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RECONNAISSANCE MINERAL AND GEOLOGICAL INVESTIGATIONS IN THE TAYYIB AL ISM QUADRANGLE, AQABA AREA, SAUDI ARABIA

by

Virgil A. Trent and Robert F. Johnson

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PREFACE

In 1963, in response to a request from the Ministry of Petroleum and Mineral Resources, the Saudi Arabian Government and the U. S. Geological Survey, U. S. Department of the Interior, with the approval of the U. S. Department of State, undertook a joint and cooperative effort to map and evaluate the mineral potential of central and western Saudi Arabia. The results of this program are being released in USGS open files in the United States and are also available in the Library of the Ministry of Petroleum and Mineral Resources. Also on open file in that office is a large amount of material, in the form of unpublished manuscripts, maps, field notes, drill logs, annotated aerial photographs, etc., that has resulted from other previous geologic work by Saudi Arabian government agencies. The Government of Saudi Arabia makes this information available to interested persons, and has set up a liberal mining code which is included in "Mineral Resources of Saudi Arabia, a Guide for Investment and Development," published in 1965 as Bulletin 1 of the Ministry of Petroleum and Mineral Resources, Directorate General of Mineral Resources, Jiddah, Saudi Arabia.

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Introduction

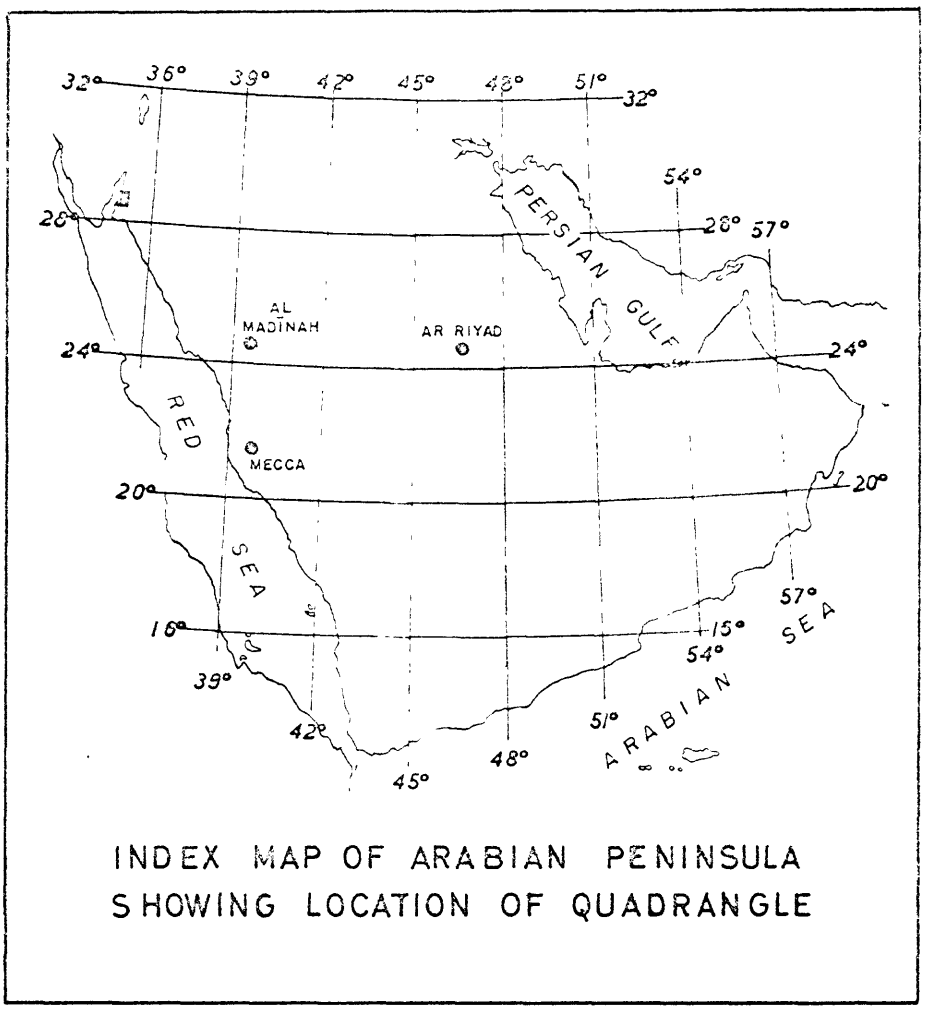
Location.

