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Meteoric diagenesis of catastrophic rockslide deposits of the Alps: diagenetic systems and implications for radiometric age-dating.

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Deposits of catastrophic subaerial rockslides (=rapid mass-wasting events involving more than a million cubic meters of rock) composed of lithologies rich in carbonate minerals may undergo precipitation of cements that, in many cases, can be used to U/Th proxy-date the rockslide event and/or subsequent changes of the rockslide mass. In the Alps, lithification of rockslide masses into breccias is observed in rockslides composed of limestones, dolostones, calcitic–dolomitic marbles, and calcphyllites. Cementation may be localized to meteoric 'runoff-shadows' below larger boulders, or may comprise a continous surface veneer of breccia or, more rarely, may affect the entire rockslide mass. In addition, precipitation of flowstone cements and stalactites may take place in megapores along the underside of boulders. Cements comprise skalenohedral calcite, prismatic calcite, blocky calcite, calcimicrite, micropeloidal calcitic cement and, rarely, isopachous to botryoidal aragonite. Cement formation probably is driven by meteoric dissolution-reprecipitation of fine-grained, abrasive rock powder generated during the rockslide event. U/Th ages of cements indicate that most, but not all, precipitation starts closely after a rockslide event. In rockslides composed of calcphyllites with an accessory content of pyrite, aside of 'normal' meteoric dissolution-reprecipitation of abrasive carbonate gauge, oxidation of pyrite drives widespread carbonate dissolution followed by reprecipitation, as a cement, of part of the dissolved calcium carbonate. Drill coring indicates that rockslide deposits composed of pyritiferous calcphyllites can be lithified from top to bottom.
Limestone-precipitating springs emerging from rockslide deposits, and well-cemented 'secondary' deposits (e. g. talus slopes or fluvial conglomerates onlapping rockslide deposits) percolated by groundwaters emerging from rockslide masses, indicate that rockslide deposits remain diagenetically active for thousands of years after emplacement. Because different 'generations' of meteoric cements can be formed over a long interval of time after the rockslide event, U/Th dating of cements not only provides a new approach to proxy-date the mass-wasting event, but also for dating subsequent geomorphic changes of a rockslide deposit.