State Department of Geology and Mineral Industries

702 Woodlark Building
Portland, Oregon

HORSE SIGN BUTTE IRON DEPOSIT (Fe,V) AGNESS DISTRICT, CURRY COUNTY

Old Names: Oregon (1914); Wild Rose (1930); Wild Rose, No. 1 and No. 2 (1942).

Owners: Larry Lucas, Agness; Phil Adams, Gold Beach; Carl Smedberg, Gold Beach.

Location: In the S 1/2 of the NW 1/4 of the SW 1/4 of sec. 17, T. 36 S., R. 11 W., Willamette Meridian, at an elevation of about 3,000 feet. See Plate I.

The property may be reached from several directions, but travel is difficult in wet weather.

(A) From Agness 3 miles by road to Oak Flat, 7 miles by trail from Oak Flat to the Fantz ranch, and 3 miles by very poor trail, climbing approximately 3,000 feet, to the deposit. Agness is 35 miles by forest road from the railroad at Powers, and 34 miles by boat up the Rogue River from Gold Beach, on U. S. Highway 101. This is probably the best way to the deposit at the present time. The last mile of trail, mainly through heavy brush, has been cut out; however, the trail is difficult to follow.

(B) From Agness 3 miles by road to Oak Flat, 8 miles by trail to the saddle above Horse Sign Butte, 2 miles without trail around the south side of Horse Sign Butte, and north down the ridge to the deposit. The last 2 miles are very brushy.

(C) From U. S. Highway 101, 23 miles by way of the Pistol River road, 13 miles by trail to Horse Sign Butte, and then to the deposit. The Pistol River road joins U. S. Highway 101, 13 miles south of Gold Beach.

History: The property was located some time before 1914 by Frank Berry of Agness and was then known as the Oregon claim. It is described by Butler and

Mitchell (16:64-66) as follows:

"The only iron ore found which can properly be classed as an impregnation deposit occurs on the ridge running easterly from Horse Sign Butte between Horse Sign and Collier Creek. The deposit in question is about 2 miles east of the butte proper, at an elevation of about 3,050 feet.

"Figure 21 is a generalized section of the ridge above-mentioned and shows that the country rock is of Myrtle age, but is intersected by two or more dikes of igneous material, and is faulted at one point. The iron ore is magnetite, and it occurs as an impregnation in Myrtle sandstone between two greenstone dikes. The contacts of the sandstone and igneous rocks are not well exposed so it is impossible to ascertain the width of the impregnated sandstone; but little pits scattered here and there over the surface indicate that it may be as much as 50 to 100 feet wide, and that it runs for some distance down both sides of the ridge. There seems no doubt that a large body of ore could be developed here. The beds appear to strike about N. 20° E., and dip 51° to the northwest.

"The weathered ore looks like a highly jointed brown sandstone, but its great weight at once suggests the presence of metallic material; and the use of a hand-lens shows that the pores between the sand grains are completely filled with magnetite. So thoroughly impregnated is the sandstone that an average sample proved to contain 51.45 percent of iron. Phosphorus, sulphur, titanium, arsenic, and copper are entirely absent.

"It seems likely that this deposit originated by deposition from solutions developed in the neighboring serpentine during the

serpentinization process. Such solutions would normally have led to the formation of one or more masses of the boulder type of iron deposit in the serpentine itself, but accidentally finding their way to the border of the serpentine, they worked outward through the greenstone, and impregnated the neighboring sandstone."

Development Work: Development at the property consists of 6 open cuts varying in length from 10 to 20 feet and in depth from 3 to 15 feet. Five of these cuts distributed over the deposit lie on the south side of the ridge; one cut is on the crest. All the cuts except no. 3, which is the most recent location hole, are caved.

Areal Geology: This section has an early mature topography. The ridges forming the skyline are fairly continuous and suggest that the area has been lowered to baselevel (possibly Miocene). The average relief is from 2500 to 3000 feet. Slopes are steep; those made up of conglomerate in places are precipitous; those of peridotite and serpentine are commonly as much as 30°. The Illinois River and its tributaries have been rejuvenated in recent time, cutting narrow inner canyons with nearly vertical walls 50 to 100 feet in height. The elevation of the Illinois River is about 150 feet, whereas that of the deposit, 1 1/2 airline miles to the west of the river, is about 3000 feet.

