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FIREBALLS, METEORITES, AND METEOR SHOWERS

By Erwin F. Lange
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About once each year a brilliant and newsworthy fireball* passes across the Northwest skies. The phenomenon is visible evidence that a meteorite is reaching the earth from outer space. More than 40 percent of the earth's known meteorites have been recovered at the terminus of the fireball's flight. Such meteorites are known as "falls" as distinguished from "finds," which are old meteorites recovered from the earth's crust and not seen falling.

To date only two falls have been noted in the entire Pacific Northwest. The more recent occurred on Sunday morning, July 2, 1939, when a spectacular fireball or meteor passed over Portland just before 8:00 a.m. Somewhat to the east of Portland the meteor exploded, causing many people to awaken from their Sunday morning slumbers as buildings shook, and dishes and windows rattled. No damage was reported. Several climbers on Mount Hood and Mount Adams reported seeing the unusual event. The fireball immediately became known as the Portland meteor and stories about it appeared in newspapers from coast to coast. For two days the pre-Fourth of July fireworks made front-page news in the local newspapers.

J. Hugh Pruett, astronomer at the University of Oregon and Pacific director of the American Meteor Society, in an attempt to find the meteorite which had caused such excitement, appealed to all witnesses of the event to report to him their observations. The data he desired included the direction of the fireball when first seen, direction when fireball ceased to be luminous, height above the horizon, color of the light, and the presence or absence of a smoke trail. He soon received over 90 replies, many from observers more than a hundred miles from Portland. The data plotted on a map indicated that the fireball came in from the direction of the Pacific Ocean, passed over Portland, and dropped to the east of the city, possibly into the Columbia River.

Between 1932 and 1939 Pruett had collected enough data from cooperating observers to be able to trace 13 bright fireballs that had passed over the Northwest skies. After each meteor, people sent him a variety of rocks

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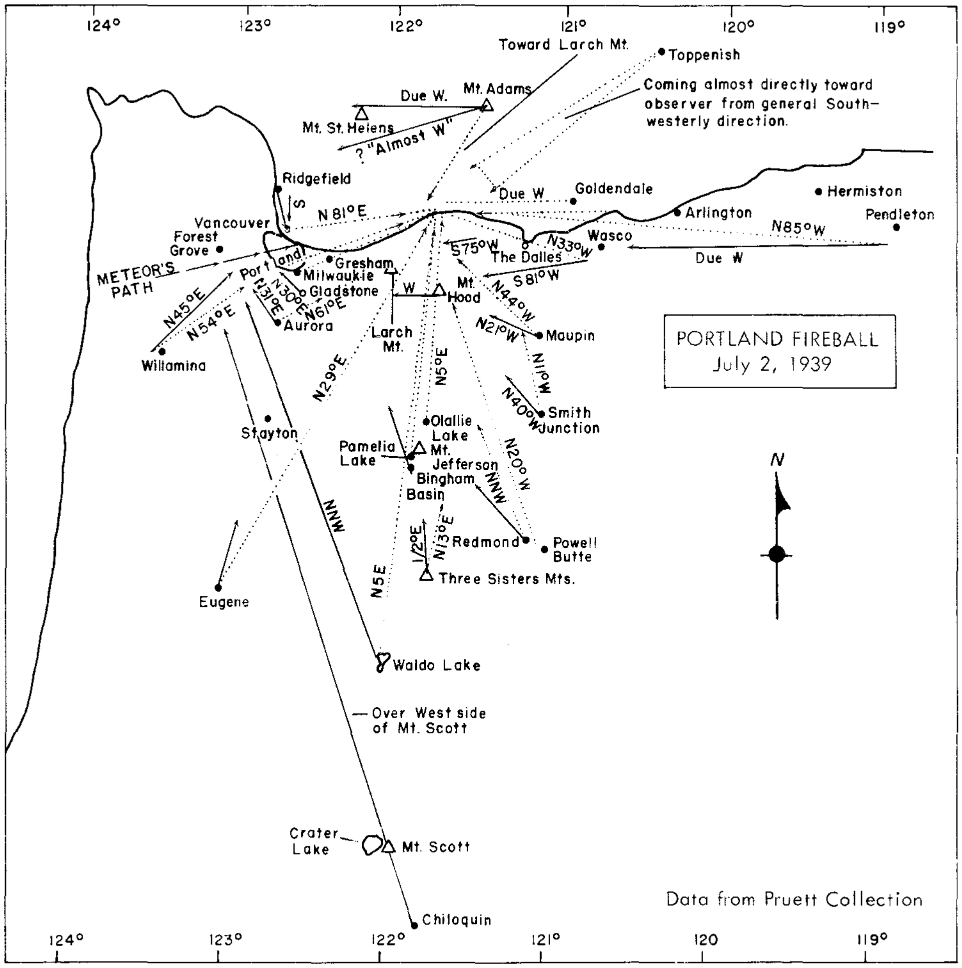
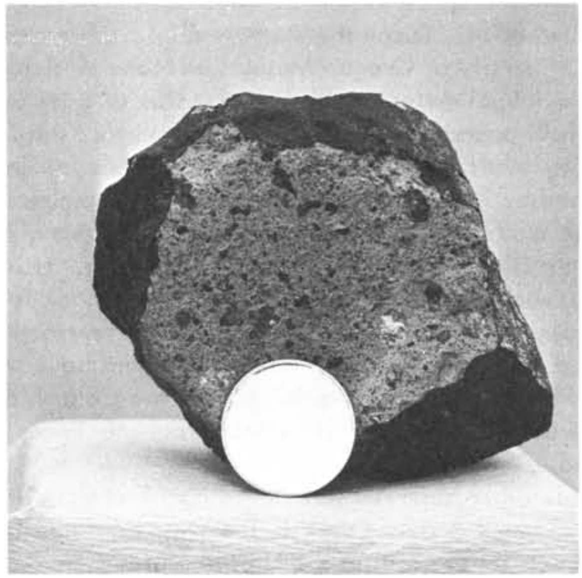
* See glossary at end of article.



