VOLUME 40, NO. 9
SEPTEMBER 1978

THE ORE BIN

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

The Ore Bin

Published Monthly
by
STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
Head Office: 1069 State Office Bldg., Portland 97201
Telephone: [503] 229-5580

FIELD OFFICES

2033 First Street
Baker 97814

521 N.E. "E" Street
Grants Pass 97526

MINED LAND RECLAMATION DIVISION
1129 S.E. Santiam Road
Albany 97321

Subscription Rates

1 year, $3.00; 3 years, $8.00
Available back issues: $.25 at counter, $.50 mailed
Second class postage paid at Portland, Oregon

State of Oregon
Department of Geology
and Mineral Industries
1069 State Office Bldg.
Portland, Oregon 97201

The ORE BIN
Volume 40, No. 9
September 1978

SOAPSTONE INDUSTRY IN SOUTHWEST OREGON

Norman V. Peterson, Resident Geologist
and
Len Ramp, District Geologist

Grants Pass Field Office
Oregon Department of Geology and Mineral Industries

"Soapstone" is a general term used to describe a metamorphic rock composed essentially of the mineral talc, a soft hydrous magnesium silicate mineral. The term is sometimes applied to all massive gray to bluish or greenish talcose rocks which are slippery and easily carved with hand tools. Steatite is a variety of talc-bearing rock which has fewer impurities than soapstone.

The mineral talc, $Mg_6(Si_8O_{20})(OH)_4$, and the rock soapstone are extremely versatile materials and have a great number of uses as industrial products. Talc's extreme softness (1 on Mohs' scale of hardness); the ease with which it can be ground into an ultrafine, white powder; its chemical inertness, high fusion point, low water absorption, low shrinkage when fired, low electrical and thermal conductivity, and high reflectivity make it useful as a ceramic tile base; paint extender; filler in rubber, paper, roofing, and plastics; and a diluent or carrier for pesticides. It is also used in rice and peanut polishing and salami dusting. Cosmetic-grade talcum powder is produced from steatite-grade talc. In the massive form, sawed soapstone slabs are used for laboratory table tops and sinks, cut pieces for crayons to mark steel, and irregular blocks for art carving.

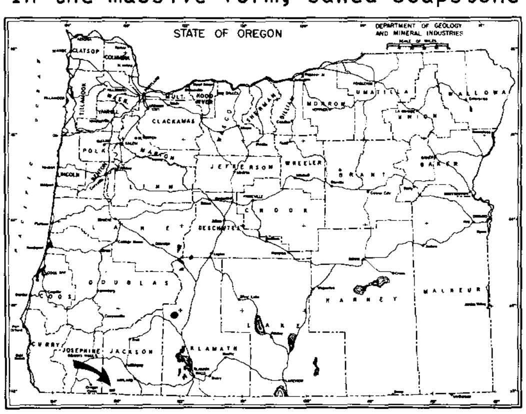


Figure 1. Map showing location of soapstone deposits.

Carving of soapstone was probably the earliest use; art objects and cooking utensils carved by prehistoric Indians have been found in California (Wells, 1975). In the mid-1800's, early-day California settlers used soapstone for ornamental and building stone, chimneys, furnace linings, and foundations.

