

## ***Interactive comment on “Tectonic Exhumation of the Central Alps Recorded by Detrital Zircon in the Molasse Basin, Switzerland” by Owen A. Anfinson et al.***

**Owen A. Anfinson et al.**

[anfinson@sonoma.edu](mailto:anfinson@sonoma.edu)

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Abstract Eocene to Miocene sedimentary strata of the Northern Alpine Molasse Basin in Switzerland are well studied, yet they lack robust geochronologic and geochemical analysis of detrital zircon for provenance tracing purposes. Here, we present detrital zircon U-Pb ages coupled with rare earth and trace element geochemistry (petrochronology) to provide insights into the sedimentary provenance and to elucidate the tectonic activity of the central Alpine Orogen from the late Eocene to mid Miocene. Between  $35\text{-}22.5 \pm 1$  Ma, the detrital zircon U-Pb age signatures are dominated by age groups of 300-370 Ma, 380-490 Ma, and 500-710 Ma, with minor Proterozoic age

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contributions. In contrast, from  $21.5 \pm 1$  Ma to  $\sim 13.5$  Ma (youngest preserved sediments), the detrital zircon U-Pb age signatures were dominated by a 252-300 Ma age group, with a secondary abundance of the 380-490 Ma age group, and only minor contributions of the 500-710 Ma age group. The Eo-Oligocene provenance signatures are consistent with interpretations that initial basin deposition primarily recorded unroofing of the Austroalpine orogenic lid and lesser contributions from underlying Penninic units, containing reworked detritus from Variscan, Caledonian/Sardic, Cadomian, and Pan-African orogenic cycles. In contrast, the dominant 252-300 Ma age group from early Miocene foreland deposits is indicative of the exhumation of Variscan-aged crystalline rocks from upper-Penninic basement units. Noticeable is the lack of Alpine-aged detrital zircon in all samples with the exception of one late Eocene sample, which reflects Alpine volcanism linked to incipient continent-continent collision. In addition, detrital zircon rare earth and trace element data, coupled with zircon morphology and U/Th ratios, point to primarily igneous and rare metamorphic sources. The observed switch from Austroalpine to Penninic detrital provenance in the Molasse Basin at  $\sim 22$  Ma appears to mark the onset of synorogenic extension of the Central Alps. Synorogenic extension accommodated by the Simplon fault zone promoted updoming and exhumation the Penninic crystalline core of the Alpine Orogen. The lack of Alpine detrital zircon U-Pb ages in all Oligo-Miocene strata corroborate that the Molasse Basin drainage network did not access the prominent Alpine-age Periadriatic intrusions or high-grade metamorphic rocks located in the southern portions of the Lepontine Dome.

Please also note the supplement to this comment:

<https://www.solid-earth-discuss.net/se-2020-44/se-2020-44-AC1-supplement.pdf>

Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2020-44>, 2020.

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