UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Technical Letter Number 51

Reconnaissance Mineral and Geologic Investigations in the Maqna Quadrangle, Aqaba area, Saudi Arabia

by

Virgil A. Trent and Robert F. Johnson

1966

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Technical Letter
Saudi Arabian Mineral
Exploration - 51
April 29, 1966

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 51
RECONNAISSANCE MINERAL AND GEOLOGIC INVESTIGATIONS IN THE MAQNA QUADRANGLE, AQABA AREA, SAUDI ARABIA

by

Virgil A. Trent* and Robert F. Johnson*

Sincerely,

Glen F. Brown

Glen F. Brown, Chief
Saudi Arabian Mineral Exploration Project

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

Previous Investigations

Burton (1878, p.330) reported that he found large quantities of gypsum, in part selenite, some sulfur and a few cobbles of hematite while prospecting in the vicinity of Maqna. He also reported that gold was found in porphyry rocks within wadis near Maqna.

Bogue (1953, pp. 13-15), U. S. Geological Survey, recommended on the basis of a regional survey in this area that no detailed studies for mineable sulfur be conducted. He considered the large quantities of gypsum to have been deposited by groundwater. He may have been pessimistic in regard to the economic potential of the gypsum because of the large amount of interbedded clastic rocks. In his report the Tertiary sedimentary rocks in which the gypsum is found are called the Mahas formation; they are here called the Raghama formation after Bramkamp and others (1963).

Richter-Bernburg and Schott (1954, p.32) working for Amt fur Bodenforschung, Hannover, Germany conducted regional studies of the sedimentary rocks in the coastal plain areas looking, in particular, for favorable petroleum traps. About 20 km south of Maqna they found beds of gypsum which contain sulfur occupying an anticlinal structure whose axis trends N.20° to N.30°E. This gypsum has thick intercalations of claystone and sand stone and is overlain by sandstone. The sulfur is in the upper part of the gypsum beds. The most important gypsum deposits in the coastal plain are said by Richter-Bernburg and Schott to crop out here; however, they suggested the need to study in detail similar but smaller deposits near Umm Lajj and Yanbu 'al Bahr because the latter deposits are closer to markets than the gypsum near Maqna. Richter-Bernburg and Schott concluded that insufficient quantities of sulfur were available in the Maqna area for exploitation.

Favorable structures for the accumulation of oil are absent from the Maqna area (Richter-Bernberg and Schott (1954, p.56) owing to the deltaic origin of the Miocene sedimentary rocks, to the shallow thickness of these rocks, and to the numerous exposures of basement rocks. The possibility of a structural basin near the mouth of Wadi Ifal was recognized by Richter-Bernberg and Schott (1954, p.57) along the eastern map boundary in the Al Bad' quadrangle (Trent, V.A., and Johnson, R. F., 1966, Technical Letter 50).

Von Gaertner and Schurenberg (1954, p.75) of Amt fur Bodenforschung, Hannover, Germany recommended detailed studies of the gypsum deposits. They found no evidence of economic deposits of sulfur during their reconnaissance investigations in this area.

Dr. Glen F. Brown, U. S. Geological Survey, compiled the geologic map (Bramkamp and others, 1963) of this area at a scale 1:500,000 from aerial photographs and the field notes of Bogue, von Gaertner and Schurenberg. The geology of this 1:100,000-scale map differs from that of the 1:500,000-scale map only in the distribution of the greenstone and the hornblende granite exposures on Jabal an Nutaysh, north of Maqna.

Geology

Unconsolidated surficial deposits of the large alluvial fan or plain flank light colored, low, rugged hills of Tertiary sedimentary rocks. Basement volcanic rocks and granite crop out within this sedimentary sequence and along the coast.

The oldest rocks in the Maqna quadrangle are dark red to black, porphyritic andesite and rhyolite flows of the greenstone unit (gd). Intruding these volcanic rocks are hornblende granite, coarse grained biotite granite, and other granitic rocks. Many granitic dikes cut the greenstone. Unconformably overlying these rocks are the clastic and evaporite beds of the Raghama formation of Tertiary age. Richter-Bernburg and Schott give a detailed description of a section of these rocks cropping out near Al Bad'. They state that a distinctive conglomerate lies at the base with crossbedded sandstone lying unconformably above. The conglomerate is poorly sorted and contains a wide variety of rock types. About 100-150 meters of sandy fossiliferous limestone overlies the sandstone. A series of mudstones and sandy claystones with interbedded gypsum strata 300 meters thick were deposited on the limestone. Capping this section is more sandstone and sandy limestone. These beds are fossiliferous in part. Bramkamp and others, (1963) estimate the thickness of this sedimentary section as more than 500 meters.

