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STRUCTURAL DATA FROM THE CHROME RIDGE AREA JOSEPHINE COUNTY, OREGON

By
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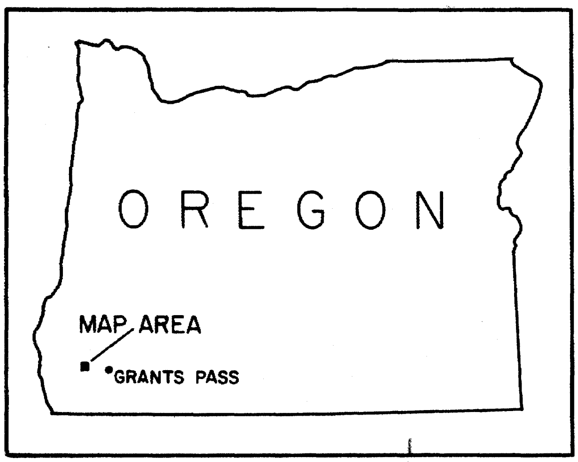
Introduction

General. This report is of a preliminary nature and represents part of the work being done in connection with a study of chromite deposits in southwestern Oregon.

Geography. Chrome Ridge is located in Josephine County about 20 miles west of Grants Pass (see index map). The area mapped in this report is about 6 miles long and 2½ miles wide extending N. 20° E. through the eastern part of T. 36 S., R. 9 W., into the southeastern portion of T. 35 S., R. 9 W. It is reached by about 19 miles of good Forest Service road from Galice. The area is very rugged and elevations range from about 2,400 to a maximum of 4,581 feet at Freeland Mountain. It is usually inaccessible during the winter months due to rain and snow.



Index Map Showing Area Covered by Geologic Map in Text

Previous work. The geology of a portion of the Chrome Ridge area was mapped on a scale of 1:2400 and the chromite deposits described by Wells, Page, and James (1940). The area is included also on the geologic map of the Kerby quadrangle (Wells and others, 1949).

Geologic setting

Chrome Ridge is underlain largely (see geologic map) by sill-like intrusives of peridotite which have been altered in part to serpentine. The peridotite is composed of the minerals olivine (60 to nearly 100 percent), enstatite, serpentine minerals, and accessory chromite and magnetite. Feldspar is lacking. Wells and others (1940) designated the ultramafic rocks as saxonite with small bodies of dunite.

Peridotite of the Chrome Ridge area has intruded the Upper Jurassic Rogue formation which is mainly an amphibole (hornblende) gneiss with lesser amounts of green phyllite, schist,

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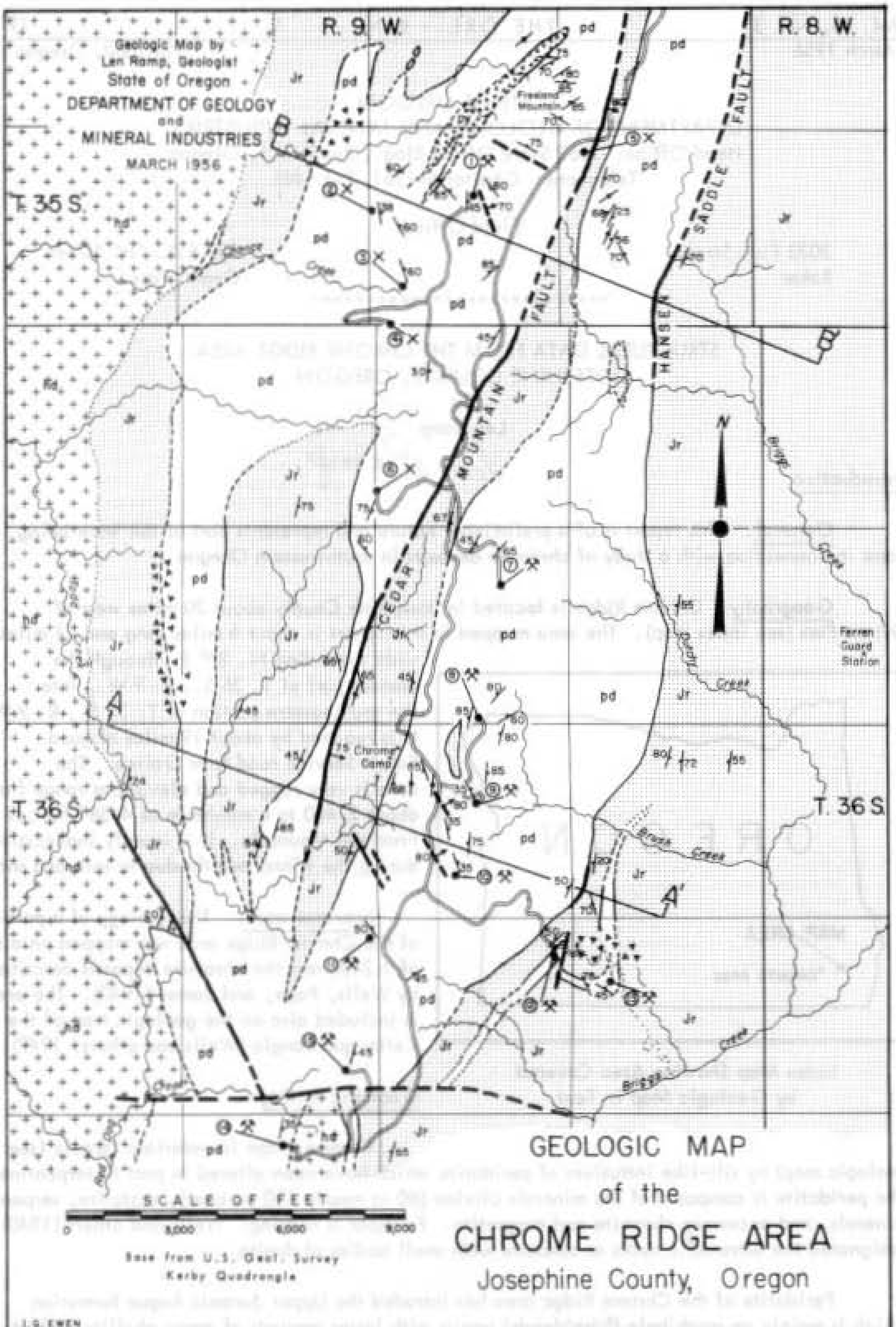
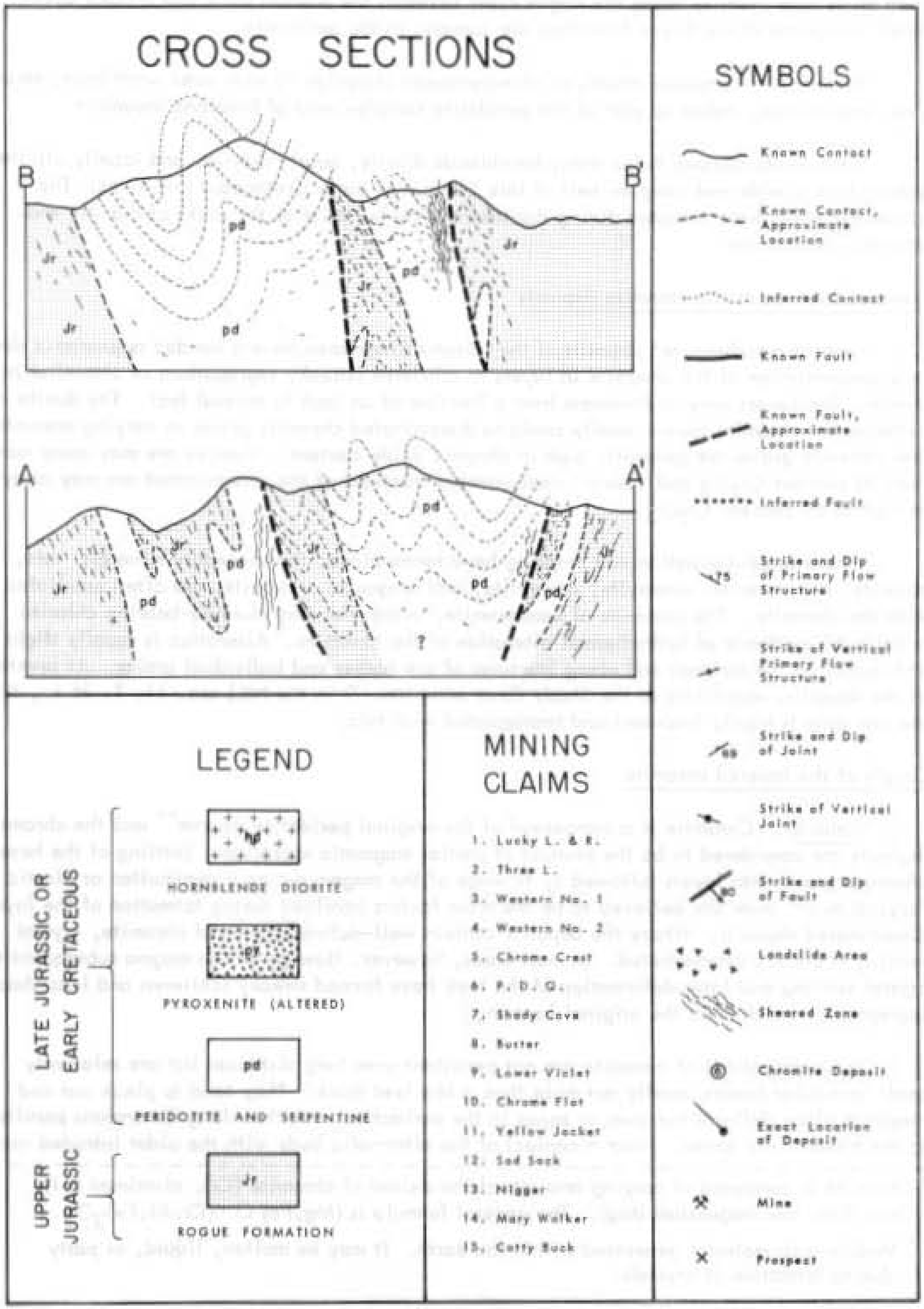


