The Ore Bin

Vol. 33, No. 8
August 1971

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

The Ore Bin

Published Monthly By

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Subscription rate $1.00 per year. Available back issues 25 cents each.

Second class postage paid
at Portland, Oregon

State of Oregon
Department of Geology
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Portland Oregon 97201

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MINING COUNCIL ADVISES WESTERN GOVERNORS

At the Western Governors' Conference, held at Jackson Lake Lodge, Wyoming, July 14, 1971, the Western Governors' Mining Advisory Council presented its view on the mining industry's involvement in the nation's environmental and economic problems. Albert C. Harding, Chairman of the Council, prepared a report which expressed the deep concern of the mineral industry leaders for these issues. The following are paraphrased excerpts from his report.

TO: THE HONORABLE WESTERN GOVERNORS

Your Council welcomes this opportunity to try to put the mining industry into rational perspective. It seems especially pertinent this year to take a comprehensive look at the industry's involvement in environmental and economic problems -- twin problems which henceforth should be inseparable.

The environment is one of the most publicized issues of the seventies. Perhaps never before has there been such widespread public involvement in a national problem. Certainly never before has the mining industry faced such a multiplicity of proposals to legislate, regulate, and even to eliminate. Unfortunately, some of the loudest voices are shouting frenetic solutions that would create more problems than they would solve. Aggravating the situation are those who cry out against all industries, all construction, all environmental changes. Although we need to stop and take a rational look at the total picture, we should not do as some industry leaders do when confronted by belligerent audiences and pledge the impossible: an undisturbed environment. We know that change is inevitable. The environment is constantly affected by tremendous earth processes over which we have no control. We know also that each of us changes the environment by simply exisiting in it, by using and polluting some part of it.

The biggest problem affecting our natural environment stems from two concurrent, continuing factors: the tremendous population growth, and man's seemingly insatiable appetite for energy. These two factors have combined over the last 25 years to increase electrical energy consumption by six times and gasoline energy sixteen times. Most of the energy is created, as is animal and human energy, by combustion, a process which always produces waste products. The resulting problems cannot be attributed directly to the mining industry. The industry acknowledges, however, an increased responsibility to avoid unnecessarily contributing to those problems.

The mining industry has factors peculiar to it. Because it is an extractive industry it is necessarily involved in creating unusable byproducts, sometimes of terrific proportions. A copper mine may recover only 8 pounds of copper from 2,000 pounds of ore, and move an equal volume of barren rock to reach ore. A gold mine, to recover a pound of gold, may treat 80,000 to 100,000 pounds of ore. Disposal of waste products is a continuing problem. However, some operations can result in actual improvement of the initial environment. In other operations some waste is put to beneficial use, or returned underground with the net effect of causing little degradation. The concern of the mining industry is, therefore, with avoiding unnecessary degradation and pollution while at the same time providing the mineral base necessary to our way of life.

A southwestern governor has called for continuing development of our mineral resources without deterioration of the environment. In a strict sense it may be that we cannot have the one without the other, but he has told mining companies in his state that the cost of removing pollutants must be part of their cost of doing business in that state. All miners now know that this and similar factors will be of increasing importance in making operating decisions. One state's new "Department of Economic Planning and Development" has already indicated that such factors will include fish and wildlife survival, urban development, and aesthetic, recreational, historic and agricultural values.

Therefore, although we are grateful to many of those people who are environmentally concerned, it seems certain that the mining industry must forever remain incompatible with those who profess concern only for a natural environment at the expense of man's economic, social, and cultural well-being. Protection of the environment cannot be absolute, but must be modified by man's need for production <u>from</u> the environment.

Our industry has not been blameless, by any means, during the years in which ecological problems have been developing. Now, however, from mining areas in every state come announcements of plans to correct and minimize damage, with special regard to water, land, and air.

