Geologic Event Cards
Student Handout

2.7 billion years ago

Approximately 2.7 billion years ago, the oldest geologic event in Yellowstone's history occurred and resulted in rocks so crumpled and changed by heat and pressure that their original form is unknown. These rocks, which came from even older rocks, are thought to be the foundation of Earth's landforms and are called "basement" rocks. At this time, there was little oxygen in the environment, but there was bright sunlight.

570 million to 75 million years ago

Yellowstone's landscape had been reduced by erosion to a flat, barren plain that soon was flooded by a shallow sea moving inland from the west. These early seas laid down layers of sand, silt, clay, and mud. Later they hardened into sandstone, shales, and limestones called sedimentary rocks. These early seas also brought the earliest signs of abundant life—trilobites (extinct creatures resembling crabs and spiders), sponges, and worms. Algae appeared and then marine reptiles and dinosaurs. The land grew tropical jungles and forests. The seas advanced and retreated across the Yellowstone region at least a dozen times over the 500 million-year period.

75 million to 55 million years ago

This is the time of Laramide Orogeny (Orogeny means mountain-building). Great underground forces bent and cracked the Earth's crust to create huge uplifts and downfolds. As these pressures increased, rock layers broke and were shoved over one another along great reverse faults. As the land was uplifted and contorted, it began to erode. Rock was eroded from the tops of uplifts and carried by streams into low basins in the form of sand and gravel. This extensive disturbance of the landforms in Yellowstone prepared the land for the great volcanic periods that followed.

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55 million to 40 million years ago

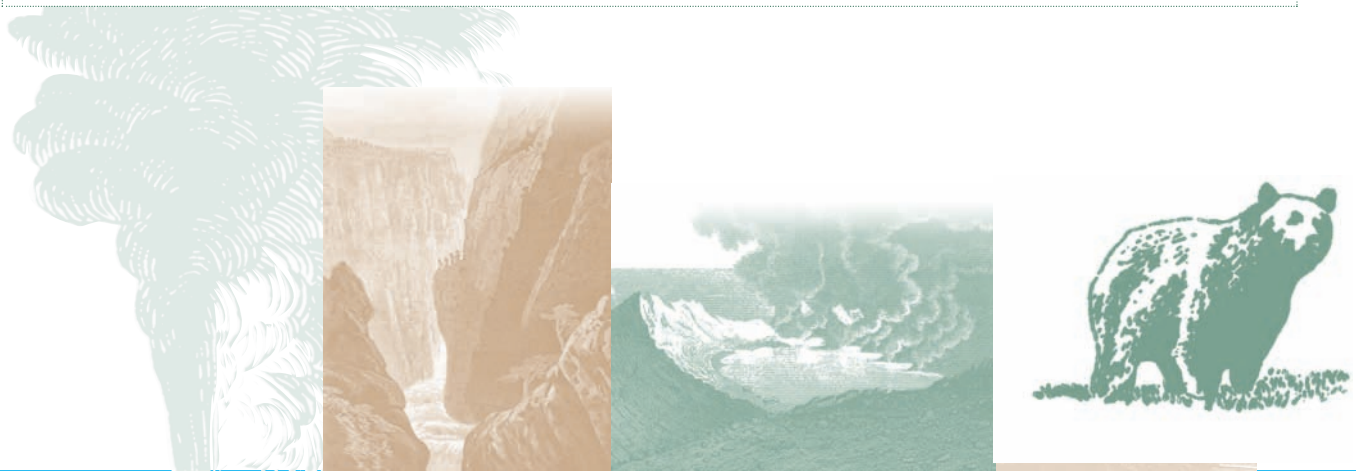
Several large volcanoes erupted in and near Yellowstone (Absaroka Volcanics). The eruptions were periodic and primarily spewed molten rock. Rain followed and caused mud and broken rock to stream down the mountainsides. At times the volcanoes were violent and covered the countryside with rocks, cinders, and ash. Sometimes the entire Yellowstone region was covered with volcanic debris. Between eruptions, there were often long periods of quiet, long enough for forests to grow. These forests were later covered by volcanic eruptions, causing the petrified forests seen on and near Specimen Ridge. Mt. Washburn and Bunsen Peak are examples of Absaroka Volcanics. At the end of this volcanic activity, all of Yellowstone lay buried under several thousand feet of volcanic material. The land must have appeared as a rolling plateau with some streams and some volcanoes appearing above ground.

