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THE CATLIN GABEL LAVA TUBES

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Introduction

During detailed mapping of the Portland Hills for the Portland Environmental Geology project, the author and his students found evidence of lava tubes near Catlin Gabel School on the western slope of the Portland Hills. A lava tube is produced by surface cooling of a lava river while the hot interior continues to drain.

Existence of the tubes was first noted by R. J. Deacon (Shannon and Wilson, Inc., 1968) during a foundation study at the St. Vincent Hospital site just west of the Catlin Gabel School and was later discussed by Squier (1970). But the origin and extent of these interesting volcanic features were unknown until our field investigation in May of 1974.

The Catlin Gabel lava tubes occur among a cluster of cinder cones and associated lava flows of Pliocene to late (?) Pleistocene age (between about 5 and 1 million years old) that occupy an area of approximately 25 square miles on the west side of the Portland Hills (Figure 1). Lava tubes have not previously been described in Oregon lava flows older than Holocene (last 10,000 years).

Mount Sylvania is the largest of the Pliocene-Pleistocene volcanoes in the map area, but at least four and possibly as many as eight other volcanic vents and associated lava flows lie to the northwest as far as Germantown Road, 12 miles north of Mount Sylvania, and one other lies to the southeast. These volcanoes are probably the westernmost of this age in Oregon.

The area covered by lava flows and vents was first mapped by Trimble (1963), who assigned these rocks to the Boring Lava, a geologic unit first named by Treasher (1942) after a cluster of volcanoes around the town of Boring about 10 miles southeast of Portland.

Discussion of the Lava Flow

The source of the lava containing the tubes is a small volcanic vent situated between two others near the southern end of the northern area of

