

174-20 - Booth No. 172: EXPLORING CONTROLS ON THE VOLUME AND REPOSE TIME OF MAGMATIC INCREMENTS INTO UPPER-CRUSTAL SILICIC MAGMA SYSTEMS AND THEIR ERUPTIVE COUNTERPARTS



Tuesday, 17 October 2023



8:00 AM - 5:30 PM



Hall B (2, David L Lawrence Convention Center)

Booth No. 172

Abstract

Calculated sediment accumulation rates are negatively correlated with the period over which they are calculated. This relationship is known as the Sadler effect and its recognition led to an appreciation for the unsteady nature of sediment accumulation with long periods of quiescence or erosion punctuated by short, rapid periods of deposition. Over the last few decades, high-precision geochronologic studies of upper-crustal silicic plutons have demonstrated that most are constructed incrementally, with periods of quiescence punctuated by shorter periods of magmatic addition. Given the similarities between incremental emplacement of silicic plutons and the unsteady accumulation of sediment we evaluate how apparent magmatic addition rates vary with the period of observation for several intrusive complexes. We use this analysis to draw conclusions about the size distribution of magmatic increments and their frequency.

Our study compiles existing U-Pb zircon CA-ID-TIMS geochronologic data for eight, Cretaceous, or younger, upper-crustal silicic plutons to construct a plot of apparent magmatic areal addition rates vs. observed durations of magmatism. The resulting plot displays a hockey stick shape, with an inverse, power law relationship at timescales less than 1 Myr, similar to Sadler's observations for sedimentary sequences, and areal addition rates that converge to a long-term average at timescales greater than 1 Myr. The inverse power law relationship suggests that the apparent addition rate is controlled by the single, largest magma increment included in the calculation, and that quiescence must dominate at timescales under 1 Myr. At timescales greater than 1 Myr, the system must accumulate enough large increments to begin converging towards a long term average. The combination of these two observations suggests that magma increment sizes are not normally distributed, and instead define a distribution where sizes vary over several orders of magnitude where smaller increments are much more common than larger increments. Similar inferences can be made by looking at eruption records from Mt. Mazama. We use these observations to discuss whether magma supply, transport efficiency, or the ability to make space is the limiting factor in the punctuated growth of magmatic systems.

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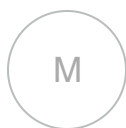
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