

The Ore Bin



Vol. 35, No. 2
February 1973

**STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES**

The Ore Bin

Published Monthly By

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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Baker 97814	Grants Pass 97526

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Available back issues \$.25 each

Second class postage paid
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THE MINERAL INDUSTRY AND THE ENVIRONMENT

John D. Beaulieu, Stratigrapher
Oregon Dept. of Geology and Mineral Industries

"Americans want electricity without nuclear plants; they want low cost and low sulphur fuel, but they don't want ships, pipelines, oil imports or off-shore exploration and rigs. They want more coal, but they don't want strip mining." They are, in a sense, "spoiled rotten." This is the opinion of C. Howard Hardesty, vice president of Continental Oil Company (quoted in article by John Chamberlain, Oregon Journal, Nov. 22, 1972).

Are we really "spoiled"? Do we want the material comforts without the labor, equipment, and possible pollution required? Since it is no longer questioned that the environment is worthy of our concern, what policies and programs are most viable in terms of 20th century American life?

What about the environment?

Only recently have we begun to realize the delicate balances among all parts of the natural machinery around us. In addition to being necessary to our survival, environmental preservation is fitting from a purely esthetic standpoint as well. How then do we equate our need for production with our need to preserve the environment?

The answers to this question are, of course, far more complex than can be handled here. Nevertheless, a few observations are pertinent. First, we need knowledge. We need to know more about nature, about ourselves, about the mechanics of our society. In addition, this knowledge must be quantified so that it can be dealt with in a precise fashion. We must know, for instance, the precise environmental cost of a certain operation, but we must also be able to balance this in precise terms against the benefits of the operation to society. Some basic needs can only be supplied with a certain definite amount of change in the physical environment.

Second, we need the kind of common sense that reminds us that nature pollutes, too. The eruptions of Krakatoa (1883), Mount Katmai (1912), and Hekla (1947) blew more particulates into the atmosphere than has all man's activities before or since. We must realize that nature, as well as man, degrades the environment.

We need critical thought rather than catchy phrases and indignation. We need the kind of critical thought that examines individual issues on an individual basis. We need to realize, for instance, that although DDT may be overused in this country, in India alone it is saving more than 750,000 lives a year by reducing malaria, and thanks largely to it the Green Revolution was made possible.

If we are to clean up the environment we need responsible action. We need the money, labor, and equipment that only a thriving economy can provide. We need these things to recycle the metal, to dredge the sludge, and to overcome the pollution that we are creating. We need balanced legislation to deal with specific polluters in a realistic way which does not overly threaten the economy. We may even need to redirect our mode of life. If we find, for instance, that in terms of environmental costs many of our conveniences are really luxuries beyond the cost we wish to pay, appropriate taxations and price structures may be called for.

Is technology to blame for our pollution?

Where there is production of goods there very commonly is pollution. It is around our factories, cities, mines, and smelters that the landscape is often scarred and the streams commonly run foul. It is along our crowded freeways that the air pollution creeps beyond acceptable levels. The list of contributors to pollution could be extended almost endlessly. Not surprisingly, then, technology is sometimes viewed as the culprit behind the environmental dilemma in which we find ourselves.

In pursuing the idea that we cannot survive without a clean environment, however, it would also be wise to remember that we cannot survive in our present numbers without technology. We sometimes forget that we are ill-equipped to deal with nature except with our heads; that we do, in fact, rely on technology for our very survival. How long would 3 billion people survive without the technology needed to produce their food, to fabricate their shelters, and to manufacture the equipment needed for everything from medicine to large-scale transportation?

Our society is basically a highly complex and sophisticated mechanism which enables far larger numbers of people to survive than would otherwise be possible. Therefore, while we recognize the shortcomings of technology we should also give due consideration to its benefits.

The way out of our environmental dilemmas is, of course, far more complex than can be handled here. We would, however, like to explore the problems and the benefits of one segment of our technological society, a segment often accused of polluting but seldom recognized as one of the most basic industries needed in our technological economy - the mining industry.

Do we really need mined materials?

Currently there is animosity toward the mining industry for digging holes and in other ways fouling the environment. Some of this attitude may be deserved. Careless strip mining operations, for example, left scars on both the land and the people that will be a long time healing. For one concerned with the environment a sensible starting point in assessing the situation is to ask if we need mines. The extremist does us all a disservice, however, when he assumes the answer is "No."