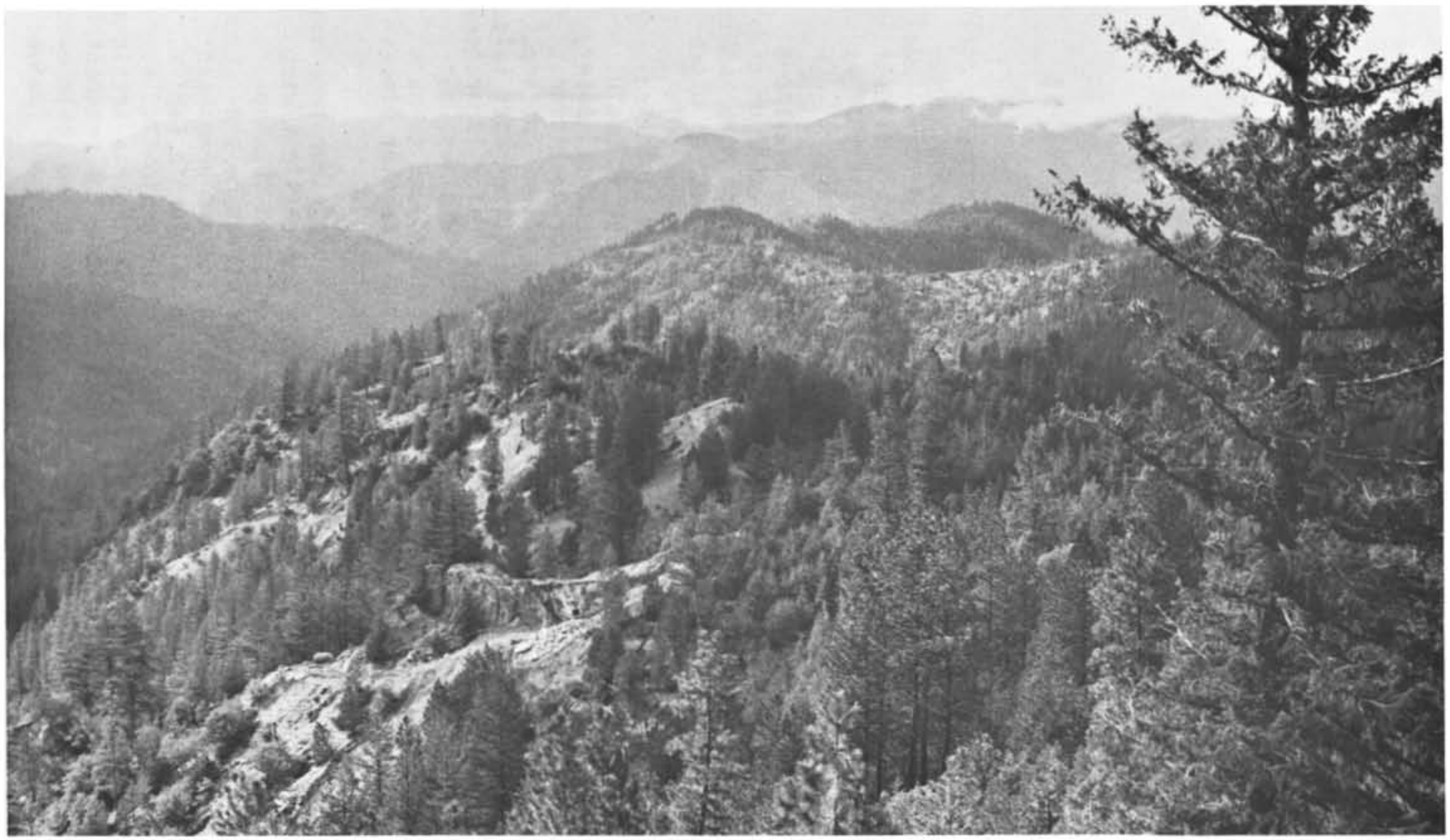


Figure 2. Looking west along Elliot Creek Ridge. Soapstone is being quarried from cut on lower left.

In talc and soapstone production statistics, art carving is listed as a minor use. It is, however, the basis for a small but steadily growing Oregon industry based in Grants Pass. Steatite of Southern Oregon, Inc., a family-owned and -operated company, mines and markets varicolored soapstone pieces and blocks for art carving throughout the western United States, Canada, and Alaska. In 1967, the company, founded by John H. Pugh of Grants Pass, began selectively mining pieces of soapstone from a landslide deposit on Powell Creek near Williams, Oregon. Their main source now is a group of relatively small occurrences in the upper Applegate-Squaw Creek-Elliot Creek Ridge area (secs. 9, 10, and 11, T. 41 S., R. 3 W.) in southern Jackson County (Figures 1 and 2).

Geology

Talc and soapstone deposits occur mainly with altered ultramafic igneous rocks or in metamorphosed dolomite. The known southwestern Oregon occurrences are all associated with serpentinized ultramafic rocks and are typical of this type of deposit. They occur as sheared lenses within or selvages on serpentinites. The talc alteration varies from thin selvages (Figure 3) to complete replacement of the serpentinite mass.

The talc and associated magnesium-bearing minerals are formed by the reaction of serpentinite with carbon dioxide or with siliceous country rocks in a suitable temperature and pressure environment. The deposits along Elliot Creek Ridge are in lenses and irregular pod-shaped masses of altered serpentinite within rocks mapped as older schists and schists of pre-Mesozoic age by Wells (1940, 1956). Hotz (1967, 1971) mapped and named similar rocks south of the border in California as the schists of Condrey Mountain and suggested possible correlations with similar California rock units from Mississippian, Triassic, and possibly Upper Jurassic rocks of the Galice Formation. Metamorphic age of these rocks, determined by potassium-argon analysis of muscovite, is 141 m.y., or Late Jurassic.

The schists, tightly folded and moderately metamorphosed, occur as a window beneath thrust plates of Triassic metamorphic rocks of the Applegate Group. The metamorphism which has changed fine-grained clayey sedimentary rocks to quartz mica and graphite schists and volcanic rocks to actinolite-chlorite schist (Figure 4) is believed to have been localized along the sole of a major thrust fault. Tectonically injected serpentinites appear to have been partly or completely altered during this period of tectonic metamorphism to talc, tremolite, chlorite, and silica-carbonate rocks.

Because the outcrops of altered serpentinite which contain the soapstone deposits are slightly more resistant to erosion than the surrounding schist, they form rough, craggy knobs and ridges at or near the crest of Elliot Creek Ridge. Soapstone

Figure 3. Surface boulder composed partly of soapstone and partly of serpentinite. This incomplete alteration makes selective mining necessary.

