

STATE OF OREGON
DEPARTMENT OF GEOLOGY & MINERAL INDUSTRIES
PORTLAND, OREGON

THE ORE.-BIN

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STATE DEPARTMENT OF GEOLOGY & MINERAL INDUSTRIES
Head Office: 702 Woodlark Bldg., Portland 5, Oregon

State Governing Board

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FERRUGINOUS BAUXITE IN WASHINGTON COUNTY, OREGON

by

F. W. Libbey*

Introduction:

So far as is now known, Oregon possesses the only bauxite in deposits of commercial size west of the Rocky Mountains. Although these deposits need considerable metallurgical research in order to determine most economical methods of treatment, their location, within 25 or 30 airline miles of aluminum reduction plants at Vancouver and Troutdale, makes them a potential source of alumina for these aluminum plants which now must haul alumina across the country from East St. Louis or Mobile. The factor of alumina supply is most important to postwar operation of these reduction plants and if Oregon bauxites prove to be economic, they may be the determining factor in producing the cheapest aluminum in the country.

The Oregon Department of Geology and Mineral Industries has been studying these deposits as time and personnel permitted since last April. Sixty-three auger holes have been put down and some pick and shovel work has been done in this exploration work. G.M.I. Short Paper No. 12 has been published as a preliminary report, and a supplemental report describing work done since No. 12 was issued is being prepared.

Location of Deposits:

These deposits so far explored are in northern Washington County, distributed over four townships, namely Tps. 2 and 3 N. and Rs. 2 and 3 W. Reconnaissance work has been done on similar deposits in Columbia County and it seems likely that material similar in grade to that in Washington County may occur in deposits of commercial size. Further investigations in both counties may show extensions of the ore-bearing areas known at present. Most of the exploration work of the Department has been done in two localities, one called the Hendrickson and the other has been given the general name of the Hutchinson locality. A few test holes have been drilled in other localities; especially noteworthy are results of samples obtained from the southern part of the area in the Helvetia locality.

Access:

The deposits are easily reached from Portland by several roads, mostly paved. The most direct route to the northern part of the area is by way of Skyline Boulevard to the Dixie Mountain road which extends south from Skyline through the eastern part of the area. The western part of the area is reached by way of the Pumpkin Ridge road from North Plains.

Columbia County deposits may be reached from U.S. 30, north and west of Scappoose.

* Paper read at annual meeting of Oregon Academy of Science, Portland, January 13, 1944.

Description of the Deposits:

These deposits are flat-lying under an overburden of silt which ranges in thickness from a few inches to 40 or more feet. Ore so far investigated averages about 11 feet thick, and ratio of overburden to ore is moderate, probably less than 2 to 1, although definite statements may not be made for all the deposits because of the small amount of drilling work done, especially in the southern part of the area. Generally speaking, the ore varies in color from yellow to brown; it is of two kinds, hard and soft. Hard ore is, for the most part, oolitic and magnetic, due probably to residual magnetite. Some sections of the ore beds may be best described as pebbly or concretionary. The soft or clay-like ore usually contains small oolites in the clay-like matrix which in places contains bauxite minerals. The ore is underlain by clay and the contact is usually fairly sharp, although in places the change from ore to waste is gradational. It is believed that the ore is made up of an intimate mixture of hydrous aluminum and iron oxides, with a minor amount of titanium. No hercynite, iron aluminum oxide, has been found. In parts of both the Hendrickson and the Hutchinson deposits, probably mining could be accomplished without blasting. It is believed that mining conditions are particularly favorable for cheap operation. Usually, especially in the northern part of the area, the many gulches would provide adequate dumping space for disposal of overburden.

Quantity of Ore:

The work in the Hendrickson locality has indicated over 2,000,000 long tons of material which analyzes approximately as follows:

Alumina	32	%
Iron	26	
Silica	9	
Phosphorus	0.14	
Titania	4.5	
Moisture	19	
Ignition loss	18	

In the Hutchinson locality, insufficient work has been done upon which estimates of tonnage may now be made. Indications are that tonnage so far explored in a preliminary way will be at least equal to that in the Hendrickson locality and although analytical results are incomplete, probably the grade will be about equivalent to that in the Hendrickson. Grade of ore in the Helvetia locality appears to be higher in alumina than in other places. Samples running up to 46 percent Al_2O_3 have been obtained on the Schmidt farm just north of Helvetia.

Origin of the Ore:

It is believed that these deposits are lateritic in origin and were formed subsequent to the last outpourings of the Columbia River lavas. Thus these ferruginous bauxites are later in age than the Scappoose limonites which have been found overlain by basalt. There is corroborative evidence of this at two localities in Washington County, one at the Berger place east of Helvetia and one in the Hutchinson locality in a gulch just east of the Hutchinson house. At both of these places, limonite in place is found stratigraphically below ferruginous bauxite. Since in all localities so far examined, the bauxite is overlain by silt only, it is believed that the ore was formed after the Columbia River basalts had been extruded in Miocene time and before the silt was deposited, largely by wind action, probably in Pleistocene time.

Possible Utilization:

Material similar in composition to the Washington County bauxites has been treated on a commercial scale in Norway by the Pedersen process. In this process French bauxite was mixed with Norwegian iron ore and smelted with lime in an electric furnace to produce both a high grade pig iron and a calcium aluminate slag. The slag was further treated by leaching

with sodium carbonate solution, and precipitating the dissolved sodium aluminate with carbon dioxide to produce aluminum hydrate which was filtered and calcined to produce anhydrous alumina. Work by the U.S. Bureau of Mines on siliceous and ferruginous bauxites in this country indicates that the Pedersen process is applicable to Washington County ore.

The Bayer process, now the only method used for producing alumina in this country, involves treatment of low silica bauxite with sodium hydrate under both heat and pressure. The resulting solution contains the aluminum as aluminum hydrate, which is precipitated according to a method developed by the Aluminum Company of America, by means of which a "seed charge" of aluminum hydrate is added to the hot solution which is gradually cooled and at the same time agitated. This treatment allows the aluminum hydrate to be precipitated as a crystalline material which facilitates filtering. The aluminum hydrate is calcined to produce pure alumina. As sodium hydrate dissolves silica, bauxites amenable to the Bayer process must be low in silica, and formerly maximum allowable silica in bauxite used in the Bayer process was 7 percent. The maximum allowable now is somewhat higher but, of course, the more silica in the bauxite, the greater the cost of treatment. Iron in bauxite is unattacked by alkalies; therefore the iron content is not important in the economics of the Bayer process except that high iron means relatively low alumina. South American bauxites contain 50 percent or more of alumina and, of course, the higher the alumina, the lower the treatment cost per pound of alumina produced. In any event, as far as the analysis of the Washington County bauxites is concerned, the Bayer process or some modification of it could be used for treating these ores. The residue remaining after the alumina is dissolved out by the sodium hydrate would contain all the iron as a high grade "red mud". This "red mud" could probably be smelted in an electric furnace to produce pig iron for which there is a good demand in the Northwest. Part of the "red mud" might be utilized in making electrolytic iron, in demand for making shapes by powder metallurgy technique.

Conclusion:

It is believed that this bauxite ore which fortuitously occurs so close to present aluminum reduction plants is of much potential importance in the industrial picture of the Northwest, and it is also believed that further exploration work will show that a very large tonnage in millions of tons exists in Washington and Columbia Counties.

REPORT ON HIGH ALUMINA CLAY DEPOSIT NEAR CASTLE ROCK, WASHINGTON

A preliminary report on the Castle Rock high alumina clay deposit, Cowlitz County, Washington, has been placed on open file at the Oregon State Department of Geology and Mineral Industries, Portland, by the U.S. Geological Survey. This report was prepared by Dr. Robert L. Nichols of the High Alumina Clay Division of the Survey, and describes geology and characteristics of the ore deposits, and gives an estimate of the reserves. The report is accompanied by maps, cross-sections, and columnar sections of the deposit. Copies of the report are also on open file at the Geological Survey offices at Washington D.C., Spokane, Washington, and Salt Lake City, Utah, as well as the Washington State Division of Mines, Olympia, and the Washington State Division of Geology at Pullman.

The Cowlitz County high alumina clay deposits were explored by the U.S. Bureau of Mines in cooperation with the U.S. Geological Survey. Results of the exploration show 8,634,000 dry tons of measured ore containing 30% available Al_2O_3 and 5.7% Fe_2O_3 . In addition, it is estimated that the deposit contains 9,249,000 dry tons containing 29% available Al_2O_3 and 6.3% Fe_2O_3 .

The report is available to persons interested in the development of the deposit.

A HIGH-FLYING BIRD'S EYE VIEW OF
PERMANENTE METALS CORPORATION MAGNESIUM AND ASSOCIATED PLANTS

by

John Eliot Allen*

On December 14, the writer had the privilege of spending a full day inspecting the various plants of the Permanente Metals Corporation, located about 15 miles west of San Jose.

The complexity and magnitude of these operations are awe inspiring, especially when one considers the short time in which they have been built and put into operation. Henry J. Kaiser's organization sponsored and built these two privately owned plants.

Magnesium is produced at Permanente by the carbothermic, or Hansgiring process; the metal being obtained from dolomite ($\text{MgCO}_3 \cdot \text{CaCO}_3$) and sea water in equal parts. The dolomite quarry is located at Natividad, about 8 miles northeast of Salinas, California, where the rock is mined by open cut quarry with electric dipper shovels and crushed and calcined at 2000°F . to the double oxide in two large rotary kilns of the cement calcining type. Calcined dolomite is trucked a distance of about 12 miles to the coast on Monterey Bay. Water is taken from the ocean at this Moss Landing plant at the rate of 6500 gallons per minute through a 5-foot diameter wood stave line and delivered to hydrotreater tanks where suspended solids and carbonates are precipitated. The treated sea water then flows through reactor tanks where the calcined dolomite, slaked to the hydroxide is introduced. Here the magnesium in the sea water, being higher in the electromotive series than the calcium in the dolomite, replaces it to produce magnesium hydroxide. This slurry is then thickened in four 250-foot thickeners and washed in a fresh-water flow of 1000 gallons a minute. The excess water is then removed in a battery of Oliver filters and the filter cake is conducted by a screw conveyor to another large rotary kiln where it is dehydrated at a temperature of 2300°F . This material, over 96 percent MgO , is trucked in large trailer trucks to the Permanente plant west of San Jose.

At Permanente the dehydrated MgO is mixed in molecular proportions with petroleum coke, and interground in a 26-foot ball mill. This material is briquetted in a series of presses and distributed to air-locked feed bins of the five 8000 KVA reduction furnaces. From this stage on until the finished metal comes out of the retorts, the process is conducted in an oxygen free atmosphere. The reduction furnaces are approximately 16 feet high, and 16 feet in diameter and are heated by three electrodes coming in from the top, each electrode being 20 inches in diameter. The electrodes are fed automatically into the furnaces and are insulated against electricity, pressure, and heat. At the operating temperature of 2000°C the reaction $\text{MgO} + \text{C} \rightleftharpoons \text{Mg} + \text{CO}$ takes place and the gaseous products come out a port in a side of the furnace where they are shock-chilled by jets of natural gas. The microscopic magnesium dust produced by this reaction and shock-chilling is removed from the gas by a battery of bag filters. When the plant was first put in operation it was found that carbon tended to build up in the discharge ports of the furnaces. An automatic reamer was then built, which periodically during the operation slides into the furnace and cleans out this port. The magnesium dust from the bag filters is conveyed to dust bins and from dust bins to gas-tight enclosed pelleting presses of special design. Pellets are loaded, still in a closed atmosphere of gas, into vertical air-tight retorts about $4\frac{1}{2}$ feet in diameter and 20 feet high. These steel retorts are metalized with aluminum on the outside to retard their oxidizing under the heat of the electric resistance furnaces into which they are then lowered. The furnaces, heated by banks of nichrome wire coils, sublime the magnesium metal at 1400°F at an absolute pressure of 0.2 mm of mercury. In the upper condensing portion of the retort is a removable liner which during the 90 hours of heating collects the crystalline magnesium sublimate. The area over which

* Geologist, State Department of Geology and Mineral Industries, on leave.

the retorts are prepared for loading, furnacing, cooling, and stripping, measures about 230 by 290 feet. The retorts, which weigh about ten tons loaded, are lifted and conveyed from place to place by two large gantry cranes. Loading is conducted on a rotating scale platform containing five retorts, which places each retort in turn beneath an automatic air-lock connected to pellet storage bins. Each retort must be completely purged of air before it is loaded. When the retorting is completed, the magnesium crystals are exposed to the air for the first time. They are cracked loose from the liners and routed to the ingot casting foundry where they are melted in gas-fired tilting furnaces. The crystals, which are over 99.99 percent pure, are alloyed in these crucible furnaces and cast into ingots to be used subsequently for sand castings, forgings, and extrusions. Sulfur and SO_2 gas are used for protecting the metal from burning during pouring.

Magnesium production is only one of the activities at Permanente. The original plant at this locality was erected by the Permanente Cement Company. The wet process is used and clinkering is done in four 364-foot kilns - the largest in the world. Limestone for the cement is mined in the hill above the plant from a great lens of dark-colored bedded limestone lying on the Franciscan series of Jurassic age. An altered volcanic rock nearby is used to furnish the siliceous and iron elements of the cement in proper amount. High-grade limestone is sold directly from the quarry and waste limestone is sold as commercial rock. The seven types of Permanente cement are sold in bags and in bulk, shipment being made by bulk-truck, box car, and company owned steamships.

The third separate and distinct operation on the property is the ferrosilicon plant. It consists of three 8000 KVA electric furnaces. Raw materials used are silica in the form of quartz, coke, and steel shavings. Quartz is mined at a company owned quarry near Merced, California, and coke is furnished by Fontana. The plant was brought into production about the middle of 1942 to furnish ferrosilicon for the Kaiser sponsored D.P.C. magnesium plant at Manteca, California. Magnesium was produced here using the silicothermic, or Pidgeon process. The government shut the Manteca plant down in 1944 and since then the ferrosilicon plant at Permanente has been supplying the ferroalloy to users throughout the country - principally steel producers.

Plants tributary to the magnesium plant include a nitrogen plant which produces an inert gas for some portions of the process. Here air and natural gas are introduced into retorts in which the oxygen is burned out of the air and the resulting nitrogen is cleaned of the other products in scrubbing towers. A Girbotol water-gas plant is operated to produce hydrogen which is used as an inert gas in portions of the process. A sand-casting plant produces magnesium castings which are going exclusively toward the war effort. A refractories plant utilizes magnesium oxide to produce periclase refractory brick for lining the cement kilns and open hearths at the Kaiser steel plant at Fontana and also for sale to other plants. A flux plant produces the various fluxes used in the foundry and also produces for sale on the outside market. Natural gas is dried and scrubbed in order to make it available for use. A complex system of piping of the various raw materials and products is spectacular in that each pipe is colored to indicate the material which it carries. Water pipes are painted black; natural gas, red; high vacuum, yellow; low vacuum, brown; high pressure, low pressure, nitrogen, hydrogen, magnesium dust, exhaust or vent pipes are all painted distinctive colors; and the complexity of various colored and sized pipes running through the pipe trenches and tunnels from plant to plant is interesting indeed.

By-products marketed by The Permanente Metals Corporation are numerous, the most important ones being:

Raw dolomite - used in open hearth steel furnaces.

Hydrated and processed) - used in the building trade, oil refining, and for
High magnesia lime) general commercial and chemical use.

Dead burned dolomite) - electric furnace and open hearth
and)

) bottom maintenance

Ramming mix)

Magnesium oxide)	- rubber compounding
(Various burns and compositions))	chemical uses
)	basic brick (periclase)
		ladle and furnace linings (periclase)
Carbothermic magnesia)	- compounding neoprene and
(Residue from the carbothermic process))	GR-S synthetic rubbers

The first four are more or less standard products and are produced and shipped direct from the Natividad or Moss Landing plants. Carbothermic magnesia is a special product produced from treating the residue obtained from the retorting step in magnesium production at Permanente. The special treating is done in a separate plant using a process developed by the research staff at Permanente.

Magnesium is the lightest metal in commercial use. It weighs only two-thirds as much as aluminum, one-fourth as much as steel, and one-fifth as much as copper. Some magnesium alloys have the tensile strength of structural steel. It can be machined faster than any other metal and can be fabricated into desired shapes by any method commonly used in making other metals. It can be sand-cast, die-cast, extruded, forged, or rolled into flat or tapered sheets. It may be rolled into sheets varying from 0.014 to 0.500 inch in thickness. Magnesium may be welded by the use of a special arc which is insulated from the air by a jet of helium or argon gas.

The writer wishes to express his appreciation to the Permanente Metals Corporation for the information in this sketch and for the courtesy extended during the visit.

SILICONES

Within the past year technical literature has indicated a growing interest in the new series of chemical products called silicones. These products are a class of organic compounds in which the silicon (instead of the carbon) atom is joined in combination with other elements and radicals to oxygen atoms to form chemical ring and chain compounds. These materials have been a laboratory curiosity for some time but with the advent of the war their useful and unusual properties have placed them in commercial production. The research which developed silicones was a culmination of glass and plastic studies, heretofore considered quite unrelated fields. The Dow-Corning Company was formed in the latter part of 1943 to make these products available for war purposes. Press releases indicate that the General Electric Company is also engaged in the production of silicones.

The primary raw materials required for the preparation of silicones are sand, brine, coal, and oil. One or more hydrocarbon groups must be carried by the silicon atoms, and these groups have a great effect on the properties of the resulting compound. The process for the preparation of silicones is complex and involves many steps. A vast new field of research has been opened up in the study of these compounds.

Silicone compounds in the form of fluids, greases, resins, and lubricants are commercially prepared at the present time. Some of the properties which are peculiar to silicones and which make them of such great use are:

1. They are chemically inert to metals, resist oxidation, and are neutral in reactions.
2. They have a low surface tension which makes them useful in the preparation of water-repellent surfaces.
3. They are insoluble in water, although they are soluble in most organic compounds.
4. They have a low dielectric constant and power factor.
5. They exhibit little change in viscosity over a wide range of temperature.

Silicones find wide use in the field of electrical insulation due to their exceptional electrical properties which allow greater life and better operation of electrical equipment. Because of their unusual thermal properties, silicones are superior to previously known organic varnishes and resins. The low surface tension of certain silicones allows them to be easily applied to glass, Fiberglas, and asbestos surfaces. They find wide use in the rubber industry also.

There can be little doubt that silicones will become of great importance in the postwar world, and many products which are seemingly fantastic now will inevitably become everyday realities in the near future.

Esther W. Miller

PAPERS PRESENTED AT GEOLOGY AND GEOGRAPHY SECTION OF

OREGON ACADEMY OF SCIENCE, JANUARY 13, 1945

Warren D. Smith, Chairman

1. "An Unusual Example of Stream Capture near Lewiston, Idaho": Lloyd L. Ruff of the United States Engineers.
2. "A Preliminary Report on the Tertiary Foraminifera of the Coos Bay Area": Mrs. Mildred Reichers Detling of the University of Oregon.
3. "Ferruginous Bauxite Deposits of Washington County, Oregon": F. W. Libbey of the Oregon Department of Geology and Mineral Industries.
4. "Eugene Silica Foundry Sand": Wallace D. Lowry of the Oregon Department of Geology and Mineral Industries.
5. "Geologic and Geographic Work in the War Effort in Washington, D. C.": Warren D. Smith of the University of Oregon.
6. "A Summary of the Stratigraphy of the Coos Bay Area": John Eliot Allen and Ewart M. Baldwin of the Oregon Department of Geology and Mineral Industries.
7. "Wind Erosion Basins in Fort Rock Valley, Oregon": Ira S. Allison of Oregon State College.
8. "Chalcedony Filled Nodules": A. W. Hancock of Portland.
9. "Results of Geography Tests Given to University Students": James C. Stovall of the University of Oregon.
10. "A Geonomic Survey of the Rogue River Valley": Willis B. Merriam of the University of Oregon.
11. "Fossil Woods": George F. Beck.
12. "A New Fossil Plant Locality near Eugene": LeRoy E. Detling of the University of Oregon.

Symposium on early man in Oregon:

Dr. L. S. Cressman, principal speaker: "The Stratigraphic Record of Early Man in Oregon."

Dr. Ira S. Allison: "Clues from Pluvial Lakes."

Dr. Henry P. Hansen: "Postglacial Climates and Chronology."

MERCURY IN NOVEMBER 1944

According to the U.S. Bureau of Mines monthly mercury report released January 3, 1945, production of mercury decreased to 2,300 flasks in November, or to the lowest rate since February 1940.

Consumption continued unmoved at the rate of 3,900 flasks reported for the 3 preceding months, the gains for some uses counteracting losses registered for others. Consumption may have been restricted in part by difficulties in obtaining metal. The situation regarding essential war needs promised improvement in December because of the Government's action in releasing metal from the stockpile for this purpose. Winter weather and labor difficulties contribute to the unfavorable outlook for noteworthy production gains in the near future. Total industry stocks declined further in November and prices continued the uptrend of recent months.

Salient statistics on mercury in the United States in 1939-43 and in January-November 1944, in flasks of 76 pounds each

Period	Production	Consumption	Stocks at end of period		Price per flask at New York
			Consumers and dealers 1/	Producers 2/	
Average Monthly					
1939 . . .	1,553	3/ 1,742	12,600	376	\$ 103.94
1940 . . .	3,148	2,233	14,100	607	176.87
1941 . . .	3,743	3,733	12,400	439	185.02
1942 . . .	4,237	4,142	10,700	1,377	196.35
1943 . . .	4/ 4,327	4,542	13,200	3,457	195.21
Monthly					
1944:					
January .	4,400	3,400	11,300	5,459	151.60
February.	3,800	3,700	9,400	5,450	130.00
March . .	3,800	3,600	9,900	5,011	130.00
April . .	3,700	3,200	9,700	5,604	128.20
May . . .	3,400	3,100	8,900	6,171	115.54
June . . .	3,000	3,400	9,000	5,757	101.69
July. . .	2,700	3,000	9,300	4,025	100.56
August. .	2,500	3,900	9,100	2,252	104.04
September	2,500	3,900	8,400	1,936	104.28
October .	2,700	3,900	7,400	2,550	109.20
November.	2,300	3,900	7,800	2,094	116.30

1/ Largely excludes redistilled metal. 2/ Held by reporting companies. 3/ Apparent consumption. 4/ Based on final figures.

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THE EUGENE SILICA FOUNDRY SAND

By

Wallace D. Lowry*

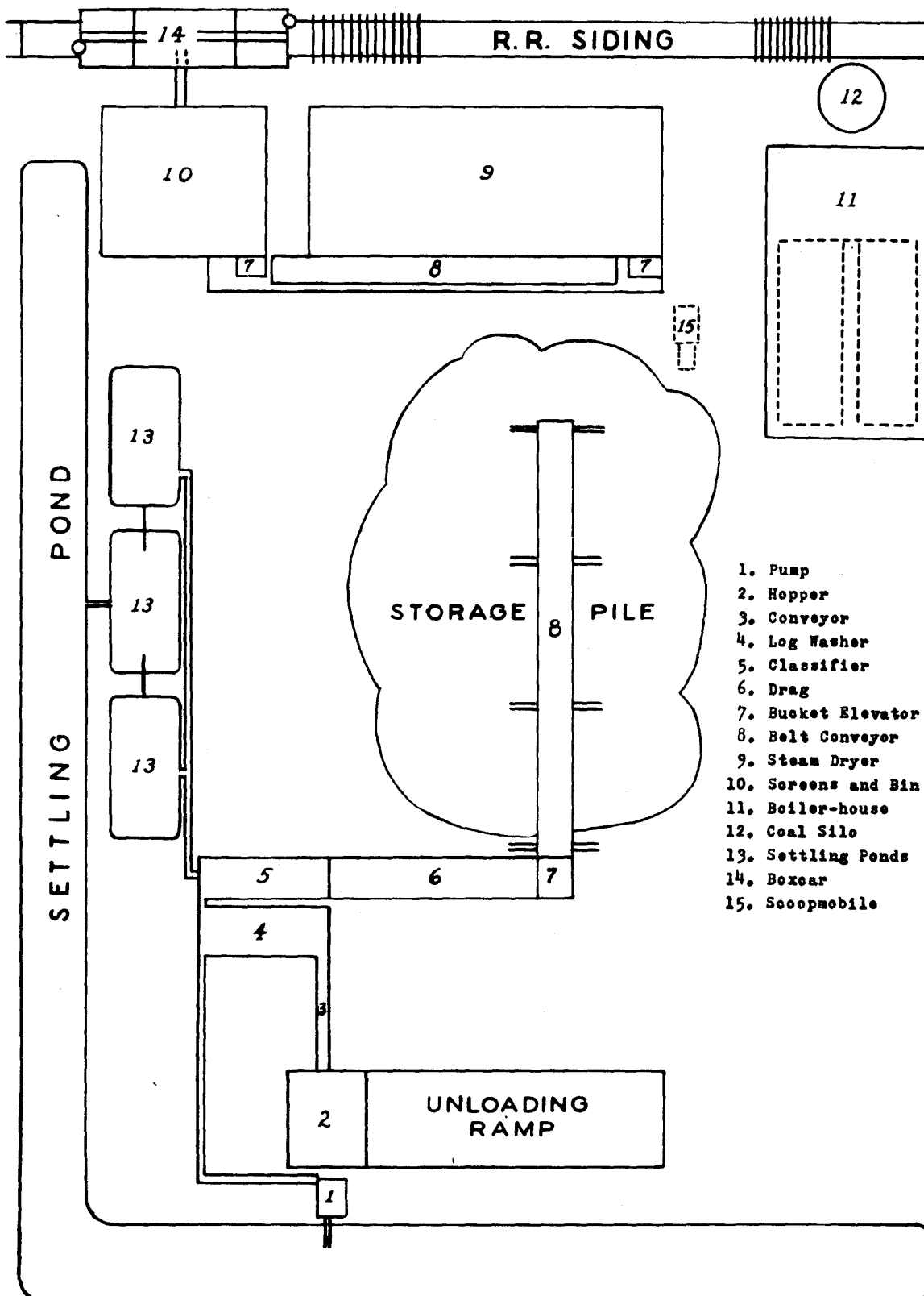
The project:

High-grade silica foundry sand is being produced at Eugene, Oregon, by Silica Products, Oreg., Ltd., and the first shipments were recently made to Portland and Seattle. This company's modern washing and drying plant, financed by the Defense Plant Corporation, is located about a mile north of the deposit which is about 3 miles west of Eugene in the NE $\frac{1}{4}$ sec. 34, T. 17 S., R. 4 W. The deposit forms most of the elongate hill known as Wallace Butte which can be reached via 11th Street.