Part of the extremist's approach is rooted in the fact that few people are readily able to relate their everyday living to mining. Actually, our way of life is founded on the use of a variety of mined materials. The following list, taken from Virginia Minerals, v. 18, no. 4, November, 1972, well illustrates that mining is fundamentally essential to our economy:

<u>Metal or Mineral</u>	<u>Common Uses</u>
Aluminum	Beverage and food cans; lawn chairs; building roofs and siding; electric appliances; air conditioners; canoes, ships, automobiles, trucks, airplanes and other transportation equipment; cooking utensils; aluminum foil for packaging and kitchen use; high-voltage power transmission lines
Asbestos	Construction cements, floor tile, paper products, brake linings, and clutches for all transportation equipment, textiles, paints, power lines, electric roofing and siding for buildings
Barite	Mud for drilling oil wells and in glass, paints, rubber and paper
Copper	All electric appliances, telephones, radios, TV sets, automobile radiators and electric systems, motors for all purposes, ornamental items made of brass and bronze, plumbing pipes, pennies, and roofing
Feldspar	Glassware, pottery, enamel and scouring powders
Fluorspar	Refrigerants for refrigerators and air conditioning equipment, steel making, refining of aluminum, manufacturing of nuclear fuels, propellants for spray paints, cosmetics and insecticides

Gypsum	Plaster, plaster board, cement, binders for orthopedic and dental casts, fertilizer, and in crayons
Iron Ore (steel)	Electric household appliances, automobiles, beverage and food cans and other containers, tools, farm and factory machinery, transportation equipment of all types; buildings
Lead	Storage batteries, gasoline additives, red lead for coating construction steel, lead foil for toothpaste tubes, solder for cans and containers, type metal for printing, radiation shielding, and sound proofing for rooms and machinery
Mercury	Electrical batteries, lamps, switches, paints, plastics, medicines, dental tooth fillings, and in the manufacture of chlorine for chemical plants
Molybdenum	Automobiles, airplanes, machine tools, pipes and tubing, catalysts to make pigments and refine petroleum in automobile greases and oils, fertilizers, welding rods, in electrical and electronic equipment, and in stainless steels
Nickel	Automobiles, airplanes, transportation equipment, household appliances, electrical machinery, ships and boats, coinage, and numerous ornamental and utilitarian alloys
Phosphate rock	Fertilizers, soap and detergents, plating and polishing, feed for animals and fowl
Platinum	Industrial chemicals, petroleum refining, glassware, telephones, dental equipment, and jewelry
Potash	Fertilizers, soap and detergents, plating and polishing soap, glass and chemicals.
Salt (sodium chloride)	De-icing agents for roads and streets; food preparation and home cooking; a source of chlorine used to make paper, plastics,

Salt (cont'd)	solvent fluids for automobiles; sprays to kill pests; and sanitation purposes
Silver	Photographic films and print paper, silverware, jewelry, industrial refrigerators, coinage, batteries, electric switches, all electronic equipment such as radios, TVs, etc.; solder in aircraft
Sulfur	Fertilizers, pigments for paints and plastics, rayon, explosives, manufacture of steel, petroleum refining, alcohols, pulp and paper, refining of many metals
Tin	Tin-coated cans, solder, pewter ware, in bronze and brass, in electrical equipment and supplies, in pigments for paints and plastics and in dry-cell batteries
Titanium and Titanium Oxide	Brilliant white pigments in paints, paper, and plastics; floor tile; printing ink; fiberglass; ceramics; and metal in jet plane turbines and structures
Zinc	Galvanized roofs, siding, fences, auto bodies; zinc die castings for carburetors, automobile grills and trim, home appliances, door handles; zinc oxide for auto tires and paints; rolled zinc in dry-cell batteries; and brass and bronze ornamental and utilitarian objects

We might add sand and gravel to this list since it is a principal mineral commodity in many states including Oregon. Some of its uses are listed in The ORE BIN, November 1972, p. 196.

As long as the American people directly or indirectly demand the products in the right hand column in the above list, we will need to mine the minerals on the left. One might ask the extremist which of the products on the right he is in all honesty willing to do without.

Must we mine in such great quantities?

Well-meaning people often suggest that perhaps we consume too much. It follows that if we reduce our consumption we can correspondingly reduce mining, industry, and pollution. Many people are trying to consume less and are actually living up to this ideal. Admirable though this may be, however, it does not represent national trends.

With their actions, the American people daily reaffirm their commitment to a high standard of living on the private, corporate, and public level. As long as consumption continues to climb, mine production must also climb. Per capita consumption continues to escalate as the following table shows:

PER PERSON USE OF RESOURCES IN THE UNITED STATES*
(in tons)

<u>Resource</u>	<u>1950</u>	<u>1969</u>
Fuel	7.2	7.5
Building materials . . .	5.4	5.8
Agricultural supplies . .	2.1	2.3
Metallic ores	2.55	2.65
Food	<u>0.75</u>	<u>0.75</u>

18.00 19.00

* Clapp, 1972

Why more mines? Can't we rely solely on the mines now in operation?

