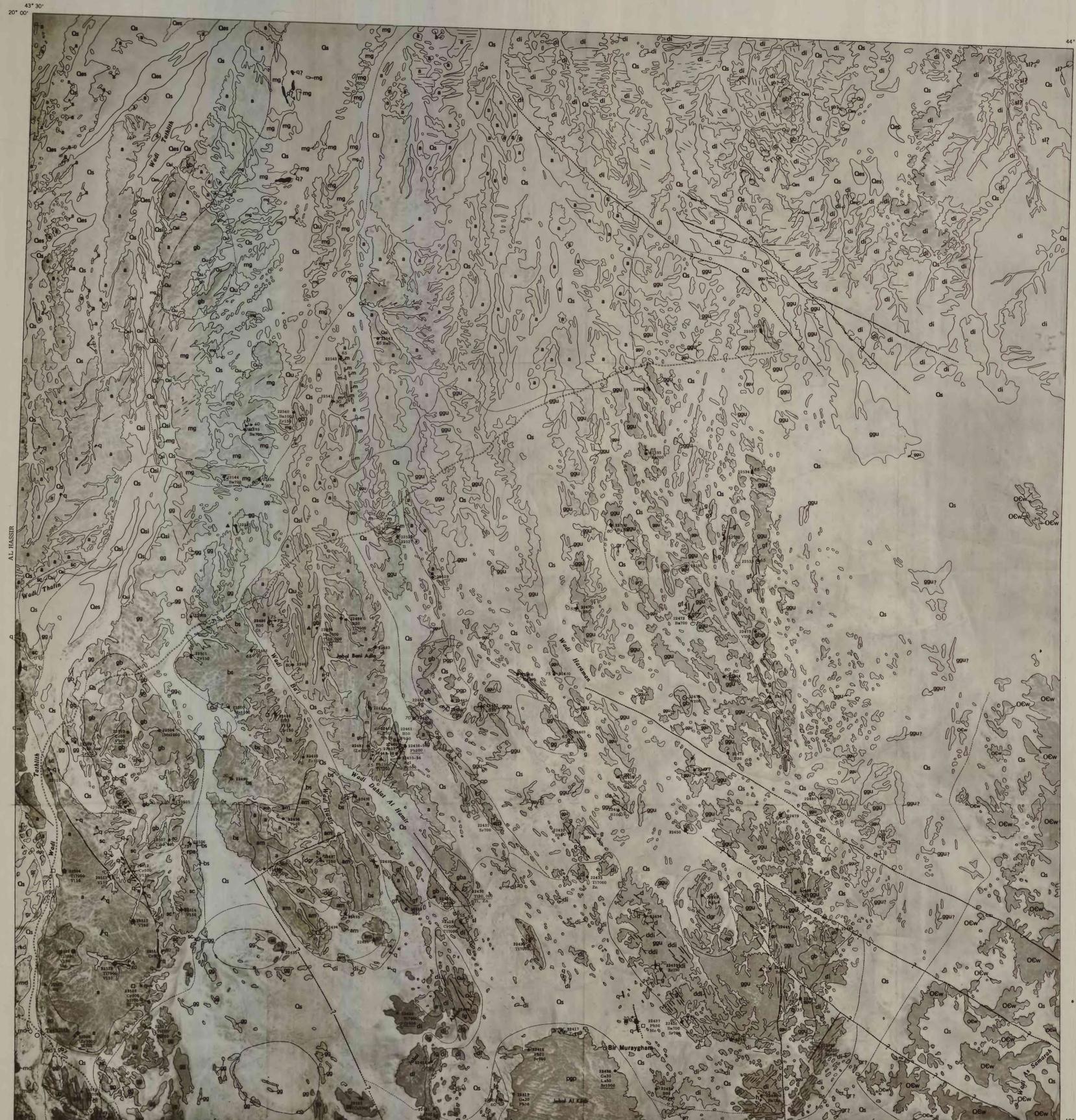


EXPLANATION



PLUTONIC AND HYFBYSSAL INTRUSIVE ROCKS,  
NONLAYERED METAMORPHIC ROCKS

LAYERED SEDIMENTARY, PYROCLASTIC,  
AND METAMORPHIC ROCKS

SELECTED ELEMENTS IN RECONNAISSANCE SAMPLES  
Showing sample numbers and results of  
spectrographic analyses of wadi sand