Water

Problems created by acid mine waters at some eastern coal mines have tarnished the image of all mines, Such conditions are relatively rare in the west. In fact, some mine waters are harmless, while others are less harmful than permissible discharges of municipalities. Some mines even develop and provide water which otherwise would not be available.

The Bureau of Mines has reported that nationally the amount of water used by the mineral industry comprises only two percent of that used by all industries, and has noted that water used in mining is quite productive in an economic sense. In the eleven contiguous western states, average gross value of mineral production is $3,250 per acre-foot of new water used, or 100 times as much as from the acre-foot used to produce a ton of alfalfa, perhaps valued at $30. The water used by the miner is also more expensive. The average cost to Nevada's mineral industry is over $32 per acre-foot, far above the agricultural economic range of $3 to $6.

For economic reasons the miner commonly re-circulates water, a process which has beneficial side effects in terms of the environment. Nevada's Carlin gold mine, for instance, discharges no water, and the only loss is to evaporation. Where water is discharged, it is now closely monitored and, when necessary, treated to avoid ecological damage. Plans to improve water discharges will cost several million at Anaconda, and $5.6 million at Homestake.

Land

Through the Mining and Minerals Policy Act of 1970, the Congress and the President recognized that mineral deposits of economic value are relatively rare, have to be mined where they are found, and require less surface area than most other land uses. The mining industry must damage some surface lands, but such damage is not extensive. Moreover, among causes of past land degradation have been the state laws encouraging some discovery work with bulldozers, which scarred the landscape and actually wasted work so far as mineral development was concerned. Some improvement has now been effected by substituting drill holes, through recommendations of the industry.

About half of the states have now adopted land reclamation laws that require that the land be returned to its natural state after mining. Considerable Federal legislation is being proposed in this regard, some of it unnecessarily restrictive and potentially disastrous. Public Land Law Review Commission recommendations, also, will result in many proposals for modification of general mining law. Some of those proposals already have mining industry endorsement, others will not be resisted, but some will require analysis when more definitely formulated. For instance, current strict legislation has curtailed our smelting capacity, compelling some companies to ship concentrates to foreign smelters, with obvious impact on domestic employment, tax revenue, and the balance of payments.

Air

Particulate matter is an obvious type of air pollution, and all industries are trying to reduce or eliminate visual emissions. Smelter operators

The photographs on these two pages illustrate good mining and reclamation methods employed in Oregon by the aluminum industry at a test site in the Salem Hills. Above: before bauxite was mined. Below: top soil set aside and ore being removed. Opposite (above): pit filled, soil replaced, and surface contoured. Opposite (below): young fir trees being planted.

and some coal burning power plants have special technological problems involving modifications for sulphur-dioxide emissions. For years methods have been sought to convert sulphur-dioxide to elemental solid sulphur. Present capabilities convert it to sulphuric acid, a process which is only partially satisfactory because of the limited demand for that product. One state alone could produce an annual excess of almost two million tons of sulphuric acid. Safe storage of this excess would be a continuing, staggering problem.

Hopeful for the future are many innovations, such as accelerated experiments in hydrometallurgy, a wet process in lieu of smelter combustion, and in development of geothermal sources and processes for power generation. Both governmental and private agencies are involved. The Bureau of Mines, for instance, is developing a wet process for recovery of mercury, and it seems likely that a wet process will be developed for copper. However, there will be an appreciable time lag for further engineering, pilot plant construction and testing. In the meantime, smelters are investing heavily toward reducing emissions at existing operations. For example, during the past six years Phelps Dodge has contracted, completed or programmed $42 million for air pollution. Magma Copper is spending $50 million for a new type of smelter. It is reported that all industries will expend between $4 and $10 billion a year for the next five years to help solve pollution problems.

There is no doubt in the mining industry that air standards are being imposed with little regard for economic and overall social consequences. Some standards have been confirmed by the Bureau of Mines as being improper conclusions based on unsubstantial data. It should be noted that air quality analysis and assessment is a science in its infancy. There are many questions to be answered involving not just the quantity of emissions but the actual effects on ecology. To help secure some answers one western state mining association last year made a grant of more than $545,000 to establish an "Atmospheric Analysis Laboratory" at its state university.

