Geology of Southwest Idaho

When Idaho was the West Coast

Along the Upper Hulls Gulch Trailhead you'll see exposures of granitic rocks of the Idaho Batholith, which forms the geologic backbone of west-central Idaho. *Batholiths* are large areas of rock that have intruded into an existing rock formation. The Idaho Batholith intruded into the existing bedrock during the late Cretaceous Period (approximately 64 to 100 million years ago).

At that time, Idaho's western border was ocean front property. The ocean floor, called the Pacific Plate, was being *subducted* beneath the continental land mass, called the North American Plate. During subduction, the Pacific Plate was driven deep into the earth's crust until heat and pressure melted the plate material. The molten material formed chambers of magma, and the relatively lighter and buoyant magma rose up through the crust. As it rose, the super hot magma liquefied and incorporated the surrounding rock. This large lake of magma stopped rising as much as 10 miles below the surface, slowly cooled, and crystallized into the granitic rocks of the Idaho Batholith.

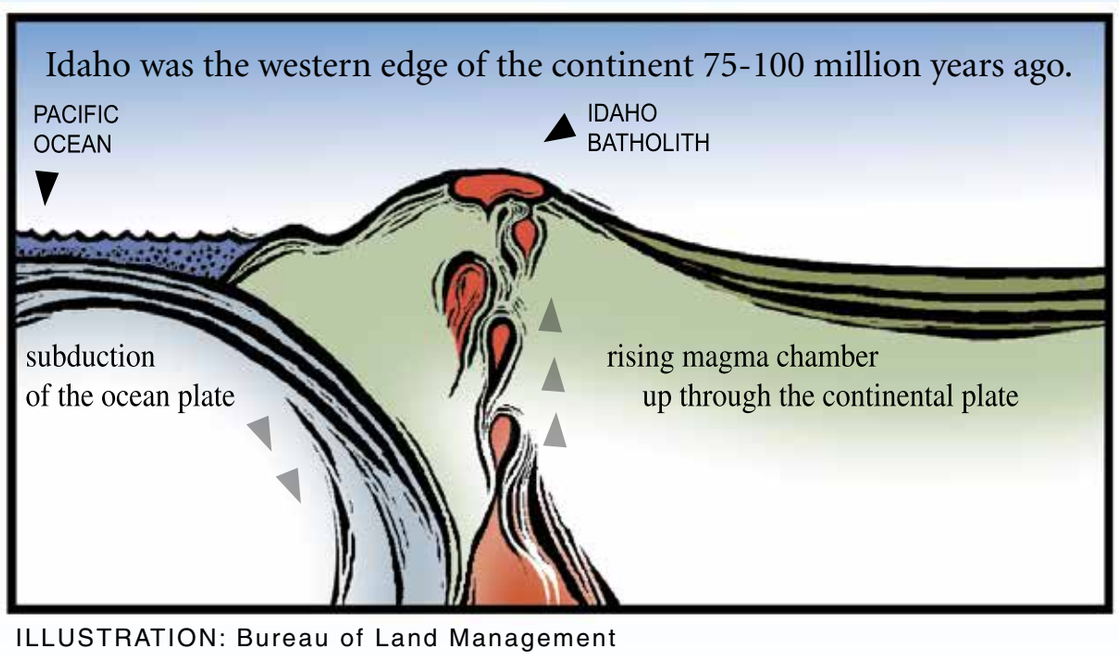


ILLUSTRATION: Bureau of Land Management

Uplift and erosion, over million of years, have exposed the granitic rocks that are now seen along the upper trail. Rounded outcrops of granite are produced by *spheroidal weathering*, a form of erosion where grains of decayed rock flake off in a concentric pattern due to the penetration of water from all sides.

