See sheet 1 for map explanation

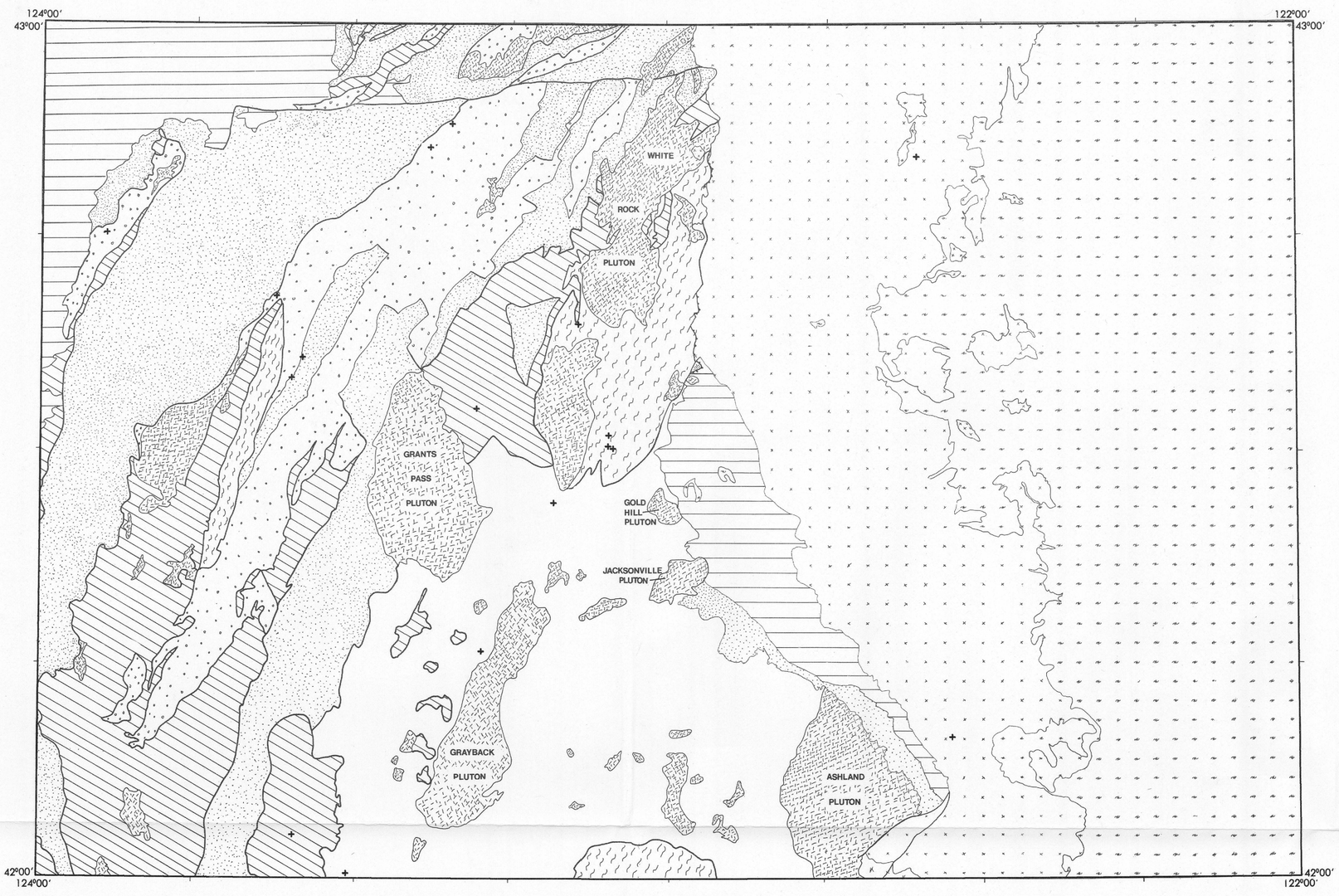

Figure 7.--Location of lode gold deposits containing reported gold, pyrite, and sphalerite with or without other minerals in the Medford 1°x 2° quadrangle.

