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MINERAL RECONNAISSANCE OF THE SOUTHERN PART OF THE WADI QARAQIR QUADRANGLE SAUDI ARABIA

by

Robert F. Johnson and Virgil A. Trent
U. S. Geological Survey

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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 Also on open file in that office is a large amount of material, in the form of unpublished manuscripts, maps, field notes, drill logs, annotated aerial photographs, etc., that has resulted from other previous geologic work by Saudi Arabian government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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ILLUSTRATION

MINERAL RECONNAISSANCE OF THE SOUTHERN PART OF THE WADI QARAQIR QUADRANGLE, SAUDI ARABIA

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Introduction

At the end of a field trip to the Wadi as Surr quadrangle (Johnson and Trent, 1967) a few days were spent in the southern part of the adjoining Wadi Qaraqir quadrangle (27°30' to 28°N. and 36° to 36°30'E.) in order to extend our mineral reconnaissance as far east as the Arabian Plateau. The area examined is shown by the distribution of sample localities on the accompanying map. No mineral deposits of economic interest were seen.

The terrain is one of broad plains and low hills that extend westward from the base of a prominent erosional scarp which forms the western edge of the Arabian Plateau. Streams cutting headward into the low-dipping massive sandstone of the Plateau have carved deep canyons with vertical walls, and outliers of the sandstone are preserved as buttes and erosional forms of varied shapes.

There are no permanent settlements in the mapped area. The one road leads up a tributary of Wadi Qaraqir to some date gardens at the base of the sandstone cliffs. A well-travelled caravan route crosses the passes at Al Khuraytah to reach the Plateau H. St. John Philby -/ strongly recommended that a road be constructed through these passes to provide direct access from Tabuk to the Red Sea coast.

Burton (1878) was probably the first European to visit the area. He was searching for mineral deposits and he also located some Nabatean ruins. Philby in company with R. G. Bogue, U. S. Geological Survey, explored the scarp in the Wadi Qaraqir

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-/ Philby, H. St. John, 1956, The mines of Midian: Unpublished manuscript, 176 pp.

valley and drove northwestward to Al Khuraytah pass. The geology of the Wadi Qaraqir quadrangle shown on the geologic map of the Northwestern Hijaz (Brown and others, 1963) was compiled from Bogue's work.

Our work consisted of making traverses around the hilly areas and up accessible wadis. We examined the rocks along the traverse routes and visited target areas that had been selected by examination of aerial photographs. Samples of wadi sediment were collected from fault zones, granite contacts, and areas that showed some evidence of hydrothermal alteration.

The work was made possible by the cooperation of officials of the Directorate General of Mineral Resources, Ministry of Petroleum and Mineral Resources, who arranged for vehicles and for accompanying personnel. We did not have a counterpart Saudi geologist for this portion of our trip.

Geology

The rocks in the area that was examined are thought to be of Precambrian age. The layered rocks consist of an older sequence of slightly metamorphosed andesitic flows and pyroclastic rocks, with minor amounts of interbedded clastic rocks and felsitic volcanic rocks. Unconformably overlying this dominantly volcanic sequence are argillite, sandstone and conglomerate of the Hadiyah formation which in turn is overlain by volcanic rocks and indurated shales that we correlate with the Shammar formation.

The intrusive rocks of the quadrangle have been grouped into four map units. The two oldest are a homogeneous hornblende-biotite granodiorite that crops out at the western edge of the quadrangle and an adjacent composite granitic intrusion shown as gr on the map. Granites in the composite intrusion range from medium-grained light-colored biotite granite to red coarse-grained hornblende granite; all show sharp intrusive contacts with metavolcanic rocks.

A fine-to medium-grained biotite granite with numerous rhyolite dikes and inclusions of granitized country rock crops out over a wide area near the head of Wadi Hujayl. The granite intrudes metavolcanic rocks but its relation to the

coarser-grained granite to the west was not determined. Brown and others (1963) mapped most of the area underlain by the fine-grained granite as Shammar rhyolite. They show two small areas of intrusive rock which they mapped as rtp and described as fine-grained hypabyssal rocks intrusive into the Shammar rhyolite. On the basis of the fine-grained texture, we used the rtp symbol to include the entire intrusive mass but it should be noted that we have no evidence either of the intrusive being hypabyssal or of its intruding the Shammar formation.

