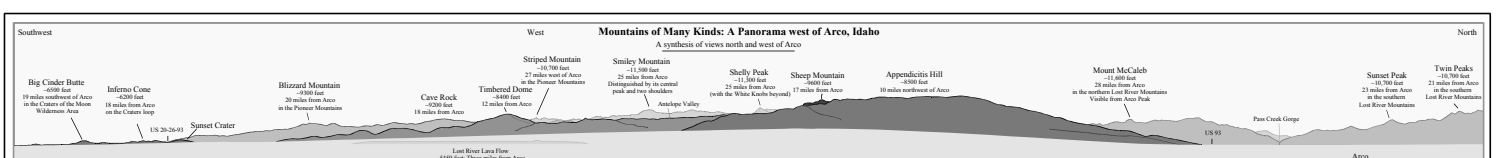


The sketch above is a synthesis of views, rather than a view from one point. In actual views from the ground, positions of nearer features (for example, Timbered Dome) will shift relative to more distant features (for example, Smiley Mountain). Shelly and Sheep can only be seen from locations sufficiently far west to not be blocked by Appendicitis Hill. They can be seen from west of the Butte County Airport.

Big Cinder Butte and Inferno Cone consist of volcanic material erupted in the last ten thousand years.

Blizzard Mountain and Scorpion Mountain consist of sandstones and conglomerates (ancient gravels) that are about 340 million years old.

Timbered Dome consists of sedimentary rocks that are about 350 million years old and that, at its top, have been infiltrated by silica to give a material called "jasperoid".

The Lost River Lava Flow is about 40 thousand years old, younger than the sediments of the Big Lost River on which it sits.

Smiley Mountain consists of volcanic and intrusive igneous rocks that are about 50 million years old.

Sheep Mountain and the hilly ridge blocking the view into Antelope consist of volcanic rocks (part of the "Challis Volcanics") erupted about 50 million years ago.

Shelly Peak consists of limestones that are about 340 million years old.

Appendicitis Hill consists of limestones (sediments of ancient seas) that are about 350 to 280 million years old. The same is true of Arco Peak and Number Hill.

The Lost River Mountains consist of sedimentary rocks that are 600 to 300 million years old. Many of its mountains, and Shelly Peak as well, were sculpted by glaciers over the last two million years.

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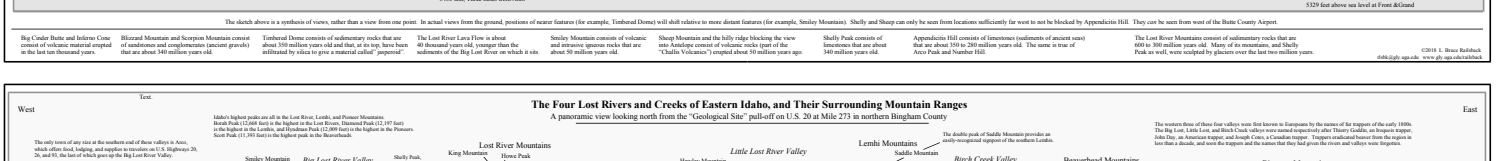



**Four rivers and streams** used to flow onto the Snake River Plain and then sink into that plain's basaltic bedrock, rather than flow to the Snake and ultimately to the sea. From west to east, and from left to right in this view, those four were the Big Lost River, the Little Lost River, Birch Creek, and Medicine Lodge Creek.

These four rivers and streams emerged southward from their respective valleys, and their paths onto and across the Snake River Plain are shown schematically above.

The flow of the Big Lost River, which has the largest and highest drainage basin of the four, was so great that the river wandered eastward across the Snake River Plain to near the mouth of Birch Creek Valley before the last of its water sank into the subsurface.

The water of these four rivers and streams then flowed in groundwater through fractures in the basalt of the Snake River Plain and emerged decades later in the Thousand Springs area near Hagerman, Idaho, more than 100 miles to the southwest and 1000 feet lower.

