

Fossils in the Making

Mammoth Bones Preserved in Frozen Earth

By Dr. Ralph W. Chaney

NEAR Fairbanks, less than two degrees from the Arctic Circle, the Fairbanks Exploration Company is removing vast quantities of frozen soil and gravel in its search for gold. It is estimated that from a single one of its gravel mines more than one-third as much earth will be moved in the next few years as was removed during the construction of the Panama Canal. With the co-operation of Mr. Roy B. Earling, general manager of the Company, opportunities were afforded me of examining the workings.

Before the gravels can be mined, the frozen overburden must be removed. This represents the fine sediments that have been washed and blown from adjacent hills, and contains large amounts of moss that has been buried as it accumulated. The first step in stripping operations is to remove the moss. Thereafter, about four inches of overburden are thawed daily by the sun, which in mid-summer shines many hours a day longer than in middle latitudes. Every day this melted material is washed away by huge streams of water, exposing the frozen sediment below. As many as two summers may be required to reach the gold-bearing gravels, and during the following summer, these are thawed by pumping into them through iron pipes large amounts of water that has a temperature of about 50°F.

In some places quantities of bones have been preserved in the overburden and gravel. Great bisons are most common, but the remains include also bones of mammoths, horses, caribou, musk oxen and occasional lions. Of the animals named, only the caribou is still found in Alaska.

At one point the skulls of two mammoths were being uncovered at the time of my visit. One of these was 4 ft. in length, with tusks 5½ ft. long and 7 in. in diameter at the base. Many antlers of caribou had been washed out at this point. But most numerous were the remains of bisons; in addition to leg bones and long-spined vertebrae, there were more than 30 skulls scattered about where they had been washed clear by the "giants," which is the term applied to the great streams of water used for hydraulic mining. One of the skulls has horns with a spread of over 3½ ft.; the horns of the modern bison are rarely over 2½ ft. in spread. On some specimens muscles, hide and hair are preserved.

Locally the tunnels and nests of ground squirrels are abundant in the frozen overburden. Their contents, cached for winter use, include many seeds of plants that still live in this region. Beaver dams, made up of thousands of tree stems, are washed out of the frozen overburden by the great jets of water.

Spruce, willow and birch are also represented by wood, preserved in its original condition. Leaves of willow, birch and alder, and twigs and cones of spruce also are found. These have not been chemically altered, and decay has been prevented by natural refrigeration.

Many of the best preserved plant fossils in western North America have been buried in volcanic ash. Accumulating rapidly, these fine particles of exploded lava provide a favourable cover under which decay of leaves and fruits may be delayed until their form is imprinted on the enclosing ash. Deep burial below other sediments or

lava flows compacts the ash into solid rock, in which prints of these leaves and fruits may show all of the surface details of living structures.

Such fossils were formed, of course, long before the day of man upon the earth. The actual mode of preservation may therefore only be surmised. The most reliable basis for such theories is a study of modern burial of plants in the accumulations of active volcanoes. The exciting events on Kodiak Island in June 1912 provide an example, although the inhabitants then had no thought of scientific discovery. A heavy mantle of volcanic ash, blown from Katmai Volcano, 100 miles distant on the mainland,

filled the air with sharp dust, blanketed fields and villages, crushed roofs and changed a green island to a gray brown desert overnight.

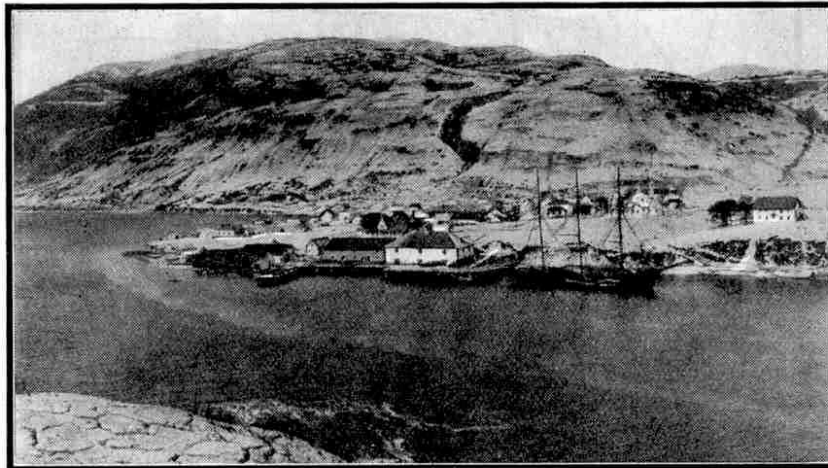
A year later I spent a few hours on Kodiak Island, and surveying this desolate land, realisation came that here might be buried, sealed away from decay, preserved for future study, a record of the forests of 1912. So I resolved to return some day to see how such entombed plants were faring.

Nearly a quarter of a century passed before this hope could be realised. Once upon the island, I lost no time enquiring the whereabouts of small lakes, for it was in lakes along ancient stream courses that many of the fossil-bearing ash deposits of the past were accumulated in the western United States. There were evidences on hand to show the effects of the ash fall upon vegetation. But only decayed structures were to be seen on the surface. What might be preserved under the layers of ash deposited in lakes and valleys?

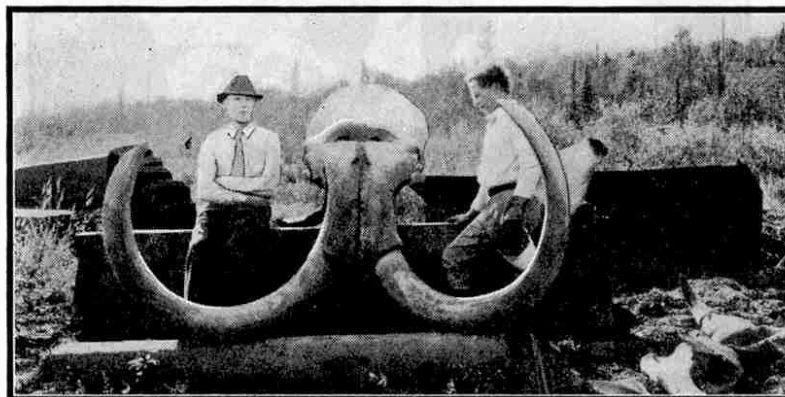
Silver Lake, dammed by beavers, is a body of water scarcely half a mile across. Along the shallow shore, light-coloured ash lies upon the gravel. Digging with pick and scooping by hand, ex-

cavations were made at various points near the shore. At convenient depths as much as a foot and a half of ash covered the rocky lake bottom, and always there were great numbers of spruce needles embedded in it. Spruce cones and leaves and stems of alder also were present, but as in the volcanic deposits of Oregon, where vast numbers of redwood needles dominate the fossil record, the relatively indestructible remains of conifers are most numerous. Broad leaves like those of the alder are more likely to be broken, so that they make up only an unrecognisable carbonaceous mass.

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Kodiak, Alaska, in 1912, covered with ash from the eruption of Mt. Katmai, a volcano 100 miles away. The illustrations to this article are by courtesy of the Carnegie Institution of Washington.



Tusks of a mammoth discovered in frozen soil in Alaska. The bones also have been found of bison, musk oxen, horses and lions, which do not now live in Alaska.