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NICKEL-BEARING LATERITE, RED FLAT, CURRY COUNTY, OREGON

by

F. W. Libbey, W. D. Lowry, and R. S. Mason
State Department of Geology and Mineral Industries

Introduction

Peridotite and serpentine which occupy large areas in southwestern Oregon contain small amounts of nickel. Samples analyzed by the Department have ranged from trace to 0.25 percent nickel. Pecora and Hobbs (1942)[1] give analyses of peridotite (saxonite) and serpentine on Nickel Mountain, Douglas County, Oregon, which contain from 0.08 to 0.35 percent nickel.

A lateritic red soil, developed on peridotite areas, has been stripped by erosion in many places, but there are some areas which still have substantial thicknesses. Samples of this lateritic soil obtained by the Department in 1943 and 1944 indicated that in the process of weathering of the peridotite, there has been some concentration of nickel in the laterite. This is shown also by Pecora and Hobbs[2] in samples of the red soil on Nickel Mountain where a veneer of brick-red soil averages 2 or 3 feet thick and ranges in thickness from a few inches up to 9 feet. Samples of this soil contained from 0.61 percent to 1.10 percent nickel.

In the summer of 1946 the Department started a project planned to investigate the nickel content of lateritic soils on the peridotite areas of Oregon with especial attention to the possibility of secondary enrichment of nickel in the lower part of relatively thick sections of the laterite.

The first work was done in an area of Curry County known as Red Flat placers near the headwaters of Pistol River, because this locality was reported to have a section of laterite at least 32 feet thick at one place. This preliminary report is concerned mainly with the work done at Red Flat.

Four auger holes were drilled as shown on the accompanying map. Samples were taken for each foot of depth. The drilling showed that the laterite contains some hard, unweathered boulders of peridotite, and when one of these was encountered in a drill hole, no further drilling could be done with the equipment available. The deepest hole was 11 feet in depth. In addition to the drilling, a brief geological reconnaissance of the area was made.

The nickel content of the laterite appears to increase with depth, as shown by accompanying analyses, but far too little work was done to give conclusive results. Either heavier drilling equipment or, preferably, test pits or shafts will be necessary in order to sample the laterite down to the peridotite in place. All of the samples of laterite contained chromite.

