



EXPLANATION

PLUTONIC AND HYPIRYSSAL INTRUSIVE ROCKS

- Peralkalic granite: Fine-grained gray to pink quartz-poor feldspathic biotite granite
- Alkalic granite: Dominantly gray, locally pink, biotite granite, fine- to medium-grained, equigranular to porphyritic

LAYERED SEDIMENTARY, PYROCLASTIC, AND METAMORPHIC ROCKS

- Qal: Sand, Alluvial, sheet wash, and aeolian sand
- Qgp: Gravel
- UNCONFORMITY
- PK: Khuff Formation: Light-colored limestone, interbedded argillaceous limestone, dolomite, marl, pyroclastic clay, shale, exposure poor, adapted from Frankamp and others, 1956
- UNCONFORMITY
- gnd: Gneissic granulite: Light-colored to dark-green gneissic granulite, diorite, and associated volcanic rocks, epidotized, chloritized, and feldspathized
- sc: Adf Formation: Dark gray and greenish gray medium- to coarse-grained graywacke sandstone, laminated argillite, calcareous graywacke, calcareous argillite, with sparse thin interbedded and lenses of gray marble metamorphosed to lowermost greenschist facies with sericite and chlorite formed in matrix, and sparse quartz-calcite veins
- zs: Z'zeiba Formation: Dark gray to greenish gray and brown graywacke pelitic conglomerate to boulder conglomerate of lowermost greenschist facies with chlorite and sericite in matrix, composed of variable mixtures of rhyolite, blue marble, gray marble, granite, andesite, diorite, and gabbro; locally the pebbles and boulders are strikingly stretched to form a lineation subparallel to axis of major syncline in conglomerate; some boulders are at least 10cm in minimum dimension
- UNCONFORMITY
- sd: Adesite, dacite, and rhyolite dikes: Dark-green, dark-brown, and dark-gray to black dikes of andesite, andesite porphyry, lamprophyre, and diorite (da) including dikes typically younger than biotite-hornblende granite but also older andesite dikes intrusive into units of the Bir al-Badriyah Group; light- to dark-gray dacite dikes and sills (da) typically intruded into slightly metamorphosed basal units of the Bir al-Badriyah Group, but unmetamorphosed, gray, brown, and dark-red unmetamorphosed rhyolite and rhyolite porphyry dikes (rd) associated with dacite in late intrusions into lower units of the Bir al-Badriyah Group and associated with andesite dikes (da) intrusive into biotite-hornblende granite
- gfp: Granite porphyry: Gray granite porphyry with round quartz phenocrysts up to 8mm across
- gh: Biotite-hornblende granite: Gray, massive to faintly gneissic, quartz-poor biotite-hornblende granite, locally biotite-free, with fine-grained hornblende-biotite-diorite border phase with strong primary flow banding parallel to contact and strong biotite lineation down dip in flow banding; locally granodioritic
- px, gbr, dgp, sgp, gba: Gabbro, pyroxenite, serpentinite, and amphibolite: Dark-green to nearly black, fine- to coarse-grained massive gabbro, (gb), locally may be gneissiferous, sheared or sparsely serpentinitized; vuggy quartz-calcite veins present but uncommon; nearly black fine- to coarse-grained, massive pyroxenite (px), locally sheared and serpentinitized; intrusive amphibolite (gbr), green, dark-green, and brown-serpentinite and serpentinitized pyroxenite, gabbro, diorite, and andesite (gbr) with associated veins and masses of white magnesite, locally as near Bir al-Badriyah, intruded by metamorphosed diorite, dark, coarse-grained amphibolite (gbr), with cores of gabbro and pyroxenite, formed by contact metamorphic effect on gabbro and pyroxenite of intrusive alkalic granites
- ha, hge, hb, hb: Badriyah Formation: Dark-green, green, dark-brown, and nearly black andesite, andesite porphyry, trachyte andesite, andesite tuff and agglomerate (ha), commonly in massive flows, locally sheared and epidotized; dark-green leucocratic andesite, greenstone, schistose andesite, and actinolite schist (hge) formed from andesite (ha) by contact metamorphic effect of gabbro (gb), pyroxenite (px), biotite-hornblende granite (gh), and alkalic granite (ga); dark-green, fine-grained hornblende schist (hb) with foliation parallel to intrusive contact of biotite-hornblende granite (gh) formed from andesite tuff (ha) by contact metamorphism, locally includes layered amphibolite of similar origin; greenish-gray and pale-green bleached zone (hb) in andesite (ha)
- UNCONFORMITY
- fm, fm: Abu Sawair Formation: Dark-green and brown graywacke pebbly sand and massive siltstone grading into dark-gray to nearly black argillite (fm), with some thin calcareous layers; much of the argillite is thin-bedded and rhythmically bedded; location of lower to white limestone near base, tuffaceous and agglomeratic near top (f); dark chlorite-sericite schist (fm) and dark-gray biotite-muscovite schist (fm) formed from contact metamorphism and dynamic metamorphism of graywacke and argillite (fm) biotite-graywacke metaconglomerate (fm) with porphyroblasts of biotite and microcline up to 1mm, contains pebbles of quartz, greenstone, and fine-grained diorite
- UNCONFORMITY
- fw: Fawara Formation: Gray blue, brown, red, and black marble, dolomitic marble, and schistose marble, grades downward into calcareous conglomerate; thin-bedded to massive, commonly intensely sheared and contorted
- UNCONFORMITY
- hs: Hsaa Formation: Gray, green, and brown graywacke conglomerate with chloritic matrix and with pebbles to boulders of quartz, chloritic quartzite, epidotized quartzite, epidotized hornblende quartz porphyry, diorite, epidiorite, gneissic granulite, granite gneiss, and gray marble; locally tuffaceous, locally strongly sheared with stretched cobbles and pebbles forming lineation parallel to direction of foliation in matrix
- UNCONFORMITY