Future Mineral Requirements

Making present problems more serious are predictions about the future. We are nationally concerned about population growth, but in the past 100 years our mineral consumption increased ten times faster than population. In approximately 30 years, when population is expected to double, energy and mineral requirements are expected to triple and quadruple. This country is far from being self-sufficient in minerals, particularly in metals, of which we supply our own needs in only one, molybdenum. Even gold, still a necessary component of reserves in international monetary structures, is in short supply. Our domestic production of gold, half of the amount needed by defense and space industries alone, equals only one-fourth of our total consumption. We currently produce about $25 billion wo rth of all primary minerals but consume $32 billion worth each year. We are told that the 1971 international currency crisis, depreciating our dollar, was due to several factors, including a 1970 national deficit of $10.7 billion in balance of payments. We know that foreign-aid programs and defense expenditures abroad, including Vietnam, contribute to the deficit in balance of payments, but $7 billion, two-thirds of the total, can be accounted for by our deficiency in minerals. The need to discover and develop additional domestic mineral deposits is becoming more and more critical. Clearly, within our proposals to improve the environment we need to expand our mineral and energy technologies and to cultivate our mineral potential for greater production.

General Economics

We are inclined to forget the fundamental economic fact that the source of all wealth still originates from the earth as basic food, fiber, or minerals. Those raw materials provide the foundation for man's subsequent ingenuity and labor, the foundation for adding additional values, the foundation for a nation's total economy. If the mining industry did not exist we would have to use our collective efforts to try to create it. Only the production of food is more important than the production of minerals, and any farmer, without the products of the mineral industry, would have difficulty supplying even the needs of his own family.

Our national income has been likened to an annual stream which flows into and through the pool of national wealth, where some of it accumulates for the benefit of future generations. It is not just this year's mineral production which contributes to our present high standard of living, but all the mineral production compounded through the years of our history. This generation's homes, highways, hospitals, and schools are available today partly because of the capital generated by the past mining camps in the Mother Lode country, the Klondike, at the Comstock, Tombstone, Goldfield, Leadville, Cripple Creek, and a thousand others, most of them less glamorous and less productive than these but contributors also to today's standard of living.

The real source of any country's annual income and accumulated wealth truly lies in its productive resources. A country's mines are among its greatest resources. It has long been acknowledged that a nation which has no mines has no other recourse but to establish a favorable balance of trade to share in the wealth of those nations which do have mineral resources. As such, the have-not nation becomes dependent on others in terms of its destiny.

The Prospector's Future

Despite all threats to and problems of the industry, we can probably predict that large, well-established mining companies will survive simply because the nation needs them. We can further predict that any unnecessary controls will cause unnecessary expenditures with increased costs, which the public will pay either through higher taxes, higher prices, or both.

It is the small operator who is most vulnerable, the man who may lack either the money or talent to cope with innumerable problems. We need to consider him for we need him, too, as we also need the present non-producer, who may have only his dreams and little capital to contribute immediately to the nation's future. The prospector still exists. He looks through more knowledgeable eyes than did most of his predecessors and often uses more sophisticated tools, but his dream is still part of the American Dream. If our environmental fears result in banishing the prospector with his dream from our western mountains and deserts something good and necessary will vanish from our way of life.

Conclusions

This Council believes that an improved environment is both necessary and possible, but we also believe that where no substantial, immediate, or irreparable hazard or damage is involved, that improvement must come in an orderly fashion, that the rule of reason must prevail so that in solving one problem we do not create others of equal or greater magnitude, that consideration must be given to preventing local economic disasters. Hopefully then we can avoid the possibility of what one newswriter has termed "a national environmental recession."