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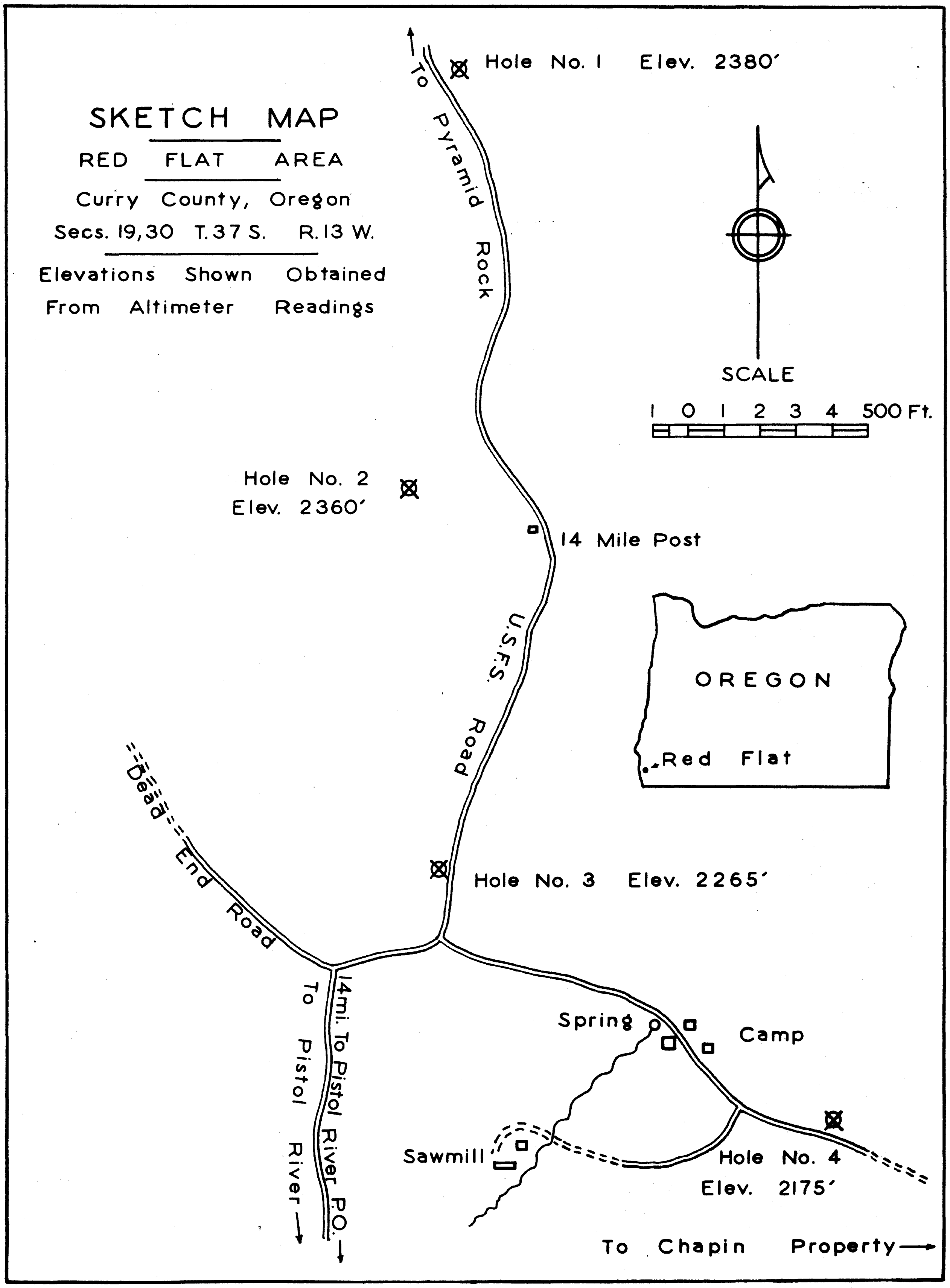
1 Pecora, William T., and Hobbs, S. Warren, Nickel deposits near Riddle, Douglas County, Oregon: U.S. Geol. Survey Bull. 931-I (1942).

2 Idem.


SKETCH MAP
RED FLAT AREA
Curry County, Oregon
Secs. 19,30 T.37 S. R.13 W.
Elevations Shown Obtained From Altimeter Readings
Hole No. 1 Elev. 2380'
To Pyramid Rock
SCALE
1 0 1 2 3 4 500 Ft.
Hole No. 2
Elev. 2360'
14 Mile Post
U.S.F.S. Road
OREGON
Red Flat
Dead End Road
Hole No. 3 Elev. 2265'
To Pistol River
14mi. To Pistol River P.O.
Spring
Camp
Sawmill
Hole No. 4
Elev. 2175'
To Chapin Property

A careful panning test of the laterite was made, using a composite of samples obtained in two drill holes, in order to get information on distribution of the mineral content which could be effected by gravity concentration. The test indicated that most of the nickel went into the tails along with a large part of the limonite. The magnetite and a large part of the chromite were concentrated in the heavy fraction.

Chemical and spectrographic analyses were made by L. L. Hoagland and Thomas Matthews, respectively, of the Department staff.

Mr. J. E. Morrison, mining engineer formerly with the Department, visited the Red Flat property in 1937 and sampled both the laterite and peridotite to check reported gold values. His samples returned 0.02 ounces per ton in the peridotite and a trace in the laterite. Mr. Randall Brown, geologist formerly with the Department, investigated reported mercury values at both Red Flat and the Chapin property, just east of Red Flat proper, in 1942. His samples returned traces of mercury. During the war period, engineers of both the U.S. Bureau of Mines and the War Production Board examined the Red Flat area. There has been no commercial production.

Location

Red Flat is about 8 miles southeast of Gold Beach, Oregon, as shown on the accompanying map. The area lies west of the North Fork of the Pistol River and is 14 miles by way of the Pistol River road from Pistol River post office on the Coast Highway (U.S. 101). The Pistol River road is graded and drained but was in only fair condition at the time of the investigation in late May and early June. Most of Red Flat is in secs. 19 and 30, T. 37S.,R. 13 W., W.M., at an elevation ranging from about 2000 to 2500 feet.

