UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Technical Letter
Saudi Arabian Mineral
Exploration - 4
Prepared February 13, 1965
Issued August 15, 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 4
EXPERIENCE IN THE USE OF COARSE SAND AND OTHER MEDIA AS SAMPLES FOR GEOCHEMICAL EXPLORATION IN SAUDI ARABIA

by

Paul K. Theobald, Jr.* and Charles E. Thompson*

Sincerely,

Glen F. Brown

Glen F. Brown, Chief
Saudi Arabian Mineral Exploration Project

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

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Paul K. Theobald, Jr.* and Charles E. Thompson*

Geochemical prospecting for copper, zinc, molybdenum, and tungsten in igneous and metamorphic rocks along the mountains of the Red Sea scarp and the interior plateau of the Precambrian shield in Saudi Arabia has disclosed that geochemical anomalies in wadi sediments are greatly diluted by wind-transported debris. The mean grain size of the diluting debris is about 100 to 150 mesh. Debris coarser than about 80 mesh does not seem to have travelled far by air. The geochemical effects of dilution of wadi sand by major inter-drainage air transport of fine-grained particles can be largely avoided by using coarse fractions of sediment for analysis. Satisfactory definition of anomalies has been obtained by abandoning the conventional -80 mesh sample and selecting instead sediment in the size -30 to +80 mesh. Tests for copper in 103 pairs of samples of sand with one member of the pair being -30 +80 mesh and the other member being -80 mesh disclosed copper in the range 20 ppm to 6000 ppm in the -30 +80 mesh and 20 ppm to 1500 ppm in the -80 mesh. With 40 ppm or less copper as background, the ratio of copper in the two sieve fractions is:

Copper in -30 +80 mesh fraction	Average ratio $\frac{\text{-30 +80 mesh}}{\text{-80 mesh}}$
background	1.2
2(background)	1.7
5(background)	2.2
10(background)	2.5
50(background)	5.3

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If the usual -80 mesh sand is used for analysis, the results: (1) are markedly affected by differences in local physiography, (2) diminish the area of a given copper anomaly, (3) reduce the magnitude of the anomaly, and (4) yield a less distinct pattern.

An example of the distribution of zinc in pairs of sand samples taken into an anomalous feature serves also to show how much better the coarse material reflects the feature than does the fine sand:

Ppm zinc in pairs of samples

Coarse fraction (-30 +80 mesh)	Fine fraction (-80 mesh)
25	<25
<25	<25
25	25
75	50
50	25
50	25
100	25
100	50
150	50
300	50
175	100
200	50
500	50
400	50
400	75
800	150
800	125
800	50
1800	150
1400	150
1000	125
2500	150
2000	400

At another locality examined with 91 pairs of samples the amount of copper in the coarse fraction was <10 to 600 ppm with 75 ppm the anomalous threshold. Zinc ranged in abundance from 25 to 800 with 100 ppm and above anomalous. In the fine fraction the copper ranged in amount from 10 to 225 ppm with the median at 75 ppm; the quantity of zinc was from less than 25 ppm to 300 ppm with the median at 50 ppm. Average ratios for the metal content of the coarse fraction compared with the fine are:

Metal content of coarse fraction (-30 +80 mesh)	Average ratio $\frac{\text{-30 +80 mesh}}{\text{-80 mesh}}$	
	Cu	Zn
background	1.3	1.5
2(background)	1.6	2.5
5(background)	2.1	4.5
10(background)	4.2	7.8

In the fine fraction the anomaly is reduced in both size and magnitude.

Two other media seem useful for reconnaissance sampling. Heavy minerals from wadi sand have given distinctive variations in molybdenum and tungsten. Magnetite displays strong regional variations in copper, zinc, and molybdenum. Both of these media give alluvial trains in the wadis in contrast to the bulk sediment, in which anomalous features are abruptly masked by local sediment.