As the pit material is about two-thirds quartz sand and one-third fire clay with a minor amount of mica, it contains too much bond to be used as a naturally bonded sand. It must be washed and the Silica Products, Oreg., Ltd.'s plant was recently built for this purpose. The flow sheet is shown in the accompanying diagram. The raw sand is loaded at the pit into dump trucks by means of a dragline. It is then trucked to the plant where it is dumped into a hopper with a drag-type conveyor feeder which carries the sand to a log washer. From the log washer the sand goes to a Dorr duplex classifier. The overflow carries off most of the clay and the partially washed sand drops into a long drag classifier, the overflow from which carries off nearly all the remaining clay, though a desirable partial film of clay is left on many of the sand grains. The sand from the drag classifier is elevated to a belt conveyor which carries it to the stockpile. A Scoopmobile transfers the sand from the stockpile to a hopper from which a bucket elevator carries it to the top of the steam drier. As the sand dries, it drops down through a network of steam pipes and is conveyed and elevated to the screening house and storage bins from which it is loaded into railroad cars for shipment. The boilers for the steam drier are heated by coal fed by automatic stokers.

Water for the washing operations is obtained from a large trench dug in porous gravels. The clay removed by the washing operations is refractory and suitable for making fire brick. It is being collected in other large pits which serve as settling ponds. Additional test work on the clay is planned, and as the P.C.E. value of the clay is above cone 31, it may prove to be of considerable economic importance.

* Associate Geologist, Oregon Department of Geology and Mineral Industries. An abstract of this paper was presented at Geology and Geography Section of Oregon Academy of Science, Portland, Oregon, January 13, 1945.



FLOW SHEET OF SILICA PRODUCTS, OREG., LTD. SAND PLANT, EUGENE, OREGON

History:

The Eugene deposit was first described in 1923 in a report by Paul W. Cook,¹ a geology student at the University of Oregon while the deposit was formerly being worked. The raw sand was then used in the manufacture of no. 2 refractory brick but the deposit was unworked for a number of years prior to acquisition by the present operators. In 1938, Mr. Ray C. Treasher, geologist with the State Department of Geology and Mineral Industries, investigated the deposit and in a preliminary report in collaboration with Mr. Hewitt Wilson of the U.S. Bureau of Mines on some of the refractory clays of western Oregon² suggested use of the sand for making glass and for molding in steel foundries.

The raw sand from the pit has been used at various times in the past by foundries but its high clay content makes it rather unsatisfactory until washed. A later report³ by Treasher in 1943 dealing only with the Eugene deposit led to actual foundry tests conducted at the Crawford & Doherty Foundry, Portland, by the writer and Mr. Ralph Mason, also of the State Department of Geology and Mineral Industries. These tests on the durability of the Eugene sand were very satisfactory and the results were published.⁴ Copies of this report and a later memorandum⁵ by the writer were sent to most of the Portland foundries. The memorandum discussed the properties of the Eugene sand and compared it with Ottawa Federal 17 which is currently used in many Pacific Northwest steel foundries. War Minerals Report 199⁶ was issued in 1944 by the U.S. Bureau of Mines whose drilling in the latter part of 1943 proved several hundred thousand tons of Eugene sand of uniform grade. On the basis of the encouraging results obtained from the various tests and upon the suggestion of H. Ries⁷ and the State Department of Geology and Mineral Industries, further foundry tests were made by the Naval Research Laboratory, Washington, D. C. Their tests showed the Eugene sand to be very satisfactory and strikingly similar to one of the leading New Jersey steel foundry sands.

Geology:

As first pointed out by Cook in 1923, it is believed that the Eugene sand is a residual deposit formed by the weathering of an indurated sandstone in the Eugene formation of Oligocene age. A similar clay and sand deposit, known as the Hawkins locality, is about 1 mile southeast of that at Wallace Butte. However, it contains some feldspar grains and compound sand grains which indicate it has not been as thoroughly weathered. This is also indicated by its somewhat lower clay content. The probable parent rock of these sand deposits crops out near the top of the hill immediately south of the Hawkins locality. It is an indurated, massive, light-colored, quartz-feldspar sandstone.

¹ Cook, Paul W., A preliminary report on the geology and economic geology of the Wallace Butte quartz sand deposit, Lane County, Oregon, an appendix to "A preliminary report on the geology of the Eugene quadrangle, Oregon," by H. G. Schenck, master's thesis, University of Oregon, 1923.

² Wilson, Hewitt, and Treasher, Ray C., Preliminary report on some of the refractory clays of Western Oregon, Bull. no. 6, Oregon Department of Geology and Mineral Industries, 1938.

³ Treasher, Ray C., Preliminary report on a possible molding or glass sand, Oregon Department of Geology and Mineral Industries, 1943, unpublished.

⁴ Lowry, W. D. and Mason, R. S., Eugene sand foundry tests, Oregon Department of Geology and Mineral Industries, 1943.

⁵ Memorandum on steel foundry sand at Eugene, Oregon, Oregon Department of Geology and Mineral Industries, 1944.

⁶ Silica sand deposits in the Eugene area, Lane County, Oregon, U.S. Bureau of Mines War Minerals Report 199, 1944.

⁷ Personal communication.

Reconnaissance geologic mapping by the writer in the southern part of the Eugene quadrangle, where these deposits are located, indicates that these sands occur at or near the base of the Eugene formation where they disconformably and possibly unconformably overlie the Fisher formation of older Oligocene or Upper Eocene age. Both strike approximately northwest and dip several degrees to the northeast. The presence of fossil wood near the contact with the underlying tuff breccias of the Fisher formation as well as field relationships indicate that these sands were laid down when the Eugene (Oligocene) sea first invaded the region. The uniform grain size of the sand suggests that it may have been derived from nearby older sandy formations such as the Spencer or Tyee of Eocene age, which in turn may have been derived from the old Klamath Mountain highland. Such reworking plus possible transportation by wind to form dunes, as suggested by field observations, may explain the unusually uniform grain size of the Eugene sand.

Foundry sand use and properties:

People not connected with the industry do not realize the importance of foundry sand which is used to make the forms in which metals are cast. A wide variety of foundry sands are employed to make the multitudinous steel, gray or cast iron, bronze, brass, and aluminum castings.

Foundry sands may be divided into molding sands and core sands. The former are used for making the molds whereas core sands are used to form the hollow portions of castings. The sands also may be divided into naturally bonded and synthetic sands. The naturally bonded sands contain a relatively small percent of clay (5-20 percent) which binds the sand grains together. Synthetic sand, whose use is increasing, is a "sharp" sand with added clay, fire clay, bentonite, or a mixture of these which binds the grains together. A "sharp" sand, according to foundrymen, is one without bond. Molding sand can be re-used and can be employed as long as the properties of the sand remain satisfactory. New sand and additional bond often can be added to the old or used sand to build it up and thus further lengthen its life. Today a number of the larger foundries have special equipment to reclaim part of the used sand by washing and screening. "Sharp" sand is used in making cores, and as they must withstand the greatest heat and stress, special binders such as resin, pitch, oil, or various cereals are added and then the cores are baked in drying ovens. After one use the cores are thrown away.

As outlined by Ries,⁸ the five important properties of a foundry sand are fineness, bonding strength, permeability, sintering point, and durability. Fineness relates to the size of the sand grains. Although degree of fineness exerts an influence on such properties as the permeability and bonding strength of the sand, probably the most important effect of fineness is on the smoothness of the casting. Within certain limits, the finer the sand, the cleaner the casting. Bonding strength refers to the strength of the sand mixture. Although the amount of clay or other bond largely determines the strength, the amount of moisture added and the shape of the sand grains are also important factors. Permeability is the property of the sand that permits the passage of gases, and is necessary for the proper venting of the gases generated during the pouring of the casting. Permeability is related to porosity and is calculated by measuring the rate of flow of air through a standard cylinder of the sand mixture. Although fine sands tend to have low permeabilities and coarse sands, high permeabilities, the uniformity of the grain sizes of a sand is an important factor in determining this property. The sintering point is the temperature at which fusion begins. The most siliceous sands are most refractory. The durability, or life, of a molding sand mixture is determined by its ability to regain most of its green (wet) strength when water is again added to it after it has been used once. Thus the durability of a sand mixture depends largely on the nature of the binder in a naturally bonded sand or on that added to a synthetic sand.

⁸ Ries, H., Special Sands, Chap. XLI of Industrial Minerals and Rocks, A.I.M.E., New York, 1937.

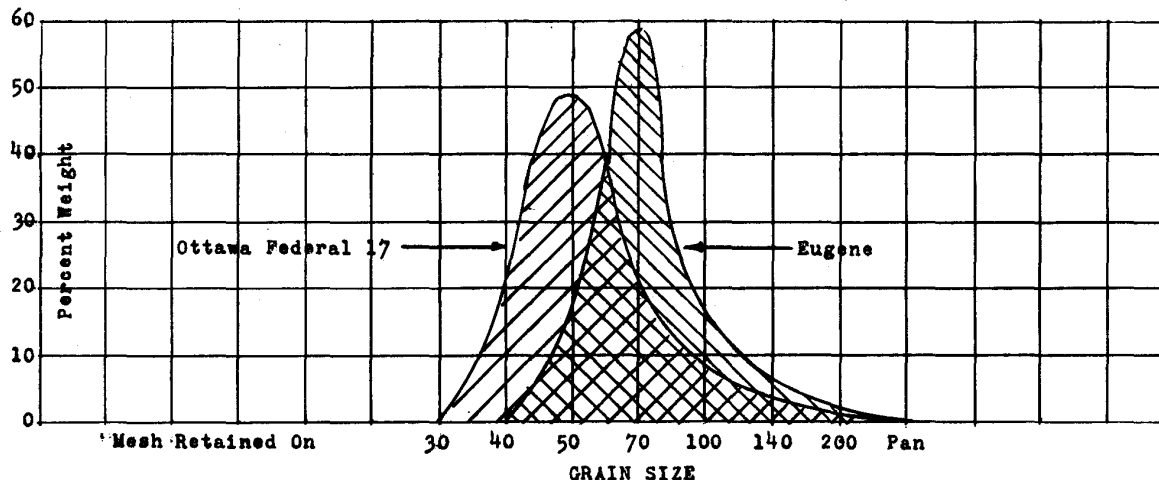
Although formerly most of the testing of foundry sand mixtures before making the molds and cores was done by an experienced foundryman who could tell by "feel," today many of the foundries have a special laboratory equipped for this testing. The various equipment includes apparatus for measuring the moisture content, the green (wet) permeability, the green strength, the dry permeability, the dry strength, the flowability, and the mold hardness of various sand mixtures.

Much of the silica sand supplied to the Pacific Northwest steel foundries comes from the Ottawa, Illinois, district where it is obtained from the St. Peter sandstone of Ordovician age. California and Nevada produce some silica sand but little reaches the Northwest. Although many sands in Oregon and the western United States can be used for gray or cast iron molds which must withstand temperatures generally below 2600° F., only a few can withstand the higher temperatures (2600° - 3000° F.) to which semi-steel and steel molding sands are subjected. To withstand these higher temperatures, the sand must be made up of only refractory mineral grains. Of the more common sand minerals, quartz is the only satisfactory one. Most Oregon sands contain a high percentage of feldspar grains which fuse at the temperatures at which steel is poured and thus they cannot be employed in steel foundries. Some research has been done on the use of crushed olivine as a foundry sand but as only the high magnesium varieties of olivine, $(\text{Fe}, \text{Mg})_2\text{SiO}_4$, are highly refractory and as they are relatively uncommon, the work has not resulted in any known commercial use. However, as Oregon and Washington are two of the few states where olivine-rich rocks occur, it is possible that further field investigation will discover high magnesium olivine deposits near enough to transportation to become of commercial interest.

Characteristics of Eugene sand:

The Eugene sand is one of the few high-grade steel foundry sands being produced in the western United States and is the only one in Oregon.

The properties of the Eugene sand for steel foundry use are somewhat similar to those of the Ottawa sand. The Eugene sand is somewhat finer than the Ottawa Federal 17 grade and as already mentioned, the report by the Naval Research Laboratory, Washington, D. C., notes that the Eugene sand is strikingly similar in fineness and other properties to a sand from the Millville area of New Jersey which is used extensively by steel foundries in the East Coast region. The report further noted that both of these sands are somewhat coarser than the average sand used for steel moldings in eastern foundries. The trend of foundry practice in the East appears to be toward the employment of finer sands. In spite of its somewhat finer grain size, the permeability of the Eugene sand is nearly equal to or greater than that of Ottawa Federal 17. This is attributable to its greater uniformity of grain size as illustrated in the accompanying diagram.



Ottawa Federal 17 is a product of screening whereas the Eugene sand is naturally graded. The possible explanation of the surprising uniformity of the grain sizes of the Eugene sand is mentioned on page 12. Unlike the rounded grains of the Ottawa sand, those in the Eugene deposit tend to be subangular and like those of the leading East Coast sands.

Apparent advantages of the Eugene sand over the Ottawa Federal 17 are that it permits the use of a finer sand without loss of permeability, which makes for cleaner castings; also the Eugene sand makes a stronger mold, as its subangular grains tend to interlock, whereas the rounded grains of the Ottawa sand do not. Actual measurements gave greater strength values for the Eugene sand, and its dry shear strength value was more than twice as great as that of the Ottawa. The partial film of clay left on many of the Eugene sand grains after washing is probably partly responsible for this greater strength.

A recent report by Mr. Roy Simpson, foundry foreman of the Oregon Steel Foundry, on tests conducted by them on the Eugene sand follows:

Base test on straight run of Eugene silica sand was 200 permeability which was too high for the 10,000-pound gear blank on which the test was to be made. By the addition of 75 pounds of banding sand and 150 pounds of silica flour the permeability was lowered to 140 which was considered about right for the test casting.

<u>Final Mixture</u>		<u>Final Green Sand Specifications</u>	
1000	lb. Eugene sand	Moisture	5.1 %
75	lb. Banding sand	Permeability	140
150	lb. Silica flour	Green compression	
6	gal. Corn flour	strength	7.5
4½	gal. Bentonite		
4½	gal. Fire clay		
		After air drying for 4½ hrs. the green comp. strength was raised to 14.4. No test on the dry shear was made.	

Type of test casting - 10,000 pound gear blank cast steel. Condition of mold before pouring: Excellent. Fine surface. Good and firm. Observations made through large shrink head while pouring. Molten metal did no cutting or scabbing on mold surface while being poured. In general the mold surface exhibited great hot strength, a quality greatly desired in the steel foundry. The mold gases generated while pouring seemed about the same as the Ottawa sand and were readily exhausted in the usual manner.

After the casting had cooled the sand broke away or peeled off very easily, or just as good as the Ottawa sand. After the casting was sand-blasted the amount of sand found burned in next to the heavy fillets on the casting was found to be less than the usual amount on the Ottawa sand casting.

We have made over 75 of these large steel castings and we can say that the Eugene sand used on this test gave us the least of all in cleaning time in regard to sand that is usually found burned in or fused together due to the great heat that a molding sand must stand up under.

/s/ Roy Simpson
Foundry foreman

Conclusion:

The Eugene sand is being marketed in Portland at \$8.75 a short ton. Ottawa Federal 17 sells for about \$11. The price favors the use of the Eugene sand in the Portland area, and as all the testing work done to date has been very encouraging, it appears that the Eugene silica sand not only will be widely employed in the Portland area but elsewhere on the Pacific Coast as well.

MIRACLE BATTERY USES MERCURY*

Tiny but incredibly powerful dry batteries which use mercury as a prime component are now helping win the war in the Pacific. Walkie-talkies and mine detectors are using the new midget-sized long-life cells. One size of the revolutionary cells measures only three-eighths of an inch long but develops as much power as a standard sized flashlight battery, and runs five times as long.

The impact of the new use for mercury is reflected in the upward surge in market quicksilver quotations. Some months back flasks of the metal were quoted at less than \$100 but market price has now risen to \$165. To supply the sudden demand for mercury the Metals Reserve Company has released supplies from its stockpile.

The new battery was invented by M. S. Ruben, an electro-chemist of New Rochelle, New York. Manufacturing rights are held by the P. R. Mallory Company, Indianapolis, which worked in close cooperation with the Army Signal Corps. Although not available yet for general civilian use the postwar possibilities are tremendous, especially where size and weight are important. More expensive to manufacture than the familiar dry cell, the new mercury cell will nevertheless find much use where longevity, bulk, and performance in tropical conditions are critical factors. Some experts predict that as much as 50 percent of postwar mercury production will go into the new batteries, and that the former peace time demand will be doubled.

The present type of dry cell is not destined to a postwar demise, however. Larger units of the old style battery are superior to the mercury unit, and the old cells function better in subzero temperatures.

Suggested uses for the midget batteries are power units for hearing aids, portable battery radios and close-range short-wave radios. Aside from the visible disparity in sizes, the "new" and "old" batteries differ greatly in their composition and structure. The old type battery is encased in a zinc can filled with a mixture of sal ammoniac and manganese dioxide, with a carbon rod in the center for a positive pole. The mercury battery is enclosed in a steel container which is its positive pole. A coil of impregnated layers of paper and zinc surrounded by mercuric oxide fills the unit and an insulated zinc pellet at one end serves as the negative pole. The old battery cannot be packed in airtight since it "breathes" through its walls. The new cell is hermetically sealed and can be tightly packed. The new cells have turned out 93.6 volts from a space $1\frac{1}{2}$ inches in diameter and less than 12 inches long, into which 72 units had been placed.

* Abstracted from the Pacific Coast Edition of the Wall Street Journal, January 19, 1945.

MERCURY IN DECEMBER 1944

The following monthly mercury report was released by the U.S. Bureau of Mines on February 12, 1945.

Salient statistics on mercury in the United States in 1939-44 in flasks of 76 pounds each

Period	Production	Consumption	Stocks at end of period		Price per flask at New York
			Consumers and dealers 1/	Producers 2/	
	Average Monthly				
1939 . . .	1,553	3/ 1,742	12,600	376	\$ 103.94
1940 . . .	3,148	2,233	14,100	607	176.87
1941 . . .	3,743	3,733	12,400	439	185.02
1942 . . .	4,237	4,142	10,700	1,377	196.35
1943 . . .	4/ 4,327	4,542	13,200	3,457	195.21
	Monthly				
1944:					
January .	4,400	3,400	11,300	5,459	151.60
February	3,800	3,700	9,400	5,450	130.00
March . .	3,800	3,600	9,900	5,011	130.00
April . .	3,700	3,200	9,700	5,604	128.20
May . . .	3,400	3,100	8,900	6,171	115.54
June . . .	3,000	3,400	9,000	5,757	101.69
July . . .	2,700	3,000	9,300	4,025	100.56
August .	2,500	3,900	9,100	2,252	104.04
September	2,500	3,900	8,400	1,936	104.28
October .	2,700	3,900	7,400	2,550	109.20
November	2,300	3,900	7,800	2,094	116.30
December	2,500	3,900	10,400	2,714	128.88
Total	37,300	42,900	----	----	5/ \$ 118.36

1/ Largely excludes redistilled metal. 2/ Held by reporting companies. 3/ Apparent consumption.

4/ Based on final figures. 5/ Average.

LIME PLANT REPORTED CLOSED

The lime plant of the Washington Brick and Lime Company at Williams has been closed, according to a report in the Grants Pass Courier of February 14. It is stated that the shutdown became necessary mainly because of lack of manpower, as most of the employees have been drafted. A secondary reason reported was that machinery replacements are required, which would be greatly delayed in delivery.

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STOCK PILING

The last Congress passed a Surplus Property Act (Public Law 457, 78th Congress) which left unsettled problems connected with disposal of surplus minerals and metals. In Section 22(d) of the Act, Congress directed

"Within three months following the enactment of this Act the Army and Navy Munitions Board shall submit to Congress its recommendations respecting the maximum and minimum amounts of each strategic mineral or metal which in its opinion should be held in the stock pile authorized by the Act of 7 June 1939. After one year from the submission of such recommendations, unless the Congress provides otherwise by law, the Board may authorize the proper disposal agencies to dispose of any Government-owned accumulations of strategic minerals and metals including those owned by any Government corporation when determined to be surplus pursuant to this Act."

The recommendations of the Army and Navy Munitions Board have been submitted to Congress in a report entitled "Strategic Materials," dated January 6, 1945, printed in Senate Document No. 5, 79th Congress, 1st Session.

This document is partially abstracted below under the headings as given in the report. Although much of the information having to do with the need of stock piling in the early part of the report was fully understood and voiced by the mining industry before the War, some of the ideas will bear repetition because they should not be forgotten.

I Necessity for stock piling:

(A) War shipping:

At the beginning of a war emergency, the great need for allocation of shipping to meet requirements of the armed forces makes it urgent that adequate supplies of strategic materials be kept stored so that shipping need not be diverted from direct war needs in order to import such materials. To illustrate this point from conditions existing at the beginning of the present war, the report states:

"While the Far East was completely shut off, other areas became inaccessible in varying degrees as the result of enemy action. Shipping routed to India, the east and west coasts of Africa, and to South America became endangered and the Mediterranean was practically closed to traffic. Consequently, supplies of material had to go by circuitous and hazardous routes, and large shipping tonnages were thus tied up for long periods of time. In an effort to shorten the time lag in transportation from foreign countries to the war plants in the United States, substantial tonnages of certain heavy materials had

to be flown from China, Africa, India, and South America. As another example, we note that in the winter of 1942-43 substantial tonnages of bauxite from the Guianas were lost due to submarine sinkings; these losses, in turn, threatened to curtail aluminum production, placed an additional burden upon domestic mining facilities, and drew labor from other important war production."

Also it is mentioned that shipping used in transporting vital war materials must be convoyed, thus using Naval vessels needed for direct military operations.

(B) Expanded requirements in war:

The problem of expanding production of raw materials quickly enough in time of war is discussed, and it is stated that "considerable time is required to develop new sources of supply and to increase the production of existing mines and smelters."

(C) Wartime efficiency:

Adequate stock piles insure efficient allocation and the elimination of competition among procurement and consuming agencies such as prevailed to some degree in 1941 and 1942. It is obvious that labor and equipment could be more advantageously used than in accumulating materials that should have been stock-piled.

(D) Depletion of domestic reserves:

Because of the enormous demands for certain minerals and metals during this war, domestic reserves have been greatly depleted. Quantity of minerals produced in 1943 was 57 percent greater than the output in 1918 and 23 percent above that in the boom year 1929. It is stated that, "the continuance of the existing domestic program of exploration of natural resources is clearly imperative. In addition, the rapid depletion of our domestic reserves emphasizes the extreme importance of developing a program for obtaining information on the location and extent of world resources and for acquiring stock piles of raw materials in which this country is largely deficient." *

* No one will deny the crying need for development of new ore reserves, but no mention is made of the inability of the mining industry to prosecute new development work because of lack of manpower, nor is mention made of the serious lack of exploration for new mineral deposits by private capital owing to Federal Government regulations, including taxes. It is perfectly obvious that mineral reserves must be seriously depleted if mining is carried on at an unprecedented rate and at the same time development work in existing mines is reduced, and no systematic exploration is undertaken by private capital. It should be pointed out that in this country the individual prospector cannot secure supplies, and the small mine producer is discouraged by restrictive taxes. Venture capital which is needed for new mining projects has disappeared owing to severe regulations which control issuance of new securities, and Government competition in loaning money. The exploration programs undertaken by Government bureaus are wholly inadequate for discovering and developing new mineral supplies in the magnitude required to maintain mineral reserves. These programs may supplement in small measure but they cannot successfully replace projects by experienced private companies. (Ed.)

(E) General considerations:

It is stated that under the stock-piling act of 1939, stocks of manila fiber, quinine, and crude rubber, as well as the purchases by Reconstruction Finance Corporation of manganese and tin, were of incalculable value in prosecuting the war. Credit is given manufacturers of the nation in building up stocks of needed materials before the war. It is noted that "Much effort and time could have been saved for other important tasks had a program been started well in advance of the war to accumulate strategic raw materials and to plan for the expansion of facilities for their production. Moreover, during the last two major conflicts this country has been fortunate in having access to large foreign sources of raw materials in friendly countries. A different alignment of nations in a future war, involving enemy control of different geographic areas, might drastically curtail the movements of such materials into the United States."

II Recent stock-pile history and legislation:

The acts authorizing purchase of strategic and critical materials are enumerated, the amount of the appropriations are given, and the amounts expended are tabulated. Finally by the act of June 25, 1940, the Reconstruction Finance Corporation was given broad powers "to produce, acquire, and carry strategic and critical materials as an aid to the Government in its national defense program." (The figures given show the striking inadequacy of the prewar stock-piling program. Even when war was seen to be inevitable, there was a definite lag in stock-piling results. Ed.)

III Development of stock-pile policy:

In the early period of the war, it is stated that estimates of strategic materials for war needs had to be constantly increased.

"Until August 1943 stock-pile objectives remained in general, on a 3-year emergency basis, but at that time the War Production Board adopted a policy establishing stock-pile objectives at 1 year's requirements. This was not, in most cases, a policy of retrenchment, for it had been impossible even to approach the desired goals. The Joint Chiefs of Staff, who had been asked to approve such a program, emphasized the importance of using the figure set for 1 year's requirements merely as a guide to over-all policy, and of considering specific materials on the basis of the particular circumstances affecting the supply of each material. This decision, in part, reflected an awareness of the adverse psychological effect of large stock piles on industry, which was anticipating with misgivings the effect of these accumulations at the end of the war. The War and Navy Departments indicated that they favored legislation which would give assurance to industry that the stock piles existing at the end of the current war would be sequestered for future national emergency or otherwise frozen to prevent disruption of industry."

Definitions of strategic and critical materials are revised and are quoted below:

"Strategic and critical materials are those materials required for essential uses in a war emergency, the procurement of which in adequate quantities, quality, and time is sufficiently uncertain for any reason to require prior provision for the supply thereof.