Ownership

Nine association placer claims of 160 acres each, known as the Red Gold Association nos. 1 to 9, are held by Carl Smedberg and associates of Gold Beach, Oregon.

Topography and climate

Red Flat is not a large nearly flat area as might be assumed from the name. However, as compared to most of the surrounding area, which is rugged and steep, it is relatively flat and undissected with a relief of two or three hundred feet. Scattered trees cover part of the area but large patches covered only by ground shrubs are common. The climate of the area is characterized by a rainy winter and a comparatively dry summer. Red Flat is well below the summit ridges which are remnants of the Klamath peneplain at an elevation of about 3500 feet.

Development

A few shallow trenches and a shaft reported by Morrison[3] to have been 32 feet deep, but now caved, comprise the bulk of the development work. A spring at the camp, when visited in June, had sufficient volume for all domestic needs and could probably supply a small mill also. Flycatcher Spring, about half a mile north of the camp junction, has a much smaller flow. The area is drained on the east by the North Fork of Pistol River, and on the west by the Big South Fork of Hunter Creek. Both stream channels lie several hundred feet below the level of the camp site.

Camp facilities include a cookhouse, bunkhouse, repair shed and other small buildings, some of which were under construction. A new sawmill and assay laboratory are located just below the camp buildings. The sawmill is used to provide lumber for construction of camp buildings. The timber is obtained from an adjacent stand of Port Orford cedar.

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[3] Morrison, J.E., Red Flat placers: Oregon Metal Mines Handbook, Coos, Curry, and Douglas Counties: State Dept. of Geology and Min. Industries Bull. 14-C, vol. I, p. 64, 1940.

Geology

As noted by Morrison, the deposit is of residual origin and was derived by the weathering in place of ultramafic rocks which underlie Red Flat and crop out on it in several places. These rocks, largely peridotite, intrude an older dark-colored greenstone (?) which occurs as isolated masses in some of the outcrops of peridotite. Greenstone (?) also crops out in a few places both just east and west of Red Flat proper. It carries quartz veinlets which are not present in the peridotite, suggesting that the greenstone (?) underwent one period of quartz mineralization that the peridotite did not.

The peridotite is one of the ultramafic intrusives which are common in southwestern Oregon and northern California. According to Wells[4] these rocks intrude all formations older than the Cretaceous including the Galice and Dothan formations of Jurassic age. A sample of peridotite from one of the outcrops on Red Flat was made up largely of olivine and darker green derived serpentine. The olivine was largely free of inclusions but magnetite grains were common in the serpentine. The greenstone (?) in the Red Flat area may be similar in age to or possibly older than the Galice and Dothan formations. The report by Butler and Mitchell[5] contains a geologic sketch map of Curry County which shows both the Dothan formation and the Colebrooke schist in contact with peridotite in the Red Flat area. According to Maxson[6], acid intrusives of late Jurassic or early Cretaceous age intrude the ultramafic rocks elsewhere in the Klamath Mountains.

The Red Flat surface was probably formed by an erosional cycle subsequent to that which formed the Klamath peneplain.[7] This is supported by Diller's statement that although residual deposits may have covered the Klamath peneplain, they have been largely removed. The Klamath peneplain, according to Diller, was developed while the Wimer beds were being laid down in the sea in the adjacent area southwest of the drainage of the Trinity River at the northern end of the Coast Range of California. As the Wimer beds, on the edge of the plateau at an elevation of about 2200 feet, 13 miles northeast of Crescent City, California, were then considered to be of Miocene age, Diller assigned the formation of the Klamath peneplain to that epoch. However, Diller pointed out that although the deposition of the Wimer beds occurred in late Tertiary time and probably in the late Miocene, further study might show that the Wimer beds and correlative formations are of Pliocene or even Pleistocene age and hence the age of the Klamath peneplain would be correspondingly reduced. Unfortunately no further attempt to date the Wimer fauna is known to have been made. Hence the development of the Red Flat surface, which apparently took place after the Klamath peneplanation, probably occurred during Pliocene time. Laterization of the Red Flat surface occurred during or subsequent to that epoch and prior to the elevation of the Red Flat surface to its present position. The uplift probably began late in the Pliocene or early Pleistocene and the ensuing erosion has removed part of the lateritic cover from Red Flat.

