On the evolution of the Western Alpine Orogen: U-Pb geochronology and Hf isotopic ratios in zircons from Adamello and Bergell amph-rich mafic and ultramafic rocks

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The orogenic belt intrusive rocks are mostly silica-rich products in which the shallow-depth crustal contamination commonly obscures the original mantle geochemical signal. The rare mafic and ultramafic rocks associated with the major intrusive bodies represent a fundamental petrological tool to track back the evolution of the orogen. The reconstruction of the Cenozoic paleogeography and the tectonic evolution of the Western Alps is still matter of debate, with complex geological models involving multiple oceans (i.e., Ligurian-Piedmontese and Valais oceans) incorporating micro-continents (i.e., Briançonnais domain). Also the origin of the Periadriatic magmatism, developed from ~44 to ~31 Ma along the Alpine belt, and its relationship with tectonic evolution of the Alpine Orogeny remains partly unclear.

We carried out U-Pb geochronology and Hf isotopic ratios on zircons from amphibole-rich mafic and ultramafic rocks of the Adamello batholith and the Bergell pluton, the two largest Cenozoic intrusive bodies of the Alpine Orogen. Results show that the Bergell mafic rocks formed ~10 Ma later than the Adamello analogues. In addition, the Bergell gabbros have a more enriched Hf isotopic signature than the Adamello counterparts. We propose that the formation of the oldest mafic rocks from the Adamello batholith is related to the subduction of the Ligurian-Piedmontese oceanic lithosphere. The mafic rocks from the Bergell pluton most likely record the partial recycling in the source of the continental material. These rocks are presumably related to the younger subduction of the Valais basin, which followed that of the Briançonnais continental block.

Abrupt shifts in Horn of Africa hydroclimate since the Last Glacial Maximum

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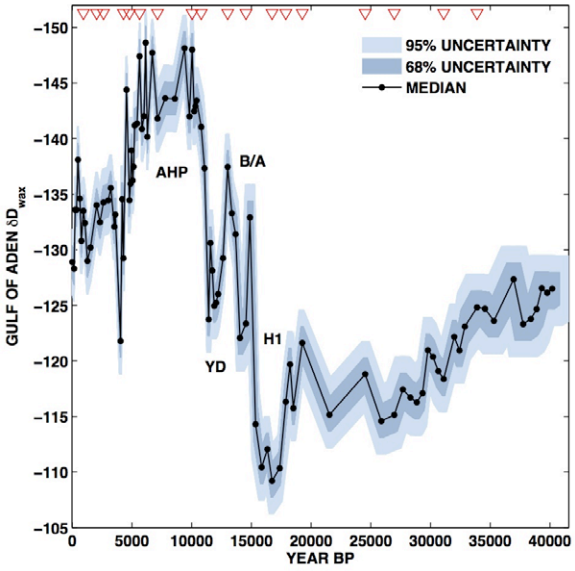
The timing and abruptness with which Africa transitioned into and out of the Early Holocene African Humid Period is a subject of ongoing debate, with direct consequences for our understanding of African climate stability, paleoenvironments, and early human cultural development. Here we present a new proxy record of hydroclimate, based on the hydrogen isotopic composition of leaf waxes, from a marine core in the Gulf of Aden that documents rapid, century-scale transitions into and out of the African Humid Period across the Horn of Africa. Similar and generally synchronous abrupt transitions at other East African sites suggest that rapid shifts in hydroclimate are a regionally coherent feature. In addition, the termination of the African Humid Period in East Africa is synchronous with the termination in West Africa. A probabilistic analysis of the abruptness of the transitions in East Africa suggests that they likely occurred within centuries, underscoring the remarkable sensitivity of Northeast African hydroclimate to external forcings. We speculate that the non-linear behavior of hydroclimate in the Horn of Africa is related to convection thresholds in the western Indian Ocean.



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