Map showing reported sightings in the Pacific Northwest of the 1939 Portland Fireball. Solid line indicates first sighting; dotted line shows direction last seen. Note that the dotted lines of most of the accurate observations point to the area where the fireball was last seen. Beyond this area, in the direction of flight, one should be able to find the meteorite or fragments of the meteorite if it became disrupted.

and minerals which suddenly seemed different to them. None, however, proved to be meteorites until August 18, 1939, more than six weeks after the Portland meteor had ceased to make news, when he received in the mail a small box containing a fine, freshly fallen stony meteorite. It had been sent by Jerry E. Best, Washougal, Wash., who had found the interesting stone inhis back yard on July 3. Having no interest in retaining the specimen, he presented it to Pruett. The Portland meteor then became the



The Washougal meteorite found on July 3, 1939, the day after the Portland fireball exploded to the east of Portland, Oregon. The meteorite is on exhibit at the Museum of Natural History at the University of Oregon. The size is compared with that of a dime.

The two pictures above are from old drawings. On the left is a fireball; on the right is a meteor shower -- probably the great meteor shower of November 13, 1833.

Washougal meteorite. Today the stone is displayed in a meteorite collection in the University of Oregon Museum of Natural History.

The Washougal meteorite is about the size of a tennis ball and weighs almost one-half pound. It has a light gray interior, throughout which are scattered many small nickel-iron particles. A fine, smooth, black fusion coating formed by its fiery passage through the atmosphere covers the entire surface. The Washougal stone belongs to a rather rare class of Howardites which are very friable and often break up in falling. It is almost inconceivable that such a small stone could create the shock felt on that early Sunday morning of July 2, 1939. Very likely it represents only one small specimen of a meteoritic shower. Some specimens have probably gone undetected, while others may have fallen into the Columbia River. Since Howardites weather rapidly, it is unlikely that specimens of this fall will still be found.

The only other observed fall in the Pacific Northwest occurred on May 26, 1893, near Beaver Creek in the West Kootenai District of British Columbia, a few miles north of the United States-Canada boundary and about 10 miles above the point where Beaver Creek flows into the Columbia River. Two stony meteorites were recovered from this fall, one weighing about five pounds, the other a larger mass of 25 pounds.

Observing a fireball or brilliant meteor is one of the most awesome sights a person can experience. It is strange that more meteorites have not been recovered, since the evidence indicates that many meteorites have fallen over the Northwest. It is hoped that the Year of the Meteorite will make some of these past falls known.

Many people have been curious about the source of meteorites in space. Today most scientists believe that meteorites have their origin in the asteroid or planetoid belt between the orbits of the planets Mars and Jupiter. In recent years a number of asteroids, following very elliptical paths, have passed rather close to the earth. These include Apollo, which came within two million miles of the earth in 1932, and Adonis, which in 1936 approached within a million miles. In 1937 Hermes came within 500,000 miles of the earth and then disappeared into space. Great public interest was generated this spring with the announcement that in June the asteroid Icarus would approach the earth within a distance of four million miles. This asteroid is of great interest, since it comes 12 million miles closer to the sun than does the planet Mercury, the sun's nearest neighbor. As small asteroids are deflected from their regular orbits by gravitational forces of bodies within the solar system, they could well come into the influence of the earth's gravitation and fall as meteorites.

A person watching the heavens on a clear night can almost always see a streak of light shooting across the sky. The light is called a meteor and is caused by a particle of matter penetrating the earth's atmosphere at high speed and becoming luminous from the heat of atmospheric friction. Most meteors are caused by particles no larger than grains of sand.

At certain times of the year the light streaks come in such large numbers as to form magnificent meteor streams or showers. One of the greatest meteor showers on record occurred on the night of November 13, 1833, when thousands of meteors could be seen every hour. The event has been compared to the falling of snowflakes in a heavy snow storm. This shower is referred to as the Leonids because all of the meteors appeared to originate in the constellation Leo. The spectacular Leonids of 1833 were seen all over the United States, and were widely reported on in scientific journals and in diaries of hunters and trappers in the Far West.

Each year on the same date a few of the Leonid meteors can be seen, but every 33-1/3 years they become impressive. The last great Leonid shower took place on November 17, 1966. Astronomers noted that the great Leonid showers occurred at the same time the Comet 1866 I, or Tempel's comet, made its appearance. This observation, along with that of other meteor showers and comets, has led scientists to believe that meteor showers are related to comets. Among the other common meteor showers are the Perseids, visible around August 12 and associated with the Comet 1862 III; the Orionids of October 22, related to Halley's Comet; and the Taurids of November 1, related to Encke's Comet, which completes its path around the sun in about 3-1/3 years, the shortest period of any known comet.

Comets, in nearing the sun, give off gaseous materials which appear as a streaming tail across the night sky. Because of light and radiation pressures as the comet nears the sun, material is lost from the comet as it completes each round trip. Some comets, such as Biela's, have disintegrated entirely and only meteor showers are seen. As the earth's atmosphere passes through the debris left in the comet's path, meteors are formed. Most of the materials vaporize and probably nothing more than meteoritic dust filters down through the atmosphere.

It is worthy of note that not a single known meteorite can be associated with the common meteor showers, while almost half of the known meteorites can be directly connected with an observed fireball. The fact that so many bright fireballs have passed over the Pacific Northwest in years past and so few meteorites have been recovered gives encouragement to the belief that the search for new meteorites will be successful, if many people become involved in looking.

Glossary of Terms

Many of the terms used in connection with meteorites are often misunderstood. It is hoped that the following explanations will be helpful.

