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# DATING OREGON'S GEOLOGIC PAST

By
Richard G. Bowen*

## Introduction

Dating of the geologic past is done by two basic methods: geological, which gives relative age, and radiometric, which gives absolute age.

Relative age determinations attempt to fit a rock into the geologic column by using such field information as stratigraphic position, index fossils and unconformities. By this method the time classification of rocks, called the geologic column, developed from a dual system of Primary (rocks considered to be part of the original crust) and Secondary (rocks derived from the erosion of the Primary rocks) into the complex classification shown on the accompanying Geologic Time Chart. These methods are relative, showing time has passed and change has taken place from one geological bench mark to another. The number of years elapsing between these bench marks has been subject to varying interpretation depending upon the criteria used by the investigator.

Absolute age, on the other hand, is the number of years that have elapsed since the rock was formed. An example of a method of determining absolute age familiar to all is counting the annual rings of a tree. Similar to this are the layers of annual deposition of sediment in lakes, called varves, which are especially useful in tracing the wasting and retreat of the continental glaciers. In terms of geologic time, however, the period of time involved and the incidents that can be dated by tree rings and varves are very limited. Absolute age determinations as they are used today are dependent upon the measurable decay of radioactive minerals.

Early radiometric work was limited to uranium-bearing igneous rocks, mainly of pre-Cambrian age, but more recent work has been extended to sedimentary and metamorphic rocks and to rocks as young as two million years.

## Uranium methods

Radioactive age dating became possible with the discovery of radioactivity by the French physicist Antoine Becquerel in 1896. Shortly after Becquerel's discovery, physicists demonstrated the constancy of radioactive decay of uranium and showed that lead and helium are always the product of this decay. By knowing the annual decay rate and the ratio of uranium (called the parent) to the lead or helium (called the daughter) it is possible to compute the original uranium content and thus the total age of the rock. It soon became apparent to workers in this field that they were getting divergent ages from different uranium-bearing minerals in the same rock. Most of this error, it was discovered, resulted from the inclusion of primary lead at the time of the

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mineral's crystallization. As a result the chemical analysis showed too much lead and made the rock appear much older than it actually was. With refinements in technique this method has once again become useful so that it is possible to determine the amount of radiogenic lead and its ratio to other forms of lead. It is an extremely involved procedure, however, and is used mostly as a check on other methods.

Most uranium-lead geochronological work today is done by the lead-alpha method. This method involved the selection and separation of a radioactive mineral (zircon has proved to be the most satisfactory) that because of the size of its crystal lattice excludes primary lead from its structure during formation. The mineral is separated from the rock then analyzed for its content of uranium and lead. The age can then be determined by equating the ratio of lead to uranium times the rate of formation of the lead. When used on older rocks the lead-alpha method has proven satisfactory, because the ratio of radiogenic lead to uranium in the zircon is low. When the ratio is low a small error in weighing the lead or uranium has only a small effect on total age. However, on younger rocks where only minute quantities of radiogenic lead have been produced since the crystallization of the zircon, its ratio to uranium is high. Here a small error makes a large difference in the age determined. For this reason the accuracy of this method begins to decrease rapidly in rocks younger than Cretaceous, and it has not been successful on rocks much younger than Oligocene.

## Potassium method

The potassium method uses an isotope of a more common element than the other systems, thereby greatly increasing its utility. Potassium is one of the most abundant elements and is a principal constituent of orthoclase and mica, both common rock-forming minerals. One isotope of potassium, $K^{40}$, is radioactive and decays to $A^{40}$ (argon of mass number 40).

By knowing the amount of potassium$^{40}$ and argon$^{40}$ in the mineral and the rate of argon$^{40}$ formation, it is possible by calculations similar to those used for the lead-uranium ratio, to determine the age of the sample. This method has several important advantages over the lead-alpha and other methods using uranium. The most important is the relatively greater abundance of potassium-bearing minerals. The uranium methods are in general restricted to igneous rocks, but the $K^{40}$ - $A^{40}$ method may be used on igneous, sedimentary, and metamorphic rocks with equal facility.

