The Ore Bin

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ARCHAEOLOGICAL EVIDENCE OF LAND SUBSIDENCE ON THE NORTHWEST COAST

Emory Strong*

The determination of changes in sea level is a tedious process, requiring world-wide instrumentation and time measured in decades or centuries. Yet in many areas archaeological sites provide a ready-made indicator for regional fluctuations. For instance, N.C. Flemming (1969), in a monumental survey of 179 ancient towns on the Mediterranean, found that land elevations had changed as much as 56 feet during the last 2,000 years. Prehistoric residents of the Northwest Coast, enjoying a prosperous marine and riverine economy, lived in shoreside villages, and their ruins, like those towns on the Mediterranean, show substantial sea-level changes.

Melting ice sheets of the last glacial period have raised sea level as much as 100 feet, but the rate of rise has sharply decreased in the past 6,000 years and has amounted to only about 5 feet in the past 2,000 years (Shepard, 1964). If recent sea-level changes are as slight as most scientists believe (Butzer, 1971), then it would appear that some regions in the Pacific Northwest are subsiding.

I first became aware of this geological phenomena while searching the banks of the Columbia River for Indian artifacts. I located all the old villages in the Portland vicinity and, when the spring flood waters were receding, hunted as many as I could in my boat to see what prizes erosion had uncovered. Most of the sites were completely submerged by even a normal freshet, and in order to rescue the relics before they were washed away (or before someone else got them) I kept a record of the normal river stage for the first and subsequent visits.

The flooded sites puzzled me. There seemed to be no acceptable reason to have a village where every spring it must be abandoned, especially as there was usually higher ground nearby. The Indians built their houses of planks, fashioned with great labor, over a pit 3 or 4 feet deep, so it is very doubtful they would have built on flood-prone land. Had they

* Mr. Strong is a retired engineer, archaeologist by avocation, and author of two books and a number of articles on early man in the West.

done so, they would have had to remove the valuable planks before the flood and afterward clean the pits of silt before rebuilding their houses. Although most sites show occasional flooding, the stratification indicates a time interval of centuries.

There are about a dozen archaeological sites in the vicinity of Portland that are covered by high water, but the most revealing one is on Lake River near Felida, Washington, about 8 miles northwest of Vancouver. On their return trip up the Columbia in 1806, Lewis and Clark recorded, "we set out and had not proceeded far before we came to a landing place (outlet of Shillapoo Lake) where there was several large canoes hauled up, and sitting in a canoe appearantly awaiting our arival with a view to join the fleet an indian who was then alongside of us. this man informed he was a Shoto and that his nation resided a little distance from the river. we landed and one of the indians pointed to the Shoto village which is situated back of a Pond (Shillapoo Lake) which lies parallel with the river on the NE. side nearly opposit the Clannahquah village."

When I hunted there many years ago, the outlines of the old houses were plainly visible (Figure 1). From 1964 to 1966 the Oregon Archaeological Society completely excavated the site, which lies at an elevation of 16 to 21 feet above sea level. Because of spring flooding, no work could be done until about the middle of July (Figure 2). Plank outlines of the houses were found and many storage pits. The floors of the houses were about 30 inches deep, and the depth of midden in their vicinity varied considerably.

Near the shore, where the eroded bank was steep, excavation had to be abandoned because the permanent water table was reached at a depth of 8 feet, although the midden extended to an unknown depth. It was evident that the houses being excavated were much younger than the old and deep midden. No C-14 dates could be obtained because of contamination from Hanford, but judging by other sites nearby, this one is not more than about 1,000 years old. Since few trade goods were found, the town was probably abandoned during the Great Pestilence of 1830-1835 -- perhaps even earlier, for no other journals mention the site.

In 1971, crews from the University of Washington excavated another site on the left bank of Lake River a short distance below Shoto. Their excavation also approached the permanent water table; when their report is released it may provide some relative or absolute dating.

Examples of drowned archaeological sites have been noted at a number of places in the Pacific Northwest. In 1938 Dr. Philip Drucker (1943) made an extensive survey of the Northwest Coast,and several of the sites to the north of Vancouver Island showed considerable wave erosion. In one of them, where the midden was 18 feet deep, it was necessary to abandon a test pit 7 feet below high tide line because of seepage, although the midden still continued. Dr. Drucker thought there might have been sudden submergence of the area.