- Qst  
Aeolian sand  
*Mobile, in dunes*
- Qs  
Alluvial and aeolian sand  
*Poorly sorted alluvial sand along wadi floors; includes small areas of mobile aeolian sand*
- Qsi  
Silt  
*Silt and associated fine sediments generally deposited by floods above restrictions in wadi; locally in poorly drained depression*
- Qu  
Alluvial fan and terrace deposits
- UNCONFORMITY
- OEW  
Wajid Sandstone  
*Reddish brown, yellow, tan, and white crossbedded sandstone, limestone and hermitite-cement layers and concentrations, thin conglomerates and clay lenses, locally overlies saprolite*

**COPPER, ZINC, AND MOLYBDENUM**

- Location of sample with 20 ppm (parts per million) or less copper; also, less than 100 ppm zinc and 2 ppm or less molybdenum, unless otherwise indicated
- Location of sample with 30 to 50 ppm copper; also less than 100 ppm zinc and 2 ppm or less molybdenum unless otherwise indicated
- Location of sample with 70-100 ppm copper; also less than 100 ppm zinc and 2 ppm or less molybdenum unless otherwise indicated; Cu = threshold

**ZINC**

- △ Threshold 100 ppm zinc; located by adjacent copper symbol
- ▽ Anomalous 200-500 ppm zinc; located by adjacent copper symbol

**MOLYBDENUM**

- Threshold molybdenum, 3 ppm; located by adjacent copper symbol
- Anomalous molybdenum, 10 ppm; located by adjacent copper symbol

**OTHER ELEMENTS**

Ag, silver; B, boron; Ba, barium; Cr, chromium; Co, cobalt; Ga, gallium; La, lanthanum; Mn, manganese; Ni, nickel; Pb, lead; Sr, strontium; Ti, titanium; V, vanadium; Zr, zirconium; located by adjacent copper symbol. In ppm, parts per million

Other anomalous elements and values  
71050  
Other threshold elements and values  
(C4500)  
Threshold element in detrital magnetite by chemical analysis: 100 Cu, 700 Zn  
+  
Scheelite and/or powellite  
Present in wadi sand (superimposed on symbol for copper)

UNCONFORMITY

Rhyolite dike  
Dark grey, massive rhyolite dikes intrusive into quartz porphyry

Quartz porphyry, felsite, and quartz veins  
Brecciated and slightly chloritized pink quartz porphyry grading into granite (qp); small lenses of stained Jasper present in quartz porphyry; grey to red felsite dikes (fg); white quartz veins and masses (q)

Granite, felsite, and pegmatite  
Dikes of fine-grained white to pink biotite granite and biotite-muscovite granite grading into white, grey, pink, or red felsite, and white to pink pegmatite; dominantly granite or granite and pegmatite (g); undivided granite and felsite (gf)

Biotite granite  
Massive to flow-banded, pink to red, generally medium-grained biotite granite (gp) in distinct plutons; porphyritic phases (gpp)

Dacite and diabase dikes  
Grey to dark-grey, medium- to fine-grained dacite dikes (da); dark-grey to black, flow-grained diabase dikes (di)

Gabbro and diorite dikes  
Dark-grey to black gabbro dikes (gb) and grey diorite dikes (di); commonly form satellite dike swarms to intrusive masses of gabbro or diorite; locally, diorite dikes and diabase dikes undivided (dd)

Diorite, gabbro, and anorthosite  
Dark-grey to black, massive to granitic, medium- to coarse-grained, equigranular to porphyritic diorite, biotite-diorite, and biotite-hornblende diorite (di); locally chloritized; diorite grading into massive biotite-hornblende granodiorite (dgr); dark-grey, greenish-grey and brownish-black, massive, fine- to coarse-grained gabbro (gb); commonly interbedded diorite and gabbro (dgb); gabbro with selvages of massive anorthosite (gbs); gabbro grading locally to pyroxenite (gpy); may include some older diorite and gabbro associated with the meta-andesite unit

