

In situ U-Pb and Hf isotopes analyses on zircon from the Giglio Island pluton

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The monzogranitic pluton of Giglio Island in the Tuscan Archipelago (Italy) is a relatively poorly studied intrusion belonging to the Tuscan Magmatic Province (TMP), an association of intrusive and effusive magmatic rocks formed between 14 and 0.3 Ma. New LA-ICP-MS geochronological U-Pb and Hf isotopic data were obtained from zircon grains separated from the two main texturally distinct units forming the intrusion: the outer, foliated Pietrabona facies (PBF), and the inner porphyritic Arenella facies (ARF). We defined from U-Pb dating an emplacement age for the Giglio intrusion of 5.448 ± 0.030 (2SE) Ma (weighted mean on 80 analyses, $^{206}\text{Pb}/^{238}\text{U}$ ages, Th disequilibrium corrected), improving the previously published age. Although individual spot ages are indistinguishable within error, the obtained weighted mean ages for the two facies are different, 5.493 ± 0.034 (49 analyses) for PBF, and 5.309 ± 0.060 (31 analyses) for ARF, thus suggesting that the pluton formed incrementally. We developed a robust method for the determination of Hf isotopic composition in zircon by LA-MC-ICP-MS obtaining crustal values of initial ϵ_{Hf} comprised between -3.5 and -11.9 (2SE \approx 1). No differences between the two facies are apparent, however each sample exhibits a large Hf isotopic heterogeneity that is statistically significant compared to the repeatability obtained for reference zircons. Such variability suggests that different crustally-derived magmas contributed to the magmatic evolution of the pluton, advocating for a complex mechanism of melt production, ascent and final emplacement.