



Limitations of source-sink relationships deduced from provenance studies: U-Pb zircon vs. $^{40}\text{Ar}/^{39}\text{Ar}$ mica ages of recent river sands of the Eastern Alps

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In order to assess the significance of U-Pb zircon and $^{40}\text{Ar}/^{39}\text{Ar}$ mica age dating techniques in provenance studies we applied these methods on recent river sands (Mur and Salzach rivers) of Eastern Alps, where the hinterland is well constrained in terms of its tectonothermal evolution. The Eastern Alps include to Alpine suture zones: (1) the Early Cretaceous suture (ca. 100–95 Ma) within the Austroalpine basement unit with abundant eclogites reflecting subduction of continental crust; (2) the Eocene to Oligocene Penninic suture reflecting the closure of the Piemont-Ligurian closure, Paleogene tectonism (50 – 30 Ma) and Paleogene overriding of the Penninic orogenic wedge by the already cool Austroalpine nappe stack with its Cretaceous tectonism.

The principal results of our study are as follows: (1) The U-Pb zircon ages do not record any sign of Alpine tectonism and, therefore, no record of the last orogenic events and metamorphism can be found as no Alpine-aged granites are exposed in the hinterland of these two rivers, which cross the Alpine sutures. In short, when there is no granite in the hinterland, no significant amount of detrital zircon in clastic rocks can be found. Consequently U-Pb zircon studies can miss the record of collisional orogeny. (2) In contrast, $^{40}\text{Ar}/^{39}\text{Ar}$ white mica age well record the last orogeny and metamorphism but show limitations in record of the pre-orogenic history. Further limitations of the method are mainly due to the grain size selected: the age of metamorphism within low-grade metamorphism is commonly not recorded. (3) Both systems, U-Pb zircon and $^{40}\text{Ar}/^{39}\text{Ar}$ white mica, yield different information in provenance studies and should be used in combination.