The $K^{40}$ - $A^{40}$ method has not completely replaced the uranium-lead methods because of the more highly refined techniques and complex equipment needed. It is rapidly supplanting it, however, particularly in younger rocks, and has been successful in dating materials as young as two million years.

## Carbon and other methods

The 1960 Nobel prize winner, Dr. Willard F. Libby, received the chemistry award for developing radiocarbon dating. Radioactive carbon (carbon of isotope number 14) is formed in the uppermost layers of the atmosphere by the nuclear reaction of cosmic-ray neutrons and nitrogen atoms. It then disintegrates by the emission of beta particles. The newly-born radiocarbon in the atmosphere reacts, within minutes or hours, with oxygen and forms carbon dioxide. The radioactive carbon dioxide, by atmospheric circulation, is brought to the surface of the earth where it is absorbed by plants. Animals eat the plants or other animals living off the plants, and consequently distribute $C^{14}$ in all living matter.

Because of the continuing interchange of carbon dioxide by living matter, the radioactivity stays constant during life. Upon the cessation of life, the carbon dioxide interchange stops and the radioactivity of the carbon begins to diminish. The radioactivity of the fresh $C^{14}$ is 15.3

## AGE DETERMINATIONS FROM OREGON

| Rock Type and Location | Method | Stratigraphic Position | Age in Years From Present | Reference |
|---|---|---|---|---|
| Log in lava flow, west of Parkdale, Hood River County | $C^{14}$ | Recent | 240 | Waters (1958) |
| Stumps buried by pumice from Newberry volcano, Deschutes County | $C^{14}$ | Recent | 2020 | Brogan (1952) |
| Stumps buried by pumice deposits from Mt. Mazama, Deschutes County | $C^{14}$ | Recent | 6500 | Williams (1953) |
| Sandals buried under ash fall from Newberry volcano, Fort Rock Cave, Lake County | $C^{14}$ | Recent | 9050 | Brogan (1952) |
| Diorite, "Hall's" Diorite, eight miles above Detroit Dam, Marion County | lead-alpha | Early Miocene | 23 million years | Jaffe (1959) |
| Vitric tuff, John Day Formation near Mitchell, Wheeler County | | | | |
| Bed 165' above base | $K^{40}$-$A^{40}$ | Oligocene | 31.3 million years | Hay (1960) |
| Bed 1110' above base | $K^{40}$-$A^{40}$ | Oligocene | 24.4 million years | Hay (1960) |
| Biotite granite, "Nimrod" granite, below Nimrod, Lane County | lead-alpha | Oligocene | 37 million years | Jaffe (1959) |
| Quartz diorite, Bald Mountain batholith, Baker County | lead-alpha | Early Cretaceous | 99 million years | Thayer (1961) |
| Granodiorite, Grouse Creek, Jackson County | lead-alpha | Jurassic or Cretaceous | 103 million years | Jaffe (1959) |