Figure 1. Shoto Village site showing house outlines. Lake River on left.

Figure 2. University of Washington crew working site on Lake River. Dark area is damp from nearness to water table.

In reply to a letter asking for C-14 dates on drowned sites, Dr. Richard D. Daugherty of Washington State University said, "It appears that on the Washington Coast the situation varies from south to north. I noticed back in 1947 when I was surveying the Washington Coast that around Willapa Bay there was abundant evidence of recent submergence, but on the northern coast the evidence is that of recent emergence. I don't have any C-14 dates that relate directly to the problem."

George Gibbs, early ethnologist and geologist, also noted changes on Willapa Bay. In 1865 he wrote (Clark, 1955), "At Shoalwater Bay, where evidence of elevation and depression of the land, apparently at no very ancient date, are visible, the Chinooks, it is said, have traditions of earthquakes that have shaken their houses and raised the ground, but I could not learn whether any superstitions were connected with the occurrence."

Petroglyphs abound on the Northwest Coast. Edward Mead (1971) wrote: "That many petroglyphs are extremely ancient is indicated by the fact that the majority are located on beaches at half to low tide levels. In most places a difference in tide level of at least twelve feet would be required to allow the carvings to stand above high tide mark."

Lambert Florin, Portland author, in a letter to me commented, "My publisher showed me the site of Oleman House near Agate Point (on Puget Sound). There are some middens around there, and some foundation poles still show at extreme low tides. The water comes in further now than then." Concerning the same site, Warren Snyder (1956) says, "The most plausible explanation of the presence of chipped stone points on the beach and their absence in the site is that an earlier site once existed on this sandspit and was destroyed by wave action just as the present site is now being destroyed."

I have found only one usable C-14 date relating to land submergence but it is most interesting. Dr. Thomas M. Newman in 1956 to 1959 conducted extensive excavations in an ancient village on Netarts sandspit in Tillamook County (Figure 3). Quoting from his report (Newman, 1959): "Of special interest is the position of this stratum in relation to the present fresh water table and sea level. At the time of excavation, during the late summer, the fresh water table beneath the surface of the site is at its lowest point. At this low point the fresh water table still bisected the lowest occupation. A winter visit to the site revealed that at that time of the year this occupation was covered by the water table to the depth of 0.5 meters or slightly more....It is quite clear that occupations of this stratum did not take place under conditions existing today. Both sea level and the water table must have been substantially lower to permit occupation. Similar conditions are reported by Drucker (1943)."

Dr. Newman postulated that the lowest occupation level should have been at least 2.5 meters (8.2 feet) higher than present for comfortable living, since the site appeared to have been directly on the beach when first occupied. Radiocarbon samples from the lower level gave a date of about 1400 A.D. The rise in sea level (or land subsidence) would then be approximately 18 inches per century.