1. Asteroids or planetoids. In our solar system nine planets revolve around the sun. Between the orbits of the planets Mars and Jupiter are

thousands of small objects sometimes called minor planets or asteroids. The largest is about 500 miles in diameter. The asteroid Icarus is thought to be but half a mile in diameter. These solid objects may have resulted from the disruption of one or more larger bodies, or they may represent material that did not form a larger object.

2. Comets. Comets are also members of the solar system revolving around the sun. Comets have a relatively large volume but small mass. They are largely composed of solid material that would be gaseous at the temperatures on the earth. As comets approach the sun, a glowing tail develops that often spreads across much of the night sky. Usually 6 to 10 comets appear each year, most of which are visible only with a telescope. Comets have very elliptical orbits cutting across the orbits of the planets.

3. Fireball. The word fireball is a common term for a very bright light or meteor that is seen passing overhead. The light is caused by the intense heat of atmospheric friction as matter from space plunges towards the earth. An exploding fireball is sometimes called a bolide.

4. Meteor. The light phenomenon produced by matter from space passing through the atmosphere is called a meteor.

5. Meteorite. Matter that reaches the earth from space is called a meteorite. The word meteoroid is often used to designate the matter while still in space.

6. Meteoritics. The science or study of meteorite is called meteoritics.

* * * * *

BUREAU OF MINES FORECASTS ENERGY NEEDS

How much energy will the U.S. economy need in 1980 and 2000? What amounts of resources will meet the demand? What mix of fuels will be used? The U.S. Bureau of Mines has made some predictions and presents the facts and formulas on which they are based in a new technical report. Total projected U.S. demand for energy in 1980 is 88 quadrillion British thermal units, and in the year 2000, 168 quadrillion BTU's. This is more than triple the 1965 use of 53.8 quadrillion BTU's. Principal sources predicted for 1980 and 2000: bituminous coal, 737 and 856 million short tons, respectively; natural gas, 24.6 and 40.4 trillion cubic feet; crude oil and gas liquids, 6665 and 9626 million barrels. The Bureau forecasts electric power generation of 2739 and 9036 billion kilowatt hours. Information Circular 8384, "An energy model for the United States, featuring energy balances for the years 1947 to 1965 and projections and forecasts to the years 1980 and 2000," is on sale for 70 cents from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402.

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NEW HORIZONS IN HISTORICAL RESEARCH: THE GEOLOGISTS' FRONTIER

By Kenneth L. Holmes
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Few people realize the tremendous influence that early geological exploration and mineral discovery had on Oregon's social and industrial development, because so little has been written about them. The Department staff has felt for some time that here was an excellent thesis for historians of the American West, and has endeavored to encourage them to delve into this subject. One product of this endeavor was an article in the June ORE BIN on early gold mining in eastern Oregon by amateur historians Miles F. Potter and Harold McCall.

Dr. Kenneth L. Holmes, whose undergraduate training and early teaching experience was in geology and general science before he turned to history as a profession, is keenly aware of the significant role frontier geology played in history and of the lack of literature on it. He writes: "Over the last few years the contemplation of the disparity between the influence of science in our culture and the neglect of the history of science as a discipline has impelled me to look in the direction of my first love, and I have sought greater understanding of the history of geology." His article in this issue of The ORE BIN is adapted from a paper he presented at the Pacific Northwest History Conference, April 22, 1962. In it he suggests three aspects of pioneer geology he believes could serve as the basis for fruitful historical research. Ed.

Introduction

In an article in the Pacific Historical Review for September 1943, entitled "The Scientist in the West, 1870-1880," Howard D. Kramer opened with the following statement:

"The scientists and geologists who took part in this work encountered their full share of the hardships and dangers which always accompany a penetration into wild and little-known country. Their exciting adventures, together with their comments on the West as they saw it, are buried in a mass of geological and technological material (underlining by Holmes). Once in a great while, though, the man of science departed temporarily from his customary detachment and it is in these rare passages that the historian can discover information which is helpful to him." (Kramer, 1943, p. 239)

Now, if we overlook the casual way in which Kramer speaks of "scientists and geologists"; if we bypass his description of some of the most undetached men of science in American history as working in "customary detachment," it is apparent that the "mass of geological and technological material" which Kramer passed over in order to find "rare passages" wherein the historian might "discover information which is helpful to him" constitutes the distilled essence of the explorations made by the creative spirits of the profession during the heroic age of American geology. Beginning with the two names known even to most historians, let us list just a few: Clarence King, John Wesley Powell, John S. Newberry, Clarence E. Dutton, Josiah Whitney, Joseph LeConte, Thomas Condon, Grove Karl Gilbert, Othniel C. Marsh, and Edward Drinker Cope, giants in the land who revolutionized American geology and had a profound influence on the discipline on a world-wide scale.

Along with such classics as James Hutton's Theory of the Earth, Lyell's Principles of Geology, and Darwin's Origin of Species, the reports of these pioneer American geologists constitute such a veritable mother lode of description, observations on method, and expressions of the geologist's philosophy that they became the criterion for subsequent research. Anyone who has taken the time to open their massive tomes, published by the United States Government, and to walk where the great frontier geologists walked has reaped rewards that have proved invaluable to him in teaching, research, and in sheer inspiration in his field, be it geology or history.

Geology Moves Westward

Joseph LeConte, first Professor of Geology at the University of California, summarized "A Century of Geology" in the Smithsonian Annual Report for 1900 (LeConte, 1900, p. 265) by saying, "Geology is one of the youngest of the sciences. It may almost be said to have been born of the present century." Then he summed up the great reconnaissance in the following manner: "It is interesting to note the ever-increasing part taken by American geologists in the advance of this science. There has been through the century a gradual movement of what might be called the center of gravity of geological research westward, until now, at its end, the most productive activity is here in America. This is not due to any superiority of American geologists, but to the superiority of their opportunities." That is one thing the frontier offered: superiority of opportunities.

