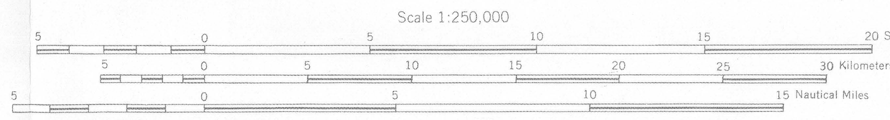
Base from U.S. Geological Survey, 1956-1976

Geology generalized from Smith and others (1982)



Scale 1:250,000

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION

MAP SHOWING ABUNDANCE AND DISTRIBUTION OF MERCURY IN ROCK SAMPLES, MEDFORD 1° BY 2° QUADRANGLE, OREGON-CALIFORNIA

By

Charles L. Whittington, Reinhard W. Leinz, and David J. Grimes

1985

CORRELATION OF MAP UNITS

QTv	QUATERNARY AND TERTIARY
Tv, Ts	TERTIARY
KJs, KJg	CRETACEOUS
Jv, Jo	JURASSIC
TrPzv	TRIASSIC AND PALEOZOIC
MzPzm	MESOZOIC AND PALEOZOIC

LIST OF MAP UNITS

- QTv — VOLCANIC ROCKS OF HIGH CASCADE RANGE (QUATERNARY AND TERTIARY)
- Tv — VOLCANIC ROCKS OF WESTERN CASCADE RANGE (TERTIARY)
- Ts — MARINE AND NONMARINE SEDIMENTARY ROCKS (TERTIARY)
- KJs — SEDIMENTARY ROCKS (CRETACEOUS AND JURASSIC)
- KJg — GRANITIC ROCKS (CRETACEOUS AND JURASSIC)
- Jv — VOLCANIC ROCKS (JURASSIC)
- Jo — OPHIOLITE (JURASSIC)
- TrPzv — VOLCANIC ROCKS (TRIASSIC AND PALEOZOIC)
- MzPzm — REGIONALLY METAMORPHOSED ROCKS (MESOZOIC AND PALEOZOIC)

CONTACT

FAULT

124 — SAMPLE LOCALITY NUMBER--Corresponds to number in table 1 and(or) discussion

A — SAMPLE LOCALITY--See figure 1 for letter values

□ — ANOMALOUS MERCURY CONCENTRATION--See figure 1 for values

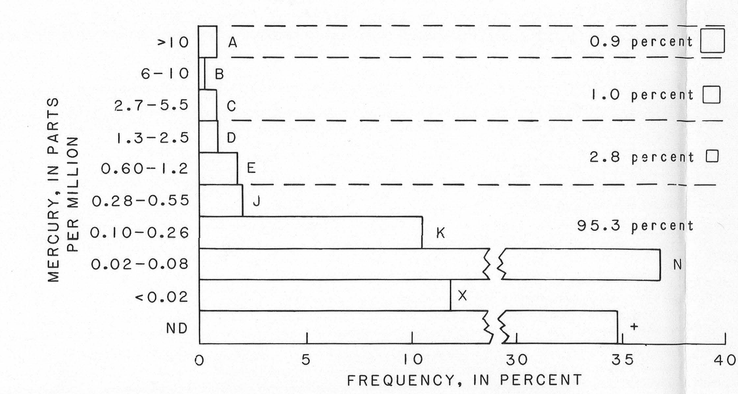


Figure 1.--Histogram showing the concentration of mercury in rock samples. ND, not detected; <, present but less than determination limit; determination limit, 0.02 parts per million; >, greater than value shown.

This map is part of a folio of maps of the Medford 1° by 2° quadrangle, Oregon-California, prepared under the Conterminous United States Mineral Assessment Program. Other publications in this folio include Page, Blakely, and Cannon (1983); Page, Johnson, and Peterson (1983); Singer and others (1983), Smith and others (1982), Whittington, Grimes, and Leinz (1985a,b,c); Whittington, Grimes and Peterson (1983), Whittington, Leinz, and Grimes (1985); and Whittington, Leinz, and Speckman (1983).