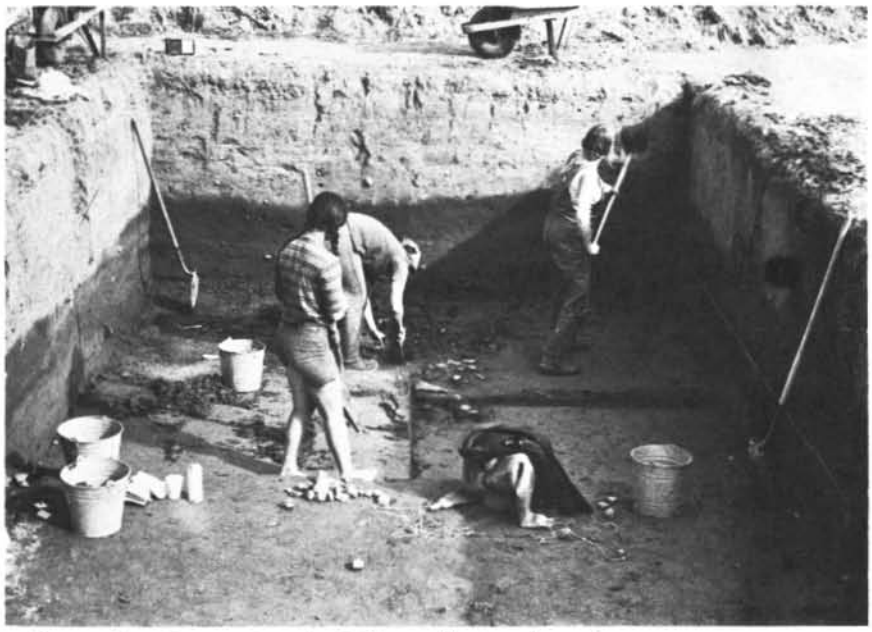

Figure 3. Excavation in Tillamook site showing permanent water table. Photo courtesy of Dr. Thomas Newman.

The Shoto village near Felida, Washington was occupied in 1806. Although Lewis and Clark did not visit the village itself, they show it on their map and record it in their ethnology report as "Shoto Tribe, No. of Houses or Lodges 8, Probable No. of Souls 460." If this estimate includes the three other towns in the vicinity, it reasonably agrees with the evidence. Land submergence in that area must have been quite rapid in the past 150 years, for the site is now flooded every year. On May 23, 1953, I wrote in my diary, "Water at 19.5 feet (Vancouver Gauge). All Shillapoo camps completely covered." And on June 7, "Water at 17.5. Camps on Shillapoo just out of water."

The examples cited here are but a few of many. The "Village Chinoak"near McGowan, Washington, home of the famous Chief Concomly, is now completely washed away, as is the great Namuit village on Sauvie Island. Along the banks of the Columbia and its sloughs, old fire lines can frequently be seen deep beneath the surface, visible only at extremely low water.

The many illustrations of drowned archaeological sites along the coast and in tidal bays and rivers of the Pacific Northwest provide evidence for land subsidence within the past few centuries. Although submergence of sites may reflect a slight world-wide rise in sea level, local downwarping appears to play the dominant role.

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FIELD TRIP GUIDEBOOKS STILL AVAILABLE

Copies of the field-trip guidebook prepared for the Geological Society of America meetings at Portland State University in March, 1973, are still available. The publication, issued as Bulletin 77 by the Oregon Department of Geology and Mineral Industries, is entitled "Geologic Field Trips in Northern Oregon and Southern Washington." It presents seven self-guiding tours to see the geology of the Coast Range in Oregon, the Columbia River Gorge, the lower Columbia River region and northern Oregon coast, the north-central Oregon region, the Pasco basin in Washington, a lava tube on the flank of Mount St. Helens in Washington, and the urban environmental geology of the Portland area.

The guidebook can be purchased from the Department at its Portland, Baker, and Grants Pass offices. The price is $5.00.

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METEORITES OF THE PACIFIC NORTHWEST

Erwin F. Lange
Portland State University

Nineteen meteorites have been recovered from the vast territory comprising Alaska, British Columbia, Idaho, Nevada, Oregon, and Washington. By contrast, 22 meteorites have been recovered from California, 26 from Arizona, and about 120 from Texas. In general, more have been found across the southern part of the United States and Mexico than across Canada and the northern part of this country.

Although approximately 40 percent of the world's 2,000 known meteorites were observed falls, only three or four of the meteorites of the Pacific Northwest were seen falling. Most of the Northwest meteorites can be considered as finds, and the following account indicates that meteorites have been found in a variety of ways associated with man's activities. Since so few meteorites have been discovered in such a large area, it is probable that many others exist and could be found if more people frequenting the outdoors became familiar with meteoritic properties. It is also quite likely that some people treasure unreported and undescribed meteorites among their possessions. Since meteorites are of most value as objects of scientific study, such unreported specimens should be described in the scientific literature.

Alaska

Only three meteorites have been found and described in the scientific literature from Alaska, a state larger than Texas.

The first meteorite from Alaska became known about 1881 when the California State Mining Bureau purchased a 94-pound iron from Indian Chief Donawack or "Silver Eye." The chief reported that the meteorite had been seen to fall at Chilkoot Inlet, Portage Bay, about a hundred years before by the father of one of the oldest members of the tribe. This iron, known as the Chilkoot meteorite, is now on display amid a large mineral collection in San Francisco at the California Division of Mines and Geology.