PHOTOGRAPHY: Katherine Jones

MAP: Bureau of Land Management

N

0 12 24 36 48 miles

IDAHO BATHOLITH

YOU ARE HERE

Boise

RIFT ZONE

OWYHEE FRONT

fault line

Jordan Valley

Hagerman

Twin Falls

The Rift

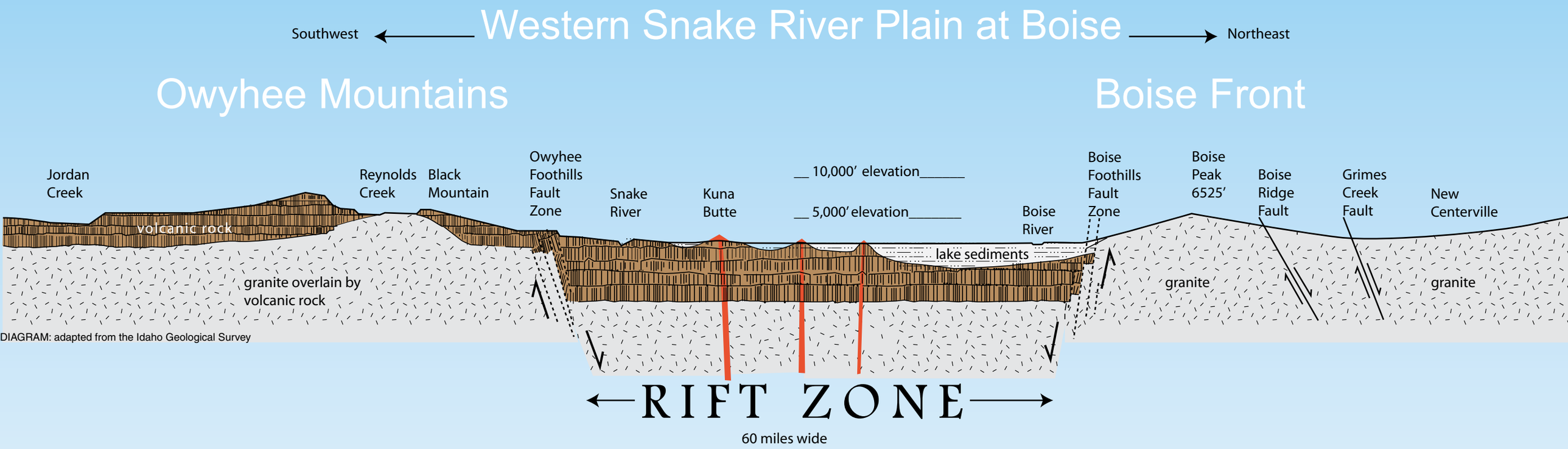


DIAGRAM: adapted from the Idaho Geological Survey

Nestled between the Boise Front and the Owyhee Mountains is the broad valley of the western Snake River Plain. While geologists debate the details of its origin, evidence indicates that the Plain began as a *rift* about 12 million years ago. A rift is a large valley bordered by faults, or fractures in the earth's crust. The earth's crust was pulled apart and became thin, much like the stretching of taffy, and the mountains rose along the fault lines bordering the valley. The Boise Front and the Owyhee Mountains were uplifted along these faults for 3 million years and had probably reached much of their current elevation by 9 million years ago.

