VOLCANOES OF THE WESTERN SNAKE RIVER PLAIN FIELD TRIP

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Craig White, Professor Emeritus, Geosciences Department, Boise State University

INTRODUCTION

The western Snake River Plain forms a distinctive topographic lowland that extends northwestward from the vicinity of Twin Falls, past Boise, and into eastern Oregon. Northwest trending normal faults along the northern margin of the plain separate it from the foothills of the central Idaho mountains; parallel faults along its southern margin separate it from Owyhee uplands. Subsidence of the plain along these faults probably began around12 million years ago.

A series of huge freshwater lakes filled the closed basin of the western plain between about 12 and 2 million years ago. Sediments shed from the highlands north and south of the plain were deposited in these lakes as the basin subsided. The lower part of this sedimentary sequence is known as the Chalk Hills Formation and the upper part constitutes the Glenns Ferry Formation. These units are composed mainly of sand and silt, and together they are about 2 kilometers thick.

During the time that lakes occupied this region, volcanoes were erupting within and adjacent to the western plain. Giant explosive eruptions in Oregon and Idaho ejected huge volumes of glassy volcanic ash high into the atmosphere, where it was carried by wind and deposited in the lakes. Layers of this volcanic ash up to 2 meters thick occur within the lake beds. In addition, smaller, less explosive volcanoes erupted on the lake floor producing distinctive "pillow" lava flows.

The last of the great lakes, known as "Lake Idaho", probably drained away around 2 million years ago as the Snake River cut the deep gorge at Hells Canyon. Between about 2 million and 700 thousand years ago, the western plain probably still contained a number of small lakes and the ground water level was much higher than it is today. This was also a period of active volcanism, and hundreds of small basalt volcanoes of this age have been identified. Because many of these volcanoes erupted beneath shallow standing water or through water saturated sediments, the hot basalt magmas caused steam explosions, known as phreatic explosions. These explosions shattered the surrounding rock and ejected fragments ranging from fine sand to the size of small cars. The magma itself was chilled to a glass and small particles of this glassy "juvenile" ash were thrown out of the vent along with "accidental" fragments of the pre-existing rock. The particles accumulated around the vents, forming layers of rock known as "phreatomagmatic tuff". This material forms the distinctive yellow-brown beds that are seen in many places along the walls of the Snake River Canyon, especially in the area near Swan Falls dam. In addition, many of the buttes and high points along the Snake River between Marsing and Glenns Ferry are remnants of phreatomagmatic volcanoes and contain thick beds of yellow-brown tuff capped by black basaltic spatter. Some of these are: Lizard Butte, Liberty Butte, Walters Butte, Guffey Butte, Sinker Butte, Coyote Butte, Castle Butte and Sailor Cap Butte.

The most recent eruptions on the western plain took place about 400 thousand years ago. By this time even the smallest remnants of Lake Idaho had dried up and the plain was much like it is today. Rising basalt magma encountered little or no water, so the volcanoes erupted lava flows similar to those at Hawaiian volcanoes. Lavas flowed away from the vents in all directions, building "shield volcanoes" with low profiles and gently dipping slopes. Kuna Butte, Initial Point volcano, Powers Butte, and McElroy Butte are all shield volcanoes that formed around this time.

NOTES ABOUT THE FIELD TRIP

The stops described below provide an overview of some of the major volcanic features of the western Snake River Plain. Depending on your time and interest, the trip can include several short hikes. If you do decide to take some of the hikes, remember the obvious warnings below:

- Rattlesnakes live in the western Snake River Plain and they especially like the rocky areas. On one trip I led, a child went scrambling over the rocks and had a close encounter with one. Fortunately, the child and the snake parted company with no harm done to either (although it probably took a while for the dad's blood pressure to get back to normal).

- It can be very hot on the plain and especially in the canyon. Know your limits, bring water, and don't hike on steep slopes unless you are comfortable doing so. If you start feeling hot or unhappy, turn around and find some shade.