Clarence King, in his first Annual Report (King, 1880, p. 4) as Director of the Geological Survey, claimed it all really began in 1867. Before that, he wrote, geology had been "a sort of camp-follower to expeditions whose main object was topographical reconnaissance." In 1867, however, King remembered that "Congress ordered the geological exploration of the 40th parallel, a labor designed to render geological maps of the country about to be opened by the Union and Central Pacific Railroads, then in process of construction. In this work geology was the sole object.

For the first time a government geologist found himself in independent command, able to direct the movements and guide the researches of a corps of competent professional assistants. At the same session of Congress, Dr. Hayden's 'Geological and Geographical Survey of the Rocky Mountain Region' was likewise placed in the field." Then King went on to say, "Eighteen hundred and sixty-seven, therefore, marks in the history of national geological work, a turning point, when the science ceased to be dragged in the dust of rapid exploration and took a commanding position in the professional work of the country."

George P. Merrill in his First Hundred Years of American Geology (Merrill, 1924, p. 251) suggested the transformation from military to geological explorations in mid-nineteenth century had developed in the following order: "some purely military, some military and geographic, with geology only incidental, and others for the avowed purpose of geological and natural history research."

There were three groups, which sometimes overlapped. Some men stayed east and received rock samples and fossils by shipment from the West and described the specimens in scientific papers. Others came west and stayed west, becoming professors in the new universities and colleges in that region, men such as Thomas Condon at the University of Oregon and Joseph LeConte at the University of California. A third group came west on expeditions for the Government, or took time off from teaching in the East, or financed themselves out of personal funds to penetrate the Great West for geological knowledge. They became pioneer teachers and founders of geology departments in eastern educational institutions; they carried out state geological surveys; they became the principal motivating force in the national geological activities.

Suggested Paths of Research

Before going farther, it must be said that the intent of this paper is not to be a definitive summary of conclusions, the result of years of research, but it is to be, rather, suggestive, pointing the way for research in the future. It is meant as much to raise questions, to posit opportunities for future historical studies, to turn a few furrows of a field that has hardly been cultivated. There are a few good works already done, but not a tithe of what has been written on the continental fur trade, for instance. The following three themes are but a triad of many, and they might be expanded fruitfully:

1. The American West contained vast stretches of land with very little ground cover, revealing land forms, geological structures, and mineral deposits in a sheer nakedness before the trained observer.
2. The West was a repository of fossil sources without precedence.

3. The West made necessary and desirable a unified approach to geology by the Federal Government.

These three themes are discussed as follows:

The West was an open book to the geological explorer

This new breed of geologist found a land in the arid part of the West that lay bare to the observer of geological phenomena. The geological explorers never tired of commenting on this. Consider the soaring words of J. S. Newberry, for whom Newberry Crater south of Bend is named, as he describes the region of the upper Colorado River in 1876:

> Could one be elevated to a sufficient height over the center of this region, and be gifted with superhuman powers of vision, he would see beneath him what would appear to be a great plain, bounded on every side by mountain ranges, and here and there dotted by isolated mountain masses, rising like islands above its surface. He would see, too, the profound chasm of the Colorado Cañon scoring with tortuous and diagonal course the plain, throughout the entire length of its greatest diameter; for nearly five hundred miles the stream flowing from 3000 to 6000 feet below the general level, and at all points bordered by abrupt, frequently perpendicular crags and precipices. Most of the surface beneath him he would perceive to be arid and desert-like; barren wastes of rock and sand; nowhere continuous forests or carpets of herbaceous vegetation; only here and there dwarfed and scattered pines and cedars and threads of green along the streams; the surface marked with long lines of mesa walls, the abrupt, often vertical sides of broad valleys of erosion; over considerable areas the denudation of soft materials, of varied and vivid colors, having fretted the surface into wonderfully truthful imitations of Cyclopean cities, crumpled by time, or devastated by fire, giving double force to the sense of desolation which the scene inspired.
>
> Such, in general terms, are the external features of the plateau country west of the Rocky Mountains, through which the Colorado flows. Perhaps no portion of the earth's surface is more irremediably sterile, none more hopelessly lost to human occupation, and yet it is but the wreck and ruin of a region rich and beautiful, changed and impoverished by the deepening channels of its draining streams; the most striking and suggestive example of over-drainage of which we have any knowledge.
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> . . . .
>
> Though valueless to the agriculturist; dreaded and shunned

> by the emigrant, the miner, and even the adventurous trapper, the Colorado plateau is to the geologist a paradise. Nowhere on the earth's surface, so far as we know, are the secrets of its structure so fully revealed as here (Newberry, 1876, p. 53-54).

Clarence E. Dutton said of the same region in 1880, "In no other portion of the world are the natural laws governing the processes of land sculpture exemplified so grandly; nowhere else are their results set forth so clearly" (Dutton, 1880, 1881). He suggested that the processes of land sculpture, denudation, and erosion could be studied in the West as nowhere else.

Israel C. Russell, who pioneered in the geological exploration of eastern Oregon and Washington, wrote, "When investigators of surface geology and geography made their bold explorations into the vast arid region ...they discovered a land of wonders, where the mask of vegetation which conceals so many is absent, and the features of the naked land are fully revealed beneath a cloudless sky" (Russell, 1898, p. IX-X).

