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UNITED STATES  
DEPARTMENT OF THE INTERIOR  
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Technical Letter  
Saudi Arabian Mineral  
Exploration - 1  
Prepared May 19, 1964  
Issued August 15, 1965

Dr. Fadil K. Kabbani  
Deputy Minister for Mineral Resources  
Directorate General for Mineral Resources  
Ministry of Petroleum and Mineral Resources  
Jiddah, Saudi Arabia

Dear Dr. Kabbani:

Transmitted herewith are 10 copies of:

TECHNICAL LETTER NUMBER 1  
GEOLOGICAL RECONNAISSANCE IN THE  
NORTHERN TUWAYQ AND WADI AR  
RIMAH QUADRANGLES, SAUDI ARABIA

by

James W. Mytton\*

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SAUDI ARABIAN PROJECT

Sincerely,

*Glen F. Brown*  
Glen F. Brown, Chief  
Saudi Arabian Mineral Exploration Project

\* U. S. Geological Survey, Jiddah, Saudi Arabia

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GEOLOGICAL RECONNAISSANCE IN  
THE NORTHERN TUWAYQ AND WADI AR  
RIMAH QUADRANGLES, SAUDI ARABIA

by

James W. Mytton\*

During March 1964 rocks of Precambrian age were examined and sampled at localities in both the Northern Tuwayq and the Wadi ar Rimah quadrangles. In addition, any indication of mineralization that might be present in the rocks examined was noted, the radioactivity of the different rock types was recorded with a Precision Model 111B scintillator in milliroentgens per hour (mr/h), and samples for wet chemical and spectro-chemical analysis were collected in the wadis.

Northern Tuwayq Quadrangle - I-207

March 11-13: The following features were examined at Al Quwayiyah and vicinity: 1) the contact between rocks of Precambrian age and the overlying Kuff Formation of Permian age; 2) a variety of rock types of Precambrian age, including metasediments, granite, and rhyolite.

At Al Quwayiyah (24°03'x 45°15') the Kuff Formation overlies reddish schistose rhyolite (?) containing prominent zones of bleaching and limonitic staining along vertical fractures which are truncated by a quartz pebble conglomerate that marks the base of the Kuff. The altered rhyolite unit, in turn, overlies reddish granite gneiss which has been intruded by dikes of felsite, andesite and gabbro. All these dikes are beveled by the rhyolite. At one place where the granite is missing, transported dry saprolitic material occupies its position and rests on diorite which is friable and weathered 6 to 7 feet below the contact with the saprolite. About 12 kilometers northwest of Al Quwayiyah (at 24°08'x 45°10') the quartz pebble conglomerate unit of the Kuff

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overlies white sugary fine-grained sandstone 6 feet thick that grades downward into a dry saprolite containing abundant iron nodules. The saprolite here rests on reddish granite.

The altered portion of the shistose rhyolite and the dry saprolite represent zones of weathering. They are not bauxitic, nor are they ferruginous laterite; however, aluminum - and/or iron-bearing material might have been removed from the pre-Permian erosion surface and deposited elsewhere prior to deposition of the quartz pebble conglomerate.

A traverse was made through an anticlinal structure ( $24^{\circ}02' \times 45^{\circ}12'$ ) whose core is made up of a metasedimentary sequence of alternating quartzose sandstone and micaceous shale intruded by gray syntectonic biotite granite gneiss and gneissic granite. The sandstone and shale grade into steeply dipping mica-hornblende schist on the flank of the anticline. The schist grades into non-schistose diorite and gabbro. Diorite and gabbro are the dominant rock. The gneissic granite contains numerous quartz veins as well as xenoliths of the metasediments and is cut by rhyolite and diabase dikes in the vicinity of a younger pink granite with a massive phase and a strongly sheared and lineated phase. The radioactivity of the rock types along the traverse ranges from 0.003 to 0.006 mr/h. No indication of mineralization, other than pyrite in both the younger granite and the quartz veins, was observed.

The most notable feature in the area is the pink granite which intrudes all the older Precambrian rocks. The granite consists of quartz, biotite and pink feldspar, is medium-grained to pegmatitic, generally equigranular but in some places it is porphyritic. The granite is unmineralized except for some malachite associated with quartz veins and sporadic hematite nodules with weathered pyrite nuclei. The radioactivity of the granite averages 0.005 mr/h.

Wadi Ar Rimah Quadrangle: I-206

March 14: While enroute from Al Quwayiyah to Ad Dawadami, a copper-iron-bearing vein was examined at Jabal Zand Abd ( $24^{\circ}04' \times 44^{\circ}59'$ ). The vein, which occurs on a steep slope, is poorly exposed because of float, but appears to be small. It occupies a fracture in a coarse-grained diorite and gabbro. Pieces of malachite, hematite and specular hematite were present on the slope below the vein. One piece contained a core of specular hematite successively rimmed by malachite and hematite. The radioactivity of the vein is 0.005 mr/h.