# GEOLOGIC TIME CHART

| AGE DIVISIONS | | | DOMINANT LIFE | | TIME | | | |
|---|---|---|---|---|---|---|---|---|
| ERA | PERIOD | EPOCH | ANIMAL | PLANT | DURATION IN MILLIONS OF YEARS: ERA | DURATION IN MILLIONS OF YEARS: PERIOD | DURATION IN MILLIONS OF YEARS: EPOCH | BEGINNING MILLIONS OF YEARS AGO * |
| CENOZOIC | QUATERNARY | RECENT | MAN | | 63.011 | 1.011 | 0.011 | 0.011 |
| | | PLEISTOCENE | | | | | 1 | 1 |
| | TERTIARY | PLIOCENE | MAMMALS, BONY FISH, BIRDS, SHELL FISH, ARTHROPODS | FLOWERING TREES AND SHRUBS | | 62 | 12 | 13 |
| | | MIOCENE | | | | | 12 | 25 |
| | | OLIGOCENE | | | | | 11 | 36 |
| | | EOCENE | | | | | 22 | 58 |
| | | PALEOCENE** | | | | | 5 | 63 |
| MESOZOIC | CRETACEOUS | | REPTILES | CONIFERS, CYCADS, GINGKOS, FERNS | 167 | 72 | | 135 |
| | JURASSIC | | | | | 46 | | 181 |
| | TRIASSIC | | | | | 49 | | 230 |
| PALEOZOIC | PERMIAN | | AMPHIBIANS, INSECTS | SCALE TREES, CORDAITES, TREE FERNS, CALAMITES | 370 | 50 | | 280 |
| | PENNSYLVANIAN (CARBONIFEROUS) | | | | | 40 | | 320 |
| | MISSISSIPPIAN (CARBONIFEROUS) | | | | | 25 | | 345 |
| | DEVONIAN** | | SHARKS | PRIMITIVE SCALE TREES AND TREE FERNS | | 60 | | 405 |
| | SILURIAN** | | LUNGFISH | PSILOPHYTES | | 20 | | 425 |
| | ORDOVICIAN** | | CORALS, BRACHIOPODS | | | 75 | | 500 |
| | CAMBRIAN** | | ECHINODERMS, TRILOBITES | FUNGI, ALGAE | | 100 | | 600 |
| PRE-CAMBRIAN | GRENVILLE OROGENY** | | BEGINNING OF PRIMITIVE PLANT AND ANIMAL LIFE | | 4000 | | | 1000 |
| | OLDEST KNOWN ROCKS IN NORTH AMERICA** | | | | | | | 2600 |
| | OLDEST KNOWN ROCKS (MURMANSK AREA)** | | | | | | | 3400 |
| | PROBABLE AGE OF THE EARTH | | | | | | | 4600 |

*ADAPTED FROM KULP, 1961

**ROCKS OF THIS AGE NOT KNOWN TO EXIST IN OREGON

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

# GENERALIZED GEOLOGIC TIME CHART FOR OREGON

| Era | Period | Epoch | PRINCIPAL GEOLOGIC EVENTS | Age * (in millions of years) |
|---|---|---|---|---|
| CENOZOIC | QUATERNARY | RECENT | Glaciers in mountains receding. Crater Lake and Newberry Craters formed by collapse of volcanic cones. Minor lava flows near Mt. Hood, at McKenzie Pass, Cow Lakes, and in central Oregon. | .011 |
| | | PLEISTOCENE | Greatly enlarged glaciers in mountains. Eruption of numerous volcanoes along crest of Cascades and in central Oregon. Large lakes in south-central part of State. Mastodons and giant beavers in Willamette Valley; camels and horses in Fossil Lake area. | 1 |
| | TERTIARY | PLIOCENE | First eruptions of lava cones at crest of Cascade Range. Extensive outpouring of lava in south-central Oregon. Horses, rhinos, camels, antelope, bear, mastodons living in John Day country. Large areas of grasslands due to drier climate east of High Cascade Range. Warm temperate climate west of Cascades initiates period of laterization. | 13 |
| | | MIOCENE | Thick layers of lava extruded over much of State (middle and upper Miocene). Seas invade coastal areas; mollusks, fish, whales, sea lions. Oreodonts, rodents, 3-toed horses, giant pigs, rhinos, tiny camels, wolves, and saber-tooth cats living in John Day country. General mild humid climate with extensive forests of Metasequoia. Last emplacement of granitic plutons in the State (Cascade Range) with accompanying mineralization. Cascade and Coast ranges begin uplift. Beginning of drier climate in eastern Oregon. | 25 |
| | | OLIGOCENE | Willamette Valley and parts of Coast Range covered by warm seas. Inhabited by abundant and varied mollusks. Warm temperate flora growing in both eastern and western Oregon, with Metasequoia, maple, sycamore, ginkgo, and katsura trees plentiful. Three-toed horses, camels, giant pigs, saber-toothed cats, oreodonts, tapirs in John Day country. Cascade Range too low to affect climate of eastern Oregon. | 36 |
| | | EOCENE | Coos Bay coal forming in coastal swamps. Coast Range begins to rise in south. Sub-tropical forests with palms, figs, avocados, pecans, and walnuts in central Oregon. Four-toed horses, rhinos, tapirs, crocodiles in Clarno area. Numerous volcanoes in area of the Cascades ending marine invasion into central and eastern Oregon. Western Oregon covered for long periods by arm of ocean, locally many mollusks. | 63 |
| MESOZOIC | CRETACEOUS | | Most of State covered by warm seas. Ammonites, trigonia, and other mollusks abundant in Medford and Mitchell areas. Tree ferns growing near Austin in Grant County. Formation of principal metalliferous deposits in State following batholithic intrusions. | 135 |
| | JURASSIC | | Oregon largely covered by seas. Brachiopods, mollusks, and ammonites abundant. Some marine reptiles. Ferns, cycads, ginkgoes, and conifers growing on land areas. Period of serpentine intrusions with formation of chromite deposits followed by granitic intrusions in Klamath Mountains, Blue Mountains, and possibly Wallowa Mountains. | 180 |
| | TRIASSIC | | Most of Oregon covered by warm seas. Sponges, corals, ammonites, gastropods, and nautiloids. Volcanoes active and widespread especially in northeastern and southwestern Oregon. | 230 |
| PALEOZOIC | PERMIAN | | Warm seas cover much of State. Limestone reefs forming. Fusilinids common. Vulcanism in northeastern part of State. | 280 |
| | CARBONIFEROUS | | Much of State covered by warm seas containing brachiopods and corals. Ferns and calamites growing on land areas. Rocks now exposed in Suplee area. | 345 |
| | PRE-CARBONIFEROUS | | "Pre-Carboniferous" includes the vast stretch of geologic time extending back to the oldest rocks found on the earth. Rocks of this age are not well known in Oregon because of covering by younger sediments and volcanics. Old schistose metamorphic rocks in southwest Oregon are probably of early Paleozoic age. Some limestones in central Oregon may be as old as Devonian. | 3400 |

