

Tectonic History and Hiking Tour of the Northern Seven Devils Mountains, West-Central Idaho

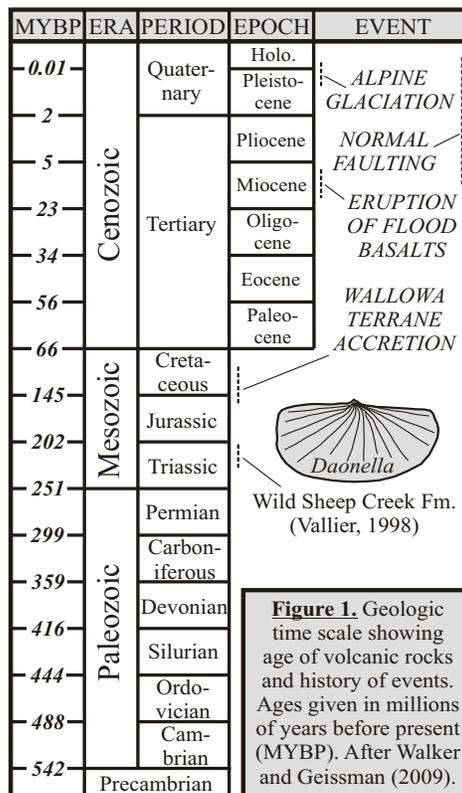


This extinct volcanic terrain was formed by major island-arc eruptions in the ancestral Pacific Ocean, plate tectonic activity, and recent alpine glaciation. It is accessed by Forest Service Road #517 off US-HWY 95, one mile south of Riggins, Idaho. Located between the Snake and Salmon Rivers, the northern Seven Devils rise above 9300 feet and comprise the westernmost mountain chain in the central Rocky Mountains. Glimpses into Hells Canyon, the deepest gorge in North America, and an occasional mountain goat sighting add to this dynamic landscape.

TECTONIC HISTORY

Island-arc volcanism is represented in the northern Seven Devils Mountains by a thick sequence of metamorphosed lava flows of Middle and Upper Triassic age (Fig. 1). Massive iron- and magnesium-rich volcanic rocks dominate this part of the Wallowa terrane¹, an 'exotic' oceanic assemblage now residing in northeastern Oregon and western Idaho. These rocks were once part of an island chain that existed far off the coast of ancient North America, similar to today's Mariana Islands in the northwestern Pacific Ocean (Vallier, 1998). During the Late Jurassic to Early Cretaceous interval, rocks of the Seven Devils region were accreted to the western edge of North America, which existed at that time ~10 miles east of Riggins, Idaho (Fleck and Criss, 2004). This slow process of terrane accretion (and continental growth) shifted the Pacific coastline westward towards its present location. In west-central Idaho, the collisional event is recorded across a broad zone of deformation known locally as the Salmon River suture (Blake et al., 2009). The island arc-continent suturing event was followed by vertical uplift along steep northerly trending normal faults which offset Miocene flood basalts. Geologically speaking, these relatively young faults have played an important role in raising the local mountains to their current elevations (Fig. 2).

¹ In this context, "terrane" refers to a displaced crustal fragment with a geologic history that differs from surrounding areas.

