

MAP A—SILVER IN THE NONMAGNETIC FRACTION

DESCRIPTION OF MAP UNITS

- QTz GRAVEL, SAND, SILT, AND CLAY (QUATERNARY AND TERTIARY)—Mainly alluvial stream terraces, fan aprons, and sediments colluvium on hill slopes and in some of the alluvial basins.
- OTb QUATERNARY AND TERTIARY—Quartzite and basaltic andesite flows and small intrusions.
- Tcvc CONGLOMERATE AND VOLCANIC ROCKS (TERTIARY)—Mainly coarse conglomerate and subordinate igneous rocks; includes some flow and andesite tuffs.
- Tm INTERMEDIATE TO BASIC VOLCANIC ROCKS (TERTIARY)—Mainly flows, scoria cones, domes, and small intrusions. Locally includes small units of felsic volcanic rocks and volcaniclastic rocks.
- TF FELSIC VOLCANIC ROCKS (TERTIARY)—Mainly rhyolite, dacite, and andesite; locally includes some volcaniclastic rocks.
- TI INTRUSIVE ROCKS (TERTIARY)—Includes granitic rocks in plutons and anorthitic and porphyritic rocks in dikes and dikes.
- TCI INTRUSIVE ROCKS (TERTIARY AND QUATERNARY)—Includes granitic rocks, commonly porphyritic, in plutons, and porphyritic rocks and breccias in dikes and dikes. Locally includes small units of andesite.
- Tka ANDESITIC ROCKS (TERTIARY AND QUATERNARY)—Mainly flows and small intrusions. Locally includes small units of andesite.
- Ksv SEDIMENTARY VOLCANIC ROCKS (CRETACEOUS)—Mainly tuffs, siltstone, sandstone, and conglomerate; includes some limestone and andesite and intermediate volcanic rocks. Mainly Lower Cretaceous. Includes some of the upper and lower Cretaceous Colorado Shale to the northeast.
- Pps SEDIMENTARY ROCKS (PERMIAN AND NONPERMIAN)—Mainly limestone. Includes some dolomite and sandstone.
- Mcs SEDIMENTARY ROCKS (MESOZOIC TO CAMBRIAN)—Mainly limestone, dolomite, shale, quartzite, and sandstone. Includes some conglomerate and andesite sandstone.
- Yd DIAMASE (MIDDLE PROTEROZOIC)—Includes gabbro and mafic rocks in dikes and irregular masses.
- Yi INTRUSIVE ROCKS (MIDDLE PROTEROZOIC)—Granitic rocks, commonly porphyritic or porphyroblastic.
- Xm METASEDIMENTARY AND METAVOLCANIC ROCKS (EARLY PROTEROZOIC)—Includes Pinal Schist and unnamed amphiboles.

INTRODUCTION

These maps (Maps A and B) show the distribution and abundance of silver in the nonmagnetic and magnetic fractions of heavy-mineral concentrates from stream sediments collected in the Silver City 1° x 2° quadrangle, New Mexico and Arizona. Geochemical maps showing the distribution and abundance of 10 other selected elements and the mineral fluorite in the Silver City quadrangle are also part of this report (Watts and Hassener, 1980; Watts and Hassener, 1981a). These maps contribute to the assessment of the Silver City 1° x 2° quadrangle as a potential source of heavy-mineral concentrates. They provide information on the distribution of silver and other selected elements in new areas containing enriched metals, not previously shown from any other source. The maps are intended to be used in conjunction with the interpretive and summary maps (Watts and Hassener, 1980) and the mineral resource assessment maps (Watts and Hassener, 1981b). Background information that pertains to published components of the Silver City 1° x 2° quadrangle (Richter and others, in press).

Geographic and physiographic

The Silver City 1° x 2° quadrangle covers approximately 8,050 mi² (20,850 km²) in southeastern Arizona and southwestern New Mexico. It includes parts of Grant, Hidalgo, and Luna Counties in New Mexico, and Cochise, Graham, and Greenlee Counties in Arizona. Principal urban centers include Silver City and Lordsburg in New Mexico, and Sanford and Wilcox in Arizona. Interstate Highways 70, 80, 180, and 666, and numerous major State and county roads provide access to most of the quadrangle. The quadrangle lies almost entirely within the southern part of the Colorado Plateau and the northern part of the Basin and Range province. The Colorado Plateau is characterized by broad volcanic uplands, and in the transition zone between the Basin and Range and Colorado Plateau provinces, the westerly flowing Gila River and other large rivers are drained therefrom. Elevations range from a low of 2,495 ft (760 m), where the Gila River leaves the northeast corner of the quadrangle, to a high of 10,606 ft (3,232 m), 22 mi (35 km) south on Mt. Graham in the Pinaleno mountain range.

Geologic setting

The north- to west-northwest-trending block-faulted mountain ranges of the Silver City 1° x 2° quadrangle consist of diverse rocks ranging in age from Proterozoic through Cenozoic. The four main groups of rocks exposed in the ranges are, from oldest to youngest: (1) Proterozoic metamorphic and plutonic rocks; (2) Paleozoic and Mesozoic sedimentary rocks; (3) Cretaceous and early Tertiary volcanic and plutonic rocks; and (4) middle Tertiary volcanic and plutonic rocks. The mountain ranges are separated by structural and topographic basins filled with late Tertiary to Holocene sedimentary rocks and unconsolidated sediments.



Figure 1.—Index map of Arizona and New Mexico showing location of the Silver City 1° x 2° quadrangle (stippled) and some major geographic and physiographic features.