Recommendation

The Council recommends the Secretary of the Interior be requested to authorize the U.S. Bureau of Mines and other resources of his department to do an economic survey of the western mining industry, including action taken by the western mining industry to prevent air, water, and land pollution and to correct past environmental damage. This report would fall under the provisions of the National Mining and Minerals Act of 1970.

The most value would be derived from this report if it could be made available to members prior to the 1972 Annual Meeting of the Conference.

The Conference Secretariat is instructed to transmit the resolution to the Honorable Rogers C. Morton, Secretary of the Interior, to the U. S. Bureau of Mines and to the Environmental Protection Agency.

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GEOTHERMAL RESOURCES COUNCIL HOLDS FIRST MEETING

The first meeting of the newly formed Geothermal Resources Council was held in Sacramento, California, on July 16, 1971. Creation of a council to advance the orderly development of geothermal resources had been proposed last spring by Joseph W. Aidlin, Los Angeles attorney, during the Northwest Conference on Geothermal Power in Olympia, Washington. The proposal was adopted and the staff of the State of Washington Department of Natural Resources then selected a steering committee comprising representatives of the geothermal development industry, equipment suppliers, public and private electric power companies, energy suppliers, universities, research organizations, concerned governmental agencies, environmental organizations, and the general public.

At its first meeting the steering committee selected as Chairman, R. G. Bowen, Economic Geologist with the Oregon Department of Geology and Mineral Industries; as Vice Chairman, R. G. Bates, Administrative Assistant to the Washington Commissioner of Public Lands; and as Secretary, David N. Anderson, Geothermal Officer of the State of California Division of Oil and Gas. An organizational policy statement was drafted as follows:

1. Encourage research, exploration, and development throughout the geothermal energy field.
2. Encourage and promote criteria for the development of geothermal resources compatible with the natural environment.
3. Encourage sound geothermal legislation.
4. Present a fair, unbiased picture on the nature of geothermal energy and its development.
5. Encourage the collection and dissemination of basic data related to geothermal development.

To carry out the policies of the Council six committees were organized with the following chairmen: Exploration and Drilling - Bob Greider, Standard Oil Co. of California; Resource Utilization - Fred Dunn, Vice President of Rogers Engineering; Regulation - David Anderson, Geothermal Officer, California Division of Oil and Gas; Environment - W. K. Summers, Staff Advisor, New Mexico Bureau of Mines and Minerals; Economics - Henry Curtis, Northwest Public Power Association; and Education and Information - Robert G. Bates, Administrative Assistant to Washington Commissioner of Public Lands.

The next meeting of the steering committee will be held in Seattle on September 24, where it will be the task of the six committees to submit a list of members, prepare a declaration of purpose, and develop a program of activities.

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OBSIDIAN HYDRATION DATING APPLIED TO DATING OF BASALTIC VOLCANIC ACTIVITY*

By Irving Friedman** and Norman Peterson***

Recent rhyolitic volcanic eruptions have been dated (1) by the thickness of the hydration rind on obsidian associated with these events. The technique is now being applied to a study of the rhyolitic volcanism in the area of Newberry volcano, Oregon, approximately 20 miles (32 km) northeast of Bend, Oregon, and in special cases (as described below) may be used to date basaltic eruptions.

On the north shore of East Lake in the Newberry volcano area, there is a small fissure where fountaining basalt magma tore off pieces of solidified rhyolite from the fissure wall during the eruption. The rhyolite has been remelted and is very vesicular. Thin sections of the remelted rhyolite show that it has a hydration layer that allows us to date the time of the remelting. The hydration thickness in three of these samples is 3.0μm ($\pm$ 0.2μm). A hydration rate of 3.1 μm^2 per 1000 years (2) yields an age for this event of 2900 $\pm$ 400 years. Rhyolite flows within 2 miles (3.2 km) of this fissure, as determined by the obsidian hydration method, date from about the same time; thus, a variety of volcanic activity at about this time is indicated.