Read with me the words of John Wesley Powell as he observed the gap by which the Green River penetrates through the heart of the Uinta Mountains in eastern Utah. He wrote in 1875 as follows:

> To a person studying the physical geography of this country, without a knowledge of its geology, it would seem very strange that the river should cut through the mountains, when, apparently, it might have passed around them to the east, through valleys, for there are such along the north side of the Uintas, extending to the east, where the mountains are degraded to hills, and, passing around these, there are other valleys, extending to the Green, on the south side of the range. Then, why did the river run through the mountains?
>
> The first explanation suggested is that it followed a previously formed fissure through the range; but very little examination will show that this explanation is unsatisfactory. The proof is abundant that the river cut its own channel; that the cañons are gorges of corrasion. Again, the question returns to us, why did not the stream turn around this great obstruction, rather than pass through it? The answer is that the river had the right of way; in other words, it was running ere the mountains were formed; not before the rocks of which the mountains are composed, were deposited, but before the formations were folded, so as to make a mountain range (Powell, 1875, p. 152).
>
> . . . .
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> We may say, then, that the river did not cut its way <u>down</u> through the mountains, from a height of many thousand feet above its present site, but, having an elevation differing but

> little, perhaps, from what it now has, as the fold was lifted, it cleared away the obstruction by cutting a cañon, and the walls were thus elevated on either side. The river preserved its level, but mountains were lifted up; as the saw revolves on a fixed pivot, while the log through which it cuts is moved along. The river was the saw which cut the mountains in two (Powell, p. 153).
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> . . . .
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> The mountains were not thrust up as peaks, but a great block was slowly lifted, and from this the mountains were carved by the clouds -- patient artists, who take what time may be necessary for their work (Powell, 1875, p. 154).

So Powell, as he looked down upon the naked land and formulated the necessary terms to describe it, postulated: "I propose to call such valleys...antecedent valleys" (Powell, 1875, p. 163). This concept has been fundamental to geologists ever since. Our own Columbia River is an antecedent stream. It was there before the Cascade Mountains were formed by successive uplifts and by layer on volcanic layer of lava. It was an ageless battle between the river and the rising mountains, and the river won, and continues to win, providing for us the scenic grandeur of the Columbia Gorge.

The West was a repository of fossil sources

The second theme is that the American West made available fossil sources that were without precedence. To mention just three: the Brea Tar Pits in southern California, the John Day beds discovered by Dr. Thomas Condon in eastern Oregon, and the Mesozoic beds in which dinosaur and mammal remains were found in Colorado, Utah, and Wyoming.

The eminent paleontologist, George Gaylord Simpson, calls the post-Civil War era in America a classical age of paleontology. During this period, he says, "Paleontology became evolutionary and developed the theories of phylogeny....This was the golden age of discovery when most of the major fossil fields of the continent were found" (Simpson, 1942, p. 131).

The two paleontological giants who towered above the rest were Othniel C. Marsh of the Peabody Museum at Yale University, and Edward Drinker Cope of the University of Pennsylvania. Both were wealthy men who used their financial resources to vie with each other in funding exploration of the fossil beds of the West. Both of them, incidentally, visited Thomas Condon in Oregon. We shall not deal with the amazing feud that developed as these two wealthy scientists tried to outdo each other in finding, collecting, and describing the fossil treasures. A comparison of the sections on Mesozoic reptiles in succeeding editions of a book such as James Dwight Dana's *Manual of Geology* reveals the landslide of reptilian fossils that this duo turned up as the years went by. They made the term "dinosaur" a household word.

Edward Drinker Cope's monograph in the Hayden Survey volumes, familiarly known as "Cope's Primer," is a fat work of more than 1000 pages and 137 plates, about as big as an unabridged dictionary. Cope discovered and named more than a third of all the fossils of the 3200 vertebrates of North America known at the time of the establishment of the U.S. Geological Survey in 1879, and had spent some $80,000 of a legacy left to him by his father in this pursuit. He is credited with 600 articles and books. George P. Merrill wrote of him that his haste sometimes led to superficiality and quotes a contemporary who charged him with describing one form "wrong end to," but adds that "his intuition was better than his logic" (Merrill, 1930, p. 421).

O.C. Marsh, Cope's protagonist in this bone-chilling contest, found and described something like 80 new forms and 34 new genera of dinosaurs. Marsh must be considered as a major contributor in exploring and understanding some of the evolutionary concepts put forward by Darwin. In commenting on the American paleontologist's monograph on the _Extinct Toothed Birds of North America_, published in 1880, Darwin wrote to Marsh saying that "your old birds have offered the _best support_ to the theory of evolution" (Marsh, 1895, p. 181).

When Thomas Huxley came to the United States in 1876, he went to New Haven to visit Marsh. He asked if he might examine some of the horse fossils. As Marsh brought forth box after box of fossil horse material collected in the West, Huxley exclaimed, "I believe you are a magician. Whatever I want you conjure it up" (Huxley, 1909, v. 1, p. 495). There were 30 species represented. Marsh had already concluded, and Huxley agreed, that "the evolution of the horse was beyond question, and for the first time indicated the direct line of descent of an existing mammal."

The West unified the Federal Government's approach to geology

The third theme we proposed to broach is that the West made necessary and desirable a unified approach to geology by the Federal Government. As long ago as 1893 Frederick Jackson Turner in a classic essay, "The Significance of the Frontier in American History," suggested that "the legislation which most developed the powers of the national government and played the largest part in its activity was conditioned on the frontier" (Turner, 1893, p. 217).

This was true in the case of geology, too. Most of the explorations were carried out in territories under federal control -- not yet states -- and called for decisive action by the national government, which entered the field for several reasons, among them being that: (1) It was playing a major role in pushing through the railroads; (2) with the California gold rush and subsequent rushes that followed mineral riches were opened up beyond belief, (3) there was need for understanding and consistent laws and administration in dealing with the public lands -- especially arid public lands -- in the West.

Clarence King summed it up briefly in 1880 as he discussed the purpose of the newly formed United States Geological Survey: "Two special and distinct branches of duty are imposed upon the Director of the Geological Survey: 1. the classification of the public land; and 2. the examination of the geological structure and mineralogical resources" (King, 1880, p. 5).

The Survey, described by G. K. Gilbert as "a great instrument of research" (Gilbert, 1902, p. 640), became just that under Clarence King and John Wesley Powell, its first two Directors, and it continues as a vital research arm of the United States Government. The part played by the West as its huge laboratory is obvious. There is a maxim that the best geologist is the one who handles the most rocks. Here was the opportunity for the geologist to see and handle rocks in abundance -- and to be paid for doing so by the Federal Government.