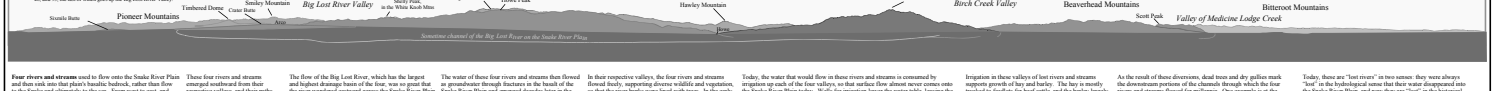
In their respective valleys, the four rivers and streams flowed freely, supporting diverse wildlife and vegetation, so that the river banks were lined with trees. In the early 1900s, hotels in Arco advertised fishing opportunities to fishermen from around the nation.

Today, the water that would flow in these rivers and streams is consumed by irrigation in each of the four valleys, so that surface flow almost never comes onto the Snake River Plain today. Wells for irrigation lower the water table, leaving the riverbeds dry, and in the Big Lost River Valley a dam above Mackay holds back flow, both to lessen spring flooding and to reserve water for summer irrigation.

Irrigation in these valleys of lost rivers and streams supports growth of hay and barley. The hay is mostly trucked to feedlots for beef cattle, and the barley largely goes to production of beer. Irrigation also supports the raising of some cattle in each of the valleys.

As the result of these diversions, dead trees and dry gullies mark the downstream portions of the channels through which the four rivers and streams flowed for millennia. One example is at the rest area on U.S. Highways 20 and 26 east of Arco, where a single dead tree stands beside a channel that is commonly dry.

Today, these are "lost rivers" in two senses: they were always "lost" in the hydrological sense that their water disappeared into the Snake River Plain, and now they are "lost" in the historical sense that they no longer flow and support wildlife in the lower reaches of their respective valleys.




**Five mountain ranges** can be seen north of the Snake River plain: the Pioneers far to the west, the Lost Rivers, the Lemhis, the Beaverheads, and the Bitterroots far to the east. These mountains consist mostly of sedimentary rocks deposited hundreds of millions of years ago, in times of high sea level and when the western margin of North America was not as elevated as it is today. These layers of rock were compressed to give folds and thrust faults, and more generally to create the Ancestral Rockies of 300 to 100 million years ago.

About fifty million years ago, a vast outpouring of volcanic material that is called the "Challis Volcanics" was erupted onto the landscape of much older folded and faulted sedimentary rocks. Antelope canyon provides views of brown volcanic rocks over the older tilted layers of gray limestone.

In the last few million years, the crust of western North America has been stretched in the northwestern part of the continent in California begun to be dragged west with the Pacific Plate. The old Ancestral Rockies were pulled apart along carving normal faults that rotated blocks of old sedimentary rock, so that the western sides of these blocks were raised to make mountain ranges like those seen here, from the Lost Rivers to the Beaverheads. The east sides of the blocks went down to make valleys.

In the last few million years, lava flows from the Snake River Plain (below) have occasionally invaded the southern ends of the valleys (as with the Lost River Lava Flow) or lapped up onto the southern ends of the mountains (as with Sunset Crater and Crater Butte).

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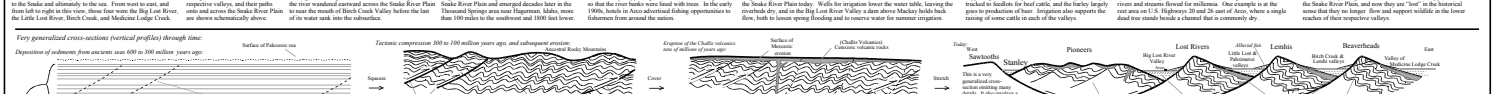


The cartoon above is not a panorama but a series of views from different points along US Highways 20 & 26 between Idaho Falls and Arco in eastern Idaho. The views are keyed to mile markers so that landscape features are each seen on lines perpendicular to the highway. Mile markers have the peculiarity that the highway east of The Puzzle is numbered in US 20 miles but the highway west of The Puzzle is numbered in US 26 miles, resulting in an overlap of numbers near The Puzzle. Curves in the highway dictate that mile markers are not spaced evenly in this document.

