DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF – 694

Base from USGS: Medford, 1963, Coos Bay, 1958, Oregon. Compiled Menlo Park base map unit (3-74) 10,000 Metre UTM ticks shown along edges

SCALE 1:250 000

5 0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

CONTOUR INTERVAL 200 FEET

Data compiled by Johnson 1973 – 74. Chromite occurrences from Raup, 1961

OCCURRENCE OF PLATINUM GROUP METALS IN ULTRAMAFIC ROCKS OF THE MEDFORD-COOS BAY 2°QUADRANGLES, SOUTHWESTERN OREGON

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INTRODUCTION

Platinum-group metals have been known to occur in beach sands and stream gravels in Oregon since the 1850's, and 2,018 troy ounces of unrefined platinum concentrates was produced during the period 1903 through 1945 (Ramp and Brooks, 1969). Most platinum production was a byproduct of gold placer mining in the Medford-Coos Bay 2° quadrangles in southwestern Oregon. Before the development of modern precise analytical techniques, the geochemistry of platinum metals in rocks was poorly known, and the platinum metals in placers were presumed to have originated from ultramafic rocks. The information presented here about the distribution of platinum-group elements in the Medford-Coos Bay 2° quadrangles was compiled as the initial part of an over-all study of the mineral potential and geology of that area.

The Klamath Mountains geologic province occupies most of the map area. Wells and Peck (1961), Irwin (1960, 1966), and Hotz (1971) outlined the general geology of the province. In this area, sedimentary, volcanic, and metamorphic rocks of Paleozoic and Mesozoic age predominate and were intruded by granitic and gabbroic plutons. The Klamath Mountains province is bounded on the west by sedimentary and volcanic rocks of late Mesozoic and Cenozoic age and on the east by Tertiary and Quaternary rocks of the Cascade province. Within the western two groups of rocks there are numerous ultramafic masses that contained previously productive chromite deposits.

This paper reports the results of 52 platinum, palladium, and rhodium analyses from 47 ultramafic rocks, 4 sedimentary rocks, and 1 mafic intrusive rock, and the identification of some platinum-bearing mineral grains from black sands and stream gravels. The occurrence of platinum-group elements in ultramafic rocks in southwestern Oregon is documented by modern analytical techniques.

OCCURRENCE OF PLATINUM-GROUP METALS

Analytical results demonstrate that platinum-group elements are detectable in the ultramafic rocks of the area and that these elements are particularly concentrated in chromitites. The presence of platinum-group metals has been verified in deposits from streams draining areas that contain ultramafic rocks and also in one unique copper-nickel lode deposit in norite. The map shows (1) the distribution of reported platinum occurrences in beach and stream gold placers (Day and Richards, 1906), (2) the location of the Shamrock mine which is a copper-nickel deposit assaying 0.03 oz/ton platinum metals (Hundhausen, 1952) and (3) the location and distribution of samples containing more than detectable limits of the elements platinum, palladium, and rhodium. The samples analyzed for this study include 24 chromitite samples collected by Len Ramp to give a representative selection of the geographical and geological distribution of known chromitite deposits throughout the area; (2) 18 samples of diverse ultramafic rocks from the Vulcan Peak alpine-type ultramafic body; and (3) 10 samples of ultramafic and sedimentary rocks from the Sixes River drainage area. Because of the limited amount of data, conclusions concerning the spatial distribution of the platinum metals were not made, but the association of relatively higher amounts of platinum group metals with chromite must be emphasized.

PLATINUM, PALLADIUM, AND RHODIUM ASSAY DATA

Table 1 lists the results of the fire assay-emission spectrographic analyses as concentrations in parts per billion (1 ppb=part per billion=0.000029 troy oz per ton). Included in the table are UTM coordinate locations for most samples, location by quadrangle and geographic area, and the type of rock analyzed. The number assigned to a sample corresponds to the number on the map that shows the location of the analyzed samples. The highest concentrations of platinum, palladium, and rhodium were found in the chromitites, which contain up to 850 ppb platinum, 16 ppb palladium, and 91 ppb rhodium and average 150.8 ppb platinum, 10 ppb palladium, and 25.4 ppb rhodium. Concentrations in the other rock types analyzed are considerably lower than the chromitites, although the harzburgites show relatively high palladium concentrations than other ultramafic rock types. Table 2 gives the arithmetic averages for platinum, palladium, and rhodium by rock type. In calculating the arithmetic averages, values of 2, 3, and 7 ppb were assigned to a trace determination (tr) for which limit of determination were <4, <5, and <10 ppb. This probably biases the averages to higher concentrations. Nevertheless, chromitites have on the average 10 times as much platinum, palladium, and rhodium as the other rock types.

