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August 8, 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 20 copies of:

TECHNICAL LETTER NUMBER 79
AREAS IN THE SOUTHERN NAJD
QUADRANGLE, SAUDI ARABIA
RECOMMENDED FOR MINERAL INVESTIGATIONS

by

Jesse W. Whitlow*

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Sincerely,

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

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

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Abstract

Eighteen areas in the Southern Najd quadrangle, Kingdom of Saudi Arabia, are recommended for further mineral exploration as a result of field and laboratory work undertaken in 1964-65. The size of each area, the coordinates of the bounding quadrilateral, and the elements justifying further search are:

1. 30 sq km; $23^{\circ}47'N.$, $23^{\circ}50'N.$, $44^{\circ}40'E.$, $44^{\circ}44'E.$; zinc.
2. 1000 sq km; $22^{\circ}43'N.$, $22^{\circ}57'N.$, $44^{\circ}07'E.$, $44^{\circ}43'E.$, tungsten and molybdenum.
3. 340 sq km; $22^{\circ}43'N.$, $22^{\circ}50'N.$, $44^{\circ}51'E.$, $45^{\circ}00'E.$; ancient mines present; zinc, silver, gold, tin.
4. 6 sq km around Ad Duwayh centered at $22^{\circ}18'N.$ x $43^{\circ}17'E.$; tungsten.
5. 36 sq km; $22^{\circ}19'N.$, $22^{\circ}23'N.$, $44^{\circ}19'N.$, $44^{\circ}22'N.$; Umm Hadid ancient mine; silver, lead, zinc, bismuth, tin, and tungsten.
6. 7 sq km; $22^{\circ}16'N.$, $22^{\circ}18'N.$, $44^{\circ}16'E.$, $44^{\circ}19'E.$; tungsten.
7. 14 sq km; $22^{\circ}05'N.$, $22^{\circ}08'N.$, $44^{\circ}42'E.$, $44^{\circ}44'E.$; tin and tungsten.
8. 16 sq. km; $21^{\circ}56'N.$, $21^{\circ}59'N.$, $43^{\circ}59'E.$, $44^{\circ}02'E.$, molybdenum.
9. 480 sq km; $21^{\circ}49'N.$, $21^{\circ}59'N.$, $44^{\circ}14'E.$, $44^{\circ}30'E.$; tungsten and molybdenum.
10. 180 sq km at Jabal Khida; $21^{\circ}18'N.$, $21^{\circ}28'N.$, $44^{\circ}28'E.$, $44^{\circ}35'E.$; tungsten.
11. 120 sq km; $20^{\circ}58'N.$, $21^{\circ}06'N.$, $42^{\circ}51'E.$, $42^{\circ}56'E.$; zinc and molybdenum.
12. 4 sq km around Dahlat Shabab ancient mine; $21^{\circ}03'N.$, $21^{\circ}05'N.$, $43^{\circ}45'E.$; $43^{\circ}47'E.$; gold, silver, tungsten.
13. 100 sq km; $21^{\circ}12'N.$, $21^{\circ}17'N.$, $43^{\circ}57'E.$, $44^{\circ}03'E.$; tin, beryllium, tungsten, and molybdenum.

14. 320 sq km; $21^{\circ}00'N.$, $21^{\circ}09'N.$, $44^{\circ}02'E.$, $44^{\circ}14'E.$; copper, molybdenum, gold.
15. 45 sq km; $20^{\circ}36'N.$, $20^{\circ}45'N.$, $42^{\circ}36'E.$, $42^{\circ}38'E.$; copper.
16. 24 sq km; $20^{\circ}13'N.$, $20^{\circ}16'N.$, $42^{\circ}30'E.$, $42^{\circ}34'E.$; lead, zinc, copper, silver.
17. 240 sq km; $20^{\circ}18'N.$, $20^{\circ}27'N.$, $42^{\circ}41'E.$, $42^{\circ}50'E.$, molybdenum and zinc.
18. 15 sq km; $20^{\circ}11'N.$, $20^{\circ}14'N.$, $43^{\circ}27'E.$, $43^{\circ}29'E.$; tungsten, copper, gold.