Terrace alluvium and gravels are the youngest deposits.

Folding in the Tertiary rocks is open and dips are generally low. A small synclinal basin with axis trending N.30°E. is located near Jabal al Musayr. The most striking structural feature in the area is the eroded dome southeast of Maqna where low dipping beds surround a core of volcanic and intrusive rocks. Some young faults offset both the sedimentary rocks and the flow rocks.

Mineral Deposits

No field evidence of base or precious metal mineralization was found in this quadrangle. Selected fractions of four wadi sand samples were analyzed spectrographically for 27 elements by Mr. C. E. Thompson, U. S. Geological Survey, in the Jiddah laboratory of the Directorate General for Mineral Resources using the modified method employed by the U. S. Geological Survey. Results of the analyses for copper, zinc, and molybdenum are shown on the map. There are no positive anomalies for copper and zinc in this area. Two of the four wadi sand samples show 3 parts per million (ppm) and 5 ppm molybdenum. Samples 4164 and 4165 each contain 70 ppm lead and the former has 1 ppm silver. These are small, positive anomalies for silver and lead. We do not know what the background for lead is in the Tertiary rocks; thus, 70 ppm may not be significant.

The east edge of a small granite hill, sample locality 4166, is covered by chalcedony. Spectrographic analysis of a sample from this material revealed no anomalous quantities of elements. Samples 4165 (sand) and 4166 (rock) are from the same locality.

We did not investigate in detail the gypsum beds within the Raghama formation. The large quantity of gypsum with interbedded shale as described by Richter-Bernburg and Schott (1954, p.32) is a potential economic resource within the Maqna quadrangle.

On the basis of previous work it is very doubtful that sulfur occurs in economic quantities in this map area.

The Al Lisan airborne magnetometer-scintillation counter survey, by Hunting Corporation, 1962, covers the southern 1/3 of the Maqna quadrangle. Don R. Maby (written communication, 1964), U.S.G.S., interpreted the Hunting maps and found no

evidence of near surface basement around the mouth of Wadi Ifal. The large plain covered by terrace gravels and alluvium in the eastern portion of the map occupies a part of the Al Bad' - Al Lisan basin (Trent, V. A., and Johnson, R. F.,1966, Technical Letter 50). This Tertiary basin may contain structures favorable for oil accumulation.

Recommendations

The only recommendation we have for this area is that a detailed examination of the gypsum deposits be made to show what grade of gypsum is available, how much tonnage is mineable, and how it occurs. This evaluation is necessary before development of the deposit can be considered.

References (TL 51 – T+J)

Bogue, R. G., 1953, Geologic reconnaissance in northwestern Saudi Arabia: Directorate General for Mineral Resources, unpub. rept., Jiddah, Saudi Arabia, 31 p.

Bramkamp, R. A., Brown, G. F., Holm, D. A., Layne, N. M. Jr., 1963, Geologic map of the Wadi as Sirhan quadrangle, Kingdom of Saudi Arabia: U. S. Geol. Survey Misc. Geol. Inv. Map I-200A.

Burton, R. F., 1878, The gold mines of Midian and the ruined Midianite cities, London, C. Kegan Paul, 392 p.

Richter-Bernburg, G., and Schott, W., 1954, Geological researches in Western Saudi Arabia: Ministry Petrol. and Mineral Resources, Dir. Gen. Mineral Resources, unpub. rept., 69p.

Trent, V. A., and Johnson, R. F., 1966, Reconnaissance mineral and geologic investigations in the Al Bad' quadrangle, Aqaba area, Saudi Arabia: U. S. Geol. Survey, Saudi Arabian Mineral Explor. Tech. Letter 50, 20 p.

von Gaertner, H. R., and Schurenberg, H., 1954, Journey through Saudi Arabia in spring, 1954: Ministry Petrol. and Mineral Resources, Dir. Gen. Mineral Resources, unpub. rept., 103p.