MAP: Bureau of Land Management

N

0 12 24 36 48 miles

SW migration of earth's crust over existing hotspot

YOU ARE HERE

Boise

Snake River Plain

OWYHEE FRONT

15.5 million years

Jordan Valley

13.7 million years

Owyhee-Humboldt Volcanic Field

14.7 million years

Bruneau-Jarbidge Volcanic Field

12.5 million years

Twin Falls

Shoshone Ice Caves

11 million years

Twin Falls Volcanic Field

Craters of the Moon

Big Southern Butte

10.3 million years

Picabo Volcanic Field

Middle Butte

East Butte

6.2 million years

Heise Volcanic Field

Menan Buttes

4.3 million years

6.6 million years

Idaho Falls

Island Park

0.6 million years

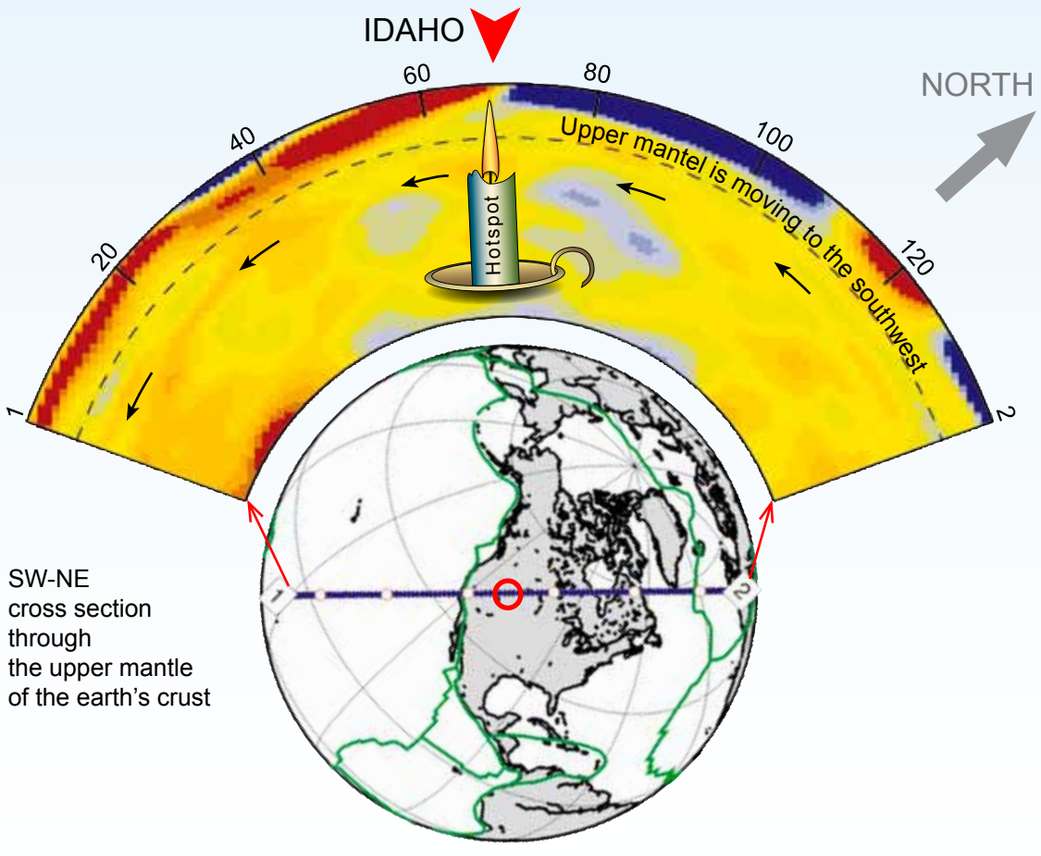
Yellowstone Plateau Volcanic Field

The Hot Spot & Volcanism

The rift of the western Snake River Plain developed at the same time that a hot spot caused volcanic eruptions farther to the south. A hot spot is a plume of molten rock rising from deep within the earth. Huge volcanic eruptions resulted—some had 1,000 times the power of Mount St. Helens. The lava and ash settled into rock layers forming the foundation of much of southern Idaho. While the hot spot has remained stationary, the earth's crust has moved slowly southwest—like a conveyor belt moving over a candle. The result is a *hot spot track*, or a chain of large craters and other volcanic features, which are progressively younger moving to the northeast over a distance of nearly 230 miles. The geysers and volcanic features of Yellowstone National Park now mark the location of the hot spot.

