In this study, we have used in-situ U–Pb, Hf and O isotopic analyses of zircon grains to gain insights into both magmatic processes and duration of magmatism in igneous rocks from the Tuscan Magmatic Province (0.1–9 Ma), Italy. Three plutonic centres have been investigated (Monte Capanne and Porto-Azzuro monzogranites in Elba and the Giglio monzogranite) as well as Capraia, the only volcanic centre in the Tuscan Archipelago. New ion microprobe zircon U–Pb data reveal a continuum of plutonic activity in Elba over 2 Ma (8.3–6.3 Ma), with coeval volcanic activity in Capraia (7.1–7.6 Ma), and plutonic activity resuming in Giglio (5.5 Ma) after a gap of 1 Ma. From these zircon data we also show that construction of the Monte Capanne pluton (Elba) may have occurred over a period of c. 0.5 Ma. A significant range of both 176Hf/177Hf (determined by LA–MC-ICPMS) and δ18O (determined by ion microprobe) in zircon (~ 7 epsilon Hf units and ~ 5‰, respectively) is present, which, together with zircon morphology and trace element data (Gagnevin et al., 2010), emphasises the importance of mixing and replenishment involving magma batches with both metaluminous and peraluminous affinities. Inherited and xenocrystic zircons also occur, but are scarce. These have a wide range of 176Hf/177Hf and δ18O values, further emphasising that a variety of crustal components has contributed to the genesis of the Tuscan magmas, either as contaminants or magma sources. While mixing undoubtedly occurred between mafic (metaluminous) and felsic (peraluminous) magmas, the range of Hf and O isotopic data suggests a diversity within the peraluminous component. The unradiogenic Hf composition (εHf(t) <− 4) and relatively heavy δ18O signature (> 6‰) of the inferred mantle-derived component (represented by Capraia volcanism, and at least in part, lamproitic in composition) strongly supports the idea that the mantle source involved in Tuscan magmatism was severely modified by subduction-related, crustal-derived metasomatic fluids.