QUATERNARY

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PERMIAN

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LOWER PALEOZOIC (?)

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PRECAMBRIAN

- gh: Biotite-hornblende granite: Gray, massive to faintly gneissic, quartz-poor biotite-hornblende granite, locally biotite-free, with fine-grained hornblende-biotite-diorite border phase with strong primary flow banding parallel to contact and strong biotite lineation down dip in flow banding; locally granodioritic
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CONTACT

- : Contact
- - -: Dashed where approximately located or inferred; dotted where concealed
- o: Fault
- - -: Showing relative horizontal movement where known; dashed where approximately located or inferred; dotted where concealed; U, upthrown side; D, downthrown side
- : Anticline
- - -: Showing crestline and direction of plunge; dashed where approximately located or inferred; dotted where concealed
- : Syncline
- - -: Showing troughline and direction of plunge; dashed where approximately located or inferred; dotted where concealed
- : Strike and dip of beds
- : Strike of vertical beds
- : Strike and dip of cleavage
- : Strike of vertical cleavage
- : Hipping
- : Strike and dip of foliation showing plane of lineation
- : Strike and dip of foliation showing horizontal lineation
- o: Marble
- o: Isolated outcrop of marble
- o: Quartz
- o: Isolated, prominent mass of milky quartz, vein, or cores of pegmatite; stratigraphic position unassigned
- o: Lithomass from aerial photographs
- - -: Presumed lineament not checked on ground; may be dikes, bedding, foliation, joints, or faults

WATER

- o: Water well
- o: Marked Dry Well where abandoned
- o: Abandoned mine or prospect
- o: 80 to 100ppm Cu, >100ppm Zn, >5ppm Mo
- o: 100ppm Cu, >100ppm Zn, >5ppm Mo
- o: Location and assay content by chemical analysis of sample of soil sediment Expressed in parts per million (ppm)
- o: 2ppm Mo, 3 to 10ppm Mo
- o: Scheelite and/or wolframite
- o: Present in concentrates from waste sand (superimposed on symbol for copper)
- o: Anomalous element in waste sand by spectrographic analysis (Lead (Pb) 200ppm (located by adjacent copper symbol), Ag, Bi, Cr, Cu, La, Mn, Ni, S, Se, Sr, Ti, U, Zn)
- o: Threshold elements in waste sand by spectrographic analysis: Silver (Ag) 10ppm, barium (Ba) 50 and 100ppm, bromine (Br) 100 and 1000ppm, copper (Cu) 10ppm, lanthanum (La) 200ppm, manganese (Mn) 1000ppm, nickel (Ni) 10ppm, potassium (K) 50 and 100ppm, tin (Sn) 10ppm, titanium (Ti) 100 and 500ppm, vanadium (V) 100ppm, zirconium (Zr) 10ppm (located by adjacent copper symbol), Cu, Mo, Zn, W
- o: Threshold elements in concentrates or detrital magnetite by chemical analysis: Copper (Cu) 1.0, 1.5, 50ppm in concentrate, 100 and 150ppm in magnetite; molybdenum (Mo) 20, 30, 100ppm in concentrate, 10ppm in magnetite; zinc (Zn) 150ppm in concentrate, 150, 300, 400ppm in magnetite; tungsten (W) 50, 120, 300ppm in concentrate (located by adjacent copper symbol), where reporting interval is the same for concentrate and magnetite; the value for magnetite is preceded by asterisk

AREA OF OTHER MAPS IN THIS SERIES

- 124 Jabal Biran quadrangle
- 125 Ayn Quay quadrangle
- 127 Sabhat Marayit quadrangle
- 128 Bir al-Chamrah quadrangle
- 129 Wadi Mahragah quadrangle

SCALE 1:100,000

0 2 4 6 8 10 KILOMETERS

0 2 4 6 8 10 MILES

Geology mapped by W. C. Overstreet and J. W. Whitlow, U. S. Geological Survey, and A. O. Ankary, Ministry of Mineral Resources, April 1964, and W. C. Overstreet and J. W. Whitlow May 1964, with additions from geologic maps by V. P. Kahr, Department of Mineral Resources, October-November 1959 and June-July 1961.

QUADRANGLE LOCATION

RECONNAISSANCE GEOLOGIC MAP OF THE BIR AL BADRIYAH QUADRANGLE, KINGDOM OF SAUDI ARABIA

By
William C. Overstreet, Jesse W. Whitlow,
Viktor P. Kahr, and Abdullah O. Ankary
1972