The climate is hot and dry for four months of the summer and extremely wet (65 inches of rainfall) during the winter. There is generally some snow and it may pile up to heights of several feet on the northeast slopes. No springs were noted in the vicinity and the nearest water is Horse Sign Creek, many hundreds of feet below the deposit. No topographic map of the area is available and the forestry map is not sufficiently detailed.

The ridge northeast of Horse Sign Butte is composed largely of Myrtle conglomerate which was determined by Diller (03:2) as being lower Cretaceous in

age on the basis of fossils found in Butte Creek, one mile southwest of Horse Sign Butte. According to Butler and Mitchell, (16:26) both Aucella crassicolis and Aucella piochi are found in sandy layers in the Myrtle conglomerate there. Later work by Taliaferro (42) indicates that the Myrtle is at least in part Jurassic. This Myrtle conglomerate is probably the basal member of a series of sediments laid down in an advancing Jurassic or Cretaceous sea. Near Horse Sign Butte, this member dips from 10 to 40° to the east and north. It has been displaced by north-south faults so that it occurs repeatedly at such isolated localities as Pebble Hill, Saddle Mountain, Horse Sign Butte, and north of the mouth of Indigo Creek.

The Horse Sign Butte ridge, as well as the ridge to the north, is composed in part of fine-grained silicified meta-igneous rocks which have been termed "greenstone" by Diller (14:17) and Butler and Mitchell (16:30-31). It is Jurassic in age (Taliaferro, '42).

The "black sand" deposit is about two miles northeast of Horse Sign Butte. It lies, in part, in the saddle between two knolls on a northeast trending ridge; the remainder extends down a slight depression to the south (see Plate II). The black sand body rests mainly on greenstone but at its southeast extent lies on an intrusive basic rock mass.

The greenstones are greenish-gray, fine to medium-grained altered lavas and tuffs. One phase of the greenstone cropping out some 2000 feet northeast of the deposit is coarser grained and preferably would be classed as a metadiorite, although this does not imply an intrusive origin. One specimen of this metadiorite contains grains of pyrite. The knoll east of the black sand body is made up in part of altered tuff breccia. These greenstones appear to have been faulted in a generally north-south direction, judged from similarly trending gulleys and cuts.

Serpentine forms the southwest extension of the ridge on which the deposit is situated. It exhibits shearing effects aligned in a northwesterly direction. This serpentine mass is probably related to the same intrusive activity as the basic rock mass occurring at the southeast edge of the deposit. They both intrude the greenstone and are Upper Jurassic (Taliaferro, '42).

Extent of Ore Body: The axis of the deposit is roughly north-south, pitching some 25° to the south. The deposit is about 650 feet long. The black sand extends about 150 feet north of the saddle whereas it extends some 500 feet south down the slope. The appearance of greenstone float and the line of disappearance of the black sand float were taken as the approximate location of the terminal boundaries. The lateral boundaries can be accurately located and the average width is about 100 feet. The thickness is unknown; an assumed average thickness of 35 feet, based on the probable configuration of a channelway or valley about 100 feet wide, is used in estimations of tonnage. The occurrence of a noticeable amount of black sand float on the west side of the knoll which bounds the deposit on the west may be the result of the laying down of the black sand on an uneven surface. There the black sand has a composition and texture similar to the main body. Possibly the western boundary of the black sand deposit is faulted and the float on the west side of the knoll may have been separated by faulting from the main body. However, the character of this black sand float and its elevation are very similar to those of the main body and favor deposition on an uneven surface.

Lithology: The black sand is a greenish-brown, indurated, medium-grained sandstone with a specific gravity of about 3.2. It is composed predominantly of magnetite particles with smaller percentages of ilmenite (also probably chromite), hornblende, zircon, quartz, garnet, tremolite, chrysotile,

and pyrite. It is not an impregnation deposit as indicated by Butler and Mitchell (16:66). Throughout its extent the composition and texture remain quite uniform. The most marked divergence from textural uniformity is seen at cut no. 3, which recently was cleaned out and enlarged to serve as a location hole. At that locality, a 3-inch layer, containing well-rounded, discoidal pebbles as much as 2 inches in length, attests to the sedimentary origin of the sandstone. The pebbles include gneisses, greenstones, and quartzites. There is no gradation from the pebbles to the medium-grained sandstone.