*From Kulp 1961

disintegrations per minute per gram of carbon. This wanes at a constant rate, and by 5,600 years the activity is 7.15 dpm/g, and at the end of 11,200 years the activity is 3.57 dpm/g. Thus the half life of $C^{14}$ is 5,600 years. This method has become widely used in anthropological and archeological research in addition to geological studies. Although it is most successful when measuring between 1,000 and 20,000 years, refinements in techniques and instrumentation will extend its future usefulness to about 60,000 years.

Other methods based on atomic disintegration have been proposed or are being developed. One that is particularly desirable, since it would bridge the gap between the $K^{40}$ and the $C^{14}$ datings is beryllium$^{10}$. Its half life is 2.5 million years, about the right magnitude to date events in the Pleistocene and late Pliocene.

## Radioactive dating and the geologic time scale

For some years now, studies have been under way to correlate absolute dating with the geologic time scale. The earlier work was limited to igneous rocks, and the most accurate results came from intrusive rocks of early Paleozoic age or older. One reason for the better results on the older rocks was the small relative error. From the time a magma was intruded to the time it cooled and precipitated the various uranium-bearing minerals, some millions of years might elapse. Where the age of the rock was determined to be 600 million years or older, as in Pre-Cambrian rocks, the time of precipitation of the minerals to be dated could extend over 5 or 10 million years and still give results of less than 2 percent variation, well within the limits of acceptable error. In younger igneous intrusions this method was not successful. An experimental error of 5 to 10 million years, the time for cooling, in a rock only 20 million years old was too great to be acceptable.

After the development of the potassium method, it was found that glauconite, a potassium-bearing mineral that formed during the deposition of sediments, could be used to determine the ages of the enclosing sediments. By this method, absolute ages could be determined for fossil-bearing, geologically-dated rocks.

The geologic time scale has been revised recently by several workers, including Holmes and Kulp. The latest revision of Kulp appears on two geologic time charts accompanying this article. In addition, there is a list of rocks in Oregon that have been radiometrically dated.