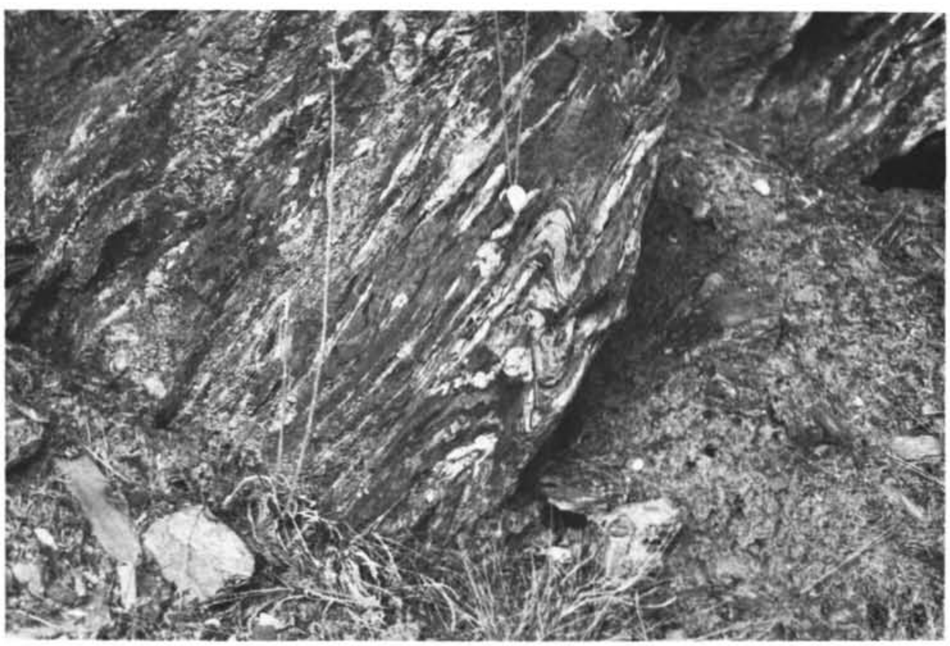


Figure 4. Tightly folded and crenulated quartz-mica-graphite schists, country rocks along Elliot Creek Ridge where soapstone deposits occur. Note hand lens for scale.

exposed at the surface is found as thin to thick selvages on the edges and as pods within the medium-grained, greenish metaserpentinite. Pyrite and limonite pseudomorphs of pyrite are present in the soapstone and in the enclosing schists. The pyrite occurs mainly in cubic form and is so abundant in some of the soapstone that it makes the rock unsuitable for carving. Green to brown chlorite, green to pale gray actinolite and tremolite, crystalline talc, and chrysotile are other minerals present in the soapstone outcrops. Magnetite, chromite, and black dendritic manganese minerals are also occasional accessory minerals found in the soapstone. The color of the massive soapstone is highly variable but is generally greenish gray. Sinuous patterns and color mottling that show original rock textures are visible on sawed or cut surfaces. In some places, former chrysotile veinlets have been completely replaced by talc without loss of the chrysotile structure (Figure 5).

Some of the Elliot Creek Ridge soapstone has small oval holes up to 4 cm in diameter extending downward from the surface, sometimes branching or intersecting (Figure 6). The inner surface of the holes has a striated pattern. At first, it appeared that soluble minerals had been removed from the rock by near-surface weathering. Cross sections, however, indicate that holes begin and end in massive talc and that material was more likely physically removed. Therefore, the most plausible explanation for these holes in the rocks is that at the base of the soil zone, small rodents such as moles, mice, or shrews encounter the soft rock and continue their burrows for a short distance into it.

Soapstone is mined selectively, using a large backhoe and small front-end loader (Figure 7). Blocks of good-quality soapstone weighing up to several tons (Figure 8) are removed and trucked to a staging area at Dividend Bar on Squaw Creek, about 2.5 mi from the mine, where they are sorted, sized, and cut into blocks for shipping (Figure 9). Basic equipment at the staging area is a front-end loader for moving large blocks, gang saw, band saw, and table trim saw. Marketing, packaging, and shipping are done from a small shop at the Pugh residence in Grants Pass.

Developing a market for an industrial mineral deposit usually takes many years of persistent and dedicated work, and the Grants Pass soapstone operation is no exception. After 10 years, orders for ton lots are being received, whereas formerly they were for samples or a few pieces. Acceptance of the good-quality soapstone by carvers from all over the country, including Alaska, and Canada now keeps the Pughs busy filling orders (Figure 10). This mineral industry still has to be considered small, but it contributes important employment and new wealth for Oregon.

The company is looking into the possibility of producing pulverized talc as a byproduct of the block operation.

Figure 5. Closeup of soapstone surface which clearly shows talc pseudomorphs after chrysotile. Area shown in photo has been completely altered to talc.

