Rhyolites in the Kimberly Drill Core, Project Hotspot: First Intracaldera Ignimbrite from the Central Snake River Plain, Idaho?

Eric H Christiansen1, Michael McCurry2, I. Bindeman3, D. Champion4, T. Knott5, M.J. Brannen5, T. Bolte6, F. Holtz7, and J. Shervais7

1Brigham Young University, 2Idaho State University, 3University of Oregon, 4U.S. Geological Survey, 5University of Leicester, 6University of Hannover, and 7Utah State University

Introduction

The tephra deposits of the Snake River Plain (SRP) are the largest known rhyolite field. They are particularly notable for the perception that they are mainly extracaldera deposits with few and small calderas. Recent studies, however, indicate that the central part of the SRP contained numerous calderas in the Pliocene to Plio-Pleistocene time interval. The Kimberly hotspot drill core, 220 km southeast of Shoshone Falls, Idaho, penetrated the uppermost 6,000 m of sedimentary and volcanic rocks, including 3,400 m of Upper Miocene-Pliocene rhyolite. We report the first identification of an intracaldera ignimbrite from the SRP and the first identification of a pre-Tertiary caldera in the SRP. The Kimberly core demonstrates the intracaldera nature of the lowermost ignimbrites and the existence of an older, 6.5 Ma caldera, the Twin Falls caldera. Paleomagnetic inclinations form a curious V-shaped profile, shallowing by about 18° between 700 and 1700 m depth but similar at the top and bottom. We interpret these flows to be between 8.9 and 6 Ma (Othberg et al., 2012) based on a tentative correlation of the upper unit of rhyolite with the rhyolite from the Shoshone Falls. The unit is nearly 130 m thick, low-silica rhyolite. Rhyolite 2 is the most highly evolved with ~75% silica and the isotope pattern of Rhyolite 2 is distinct from the upper units, very homogeneous, not vertically zoned, and lacks multiple populations of olivine. We interpret this to be the result of slower cooling of the mid-part of the intracaldera tuff. The unit is a low-silica rhyolite with high concentrations of Fe and Ti—among the highest of any known ignimbrite on the SRP. It is chemically distinct from the upper units, very homogeneous, not vertically zoned, and lacks multiple populations of olivine. We interpret this to be the result of slower cooling of the mid-part of the intracaldera tuff. The unit is a low-silica rhyolite with high concentrations of Fe and Ti—among the highest of any known ignimbrite on the SRP.

The study of surface outcrops is maturing rapidly. However, in the central part of the track, where silicic volcanism is most voluminous, compositionally distinctive, and isotopically most anomalous, study of these large gaps; it penetrates through surficial basalt, deep into the rhyolitic underpinnings on the southern margin of the Twin Falls caldera is shown along the dashed white line marks the southern extent of the tuffs in the Cassia Mountains south of the Kimberly drilling site. Speculative boundary for the Twin Falls caldera is shown along the dashed white line marks the southern extent of the tuffs in the Cassia Mountains south of the Kimberly drilling site.