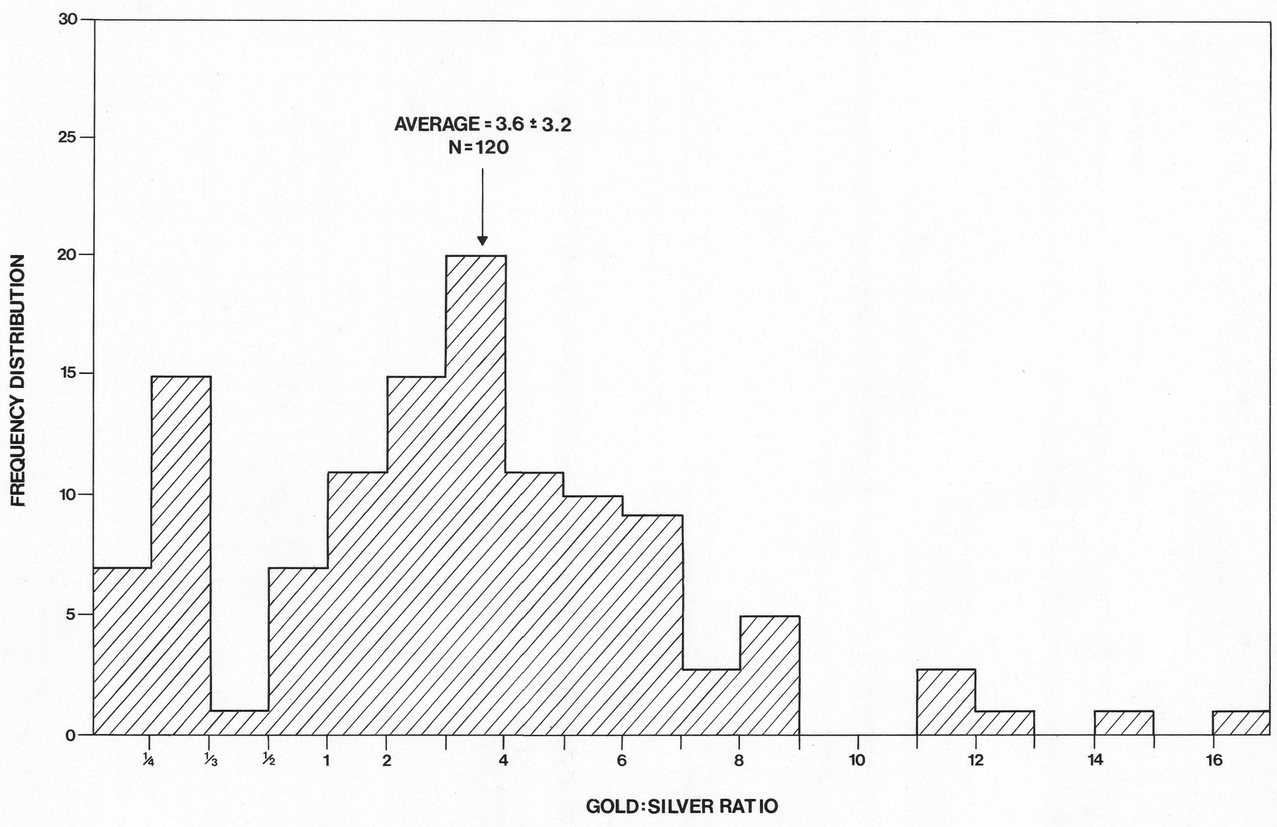

Figure 8.--Histogram of gold-to-silver ratios for 120 lode gold deposits in the Medford 1°x 2° quadrangle.