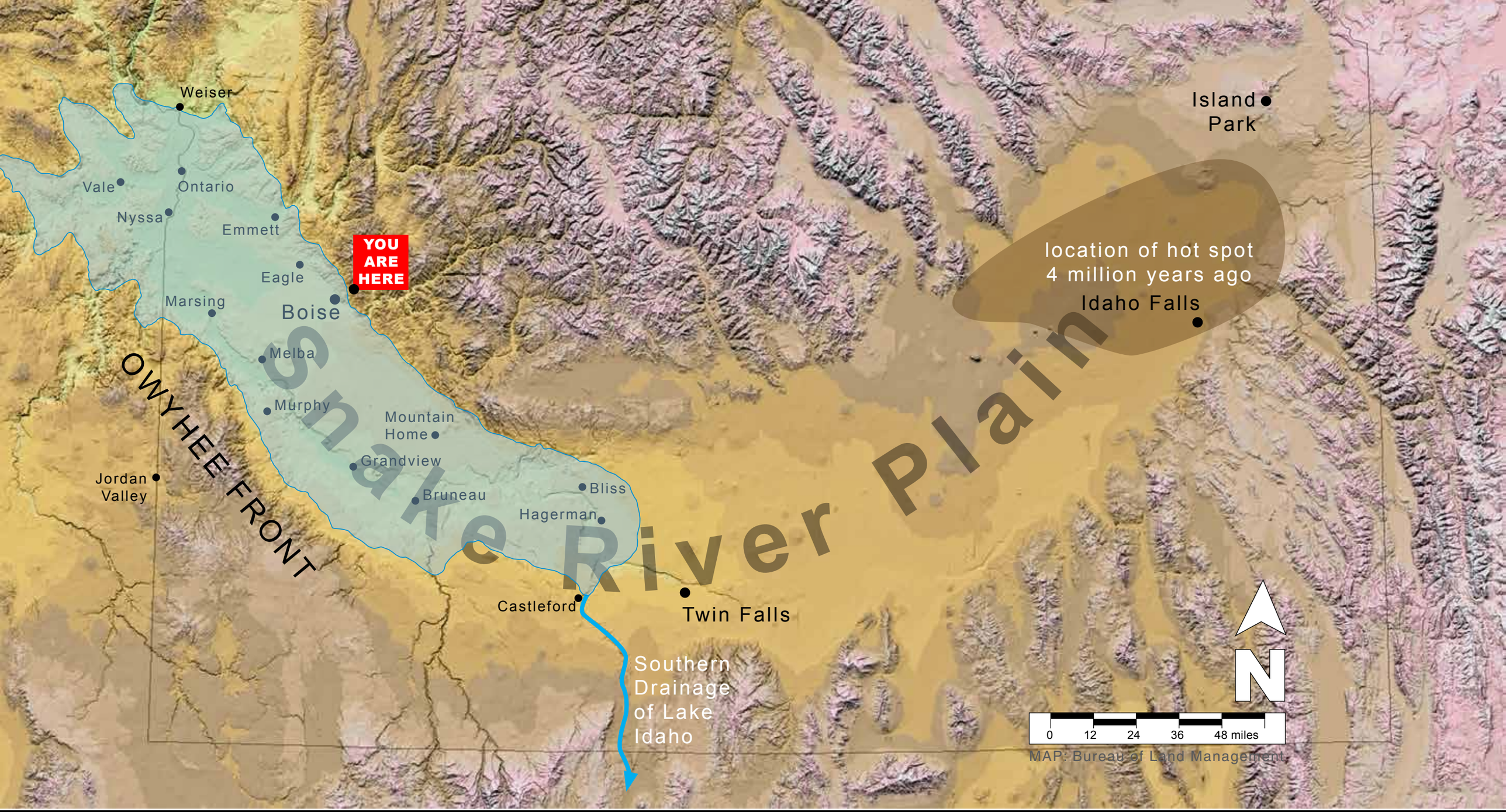
THE CONVEYOR BELT

The earth's crust moves slowly over the stationary hot spot, currently at Yellowstone National Park.



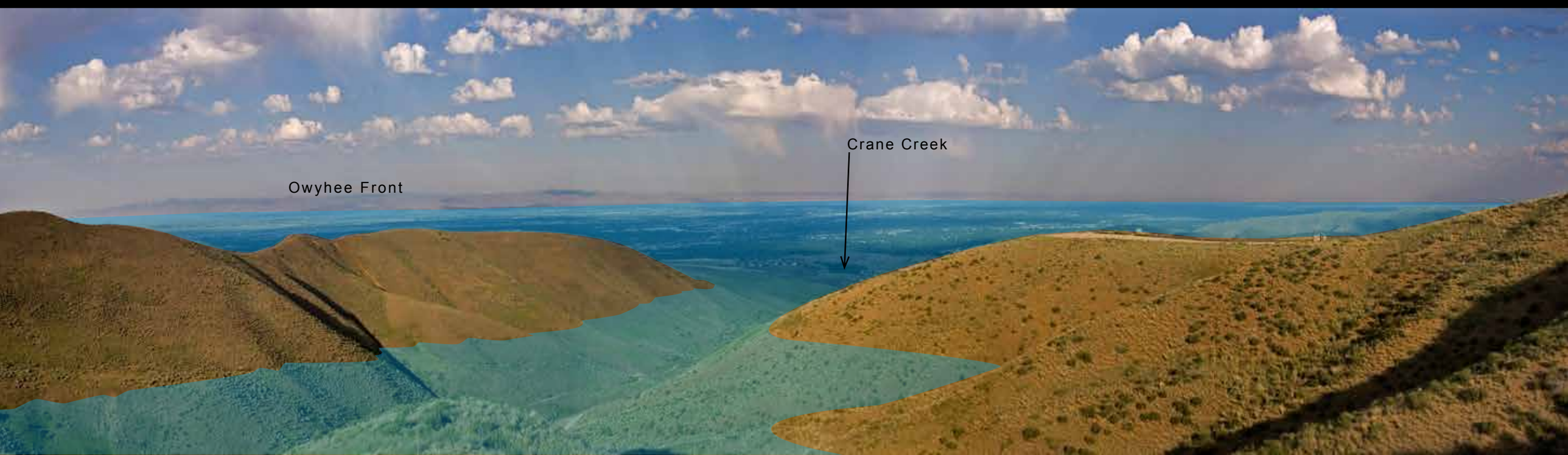
SW-NE
cross section
through
the upper mantle
of the earth's crust

adapted from Geological Society of America Bulletin, October 2002



Lake Idaho rose to 3800 feet above sea level about 4 million years ago and drained south into Nevada. Streams and marshes near Hagerman were home to a diverse set of animals, including the Hagerman horse. Pygmy musrat and giant beaver fossils also lived in these areas.