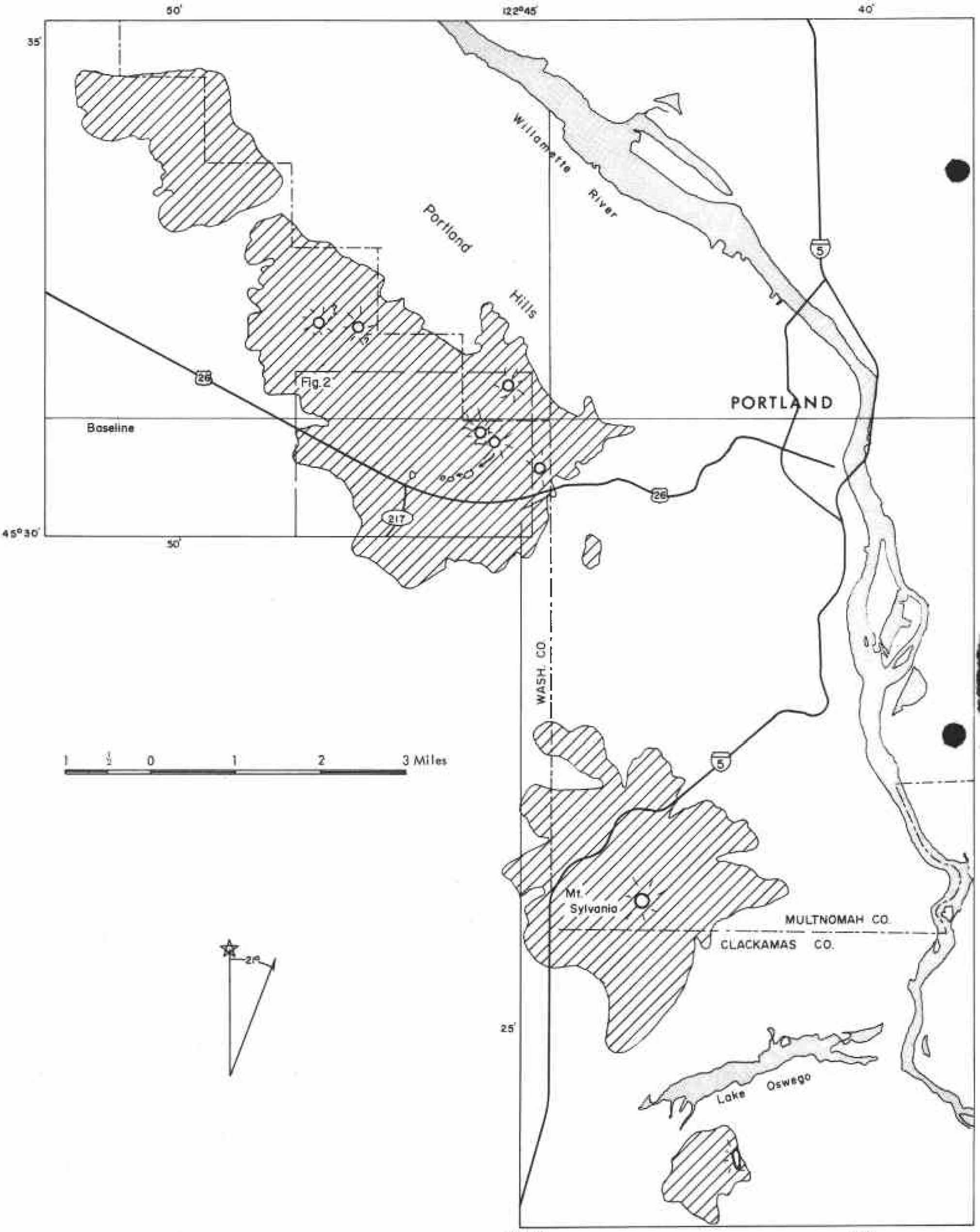

Figure 1. Index map of Boring Lava flows and vents west of the Willamette River, Oregon. Area of Figure 2 indicated by boxed area.

volcanoes (Figure 1). Its elevation is 974 feet above sea level. From the base of this vent, the lava extends south and then west for about $2\frac{1}{2}$ miles. It is about 2,500 feet wide and slopes approximately 150 feet per mile, or 3 percent (Figure 2). Near its center the total thickness of lava is 235 feet, as shown by a drill hole located 1,000 feet south of the central depression (Schlicker and Deacon, 1967, pl. 2, C-C').

The lava overlies 434 feet of silt of the Troutdale Formation, which in turn lies upon Columbia River Basalt. The surface of the Columbia River Basalt rises very steeply to the northeast and crops out only 2,000 feet east of the vent (Figure 3).

During foundation excavation for the St. Vincent Hospital, Shannon and Wilson (1968) found that the upper lava unit containing the tubes was about 90 feet thick and overlay very compact silt.

Recent erosion has modified the original surface expression of the lava, and a mantle of Portland Hills Silt as much as 30 feet thick has further masked the surface. It is perhaps surprising, in view of the age of the flow, that its outlines can still be mapped with a reasonable degree of confidence (Figure 2).

A southern lobe of lava, which extends almost a mile south of Sunset Highway (Figure 2), is interpreted to be an older flow unit, possibly from the same vent, that filled most of a pre-Boring valley.

Origin of Lava Tubes

Greeley (1971, p. 5) has carefully described the formation of lava tubes, which occur usually in flows of very fluid (pahoehoe) lava. "Tubes are so common in pahoehoe flows that they are evidently the primary means of flow advance." As molten lava flows down a valley, the bottom and sides chill and solidify; as it slows down, the top of the flow also congeals to form a solid crust, but the lava continues to flow beneath this insulating cover. When the eruption ceases, the entrapped lava continues to flow and drains the tube. More than 17,000 meters of lava tubes in the western United States have been examined and mapped in detail, according to Greeley (1971).