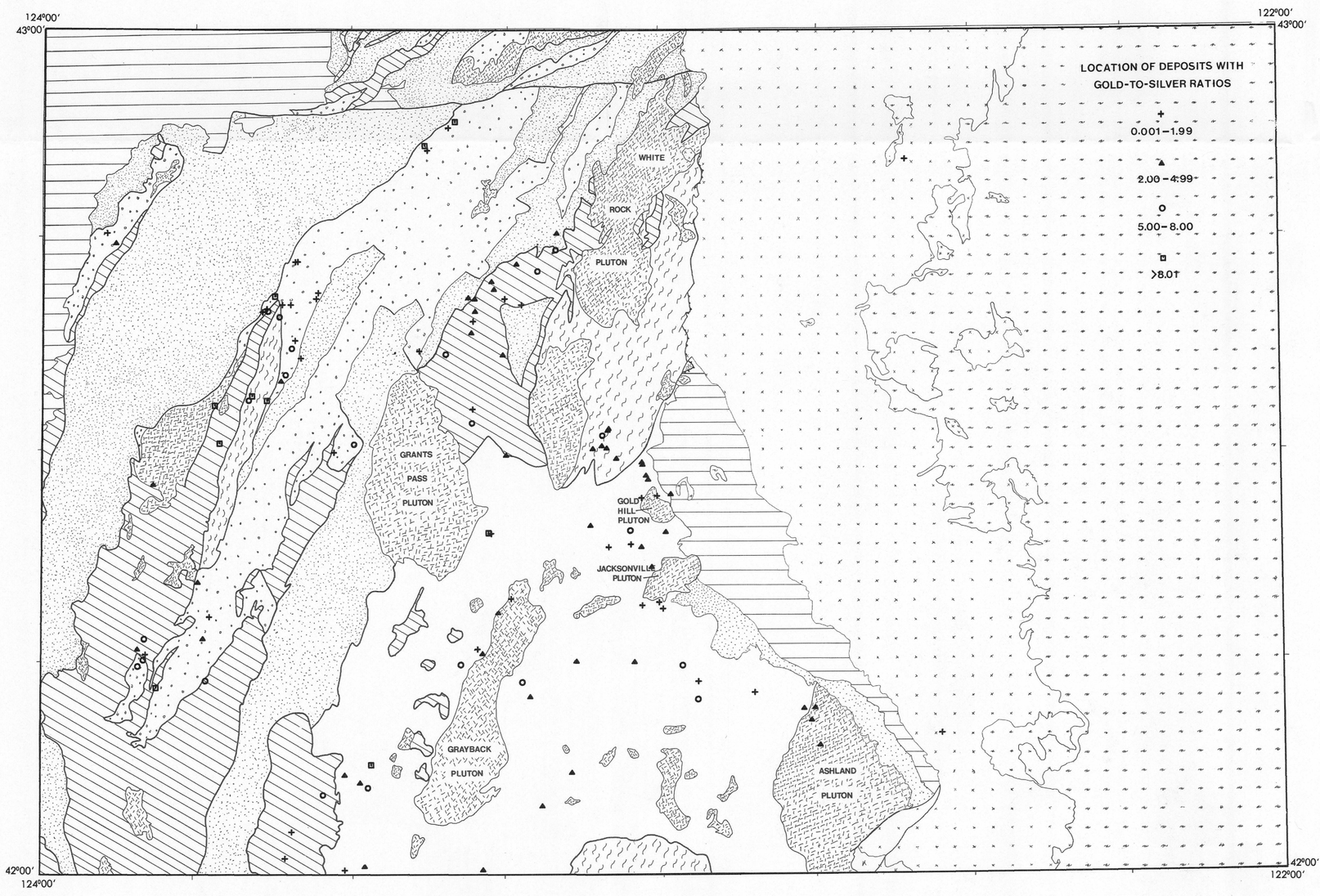

Figure 9.--Spatial distribution of gold-to-silver ratios in lode gold deposits of the Medford 1°x 2° quadrangle.

Table 1.--Selected lode gold deposits in the Medford 1° x 2° quadrangle arranged by estimated production and located on the map (fig. 1).

Map number	Deposit name	Deposit type	Approximate production (in ounces Au)
1	Greenback	Vein	100,000
2	Ashland	do.	43,000
3	Gold Hill Pocket	do.	20,000
4	Benton	do.	13,500
5	Steamboat Pocket	do.	11,500
6	Bunker Hill	do.	9,000
7	Opp	do.	7,100
8	Daisy	do.	7,100
9	Oregon Belle	do.	7,100
10	Warner	do.	5,700
11	Lucky Bart	Volcanogenetic	5,700
12	Boswell	do.	4,200
13	Peck (Robert E.)	Vein	3,400
14	Revenue Pocket	do.	2,900
15	Granite Hill	do.	2,100
16	Almeda	Massive sulfide	1,500
17	Sylvanite	do.	1,500
18	Humdinger	do.	1,400
19	Braden	do.	860
20	Shorty Hope	do.	860
21	Al Sarena (Buzzard)	Vein	540
22	Silver Peak	Massive sulfide	490
23	Eureka	Vein	180
24	Barron	do.	80