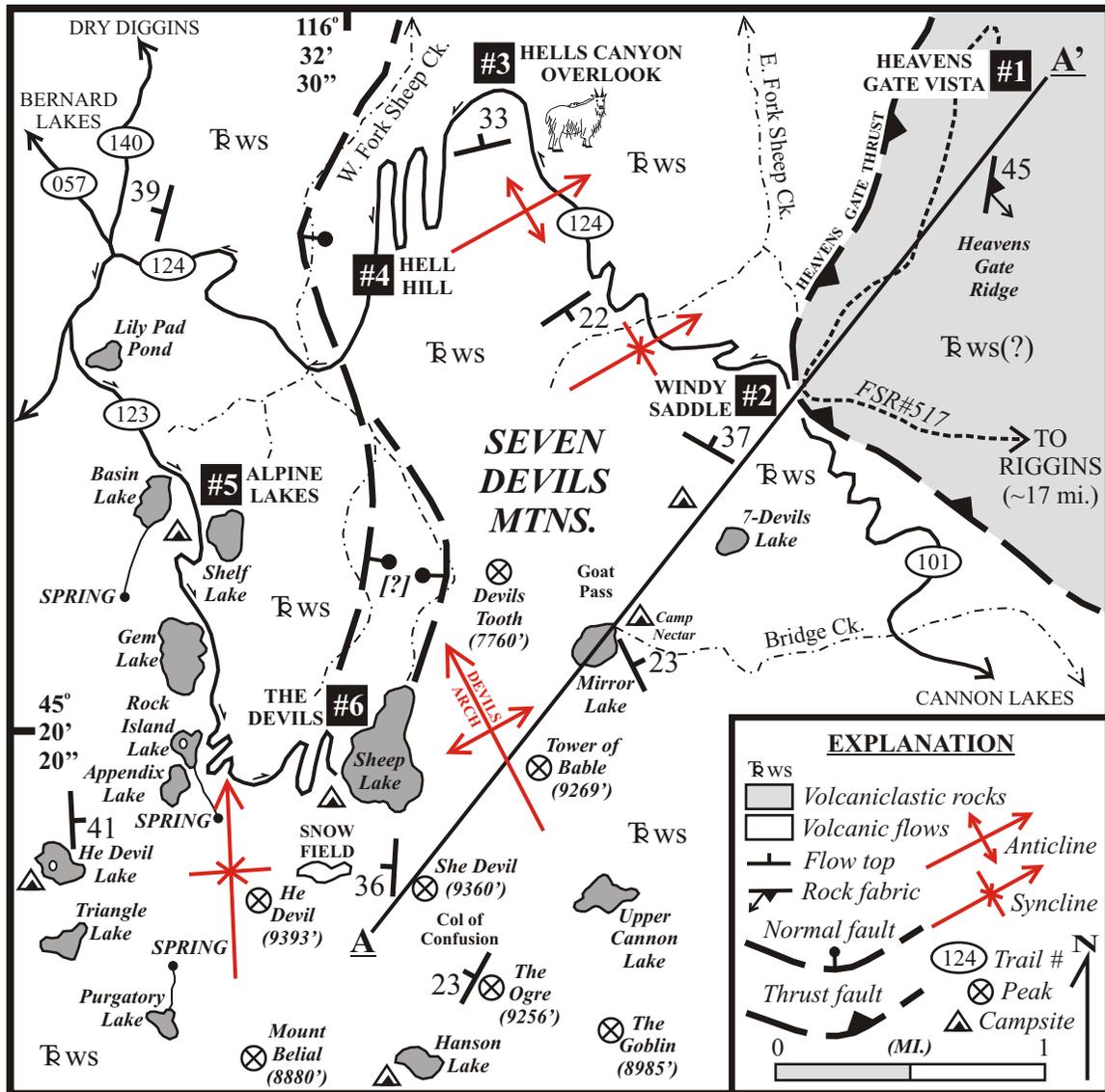


HIKING TOUR

Stop #1: Heavens Gate Vista (8429'). From the parking area, follow the footpath ~¼ mile east up onto the ridgeline for spectacular panoramic views into Oregon, Washington, and Montana. At the forest fire lookout (built ca. 1978), signposts inform of the surrounding peaks, rivers, and canyons. Below the lookout are moderately inclined, olive-green metasedimentary rocks containing rounded pebbles, cobbles, and boulders. These mixed volcanic 'clasts' were likely sourced from lava flows similar to those exposed in

the Upper Cannon Lake area (Fig. 2). Many clasts display symmetrical cigar (stretched) or pancake (flattened) shapes acquired during metamorphism and deformation related to island arc-continent collision. Strong linear and planar deformation fabrics characterize western portions of the Salmon River suture zone (Gray et al., 2012)

Stop #2: Windy Saddle (7606'). Through this narrow wind gap runs the shallow northeast dipping Heavens Gate fault (Gray and Oldow, 2005), which separates the deformed rocks viewed at Stop #1 and basaltic island-arc lava flows comprising the northern Seven Devils Mountains (Fig. 2). Only remnants of the fault are preserved here; deeply



*Base map modified after Jones (2003) – Geology by K. Gray (1997-2011).