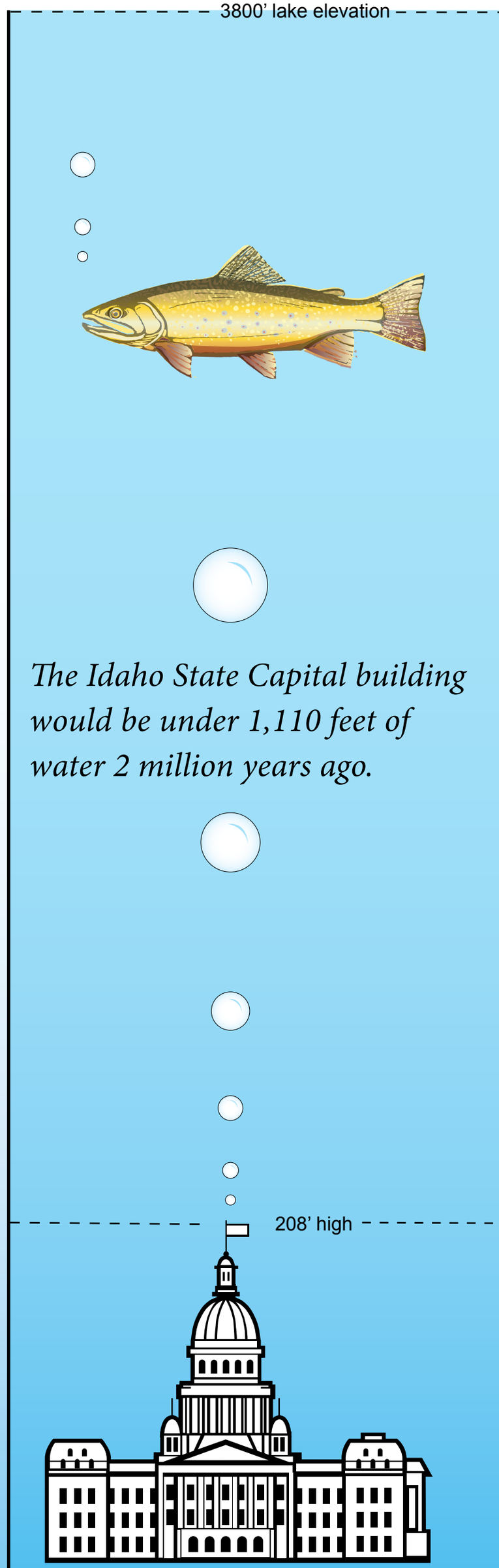
PHOTOGRAPHY / ILLUSTRATION: Bureau of Land Management



Lake Idaho

From about 9 to 2 million years ago, Lake Idaho occupied much of the western Snake River Plain. Although the lake level fluctuated over time, we know the lake persisted because thousands of feet of lake sediments were deposited on the Plain. At times, volcanoes also occurred and produced basalt lava that flowed into Lake Idaho. Changes in the basalt caused by contact with water are used by geologists to detect the Lake Idaho shoreline. The 3,800-foot elevation contour represents the highest level of the lake shoreline. At this level, Lake Idaho was more than 200 miles long and 35 miles wide.

Lake Idaho existed for more than 6.5 million years. Where did it go? Geologists aren't certain, but many think that, between 2-4 million years ago, melting glaciers caused the lake to overflow and drain west in a massive flood that gouged Hell's Canyon, the deepest canyon in North America.



The Idaho State Capital building would be under 1,110 feet of water 2 million years ago.

Molten lava oozing from a shield volcano in Hawaii today is like the volcanism in the Treasure Valley 2 million years ago.

