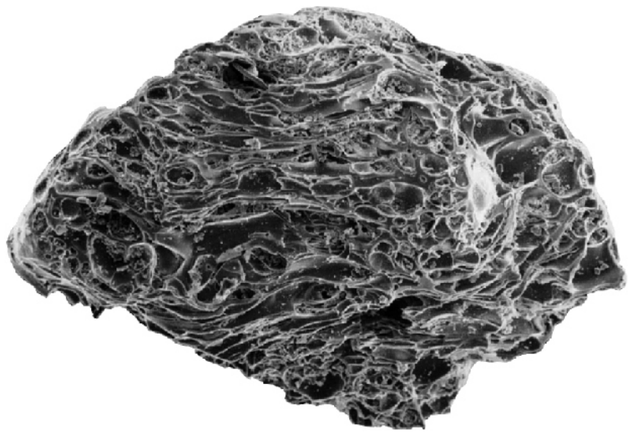
Why Study Ash?



Highly magnified ash particle (x 1200) with abundant vesicles (gas bubbles), strikingly elongate due to violence of the eruption. Such grains can float on water.

Geoscientists study the White River ash to learn more about the volcanic history of Mt. Churchill, to examine the possibility of future eruptions and to evaluate potential hazards. The records of large explosive eruptions from this volcano suggest that future eruptions could be harmful to aircraft, fauna, vegetation, and people living not only in the immediate vicinity of Mount Churchill, but also over broad regions of Alaska and Canada. By piecing together clues of the volcano's past, geoscientists can begin to determine if Mt. Churchill poses a significant risk to us and our environment, and also learn more about volcanic eruptions, processes and products.

The White River ash is currently being studied by geologists and geophysicists of the United States Geological Survey (Alaska Volcano Observatory), the Geological Survey of Canada, and the Department of Earth Sciences, Carleton University, Ottawa, ON.

Further Reading

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For more information, check the Yukon Geological Survey website:

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WHITE RIVER ASH

Recent Volcanic Ash

YGS Brochure 2007-1

Mt. Churchill - Bona Complex, source of the White River ash. View looking southeastward over Russell Glacier, Alaska. This region, part of the Wrangell-St. Elias Mountain Ranges, is a World Heritage Site.

- The eruptions of the White River ash are among the largest volcanic eruptions to occur in North America within the last 2000 years.
- The White River ash was erupted from Mt. Churchill in the Wrangell-St. Elias National Park.
- The White River ash covers a total area of 540 000 km^2, extending from eastern Alaska through much of the Yukon to the Great Slave Lake in the Northwest Territories.

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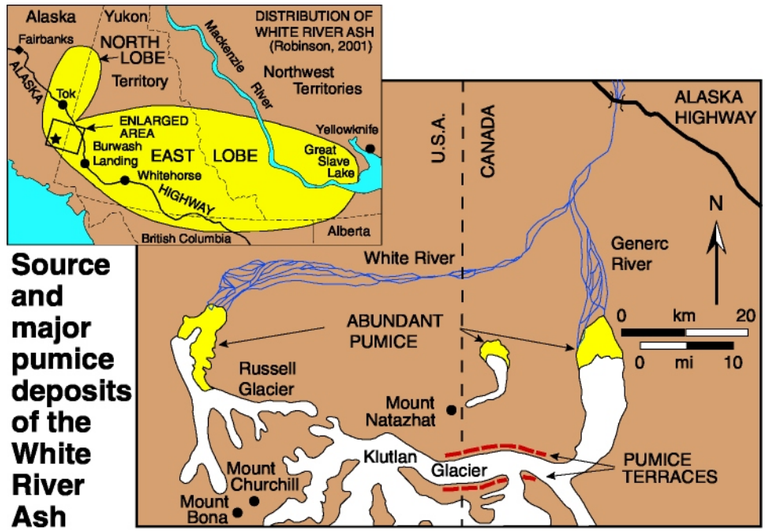
Introduction

Whether you are a long-term resident of Alaska-Yukon country, or a visitor passing through, chances are you have noticed the White River ash. In the summer months, this fine-grained layer of volcanic ash looks almost exactly like a layer of pure white snow. The ash, however, was ejected over much of northern Canada and Alaska during two volcanic eruptions less than 2000 years ago. These eruptions were so cataclysmic that they are considered to be among the largest volcanic events in North American history.

