Interrogating the paradigm of the compositionally-zoned magma chamber:a stratigraphically-constrained ^{238}U-^{230}Th-^{226}Ra study of Katmai-Novarupta 1912.

R. George[1]; S.Turner[1]; M. Reagan[2]; C. Hawkesworth[3];W. Hildreth[4]

1.GEMOC Key Centre, Department of Earth and Planetary Sciences, Macquarie University, Sydney, NSW 2109 Australia2.Department of Geoscience, University of Iowa, Iowa City, IA 52242, USA.3.Department of Earth Sciences, Bristol University, Queens Road, Bristol BS8 1RJ, UK.4.US Geological Survey, MS 910, 345 Middlefield Rd, Menlo Park, CA 94025, USA.

Time provides a fundamental constraint for models of magma differentiation and storage of magmas in the crust.It thus has the potential to distinguish between key paradigms used to explain the origin and evolution of compositionally-zoned eruptive deposits.Do the variations in bulk composition reflect factors intrinsic to closed-system magma differentiation of a single magma chamber? Or are these manifestations of mixing prior to eruption? We sought to answer these questions using the canonical example of a compositionally-zoned eruption,Katmai-Novarupta 1912.Following on from Reagan et al.(2003),we have undertaken a detailed stratigraphic Uranium-series study including ^{226}Ra-disequilibrium measurements using representative samples from the base and top of each eruptive unit (layers A-D, F-G and S; of Hildreth, 1983). Our ^{238}U-^{230}Th data are in agreement with that of Reagan et al.(2003),showing that U-series isotope variations between magma batches are small,highly systematic,and are strongly dependent on bulk composition. ^{226}Ra-excesses range from >200% in andesites to near-equilibrium values in the dacitic batches.The Novarupta rhyolite lies within error of equilibrium,but at the base of Layer A,the rhyolite preserves a 20% ^{226}Ra-excess which is beyond analytical error.These data appear to favour the repeated influx of andesitic magma into the shallow crust in the recent past (<8 kyr).These results will be discussed in the light of the competing models for layered magma chamber evolution.