40 million to 10 million years ago

It must have been geologically quiet and very dry during these years in Yellowstone. No rocks of this age have been identified in the park. If they ever existed in Yellowstone, they were eroded away or buried by younger volcanic rocks. Animals, such as camels, short rhinoceroses, giant pig-like animals, and early horses, grazed on the plentiful grasslands.

10 million to 2.1 million years ago

The entire region was uplifted to several thousand feet above its previous level. Great forces pulled the region apart and broke parts of it into enormous blocks, creating large faults that extended many miles. Both the Gallatin and Teton mountain ranges were uplifted. This tremendous rise in elevation and the subsequent breaking of the region into fault blocks increased erosion. Gentle streams became running rivers, cutting deeply through Yellowstone's plateaus. Over two million years ago, Yellowstone was covered with mountains, basins, and canyons.



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2.1 million years to 640,000 years ago

Once more, a vast quantity of molten rock (magma) that had accumulated deep within the Earth produced two violent volcanic eruptions in the Yellowstone region. The first, 2.1 million years ago in the central part of Yellowstone, formed the first caldera in the area. It is thought that a dome was formed as pressure increased from the magma chamber below. Lava flowed from cracks in the dome. Finally, a violent eruption occurred, spewing hot pumice, rock, and ash across the countryside. As the molten rock was suddenly spewed from the volcano, the roof of the volcano collapsed, creating a huge crater, or caldera. Today, remnants of this volcano can be seen on Mt. Everts, Tuff Cliffs, and Golden Gate. Most of the volcanic remnants, however, were covered by subsequent eruptions. A second smaller eruption occurred 1.3 million years ago just southwest of Yellowstone and contains evidence of the oldest possible glaciation in the region.

640,000 years ago

This is the geologic event that shaped much of today's Yellowstone. Hot molten rock, or magma, in two chambers beneath Yellowstone created a huge volcanic dome. After spewing small amounts of lava through the cracks in the dome, a violent explosive eruption occurred, spreading volcanic debris—hot pumice, rock, and ash—over thousands of square miles. The dome collapsed and a huge crater, or caldera, appeared. The caldera extended 30 miles by 45 miles and was probably several thousand feet deep. Inside this crater is where we find many of Yellowstone National Park's natural wonders. For example, heat from the magma chamber still sustains the thermal features. Also the thick lava flowing within the caldera after the violent eruption created the plateaus in the central part of the park. Closely related to this violent volcanic activity are the carving of the Grand Canyon of the Yellowstone and the creation of the basin forming Yellowstone Lake.

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640,000 to 70,000 years ago

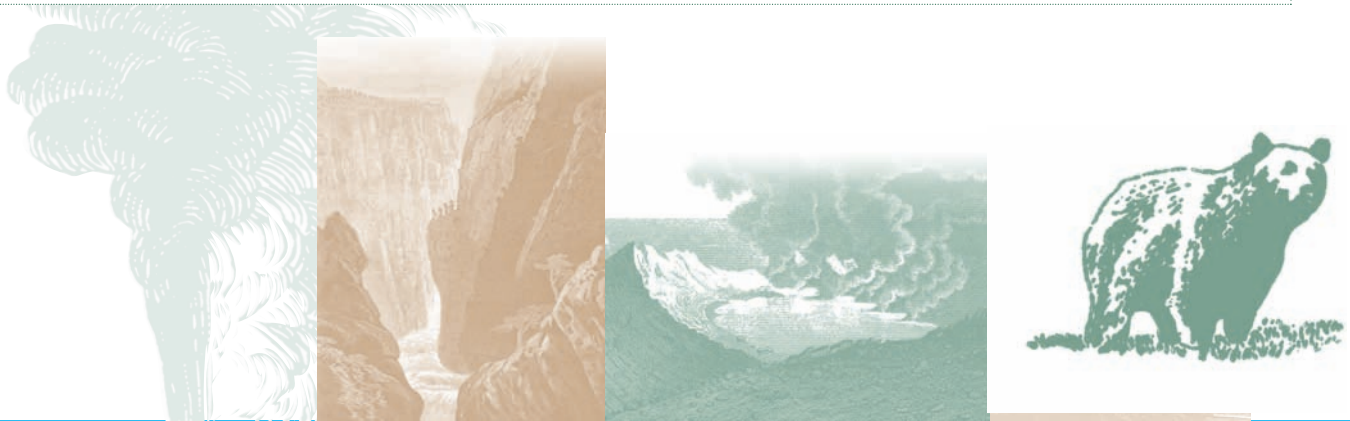
After the violent eruption 640,000 years ago, molten rock again began to build under a dome within the caldera. This time the lava poured out quietly from many openings. The lava flowed mainly into the caldera, but sometimes it flowed over the caldera rim and hardened into ridges and plateaus. The first lava flows occurred about 600,000 years ago, and the last ones occurred about 70,000 years ago. This time, no violent eruption followed. An additional caldera-forming event occurred about 150,000 years ago. It produced a smaller caldera that is now filled by West Thumb of Yellowstone Lake. At the end of this volcanic activity, it seemed volcanism in the Yellowstone region was finally quiet. What remains today is the hydrothermal activity. Could volcanoes become active again in Yellowstone? What do you think?