INTRODUCTION

The Medford 1° by 2° quadrangle is located in mountainous southwestern Oregon adjacent to the California border and a short distance east of the Pacific coast. Various parts of this area lie in different geologic provinces. Most of the western half of the quadrangle is underlain by pre-Tertiary rocks of the Klamath Mountains province. However, the Coast Range province is represented by the Tertiary sedimentary rocks in the northwest corner. Much of the eastern half of the quadrangle lies in the Cascade Range. In Oregon, because of differences in physiographic expression and age of rocks, this province is commonly divided into the more rugged High Cascade Range on the east and the more subdued Western Cascade Range on the west. This division is approximated on the map by the contact between the Quaternary and Tertiary volcanic rocks of the High Cascade Range and the Tertiary volcanic rocks of the Western Cascade Range. The geology shown on the map is generalized from a more detailed compilation by Smith and others (1982).

DISCUSSION

This map presents data on the abundance and distribution of mercury in 3,146 rock samples from the Medford quadrangle. Most of the rock samples were collected incidental to geologic, geochemical, and mineral resource studies in the period from 1974 to 1980, but about 6 percent date from earlier investigations (Wells, 1940; 1956; Wells and others, 1949).

Rock samples were crushed to approximately minus 6 mm in a jaw crusher and split with a riffle-type splitter; a representative split was ground to approximately minus 0.1 mm in a vertical pulverizer equipped with ceramic plates. The pulverized splits were analyzed for 20 or more elements by a semiquantitative emission spectrographic method (Grimes and Marranzino, 1968), and, except for some samples from wilderness areas, for mercury by vapor-detection techniques (Vaughn and McCarthy, 1964; McNerney and others, 1972). Selected samples were analyzed for gold by atomic absorption (Ward and others, 1969, p. 35-37) and for arsenic by colorimetry (Ward and others, 1963, p. 40-44), because these methods have lower detection limits than the spectrographic method.

The geochemical plot for mercury was produced on a flat-bed plotter from computer-stored geochemical data. Prior to making the plot, the authors manipulated and reduced the data by computer, using a method described by Whittington, Grimes, and Peterson (1983). About 15 percent of the sample localities shown on the map resulted from merging of closely spaced sample sites, and an additional 8 percent of the sample localities were sites of multiple rock-sample collection. For those sample localities representing more than one rock sample, only the maximum analytical value for mercury was plotted.

The map shows abundance and distribution of mercury in rocks from the Medford quadrangle. Sample localities and concentrations of mercury are represented by letters or symbols whose values are given on the histogram in figure 1. For purposes of this discussion concentrations of mercury of 0.60 ppm (parts per million) or more, the upper 4.7 percent of the values, are considered anomalous and are outlined by squares on the map. For other purposes, however, Singer and others (1983) considered concentrations of 0.20 ppm or more, the upper 9.1 percent of the values, to be anomalous. Partial analytical results of selected samples containing 0.60 ppm or more mercury are listed in table 1. Complete analytical data for the rock samples are tabulated in Whittington, Grimes, and Peterson (1983), wherein sample localities are designated by numbers that increase from 1 to 2,011 with increasing values of the Y-coordinate (northing) in the Universal Transverse Mercator grid system. The selected sample localities referred to on this map are identified by the same series of numbers.

Mercury occurs principally as the red sulfide cinnabar and to a much smaller extent as the native element or in other mercury compounds. Mercury often occurs in smaller concentrations in sulfides and other minerals. It is present in trace amounts in many rocks, soils, natural waters, and in the atmosphere (Jonasson and Boyle, 1972). The element is of interest not only in that it forms its own deposits and acts as a guide to those deposits but it also serves as a pathfinder for base- and precious-metal deposits of various kinds.

The geochemical map shows the general abundance and distribution of mercury in the quadrangle. Only six of the 43 known mercury mines and prospects in the quadrangle (Brooks, 1963, p. 58-99; Brooks, 1971) were sampled. It is noteworthy that the six samples from known mercury occurrences are generally lacking or relatively low in other trace metals, a normal trait of mercury deposits (Brooks, 1963, p. 20). The six sample localities include 38 and 56 near the south-central map boundary, 414 about 3 km northwest of the city of Ashland, 581 about 14 km northeast of Ashland, 1175 about 12 km north of the center of the quadrangle, and 1258 about 5 km north of 1175. The cobalt, chromium, and nickel at locality 56 and the small amounts of tungsten in some samples are not believed to be genetically related to the mercury in these samples.