The area covered by the Tayyib al Ism quadrangle (fig. 1) is east of and adjacent to the Gulf of Aqaba in the mid-section of the Midyan peninsula. Tayyib al Ism literally translated means "good name." At one time there probably was a small village here but now only a solitary police post situated on the margins of Wadi Tayyib al Ism marks the location. West of the police post, at sample locality 4140, the wadi penetrates the granitic mountains and winds its way for 2 km down to the sea. This part of the wadi is quite spectacular. Its walls are 10 to 20 meters apart and rise about 100 meters above the wadi floor.

The most characteristic feature of this quadrangle is the absence of a coastal plain in some areas. Steep granitic mountains rise directly out of the sea.

Previous investigations.

H. R. von Gaertner and H. Schurenberg (1954, p. 65) employed by Amt fur Bodenforschung, Hannover, Germany made a regional minerals and geological survey that included the Aqaba area in part. They sailed from Haql to Maqna (see map I-270B) and stopped alongshore at several places in the Tayyib al Ism quadrangle to examine the rocks and make short traverses. A large variety of granitic rocks, granodiorites, and probable diorites were observed in the wadi south of the Ra's Suwayhil as Saghir. They state that the coastal mountains are largely red, coarse grained granites except for a large mafic body of rock 250° from Jabal Marshah. No landing was possible here, but they recommended that this area be examined for serpentinized rock.



INDEX MAP OF ARABIAN PENINSULA
SHOWING LOCATION OF QUADRANGLE

FIGURE

The Tayyib al Ism area is included in a 1:500,000 scale geologic map (Bramkamp and others, 1963) compiled by Dr. Glen F. Brown, U.S.G.S., from field notes of von Gaertner and Schurenberg and studies of aerial photographs. Our 1:100,000-scale map of the Tayyib al Ism quadrangle does not include the ultramafic rocks or serpentine shown by Brown, because the rocks cropping out in those areas proved to be dark granite.

Dr. Viktor P. Kahr, Senior Geologist, Ministry of Petroleum and Mineral Resources, has worked in this area while making a regional geologic and mineral reconnaissance (personal communication, 1966).

Present work.

This work was completed under terms of an agreement between the Directorate General of Mineral Resources and the U. S. Geological Survey to assess the mineral potential of Western Saudi Arabia. Seven man-days were spent in the Tayyib al Ism quadrangle during October 1964. Aerial photographs were used for laying out traverse routes, locating structures and contacts, and checking light-or dark-colored rocks. In addition to the field mineral prospecting, samples of wadi sand were collected for trace element analyses.

The assistance and cooperation of officials and employees of the Directorate General of Mineral Resources made this study possible and to them we express our appreciation.

Geology

Several varieties of Precambrian granite and granodiorite crop out from the north to the south-central portion of the quadrangle where they are unconformably overlain by sedimentary rocks of the Raghama formation

of Tertiary age. A thick sequence of meta-sedimentary rocks occurs in the greenstone unit (gd). Mafic intrusive rocks are limited to diorite (d?) in hornblende granits (gh).

The oldest rocks cropping out in the quadrangle are greenstone (gd), consisting of probable intermediate flows metamorphosed to the greenschist facies, and a thick sequence of metamorphosed sedimentary rocks. Relict bedding was found in the meta-sedimentary rock, and thin section studies of samples from station T91 indicate the rock is quartz-feldspar-hornblende hornfels. This is the thickest sequence of meta-sedimentary rocks within the gd unit that we have seen in the Aqaba area.

Light gray, medium-to coarse-grained granite (gg) with abundant felsic and lamprophyre dikes and dike swarms, intrudes the metasedimentary rocks. Xenoliths of the older rocks are common in the granite.

Granodiorite and hornblende granite (gh) is the predominent type of rock in the quadrangle. It occurs in the mountains along the coast, and in the northern and south-central parts of the quadrangle. The color varies from dark red to red. Probably several varieties of granitic rocks are included in this unit.

Near sample locality 10,184 two small stocks of granite (gp?) crop out. These stocks are classified as peralkalic granite on the basis of a trace element content similar to peralkalic granites in other parts of the Arabian shield (oral communication, W. C. Overstreet, U.S.G.S., 1966).

