10, Boulder.

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

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In order to assess the significance of U-Pb zircon and $^{40}Ar/^{39}Ar$ mica age dating techniques in provenance studies, we applied these methods on recent river sands (Mur at Hinterberg near Leoben and Salzach near Werfen) 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.

U-Pb zircon ages from the Salzach river range from ca. 240 to 840. These include a very dominant group at ca. 295 Ma, and small clusters at ca. 240 and 340 Ma, and single ages ranging from 400 to 840 Ma. No Alpine age has been found.

Two grain size fractions of white mica have been selected to monitor the signals from Austroalpine low-grade metamorphic units and Penninic medium and low-grade units. The $^{40}Ar/^{39}Ar$ white mica ages from both fractions range from ca. 22 to 44 Ma and no older grain has been found. The dominant age cluster is younger in the finer fraction.

U-Pb zircon ages from the Mur river display a wide variety of ages ranging 290 to 720 Ma. No older grain has been found. Three dominant clusters can be observed in decreasing order of abundance: (1) ca. 470 Ma, (2) ca. 360 Ma, and (3) ca. 300 Ma. The others represent subordinate clusters, mainly between 500 and 660 Ma. The clusters at ca. 360 and 300 likely represent two stages of Variscan granitoids.

The $^{40}Ar/^{39}Ar$ white mica ages cluster between 80 and 100 Ma, with a few slightly older outliers. As expected, this age group records Cretaceous metamorphism of the Austroalpine unit. A single grain with an age of ca. 28 Ma has been found, too.

The principal results of our study are, therefore, 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, $^{40}Ar/^{39}Ar$ 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 $^{40}Ar/^{39}Ar$ white mica, yield different information in provenance studies and should be used in combination.

Quantifying evolution - ancient paleolake mollusks from the Dinaride Lake System (Middle Miocene, Sinj Basin, SE Croatia)

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During the Early and Middle Miocene the Balkan Peninsula accommodated a series of long-living freshwater lakes, termed the Dinaride Lake System. These environments gave rise to an outstanding evolution of endemic mollusks. The present investigation deals with the mollusk evolutionary patterns and environmental change in an early Middle Miocene succession in the Sinj Basin (Dalmatia, SE Croatia).

The Sinj Basin represents a classic area of fossil mollusk research, widely known as the freshwater Miocene of Dalmatia. The taxonomic frame was established already by the end of the 19th century in the line with numerous extensive monographic studies. Subsequently, the presence of striking evolutionary lines of melanopsid and prosothenid snails at studied section has been documented. Despite to its mature investigation stage the study of quantified mollusk record providing objective insight to species contributions, taxonomic relationships and the nature of the morphologic change is completely missing up to now.

The patterns of taxonomic diversification for freshwater gastropods and its relationship with morphologic disparity events are documented for a c. 100-m-thick section representing the topmost infill of the basin. The study provides statistical treatment of quantified samples accompanied by a throughout taxonomic revision of occurring taxa. Subsequently, based on the mollusk distribution a paleoenvironmental interpretation is given. This is supported by sedimentological data and previous palynological analysis. Obviously, changes in morphology and disparity are tightly linked to environmental changes. Based on the available age model, these changes are happening extremely fast on a millennial scale.

The results represent contribution to the Austrian FWF Project P18519-B17: „Mollusk evolution of the Miocene Dinaride Lake System".