bs

**lg** — LEUCOGNEISS--Very leucocratic, in part garnetiferous quartzofeldspathic gneiss, biotite-hornblende-plagioclase-quartz schist, and apparently interlayered amphibolite. Mapped along southern border of quadrangle; better exposed in adjoining Najran quadrangle; interpreted to be paragneiss

**bqs** — BIOTITE QUARTZ SCHIST--Generally gray subleucocratic schistose and gneissic rock exposed in several belts in southern part of quadrangle; includes biotite-pyrobole-plagioclase-quartz schist, biotite-amphibole-quartzo-feldspathic schist, biotite-microcline-albite-muscovite-quartz schist and schistose gneiss, and apparently interlayered tonalite, quartz diorite, and amphibolite gneiss. May in part represent recrystallized mylonite; interpreted to be largely paraschist and paragneiss

## SYMBOLS

CONTACT--Showing direction of dip

FAULT OR ZONE OF SHEAR--Dashed line represents inferred concealed fault. Arrows indicate sense of displacement; bar and ball on downthrown side.

SHEAR ZONE

SYNFORM--Showing troughline and direction of plunge, where known

ANTIFORM--Showing crestline and direction of plunge, where known

MONOCLINE--Arrow shows direction of dip

STRIKE AND DIP OF BEDS

Vertical

Inclined--Tops not implied

STRIKE AND DIP OF FOLIATION (Includes cleavage)

Vertical--May represent primary or superimposed foliation

Inclined--May represent primary or superimposed foliation

STRIKE AND DIP OF JOINTS

Vertical

Inclined

TREND LINES--From aerial photographs

AVERAGE DIP DIRECTION AND DEGREE OF FORESET BEDDING

SULFIDE-BEARING ROCKS

PAVED HIGHWAY

GRADED ROAD