Table 2. Reported sulfide mineral assemblages from gold occurrences, prospects, and deposits in the Medford 1X2° quadrangle [Parentheses indicate assemblage with and without native gold being reported. Au, gold; ccp, chalcopyrite; py, pyrite, bn, bornite, po, pyrrhotite, cc, chalcocite; sp, sphalerite; gn, galena; as, arsenopyrite, Ag, silver; th, tetrahedrite; tn, tennantite; mo, molybdenite; w, scheelite, hg, cinnabar; cb, cubanite; sb, stibnite; km, kermesite; co, cobaltite; ty, tetradymite; te, tellurides including petzite, hessite, sylvanite, and unidentified telluride minerals. Number indicates the number of reported sulfide assemblages including both those with or without reported gold]

1 phase		2 phases		3 phases		4 phases		5 phases		6 phases		7 phases	
Au	124	Au+(ccp)	12	Au+ccp+cc	1	(ccp+cc+py)	1						
				Au+(ccp+py)	39	Au+ccp+py+bn	1	Au+(ccp+py+bn+po)	2				
								(ccp+py+bn+sp)	1			(ccp+py+bn+gn+sp+tn)	1
						Au+(ccp+py+po)	5	(ccp+py+po+cb)	1				
								(ccp+py+po+sp)	2				
						Au+(ccp+py+gn)	10	Au+(ccp+py+gn+po)	3	Au+(ccp+py+gn+po+sp)	2		
								Au+(ccp+py+gn+as)	2	Au+ccp+py+gn+as+Ag	1		
								Au+(ccp+py+gn+sp)	3	(ccp+py+gn+sp+as)	2		
										(ccp+py+gn+sp+th)	1		
								Au+ccp+py+gn+te	2				
								Au+ccp+py+gn+mo	1				
						Au+(ccp+py+as)	4	Au+ccp+py+as+po	1				
						(ccp+py+sp)	2						
						Au+ccp+py+te	1						
						Au+ccp+py+mo	3						
						Au+ccp+py+Ag	2						
				Au+(ccp+po)	4	(ccp+po+cb)	1	(ccp+po+gn+sp)	1	(ccp+po+cb+sp+co)	1		
				Au+ccp+as	2								
		Au+(py)	75	Au+(py+gn)	7	Au+py+gn+sp	1	(py+gn+sp+te)	1				
								Au+py+gn+sp+Ag	1				
								(py+gn+mo+w)	1				
				Au+py+as	4								
				Au+py+te	4			Au+py+te+po+ty	1				
				Au+py+mo	2								
				Au+py+w	1								
		(po)	1	(po+sp)	1								
				Au+gn+sp	1								
				Au+gn+w	1								
		Au+(as)	5	Au+as+gn	1								
		Au+(te)	4										
		Au+(mo)	2										
		(sb)	1	Au+sb+km	1								
		Au+hg	1										

INTRODUCTION

About 500 lode gold occurrences, prospects, and mines have been reported from the Medford 1° by 2° quadrangle, Oregon-California. Summary descriptions of individual lode gold deposits and districts which include those occurrences in the Medford 1° by 2° quadrangle have been published by Brooks and Ramp (1968) and Hotz (1971) and by others cited in the reference lists in these two publications. As part of the Medford CUSMAP project between 1974 and 1980, some of these deposits were examined in the field during geologic mapping and geochemical sampling and most of the available information on individual deposits was compiled into a CRIB computer file (Computerized Resource Information Bank). This report is a summary of the more pertinent geologic and economic characteristics of the lode gold deposits for use in the resource evaluation part of the Medford CUSMAP project. The significant features described include the distribution of deposits and their relation to gross geologic and lithologic features, production information, mineralogy of the ore and gangue, gold-silver ratios, and speculations on possible genetic models for some types of deposits.

The efforts of Floyd Gray, Jerome K. Cannon, and Will N. Blair are acknowledged for their part during the last stages of the compilation of information on individual deposits.