The laterite

The name Red Flat was undoubtedly suggested by the reddish color of the residual soil or laterite which covers much of the flat. Outcrops of country rock are fairly common. Color of the laterite ranges from yellow through yellowish brown and brown to deep reddish brown, and the texture is soft and earthy or mealy when dry. However, the moist laterite from the drill holes tended to be darker and mottled in places; some of the samples obtained

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4 Wells, F.G., Preliminary geologic map of the Grants Pass quadrangle, Oregon: State Dept. of Geology and Min. Industries, 1940.

5 Butler, B.S., and Mitchell, G.J., Preliminary survey of the geology and mineral resources of Curry County, Oregon: Oregon Bur. Mines and Geology, Min. Resources of Oregon, vol. 2, no. 2, October 1916.

6 Maxson, J.H., Economic geology of Del Norte and Siskiyou Counties, northwesternmost California: California Jour. Mines and Geology, vol. 29, nos. 1 and 2, January and April 1933.

7 Diller, J.S., Topographic development of the Klamath Mountains, U.S. Geol. Survey Bull. 196, 1902.

were quite plastic. As shown in roadcuts and by auger drilling, unaltered or only partially altered ultramafic rock ranging in size from small pieces to boulders occur scattered through the laterite. As a result some of the laterite in the drill holes was quite gritty. The surface of the laterite as well as that of outcrop areas is in places covered by numerous hard round "shots" or concretions commonly 1/8 to 1/4 inch in diameter. The areal extent of the lateritic soil is limited by that of the flat itself but the maximum thickness is not known. None of the four drill holes went deeper than 11 feet. However, the laterite may actually be thicker in places for it is believed that the peridotite rocks encountered at the bottom of three of the holes were loose. A caved shaft a short distance north of the mining camp near the south end of Red Flat is reported to have penetrated somewhat more than 32 feet of lateritic material. Thus the thickness of the laterite ranges from nil where the country rock crops out to at least 32 feet in places.

The chemical composition of the laterite is shown by the following analyses. Sample P-5452 is a composite of the samples from hole 1, and sample P-5455 is a composite of samples from hole 4. Sample P-5455 contained numerous rock fragments which account for a much higher silica and a lower iron content.

	P-5452 (composite of hole 1)	P-5455 (composite of hole 4)
Fe	42.51 %	22.36 %
Al_2O_3	10.76	16.80
SiO_2	7.58	24.49
Cr_2O_3	3.31	1.53
Ni	0.845	0.516
TiO_2	0.75	1.16
Au	0.015 oz/ton	0.004 oz/ton
Pt group metals (determined spectrographically)	nil	nil

Analyses of the samples from the 4 auger holes are shown graphically on following pages. Most of the samples contained only a trace of gold or silver but two samples did contain 0.02 ounce gold and a third contained 0.20 ounce silver. Although mercury has been reported to occur in the laterite, none was present in any of the samples collected by the Department.

As shown by these analyses the nickel content ranges from 0.27 to 1.46 percent. Partial chemical analyses of successive pan concentrates, tailings, and slimes of a composite sample of material from holes 1 and 4 are given on the following page. They indicate that the nickel content of the lighter fractions is much greater than that of the concentrate.

