Hf isotopic constraints for Austroalpine basement evolution of Eastern Alps: review and new data

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The Alps as part of the Alpine mountain belts are one of the classical examples of orogenesis where the Mesozoic-Cenozoic tectonic evolution is well known, but not of the basement because of poor age data. New data from the pre–Alpine basement of the Austroalpine megaunit indicate that this basement is composed of a series of continental rocks, island arcs, ophiolites and subduction mélanges, accretionary wedges, and seamounts with different metamorphic, but often amphibolite facies grade. This study presents new results of LA–ICP–MS U–Pb and MC–ICP–MS Lu–Hf dating of zircons from three key areas of Austroalpine basement units: i) the Wechsel–Waldbach–Sieggraben, (ii) the Saualpe–Koralpe –Pohorje, and (iii) the Schladming Mts. areas. As a result, the Wechsel unit is a continental magmatic arc during 500-560 Ma, and 2.1 to 2.2 Ga and 2.5 to 2.8 Ga age show the close relationship to northern Gondwana, with depleted mantle model ages as old as 3.5 Ga. Even the Wechsel Phyllite Unit overlying the Wechselgneiss, but they have partly different sources, include juvenile crust formed at ca. 530 Ma. The Waldbach Complex is constantly added new crustal material during 490-470 Ma, and considerably more positive εHf(t) values from 700 to 500 Ma interpreted being part of a magmatic arc during closure of the Prototethys and got metamorphosed during Variscan orogenic events. We consider that Schladming to Wechsel Complexes represent a Cambrian-Ordovician volcanic-magmatic arc system followed proto-Tethys subduction, and the ophiolitic Speik complex represent a back-arc basin. Many granites were formed during Permian (Grobgneiss and various granites in Pohorje Mts.) likely in an extensional environment, remelting a crust with mainly Middle Proterozoic model Hf isotopic model ages. The Plankogel Complex represents accreted oceanic, ocean island and continental-derived materials, it should belong to the accretion complex formed during Permotriassic closure of Paleotethys. We argue that the various basement complexes of the Austroalpine are different sources of ages of different tectonic evolutionary histories and likely represent, different locations before drifting. Consequently, the Austroalpine meagunit represents a composite pre-Alpine mega-unit likely assembled not earlier as Permian or Triassic times.