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EARTH SCIENCE

SPEAKERS CLUB

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Petrochronology applied to silicic magma genesis

Mark Schmitz

Department of Geosciences

Boise State University

The traditional view of magma chambers under many large intermediate-silicic volcanoes is one of long-lived, batholith scale mush piles periodically rejuvenated by more mafic magmas and partially erupted in caldera-forming events (e.g. Bachmann and Bergantz, 2004; Barboni et al., 2016). These views are being refined and challenged by in situ measurements of stable isotopes and trace element diffusion profiles, high resolution geochronologic studies, and numerical models of magma chamber convection and dynamics that suggest the ease with which heat is transferred and consumed, pre-existing rhyolites are remelted, and magmas are erupted out of 'cold storage' (e.g. Bindeman and Simakin, 2014; Cooper and Kent, 2014). In particular, the integration of crystal-scale geochemical and geochronological records—petrochronology—is being increasingly used to frame and test hypotheses regarding the eruptibility of magmatic systems.

In this presentation I will review recent developments in the integration of in situ geochemistry and high-precision geochronology utilizing tandem LA-ICPMS and chemical abrasion ID-TIMS analyses on the same crystals to better interpret the petrological significance of U-Pb zircon ages for silicic volcanic rocks. The geochemistry of zircon and its fidelity for recording magma evolution will be discussed. Case studies from the Pleistocene Huckleberry Ridge and Mesa Falls cycles of the Yellowstone magmatic system (Rivera et al., 2014; 2016) will be presented, and contrasted with recent results from the 'monotonous intermediate' Fish Canyon Tuff of the Neogene San Juan volcanic field, in order to explore broader implications for the time scales of silicic magma genesis, differentiation and storage.