During a recent collecting trip to Newberry crater, Peterson (3) mentioned the occurrence of cored bombs - that is, basaltic bombs that contain centers of other rocks, including rhyolite. These cored bombs occurred in some quantity at the Diamond craters, an area of recent volcanism near the center of Harney County in southeast Oregon. The area is in T. 28-29 N, R. 32 E, about 60 miles (96 km) south of Burns. Rhyolitic glass from four of the bombs was examined for occurrence of a hydration rind, and hydration rind was found on all the samples examined (see Fig. 1). All the samples displayed rinds that ranged in thickness from 7.0 to 7.3 μm. Using the hydration rate as mentioned above (3.1 μm^2 per 1000 years) gives an age for this explosive volcanicity at Diamond craters of 17,000 $\pm$ 2,000 years.

Remelted obsidian-like material associated with basalts probably is not uncommon. The presence of such material makes it possible to date basaltic eruptions that remelt the rhyolite, provided that the eruptions occurred in the time interval from 200 to 250,000 years ago (4).

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* Reprinted from Science, vol. 172, pp. 1028, June 4, 1971. Copyright 1971 by the American Association for the Advancement of Science.

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*** Oregon Department of Geology and Mineral Industries.

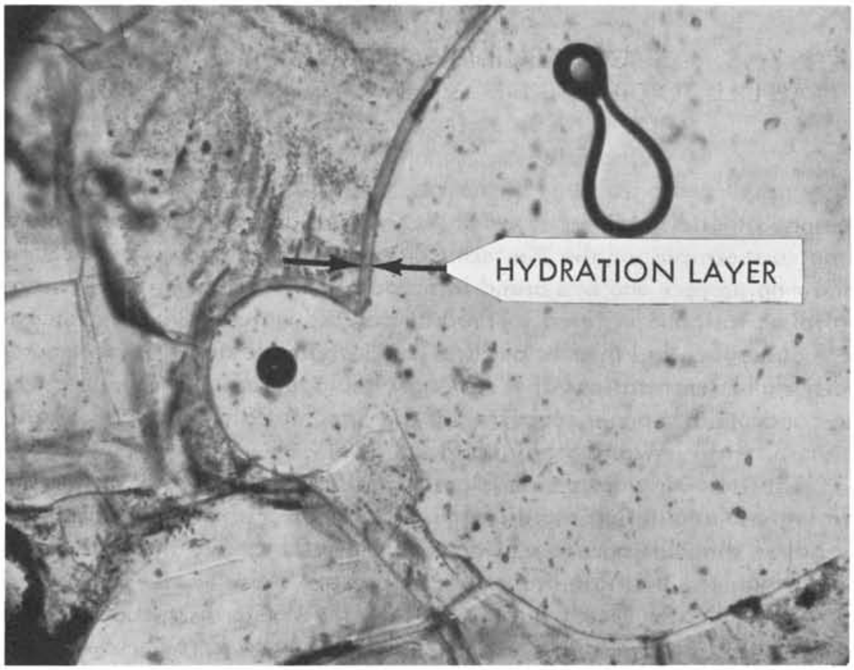

Figure 1. Photomicrograph of a thin section of cored bomb from Diamond craters, Oregon, with the hydration layer (7 μm thick) indicated.

References and Notes

1. I. Friedman, 1968, Science vol. 159, p. 878.
2. L. Johnson, Jr., 1969, Science vol. 165, p. 1354, determined a hydration rate of 3.5 μm^2 per 1000 years for archeological material found near Newberry. The rate was based on the measurement of hydration thickness on obsidian artifacts from archeological horizons dated by the ^{14}C method. Correcting for the variations in the original ^{14}C content of the atmosphere in past time (the "zero" of the ^{14}C time scale) (H. Suess and M. Rubin, personal communication) reduces the hydration rate to 3.1 μm^2 per 1000 years. For further information, see Radiocarbon Variations and Absolute Chronology, Nobel Symposium, 12th, I. U. Olsson, Ed. (Wiley, New York, 1970).
3. N. V. Peterson and E. A. Groh, 1964, Ore Bin, vol. 26, p. 29.
4. I. Friedman and R. L. Smith, 1960, Am. Antiq., vol. 25, p. 476.