As a comparison, other modern platinum-group element analyses from alpine-type ultramafic complexes, for example, 18 dunites and harzburgites from Burro Mountain, Calif., average 12.6 ppb platinum, 3.7 ppb palladium, and <5 ppb rhodium (Loney and others, 1971). Dunites, harzburgites, and stellar rocks from Red Mountain and New Idria, Calif., and Twin Sisters and Cypress Island, Wash., average <10 ppb platinum, <5 ppb palladium, and <5 ppb rhodium (Page, 1969). These values are also similar to those obtained for the Vulcan Peak area, Curry County, Oreg. However, chromitites from Red Mountain and New Idria localities averaged slightly higher: 36 ppb platinum, 10 ppb palladium, and 9.5 ppb rhodium (Page, 1969). The chromitites analyzed from ultramafic complexes in the Medford-Coos Bay 2° quadrangles tend to be high in average rhodium; indeed 23 of the 26 chromitites showed detectable rhodium. It should be noted that even the highest values of platinum, palladium, and rhodium in chromitites (table 1) are low when compared with averages of platinum-group metal contents of 8,000 ppb from the Merensky Reef, 3,900-5,100 ppb from the Great Dyke, 860 ppb from Sudbury (Aller, 1960), and 1,946 ppb from chromitites from the Stillwater Complex (Page and others, 1969).

Figure 1 is a plot of platinum, palladium, and rhodium ratios for all diverse samples listed in table 1. The distribution pattern of the ratios illustrates the relative enrichment of the chromitites in rhodium and platinum in comparison to other rock types in southwestern Oregon. Comparison with the Stillwater data (Page and others, 1972) suggests that similar platinum, palladium, and rhodium ratios are found in stratiform and alpine-type complexes for individual samples, but with the present number of analyses it is impossible to tell if two distinct populations of ratios exist for the different environments.

The mineralogical occurrence of the platinum metals in chromitites from Oregon is unknown, and little is known about the mineralogy of the placer occurrences. Qualitative electron-microprobe analyses were performed on grains from three samples of black sands from the Otter Point beach and on two samples of stream gravels from the Sixes River (samples collected by Larry Phillips, U.S. Geol. Survey). Platinum-iron alloys and platinum-gold alloys were identified in the Otter Point beach samples, and osmiridium alloys were found in samples from the Sixes River. In view of the presence of osmiridium alloys in the placers, it is important eventually to examine the concentration of osmiridium and iridium in the ultramafic rocks.

CONCLUSIONS AND ECONOMIC CONSIDERATIONS

The concentrations of platinum, palladium, and rhodium reported herein have no economic potential at this time, but the data are still limited in amount and areal distribution. It is debatable whether a deposit will be found that can be mined for its platinum-group metal content, but in the future, the possibility of obtaining byproduct platinum-group metals from chrome mining operations should not be overlooked.

References

Allen, C. C., 1960, The platinum metals: Canada Mineral Resources Div., Dept. Mines and Tech. Surveys Mineral Rept. 3, 58 p.
Day, D. T., and Richards, R. H., 1906, Useful minerals in the Black Sands of the Pacific Slope: U.S. Geol. Survey, Mineral Resources 1905, p. 1175-1246.
Hafffty, Joseph, and Riley, L. B., 1968, Determination of palladium, platinum, and rhodium in geologic materials by fire-assay and emission spectrography: Talanta, v. 15, p. 111-117.
Himmelberg, G. R., and Loney, R. A., 1973, Petrology of the Vulcan Peak alpine-type peridotite, southwestern Oregon: Geol. Soc. America Bull., v. 84, p. 1585-1600.
Hotz, P. E., 1971, Geology of lode gold districts in the Klamath Mountains, California and Oregon: U.S. Geol. Survey Bull. 1290, 81 p.
Hundhausen, R. J., 1952, Investigation of Shamrock copper-nickel mine, Jackson County, Oregon: U.S. Bur. Mines Rept. Inv. 4895, 12 p.
Irwin, W. P., 1960, Geological reconnaissance of the northern Coast Ranges and Klamath Mountains, California, with a summary of mineral resources: California Div. Mines Bull. 179, 80 p.
_____1966, Geology of the Klamath Mountains province, in Bailey, E. H., ed., Geology of northern California: California Div. Mines and Geology Bull. 190, p. 19-38.
Loney, R. A., Himmelberg, G. R., and Coleman, R. G., 1971, Structure and petrology of the alpine-type peridotite at Burro Mountain, California, U.S.A.: Jour. Petrology, v. 12, p. 245-309.
Page, N. J, 1969, Platinum content of ultramafic rocks, in U.S. Geol. Survey Heavy Metals program progress report 1968--topical studies: U.S. Geol. Survey Circ. 622, p. 7.
Page, N. J, Riley, L. B., and Hafffty, Joseph, 1969, Platinum, palladium, and rhodium analyses of ultramafic and mafic rocks from the Stillwater Complex, Montana: U.S. Geol. Survey Circ. 629, 12 p.
_____1972, Vertical and lateral variation of platinum, palladium, and rhodium in the Stillwater Complex, Montana: Econ. Geology, v. 67, p. 915-930.
Ramp, Len, 1961, Chromite in southwestern Oregon: Oregon Dept. Geology and Mineral Industries Bull. 52, 169 p.
Ramp, Len, and Brooks, H. C., 1969, Platinum group metals, in Mineral and water resources of Oregon: U.S. 91st Cong., 2d sess., Senate Comm. Interior and Insular Affairs, Comm. Print, p. 167-171.
Wells, F. G., and Peck, D. L., 1961, Geologic map of Oregon west of the 121st meridian: U.S. Geol. Survey Misc. Geol. Inv. Map I-325, scale 1:500,000.