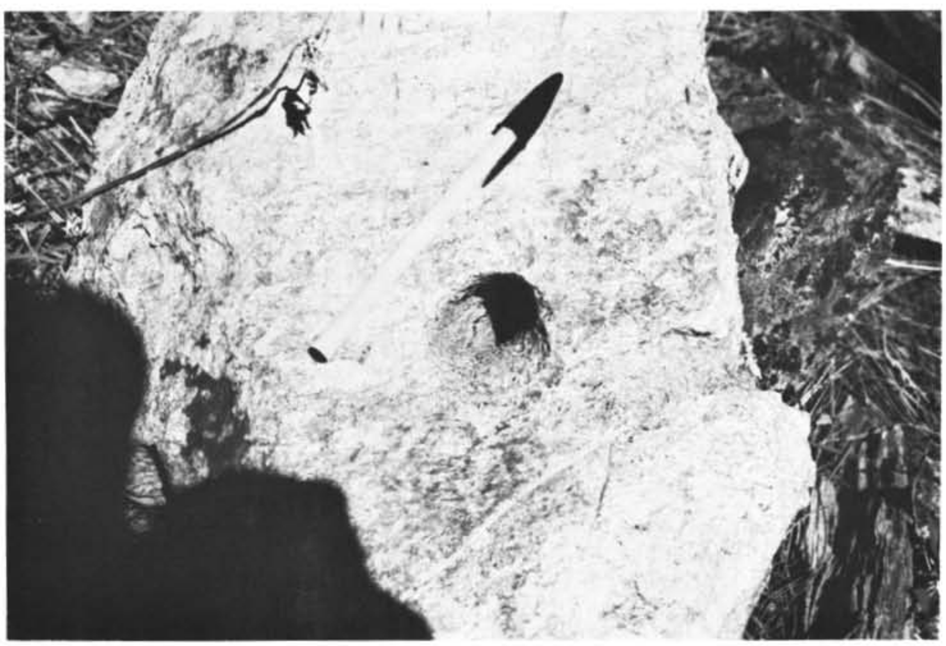


Figure 6. Oval-shaped holes on surfaces of soapstone blocks are believed to be rodent burrows.

Figure 7. Soapstone blocks are removed and loaded with large backhoe and smaller front-end loaders for haulage to Dividend Bar, where they are stockpiled.

Figure 8. Large block of nearly pure soapstone on Elliot Creek Ridge.

Figure 9. Soapstone is soft enough to be trimmed by chain saw, band saw, or other saw with specially hardened teeth. Here it is being cut with a special gang saw into specific sizes for marketing.

Figure 10. Carvings produced from southern Oregon soapstone. (Photo courtesy John Pugh)

Selected References

Englehardt, C.L., 1966, The Paleozoic-Triassic contact in the Klamath Mountains, Jackson County, southwest Oregon: University of Oregon master's thesis, 98 p.

Hotz, P.E., 1967, Geologic map of the Condrey Mountain Quadrangle and parts of the Seiad Valley and Hornbrook Quadrangles, California: U.S. Geological Survey Map GQ-618.

--- 1971, Geology of the lode gold districts in the Klamath Mountains, California and Oregon: U.S. Geological Survey Bulletin 1290, 91 p.

Wells, F.G., 1956, Geologic map of the Medford Quadrangle, Oregon-California: U.S. Geological Survey Map GQ-89.

Wells, F.G., Gates, G.O., Grantham, R.M., Hotz, P.E., James, H.L., Kennett, W.E., Newman, J.V., Jr., Rynearson, G.A., Smith, C.T., Tabor, E.C., Jr., and Tate, E.J., 1940, Preliminary geologic map of the Grants Pass Quadrangle: Oregon Department of Geology and Mineral Industries Map 5.

Wells, J.R., 1975, Talc, soapstone, and pyrophyllite, *in* Mineral facts and problems, U.S. Bureau of Mines Bulletin 667, p. 1079-1090.

* * * * *

U.S. SCIENTISTS MAP POTENTIAL HAZARDS FROM VOLCANO IN ECUADOR

A map showing potential hazards from future eruptions of Cotopaxi Volcano, Ecuador, has been compiled by scientists of the U.S. Geological Survey, Department of the Interior, with the assistance of an Ecuadorian scientist.

Cotopaxi, a 19,347-ft (5,897-m) volcano located about 35 mi (56 km) south-southeast of the capital city of Quito, has erupted more than 50 times since 1738; at least five of the eruptions resulted in significant loss of life and property. Future eruptions are likely to endanger people, property, and agricultural land, especially in the broad valleys which lead away from the flanks of the volcano.

In November 1975, Cotopaxi showed signs of geological "restlessness" and began emitting heat and steam, with resultant melting of ice and snow near the crater rim. This activity -- notably above the town of Mulalo near the western base of the volcano -- suggested the possibility of an explosive eruption with resulting large mudflows.

With the possibility of an eruption and mudflow in mind, Ecuadorian officials requested U.S. assistance in monitoring the activity of Cotopaxi and assessing the nature of the potential hazards posed by the volcano. Responding to the request, which was made through the Office of Foreign Disaster Assistance, Agency of International Development (AID), three USGS scientists -- C. Dan Miller, Donal Mullineaux, and David Harlow -- were sent to Ecuador to assist Ecuadorian scientists in evaluating the situation.

The USGS map and accompanying text, prepared by Miller, Mullineaux, and Minard Hall of the Escuela Politecnica Nacional at Quito, summarize the results of their investigations. The map shows the hazard zones around Cotopaxi related to eruptive phenomena (mudflows, ashfalls, etc.) likely to occur in the future; the text describes the hazards associated with such eruptions.

The cone of Cotopaxi itself constitutes a zone of maximum hazard from future avalanches of hot rock debris, lava flows, mudflows, and floods. Main valleys leading away from Cotopaxi are divided into zones of severe hazard and lesser hazard from future mudflows and floods. Ashfall-hazard zones delineate a large sector southwest, west, and northwest of Cotopaxi into which prevailing winds will carry volcanic ash from most future eruptions, and a smaller area west of Cotopaxi where the hazard from ashfall is greatest.

The text accompanying the map also outlines measures which can be taken to reduce loss of life and property in the vicinity of Cotopaxi before, during, and after future eruptions. Some general measures include:

1) Identification of areas of potentially high hazard from the map, along with kinds of events that can be

expected to affect them so as to provide for contingency planning.