King's close personal friend, Henry Adams, wrote an accolade of tribute to his geological companion in a memorable passage in The Education of Henry Adams:

> King's abnormal energy had already won him success. He had managed to induce Congress to adopt almost its first modern act of legislation. He had organized, as a civil -- not military -- measure, a Government Survey. He had paralleled the Continental Railway in Geology; a feat as yet unequalled by other governments which had as a rule no continents to survey. He was creating one of the classic scientific works of the century (Adams, 1918, p. 312).

In discussing these men and their contributions, James Gilluly of the Geological Survey says, "That most of these men were exceptionally able is generally agreed, but it seems to me that the impact they made upon science was even larger than their abilities would normally have justified. The combination of great challenge, mutual stimulus, and the financial support that enabled them to study many facets of geology, not only areally but also in depth, made possible the flowering of the science in America" (Gilluly, 1963, p. 220).

Often their intuitions overwhelmed their logic, and we know now that there were times when both their intuitions and their logic were wrong, but as we look upon the careers and achievements of these giants in the land, who today is able to bend their bow?

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LAND WITHDRAWALS FOR RECREATION

The Bureau of Land Management has announced the proposed withdrawal of 621.07 acres of O&C and public domain land from location under the mining laws in Clackamas, Marion, Benton, and Douglas Counties. The land is to be used for four recreation sites.

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ATLANTIC-RICHFIELD BUYS URANIUM REDUCTION PLANT

The uranium reduction plant north of Lakeview, Oregon, has been purchased by Atlantic-Richfield Co. The plant was built in 1958 by Lakeview Mining Co. at a cost of about $2,800,000, and Atlantic-Richfield becomes the sixth owner. (Examiner photograph, 1959)

Atlantic-Richfield, a major oil- and gas-producing corporation which is also engaged in uranium exploration, acquired the plant July 17 from Commercial Discount Corp. of Chicago for an undisclosed amount. A company spokesman for the purchaser told Chick Chaloupka, local agent for Commercial Discount, that no immediate plans have been made for utilization of the mill, but that an engineering study will be made this year to determine its mechanical condition.

The Lakeview plant was built to produce uranium oxide (U-308) from the ores of the White King and Lucky Lass mines which the plant builder, Lakeview Mining Co., had leased. The plant, using the acid leach process, went on stream in November 1958 and was operated by that company until November 1960, when it was shut down, and it has not operated since that date.

On March 27, 1961, Kerr-McGee Oil Industries of Oklahoma City announced its subsidiary, Kermac Nuclear Fuels, had obtained ownership of the plant, and on November 12, 1964, a group of Lakeview investors organized as Oregon Pacific Industries bought the plant with the intent of getting an industry into it. This group included Don Clause, Jim Farleigh, Jim Olson, Roy Matchett, and Nancy and Ed Taylor.

On March 10, 1966, sale of the plant by Oregon Pacific to Continental Mining & Milling Co. of Chicago was announced. The latter firm announced extensive plans for processing uranium plus other circuits for a number of minerals. These plans did not materialize, and a mortage against Continental was foreclosed in 1967 by Commercial Discount Corp., which took ownership and has now sold to Atlantic-Richfield.

The uranium story in Lake County began in 1955. In July discovery of the White King on Augur Creek, 12 miles northwest of Lakeview, was announced by Don Tracy, Wayland Roush, John Roush, Walter Leehmann, Sr. and Jr., the prospect having been found in March by Tracy. The following week, Don Lindsey, Bob Adams, Clair Smith, and Choc Shelton announced discovery of the Lucky Lass, about one mile from the King.

These events set off wholesale prospecting and claim taking in wide areas of the county, with upwards of 3000 claims filed. That fall, both of the original discoveries were leased to Thornburg Brothers of Grand Junction, Colo. The latter, Dr. Garth W. Thornburg and Vance Thornburg, joined with the Richarson-Bass interests of Fort Worth, Tex., and the Murchison Trusts of Dallas, Tex., to form Lakeview Mining Co., which explored the properties and in 1958 built the reduction plant.

The plant initially processed ore from the King and some from the Lass. When underground mining operations at the White King proved difficult and expensive, the operation shifted to open pit and this method produced all the ore it could by late 1959. The King was shut down then, and the mill continued operating for about one year, using ores shipped in from Nevada and California. The Lucky Lass owners did some extensive open-pit work in 1964, shipping its ores to Salt Lake City for processing. In July, 1966 the White King group of 19 claims was leased to Western Nuclear, Inc., of Denver, and in December of that year Don Tracy announced he had leased his Lucky Day group of claims on Thomas Creek to that firm. Since taking the White King lease, Western Nuclear has done extensive core drilling, which is still continuing. (Lake County Examiner, July 25, 1968)

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MOUNT JEFFERSON ROCKS ANALYZED

"Petrography and Petrology of Volcanic Rocks in the Mount Jefferson Area, High Cascade Range, Oregon," by Robert C. Green, has been published by the U.S. Geological Survey as Bulletin 1251-G. It is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The price is 30 cents.