In 1921 the U.S. National Museum (Smithsonian Institution) received a 40-gram and a 280-gram specimen of a pallasite meteorite which had been found on top of a mountain about three miles west of the trading post at Cold Bay on the Alaskan Peninsula. The two fragments of the Cold Bay meteorite were badly rusted, resembling terrestrial limonite, but the interior revealed an irregular sponge of shiny metal with interstices of yellow olivine characteristic of pallasite meteorites.

On August 11, 1942, a gold dredge uncovered a 95-pound iron meteorite from 12 feet underground along Aggie Creek on Seward Peninsula about 90 miles southeast of Nome. The operator, on hearing the thump of something very heavy hit the dump plate, shut down the dredge to investigate more carefully. At first he thought he had hit real gold because of the weight and color of the heavy rock, but after scratching the surface with a file he found to his disappointment a silver-colored metal. This fine meteorite is displayed at the University of Alaska.

British Columbia

Two stony meteorites, both observed falls, have been reported from British Columbia. Data regarding the falls are very scanty.

The first observed fall in the Pacific Northwest occurred on May 26, 1893, after many persons had heard the noise of a passing meteor. Two masses weighing 5 and 25 pounds respectively fell near Beaver Creek, a few miles north of the American-Canadian boundary and about ten miles above the point where Beaver Creek flows into the Columbia River. Fragments of these two specimens have become widely distributed in the world's important meteorite collections. The largest extant piece, weighing about 6.5 pounds, is in the meteorite collection of the American Museum of Natural History in New York; a smaller piece, weighing about 4.5 pounds, is in the Field Museum of Natural History in Chicago.

A brilliant fireball crossed British Columbia on March 31, 1965, and after a search was carried out two very small fragments of a stony meteorite weighing about 1 gram were recovered. These specimens were found about 38 miles northwest of Revelstoke, the name by which this meteorite is now known.

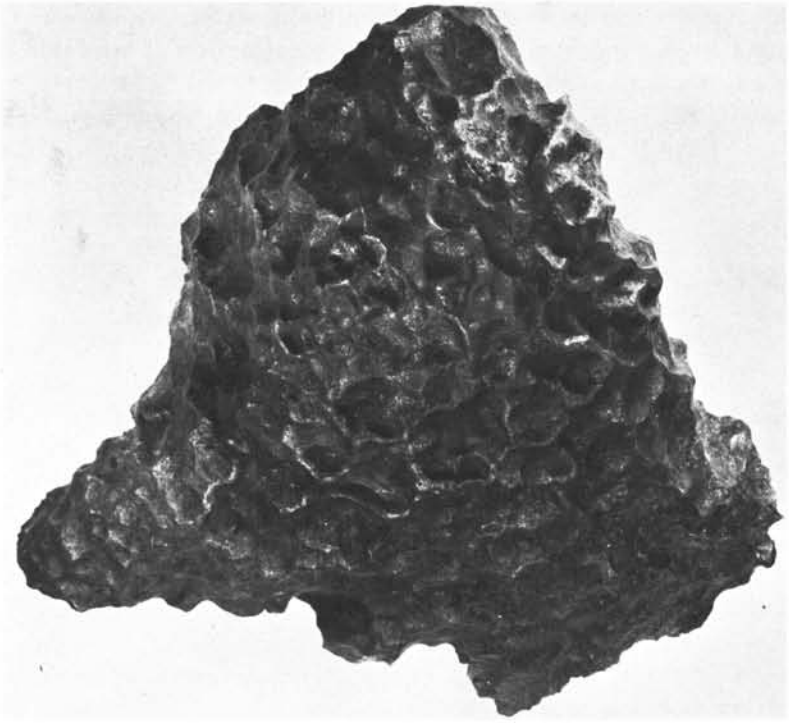
Idaho

Three meteorites are known from Idaho. The first, a small $9\frac{1}{2}$-ounce iron, was found sometime before 1895 by a gold prospector at the bottom of a 12-foot shaft on Hayden Creek. For weeks the prospector pounded on the small iron with a sledge hammer, thinking the object was gold. When he finally succeeded in breaking it in two he was greatly disappointed at the shiny silver-white interior. The two pieces were cut up further so that specimens of this meteorite are in many meteorite collections.