2) Development of seismic and other instrumented monitoring systems to detect earliest signs of volcanic activity.
3) Development of effective plans to improve communication and public awareness before an emergency situation develops.

Some specific recommendations of actions to reduce losses in zones of severe hazard when an eruption appears imminent are also given in the text of the map.

Cotopaxi, one of numerous volcanoes that rise above the Andes Mountains of South America, has a long history of historic and prehistoric eruptions. Beginning with 1742, at least five major eruptions of Cotopaxi have caused death, injury, or widespread property and crop damage. An eruption in 1877 triggered a large-scale melting of snow and the formation of devastating mudflows, which extended more than 60 mi (100 km) from the base of the volcano. Major activity also took place during the period 1532-1534, but no reports of the effects of that eruption are available.

Since 1742, eruptions at Cotopaxi have occurred at an average rate of about one per 10 years. These eruptions, however, did not occur at regular time intervals, but were clustered in episodes that were separated by quiet intervals of variable length. The duration of such quiet intervals cannot be predicted. At the present time, Cotopaxi has been inactive for at least 36 years, and perhaps as long as 74 years.

Robert I. Tilling, chief of the Office of Geochemistry and Geophysics at the U.S. Geological Survey's National Center, Reston, Virginia, said that the investigations at Cotopaxi should prove the value of hazards assessment in advance of a potentially dangerous situation.

"Such assessment," Tilling said, "is similar to that being carried out on the potentially active volcanoes of the Cascade Range in the northwestern United States. If Cotopaxi does erupt and does produce destructive mudflows, we may have an immediate test of our hazards evaluations, and the knowledge learned should materially improve the Survey's volcano hazards studies in the western United States."

Copies of the map showing potential hazards from Cotopaxi Volcano, published as USGS Miscellaneous Geologic Investigations Map I-1072, may be purchased from the USGS Branch of Distribution, 1200 South Eads Street, Arlington, VA 22202, at $1.50 per copy (checks or money orders payable to the U.S. Geological Survey).

* * * * *

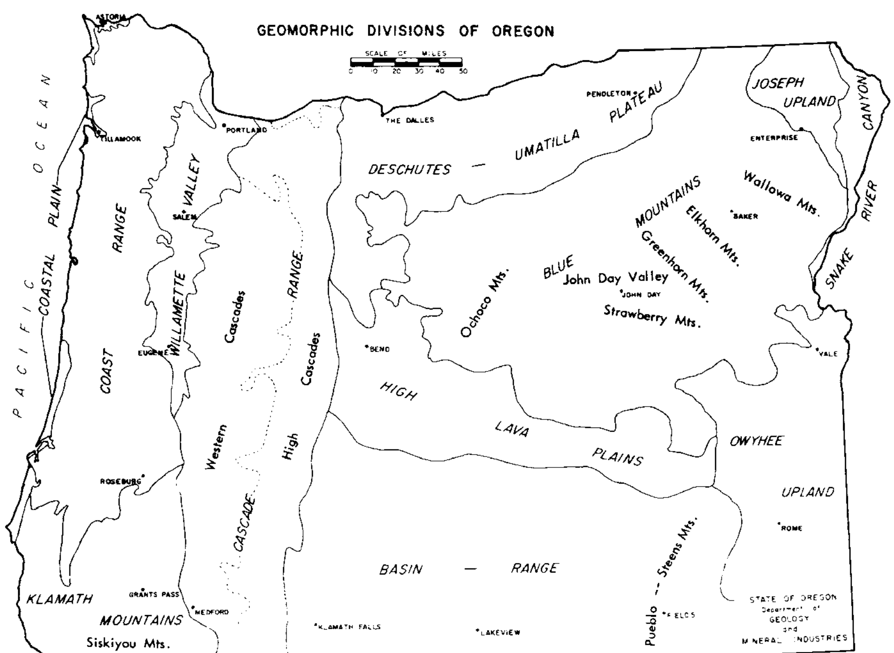
MINERAL EXPLORATION EXPENDITURES SUMMARIZED

Donald A. Hull, State Geologist
Oregon Department of Geology and Mineral Industries

Oregon's varied geologic environments contain a diverse group of mineral and energy-mineral resources and potential resources. The spectrum of mineral products produced historically in Oregon ranges from common varieties, such as sand, gravel, and crushed stone, to rarer metallic commodities, such as nickel, mercury, gold, silver, copper, and chromium.

Included in past production are mineral commodities such as uranium that are basic sources of energy. In recent years, the State has witnessed a relatively high level of exploration for a variety of minerals, including petroleum and natural gas, which have never been produced in commercial quantities here.

A recent survey of exploration activity reveals that expenditures for metallic mineral exploration in 1976 and 1977 exceeded \$2.3 million and \$3.6 million respectively. Most of this money was spent in searching for copper and gold, with lesser amounts



Modified from Dicken, Oregon Geography, 1950.

for uranium, nickel, and zinc. Metallic mineral exploration has been concentrated in the Blue Mountains; the second most active area has been the western part of the Cascade Range. The Klamath Mountains in the southwestern part of the State and the Basin and Range area of south-central Oregon have also received important attention from prospecting groups.