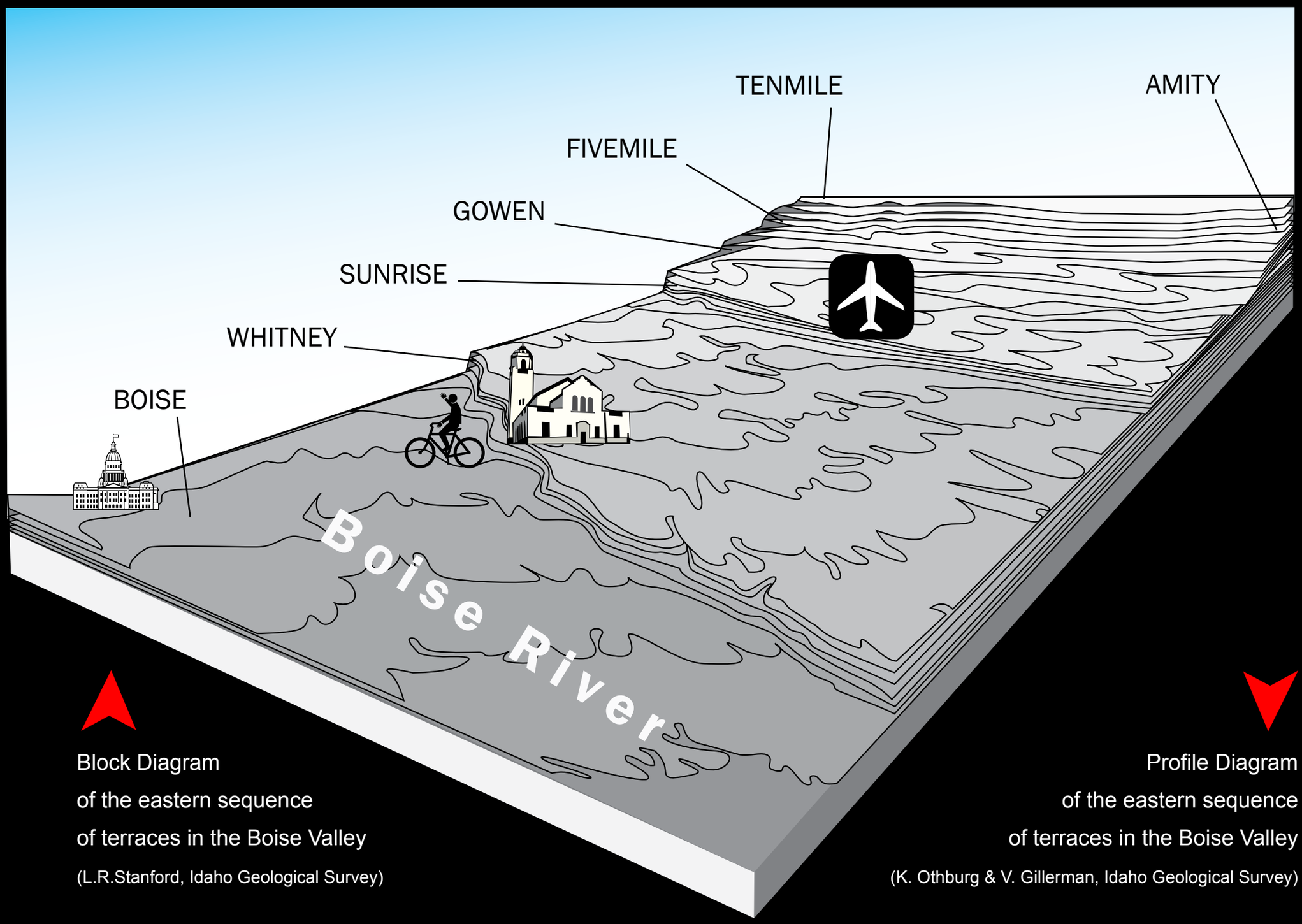
PHOTOGRAPHY: Glenn Oakley

Shield Volcanoes

Volcanoes with broad, gentle slopes, called *shield volcanoes*, were the sources of younger (less than 2 million-year-old) lava flows that erupted and covered the surface of the western Snake River Plain. Kuna Butte, seen in the distance to the northwest, is one in a series of shield volcanoes that span from Kuna to Mountain Home. The youngest of these volcanoes erupted as recently as 100,000 years ago.