"The adoption of one broad definition with emphasis upon the importance of 'prior provision' and the recognition that physical stock piling represents only one of the several media for assuring adequate supplies of strategic and critical materials led to classifying such materials into three major subdivisions, based on the following corollary definitions:

"Group A comprises those strategic and critical materials for which stock piling is deemed the only satisfactory means of insuring an adequate supply for a future emergency.

"Group B comprises additional strategic and critical materials the stock piling of which is practicable. The Army and Navy Munitions Board recommends their acquisition only to the extent they may be made available for transfer from Government agencies, because adequacy of supply can be insured either by stimulation of existing North American production or by partial or complete use of available substitutes.

"Group C comprises those strategic and critical materials which are not now recommended for permanent stock piling because in each case difficulties of storage are sufficient to outweigh the advantages to be gained by this means of insuring adequate future supply.

"In addition to the materials included in the above groups, the conduct of a war requires the use of an encyclopedic list of semi-processed and processed materials, such as aviation gasoline, synthetic rubber, chemicals, drugs, ferro-alloys, steel, light metals, and the like. In order that peacetime production may be quickly expanded to a wartime footing, a constant review of the facilities available to meet anticipated requirements will be necessary, together with continuing studies of new processes."

* * * * *

The remainder of the Army and Navy Munitions Board report is concerned with recommendations. Some information on minimum and maximum quantities of materials which the Board believes should be stock-piled is considered confidential and is not pointed.

An appendix is attached to the report which contains (1) tabulation of stock-pile activity under act of June 7, 1939, and (2) lists of strategic and critical materials. (1) and part of (2) are reproduced below:

Table 1: Statistical summary of stock-pile activity under act of June 7, 1939.

Material	Unit of measure	Quantity purchased to Oct. 31, 1944	Quantity released to Oct. 31, 1944	Balance in stock pile Oct. 31, 1944
Cadmium	Pound	399,672.47	399,672.47	None
Chrome ore	Long ton	239,839	None	239,839
Industrial diamond	Carat	1,089,146.19	None	1,089,146.19
Manganese ore	Long ton	128,666	None	128,666
Manila fiber	Bale	146,057	146,057	None
Mercury	Flask	20,010	None	20,010
Mica:				
Block	Pound	700,646.5/8	700,646.5/8	None
Splittings	Pound	5,000,512.1/2	None	5,000,512.1/2
Monazite sand	Metric ton	2,934	None	2,934
Optical glass	Pound	12,176.75	12,176.75	None
Quartz crystals	Pound	52,413	14,718	37,695
Quinine hydrobromide	Ounce	1,491,457	None	1,491,457
Quinine sulfate	Ounce	7,194,749	4,917,382	2,277,367
Tin (pig)	Short ton	11,457	None	11,457
Tungsten ore	Short ton	5,830	None	5,830

CURRENT LIST OF STRATEGIC AND CRITICAL MATERIALS

Group A: Materials for which stock piling is deemed the only satisfactory means of insuring an adequate supply for a future emergency.

Agar	Cobalt
Antimony	Coconut oil ²
Asbestos: ¹	Columbite
Rhodesian chrysotile	Copper
South African amosite	Cordage fibers: ²
Bauxite	Manila
Beryl	Sisal
Bismuth	Corundum
Cadmium	Diamonds, industrial
Castor oil ²	Emetine
Celestite	Graphite:
Chromite:	Amorphous lump
Metallurgical grade	Flake
Refractory grade:	Hyoscine
Rhodesian origin	Iodine ¹
Other origin	Pyrethrum: ²
Jewel bearings:	Quartz crystals
Instrument jewels, except V jewels	Quebracho
Sapphire and ruby V jewels	Quinidine
Watch and timekeeping device jewels	Quinine ¹
Kapok ²	Rapessed oil ²
Kyanite, Indian	Rubber: ^{1 2}
Lead	Crude rubber
Manganese ore:	Natural rubber latex
Battery grade	Rutile
Metallurgical grade	Sapphire, and ruby
Mercury	Shellac ²
Mica:	Sperm oil ²
Muscovite block and film, good	Talc, steatite, block or lava
stained and better	Tantalite
Muscovite splittings	Tin
Phlogopite splittings	Tung oil ²
Monazite	Tungsten
Nickel	Vanadium
Opium ^{1 3}	Zinc
Optical glass	Zirconium ores:
Palm oil ²	Baddeleyite
Pepper	Zircon
Platinum group metals:	
Iridium	
Platinum	

1 Require special storage conditions.

2 Require rotation of stocks.

3 Stocks to be held by Treasury Department, Bureau of Narcotics.

GEOLOGIC MAP OF SALEM HILLS

Bulletin No. 15, Geology of the Salem Hills and North Santiam River Basin, Oregon, by T. P. Thayer, is out of print but the Department has on hand a few extra copies of the geologic map which accompanied the bulletin. These maps are for sale at 702 Woodlark Bldg., Portland. Price is 25 cents postpaid.

UNIT ODDS AND ENDS

The standard U.S. liquid gallon contains 231 cubic inches. The Imperial gallon, standard in Great Britain, is the volume of 10 pounds of pure water at 62° F. with barometer at 30 inches, or 277.4 cubic inches. The U.S. gallon is therefore 83.3 percent of the Imperial gallon.

- 1 U S. liquid gallon equals 3.785 liters equals 3785 cubic centimeters.
- 1 fathom equals 2 yards equals 6 feet.
- 1 furlong equals 660 feet equals 1/8 mile.
- 1 nautical mile equals 6080.2 feet equals 1.1516 statute miles. It is defined by the U.S. Coast and Geodetic Survey as the length of one minute of arc of a great circle of a sphere the surface of which equals the earth.
- 1 knot equals 1 nautical mile per hour equals 1.8532 kilometers per hour.
- 1 league equals 3 nautical miles.
- 1 acre equals 43,560 square feet equals 4046.9 square meters equals 208.71 feet square.
- 1 hectare equals 1000 centares or square meters.
- 1 short ton equals 2000 pounds equals 907.18 kilograms.
- 1 long ton equals 2240 pounds equals 1.12 short tons equals 1016.1 kilograms.
- 1 metric ton equals 1000 kilograms equals 2204.6 pounds.
- 1 horsepower equals 550 foot pounds per second equals 745.7 watts or 0.7457 kilowatts equals 0.7066 B.t.u. per second.
- 1 British thermal unit equals heat necessary to raise 1 pound of water 1° F., 0.0002932 kilowatt hours equals 778 foot pounds equals 0.252 calories.
- 1 calorie equals heat necessary to raise 1 kilogram of water 1° C.
- 1 board foot equals volume of a board 12 inches square and 1 inch thick.
- 1 unit of sawdust equals 200 cubic feet.
- 1 verst (Russian) equals 3500 feet equals 0.6629 mile equals 1.0668 kilometer.
- 1 sagene (Russian) equals 7 feet.
- 1 pod (Russian) equals 0.01806 short ton.
- 1 vedre (Russian) equals 3.249 U.S. gallons.
- 1 pu (Chinese) equals 1.6 meters.
- 1 sheng (Chinese) equals 1.0355 liters.
- 1 liang (Chinese) equals 37.3 grams.
- 1 arreba (Spanish-American) equals 25.4 pounds.
- 1 vara equals 2.75 feet (Peru).
- 1 fanega equals 1.65 acre (Peru).

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IT IS JUST NOT SO
by

George W. Gleeson
Acting Dean of Engineering, Oregon State College

Criticism has been aimed at the curricula of our engineering schools for failure to include more "cultural" subjects, and engineers will be interested in facts presented by Dean Gleeson to show that engineers are not, as has been often alleged, deficient in understanding of subjects outside their own profession.

Engineers as a group lack culture, lack appreciation for the "finer" things of life, lack understanding of contemporary political, economic, and social institutions, and, in general, exist at an inferior educational level. DON'T YOU BELIEVE IT.

In the last two or three years, a distinct national pattern has developed in technical education wherein emphasis has been directed toward broader understanding of the social science fields. As a corollary to this development, the "appreciation fields" of art and literature have received due consideration. Perhaps the most significant outcome of the various deliberations is the recommendation recently adopted by the Society for the Promotion of Engineering Education in which it is suggested that technical curricula specify approximately 20 percent humanistic subject matter as a degree requirement. This recommendation has been the subject of extensive debate, but it is quite evident that the principle of a broader base for technical education is, in general, favored by the technological professions and curricula patterns are developing in this direction.

It should be emphasized that the above described trend reflects the deliberations of the technical fraternity, and that it is not in response to the pressure of various unaffiliated groups. Furthermore, the recommendations in no manner infer indorsement of any particular humanistic field or, what is more important, of current teaching practices or subject matter selection in these fields. Briefly, the technologists have concluded that it is evidently necessary for them to expand their activities outside the technical sphere if they are to accomplish their objectives.

It is not surprising, but it is unfortunate, that many groups have taken advantage of the circumstance of the broadening of the pattern, particularly of engineering education, to "grind their axes." The engineer has once again become the subject of discussion among the "cultured," and his "shortcomings" have been the theme of such effective propaganda that even many in the engineering profession have engaged in self condemnation. Suppose we adhere to our proved procedure and look at the facts.

The statement of Dr. W.S. Learned before the seventh session of the Conference on Examinations, Dinard, France, in 1938 gives a clue. Said Dr. Learned in part " . . . students of engineering absorbed far more general academic knowledge than students either of education or of business even when their average intelligence test records showed them to be of approximately the same ability." Surely, such a statement provokes further reading and reference to "The Student and His Knowledge", Bulletin 29, Carnegie Foundation for the Advancement of Teaching, provides somewhat startling information. The report is lengthy, and the following resume does not do justice to the study. To those who claim the engineer to be uncultured, the report gives an answer. IT IS JUST NOT SO.

Some ten years were devoted to the preparation and administration of a test battery which should indicate general cultural attainment. That the test was sound and adequate is indicated by the expressed opinions of the best authorities in the field. In brief, the battery consisted of 251 questions in fine arts, 346 questions in history and social studies, 333 questions on translated literature from languages other than English, and 292 questions in natural science, or a total of 1,222 questions assembled under the heading of GENERAL CULTURE. The scope of the battery can best be evaluated by reference to the report which gives a complete subject outline. For the purpose of this writing, it is sufficient to quote, "The engineers, for whom a general test in liberal arts and sciences would appear as little appropriate as for any group, from a curricular point of view, score a trifle better than the A.B. group for which the test might be thought to have been designed. Whatever superiority they display . . . would surely not be due to any advantage in their curriculum, which is more highly technical and therefore lies farther from the average demands of the test than any other."

The "trifle better" is reflected in Table I.

TABLE I
General Culture Scores of Curriculum Groups

	Test Scores			Number of Participants
	Minimum	Median	Maximum	
Engineering	65	280	755	543
Bachelor of Arts	55	275	725	1774
Bachelor of Science	65	259	645	1358
Business Administration	25	217	595	589
Education				
Arts College	25	235	565	608
Teachers College	45	211	555	796
Certificate	25	155	425	558

The results of Table I are not for a "selected" group. Some 49 institutions of high caliber participated, and the 6,226 individuals were scattered among 7 Engineering Schools, 35 B.A. Schools, 27 Schools of Science, 9 Schools of Business Administration, 9 Schools of A.B. or B.S. in Education, 12 Teachers Colleges, and 3 schools offering teaching (2-year) certificates. The "trifle better" amounts to this; by means of a test battery specifically designed to test general culture and taken over a wide enough range to eliminate any selected groups, the engineers showed evidence of higher cultural attainment than any other educational group.

There are further test results which are significant. The testing procedure was repeated over a time interval of two years (1930-1932) to test the progress in general cultural attainment. The report states, "The students in women's colleges made a mean gain of 0.65 sigma as compared to the general mean of 0.50 sigma. This fact possibly indicates that the opportunity for gain favored the literary, linguistic, and social studies of the usual women's curriculum. But there was a large group consisting solely

of engineers engaged in professional, non-literary studies which nevertheless gained 0.32 sigma, while a collegiate division in professional education, where social and literary tendencies would presumably dominate, remained almost unchanged." Did someone remark that culture was attained through courses of study?

Table II presents the results (broken down by proposed occupations) of the general cultural test for 2630 individuals. Note the top position of the technologist and note also that on a cultural test there is compatibility between the gain or progress overall and in the subject of greatest gain which would obviously be in the general science portion of the test.

TABLE II

Average Gains Of Prospective Occupation Groups, 1930-32

<u>Proposed Occupations</u>	<u>Number</u>	<u>Av. sigma position total score 1930</u>	<u>Av. gain '30-'32 sigma of 1930</u>	<u>Greatest gain in</u>	<u>Sigma (1930) value of greatest gain</u>
Engineers, chemists, technicians	292	56.7	.42	Gen. Sci.	.45
Journalists and writers	45	54.9	.55	For. Lit.	.70
Artists, musicians, dramatists	25	53.2	.73	Fine Arts	1.10
Physicians	187	53.1	.50	Gen. Sci.	.54
Librarians	32	52.2	.57	Fine Arts	1.05
Lawyers	177	51.6	.51	Soc. Studies	.84
Ministers	99	51.3	.60	For. Lit.	.85
Teachers (Arts Colleges)	1,036	50.0	.56	For. Lit.	.72
Business	290	49.4	.37	Soc. Studies	.47
Teachers (Teachers Coll.)	273	47.1	.56	For. Lit.	.66
Secretaries	72	47.1	.43	Soc. Studies	.50
Teachers (Health and Physical Education)	101	40.9	.29	Gen. Sci.	.35

It is of interest to compare results for a single institution. In this case, University of Pennsylvania with six major schools involved gave tests to 919 seniors. This test was somewhat broader than the general culture test battery, and the Moore School of Electrical Engineering represented the Engineering profession. Table III shows the placement of the engineering students.

TABLE III

Placement of Moore School of Electrical Engineering

<u>First place</u>	<u>Number of questions</u>	<u>Third place</u>	<u>Number of questions</u>
Mathematics	117	Languages	150
Physics	102	English Literature	183
Astronomy	40	Geography	29
Scientific Method	59	Biology	65
Politics	134	Modern Literature	65
Intellect. History	149	Oriental Civilization	36
Modern Science	61	Roman Civilization	125
Social Stud. Meth.	84	Social Theory	90
		German Literature	77

<u>Second place</u>	<u>Number of questions</u>	<u>Fourth place</u>	<u>Number of questions</u>
Economics	111	Natural Science	168
Legal Inst.	57	Econ. Pol. Hist.	298
Chemistry	115	Soc. Sci. Anthrop.	104
Bible	28	Greek Civilization	222
Fine Arts	161	Other Literature	79
Geology	37		
Education	49	<u>Fifth place</u>	
Modern Art	75	Social Conventions	52
French Literature	127	Near East	89
Religion	94	Prim. Society	50

Moore School was in Sixth Place in no subject.

In overall results, the Moore School of Electrical Engineering placed first in the 3482 questions with an average percentage of 24, the School of Education second with 22, the College of Arts and Science third with 20, the Wharton School of Finance fourth with 17, Towne Scientific School fifth with 16, and the School of Fine Arts last with 15.

It would be possible to digress at this point and effect an essay upon education in general and particularly upon the most recent propaganda entitled "fragmentation". Suffice to mention some very interesting data in Bulletin 29 which leads to the obvious conclusion that the sequential material of science and engineering creates permanent knowledge. This is less true with language, literature, and fine arts, and almost non-existent in the social sciences. To quote briefly " . . . as the students accumulate credits without knowledge in social studies, their knowledge in other fields does not increase; it actually recedes."

As a last reflection, but already rather widely recognized as "natural" selection, Table IV presents the intelligence test results of the individuals taking the cultural test battery.

TABLE IV

Intelligence-test Scores of Curriculum Groups

	<u>Test Scores</u>		
	<u>Minimum</u>	<u>Median</u>	<u>Maximum</u>
Engineering	27	61.4	75
Bachelor of Arts	21	57.3	75
Bachelor of Science	21	56.0	75
Business Administration	29	55.4	75
Education			
Arts College	22	52.7	74
Teachers College	23	51.9	75
Certificate	18	48.7	74

Note that the order of curriculum groups in Table IV is the same as in Table I. This would infer that the higher intelligence of the engineering group was responsible for their higher cultural attainments. This is an easy matter to examine, since it is possible to break each group down into sub-groups of equal intelligence and then compare the cultural scores of the equal intelligence groups. This breakdown was into six intelligence groups with 1 designating the lowest and 6 the highest intelligence score. The progress of each equal intelligence group over a two-year period can likewise be compared, since the data were so obtained. The results are given in Table V.

TABLE V
Achievement of Equal-ability Groups

	Test scores for intelligence groups					
	Low	1	2	3	4	5 6 High
Engineering	571	604	612	655	736	828
Liberal Arts	463	530	580	622	682	800
Education	413	498	527	535	603	651
Business Administration	405	466	505	549	616	676
Repeat Test (1932)						
Engineering	639	675	685	701	793	894
Liberal Arts	545	612	681	709	782	904
Education	459	523	563	611	680	704
Business Administration	445	501	550	607	663	747
Gain						
Engineering	68	71	73	46	67	66
Liberal Arts	82	82	101	87	100	104
Education	46	25	36	76	77	53
Business Administration	40	35	45	58	47	71

It appears odd that in no intelligence group under the Schools of Education and Business Administration did the students after a two-year interval match the score of the engineers in the first test. The conclusion might be drawn that even after two years of study, the students in Education and Business Administration were not as cultured as the freshman engineer. There is no factual indication that they would ever be.

From the foregoing brief resume of an extensive study, a number of far-reaching conclusions might be drawn; however, they are sufficiently obvious. It would be more pertinent to formulate a specific recommendation, namely, that the engineering profession should think better of the inherent qualities of a technical education, and should refuse to accept unsupported condemnation. That the engineer is uncultured is just not so. By the same token may we refrain from the condemnation of others, but one cannot help but wonder what the test scores would look like had the examination included technical subject matter compatible with the importance of technology in the culture of our present-day civilization.

OREGON ALUMINA RESERVES EXTENSIVE

Extensive new areas containing low grade bauxitic iron ore deposits have been found in Washington and Columbia Counties from 35 to 60 miles northwest of Portland, according to the Oregon Department of Geology and Mineral Industries. Some of these deposits have been mapped and sampled by the Department, and records of the exploration including analyses of samples, have been placed in open file at the Department office at 702 Woodlark Building, Portland, where they may be examined by interested persons. Later a report containing all the records will be published.

The Department began the study of these deposits more than a year ago, and a preliminary report describing deposits in Washington County was published in August 1944. Since then, investigations have been continued and the area containing the same type of deposits has been found to extend over a large part of Columbia County in addition to northern Washington County. In the aggregate, the deposits will contain many millions of tons of ore which could be cheaply mined.

According to the Department, these deposits are unique in mineral composition for occurrences of large extent. They are made up of an intimate mixture of aluminum and iron oxides in approximately equal amounts with minor amounts of titanium oxide.

High grade bauxite is the ore from which aluminum is now being produced. The ore is first treated to obtain pure aluminum oxide, or alumina as it is called, and the alumina is then reduced electrolytically in aluminum reduction plants to produce aluminum metal. All alumina for Northwest aluminum plants is now being produced in the east and hauled across the country to Oregon and Washington. The process now being employed to produce alumina from high grade bauxite would not be applicable to the Oregon ore.

Alcoa Mining Company has recently announced plans for investigating the Oregon deposits. According to the announcement, the investigation will include drilling and sampling to determine size and quality of deposits as well as metallurgical testing to attempt to work out an economic method of ore treatment.

QUICKSILVER REPORT

The monthly mercury report for February 1945 issued by the U.S. Bureau of Mines April 10, 1945, gives a tabulation of statistics as given below. According to this release it is currently reported that mercury from Spain would soon be available in the domestic market. The average quoted market price in February was nearly \$166 a flask.

Salient statistics on mercury in the United States in 1939-44
and in January and February 1945, in flasks of 76 pounds each

and in January and February 1945, in flasks of 75 pounds each					
Period	Production	Consumption	Stocks at end of period 1/ Consumers and Producers		Price per flask at New York
			dealers 2/	3/	
	Average monthly				
1939	1,553	4/ 1,742	12,600	376	\$ 103.94
1940	3,148	2,233	14,100	607	176.87
1941	3,743	3,733	12,400	439	185.02
1942	4,237	4,142	10,700	1,377	196.35
1943	4,327	4,542	13,200	3,457	195.21
1944:	Monthly				
January . .	4,400	3,400	11,300	5,459	151.60
February .	3,800	3,700	9,400	5,450	130.00
March . . .	3,800	3,600	9,900	5,011	130.00
April . . .	3,700	3,200	9,700	5,604	128.20
May	3,400	3,100	8,900	6,171	115.54
June	3,000	3,400	9,000	5,757	101.69
July	2,700	3,000	9,300	4,025	100.56
August . . .	2,500	3,900	9,100	2,252	104.04
September .	2,500	3,900	8,400	1,936	104.28
October . .	2,700	3,900	7,400	2,550	109.20
November .	2,300	3,900	7,800	2,094	116.30
December .	2,500	3,900	10,400	2,714	128.88
Total . . .	37,300	42,900	- - -	- - -	\$ 118.36 5/
1945:					
January . .	2,500	5,200	9,000	1,852	\$ 156.85
February .	2,700	5,100	12,000	1,189	165.55

1/ Based on location rather than ownership. 2/ Largely excludes redistilled metal.

3/ Held by reporting companies. 4/ Apparent consumption. 5/ Average.

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SERPENTINE - SUPERPHOSPHATE FERTILIZER

A discovery by a New Zealand chemist showed that serpentine, essentially magnesium silicate, mixed with commercial superphosphate produced a superior fertilizer at a lower cost to the farmer. Because of the widespread occurrence of serpentine in certain areas of Oregon, the Department wished to obtain authoritative information concerning this adaptation of serpentine for fertilizer and wrote to the Mines Department of New Zealand to obtain up-to-date information. The following letter was received in reply:

"Mines Department
P.O. Box 184, Te Aro
Wellington, New Zealand
16th January, 1945

"Dear Sir,

I have to acknowledge receipt of your letter of November 10th containing an enquiry as to the use of serpentine in fertilizers in New Zealand.

Finely ground serpentine is used in the preparation of serpentine superphosphate which is prepared by mixing 1 part of ground serpentine with 3 parts of hot superphosphate. The resulting mixture has many advantages on the straight superphosphate in particular the drying of the serpentine and superphosphate mixture due to the binding of hygroscopic water into water of crystallization of the new phosphate compounds formed during the reaction between the components of the mixture, facilitates the application of the fertilizer to the ground by the drilling machine, preserves the containing bags and generally makes for easier handling. Again the reaction results in the reduction of water soluble phosphoric acid to less than 4 per cent while the content of citric acid soluble phosphoric acid remains unchanged. The reduction on content of water soluble phosphoric acid is accompanied by a marked increase in the water soluble magnesium while silica and iron also appear in a readily soluble form. As the result of extensive field trials, it has been established that serpentine superphosphate is in all cases equal in value to standard superphosphate while in many cases it possesses greater value.

Its use has now become obligatory in New Zealand as owing to the occupation of Nauru Island by the Japanese, New Zealand is cut off from its main source of rock phosphate while there are enormous deposits of serpentine available in New Zealand. The use of serpentine helps to eke out our limited supplies of rock phosphate.

In 1943 some 62,000 tons of serpentine were used by the fertilizer industry in New Zealand as against 31,000 tons in 1942. Present indications are that the use of serpentine will expand and will be maintained even in after war years when phosphate supplies are again readily available.

"The germ of the idea was obtained from Russia where dunite has been used with the more concentrated triple superphosphate. Particulars of the Russian work by I.V. Druschinin are contained in Transactions of Science Institute for Fertilizers and Insecto-fungicides, Leningrad, (1936) while references to this work are contained in American Chemical Abstracts in particular in 30,8493 (1936) and 31,3193 (1937).

References to local practice will be found in issues of the New Zealand Journal of Science & Technology in particular the issues May 1942, September 1942, and November 1942.

Yours faithfully,

/s/ C.N. Benney
Under-Secretary"

An abstract from the New Zealand Journal of Science and Technology, issues of May, September, and November 1942*, provides some additional information concerning the technology of this fertilizer.

Results of experiments conducted in Russia showed that when from 8 to 9.5 percent dunite was added to the superphosphate, plant growth was greater than with straight triple superphosphate. This extra boost is attributed to the magnesia and colloidal silicon dioxide provided by the addition of the dunite. Raw, commercial triple superphosphates and the less concentrated superphosphates are difficult to handle due to excess moisture, which being acidic, attacks the containing bags. Also, the same moisture tends to make lumps which cause difficulty when distributed by means of a drill. The reduction of the excess acidic moisture is accomplished in two ways: first, the acid is neutralized by the dunite, and second, the excess moisture is taken up by rendering the material less hygroscopic. Although the Russians were merely attempting to neutralize their superphosphate without destroying any of its beneficial effects, the New Zealand process causes wholesale reversion of calcium superphosphate by addition of as much as 25 percent serpentine. This reversion, resulting in a lessening of water-soluble P_2O_5 without any decrease in the citrate-solubility, does not affect the fertilizing value of the serpentine-superphosphate. The unusual feature of this reversion is that the complex chemical reactions can take place in a dry, or nearly dry state, and at normal temperatures. The serpentine is merely finely ground (92.4 percent -100 mesh; 81.5 percent -165 mesh) and intimately mixed with three or four times as much superphosphate. When mixed dry the reaction between the two constituents was virtually complete at the end of two weeks. When 5 percent water was added during mixing, the reaction was greatly accelerated and was practically complete in four days.

A comparison of the water-soluble constituents of commercial superphosphate, dry mixed serpentine and superphosphate (1:3), and wet mixed serpentine and superphosphate (1:3) is given in the table below:

	Water-soluble constituents			
	P_2O_5	CaO	MgO	SO_3
	20.5 %	14.5 %	0.3 %	10.6 %
Superphosphate				
Serpentine-superphosphate, dry mix 14 days after mixing	7.90	3.3	2.2	3.6
Serpentine-superphosphate, wet mix 14 days after mixing	1.68	2.23	1.05	3.70
Small factory sample, wet mix (1:3) 12 days after mixing	6.46	2.23	2.05	2.76

* Copies obtained through the courtesy of Professor George W. Gleason, Oregon State College.