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## STATE LEGISLATIVE NEWS

The following bills of direct interest to the mining industry are now being considered in the Oregon Legislature:

SB 227 would abolish the Department of Geology and Mineral Industries and its Governing Board and establish a Mineral Resources Division and an advisory Mineral Resources Board within a Department of Natural Resources. Referred to the Committee on State and Federal Affairs and later referred to the Committee on Ways and Means.

HB 1136 would give authority for all boards, departments and commissions owning or controlling state lands to lease the lands for mineral development and amend existing laws to allow for hard rock mineral leases and oil and gas leases to be on the same land and to validate existing state leases. Two hearings have been held by the Committee on Natural Resources and a third is scheduled. This bill is intended to clarify state leasing laws.

HB 1316 would grant easements and licenses across the shore of the Pacific Ocean between high and low tides. This would allow for pipe lines and the like to be put under the ocean beach which is now declared a state highway and to be nonviolate. Passed by the House February 8. Now in Senate Committee on State and Federal Affairs.

HB 1394 would establish a research program to determine damage done to cherries by exposure to fluorine gases from aluminum reduction plants. Now in Committee on Ways and Means.

HB 1416 would provide that mineral exploration and mineral development on reforested lands would not be permitted. Hearings have not been set up by Committee on Natural Resources as yet.

HB 1532 would allow the State Land Board, upon consultation with the Department of Geology and Mineral Industries, to lease offshore lands for oil and gas explorations. Sets up procedures for: (1) notification of intention to lease, (2) leasing, (3) establishing size of lease parcels, (4) rent required, and (5) royalty on production. Provides that consideration be given when preparing lease whether operations would "(1) Be detrimental to the health, safety, comfort, convenience or welfare of persons residing, owning real property, or working in the neighborhood of the leased area; (2) Interfere with shoreline recreational or residential areas to an extent that would render such areas unfit for recreational or residential uses or for park purposes; (3) Destroy, impair, or interfere with the esthetic and scenic value of such recreational, residential, or park areas; or (4) Create any fire hazard, smoke, smog or dust nuisance, or pollution of waters surrounding or adjoining the leased areas." Prohibits pollution and contamination of the ocean and impairment and interference with bathing, fishing, or navigation.

HB 1568 would establish provisions for compulsory unitization either upon motion of the Board or upon application of any interested person. This bill is copied from the Interstate Oil Compact Commission's model law on compulsory unitization and prior to introduction was circulated widely throughout the oil industry. Introduced at the request of the Department.

To be introduced soon: A bill setting up rules and regulations for locating placer mining claims. (Oregon has no specific laws at present for locating placer claims.)

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## FEDERAL LEGISLATION

Bills introduced in the House and the Senate through February 15 of interest to the mining industry are listed below in summary form. This information has been compiled from the American Mining Congress Bulletin Service. If further information is desired, it is suggested that you obtain copies of the bills from your Congressional delegation.

### Lands

S 174 National Wilderness Preservation System - Anderson (New Mexico) and 13 others. Senator Clinton N. Anderson, Chairman of the Senate Interior Committee, has announced that public hearings will be held on this bill February 27-28, in Washington, D. C. This bill would establish a multimillion acre National Wilderness Preservation System composed in large part of national forest and public domain lands now subject to the general mining laws. Under the proposed legislation, the mining laws would no longer be applicable to the wilderness lands; the President would be given discretionary authority to permit mining in specific areas under such regulation as he may deem desirable. The mining and oil, forestry, grazing, and ranching industries have expressed vigorous opposition to any legislation which would hinder multiple use development of the natural resources on the public domain. Persons wishing to express views should write their Congressional delegation immediately.

Similar bill - HR 293 by Baldwin (California) and many others.

