Geophysical Research Abstracts
Vol. 21, EGU2019-162, 2019
EGU General Assembly 2019

Dating crystalline basement exhumation in the Alps using detrital garnet geochemistry in the foreland basin deposits

Laura Stutenbecker (1), Peter M.E. Tollan (2), Andrea Madella (3), and Pierre Lanari (2)

(1) TU Darmstadt, Institute of Applied Geosciences, Darmstadt, Germany (stutenbecker@geo.tu-darmstadt.de), (2) University of Bern, Institute of Geological Sciences, Bern, Switzerland, (3) University of Tuebingen, Department of Geosciences, Tuebingen, Germany

Compositional changes in the ca. 31-14 My old sediments comprising the Swiss part of the north Alpine foreland basin are thought to reflect tectonic and erosional processes in the immediate hinterland, the Central Alps. Accordingly, these deposits have been studied intensely in the last decades in order to reconstruct the evolution of the Alpine orogen. Changes in sediment composition have been assigned to the unroofing of the Austroalpine sedimentary cover and crystalline basement nappes, as well as to the exhumation of the Lepontine dome. The Helvetic crystalline basement units ("external massifs", e.g. Aar massif, Mont Blanc massif, Gotthard nappe) were never considered a major sediment source. This is based on structural reconstructions and thermochronological data, which suggest that the surficial exposure of the external massifs post-dates the youngest preserved Molasse deposits.

We here present detrital garnet compositions from 14, 19 and 25 My old sediments preserved in the Napf megafan in the central part of the basin. By comparing the obtained chemical compositions to those of garnets in different source rocks exposed in the Central Alps today, we partially confirm already existing provenance interpretations for the 19 and 25 My old sediments. In the youngest ($\sim$14 My) sample, however, the abundance of rather unusual Mn-Ca-rich garnets marks a substantial provenance change with respect to older deposits, that generally contain Fe-rich garnet. Garnets of this particular composition are presently only found in the Variscan granite intrusions of the external massifs (Zentraler Aaregranit, Rotondo granite, Mont Blanc granite), where they were formed during alpine metamorphism under greenschist facies conditions.

These new findings question the existing tectonic models of external massif exhumation. In particular, we suggest that parts of the external massifs must have already been exposed to erosion 14 My ago, which is incompatible with the proposed exhumation rates. Furthermore, our data support the existence of a substantial amount of (recently eroded) crystalline rock on top of the modern topography that is unaccounted for in many structural reconstructions.