The northern boundary of Jabal El Ehn ( $24^{\circ}07'x 44^{\circ}52'$ ) was also examined. The Jabal is a granite stock composed of coarse pink feldspar, quartz, biotite and minor hornblende. It is in sharp contact with dark biotite-hornblende schist. Dikes of fine-grained granite, felsite, aplite and pegmatite with bluish quartz are in the schist near the contact. A prominent pegmatite dike is in the granite near the contact. None of these dikes appears to be mineralized. The radioactivity of the granite is 0.005 mr/h.

March 15-16: Accompanied Dr. Harold Quinn on tour of Jabal Umm Urgabah and Samrah silver mines ( $24^{\circ}22'x 44^{\circ}21'$ ).

March 17-21: Salient features were examined at Ash Shubayrimah ( $24^{\circ}41'x 43^{\circ}33'$ ) and vicinity, including dike swarms in the major granite units, the complex of diorite and gabbro, the regional faults and related shear zones, and the metasedimentary rocks.

The extensive granitic terrain northeast of Ash Shubayrimah consists of gray sheared biotite granite with gneissic structure. The granite is medium to coarse-grained and is composed of quartz, biotite and plagioclase (albite?). It is essentially unmineralized. East-trending zones ( $24^{\circ}41'x 43^{\circ}38'$ ) of dark colored granite were seen in which the biotite is altered to chlorite and/or hematite. These linear zones weather black in contrast to the surrounding gray biotite granite. The radioactivity of the gneissic granite averages 0.006 mr/h.

Most of the dikes examined are granitic, the east-trending ones being chiefly medium to coarse-grained and pegmatitic, the north-trending ones being chiefly fine-to medium-grained pink to gray granite and pyrite-bearing. The east-trending dikes contain abundant biotite much of which is altered to chlorite. A few dikes of rhyolite and one prominent north-trending linear body of milky quartz ( $24^{\circ}50'x 43^{\circ}38'$ ) containing some pink feldspar were also observed. The radioactivity of the quartz body is 0.005 mr/h. On the outskirts of the village of Zafaranah ( $24^{\circ}47'x 43^{\circ}34'$ ) a northwest-trending ridge with a dike-like appearance represents a zone of fracturing which contains silicified breccia and veins and stringers of quartz and calcite.

The major granitic area southwest of Ash Shubayrimah consists of gray coarse-grained granite, which also contains a variety of dikes, including fine-grained granite, felsite and rhyolite. The radioactivity of a north-west-trending rhyolite dike ( $24^{\circ}31'x 43^{\circ}23'$ ) that forms a prominent ridge is 0.012 mr/h. A quartz-rich pegmatite composed of abundant milky quartz, minor pink feldspar and sporadic altered biotite or hornblende (?), and containing inclusions of pink medium-grained granite, is adjacent to the rhyolite dike. The radioactivity of the pegmatite is 0.004 mr/h. Numerous east-trending veins of ribbon type quartz ( $24^{\circ}32'x 43^{\circ}26'$ ) occur in the Murdama formation near its contact with the granite. The Murdama in this area consists of metasediments represented by limy shales to argillaceous limestones and some quartzites. Altered and fractured dioritic material is present at the approximate locations of the major faults ( $24^{\circ}35'x 43^{\circ}30'$ ,  $24^{\circ}39'x 43^{\circ}32'$ ) which bound the Murdama to the north. No mineralization was seen.

The mountains west of the village of Mishash ( $24^{\circ}49'x 43^{\circ}32'$ ) consist of diorite and gabbro which is epidotized and in places contains dark bodies of amphibole and pyroxene. A prominent north-trending pyrite-bearing felsite dike occurs in the diorite just west of the village of Al Mishah. The radioactivity of this dike is 0.003 mr/h.

An ancient gold mine, the Haleet Mine ( $24^{\circ}48'x 43^{\circ}29'$ ) is located within the diorite and gabbro complex. The workings are in a quartz vein which occupies an east-trending fault. The country rock adjacent to the fault has a gneissic structure as the result of local shearing. The vein, where not mined out, contains fractured material which is hematitic and has a trace of malachite. Stringers of barren quartz fill many of the fractures. Just north of the main workings is a north-trending vein of ribbon type quartz with hematite, malachite and some pyrite. A minute flake of gold was observed in one piece of quartz.