HR 2960 Limit access over national forest lands - Ullman (Oregon). Would direct the Secretary of Agriculture to "(1) grant easements for specified periods of time or otherwise in, upon, across, and over lands administered by the Forest Service for rights-of-way for roads upon such terms and conditions as he may deem are in the public interest; and (2) enter into agreements to exchange hauling rights or rights-of-way and easements for roads with those who own, control, or use lands intermingled with or adjacent to lands administered by the Forest Service and where mutual needs for access exist and not withstanding any other provisions of law, to condition the grant of any right-of-way or permission to cross Forest Service lands upon the granting to the United States of rights or permission to cross lands owned, controlled, or used by the applicant to the extent the Secretary deems necessary and to make or receive reasonable compensation for such rights or permission: Provided, That no such conditions shall be imposed upon persons residing within or adjacent to lands administered by the Forest Service seeking rights of ingress and egress to their homes."

Identical bill S 501 - Morse (Oregon) and 15 others.

HR 3342 Public land withdrawals - Rivers (Alaska). Would amend sections 1 and 2 of the Public Lands Withdrawal Act to extend their application to ". . . any department or agency of the government." The withdrawal limitation presently applies only to the Department of Defense for defense purposes.

HR 4060 Land withdrawals for nondefense purposes - Aspinall (Colorado). Would provide that withdrawals, reservations or restrictions of 5,000 acres or more of public lands for any government agency or department shall not become effective until at least 60 days after the proposed withdrawal has been submitted to the committees on Interior and Insular Affairs of the Senate and House.

### Gold

HR 26 Provide for coinage of $5.00 and $10.00 gold pieces - Kearns (Pennsylvania).

HR 333 Free market for gold - Chenoweth (Colorado). Similar bill, HR 981 - Johnson (California).

HR 334 Authorize $35 per ounce subsidy for domestically mined gold - Chenoweth (Colorado). Similar bill, HR 1991 - Baring (Nevada).

HR 391 Establish gold standard and redeemable currency - Hiestand (California).

HR 2573 Authorize payment of $70 per ounce for domestically mined gold - Rivers (Alaska). Similar bill, HR 2212 - Baring (Nevada).

HR 3636 Gold depletion increase - Berry (South Dakota). Would provide a 23 percent rate of depletion for gold produced from domestic deposits.

HJ Res 185 Incentive payments to domestic gold producers - Johnson (California). Amount of incentive payment to be allowed by the Secretary of Interior but in no case would exceed $35 an ounce. No incentive payments could be made during any period in which the U. S. Government gold reserves equal or exceed 23 billion dollars. Identical to SJ Res 44 by Engle (California), Case (South Dakota), Kuchel (California).

Lead-zinc

HR 84 Federal subsidies to small lead-zinc producers - Edmondson (Oklahoma). Would direct the Secretary of Interior to establish a program of stabilization payments to small domestic producers of lead and zinc ores and concentrates. Payments to eligible producers would be at a rate to provide the equivalent of the difference between what they actually receive and what they would have received at market prices of 17 cents and 14½ cents per pound for lead and zinc, respectively. Would define a "small domestic producer" as one who, during the 12 months preceding the period for which he seeks subsidy payments, has not produced or sold ores or concentrates the recoverable content of which is more than 2,000 tons of lead and/or 2,000 tons of zinc for each single operating unit, with the further provisions that "a domestic producer shall be treated as a small domestic producer with respect to one, but only one, operating unit in any one state or mining district." Similar bills, HR 163 - Thompson (Wisconsin); HR 2505 - Montoya (New Mexico); HR 2874 - Baring (Nevada); HR 4003 - Pfost (Idaho); S 115 Kerr and Monroney (Oklahoma), Schoeppel (Kansas), Bible and Cannon (Nevada), Church (Idaho), and Metcalf (Montana).

HR 3416 Provides limited subsidies and import taxes on lead and zinc - Aspinall (Colorado). Would (1) authorize the Secretary of Interior to make limited stabilization payments to domestic lead-zinc miners; (2) create in the United States Treasury a Lead and Zinc Stabilization Payments Fund into which would be paid receipts from lead-zinc import taxes imposed by the bill; and (3) replace current tariff duties on lead and zinc with a system of import taxes. Identical bills, HR 3425 - Baring (Nevada); HR 3447 - King (Utah); HR 3461 - Peterson (Utah); HR 3471 - Ullman (Oregon).

