VOLCANOLOGY

Volcanic Eruptions Predicted

Even This Awesome Natural Phenomenon Can be Forecast And Its Heat And Lava Put to the Service of Man

By RONALD L. IVES

See Front Cover

WHERE will the next great volcanic eruption occur, and when?

Will the older, semi-dormant volcanos burst forth into new activity or will the well-known active volcanos supply us with our next display of terrestrial pyrotechnics?

Will the new volcano which destroyed Rabaul, in New Guinea, recently, continue to erupt, or will it sink back into the sea and be heard of no more?

How can we tell?

Scientists have been studying the activities of nearly all the known volcanos, and from these studies can sometimes predict with some accuracy the approximate time of an eruption.

Fragmentary accounts of the eruption at Rabaul, New Guinea, tell us graphically of the danger and terror accompanying the eruptions of Matupi and Vulcan volcanos, in Rabaul harbor. On May 29 of this year, shortly after 4 P. M., Vulcan blew up. There were landslides and a mild earthquake, and in the words of witnesses, the sea seemed to draw away from the shore as if fearing the wrath of Pele, the volcano goddess.

Great crevasses opened on Matupi early that morning. Then came the black clouds and the explosion on Vulcan. Smoke and pumice, carrying along plumes of steam, blanketed everything.

The Matupi volcano also poured out molten earth. The night was terrible, with rain deluging everything.

Rescue

Capt. Eugene Olson of the Golden Bear pulled up anchor from Blanche Bay at New Britain proper and struck out for the islands whose doom had been proclaimed as far as the eye could see. The passage into the open Pacific required that he steer his course between Vulcan and Matupi, and he drove between this modern Scylla and Charybdis over water thick with floating pumice and silt.

The Golden Bear picked up the first refugees from Nordrup Beach where they were gathering. Amid terrific heat and humidity, over roads blocked with deposits of dust and fallen trees, 8,000 people fled to the Beach and were taken off by the Golden Bear and numerous small craft on that "Black Saturday."

Sunday brought new horror with a fresh eruption of Matupi. The Golden Bear, with the Montoro, a freighter which had been recalled from a voyage, carried off 1,000 persons. The surrounding sea area within 100 miles of Rabaul was covered with volcanic dust. Latest estimates of the loss of life, 261 natives and two Europeans, seems incredibly low in view of the monstrous demonstration of Nature in one of her angriest moods.

Dr. T. A. Jaggar, who has lived for many years on the summit of Kilauea in Hawaii, has been able to predict, as a result of his long study, many of the eruptions of Kilauea and its neighbors. Dr. E. G. Zies, of the Geophysical Laboratory of the Carnegie Institution of Washington, has been studying the volcanos of Guatemala for many years, and from these and other studies a similarity between the volcanos of Guatemala and Java have been found.

Warning Earthquakes

Earthquakes of increasing frequency and violence are well-known precursors of eruptions in volcanic regions. These warnings were first noted by Pliny, in his description of the eruption of Vesuvius, which destroyed Pompeii and Herculaneum in the year 79 A. D. Today, studies of earthquakes in known volcanic regions are being made in an effort to predict eruptions. Perhaps the next great eruption will take place in the West Indies, where a series of tremors have been observed on and near the island of Montserrat for some time. Will Montserrat be the site of a great cataclysm in the near future, such as occurred at Mont Pelee in 1902? Time alone will tell, but modern knowledge of volcanology will do much to protect the human population of this fertile and unstable area.

The United States, at the present time, is one of the few large countries that has little to fear from volcanic activity. Mount Lassen, in California, is our only active volcano, and its activity is slight. In the not-very-remote past, however, there were many active volcanos in the United States. Only about 1,000 years ago, eruptions occurred in the southwest, and greatly influenced the life of the cliff-dwellers there. Layers of volcanic ash are found in many of the ruined cliff houses, and several tribes have legends of fires on the mountains.

Many in Mexico

Mexico, our southern neighbor, has many volcanos, some of them intermittently active. Pinacate Volcano, in northern Sonora, just south of the international boundary, was the site of an explosive eruption in 1935, which was preceded by violent earthquakes. The last eruption there, prior to 1935, was so ancient that it is known only in Indian legends, but the legends are easily verifiable by geologic evidence. Before the coming of the Indians, this volcano poured out 1500 square miles of lava onto the desert, and then blasted a number of great craters, some of them 4,000 feet across and 700 feet deep, through the lava.