Notable lava tubes in the northwest occur in Oregon south and southeast of Bend, and southeast of Burns, and in Washington south of Mount St. Helens (Greeley and Hyde, 1970). Greeley (1971) described 19 tubes in the Bend area that have a total mapped length of 3.6 miles. There appear to be at least two types: minor lava tubes and major lava tubes; minor tubes are generally less than 50 feet wide and a few hundred to a few thousand feet long. "Lava flows restricted to valleys are narrow and generally have a single main tube, or multiple tubes that are vertically stacked...minor tubes are often feeder tubes from larger tubes," (Greeley, 1971, p. 5). The Catlin Gabel tubes would seem to fall into the category of minor tubes.

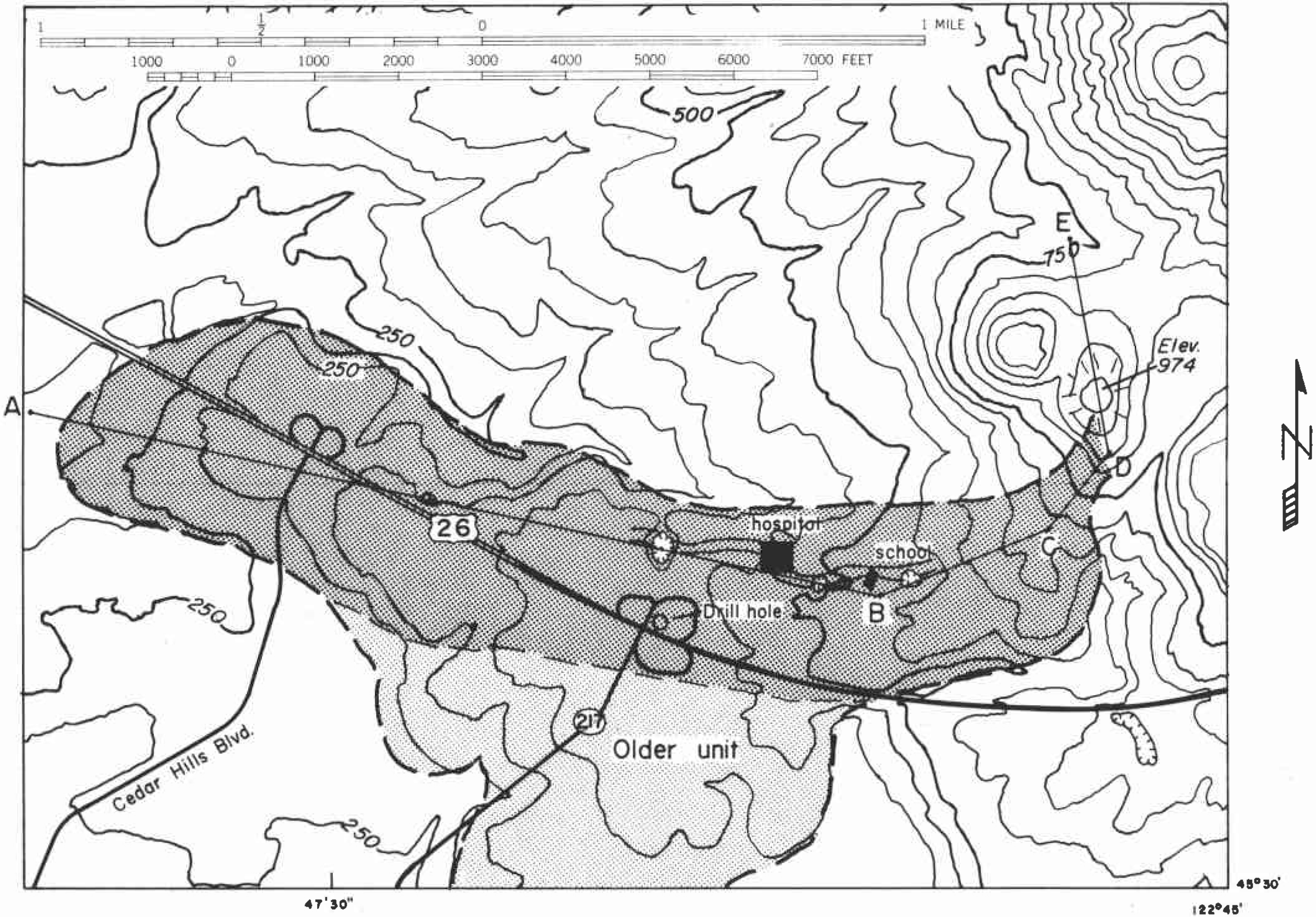

Figure 2. Catlin Gabel lava flow and lava-tube depressions.