Policy

S 210 Establish national mining and minerals policy - Allott (Colorado), Bennett (Utah), and Bartlett (Alaska). Would declare it the continuing policy of the Federal Government "to foster and encourage (1) the development of an economically sound and stable domestic mining and minerals industry, (2) the orderly development of domestic mineral resources and reserves necessary to assure satisfaction of industrial and security needs, and (3) mining, mineral, and metallurgical research to promote the wise and efficient use of our mineral resources."

S 239 National policy on utilization of natural resources - Engle (California) and 30 others. Would require the President to transmit annually to Congress a Resources and Conservation Report setting forth "(1) the condition of the soil, water, air, forest, grazing, mineral, wildlife, recreational, and other natural resources with particular reference to attainment of multiple purpose use; (2) current and foreseeable trends in management and utilization of the aforesaid natural resources; (3) the adequacy of available natural resources for fulfilling human and economic requirements of the nation; (4) a review of the conservation programs and activities of the Federal Government, the state and local governments, and nongovernmental entities and individuals with particular reference to their effect on full conservation, development, and utilization of the

natural resources; (5) a program for carrying out the policy . . . together with such recommendations for legislation as he may deem necessary or desirable." Similar bill, HR 3436 - Dingell (Michigan).

HR 2875 Comprehensive program for a healthy mining industry - Baring (Nevada). Would state that "Congress has determined that it is essential that the United States be as nearly self sufficient as is reasonably economically possible in all useful minerals and metals as well as those classified by the Government as strategic and critical, since dependence upon foreign sources invites possible national suicide."

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## OREGON MAN NAMED BLM DIRECTOR

Interior Secretary Stewart L. Udall has announced the appointment of Karl S. Landstrom, a native of Lebanon, Ore., as Director of the Bureau of Land Management. He succeeds Edward Woozley of Malad, Idaho, who had headed the Bureau for nearly eight years. Landstrom, a career civil servant, has had nearly 25 years of experience in the natural resource field. He joined the Bureau of Land Management in 1949, as Regional Chief of Lands and Minerals in Portland, and in recent years had been a member of the staff of the House Interior Committee.

The secretary's announcement said that Landstrom's "experience and understanding of public land management will assure development of progressive policies and programs in concert with the resource conservation goals of the Kennedy Administration." (American Mining Congress Bulletin Service, 2-3-61.)

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## NORTHWESTERN MINING COUNCIL HOLDS ANNUAL ELECTION

The Northwestern Mining Council, Inc., of Medford, Oregon, held its annual election on February 2, 1961. Officers for the coming year are as follows: W. H. Holloway, re-elected as President; Mrs. Truman Bishop, Vice President; Mrs. R. A. Mitchell, Secretary; Mrs. Glenn Hall, Correspondence Secretary; R. A. Mitchell, Treasurer. New directors are Glenn Hall and Fred Adams, while directors already in office are George Brewer and Claud Stevens.

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## TUNGSTEN CASTS MADE AT ALBANY

The first castings of pure tungsten metal ever made in the United States, if not in the world, were accomplished last month by Oregon Metallurgical Corporation of Albany, Oregon. Company President Stephen M. Shelton reports that tungsten, with a melting point of 6,170° F. -- the highest melting point of any metal, was hitherto considered prohibitive of casting. Oregon Metallurgical succeeded in producing two castings, each consisting of a missile nozzle containing 240 pounds of tungsten. The nozzles, which were made for the U. S. Government, must undergo severe tests to prove whether they are able to withstand tremendous blasts of heat. (Abstracted from The Oregonian, 1-27-61.)

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## OREGON SECTION, AIME, ELECTS NEW OFFICERS

The Oregon Section of the AIME elected the following as its officers for 1961 at its regular meeting in January: S. L. Sampson (Electric Steel Foundry), Chairman; Gordon E. White (Reynolds Metals Company, Troutdale), Vice-Chairman; and Charles McVicker (E. J. Bartells Company), Secretary-Treasurer.

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