EXPLANATION

- Ultramafic rocks
- Chromite
- 12 Chromite with Pt, Pd, or Rh. Number refers to table one.
- △ Dunite with Pt, Pd or Rh
- ○ Harzburgite with Pt, Pd, or Rh
- ← Placer with Pt, Os, or Ir

LOCATION DIAGRAM FOR NK 10-5

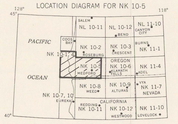

Table 1.--*Platinum, palladium, and rhodium analyses of rocks from the Medford-Coos Bay 2° quadrangles, Oregon*

[Analysts: Joseph Hafffty, W. D. Goss, A. W. Haubert, and L. B. Riley. Samples were analyzed by a combination fire assay-optical emission spectrographic method (Hafffty and Riley, 1968). Limits of determination: <10 ppb Pt, <4 ppb Pd, <5 ppb Rh; tr, indicates element is present but below limits of determination and too low to be assigned a value]

Sample no.	Coordinates (UTM)	15' quad	Locality name	Rock type	Pt	Pd	Rh	Reference
1.	4756275 N; 463820 E	Canyonville	Nickel Mountain Group	chromitite	<10	<4	25	Ramp, 1961, p. 120
2.	4671550 N; 440560 E	Cave Junction	Tennessee Chrome	do	<10	<4	18	Do. p. 155
3.	4669200 N; 443850 E	do	Lucky Strike	do	81	7	58	Do. p. 157
4.	4671239 N; 441792 E	do	Tennessee Pass	do	450	<4	63	Do. p. 155
5.	4684500 N; 441450 E	do	Woodcock Creek	do	<10	<4	10	This report
6.	4658570 N; 448085 E	do	Esterley	do	<10	<4	5	Ramp, 1961, p. 150
7.	4659303 N; 454306 E	do	Collard	do	<10	<4	tr	Do. p. 154
8.	4651750 N; 432900 E	Chetco Peak	Black Bear no. 1; 2	do	<10	<4	16	Do. p. 157
9.	4651350 N; 434200 E	do	Last Drink no. 1	do	13	6	tr	Do. p. 156
10.	4671750 N; 418750 E	do	Gardner mine	do	26	16	22	Do. p. 98
11.	4674900 N; 465874 E	Oregon Caves	Parsalles no. 2	do	19	4	18	Do. p. 137
12.	4680820 N; 431150 E	Pearsoll Peak	McCalab Sourdough	do	19	11	11	Do. p. 106
13.	4680700 N; 429610 E	do	Prospectors Dream	do	<10	<4	13	Do. p. 104
14.	4684563 N; 435638 E	do	Deep Gorge	do	41	15	21	Do. p. 44
15.	4688021 N; 436658 E	do	Oregon Chrome	do	<10	<4	15	Do. p. 50
16.	4682300 N; 433370 E	do	Twin Cedars	do	<10	8	<5	Do. p. 42
17.	4680550 N; 430175 E	do	Little Silveria	do	<10	<4	21	Do. p. 103
18.	4683100 N; 433000 E	do	Young's mine	do	<10	<4	12	Do. p. 43
19.	4694975 N; 445800 E	Salma	Big Bear	do	<10	<4	17	Do. p. 133
20.	4698951 N; 440147 E	do	Violet	do	<10	<4	18	Do. p. 80
21.	4702009 N; 453723 E	do	Salt Rock	do	850	4	91	Do. p. 132
22.	4700600 N; 440400 E	do	Shady Cove	do	<10	<4	19	Do. p. 77
23.	4679582 N; 443213 E	do	Griffin	do	<10	tr	82	Do. p. 138
24.	4656450 N; 513500 E	Talent	Red Mountain	do	12	<4	23	Do. p. 89