Not so long ago, geologically speaking, the Columbia River plateau was the scene of enormous outpourings of lava, and the activity continued until after the coming of the Indians. Today, atop the 1500-foot-thick flows of lava, fumaroles surrounded by charred sagebrush have been discovered.

In the great park region of Colorado, just west of the Front Range, numerous recently-extinct craters have been discovered, and in the area from the east side of the Rocky Mountains to the California Coast Range, north to the Canadian Border, and south to Mexico, extinct volcanos, hot springs, and great lava flows are numerous. Yellowstone Park, famed for its geysers and hot springs, is only one of many areas where volcanic activity took place within the last few million years. Here, buried lava flows supply the heat which warms the springs and operates the many geysers.

Alaska and the Aleutian Peninsula are noted for their volcanos. Perhaps the best known eruption in this area was that of Katmai, which in 1912 exploded with terrific violence, lowering the peak, spreading a thick layer of volcanic ash over the surrounding country, and creating the famous "Valley of Ten Thousand Smokes," which is now a National

Park. Many new volcanos have been discovered on the Alaskan coast in recent years, and at frequent intervals new volcanos rise from the sea in the Aleutian area, creating new islands.

Krakatau, whose eruption was the greatest in history, was once a small circular island, the eroded remnant of a great prehistoric volcano. After a few months of rather mild and unrecognized premonitory phenomena, it exploded violently in 1883, destroying most of the old crater, and throwing four and a half cubic miles of dust into the air. The blasts were heard nearly 5,000 miles away, and for several years afterwards sunsets all over the world were reddened by the dust suspended in the air. Recently there has been renewed activity in the old crater of Krakatau, now a hollow in the sea floor.

Geologists have found that volcanos are most common in certain definite areas, generally near the sea, and less frequently near great mountain ranges. In these areas, there are great inequalities of pressure, and often zones of ruptured or strained rock, called faults.

Relief Through Faults

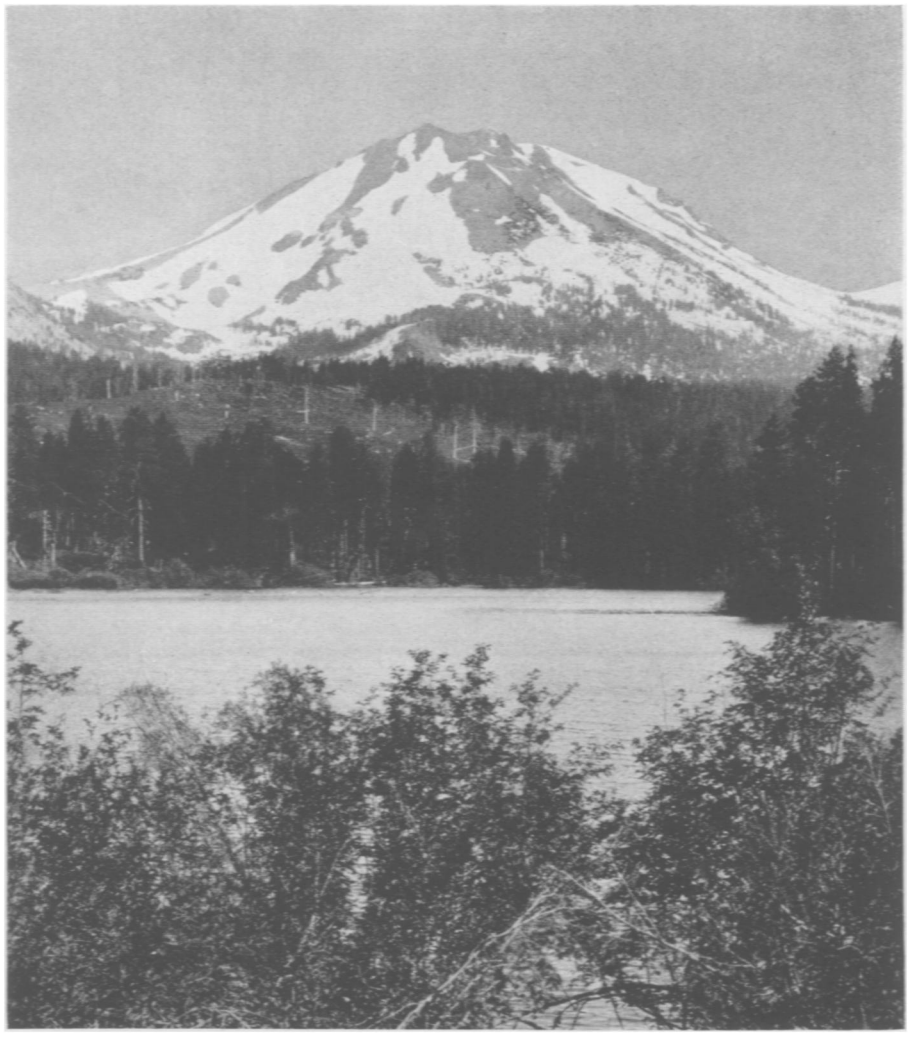
Earthquakes are relatively common here, as a result of these strains. Under present theories, these faults allow the escape of heated and compressed material from deep in the crust of the earth, and when the unequal stresses have been relieved, the eruptions stop. These faults are not, as was once believed, open cracks leading down into the molten interior of the earth. Under present theories, the source of lavas is in pockets of molten material relatively near the surface of the earth.

