Post-supereruption reconstruction of Taupo volcano (New Zealand) through systematic crystallization episodes

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Large explosive silicic supereruptions have received much attention because of the challenges in explaining how such large volumes of magma are accumulated and stored, and over what time intervals. The processes that follow supereruptions are less fully documented and, in particular, how and on what time scales the overall magma system moves into a post caldera mode of activity. The 530 km^3Oruanui eruption from Taupo volcano, New Zealand, is the worlds youngest (25.4 ka) supereruption. Following this event and after only 5 kyr of quiescence, Taupo volcano erupted three dacitic pyroclastic units of modest volume (<0.1 km^3), followed by another 5 kyr year time break, and then eruption of the modern sequence of rhyolitic units starting at 12 ka. Here we present U/Th model age dating of zircons extracted from the post Oruanui eruption products to investigate how Taupo's magmatic system was reactivated following a supereruption. Zircon model ages in first erupted rhyolites indicate that there is minimal or no inheritance of crystals from either of the two dominant age modes (35 and 90 ka) in the Oruanui magma source. Post Oruanui age spectra are typically centered close to eruption ages with subordinate pre 300 ka plutonic and pre 100 Ma greywacke grains. In addition, there is consistent inheritance of grains between the temporally spaced but geographically overlapping post Oruanui eruption groups, allowing the identification of systematic dominant age peaks since the Oruanui supereruption. We interpret this consistent and repeated pattern to result from recycling of crystals from post supereruption episodic heating and cooling cycles, reflecting periods of magmatic rejuvenation and eruption, versus cooling and crystallization, acting within a crustal protolith independent of that which was dominant in the Oruanui system.