Discussion of the Catlin Gabel Lava Tubes

Multiple eruptions from the source vent produced several flow units which apparently followed down a pre-existing valley on the west slope of the Portland Hills. The lava tubes developed in the uppermost flow when the surface of the lava congealed and the interior continued to advance until drained.

The lava of the latest flow extends south from the vent and then west in an arc which lies just north of and nearly parallel to Barnes Road (Figure 2). Along the center of the arc, within a distance of 6,000 feet, are five closed depressions which were caused by collapse of the roofs of the lava tubes.

From east to west, the five depressions are as follows: The first (55 feet deep and 500 feet across) lies just east of Catlin Gabel School; the next two depressions (35 and 45 feet deep, 100 and 200 feet across) lie just west of the school; the fourth (30 feet deep and 400 feet across) is north of the interchange of Highway 217 with Sunset Highway; and the fifth depression (50 feet deep, 150 feet across) lies just north of Sunset Highway and 1,000 feet east of the Cedar Hills Boulevard interchange. (See U.S.G.S. Linnton $7\frac{1}{2}$-minute topographic quadrangle.)

Since there are no visible openings to uncollapsed segments of the tube system, little is known of its characteristics. Apparently at least part of its course was made up of branching or tributary lava tubes. At the St. Vincent Hospital site, excavation revealed two northwest trending collapsed tubes that joined to the northwest. The two rubble-filled channels were up to 40 feet wide and 60 feet deep and required special engineering design for the foundation of the 15-story building (Squier, 1970).

Engineering Considerations

Although the cross section (Figure 3) shows segments of the tube still intact, an alternate possibility exists -- the entire tube system may have collapsed. In that event, the tubes would consist of channels filled with the debris of the collapsed roofs. According to R. J. Deacon (Shannon & Wilson, 1968), the "rubble-filled channels" beneath the hospital site were masked by undisturbed layers of ash and silt. This indicates that the roof of the two tubes at that location had fallen in <u>before</u> deposition of the overlying sediments.

The above disclosure suggests the further possibility that the five existing depressions represent the last parts of the tube roofs to break down and that their collapse occurred <u>after</u> the ash and silt were deposited. If this alternative is valid, it has important engineering implications: those structures, such as Catlin Gabel School, that directly overlie the projected course of the tubes would not be in danger of eventual collapse.