FIELD TRIP STOPS

From Boise, drive west on I-84 to the Kuna-Meridian exit. Turn left after exiting the freeway and drive south on Meridian Rd toward Kuna. Turn left on Swan Falls Rd toward Swan Falls dam and the Birds of Prey Natural Area. After 8 miles, turn left on the gravel Initial Point Rd., drive up the gentle flank of the Initial Point shield volcano, and park at the base of Initial Point itself. Walk up the dirt road to the rocky point on top.

Stop 1: Initial Point. It was from this point that the base lines for the Idaho township and range system were first surveyed in the late 1800's; the town of Meridian is named for this north-south base line (the meridian). From here we get a good look at the neighboring Kuna Butte shield volcano and, in clear weather, we can see both margins of the western Snake River Plain graben. Both Initial Point volcano and Kuna Butte volcano formed after Lake Idaho had drained away and the plane was essentially dry. They are among the youngest of the western Snake River Plain volcanoes and have been radiometrically dated at about 400,000 years before present.

Go back to Swan Falls Rd and continue south toward Swan Falls Dam. Stop at the gravel overlook just before heading down to the dam.

Stop 2: Snake River Canyon overlook. The impressive mesa-like feature across the river from the picnic area is Sinker Butte, a volcanic center that erupted about 1.2 million years ago. The well exposed section in the far cliff contains a lower sequence of basaltic lava flows overlain by a thick series of phreatomagmatic tuffs, which in turn are capped by more basaltic lavas. Radial dikes cut the tuffs and lower flows, and several of them form spectacular fins on the hillsides where the less resistant tuffs have been preferentially eroded away.

Previous workers assumed the lower basalts were as much as 2 million years older than the overlying deposits; however, our studies (including two new radiometric dates) suggest the entire sequence was erupted over a relatively short period of time. Our current hypothesis is that lava flows disrupted and dammed the ancestral Snake River, causing water to rise and mix with the magma column. This resulted in a prolonged episode of explosive (phreatomagmatic) eruptions. A return to normal water levels or sealing of the vent allowed the system to revert back to non-explosive, lava flow producing eruptions. The flat top of the butte is probably the remnant of a lava lake that pooled within the broad crater of the tuff cone. The present day canyon is much younger than the volcano and cuts through its eastern flank.

Drive down to the historic Swan Falls dam and park. Bathrooms are available here and a display tells the interesting history of the dam. The shady area by the parking lot provides a nice spot for a picnic lunch.

Stop 3: Sinker Butte volcano (Optional). We have several options here. If people are interested, we can walk across the dam and head up the dirt road to examine the lavas and tuffs of the Sinker Butte volcano. Some of the basalts along the dirt road contain good examples of "pillows", which indicate these lavas flowed into water. The thick deposits of gray and brown ash overlying the lower basalt flows in the cliffs are the products of explosions caused when magma mixed with external water. Some of these explosions ejected large blocks composed of sediment and older lava; look for bomb sags where these large blocks landed on wet beds of finer grained ash. If you don't hike up the dirt road on the other side of the dam, you can still examine the gray and brown phreatomagmatic deposits in cuts along the paved road leading back out of the canyon.

Drive out of the canyon and back toward Kuna. However, after the road heads north away from the canyon, turn left onto Victory Lane (see attached map). Victory makes a couple jogs and becomes Warren Spur Rd.

Stop 4: Overview. This will be a quick stop to look out over an area of the Snake River where the canyon opens out into what is known as the Melba embayment. From here we can see Guffey Butte, Walters Butte and White Butte, all of which are phreatomagmatic volcanoes. We will also briefly discuss the Bonneville flood.

Continue on Warren Spur Rd, cross Can-Ada Rd, then eventually turn left on Sinker Rd (by a small feed lot) and proceed to Celebration Park. If parking is available, we may want to stop first at the old Guffey railroad bridge (now a foot bridge), which affords a better view of Guffey Butte.

