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New insights into eruption ages of Plio-Pleistocene maars and scoria cones of south-eastern Australia via high precision $^{40}Ar/^{39}Ar$ dating of feldspar 'megacrysts'

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The Pliocene-Holocene monogenetic basaltic Newer Volcanic Province (NVP) of southeastern Australia covers >19,000 km^2 and contains at least 416 volcanic centres [1]. The eruption history is not well-constrained, and the existing geochronology dataset is largely restricted to lava flows >300 ka [2]. $^{40}Ar/^{39}Ar$ (and K-Ar) dating of basaltic volcanoes <0.5 Ma has historically been compromised by the difficulty in resolving extremely small radiogenic ^{40}Ar signals from magmatic argon. However, recent advances in noble gas mass spectrometry have improved analytical precision of the $^{40}Ar/^{39}Ar$ dating technique by an order of magnitude [3,4]. As a result, the $^{40}Ar/^{39}Ar$ step-heating technique has been applied successfully to holocrystalline groundmass basaltic samples younger than 100 ka using an ARGUSVI multi-collector mass spectrometer. For example, the Tyrendarra basalt from the NVP gives a mean age of 35,200 ± 500 years (1.4%, 2σ).

A significant proportion of the eruption centres in the NVP are maars or scoria cones that have not experienced any significant degree of effusive volcanism and therefore lack holocrystalline lavas suitable for $^{40}Ar/^{39}Ar$ dating. In these cases, published age constraints have been largely derived from radiocarbon dating of underlying swamp material or crater lake sediments, complemented by a small number of cosmogenic nuclide exposure dating studies, and luminescence studies. Sediment sequences in several of the maars record important paleo-climate information [5], and establishing eruption ages would serve to provide an independent framework for paleoclimatic transitions, as well as improving understanding of eruption frequency in the NVP.

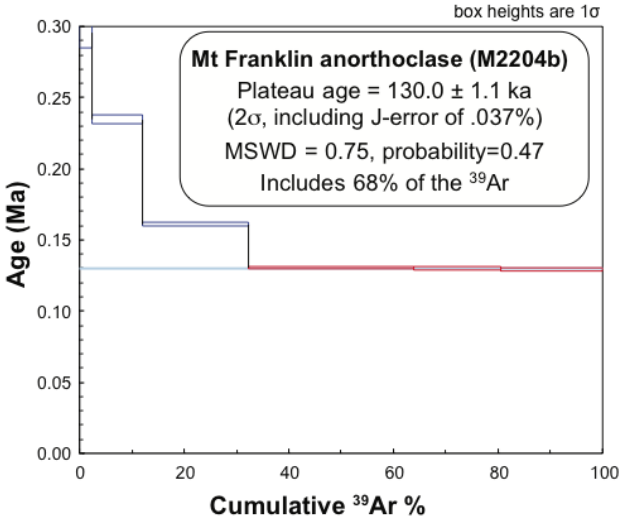

Figure 1: Age spectrum for Mt Franklin anorthoclase

Abundant feldspar 'megacrysts' (dominantly anorthoclase) are present in a number of phreatomagmatic and scoria deposits within the NVP. These crystals are considered to have formed at depth shortly before eruption. We present new high precision $^{40}Ar/^{39}Ar$ age data for individual feldspar megacrysts from several eruption centres in the NVP, and discuss implications for eruption of the host lavas.

References:

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