From the table it will be noted that the dry-mixed sample did not react as completely as either of the two wet mixes. Difficulties in properly wetting the small factory samples, plus near-freezing temperatures during the test probably account for the difference between the two wet mixes. By allowing a greater reaction time for the factory sample an analysis much closer to the laboratory wet mix was obtained. Both wet-mixed batches became dry enough to use after three or four days and were dusty by the time the experiment ended. This apparent drying up is not due so much to any real moisture loss as it is to a redistribution of the contained water between hygroscopic water and water of crystallization.

EARLY OREGON MINING REGULATIONS

In the early days of western mining when activity was practically all confined to placering by individuals or groups, it was soon found necessary by the miners to adopt strict regulations to prevent abuses and inequities by those who had no concern for the rights of others. The following reproduction from The City Journal of Canyon City, Oregon, January 1, 1869, gives the rules adopted for the John Day District in 1862. These rules show the result of experience in other boom districts starting at Coloma, California in 1848.

The City Journal

"A Paper for the Miner, Farmer, Mechanic and Professional Man."

Vol. 1

Canyon City, Grant County, Oregon, January 1, 1869.

No. 2

MINING LAWS OF JOHN DAY DISTRICT,

Adopted by the Miners, at Canyon City,
on Wednesday, Dec. 31, 1862.

Article 1. - This district shall be known as John Day Mining District, and shall hereafter be considered to contain all the territory embraced within the following bounds: Beginning at a point on John Day river on a straight line with the dividing ridge lying on the west side of Canyon creek; thence following said ridge to the dividing ridge separating the waters of the Malheur from those of John Day; thence following said ridge in an easterly direction to the summit of the main ridge adjoining and east of Bissel's creek; thence down said ridge to John Day river; thence down said river to place of beginning.

2. There shall be a Recorder elected, who shall hold office for one year from the date of his election or until his successor be elected, whose duty it shall be to keep a record of all miners' meetings held in the district; to record all claims, when requested by the claimants, in a book to be kept for that purpose; and to call miners' meetings, by posting notices in three public places in the district, when seven or more miners of the district shall present him with a petition stating the object of the meeting: provided, that in the absence of the Recorder the above named number of miners shall not be disqualified to call a meeting.

3. All claims located in this district, after the passage of these laws, shall be of the following size, viz.: A Creek Claim shall be seventy-five feet running with the stream, and extending from high water mark to high water mark. A Bank Claim shall be seventy-five feet running with the stream and extending back three hundred feet from creek claims. A Tunnel or Shaft Claim shall be seventy-five feet front and extending to the center of the hill. A Surface Claim shall be one hundred and fifty feet by one hundred feet. A Gulch Claim shall be one hundred and fifty feet running with the gulch and fifty feet in width on each side of the channel.

4. No person or persons shall be allowed to hold more than two full claims within the bounds of this district by location, nor shall they consist of more than four parcels of ground the sum of the area of which shall not exceed two full claims; provided, nothing in this article shall be so construed as to prevent miners from associating in companies to carry on mining operations, such companies holding no more than two claims to each member, one of which must be of one class of claims and the other one of another class of claims.
5. That each gulch, bank and surface claim shall be worked within five days after the date of location, if water can be obtained.
6. That each person or company holding tunneling or shafting claims, in order to hold the same, shall be required to perform work to the amount of two days in each week. Work done on any part of a company's claims secures the title to the whole of it.
7. All persons holding claims in Canyon creek are exempted from working the same until the 15th of June next.
8. All work done preparatory to working claims, such as procuring sluice boxes or other machinery, digging tail or drain races, or cutting ditches for the purpose of bringing water upon the said claims, shall be considered the same as work done upon said claim or claims.
9. Any person or persons claiming more ground or claims than the laws of this district entitles them to forfeits all right and title to any claim whatsoever, and any and all claims of such person or persons are hereby subject to re-location.
10. Any and all claims now located, or that may be located and worked, can be laid over at any time, for any length of time not to exceed six months, by the person or persons holding the same appearing before the Recorder of the district, with two or more disinterested miners, who shall certify over their own signatures that the said claim or claims cannot be worked to advantage, and by having the same recorded according to the law of the district and by paying a fee of fifty cents each; provided that each claimant shall sign the record in person or by legal representative, stating at the same time that said claim is held by location or by purchase.
11. All persons may hold any number of claims by purchase, provided they are represented according to the provisions of the foregoing laws, provided such claims shall be shown to be bona fide purchases.
12. Claims shall be forfeited when parties holding them have neglected to fulfill the requirements of the proceeding articles, or have neglected working them for five days after water can be procured, unless prevented by sickness or other legal cause.
13. Any person or persons working bank, hill, gulch or surface claims shall not be allowed to run their tailings upon river or creek claims to the injury of the parties while working said river or creek claims.
14. The holders of a claim or claims shall have the right to work the same without any hindrance from later claimants. Subsequent locaters shall not be allowed to dam up the water so as to turn it back on the prior claim, nor to run tailings, nor to erect any obstruction to the detriment of the prior claimants.
15. From and after this date, parties owning claims in a creek, ravine or gulch, shall be entitled to cut a tail or drain race through any ground below them; such tail race shall be cut through the lowest point in the center of said creek or gulch, and any or all dirt that comes out of the aforesaid race shall be deposited on the bank. Any objection, if such should be made, shall be left to the decision of four referees, and in case of disagreement, they to choose an umpire.

16. It shall be the duty of the Recorder to place on Record all claims brought to him for that purpose, when such claims shall not interfere with or affect the rights and interests of prior locaters, recording the same in order of their date; for which service he shall receive fifty cents for each claim recorded, and fifty cents for recording transfers, bills of sale, deeds of and to any mining property. It shall also be the duty of the Recorder to keep his books open at all times to the inspection of the public. He shall have the power to appoint a deputy, for whose official act he shall be held responsible.

17. The limits of this district shall not be changed without the consent of a regularly called mass meeting of the miners of the district.

18. No miners' meetings held outside of Canyon City for the purpose of making laws to govern any portion of the district, or to amend these laws in any manner, shall be considered as legal.

19. No Asiatic shall be allowed to mine in this district.

20. These laws may be altered or amended by a two-third vote of those present owning claims in the district, at any time ten days' notice of such intention shall have been given by posting notices in three public places in the district.

21. All mining laws made previous to the foregoing are hereby repealed.

Geo. L. Woodman,
Recorder.

Dec. 31st, 1862.

BAUXITE FOUND NEAR SALEM

High-grade bauxite float has been found by the Oregon Department of Geology and Mineral Industries in several localities both north and south of Salem. Pieces of this float made up largely of gibbsite, a well known bauxite mineral, are scattered widely over the surface, and also occur as nodules distributed in the overburden at places in the southern part of the Eola Hills and in several localities in the Salem Hills. Chemical analyses of this float show 50 to 60 percent alumina, 1 to 13 percent iron, and 2 to 6 percent silica. The Department has been searching for and investigating bauxite deposits for over a year.

As exposed in some roadcuts under this float material, low-grade high iron bauxite occurs as a bedded deposit several feet thick, similar in chemical characteristics to the ferruginous bauxite found in Washington and Columbia Counties and described in a recent report issued by the Department. Alcoa Mining Company is now making an extensive investigation of the Washington County deposits.

Samples so far analyzed by the Department indicate that the Salem low-grade ferruginous bauxite contains about 35 percent alumina, 20 percent iron, and 10 percent silica. Insufficient sampling has been done to predict what the average grade will be for all deposits.

From the small amount of field work so far done by the Department, the deposits in the Salem area appear to have large areal distribution and reserves may be extensive.

According to the Department, the large amount of high-grade gibbsite found as float may be significant. This float is much more common in the Salem area than in Washington and Columbia Counties. Whether or not the large amount of high-grade float material will prove to be commercially important has not yet been determined. If it is proved to occur in large enough quantity, it will be highly important as a source of alumina to supply Northwest aluminum plants. High-grade bauxite is also important in the chemical industry, as a refractory, in oil refining, and as an abrasive. The Department plans further field work in the Salem area with particular attention to commercial possibilities of the high-grade material.

Sampling records of the Salem deposits are on file in the Department office at 702 Woodlark Building, Portland, and may be examined by interested persons.

SPECTROGRAPHIC ANALYSES OF OREGON CLAYS

Recently spectrographic analyses were made by the Department on specimens of clays from the Hobart Butte and Molalla deposits. This preliminary work was to indicate the elements in the clays which occur in minor amounts. Further work in the study of more representative samples is planned. The Hobart Butte specimen was a piece of white kaolinite with no arsenic minerals. The Molalla clay specimen was light-gray in color and probably was representative of relatively high iron. Following are the analyses of the two specimens:

<u>Hobart Butte</u>		<u>Molalla</u>
Concentration	Element	Element
Over 10%	Silicon	Silicon
	Aluminum	Aluminum
10% - 1%	Titanium	Titanium
	Strontium	Iron
	Sulphur	
1% - 0.1%	Calcium	Calcium
	Iron	Magnesium
	Barium	Sulphur
0.1% - .01%	Zirconium	Zirconium
	Chromium	Chromium
	Vanadium	Vanadium
	Lithium	Lithium
	Boron	Sodium
		Manganese
.01% - .001%	Magnesium	Barium
	Manganese	Strontium
.01% - .001%		Cobalt
		Nickel
		Boron
Below .001%	- - -	- - -

CLEARING HOUSE

CH-No. 83: For Sale, gold mine, Idaho County, Idaho, about 2½ miles south of Dixie postoffice. Known as Robinson Dyke. Large tonnage available. Surface mining methods may be employed. Formerly produced concentrates shipped to Bunker Hill smelter. Anyone interested should write or see owner, Mrs. Mary Robinson, King Albert Apts., 1809 S.W. 11th Avenue, Portland, Oregon.

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STATE OF OREGON
DEPARTMENT OF GEOLOGY & MINERAL INDUSTRIES

PORTLAND, OREGON

THE ORE.-BIN

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A GEOLOGICAL QUIZ

Two evening meetings of the Geological Society of the Oregon Country, recently, were given over to "quiz" programs at which written questions were answered by members of a group of geologists. The programs were entirely unrehearsed. Some of the questions of general interest and their answers are given below. A few of the answers have been expanded somewhat in order to include pertinent references.

Where is the oldest formation in Oregon?

As fossil evidence is missing in the older metamorphic rocks, it is difficult to name accurately the oldest formation in Oregon. Schists in southern Jackson County near the California line are believed to be a part of the Abrams mica schist or the Salmon hornblende schist, both of which are more extensive in northern California. The age of these formations is tentatively given as pre-Cambrian as they are older than nearby Paleozoic strata. The Colebrook schist of Curry County is a metamorphic rock that is assigned to a pre-Devonian age. It may be of similar age to that of the Abrams and Salmon schists.

The Burnt River schists of northeastern Oregon which crop out near Baker, Oregon, are probably lower Paleozoic in age although there is little evidence for dating them.

What is the oldest fossil found in Oregon?

As fossil evidence is missing in most of the older rocks, the oldest known fossils are much younger than some of the rocks found in Oregon. Mississippian fossils (about 300 million years old) from the Suplee area are probably the oldest fossils that have been accurately determined. Horn corals and certain straight-coned cephalopods have been found in the Ironside Mountain area southwest of Baker in eastern Oregon. These may be Ordovician to Devonian (about 400 million years) in age and if so would be the oldest known fossils in Oregon.

What is the origin of bauxite?

Bauxite is the product of weathering in a moist, tropical or sub-tropical climate. Such weathering is called laterization. The parent rock must have little or no quartz and be upon a low-lying terrane in which the water table is high and erosion negligible. Such weathering results in leaching of soluble salts and combined silica from the rock, leaving an aluminous concentrate in the weathered rock called laterite. If this concentration of alumina is carried far enough bauxite is formed.

Please comment on the earthquake of May 1945 which was felt in the vicinity of the Good Samaritan Hospital and State Medical School. Is there a fault in this locality?

The shock referred to was felt by relatively few people and there might be some question as to its true origin, as heavy trucks, trains, and blasting give rise to reports of minor shocks. However, slight earthquake shocks have been common in Oregon, more common than most people believe; therefore it is not unlikely that the reported shock was a true earthquake.

Earthquakes in Oregon have been catalogued since 1846, and the record is being kept up to date by trained observers. The time and intensity are recorded. At least one shock has been recorded nearly every year.

Probably the most severe shock ever felt in Portland occurred February 3, 1892, at 8:30 p.m. It was rated an intensity of VII on the Rossi-Forrel¹ scale. The shock was described as follows:

"A severe earthquake shock occurred here at 8:30 o'clock to-night. Brick buildings swayed and windows rattled, terrifying the inmates, who in many instances rushed into the street. The shock lasted about thirty seconds, and was probably the most severe earthquake ever felt in this city. As far as known no damage was done."

Intensity VII of the Rossi-Forrel scale is listed as follows:²

"Overturning of loose objects; fall of plaster; striking of church bells; general fright, without damage to buildings."

Although few other quakes have been felt in Portland, the "State Line earthquake" of July 15, 1936, near Milton, Oregon, and Walla Walla, Washington, was of equal if not greater intensity, causing some damage.

Several writers have proposed a fault along the east face of the Portland Hills in order to account for the steep escarpment as well as the relatively straight trend. However the Portland Hills may be a fold, with the steeper side to the east. Dips of 10-14° to the east have been found near Linnton. Undercutting by the Willamette River, which was probably crowded against the Portland Hills during development of the Portland Delta, may explain the steep eastward slope.

Thus it is difficult to determine at this time whether there is a fault in this vicinity. Some earthquakes in volcanic regions are attributed to shifting of underground magmas.

Please explain how an ice sheet can move over level country.

Ice, although showing considerable rigidity, will, given time, yield to very little pressure. A great thickness of ice in the center of an ice field tends to spread out slowly. Ice will move up hill locally, but when viewed in perspective, this local movement is seen to be the result of pressure from a static head elsewhere transmitted through the ice. When ice spreads over relatively level ground, it is being pushed by the weight of a higher mass of ice.

Are fossils ever found in igneous rock?

The answer is generally no but some exceptions do occur. Large masses of the intruded rock are sometimes included in igneous masses. These masses are called xenoliths and they sometimes are fossil-bearing. Lava flows pick up some fossil material as they roll over sediments, including some of the sediments and fossils along with the lava.

¹ Townley, S.D., and Allen, M.W., "Descriptive catalog of earthquakes of the Pacific Coast of the United States 1769 to 1928," Seismological Soc. Am. Bull., vol. 29, no. 1, p. 254, 1939.

² Idem., p. 11.

Plant materials, commonly trees, are often found in a charred condition where flows have surrounded them, and plant remains are probably more common than animal remains which require much more unusual conditions for inclusion within igneous rock.

Is it true that eastern Oregon at one time was a large inland lake or sea?

Eastern Oregon has been a part of the sea many times during geologic history. Marine sediments, which include shales, sandstone, and limestone of the upper Paleozoic formations are known, and there is good reason to believe that marine sediments of the lower Paleozoic are also present. Then again in the Triassic, Jurassic, and Cretaceous periods, seas invaded much of Eastern Oregon. There were, no doubt, many withdrawals and periods of erosion and nondeposition.

No arm of the sea is known to have invaded eastern Oregon during the Tertiary, but there were basins of interior drainage, which if not full of water, must have had ephemeral lakes such as broad playa lakes common in semiarid basins of interior drainage. The John Day fossils were buried by volcanic ash falling into such lakes. According to Dr. Hodge of Oregon State College:¹

"Condon Lake first formed as a result of partial damming of the ancestral Columbia River by the Dalles formation in the Cascade zone."

The Dalles formation is considered to be Pliocene by some and Pleistocene by others.

Hodge further suggests that Condon Lake was recreated by the damming of the ancestral Columbia when Mt. Hood was formed in approximately the location of the old river valley. The lake spilled over the range at its lowest place, its present site. Later down-cutting drained Condon Lake and superimposed many of the streams east of the mountains upon the lavas beneath the softer lake sediments.

Where are the proposed Willamette Valley dams?

The following seven dams have been planned, of which two have been completed and several authorized:

1. Fern Ridge Dam, northwest of Eugene, on Long Tom River, completed.
2. Cottage Grove Dam, south of Cottage Grove, on Coast Fork of Willamette River, completed.
3. Dorena Dam, east of Cottage Grove, on Row River has been authorized.
4. Meridian Dam near Lowell, on the Middle Fork of the Willamette River.
5. Quartz Creek Dam, east of Eugene, on the McKenzie River.
6. Sweet Home Dam, southeast of Albany, on the South Santiam River.
7. Detroit Dam, east of Salem, on the North Santiam River.

Are there any minerals of value in the Cascade Range?

Mines located in the Cascade Range have produced minerals totalling in value nearly \$2,000,000. Gold and quicksilver lead the list, with silver, copper, lead and zinc having contributed to the total. The minerals which contain the values are pyrite, chalcopyrite, galena, sphalerite, and cinnabar.

Most of the mines are located in well-defined districts in the Western Cascades, no minerals having been produced from the High Cascades. These districts are in Clackamas, Marion, Linn, and Lane counties, and lie from 15 to 25 miles east of the edge of the Willamette Valley. The most important, from the standpoint of production, are the Bohemia district southeast of Cottage Grove, and the Black Butte quicksilver district a few miles south of Cottage Grove.

The districts may be described, from north to south, as follows:

¹ -----
Hodge, E.T., "Geology of the lower Columbia River," Geological Soc. Am. Bull., vol. 49 pp. 831-930, 1938.

Chena or Cheeney Creek district: Four miles south of Zig Zag on a branch of the Salmon River. Chinese produced about \$1000 in gold in 1893, and in 1903 several tunnels and a shaft were dug.

Oak Grove district: Just below the Portland Electric Power Company dam on the Oak Grove fork of the Clackamas River, 25 miles southeast of Estacada. Several veins of cinnabar in calcite have been prospected during the last 10 years and have yielded a small production of quicksilver.

North Santiam district: Twenty miles east of Mehama on the north fork of the Santiam River. It was first developed in the 1890's, but most of the production was intermittent between 1915 and 1930. Metals produced have been gold, silver, copper, lead and zinc. This is one of the few zinc districts in the state. Recorded production of these metals between 1880 and 1941 is \$14,884.

Quartzville district: About 25 miles northeast of Sweet Home on the Quartzville fork of the Middle Santiam River. This district was discovered in 1863, and was most active in the 1890's. Recorded production between 1880 and 1941 amounted to \$181,494 in gold and silver.

Blue River district: Forty miles east of Eugene on the Blue River fork of the McKenzie River. This district had its greatest production between 1900 and 1912. Most of the recorded production of \$173,789 in gold, silver, copper and lead came from the famous Lucky Boy mine.

Fall Creek district: Located 25 miles north of Oakridge near the North Fork of the Willamette River. Active around 1901-1903. Very little production.

Bohemia district: About 25 miles southeast of Cottage Grove on the upper drainage of the Row River. It was discovered in 1858, scarcely a decade after the first discovery of gold in southwestern Oregon. Much of the mining was done in the 1890's, between 1905 and 1916, and in the years just before World War II. Recorded production is nearly one million dollars, largely from the group of four mines, the Champion, Musick, Helena, and Noonday.

Black Butte district: Located 15 miles due south of Cottage Grove. One of the largest quicksilver mines in Oregon, the Black Butte mine was discovered in the early 1890's, and was worked intermittently until 1908, and between 1916 and 1919. The mine worked steadily from 1927 until 1942 when it closed down. Total production has been well over a million dollars.

GEM STONES IN 1944 ^{1/}

Domestic Production Greatly Depressed

According to data compiled by the Bureau of Mines, United States Department of the Interior, the value of uncut stones, from domestic sources, used in jewelry and related industries approximated \$41,000 in 1944, which is substantially lower than the \$67,000 and \$150,000 reported in 1943 and 1942, respectively. The professional gem miner sought strategic minerals; the amateur collector did not have gasoline or tires to pursue his hobby, and the tourist (the principal purchaser of domestic gem stones) was almost non-existent. The western lapidaries, professional and amateur, largely cut stock collected in a happier day. A few gem stones were byproducts of the intensive search for mica in the New England States. As producers, the leading States ranked as follows: Arizona, Wyoming, Colorado, Washington, Montana, and Oregon.

* * * * *

^{1/} Prepared by Sidney H. Ball, under the supervision of Oliver Bowles, Chief, Nonmetal Economics Division; Economics and Statistics Branch.

Agates, jaspers, and related quartz minerals probably were next in importance. Most of them are obtained in Washington and Oregon. Other producers were Montana (moss agates), Arizona (agatized wood and chalcedony), Idaho, Colorado (agates), South Dakota (agates) and Wyoming (Sweetwater moss agates). Scotts Rose Quartz Co., Custer, S. Dak., sold a little rose quartz for jewelry use and larger quantities of lower grade material for rock gardens.

Bert A. Rhoades reports that 3,000 to 4,000 pounds of jade (nephrite) were mined in the Lander, Wyoming, field. He and Mr. Byford Foster ran small cutting shops continuously and readily sold all they could cut. Three other cutters worked part time. Fred Abernathy sank a pit on nephrite in place, but the nephrite so far found is in part altered. In the summer of 1944, rough nephrite was being sold at \$1 to \$10 a pound. Some of the green jade is of good quality and the black makes a good material for objects d'art.

Chinese agents purchased 5,890 pounds of Wyoming jade during the year to be shipped to China after the war.

The Montana sapphire industry had a poor year. Virtually all this sapphire is used industrially, only a small percentage being set in jewelry. The Perry-Schroeder Mining Co. of Helena, Montana, operated during only the first 4½ months of 1944. It produced about 4,500 ounces of culled sapphire containing \$200 to \$300 worth of gem material. No other Montana sapphire mine operated.

Alfred M. Buranek reports that the Clay Canyon, Utah, variscite deposit was worked for a short time in 1944 and that some good nodular variscite was shipped to the East. Smaller amounts were recovered from the Grantsville (Tooele County) and Lucin (Box Elder County) deposits. He estimates the value of the 1944 Utah production at approximately \$2,000. He adds that Japanese internees collected some topaz from Topaz Mountain; that a little fine malachite and azurite were obtained from the Dixie Apex mine near St. George; and that other gem stones collected in the State included "snowflake obsidian" (Black Creek), jet (southeastern Utah) and agate and chalcedony (Colorado and Utah).

Dr. Stuart A. Northrop reports that some fine green smithsonite was produced in the Magdalena district, Socorro County, New Mexico.

Other gem stones produced in the United States in 1944 were transparent albite (Newry, Maine), amethyst (Stow, Maine), aquamarine (Newry, Maine; New Hampshire, North Carolina, and Virginia), caesium beryl (Maine), garnet (Arizona), golden beryl (Maine), obsidian (Arizona), peridot (Arizona), white topaz (Maine) and colored tourmaline (Rumford, Maine).

* * * * *

Postwar Prospects

As to the postwar outlook, competition within the retail trade will be keen, but for a time the jewelry trade will have an advantage, for its reconversion should be rapid. One encouraging factor is that during the war many Americans have repressed a desire to spend money on beautiful things. However, if in the postwar period a substantial reduction in the national income occurs, the jewelry trades will be more adversely affected than those dispensing food, clothes and other necessities. With the re-entry of the European cutters into the market, gem cutters in the United States, South Africa, and Palestine will have keener competition. Some of the war-born cutting centers are likely to shrink in size or disappear. Although the consumption of industrial diamonds may decrease for a time, their expanding use in drill bits and wire drawing dies indicates that the industrial market will be well maintained.

Imports 2/

Precious and semiprecious stones (exclusive of industrial diamonds) imported
for consumption in the United States, 1943-44

Commodity	1943		1944	
	Carats	Value	Carats	Value
Diamonds:				
Rough or uncut (suitable for cutting into gem stones), duty free	751,240	\$37,443,240	896,547	\$43,445,219
Cut but unset, suitable for jewelry, dutiable	193,701	31,458,089	169,097	29,263,121
Emeralds:				
Rough or uncut, free	8	248	1,966	1,668
Cut but not set, dutiable	3,194	32,508	38,666	81,233
Pearls and parts, not strung or set, dutiable:				
Natural	- - -	167,284	- - -	242,221
Cultured or cultivated	- - -	107	- - -	15,394
Other precious and semiprecious stones:				
Rough or uncut, free	- - -	47,726	- - -	105,401
Cut but not set, dutiable	- - -	2,590,931	- - -	3,725,453
Imitation, except opaque, dutiable:				
Not cut or faceted	- - -	2,621	- - -	14,550
Cut or faceted:				
Synthetic	- - -	167,166	- - -	503,718
Other	- - -	102,450	- - -	23,887
Imitation, opaque, including imitation pearls, dutiable	- - -	8,149	- - -	23,113
Marcasites, dutiable:				
Real	- - -	96,154	- - -	84,828
	- - -	72,116,673	- - -	77,529,806

2/ Figures on imports compiled by M. B. Price, of the Bureau of Mines, from records of the U.S. Department of Commerce.

CLEARING HOUSE

CH-No. 84: R. E. Plumb, 1703 Moreland Drive, Alameda, California, has the following dredging and earth-moving equipment available:

Northwest combination shovel and dragline, gas-driven, 1½-yard power and ¾-yard bucket, 55-ft. booms.

Washing plant, portable on cat. tracks, 33-ft. scrubber, sand pumps, conveyor loader, and stacker.

Gold saving devices - Pan American and Bendelari jigs, Ainsley bowls, sluices.

Dump trucks, DH7 bulldozer, caterpillar, elec. and gas welder, pumps, engines, camp equipment, pipe, testing machines.

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THE SEED CORN OF SCIENTIFIC PROGRESS

by

Dr. Arthur F. Scott
Acting President, Reed College

Scientific research holds a new and proud position in the country. Most Americans now begin to appreciate the important part it has played in winning the war and they look to this same research in peacetime to create new industries and products, and to make possible a continually higher standard of living.

The lay public does not always realize, however, how this industrial scientific research builds upon the results of pure or fundamental research and how dependent it is on a constantly growing body of young scientists who are trained in research. The importance of both of these factors may soon be evident to everyone because the effects of the war in stopping both pure research and the training of young scientists are bound to make themselves felt in the very near future. The seriousness of the situation has been set forth in no uncertain terms by the country's scientific leaders in reports and addresses.