"America is the land of plenty." Surely here we can pick and choose between those mineral deposits we develop and those we leave untouched. This is a prevalent attitude in the minds of many, but unfortunately it is not supported by the facts. Leith (1972) presents a chart showing the small size of known mineral reserves both in the United States and the world at current minable grades and rates of consumption (Figure 1). He also describes in realistic terms this country's posture in terms of mineral wealth:

"The flush of discovery in the United States is passed. . . . Reserves can be approximately measured. Discovery has not stopped, but the rate has been slowing down for a considerable time. Of 33 metal-mining districts that have yielded the greatest wealth to date, only five have been discovered since 1900 and none at all since 1907. The coal and iron fields are pretty thoroughly mapped. The chance of finding another Mesabi Range or another Pittsburgh coal field is small indeed. The rate of discovery of oil and gas still continues high, but the geological limitations are pretty well understood, and the chances of finding another East Texas or Kettleman Hills are not promising.

"Finally, the United States leads the world in the speed with which it is exploiting and exhausting its resources. For the metals and fuels, despite a magnificent endowment, depletion is further advanced than even mining men generally realize. In gold, the peak of American production was passed

in 1915, and despite the enormous stimulus of falling commodity prices and devaluation of the dollar, production today is still far below the pre-war level. In silver, also, we seem to have passed the peak. The copper mines of Michigan have gone a mile below the surface, by far the deepest copper mines in all the world, and at those depths, despite the ablest of engineering, they are quite unable to compete with many low-cost districts here and abroad. Mining at Butte has reached deep levels and has long since passed its peak. The great tri-state zinc district of Missouri, Oklahoma and Kansas is no longer expanding, and no notable geographic extensions are in sight. In the oil industry the glut produced by east Texas makes us forget the hundreds of dead or dying pools in other areas. The Southwest gas production hides the decline of many eastern districts and the death of the Indiana gas belt. Even in coal, one of the most abundant of our resources, it is estimated that the anthracite fields of Pennsylvania are 29 percent exhausted. While the total supply of bituminous coal is huge, the exhaustion of the best of the bituminous beds is well advanced. About half of the known high grade iron ore of the Lake Superior region has been produced."

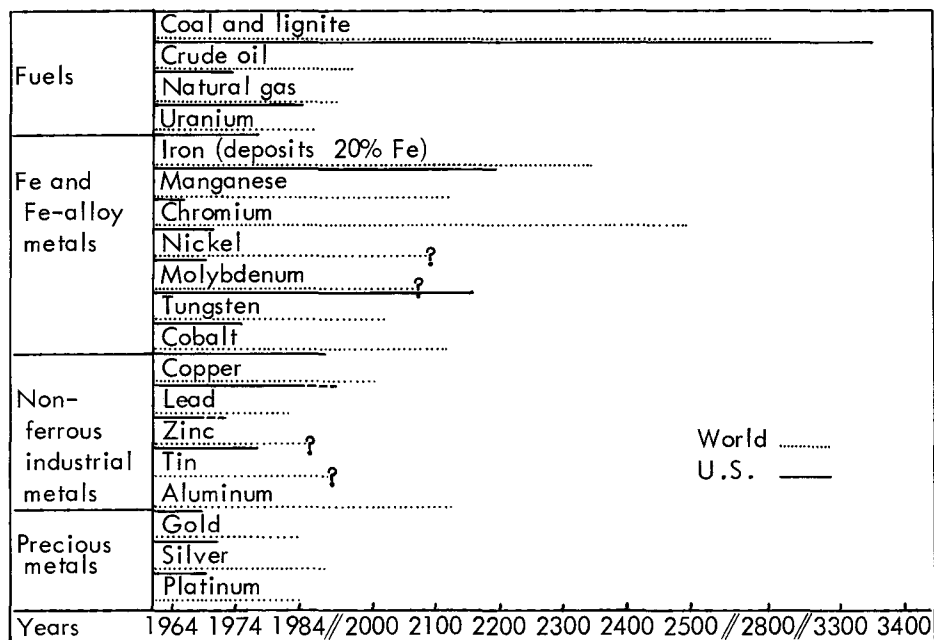


Figure 1. Lifetimes of estimated recoverable reserves of mineral resources at current minable grades and rates of consumption.

