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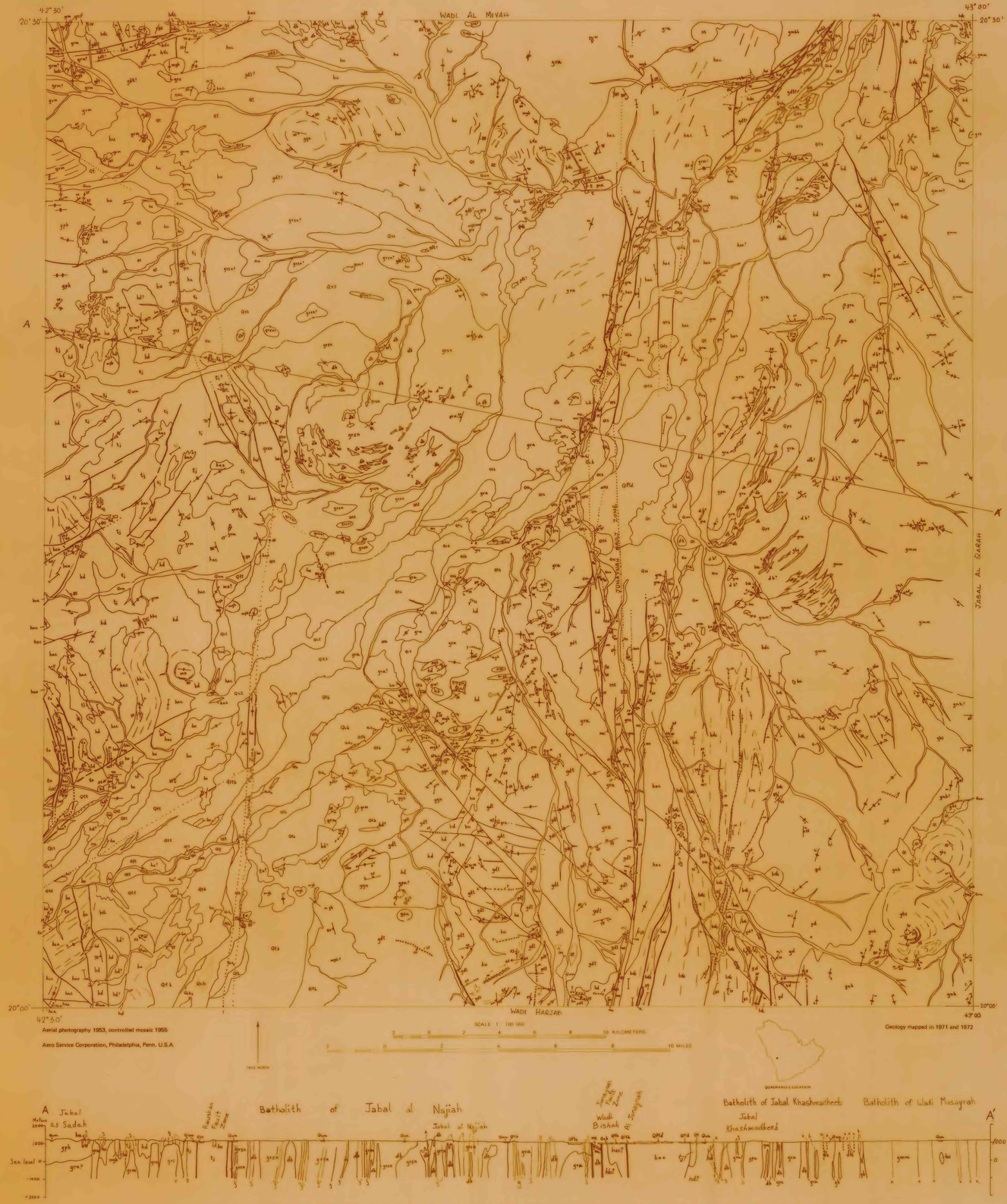
PLATE I