Roger Adams, Chairman of the Board of Directors of the American Chemical Society, touched on this problem in his talk on the U.S. Rubber Company's nation-wide radio program on Sunday, May 20. After a brief introduction of his subject, he stated:

"Today I want to tell you part of the story behind this research. The layman often is inclined to regard the results of this scientific quest as miracles. Research has produced a host of brilliant discoveries. But they were not miracles. Instead, they were the product of years of patient, painstaking work by highly trained scientists, usually working in teams and utilizing the skills of numerous specialists.

"I could mention dozens of scientific accomplishments which appear to be miracles, but each of which was actually the culmination of long-continued cooperative effort of experts. Let me be content to mention only a few outstanding examples, such as high-octane gas, which powers our fighting aircraft; synthetic rubber, without which the wheels of war could not move; atabrine, which protects our soldiers and sailors from malaria; the sulfa drugs; penicillin; DDT; the beautiful transparent plastics which now are used primarily for windows in the turrets and noses of our bombers; powerful new explosives; marvelous new alloys.

"How are such discoveries made? How are these attractive, useful, and essential materials created? Not a single discovery is the result of a miracle or of crystal gazing."

The bulk of Dr. Adams talk was given over to the documentation of his statement in the last sentence of the foregoing quotation and he concluded with the following summary and reference to the future:

"Achievements such as those I have mentioned can be accomplished only by close cooperation between academic and industrial research laboratories. The war has all but stopped the basic, academic research which finds new truths and supplies new material upon which much of the industrial progress of the future depends. Years will be required before basic research activity again reaches its prewar level. The war also has stopped the training of new research chemists and chemical engineers. Thousands of academic and industrial chemists have been drafted into the armed services, with only a few of them in positions where they can use their technical knowledge. Furthermore, the research organizations associated with industry, which find new products and upon which industry relies for expansion and for creation of new jobs, are at a low ebb. There is no possibility that they can recover quickly in the near future. This is a matter of great concern to the scientists and should be to the public, for only by years of patient research by trained and competent investigators can we maintain the high level of achievement in the field of science, on which is based our position of eminence among nations."

Another picture of the problem is given by the following excerpt from the report of THE ROCKEFELLER FOUNDATION, "A Review for 1944", by Raymond B. Fosdick.

"The policy of the American government in regard to the training of scientific men during wartime has been characterized in many responsible quarters as fundamentally shortsighted. Unfortunately, the accuracy of the characterization can scarcely be challenged. Where England and Russia have sought to protect their future by guarding the flow of new scientific personnel, our policy seems to have been largely dictated by expedience and the apparent necessities of the moment. In Russia, students of ability in science are not permitted in the armed forces while Great Britain has succeeded in minimizing interruption in the training of the men who will be her scientific leaders and teachers in the next generation. With us, science professors and students alike have largely left the universities. Except for a few 4-F's, we now have practically no male students over eighteen studying science. Rightly or wrongly', says a recent report of the American Institute of Physics, 'Some of the seed-corn of American scientific progress for years has been ground up to make a day's feed for the war machines'.

"In handling of scientific personnel during the war, we here in the United States have been spending our capital with reckless disregard of the future. As an officer of the National Research Council expressed it: 'We are committed to a policy of getting along with our present stock pile of trained personnel in the technical branches, even though that stock pile comprises a very perishable commodity.' In other words, we gambled on a short war. Dr. Arthur Compton has underscored the sobering possibility that when the war is won, we may find that we have gained a Pyrrhic victory, having lost so much of our technical strength that we shall be unable to meet the needs of the next generation."

The Rockefeller Foundation has itself taken a step to help remedy the situation by making a grant of \$335,000 to the National Research Council for the establishment of a temporary national program of pre-doctoral fellowships for graduate study in the natural sciences. The announcement in SCIENCE carries the following statement:

"The council and the foundation have developed this program to help to alleviate the very serious set-back to American scientific competence resulting from the war's interference with normal educational processes.

The almost complete cessation of consecutive professional training which has occurred in scientific fields will make impossible for some time the normal accession of additional highly trained personnel. These losses, in the face of sharply increasing demands for such personnel, will inevitably retard to the danger point the resumption of scientific progress after the war. The resulting handicap to postwar industrial recovery, public health and military security is a matter of national concern.

"It should be realized, however, that this generous grant is sufficient to furnish financial assistance to only a moderate fraction of all graduate students who should resume study for advanced professional degrees in the natural sciences and that, therefore, other types of assistance heretofore available should not be curtailed. The program is planned also not to divert too many qualified candidates from part-time teaching positions, since it is expected that colleges and universities will, after the war, be overburdened with undergraduate students in these fields."

The problem set forth in these statements is of particular concern to us in the Northwest. We are about to launch a program calling for new research and an expansion of present research activity at a time when there is a shortage of trained personnel and an accumulated deficit in pure research. Since we cannot afford to postpone longer the program for industrial scientific research on the Northwest's great resources (forests, fisheries, minerals, and power) it behooves all who are interested in this research to lend support and encouragement to all universities and colleges sponsoring research of any kind and to see to it that all young high school students with talent and aptitude for science are encouraged to go to college to get as much of a start in their training as is possible under present conditions. The problem is an urgent one; the remedial steps are vital to the development of the Northwest.

OREGON MINING NEWS

The Sumpter Valley Dredge resumed operations July 5, 1945. Prior to commencing operations the dredge was completely reconditioned and modernized by the installation of Pan American jigs designed to facilitate the recovery of finer gold.

* * * * *

Messrs. Bodelson and Sammons are continuing to explore a large acreage of placer ground they control in lower Sumpter Valley, Baker County. This work consists of both shaft and drill exploration and has been in progress for a period of approximately eight months.

* * * * *

The tailings from the old Rainbow Mine in Mormon Basin, Baker County, will be cyanided in a plant being installed by Messrs. Gardner and Bradshaw who have successfully conducted similar operations on other tailings in eastern Oregon during recent years.

* * * * *

Mr. Kapschull has just concluded a preliminary survey and examination of the Rainbow Mine, Mormon Basin, Baker County, with the view of conducting some exploratory development in the near future. The nature of the proposed exploration is uncertain at the moment, but several cross-cut tunnel sites have been spotted and diamond drilling is being considered.

* * * * *

Installation of a mill at the Gray Eagle antimony mine near Baker, Oregon, is about completed. Mining operations, which were suspended while the mill was being installed, are scheduled to be resumed in the near future according to Mr. Anthony Brandenthaler, owner and operator of the property.

* * * * *

In addition to its regular cement production, the Oregon Portland Cement Company has a contract to deliver 66,000 tons of agricultural lime rock, according to an announcement by the A.A.A. in PIT AND QUARRY, June 1945. This rock will come from the company's quarry at Lime, Baker County, Oregon, and will be used almost exclusively in the Willamette Valley.

* * * * *

The Woodward property on East Eagle Creek, Baker County, is being reopened by the Chadwell brothers. Work consists of both new drifting and cleaning out of old caved workings.

* * * * *

Ibex Mining Co., P.O. address Vancouver, Washington, is milling ore from the Ibex Mine, Cracker Creek District, Baker County. About 10 men are employed in the mine and mill.

* * * * *

Small but steady production of monumental granite is being maintained at the Northwest Granite Quarry, operated by George Burr, Haines, Baker County, Oregon.

* * * * *

The Baker Diatomite Company has recently taken over property containing diatomaceous earth occurrences near Keating, Baker County.

* * * * *

The Grande Ronde Oil and Gas Company, Mr. M. R. Wallace, Piedmont, California, is planning to drill a deep test well for oil in the La Grande valley near Hot Lake, Union County. Work on the derrick is about completed.

* * * * *

The Union Silver Mining Company is now re-equipping its Indiana Mine, Camp Carson District, Union County, with heavier machinery, and plans to continue exploratory work. The ore is a lead-zinc-silver ore.

* * * * *

The Enterprise Lime Company has taken over the old Black Marble Company quarry and plant near Enterprise, Wallowa County. Some lime was burned late in 1944, but operations were temporarily suspended due to difficulties in trucking between the quarry and plant during the spring thaws. The plant is completely reconditioned and the company plans to resume burning of lime immediately. The entire production to date has gone into industrial channels, but the plant is equipped to produce several of the various processed products for the building trade and agricultural use after the war.

* * * * *

Light weight cement building blocks are being made in Bend, Deschutes County, by the Bend Concrete Products Co. Pumice is used for the aggregate.

* * * * *

Various mine owners have returned to their properties and plan to spend the summer doing prospecting work. In the Greenhorn District, Grant County, Mr. Van Hallberg is at the Banzette; Mr. Hayes is at the Rabbit Mine; Frank Klein is at the Golden Gate and Mr. Helmer is at the Paramount claims. In Mormon Basin, Mr. McAllister has returned to his Mannahan Group.

* * * * *

Mr. Arnold Muck of Portland has completed an access road to his limestone deposit on Cheney Creek which is about eight miles southwest of Wilderville in Josephine County. Some equipment has been moved to the quarry site to be used in development and exploration.

* * * * *

The Sullivan Lime Co. at Rogue River is mining and grinding 80 tons of agricultural limestone daily from their quarry on the left fork of Footh Creek. The limestone is going largely to the Willamette Valley where it is being used for agricultural purposes. A small quantity is also sold locally.

* * * * *

Mr. P. H. Holdsworth of Seattle is preparing to pump out the Alameda mine which has been flooded since 1942 when closed because of war conditions. Prior to closing ore was shipped to the American Smelting and Refining Co.'s smelter at Tacoma. Mr. Holdsworth expects to resume his diamond drilling and exploration program and to ship siliceous gold ore to the Tacoma Smelter as labor and materials become available.

* * * * *

Mr. H. S. Fowler, examining engineer for the Consolidated Mining and Smelting Co. of Canada, Limited, spent a week during the early part of June examining copper and gold properties in southwestern Oregon.

* * * * *

Mr. Ben Baker is putting his 20-ton concentrating mill in operation near Bolan Lake to treat lead, gold, and silver ore from several adjacent properties.

* * * * *

Mr. W. B. Robertson has resumed diamond drilling at the Oregon Chrome Mine on the Illinois River as a result of the Metals Reserve Co. announcement that they would continue to purchase chrome ore until the end of 1945.

* * * * *

Mr. D. C. Beyer has resigned as engineer in charge of the Grants Pass stock pile for the Metals Reserve Co. His assistant, Mr. H. A. Jensen, is in acting charge of ore purchase. The Metals Reserve Co. has not announced who will replace Mr. Beyer.

COOS BAY COAL REPORT

Important coal reserves amounting to many millions of tons located close to tidewater are described in a 160-page bulletin entitled "Geology and Coal Reserves of the Coos Bay Quadrangle, Oregon," just released by the State Department of Geology and Mineral Industries. This report gives the results of a survey authorized by the forty-second Oregon Legislative Assembly and financed jointly by the State and Coos County. John Eliot Allen and Ewart M. Baldwin, department geologists, are the joint authors.

Many analyses show Coos Bay coal to be satisfactory for both domestic heating and industrial purposes. Formerly this coal was mined and shipped to San Francisco by coastal vessels. Cheap fuel oil killed this market, and until recently, mining of Coos Bay coal has been relatively dormant. A new project designed to mine and clean coal by modern methods has recently been put into production at Coos Bay.

The bulletin contains a detailed description of the geology of the Coos Bay area, and includes a two-color geologic map of the Coos Bay quadrangle. Results of exploration of 1000 acres of coal land by shallow drilling in search of stripping coal are also given. The price of the bulletin is \$1.00 postpaid; it may be obtained by writing the Department at 702 Woodlark Bldg., Portland 5, Oregon.

OREGON'S OLDEST PRACTICING ENGINEER PASSES

DeWitt Clinton Nelson of Baker, who actively practiced civil and mining engineering in Baker, Oregon, for 67 years, died July 3. He practiced up to within a few days of his death and would have been 94 years old had he lived twelve days longer. It is believed that in point of long continued professional work his remarkable record has been unsurpassed.

Mr. Nelson was born in Butler, Montgomery County, Illinois, July 15, 1851, the son of Levi and Nancy J. (Wood) Nelson. The family crossed the plains by ox team arriving at Portland, Oregon, in September 1852. They lived in Portland until 1865 when they moved to LaGrande and thence to Baker in 1867.

In 1878 Mr. Nelson began his professional career as a civil and mining engineer. He became a U.S. Deputy Mineral Surveyor and was also active as a stockholder in the Baker Iron and Supply Company. Mr. Nelson married Miss Mary A. McNulty in 1877. The two nearest surviving relatives are Mr. V.V. Sparks, Caldwell, Idaho, and Mrs. Mabel Nelson, Baker, Oregon.

Mr. Nelson was very prominent in the Masonic order, and was a member of the Baker Lodge, No. 47, F. & A.M.; Keystone Chapter, No. 15, R.A.M.; Hiram Council, No. 18, R. & S.M.; Esther Chapter, No. 11, O.E.S.; Baker Commandery, No. 9, K.T.; Oregon Consistory, A. & A.S.R.; and Al Kadar Temple, A.A.O.N.M.S.

PORT ORFORD METEORITE

"Mr. Fixit" in the Oregon Journal of July 15 gives an interesting account of the discovery of the illusive Port Orford meteorite and credits Professor J. Hugh Pruett of the University of Oregon for the information supplied as follows:

In the year 1859 Dr. John Evans, government geologist for Oregon and Washington, was exploring the region near the coast in Southern Oregon. It was his habit to forward rock specimens to scientists in the East for laboratory analysis. One of these scientists was Dr. Charles T. Jackson of New York. While examining a package of new arrivals Jackson made a sensational discovery. In the lot was a piece of rock like nothing on earth. It consisted of a metallic network, inclosing stony material. Chemical analysis showed that the metal was principally iron containing about 9 percent nickel. This clue confirmed by other evidence, proved that the specimen was part of a meteor of unusual characteristics.

When the discoverer, Dr. Evans, learned what he had found he furnished from memory a description of the meteoric mass from which he had taken it. He said that it was "in the mountains about 40 miles from Port Orford and easily accessible by mules." He estimated its weight at fully 22,000 pounds and said that the exposed surface rose about three feet from the ground. When a Boston scientific society prepared a memorial to congress asking that search be made for the treasure, Dr. Evans recalled more details. He wrote: "There cannot be the least difficulty in finding the meteorite. The western face of Bald mountain where it is situated is, as its name indicates, bare of timber, a grassy slope without projecting rock in the immediate vicinity of the meteorite. The mountain is a prominent landmark, seen for a long distance on the ocean, as it is higher than any of the surrounding mountains." But in 1860, before arrangements for the expedition to find and unearth the strange meteorite had been completed, Dr. Evans died. No one else had his exact knowledge of its whereabouts. The missing meteorite has never been found. It is mentioned among the who's who and where's where of meteorites in scientific catalogs with the location given as "latitude 42 degrees, 46 minutes north and longitude 124 degrees, 28 minutes west." This would be about right for Port Orford, but it doesn't help to spot the meteorite. The conservative and scientifically skeptical Smithsonian Institution offers a reward for its discovery and plenty of scientific bodies would pay a good price for it.

So if anyone wants to pick up a little loose change and get his name into a scientific publication, all he has to do is to find the lost Port Orford meteorite. The winds and storms of many years may have covered it with dirt, but it is probably still lying where it fell. Rocks of that size and weight are likely to stay put.

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WHY STUDY FOSSILS?

by

Dr. E. L. Packard

Head of Geology Department, Oregon State College

Pleistocene man was both a student of minerals and fossils. He early recognized the superior qualities of flint for the manufacture of his sharp-edged tools and he brought fossil specimens into his caverns.

Twenty thousand years later the Greek philosophers were puzzling over strangely marked stones which had some resemblances to the shelled life of the sea. Even Aristotle did not understand them. He seemed to have believed that fossil fish lived motionless in the rocks. Some of his contemporaries and followers expressed their wierd conceptions of the origin of fossils. For some fifteen centuries no one made a careful study of fossils, and all adhered to the ancient idea that fossils were formed by some plastic force of nature; represented some strange manifestation of the influence of the stars; were the unsuccessful attempts of the Creator to populate the earth; or that they were due to some other equally fantastic action. Finally men began to examine fossils more critically and realized that they represented animals and plants that once had lived on earth. Their study, however, was restricted to the mere description, for no scheme had been devised that would tell when they were living or the order of their appearance on earth.

As early as 1719 writers were showing the evidence for their belief in an orderly arrangement of the rocks of the earth's crust, and the idea of a succession of beds or "formations" was formulated. Among such writers was Linnaeus, (1768) and Justi, (1771). They introduced the time element, for they recognized that the bottom most bed in a geologic section was the eldest in the series. Werner emphasized this time conception and taught the necessity of precise description of the mineralogical characters of each "formation". William Smith advanced a step further by proving that the fossil content of a stratum would serve as a valuable aid for the identification of a given bed or formation. This made it possible to correlate fossiliferous beds outcropping at distant places. Thus fossils became a tool for correlation in the hands of that founder of stratigraphy, and geologic mapping of contemporaneous strata became possible. All stratigraphic geology is founded on these principles of superposition of strata and the contemporaneity of identical or closely similar faunas and floras.

Still another step was necessary before the study of fossils could be made to reveal the history of life. Cuvier described the fossils of a given formation, and recognized that those from one bed differed from those in a bed above. He attributed the difference to world catastrophes, as the Deluge, and a subsequent recreation of the life as represented by the fossils in overlying beds. Lyell in 1832 objected to such an interpretation but it remained for Charles Darwin to explain clearly such faunal differences on the basis of organic evolution.

Fossils then acquired an added interest. The biologists sought among fossil specimens the evidences of primitive ancestors of living types; and their colleagues, the paleontologists, discovered remarkable evolutionary sequences, such as the horse series, and described unimagined animals of past ages. The whole vista of life, thus was extended back for hundreds of millions of years, and the outline of the history of life became clearer.

Since the study of fossils was of interest to both the stratigrapher and the biologist, an extensive literature has been developed. Fossils found in innumerable localities have been named, described, and their geologic ranges accurately determined. This body of information so necessary to the identification and correlation of strata has become, in the hands of the trained geologists, an invaluable tool for all geologic work involving sedimentary rocks.

The economic importance of the study of fossils was first recognized some thirty or forty years ago when active exploration for oil began in this country. It was evident that the petroleum geologist must know sequences of strata through which the bit was passing. To do this he relied in part on the fossils which were brought up by the driller and which matched those in the sequences he had established from nearby surface exposures. Thus the correct identification of the index or key fossils from each horizon was of great importance. Trained paleontologists were therefore employed to build up faunal successions and to identify each fossiliferous horizon passed through by the drill.

This demand for closer correlations led to more extensive collecting, accurate determination, and the publication of faunas by federal, state, or institutional agencies. Universities and colleges were called upon to train paleontologists, who readily found employment with producing oil companies. Such studies led ultimately to an investigation of the long neglected group of minute fossils known as Foraminifera, whose calcareous shells, though abundant, had never been adequately studied. By the twenties, the importance of microfossils was recognized. Hundreds or thousands of specimens might occur in a cubic inch of rock taken from a well core. Micropaleontology laboratories were soon established in educational institutions and by the leading oil companies. Other groups of minute fossils were discovered. Consequently the microscope has become a necessity in the laboratories of the oil companies.

The study of fossils, as we have seen, has through thousands of years, given man glimpses of the life of the past; furnished proof of the fact of organic evolution; given an outline of the history of life on earth through some 1800 millions of years, and unexpectedly developed into a tool in the hands of stratigraphic and economic geologists which permits precise identification of strata often containing a wealth of oil or other geologic resources.

The future of paleontology lies in the further development of that "pure" science: its future contributions to a number of biological sciences, and the further expansion of these practical aids to the economic and industrial life of the country.

How can we contribute to the advancement of "pure" and applied paleontology of this state?

1. By intensive systematic collecting, at all known fossiliferous horizons of the State.
2. By the establishment of adequately equipped and staffed laboratories at Oregon State College, the University of Oregon, and the State Department of Geology and Mineral Industries.
3. By the study, identification, and publication of paleontologic data in such a form that it may be easily available to the general public as well as specialists.
4. By the building up within the State a complete collection of carefully labeled fossils, and by so organizing the collection that it may be available to qualified persons for the identification or further studies of the ancient animal and plant life of Oregon.

ATOMS AND THINGS

In September 1940 the ORE.-BIN contained a brief article commenting on the uranium isotope U 235. Because of the recent astounding development in bombing Japan, this article appears to have present-day interest and is reproduced herein.

Understanding of internal combustion engines was acquired by hundreds of thousands of people by intimate association with Henry Ford's Model T. Knowledge of radio circuits and vagaries of the ether became rather commonplace with the universal use of radio sets. Flying is becoming so ordinary that most schoolboys know their aeronautics better than their spelling. So what! Well, these are just thoughts in contemplation of how greatly scientific discoveries influence our existence and of how surely and simply scientific phenomena, at first understood by only a few Einsteins, may be brought into our daily lives and become common knowledge.

The stage being set, meet U 235, for this mysterious looking symbol (not a German submarine) is likely to be the cause of making physicists out of future generations and be the incentive for the boys and girls to get intimately acquainted with atomic nuclei, protons, neutrons, isotopes, atom smashing, gamma rays, and other of that ilk, now known or partly known to only a few of the members of the inner circle of top-flight scientists. Perhaps in the not very distant future U 235, or some of its robotian relatives, will be heating and lighting the house (or bomb shelter), cooking the food, driving the automobile and airplane, propelling ocean liners, and rocketing space ships out from Mother Earth to disturb the tranquillity of our neighbors of the solar system. (Who doesn't enjoy the role of oracle!)

But to get down to cases and atoms. In the early horse and buggy days, it was scientific gospel that the atom was an indivisible particle - the smallest particle of an element that could exist. That theory is literally shot to pieces. Now, an atom is believed to be a sort of blur held together by electrical forces. There is a central atomic nucleus made up essentially of particles called protons and neutrons. The proton has a positive charge; the neutron has none. About the nucleus is a gyrating bunch of negatively charged electrons, each spinning on its own axis and arranged in concentric layers about the nucleus. In a staple atom, there are as many electrons as there are protons in the nucleus in order to have the electrical charges balance. The number and arrangement of the electrons determine the chemical properties of the atom. But it is with the nucleus that we are concerned now. The various elements have various combinations of protons and neutrons and the total of the number of these particles in an atomic nucleus equals its atomic weight. Thus, hydrogen, the lightest element, has a single proton and an atomic weight of 1. Uranium, until very recently, thought to be the heaviest element, has 92 protons and 146 neutrons to give an atomic weight of 238. Thus, we have U 238 as a symbol of the normal uranium atom. The number of protons in a nucleus determines the charge, or atomic number of an element, and there exists an element for each number from 1 (hydrogen) up to 92 (uranium). (Recently, discoveries of heavier elements have been reported).

Physicists (and among them a number of Nobel prize winners) have discovered that by bombarding an atomic nucleus with high speed particles, such as obtained by using very high voltage apparatus, neutrons may be added or subtracted, thus changing the atomic weight. Such changed atoms are called isotopes. What concerns us most, however, is that, in this process of atom-smashing, energy is released in enormous quantities. The isotope of particular interest at the present time is U 235, which has 3 less neutrons than U 238.

While atomic nuclei may be smashed with release of energy, the energy required is usually greater than that obtained as a result of the smashing. But the isotope U 235 is, at present at least, unique in that it may be readily smashed with the resulting release of a stupendous amount of energy. Various estimates of the quantity of this energy have been made, all showing, by comparison with our present sources of energy, the tremendous amount of released power potentially available. These figures are something of the order of comparing the force of a boy's air-rifle with that of a battleship's 16-inch gun. The picture is disturbing to the imagination, but we may as well take it calmly. U 235 hasn't been tamed as yet.

There are various hurdles to take before this atomic energy can be utilized. The present problem is how to isolate a sufficient quantity of U 235 so that it may be tested. Various methods have been tried without much success so far, but it seems rather inevitable that the problem will be solved eventually, for it is reported that over 300 scientists are at work on this and related problems. Probably other usable isotopes will also be found and put to work. Then a few ounces of U 235 or a brother isotope would be capable of driving your car or plane to New York and back and still have some power left over.

The question of control of such concentrated power naturally arises. As far as this writer is concerned, he'd prefer a nice safe dynamite factory in which to work rather than a laboratory containing a couple of grams of U 235. At this distance, investigating isolated U 235 appears to be something along the lines of jiggling a can of nitroglycerine.

F.W.L.

URANIUM NOTES

by

John Eliot Allen

In 1896 Henri Becquerel discovered that phosphorescent salts of uranium emit radiations capable of passing through black paper opaque to ordinary light and of affecting the silver salts of a photographic plate. These radiations are called Becquerel rays and substances which emit such rays are said to be radioactive. All uranium and thorium minerals are radioactive - that is, their atoms are unstable, and slowly undergo spontaneous disintegration to form substances some of which may be separated and identified. Mme. Curie, one of Becquerel's pupils, discovered that one uranium mineral, pitchblende, was much more strongly radioactive than could be accounted for by its uranium content, and after months of work she succeeded in identifying two more highly active elements, radium and polonium.

Since that time it has been shown that both thorium and uranium successively disintegrate into one after another of a long string of elements and their isotopes (varieties of the same element with different atomic weights).

In 1939 it was discovered that an isotope of uranium with an atomic weight of 235 (common uranium has a weight of 238) could be split in two by bombarding it with electrical particles in a cyclotron, and when this breakdown occurred there was a release of tremendous amounts of energy. The application and control of this energy suggested the possibility of a revolution in power production. Workers then were unable to separate the isotope 235 from uranium 238 but the potentialities of the discovery were so great that after this war broke, the allied governments devoted all available scientific talent - some 300 or more of the best chemists and physicists in the nations - and all of the available uranium supply - some hundreds of tons from the mines in Colorado, in northern Canada, and in the Belgian Congo - towards the solution of the problem. Their success has ended the war with Japan within one week of the time the first atomic bomb was dropped, and the cost of the project, although amounting to more than two billions of dollars, has been repaid many times over in shortening the war and saving lives of our service men.

Radium is always present as an impurity in uranium minerals in the ratio of about 1 (radium) to 3,000,000 (uranium); in other words, it takes 5.2 tons of metal to produce 1 gram of radium. Uranium 235 is much more abundant, with a ratio of only 139 to 1 which gives 6,500 grams or over 14 pounds per ton, if the recovery of the rare element could be made 100 percent, which is doubtful.