Detailed petroleum and natural gas exploration totals are not yet available, but statewide expenditures for both 1976 and 1977 are estimated to be in excess of $2 million and may have exceeded the totals for metallic mineral searches in these years. The areas of prime interest for oil and gas in recent years have been the Coast Range, southern Willamette Valley, and northern Harney County, in the central part of the State.

In 1976 and 1977, the search for geothermal energy by private companies resulted in expenditures exceeding $1.4 million and $600,000 respectively. The lower 1977 total is due to the lack of deep production drilling by industry in that year. In 1977, the geothermal resource assessment expenditures by various public groups, including Federal, State, and university organizations, were approximately the same as the industry costs, whereas in earlier years, the private sector conducted most of the geothermal resource assessment work.

Although most of the geothermal energy exploration and much of the metallic minerals prospecting are conducted on Federal lands, recent petroleum and natural gas drilling has been principally on private acreage. The future level of exploration for mineral and energy resources in the State is difficult to forecast; it is dependent upon economic conditions as well as public policies regarding taxation and land use.

* * * * *

IRVING RAND DIES

Irving Rand, a well-known mining attorney and son of a pioneer family, died July 20th in Baker, the city in which he was born October 27, 1896. During his 81 years, Rand led an active life both professionally and in many civic undertakings. After being educated at Dartmouth and Harvard, he was admitted to the Oregon State Bar in 1922. He practiced law in Portland for many years before returning to Baker to retire and devote his energies to various charitable activities. He was widely known as one of the few attorneys in the area having a comprehensive knowledge of mining law.

* * * * *

NMA SCHEDULES EXPLORATION GEOPHYSICS COURSE

The Northwest Mining Association preconvention short course scheduled November 27, 28, and 29 at the Davenport Hotel in Spokane, Washington, has been approved for graduate credit by Eastern Washington University.

The course, titled "Practical Geophysics for the Exploration Geologist," has been developed by R. "Dutch" Van Blaricom, supervisory geophysicist for the exploration office of Cominco American, Inc. It will present the practical application of six basic geophysical methods to mineral industry problems.

The course is divided into two major parts: the first will briefly explain the theory of each geophysical method but concentrate on application of the method to include case histories and model results; the second will be a comprehensive study of the particular geophysical techniques to use for each class or type of metallic and nonmetallic deposit.

The six basic methods to be covered in the course are (1) induced polarization and resistivity, (2) gravity, (3) magnetics, (4) seismics, (5) radiometrics, and (6) electromagnetics.

Authorities to present each unit include Philip G. Hallof and William H. Pelton, Phoenix Geophysics Limited; Don A. Hansen, ScienTerra, Inc.; Douglas J. Guion, EDCON (Exploration Data Consultants, Inc.); Sheldon Breiner, GeoMetrics, Inc.; Douglas B. Crice, GeoMetrics, Nimbus Division; Jan Klein and Jules Lajoie, Cominco Limited.

A text will be provided for the course and will be published as a formal volume for sale to the public after the course.

Complete information regarding course content and advance registration requirements is available from the Northwest Mining Association, West 1020 Riverside Ave., Spokane, WA 99201.

* * * * *

NEW GEOTHERMAL GRADIENT DATA IS COMPILED

Geothermal gradient measurements from water wells, mineral exploration holes, and oil wells have been presented in tabular and graphic form in the Department's latest open-file report, O-78-4, entitled "Geothermal Gradient Data."

The data were collected between December 1976 and December 1977 by Donald A. Hull, David D. Blackwell, and Gerald L. Black. Their measurements were made primarily in the Deschutes-Umatilla Plateau (Columbia Plateau), Cascade Range, and northern Willamette Valley physiographic provinces.

The Department sells the report at its Portland office. The price is $5.00.

APPLICATIONS FOR PERMITS TO DRILL GEOTHERMAL WELLS

Permit number	Company	Location	Proposed depth (ft)
32	Chevron Resources	NW1/4 sec. 9, T. 18 S., R. 43 E. Malheur County	2,000
33	Chevron Resources	SW1/4 sec. 5, T. 18 S., R. 43 E. Malheur County	2,000
34	Wy'East Exploration	NE1/4 sec. 7, T. 3 S., R. 9 E. Timberline Lodge Clackamas County	2,000
35	Anadarko Oil	SE1/4, sec. 6, T. 33 S., R. 36 E. Harney County	2,000
36	Anadarko Oil	SW1/4 sec. 7, T. 33 S., R. 36 E. Harney County	2,000
37	Anadarko Oil	SW1/4 sec. 18, T 33 S., R. 36 E. Harney County	2,000
38	Anadarko Oil	SE1/4 sec. 14, T. 33 S., R. 35 E. Harney County	2,000
39	Anadarko Oil	NE1/4 sec. 14, T. 33 S., R. 35 E. Harney County	2,000
40	Anadarko Oil	SW1/4 sec. 34, T. 34 S., R. 34 E. Harney County	2,000
41	Anadarko Oil	NE1/4 sec. 8, T. 35 S., R. 34 E. Harney County	2,000
42	Anadarko Oil	SE1/4 sec. 10, T. 37 S., R. 33 E. Harney County	2,000
43	Anadarko Oil	SW1/4 sec. 13, T. 37 S., R. 33 E. Harney County	2,000
44	Anadarko Oil	NW1/4 sec. 22, T. 37 S., R. 33 E. Harney County	2,000

* * * * *

NOTICE TO ORE BIN SUBSCRIBERS

Because of printing problems, some copies of recent ORE BIN issues were bound with blank pages. A few of these defective copies were inadvertently mailed to our subscribers. If you received a copy with blank pages, please notify the Portland office, and we will replace the defective copy.

