April 1952 Portland, Oregon

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METEORITES*

1. Introduction. Meteorites are scientifically important and worthy of study and preservation. They are commoner than is generally thought, knowledge and interest of people being great factors in finding them. The institutions named below* are anxious to add specimens of meteorites to their collections and to get facts about the falling and finding of meteorites.

Consider the tests and the descriptions given in this circular, prepared with the assistance of Dr. H. H. Nininger of Arizona and Dr. Oscar E. Monnig of Texas. If you think you have a meteorite, send it in. We will make an offer for its purchase or return it, and any tests will be without charge. If the possible meteorite is too large to send cheaply, write us a description and we will arrange to test a sample of an ounce or so.

Stray pieces of matter from unknown sources, moving through space at high speeds, often meet the earth. At about 75 miles above the ground, friction between these particles and the air makes them so hot that a light is produced and we see a "falling" or "shooting" star. These are properly called "meteors" and the extremely bright ones are known as "fireballs." Ordinary meteors are very small, and are reduced to gas or dust in their dash through the air. Fireballs may be as bright as the moon or even the sun. They are larger pieces of matter, and while even such fireballs may seem to "go out" at least several miles above us, they are often not actually "burned up" but only slowed down to relative coolness and may drop to the ground. These pieces of stone or iron that fall on the earth from outer space are called "meteorites."

2. Appearance and sound of fall. When the fireball seems to reach the earth or end low in trees, the meteorite (if any remains) has generally fallen from 150 to 300 miles away. When a fireball "ends" (goes out) high in the sky, a meteorite from it may fall nearby. Thunderous noises made by its disturbing passage through the air are often heard up to 50 miles from where the meteorite "lands." Persons within a fraction of a mile of the place of fall are likely to hear also a different kind of sound -- a whizzing or whirring noise, like an airplane with the meter cut off. Meteorites may fall at any time of the day or night, or year, or in any kind of weather; if it is cloudy, the fireball from which they come may not be seen, being entirely above the clouds. On clear days, especially in twilight, the fireball may leave a white cloud of dust in the sky; this sometimes remains visible for many minutes. Photographs of these dust trails are important and desirable.

3. Material. Some meteorites are metal; these are almost entirely iron, with about 5 to 10 percent of nickel. Most meteorites are stony, with a sprinkling of metallic iron granules or patches in them. The stony materials are mostly of various kinds known as

* Prepared by the Brown Foundation, Walla Walla, Washington, in cooperation with the American Meteorite Museum, Winslow, Arizona, and the Texas Observers, Fort Worth, Texas.

"silicates." Some few meteorites are types "in between" the iron and the stone kinds, consisting of about equal parts of iron and certain stony minerals, generally gray, yellowish, or greenish in color. No meteorites are intrinsically valuable, as the metals and minerals found in them are mostly common. Reported cases of such items as gold or diamonds refer to very tiny quantities, insufficient to be of commercial value. The real value of meteorites is their scientific importance, and the prices paid for them are rewards to stimulate interest and search. On this basis, we will pay liberal prices for any meteorites submitted to us.

4. Test. The best single test for any suspected meteorite is to grind a small area on a clean carborundum or emery wheel. A square inch or less is generally enough. As iron meteorites, and some stony ones are very hard, it is best to select a small surface already nearly flat. If the grinding reveals a stony interior, look closely at the surface uncovered and see if any metal patches or specks have appeared. A small magnifying glass is a help in seeing these, but they can generally be easily noticed as a scattering of irregular, silvery-appearing flecks. If metallic iron occurs in a stony mass, the piece is almost certainly a meteorite. An all-metal (iron) meteorite when ground, will show the fresh, iron interior at once; in cases like this, try a magnet on the mass as a confirming test, as any iron meteorite will be attracted by a magnet.

5. Size. Meteorites vary in size from pieces barely large enough to recognize to huge masses of 50 tons or more. What the average person is likely to find is one weighing from a fraction of a pound up to 50 or 100 pounds.