Idaho's largest meteorite, the 260-pound Oakley iron, was found in May 1926 by two teenage boys who were cutting cedar posts in the hills a few miles east of Oakley. As the axe struck the iron the boys were startled by a ringing sound. After the meteorite was displayed in Oakley, it was purchased by the Smithsonian Institution for its collection of meteorites.

In 1954 a 15-pound stony meteorite was found in Jerome County. No details of this find are known.

The Chilkoot meteorite, a 94-pound iron found by Indians at Chilkoot Inlet, Alaska, about 200 years ago.



Idaho's largest meteorite, the 260-pound Oakley iron.

Nevada

Four meteorites, all irons, have been found in Nevada. One of these was a small 10.6-pound iron discovered near Quartz Mountain in central Nevada in 1935. It lay under rocks and debris and was covered with a layer of reddish-brown iron oxide, indicating an old fall. The meteorite was presented to the University of Nevada at Reno where the specimen is on display in the Mackay Museum.

An unknown prospector discovered one of the West's great meteorites in 1908 on the western slope of the foothills of the Quinn Canyon Mountain range about 90 miles due east of Tonopah. The meteorite, shaped like a giant turtle, weighed 3,275 pounds and required the use of a heavy freight wagon with six horses, a crew of three men, a derrick, cables, and pulleys in order to move it to Tonopah, the nearest rail center. The moving took eight days.

This meteorite has a fine low-cone shape due to its oriented attitude in flight through the atmosphere. In flight the apex of the cone is forward. This has resulted in a series of furrows and channels from atmospheric shaping. The Quinn Canyon, like many large iron meteorites, also has many pits or holes which penetrate the mass for several inches. The openings of nearly all the holes are smaller in diameter than the cavities. The Quinn Canyon iron is the largest specimen in the meteorite collection of the Field Museum of Natural History in Chicago.

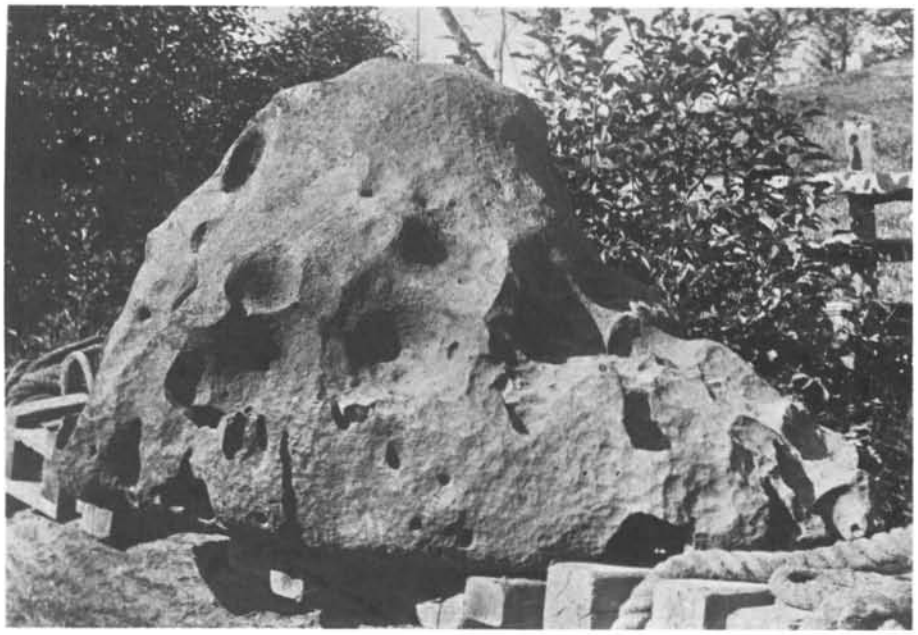
Two other irons, of which little is known, have been found in Nevada. One was a mass of unknown weight discovered in 1930 about 30 miles north of Las Vegas. A specimen of about 6.5 pounds of the Las Vegas meteorite is in the U.S. National Museum. Another meteorite of unknown weight was found near Tonopah sometime before 1947; a small 33-gram piece is in the U.S. National Museum.