SAMPLE COLLECTION, PREPARATION, AND ANALYSIS

Geochemical sampling in the Silver City 1° x 2° quadrangle was completed in 1981. The sample density of the drainage survey is highly variable over the Silver City 1° x 2° quadrangle. Some of the highest numbers of samples per square kilometer are in the northeast corner of the Silver City 1° x 2° quadrangle, where the drainage survey was most intensive. This area was the subject of detailed studies of stream-sediment mineral concentrations in 1978 and 1979, and is the subject of other reports (Watts and others, 1978; Watts and others, 1981). Other areas of the quadrangle with unusually high element concentrations in the more widely spaced regional reconnaissance survey were further sampled by the drainage survey. The heavy-mineral samples were collected as composites from multiple deposit locations in the channels of the drainage survey. The amount of material that was sampled is 15 to 30 kg (33 to 66 lb) or roughly the amount of material that would be expected to be present in the channels of streams where they exist from the range of stream discharges that occur in the Silver City 1° x 2° quadrangle. The samples were collected from the channels of streams where they exist from the range of stream discharges that occur in the Silver City 1° x 2° quadrangle. The samples were collected from the channels of streams where they exist from the range of stream discharges that occur in the Silver City 1° x 2° quadrangle.

STATISTICS AND MAP GENERATION

The statistical distribution of the data is shown on the histogram (Fig. 2). The frequency distributions of the two fractions of heavy-mineral concentrates are superimposed on each other on the histogram to facilitate their comparison, which is useful for interpretations. The symbols used on the histogram to facilitate their comparison represent element concentrations as shown on the histogram. The maps were computer plotted. The plotting symbol (•) represents the lowest class interval of reported element concentrations, which is regarded as the background range of element concentrations. These element contents are mostly derived from normal rock-forming and rock-accessory minerals and their weathering products, which compose the bulk of heavy-mineral concentrates. The resulting class intervals show some ranges of element concentrations regarded as high background or weakly anomalous to highly anomalous as a result of either unusual trace-element substitutions in rock-forming minerals or the presence of ore-forming minerals; increasing trace-element content is indicated by increased size of symbol.

SELECTED REFERENCES

- Drewes, Harold, Houser, R. S., Hedlund, D. C., Richter, D. H., Thomas, C. A., and Finnell, L. L., 1988, Geologic map of the Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Investigations Series Map I-1131-A, scale 1:250,000.
- Grimes, S. J., and Marranzino, A. P., 1966, Direct-current arc and alternating-current spark spectroscopic analysis of geochemical materials: U.S. Geological Survey Circular 591, 6 p.

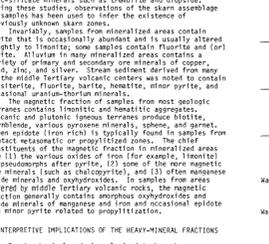


Figure 2.—Histogram showing distribution of silver. Symbols show within each class interval of reported element concentrations corresponds with symbol shown on map. Nonmagnetic fraction is shown by circles; magnetic fraction is shown by crosses. Upper number below class interval symbol is number of samples in the nonmagnetic fraction; lower number is number of samples in the magnetic fraction.

Hassener, J. R., Finnell, L. L., Houser, R. S., and Watts, K. C., 1981, Analytical results for stream-sediment heavy-mineral concentrates from the Silver City 1° x 2° quadrangle, New Mexico: U.S. Geological Survey Open-File Report 81-44, 40 p.

McNeal, S. K., Finnell, L. L., Hassener, J. R., and Watts, K. C., 1981, Analytical results for stream-sediment heavy-mineral concentrates, silver, from the Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey MTS Report 81-20, 86 p. Computer tape available from U.S. Department of Commerce, National Technical Information Service, Springfield, Va. 22161.

Richter, D. H., Houser, R. S., Watts, K. C., Klein, S. P., Shaw, R. C., and Finnell, L. L., 1988, Mineral resource assessment of the Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Open-File Report 88-254, 71 p.

VanDer, J. R., and Winesch, A. T., 1973, The U.S. Geological Survey ASS-STATAC system for management and statistical reduction of geochemical data and Computers in Geoscience, v. 3, no. 3, p. 475-488.

Watts, K. C., and Hassener, J. R., 1980, Distribution and abundance of fluorite in stream-sediment concentrates, Silver City 1° x 2° quadrangle, Arizona and New Mexico: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-A, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of lead in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-B, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of zinc in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-C, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of cadmium in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-D, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of cobalt in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-E, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of manganese in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-F, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of nickel in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-G, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of copper in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-H, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of iron in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-I, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of barium in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-J, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of strontium in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-K, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of rubidium in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-L, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of cesium in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-M, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of potassium in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-N, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of sodium in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-O, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of calcium in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-P, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of magnesium in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-Q, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of aluminum in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-R, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of silicon in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-S, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of titanium in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-T, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of vanadium in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-U, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of chromium in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-V, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of manganese in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-W, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of iron in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-X, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of cobalt in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-Y, scale 1:250,000.

Watts, K. C., Hassener, J. R., Finnell, L. L., and Siems, D. F., 1980, Geochemical maps showing distribution and abundance of nickel in two fractions of stream-sediment concentrates, Silver City 1° x 2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1183-Z, scale 1:250,000.

GEOCHEMICAL MAPS SHOWING DISTRIBUTION AND ABUNDANCE OF SILVER IN TWO FRACTIONS OF STREAM-SEDIMENT CONCENTRATES, SILVER CITY 1° X 2° QUADRANGLE, NEW MEXICO AND ARIZONA