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STRUCTURE OF THE OREGON CASCADES

By J. D. Beaulieu*

In a regional geologic study of the Western Cascades of northern Oregon, Peck and others (1964) presented their interpretation of the larger structures of the northern part of the Western Cascades. Their study was a reconnaissance map project and was broad in scope. It was based in part on a doctoral dissertation completed in 1960 at Harvard University by Dallas Peck.

Subsequently Wheeler and Mallory, who have questioned numerous traditional interpretations of West Coast geology, presented their alternative concepts in a paper submitted at the Second Columbia River Basalt Symposium (Cheney, Washington, 1969).

The following discussion is presented for the purpose of more clearly defining and evaluating the diametrically opposed ideas of the two parties. It is hoped that this article will generate some objective interest in this and related problems by those doing research in the area.

According to Peck and others (1964) the Western Cascades of northern and central Oregon are composed of a volcanic pile of rocks which includes in ascending order the Little Butte Volcanic Series of Oligocene to early Miocene age, the Columbia River Basalt of middle Miocene age, and the Sardine Formation of middle and late Miocene age. The Plio-Pleistocene High Cascades lavas cap the older volcanic rocks to the east. Peck and others envisage the structure of the Little Butte Volcanic Series and the Columbia River Basalt to be downwarped beneath a younger pile of volcanic rocks which they assign to the Sardine Formation.

Wheeler and Mallory (1969), on the other hand, view the Western Cascades of Oregon as an accumulation of Oligocene and early Miocene rocks (their Little Butte Volcanic Series or pre-Ochocoan basement) which has been upwarped to yield the present day topography. According to them the Columbia River Basalt originally overlay significant portions of the present day range and has been subsequently eroded to give its present distribution about the periphery. According to them also, much of the Sardine Formation of Peck and others (1964) has been misdated and should be included in the older Little Butte Volcanic Series. They do not recognize any post-Columbia River Basalt pre-High Cascades volcanism of any consequence in the northern and central Western Cascades of Oregon.

Most geologists are in agreement with the theory that the Western Cascades represent a volcanic pile as described by Peck and others (1964), and that the range is not upwarped to the extent proposed by Wheeler and Mallory (1969). Regardless of the weight of present consensus, however, the writer feels that part of the paper of Wheeler and Mallory warrants

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careful consideration, because it appears to point out some legitimate criticisms of the paper by Peck and others (1964). Moreover, it prompts more refined inquiry into certain aspects of the Cascades which may, in turn, lead to a better understanding of the range.

Geologic conclusions are only as valid as the map from which they are derived. With this axiom in mind the reader must look at both the views of Peck and others and the views of Wheeler and Mallory with some skepticism. The map by Peck and others was compiled in rapid reconnaissance style with much mapping being done from the highway and with actual field contact being limited to grab sampling along the roadside in numerous cases. Moreover, previous maps dating back 30 years or more were relied upon heavily in some areas.

Wheeler and Mallory (1969) present no detailed geologic map, but choose rather to refer primarily to the map of Peck and others in presenting their case. Although this method is useful in pointing out particular areas of conflict, it has a shortcoming in that the consistency or inconsistency of their conclusions cannot be tested in a regional sense on a map of their making.

The above discussion is not intended to be overly critical. It is understood that both parties operated within tight schedules and that both did what could be done in the time available. It is emphasized, however, that the mapping aspects of both studies are not ideal and that the conclusions drawn from them should be evaluated accordingly.