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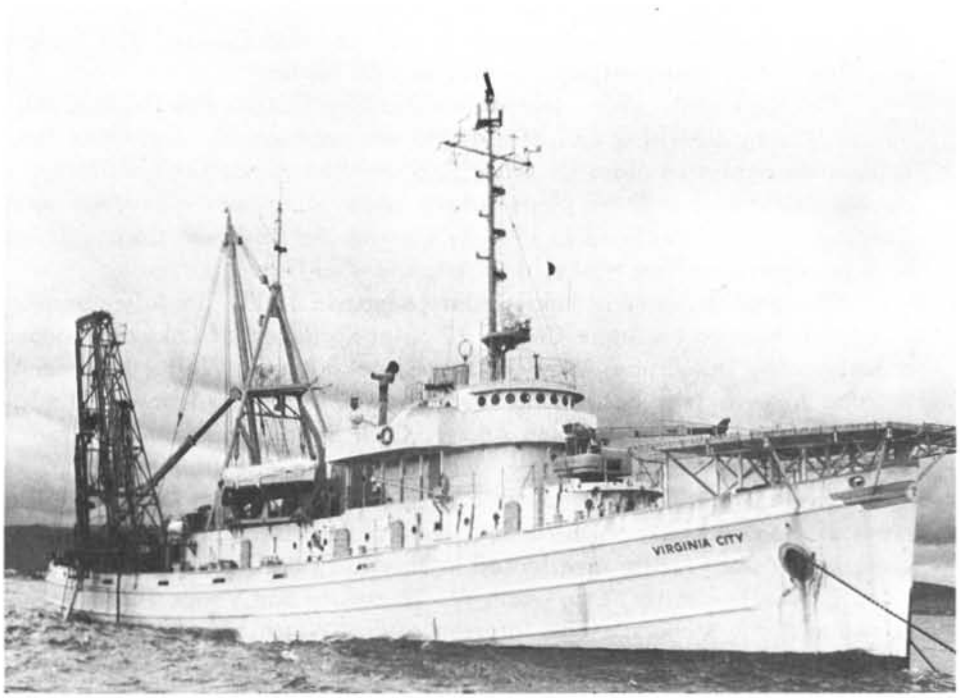

USBM MARINE DRILLING VESSEL - THE R/V VIRGINIA CITY

The R/V Virginia City, shown in the above photograph, left the U.S. Bureau of Mines Marine Mineral Technology Center at Tiburon, Cal., August 18 to work off the southern Oregon coast. The vessel is expected to be in the vicinity of Port Orford the week of September 1 and near Gold Beach the week of September 9. Drillings will be made in four areas having concentrations of heavy minerals, mainly gold, platinum, chromite, magnetite, and zircon. The four areas are situated in the ocean, mostly in lands under State control, six miles north of Coquille, at Cape Blanco, north of the mouth of the Rogue River, and at the mouth and south of the mouth of the Rogue. Location of the drilling sites is indicated on maps in the May ORE BIN and in U.S. Geological Survey Circular 587.

The ship has a capability of core drilling to a depth of 240 feet from the ocean surface. Several years of work by the Department of Oceanography at Oregon State University and by the Office of Marine Geology and Hydrology of the U.S. Geological Survey identified the deposit areas. This cooperative work is part of the Department of Interior's Heavy Metals Program.

The concentrations of heavy minerals off the coast of southern Oregon had their origin in the mineralized and ultramafic rocks of the Klamath Mountains, and lie as submerged beaches and stream channels off the mouths of the larger rivers.

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PARTICIPANTS OF THE ANDESITE CONFERENCE

Fifty-two scientists from 11 countries attended the second international conference on Oregon's volcanic rocks. The Andesite Conference, held at Bend June 30 to July 5, 1968, was under the sponsorship of the International Upper Mantle Committee, the Center for Volcanology at the University of Oregon, and the State of Oregon Department of Geology and Mineral Industries. Headquarters for the meetings were at Central Oregon College at Bend; college buildings can be seen in background of photograph. (Photograph by Earl C. Roarig, Bend, Oregon.)

The Department published the conference guidebook, which was included in the Upper Mantle Committee's scientific report series. Like the guidebook which the Department published for the Lunar Geological Field Conference in 1965, and which is in its third printing, the volume for the Andesite Conference (Bulletin 62) contains many photographs and colored geologic maps to illustrate field trips, road logs, and discussions on Oregon Cascade rocks. The first definitive work to be published on the geology of Mount Hood is included in the bulletin. Other areas covered are the Santiam-McKenzie Pass area, Crater Lake, and Newberry caldera.

"Andesite Conference Guidebook" should be enjoyed as much by the layman and tourist as was its predecessor, "Lunar Geological Field Conference Guidebook."

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NATIONAL OCEANOGRAPHY CONFERENCE SCHEDULED

Oregon Governor Tom McCall and Admiral J. M. Lyle, president of the National Security Industrial Association, announced August 19 that Oregon will host a National Conference of Coastal States December 11, 12, and 13 in Portland. The conference will bring together representatives of the 23 coastal states and of industries interested in ocean resources.

The purpose of the conference is to develop specific guidelines on hard metal mining from the ocean-submerged lands under state control. Representatives from the petroleum, commercial fisheries, recreation, and mining industries will meet with state people from the executive and legislative branches of government and the public to develop guidelines under the multiple-use concept. More than 100 official delegates are being named, with many other industry, government, public, and conservation organizations from the entire nation expected to attend as observers.

The conference is the first in a planned annual series of Governor McCall's Conservation Congresses, each to consider an individual resource problem.

This conference is a joint effort by the Sea Grant Program of Oregon State University, the Governor's Committee on Oceanography, and the Committee on Natural Resources. Joining with Oregon in sponsoring the workshop is the Ocean Science and Technical Advisory Committee of the National Security Industrial Association of Washington, D.C.

Further information may be obtained from Commander John H. Jorgenson, OSTAC Executive Committee, 1030 15th N.W., Suite 800, Washington, D.C. (20005) or from Kessler Cannon, Governor's Office, Salem, Oregon (97310).

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METAL PRICES AND PREDICTIONS REPORTED

SILVER:- The price of silver has dropped to $2.09 per troy ounce. At the first silver sale since June in which General Services Administration offered commercial (99.9% fine) silver, all bids were rejected by the Government.