* * * * *

APPLICATIONS FOR OIL AND GAS DRILLING PERMITS

Permit number	Company	Well name	Location	Proposed depth (ft)
76	Agoil of Oregon	Hay Creek Ranch #1	NE1/4 sec. 23, T. 11 S., R. 15 E. Jefferson County	5,500
77	Agoil of Oregon	Hay Creek Ranch #2	NW1/4 sec. 6, T. 11 S., R. 15 E. Jefferson County	5,500
78	Farnham Chemical	W. Smith #1	NW1/4 sec. 32, T. 11 S., R. 1 W. Linn County	4,500

* * * * *

NOTICE OF HEARING
TO REVIEW CHANGES IN OIL AND GAS REGULATIONS

Oregon oil and gas regulations have not been revised since 1956. Since then, some changes have been made in the statutes. The only significant change proposed at this time is to raise the amount of surety bond from $4,000 to $10,000.

1. On September 12, 1978, at 9:30 a.m., a public hearing will be held in Room 773 of the State Office Building, 1400 S.W. Fifth Avenue, Portland, Oregon, to consider adoption by the State Geologist of revised rules governing oil and gas drilling.

2. The Oregon Oil and Gas Rules are being revised to reflect modifications in the statute made since the rules were last amended in 1956. These proposed changes in the rules include amendments and the additions of new rules.

3. The amendments relate to the right of the State Geologist to revoke permits, drilling practices, construction of sumps, hole deviation, and flaring of gas. New rules cover wording for the bond form, disposal of wastes, underground storage wells, measurement of oil, and transportation reports.

4. Interested parties may submit comments by mail or appear in person to present their views to the State Department of Geology and Mineral Industries, 1069 State Office Building, 1400 S.W. Fifth Avenue, Portland, Oregon 97201.

5. Copies of the proposed rules may be obtained by writing the Department of Geology and Mineral Industries at the above address and enclosing 50 cents for postage and handling.

6. The State Geologist or his representative will conduct the hearing.

Donald A. Hull
State Geologist

Dated: August 25, 1978

A V A I L A B L E   P U B L I C A T I O N S

(Please include remittance with order; postage free. Minimum mail order, $0.50. All sales are final - no returns. A complete list of Department publications, including out-of-print, mailed on request.)

BULLETINS		Price
26.	Soil: Its origin, destruction, and preservation, 1944: Twenhofel	$ .45
33.	Bibliography (1st suppl.) geology and mineral resources of Oregon, 1947: Allen	1.00
36.	Papers on Tertiary foraminifera: Cushman, Stewart and Stewart, 1949: v.2 . .	1.25
39.	Geol. and mineralization of Morning mine region, 1948: Allen and Thayer . .	1.00
44.	Bibliog. (2nd suppl.) geology and mineral resources of Oregon, 1953: Steere .	2.00
46.	Ferruginous bauxite deposits, Salem Hills, 1956: Corcoran and Libbey . . .	1.25
49.	Lode mines, Granite mining district, Grant County, Oregon, 1959: Koch . . .	1.00
53.	Bibliog. (3rd suppl.) geology and mineral sources of Oregon, 1962: Steere, Owen	3.00
57.	Lunar Geological Field Conf. guidebook, 1965: Peterson and Groh, editors . .	3.50
62.	Andesite Conference guidebook, 1968: Dole	3.50
63.	Sixteenth biennial report of the Department, 1966-1968	1.00
64.	Mineral and water resources of Oregon, 1969: USGS with Department	3.00
65.	Proceedings of Andesite Conference, 1969: [copies]	10.00
67.	Bibliog. (4th suppl.) geology and mineral resources of Oregon, 1970: Roberts .	3.00
68.	Seventeenth biennial report of the Department, 1968-1970	1.00
71.	Geology of selected lava tubes in Bend area, Oregon, 1971: Greeley	2.50
76.	Eighteenth biennial report of the Department, 1970-1972	1.00
77.	Geologic field trips in northern Oregon and southern Washington, 1973 . . .	5.00
78.	Bibliog. (5th suppl.) geology and mineral resources of Oregon, 1973: Roberts .	3.00
79.	Environmental geology inland Tillamook and Clatsop Counties, 1973: Beaulieu .	7.00
80.	Geology and mineral resources of Coos County, 1973: Baldwin and others . .	6.00
81.	Environmental geology of Lincoln County, 1973: Schlicker and others . . .	9.00
82.	Geol. hazards of Bull Run Watershed, Mult., Clackamas Counties, 1974: Beaulieu	6.50
83.	Eocene stratigraphy of southwestern Oregon, 1974: Baldwin	4.00
84.	Environmental geology of western Linn County, 1974: Beaulieu and others . .	9.00
85.	Environmental geology of coastal Lane County, 1974: Schlicker and others . .	9.00
86.	Nineteenth biennial report of the Department, 1972-1974	1.00
87.	Environmental geology of western Coos and Douglas Counties, 1975	9.00
88.	Geology and mineral resources of upper Chetco River drainage, 1975: Ramp . .	4.00
89.	Geology and mineral resources of Deschutes County, 1976	6.50
90.	Land use geology of western Curry County, 1976: Beaulieu	9.00
91.	Geologic hazards of parts of northern Hood River, Wasco, and Sherman Counties, Oregon, 1977: Beaulieu	8.00
92.	Fossils in Oregon (reprinted from the ORE BIN), 1977	4.00
93.	Geology, mineral resources, and rock material of Curry County, Oregon . . .	7.00
94.	Land use geology of central Jackson County, Oregon, 1977	9.00
95.	North American ophiolites	7.00
96.	Magma genesis	12.50