Earthquakes, under this theory, are minor slips of the upper layers of the earth's crust, which wholly or partially relieve the crustal stresses. When the stresses are relieved, the quakes stop until more stresses are built up.

If a pocket of molten material is cut by a fault, and the pressure is sufficient, a volcano may be created along or near the fault plane, and eruptions will continue at this vent until pressures are relieved. When new pressures are built up, additional eruptions from the same vent, or from adjacent vents, may occur.

While earthquakes almost invariably accompany volcanic action, earthquakes often also occur when no pocket of molten material is disturbed, and in this rather common case no volcanic phenomena accompany the quakes.

At times, when the outlet from a pocket of molten material is small, the lava will harden in it before pressure is relieved, and action will be temporarily stopped. At some later time, when accumulated pressure is great enough to push out the obstruction or make a new vent, another eruption occurs. From this, it has been roughly determined that volcanos in relatively continuous activity seldom have violent eruptions, while those in intermittent activity act with greater violence.



AMERICA'S ACTIVE VOLCANO

Mt. Lassen in a placid mood.

Volcanos, at the beginning of their life, are often small vents in the ground, surrounded by the debris thrown out onto the adjacent land. After some time, the debris piles up around the vent, and a cone is built, which grows in height and circumference as material from within is poured and thrown upon it.

Thus, by studying the layers of material on the slopes of a cone, volcanologists may determine the probable past history of a given volcano, and in a few cases, as at the Pedregal, in Mexico, roughly date the eruptions by the age of the human culture buried by the lava flows. Another example of this dating is in California where eruptions are approximately dated by a study of the rings in the trees killed by the lava flows and ash falls.

While lava flows and ash falls are the best known volcanic phenomena, many others accompany a volcanic eruption. Great flashes of lightning have been observed on the peaks of erupting volcanos, violent rainstorms, which cause mud flows down the cones as the water floats away the newly-fallen volcanic ash, clouds of noxious and superheated vapor, and small tornados have also been noted as accompanying eruptions. Noises are always present during an eruption, and the loud blasts that follow explosive eruptions are frequently heard for distances of hundreds of miles.

Direct damage to human life and

property is done by lava flows, dust falls, and gas clouds, the toll frequently being measured in hundreds of lives and millions of dollars. The indirect damage to man is perhaps even greater.

Volcanic dust hangs in the air for months, and sometimes for years, reddening the sky, and upsetting normal precipitation. It has been suggested by many workers that a series of eruptions in relatively rapid succession might easily mask out enough of the essential ultraviolet radiation from the sun to definitely harm life on the earth, causing decreased growth in plants, and rickets in animals.

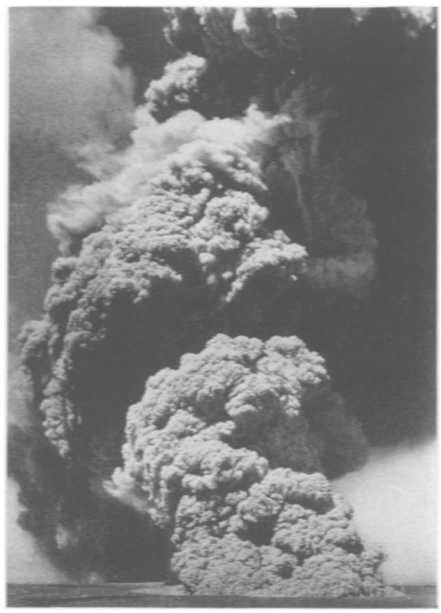
Further, the lesser radiation received by the earth would result in a decreased temperature, and perhaps, in an extreme case, in another ice age. Can we, then, assume that our recent ice ages, the last of which ended only about 20,000 years ago, were caused by great volcanic activity? We know that during the time of the ice ages (Pleistocene) many volcanos were active. Climatologists will not state definitely that this is so, and there are other factors to be considered, but volcanic dust may well have been one of several factors influencing the formation of the great Pleistocene ice sheets.

