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Uranium/Thorium dating of catastrophic rock slope failures

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Abstract

Deposits of catastrophic rockslides and rock avalanches composed of lithologies rich in carbonate minerals may undergo precipitation of calcite cements, crusts and small stalactites that can be used to proxy-date the slope failure event and/or subsequent geomorphic changes of the mass movement accumulations. Lithification of rock slope failure deposits to breccias may be localized to meteoric 'runoff-shadows' below larger boulders, or may comprise a layer of breccia or may affect a rockslide/ rock avalanche mass down its base. In addition, precipitation of cements and small stalactites may take place in megapores on boulder undersides. Initial cement formation probably is driven by meteoric dissolution–re-precipitation of (mini-) micritic abrasive rock powder generated by dynamic disintegration during the failure event. $^{234}U/^{230}Th$ ages of the cements support a concept that cementation starts immediately or early after a rock slope failure event.

We describe minimum age dating of a row of catastrophic rock slope failures by the U–Th isochron method, applied to meteoric calcite and aragonite cements that precipitated shortly after the failure event. For several rockslides and rock avalanches a comparison of these U–Th ages with radiocarbon ages and surface exposure ages indicates that the cementation age represents a precise and accurate proxy of the catastrophic event age. We present a concept of cement precipitation in small-scale meteoric diagenetic systems that integrates the local setting of accumulated boulders and their size and exposition.

Additionally, a very recent study showed that comminution age-dating of a large scale rockslide within prasinite lithology gained reliable results.