GEOLOGY OF THE AL JUNAYNAH QUADRANGLE, SHEET 20/42 D, KINGDOM OF SAUDI ARABIA

by

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DESCRIPTION OF MAP UNITS

INTRUSIVE ROCKS

q — QUARTZ VEIN--Small, lenticular, 1 m or less thick; locally contains sparse pyrite, base-metal sulfides and trace of gold

qz — QUARTZ BRECCIA ZONE--Silicified breccia in small fracture zone; mostly Najd age, a few may be older

a — ALTERATION ZONE--Propylitized rock in fracture zone, commonly 1 to 10 m wide, central part weathers reddish brown from oxidation of disseminated pyrite; may contain calcite-quartz veinlets

d — DIABASIC DIKE--Mostly deuterically(?) altered, commonly 1 m to several meters thick; locally associated with rhyolite. Mostly in northwest-trending fractures of Najd age

sf — SHEAR-FRACTURE ZONE--Brecciated, sheared, and altered zone where conspicuously exposed; 1 m to 10 m wide; commonly weathers reddish brown

d — DIABASIC DIKE--In places associated with rhyolitic dike (r)

r — RHYOLITIC DIKE--Red, commonly granophyric, porphyritic; in places associated with diabasic dike (d)

b — BASALT DIKE--Associated with gabbro of Jabal as Sidan

gbs / sg — GABBRO OF JABAL AS SIDAN--Dark-gray, medium-grained leucogabbro and subordinate dunite in concentrically layered pluton, mostly in steep dipping, thick layers; dunite mostly altered to serpentinite (sp); posttectonic

gpa — PERALKALIC GRANITE--Light-gray to light-red, fine- to coarse-grained, leucocratic, perthitic alkali granite containing sparse acmite, relbeckite, aenigmatite, and fluorite; contact inferred; posttectonic

gph — GRANOPHYRE--Dark red-brown, very fine to medium-grained, slightly porphyritic rock

gnf — FINE-GRAINED GRANITIC GNEISS--Red, fine-grained, leucocratic, crystalloblastic gneiss

s / ss — SYENITIC DIKE AND PLUG--Red-brown or blue-gray, very fine to fine-grained rock, some aphanulitic; some 1m thick dikes (s) and plugs or small stocks (ss); most probably related to alkali-feldspar granite plutonism

k — MICROGRANITE DIKE--Red, fine grained, leucocratic, biotite monzogranite to alkali-feldspar granite; various ages, spans time of posttectonic granite plutonism; crosshatch indicates many crisscrossing dikes in surrounding area

a — APLITE--Red, fine-grained, leucocratic, granite

p — PEGMATITE--Red, coarse-grained, leucocratic, granite

grs — ALKALI-FELDSPAR GRANITE--Red, medium- to coarse-grained, hornblende-perthite granite containing some biotite and fluorite; in large plutons, type is semiring-structured batholith of Jabal Khashmadheeb; posttectonic

grsn — SYENOGRANITE OF JABAL AL NAJIAH--Red, fine and coarse-grained, leucocratic, biotite-perthite, monzogranite and syenogranite; in ring-structured batholith of Jabal al Najiah; posttectonic

grs — SYENOGRANITE--Red, medium and coarse-grained, leucocratic, biotite-perthite granite in small plutons and stocks; most is probably related to the alkali-feldspar granite; posttectonic

db — DIABASE--Dark, fine- to medium-grained, diabasic texture, commonly contains abundant biotite; a small amount grades to diabasic hybrid to granitic hybrid; diabase is comagmatic with alkali-feldspar granite

mz — MONZONITE--Medium-gray to red-gray, medium-grained, gneissic, flow foliated, contains hornblende (15 to 25 percent); incompletely mapped

dg — DIABASIC HYBRID AND GRANITIC HYBRID DIKES--Red and gray, fine-grained porphyritic; associated with alkali-feldspar granite and diabase

grm — MONZOGRANITE--Pink, medium-grained biotite granite in plutons and small stocks; posttectonic

gmbh — MONZOGRANITE, HORNBLENDE-BIOTITE--Red, Medium- to coarse-grained granite; part of large pluton in the quadrangle to the north, posttectonic

gmn• — GRANODIORITE-MONZOGRANITE OF WADI MUSAYRAH--Light-gray, fine- to medium-grained, biotite granite; commonly mineral foliated, some flow layering; late synkinematic; quadrangle contains western half of the Wadi Musayrah batholith