Summing up the situation, Mr. Johnson of the U.S. Department of the Interior stated that our mineral production, once the envy of the world,

"has deteriorated over the past 20 years at an accelerating pace, and we have reached an alarming point of dependency on uncertain foreign sources for a substantial part of our mineral needs. As far as mineral needs are concerned, we have permitted ourselves to become a 'have-not' nation. . . . This has not come about because we lack resources. . . . We have, in fact, effectuated national policies that have discouraged development of mineral resources. So, whatever has been done to us, we have done it to ourselves."*

Can we get the needed minerals from other countries?

Since the beginning of civilization man has engaged in trade - the exchange of surplus goods on the one hand for those that are lacking on the other. At present, daily trade provides us with a partial answer to mineral needs, including oil. It is easy to think increased trade in the future will continue to supply our increasing demand. However, in trading its natural resources a nation trades a piece of its national security, a share of its monetary stability, and a say in its national destiny. The balance of trade is threatened by excessive United States imports, and the price is paid in terms of added inflation. Although free exchange of materials between nations is good, we cannot begin to supply all our natural resource needs through trade. The quantities are too great and the price in terms of national independence is too high.

In ethical terms, there is a more basic issue involved as well. A way of life which demands both high mineral consumption and a well-scrubbed environment but which, in effect, denies this to a trading foreign country is inconsistent. Other nations are already reacting to our shortsighted views. According to Leider (1962),

"The evident hypocrisy of subjecting other nations to the depredations of bulldozers, power shovels, and chain saws, so as to spare one's own land from the machines, causes intense animosity and resentment. Few factors provide more fuel to Canadian nationalism than the vision of a future as a raw material reservoir for the U.S. consumer appetite. Public attitudes are hardening on the sale of oil, natural gas, and minerals to the United States. Bringing American investments to a halt and talk of expropriation have become popular political issues. To escape, Canada may turn in new directions to join different partners."

* David A. Loehwing, To have or have not, Barron's, September 25, 1972, p. 7-8.

We cannot ask other countries and other peoples to bear the burden of supplying our way of life. Moreover, by taking the resources of underdeveloped countries now, we are forever removing a portion of whatever future betterment their land may hold for them. If human environment is a legitimate concern, then human squalor surely must also be. In honesty we cannot consciously trade one for the other anywhere else in the world to supply our particular wants.

If we need new mines, can't we locate them out of sight?

Mining is thought of as dirty business. It often involves heavy equipment, noise, and large-scale earth movement. Although it would be desirable to keep it out of sight, economic geology tells us this is an unrealistic expectation. Cloud (1972) points out,

"Economics and technology play equally important parts with geology itself in determining what deposits and grades it is practicable to exploit. Neither economics, nor technology, nor geology can make an ore deposit where the desired substance is absent or exists in insufficient quantity."

Any ore, like gold, is where you are lucky enough to find it. This is one basic fact we cannot ignore. Criticizing the location of gravel pits and metal mines in sight of freeways as we speed by in our automobiles is not a rational mode of behavior.

Is our mineral posture equally as grim as our environmental situation?

With the realization that there are no panaceas for the problems arising from our material consumption, we as a nation must objectively look to the future in anticipation of what it holds for us. Where do we get the needed minerals? What do we do about the environment? Must we pit one against the other?

From the preceding graph of the known national and world mineral reserves, page 27, total depletion of our mineral wealth may lie only a short distance ahead. A critical factor must not be overlooked, however. The estimated reserves are based on deposits of current minable grades. Man's capacity to make lower-grade deposits profitable is a key with which we can extend our known reserves almost indefinitely.

Eugene Holman, President of Standard Oil Company of New Jersey, approaches the concept thus:

"Archaeologists have shown us that prehistoric men used axes, drills, and other implements made of flint and other hard stone. With these tools they were able to create simple societies,

which, in turn, made possible the accumulation of knowledge about the natural world.

"The Stone Age developed both the instruments and the knowledge which enabled men to use certain of the softer metals, especially copper and tin. Humanity then stepped up to the Copper and Bronze Age. Now man had more tools and more serviceable ones. He could fell trees faster and thus have more buildings for shelter and more vehicles for transport. He could move more widely than before over the earth.

"As the men equipped with bronze tools learned more and more about the world, humanity stepped up again--this time to an age of Iron. Now man began fashioning a really formidable array of tools. He had new power to cut, grind, hammer, and otherwise work materials. He could handle masses of material with stronger levers, wedges, pulleys, gears, hooks, eyes and pincers.

"In modern times the age of Iron has given way to the Steel Age. And within our own lifetimes there has been superimposed on the Steel Age what we may call the age of lightweight metals, plastics and atomic fission."