GEOLOGIC FRAMEWORK OF LODE GOLD DEPOSITS

The Medford 1° by 2° quadrangle is composed of parts of three major geologic provinces: the northern part of the Klamath Mountains, the Coast Ranges, and the central part of the Cascade volcanic province. Lode gold deposits are predominantly restricted to the Klamath Mountain province and western part of the Cascade province. The Klamath Mountains are underlain mainly by Paleozoic and Mesozoic sedimentary, volcanic, and metamorphic rocks in which there are numerous granitic plutons of Mesozoic age (Page, Blakely, and Cannon, 1981), and ultramafic and gabbroic masses. The province is bordered on the west and northwest by the Coast Range province which contains Jurassic to Tertiary sedimentary rocks, and on the east by the Cascade volcanic province consisting of Tertiary and Quaternary volcanic and sedimentary rocks. The geologic and lithologic base map upon which lode gold occurrences are shown illustrates the major geologic provinces (fig. 1, sheet 1).

The specific lithologic and age groupings shown on the map as units were chosen to emphasize the relation of gold lode deposits to particular lithologic-tectonic environments. The boundaries between units were derived and generalized from new mapping in the Medford CUSMAP project between 1974 and 1980, some of which has been published (Page and others, 1977, 1978, 1981; Johnson and Page, 1979; Smith and Page, 1977; Page and others, 1981) and from our modifications of mapping by Diller and Kay (1924), Ramp (1972, 1975), Ramp, Schlicker and Gray (1977), Ramp and Peterson (1979), Wells (1955), Wells and others (1940, 1949), Wells and Peck (1961), and Wells and Walker (1953).

Units not predominantly associated with lode gold deposits are volcanic rocks of the High Cascade Range, marine and nonmarine sedimentary rocks of Tertiary age, and sedimentary rocks of Jurassic and Cretaceous age. Included within the last category of nonproductive rocks are the graywacke and shale assemblages of the Dothan and Otter Point Formations; the sandstones, mudstones, and conglomerates of the Myrtle Group and Hornbrook Formation; and the mudstone-shale-sandstone assemblages of Jurassic age which represent the sedimentary basin deposits interbedded with more productive volcanic rocks of the same age. All of the sedimentary rocks lumped into this Mesozoic unit generally do not host lode gold deposits nor do they appear to be the source of the precious and base metals that occur elsewhere in the quadrangle.

Volcanic rocks of the Western Cascade Range, granitic plutonic rocks of Jurassic and Cretaceous age, and regional metamorphic rocks of Paleozoic and Mesozoic age appear to have hosted a relatively small proportion of the known lode gold deposits. The few known occurrences in volcanic rocks of the Western Cascade Range may indicate that this poorly exposed, forest-covered unit has been incompletely explored for precious- and base-metal deposits because the Al Sarena and Barron mines (nos. 21 and 24, table 1, sheet 2; and fig. 1, sheet 1) appear to indicate a potential for more deposits similar in character to these. Regional metamorphic rocks of Mesozoic and Paleozoic age include the Condrey Mountain Schist, the May Creek Formation, the Briggs Creek Amphibolite of Coleman, Garcia, and Anglin (1976), and amphibolites from the metamorphosed melange of the Dutchmans Peak area. Previous production of lode gold in the unit is from near Wimer in the May Creek Formation and from the Briggs Creek Amphibolite near the North Fork of Galice Creek. The granitic plutonic rocks range in composition from diorite to granite (with tonalite the most common composition). Their petrologic, geophysical, and geochemical characteristics have been described by Page, Blakely, and Cannon (1981). The only major plutons that appear to have hosted lode gold deposits are the Ashland and Gold Hill plutons (fig. 1, sheet 1).

