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Precise dating of large flank collapses by single-grain $^{40}Ar/^{39}Ar$ on pyroclastic deposits: example from Flores Island (Azores)

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Large-scale flank collapses represent one of the main hazards associated with volcanic islands evolution. Precisely dating past events is critical to evaluate the frequency of destabilization episodes and assess their potential links with internal and/or external factors such as volcano dynamics, regional tectonics, and global paleoclimatic changes. Here we constrain the age of a pumice-rich pyroclastic deposit exposed on the eastern flank of Flores Island (Azores), which we interpret as a co-blast deposit generated by a major flank collapse that destroyed the whole western flank of the former volcanic edifice. Twelve single-grain $^{40}Ar/^{39}Ar$ analyses performed on 250-500 microns anorthoclase feldspars (K/Ca around 5) with our high-sensitivity multi-collector NGX mass spectrometer provide a robust age of 1.32 ± 0.01 Ma (2 sigma). This new age is consistent with previous K/Ar data [1] bracketing the flank collapse between 1.30 ± 0.04 and 1.18 ± 0.09 Ma (2 sigma), and indicates that this event occurred at the end of the main construction phase of the former volcano. The explosion produced a pumice-rich volcanic layer preceded by lahar emplacement as attested by a polygenetic mudflow deposit present underneath. The eruption of differentiated lavas just before the collapse suggests that fast differentiation was ongoing in a shallow magma reservoir. Drastic increase in magma viscosity likely favored edifice inflation, ground shaking, and flank failure triggering the decompression-induced violent eruption. Finally, our study shows that high-sensitivity mass spectrometers have reached analytical performances allowing to measure precise ages on relatively small and moderately K-rich single feldspars, which is particularly suitable for meaningful dating of potentially-heterogeneous blasts and tephra deposits induced by large-scale flank collapses during the late Quaternary.

References

[1] Hildenbrand et al. (2018). Large-scale mass wasting on small volcanic islands revealed by the study of Flores Island (Azores). Scientific Reports **8 (1)**, p. 13898