Holman emphasizes that our progress has been geometric, with each successive stage opening broader horizons for us, that each stage has been dependent on the one before it, and that man's ingenuity has been instrumental in his profitable use of the resources around him.

Increasing knowledge has allowed us to discover new sources of raw materials, to extract resources from lower and lower tenor ores, to develop more efficient methods of use and to develop more uses for previously unused materials. It has been through the use of our resources, rather than non-use, that we have acquired the knowledge so essential to our sophisticated development. The oil industry provides us with an informative example of how this process operates in the present day.

"By producing and using oil we have built a dynamic oil industry and have accumulated the means, both financial and technical, to find more oil. We have developed methods for locating and mapping structures with greater speed and accuracy. We can select where to drill a structure with better odds of success. We can reach deeper strata. As a result, in the United States alone, there has been produced since 1938 as much oil as was known to exist in the country at that time. And despite that great withdrawal, the domestic industry's proved reserves are at an all-time high level. It's as though we started out with a tank of oil, used it all up, and had a bigger tankful left.

"...The idea of a storehouse--or at least, a single-room storehouse--does not correspond with reality. Instead, the fact seems to be that the first storehouse in which man found himself was only one of a series. As he used up what was piled in that first room, he found he could fashion a key to open a door into a much larger room. And as he used the contents of this larger room, he discovered there was another room beyond, larger still." (Holman 1972)

The march of progress from storehouse to storehouse has depended in large part on scientific knowledge and furthered by industrial aggressiveness; both, in turn, have been aided by favorable political and social conditions. Unrealistic repressive conditions in the social and political realm could ultimately halt our forward progress in mineral production.

Mining is directly responsible for a very small percentage of this nation's pollution. Yet it provides us with all the natural resources upon which our society, our survival mechanism, depends. It makes little sense then to translate one's concern for the environment into a "shut 'em down" approach toward the mining industry.

We simply must go forward. The storehouses behind us are empty. Our mineral posture is as grim or as promising, therefore, as we choose to make it. Now, in the 20th century with 3 billion lives at stake and accumulated ingenuity beyond early man's wildest dreams, we can ill afford to turn our backs on that simple lesson, nor do we need to.

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JACKSON INTRODUCES SURFACE MINING BILL

Sen. Henry M. Jackson has introduced a surface mining reclamation bill (S. 425) to "counteract the environmental abuses of surface mining, while recognizing the critical dependence of the nation on its products."

The bill would place primary responsibility for regulation with the states, subject to federal review and preemption; a \$100 million fund to reclaim abandoned strip mine lands would be established; requirements of the legislation would be applied to all commercial surface mining operations, public corporations and utilities, and federal and Indian lands.

The five major goals of the Jackson bill are (1) prohibition of strip mining when full reclamation is impossible; (2) national standards to reduce inequities among states and to protect the national interest if a state fails to act; (3) imposition of social and environmental costs such as erosion, slope failures, and water pollution on the mining companies; (4) return of all areas to a condition capable of supporting at least pre-mining uses, and (5) administrative procedures which are fair and flexible enough to cope with unique conditions in various regions of the country.

The bill also requires: administration by a new Interior Department office without mineral development or promotion duties; Federal coal regulations within 90 days and all others within one year; a moratorium on all new strip mines pending issuance of states' permits; an acceptable applicant reclamation plan and bond adequate to pay reclamation costs; bond money returned on fulfillment of reclamation plan; individuals and companies hurt by the new regulations get first chance at strip mine reclamation contracts; Federal grants for state land-use planning involving designation of parks,

streams, and other public areas as unsuitable for strip mining; and special Presidential exemption for national emergencies.

Jackson said slope limitations included in the House strip mine bill, passed last fall, would effectively ban most coal surface mining. "In the rush to pass the legislation before adjournment the House members, in my judgment, did not strike a proper balance between our energy and environmental needs. Strong actions are imperative to protect us from the specter of a ravaged land. Yet, we must also produce the energy needed for our homes, farms, and factories," he said.

A Council on Environmental Quality study of the effects of the House ban has been requested by Jackson. Preliminary findings will be presented during hearings on the Senate bill to be held in late February and early March. As introduced, the Senate bill requires mine operators to meet tough reclamation goals and performance standards but does not impose an arbitrary slope limitation.

Representatives of mining companies, conservation organizations, individual mine operators, reclamation experts, mine workers, local citizens, and consumers will testify during the Interior Committee hearings.