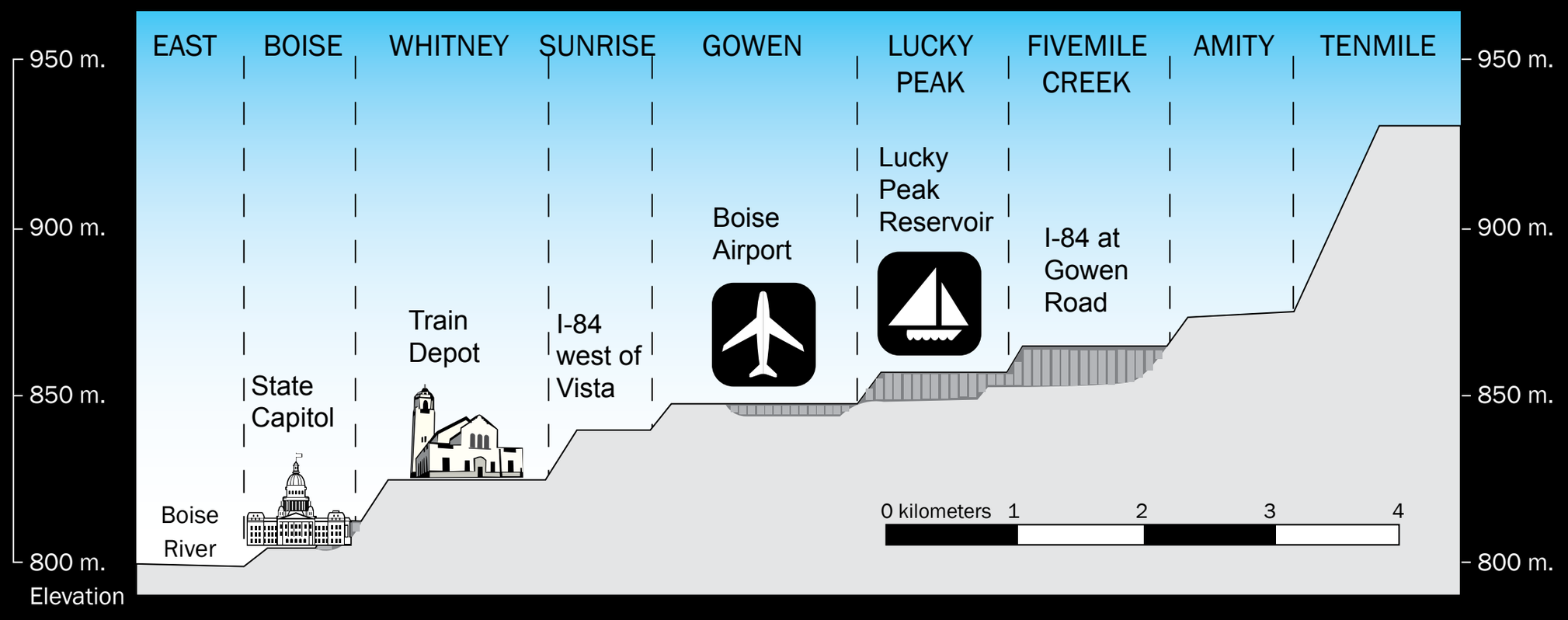
PHOTOGRAPHY: Bureau of Land Management

Christmas Mountain, 22 miles southeast of Boise, is one in a series of shield volcanos.



Block Diagram
of the eastern sequence
of terraces in the Boise Valley
(L.R.Stanford, Idaho Geological Survey)

Profile Diagram
of the eastern sequence
of terraces in the Boise Valley
(K. Othburg & V. Gillerman, Idaho Geological Survey)