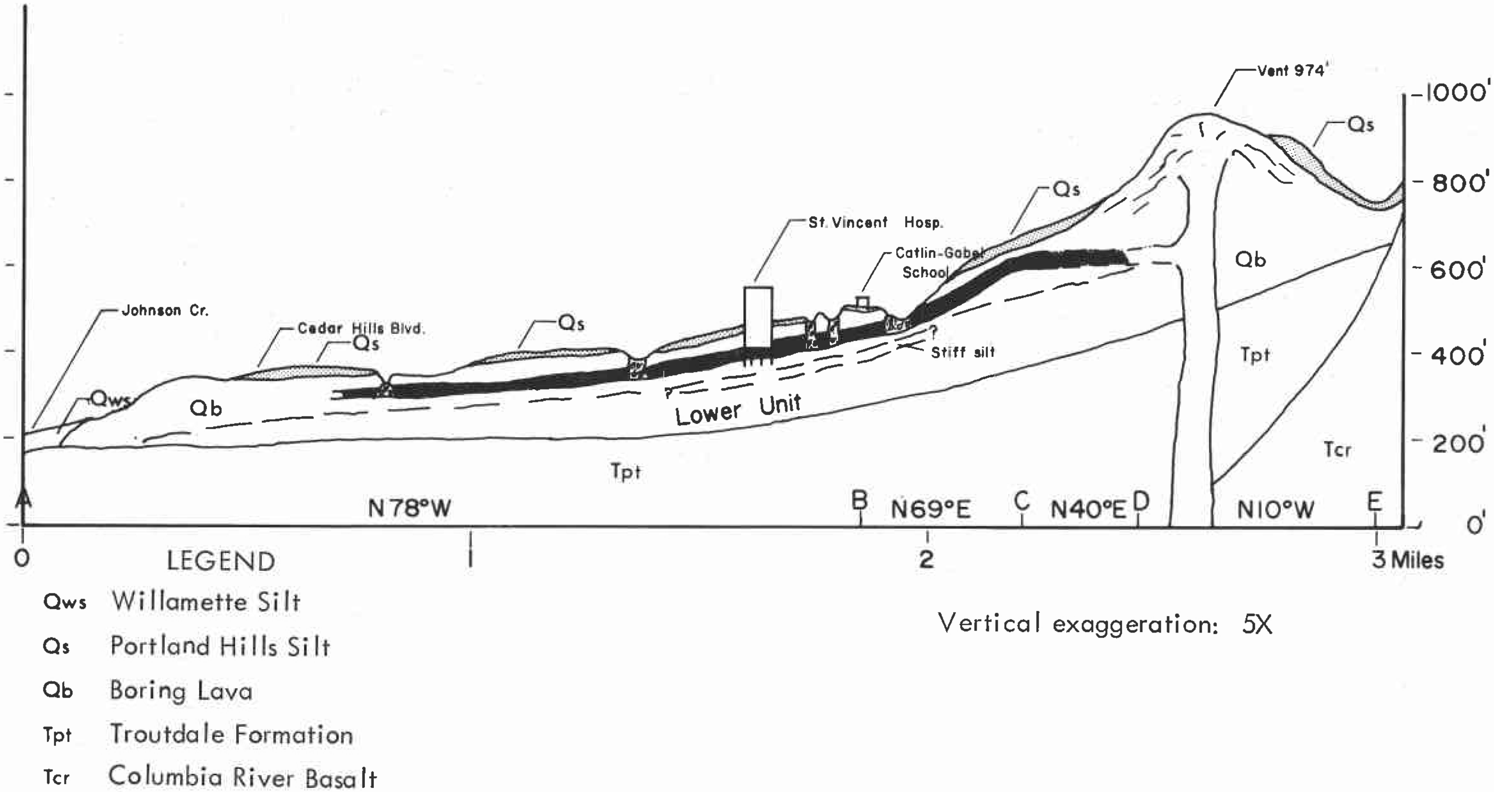

Figure 3. Generalized longitudinal section of the Catlin Gabel lava flows showing relative position of tube and latest collapse depressions. Plan of cross section A through E shown in Figure 2.

Planning for future heavy structures, such as St. Vincent Hospital, along the route of the Catlin Gabel lava tubes should carefully explore the subsurface for potential foundation problems arising either from channels filled with basalt rubble or from uncollapsed tubes subject to roof failure.

Bibliography

Greeley, Ronald, 1971, Geology of selected lava tubes in the Bend area, Oregon: Oregon Dept. Geol. and Mineral Indus. Bull. 71, 46 p.

Greeley, Ronald, and Hyde, J. H., 1970, Lava tubes of Mount St. Helens, Washington [abs.]: Geol. Soc. America, Abstracts with Programs, v. 2, no. 2, p. 96-97.

_____, 1972, Lava tubes of the Cave Basalt, Mount St. Helens, Washington: Geol. Soc. America Bull., v. 83, no. 8, p. 2397-2418.