6. Weight. Meteorites are generally heavier than ordinary rocks, but this is not always or noticeably true. Extra heaviness alone is not a conclusive test. Iron meteorites are extremely heavy, weighing almost three times as much as ordinary rocks of the same size. Stony meteorites are, as a rule, less than $1\frac{1}{2}$ times as heavy as ordinary stone, and a very few are even lighter than common rock.

7. Shape. Meteorites may occur in almost any form, but they are generally very irregular in shape, and are rarely symmetrical. None are known which are round or ball-shaped, and any such objects are generally terrestrial "concretions" of a common nature. Meteorites are often cone-shaped, but square angles on them are surprisingly frequent.

8. Crust. Freshly fallen meteorites are covered with a thin, melted crust which is more often dull than shiny; it is always thin, and generally black. Fresh crusts are often "threaded" or in small ridges, showing flowlines of the material which melted. The effects of the weather change the crust quickly, making it dull or changing the color to gray or even brown (caused by the rusting of the metal) and later tending to wear away and destroy the crust. Old, weathered meteorites will generally show a rusty-brown, outside appearance, not very different from some ordinary rocks, especially certain sandstones. Fairly smooth pits or "thumb-marks" of varying size are sometimes present on the surface of meteorites. The crustal appearance is a guide principally for experienced persons.

9. Interior. It is not advisable to break or cut open a possible meteorite, as this lessens its value for scientific study by destroying some of the material and the original form, as well as injuring the crust. Iron meteorites resist efforts to pound them open or to chisel pieces off and are cut with hacksaw blades only with the greatest of effort; no such treatment should be given them. Whenever an iron meteorite is ground or cut so as to expose the inside material, it will be seen to be fresh, metallic iron, looking like silver. Stone meteorites, broken open, vary considerably in appearance, from dense, grainy, orelike rocks to very broken-looking mixtures of materials, and the general, interior color may be anything from white to black, greenish or brown; the usual interior color of the stone meteorite is light to dark gray. The free iron present will soon rust on exposed surfaces. Stony meteorites range from very hard to soft or even crumbly material. Meteorites never show gas bubble holes like artificial slag, and are never frothy or honeycombed like some lavas or volcanic rocks. They are always solid or compact.

10. Temperature. Contrary to popular opinion, meteorites are not extremely hot or flaming when they strike the ground. They do not make "glowing craters" or "burn for days." They have been out in space and are very cold; their flight of a few seconds through the air strips the thin surface material which is heated only by friction, and the remnant which hits the ground will be solid and only mildly warm if not actually cool to intensely cold. They do not spatter on striking. The only sign of melting on a meteorite is in its thin, fusion crust. Ordinary rocks which have been lying in the sunshine for some hours and are naturally quite hot are often picked up by mistake for meteorites.

11. Where found. There is no sure way or place to find meteorites. As they generally fall in groups, sometimes as much as 10 miles or more apart, others are likely to be found in a region after one has been picked up. Small ones up to several pounds in weight may bury themselves only partially or a few inches when they hit, or bounce and stay on the surface of the ground. Very large ones may penetrate into the earth for several feet, scattering some dirt outside the hole and covering the meteorite with loosely packed soil. Such holes are generally not very conspicuous. People who are outdoors a great deal and have a good idea of the ordinary or natural rocks of a country are very likely to find them. Farmers plowing often discover them. As land weathers away or is changed on the surface by working, meteorites formerly buried are likely to come to the surface.

12. Things mistaken for meteorites. Earthly nodules of iron compounds, especially "hematite," a dark-red, heavy, iron oxide which is very common, are frequently mistaken for meteorites. When one of these is ground, it will not show free metal, and even though the ground surface shows a metallic luster, it will not be silvery, and the piece will generally not be magnetic. Artificial slags or cinders sometimes contain free iron, but it is often in round pellets or drops in such formations. It never occurs so in meteorites. Slags or cinders will generally be very porous or spongy, and meteorites never are. Pieces of old, artificial, iron tools are sometimes mistaken for meteorites; a simple, chemical test for nickel distinguishes these. Rocks showing conspicuous or well-shaped crystals are not likely to be meteorites. Meteorites are solid, not porous; irregular in shape; heavy for size; black or brown; show metallic iron when ground; are different from the usual kinds of rocks found in that country. Coincidence of your specimen with these points may indicate that you have a genuine meteorite.