Oregon

Four meteorites have been authenticated from Oregon. A piece weighing about one ounce in the U.S. National Museum and a still smaller fragment in the Natural History Museum in Vienna are the only evidence of the lost Port Orford pallasite meteorite reportedly found by Dr. John Evans about 1856 on the western face of Bald Mountain. When Dr. Evans died any further knowledge of the site of discovery was lost. The Port Orford meteorite is estimated to weigh ten to eleven tons. A feature article in Argosy, March 1963, called "The Treasure From Outer Space," pointed out that $2,200,000 awaited the finder of the great meteorite. This fantastic claim has excited many searchers each year.

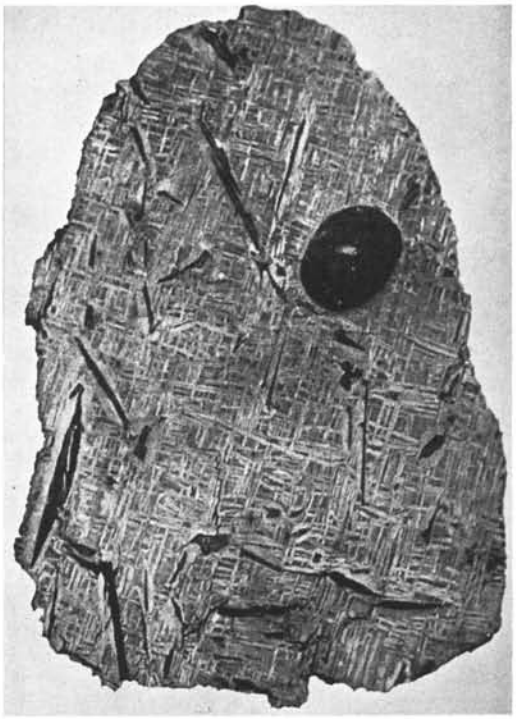
In 1894 a 15-pound iron meteorite was found near the community of Sams Valley, north of Medford. About 1914 the specimen was sold to the

One of the largest meteorites of the West, weighing 3,275 pounds, found near Quinn Canyon Mountain, Nevada. (Courtesy of Chicago Natural History Museum)



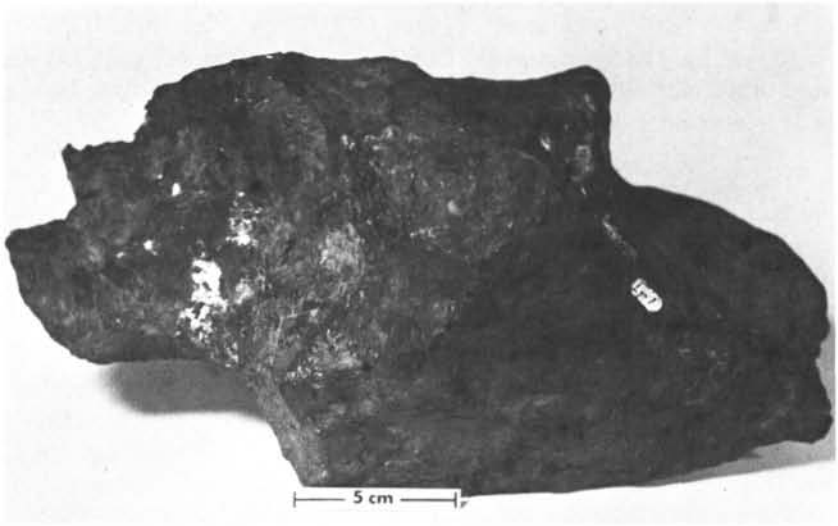
The famous 15½-ton Willamette iron, largest meteorite ever found in the United States, discovered in 1902 near Willamette, Oregon. (Oregon Historical Society photograph)

Foote Mineral Company, which had it cut into a number of pieces for distribution to various collections. Over the years several smaller specimens were found in the same area, giving evidence that the Sams Valley fall was a meteoritic shower. Pieces of the Sams Valley iron are in the Natural History Museum of the University of Oregon and the Jacksonville Museum.