American Mining Congress News Bulletin

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OREGON'S MILLION-DOLLAR-A-YEAR CLUB, 1971

<u>County</u>	<u>Mineral production</u>	<u>County</u>	<u>Mineral production</u>
Baker	\$ 8,249,000	Lincoln	1,033,000
Clackamas	12,495,000	Malheur	1,360,000
Douglas	10,294,000	Marion	1,120,000
Grant	1,011,000	Multnomah	7,940,000
Jackson	1,700,000	Umatilla	2,008,000
Josephine	2,076,000	Union	1,676,000
Klamath	2,228,000	Washington	2,131,000
Lane	5,288,000		

In addition to the values shown, there was a total of \$11,746,000 which could not be assigned to specific counties. Furthermore, production figures for Clatsop, Columbia, Curry, Gilliam, Harney, Hood River, Jefferson, Morrow, and Wasco Counties were concealed by the U.S. Bureau of Mines to avoid disclosing individual company confidential data.

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PRIVATE GOLD POSSESSION BAN MAY BE LIFTED

The law which prohibits private possession of gold by American citizens should be repealed after international monetary reforms become effective. That is the recommendation made by the Joint Economic Committee's subcommittee on international exchange and payments.

The prohibition against the private possession of gold for any but ornamental or industrial purposes has existed since 1933, when the United States partially abandoned gold as the sole backing for its currency.

"As soon as the international monetary reform that is currently being negotiated is achieved, all prohibitions on the purchase, sale and holding of gold by American citizens should be promptly abolished," the subcommittee recommended.

Such a move, it said, would be a step "toward removing the mystique from gold and making it a commodity that is traded in the same manner as other metals."

The subcommittee called for reforms which would enhance the role of special drawing rights (SDR) in international monetary affairs and downgrade the role of gold.

Special drawing rights, commonly known as "paper gold," are an artificial reserve asset created in 1968 by the International Monetary Fund (IMF) and distributed to its members in proportion to their economic importance in the world economy. SDR's are used in the same fashion as gold, dollars or other currencies to settle debts between nations.

Under reforms now under discussion, the subcommittee said, "SDR's should be acceptable in lieu of gold in all transactions between the IMF and its member countries."

The subcommittee called for continuing existing agreements under which the world's central banks are prohibited from purchasing gold in the free market or directly from South Africa.

But it said the current agreement committing the IMF to purchase gold from South Africa under specified conditions should be terminated when it expires in two years.

When reforms make SDR's the chief international reserve asset, the subcommittee said, gold will become just another metal with its value determined by the economics of mining and refining and the demand for artistic and industrial uses.

GOLD IN DECEMBER

The average price for gold, as reported by E&MJ, for December 1972 was \$63.909 for London bullion buyers and \$64.311 for the Engelhard selling price. The London price is based on a 1000 fine troy ounce, the Engelhard on 99.95 percent pure gold in 400 ounce bars.

HELP FOR GOLD HUNTERS

According to a U.S. Geological Survey geologist, "a sort of old-fashioned gold fever seems to strike many people in the late spring and summer; requests for maps and reports that describe the known deposits of gold in the country -- particularly in the west -- mount rapidly." To help answer the many inquiries, the Survey has prepared three companion-piece nontechnical leaflets entitled: 1) GOLD, 2) PROSPECTING FOR GOLD, and 3) SUGGESTIONS FOR PROSPECTORS. Single copies of each of these three leaflets may be obtained upon request from the Information Office, U. S. Geological Survey, Washington, D.C. 20242.

The Oregon Department of Geology and Mineral Industries has published information on gold in Oregon: history, mines, production figures, deposits, and prospecting and panning methods. Obtainable from its three offices in Portland, Baker, and Grants Pass are the following: "Gold and Silver in Oregon," a 337-page, illustrated, bulletin which sells for \$5.00; "Lode mines in the central part of the Granite mining district, Grant County" (\$1.00); "The Almeda mine, Josephine County," (\$2.00); "Oregon's gold placers," (25 cents); Oregon mineral deposits map and key (45 cents).

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WASHINGTON DIVISION OF MINES ISSUES NEWSLETTER

The Washington State Division of Mines and Geology has joined the club of state geologic surveys that issues a periodical. "Washington Geologic Newsletter," the name of the Division's new endeavor, is a quarterly publication and the realization of a long-time hope. As stated in the opening paragraph:

For years the Division of Mines and Geology has considered the possibility of publishing a quarterly news report on geologic happenings in the state. Now, after much thought, the quarterly newsletter has become a reality. Through it, we hope to keep the people of Washington abreast of events that are of geologic significance in our state.