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PORT ORFORD METEORITE

This issue of the Ore.-Bin is principally concerned with meteorites, and the following description of the Port Orford meteorite is taken from the July 1945 Ore.-Bin as originally written by Dr. Hugh Pruett and published in the Oregon Journal. The succeeding article describes the Willamette meteorite, one of the most famous of them all. The description, somewhat condensed, is from the Geological Society of the Oregon Country News Letter, March 25, 1943.

Ed.

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 meteorite 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.

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THE WILLAMETTE METEORITE

By
J. Hugh Pruett
GENERAL EXTENSION DIVISION, UNIVERSITY OF OREGON

> "Meteorites, though not imbedded in the earth, are real estate, and consequently belong to the owner of the land on which they are found. . . .Seeing there is no error in the record, the judgment of the circuit court will be affirmed."

Speaking was Chief Justice Wolverton of the supreme court of Oregon in the case of the Oregon Iron and Steel Company vs. Ellis Hughes. The date, July 17, 1905.

Three years earlier on a wooded hillside (property of the plaintiff) near Willamette, Oregon, the defendant had discovered a curious mass of metal - almost 16 tons of it. Later he moved it onto his own land. When the real nature of this find became known, the plaintiff brought suit to recover it and won a decision in the lower court. The defendant appealed to the higher court but was there finally forced to abandon his claims to the huge chunk of nickel-iron which later became famous as the Willamette meteorite, the largest object of its kind ever found throughout the vast expanse of the United States and Canada.

To the day of his sudden death, December 3, 1942, at the age of 83, Mr. Hughes considered this decision an inglorious and unjust defeat. This sturdy intelligent Welsh woodsman who lived his last 50 years within less than a mile from the spot of the Willamette's discovery, likely never realized that his lasting honor in scientific circles far overbalanced the loss of the mere material possession of the meteorite.

In July 1938, a party from the University of Oregon visited the scene of discovery, interviewed Mr. Hughes and others familiar with the early history of the event, and obtained many valuable photographs. At that time Mr. Hughes seemed in good health and very graciously related to Miss Betty Jane Thompson, the journalist of the visiting group, many details not found in earlier published accounts.

> "I was coming home," said Mr. Hughes, "from where I had been cutting wood for the Willamette school. I noticed this big rock for the first time but didn't think anything of it. The next day I saw a very rusty broken saw near it. I sat down on the rock which was very flat and about 18 inches above the ground. Bill Dale came along.
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> "Then I picked up a white stone and started to hammer on the rock. It rang like a bell. Dale said he bet it was a meteor. It would probably be there yet, but my wife - you know how women are - had ideas. She was afraid somebody would go up and get it the next day."

After months of urging by his wife, Mr. Hughes went to work on a crude truck with which to move the huge mass to a spot near his house three-quarters of a mile away. He trusted no one to help him aside from his wife, his 15-year old boy, and his horse. He made the truck of logs and mounted it on ungainly wheels sawn from a tree trunk. Long and tiring work with levers and blocking was required to get the object elevated above the ground level. Finally, when it was sufficiently raised, the meteorite flopped over and tumbled onto the truck flat side down. Mr. Hughes thrilled at the fond remembrance. "It couldn't have been done better if you'd laid it there with your own hands."

Mr. Hughes next set up a "Spanish windlass" which he securely anchored with a chain. One end of a 100-foot cable of braided wire connected with the truck; the other wound on the barrel of the windlass as his horse walked in a circle around it. Thus a relatively small force exerted by the horse resulted in an immense pull on the cable.