Uranium occurs most abundantly in two minerals, carnotite and pitchblende. Carnotite is a mixture of uranium, vanadium, and potassium oxides. Theoretically the pure mineral contains over 67 percent uranium oxide, but in nature impurities reduce this percentage. Analyses of two samples of carnotite from Montrose County, Colorado, are given in U.S. Geological Survey Bulletin 770, page 726, as 54.89 percent and 54 percent uranium oxide (UO_3) respectively. Pitchblende, or uraninite, is an indefinite mixture of uranium oxides. Analyses given in the bulletin cited above range from 65.06 percent to 83.91 percent uranium oxides (UO_2 and UO_3). At least 40 rarer minerals contain uranium.

Thorium is a constituent of monazite, a not uncommon mineral, found chiefly as one of the heavy minerals in some sands, although the primary sources are in granites, gneisses, and pegmatites. The principal commercial sources of monazite have been Brazil, India, and Ceylon, although deposits are known in the Carolinas and Idaho. Some 9 other minerals contain thorium.

Carnotite is found in lode veins in metamorphic rocks (in South Australia), and in ancient sediments associated with vanadium minerals near Placerville, Colorado, and in adjoining regions. There it is probably derived from veins nearby by solution and re-deposition. Much of this deposition appears to be governed by presence of organic matter in the sediments, since extremely rich concentrations are found in petrified tree trunks. According to "Ore Deposits of the Western States" two petrified logs at the San Miguel River yielded 105 tons of ore, which contained \$175,000 in radium, \$27,300 in uranium, and \$28,200 in vanadium. The ore averaged 1.25 to 1.5 percent U_3O_8 . Carnotite has a characteristic bright canary yellow color, not the reddish yellow of iron oxides. The common occurrence is as a yellow powder in sandstones. It coats cracks in the sandstone and fills cavities between the grains. The sand is also commonly cemented with calcite near the deposits. Fossil wood, leaves, and reed fragments, as well as fossil bones are nearly always associated with carnotite, which sometimes replaces the organic material. In some places the ore is green, occasionally showing a little black in the richer portions. It varies from medium to a light green, but usually has a yellowish tinge.

Pitchblende occurs in gold-bearing quartz veins in granite, often associated with silver, cobalt, nickel, and other metals. It occurs in a number of localities in the United States, but these are relatively unimportant in comparison with the deposits discovered in 1930 by Gilbert La Bine on the shore of Great Bear Lake near the Arctic Circle. These deposits, developed by the Eldorado Gold Mines, Ltd., produced in 1940 nearly 40 percent of the world's radium, and yielded 1,100 tons of concentrate during 1939, with a radium content of 8 grams monthly. This would mean that the uranium production was of the order of 3,000,000 times this amount, or about 3 tons of uranium metal per month, or over 30 tons per year.

The pitchblende ore from which Mme. Curie first produced radium came from mines at Joachimsthal in Bohemia, which formerly were operated by the Czechoslovakian government, and were taken over by Germany in October 1938. The deposits were estimated to contain 300 grams of radium yet unmined, which in proportion would be associated with 1000 tons of uranium. In 1938 they were producing at a rate of about 5 grams of radium per year, less than that produced per month in Canada. Before the mines were acquired by Germany the Reich's only other source, besides imports, was from radioactive silt at Bad Kreuznach. This source yielded about 20 metric tons per year, containing about 1.75 milligrams of radium per ton.

Portugal also produces small amounts of radium but the largest mines in the old world are in the Belgian Congo which, beginning in 1925, have shipped to the United States several hundred thousand pounds of uranium oxide, according to reports in "Mineral Resources of the United States," published by the U.S. Geological Survey, and "Minerals Yearbook" published by the U.S. Bureau of Mines. In 1939, 1,439,324 pounds was imported by the United States from this source. In 1940 several thousand tons of crude ore was imported, since the refineries at Oelen, near Antwerp, had fallen into German hands.

The analyst can determine radioactivity in minerals by means of the electroscope and the Geiger counter apparatus. Both instruments have a high degree of sensitivity. Amounts of uranium as low as 0.1 percent can be determined by the spectrograph. Uranium will darken a photographic plate if left near it overnight; this is a reliable and inexpensive field test.

Pitchblende is a heavy black mineral, heavier than common black sand minerals and almost as heavy as tin ore or cinnabar, and hence the black concentrates from the tried and true panning method of prospecting will include pitchblende if it is present. It is usually massive, and can be scratched with a knife although it is hard enough to scratch a copper penny. It has a pitchy lustre, hence its name.

Pitchblende is found in granitic and metamorphic rocks in quartz veins, nearly always with sulphides of other metals such as lead, iron, copper, cobalt, and zinc.

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NEW CHAMBER OF COMMERCE BOOKLET

"Let's Look at Portland" is the title of a new booklet issued by the Portland Chamber of Commerce and sponsored by the Industries Department, Chester K. Sterrett, Manager. Although this booklet is aimed at furnishing basic industrial information on metropolitan Portland and tributary communities, in so doing, it contains a large amount of worth-while information on the natural resources of the whole state and region. Factual information is supplemented by many illustrations throughout its 48 pages. This booklet is a valuable report, in condensed form, on Oregon resources and industries.

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HISTORICAL NOTES

Eastern Oregon contains some gold-bearing alluvial areas which have received relatively little attention since early days of mining because of lack of easily obtainable water. One of these is in northern Malheur County as described below. The description is taken from the report of J. Ross Browne on the "Mineral Resources of the States and Territories West of the Rocky Mountains" for the year 1868. In this as in all other placer areas discovered in the pioneer days, the first mining was by small scale methods; later ditches were constructed, some of them over long distances, to supply water for hydraulicking. The water thus obtained was expensive and usually insufficient to supply all demands. When the richest and most easily accessible gravels were mined, activities languished. It would appear that some of these "high bars" now offer possibilities of profitable large-scale operation because of improvements in handling materials. Investigations of these areas seem to be warranted in the light of modern conditions.

Additional items from the above-named report are appended to give other sidelights on the Oregon picture as they appeared to pioneer writers and investigators.

Editor

Mineral Resources

The mineral resources of Oregon, though not so thoroughly prospected as those of adjacent States and Territories, are both extensive and valuable, and will no doubt at some future time form a prominent source of wealth.

Placer mining has been carried on extensively and profitably in the southern counties since 1852, and the mines of John Day and Powder river have yielded several millions of dollars since their discovery in 1860. The annual product of these mines, until within the last two years, has been from \$1,500,000 to \$2,000,000. In common with the surface deposits of elsewhere, there is a gradual diminution as the placers become exhausted. New discoveries, however, are being continually made.

Willow Creek Mines:

A writer in the Oregonian thus describes the mines in the Willow creek country, a region which has attracted considerable attention of late:

"Willow creek is a branch of the Malheur, having its source near the head of John Day's river, and, flowing near 100 miles in an easterly direction, discharges its waters into the Malheur about 15 miles above its junction with Snake river. Although a long stream, Willow creek, owing to the nature of the country through which it flows, much of it being a low mountain or hill country, destitute of timber, receives but few tributaries, and those few of small size. It is but a small stream in proportion to its length, and its surroundings are gloomy enough and differ but little from those of the Malheur, Owyhee, and other tributaries, on the south side of Snake river, between Farewell Bend and old Fort Hall.

"The mines on the tributaries of Willow creek were, I believe, first discovered in 1862, at what is known as Mormon or Humbolt basin, nearly at the same time, by one party from Salt Lake and another from the Humbolt mining region in Nevada. This is a small but rich camp, and only lacks plenty of water to render it one of the richest in the upper country. But water it can never have from any outside source, as the basin is higher than the source of any of the streams around it, so that the miners in that locality will have to be content with the scanty supply they now have for three or four months in the year.

"But what are known as the Willow creek mines are situated on the south slope of the divide, between the waters of Willow creek and Burnt river, and are now divided into Shasta, Easton, and Willow Creek districts.

"Shasta district comprises Shasta creek, Rich creek, Cottonwood creek, Quartz gulch, and many others. Mining has been carried on to some extent on Shasta creek for several years, but it was not until last summer that the district was prospected to any extent, or assumed any importance as a mining camp, or became known as such outside of its immediate vicinity. Since then greatly exaggerated reports have gained circulation in Idaho, Oregon, California, &c., as to the richness and extent of the mines. In most of the creeks and gulches in Shasta district good prospects have been obtained of rather coarse gold, mostly on the bed rock, which is usually of slate, and generally from 10 to 25 feet below the surface. Shasta, like most of mining districts, contains an embryo town which rejoices in the name of El Dorado City, indifferently supplied with everything but whiskey.

"Easton district was organized last summer, and is situated east of and joining Shasta district. It contains a large number of gulches, some of which were worked during last summer, paying very well. Good prospects have been obtained in many others, and if water were plenty it would be a lively camp next season, and continue so for two or three years. In these districts the gold is finer than in Shasta district, and the bed rock (if rock it can be called) is a kind of cement of clay and gravel.

"Willow Creek district has recently organized, and comprises the lower part of Mormon Basin creek and a number of gulches east of it, but gold in paying quantities has only been found in one of them. This district is immediately east of Easton district, and the mines are of the same character. These districts are all on the north side of Willow creek, and are comprised in a space of about 12 miles in length and but little over one in width.

"Water is very scarce in all the mines in this vicinity. During the spring the melting snow furnishes a good many gulches with water for two or three months. After that is gone, all the natural water in Shasta district would not amount to more than one sluice head in Easton district, including the water in Mormon basin creek, about two, in Willow Creek district about one. And in speaking of creeks in those districts the reader must bear in mind that all the gulches in which water flows during summer (no matter how small the quantity)

is called a creek. Most of the gulches are dry during the fall and winter, and a prospector frequently has to carry dirt one-half mile or more to find water to wash it. Another great inconvenience here is the scarcity of timber, it being on the mountains and in cañons remote from the mines. Lumber for mining and building purposes has to be hauled from 8 to 16 miles, and fire-wood from two to five miles, the former costing about \$70 per 1,000 feet, and the latter from \$12 to \$14 per cord.

"The climate here is similar to that of the Grande Ronde and Powder River valleys, the amount of snow falling being much less than in the mining regions of Idaho. Yet the winters are very cold. The past two weeks have been about as cold as any weather I ever saw during several years' residence in the mountains. The snow is now about 10 inches deep in the mines, and perhaps two feet deep on the divide between Willow creek and Burnt river.

"There is much good agricultural land along Willow creek, Burnt river, and other streams in this vicinity, upon which abundant supplies could be raised for all this part of Oregon, unless the crickets, which seem to be one of the natural productions of the country, should claim too large a percentage of the crop.

"Several different ditches have been talked of for bringing water from Willow creek and Burnt river for mining purposes, which would supply Shasta district and subsequently districts east of that, only one of which has been prosecuted to any extent; that being the ditch of Carter, Packwood & Company, which is one of large extent, and will, when completed, supply a large extent of mining ground with water and give employment to many men. But unfortunately there is little probability of its completion in time to do any good next summer; so that many owning claims will have to wait another year before they can work them to any extent, as the mines are of such a nature that they can only be worked by the hydraulic or ground sluice, which requires a large amount of water.

"There is a large extent of unprospected country in this part of Oregon, in much of which it is probable gold may be found. Were the facilities better for working the mines, this would soon be a populous portion of the State, but much of the country is destitute of timber and water.

"There is but little to induce men to come here at present, but if any do come from Oregon and California, they had best not come before the first of May, as before that time the weather will be stormy and unsettled, and they will find it rough camping out in a country where even sage brush for fuel is not very plenty.

"There are a few stores in the country, at Clark's creek, Mormon Basin, and other camps, but they are poorly furnished with mining tools, clothing, groceries, and in fact everything but whiskey, and other beverages of like nature, which are supposed to be necessary in a country where water is not very plenty. Our nearest post office is at Express, nearly 20 miles. We get our mail matter from there or from Auburn, which is upwards of 35 miles distant. A mail route which would accommodate Clark's Creek, Mormon Basin, and the Willow mines is very necessary, and should receive the attention of our postal authorities."

* * * * *

The following extracts from a premium essay written by Mr. W. Lair Hill for the State Agricultural Society give a correct idea of the general resources and productions of Oregon. The descriptions of the country and facts stated are entirely reliable:

* * * * *

"Physical Geography, &c: All the country in North America lying west of the Mississippi river has a common axis of elevation, which is the great chain of the Rocky mountains, and their southern continuation, the Cordilleras of Mexico. The Sierra Nevada range, with its northern extension, the Cascade mountains of Oregon and Washington Territory, constitutes a secondary axis which materially affects the entire country of the Pacific coast, both in soil and climate. To the volcanic forces of these two great central lines of subterraneous commotion is originally due the physical geography of Oregon.

"It is generally known that the Rocky mountain range is chiefly of igneous composition. Some portions of this range are of plutonic character, while some bear unmistakable evidences that their upheaval was prior to the process of consolidation. Sandstone abounds in many places in these mountains and very considerable silurian deposits are also found. Gold-bearing rocks occur in various localities. Where sedimentary rocks are found they are frequently regular in their stratification; generally, indeed, distorted from their original position, but nevertheless retaining perfectly their stratified character. These rocks are usually interlaid with micaceous slate, and rest on masses of granite and gneiss. Mica is so abundant in some places that it may be found in extremely thin flakes in all the water of the mountain streams.

"Of the same general character is the geological structure of the Cascade range, except that there is less of stratified rocks, and stronger indications of recent volcanic action are observed. Basaltic and granitic rocks constitute the geological basis of the country. Slate and other argillaceous rocks, and a sort of irreducible limestone, also characterize the western slope of the continent. Metamorphic features become more marked the nearer we approach the Pacific coast, until, arriving at the Cascade range, this characteristic is seen in its most clear and unmistakable aspects."

* * * * *

"Although the general character of this region is indicative of its having had formerly a volcanic origin, still there is found here a large proportion of sedimentary rocks, especially sandstone and a sort of conglomerate of highly silicious composition, which often contains shells and other indications of its sedimentary formation. In the Willamette valley this feature is chiefly observed on the western side of the river, and in the Umpqua and Rogue River valleys it becomes more marked on approaching the sea-coast. Shales and a sort of argillaceous limestone, irreducible by the ordinary process of heating and slaking, also abound in many places. The country here is of a much less mineral character than that east of the Cascade mountains, or even than those mountains themselves. Notwithstanding the evidences of volcanic origin common to all the western coast of America, and of which this region presents many, the rocks here, and especially on the Coast mountains, are often found regularly stratified, and in some instances their parallelism remains undisturbed for considerable distances.

"The geological basis of the Coast mountains is sandstone. Scoriaceous and trappean masses occur in the more volcanic localities. At the intersection of these mountains by the Umpqua river, sandstone prevails, and the strata remain uninterrupted, except at long intervals."

* * * * *

"The Grande Ronde, lying a few leagues north of the Powder River valley, is a beautiful circular valley some 20 or 30 miles in diameter, watered by a stream bearing the same name. Surrounded by high hills or spurs of the Blue mountains, its amphitheatrical form, relieving its smooth, grassy surface, intersected by a bold stream fringed on either margin with small trees, renders it sufficiently

charming, to say nothing of the fertility of its soil, which is unsurpassed. Settlements are being made in this valley, also, by the emigrants who have come over the plains, but it will not all be occupied this season.

"The following analysis of the soil in Powder River and Grande Ronde valleys is reported by Fremont:

<u>Powder River</u>		<u>Grande Ronde</u>	
Silica	72.30	Silica	70.81
Alumina	6.25	Alumina	10.97
Carbonate of lime . .	6.86	Lime and magnesia . .	1.38
Carbonate of magnesia	4.62	Oxide of iron	2.21
Oxide of iron	1.20	Organic matter	8.16
Organic matter	4.50	Phosphate of lime . . .	1.38
Water and loss	4.27	Water and loss	5.46
	<u>100.00</u>		<u>100.00 "</u>

PAINT PIGMENT SHIPPED

During the past month 20 cars of limonite, mined from the Ironcrest property, have been shipped from Seappoose, 20 miles northwest of Portland. This material will be used as paint pigment in the San Francisco Bay region.

QUICKSILVER INDUSTRY MAY BE DOOMED

Since the termination of the war in Europe, Spanish quicksilver has been imported into the United States in large amounts. There have also been large steady receipts of Mexican quicksilver. Thus supplies in this country have been built up to a size that is dangerous to an orderly market. The price has dropped below \$100 a flask but there are few buyers. One producer is reported to have over a thousand flasks on hand for which there is no market. This "dumping" of foreign quicksilver on the United States market can have but one result unless a halt is called; and that is the complete shut-down of the quicksilver industry in this country.

MERCURY IN JULY 1945

The following items are taken from the U.S. Bureau of Mines monthly mercury report for July released September 13, 1945:

Record-breaking imports were the feature of the mercury industry in July, according to the Bureau of Mines, U.S. Department of the Interior. Imports amounted to 19,354 flasks and were 77 percent above the previous high monthly record for April. Meanwhile consumption dropped to 6,600 flasks, 1,900 below June and 2,300 below the high record in May. Stocks in the hands of consumers and dealers at the end of July were three times those held at the beginning of the year and inventories in the hands of producers likewise trended upward. The price continued the downtrend that has been in progress since February.

Salient statistics on mercury in the United States.
October 1944 to July 1945, in flasks of 76 pounds

Period	Production	General imports	Exports	Consumption	Stocks at end of month 2/		Price per flask at New York
					Consumers and dealers 4/	Producers 5/	
1944:							
October	2,700	886	33	3,900	7,400	2,550	\$109.20
November	2,300	1,270	42	3,900	7,800	2,094	116.30
December	2,500	935	20	3,900	10,400	2,714	128.88
Total 1944	1/ 37,688	19,819	748	42,900	----	---	\$118.36 6/
1945:							
January	2,500	846	28	5,200	9,000	2,188	156.85
February	2,700	2,835	9	5,100	13,000	1,946	165.55
March	3,000	2,263	25	6,100	7/ 12,200	1,584	162.00
April	3,000	10,963	30	7,500	7/ 15,800	2,148	156.84
May	3,300	7,242	70	8,900	7/ 15,600	2,760	153.69
June	3,000	3,677	22	8,500	7/ 16,100	1,377	147.73
July	3,600	19,354	(2/)	6,600	7/ 32,000	3,179	140.72

1/ Final annual total; monthly figures not adjusted. 2/ Data not yet available. 3/ Based on location rather than ownership. 4/ Largely excludes redistilled metal. 5/ Held by reporting companies. 6/ Average. 7/ Excludes metal afloat from Europe.

Mine production:

Figures covering mercury production at domestic mines, obtained from companies that accounted for 99 percent of the total output in 1944, indicate that 3,600 flasks were produced in July and 17,500 flasks were recovered in the first six months of 1945. Production in the first six months was 7 percent below the rate that prevailed in all of 1944 but it was 15 percent above the rate for the latter half of 1944. California produced about 12,600 flasks in the first half of 1945 and accounted for 72 percent of the country's total, a continuation of the advanced relative importance assumed by this State in 1944. The 1945 rate, however, was about 10 percent below that for all of 1944. Nevada was second with 2,100 flasks, indicating a noteworthy gain over the 1944 rate. The Bureau of Mines is not at liberty to publish 1945 details for the remaining States of Arizona, Arkansas, Idaho, Oregon, and Texas and for Alaska, because there were less than three reporting companies in each of these areas.

Foreign trade:

Imports of mercury totaled 19,354 flasks in July, according to records of the Department of Commerce, or more in a single month than the average annual rate for the period of high importation and low domestic production of the nineteen twenties. The imports in July were 77 percent above the previous record of 10,963 flasks in April. Details by countries for July are not yet available.

Mercury imported into the United States in October 1944 - June 1945,
by countries, in flasks (general imports)

	1944		1945						
	Oct.-Dec.	Total	January	February	March	April	May	June	Total
Canada	---	1,565	20	1,700	---	---	---	----	1,720
Chile	101	981	----	---	300	---	---	200	500
Honduras	---	---	----	---	---	---	---	23	23
Mexico	2,990	17,221	826	1,055	1,963	1,909	1,390	1,452	8,595
Peru	---	52	----	80	---	51	---	----	131
Spain	---	---	----	---	---	9,003	5,852	2,002	16,857
	3,091	19,819	846	2,835	2,263	10,963	7,242	3,677	27,826

Exports of mercury thus far in 1945 have failed to reach 100 flasks in any month; they totaled 184 flasks in the first six months of 1945. Data for July are not yet available.

State of Oregon

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ATOMIC PLANNING

Complete control of sources of supply of radio-active minerals by the Government will be effected by Congressional and Executive action. The recent order of the President as given below is one of the steps in the program. Many complex problems are involved and will continually arise in making the control of raw materials effective, as well as in supervision of all industrial and scientific applications of radio-active minerals, including research. As this program is without doubt the most critical and most important ever to confront this country, and as adequate planning must be based on expert knowledge, Congress and the President will need to rely on scientists more and more as time goes on. It would seem to be a wise move to set up a Federal department of science headed by a scientist with cabinet rank.

Editor

Executive Order 9613

Withdrawing and Reserving for the Use of the United States
Lands Containing Radio-Active Mineral Substances

By virtue of the authority vested in me as President of the United States, it is hereby ordered as follows:

1. Subject to valid existing rights, all public lands of the United States, including Alaska, which contain deposits of radio-active mineral substances, and all deposits of such substances, are hereby withdrawn from sale and all other forms of disposal under the public-land laws, including the mining laws, and reserved for the use of the United States.
2. So far as not in conflict with existing law, all lands in the United States, its territories or possessions, heretofore acquired by the United States which contain deposits of radio-active mineral substances owned by the United States are hereby reserved from sale, and all leases, licenses, or other authorizations of whatever kind hereafter granted to occupy or use such lands, shall reserve to the United States the right, at any and all times, to enter upon such lands, and mine and remove such mineral substances; and all such lands hereafter acquired by the United States shall become subject to the provisions of this paragraph upon their acquisition; PROVIDED, That no reservation under this paragraph shall interfere with the use of the lands established or indicated by any act of Congress.

HARRY S. TRUMAN

The White House
September 13, 1945

CERAMIC TESTING

Introduction

The ceramic industry is not only one of the oldest but also one of the largest industries in the country today. Its scope is wide, as it embraces nearly all of the silicate industries, such as those which make whitewares, refractories, abrasives, and glass. The fact that silicon is second only to oxygen as the most widely found element in the earth's crust is an indication of the far-reaching application of this industry. The art and science of ceramics have been instrumental in paving our roads, building our skyscrapers, smelting our metals, providing us with dinnerware, and offering us all sorts of ornamental forms to appease our aesthetic sense.

Clay originally was the foundation of ceramic enterprise, and although many other substances have come into auxiliary use, clay is still regarded as the most important of ceramic materials. The intrinsic property of clay, which allows it to be mixed with water to form a plastic mass and then to be fired to a hard durable body, is the basis for its wide use. A combination of both chemical and physical factors is involved in the use of clay and, on firing, any number of complex silicates can be formed, depending on the original material and its subsequent treatment. The knowledge and application of such branches of science as colloid chemistry, thermo-chemistry, mineralogy, mechanics, and phase rule studies are required to fashion our wide variety of ceramic articles on a twentieth century production scale.

Because of the many factors which, during the manufacturing process, have an effect on the final ceramic article, the testing of clays must follow the commercial practice as much as possible. It is important to know what happens to each clay as it is subjected to the processes used in ceramic enterprise. Thus it is the purpose of this paper to describe the more commonly known clays and some of their basic tests, and to show how these tests are important in the evolution of the final ceramic product.

Types of clay

One might say that there are as many types of clay as there are types of people. Numerous classifications of clay¹ (based on various factors) have been made. Ries, Buckley, Edward Orton, Jr., and Grimsley and Grout classify clays according to the manner in which they are geologically formed; Orton, Sr., classifies them according to low- and high-grade types; Wheeler and the U.S. Bureau of Mines according to uses. Each clay type has a number of names and the following are often referred to in ceramic circles.

Common clays burn to the darker colors. They are usually non-refractory, and are used to make heavy clay products such as sewerpipe, draintile, common and paving brick, etc., and in art pottery.

Refractory clays may be heated to a high temperature without deformation; cone 19 (1515° C.) is considered the lowest softening point for refractory clays. They usually fire to a buff color and are used for making firebrick, refractory shapes and forms, and some stoneware products.

Stoneware clays fire to a fairly dense, gray-colored body at approximately cone 8 (1225° C.). Some buff-burning refractory clays are considered stoneware clays, however. Stoneware clays are used in the making of earthenware, chemical stoneware, and art pottery.

Whiteware clays are light-colored, fine-grained clays and are used for making fine dinnerware, porcelain, and electrical insulators. The two principal types

¹ Ries, H., pp. 32-37

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of whiteware clays are china clay or kaolin and ball clay. China clays or kaolins tend to be light-colored in both the raw and fired state and are not as fine-grained and plastic as the ball clays. Ball clays are highly plastic, fine-grained, and refractory. They fire to a white or cream color and have a high bonding strength. Mixtures of china and ball clays are usually used in whiteware bodies.

Making ceramic ware

A biographical sketch of the life of a clay from the time that it is prepared for mixing to the stage of final firing emphasizes those critical points and peculiarities which must be controlled for any successful ceramic enterprise. These critical points and changes are the foundation for the procedures which have been developed for ceramic testing of clays. Only those operations which are common to all ceramic products will be considered.

Four processes must be carried out in the making of any ceramic ware. These are:

- (1) preparation of the clay-water mix, (2) forming of the ware, (3) drying of the ware, and (4) firing of the ware.

As water is added to the clay, the mixture first becomes crumbly and the particles do not hold together well except under great pressures such as are used in the dry-press method for forming ceramic ware. As more water is added, the clay reaches a stage where it can be deformed and the mass will hold its shape. This is its maximum plasticity and the amount of water required to bring the clay to this stage is known as its water of plasticity. This clay mixture is ideal for the stiff-mud or extrusion processes. Further addition of water causes the clay to become sticky and soft. This consistency is used in the soft-mud process. When sufficient water has been added, the clay becomes fluid and is well adapted to the casting process.

A plastic mass of clay contains a series of capillaries of varying size and because of these capillaries, which have a force more than three thousand times as great as the force of gravity, water is retained in the plastic mass.