Volume 1, no. 1, January 1973, is an 8½ by 11 pamphlet of seven pages containing short articles on history and goals of the Division, news on environmental geology, land reclamation, metal production, geologic studies in the Olympic Peninsula, and a report from the State Geologist, Vaughn E. Livingston, Jr. Included is a map showing the new location of the Division's offices east of the State Capitol in Olympia. Persons interested in subscribing to the Newsletter are invited to write to the Department of Natural Resources, Division of Mines and Geology, Olympia, Washington 98504.

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GEOLOGICAL SOCIETY OF AMERICA TO MEET IN PORTLAND

The Cordilleran Section of The Geological Society of America will meet March 22, 23, and 24, 1973, at Portland State University in Portland. Hosts for the meeting will be the Department of Earth Sciences, Portland State University, and the Oregon Department of Geology and Mineral Industries. Meeting jointly with the Cordilleran Section will be the Pacific Coast Section of the Paleontological Society.

The meetings will be held in Cramer Hall, Portland State University. There will be a registration fee for those who attend the scientific sessions and additional fees for the individual field trips.

Scheduled for the program are 250 papers in 20 categories as follows:

Pre-Tertiary Evolution of the Pacific Northwest,

17 papers, all day Wednesday

Biostratigraphy, 8 papers Thursday a.m., 7 papers Friday a.m.

Economic and Engineering Geology, 10 papers Thursday a.m.

Geomorphology, 8 papers Thursday a.m.

Mineralogy and Petrology, 10 papers Thursday a.m.; 10 papers

Friday a.m.; 11 papers Friday p.m.

Structure and Tectonics, 9 papers Thursday a.m.; 9 papers

Friday a.m.; 8 papers Friday p.m.; 7 papers Saturday a.m.

Marine Geology, 7 papers Thursday p.m.

Paleontology, 5 papers Thursday p.m.; 8 papers Friday p.m.

Sedimentary Petrology, 6 papers Thursday p.m.

Ignimbrites and Volcanoclastics, 11 papers Friday a.m.

Urban and Environmental Geology, 12 papers Friday a.m.

General Geology, 11 papers Friday a.m.

Heat Flow, 10 papers Friday p.m.

The Nasca Lithospheric Plate, 12 papers Friday p.m.

Stratigraphy, 11 papers Friday p.m.

Stratigraphy of the Columbia River Basalt, 10 papers Saturday a.m.

Geochemistry and Geochronology, 12 papers Saturday a.m.

Pleistocene Geology, 8 papers Saturday a.m.

Sedimentology, 12 papers Saturday a.m.

West Coast Mesozoic Micropaleontology, 8 papers Saturday a.m.

Detailed programs and abstracts will be handed out with Registration, beginning Wednesday, March 21 at 2:00 p.m.

Six field trips are scheduled for the periods before and after the meetings: 1) North-central Oregon; 2) Central Coast Range; 3) Northwestern Oregon and southwestern Washington; 4) Columbia River Gorge; 5) Portland area; and 6) Pasco Basin, Washington. A field trip guidebook, included in cost of trips, will be for sale for \$5.00 for those who may wish to make self-guided tours later. The guidebook, published by Oregon Dept. of Geology and Mineral Indus. as Bulletin 77, will also be for sale in the Department's offices after the close of the GSA meetings.

AVAILABLE PUBLICATIONS

(Please include remittance with order; postage free. All sales are final - no returns. Upon request, a complete list of Department publications, including out-of-print, will be mailed)