Unconformably overlying the Precambrian rocks in the southern portion of the mapped area are the Tertiary sedimentary rocks of the Raghama formation (Tra). The formation consists of fossiliferous limestone,

sandstone, shales with thin beds of gypsum, and a very coarse, heterogeneous, poorly indurated conglomerate at the base.

The youngest units in the area are the surficial deposits of clay, silt, sand and gravel in the wadis (Qu), and gravel terraces occurring along the shoreline (Qt).

Faults.

The granodiorite and granite (gh), light gray granite (gg) and granite (gp?) are locally sheared. The shearing appears to be related to a close-spaced fault pattern which is evident in the quadrangle.

Prominent faults strike N20°E to N30°E generally parallel to straight segments of the coast, suggesting that these are fault controlled. Long straight wadis similarly aligned suggest that these too are fault controlled. These faults are probably subsidiary to the main Aqaba-Wadi Araba- Dead Sea rift zone. Movement on one of these faults near sample locality 4129 is left lateral.

Geochemical Exploration

Fourteen wadi sand samples were collected and screened to the plus 30 minus 80 mest size fraction in the field and returned to Jiddah for spectrographic analysis in the laboratories of the Directorate General of Mineral Resources, Ministry of Petroleum and Mineral Resources. C. E. Thompson, U.S.G.S., completed the spectrograph analysis for 27 elements using the modified method employed by the U. S. Geological Survey. J. Goldsmith performed wet chemical trace analysis on the same samples. A magnetite fraction of each of these samples was analyzed using wet chemical methods by L. Aldugiather. The latter results are not presented here.

Results of analyses over a wide area are compared in order to determine background amounts of trace elements. Amounts of an element greater than about 2 times the average amounts for the element are considered to be anomalous.

The results of the spectrographic determinations for copper, zinc, and molybdenum are shown on the map. No significant anomalies for copper were found. Anomalous amounts of zinc and molybdenum are present in sampler 10,205 and 10,206 which contain 200 ppm and 300 ppm zinc respectively, and 10 ppm molybdenum. Molybdenum also occurs in anomalous quantities in the central and south-central portion of the quadrangle. Sample number 4125 contains 50 ppm molybdenum. These are positive anomalies and may be related to mineralization along the northeast-trending faults in the area.

Samples 10,184 and 10,210 contain 30 ppm and 50 ppm lead respectively. The former sample was collected near a high pass between masses of dark red granite. The source of the material analyzed in sample 10,184 is the red granite (gp?) intrusive mass directly north. The sample has anomalous amounts of zirconium (1500 ppm), beryllium (5 ppm), molybdenum (7 ppm), lanthanum (150 ppm), and niobium (100 ppm). This array of trace element amounts compares closely with other young peralkalic granites mapped in Saudi Arabia.

Mineral Deposits

No ancient mines or prospects were located in the quadrangle. Sample 10,205 was collected from a shear zone in light gray granite (gg) which also has aplite dikes containing pyrite. Granite (gg) is the country

rock but grades to aplite through red porphyritic granite and siliceous rock. Some calcite was found. Hand samples 10,208 and 10,209 both contain pyrite and an unidentified oxidized mineral.

This area may be localized in one of the large northeast trending faults.

The composition of sample number 10, 184 probably reflects the trace element content of the young granite (gp?) rather than possible pegmatites within granite.

The Raghama formation in the southern part of the quadrangle contains beds of gypsum and limestone. This resource was discussed more fully by Trent and Johnson (1966, p. 3).

Recommendations

In view of the results of the spectrographic analysis of wadi sand samples collected in this quadrangle some additional field work is recommended. Rocks cropping out in the vicinity of samples 10,205 and 10,206 merit further examination and sampling for zinc metallization.

Additional wadi sand samples should be collected near the red granite (gp?) and the radioactivity should be checked.

Mineralization is possibly controlled by the large northeast-trending faults. A closer examination and sampling of known and probable faults is needed. The granite mountains in the west central part of the area are very rugged and inaccessible; helicopter support for geologists working this area would be valuable. With such support the additional work outlined above could be completed and the remainder of the Tayyib al Ism quadrangle examined by two geologists in 1/2 man-month.

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