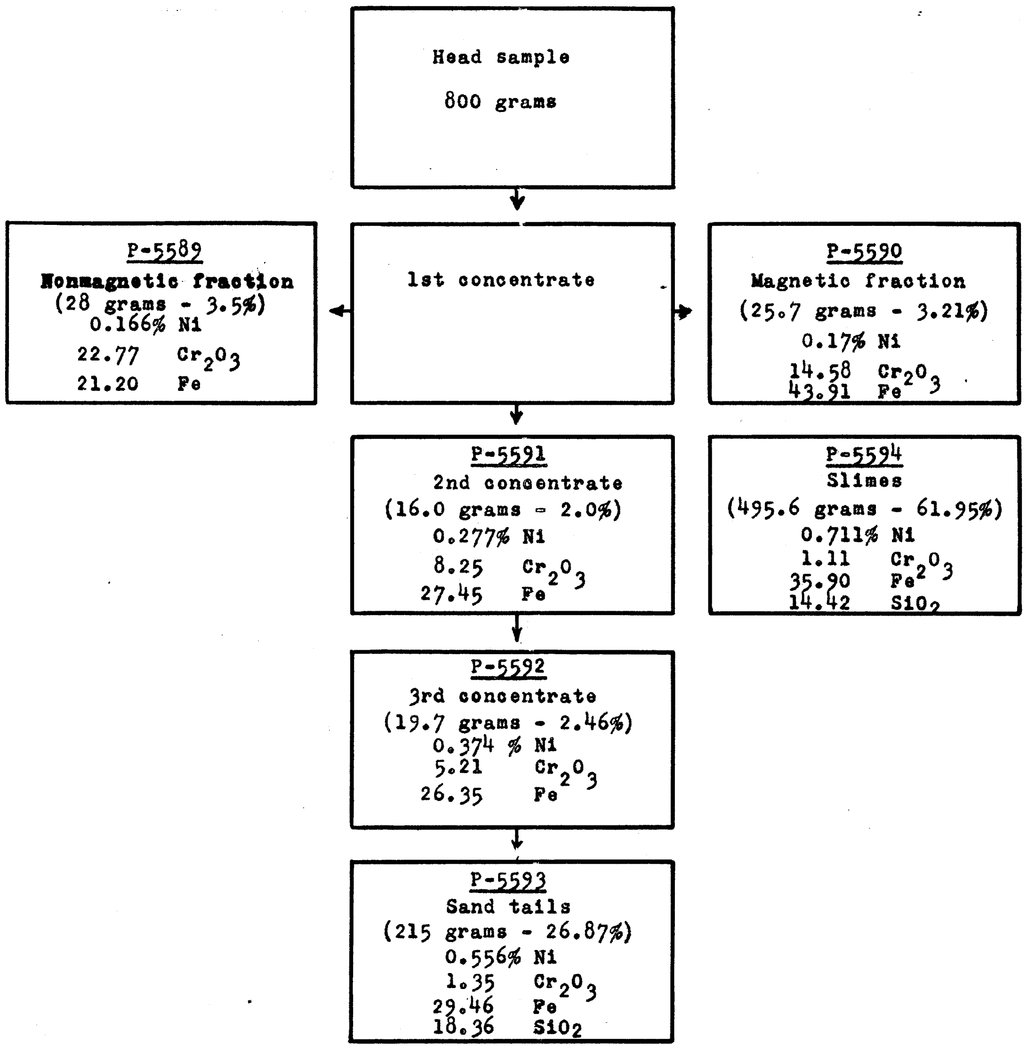
Petrographic examination of the laterite from hole no. 1 (sample P-4838) failed to reveal the nickel-bearing mineral or minerals. Most of the laterite is made up of limonite, largely goethite, and magnetite grains. The magnetite grains, which are residual from the weathering of the peridotite, contain a small amount of nickel. Chemical analysis shows that most of the nickel in sample P-4838 occurs in the slimes which are largely limonite. Other constituents of sample P-4838, which together contain only a small percentage of nickel, are serpentine (chrysotile), opal (including associated chalcedony), chromite, and a mica-like mineral. The last is fairly common and is similar in most properties to phlogopite but differs in that, unlike the micas, it has an optically positive interference figure.

Chemical analysis of a selected portion of the slimes (sample P-5594 of panning test) showed that it contained 0.74 percent nickel, 4.70 percent magnesia, 13.88 percent silica, and 65.88 percent R_2O_3 (mainly iron oxides). Petrographic examination of this selected slimes sample showed it to be predominantly limonite. No nickeliferous minerals were identified. A sample of soft limonite from Nickel Mountain near Riddle, Oregon, carefully collected by Pecora and Hobbs[8] in 1942, was reported to contain 1.3 percent nickel.

8 op. cit.

Thus the analyses indicate that most of the nickel, as well as silica, is intimately associated with the limonite. Possibly the nickel is tied up molecularly with the limonite.