Much of the criticism that Wheeler and Mallory (1969) level at Peck and others (1964) can be traced ultimately to the differing concepts the two parties have employed in identifying the various formations in the field. Much of what is identified as Sardine Formation by Peck and others is labeled Columbia River Basalt by Wheeler and Mallory. For example, on the west wall of Fish Creek Valley (Sec. 26, T. 5 S., R. 5 E.,) in Clackamas County, Wheeler and Mallory report Columbia River Basalt overlying rocks which they assign to the Little Butte Volcanics. At the same locality Peck and others (1964) assign all the rocks to the Sardine Formation. Immediately to the north Wheeler and Mallory assign the Sardine Formation of Peck and others to the Columbia River Basalt. The fact that the unit dips northerly and north-westerly away from the Cascade Range suggests to them that the Columbia River Basalt has been upwarped and eroded from the Cascade Range in that area.

Immediately south of the Columbia River Gorge in the Eagle Creek drainage between Sandy River and Portland, beds mapped as Plio-Pleistocene tuffs by most authors are mapped as Little Butte Volcanics by Wheeler and Mallory. From this designation the interpretation that the Columbia River Basalts rise structurally above the Cascades in this area immediately follows.

More examples of contradictory formational assignments by the two sets of authors are present farther to the south in the vicinity of Oakridge southeast of Eugene. Near Lookout Point Reservoir (Sec. 21, T. 20 S., R. 7 E.)

Wheeler and Mallory assign to the Columbia River Basalt outcrops exhibiting a distinctive flow on flow structure. Peck and others (1964) assign the exposures to the Little Butte Volcanic Series.

With regard to the dating of the Sardine Formation by Peck and others Wheeler and Mallory bring out some interesting points. The most notable fact is that several of the floras of reported late Miocene age in the unit are very similar to the Oligocene and early Miocene floras of the Little Butte Volcanic Series reported elsewhere in the text. They conclude that a middle to late Miocene age cannot be applied to the Sardine Formation solely on the basis of floral content and, hence, that much of the argument in favor of erecting the Sardine Formation in the center of the range is invalid. Wheeler and Mallory assign the involved rocks to the Little Butte Volcanic series on the basis of lithology.

Both sets of authors support their structural interpretations with field evidence. The conflict arises because they apply different formational names to the same outcrops. It follows that much of the controversy could be eliminated by more accurate mapping and sampling in the critical areas. Trace element studies might also prove informative. Until such studies are conducted, however, the weight of the evidence seems to lie with Peck and others (1964), for they at least present petrographic data in support of their formation assignments. A check of their sampling localities, however, shows that no samples are reported from the critical localities mentioned above.

Strictly speaking, the Cascade Range may represent neither a "downwarped pile of volcanic rocks" (Peck and others, 1964) nor an upwarped Oligocene-early Miocene basement (Wheeler and Mallory, 1969), but rather a combination of the two. In the center of the range, for example, similarity of deformation and propylitization of both the Little Butte Volcanic Series and the Sardine Formation suggest that part of the Sardine Formation may, in fact, be Little Butte in age. Such an interpretation is in accord with the evidence presented by Wheeler and Mallory.

On the other hand there is little evidence to support the interpretation of Wheeler and Mallory that the present structure and topography of the Western Cascades is due primarily to post-Little Butte upwarping. That is, the Little Butte Volcanic Series may have had a positive topographic expression in the middle Miocene as well as the present. It follows that although flows assigned to the middle Miocene Columbia River Basalt may have been deposited about much of the periphery of the Range, they may never have occupied the interior as proposed by Wheeler and Mallory.

To summarize, the Cascade Range of Oregon is subject to two structural interpretations. When bias is set aside for the moment it is seen that evidence in support of either theory is not ideal, but that both theories have some strong points. It is concluded that more accurate mapping and more critical sampling will be needed, first, to resolve the conflict introduced by Wheeler and Mallory on a scientific rather than a rhetorical basis, and, second, to define more accurately the complex geologic relationships of the Cascade Range. It is further concluded that the use of a broad term such as Sardine Formation is perhaps ill-advised in that it obscures rather than clarifies many critical relationships.