Volcanic rocks of Jurassic age, rocks of dismembered ophiolitic sequences of Jurassic age and volcanic rocks of Paleozoic and Triassic age host by far the greatest number of lode gold deposits. Locally all the rocks within these units have been altered and metamorphosed to zeolite and low-grade greenschist facies mineral assemblages and near granitic plutons to higher grade rocks by contact metamorphic processes. Volcanic rocks of Jurassic age range in composition from basalt to rhyodacite but andesitic flows, tuffs, and agglomerates are the most abundant. This lithologic and tectonic unit is interpreted to represent an island-arc volcanic system(s) in the western Jurassic belt of Irwin (1966) and Hotz (1971). Massive sulfide deposits of volcanogenic origin occur within the volcanic rocks and some of the lode gold occurrences may be the hydrothermal feeder systems of these deposits. Rocks of the dismembered ophiolite sequences of Jurassic age include metamorphic and cumulate ultramafic rocks, and gabbroic rocks, sheeted and nonsheeted diabase dike complexes, basaltic volcanic rocks, shale and chert, hornblende gabbro complexes, and melanges of these rocks. Between the Ashland and Grayback plutons in the southern part of the quadrangle some of the included ultramafic rocks may be of Paleozoic and Triassic age. Serpentinized ultramafic and altered mafic rocks are favorable hosts for lode gold deposits. Volcanic rocks of Paleozoic and Triassic age range in composition from basalt to dacite but the most abundant rocks are hornblende and augite porphyritic andesite flows, agglomerates, and tuffs. Interbedded in the volcanic rocks are minor amounts of volcanoclastic rocks including wackes, shales, and argillites. Gold lode deposits and occurrences are abundant in the volcanic rocks of the Paleozoic and Triassic belt of Irwin (1966) and Hotz (1971).

LODE GOLD OCCURRENCES AND THE CRIB DATA BASE

All reported occurrences and deposits of lode gold were catalogued in the CRIB system (Keefer and Calkins, 1977) with respect to location, commodities present, description of the deposit, geology, mineralogy, production, reserves, potential resources, and references when the particular piece of information was available. Where possible, field observations were added. The maps, graphs, diagrams, and tables are based mainly on this reported information.

Figure 1 (sheet 1) shows the location of all known occurrences of lode gold and table 1 (sheet 2) lists the names of selected deposits including the major producers. Scrutiny of the list in table 1 indicates that a variety of genetic deposit types are represented by the available information. Gold was recovered from gossans and oxidized portions of volcanogenic massive sulfide deposits which occur in both felsic and mafic volcanic host rocks. Some of the massive sulfide deposits produced gold as a byproduct of copper mining of the unoxidized ore. At least three types of gold-quartz-base-metal veins and fissure deposits are present in the quadrangle. The feeder or plumbing system of massive sulfide deposits (here called volcanogenic) consist of gold-bearing quartz veins and fissures in metavolcanic and metasedimentary rocks. Other gold-quartz veins are unrelated to massive sulfide deposits and form in a variety of host rocks. They occur predominantly in ophiolitic sequences, commonly in serpentinized ultramafic rocks, and commonly in metavolcanic and metasedimentary rocks of Paleozoic and Triassic age. Lode gold also has been produced from epithermal vein systems in volcanic rocks of the western Cascade Range.

DISCUSSION OF GOLD PRODUCTION DATA

Production of gold began in southwestern Oregon in 1850 mainly from placers, but by the 1890's the contribution from lode deposits to total production began to increase (Brooks and Ramp, 1968). Estimates of total production tend to be inaccurate either because records were not kept or the records are incomplete. All of Oregon is estimated to have produced about 3,700,000 oz of placer and lode gold between 1877 and 1965 whereas the contribution from Josephine and Jackson Counties was about 454,000 oz between 1902 and 1965 (Brooks and Ramp, 1968). Comparing the production from these two counties with a similar period of time for all of Oregon suggests that the Medford 1° by 2° quadrangle may have produced about 20 percent of the gold from Oregon and that about 40 percent of this production was derived from lode deposits.

About 95 deposits have reported gold production in the Medford 1° by 2° sheet. Figure 2 shows those deposits with reported production and table 1 gives estimated gold production for 24 of them. The estimates are either from reported numbers in ounces of gold or were derived by dividing dollar amounts of gold production by $35 and thus probably represent minimum production numbers. The bulk of the lode production came from about six mines; the two largest being the Greenback and Ashland mines (nos. 1 and 2, fig. 1, sheet 1; table 1, sheet 2) with production of about 100,000 and 43,000 ounces of gold, respectively. It is estimated that over 75 percent of the lode-gold deposits produced less than 100 ounces.