Results of Panning Tests, Red Flat Laterite
Composite of Drill Holes 1 and 4



Loss of slimes and sand during panning amounted to 10.48 percent.

The lateritic origin of the deposit is indicated by the presence of residual magnetite, chromite, and serpentine as well as by pieces of peridotite.

Derivation of the laterite from the peridotite is also shown by the following spectrographic analyses. Sample P-4848 is a specimen of peridotite exposed near hole 2, and sample P-4827 is laterite from hole 1. Also listed in the table is the spectrographic analysis of the concretions or "shots", sample P-4849, which occur on the surface near hole 2.

Table 1

Percentage	P-4848 (peridotite exposed near hole 2)	P-4827 (laterite from hole 1. 0' to 1'2")	P-4849 (concretions from surface)
More than 10%	iron silicon magnesium	iron	iron aluminum (Chem., 19.92% Al_2O_3)
1 - 10%	----	silicon aluminum	silicon (Chem., 9.38% SiO_2)
0.1-1%	aluminum calcium	magnesium chromium cadmium nickel (Chem., 0.33%)	magnesium chromium cadmium sodium nickel (Chem., 0.178%)
0.01 - 0.1%	chromium nickel (Chem., trace) cadmium vanadium manganese sodium	calcium vanadium manganese sodium titanium boron tin	calcium vanadium manganese titanium
0.001 - 0.01%	titanium boron tin copper cobalt zirconium strontium potassium	copper cobalt zirconium strontium potassium	boron copper cobalt zirconium strontium potassium tin molybdenum
Less than 0.001%	barium silver molybdenum	barium silver molybdenum	barium

All of the elements shown to be present in the laterite occur in the peridotite. The spectrographic analyses show that of the major constituents of the peridotite the laterization removed much of the magnesium and part of the silicon, and concentrated the iron. The weathering process also concentrated the nickel and aluminum. Chemical analyses show that the peridotite near hole 2 contains a trace of nickel whereas a composite sample of the laterite from hole 2 contains 0.796 percent nickel. A sample of the greenstone, P-4860, from an outcrop northeast of hole 1 did not contain any nickel.

As previously noted, the weathering which produced the laterite probably occurred during the Pliocene before the area was elevated to its present position. Erosion has already removed part of the laterite as indicated by the presence on outcrop areas as well as on the surface of the laterite of hard round "shots" or concretions which were uncommon in the samples from the auger holes. The spectrographic analysis of a sample, P-4849, of the "shots" from the surface near hole 2, given in table 1, shows a further reduction in the magnesium content and a further increase in the aluminum content. Chemical analysis of this sample shows that the "shots" contain 19.92 percent Al_2O_3 (and 9.38 percent SiO_2) or nearly twice as much alumina as in the laterite from hole 1. The nickel content of this sample was 0.178 percent and that of the "shots" from 30 feet west of the road and 0.19 mile south of hole 1 was 0.341 percent.

From the amount of sampling done, there appears to be a tendency for the nickel content to increase with depth. If the concretions represent a former higher horizon, their lower nickel content follows the apparent trend. The apparently greater nickel content of the lower part of the lateritic section may be the result of greater leaching of the nickeliferous material in the upper part of the section or it may be due to an enrichment from above. Possibly both processes are responsible. However, if the nickeliferous minerals are formed near the bottom of the lateritic section from the olivine in the peridotite at the same time as the limonite, as seems reasonable, the lower nickel content of the upper part of the laterite may be largely the result of leaching. Possibly prospecting at depth will show appreciable enrichment.

The Red Flat deposit is similar in several respects to the brick-red laterite soil at Nickel Mountain[9] which ranges in thickness from a thin veneer to 9 feet. Three composite samples of the Nickel Mountain laterite were reported to contain 0.95, 1.02, and 1.10 percent nickel, respectively. Pecora and Hobbs stated that the mineral in the soil containing the nickel is not known.

The Department plans to make further studies of Oregon nickel-bearing laterite.