At Mishah a green to steel blue schist is interbedded with sills of rhyolite to andesite. A high degree of serpentization has taken place along some of the bedding planes and in small cross faults in the schist. To the east are metasedimentary rocks consisting of aphanitic limestone, quartzite and argillite. The sequence of greenschist-rhyolite-andesite appears to be

a transition between the diorite to the west and the metasediments to the east and may represent a zone of shearing with attendant igneous activity. The metasediments grade eastward into chlorite and biotite schist containing lenses and nodules of dolomite and limestone, and which is in sharp contact with the sheared syntectonic granite that contains the dike swarms. The presence of sills and dikes of granite in the schist and of xenoliths of the schist in the granite, shows the schist to be older than the granite.

March 22: The west side of Jabal Jabalah ( $24^{\circ}49'x 43^{\circ}52'$ ) was briefly examined while en route from Ash Shubayrimah to Ar Rass. Where examined, it is a gray to pink coarse-grained biotitic granite containing both white and pink feldspar and some altered biotite. Its radioactivity is 0.009 mr/h.

March 23: A north-trending body of milky quartz was checked for mineralization just south of Ar Rass at the personal request of the Emir of Ar Rass. The body read 0.005 mr/h on the scintillator and was completely barren.

March 24-28: The major granite stocks and their associated dikes and veins as well as several ancient workings were examined at Fawwarah and vicinity.

The main rock units in the area are the Murdama Formation, which consists of argillaceous limestones, argillites, and quartzites and young gray to pink granite. The contact between the granite and the Murdama Formation is best seen on the north end of Jabal Qutn ( $26^{\circ}04'x 42^{\circ}23'$ ) where gray to pink coarse-grained biotite granite has intruded metasediments made up of argillite and quartzite and locally converted them to a massive dense amphibolite and an amphibolite gneiss with alternating light (quartzitic) and dark (amphibolitic) bands. The granite near the contact varies from medium-grained to pegmatitic and gray to pink in color. Its radioactivity is 0.011 mr/h. Dikes of white to gray fine-grained granite and aplite radiate from the granite stock. Away from the stock, quartz veins become more numerous with most veins containing ribbon type quartz. Two prominent white bodies were examined northeast of Jabal Katan at ( $26^{\circ}05'x 42^{\circ}28'$ ). Both consist of northeast trending veins and stringers of fractured ribbon type quartz in an altered gray coarse-grained granite. Some felsite to aplite containing altered pyrite is present. The granite contains much limonite after biotite; the quartz contains much

hematite in fractures and pockets, as well as limonite, and some fresh pyrite is present. The radioactivity of these bodies is around 0.005 mr/h.

North and west of Jabal as Silsileh ( $26^{\circ}10'x 42^{\circ}40'$ ) several dikes of granite porphyry and rhyolite porphyry were observed. A northeast trending dike which forms a prominent ridge referred to as Ashgar Meshaheed ( $26^{\circ}11'x 42^{\circ}31'$ ) consists of pink feldspar phenocrysts in a groundmass of finer-grained granite. Few dark minerals are present. Some east-trending veins of ribbon type quartz with limonite rather than hematite in the fractures were observed near this dike. The radioactivity of both this dike and another prominent one of brick red rhyolite porphyry ( $26^{\circ}15'x 42^{\circ}36'$ ) is 0.01 mr/h. A north-trending light gray felsite dike with abundant pyrite cubes altered to hematite was observed east of Jabal Hadhira (at  $26^{\circ}06'x 42^{\circ}49'$ ). In some places where dikes cut the argillaceous phase of the Murdama, the argillites have been converted to slate.

All the ancient workings examined are buried and no significant mineralization, beyond the presence of hematite and limonite in fractured quartz, was seen in fragments in old dumps or on the ground. The workings appear to have been in quartz-bearing veins which occupied fractures in the Murdama, the quartz being the ribbon type. At Meshaheed ( $26^{\circ}13'x 42^{\circ}25'$ ), however, the workings are in a gray friable coarse-grained biotite granite which is present in the Murdama. A brownish hard siliceous granite to rhyolite is also present and may be more closely associated with the veins that were mined.

March 29: The contact between the Murdama formation and a cross-bedded sandstone unit reported to be Cambro-Ordovician (?) in age was examined at Jabal Tamiyah ( $25^{\circ}37'x 42^{\circ}01'$ ). The Murdama below the contact includes green to purplish metasediments, consisting chiefly of thin-to medium-bedded calcareous argillites and graywackes. About 75 feet below the contact the argillites are predominantly red in color. The Cambro-Ordovician (?) unit above the contact consists of a yellowish-brown very fine-grained well-sorted quartz sandstone showing medium-scale cross strata in the lower part of the unit and large-scale cross strata in the upper massive cliff-forming portion which is suggestive of eolian deposition. The Precambrian surface has slight relief and strongly suggests peneplanation. The contact itself is poorly exposed, however no basal conglomerate was seen in the float. The sandstone other than having a ferruginous cement shows no signs of mineralization.