f — FELSIC DIKE--Gray, fine-grained, leucocratic rock of variable composition and age, older than the red microgranite dikes (g); light-gray alaskitic dikes and micro-granodioritic dikes may be same age as the Wadi Musayrah batholith; some porphyritic dacitic dikes may be as old as the metavolcanic rocks

gmh — MIGMATITE OF JABAL UMM AL HASHIYAH--Light-gray, fine and medium-grained, biotite, interlayered granodioritic and monzoquanitic gneiss, synkinematic

ggn — GRANITIC GNEISS--Light-gray, fine and medium-grained, biotite migmatitic gneiss of granodioritic to syenogranitic composition; synkinematic; probably correlates in time with the migmatite of Jabal Umm al Hashiyah

gd — GRANODIORITE--Gray, medium-grained, hornblende-biotite rock; pretectonic; moderately foliated and metamorphosed

m — MAFIC DIKE--Melanocratic rock of variable composition and age; many are basaltic, some are porphyritic andesite

gdt — GRANODIORITE AND TONALITE--Medium- to light-gray, medium-grained, hornblende-biotite and biotite rock of variable composition from tonalite to granodiorite; pretectonic; nondeformed to intensely sheared, metamorphosed with variable redistribution of potassium feldspar; unit, as mapped, includes some younger granitic rocks

to — TONALITE--Medium-gray, medium-grained, biotite-hornblende rock; constitutes contact zone of large trondhjemite batholith to west; pretectonic; shear foliated, metamorphosed, with irregular zones of potassium metasomatism

tj — TRONDHJEMITE--Medium-gray, medium-grained, hypidiomorphic granular, biotite-hornblende rock; pretectonic; subsequently deformed, metamorphosed with local irregular zones of potassium metasomatism

hd — HORNBLENDE DIORITE--Dark-gray, medium-grained, massive diorite, grades to quartz diorite and low-quartz tonalite; may locally include metagabbro; subvolcanic; extensively metamorphosed

mgb / sp — METAGABBRO--Dark-gray to black, medium-grained gabbro in small plutons, includes leucogabbro, and locally subordinate ultramafic rock altered to antigoritic serpentinite (sp); subvolcanic; extensively metamorphosed

CORRELATION OF MAP UNITS

INTRUSIVE ROCKS

UNCONFORMITY

UNCONFORMITY

UNCONFORMITY

UNCONFORMITY

SEDIMENTARY, VOLCANIC, AND METAMORPHIC ROCKS

Qwa — WADI ALLUVIUM--Nondivided

Qcb / Qct — CHANNEL ALLUVIUM--Present-day channel sand and gravel of Wadi Bishah (Qcb) and of Wadi Tabalah (Qct) and recently abandoned channel deposits of Wadi Bishah (Qcb_2)

Qfb / Qft — FLOOD-PLAIN DEPOSIT--Present-day flood silt of Wadi Bishah (Qfb) on terraces 1 to 2 m high, and silt on slightly higher terraces and flood channels (Qfb_2) that are inundated only during largest floods; flood silt of Wadi Tabalah (Qft) on terraces and high-level channels, about 1 m high

Qps — PEDIMENT DEPOSIT--Locally derived sand and gravel and washed eolian sand on pediments; included presently active pediments and pediment terraces; deposits are widespread but only locally mapped

Qss — PEDIMENT FLOOD SAND--Reworked eolian sand on large pediments; entire surface is flooded and worked during heavy rains

Qds — DUNE SAND--Mobile eolian sand in barchan dunes

Qsb — SALINE ALLUVIUM--White, saline-encrusted alluvium

Qtb / Qt — TERRACE DEPOSIT--Sand and gravel of Wadi Bishah (Qtb) on cut terrace, to about 7 m high; Qtb, on less abundant higher terraces; sand and gravel of Wadi Tabalah (Qtt) on cut terrace

Qt — TERRACE DEPOSIT, NONDIVIDED--Sand and gravel on small cut terraces of wadis and on pediment terraces

Q1tb, Q1tt — LOESSIC SILT--Buff, loessic silt of Wadi Bishah (Q1tb) and Wadi Tabalah (Q1tt) in aggradational terrace (on Wadi Bishah about 11 m high); commonly forms a miniature badland topography; altithermal age

QPld — DUNE SAND, STABILIZED--Buff, eolian sand deposit with subtle, eroded dune form