Volcanos, however, are sometimes beneficial to man. The slopes of Vesuvius and other volcanos are extremely fertile, and men occupy and farm these slopes despite the known danger from eruptions. Prior to most of its eruptions vineyards were planted on its slopes, and even when the danger of eruption was imminent, the farmers stayed on the slopes to harvest their crops, often losing their lives in doing it.

Fertile Soil

In Hawaii, Java, and other volcanic regions, the fertility of the volcanic soil likewise attracts farmers, in spite of the danger of the location. Some of the early Indian agriculturists of the Southwest probably benefitted from the fertility added to their fields by falls of volcanic ash, and their cultures may have declined more rapidly because of the exhaustion of the minerals in this newly-added soil.

Recently, in Italy and in California, attempts have been made to harness the heat of volcanos, with some success, and for many years, the hot springs of Iceland have been used as sources not only of hot water but of heat. While the problem of volcanic power is by no means solved, recent developments in corrosion-resistant pipe and deep drilling methods are of great assistance in harnessing this underground power. Perhaps, as our supplies of coal and oil become exhausted, and our water power is used up to its limit, we will turn to volcanic power, and build on this a new series of power-consuming industries.



DUST

This is what pours from the mouth of an active volcano to redden the sunsets for many nights to come.

Much has been learned in recent years about the whys and wherefores of volcanos, and much more has been suspected but not proven. Not many years ago, volcanos were regarded as supernatural things—the workshops of the fire gods, or as "chimneys to Hell," or even as leaks in the earth's crust, allowing the molten interior of the earth to escape. While we still have much to learn about them, we now know that they are natural phenomena, having their sources of heat relatively near the earth's surface, and that volcanos, instead of being sources of great danger, are more nearly like great terrestrial safety valves, which keep pressure from accumulating under the surface, and by erupting prevent more violent and devastating explosions.

Today, although our modern civilization is more easily damaged than ever before in history, and although we have no means of preventing eruptions, damage to man from volcanic action is less to be feared than ever before in the past, for we have rough methods of predicting activity of a volcano; we are able, in some cases, to dam up or divert lava flows, our modern methods of transportation permit rapid evacuation of a threatened area, and this same rapid transportation enables relief to be rushed to the stricken areas. Perhaps, in the not too distant future, we will be able to divert not only lava flows, but the eruptions themselves, from areas of great economic importance into nearby areas of lesser value.

Science News Letter, October 2, 1937

ARCHAEOLOGY

Mysterious Cave Men Inhabited Utah Caves

NEW and mysterious cave men must be added to the story of ancient America, explorations in Utah reveal.

Excavating floors of caves in Utah's Salt Lake region, Dr. Julian H. Steward of the Smithsonian Institution has discovered traces of human life entirely different from the Pueblo Indians, or the older Basket Maker Indians, or the old, old Folsom bison hunters, who represent the main stream of ancient history in our Southwest. The expedition, the report of which Dr. Steward has just published, was financed jointly by the Smithsonian and the University of Utah.

Salt Lake cave dwellers, thus suddenly thrust into the limelight, go back at their earliest to 10,000 or even 15,000 years ago, Dr. Steward estimates from geology of the region. Black Rock Cave, scene of some of the discoveries, became dry and habitable about that time when old Lake Bonneville was receding, and the evidence is that early hunters lost little time moving in.

A baby found buried in the floor of the Black Rock Cave was one of its earliest occupants. With the child, Dr. Steward found only a dagger-like article of bone. Hunting weapons of men of this era were also unearthed, and the archaeologist reports that these small dart or arrow points do not offer any evidence that these Utah cave dwellers were related to the Folsom bison hunters, though they may have been contemporaries in the Southwest.

So new are the Salt Lake aborigines to science that even the successive occupants of two caves cannot be fitted into their relationships one with another.

The latest inhabitants, who lived in the region about 1000 A.D., after Pueblo Indians had vanished from northern Utah, have left numerous clues to their way of living. Dr. Steward suggests calling these Indians the Promontory people, from a cave at Promontory