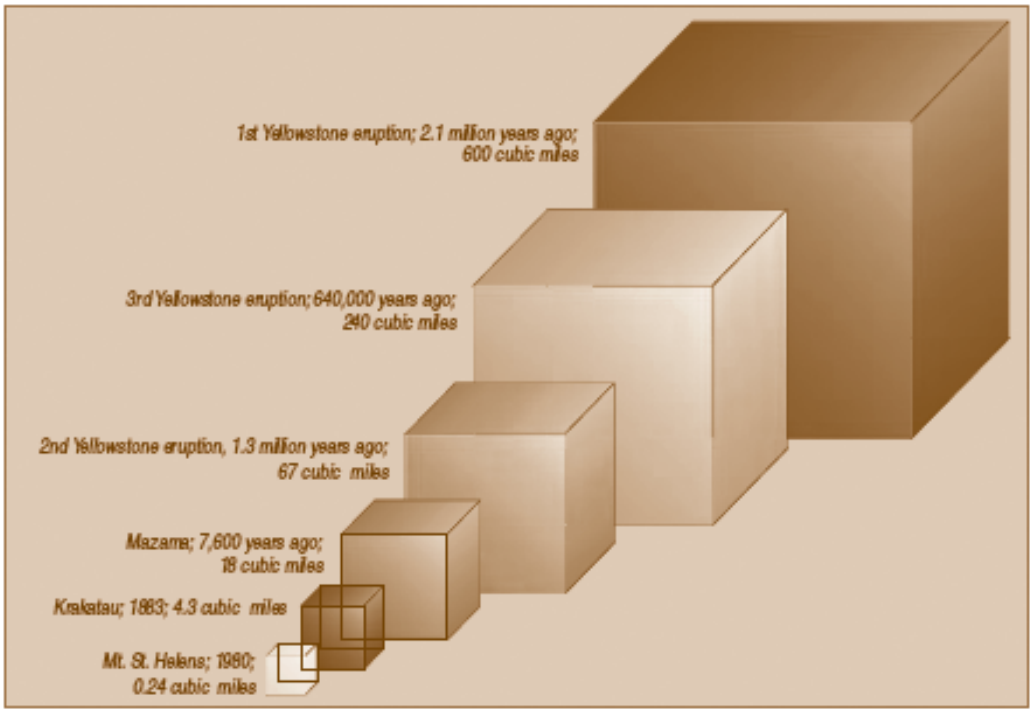
70,000 to 14,000 years ago

Glaciers form when more snow accumulates in the winter than is melted during the summer. If this happens over centuries, the snow becomes ice. Expansive ice fields grow and begin moving downward under their own weight. This action carves U-shaped valleys. The most recent glaciation, called the Pinedale Glaciation, occurred from about 70,000 to 14,000 years ago with its maximum extent 25,000 years ago. It was during this period that many huge ice masses flowed into and out of Yellowstone and covered about 90% of the region. The ice mass over the Yellowstone Lake basin grew to be as much as 4,000 feet thick.

14,000-8,500 years ago

By about 14,000 years ago, these glacial ice masses had melted from most areas except for mountain valleys where glaciers existed until 8,500 years ago. As the glaciers began to melt, they left behind rock debris that the glaciers had gouged from landforms and carried along with them as they moved. They also dropped huge boulders, called glacial erratics, and left behind glacial or kettle ponds. Even though a few snowfields exist throughout Yellowstone during the summer, there are no longer glaciers in the park today. Could this change? If so how?





Comparative Volume of Volcanic Eruptions
Adapted with permission from *Windows Into the Earth,* Dr. Robert Smith and Lee J. Seigel, 2000