A graphic representation of drill-hole sampling results follows:

Hole No. 1

Sample number	Depth feet		Assay Au oz.	Ag oz.	Ni %	Hg %
	0					
P-4827	1		nil	tr	0.33	---
P-4828	2		0.02	tr	0.362	nil
P-4829	3		---	---	0.29	---
P-4830	4		nil	tr	0.59	nil
P-4831	5		tr	tr	0.695	nil
P-4833	6		tr	tr	0.959	nil
P-4834	7		nil	nil	1.09	nil
P-4835	8		0.02	tr	1.25	nil
P-4837	9		tr	nil	1.34	nil
P-4838	10		nil	nil	1.46	nil
P-4839	11	Bottom	---	---	1.18	---

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9 Pecora, W. T., and Hobbs, S. W., op. cit.

Hole No. 2

Sample number	Depth feet		Au oz.	Ag oz.	Ni %	Hg %
	0					
P-4841	1		nil	nil	0.46	---
P-4842	2		---	---	1.38	---
P-4843	3		nil	nil	0.65	nil
P-4844	4		tr	tr	0.62	---
P-4845	5		---	---	0.62	---
P-4846	6		nil	tr	1.007	nil
P-4847	7	Bottom	nil	tr	1.29	---

Hole No. 3

Sample number	Depth feet		Au oz.	Ag oz.	Ni %	Hg %
	0					
P-4851	1		nil	0.20	1.17	---
P-4852	2		nil	tr	0.934	nil
P-4853	3		nil	tr	0.857	nil
P-4854	4		---	---	1.02	---
P-4855	5		nil	tr	1.14	---
P-4856	6		nil	tr	1.129	nil
P-4857	7	Bottom	nil	tr	1.25	---

Hole No. 4

Sample number	Depth feet		Au oz.	Ag oz.	Ni %	Hg %
	0					
P-4861	1		nil	nil	0.357	nil
P-4862	2		nil	nil	0.585	nil
P-4863	3		---	---	0.406	---
P-4864	4		---	---	0.27	---
P-4865	5		nil	nil	0.516	nil
P-4866	6		---	---	0.605	---
P-4867	7		---	---	0.69	---
P-4868	8	Bottom	---	---	0.772	---

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OREGON CHROME REOPENED

Mr. W. S. Robertson has resumed work at the Oregon Chrome mine on the Illinois River, Josephine County, which had been closed down for nearly a year. Six men are employed - 3 shifts, 2 men to the shift-in driving a 500-foot drainage and access tunnel.

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TEXACO OIL TEST

On March 19 Texaco's test well, Clark and Wilson No. 6-1, was drilling ahead at 6500 feet.

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BILL SUSPENDS COPPER IMPORT TAX

HR 2404 which suspends the copper import tax until March 31, 1949, passed the House of Representatives March 12, 1947. The bill is now under consideration by the Senate Finance Committee.

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METAL MARKET PRICES

Copper has advanced to 21½¢ a pound, Connecticut Valley; lead to 15¢ a pound, New York. Zinc remains steady at 10½¢, East St. Louis. Foreign silver advanced early in the month from 75-3/4¢ to 86-1/4¢ on orders for export to India. However, the Reserve Bank of India issued an order prohibiting imports of silver, and the price receded to 77¢. Price of silver mined in the United States is fixed by law at 90½¢ an ounce. The quicksilver market has strengthened somewhat with quotations from $87 to $90 a flask, but trading has been moderate because of the usual uncertainties.

According to the Engineering and Mining Journal, New York, the advance in the price of copper and lead is caused by the heavy demands both here and abroad. Domestic prices were advanced to make them equivalent to foreign prices. The St. Joseph Lead Company issued a statement to the effect that the company raised its price reluctantly and felt that it is a mistake to make the price for the larger tonnages of lead consumed in this country the same as for the relatively small tonnages of foreign lead.

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CLEARING HOUSE

CH-93: WANTED - deposits of white potash feldspar. Philip S. Hoyt, 1002 Mills Bldg., El Paso, Texas.

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HENDRYX REAPPOINTED

Governor Earl Snell has reappointed Mr. H. E. Hendryx, Baker, as a member of the Governing Board of the State Department of Geology and Mineral Industries. Mr. Hendryx was named for a four-year term beginning March 19, 1947, and ending March 16, 1951. The appointment was confirmed by the State Senate March 18.

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