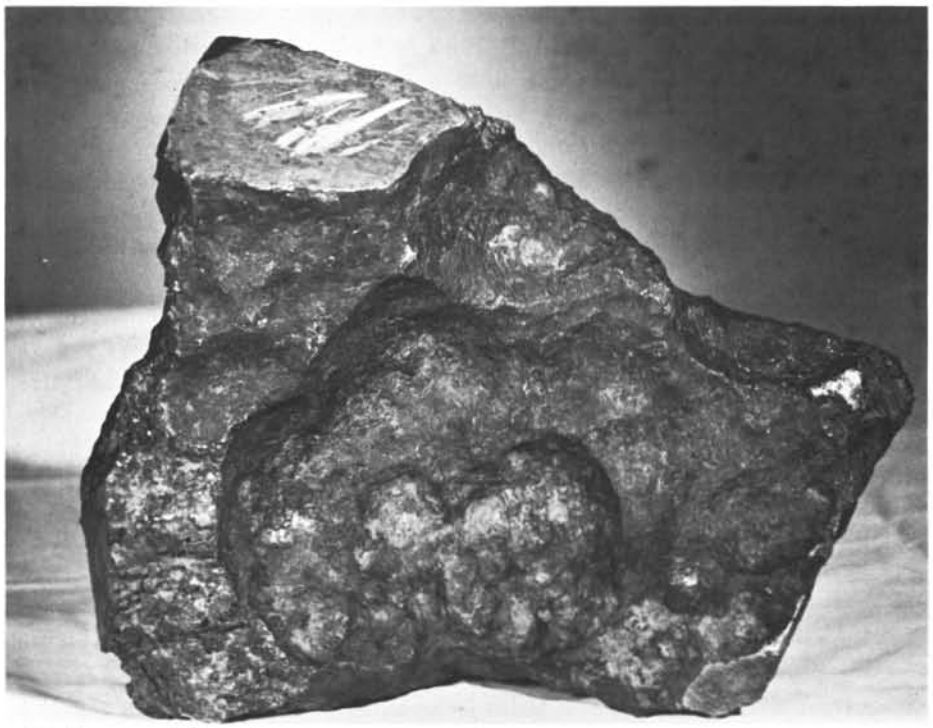


A slice of the 15-pound iron meteorite from Sams Valley, Oregon. (From Foote, 1915) Approx. $\frac{1}{2}$X

One of the most interesting and majestic meteorites found any place on earth is the 15$\frac{1}{2}$-ton Williamette iron, the largest meteorite ever found in the United States. It was discovered in 1902 by Ellis Hughes on land belonging to the Oregon Iron and Steel Company in the hills near Willamette, now a community in the city of West Linn. The ownership of this great meteorite involved Indian rituals and two court cases. Both the circuit court in Oregon City and the State Supreme Court ruled in favor of the Oregon Iron and Steel Company, a decision which embittered Mr. Hughes the rest of his life. After the meteorite was on display at the Lewis and Clark Exposition in Portland in 1906, it was sold to the American Museum of Natural History in New York. There it is prominently displayed in the hall of the Hayden Planetarium along with the great Greenland irons brought to the United States by Admiral R. E. Peary.



The Klamath Falls iron meteorite weighing 37.5 pounds found in 1952.



Washington's largest meteorite, weighing 75 pounds, found near Waterville about 1927. (Jay McMullen Photography)

After 50 years without new meteorite finds in Oregon, the 37.5-pound Klamath Falls iron was discovered in 1952 by Jack Halsell, at that time a logger for Ellingson Lumber Company. The mass was sold to the Institute of Meteoritics at the University of New Mexico in Alburquerque, where it is now on exhibition.

Washington

The three Washington meteorites are of interest in that all have remained in collections in the Pacific Northwest.

The largest Washington meteorite is the 75-pound iron found by Fred Fachnie while harvesting wheat on his farm about 16 miles northwest of Waterville in central Washington. The exact date is not known but it is assumed that the discovery was made in 1927. The specimen was first displayed in a local hardware store and then loaned to the Washington Historical Society, where for many years it was exhibited amid a mineral collection in the Society's Tacoma Museum. In 1962 it was returned to Waterville, where it is now exhibited in the local historical museum. A second Waterville meteorite, an iron weighing 19.5 pounds, is also on display. This Waterville meteorite has been of particular interest to science because of the rich abundance of troilite (iron sulfide) nodules scattered through its mass.