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MINERALIZED AREA IN DOUGLAS COUNTY IN MAPPING PROGRAM

Dr. M. Allan Kays, Associate Professor of Geology at the University of Oregon, has resumed geologic mapping of the May Creek schist belt near Tiller. In two previous field seasons Dr. Kays has completed detailed geologic mapping of an area extending north of Cow Creek in the Days Creek and Tiller quadrangles. Len Ramp, Resident Geologist of the Department of Geology and Mineral Industries' Grants Pass field office, will be working with Dr. Kays to extend the map area into the Evans Creek drainage.

The project is aimed at relating the widely scattered metallic mineralization in this region to the complex structure and geology.

The region is underlain by Triassic and Jurassic schists and gneisses, which are intruded and folded with a sequence of ultramafic-mafic rocks. Field studies will determine the distribution and character of the metamorphic facies. Metamorphism is apparently synchronous with intrusions of Late Jurassic quartz diorite plutons.

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DEPARTMENT OFFERS NEW SERVICE IN TOPOGRAPHIC MAPS

For the first time the Department is selling U.S. Geological Survey topographic quadrangle maps of Oregon. The $7\frac{1}{2}$' and 15' maps are $.50 at the counter and $.75 mailed. AMS 1:250,000 series maps are $.75 at the counter and $1.00 by mail.

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DEPARTMENT CONDUCTS STUDY OF CLATSOP AND TILLAMOOK COUNTIES

The winter storms of 1970-71 inflicted heavy damage on the coastal areas of northwestern Oregon in terms of flooding and landsliding. Shortly thereafter parts of Tillamook and Clatsop Counties were designated as disaster areas by the Federal government and funds were appropriated to help finance a study of the geologic hazards of the area. The State of Oregon Department of Geology and Mineral Industries contracted to conduct the study and on June 1 began an extensive investigation of ground stability and potential flooding. The total cost of the project is $80,000, of which the Federal government is financing 50 per cent, the State Department of Geology 30 per cent, and the counties 20 per cent.

One year will be needed to complete the project. Presently a geologic map is being prepared to serve as a base for more detailed studies to follow. Mapping will cover a coastal strip ten miles wide in the two counties. Well data, discharge data, and other pertinent information regarding ground and surface water is also being assembled. Results of the study will be used as a guide to future development of the area. The study is of particular significance in view of the anticipated high rate of growth.

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TEXACO TO DRILL IN CENTRAL OREGON

The Department issued State Permit No. 63 to Texaco, Inc. on August 2, 1971, for a 10,000-foot oil and gas test hole. The location filed was in the SW$\frac{1}{4}$ sec. 31, T. 17 S., R.23 E., Crook County, along the South Fork of the Crooked River approximately 40 miles southeast of Prineville. The firm has leased holdings in the area of 250,000 acres.

Geologic mapping by D. A. Swanson, 1969 (U.S. Geological Survey Map I-568) shows that the test site is on the crest of a northeast-trending anticline, with the Clarno Formation exposed at the surface. Texaco will have to drill through an estimated 4,000 feet of Clarno volcanics before reaching pre-Tertiary marine rocks. Company representatives indicated that operations would begin in Crook County by the end of August.

The last deep drilling in Crook County was done in 1958 by Sunray Mid-Continent Oil Co. near Post, 23 miles west of the new Texaco location. In 1955, Standard of California drilled a 7600-foot hole at Hampton Butte, 17 miles southwest of the new location. No production was obtained in either hole.

Records and cores from oil and gas drillings are required by law to be filed with the Department of Geology. These are kept confidential for two years and are then available to other interested persons.

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AVAILABLE PUBLICATIONS

(Please include remittance with order. Postage free. All sales are final and no material is returnable. Upon request, a complete list of the Department's publications, including those no longer in print, will be mailed.)

BULLETINS

8.	Feasibility of steel plant in lower Columbia River area, rev. 1940: Miller	0.40
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