DISCUSSION OF MINERAL ASSEMBLAGES

The 1:500,000-scale lithologic-geologic maps with overlays of mineral assemblages (figs. 3, 4, 5, 6, sheet 1 and 7, sheet 2) and table 2 (sheet 2) summarize the information available on the sulfide mineralogy of the lode gold deposits. The deposits generally contain quartz and locally include barite, calcite, rhodochrosite, rhodonite, pyrolusite, and marcasite. Cuprite, native copper, malachite, azurite, chryscolla, and copper sulfates occur alone, or in combinations, as secondary minerals associated with copper-bearing assemblages. The assemblages listed in table 2 are arranged so that phases containing Au, Cu, Fe, Pb, As, Zn, Te, Mo, Ag, W, Sb, and Hg appear approximately in that sequence from top to bottom and from left to right. Assemblages that are in parentheses only are assumed to have had gold present although it was not reported as a separate mineral; for example, gold is the assumed third phase with (po+sp) or the 6th phase with (ccp+py+gn+sp+as).

Various problems arise in trying to interpret the information available on mineral assemblages. Published mineralogic data on the deposits may not be representative because (1) the mineralogic identifications depended upon the skills of large variety of reporters, (2) assemblages may not be complete for any one mine, (3) no assemblages were reported for some mines, (4) sulfide assemblages vary within a deposit spatially, and (5) it is impossible to confirm most of the older identifications because the ores have been mined, samples lost, mines covered over by roads, dumps used for road metal, etc. Therefore, the following comments and interpretations should be viewed with some skepticism.

The most common assemblages are gold, gold-pyrite, gold-pyrite-chalcopyrite, gold-chalcopyrite, and gold-pyrite-chalcopyrite-galena. Figures 3 and 4 (sheet 1) show the distribution of deposits containing at least pyrite-gold and pyrite-gold-copper minerals, and thus represent the more common assemblages in table 2 (sheet 2). Each of the deposits located in these figures may also contain other sulfide minerals, for example, the assemblage may be gold-pyrite-chalcopyrite-galena would be represented in both figures 3 and 4. Other moderately common phases present are arsenopyrite, sphalerite, and telluride minerals.

Figures 5, 6, (sheet 1) and 7 (sheet 2) illustrate the distribution of deposits with mineral assemblages containing arsenopyrite and (or) tellurides, galena, and sphalerite, respectively. A large proportion of the deposits containing these minerals occur in volcanic rocks of the Paleozoic and Triassic unit and the adjacent ophiolite to the northwest. As shown by Page, Blakely, and Cannon (1982), this area also corresponds with a regional positive gravity anomaly which appears to result from a deep-seated, high-density source and not from rocks exposed at the surfaces. They speculated that the anomaly represented ultramafic material at depth which may have been the source of the gold.

DISCUSSION OF GOLD-TO-SILVER RATIOS

Gold-to-silver ratios were derived from reported assay data on the ore production or from reported ratios from 120 deposits. The histogram (fig. 8, sheet 2) shows the frequency distribution of the gold-to-silver ratio which averages 3.6. Figure 9 (sheet 2) shows the distribution of the gold-to-silver ratios superimposed over the simplified lithologic-tectonic map. Examination of the spatial distribution of the ratio of vein deposits suggests that there may be a local zonal pattern associated with some of the plutons. For example, the gold-to-silver ratio tends to decrease from the Greyback pluton to the east and to decrease from Gold Hill and Jacksonville plutons to the west (fig. 1, sheet 1). However, because of the limited data, any inferred zonal pattern is highly speculative. The massive suifide deposits in the volcanic rocks of Jurassic age tend to have high gold-to-silver ratios.

SUMMARY

In general, lode gold deposits in the Medford 1° by 2° quadrangle have had small amounts of production, are numerous and restricted to particular geologic environments, and have diverse mineralogies. Lode gold deposits of "volcanogenic" or massive sulfide type are restricted to the Jurassic metavolcanic and metasedimentary terranes whereas the vein deposits may occur in this lithologic-tectonic environment but occur more frequently in the Paleozoic and Triassic metavolcanic and metasedimentary terrane and the serpentinites of the ophiolite that occupy a regional positive gravity anomaly. Lode gold deposits are almost absent from Jurassic and Cretaceous sedimentary rocks. Vein deposits in the Western Cascade volcanic rocks are probably true epithermal vein systems related to Tertiary volcanism.

REFERENCES CITED

Brooks, H. C., and Ramp, L., 1968, Gold and silver in Oregon: Oregon Department of Geology and Mineral Industries Bulletin 651, 338 p.

Coleman, R. G., Garcia, M. O., and Anglin, C., 1976, The amphibolite of Briggs Creek: a tectonic slice of metamorphosed oceanic crust in southwestern Oregon [abs.]: Geological Society of America Abstracts with Programs, v. 8, no. 3, p. 363.