25.	4738750 N; 400075 E	Powers	Sixes River	Humbug Cong.	<10	<4	<5	This report
26.	4735770 N; 402200 E	do	do	diorite	<10	<4	<5	Do.
27.	4736075 N; 402025 E	do	do	Gallice Fm. (shale)	<10	<4	<5	Do.
28.	4740075 N; 396925 E	Langlois	do	Umpqua Fm. (sandstone	<10	<4	<5	Do.
29.	4739750 N; 392425 E	do	do	Otter Point Fm. (cong.)	<10	<4	<5	Do.
30.	not in place	do	do	serpentine	<10	<4	<5	Do.
31.	do	do	do	do	<10	4	<5	Do.
32.	do	do	do	do	<10	<4	<5	Do.
33.	do	do	do	do	<10	4	<5	Do.
34.	do	do	do	do	<10	<4	<5	Do.
35.	4671375 N; 418475 E	Chetco Peak	Vulcan Peak	dunite	23	<4	<5	Do.
36.	4669175 N; 418550 E	do	do	do	tr	tr	<5	Himmelberg and Loney, 1973(2-YP-68)1/
37.	4669050 N; 418625 E	do	do	do	<10	<4	<5	Do. (4-YP-68)
38.	4669050 N; 418625 E	do	do	do	<10	<4	<5	Do. (6-YP-68)
39.	4669500 N; 418825 E	do	do	do	tr	<4	<5	Do. (13-YP-68)
40.	4670475 N; 418775 E	do	do	do	<10	<4	<5	Do. (15-YP-68)
41.	4669500 N; 418450 E	do	do	do	<10	<4	<5	Do. (16-YP-68)
42.	4670875 N; 418425 E	do	do	do	15	<4	<5	Do. (19-YP-68)
43.	4669175 N; 418550 E	do	do	harzburgite	tr	10	<5	Do. (1-YP-68)
44.	4669175 N; 418550 E	do	do	do	15	13	<5	Do. (3-YP-68)
45.	4669050 N; 418625 E	do	do	do	tr	6	<5	Do. (7-YP-68)
46.	4669075 N; 418950 E	do	do	do	tr	6	<5	Do. (10-YP-68)
47.	4669500 N; 418825 E	do	do	do	tr	<4	<5	Do. (12-YP-68)
48.	4669675 N; 418750 E	do	do	do	tr	7	<5	Do. (14-YP-68)
49.	not located	do	do	pyroxenite	<10	<4	<5	Do. (5-YP-68)
50.	do	do	do	do	tr	tr	<5	Do. (9-YP-68)
51.	4671350 N; 418550 E	do	do	chromitite	tr	tr	<5	Do. (18-YP-68)
52.	4671200 N; 418600 E	do	do	do	<10	<4	<5	This report

1/Sample numbers in parentheses.

Table 2.--*Arithmetic average of Pt, Pd, and Rh, in parts per billion, for rock types in the Medford-Coos Bay 2° quadrangles*

[Number in parentheses is number of samples with metal values above detection limits that are included in the average]

Rock type	No. of samples analyzed	Arithmetic average Pt	Pd	Rh	Sum of averages Pt+Pd+Rh
Chromitite	26	150.8(10)	7.5(10)	25.4(23)	183.7
Dunite	8	13.0(4)	2.0(1)	<5.0(6)	15.0
Harzburgite	6	8.3(6)	8.4(5)	<5.0(6)	16.7
Pyroxenite	2	7.0(1)	2.0(1)	<5.0(2)	9.0
Serpentinite	5	<10.0(5)	<4.0(5)	<5.0(5)	
Sedimentary rock	4	<10.0(4)	<4.0(4)	<5.0(4)	
Diorite	1	<10.0(1)	<4.0(1)	<5.0(1)	

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Oregon, Medford-Coos Bay quad., Platinum, 1:250,000, 1975.
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