STOP 5a: Deposits of the Bonneville Flood. Although not related to the volcanic story, we can't pass up the opportunity to mention the Bonneville flood. This event took place about 14 thousand years ago, long after the last of the western SRP volcanic eruptions. The flood was caused by the rapid erosion of sediments that formed part of divide between the giant Lake Bonneville in Utah and the Snake River drainage system to the north. The failure of this divide can be compared to the failure of an earth fill dam (like the Teton dam disaster), although on a much vaster scale. Maximum outflow at Red Rock Pass is estimated to have been about one million m^3/second (~35 million cfs). Flow was confined to the deep and narrow Snake River Canyon just up stream from this stop, but when flood waters spread out over the broad valley in front of us they slowed and deposited the thousands of boulders that form the huge Walters bar which we just crossed on Sinker Rd.

Stop 5b: We also want to look across the river at the eroded Guffey Butte volcano and the flat topped mesa called Guffey Table. A number of eruptions took place in this area between about 1 million and 700 thousand years ago. Many of these eruptions were "phreatic", meaning that they were associated with steam explosions caused when hot rising magma interacted with water in shallow aquifers beneath the surface. The underground explosions produced large craters (called maars) and ejected blocks and ash which accumulated in and around the crater. The effect was similar to setting off a nuclear explosion a hundred feet or so beneath the ground surface. The east (upstream) side of Guffey Butte is open for public access; however, the dirt road that heads downstream is blocked by a fence and is not open to the public. If you don't mind scrambling on steep rocky surfaces, it is well worth examining the volcanic deposits at the top and sides of this eroded maar volcano.

Stop 5c: While at Celebration Park be sure to examine the interesting Native American petroglyphs that were carved on some of the big boulders deposited by the Bonneville flood.

This is the last formal stop on the field trip. You can return to Boise or Meridian by retracing our route back to Swan Falls Rd and taking Meridian Rd to I-84. To go directly to Nampa, you can follow back roads to highway 45. Refer to the attached map for either route.