During the drying process the water evaporates from the surface of the clay and water is replaced at the surface from the center of the clay piece by this capillary action. As water is removed from the clay, the particles come closer together and the clay shrinks. The amount of this shrinkage is known as the drying shrinkage and if it is excessive, distortion, warping, and cracking may occur.

When the clay has been dried, it is ready to be fired. As the ware enters the kiln, it is partly shrunk, very fragile, and porous. It is in the form and shape of the finished product and is composed of the same minerals with which it started. It has a definite specific gravity and color, which depend on the character of the original material. When the ware leaves the kiln, its shrinkage has increased and it is hard and strong, but not very porous. It has the same shape as before firing, but its mineral composition, color, and specific gravity have changed.

In the early stages of the firing any uncombined water is removed and continues to vaporize until a temperature of approximately 600° C. is reached. This is called the dehydration period. Before all the water is removed oxidation begins to take place and continues until the temperature is about 950° C. Sulfur and carbon are oxidized and volatilized in this period, while iron is oxidized to ferric oxide. At 900° C. vitrification begins. At this point eutectics* and solid solutions are formed with a rearrangement of the molecular structure of the clay and its associated minerals. There is no limit to the vitrification period and the amount of vitrification in any product depends on the final properties desired in the ware.

* Refers to that particular mixture of a definite composition of two or more given substances which has the lowest point of solidification.

The firing behavior of any clay is similar to that of kaolinite, but it is affected by any other minerals which may be present. All ceramic clays contain kaolinite and the critical temperatures of kaolinite are as follows:

Less than 450° C.	Remaining uncombined water is removed.
500 - 600° C.	Combined water is removed leaving $Al_2O_3 \cdot 2SiO_2$ (aluminum silicate).
850 - 1000° C.	Amorphous mullite ($3Al_2O_3 \cdot 2SiO_2$) and tridymite (SiO_2 unstable at room temperature) are formed.
1350° C.	The crystallization of mullite takes place.
1470° C.	The conversion of tridymite to cristoballite (stable form of SiO_2 at 1470° C.) occurs and the specific gravity increases.
1545° C.	The eutectic melting of alumina and silica occurs. This eutectic consists of 5.5% alumina and 94.5% silica.
1745° - 1790° C.	The entire material melts.
2000° C.	The silica is reduced to SiO and the remainder of the material is nearly pure mullite.

Testing procedure

With this brief sketch in mind we are ready to step into the laboratory and see how the testing data is obtained and how it is related to the mass production of ceramic ware. At least 5 pounds of a representative sample of the clay is required for testing. When a clay arrives at the laboratory, its visible properties such as color, texture, hardness, and the presence of impurities are first noted. The sample is then air-dried and crushed to 20-mesh.

A screen test is carried out in which a weighed amount of the clay is mixed with water to form a slurry. This is passed through 60-, 100-, and 200-mesh screens. The results of the screen test and examination of the fractions on each screen show whether beneficiation of the clay will be necessary. The amount of purified clay per ton of raw material to be expected, the possible by-products to be obtained from the processing of the clay, and the type of beneficiation to be used are often indicated by this test.

A standard procedure for the testing of the ceramic properties of clays was developed by the American Ceramic Society in 1928. This procedure is in wide use and is accepted as standard throughout the country. In general, ceramic testing involves the preparation of bars of convenient size, and the determination of the weight and volume of the bars when they are dried and then fired to different temperatures. The clay is mixed with water until it reaches its maximum plasticity. Care must be taken to obtain uniform mixing of the clay and water. The test specimens are formed in a mold. They are then labeled and a reference line of given length may be marked on the bars to be used in determining the linear shrinkage. The specimens are weighed and their volumes are measured in a volumeter. Length of the reference line and weight and volume of each specimen are determined after the bars have been dried to constant weight. The specimens are divided into groups and each group is fired to a different temperature. Length of the reference lines and weights and volumes of the bars are determined after each firing. The fired specimens are then boiled in water for two hours and allowed to remain in the water until it has cooled to room temperature. The specimens are then weighed and this weight is called the saturated weight. Symbols for the measurements on the specimens are as follows:

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 W_p - Weight of the plastic specimen V_p - Volume of the plastic specimen L_p - Length of the reference line
of the plastic specimen W_d - Weight of the dry specimen V_d - Volume of the dry specimen L_d - Length of the reference line
of the dry specimen W_f - Weight of the fired specimen V_f - Volume of the fired specimen L_f - Length of the reference line
of the fired specimen S_f - Saturated weight of the fired
specimen

From these measurements several properties may be determined and the results are reported as percentage values.

The water of plasticity is the amount of water required to bring the clay to its maximum plasticity. It is calculated according to the following formula:

$$\text{Percent Water of plasticity} = \frac{W_p - W_d}{W_d} \times 100$$

This indicates the amount of water to be added to the clay each time a mix is prepared and control of the water content is greatly increased.

The shrinkage water is the water given off up to the point where shrinkage ceases. It is calculated according to the following formula:

$$\text{Percent shrinkage water} = \frac{V_p - V_d}{V_d} \times 100$$

This information is of value in controlling the drying process.

The pore water is the water which is in the pores of the clay after shrinkage has ceased, but is driven off at 110° C. It is the difference between the water of plasticity and the shrinkage water.

The drying shrinkage is the change in size of the clay on drying. The linear drying shrinkage is determined by measuring the reference lines on the clay specimens and is calculated according to the formula below. The volume drying shrinkage is calculated as shown:

$$\text{Percent Linear drying shrinkage} = \frac{L_p - L_d}{L_p} \times 100$$

$$\text{Percent Volume drying shrinkage} = \frac{V_p - V_d}{V_d} \times 100$$

From this measurement the size of the dried ware can be calculated before it has even been made. Also, if the shrinkage is too large or too small, the ceramic body may be altered by the addition of other materials to produce a mixture of proper shrinkage.

As the clay is fired, progressive changes in color, texture, hardness, porosity, volume, absorption and strength occur. The color, texture, and hardness of the specimen at each temperature is noted. The other properties are determined by calculation.

Apparent porosity is the volume of all the pores in the material that can be filled by saturating the specimen with water. This is calculated according to the following formula:

$$\text{Percent apparent porosity} = \frac{S_f - W_f}{V_f} \times 100$$

Volume change is the change in the volume of the specimen from the dried to the fired condition. This calculated as follows:

$$\text{Percent volume change} = \frac{V_d - V_f}{V_f} \times 100$$

When a product of given size is required, this information is used to calculate the size of the forming mold to be used. In the case of some products, such as electrical porcelain, the size specifications are very rigid.

By plotting the apparent porosity and volume change against the firing temperature, the firing range of the clay is indicated. A wide firing range allows greater variation in the firing without disastrous results, whereas with a narrow firing range the firing schedule must be very accurately controlled.

The mechanical strength of a clay can be determined by the weight required to break a test specimen. This determination is often beyond the scope of the small laboratory because of the large and costly equipment required. Nevertheless this is a very important property.

The pyrometric cone equivalent, usually expressed as PCE, is a measure of the softening point of the clay. It is of importance in classifying refractory clays. Small cones are prepared of the clay being tested and are placed in a plaque with similar cones of known softening temperatures or pyrometric cone equivalent values. The plaque is heated up according to a standard schedule and the standard cone, whose time of bending is the same as that of the clay cone, indicates the pyrometric cone equivalent of the clay.

When the testing is completed, much is known about the value of the clay. It has been classified and "finger-printed". The first step between the laboratory and the plant has been made. But this is just the beginning, for it is the constant cooperation between plant and laboratory which has made possible the utilization of materials heretofore considered of little value. It is this cooperation that has developed new and improved products at lower costs and increased plant efficiency and production scales to formerly unheard-of heights.

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Esther W. Miller

COOS BAY MINE ACCIDENT RATE

As reported in the press October 5, 1945, a U.S. Bureau of Mines coal mine inspector stated that the accident rate at the Southport mine of the Coast Fuel Corporation, Coos Bay, was high compared to the average rate for the country's bituminous mines as a whole. The basis of the comparison was the number of tons mined for each disabling injury during the six months ending June 20, 1945.

Such a comparison gives a distorted picture wholly unfair to the Coos Bay mine. During this period the Southport mine was engaged in development work underground and construction work on the surface; therefore, of necessity, production of coal was secondary to this "dead work" which is always required before mining may be undertaken along engineering lines. The accident rate for the nation's mines as a whole would be determined from a large number of producers whose predominant activity was mining coal already developed.

It is difficult to understand why such a grossly unfair comparison was given to the press.

PROSPECTOR'S COURSE

The University of Washington announces the opening of a Prospector's Course at the College of Mines on November 1, 1945. This course will be open without examination to all men past high-school age. The instruction will cover prospecting as commonly understood and the elements of geology, mineralogy, chemistry, and metallurgy. Operations in the mineral industry on which a prospector should be informed will be described with the aid of mine maps, motion pictures, and views of current practice.

The prime object of the course is to give each man familiarity with ores and minerals by means of study and tests in the laboratories. Practice will be given with standard mining and milling machinery, microscopes, furnaces, and the other extensive equipment in Mines Laboratory. Field trips will be made to mining operations, to geological features, the Tacoma Smelter, and other metallurgical plants.

The course continues from November 1 to February 23. A regular schedule of laboratory and class work is followed daily from Monday to Friday, with field trips at intervals. For those that can remain longer, the course will be continued from March 1 to June 15. Application may be made now in writing or in person to Dean Milnor Roberts, Mines Laboratory, Seattle 5, Washington. Registration will take place October 22 to 31.

SURPLUS MINERALS

A recent list of surplus property issued by the Reconstruction Finance Corporation shows an amazing variety of materials for sale by the Government. The surplus mineral products as listed below (not including metals and alloys) is a nearly complete coverage of the mineral production of the country.

Incidentally anyone wishing to buy some "marine animals" should contact R.F.C., and as a further note, there appears to have been a brisk demand for them, whatever this classification includes.

Alkali minerals, crude.
Aluminum ores, tailings and unrefined products.
Calcium and magnesium carbonate minerals, ground.
Clays and earths.
Coal.
Fertilizers - phosphatic.
Fluoride minerals and rocks, ground.
Iron ores, tailings, and concentrates.
Mica.
Mineral basic products, chiefly non-structural.
Mineral basic products chiefly structural.
Mineral products, ground.
Mineral wool, basic products.
Minerals, natural, inorganic, general grade.
Minerals non-metallic, crude.
Miscellaneous metallic ores, tailings, etc.
Natural asphalt and bituminous rock.
Ores, tailings, and concentrates - precious metal.
Peat.
Pottery basic products, chiefly structural.
Precious metal and precious metal-base alloy basic shapes and forms.
Refractories, clay.
Sand and gravel.
Silica minerals and rocks, ground.
Sticks and stones abrasive

Stone crushed and broken.
Stone products natural, structural.
Waxes, mineral, except paraffin.
Whiting.

MERCURY IN AUGUST 1945

The U.S. Bureau of Mines issued the following release on October 20, 1945:

Imports and consumption of mercury in August fell well below the high record monthly rates established in July and May, respectively, but were higher than the average monthly rates for any year prior to 1945, according to the Bureau of Mines, U.S. Department of the Interior. The full effects of the cancellation of war contracts on consumption of mercury is not evident in the August figures. Production dropped 8 percent from July, but the August total was high in comparison with the other months of 1945. Stocks continued at the high level reached in July and prices continued their accelerating decline.

Salient statistics on mercury in the United States,
October 1944 to August 1945, in flasks of 76 pounds

Period	Production	General imports	Exports	Consumption	Stocks at end of month 3/		Price per flask at New York
					Consumers and dealers 4/	Producers 5/	
1944:							
October	2,700	886	33	3,900	7,400	2,550	\$109.20
November	2,300	1,270	42	3,900	7,800	2,094	116.30
December	2,500	935	20	3,900	10,400	2,714	128.88
Total 1944	1/ 37,688	19,819	748	42,900	---	---	\$118.36 6/
1945:							
January	2,500	846	28	5,200	9,000	2,188	\$156.85
February	2,700	2,835	9	5,100	13,000	1,946	165.55
March	3,000	2,263	25	6,100	12,200	1,584	162.00
April	3,000	10,963	30	7,500	15,800	2,148	156.84
May	3,300	7,242	70	8,900	15,600	2,760	153.69
June	3,000	3,677	22	8,500	16,100	1,377	147.73
July	3,600	19,504	23	6,600	7/ 33,600	3,179	140.72
August	3,300	4,417	(2/)	5,300	32,300	3,266	123.20

1/ Final annual total; monthly figures not adjusted. 2/ Data not yet available. 3/ Based on location rather than ownership. 4/ Largely excludes redistilled metal. Excludes metal afloat from Europe.

5/ Held by reporting companies. 6/ Average. 7/ Revised.

* * * * *

Mercury imported into the United States in January-August 1945,
by countries, in flasks (general imports)

	January	February	March	April	May	June	Total 6 months	July	August
Canada	20	1,700	---	---	---	---	1,720	---	---
Chile	---	---	300	---	---	200	500	100	150
Honduras	---	---	---	---	---	23	23	---	---
Mexico	826	1,055	1,963	1,909	1,390	1,452	8,595	1,170	1,233
Peru	---	80	---	51	---	---	131	---	32
Spain	---	---	---	9,003	5,852	2,002	16,857	18,234	3,002
	846	2,835	2,263	10,963	7,242	3,677	27,826	19,504	4,417

Exports of mercury averaged only 30 flasks a month in Jan.-July, 1945. Data for Aug. are not yet available.

CLEARING HOUSE

CH-85: For sale or lease four and a fraction patented quartz claims in Virtue mining district, east of Baker, Oregon. Formerly known as Rachel Consolidated. Value of production reported as about \$150,000. Considerable underground development, probably about 4000 ft., was done by former operators. High-grade assays have been obtained. Interested persons should get in touch with owner, H.H. Waggoner, 2690 Broadway, Baker, Oregon.

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PLAIN GEOLOGY
by
George Otis Smith

The following article was published many years ago in Economic Geology. The thoughts so well expressed by Dr. George Otis Smith, then director of the U.S. Geological Survey, are just as timely today - they will always be timely.

Editor

Some years ago I spoke to an audience of mining men on the subject of plain writing. My talk was an appeal for the simple and direct statement of scientific thought in popular language; but that appeal was addressed to consumers of geological literature, and I should probably do better to make a similar appeal to some of the producers of geological literature.

Geology has of late been presented to the public in so many new aspects - commercial, military, political, and even legal - that he would be bold who would add to its modern varieties; therefore I ask here only a return to a primitive type, and my topic is "Plain Geology."

I am convinced that, at its best, science is simple - that the simplest arrangement of facts that sets forth the truth best deserves the term scientific. So the geology I plead for is that which states facts in plain words - in language understood by the many rather than only by the few. Plain geology needs little defining and I may state my case best by trying to set forth the reasons why we have strayed so far away from the simple type.

First of all, I suppose we may as well admit a certain liking for the sound of words, and the longer the word the more sound it has. Especially enjoyable is this mild form of hypnotism if both ideas and words are such as to make us feel that we are moving in the highest circles. At the meeting of the British Association this year one physicist frankly explained that the idea of relativity is popular because to most people it is "pleasantly incomprehensible." It was a hardened reader of manuscript who confessed that he liked to hear a psychologist talk. "Of course, I understand not a word he is saying, but it is a noble and an inspiring spectacle to see a mere human being crack a whip over an entire vocabulary and see the words jump up on their little red chairs like so many trained seals." But, as I wish to suggest, doing tricks with words may be more entertaining than really useful.

Again, I fear lest in our writing we lose sight of our audience, if, indeed, some of us ever see at all the audience to whom we address our written reports. The chief purpose of words is to convey thoughts, and unless the wave-lengths of the words are right the receiving apparatus will utterly fail to pick up the thoughts. How easily we can underestimate the difference in vocabulary between our audience and ourselves was brought to my notice recently when I heard a brother geologist speak at a dinner to a large group of oil operators, highly intelligent but not broadly educated men, to most of whom the oil business was simply a profitable side line. I thought the talk unusually free from the technical terms so commonly used in the inner circle of our fraternity and was therefore surprised when a table companion remarked that this talk didn't get across because it included many words not understood by the majority of those who heard it. I asked for particulars, and he at once specified "periphery," a word the speaker had repeatedly used in describing where to test out this or that oil pool. "Half of those people don't know what 'periphery' means," said this gentleman, who knew the audience better than I did, and I saw that he was right; and then I realized how much better that common every-day word "edge" would have served - so many things have edges and to so few do we need to attribute peripheries! And when we come to think of it, we realize that "edge" is a sufficiently exact term to apply to an oil pool, the position, shape, and extent of which we know only in very general terms.

This brings me to a third reason for our use of highly technical language: we too often try to overdress our thoughts. Just as there is a somewhat prevalent notion that clothes make the man, so we subconsciously believe that words make the idea. We follow the precept, "To be scientific, use scientific terms," and in so doing we deceive ourselves. I do not wish to be unduly autobiographic in this analysis, but to show my true sympathy for those whose practices I denounce, I confess that I, too, have had the unhappy experience of stripping the technical words from what looked like a good-sized geological deduction only to find that the naked idea was rather small and not my own. It is also a common experience to make the sad discovery that a piece of involved and obscure writing is simply the product of roundabout reasoning or twisted thinking. Our own words fool us, and unconsciously we cover up with long words or tangled rhetoric our lack of plain thinking.

In picking my samples of the wordy sins of scientists, I naturally turn to the writings of my associates on the United States Geological Survey, not because they are the worst offenders but because they are sinners with whom I am best acquainted. Some of these writers, after setting down a technical phrase, realize the need of reaching their readers with words more easily understood and so translate their own scientific terminology on the spot; for example, one good geologist refers to "disseminated grains scattered through the rock," and another addresses the two parts of his audience with this sentence, "Disintegration is slow in these rocks, and they do not break up rapidly." "Disseminated" and "disintegration" are words that please every ear, trained or untrained, while the garden variety of mind is helped along by the plain words "scattered" and "break up."

It seems that in our hunt for general principles we feel the need of tagging each observed fact with some word that may connect it with the language in which the great fundamental laws of the universe are proclaimed at the seats of learning. For this reason - I prefer to suggest no other - a Survey author refers to cracks and crevices in rocks as "spaces of discontinuity." I remember a long sentence in the manuscript of a report on a western coal field in which the fairly common fact that shale is softer than sandstone was stated with full acknowledgments to "differential erosion" and due respect for the "physiographic cycle," terms very comforting to the graduate student at our greater universities, but not at all useful to the practical man trying to open up a coal mine in Montana.

It takes years for some geologists to break the fetters of this scholastic habit of using big words for small ideas. Probably every one of us has been guilty of sentences like the following, which appeared in a Survey manuscript: "The argillaceous character of the formation is very prominent in some localities, although it is usually subsidiary to the arenaceous phase." On being translated this means: At some places the formation includes considerable clay, but generally it is made up chiefly of sand.

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In our writing I believe, however, we are tending to write more plainly - to say "sand" instead of "arenaceous deposit," "clay" instead of "argillaceous stratum," "close folding" instead of "intense plication," "river banks" instead of "riparian borders," "mouth" instead of "debouchure," "shore" instead of "littoral margin," and "the overlying bed is limestone" instead of "the superincumbent material consists of a stratum of calcareous composition."

I even hope the day may come when more of us will say "beds" instead of "strata," for the context usually shows that we are talking about rocks, not about furniture. I, too, love the sound of "strata," but all the pleasure I get from it is wholly lost when those who strive to copy our learning speak of "stratas." As a measure of our progress, I may quote from a Survey author of an earlier day, who referred to "autogenous hydrography on a vertically heterogeneous terrane" - truly a nut of a thought, which I'll not try to crack, lest I find it all shell. It was a Survey graduate, I believe, who defined "form value" as "an intangible quality expressing the broad applicability of the energy form in contrast to its theoretical thermal value as commonly expressed in B.T.U." Words fail me, either to translate that definition or to describe it, though I may apply to such language a few words used in another connection by a Survey writer: "This holds the promise of large potential possibilities."

But I do not wish to claim for the Federal Survey any monopoly in learned writing. It was one outside of our fold who urged me to use plain language at a meeting where we were both on the program. I tried to follow his excellent advice, but in his own address before a mixed audience I listened with rapt attention to sentences like this: "So now every legitimate evidence of fact and deduction points to the origin of microbial unicellular life in the moist, subaerated soil away from the direct sun; and the soils of today are alive - a mighty host - with such microbial creations existing under paraneobiotic conditions." Before such words I realized that I, too, was a layman, for what I heard was, in the words of the speaker, "difficultly intelligible," if, indeed, I might not appropriately adapt to my use other sounding words in the same address and frankly confess that such language "outstripped the early promise of my cephalic ganglia and left me hopelessly decephalized."

Technical terms have their places, and I am on record as admitting that exact scientific statement needs special terms, words that best keep their razor edge when used only for hair-splitting distinctions. This limited use of a highly specialized terminology is wholly defensible, for it would be folly to throw away tools so well fitted for special purposes, just as it is unwise to put them to everyday uses with everyday people. "Transsubstantiation," "transpiration," and "transgression" are technical words that are useful enough to the professional theologian, biologist, and geologist, but they are code words that must be decoded before others can understand them. We know that a telegraphic code saves words for those who use it, but it also most effectively conceals information from the uninitiated.

I have a very definite purpose in this appeal for plain geology that a larger part of our people can understand. Today our science has more contacts with life than ever before: industry has taken geology into partnership, and engineers and capitalists and statesmen all look to geologists for advice. This greater demand has called to the ranks many with varying degrees of professional incompetence, a polite phrase by which I mean in plain English that some who call themselves geologists are knaves, others are fools, and yet others are hybrids. Now, the universal camouflage of the fake geologist - whether of the untaught or uncaught variety - is his protective coloring of technical words. To his clients or his dupes who are weak in geological knowledge these long and unusual words are impressive and serve his purpose, but to those who have had the advantage of special training and experience his use of geologic terms at once exposes his true character. Indeed, this is the basis of the practical test that some of us apply to the report in an oil prospectus if, as so commonly happens, we have never heard of the so-called "well-known authority on the geology of the greatest oil fields of the world." Such an expert uses all the latest terms, but he mixes their meanings, his report is senseless, and we know him to be a faker. But I have yet to note the fake geologist imitating plain statements of geologic

facts - that kind of masterpiece he doesn't attempt to copy. So I suggest this method of protecting our useful science from successful imitation: the economic geologist should tell his story in plain English, then because of the transparency of his statements his clients or the public can see things as they are and will learn to refuse the highly colored substitute offered by his quack imitators.

There is really somewhat of an obligation upon us, both as scientists and as partners in the world's business, to show the world that geology is not mystery or magic, but only common sense. I have told practical men of business that they should give little credence to the geologist who can not tell his story in common language. The world has a right to discount our usefulness and even to distrust our honesty if we persist in concealing our thoughts, or lack of thoughts, behind a mask of professional jargon. The lawyers and the physicians whom I trust most can and do explain their technicalities to me in words that I can understand. Isn't plain geology the safest and most useful kind?

Director, U.S. Geological Survey
Washington, D.C.

(Reprinted by permission from Economic Geology, vol. XVII, no. 1, January-February, 1922)

OREGON MINING NEWS

Edward Woodford, civil engineer of Roseburg, Oregon, has leased the old Continental Mine on the South Fork of Myrtle Creek, Douglas County.

* * * * *

The bucketline dredges owned by the Sunshine Mining Company, Burnt River Division, and the Western Dredging Company have resumed operations on Burnt River near Whitney and at Mt. Vernon on the John Day River, respectively.

* * * * *

The Associated Dredging Company is installing a dragline dredge on lower Burnt River, Baker County. The work is under the joint direction of Mr. W. A. Hilliard and Mr. Ira Proud.

* * * * *

The Salem alumina plant, which will test and develop the Chemical Construction Company's ammonium sulphate process for production of alumina from Northwest clays, is now producing ammonium sulphate. Difficulty in obtaining ammonium sulphate has necessitated combining sulphuric acid and ammonia in the plant, according to the Chemical Construction Company's process for regenerating ammonium sulphate. Because of the need for supplying farmers with this fertilizer, the Salem plant is now selling ammonium sulphate for agricultural purposes. A further supply will be made up for starting the testing work on clays.

* * * * *

The Southport mine of the Coast Fuel Corporation, Coos Bay, is now producing at the rate of about 200 tons a day. All of this coal is coming from the double entry being driven from the new slope under the old workings. A new trolley locomotive has recently been installed underground.

* * * * *

The Pyx mine, Greenhorn area, Grant County, is being opened up by Dr. Young and Jess Edwards of Baker. Frank Klein, with a small crew, is sinking a new shaft. It is planned to continue this work throughout the winter.

* * * * *

1945

The Argonaut mine, in the Bourne area west of Baker, has been taken over by Washington D.C. interests, and will be operated as the AMOL (Argonaut Mine, Oregon, Ltd.) Organization plans include construction of a 50-ton mill. The company was formed through the efforts of Col. Frank M. Arthur and Mr. John Arthur.

* * * * *

The Enterprise Mining Co., Oakland, California, is planning to test placer ground in Eagle Valley, Baker County.

* * * * *

Chadwell brothers are cleaning out the old McGee mine on East Eagle Creek, Baker County, for the purpose of sampling.

MONTANA MINING INDUSTRY

The first official News Letter of the Mining Association of Montana was published early in November 1945. The issue contains much information of value not only to Montana but also to the mining industry in general. The comprehensive program of the State Bureau of Mines and Geology is described in detail.

Comments on gold and silver as given in the News Letter are reproduced below:

Gold:

At the hearing of the Mining Subcommittee of the Senate Small Business Committee held at Helena on August 6 and 7, 1945, the solution of the problems of the gold mining industry was crystallized in a short statement made by John T. Potts, President of Victoria Mines, Inc., of Silver Star, Montana. Mr. Potts made his statement after consultation with Senator James E. Murray, Chairman of the Committee, who presided, Congressman Clair Engle of California, a guest member of the Committee, and W. C. Broadgate, the Committee's Technical Consultant. Mr. Potts stated:

"Most of the shutdown gold mines, after they are opened, need money to rehabilitate their property to resume operations and a higher price for gold to continue operations."

Mr. Potts and other witnesses also advocated that gold mines shut down by government edict, L-208, should look to the government for loans to rehabilitate and resume operations and for relief payments to cover losses sustained during the shutdown.

