VOLCANOES OF THE WESTERN SNAKE RIVER PLAIN FIELD TRIP

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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 around 12 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 the wind and eventually 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 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. 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 probably much like it is today. Rising basalt magma encountered little or no water, so the volcanoes generally erupted lava flows similar to those produced by Hawaiian eruptions. The fluid 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 will give us an overview of some of the major volcanic features of the western Snake River Plain. Closed toed shoes are required, although hiking in general will be minimal. Please remember:

- Rattlesnakes live in the western Snake River Plain and they especially like the rocky areas.
- Bring layers, food and water for the day, sun protection, and rain protection.
- The times for field trip stops (below) are approximate and subject to change.

FIELD TRIP REGISTRATION AND STOPS

The trip will register at the ***Albertson's parking lot in Kuna at 8 AM (700 E Avalon St, Kuna, ID 83634)****, with a planned departure by 8:30 AM. Please look for a vehicle with an "IMMG Field Trip Registration" sign on the side.*

We will turn right onto Avalon Street in Kuna, then turn left on Swan Falls Rd toward Swan Falls dam and the Birds of Prey Natural Area. After about 8 miles, we will 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. We will walk up the dirt road to the rocky high point.

Times for field trip stops below are approximate and subject to change.

Stop 1: Initial Point (9 -10 am). 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 (10:30 - 11 am). 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 in the broad crater of the tuff cone. The present day canyon is much younger than the volcano and cuts through its eastern flank.

Walk down the road to view the volcanic rocks in outcrop.

Stop 3: Sinker Butte distal outcrop along road to Swan Falls dam (~11 am -12 pm). We will examine the rocks exposed in the road cut on the way into the canyon. These are the same gray and orange ash deposits we see in the cliffs across the river, but the section is much thinner here because ash was deposited farther from the volcanic vent. The thick deposits of gray and brown ash overlying the lower basalt flows are the products of explosions caused when magma mixed with external water. We will examine interesting features formed by ballistic ejecta, fall and ground hugging flows of gas, ash and rock (called pyroclastic flows). 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.

Drive down to the historic Swan Falls dam and park. Bathrooms are available here and a display tells the interesting history of the dam.

Stop 4: Swan Falls Dam (12:15 – 1 pm). We will take a break here for folks to use the restroom. Depending on the time, we will likely eat lunch in the shady picnic area next to the dam.

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. 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 view of Guffey Butte.

Stop 5a: Celebration Park Bridge (1:45 – 2 pm). Here we will look across the river at the eroded Guffey Butte volcano and the flat topped mesa called Guffey Table. Guffey Butte is a “maar” volcano, formed about 1 million years ago when rising magma mixed with groundwater causing a series of violent steam explosion. These underground explosions formed large craters in the pre-existing land surface and ejected rock fragments up to several meters across. The effect was similar to setting off a nuclear explosion a hundred feet or so beneath the ground surface. The eastern (upstream) side of Guffey Butte is open to public access, although we won’t be hiking up there today. If you don’t mind scrambling on steep rocky surfaces, it is well worth examining the spectacular volcanic deposits at the top and sides of this eroded maar volcano.

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, although on a much vaster scale. Recent studies by Utah State geologists suggest that the failure may have been triggered by an earthquake. Maximum outflow at Red Rock Pass is estimated at one million m^3/second (~35 million cfs). Flow was confined to the deep and narrow Snake River Canyon just upstream 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, which we can see upstream and downstream.

Stop 5b: Celebration Park (2– 3 pm). People who have been to Celebration Park know that some of the big Bonneville flood boulders contain interesting Native American petroglyphs. If you haven't seen them, this is a good opportunity to do so.

Return back along Sinker Rd. Turn left onto Warren Spur Rd and continue onto Hill Rd. Turn left onto Ferry Rd. In 2 miles, turn right onto ID-45 N. In 2.5 miles, turn left and park next to two large grain silos.

Stop 6: Grouch Drain Maar (3:15 – 3:45 pm). Our final stop will examine the surface expression of a maar volcano. Again, a maar volcano forms when rising magma mixed with groundwater causing a series of violent steam explosions. The surface expression of a maar volcano is thus a giant hole in the ground, which we can see well here.

Participants may depart at their leisure. Continue North along ID-45. In ~9 miles, turn right on Deer Flat road, then left onto S Robinson Rd, then right onto E Amity Ave, then Left onto S Ten Mile Rd. The ramp to interstate 84 will be two miles ahead. Safe travels!

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 he Bonneville flood". Geological Society of America Special Paper 274, 83 p.

"Exploring Idaho Geology" by Terry Maley is recommended for anyone interested in Idaho geology.