Sample localities 1175, 1236, 1250, and 1258 lie in the area of greatest mercury production in the quadrangle (Brooks, 1963, p. 67-80). This area straddles the contact between Tertiary rocks on the east and older metamorphic rocks on the west and extends northward from about 7 km north of the center of the quadrangle to the vicinity of locality 1258. The area has been described as "sheared and altered zones along the thrust-faulted contact..." (J. G. Smith, written commun., 1981). Mercury production has come from faulted and sheared areas of alteration on both sides of the contact. The sample from locality 1258 was collected at the dump of a small mercury mine, but the other samples were collected from outcrops.

Cinnabar-bearing opalized tuff (opalite) occurs in an area a short distance northwest of Shale City. Sample locality 581 is one of three known mercury prospects in the area (Brooks, 1963, p. 81-82). The opalite and the surrounding area of hydrothermal alteration are thought to have resulted from hot-spring action (J. G. Smith, written commun., 1981).

Anomalous mercury in tuffaceous shale and sandstone at locality 551, the small oil shale deposit at Shale City, may be genetically related to the ancient hot spring referred to above, because the amount of mercury present exceeds the usual maxima expected for these rock types (Jonasson and Boyle, 1972). The sedimentary beds at Shale City are believed to have been deposited in a lake (Wells, 1956; Newton, 1969); their areal extent is too small to show at 1:250,000 scale.

Ultramafic rocks may occasionally host mercury deposits as exemplified by the mercury prospect at locality 56 and by the mercury occurrence at a chromite prospect at locality 242, about 12 km southwest of Ashland. The majority of the samples listed in table 1, however, illustrate the frequent association of mercury with gold and base-metal occurrences. Mercury may form halos around these deposits and provide broad targets for mineral exploration.

REFERENCES CITED

Brooks, H. C., 1963, Quicksilver in Oregon: Oregon Department of Geology and Mineral Industries Bulletin 55, 223 p.

______1971, Quicksilver deposits in Oregon: Oregon Department of Geology and Mineral Industries Miscellaneous Paper 15, scale 1:1,000,000.

Brooks, H. C., and Ramp, Len, 1968, Gold and silver in Oregon: Oregon Department of Geology and Mineral Industries Bulletin 61, 337 p.

Callaghan, Eugene, and Buddington, A. F., 1938, Metalliferous mineral deposits of the Cascade Range in Oregon: U.S. Geological Survey Bulletin 893, 141 p.

Grimes, D. J., and Marranzino, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for the semiquantitative analysis of geologic materials: U.S. Geological Survey Circular 591, 6 p.

Jonasson, I. R., and Boyle, R. W., 1972, Geochemistry of mercury and origins of natural contamination of the environment: Canadian Mining and Metallurgical Bulletin, v. 65, no. 717, p. 32-39.

McNerney, J. J., Buseck, P. R., and Hanson, R. C., 1972, Mercury detection by thin gold films: Science, v. 178, p. 611-612.

Newton, V. C., Jr., 1969, Oil shale; in Mineral and water resources of Oregon: Oregon Department of Geology and Mineral Industries Bulletin 64, p. 278-280.

Page, N. J., Blakely, R. J., and Cannon, J. K., 1983, Map showing geologic, geophysical, and geochemical characteristics of granitic plutons in the Medford 1° by 2° quadrangle, Oregon-California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1383-E, scale 1:250,000.

Page, N. J., Johnson, M. G., and Peterson, J. A., 1983, Map showing characteristics of lode gold in the Medford 1° by 2° quadrangle, Oregon-California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1383-D, 2 sheets, scale 1:250,000.

Ramp, Len, 1972, Geology and mineral resources of Douglas County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 75, 106 p.

Ramp, Len, and Peterson, N. V., 1979, Geology and mineral resources of Josephine County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 100, 45 p.

Singer, D. A., Page, N. J., Smith, J. G., Blakely, R. J., and Johnson, M. G., 1983, Mineral resource assessment maps of the Medford 1° by 2° quadrangle, Oregon-California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1383-C, 2 sheets, scale 1:250,000.