Hyde, J. H., and Greeley, Ronald, 1973, Geological field trip guide, Mount St. Helens lava tubes, Washington, in Geologic field trips in northern Oregon and southern Washington: Oregon Dept. Geol. and Mineral Indus. Bull. 77, p. 183-206, 24 figs.

Schlicker, H. G., and Deacon, R. J., 1967, Engineering geology of the Tualatin Valley region, Oregon: Oregon Dept. Geol. and Mineral Indus. Bull. 60, 103 p.

Shannon and Wilson, Inc., 1968, Report of study of subsurface conditions of proposed foundations for St. Vincent Hospital, Beaverton, Oregon: Portland, Ore., private engineering report, 26 p., unpub.

Squier, L. R., 1970, Lava tubes cause foundation design change: Civil Engineering, A.S.C.E., v. 40, no. 8, p. 61-62.

Treasher, R. C., 1942, Geologic history of the Portland area: Oregon Dept. Geol. and Mineral Indus. Short Paper 7, 17 p.

Trimble, S. E., 1963, Geology of Portland, Oregon and adjacent areas: U.S. Geol. Survey Bull. 1119, 119 p.

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ANDESITE CONFERENCE PROCEEDINGS REPRINTED

Bulletin 65, "Proceedings of the Andesite Conference," published by the Department in 1969, has been out of print for several years. Until now, duplicated copies have been provided at cost on an individual basis, but because of the continuing demand for the publication, it has been reprinted by offset process and can be purchased from the Department's office in Portland for $10.00. The 193-page book contains papers by geologists, geophysicists, and geochemists who attended the conference held in Bend, Oregon in 1968.

* * * * *

MATERIALS SHORTAGES IN INDUSTRY SURVEYED

Materials shortages being experienced by the "Fortune 500" companies are the basis for a report published by the Permanent Subcommittee on Investigations of the Senate Government Operations Committee.

According to the report, the most consistent complaint from the companies concerned the insufficient production capacity of industry, which created shortages. This was attributed to:

1. Physical depletion of many material resources when world demand is rising.
2. High interest rates and low rates of return on investments, which discourage construction and expansion.
3. Price controls, which kept domestic prices low.
4. Two devaluations of the dollar.
5. Inflexibility of environmental protection laws and regulations.
6. Requirements of the Occupational Safety and Health Act.
7. Shortages of energy minerals.

* * * * *

MINING CLAIMS OPINION GIVEN

The rights of the public to use the surface of unpatented mining claims filed after July 23, 1955 for recreational purposes have been determined in a recent Department of the Interior opinion, Bureau of Land Management officials reported.

Archie D. Craft, BLM Oregon State Director, noted that the opinion states that recreational use is an authorized form of resource management and therefore can be permitted on those unpatented mining claims filed after July 23, 1955, the date the Multiple Use Mining Law (Public Law 167) was passed by Congress. In certain instances, recreational use may also be appropriate on older claims where the rights to surface resource management have been obtained by the Government.

The Department opinion, Craft said, is based on recent interpretations of the 1955 law and policy changes toward outdoor recreation management. It reiterates the fact that recreational use of national resource lands is a recognized form of surface resource management authorized by law.

The opinion related that under the law the claim operator is entitled to preclude recreational uses which endanger or materially interfere with his bona fide operations.

Craft said the recreationist, such as hunters, must exercise considerable judgment in recognizing legitimate mining activities and what constitutes material interference with mining.

* * * * *

WOULD YOU RATHER OWN A DIAMOND MINE OR A GRAVEL PIT?

Shortly after our wedding, my wife confessed that she married me because she figured that I might find her a diamond mine. I pointed out that she would be better off if I found a gravel pit! The simple fact is that although the U.S. has no commercial production of diamonds, the value of sand and gravel mined last year was $1.2 billion. The message here is that real value is not necessarily connected with glamour materials. In recent months our attention has been focused on prices and shortages of mineral fuels, and while there is also a growing concern over our increasing dependence on foreign sources of metallic minerals, there still is a surprising lack of awareness of the tremendous role which non-metallic, industrial minerals serve in our economy.

