UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Technical Letter
Saudi Arabian Mineral
Exploration - 29
Prepared October 17, 1964
Issued October 3, 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 29
PRELIMINARY REPORT OF A MINERAL RECONNAISSANCE
IN THE
AL MADDAH-HARFAYN AREA, ASIR QUADRANGLE,
SAUDI ARABIA

by

Jesse W. Whitlow*

Sincerely,

Glen F. Brown

Glen F. Brown, Chief
Saudi Arabian Mineral Exploration Project

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

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PRELIMINARY REPORT OF A MINERAL RECONNAISSANCE IN THE AL MADDAH-HARFAYN AREA, ASIR QUADRANGLE, SAUDI ARABIA

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Jesse W. Whitlow*

Introduction

A mineral reconnaissance was made between June 24 and August 2, 1964, in the Al Maddah-Harfayn area, a part of the Asir quadrangle bounded by 18°30' and 19° 00'N. by 43°00'E. and the divide east of 42°00'E. separating drainage to the Red Sea from drainage toward the interior of Arabia (Fig. 1 and Fig. 2). The work was primarily a search for usable deposits of any mineral needed by modern industry. A partial check of the geology as presented on map I-217 by G. F. Brown and R. O. Jackson (1959) was made in conjunction with the mineral search.

The work was supported by the Saudi Arabian Directorate General for Mineral Resources, Ministry of Petroleum and Mineral Resources, which furnished funds, work space in Jiddah, equipment, and supporting personnel as part of the Ministry's program to evaluate the mineral potential of the shield area of Arabia.

The writer was accompanied by Homoud El Shebany who served as guide and guard, and by Misri Madak, truck driver, who was also interpreter. Two Ford 250 series 4 wheel drive pick-up trucks were used, and sufficient supplies of gasoline and water for about two weeks were taken and replenished as needed. Food for the entire trip was taken from Jiddah.

Field work

Procedure for field work was for the vehicles to stay together for mutual aid as the party moved in the area checking the rocks for useful minerals and collecting samples for chemical analysis. Camp was in a different place each night.

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The area of each camp site was scanned with a short wave length ultra-violet lamp for fluorescent minerals. Rock specimens collected during the day were also checked in the evening for fluorescent minerals. About 40 samples of magnetite, 40 samples of -30 +80 mesh sand, and 340 samples of soil and wadi sand were collected, at which the 340 are to be panned for heavy minerals. Sample and camp locations were plotted on 1:50,000 photo-mosaics.

The field work is not evenly distributed in the area because of access problems; however, all roads shown on figure 2 were traversed, and much cross country travel was done. The granite areas were generally the easiest to travel, except where the granite is sheeted by horizontal joints. Areas of sheeted granite were nearly as difficult to travel as areas of metasediments. Access west of 42°30'E. was especially difficult. The large granite body north of the Ghurayrah-Al Muwan road was not studied because of access problems and lack of time.

Scanning of the campsites with an ultra-violet light showed that several areas contain scheelite, $CaWO_4$, and a few contain some powellite, $Ca(MoW)O_4$. The first occurrence of scheelite and powellite in Saudi Arabia was discovered at the locality marked 1 on figure 2. Scheelite and powellite occur as thinly scattered mineral grains in healed fractures in granite. These minerals are not restricted to large bodies of granite because samples containing considerable scheelite also come from wadis that drain metasediments cut by dikes of granite. Only one pegmatite of many examined with the ultra-violet light contained a trace of scheelite. An unidentified secondary green fluorescing mineral insoluble in weak acid is at several campsites, but is abundant at only two (3 and 5 on fig. 2.). Possibly there are two different minerals giving green fluorescence, because there is considerable difference in intensity of fluroescence. Identification will be made later.

Concentrations of a salt or salts appear to be present in ground water around granite masses, but are absent in areas underlain by metasediment. Ground water in Wadi Shaman and Wadi Arrat is too salty for irrigation except locally at or near a tributary wadi. A small area associated with two dark red dikes of felspar and quartz contains considerable salt (6 on fig. 2). Other small concentrations were

seen but not recorded, and all concentrations are in or near granite bodies. No salt concentrations were noted in the metasediments in the western half of the area worked.

Sample preparation

The technical work of preparing the samples for analysis is being done in the Jiddah office and is partly completed. Each bulk sample of wadi sand and soil is being sieved to collect about 2 ounces of -30 +80 mesh material for analysis, and each sample is being scanned with an ultra-violet light for fluroescent minerals. Most samples contain fluorescent calcite and some contain scheelite. These are about evenly distributed between samples from areas underlain by granite and by metasediments. Heavy minerals in the remainder of the bulk sample are being recovered by panning, and magnetite is being removed from the concentrate with a horseshoe magnet. Approximate locations of the samples that contain scheelite are shown on figure 2.

Wet chemical analyses have been made by C. E. Thompson, U.S.G.S., for zinc, copper, and molybdenum in about 250 samples of the -30 +80 mesh material. The maximum for any metal is 40 ppm (parts per million) copper, which is above the background for the area but is not enough to justify more work for copper. Two samples have a possible trace of vanadium; verification will have to await completion of the laboratory. Owing to lack of laboratory facilities and personnel, complete analyses of the samples will not be available for about six months.

Results

The major result of the work is the discovery of scheelite and powellite in Saudi Arabia, and the definition of the distribution of the tungsten minerals in this area. Eighty of the 340 samples contain several grains or more of scheelite and/or powellite, and many of the remaining 260 samples contain a grain or two of one or both minerals. Scheelite and powellite were not found west of 42°33'E. Even the young granite and contact zones west of that longitude are barren of the two minerals. The amount of magnetite and zircon in concentrates varies widely, but it is generally lower in the western half of the area than in the eastern half.

Geologic ages of rocks vary from old metasediments to questionable late

Precambrian granite (fig. 2). Most of the geologic contacts shown on the map (fig. 2) were taken from the work of Brown and Jackson (1959), but a few revisions in boundaries and rock types are based on work done in 1964. The time sequence and structural geology is complex and needs more detailed work for a thorough understanding of the relationships of the different rocks. The oldest rocks in the area are metasediments and possibly some metamorphosed igneous rocks. Sericite schist and chlorite schist, phyllite, slate, and carbonaceous schist are dominant west of 42°30'E., and amphibolite and hornblende schist, graywacke, and pyroclastic rocks are more common east of this longitude. Most of the layers of schist in the granite bodies are interpreted to be roof pendants, and the inference is made that erosion has progressed only a short distance into the granite. Erosion of the young granite appears to be especially shallow. The sheeted granite contains fewer inclusions, and it is possibly more deeply eroded, but local relief is not greater for the oldest than for the youngest granite.

Conclusion

Areas 2 and 3 on figure 2 possibly justify more work to learn the sources and concentration of the tungsten minerals. No other minerals were seen that would be pf possible commercial interest.

References

Brown, G. F., and Jackson, R. O., 1959, Geologic map of the Asir quadrangle, Kingdom of Saudi Arabia: U. S. Geol. Survey Misc. Geol. Inv. Map I-217A.