Of these areas, number 2, 5, 7, 8, and 13 should be accorded a higher priority for investigation than the others.

Introduction

Eighteen mineralized areas regarded as meriting further investigation for mineral deposits were identified during geologic reconnaissance in 1964-65 of the 137,182 sq km covered by the Southern Najd quadrangle, Kingdom of Saudi Arabia (Jackson and others, 1963). The location of the quadrangle is shown on figure 1 where the area is seen to be in the south-central part of the Arabian Peninsula. Distribution of the 18 mineralized area is shown on figure 2.

The 18 areas range in size from 4 sq km to 1000 sq km and aggregate 2977 sq km in area. The individual areas are accessible from Jiddah by way of main routes and lesser tracks, but working access within some of the areas is poor even to four-wheel-drive vehicles.

Three orders of priority for further work are assigned to the areas shown on figure 2. First priority is given to areas numbered 2, 5, 7, 8, and 13. Second priority includes areas 3, 4, 6, 9, 12, and 16. Third priority

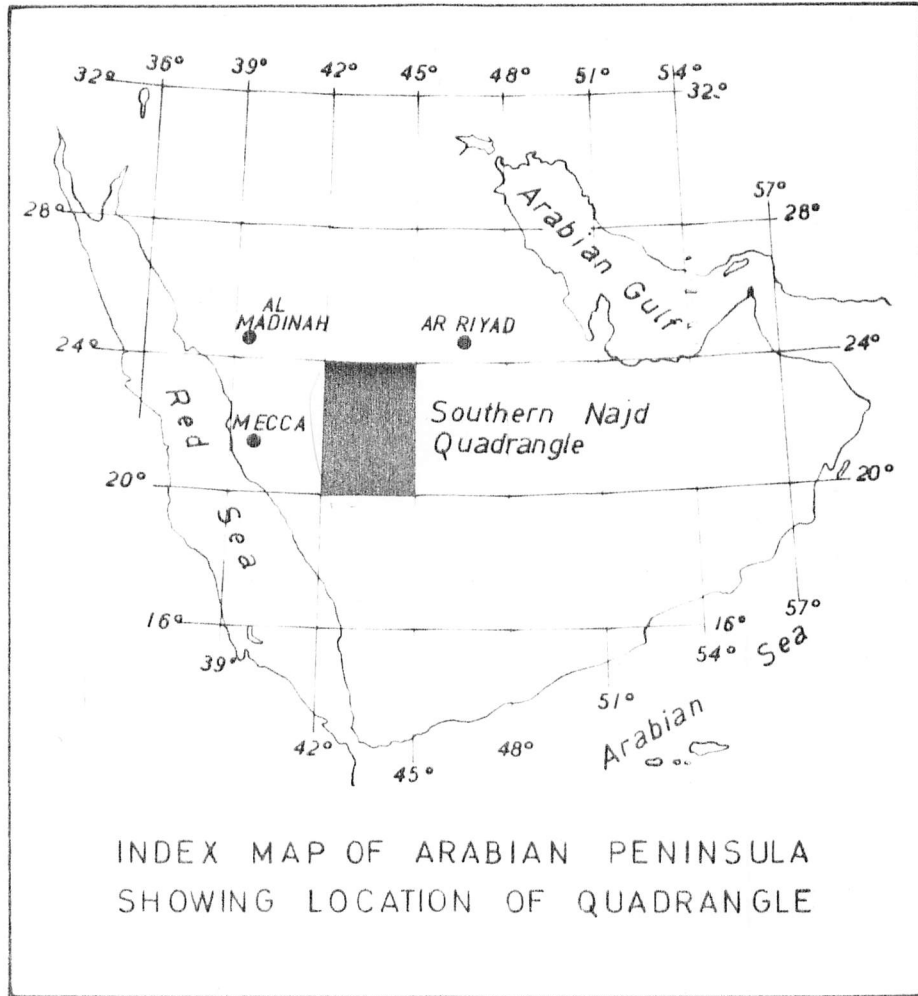


Figure 1

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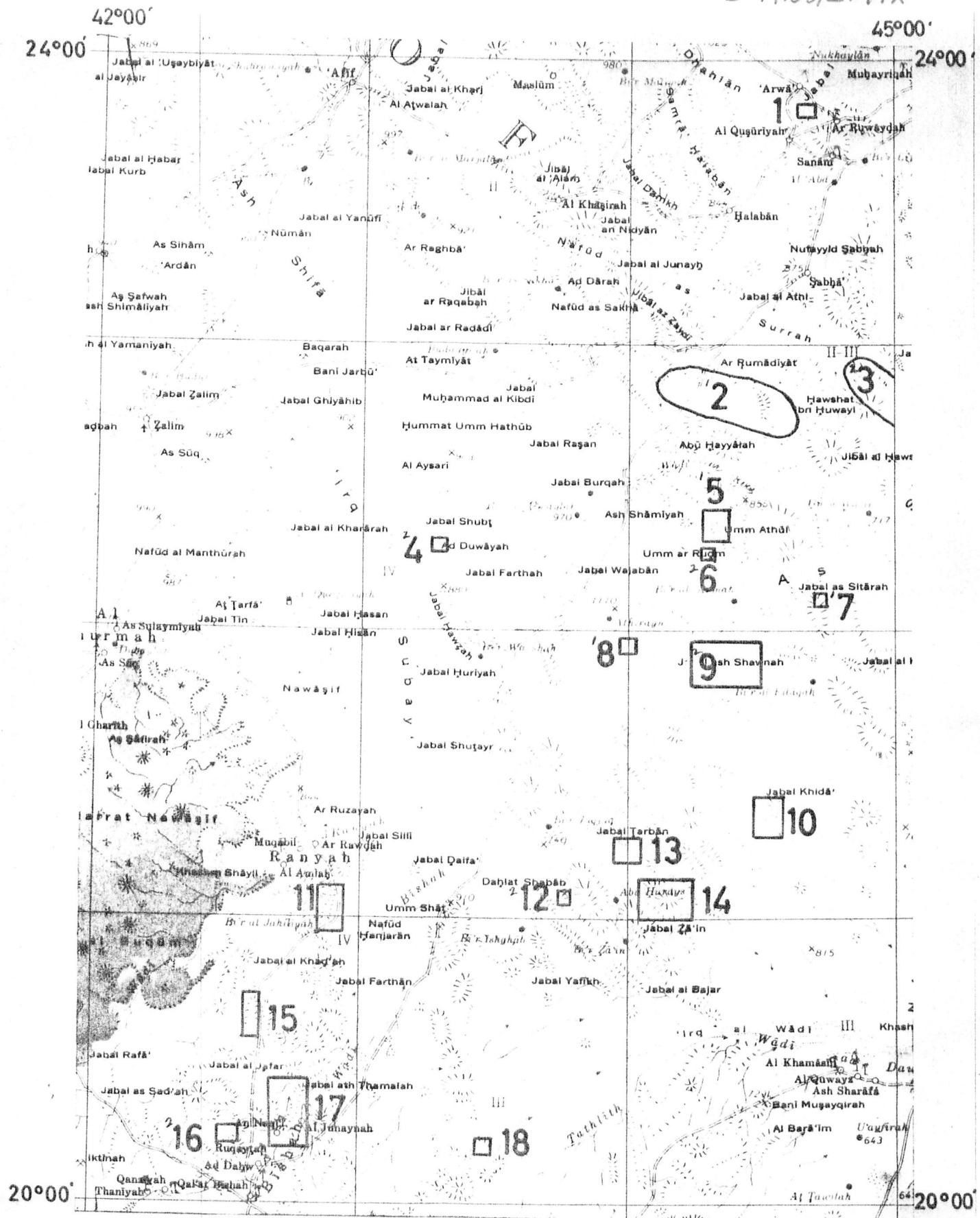


FIGURE 2

MAP SHOWING NUMBERED AREAS RECOMMENDED FOR DETAILED STUDY IN THE SOUTHERN NAJD QUADRANGLE KINGDOM OF SAUDI ARABIA

Scale 1:2,000,000

areas are numbered 1, 10, 11, 14, 15, 17, and 18.