Last year the total value of all metallic minerals produced in the U.S. (including gold, silver, copper, lead, zinc, manganese, etc.) totaled $3.5 billion, but the combined value of all the non-metallic categories (stone, cement, sand and gravel) had a $4.2 billion production value, thus exceeding all metallic mineral production.

The importance of non-metallic mineral resources can further be demonstrated by per capita use data. In 1973 for every man, woman, and child, the U.S. used 9,000 pounds of sand and gravel, 8,500 pounds of stone, 800 pounds of cement, 600 pounds of clays, 450 pounds of salt, 1,200 pounds of other non-metals. This made a total of 20,550 pounds per capita of all non-metallic, as compared with 1,340 pounds of metals per person.

In Pennsylvania last year nearly 40 percent of the Commonwealth's $1.3 billion total mineral production value consisted of non-metallic industrial minerals: cement, stone, lime, sand and gravel, and clay.*

These non-metallic minerals are called industrial minerals for the very reason that they are critical raw materials necessary to maintain our industrial capability and responsible for employment of great numbers of people. Non-metallics also provide the raw materials from which we construct our homes, offices, factories, roads, bridges, railroads, and airports.

With their great dollar value and importance to our society, we are fortunate that the U.S. has great reserves of the industrial minerals. We must, however, assure their future availability by carefully mapping their distribution, planning for their accessibility, and establishing mining procedures compatible with being good neighbors to our citizens and our environment. --Arthur A. Socolow, State Geologist, Pennsylvania

(Reprinted from Pennsylvania Geology, v. 2, no. 5, 1974)

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* In Oregon 66 percent of the State's $81.5 million mineral-production value is from sand and gravel and stone.

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JOINT ECONOMIC COMMITTEE HEARS MINING SPOKESMAN

The Subcommittee on Economic Growth of the Joint Economic Committee held a series of hearings in July on raw materials adequacy; Robert N. Pratt, president of Kennecott Sales Corp., testified on many of the problems and issues confronting the mining industry.

Covering copper pricing and the supply and demand outlook, Pratt said that with sound policies, the U.S. can continue to become more self-sufficient in copper, even though the nation currently faces short-term shortages. The one deterrent to increasing productive capacity, he said, is the huge capital investment required.

He stated that realistic and workable laws and regulations are necessary if a strong domestic mining industry is to be maintained. He acknowledged that government has a vital role to play in encouraging a strong domestic mining industry and that access to resources must not be frustrated. A copy of Pratt's statement is available upon request to the American Mining Congress. (Amer. Mining Cong. News Bull. July 26, 1974

* * * * *

CARLSON NOMINATED FOR INTERIOR POSITION

Jack W. Carlson has been approved by the Senate Interior Committee to be Assistant Secretary of the Interior for Energy and Minerals, succeeding Stephen Wakefield, who resigned. Carlson has served as assistant to the director, Office of Management and Budget, since 1972; previously was senior staff economist on the President's Council of Economic Advisers, 1966-67; and in 1968 became assistant director of the Bureau of the Budget.

* * * * *

ENERGY-USE STUDY OF MINERAL INDUSTRIES UNDER WAY

Finding out how much energy is used by industries that extract and process the nation's metals and non-metallic minerals and recommending ways for those industries to conserve energy are the twin objectives of a new study launched by the U.S. Bureau of Mines.

The study, scheduled for completion in 18 months, will be conducted for the bureau by Battelle Columbus Laboratories under a $661,000 contract. The project is designed to provide comprehensive information on energy consumption by type and quantity for each phase of the metals and minerals industries, except fossil fuels, from mining to primary product, including energy required for transportation.