After treating the crushed sand with hydrochloric acid until the magnetite grains were fairly free of encrustation, the separates were weighed. The strongly magnetic separate constituted 95 percent of the mass.

The magnetite grains are fairly uniform in size, averaging about 0.25 mm in diameter. The particles are angular and but very slightly rounded; some grains are nearly complete octahedrons and dodecahedrons.

The non-magnetic separate includes slightly magnetic minerals. Ilmenite (and probably chromite) constitutes 2/3 of the non-magnetic separate. They average about 0.15 mm in size and are but very slightly rounded. Leucoxene is developed on the ilmenite. Hornblende makes up 15 percent of the non-magnetics. The grains are elongate with splintery or frayed ends, averaging some 0.15 mm in length. Quartz grains, about 0.35 mm in diameter, make up several percent of the non-magnetics and show angular anhedral outlines. However, several nearly perfect prismatic crystals of quartz with well-developed terminations are present. Grains of zircon are but very little rounded and exhibit first and second order tetragonal prisms and pyramids. Some grains are fragmental but they may have broken during the crushing operation. The zircons are 0.2 to 0.3 mm in length. Some crystals show unusual growths known as saw-fish structures. Dodecahedral grains of garnet about 0.15 mm in diameter show no

appreciable rounding. One cluster of pyrite cubes, about 0.4 mm in size, and one grain of chrysotile, about 0.3 mm in length, are also present. No minerals containing vanadium were seen.

Specimens from different parts of the deposit show a variation in the percentage of non-magnetic minerals present.

Examination of a thin section of the rock from cut no. 3 showed that the size of the magnetite and other black sand particles ranged from less than .03 mm to more than 1 mm, the average size being about 0.25 mm in diameter. The magnetite grains appear to be mainly subhedral in outline, though some seem to be euhedral octahedrons and dodecahedrons. Some non-magnetic minerals occur in the section. The interstitial material is largely a cryptocrystalline aggregate.

Structure: The black sand where favorably exposed shows no well-developed bedding. The 3-inch pebbly layer shown at cut no. 3 suggests that the sand dips 45° to the southwest and strikes about N. 55° W.

The sand shows some jointing and weathering effects and is streaked with dark gray veinlets. In comparison with surrounding greenstone and serpentine rocks, this alteration appears minor.

Origin and Age: The high percentage of heavy minerals may be due in part to nearby source rocks but vigorous agitation or circulation of water was necessary to carry away the lighter materials which also occur locally. Possibly not much erosion of the local rocks was taking place when these sediments were being deposited. If the sediments were largely of local origin, most of the lighter materials were carried away, leaving the heavier magnetite, ilmenite, zircon, and hornblende grains. However, some quartz was left. The

saw-fish structures on the crystal faces of some of the zircon grains, if formed before the grains were freed, indicate little transportation. The pebbly layer shown at cut no. 3 contains rocks of less local derivation and indicates a longer distance of transport, but this layer is definitely not typical and may be due to an unusual disturbance in current or wave action.

If, as believed, the magnetite deposit is of sedimentary origin, such extensive selective sorting, both as to specific gravity and size of grains as this deposit shows, may be attained by relatively few agents. Ocean currents are capable of such selective sorting as shown here. The lack of rounding effects does not necessarily denote lack of transportation. Twenhofel (283:39) says that aqueous sand particles having diameters less than 1/10 mm show very little rounding .... he states that sands deposited in the ocean tend to have a more uniform texture and more continuous bedding than those deposited in rivers.

The deposit is believed to have originated when the sea was encroaching on this part of the Klamath Mts., probably in Cretaceous time. The shoreline, following the Nevadian disturbance, was probably irregular and at certain localities, favorable for accumulations of black sand deposits produced by the selective sorting action of the waves. It possibly is similar in origin to the black sand lenses found along this section of the Oregon coast, described recently by Twenhofel (43).

The coarse-grained basic rock along the southeast extent of the deposit probably served as a source for some of the black sand. The rock is magnetic and spectrographic analysis shows the following elements to be present (P 974):

V	.1%	Fe	10%
Cr	2 - 5%	Ni	.1 - 1%
TiO_2	about 1%	Co	.1 - 1%
Al	10%	Ca	1%
Mg	10%	Na	in the tenths of 1%
Si	10%		

This rock is correlated with the serpentines and peridotites of Upper Jurassic age. The presence of a grain of chrysotile in this black sand implies it is younger than and derived from the serpentine. The inclusion of a grain of pyrite indicates the deposit is younger than the greenstone which contains pyrite. A thin section of a medium-grained Myrtle sandstone from the saddle at the west of Horse Sign Butte shows angular quartz grains and angular grains of black sand.