QPls — LOESSIC SILT DEPOSIT--Buff, faintly to moderately thick-bedded, reworked loess; underlies Holocene deposits of Wadi Bishah

MURDAMA GROUP

ms — SANDSTONE AND SILTSTONE--Reddish-gray, thick, well-bedded, interbedded gritstone and sandstone grading upward to thin well-bedded, fine-grained sandstone and siltstone

mc — POLYMICTIC CONGLOMERATE--Dark reddish gray, thick-bedded to massive, coarse conglomerate derived largely from underlying granitic rocks and filling paleovalleys and paleochannels

HALABAN GROUP

hdc — DACITIC AND VOLCANICLASTIC ROCKS--Light brown to green, well bedded sedimentary rock derived from volcanic rocks, includes marble (m) and tactite (t); abundant dacitic to rhyodacitic, crystal and lithic tuffs, subordinate dacitic and andesitic flows; metamorphosed to greenschist facies, grades locally to higher grade hornfels facies

hac — ANDESITIC AND VOLCANICLASTIC ROCKS--Dark-green, fine-grained, andesitic pyroclastic tuffs, subordinate basaltic and andesitic flows and minor dacitic rocks, associated volcaniclastic rocks common; metamorphosed to greenschist facies, grades locally to higher grade hornfels facies

hca — VOLCANICLASTIC AND ANDESITIC ROCKS--Light- to medium-gray, fine-grained, well-bedded, volcaniclastic rocks of andesitic derivation, subordinate dacitic tuffs, sparse andesitic and basaltic flows; metamorphosed to greenschist facies, commonly grades to higher grade hornfels facies

hbc — BASALTIC AND VOLCANICLASTIC ROCKS--Dark-green, fine-grained, porphyritic andesitic and basaltic; metamorphosed to greenschist facies, commonly grades to higher grade hornfels facies

hu — NONDIVIDED ROCKS OF HALABAN GROUP--Volcanic and volcaniclastic rocks, metamorphosed to amphibolite facies, includes marble (m); used chiefly where rocks have not been classified according to principal volcanic type; includes small inclusions in some intrusive rocks

m / t — MARBLE--In various rocks of the Halaban group as indicated

TACTITE--In various rocks of the Halaban group as indicated

SYMBOLS

CONTACT--Dashed where approximately located, dotted where concealed

FAULT--Showing relative horizontal movement, dashed where approximately located, queried where inferred, dotted where concealed

FOLD AXES

Minor anticline, showing plunge

Minor syncline, showing plunge

Minor folds, showing plunge of axes

Major syncline, showing direction of plunge

PLANAR FEATURES AND LINEAR FEATURES

Planar and linear symbols may be combined

STRIKE AND DIP OF BEDDING

Inclined; arrow points toward top of bed

Inclined; arrow showing paleocurrent flow direction from rippelmarks (corrected for dip of bedding)

Vertical

Overturned

STRIKE AND DIP OF FOLIATION OR SCHISTOSITY

Inclined

Inclined, showing plunge of lineation

Inclined, strike variable

Vertical

Vertical; of secondary foliation

Horizontal

Letter symbols indicate type of folliation:

b — banding or layering

i — inclusions

m — mineral, commonly biotite

sf — shear fracture, late

STRIKE AND DIP OF CLEAVAGE

Inclined

Vertical

BEARING AND PLUNGE OF LINEATION

Plunging

Plunging, plunge variable

Letter symbols indicate type of lineation

r — rodding

p — pebble or inclusion alinement

t — tectonic shear, mineral alinement

STRIKE AND DIP OF JOINTS

Inclined, dominant joint set

Inclined, secondary joint set: r indicates red weathering; m, mineral-coated; a, altered wall rock

Vertical, dominant joint set

Vertical, secondary joint set, variable strike

Horizontal, secondary joint set

STRIKE AND DIP OF DIKE OR VEIN

Inclined

Vertical

TREND LINES--Average trend of bedding in metavolcanic rocks and composition layering in plutonic rocks

MINE OR PROSPECT

Small ancient mine or prospect; letter symbol identifies site in text

Mineral site; letter symbol identifies site in text

OTHER

Bir (well), ephemeral

Sample number and location of radiometric age determination

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards.