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PRELIMINARY GEOLOGY OF THE LAKEVIEW URANIUM AREA, OREGON

By
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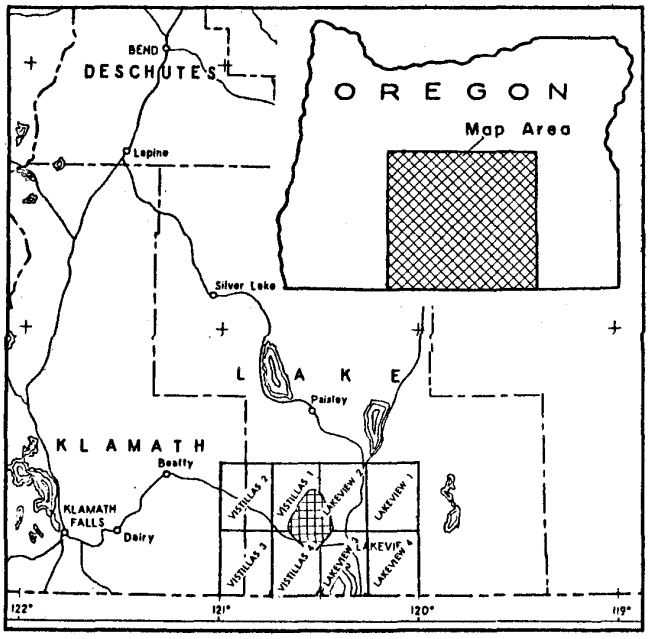
Introduction

This preliminary report is part of the Department's continuing uranium project intended both to enlighten and encourage the uranium prospector and to obtain basic stratigraphic information in areas of mineral significance that may lead to additional mineral discoveries. This basic information may also be used as needed to fill in gaps in the State Geologic Map.

The White King and the nearby Lucky Lass deposits of Lake County are the only economic occurrences of uranium so far discovered in Oregon. These deposits served as a starting point for the reconnaissance and semidetailed geologic mapping (see accompanying map) that was done during the summer field season of 1958. Mapping was begun in the vicinity of the uranium occurrences and extended in all directions to cover about 140 square miles.



Index Map showing location of area mapped.

Location

The Lakeview uranium area is in southwestern Lake County about 20 miles northwest of Lakeview. The area lies in the southern part of the Fremont Mountains just west of the northern edge of the Goose Lake Valley and within the Basin and Range physiographic province. Elevations vary from just over 5,000 feet above sea level at the base of the foothills northwest of Goose Lake to 7,925 feet at the top of Cougar Peak.

Northwest-trending fault-block ridges and their parallel streams that drain southeast into Goose Lake are typical of the topography in this part of the Fremont Mountains. Heavy soil cover and abundant timber are common throughout the area.

General geology

The general area is underlain by a great variety of volcanic rocks of Tertiary and Quaternary age. The oldest rocks are a series of indurated, light-colored, acid-to-intermediate tuffs, lapilli tuffs, and welded tuffs. For mapping purposes this series is called "Older tuffs."

These Older tuffs are overlain apparently conformably by another group of pyroclastic rocks mapped as "Younger tuffs" that are generally less indurated agglomerates, clayey tuffs, and a thick section of tuffaceous lake beds.

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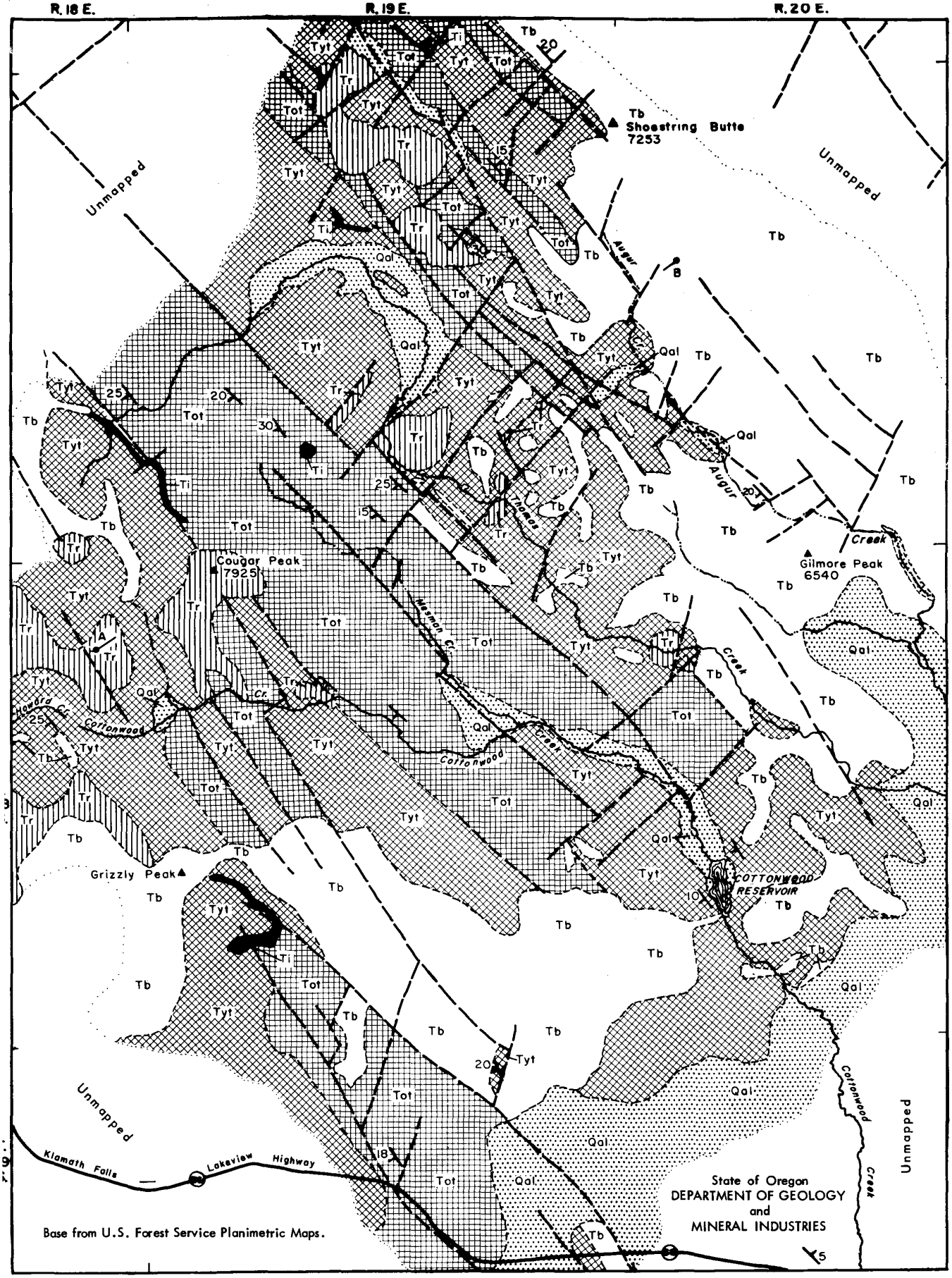
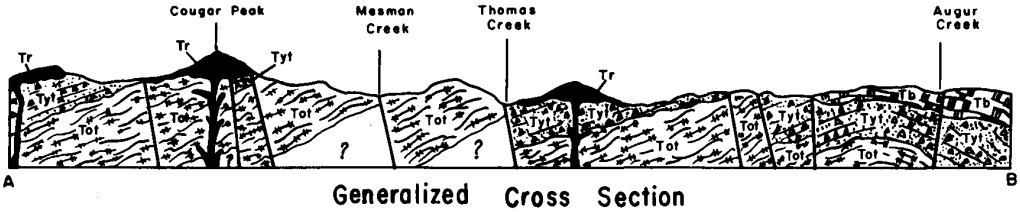


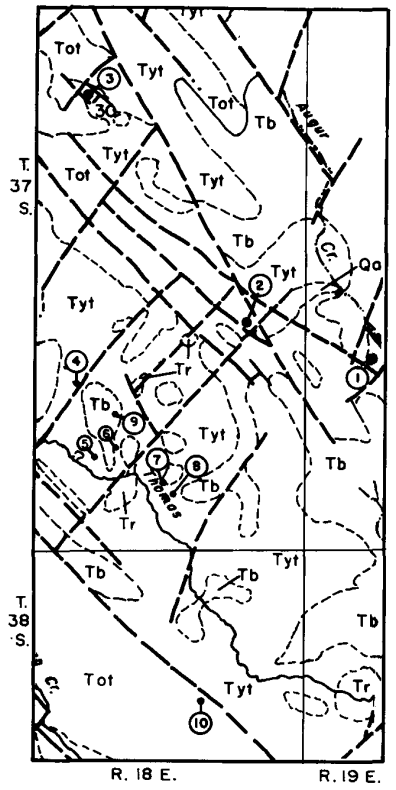
PRELIMINARY GEOLOGIC MAP LAKEVIEW URANIUM AREA



Generalized Cross Section

Scale 1 1/4 1/2 3/4 0 1 2 3 4 5 Miles

Feb. 1959



Section of Geologic Map Showing Radioactive Occurrences in the Vicinity of the White King Mine

1. White King
2. Lucky Lass
3. Marty K
4. Los Oros
5. Diamond Vee
6. Don Tracy Claims
7. Pie 1
8. Hammersley Claim
9. No Name
10. S & M #1

EXPLANATION

Quaternary	Pleistocene & Recent	Qal — Alluvium
Tertiary	Pliocene (?)	Tr — Glassy, flow-banded rhyolite
	Pliocene	Tb — Olivine basalt flows (Warner basalt)
		Ti — Basalt or gabbro dikes, sills, and necks
	Mio-Pliocene	Tyt — Younger tuffs (easily eroded clayey tuffs, lapilli tuffs, agglomerates, and tuffaceous lake beds)
	Miocene	Tot — Older tuffs (indurated acid tuffs, lapilli tuffs, and welded tuffs; minor tuffaceous sediments)

Dip and Strike 30

Fault

Contacts

Limit of Mapped Area

The Younger tuffs are in turn covered by a series of thin-to-thick olivine basalt flows (Warner basalt). The tuffs have been intruded by basalt dikes and sills that have a composition similar to the basalt flows.

The youngest rocks recognized in the area are light-gray glassy rhyolites that occur occasionally in dikelike masses and more commonly in conspicuous rounded to cone-shaped hills and elongate ridges.

Faulting is the dominant structural feature and controls both the topography and drainage. Field mapping has revealed a northwest-trending anticlinal fold in the northeastern part of the map area.

Stratigraphy

Older tuffs: The series of rocks that has been mapped as Older tuffs is at least 2,000 feet thick. It contains indurated light-colored acid tuffs, lapilli tuffs, welded tuffs, and a minor amount of dark red tuffaceous sedimentary beds. The color of the tuffs is variable but they are mainly tans, greens, and reddish browns. The Older tuffs occur in bold outcrops mainly in northwest-trending fault-block ridges. They are the most prominent rocks between Cottonwood Creek and Thomas Creek, and they form spectacular outcrops along U.S. Highway 66 in Antelope Canyon just west of the Goose Lake Valley.

In the lowest part of the Older tuffs there are about 250 feet of dark-red sedimentary beds. In these sedimentary beds a vertebrate tooth was found and later identified by Dr. J. Arnold Shotwell, of the University of Oregon, as being from a Diceratherium a rhinoceros of John Day age (lower Miocene). Several fossil leaves from the same fossil locality have been identified and compared to species in a flora that appears to be of Middle Miocene (Hemingfordian) age by Jack A. Wolfe of the University of California. Wolfe adds that an early or late Miocene age for these leaves would not be impossible.

Even though the lithology appears quite different this series may be correlative with a part of the Cedarville series as described by Russell (1928) in northeastern California.

Younger tuffs: The Younger tuffs are another group of highly variable pyroclastic rocks that appear to lie conformably on the Older tuffs. They are generally less indurated and consist of massive beds of clayey tuff, pumiceous lapilli tuff, agglomerates, and a thick section of thin-to-thick-bedded lacustrine sediments. The thickness of this group of tuffs is variable. As much as 1,000 feet have been measured in one section near the head of Howard Creek in the southwestern part of the mapped area. The rocks in this group are very easily eroded and usually do not form conspicuous outcrops. They are the predominant rocks northeast of Thomas Creek and underlie a large area in the vicinity of Cox Flat the largest upland meadow in the area. Along Howard Creek and to the northwest of the mapped area the lake bed section is exposed in sharp cliffs as much as 100 feet high. Fossil leaves were collected from several localities within the Younger tuffs and the one species identified is known elsewhere from late Miocene and earliest Pliocene. There is the possibility that this sequence may also correlate with the uppermost Cedarville series of Russell (1928), or with the Alturas formation in northeastern California described by Dorf (1930), and later by La Motte (1936), as having a Pliocene florule and a lower to middle Pliocene vertebrate fauna. Newcomb (1958) has recently described similar pyroclastic rocks as the Yonna formation of middle Pliocene age to the west in the Klamath Basin. No positive correlation of the Younger tuffs is proposed at this time.

Olivine basalt flows (Warner basalt): In the series of thin-to-thick olivine basalt flows that have been mapped as Warner basalt there are two distinct textural types. These textures appear to represent two periods of closely related volcanic activity. The lowermost flows are black porphyritic lavas with occasional large phenocrysts of feldspar (1 by 1-inch crystals are common) in a dense groundmass. The upper and most predominant flows are the typical light-

gray open-textured "diktytaxitic" variety of olivine basalt. Both types of basalt are highly fractured, show rough columnar jointing, and at tops and bottoms are highly vesicular. The total thickness of the basalt is variable from a few thin flows a few feet thick to many flows as much as 800 feet thick. Massive exposures of basalt are found east of Augur Creek and in the Camp Creek burn area. Residual fragments of basalt often form a thin layer on the Younger tuffs so that in most cases float cannot be used to map the underlying rocks.

The basalt appears to overlie the Younger tuffs conformably except in a few cases where the contact resembles an old erosion surface. Its stratigraphic position makes a correlation with the Warner basalt of Pliocene age plausible.

Basalt and gabbro dikes: Occasional dense to coarse-grained olivine basalt and olivine gabbro dikes and sills cut the Older tuff and Younger tuff sequences. Their composition is similar to the basalt and they are probably the source of the flows. The dikes range in size from 6 inches thick to more than 100 feet thick and some, like the prominent gabbro dike just north of Fish Lake in the southern part of the area, can be traced for more than a mile.

Rhyolite: The youngest Tertiary rocks recognized in the area are white to light-gray glassy flow-banded rhyolites that occur occasionally in dikelike masses and more commonly in conspicuous rounded to cone-shaped hills and domes. The domes appear to be accumulations of blocks and fragments of platy flow-banded rhyolite and are believed to be similar to the cumulo-domes described by Cotton (1952). Cotton describes them as being acid lavas extruded in such a highly viscid condition that they will not flow. They disintegrate explosively and while still hot are buried in debris. The highest peak in the area, Cougar Peak, is an excellent example of this type. It is a cone-shaped peak made up of rhyolitic rubble and is perched on a fault-block ridge of Older tuff. A cluster of smaller domes can be seen just north of Cox Flat.

The rhyolites appear to be in part intrusive and in part extrusive. They generally contain bands and irregular masses of white ashy material and, in most cases, intricate flow banding is highly developed. Perlite is well developed at the edges of many of the exposures and locally the rhyolite is partially to completely opalized. The age of the rhyolite is not known except that it is post-Warner basalt. The very slight erosional effects on the domes give them the appearance of being very young features and they may be of Pleistocene or even Recent age.

Structure

Waring (1908) suggested a major anticline extending from Silver Lake southward through the Goose Lake Valley. In the course of the present field work, the axis of an anticlinal fold trending about N. 35° W. to N. 45° W. was found just east of Augur Creek in the northeast part of the map area. Dips on the limbs of the fold range from 15° to 40° to the southwest and northeast.

Faulting is the dominant structural feature, in fact the whole area has been intricately faulted. The topography and drainage are controlled by prominent fault sets in three directions: N. 45° W., N. 45° E., and N. 15° E. The faults appear to be high-angle normal faults showing rather small displacements ranging from a few tens to a few hundred feet. There are at least two exceptions, however: the fault zone paralleling Mesman Creek where at least 2,000 feet of the Older tuff sequence is repeated, and again along Thomas Creek where 2,000 feet of Older tuffs are exposed in the upthrown block and the top of the Younger tuff is exposed on the northeast or downthrown side. The faulting does not appear to be of different ages, that is, one direction does not appear to consistently truncate another direction. Movements along the faults probably began contemporaneously in late Tertiary time and have probably continued sporadically up to the present.

Mineral deposits

Preliminary reports on the mineralogy and origin of the White King and Lucky Lass deposits by Schafer (1955, 1956) and Peterson (1958) show that the uranium was probably introduced into agglomerate and tuff beds of the Younger tuff unit along numerous fault and shear zones as a late phase of volcanic activity. Black uranium oxides (uraninite, sooty pitchblende, coffinite(?)) and associated realgar, stibnite, pyrite, cinnabar, molybdenum sulfides, galena, and chalcedony indicate a hydrothermal origin at relatively low temperature and pressure. Opalization and clay alteration are also prominent in the ore bodies especially in the vicinity of faults. The presence of the porous agglomerate bed with the large number of small faults probably accounts for the localized mineralization at the White King mine. Movement on the numerous faults occurred both before and after the uranium was emplaced,and ore bodies are offset by the later movement.

Although the age of mineralization has not been determined, bleaching and alteration of the Pliocene flow basalt near the White King mine and the occurrence of secondary minerals in vesicles of the basalt at the Lucky Lass deposit show that the mineralization is post basalt. The direct association with the younger rhyolite intrusive rocks makes a late Pliocene or younger age for the mineralization possible.

From a study of the White King deposit there are several structural, lithologic, and mineralogic guides that may be used to indicate a favorable location for uranium mineralization:

1. Areas in which there are intersections of fault zones or a concentration of faults or shear zones.

2. The presence of near-surface intrusive bodies of rhyolite or acid rocks and especially the contact between the glassy flow-banded rhyolite and the Younger tuff unit.

3. Silicified and opalized zones within the rhyolite or Younger tuff unit.

4. Bleached or heavily iron-stained rock outcrops should be checked for evidence of metallic minerals such as pyrite, cinnabar, or secondary uranium minerals.

After determining favorable geological locations there are many geochemical prospecting methods such as soil sampling and testing of ground water or surface stream waters that may lead to the discovery of concealed deposits.

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GEOLOGY CONFERENCE TO BE HELD AT OREGON STATE COLLEGE

Oregon State College has been singled out by the National Science Foundation to conduct the 1959 Summer Conference in Geology for College Teachers. This conference is one of 19 to be sponsored this summer by the Foundation. Other conferences will cover the fields of biology, chemistry, engineering, mathematics, physics, and psychology, and will be held at various institutions in the United States.

The geology conference will be held from June 15 through June 27, 1959, on the campus of Oregon State College. It will consist of one week of lectures and discussions followed by two field trips. The topic selected for the conference is "Stratigraphy and structural development of the Mesozoic of the Pacific Coast with particular reference to the problems of the Pacific Northwest." Noted specialists in Mesozoic geology will be on the conference staff. The following program is planned:

June 15 - Triassic - Dr. Siemon Muller, Stanford University

June 16 - Jurassic - Dr. Ralph Imlay, U. S. Geological Survey

June 17 - Cretaceous - Dr. David Jones, U. S. Geological Survey
Dr. E. L. Packard, Oregon State College (Emeritus)

June 18-19 - Structural development - Dr. A. J. Eardley, University of Utah

June 20-22 - Regional Correlation - Dr. H. E. Wheeler, University of Washington

Field trips: June 21 - Oregon Coast - Oregon State College staff

June 23-27 - Central Oregon and Columbia River Gorge

W. D. Wilkinson - Oregon State College
T. P. Thayer - U. S. Geological Survey
Ralph Imlay - U. S. Geological Survey
J. E. Allen - Portland State College

Professor W. D. Wilkinson, who was responsible for securing the grant from the National Science Foundation to conduct the conference, will be in charge. Those interested in participating in the program may obtain information and application forms from Dr. Wilkinson, Geology Department, Oregon State College, Corvallis, Oregon. Applications should be submitted as promptly as possible. Only those applicants actively engaged in teaching undergraduate college geology who have had at least three years of experience will be considered. Most of the participants will have Ph.D. degrees, although some applicants having Masters' Degrees will be chosen if they are otherwise qualified. Selection of thirty college teachers will be made.

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U.S. BUREAU OF MINES CONTINUES OUTSTANDING NEW DEVELOPMENTS

The recent announcements by the U.S. Bureau of Mines Electrodevelopment Laboratory at Albany, Oregon, of the production of ductile yttrium metal and the shape-casting of molybdenum marks two more important achievements by its staff members. These metallurgical triumphs climax 15 years of dedicated research which has gone practically unnoticed by the general public.

The Laboratory was established in 1944 on the campus of the old Albany College, and here the Bureau assembled a topnotch staff of scientists, technicians, and engineers. Today this Laboratory is recognized throughout the world as a leading metallurgical research center. Originally the facility was to develop new uses for Northwest electric power through the beneficiation of the area's raw mineral materials. In the ensuing years the scope of activities has expanded far beyond this concept and it is now engaged in not only studying processes for upgrading ores and metals but in conducting pilot-plant operations designed to smooth the difficult transition from test tube to full-scale private commercial operation. The Bureau's Laboratory does a lot of "pure" research but it should not be called an "ivory tower."

Ductile yttrium metal was long considered an impossibility, as the metal formerly produced was brittle and could not be formed. The Bureau succeeded in developing special metallurgical techniques which enabled it to produce a tissue-thin yttrium foil.

The other Bureau "first" recently announced is the shape-casting of molybdenum. Molybdenum has a high melting point and for this reason has resisted being cast in conventional molds. The Bureau solved the problem with a water-cooled copper crucible and special procedures. The missile program uses molybdenum to combat extremely high temperatures developed in exhaust systems. The new availability of cast shapes will make fabrication much simpler since pieces will not have to be machined "out of the solid."

The production of ductile zirconium, using a process perfected by Dr. W.J. Kroll, was one of the first major developments at Albany. The Kroll process was the basis for the successful processing of ductile yttrium. Zirconium and yttrium are called "reactive metals" as they are useful in atomic reactors because of special nuclear properties. Pure hafnium, another reactive metal, was first prepared by the Bureau, which also perfected a process by which columbium and tantalum could be separated economically and in sufficient volume to make the metals commercially useful. The Bureau at Albany is still the world's only source of high-purity, ductile chromium which is drawn into fine wire, made radioactive, and used in cancer research.

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DEFINITION OF "COMMON VARIETIES" IS AMPLIFIED

In a letter to Senator James E. Murray, the Bureau of Land Management's definition of "common variety" materials as provided under Public Law 167 was amplified by Earl J. Thomas, acting director.

According to Thomas, the department believes that a "common variety" of material is one that has no special physical or chemical properties which differentiate it from other deposits of such material so as to give it a special or distinct value. By stressing the chemical or physical properties of the material itself, he said, the department has attempted to differentiate from geographical location as it is of the opinion that location alone would not be a determining factor as to whether a material is a "common variety" or not.

"Under our definition of the term," Thomas continued, "limestone, quartzite, or other material valuable for metallurgy, limestone suitable for cement making, stone suitable for cutting into blocks or naturally cleavable into slabs suitable for building, or silica sand suitable for glass manufacture or foundry use, for example, would not be a 'common variety.' Such materials would remain subject to location under the mining laws upon a valid discovery and would, as in the past, be subject to patent upon proper application."

The "common varieties" of sand, stone, gravel, pumice, pumicite, cinders, clay, etc., may be acquired only under terms of the Materials Disposal Act. Since enactment of Public Law 167 on July 23, 1955, these materials are no longer considered "valuable mineral deposits" within the meaning of the mining laws, and thus no longer subject to such locations.

In Circular No. 1961, giving general mining regulations and rights acquired by location pursuant to Public Law 167, the Department of Interior has stated:

> "Common varieties as defined by decision of the department and of the courts include deposits which, although they may have value for use in trade, manufacture, the sciences, or in the mechanical or ornamental arts do not possess a distinct, special economic value for such use over and above the normal uses of the general run of such deposits." (From Pay Dirt, December 19, 1958.)

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LEGISLATIVE COMMITTEES

In January 1959 the Eighty-sixth Congress of the United States and the Fiftieth Legislative Assembly of the State of Oregon convened. It is expected that both bodies will enact laws affecting the mining industry. For convenience a memorandum of both Federal and State Senate and House committees that would deal with mining legislation is listed below:

Congressional Committees

Senate Interior and Insular Affairs Committee

Murray (Mont.), Chairman; Anderson (N.M.); Jackson (Wash.); O'Mahoney (Wyo.); Bible (Nev.); Neuberger (Ore.); Carroll (Colo.); Church (Idaho); Gruening (Alaska); Moss (Utah); Dworshak (Idaho); Kuchel (Calif.); Goldwater (Ariz.); Allott (Colo.); and Martin (Iowa).

House Interior and Insular Affairs Committee

Aspinall (Colo.), Chairman; O'Brien (N.Y.); Rogers (Tex.); Pfost (Idaho); Haley (Fla.); Powell (N.Y.), Chairman, Mines and Mining Subcommittee; Edmondson (Okla.); Christopher (Mo.); Sisk (Calif.); Udall (Ariz.); Rutherford (Tex.); Baring (Nev.); Ullman (Ore.); Anderson (Mont.); Saund (Calif.); McGinley (Neb.); Morris (N.M.); Rivers (Alaska); Burdick (N.D.); Saylor (Pa.); Wharton (N.Y.); Berry (S.D.); Westland (Wash.); Hosmer (Calif.); Chenoweth (Colo.); Collier (Ill.); Withrow (Wis.); Wilson (Calif.); Cunningham (Neb.); Langen (Minn.); and Simpson (Ill.).

Senate Interstate and Foreign Commerce Committee

Magnuson (Wash.), Chairman; Pastore (R.I.); Monroney (Okla.); Smathers (Fla.); Thurmond (S.C.); Lausche (Ohio); Yarborough (Tex.); Engle (Calif.); Bartlett (Alaska); Hartke (Ind.); McGee (Wyo.); Schoeppel (Kan.); Butler (Md.); Cotton (N.H.); Case (N.J.); Morton (Ky.); and Scott (Pa.).

House Interstate and Foreign Commerce Committee

Harris (Ark.), Chairman; Williams (Miss.); Mack (Ill.); Roberts (Ala.); Moulder (Mo.); Staggers (W.Va); Dollinger (N.Y.); Rogers (Tex.); Friedel (Md.); Flynt (Ga.); Macdonald (Mass.); Rhodes (Pa.); Jarman (Okla.); O'Brien (N.Y.); Moss (Calif.); Dingell (Mich.); Kilgore (Tex.); Rogers (Fla.); Hemphill (S.C.); Rostenkowski (Ill.); Brock (Neb.); Bennett (Mich.); Springer (Ill.); Bush (Pa.); Schenck (Ohio); Derounian (N.Y.); Younger (Calif.); Avery (Kan.); Collier (Ill.); Glenn (N.J.); Devine (Ohio); Nelson (Minn.); and Keith (Mass.).

State Legislative Committees

Senate Natural Resources Committee

Naterlin (Tillamook, Lincoln), Chairman; Thiel (Clatsop, Columbia), Vice-Chairman; Cameron (Josephine); Hopkins (Union, Wallowa, Baker); Key (Umatilla); Leth (Polk); and Ziegler (Benton).

Senate Ways and Means Committee

Alfred Corbett (Multnomah), Chairman; Cook (Multnomah), Vice-Chairman; Durno (Jackson); Key (Umatilla); Lewis (Multnomah); Thiel (Clatsop, Columbia); and Ziegler (Benton).

House Forestry and Mining Committee

Monaghan (Clackamas), Chairman; Christopher (Multnomah), Vice-Chairman; Back (Coos, Curry); Bristol (Josephine); Fisher (Lane); Flegel (Douglas); Haight (Baker); Hoyt (Benton); and Metke (Deschutes).

House Planning and Development Committee

Benedict (Multnomah), Chairman; Turner (Columbia), Vice-Chairman; Goss (Multnomah); Heider (Marion); Kelsay (Douglas); Orr (Clackamas); and Chadwick (Marion).

House Ways and Means Committee

Skelton (Lane), Chairman; Annala (Hood River), Vice-Chairman; Barton (Coos); Cady (Grant, Harney, Lake); Chadwick (Marion); Davis (Washington); and Hansell (Umatilla).

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THREE NEW LAND WITHDRAWALS

The Portland office of the U.S. Bureau of Land Management has notified the Department that three applications for withdrawal of land in Oregon were made in February. Total land embraced in the three withdrawals is a little more than 4,000 acres. Applications have been submitted to the Bureau of Land Management by the U.S. Bureau of Reclamation, U.S. Department of Agriculture (Forest Service), and the U.S. Bureau of Sport Fisheries and Wildlife. All withdrawals are subject to valid existing rights and all would prevent location of mining claims under the general mining laws. General location and bureaus requesting withdrawals are as follows:

U.S. Bureau of Reclamation - proposes to use land for reclamation purposes in the proposed development of the Lower Grande Ronde and Catherine Creek areas of the Grande Ronde Project.

T. 2 S., R. 36 E., part of sec. 34.
T. 3 S., R. 36 E., parts of secs. 2, 3, 4, 8, 9, 10, 11, 15, 16, 17, 20, and 30.
T. 5 S., R. 41 E., part of sec. 7.
Approximately 3,917 acres.

U.S. Department of Agriculture - desires use of land for the Sunshine Bar Recreation Area.
T. 33 S., R. 14 W., part of sec. 13.
Approximately 55 acres.

U.S. Bureau of Sport Fisheries and Wildlife - desires the land for use by the Oregon State Game Commission for the purpose of developing and providing public access to the Wallowa River for fishing in connection with the Wallowa River Wildlife Management Area.
T. 2 N., R. 41 E., parts of secs. 19, 20, and 30.
Approximately 140 acres.

All persons who wish to submit comments, suggestions, or objections in connection with the proposed withdrawals have 30 days in which to present their views in writing to the State Supervisor, Bureau of Land Management, 809 N.E. 6th Avenue, Portland 12, Oregon.

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STONE CUTTING AND POLISHING DESCRIBED

"Stone Cutting and Polishing," by Oliver Bowles, has been issued by the U.S. Bureau of Mines as Information Circular 7863. The 26-page publication describes techniques and equipment for cutting and polishing stones for architectural, memorial, jewelry, and other varied uses. It contains photographs and a bibliography on cutting and polishing stones and gems. The publication is available only from the Superintendent of Documents, Washington 25, D.C., at 25 cents a copy.

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CENTURY OF OIL INDUSTRY DESCRIBED

The 100-year history of the petroleum industry is presented in a magnificent issue of The Oil and Gas Journal entitled "Petroleum Panorama." This commemorative number (vol.57, no. 5, Jan. 28, 1959) traces the development of exploration, drilling, production, transportation, and refining from earliest days to the present. It contains hundreds of illustrations, many of which are published for the first time. "Petroleum Panorama" may be obtained from The Oil and Gas Journal, Box 1260, Tulsa 1, Oklahoma. The price is $2.50.

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