Smith, J. G., Page, N. J., Johnson, M. G., Moring, B. C., and Gray, Floyd, 1982, Preliminary geologic map of the Medford 1° by 2° quadrangle, Oregon and California: U.S. Geological Survey Open-File Report 82-955, scale 1:250,000.

Vaughn, W. W., and McCarthy, J. H., Jr., 1964, An instrumental technique for the determination of submicrogram concentrations of mercury in soils, rocks, and gas: U.S. Geological Survey Professional Paper 501-D, p. D123-D127.

Wagner, N. S., 1944, Antimony in Oregon: Oregon Department of Geology and Mineral Industries GMI Short Paper 13, 21 p.

Ward, F. N., Lakin, H. W., Canney, F. C., and others, 1963, Analytical methods used in geochemical exploration by the U.S. Geological Survey: U.S. Geological Survey Bulletin 1152, 100 p.

Ward, F. N., Nakagawa, H. M., Harms, T. F., and Van Sickle, G. H., 1969, Atomic-absorption methods of analysis useful in geochemical exploration: U.S. Geological Survey Bulletin 1289, 45 p.

Wells, F. G., 1940, Preliminary geologic map of the Grants Pass quadrangle, Oregon: Oregon Department of Geology and Mineral Industries, scale 1:125,000.

______1956, Geology of the Medford quadrangle, Oregon-California: U.S. Geological Survey Geologic Quadrangle Map GQ-89, scale 1:96,000.

Wells, F. G., Hotz, P. E., and Cater, F. W., Jr., 1949, Preliminary description of the geology of the Kerby quadrangle, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 40, 23 p.

Whittington, C. L., Grimes, D. J., and Leinz, R. W., 1985a, Map showing abundance and distribution of copper in oxide residues and sieved fractions of stream sediments, Medford 1° by 2° quadrangle, Oregon-California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1383-G, scale 1:250,000.

______1985b, Map showing abundance and distribution of silver in stream-sediment samples, Medford 1° by 2° quadrangle, Oregon-California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1383-H, scale 1:250,000.

______1985c, Map showing abundance and distribution of chromium in stream-sediment samples, Medford 1° by 2° quadrangle, Oregon-California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1383-I, scale 1:250,000.

Whittington, C. L., Grimes, D. J., and Peterson, J. A., 1983, Spectrographic and chemical analyses of rock and soil samples from the Medford 1° x 2° quadrangle, Oregon-California: U.S. Geological Survey Open-File Report 83-344, 218 p.

Whittington, C. L., Leinz, R. W., and Grimes, D. J., 1985, Map showing abundance and distribution of arsenic in oxide residues of stream-sediment samples, Medford 1° by 2° quadrangle, Oregon-California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1383-J, scale 1:250,000.

Whittington, C. L., Leinz, R. W., and Speckman, W. S., 1983, Analytical results of stream-sediment samples from the Medford 1° x 2° quadrangle, Oregon-California: U.S. Geological Survey Open-File Report 83-349, 140 p.

Table 1.--Partial analytical results of selected rock samples containing anomalous amounts of mercury, Medford 1° by 2° quadrangle, Oregon-California

[Values in parts per million; number in parentheses (5) indicates determination limit for method used; ND, not detected; <, present but less than determination limit; >, greater than value shown; --, no data collected or does not apply; ?, lithology unknown. Analytical methods: Hg by vapor detector, As by colorimetry or by emission spectroscopy (starred values), Au by atomic absorption, all other elements by emission spectroscopy. Analysts: D. J. Grimes; R. W. Leinz; C. L. Whittington; and R. T. Hopkins]