GEOLOGIC MAP
of the
CHROME RIDGE AREA
Josephine County, Oregon


CROSS SECTIONS
B
B'
A
A'
pd
Jr
?
SYMBOLS
Known Contact
Known Contact, Approximate Location
Inferred Contact
Known Fault
Known Fault, Approximate Location
Inferred Fault
Strike and Dip of Primary Flow Structure
Strike of Vertical Primary Flow Structure
Strike and Dip of Joint
Strike of Vertical Joint
Strike and Dip of Fault
Landslide Area
Sheared Zone
Chromite Deposit
Exact Location of Deposit
Mine
Prospect
LEGEND
LATE JURASSIC OR EARLY CRETACEOUS
hd
HORNBLENDE DIORITE
py
PYROXENITE (ALTERED)
pd
PERIDOTITE AND SERPENTINE
UPPER JURASSIC
Jr
ROGUE FORMATION
MINING CLAIMS
1. Lucky L. & R.
2. Three L.
3. Western No. 1
4. Western No. 2
5. Chrome Crest
6. P. D. Q.
7. Shady Cove
8. Butter
9. Lower Violet
10. Chrome Flat
11. Yellow Jacket
12. Sad Sack
13. Nigger
14. Mary Walker
15. Catty Buck

and locally impure quartzite. The Rogue formation is more highly metamorphosed in this area than at its type locality along the Rogue River between the Almeda mine and Whisky Creek. Small inclusions of the Rogue formation are common in the peridotite.

Pyroxenite, composed mainly of clinopyroxene (diopside ?) with some amphibole, serpentine, and olivine, makes up part of the peridotite complex west of Freeland Mountain.

West of the Chrome Ridge area, hornblende diorite, quartz diorite, and locally olivine gabbro form a wide and complex belt of late Jurassic or early Cretaceous intrusives. The ultramafic rocks were intruded during the same period but prior to the rocks of dioritic and granitic composition.

General features of the chromite deposits

Most of the chromite* deposits of the Chrome Ridge area have a banded appearance due to a concentration of the chromite in layers or schlieren (streaky segregations of chromite) in dunite. The layers vary in thickness from a fraction of an inch to several feet. The dunite in between the chromite layers usually contains disseminated chromite grains in varying amounts. The chromite grains are generally high in chromic oxide content. Massive ore may assay more than 50 percent Cr_2O_3 and "clean" concentrated fractions of the disseminated ore may assay as high as 60 percent Cr_2O_3.