This "black sand" is tentatively correlated with the Myrtle formation of Cretaceous age. As mentioned under Areal Geology, the Myrtle formation occurs as remnant masses on several of the higher prominences, Horse Sign Butte being nearest to this deposit.

Analyses: A sample was taken from each of the six workings and a grab sample was taken of float at intervals of 5 feet across the deposit along the crest of the ridge.

Spectrographic estimates of the vanadium content of grab samples of the unseparated rock from these seven localities made by checks against standards varied between .1 and 1%. Other elements present were: iron, titanium, zirconium, aluminum, and magnesium.

Chemical assays are as follows:

Lerch Bros., Hibbing, Minnesota

Fe	54.94%
S	0.114%
V	0.37%
TiO_2	2.70%
P	0.004%

John Beede, Portland

V	0.43%

A spectrographic analysis of the magnetic separate (Sample 927-933) shows the following elements to be present:

V	.1 - 1%	Si	1% plus
TiO_2	1 - 5%	P	trace
Cr	2 - 5%	As	trace
Fe	over 10%	Ca	trace
Al	.1 - 1%		

The non-magnetic separates were shown spectrographically to contain almost no vanadium, indicating it is contained within the magnetite.

As no vanadium minerals were identified by microscopic methods and as the non-magnetic separates contain almost no vanadium, it appears that the vanadium is isomorphously mixed with the iron in the magnetite molecule. This is probably also true of at least part of the titanium.

Tonnage Estimates: The length and width of the deposit can be accurately judged, but the thickness of the deposit can only be estimated. The deposit is thought to have been laid down on an uneven greenstone surface. The lateral boundaries are quite well-defined and this may signify deposition in a rather well-defined channel-way.

The length is taken as 650 feet and the average width as 100 feet. For this width an average depth of 35 feet may be near the actual thickness, though considerable variations either way should be anticipated. These figures give an estimated 2,275,000 cu. ft. of black sand in place. With an average specific gravity of 3.2 (3.17 - 3.24) or about 10 cubic feet to the short ton; this means a probable tonnage of 227,500 short tons. Should the deposit be limited on the west by a fault, the possible tonnage might approach 400,000 short tons. However, this does not appear to be the case as black sand float occurs on the other side of the knoll which bounds the deposit on the west.

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Twenhofel, W. H., "Principles of Sedimentation", McGraw Hill Book Co., New York 1939, pp. 283-284. "Origin of the Black Sands of the Coast of Southwest Oregon", Bull. 24, Ore. State Dept. of Geology and Mineral Inds., 1943.

Report by: John Eliot Allen and Wallace D. Lowry
October 14, 1942.

Curry AGNESS

A VANADIUM-BEARING BLACK-SAND DEPOSIT OF MIDDLE MESOZOIC AGE, IN CENTRAL CURRY COUNTY, OREGON
(Abstract)

by
John Eliot Allen, Oregon Department of Geology and Mineral Industries*

The Pleistocene black-sand deposits lying upon sea-terraces up to 300 feet in elevation along the southern Oregon coast are well known in the literature, and are at the present time being mined on a large scale for their chromite content. A deposit of black sand lying at an elevation of 3,000 feet in central Curry County twenty miles inland, which had previously been called an "impregnation iron deposit" has been found to be a consolidated titaniferous magnetite sandstone containing amounts of vanadium varying from one tenth to one percent.

The elongated deposit, 650 feet long and 100 feet wide, crosses a shallow saddle in an east-west trending ridge composed of "greenstone" (altered lavas and tuffs) and serpentine. Elsewhere along this ridge are down-faulted blocks and conglomerate and sandstone with fossils showing them to be of "Myrtle" (upper Jurassic of lower Cretaceous) age, younger than the Jurassic greenstones and serpentines. Most of the deposit lies south of the saddle, ranging in elevation from 2,650 feet at the lower southern end to 2,900 feet in the saddle. It is a massive greenish-brown sandstone of uniform composition and a specific gravity of a 3.2. A few layers of exogenic pebbles were found at one locality. The sandstone is medium grained (averaging 0.25 mm diameter), indurated, and composed of 95% magnetite, about 3% ilmenite, less than 1% hornblende, with minor amounts of zircon, quartz, garnet, tremolite, chrysotile, pyrite, and probably chromite.