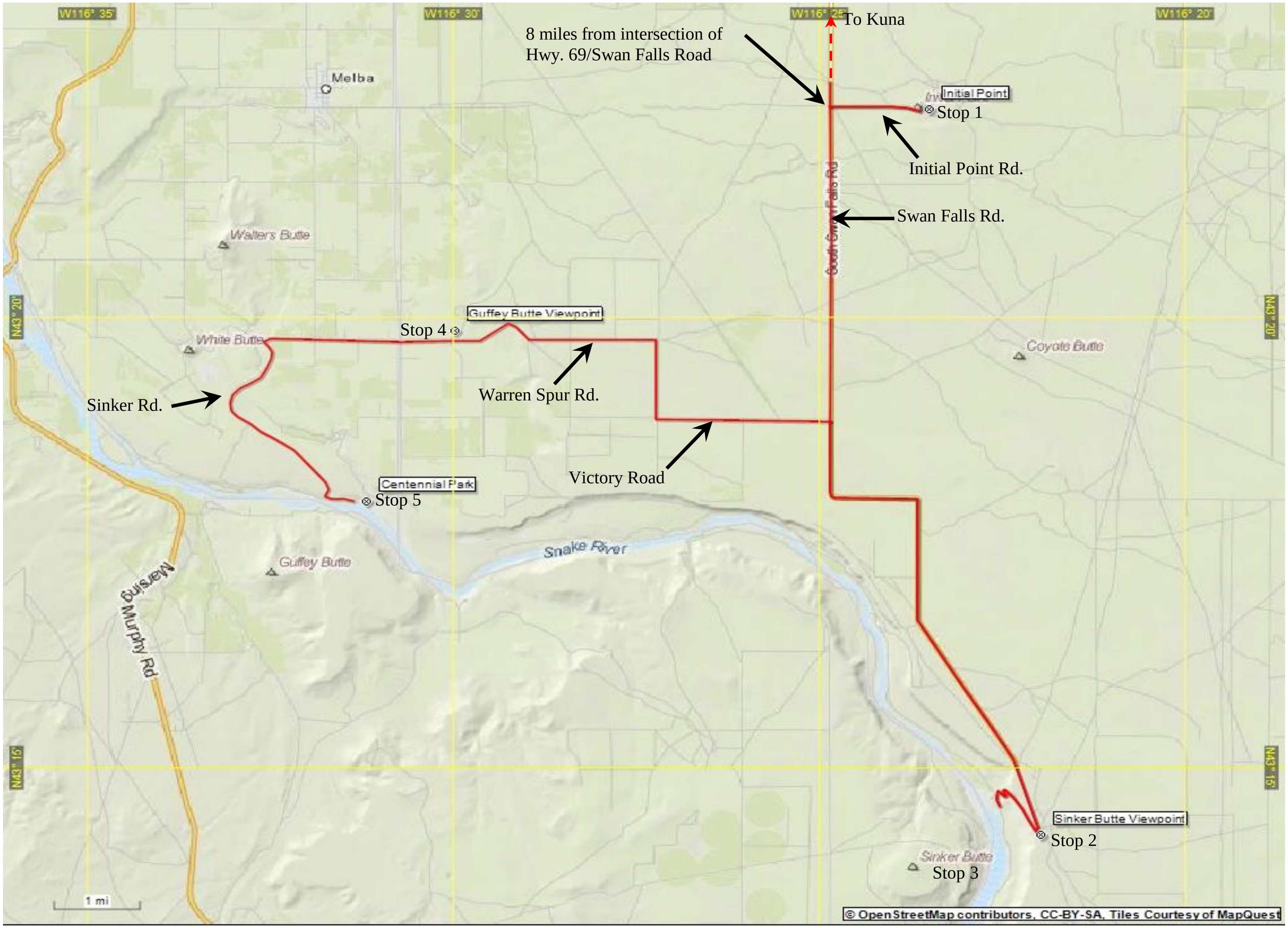
REFERENCES. The following books are recommended if you want to read more about the Snake River Plain, its volcanoes, the Bonneville flood, or Idaho geology.

The best single reference about the Snake River Plain for the non-specialist is the book "Snake: The Plain and its People", edited by Todd Shallat. It contains beautifully illustrated articles on the geology, history and people of the Snake River Plain.

The best technical reference on the plain for geologists is the volume of papers published in 2004 by the Idaho Geological Survey. The reference is: Bonnichsen B, White CM and McCurry M (eds), "Tectonic and Magmatic Evolution of the Snake River Plain Volcanic Province, Idaho", Geological Survey Bulletin 30, 482 p. It can be ordered directly from the IGS on their website at: www.idahogeology.org/

The definitive study of the Bonneville flood was made by James O'Connor and is published as a monograph by the Geological Society of America. The reference is: O'Conner, JE (1993) "Hydrology, hydraulics, and geomorphology of the Bonneville flood". Geological Society of America Special Paper 274, 83 p.

Two books by Idaho geologist Terry Maley are highly recommended for anyone interested in geology in general and Idaho geology in particular. They are: "Exploring Idaho Geology" and "Field Geology Illustrated". The latter book contains many examples from Idaho. Both are available from Amazon.



W116° 35'
W116° 30'
W116° 25'
W116° 20'
To Kuna
8 miles from intersection of
Hwy. 69/Swan Falls Road
Melba
Initial Point
Stop 1
Initial Point Rd.
South Swan Falls Rd
Swan Falls Rd.
Walters Butte
N43° 20'
Guffey Butte Viewpoint
Stop 4
White Butte
Coyote Butte
Warren Spur Rd.
Sinker Rd.
Victory Road
Centennial Park
Stop 5
Snake River
Guffey Butte
Marsing Murphy Rd
N43° 15'
Sinker Butte Viewpoint
Stop 2
Sinker Butte
Stop 3
1 mi
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