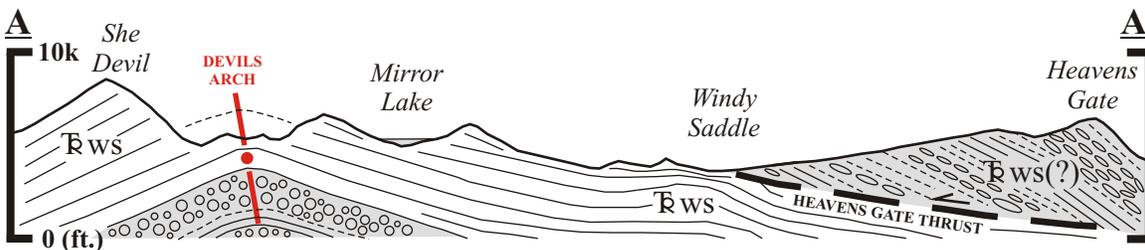


Figure 2. Simplified geologic map and cross-section, northern Seven Devils Mountains. Tws: Middle to Upper Triassic Wild Sheep Creek Formation (Vallier, 1998).

eroded, reddish-brown volcanic rocks near the kiosk show evidence of high-temperature fluids moving into the fault zone (veins). Motion along the fault postdates formation of linear-planar fabrics (Early Cretaceous) on Heavens Gate Ridge and predates the eruption of Miocene basalts that once covered this area (Gualtieri and Simmons, 1978).

Stop #3: Snake River Overlook (~8000'). From Windy Saddle, descend on Trail #124, which crosses the East Fork of Sheep Creek (Fig. 2) and passes through an old burn area up onto the ridgeline overlooking Hells Canyon. This point is >6000 feet above the Snake River, and offers views into the Wallowa Mountains of northeastern Oregon. On the west side of Hells Canyon, a sharp angular unconformity separates southeast oceanic tilted strata of the Wallowa terrane (below) and subhorizontal flood basalts (above). This prominent erosional surface represents a 200+ million year time gap in local Earth history. Mountain goats are sometimes encountered along this winding trail segment.

Stop #4: Hell Hill (~7100'). At this locality, Trail #124 skirts across a steep talus slope consisting of fractured grayish-green volcanic rocks. Look for lighter colored blocks of bedded limestone in the rubble, which may contain the 'flat-clam' *Daonella*, a shallow marine fossil species (Fig. 1) used to date rocks in the Wallowa terrane. Downslope movement of mechanically weathered material has formed this vast apron of loose, unconsolidated rock. From here, continue hiking towards the West Fork of Sheep Creek (Fig. 2). Devils Tooth and other sharp peaks rise in the distance. After crossing the streambed, ascend ~1000 feet onto a grassy basalt plateau. Watch for Trail #123 on your left.

Stop #5: Alpine Lakes (~7600'). Trail #123 branches southeast (left) near Lily Pad Pond and passes several small cirque basins perched below the northern Seven Devils. Volcanic bedrock hosting these lakes was scoured by mountain glaciers that existed here ~25,000-12,000 years ago; linear grooves carved into local rock surfaces (e.g., Basin Lake; Fig. 2) attest to glacial activity in this area. Perennial springs and snowfields feed into the lakes, some of which are planted seasonally with juvenile rainbow or cutthroat trout by Idaho Fish & Game (Jones, 2003).

Stop #6: Foot of the Devils (~8200'). Unobstructed views of He Devil (9393') and She Devil (9360'), the two highest peaks of this range, compliment the magnificent geology surrounding Sheep Lake. This area exposes massive volcanic rocks of the Middle and Upper Triassic Wild Sheep Creek Formation. Here, a thick sequence of basaltic lava flows and sills define the western limb of a broad anticline—in cross-section, an upright symmetric fold emerges ('Devils Arch', Fig. 2). Local topographic highs reflect upward arching of thick (>5000 feet) volcanic rocks and block uplift along steep northerly trending normal faults. Subparallel faults in this area are inferred to follow tributary streams of the upper Sheep Creek drainage network (West Fork), and may represent the southern continuation of a high-angle fault system identified along lower Sheep Creek (Vallier, 1998).

FURTHER INFORMATION

This *GeoNote* is intended to provide a general geologic overview of the northern Seven Devils Mountains. More technical reports and maps are found in the reference list below.

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