The landscape south of US Highways 20 and 26 from Idaho Falls to Arco is a sampler of **volcanic features**, from that lava flows to gently peaked shield volcanoes to sharply upright volcanic domes. It is the result of volcanic eruptions over the last million years, and as recently as 5,000 years ago, a blink of an eye in geologic time.

**A butte** ("byoot") is an isolated hill, typically with steep sides and commonly with a relatively flat top. A butte can thus consist of any geological material, but all of the buttes shown on this document are volcanic features. They rise from a vast plain of basalt, a common volcanic rock, that has been erupted here over the last 4 to 5 million years. The unnamed butte at Mile 299 provides travelers with a close look at the vent at the top of a volcanic butte, as does Microwave Butte at Mile 279-280.

Igneous rocks are the rocks that form from magma (molten mineral material), and **volcanic rocks** are the igneous rocks that form when magma rises from Earth's interior all the way to the surface. Magmas have a spectrum of chemical compositions that range from rich in magnesium and iron ("mafic" is the made-up word for them) to rich in silicon and aluminum ("felsic" is the made-up word for them). This chemical distinction leads to two things that one can see from miles away. First, abundant silicon makes a magma viscous, so that it does not flow across the landscape and instead piles up in a dome, whereas a mafic magma (with less silicon) will flow for miles and miles to make a flat lava field or a low-sloping shield volcano. Second, the iron of mafic magmas makes the resulting rocks (basalts) black in color, whereas the lack of iron in felsic magmas makes the resulting rocks (rhyolites) white. Thus one looks across the Snake River Plain and sees light-gray domes of felsic rhyolite like the big Southern Butte and East Butte, and seen broad flat expanses of mafic black basalt like the Hell's Half Acre Lava Field. Lens apparatus is that the same entire plain consists of older basalt that is commonly covered with lighter-colored wind-blown dust and/or with a coating of white calcite, a secondary surficial coating of calcium carbonate common in dry environments.

The difference between viscous rhyolitic magma and flowing basaltic magma means that the eye is impressed with **rhyolitic domes** and misses **basaltic lava fields** that have an equally large or even larger area. For example, the Big Southern Butte has a footprint of about 10 square miles. Sizemile Butte, which looks much more modest, produced a lava field with a larger area, of at least 12 square miles. Even larger, Crater Butte (over which most people drive without noticing) has a lava field with an area of at least 50 square miles. Thus the Big Butte might better be called Tall Butte or Steep Butte, in deference to the basaltic buttes from which much more lava has poured much more frequently to cover a much larger area.

**The Big Southern Butte** is easily the most prominent of the buttes of the Snake River Plain. It rises to 7548 feet (2300 m) above sea level, and thus about 2400 feet (730 m) above the Snake River Plain, with slopes exceeding 30° on its sides. Clouds sometimes cover its upper reaches when the surrounding plain is clear. The Bureau of Land Management says the Big Southern Butte is "one of the largest volcanic domes in the world", and the butte gives Butte County its name.

**The Big Southern Butte** is locally called just "the Big Butte". However, there is also a "Big Butte" near Grangeville in Idaho County, Idaho, and so distinction between the two is needed. One might ask why the one at Grangeville wasn't called "northern", and the butte here would more logically be called the "Southern Big Butte" – but it is formally named the Big Southern Butte.

**Crater Butte** is a shield volcano covering more than 50 square miles and reaching an elevation of 5367 feet above sea level. A 100-foot deep crater at the top of Crater Butte gives it its name, but that crater is inaccessible to visitors because it is in the restricted area of the Idaho National Laboratory. Crater Butte is sufficiently high that, from the highest point that Highways 20 and 26 reach on its flank, the Tetons can be seen on the eastern horizon on clear mornings. It is also high enough to be seen in the far west in the view in the panel above this one.

All of the rocks and geologic features in the Snake River Plain are remarkably young by geological standards: hardly anything seen at the surface is more than a million years old. For comparison, the rocks in the Lost River, Lemhi, Beaverhead, and Bitterroot Mountains visible to the north are largely hundreds of millions of years old, and the mountain ranges into which they are arranged today are several million years old. Earth itself is four and a half billion years old.