It is recommended that brief examination be given each of the areas to determine if the elements identified in the present work are possibly present in sufficient abundance to justify the intensive exploration needed to prove minable concentrations of the elements. About 400 man-days of work would be needed to make this appraisal. Inasmuch as most of the areas have some indication of high-unit-value minerals, the first-priority areas should be regarded as potentially important targets. Further information on areas Jabal Khida, Jabal Sahah, Jabal Ash Shumrah, Jabal al Hawshah, and Al Kushaymiyah is given in a series of reports prepared in 1966 (Whitlow, 1966a-1966e).

Recommendations

Area 1.

Approximately 30 sq km bounded by $23^{\circ}47'$ and $23^{\circ}50'N.$, $44^{\circ}40'$ and $44^{\circ}44'E.$ should be studied to learn the relation of zinc in granite and to evaluate the small ancient mine in metamorphosed sedimentary rock. The ancient mine appears to have been opened for copper. Recommend 10 man-days of work.

Area 2.

Approximately 1,000 sq km bounded by $22^{\circ}43'$ and $22^{\circ}57'N.$, $44^{\circ}07'$ and $44^{\circ}43'E.$ should be studied to determine the tungsten and molybdenum minerals present, their concentration and distribution, relations of the minerals to structures in the granite and to silicified granite. Concentrates from wadi sand in the area contain as much as 6000 ppm (parts per million) tungsten and 300 ppm molybdenum.

Low positive anomalies for copper, chromium, and nickel are also present.

Recommend 65 man-days of work.

Area 3.

Approximately 340 sq km within an area bounded by $22^{\circ}43'$ and $22^{\circ}50'N.$, $44^{\circ}51'$ and $45^{\circ}00'E.$ should be studied to determine the potential for economic minerals. As much as 3000 ppm zinc was found in detrital magnetite from granite, and wadi sand contains anomalous lanthanum and yttrium and traces of beryllium, niobium, and tin. Bedouin report many prospects and small mines in the Halaban Formation; one mine in the Halaban Formation in this area was examined.

Access will be a problem. Recommend 60 man-days of work.

Area 4.

Six sq km around Ad Duwayah at approximately $22^{\circ}18'N.$ x $43^{\circ}17'E.$ should be examined to determine the source and abundance of tungsten around old mine workings. A concentrate from the mined area contains 8000 ppm tungsten and traces of copper and molybdenum. Recommend 25 man-days of work.

Area 5.

An area of about 36 sq km known as Umm Hadid and bounded by $22^{\circ}19'$ and $22^{\circ}23'N.$, $44^{\circ}19'$ and $44^{\circ}22'E.$ should be studied to assess the need for further explanatory work and drilling around the many pits, trenches, and shafts of this ancient mining center. Anomalous silver, lead, zinc, bismuth, and traces of beryllium, tin, and tungsten were found in material from the dumps. Ground

geophysical surveys for sulfide bodies may be useful after surface geology and geochemistry is completed. Recommend 50 man-days of geologic field work.

Area 6.

About 7 sq km bounded by $22^{\circ}16'$ and $22^{\circ}18'N.$, $44^{\circ}16'$ and $44^{\circ}19'E.$ should be studied to determine the source and abundance of tungsten minerals present. A heavy-mineral concentrate contained 1600 ppm tungsten. Recommend 15 man-days work.

Area 7.

Approximately 14 sq km bounded by $22^{\circ}05'$ and $22^{\circ}08'N.$, and $44^{\circ}42'$ and $44^{\circ}44'E.$ should be studied to determine the abundance and distribution of tin and tungsten in a granite plug and rocks of the Halaban Formation. Concentrates from the area contain as much as 5000 ppm tin (1/2%) and 1000 ppm tungsten. Estimate 35 man-days of work.

Area 8.

Approximately 16 sq km bounded by $21^{\circ}56'$ and $21^{\circ}59'N.$, $43^{\circ}59'$ and $44^{\circ}02'E.$ should be studied for molybdenum minerals and to determine if granite should be drilled to sample for molybdenum. Nodules of red granite in a reddish granite contain as much as 10,000 ppm (1%) molybdenum. Molybdenite also occurs in quartz pegmatite. Recommend 15 man-days of preliminary work to evaluate need for drilling.