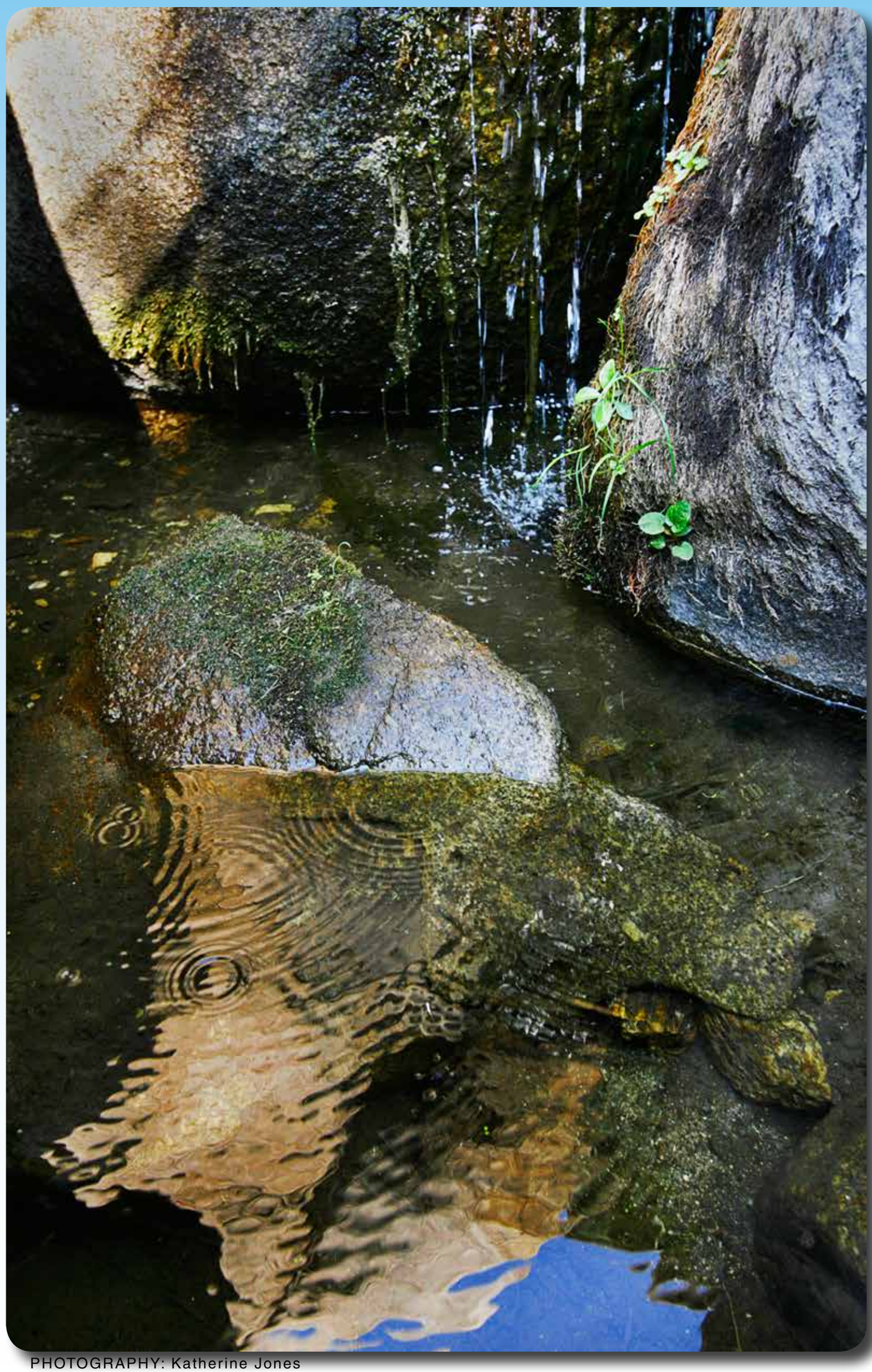
The Boise River Terraces

The filling of the western Snake River Plain with lake sediments was followed by a geologic process called *river entrenchment*. The Boise Valley was formed by the Boise River cutting down through the sediments deposited by Lake Idaho. This process began about 2 million years ago, at the beginning of Pleistocene Ice Age. After each period of down-cutting the river stabilized and deposited a gravel *terrace* on its new floodplain. The Tenmile terrace, located about four miles south of the Boise Airport, indicates the earliest course of the Boise River. Over time, the Boise River has evidently migrated northward towards the Boise Front. A total of eight river-cut terraces, or benches, mark past locations of the ancestral Boise River.

Q: *What does this bicyclist on Capitol Boulevard have to do with geology?*

A: *He is riding on the Boise Bench, one of the youngest terraces carved by the Boise River. The Depot building behind him is on an older terrace called the Whitney Bench.*

PHOTOGRAPHY: Bureau of Land Management



PHOTOGRAPHY: Katherine Jones

Today

Geologic processes are not just history—they are alive and continue with or without man's influence. With every storm, the Boise Foothills are carved by small streams that continue to erode gullies, sculpt hillsides, and deposit sediment downstream as part of the complex interaction of geologic processes.

The "slump" below is soil moving downslope.
It is a result of oversaturated soils on steep slopes.

PHOTOGRAPHY: Bureau of Land Management

EON	ERA	PERIOD	EPOCH
Phanerozoic	Cenozoic	Quaternary	Holocene 0.01
			Pleistocene 2
		Tertiary	Pliocene 5
			Miocene 24
			Oligocene 34
			Eocene 55
			Paleocene 65
	Mesozoic	Cretaceous 144	
		Jurassic 206	
		Triassic 248	
		Permian 290	
	Paleozoic	Pennsylvanian 323	
		Mississippian 354	
		Devonian 417	
		Silurian 443	
		Ordovician 490	
		Cambrian 543	
Proterozoic		900	
		1600	
		2500	
Archean		3000	
		3400	
		3800	
Hadean		no record	

Geologic Time

Southwestern Idaho geology formed during the Quaternary and Tertiary Periods

(numbers are absolute dates of period/ epoch in millions of years before present time)

This flipbook was produced by the Bureau of Land Management for the Hulls Gulch National Recreation Trail in Idaho