Where serpentinization and shearing have taken place, the secondary minerals, talc, chlorite, kammererite, uvarovite, deweylite, and aragonite or calcite, are often associated with the chromite. The presence of kammererite, uvarovite, and alumina-bearing chlorite is believed evidence of hydrothermal alteration of the chromite. Alteration is usually slight and occurs on the surfaces and along fractures of ore bodies and individual grains. At several of the deposits, especially at the Shady Cove mine (no. 7) in the NE¼ sec. 11, T. 36 S., R. 9 W., the ore zone is highly fractured and impregnated with talc.

Origin of the layered chromite

General. Chromite is a component of the original peridotite magma** and the chromite deposits are considered to be the product of partial magmatic segration. Settling of the heavier chromite grains into layers followed by flowage of the magma during a semimolten or plastic "crystal mush" state are believed to be the main factors involved during formation of the layered-disseminated deposits. Where the deposits contain well-defined layers of chromite, crystal settling is clearly demonstrated. In most cases, however, flowage of the magma subsequent to crystal settling and later deformation of the rock have formed streaky schlieren and lens-shaped segregations which mask the original layering.

The segregations of chromite are not persistent over long distances but are relatively small lenticular bodies usually not more than a few feet thick. They tend to pinch out and reappear along definite horizons or zones in the peridotite with their long dimensions parallel to the trend of the zones. Near a contact of the ultramafic body with the older intruded rocks,

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* Chromite is composed of varying amounts of the oxides of chromite (Cr), aluminum (Al), iron (Fe), and magnesium (Mg). The general formula is $(Mg,Fe)O \cdot (Cr,Al,Fe)_2O_3$.

** Mobile rock material generated within the earth. It may be molten, liquid, or pasty due to formation of crystals.

the ore zones parallel the contact and have attitudes similar to the older rocks. A knowledge of the distribution and trend of the chromite segregations provides a good guide to development and prospecting for ore bodies.

Layered chromite at the Lower Violet mine. An excellent exposure of layered-disseminated chromite in a zone about 5 feet thick is exposed in the vertical north wall of the glory hole at the Lower Violet mine (no. 9), sec. 14, T. 36 S., R. 9 W. The zone, striking N. 10° E. and dipping 85° E., is made up of more than 20 separate chromite-rich layers (chromitite) in dunite. The layers range from a fraction of an inch to nearly 2 feet in thickness, although most are less than half an inch thick. The greatest amount of chromite in any single layer was estimated to be 70 percent. The chromitite layers are separated by light-green altered dunite containing 1 to 20 percent chromite disseminated through it. The size of the chromite grains where concentrated in the chromitite layers is as much as 2 mm in diameter; whereas sparsely disseminated chromite grains in the dunite layers average about 0.5 mm in diameter and are often as small as 0.2 mm.

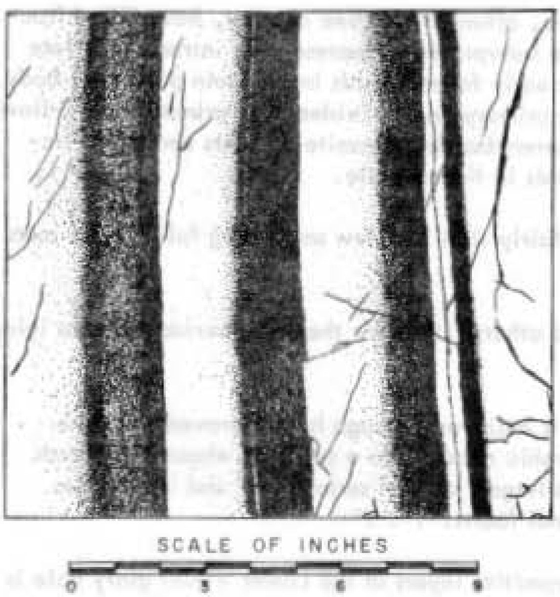

Plate 1 - Ink tracing from photograph of layered chromite exposed in vertical north wall of glory hole at Lower Violet Mine. Note composite nature of layers and gradational west edges. Layers strike N. 10° E. and dip 85° E.