Then began the long haul. The ground was soft and board tracks had to be laid and relaid. The windlass had to be moved and re-anchored each time the 100-foot cable was wound on it. So great were the difficulties that some days the truck was scarcely moved more than its own length.

During the process of moving, a neighbor chanced by. The next day a newspaper reporter from the Portland Oregonian appeared but found the meteorite covered with burlap. He insisted on a view of the object but the covering was not removed. Mr. Hughes said with a twinkle in his eye, "When he asked why I wouldn't, I explained the sun might warp it."

After three months of hard work in the forest, during which time few outside the Hughes family knew what was taking place, the meteorite reached its desired destination. When it was at last safely housed in a wooden building on the Hughes' property, it was put on display for an admission fee of 25 cents. People from far and near flocked to see the curiosity.

As luck would have it, among those who paid admission was a lawyer from the company on whose property the meteorite was found. "He offered $50 for the whole piece," said Mr. Hughes, "and said he wanted to show it at the Buffalo World's Fair. I wouldn't listen to him."

Not long after the attorney's visit, suit was filed by the land owners for possession of the meteorite. Public sympathy throughout the trial was generally with Mr. Hughes. The defense advanced the claim that the mass had originally been the property of the Clackamas Indians, had finally been abandoned by them at the spot where found in 1902, and therefore was not necessarily part of the land. Two old Indians, one of the Wasco tribe and the other a Klickatat, appeared in court in substantiation of this claim. Their testimony ran as follows:

The meteorite, Temanowos, had originally fallen from the moon and was thought to possess magical powers. It was held in high regard by the Indians. Rain collecting in its hollows was considered "holy water," and into this the Clackamas tribe dipped their arrows before going to war. Their young warriors were initiated by being compelled on the darkest of nights to climb the hill and visit the lonely spot where the celestial visitor reposed.

The account of a somewhat similar litigation was well aired in court by the plaintiff. This was the case of the Wennebago meteorite in Iowa. The tenant on the property saw the meteorite fall - it was comparatively small - and bury itself three feet deep. The next day he dug it up and assumed ownership. Later he sold it. The land owner brought suit and after several years the court granted possession on the ground that such objects belong to the "owner of the soil upon which they fall."

The defense, however, held there was a marked distinction between the Iowa and Oregon cases. In the former, both sides agreed on the place of fall; in the latter, no one knew where it originally landed. The Indians might have moved the meteorite from some other spot in order to give it a place of preminence on the hill. In prehistoric times when water

covered the Pacific slope the metallic mass, together with granite boulders lying near it, might have floated from a distant region on an ice floe. In the language of geologists, it would thus be an "erratic," similar to many large granite masses now found in fields and other places where they do not seem to belong.

Finally the circuit court granted possession to the Oregon Iron and Steel Company. The latter soon hauled the contested object from the Hughes property but got no farther down the road than the Johnson house when Mr. Hughes' appeal to the supreme court stopped further movement. Mr. Johnson, father of Harold Johnson who still resides in the same locality, was then appointed to guard the meteorite against removal or theft of any parts of it.

Harold Johnson tells that during the many months the mass remained there, the family's sleep was often interrupted by souvenir hunters.

> "Today with acetylene torches it might be an easy matter to get a specimen without much disturbance, but in those days their only tools were saws and hammers, and the meteorite would ring like a bell when struck. Often in the middle of the night the 'bell' would clang. Then out of bed jumped Father, grabbed his gun and, muttering to himself, rushed outside to start the intruder on his way. I still have a small chunk which Father took from a fellow who almost got away with it."

Before the meteorite was placed under guard, small pieces were cut off by various persons. At the request of the National Museum at Washington, Dr. A. W. Miller, Oregon geologist, inspected the huge mass. In an article in the Portland Oregonian of June 2, 1912, he described his study of the celestial visitor and mentioned that he removed several pieces. Dr. Henry A. Ward, Rochester scientist, made a trip across the continent to study the object. He also obtained several specimens.