Bills to cover the recommendations have been introduced in Congress in both the House and Senate. Senator Murray and Congressman Engle have introduced companion bills, S. 1497 and H. R. 4393, to cover relief for gold mines and bill S. 1200 has been introduced by Senator Murray to liberalize RFC loans for the development of mineral resources, including gold mines closed by order L-208. A bill earlier introduced by Senator McCarran of Nevada, known as S. 27, passed by the Senate and now in the House Committee on Mines and Mining, also provides for relief of shutdown gold mines including relief from property and other payments during the shutdown. A somewhat similar, but broader bill was introduced in the House by Congressman Engle at the time that Senator McCarran's S. 27 was introduced in the Senate. All of these bills or a combination of them, are being urged for passage of the two Houses by the mining industry.

In several countries where they have more faith in metallic money than in "managed currency", gold is selling at from \$48 to \$90 per ounce. We understand that the Italian lira recently was devaluated 50% and a number of economists and financiers are of the opinion that the economic situation in France will not be stabilized until the franc is devaluated. These conditions may bring about an increased price for gold all over the world.

It is reported in Washington that bills will be introduced in Congress to give the President the power to further devalue the dollar and also asking for an increased price for domestically produced new gold.

Silver:

One of the foremost silver experts in the United States recently advised us,

"The present shortage of silver, in my opinion, will soon force the price to a higher level. The industrial demand during the next twelve months will amount to more than twice as much as the domestic production. The coinage demand for the next five years throughout the world will be the greatest in its history."

According to late figures the United States will this year use 100,000,000 ounces of silver in industry against domestic production of less than 40,000,000 ounces. The world will use 125,000,000 ounces in industry against a world production this year of 100,000,000 ounces. Recently the OPA advanced foreign silver from 45¢ to 71.11¢ per ounce the same as the price for domestically produced silver. Senator Green of Rhode Island has introduced a bill, S. 1508, to extend the privilege of U.S. silver manufacturers to buy surplus Treasury silver at not less than 71.11¢ per ounce for a period of two years after January 1, 1946. Senator McCarran of Nevada has introduced two bills to raise the present domestic price of silver to \$1.29 per ounce. Our domestic silver manufacturers are distinctly short of silver and it seems the only way to get it is to stimulate domestic production by raising the price. Manufacturers using silver heretofore have opposed price raising but some are said at this time to urge higher prices.

O AND C LANDS

Senator Guy Cordon states that his bill S. 313 to reopen O and C lands to exploration, location and entry under general mining laws is still pending before the Senate Committee on Public Lands. The Secretary of the Interior made an adverse report on this bill and Senator Cordon then incorporated its provisions in another bill, S. 723, which contains provisions in which the Interior Department is much interested, and Senator Cordon believes that this new bill will be supported by the Interior Department. However, the Department of Agriculture is opposed to the provisions of the bill relating to administration of controverted O and C lands and this disagreement between the two departments is delaying action. If, because of this disagreement, it develops that the chance of getting S. 723 out of committee and through the Senate appears to be poor, Senator Cordon will press for action on S. 313 notwithstanding the Interior Department's adverse recommendations. The matter is being actively considered in both the Senate and House Public Lands Committees and in the departments.

GOLD*

As High as \$89 per Ounce

The following is a partial schedule (obtained from the United States Treasury) of gold prices prevailing in foreign countries:

<u>Country or City</u>	<u>Per Ounce</u>
Chile	\$ 48.00
Argentina	48.00
Bombay	62.40
Greece	80.00
Cairo	88.50
Bagdad	89.00

When foreign countries will accept gold at these prices in payment for their products, shipped to other countries, the United States is going to find itself out on a limb in demanding over twice as much gold for its exports. Trade is going to go to the nations which will accept the least quantity of gold in payment.

*Pay Dirt, October 1945. published by the Arizona Small Mine Operator's Association.

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FOSSILS WILL TELL

by

R. E. Stewart*

The Earth Story

Two thousand million years is a long time in anybody's language; even in that of a geologist.

Yet our earth is believed to be at least 2,000,000,000 years old, perhaps 2,050,000,000, perhaps much older.

During that time the earth's crust has been repeatedly bent, broken, and contorted ... raised high into the air ... plunged deep under the sea ... shaken by great earthquakes and volcanic eruptions ... buried under continental ice sheets ... parched and baked by the desert sun ... lashed by angry seas and stormwinds ... caressed by cool temperate breezes and by gentle zephyrs of the tropics.

And all the while, over most of the earth's surface, and especially upon the bottoms of lakes, seas and oceans, beds of conglomerate, gravel, sand, clay, lime, mud, and deep-sea ooze have been piled one upon another; and in them, as upon the pages of a great book, has been recorded for those who will take the trouble to learn to read it, the story of the ages.

Plants and animals in great abundance and variety populated the earth throughout most of recorded geologic time even as they do today; lived, died, and were buried in the sediments that went to form the rocks in which we now find their fossil remains. Occasionally fossils are also found in igneous rocks. All animals and plants of the present are descendants of this long "Parade of the Living"¹ and consequently the rocks of the earth, together with the land, water and air of the present day, constitute a veritable museum and laboratory of natural science and hold the most complete known record of the development of life upon the earth.

Nature has divided her story into eras, periods, epochs, and lesser units, even as our authors divide theirs into chapters, paragraphs, sentences, and phrases. Her divisions constitute the divisions of geologic time. Each raising or lowering of the land or sea, each change or shift of climate, each period of volcanic activity, when occurring on so grand a scale as the earth has witnessed many times during its history, interrupts or alters the development and distribution of life forms and the deposition of the rock material in which their remains are buried and preserved. When the land is covered by comparatively quiet waters it is built up by the addition or deposition of rock material which is continually being carried into the water by streams and the wind. When the land is raised above the water and exposed to winds and storms, waves, running water and various other forces of nature, much of the deposition ceases, erosion or wearing down of the land begins, and the continuity of sedimentation and of the record of life is broken, although partial records may be preserved in deposits formed over restricted areas by lakes, streams,

* Geologist, Oregon Department of Geology and Mineral Industries.

¹ Bradley, John Hodgdon, Jr., Parade of the Living, Coward-McCann, Inc., New York, 1930.
A nontechnical "story of the geologic history of life on earth."

vulcanism, wind, and other agencies. The widespread deposits which have accumulated during times of general land submergence carry the story of the main chapters of geologic history, while breaks in the sequence of deposition caused by intervening periods of widespread emergence and erosion serve to separate these chapters one from another.

The following table shows the major divisions of geologic time during which the known sedimentary rocks of the earth were deposited, together with the approximate number of years that are believed to have elapsed since the beginning of each division.

Eras	Periods	Epochs	Approximate elapsed time in years
Cenozoic (Recent life)	Quaternary	Holocene or Recent	25,000
		Pleistocene (Glacial)	1,000,000
	Tertiary	Pliocene	15,000,000
		Miocene	35,000,000
		Oligocene	50,000,000
		Eocene	70,000,000
Mesozoic (Mediaeval life)	Cretaceous		120,000,000
			150,000,000
			190,000,000
Paleozoic (Ancient life)		Permian	220,000,000
		Pennsylvanian	254,000,000
		Mississippian	280,000,000
		Devonian	320,000,000
		Silurian	350,000,000
		Ordovician	400,000,000
		Cambrian	500,000,000
Proterozoic (Earlier life)			
Archeozoic (Primeval life)			
Eozoic (Dawn life)			
Unrecorded interval of earth history		At least	1,750,000,000
Origin of the earth		At least	2,000,000,000

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The Specialist and Fossils

Our good fossil-record begins with the Cambrian, but the animals of that period were so highly developed that the existence of animal life upon the earth before that time appears to be a certainty, and objects believed to be fossils have been reported from as far back as the Archeozoic. Fossil shells and shell-like animal remains may be collected from all of the post-Proterozoic sedimentary rock series, which have a reported² maximum known thickness of 306,700 feet, or approximately 58 miles.

To the geologist and biologist falls a major portion of the task of reading and interpreting this record of the earth's history.

The scope of geology has become so broad and its applications so varied that every geologist must, almost of necessity, become a specialist along some line before he has been long out of college. Some will go into teaching, some into industrial work; others will join various governmental surveys and still others will make expeditions to distant, little known regions of the earth - all in the interest of geology and its application to the knowledge, wealth and welfare of mankind.

Among all of these will be specialists galore. There will be economic geologists, mining geologists, mineralogists, petrologists, petroleum geologists, field geologists, subsurface geologists, engineering geologists, military geologists, geophysicists, geochemists, oceanographers, volcanologists, historical geologists, structural geologists, stratigraphers, paleontologists, and many others.

The work of some of these has a more obvious and immediate practical application than that of others, but the work of each is actually very closely tied in with and very important to that of all the rest. The contribution of the "pure" scientist, that frequently scorned and often unheralded Daniel Boone of science who probes the distant frontiers and horizons of theoretical possibility, is, in the long run, probably most important of all.

It would be difficult to pick from the various fields of geology any one that is more fundamental, more indispensable than any of the others. In all probability, however, stratigraphy and structural geology would be placed at or near the top of the list by any experienced geologist.

Stratigraphy is the study of rock strata, the conditions of their deposition, their composition, character, distribution, geologic sequence and relative age. It deals largely, although not entirely, with those features and characteristics which date back to the time of deposition.

Structural geology deals with the attitudes of rock strata, with those features and relationships which have developed for the most part since deposition as a result of folding, breaking, and faulting. Folding and faulting may result in the accumulation of oil, gas, and water and in exposing or bringing to within workable distances of the surface all manner of ores and other mineral resources. Breaking and faulting form zones favorable for subsequent mineralization. From both economic and a purely scientific standpoint, therefore, it is very important to map the stratigraphic and structural geology of areas which may have mineral possibilities and to map it carefully and well.

One of the most important tools in stratigraphic and structural geology, and, therefore, in geologic mapping is paleontology, the science of the life of past geologic time.

The Ore.-Bin³ recently carried an excellent review of man's interest in fossils from the time of his earliest fantastic misconceptions of their true origin, nature and significance to that of his final realization that they represent animals and plants that once lived upon the earth, his knowledge of their significance in the chronology of life development and earth history, and his application of this knowledge to practical problems in biology and geology. In summary the author states that:

²Wilmarth, M. Grace, The geologic time classification of the U.S. Geological Survey compared with other classifications: U.S. Geol. Survey Bull 769, pp. 6-7, 1925.

³Packard, E. L., Why Study Fossils, The Ore.-Bin, vol. 7, no. 8, pp. 47-48, August 1945.

"The study of fossils ... has through thousands of years, given man glimpses of the life of the past; furnished proof of the fact of organic evolution; given an outline of the history of life on earth through some 1800 millions of years, and unexpectedly developed into a tool in the hands of stratigraphic and economic geologists which permits precise identification of strata often containing a wealth of oil or other geologic resources."

Fossils constitute the chief evidence in problems of correlation and are among the best indicators of geologic age.

Geologic Age and Time

Strictly speaking, the geologic age of rocks should probably be considered in terms of the number of years that have elapsed since their deposition. Actually, however, geologists usually think of geologic age in terms of stratigraphic position and date the age of strata more with regard to their place in the record of a series of geologic events than to any consideration of actual elapsed time in years. For example, the Coaledo formation is said to be "upper Eocene" in age, not "55,000,000 years old," and the Astoria formation is similarly dated as "middle Miocene."

Rocks exposed in separated localities are said to correlate if they are of equivalent geologic age. The geologist's work in correlating them consists in determining this age equivalence. Correlation may, therefore, be defined as the determination of equivalence in geologic age and stratigraphic position of stratigraphic units in separated areas.

As we have already seen, the time during which the fossiliferous rocks of the earth were deposited is measured, not in just thousands, tens of thousands or even hundreds of thousands of years, but in hundreds of millions and perhaps in billions of years. During that time earth's first and simplest living things made their appearance, and from them through the processes of organic evolution have developed the whole past and present plant and animal kingdoms of our planet.

Effects of Environment

The changes involved in these evolutionary processes were made largely in response to changes in the environments in which the organisms were privileged or forced to live, as, for instance, changes in temperature, humidity, light, food supply, enemies, relative elevations of land and sea, and, in the case of water-living forms, such additional factors as depth, salinity, and turbulence of the water.

In general these environmental changes took place gradually and at rates which permitted most of the plants and animals either to adapt themselves to the new conditions or migrate to areas where their normal environment still prevailed. Sometimes, however, new conditions developed so rapidly that many species and groups in the areas so affected were unable either to survive or escape the changes, and consequently dropped out of the picture altogether. Unless their lines were perpetuated in other areas of favorable environment, the exit of these forms was final and they became extinct.

So long, however, as they persisted elsewhere without appreciable evolutionary change, they might reappear with recurrences of favorable environment. Such migratory reappearances usually threw them into different floral and faunal associations than before, thus giving rise to distinctive fossil assemblages which we now find even more valuable than index fossils in many problems of correlation.

It follows, therefore, that most sedimentary rocks contain fossils and fossil assemblages which differ from those in older and younger rocks but resemble those in rocks of equivalent age, and that consequently the geologic age and correlation of rock strata may be determined from the fossils they contain.

Not all rocks contain fossils, but in many cases the age of unfossiliferous rocks may be determined from their stratigraphic and structural relationships to fossil-bearing beds. In general they may be assumed to be older than overlying beds and

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younger than underlying beds, although older beds may overlie younger as a result of overturn, faulting, or intrusion. Igneous rocks are younger than rocks through which they have passed in working their way toward the earth's surface.

Fossils also indicate the conditions of deposition of the rocks in which they occur. Since organic development was primarily a response to environment, the fossil remains of the plants and animals of the past reflect the conditions which brought them into being and thereby give authentic evidence of the conditions under which the sediments of their time were deposited.

The Role of Paleontology in Oil Exploration

Paleontology plays an important role in many branches of economic geology. A good example is its application to the discovery and production of petroleum.

The four primary requirements for an oil field are (1) a source, (2) a reservoir, (3) a trap, and (4) a discoverer.

The discoverer is usually an experienced operator with initiative, "know-how," ample finances, good equipment, experienced personnel, persistence and courage. Occasionally a discovery is made by the fellow who comes in (frequently "on a shoestring") equipped with little except the courage to rush in and a desire to gamble (usually with other people's money) on something involving greater risk than the puppies and the ponies.

Experienced, legitimate operators nearly always, and other operators sometimes⁴ base their exploratory drilling upon careful, detailed geological and, often, geophysical studies.

The problems that face a geologist upon going into a new area are legion, but, regardless of all others, if he is in search of petroleum he will be constantly on the lookout for (1) organic shales which may have served as source beds for oil and gas; (2) permeable, porous beds which may serve as reservoir rocks; and (3) traps in which the oil and gas may be accumulated and held under high pressures.⁵

Organic shales commonly contain the remains of many minute plants and animals from which petroleum is believed to have been derived. Most of our west coast oil appears to have come from diatoms - plants so small that thousands of them may be found in less than a cubic inch of shale.

Reservoir rocks must be sufficiently porous to provide storage space for oil and gas, and sufficiently permeable to permit relatively free migration. They must also be accessible to oil and gas from the source beds, as by direct contact between the source and reservoir beds, or by movement of the oil and gas through intervening beds or along faults or other fractured zones.

Within areas of accumulation, however, there must be no avenue of escape from the reservoir beds if wells drilled into them are to be commercially productive. These areas constitute the traps and oil pools which are the final objective of the field geologist.

These traps may be either structural, stratigraphic, or both.⁶ Their multiplicity of types is too great to fall within the scope of this paper, but they may be found both described and illustrated in almost any good textbook on petroleum geology.

⁴Meinzer, O. E., (in charge of Div. of Ground Water, U.S. Geol. Survey), "Introductory Note" to Ellis, A. J., The Divining Rod, A History of Water Witching, U.S. Geol. Survey, Water-Supply Paper No. 416, pp. 5-6, 1917. Considers and discredits the forked twig, or so-called divining rod, and other more complicated spurious instruments (frequently referred to as "witch sticks," "doodlebugs," etc.) used for locating water, oil, or other minerals.

⁵Illing, Vincent C., Role of Stratigraphy in Oil Discovery, Bull. Amer. Assoc. Petrol. Geol., Vol. 29, No. 7, pp. 872-884, July 1945. Treats the subject under three sub-titles: (1) Stratigraphy and Source Rocks, (2) Stratigraphy and Reservoir Rocks, (3) Stratigraphy and Oil Preservation.

⁶Wilhelm, O., Classification of Petroleum Reservoirs, Bull. Amer. Assoc. Petrol. Geol., Vol. 29, No. 11, pp. 1537-1580, November 1945. An excellent detailed study and classification of petroleum reservoirs.

Structural traps are due chiefly to folding and faulting; stratigraphic traps to pinching out of the reservoir beds or to variations of permeability within them. Structural traps are the ones most commonly reflected at the surface. In the search for stratigraphic traps and for structural traps that lack surface expression we are largely dependent upon subsurface geology and geophysics.

Faulting may literally make or break a trap; make it by sealing off the upper truncated ends of broken and tilted reservoir beds against rocks which are impervious to oil and gas, or break it by providing a fractured zone along which oil and gas may escape or water may enter the reservoir sands.

In nearly all cases the field geologist will need fossil evidence in connection with his stratigraphic and structural studies from the very beginning. He will want to be able to recognize and correlate all rock formations within his area. As the work progresses he will need to correlate more closely in order to detect faults and other structural irregularities which may have a bearing upon oil accumulation.

His first knowledge of possible source and reservoir rocks will be based upon surface evidence, but any hole drilled to test them for oil and gas will be so located as to penetrate them at depths of several hundred or several thousand feet. Consequently he will need to know the stratigraphic interval between the surface rocks at the drill site and the sand he wishes to test in order to be able to estimate the depth at which the sand should be encountered. This calls for detailed analysis of fossil ranges.

As soon as possible after going into the field, therefore, the experienced geologist familiarizes himself with the fossils of his area. Many require detailed study for which he has neither time nor facilities in the field, and consequently they are sent to laboratories especially staffed and equipped for such work. This is particularly true of the microfossils whose ranges are worked out in great detail from samples taken at close intervals throughout all exposed sections of the sedimentary rocks of the area.

During the drilling that follows these field and laboratory studies, paleontology work is continued in even greater detail than before. The problem shifts from surface to subsurface geology, and buried details of stratigraphy and structure that control the accumulation of oil and gas are worked out largely through the study of well cuttings and cores. Micropaleontology, the study of microscopic fossils, is one of the most important branches of subsurface geology.

Statistics⁷ show that in California:

"Fourteen of the 32 (oil and gas) fields discovered during 1944 were located through subsurface studies. Another 4 discoveries resulted from a combination of subsurface and surface geology and 7 more discoveries from a combination of subsurface geology and geophysical work. Subsurface geology, therefore, played a major role in the discovery of new fields."

Fossil Study, a Universal Aid

Petroleum geology is by no means the only field to which paleontology is extremely important. Any project involving field work and mapping in marine sedimentary rocks will of necessity draw heavily upon paleontology for some of its most critical data.

Fossils are closely tied in with every important relationship of sedimentary rocks, for they are scattered through all of the earth's sedimentary series and some of its igneous rocks as a part of the rocks themselves. They are coal. They are diatomite. They are building stone. They are the remains of organisms from which petroleum and natural gas have been formed. They constitute the chief evidence in problems of correlation and are among the best indicators of geologic age. They indicate the conditions under which the sediments of their time were deposited. They have lived during periods of earth history when horses had five toes, fishes wore coats of armor, and enormous beasts and reptiles roamed the lands and swam the seas.

⁷Moody, Graham B., Developments in California in 1944, Bull. Amer. Assoc. Petrol. Geol., Vol. 29, No. 6, p. 652, June 1945.

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What stories these fossils could tell if they could only talk!

Better let us say, what stories they could tell if we but understood their language, because to the person who has learned to understand them, fossils - no daisies they - will tell their secrets any day.

OREGON BAUXITE DESCRIBED

Large reserves of ferruginous bauxite, an ore which may constitute an important source of alumina to supply Northwest aluminum plants, are described in a bulletin just issued by the Oregon Department of Geology and Mineral Industries. The deposits are widespread in northwestern Oregon but are found mainly in Washington, Columbia, and Marion Counties.

Discovery of high-iron bauxite in Washington County about 35 miles northwest of Portland was first announced by the department in 1944 and a short report on the discovery was issued in August of that year. Since that time additional field work has extended the known occurrences into other counties and revealed an entirely new bauxite area near Salem.

Considerable interest in the aluminum-bearing deposits has been shown by some of the large industrial companies, and Alcoa Mining Company, a subsidiary of the Aluminum Company of America, is at present engaged in a large-scale drilling and exploration project on these deposits in Washington and Columbia Counties.

F. W. Libbey, W. D. Lowry, and R. S. Mason of the department staff are the authors of the 97-page publication, which discusses the geology and economics of the deposits, and describes the 94 localities where the bauxite has been found. Not all of these localities are of commercial grade or size, however. Descriptions of two exploration projects by the department which indicated over 5,000,000 long tons of ore are given. Numerous analyses of the ore, together with maps and illustrations, are included in the publication which is available at the office of the department, 702 Woodlark Building, Portland, and the field offices at Baker and Grants Pass. Price postpaid \$1.00.

NEW MAP OF THE GEOLOGY OF NORTHWEST OREGON

The first report on the U.S. Geological Survey's recent investigations of the stratigraphy, structure, and oil and gas possibilities of the Coast Ranges in northwest Oregon has been released. The report is accompanied by a geologic map of an area including about 4,250 square miles west of the Willamette River and north of latitude 45°15'.

The map, which is on a scale of about 1 inch = 2.3 miles, shows the distribution of the major geologic units, ranging in age from Eocene to Recent, by patterns overprinted in green on a topographic base map printed in black. It is accompanied by two structure sections showing the relations of the strata, and by six stratigraphic sections showing the nature of the various rock units.

As an aid to oil geologists and others interested in the geology of the region, the fossil localities are indicated by symbols on the map, and lists of the fossils found at each locality are printed on the same sheet. A brief accompanying text summarizes the stratigraphy and structure of the area.

The map, measuring 44 by 64 inches, and entitled "Geology of northwest Oregon west of Willamette River and north of latitude 45°15'," has been issued as Preliminary Map 42 of the Oil and Gas Investigations series. Copies may be purchased on or after December 11, 1945 from the Director of the U.S. Geological Survey, Washington 25, D.C., at 70 cents each,

and will also be available for "over-the-counter" sale at the U. S. Geological Survey offices at Room 234 Federal Building, Tulsa, Okla.; Room 533 U. S. Post Office and Court-house Building, Los Angeles, Calif.; and at Room 314 Boston Building, 828 17th Street, Denver, Colo.

JUSTICE FOR GOLD MINERS

Identical bills S. 1497 and H.R. 4393 have been introduced in the Senate and House of Representatives by Senator Murray and by Representative Engle. The provisions are reproduced below:

A BILL

For the relief of the owners of certain gold mines which were closed or the operations of which were curtailed by War Production Board Limitation Order L-208.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, THAT ANY OWNER OF A GOLD MINE WHO INCURRED A FINANCIAL LOSS DUE TO THE CLOSING OR CURTAILMENT OF OPERATIONS OF SUCH MINE AS A RESULT OF THE RESTRICTIONS IMPOSED BY WAR PRODUCTION BOARD LIMITATION ORDER L-208 DURING THE EFFECTIVE LIFE THEREOF MAY, WITHIN SIX MONTHS AFTER THE EFFECTIVE DATE OF THIS ACT, FILE A CLAIM OR CLAIMS FOR THE AMOUNT OF SUCH LOSS, INCLUDING THE COSTS OF PLACING SUCH MINE IN A CONDITION EQUIVALENT TO THAT WHICH IT WAS IN AT THE TIME SUCH MINE WAS CLOSED OR ITS OPERATIONS CURTAILED AS A RESULT OF SUCH ORDER, BUT NOT INCLUDING PAYMENT FOR LOST PRODUCTION.

Sec. 2. (a) THE SECRETARY OF THE TREASURY IS AUTHORIZED AND DIRECTED TO APPOINT AN EXAMINER, WHO SHALL BE PAID A COMPENSATION AT THE RATE OF \$7,500 PER ANNUM, AND SHALL BE FURNISHED WITH AN ADEQUATE STAFF TO CONSIDER SUCH CLAIMS. IT SHALL BE THE DUTY OF SUCH EXAMINER TO CONSIDER ALL CLAIMS FILED UNDER THIS ACT AND TO CERTIFY FOR PAYMENT BY THE SECRETARY OF THE TREASURY SUCH CLAIMS AS HE SHALL FIND QUALIFIED FOR PAYMENT UNDER THE TERMS OF THIS ACT, IN SUCH AMOUNTS AS HE SHALL FIND ARE DUE. IT SHALL FURTHER BE THE DUTY OF THE EXAMINER TO SETTLE ALL CLAIMS WITHIN ONE YEAR AFTER THE DATE OF FILING THEREOF, EXCEPT WHERE PREVENTED BY UNUSUAL CIRCUMSTANCES.

(b) THE PERTINENT RECORDS OF OTHER AGENCIES OF THE FEDERAL GOVERNMENT SHALL BE MADE AVAILABLE TO THE EXAMINER UPON REQUEST.

Sec. 3. THE SECRETARY OF THE TREASURY IS AUTHORIZED AND DIRECTED TO PAY, OUT OF SUCH SUMS AS MAY BE APPROPRIATED UNDER THE TERMS OF THIS ACT, SUCH CLAIMS AS ARE CERTIFIED TO HIM UNDER THE TERMS OF THIS ACT.

Sec. 4. APPEAL MAY BE TAKEN FROM ANY DECISION OF THE EXAMINER BY A SUIT BROUGHT IN THE UNITED STATES DISTRICT COURT FOR THE DISTRICT WHEREIN THE PETITIONER IS DOMICILED OR WHEREIN HIS MINING OPERATIONS WERE CONDUCTED.

Sec. 5. THERE ARE HEREBY AUTHORIZED TO BE APPROPRIATED SUCH SUMS AS ARE NECESSARY TO CARRY OUT THE PROVISIONS OF THIS ACT.

Sec. 6. THIS ACT SHALL TAKE EFFECT ON THE FIRST DAY OF THE FIRST CALENDAR MONTH FOLLOWING THE DATE OF ITS ENACTMENT.

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