Sample Locality No.	Field No.	Hg (0.02)	Ag (0.5)	As (10) (200)*	Au (0.05)	Cu (5)	Mo (5)	Pb (20)	Zn (200)	Others	Lithology	Mine or Prospect	Commodity	Reference
		Elements												
38	39PH103	>10	ND	ND	--	100	ND	ND	ND	W,70	?	Jeldness and Rhodes	Hg	Brooks, 1963, p. 92-93.
56	38WK145	>10	ND	ND*	ND	10	ND	<20	ND	Co,200;Cr,5,000;Ni,3,000	Serpentinite	Ruby	Hg	Brooks, 1963, p. 91-92.
104	38WK189	>10	ND	2,000*	ND	30	ND	20	ND	Sb,>10,000	Igneous intrusive	Lowry	Sb	Wagner, 1944, p. 12-14.
131	38WK221	10	7	>10,000*	9.0	30	ND	ND	700	Sb,700	Quartz	Steamboat	Au	Brooks and Ramp, 1968, p. 264.
242	38PH029	>10	ND	10	--	7	ND	ND	ND	Co,300;Cr,>5,000;Ni,1,500	?	Cass Ranch	Cr	Wells, 1956.
283	38WK072	>10	200	800	4.0	1,000	2,000	7,000	>10,000	Cd,500;Sb,3,000;Sn,10	?	Barron	Au,Ag	Callaghan and Buddington, 1938, p. 134-136.
414	38WK048	>10	ND	ND	--	7	ND	ND	ND	--	?	Vicinity of Phillips	Hg	Brooks, 1963, p. 83.
516	38BGZ00	1.1	200	80	70	700	ND	70	ND	--	?	Oregon Bonanza	Au	Ramp and Peterson, 1979, table 1.
551	77FG004A	>10	ND	ND	ND	50	<5	20	ND	--	Shale	Shale City	Oil	Newton, 1969.
581	75SJ240C	>10	ND	<10	ND	<5	ND	ND	ND	--	Probably opalite	Mammoth	Hg	Brooks, 1963, p. 81-82.
884	39PH104	5.0	10	10	0.05	5,000	1,000	100	ND	Bi,100	?	Hidden Treasure (Homestake)	Au	Brooks and Ramp, 1968, p. 256.
925	41GB119	10	20	ND	60	20,000	ND	<20	ND	Bi,20	?	Old Glory	Au	Ramp and Peterson, 1979, table 1.
1175	80SJ145	4.0	ND	<10	ND	30	ND	ND	ND	W,<50	Sheared dike rock	Vicinity of Dave Force	Hg	Brooks, 1963, p. 76-78.
1209	76GD008	1.3	30	ND*	0.80	15,000	150	ND	7,000	Co,700	Greenstone	Copper Queen	Cu,Au,Ag	Ramp and Peterson, 1979, table 1.
1236	80MJ260R	3.0	ND	120	ND	100	7	20	ND	W,<50	Fe-stained rock	--	--	
1250	80MJ118A	>10	ND	120	ND	30	ND	ND	<200	W,100	Yellow-red gossan	--	--	
1258	80MJ118B	>10	<0.5	30	ND	20	ND	ND	ND	W,<50	Fe-stained rock	Roxana	Hg	Brooks, 1963, p. 72-73.
1410	76GA066	>10	70	2,000*	14	5,000	300	2,000	ND	Bi,20;Sb,150;Sn,500	Gossan	Gary Johnson (Mt. Reuben)	Au,Cu	Ramp and Peterson, 1979, table 1.
1479	75GL058	4.0	20	ND*	ND	700	20	2,000	>10,000	Cd,100	Rhyodacite	--	--	
1608	79SJ102	3.0	0.7	200	ND	5	10	20	200	Sb,150	Pitchstone	--	--	
1723	79MS005	1.3	0.5	10	0.10	5,000	ND	ND	ND	--	?	Banfield	Cu	Ramp, 1972, p. 26.
1744	80MJ360R	2.5	15	600	0.20	15	5	1,000	1,000	Sb,<100;W,<50	?	Al Serena (Buzzard)	Au	Callaghan and Buddington, 1938, p. 131-132.
1756	75CY238C	0.70	100	300*	0.20	>20,000	50	70	<200	Sb,100	Felsic breccia	Silver Peak	Cu,Ag,Au	Ramp, 1972, p. 29.
1969	79SJ067	>10	ND	400	ND	20	<5	<20	200	Sb,<100	Tuff	--	--	
2006	77FG087A	9	ND	5,000	ND	150	20	20	ND	Co,150;Sb,500	Igneous rock	--	--	

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