At last came the 3000-word decision of the Oregon supreme court in which the lower court was upheld. After this, the Willamette was taken by water to Portland. From the river it was hauled by twelve powerful horses to the Lewis and Clark Exposition grounds where it was exhibited during the few weeks remaining of this Fair.

Scientifically minded Oregonians hoped that this interesting meteorite might remain in the State. But a very tempting bid came from Mrs. William Dodge II of New York to whom it was sold on February 15, 1906. Mrs. Dodge presented it to the American Museum of Natural History of New York. It was delivered to this museum April 14, 1906, and placed on exhibition June 7 of the same year. One condition prescribed by the donor was that the main mass should be kept intact in one piece. This weighs 31,107 pounds according to the museum catalog. In addition the museum has four other pieces which were evidently removed before Mrs. Dodge's purchase.

In June 1938, the New York museum, through the kindness of Dr. Clyde Fisher, sent to the University of Oregon a beautiful etched slab of the Willamette on an open exchange "in order that your school may have a part of the great meteorite found in your state." In addition to this, small specimens are owned by various Oregon residents related to the Hughes and Johnson families and through purchase from them.

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The composition of the Willamette is approximately 92 percent iron and eight percent nickel. . . .

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OREGON BLACK SAND OPERATIONS

Coast Minerals Company, Ltd., is reported to have started stripping operations on its black sand deposit near the coast north of Bandon, Coos County. Operations looking toward production from black sand deposits on Whisky Run beach are also reported. Probably Whisky Run was the scene of the first discovery of rich placer gold along the Oregon beaches.

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SNOW MEASUREMENTS

The presence of unusually great amounts of water in the hills this year means different things to different people. Foresters, farmers, and power companies welcome the predicted abundant runoff while lowlanders in some localities have cause for concern over the danger of floods. Chrome miners anxious to get back into the hills will be delayed. Not only will the above-average snow pack take longer to melt but roads and bridges will probably suffer unduly from the runoff and may require greater than normal maintenance.

The following snow-pack measurements of representative areas in the State have been abstracted from the April 1 report of the Federal-State Cooperative Snow Surveys and Irrigation Water Forecasts:

Snow Course	Location Sec.	T.	R.	Elev.	Snow Depth (in.)	Water content (in.) 1952	Years of record	Av. water content (in.)
Dooley Mountain (Baker County)	32	11S	40E	5430	38.3	14.8[bc]	13	8.6
Bourne (Baker County)	33	8S	37E	5800	56.3	20.1	16	15.5
Olive Lake (Grant County)	14	9S	33½E	6000	71.9	27.7	16	19.3
Ochoco Meadows (Crook County)	21	13S	20E	5200	43.1	17.5[b]	23	9.3
McKenzie (Lane County)	35	15S	7½E	4800	140.4	60.6	14	41.3
Willamette Pass (Lane County)	21	24S	5½E	5600	166.0	64.6[bc]	8	40.4
Diamond Lake (Douglas County)	29	27S	6E	5315	89.6	40.7[bc]	23	19.0
Wagner Butte (Jackson County)	1	40S	1W	6900	73.9	30.0[bc]	17	16.9
Park Headquarters (Klamath County)	8	31S	6E	6450	198.4	90.5[bc]	8	61.5
Scraggy Mountain (Siskiyou County)	9	47N	10W*	6200	123.7	62.3[bc]	10	26.0
Grayback Peak (Josephine County)	9	40S	5W	6000	109.4	50.5	16	24.5
Althouse (Josephine County)	17	41S	7W	4400	59.9	24.3[b]	15	6.7
Annie Spring (Klamath County)	19	31S	6E	6018	175.9	77.3[bc]	19	44.5
Sun Mountain (Klamath County)	22	32S	7½E	5350	114.9	47.4[bc]	15	26.9
Stinking Water (Harney County)	33	21S	34E	4800	25.1	9.2[bc]	13	0.5
Disaster Peak (Harney County)	8	47N	34E	6500	76.4	36.2[a,b]	3	10.8

[a]Telephonic.