At the Lower Violet exposure the western contacts of the chromitite layers with the dunite are nearly always gradational while the eastern contacts are usually fairly sharp (see plate 1). This can be explained as follows: In the formation of layered-disseminated chromite ore the precipitation of chromite and olivine is simultaneous, with the chromite crystallizing in an intermittent or cyclic manner due to a sensitive balance in at least one of the oxide components, possibly Al_2O_3 (Smith, 1953, indicated the importance of alumina in precipitation of the Newfoundland chromites). It is believed that precipitation of chromite begins more rapidly than it ceases; consequently the base of each chromite layer tends to be sharp and the top of each layer gradational. Precipitation of olivine would have little or no influence on the layering effect, as it would be continuous. It seems most likely that deposition of the chromite crystals occurred in horizontal planes due to gravitational settling. Similar conclusions regarding origin of layered chromite were proposed by Westgate (1921) and Peoples and Howland (1940) who studied the Stillwater Complex, Montana, where individual chromite layers may be traced for several miles. Since the western edges of the nearly vertical chromitite layers in the Lower Violet mine are in most cases gradational, they are interpreted as being the upper side.

Structure of the ultramafic rocks

Faulting. There are apparently two main sets of faults in the area: those which trend north and those which trend northwest. The northerly set appears to be the older of the two as it has been offset by the northwesterly set. The large east-west fault in the southern part of the area is probably related to the later northwest-trending set. Several small northwest-trending faults in the area around Chrome Camp are shown on the map of Wells and others (1940), and have a northwestward displacement of their southwestern blocks. During the present investigations, similar faults were seen cutting some of the chromite deposits. Where the displacement was determined, the direction of horizontal movement along the faults agrees with the observations of Wells and others (1940).

Two large high-angle longitudinal faults, the Cedar Mountain and Hansen Saddle faults, are projected southward into the area of the map from the geologic map of the Galice quadrangle. These major faults strike approximately N. 20° E.

Folding. The ultramafic rocks in the Chrome Ridge area have apparently undergone considerable folding as well as jointing and faulting. (See geologic map and cross-sections.) Closely spaced vertical joints or cleavages (?) and occasional shear zones have developed at or near the crests and troughs of some of the folds.

Narrow veinlets of pyroxenite and dunite, often cutting one another, have filled fractures cutting the peridotite. Such veinlets are interpreted as representing intrusions of late residual portions of the ultramafic magma into early formed joints in the main peridotite body. These secondary structures tend to obscure the primary ones. Evidence of primary (platy-flow) structures is best seen in the layered and schlieren-banded chromite deposits and in the occasional streaky distribution of pyroxene crystals in the saxonite.

Folding in the peridotite appears to be fairly tight. A few small drag folds whose axes plunged at high angles were observed.

Folding was first suggested by Wells and others (1940) for the large peridotite area lying east of Chrome Camp as follows:

> "The sill-like body of peridotite is believed, though hardly proved, to have been folded, together with the metamorphic rocks, into a syncline whose axis trends northeastward through the middle of the largest area of serpentine, and it may also have been displaced by large longitudinal faults. . . ."

If the interpretation of origin of the chromitite layers at the Lower Violet glory hole is correct and their western edges indicate the direction of the upper side, it can be assumed that the peridotite at this exposure has been overturned and is on the steeply dipping eastern limb of a syncline. About 1500 feet south of the mine, the eastern limb of this same syncline is more steeply dipping than the western limb, but it does not appear to be overturned (see highest point of cross-section A - A').

Structural data collected here is insufficient to present a complete and accurate interpretation of the area as a whole. It does, however, support the fact that the ultramafic rocks have been folded, in some places intensely. Folding of the peridotite probably took place shortly after its intrusion. In northern California, Wells and others (1949) concluded that the peridotite was folded while the rock was still plastic, since flowage took place from the limbs to crests of folds with no evidence of any concommitant fracturing.

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MORE ON ROGUE RIVER WITHDRAWALS

The March 14, 1956, Federal Register carried a notice of proposed withdrawals from location or entry under the mining laws of 7,870 acres of land along the Rogue River in the Siskiyou National Forest, Curry and Josephine counties, Oregon. The stated purpose of the withdrawal is to reserve the land for use by the U.S. Forest Service as a public recreation area.