COPPER:- Producers and dealers predict that a drop in the present price of 42 cents a pound for domestic copper is almost a certainty. The prediction is based on the drop in the price of U.S. scrap, a decline in copper quote on the London Metal Exchange, a recent decrease in the price of Canadian copper sold to Canadian users and increased production of new copper. Dealers' forecasts range from a modest 1 cent per pound drop to retrenchment as far as the 38-cent price prevailing before the 8½-month copper strike was ended last March. (Nevada Mining Assn. News Letter, August 15, 1968)

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AVAILABLE PUBLICATIONS

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

BULLETINS

2. Progress report on Coos Bay coal field, 1938: F. W. Libbey . . . . . $ 0.15
8. Feasibility of steel plant in lower Columbia River area, rev. 1940: Miller . 0.40
26. Soil: Its origin, destruction, preservation, 1944: Twenhofel. 0.45
33. Bibliography (1st supplement) of geology and mineral resources of Oregon, 1947: Allen 1.00
35. Geology of Dallas and Valsetz quadrangles, Oregon, rev. 1963: Baldwin . 3.00
36. (1st vol.) Five papers on Western Oregon Tertiary foraminifera, 1947: Cushman, Stewart, and Stewart 1.00
(2nd vol.) Two papers on Western Oregon and Washington Tertiary foraminifera, 1949: Cushman, Stewart, and Stewart; and one paper on mollusca and microfauna, Wildcat coast section, Humboldt County, Calif., 1949: Stewart and Stewart 1.25
37. Geology of the Albany quadrangle, Oregon, 1953: Allison 0.75
44. Bibliography (2nd supplement) of geology and mineral resources of Oregon, 1953: Steere 1.00
46. Ferruginous bauxite deposits, Salem Hills, Marion County, Oregon, 1956: Corcoran and Libbey 1.25
49. Lode mines, Granite Mining Dist., Grant County, Ore., 1959: Koch . . 1.00
52. Chromite in southwestern Oregon, 1961: Ramp 3.50
53. Bibliography (3rd supplement) of the geology and mineral resources of Oregon, 1962: Steere and Owen 1.50
56. Fourteenth biennial report of the State Geologist, 1963-64 . . . . . . Free
57. Lunar Geological Field Conference guide book, 1965: Peterson and Groh, editors 3.50
58. Geology of the Suplee-Izee area, Oregon, 1965: Dickinson and Vigrass . . 5.00
59. Fifteenth biennial report of the State Geologist, 1964-1966 . . . . . . Free
60. Engineering geology of the Tualatin Valley region, Oregon, 1967: Schlicker and Deacon 5.00

GEOLOGIC MAPS

Preliminary geologic map of Sumpter quadrangle, 1941: Pardee and others . . . 0.40
Geologic map of the St. Helens quadrangle, 1945: Wilkinson, Lowry & Baldwin . 0.35
Geologic map of Kerby quadrangle, Oregon, 1948: Wells, Hotz, and Cater . . 0.80
Geologic map of Albany quadrangle, Oregon, 1953: Allison (also in Bull. 37) . . 0.50
Geologic map of Galice quadrangle, Oregon, 1953: Wells and Walker 1.00
Geologic map of Lebanon quadrangle, Oregon, 1956: Allison and Felts . . . 0.75
Geologic map of Bend quadrangle, and reconnaissance geologic map of central portion, High Cascade Mountains, Oregon, 1957: Williams . . . 1.00
GMS-1 - Geologic map of the Sparta quadrangle, Oregon, 1962: Prostka . . . 1.50
GMS-2 - Geologic map, Mitchell Butte quad., Oregon, 1962: Corcoran et al. . 1.50
GMS-3 - Preliminary geologic map, Durkee quad., Oregon, 1967: Prostka . . 1.50
Geologic map of Oregon west of 121st meridian (over the counter) 2.00
folded in envelope, $2.15; rolled in map tube, $2.50 . . . . .
Gravity maps of Oregon, onshore and offshore, 1967: [Sold only in set] flat . . 2.00
folded in envelope, $2.25; rolled in map tube, $2.50 . . . . .

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18.	Radioactive minerals the prospectors should know (2nd rev.), 1955: White and Schafer	0.30
19.	Brick and tile industry in Oregon, 1949: J.E. Allen and R.S. Mason .	0.20
20.	Glazes from Oregon volcanic glass, 1950: Charles W. F. Jacobs . . .	0.20
21.	Lightweight aggregate industry in Oregon, 1951: Ralph S. Mason . . .	0.25
23.	Oregon King Mine, Jefferson County, 1962: F.W. Libbey and R.E. Corcoran	1.00
24.	The Almeda Mine, Josephine County, Oregon, 1967: F. W. Libbey . .	2.00

MISCELLANEOUS PAPERS

2.	Key to Oregon mineral deposits map, 1951: Ralph S. Mason	0.15
3.	Facts about fossils (reprints), 1953	0.35
4.	Rules and regulations for conservation of oil and natural gas (revised 1962)	1.00
5.	Oregon's gold placers (reprints), 1954	0.25
6.	Oil and gas exploration in Oregon, rev. 1965: Stewart and Newton . .	1.50
7.	Bibliography of theses on Oregon geology, 1959: H. G. Schlicker . .	0.50
7.	(Supplement) Bibliography of theses, 1959 to Dec. 31, 1965: M. Roberts	0.50
8.	Available well records of oil & gas exploration in Oregon, rev. 1963: Newton	0.50
10.	Articles on Recent volcanism in Oregon, 1965: (reprints, The ORE BIN) .	1.00

MISCELLANEOUS PUBLICATIONS

Oregon mineral deposits map (22 x 34 inches), rev. 1958	0.30
Oregon quicksilver localities map (22 x 34 inches) 1946	0.30
Landforms of Oregon: a physiographic sketch (17 x 22 inches), 1941	0.25
Index to topographic mapping in Oregon, 1961	Free
Index to published geologic mapping in Oregon, 1960	Free
Geologic time chart for Oregon, 1961	Free

OIL and GAS INVESTIGATIONS SERIES

1.	Petroleum geology of the western Snake River basin, Oregon-Idaho, 1963: V. C. Newton, Jr., and R. E. Corcoran	2.50