[b]Greatest April 1 water content recorded.

[c]Greatest water content, regardless of date, since record began.

*Mt. Diablo Meridian.

STANDARD MINE CHANGES HANDS

Ray Summers, John Day, Oregon, has purchased the lease on the old Standard mine north of Prairie City, Grant County, Oregon, from Bert Hayes. As soon as weather conditions permit, Mr. Summers plans to start active underground development.

The Standard mine is one of the oldest lode mines in the State. Development of the property started about 1880, but the most active period was between 1900 and 1907. Waldemar Lindgren, then with the U.S. Geological Survey, reported on the mine in 1900. D. F. Hewitt of the Survey examined and mapped the property in 1915. Messrs. Gilluly, Reed, and Park reported on the Standard in 1933 (U.S. Geol. Survey Bull. 846-A).

The mine is noteworthy in that the ore contains cobalt and it reportedly shipped some cobalt ore to the Edison laboratory. Principal production has been copper, but vein minerals are unusually varied. Gilluly, Reed, and Park report pyrite, chalcopyrite, arsenopyrite, cobaltite, glaucodot, bismuthinite, native bismuth, galena, and sphalerite.

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DREDGING MONAZITE SANDS

The Wall Street Journal, March 20, 1952, contains an article on rare earth minerals which are being extracted from the Idaho sand deposits in Warren Valley about 80 miles north of Boise. The monazite sands are extracted by three dredges owned by Baumhoff-Marshall Company, Warren Dredging Company, and Idaho Canadian Dredging Company. The heavy sands are concentrated on the dredges and are then trucked to a separating plant at Boise. In this plant electromagnetic machines are used. Besides monazite, which is the real incentive for mining the sands, magnetite, ilmenite, garnet, and zircon are recovered. At present these by-products have little or no market, but are potentially valuable. Most of the Idaho output goes to the Lindsay Light and Chemical Company, Chicago. Shipments to this company are at the rate of about 1500 tons yearly and it is expected that additional dredges will be put into operation and that in another year the amount to be treated by the firm will be three times as much as at present. Rare Earth, Inc., Patterson, New Jersey, is another consumer of the monazite.

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PACIFIC NORTHWEST A.I.M.E. CONFERENCE

The Pacific Northwest Joint Conference of the Industrial Minerals Division and the Metals Branch of the American Institute of Mining and Metallurgical Engineers will be held at the Davenport Hotel, Spokane, Washington, May 8, 9, and 10. This is the first time that a joint meeting of the Industrial Minerals Division and the Metals Branch of the Institute has been held in the Northwest. It will be the fifth meeting of the Northwest Industrial Minerals Division which have been regularly rotated among Portland, Spokane, and Seattle.

Trips to the magnesium reduction plant of the Northwest Alloys Corporation; the aluminum reduction plant and aluminum rolling mill, both of the Kaiser Aluminum and Chemical Corporation; and the Northwest Magnesite Company operations at Chewelah, Washington, will be made.

The program of papers covers a wide field of industrial minerals occurrence and utilization as well as physical and extractive branches of metallurgy. Papers which are to be presented by Oregonians are as follows:

"Industrial Utilization of Iron Oxide" - J. M. Orr, Orr Chemical and Engineering Corporation, Scappoose, Oregon.

"The Propagation of Slip Lines in Face Centered Cubic Metals" - Harry Czyzewski, President, Metallurgical Engineers, Inc., Portland, Oregon.

"Electric Furnace Melting Practices for Low and High Alloy Steels" - James Gow, Electric Steel Foundry Company, Portland, Oregon.

The featured speaker at the banquet, which will conclude the sessions May 10, will be James F. Bell, Vice-President of the Portland Gas and Coke Company. The subject will be "Quartz and Mica Mining in Brazil."

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