Granite  
Grey to pink calc-alkalic biotite granite, generally medium-grained; inequigranular to porphyritic; may have bluish-colored quartz; may include some biotite granite of the paritakic magma series

Biotite granite gneiss and biotite-hornblende granodiorite gneiss  
Light grey to grey, medium- to coarse-grained, massive to strongly foliated biotite granite gneiss (g) and biotite-hornblende granodiorite gneiss; consists between the two units generally obscure leading to the undivided map unit of biotite granite gneiss and biotite-hornblende granodiorite gneiss (gg); intrusive into metagabbro and meta-andesite

Serpentinite  
Dark-green to brownish-green, fine-grained serpentinite intrusive into meta-andesite; foliate in serpentinite commonly coated with magnetite and calcite, which also form small veins in the serpentinite

Slate, felsite, and quartzite  
Light- to dark-grey, locally schistose, slate, felsite, and quartzite adapted from Brown and Jackson (1959); may be equivalent of rhyolite (rp)

Diorite and amphibolite  
Dark microcrystic diorite, and gabbro, mainly biotite diorite, biotite-hornblende diorite, and quartz diorite, locally metamorphosed to dark grey, nonlayered, biotite-rich quartz-poor porphyroblastic gneiss (md) gabbro rocks metamorphosed to amphibolite (am)

**MINERAL RESOURCES**

**METALLIC MINERAL DEPOSITS**

- △ Avala  
Ancient mine or prospect
- Gold mine: Avala; gold prospect: unnamed

**INDUSTRIAL MINERALS AND ROCKS**

- Quartz
- 22417  
Ancient quarry for grindstones

Limestone and marble  
Chemical analysis given in table 14 for sample number with asterisk

**MINERALS OF LITTLE OR NO ECONOMIC IMPORTANCE**

- Chromite
- + Detrital scheelite or powellite
- Gossan
- Graphite
- Ilmenite
- Magnetite
- Pyrite

**CONTACT** - Dashed where approximately located or inferred; dotted where concealed

**FAULT** - Dashed where approximately located or inferred; dotted where concealed; quarry probable U, upthrown; D, downthrown

**MINOR FOLD AXIS** - Showing plunge

**STRIKE AND DIP OF FOLIATION**

- Inclined
- Vertical
- With plunge of lineation marked by oriented hornblende (h), sericite (s), chlorite (c), and biotite (b)
- With horizontal lineation marked by biotite (b)

**STRIKE AND DIP OF PRIMARY FLOW BANDING**

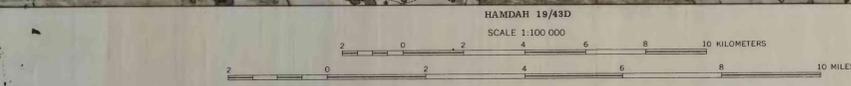
**STRIKE AND DIP OF CATACLASTIC FOLIATION** - With plunge of lineation marked by slickensides (sl), biotite and feldspar porphyroclasts (bf), chlorite (c), sericite (s), and quartz blades (q)

**POSSIBLE SHEETED CONTACT** - Elliptical feature interpreted from aerial photographs to be possible sheeted contact over unbreached intrusive

**ISOLATED OUTCROP OF MARBLE**

**LINEAMENT FROM AERIAL PHOTOGRAPHS** - Not checked on ground; may be dikes, foliation, joints, bedding, or faults

Aerial photography and controlled mosaic, 1951, for south two-thirds and aerial photography, 1955, and controlled mosaic, 1956, for north one-third. The two mosaics were controlled to different datums and are not reconcilable, but have been combined to give the best possible fit of detail and also conform to parallels and meridians for both 1951 and 1955 mosaics. A small wedge along east side from undistorted photography



RECONNAISSANCE GEOLOGY OF THE WADI HARAMAN QUADRANGLE, SHEET 19/43B, KINGDOM OF SAUDI ARABIA

By  
William C. Overstreet  
1978