BULLETINS

8. Feasibility of steel plant in lower Columbia River area, rev. 1940: Miller . . .	\$0.40
26. Soil: Its origin, destruction, preservation, 1944: Twenhofel . . .	0.45
33. Bibliography (1st suppl.) geology and mineral resources of Oregon, 1947: Allen . . .	1.00
35. Geology of Dallas and Valsetz quadrangles, Oregon, rev. 1963: Baldwin . . .	3.00
36. Papers on Tertiary foraminifera: Cushman, Stewart & Stewart. vol. 1 \$1.00; vol. 2 . . .	1.25
39. Geology and mineralization of Morning mine region, 1948: Allen and Thayer . . .	1.00
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
52. Chromite in southwestern Oregon, 1961: Ramp . . .	3.50
57. Lunar Geological Field Conf. guidebook, 1965: Peterson and Groh, editors . . .	3.50
58. Geology of the Supplee-Izee area, Oregon, 1965: Dickinson and Vigrass . . .	5.00
60. Engineering geology of Tualatin Valley region, 1967: Schlicker and Deacon . . .	5.00
61. Gold and silver in Oregon, 1968: Brooks and Ramp . . .	5.00
62. Andesite Conference Guidebook, 1968: Dole . . .	3.50
64. Geology, mineral, and water resources of Oregon, 1969 . . .	1.50
66. Geology, mineral resources of Klamath & Lake counties, 1970: Peterson & McIntyre . . .	3.75
67. Bibliography (4th suppl.) geology and mineral industries, 1970: Roberts . . .	2.00
68. The Seventeenth Biennial Report of the State Geologist, 1968-1970 . . .	1.00
69. Geology of the Southwestern Oregon Coast, 1971: Dott . . .	3.75
70. Geologic formations of Western Oregon, 1971: Beaulieu . . .	2.00
71. Geology of selected lava tubes in the Bend area, 1971: Greeley . . .	2.50
72. Geology of Mitchell Quadrangle, Wheeler County, 1972: Oles and Enlows . . .	3.00
73. Geologic formations of Eastern Oregon, 1972: Beaulieu . . .	2.00
74. Geology of coastal region, Tillamook Clatsop Counties, 1972: Schlicker & others . . .	7.50
75. Geology, mineral resources of Douglas County, 1972: Ramp . . .	3.00
76. Eighteenth Biennial Report of the Department, 1970-1972 . . .	1.00
77. Geologic field trips in northern Oregon and southern Washington, 1973 . . .	in press

GEOLOGIC MAPS

Geologic map of Oregon west of 121st meridian, 1961: Wells and Peck . . .	2.15
Geologic map of Oregon (12" x 9"), 1969: Walker and King . . .	0.25
Geologic map of Albany quadrangle, Oregon, 1953: Allison (also in Bulletin 37) . . .	0.50
Geologic map of Galice quadrangle, Oregon, 1953: Wells and Walker . . .	1.00
Geologic map of Lebanon quadrangle, Oregon, 1956: Allison and Felts . . .	0.75
Geologic map of Bend quadrangle, and portion of High Cascade Mtns., 1957: Williams . . .	1.00
GMS-1: Geologic map of the Sparta quadrangle, Oregon, 1962: Prostka . . .	1.50
GMS-2: Geologic map, Mitchell Butte quad., Oregon: 1962, Corcoran and others . . .	1.50
GMS-3: Preliminary geologic map, Durkee quadrangle, Oregon, 1967: Prostka . . .	1.50
GMS-4: Gravity maps of Oregon, onshore & offshore, 1967: Berg and others [sold only in set] flat \$2.00; folded in envelope . . .	2.25
GMS-5: Geology of the Powers quadrangle, 1971: Baldwin and Hess . . .	1.50

OIL AND GAS INVESTIGATIONS SERIES

1. Petroleum geology, western Snake River basin, 1963: Newton and Corcoran . . .	2.50
2. Subsurface geology, lower Columbia and Willamette basins, 1969: Newton . . .	2.50

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| 18. Radioactive minerals prospectors should know, 1955: White and Schafer | \$0.30 |
| 19. Brick and tile industry in Oregon, 1949: Allen and Mason | 0.20 |
| 21. Lightweight aggregate industry in Oregon, 1951: Mason | 0.25 |
| 24. The Almeda mine, Josephine County, Oregon, 1967: Libbey | 2.00 |

MISCELLANEOUS PAPERS

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| 1. Description of some Oregon rocks and minerals, 1950: Dole | 0.40 |
| 2. Key to Oregon mineral deposits map, 1951: Mason | 0.15 |
| Oregon mineral deposits map (22" x 34"), rev. 1958 (see M.P. 2 for key) | 0.30 |
| 4. Rules and regulations for conservation of oil and natural gas (rev. 1962) | 1.00 |
| 5. Oregon's gold placers (reprints), 1954 | 0.25 |
| 6. Oil and gas exploration in Oregon, rev. 1965: Stewart and Newton | 1.50 |
| 7. Bibliography of theses on Oregon geology, 1959: Schlicker | 0.50 |
| 7. (Supplement) Bibliography of theses, 1959 to Dec. 31, 1965: Roberts | 0.50 |
| 11. A collection of articles on meteorites, 1968, (reprints, The ORE BIN) | 1.00 |
| 12. Index to published geologic mapping in Oregon, 1968: Corcoran | Free |
| 13. Index to The ORE BIN, 1950-1969, 1970: Lewis | 0.30 |
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| Landforms of Oregon: a physiographic sketch (17" x 22"), 1941 | 0.25 |
| Index to topographic mapping in Oregon, 1969 | Free |
| Geologic time chart for Oregon, 1961 | Free |
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