The proposed action is a companion to the withdrawal and proposed withdrawal by the U.S. Bureau of Land Management made in June and December 1955 in this same area (see Ore.-Bin, January 1956). If these withdrawals are consummated, essentially all of the area immediately bordering the Rogue River will be closed to prospecting, mining, and mining property access from Agness to several miles upstream beyond Galice.

If no protests are made, the withdrawal will be established. If sufficient protests are received, the State Supervisor of the Bureau of Land Management may order a public hearing on the proposal. Persons interested in filing a protest should write to Mr. Virgil T. Heath, State Supervisor, Bureau of Land Management, 1001 N.E. Lloyd Blvd., P.O. Box 3861, Portland 8, Oregon. Expiration date for filing of protests is April 13, 1956.

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NIEL ALLEN REAPPOINTED

Niel R. Allen, Grants Pass, was recently reappointed to the Governing Board of the Oregon Department of Geology and Mineral Industries by Governor Elmo Smith. The appointment was made February 28, 1956, and is to run through February 29, 1960. Mr. Allen, senior partner in the law firm of Allen, Schultz & Salisbury, Grants Pass, was first appointed to the Governing Board by Governor Earl Snell in October 1943, and has since been reappointed by Governors Hall and McKay. For six years Mr. Allen served as Chairman of the Board, a position now held by Mason L. Bingham, Portland. The other member of the Governing Board is Austin Dunn, Baker.

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AIME TO MEET IN SEATTLE

The 1956 AIME Metals and Minerals Conference, Pacific Northwest Region, will be held on May 3, 4, and 5 at the Olympic Hotel in Seattle. The program will be devoted primarily to meetings of the various conference sections at which technical papers on geology, mining, milling, industrial minerals, petroleum, iron and steel, and metallurgy will be presented.

The annual banquet will be held at 7:00 p.m. Friday, May 4, at which Grover J. Holt, AIME President-elect and General Manager of the Ore Mining Department of the Cleveland-Cliffs Iron Company, Ishpeming, Michigan, will speak. The Mining Branch luncheon on Friday will be addressed by Mr. Desmond F. Kidd, Past President of the Canadian Institute of Mining and Metallurgy. Speaker at the Metals Branch luncheon on Thursday will be Dr. J. Gordon Parr, Associate Professor of Metallurgy, University of Alberta.

Other activities scheduled for the three-day program will include a mineral industries education session at 8:00 p.m. Thursday, May 3. A symposium on X-ray analysis and X-ray equipment will be held at the University of Washington campus Friday afternoon and all day Saturday. Industrial plant tours are scheduled for Saturday morning, May 5. Titles and authors of a few of the papers to be presented at sessions of the Mining Branch are listed below:

"Petroleum and Natural Gas in British Columbia," by Dr. Courtenay E. Cleveland, Senior Geologist, Pacific Petroleums Ltd., Vancouver, B.C.

"Importance of Washington Coal Reserves in the Regional Power Picture," by J. Frank Ward, Managing Director, Washington State Power Commission, Olympia, Washington.

"Localization of Ore in the Kootenay Arc," Dr. M. S. Hedley, Senior Geologist, and Dr. J. T. Fyles, Geologist, British Columbia Department of Mines, Victoria, B.C.

"Tectonic Patterns of the Western United States," by Dr. Peter Misch, Department of Geology, University of Washington, Seattle, Washington.

"Granites of Magmatic Origin as Distinguished from Granites of Metasomatic Origin," by Professor G. E. Goodspeed, University of Washington, Seattle, Washington.

"Industrial Mineral Industries of the Pacific Rim - Recent Developments and Expected Trends," by R. J. Anderson, Assistant to the Director, Battelle Memorial Institute, Columbus, Ohio.

"Requirements for Industrial Silica in the Pacific Northwest," by Dr. E.E. Mueller, Associate Professor, Department of Ceramics, University of Washington, Seattle, Washington.

"Olivine," by Kermit Bengtson, Graduate Student, Chemical Engineering Department, University of Washington, Seattle, Washington.

"A Review of Uranium Milling Practice to Date," by Edmund C. Bitzer, Metallurgical Engineer, Golden, Colorado.