On Sunday morning, July 2, 1939, a brilliant fireball passed over Portland, Oregon, shortly before 8:00 a.m. Just east of Portland the meteor exploded, shaking many buildings in the city and surrounding areas. The fireball, called the Portland meteor, proved to be exceptionally newsworthy and was reported in newspapers from coast to coast. In August of 1939 a small meteorite was found by Jerry E. Best of Washougal, Washington, who sent the specimen to J. Hugh Pruett in Eugene. Today the Washougal stone is in the Natural History Museum of the University of Oregon. It is about the size of a tennis ball and weighs about half a pound. It has a smooth, black fusion coat formed by its fiery passage through the atmosphere. Small particles of nickel-iron are distributed throughout its light-gray interior.

Washington's most recent meteoritic fall is very controversial. Between January 17 and 20, 1955, several Seattle and nearby Kirkland newspapers reported on two small iron meteorites coming through the dome of an observatory belonging to an amateur astronomer. Although the fall received unusual publicity, it was not investigated by scientists from the Seattle area. However, in 1960 Dr. W. F. Read of Lawrence College, Wisconsin, came to Kirkland to investigate the unusual occurrence. He found two small iron specimens which someone had badly mutilated with acid but which were true meteorites. He also found two holes in an aluminum panel of the dome of the observatory. The holes appeared to have been made by melting rather

than rupture by a projectile. Several meteoritic scientists have considered the event a hoax. The two meteorites, along with the aluminum panel, are on display in the Waterville Historical Museum with the Waterville meteorites. The Kirkland irons are now referred to in the scientific literature as a very doubtful fall.

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WASHINGTON DIVISION OF MINES ISSUES OPEN-FILE REPORT

A preliminary geologic map of the Southern Cascade Range, Washington, has been released for public inspection and reproduction. The report, prepared for the Division by Dr. Paul E. Hammond of Portland State University, is a part of the geothermal energy research program of the Washington Department of Natural Resources.

Hammond's report consists of a geologic map with cross sections that covers an area from Stevens Pass to Vancouver and from Puget Sound east to Yakima, a detailed geologic map of the area between Mount Adams and Mount St. Helens, a chart showing the chronologic relationships of volcanic eruptions, and a brief explanation.

Copies are available for inspection at the Division of Mines and Geology in Olympia, Washington, the California Division of Oil and Gas in Sacramento, California, and the Oregon Department of Geology and Mineral Industries in Portland. Reproductions are available at Ivor McCray's Copy Center, 121 W. Legion Way, Olympia, Washington 98501.

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THOMS TO HEAD EARTH SCIENCES DEPARTMENT AT PSU

Richard E. Thoms has been elected chairman of the Department of Earth Sciences of Portland State University. John Eliot Allen, who has been chairman and head of the Department since its formation in 1956, retired from administration July 1. He will continue to teach during the coming year.

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U.S.G.S. ISSUES NEW JOURNAL OF RESEARCH

"Journal of Research of the U.S. Geological Survey," is the outgrowth of the Survey's 13-year series of professional papers entitled "Geological Survey Research," also known informally as the "annual review" series. The Journal is published 6 times per year for the purpose of making the Survey research more readily available to readers. It contains papers by members of the Geological Survey on geologic, hydrologic, topographic, and other scientific and technical subjects.

For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D. C., 20402. Current annual subscription rate is $15.50. Single copies are $2.75.

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AVAILABLE PUBLICATIONS

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BULLETINS

8. Feasibility of steel plant in lower Columbia River area, rev. 1940: Miller . . . $0.40
26. Soil: Its origin, destruction, preservation, 1944: Twenhofel 0.45
33. Bibliography (1st suppl.) geology and mineral resources of Oregon, 1947: Allen. . 1.00
35. Geology of Dallas and Valsetz quadrangles, Oregon, rev. 1963: Baldwin. . . . 3.00
36. Papers on Tertiary foraminifera: Cushman, Stewart & Stewart. vol. 1 $1.00; vol. 2 1.25
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