Location of White River Ash



Source and major pumice deposits of the White River Ash

Deposits of White River ash are widespread in northern Canada and the U.S. extending from eastern Alaska through much of the Yukon to Great Slave Lake in the Northwest Territories. The ash covers a total area of 540 000 km^2. Wind direction at the time of each eruption determined where the ash fell. Canada received most of the ash because of strong winds from the west at the time of the last eruption.

In Yukon-Alaska, exposures of White River ash are abundant in Kluane National Park (Yukon) and Tetlin National Refuge (Alaska). The ash is readily visible along most of the main traffic arteries including the Klondike Highway between Whitehorse and Stewart Crossing, along the Alaska Highway between Burwash Landing and Tok, and sections of the Robert Campbell Highway near Ross River. Layers of ash are also exposed in road cuts, gravel pits, or riverbanks where a lengthy profile of the soil can be seen.

The Eruption

The White River ash is a white- to beige-coloured layer comprising mainly angular glassy fragments that formed when gas bubbles in partly solidified magma exploded during two violent volcanic eruptions.

The first eruption occurred ca. 1887 years ago (10-20 cubic km) and produced a lobe of ash in northwestern Yukon and eastern Alaska (see map above). Ash from this event is referred to as the northern lobe because at the time of the eruption the wind carried the majority of ash north of the volcanic vent. During a second eruption ca. 1147 years ago, the wind carried the ash across southern Yukon, Alaska, and the Northwest Territories, producing an eastern lobe (15-30 cubic km).

The north and east lobe eruptions of White River ash are among the largest eruptions that have occurred in North America in the last 2000 years. In fact, the east lobe eruption itself may have been more than 30 times the size of the 1980 Mount St. Helens eruption. Although the north lobe eruption was significantly smaller, both events would have greatly affected local vegetation, fauna, and human activity, as well as world climate. Some anthropologists have suggested that the 1200-year-old eruption triggered the migration of some indigenous groups to the southwestern United States.

The Ash

Vertical section through ash layer on east side of the Alaska Highway, near the Donjek River Bridge

In regions at least 100 km from Mt. Churchill, the White River ash is similar in appearance to a layer of snow nestled just below the surface of the soil. The fine-grained layer of ash typically occurs between layers of silt and organic material and varies in thickness from 3 to 60 cm depending on the distance from the source (closer to Mt. Churchill the deposit becomes thicker). Layers of ash are uncemented and composed of very tiny particles (0.125 to 2 mm) of pumice and ash. The white colour of the ash is due to its silica-rich composition; the secondary beige tint is attributed to organic staining. Closer to the source volcano, layers of ash may be up to 50 m thick.

Deposits of east lobe ash are typically coarser grained than ash from the north lobe because of the greater magnitude of the later event. In some regions (where the north and east lobes overlap), a double horizon of White River ash may be present. In most places, however, there is only one layer of ash. Multiple layers may also be present if the ash was reworked after deposition occurred.

Mt. Churchill

Both eruptions of White River ash were highly explosive events during which vast amounts of volcanic material (blocks, lapilli and ash) were thrown into the air. The source volcano was thought to be Mt. Natazhat, until a USGS expedition in 1990 established the volcanic source to be Mt. Churchill, about 25 km west of the Alaska-Yukon border, in Wrangell-St. Elias National Park. The summit of Mt. Churchill is so high (4800 m) it is covered with ice and snow year-round. Thus, when red-hot ash was blown out of the summit, the ice and snow melted, producing enormous volumes of water that mixed with volcanic debris to generate catastrophic avalanches. One such avalanche sent pumice over Klutlan Glacier in Canada, depositing thick pumice terraces along the margins of this glacier, and also creating a vast deposit of pumice at the glacier terminus.

Pumice terrace, 10 m (30 feet) thick, on north margin of Klutlan Glacier, Yukon, which flows from Mt. Churchill, Alaska. This pumice was deposited 1200 years ago during the last eruption of Mt. Churchill as a result of a flood created by melting of snow and ice at the summit. The uppermost layer was produced by fallout from the associated ash cloud. Such terraces are up to 100 m (300 feet) above the present level of Klutlan Glacier, recording significant melting during the past 1200 years.