Uranium/Thorium age-dating of „impure“ carbonate cements of selected Quaternary depositional systems of western Austria: results and implications.

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In the Quaternary of the Northern Calcareous Alps, coarse-grained deposits (talus successions, pebbly alluvium, rockslides) and erosional relicts thereof are common but to date their age, or minimum age, was very poorly constrained or controversial. For these deposits, U/Th age-dating of carbonate cements at present provides the only possibility to deduce cementation ages as „minimum depositional“ ages (or „half-bracket“ depositional ages). The carbonate cements of selected sites were age-dated by the U/Th method.

In the Quaternary of the Alps, the age of lithified talus relicts was notoriously uncertain. Because of their high-altitude depositional setting, prevalently coarse-grained facies, lack of chronostratigraphic indicators and by absence, in most cases, of a clear-cut stratigraphic context, most of the talus relicts remained practically undated. By analogy to the well-preserved alluvial fan-to-talus succession of the Höttinger Brekzie near Innsbruck, if stratigraphic relations did not indicate otherwise, these talus relicts were commonly assigned to the Riss-Würm Interglacial. The talus relicts typically are lithified by micritic cements and/or by fringes of calcite cement. Fringes of calcite cement more than about 0.5 mm in thickness were found to be suited for sampling with a 0.5 mm microdrill. Well-developed fringes of calcite cement typically are confined to layers of openwork breccias devoid of primary matrix.

Our data show that the cementation ages of 22 talus relicts together cover an age range between 480 ka and 5 ka. No cluster of cementation ages could be identified for the total of dated sites. The Riss-Würm interglacial age assigned, often by tradition, to lithified talus relicts thus seems to be obsolete. Within the limits of cement sampling with a 0.5 mm microdrill, in no case we recognized discrete phases of cementation (i. e. phases of cementation separated by an interval of time significantly longer than the 2SE standard error of the calculated age). This may suggest that cementation of the talus successions takes place in limited intervals of time of, perhaps, a few hundreds of years.

The U/Th method also revealed as a powerful tool for minimum-age dating of catastrophic rockslide deposits. For the Fern Pass rockslide, U/Th dating of early aragonite cement yielded an age of 4.15 ± 0.1 ka as a minimum age for the sturzstrom event. The minimum age determined by the U/Th method proved as a valuable constraint on exposition ages

(produced by other authors) for the rockslide, and to date is the most precise proxy for the event (see contribution by Ostermann et al., this volume; and Prager et al., this volume). Similar early cements were identified or are described from coarse-grained rockfall deposits and other rockslides, too. U/Th age-dating of cemented portions of rockslides thus may represent a new, comparatively rapid and cheap approach to proxy-date catastrophic mass failures.

In age-dating of impure carbonate cements by the U/Th method, a multisample („isochron-errochron“) approach must be taken. In this approach, samples that potentially were subject to re-opening after closure, and samples strongly contaminated by detrital Th can be better-recognized, and sorted out from age calculation.