Reddish massive amphibole granite crops out near the southeast corner of the quadrangle. It intrudes the Hadiyah formation and rocks that we have mapped as Shammar formation. It may be the youngest plutonic rock in the area. Following the convention of Brown and others (1963) the symbol gp was used for this intrusion.

Reddish low-dipping sandstone of Cambrian age overlies the rocks described abov The sandstone was deposited on an uneven surface of low relief. Irregularities in the old surface were clearly seen from the top of a hill above sample locality 10311 on the east side of Wadi Qaraqir where we could look northeastwards essentially down the dip of the old surface.

All of the rocks except the Cambrian sandstone are cut by dikes that range from rhyolite to lamprophyre in composition. The dikes do not seem to be related to mineralized areas and were not studied in detail. Only the larger dikes are shown on the map.

The most prominent structural features of the quadrangle are northwesterly striking faults that are commonly well marked topographically. One fault near the east edge of the map is of interest in that it has offset the Cambrian sandstone indicating post-Precambrian movement. The bedded rocks are folded but not enough time was available to work out the structure.

Economic geology

The primary purpose of the work to extend the mineral reconnaissance to the edge of the Plateau. Traces of secondary copper minerals were seen at Al Khuraytah pass and near specimen locality 10311 east of Wadi Qaraqir but the deposits

are not of economic interest. In addition to the visual examination we took 13 samples of wadi sediment for trace-element analysis. The samples were screened in the field to a size range of from 0.175 to 0.495 millimeters and were analyzed spectrographically for trace amounts of 27 elements in the laboratories of the Directorate General of Mineral Resources in Jiddah. Charles E. Thompson of the U.S. Geological Survey made the analyses. Wet analyses for copper, molybdenum and zinc were made by L. Al Dugiather, chemist for the Directorate General of Mineral Resources.

The results of the analyses confirmed the visual inspection in that the area is not highly mineralized. The analytical results for copper are shown by circles on the enclosed map at the sample sites. Only one sample contained more than 20 ppm (parts per million) of copper, and it only had 30 ppm. Slightly anomalous amounts of molybdenum are present in five samples, three of which were obtained near Al Khuraytah pass. All other elements occurred in normal amounts except for lead in sample number 4218 taken in a wadi that drained rhyolitic rock west of Wadi Qaraqir. The sample contained 100 ppm lead or about 10 times background.

With the exception of the one lead-bearing sample, the significance of which is not known, the area is not promising and no further work is recommended.

References

Brown, G. F., Jackson, R. O., Bogue, R. G., and Elberg, E. L. Jr., 1963, Geologic map of the Northwestern Hijaz quadrangle, Kingdom of Saudi Arabia: U. S. Geological Survey Misc. Geol. Inv. Map I-204A.

Burton, R. F., 1878, The land of Midian revisited, London, C. Kegan Paul, 2 vol.

Johnson, R. F., and Trent, V. A., 1967, Mineral reconnaissance of the Wadi as Surr quadrangle, Saudi Arabia: Saudi Arabia Directorate Gen. Min. Res. MI Map 5.

Explanation

Quaternary	Qal	Alluvium and wadi fill
Precambrian	Gp	Massive, reddish amphibole granite that intrudes Shammar formation.
	rtp	Fine-to medium-grained biotite granite cut by numerous rhyolitic dikes. Granitized inclusions common. Age relationships not known.
	sr	Shammar formation. Greenish flow rocks and brown andesite flows with interbedded indurated shale.
	gr	Granite of various kinds. Light-colored, medium-grained biotite granite, red coarse-grained hornblende granite. Intrudes metavolcanic rocks and Hadiyah formation.
	dg	Gray hornblende-biotite granodiorite.
	h	Hadiyah formation. Maroon and green argillite and dark silt stone with minor sandstone and conglomerate.
	gd	Metavolcanic rocks. Slightly metamorphosed andesitic flows and and pyroclastic rocks. Minor felsitic volcanic rock and wacke.
	Cu	Cambrian sandstone outside of mapped area.
		Contact, dashed where approximately located, dotted where concealed.
		Fault, dashed where approximately located, dotted where concealed.
		Dike
	●	Samples of wadi sediment with 20 ppm (parts per million) or less of copper.
	○	Sample with 30 ppm copper.
	□	Sample with from 5 to 7 ppm molybdenum.
	4018	Sample or specimen number and locality.
	X	Rock specimen locality
	10311 TS	Rock specimen with thin section
	(10311A)	Analyzed rock specimen.