Topographic Development of Southern Idaho: The Passage of the Yellowstone-Snake River Plain Hotspot

The diagrams on the back cover are designed to illustrate the important topographic changes that have occurred in southern Idaho as it has passed over the Yellowstone-Snake River Plain hotspot during the last 17 million years. These topographic cartoons are a blend of well-constrained interpretation and conceptual inference. We present them to facilitate discussion and we welcome all comments and suggestions. The digital elevation models were produced at the USDA Forest Service GIS Center of Excellence in Ogden Utah, using ESRI Arc/Info 7.1.2 software and Defense Mapping Agency 1:100,000 scale digital elevation data.

**View 1.** About 17 million years ago the Columbia River flood basalts were erupted from a set of north-northwest-trending fissures in eastern Oregon and Washington. The orientation of these fissures was controlled by Basin and Range extension, on the northern projection of the Northern Nevada Rift. In eastern Idaho, drainage was eastward across a broad erosional surface sloping off of the Idaho batholith, and beveled across the eroded thrust belt.

**View 2.** About 10 million years ago the hotspot system is fully active; we show two calderas (Twin Falls and Picabo, sources for the Idavada Volcanic Group) on the Snake River Plain, with the Owyhee rhyolite plateau to the southwest and early Basin and Range mountains to the east. The continental divide has migrated eastward, controlled by tectonics over the hotspot. Southward drainage into the nascent Bonneville basin is shown, as is northward drainage along what was to become the Salmon River. The earliest phase of Lake Idaho, a closed-basin lake in the western Snake River Plain is shown northwest of Boise. The western Plain has begun to form as a northeast-tilted half-graben, by collapse of the northwest shoulder of the topographic bulge, combined with Basin and Range extension.

**View 3.** About 3 million years ago the hotspot is located in eastern Idaho, under the Heise caldera. Lake Idaho on the subsided central and western Snake River Plain, was at its maximum extent during deposition of the Glenns Ferry Formation of the Idaho Group. The lake drained intermittently southward into northern Nevada, as suggested by vertebrate faunal and detrital zircon evidence. Drainage is shown centrifugal to the hotspot, south to the Bonneville Basin and northward into Montana. Teewinot Lake occupies Jackson Hole, and the headwaters of the Snake River still drain eastward to the Green River.

**View 4.** About one million years ago, during a Pleistocene glacial maximum, we show Lake Idaho, Raft Lake, and Lake Terreton on the Snake River Plain. The Snake River has begun to cut Hells Canyon, and is integrated with the Salmon-Columbia system. Topographic collapse of the eastern Snake River Plain has captured the headwaters of the Snake River, and the continental divide has migrated northeastward to Montana and Wyoming. The Bear River in southeast Idaho is shown as draining northward into the Snake. Only within the last 50,000 years has it established its modern course southward into the Bonneville Basin. The steep canyons of the Salmon River are shown, being actively cut across the Idaho batholith.

**View 5.** Present topography.