* * * * *

INTERIOR SECRETARY MORTON STRESSES NEED FOR RESOURCE EXPLORATION "NOW"

In an address presented August 26, 1974 to the more than 800 earth scientists from about 30 nations attending the opening session of the Circum-Pacific Energy and Mineral Resources Conference in Honolulu, Hawaii, Interior Secretary Rogers C. B. Morton stressed both the necessity to begin now the exploration for the vital mineral resources that will be required to supply future needs and the important role that the largely unexplored Pacific basin could play in supplying those needs.

Secretary Morton's address, presented by Dr. V. E. McKelvey, Director of the U.S. Geological Survey, Department of the Interior, noted that "at some time in the future we shall indeed reach a point of equilibrium between the world's population and available resources -- if not by design, then later by necessity. But there is a world of difference between preparing for the ultimate arrival of the equilibrium between resources and population and supinely resigning ourselves to some inevitable doomsday soon to come."

"The fact is that we have the capacity to create additional resources by discovery of deposits whose existence and location are presently unknown to us, and we can increase our ability to use more efficiently the resources we have. These are the processes by which men have satisfied their increasing needs for at least 8,000 years," Secretary Morton said.

The Interior Secretary noted that "everything we can infer about the presence of minerals in the Earth's crust leads us to believe that vast resource remain to be discovered and developed." Among the recent reminders of this he cited:

The huge iron and bauxite deposits of Australia that were discovered within the last 25 years, although the continent has been explored for more than 200 years.

New discoveries of tin deposits in the British Isles, where tin has been mined for 4,000 years.

New deposits in the lead belt of the U.S. where lead has been extensively mined for two centuries.

And in Hawaii, the center of a region that contains enormous deposits of metal-rich nodules on the sea floor, for which the recovery technology is now within our grasp.

"The Pacific region is not only a major area to explore for resources," Morton said, "it is also the world laboratory for the study of active processes of geotectonics as they relate to the origin of energy and mineral resources. By any measurement, the Pacific region is enormous. A billion people live along its shores, and the entire land area of the Earth could easily be contained in the Pacific basin. To identify and assess the mineral wealth of such a region will be a formidable task indeed."

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GEOTHERMAL LEASE ISSUED FOR VALE AREA

Archie D. Craft, State director of Bureau of Land Management in Oregon, has approved the lease of 1,347 acres of national resource lands in the Vale Known Geothermal Resource Area near Vale, Oregon, to Republic Geothermal, Inc., Whittier, California.

Four bids were received on June 27, 1974 to lease the acreage for geothermal exploration and development. Republic was successful with a bid price of $10.26 per acre, for a total of $13,831.

Qualifications of the bidder for the long-term lease (ten-year, renewable for 40 years) has been verified and the U.S. Geological Survey agreed that the lease rate was appropriate.

The lessee submitted a bond for $10,000 for compliance with regulations, and a bond for $5,000 for protection of personal property.

Republic's plans, filed with BLM, provide for initial work to be primarily geological mapping, followed by data collection and heat-flow studies.

Under the lease arrangements, the firm has the right to contract for a power plant on the site, subject to certain permits. It must be able to prove to the Federal Power Commission, however, that there is 30-year reserve on site before a power plant permit will be considered.

Today's action is in line with the Geothermal Steam Act of 1970, which authorizes the Secretary of the Interior to make disposition of geothermal resources under such terms and conditions as he prescribes.

The lease of geothermal lands is the first in the Oregon-Washington area and among the first in the nation.

* * * * *

EARTHQUAKE HAZARD-REDUCTION PROGRAM SETS GOALS

The U.S. Geological Survey is now directing the single largest research and data-gathering effort on earthquake hazard reduction in the United States. The program is the result of outgrowth and merging the earthquake research programs of several agencies. Under one administrative guidance, the U.S.G.S. hopes to mold a more effective program. The specific goals and approaches are outlined in a recent publication, "Goals, strategy, and tasks of the earthquake hazard-reduction program," issued as U.S. Geological Survey Circular 701. Copies of the 27-page illustrated circular are available free from the U.S. Geological Survey, National Center, Reston, Virginia 22092.

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