GEOLOGIC MAPS		
	Geologic map of Galice quadrangle, Oregon, 1953	1.50
	Geologic map of Albany quadrangle, Oregon, 1953	1.00
	Reconnaissance geologic map of Lebanon quadrangle, 1956	1.50
	Geologic map of Bend quadrangle and portion of High Cascade Mtns., 1957	1.50
	Geologic map of Oregon west of 121st meridian, 1961	2.25
	Geologic map of Oregon east of 121st meridian, 1977	3.75
	Geologic map of Oregon (9 x 12 inches), 1969	.25
GMS-3:	Preliminary geologic map of Durkee quadrangle, Oregon, 1967	2.00
GMS-4:	Oregon gravity maps, onshore and offshore, 1967 [folded]	3.00
GMS-5:	Geologic map of Powers quadrangle, Oregon, 1971	2.00
GMS-6:	Prelim. report on geology of part of Snake River Canyon, 1974	6.50
GMS-7:	Geology of the Oregon part of the Baker quadrangle, Oregon, 1976	3.00

The ORE BIN
1069 State Office Bldg., Portland, Oregon 97201

Second Class Matter
POSTMASTER: Form 3579 requested

The Ore Bin

Available Publications (continued)

THE ORE BIN		Price
Issued monthly - Subscription	[Annual]	$ 3.00
	[3-year]	8.00
Single copies of current or back issues	[Over the counter]	.25
	[Mailed]	.50

OIL AND GAS INVESTIGATIONS

2.	Subsurface geology, lower Columbia and Willamette basins, 1969: Newton	3.50
3.	Prelim. identifications of foraminifera, General Petroleum Long Bell #1 well	2.00
4.	Prelim. identifications of foraminifera, E.M. Warren Coos Co. 1-7 well, 1973	2.00
5.	Prospects for natural gas prod. or underground storage of pipeline gas	5.00

SHORT PAPERS

18.	Radioactive minerals prospectors should know, 1976: White, Schafer, Peterson	.75
19.	Brick and tile industry in Oregon, 1949: Allen and Mason	.20
21.	Lightweight aggregate industry in Oregon, 1951: Mason	.25
24.	The Almeda mine, Josephine County, Oregon, 1967: Libbey	3.00
25.	Petrography, type Rattlesnake Fm., central Oregon, 1976: Enlows	2.00

MISCELLANEOUS PAPERS

1.	A description of some Oregon rocks and minerals, 1950: Dole	1.00
2.	Oregon mineral deposits map (22 x 34 inches) and key (reprinted 1973):	1.00
4.	Laws relating to oil, gas, & geothermal exploration & development in Oregon	
	Part 1. Oil and natural gas rules and regulations, 1977	1.00
	Part 2. Geothermal resources rules and regulations, 1977	1.00
5.	Oregon's gold placers (reprints), 1954	.50
6.	Oil and gas exploration in Oregon, rev. 1965: Stewart and Newton	3.00
7.	Bibliography of theses on Oregon geology, 1959: Schlicker	.50
	Supplement, 1959-1965: Roberts	.50
8.	Available well records of oil and gas exploration in Oregon, rev. 1973: Newton	1.00
11.	Collection of articles on meteorites, 1968 (reprints from The ORE BIN)	1.50
12.	Index to published geologic mapping in Oregon, 1968: Corcoran	.50
13.	Index to The ORE BIN, 1950-1974	1.50
14.	Thermal springs and wells, 1970: Bowen and Peterson (with 1975 suppl.)	1.50
15.	Quicksilver deposits in Oregon, 1971: Brooks	1.50
16.	Mosaic of Oregon from ERTS-1 imagery, 1973	2.50
18.	Proceedings of Citizens' Forum on potential future sources of energy, 1975	2.00
19.	Geothermal exploration studies in Oregon - 1976, 1977	3.00

MISCELLANEOUS PUBLICATIONS

Oregon base map (22 x 30 inches)	.50
Landforms of Oregon (17 x 12 inches)	.25
Mining claims (State laws governing quartz and placer claims)	.50
Geological highway map, Pacific NW region, Oregon-Washington (pub. by AAPG)	3.00
Fifth Gold and Money Session and Gold Technical Session Proceedings, 1975 (including papers on gold deposits, exploration, history, and production)	5.00

Colored postcard, GEOLOGY OF OREGON . . . 10¢ each; 3 for 25¢; 7 for 50¢; 15 for 1.00