Area 9.

About 480 sq km bounded by $21^{\circ}49'$ and $21^{\circ}59'$ N., $44^{\circ}14'$ and $44^{\circ}30'$ E. possibly has a potential for tungsten and molybdenum. Concentrates contain as much as 9,000 ppm (9/10%) tungsten and 160 ppm molybdenum, and low positive anomalies for copper and zinc. Estimate 25 man-days is needed.

Area 10.

Approximately 180 sq km at Jabal Khida bounded by $21^{\circ}18'$ and $21^{\circ}28'$ N., $44^{\circ}28'$ and $44^{\circ}35'$ E. should be studied to determine the source of tungsten. Estimate 10 man-days for the examination.

Area 11.

Approximately 120 sq km bounded by $20^{\circ}58'$ and $21^{\circ}06'$ N., and $42^{\circ}51'$ and $42^{\circ}56'$ E. should be studied for possible zinc and molybdenum. Detrital magnetite from the area contains as much as 1000 ppm zinc and 60 ppm molybdenum. No enrichment of these metals was found in wadi sand or concentrates. Recommend 10 man-days of work.

Area 12.

An area around Dahlat Shahab mine of approximately 4 sq km bounded by $21^{\circ}03'$ and $21^{\circ}05'$ N., $43^{\circ}45'$ and $43^{\circ}47'$ E. should be examined for tungsten and other economic minerals. A sample from the mine waste contained more than 6000 ppm tungsten. Recommend 10 man-days of work.

Area 13.

Approximately 100 sq km bounded by $21^{\circ}12'$ and $21^{\circ}17'N.$, $43^{\circ}57'$ and $44^{\circ}03'E.$ should be studied to evaluate tin, beryllium, tungsten, and molybdenum. Wadi sand contained 700 ppm tin and a concentrate contained 5000 ppm (1/2%) tin. Other concentrates contain as much as 110 ppm molybdenum and 80 ppm tungsten. Rare small crystals of beryl are in a small pegmatite dike. Recommend 40 man-days of work.

Area 14.

Approximately 320 sq km bounded by $21^{\circ}00'$ and $21^{\circ}09'N.$, $44^{\circ}02'$ and $44^{\circ}14'E.$ should be studied because of a low positive anomaly for copper and molybdenum. Also two small ancient gold mines are in the area. Recommend 20 man-days of work.

Area 15.

Approximately 45 sq km bounded by $20^{\circ}36'$ and $20^{\circ}45'N.$, $42^{\circ}36'$ and $42^{\circ}38'E.$ should be studied for possibly economic copper deposits. A long ridge of quartz and marble in metamorphosed sedimentary rocks was mined at the north end for copper, and about 500 tons of slag is at the mine site. Recommend 15 man-days of geologic and geochemical work accompanied or followed by ground EM geophysical survey.

Area 16.

Approximately 24 sq km bounded by $20^{\circ}13'$ and $20^{\circ}16'N.$, $42^{\circ}30'$ and $42^{\circ}34'E.$ contains many patches of granite stained red by weathering of sulfide minerals.

Samples of wadi sand from the area contain as much as 5000 ppm lead, 700 ppm zinc, a low positive anomaly for copper, and traces of silver and molybdenum. An ancient copper mine is in the area. Recommend 40 man-days of work.

Area 17.

Approximately 240 sq km bounded by $20^{\circ}18'$ and $20^{\circ}27'N.$, $42^{\circ}41'$ and $42^{\circ}50'E.$ contains as much as 300 ppm molybdenum and 1000 ppm zinc in detrital magnetite and traces of tin and beryllium in wadi sand. Recommend 15 man-days of geologic work studying the sources of these elements.

Area 18.

Approximately 15 sq km bounded by $20^{\circ}11'$ and $20^{\circ}14'N.$, $43^{\circ}27'$ and $43^{\circ}29'E.$ should be studied for tungsten and other economic minerals. An ancient copper and gold mine in quartz veins in metamorphosed sedimentary rock is in this area. The scree slopes were mined for gold. A concentrate from the mined area contained 2400 ppm tungsten. Recommend 10 man-days of work.

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