Diller, J. S., and Kay, G. F., 1924, Description of the Riddle quadrangle, Oregon, folio 218 of Geologic Atlas of the United States: U.S. Geological Survey.

Hotz, P. E., 1971, Geology of Lode gold districts in the Klamath Mountains, Californian and Oregon: U.S. Geological Survey Bulletin 1290, 91 p.

Irwin, W. P., 1966, Geology of the Klamath Mountains Province, in Bailey, E. H., ed., Geology of northern California: California Division of Mines and Geology Bulletin 190, p. 19-38.

Johnson, M. G., and Page, N. J, 1979, Preliminary geologic map of the metavolcanic and associated rocks in parts of the Canyonville, Days Creek and Glendale quadrangles, Oregon: U.S. Geological Survey Open-File Report 79-283, scale 1:62,500.

Keefer, E. K., and Calkins, J. A, 1978, Descriptions of individual data items and codes in CRIB: U.S. Geological Survey Circular 755-B, 32 p.

Page, N. J, Blair, W. N., Gray, Floyd, Cannon, J. K., Grimes, D. J., and Leinz, R. W., 1977, Preliminary reconnaissance geologic map of the Wimer quadrangle, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-848, scale 1:62,500, 2 sheets.

Page, N. J, Blakely, R. J., and Cannon, R. K., 1983, Map showing geological, 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., Moring, Barry, Blair, W. N., Gray, Floyd, and Cannon, J. K., 1978, Preliminary reconnaissance geologic map of the Glendale quadrangle, Oregon: U.S. Geological Survey Open-File Report 78-518, scale 1:62,500.

Page, N. J, Gray, Floyd, Cannon, J. K., Foose, M. P., Lipin, Bruce, Moring, B. C., Nicholson, S. W., Sawlan, M. G., Till, Alison, and Ziemianski, W. P., 1981, Geologic map of the Kalmiopsis Wilderness area, Oregon: U.S. Geological Survey Miscellaneous Field Studies Map MF-1240-A, scale 1:62,500.

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

_____1975, Geology and mineral resources of the upper Chetco drainage area, Oregon, including the Kalmiopsis Wilderness and Big Craggies Botanical Areas: Oregon Department of Geology and Mineral Industries Bulletin 88, 47 p.

Ramp, Len, Schlicker, H. G., and Gray, J. J., 1977, Geology, mineral resources, and rock material of Curry County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 93, 79 p.

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

Smith, J. C., and Page, N. J, 1977, Preliminary reconnaissance geologic map of part of Jackson County, Oregon: U.S. Geological Survey Open-File Map 77-318, scale 1:250,000.

Wells, F. G., 1955, Preliminary geologic map of southwestern Oregon west of meridian 122° west, and south of parallel 43° north: U.S. Geological Survey Mineral Investigation Field Studies Map MF-38, scale 1:250,000.

_____1956, Geology of the Medford quadrangle, Oregon-California, U.S. Geological Survey Geologic Quadrangle Map GQ-89, scale 1:96,000.

Wells, F. G., Gates, G. O., Grantham, R. M., Hotz, P. E., James, H. L., Kenneth, W. E., Neuman, J. V., Jr., Rynearson, G. A., Smith, C. T., Tabor, E. C., and Tate, E. J., 1940, Preliminary geologic map of the Grants Pass quadrangle, Oregon: Oregon Department of Geology and Mineral Industries Map 5, 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.

Wells, F. G., and Peck, D. L., 1961, Geologic map of Oregon west of the 121st meridian: U.S. Geological Survey Miscellaneous Geological Investigation Map I-325, in cooperation with Oregon Department of Geology and Mineral Industries, scale 1:500,000.

Wells, F. G., and Walker, G. W., 1953, Geologic map of the Galice quadrangle, Oregon: U.S. Geological Survey Map GQ-25, in cooperation with Oregon Department of Geology and Mineral Industries, scale 1:62,500.

MAP SHOWING CHARACTERISTICS OF LODE GOLD IN THE MEDFORD 1° BY 2° QUADRANGLE, OREGON-CALIFORNIA

By
Norman J Page, Maureen G. Johnson, and Jocelyn A. Peterson

1983