"Recent Advances in the Structural Clay Products Industry," by Neal R. Fosseen, President, Washington Brick & Lime Company, Spokane, Washington.

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ADMINISTRATIVE ORDER NO. G.M.I. 3

At a public hearing held March 16 and 19, 1956, in the State Office Building, Portland, Oregon, Rule L of the Rules and Regulations for the Conservation of Oil and Natural Gas promulgated September 15, 1953, as Administrative Order No. G.M.I. 1, was amended by Administrative Order No. G.M.I. 3 as follows:

Rule L

ORS 520.095 (1) (13)

Abandonment, Unlawful Abandonment, Suspension, Well Plugging

A. Oil, Gas, and Water to be Protected

Before any well or any producing horizon encountered therein shall be abandoned, the owner or operator shall use such means, methods, and procedure as may be necessary to prevent water from entering any oil or gas-bearing formation, and to protect any underground or surface water that is suitable for domestic or irrigation purposes from waste, downward drainage, harmful infiltration and addition of deleterious substances.

The operator of any hole drilled for oil and gas which penetrates a usable fresh-water horizon, except those drilled for the purposes of seismic prospecting, shall be required to set casing through this formation and cement such casing from top to bottom, unless special exception is granted by the Board.

B. Suspension: Removal of Equipment: Application: Extension

The Board may authorize a permittee to suspend operations or remove equipment from a well for the period stated in the Board's written authorization, given upon written application of the permittee and his or its affidavit showing good cause. The period of suspension may be extended by the Board, upon written application therefor made before expiration of the previously authorized suspension, accompanied by affidavit of the permittee showing good cause for the granting of such extension.

C. Abandonment: Notice of Intention: Presumptions

1. Before any work is commenced to abandon any well drilled for oil or gas, the permittee shall give written notice to the Board of his intention to abandon such well. The notice shall be upon forms supplied by the Board and shall contain the permit number of the well and such other information as reasonably may be required by the Board.

2. After operations on or at a well have been suspended with the approval of the Board pursuant to Section B of this rule, if operations are not resumed within six months from the date specified in such approval of suspension, an intention to abandon and unlawful abandonment shall be presumed unless the permittee has obtained from the Board an extension of time of such suspension, upon his or its written application and affidavit showing good cause for the granting of such extension.

3. Whenever operations on or at any well shall have been suspended for a period of six months without compliance with these regulations, the well shall be presumed unlawfully abandoned.

4. A well shall be deemed unlawfully abandoned if, without notice given to the Board as required by these rules, any drilling or producing equipment is removed.

5. Any unlawful abandonment under these regulations shall be declared by the Board and such declaration of abandonment shall be entered in the Board minutes and written notice thereof mailed by registered mail both to such permittee at his last known post office address as disclosed by the records of the Board and likewise to the permittee's surety; and the Board may thereafter proceed against the permittee and his or its surety.

6. All wells abandoned or declared abandoned as herein provided shall be plugged as required by law and by these regulations.

7. The bond furnished by permittee shall not be released until all procedures required by these regulations shall have been completed and the Board in writing shall have authorized such release.

D. Plugging Methods and Procedure

(No change)

E. Affidavit on Completion: Copies

(No change)

F. Seismic Core and Other Exploratory Holes to be Plugged: Methods: Affidavit

Before abandoning any hole drilled for seismic, core, or other exploratory purposes, which hole penetrates a usable fresh-water horizon, it shall be the duty of the owner or driller of such hole to plug the same in such manner as to protect properly all water-bearing formations; and within sixty (60) days after such plugging, an affidavit shall be filed with the Director by such owner or driller, setting forth the location of the holes and the method used in plugging the same to protect water-bearing formations.

G. Wells Used for Fresh Water

When the drilled well to be plugged may safely be used as a fresh-water well and such use is desired by the land owner, the well need not be filled above the required sealing plug set below fresh water; provided, however, that authorization for use of any such well shall be obtained from the State Engineer, in conformance with Chapter 708, Oregon Laws 1955.

Application for leaving the well partially unplugged as a fresh-water well may be made to the Board by the land owner, accompanied by his affidavit as to his need of water and the intended use of the well, together with certified copy of the State Engineer's order or permit, or that officer's statement that no permit is required.

The operator shall leave the fresh-water well in a condition approved by the Board.

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