Chemical and spectrographic analyses of the original rock, and of magnetic and heavy mineral separates show the composition to be as follows:

Chemical		Spectrographic		
Fe	54.94%	Cr		2.0-5.0%
TiO_2	2.7	Al	less than	1.0
V	0.37-0.43	Si	about	1.0
P	0.004	Ca	trace	
S	0.114	As	trace	

The non-magnetic separate showed no vanadium, and no vanadium minerals were identified microscopically. It is thought to be contained in the magnetite molecule, as is much of the titanium.

All the contained minerals are also present in relatively small amounts in the adjacent meta-igneous and serpentine rocks of Jurassic age. The small chromite content, in comparison to the large chromite content (up to 40%) in the Pleistocene black-sand deposits, indicate that the serpentines and peridotites from which the chromite is derived had at the time of formation of this deposit, only begun to be exposed to erosion, and thus be able to contribute their minerals to the deposit.

The deposit is thought to have been deposited along the shore of the Myrtle (late Jurassic or early Cretaceous) sea which covered much of the Klamath province at that time.

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702 Woodlark Building
Portland 5, Oregon

ANALYSES OF HORSE SIGN BUTTE SAMPLES

Spectrographic Analysis

V	.1%
Cr	2 - 5%
TiO_2	about 1%
Al	10%
Mg	10%
Si	10%
Fe	10%
Ni	.1 - 1%
Co	.1 - 1%
Ca	1%
Na	in the tenths of 1%

Spectrographic Analysis of the Magnetic Fraction

V	.1 - 1%
TiO_2	1 - 5%
Cr	2 - 5%
Fe	over 10%
Al	.1 - 1%
Si	1% plus
P	trace
As	trace
Ca	trace

Larch Bros., Hibbing, Minnesota

Fe	54.94%
S	0.114%
V	0.37%
TiO_2	2.70%
P	0.004%

John Reede, Portland

V	0.43%

J.E.A.

Black sand lens in cg. at W. end of Horse-sign Butte, Curry Co.

General Laboratory Number P2426 Date received 5/31/[illegible]

Spectrographic Laboratory Number 877 Sample received from J.E. Allen

QUALITATIVE SPECTROGRAPHIC ANALYSIS
(Quantities estimated to nearest power of ten)

1. Elements present in concentrations over 10%.

Si, Al, Fe — Ilmenite

2. Elements present in concentrations 10% - 1%. — Zircon

Ca, Na, Ti, Zr

3. Elements present in concentrations 1% - 0.1%.

Mg, Mn, Cr

4. Elements present in concentrations 0.1% - .01%.

V, Sr. — Note Vanadium

5. Elements present in concentrations .01% - .001%.

Ni, B

6. Elements present in concentrations below .001%.

Mo, Cu, Ag, Co

Dr. H. C. Harrison, Spectroscopist

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702 Woodlark Building
Portland, Oregon

HORSE SIGN BUTTE (Fe, V, T.)

ACNESS DIST

This is the property that was claimed in 1930 by the Pacific Minerals Company, Arnold Goss, David Wilson, Carl Smedburg, and Wm. F. Hayden were all connected with it according to Al LaChance, who located the claims for them and took out most of the samples for them at that time. La Chance says that they had the ore assayed and that it contained around 1% vanadium and some uranium.

Careful estimation of the specific gravity of the ore, by means of covering it with a thin coat of parrafin (since it is q uite porous) and weighing it in and out of water, gave a value of 3.2. This is about 11.2 cubic feet to the long ton. Various estimates of tonnage can be made as follows:

(A)	$\frac{100 \times 600 \times 50}{11.2}$	: 267,000 short tons	Highly probable
(B)	$\frac{100 \times 800 \times 50}{11.2}$	: 356,000	Probable
(C)	$\frac{300 \times 600 \times 50}{2 \times 11.2}$	: 400,000	
(D)	$\frac{300 \times 800 \times 75}{2 \times 11.2}$	: 800,000	Possible

Further development ~~wash~~ work may well extend the length of 600 to 800 feet used in the above estimates, and as the length increases the backs will also rapidly increase.