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Emplacement timing of the Markagunt Gravity Slide (Utah, USA): an example of instantaneous lithospheric change

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Large-scale natural hazards have the ability to instantaneously change the lithosphere. In southwestern Utah, mid-Cenozoic growth of the lithosphere occurred via subduction of the Farallon Plate, and produced the Marysvale Volcanic Field (MVF). The MVF consists of clustered stratovolcanoes and ash-flow tuffs generated from caldera-forming eruptions. However, growth of the MVF was punctuated by multiple gravity slide events that instantaneously altered the lithosphere and dramatically changed the surface landscape. The late Oligocene to early Miocene Marysvale Gravity Slide Complex (MGSC, estimated to be >4000 km^3) consists of three gravity slides each similar in size and structure to the Eocene Heart Mountain Gravity Slide (Wyoming, USA). Landslides of this scale are difficult to identify due to their structural similarities to tectonic features, and despite their impact to the land surface, are likely undetected. The Markagunt Gravity Slide (MGS) is composed of volcanic materials derived from the MVF. While it thins towards the south, it has an estimated thickness of 1-2 km in the source area. This gravity slide event is bracketed by ash-flow tuffs deposited post-slide emplacement, and by pseudotachylyte generated during slide emplacement through friction-induced melting. We present new $^{40}Ar/^{39}Ar$ ages for the pseudotachylyte found near the base of the MGS and for sanidine derived from the Haycock Mountain Tuff, which post-dates slide emplacement. These new $^{40}Ar/^{39}Ar$ ages are coupled with zircon U/Pb dates from the same tuff, the basal layer of the gravity slide, clastic dikes injected into the base of the gravity slide, and the sandstone unit that underlies the pseudotachylyte. We can thus bracket the age of emplacement using this multi-method geochronologic approach to ~23 Ma. Though the MGS was emplaced in a geologic moment, temporal constraint provides an anchor point for rapid change to the lithosphere, which can be used in future studies to connect lithospheric alterations and large-scale natural hazards. Additional work on the timing of other gravity slides in the MGSC may provide insights to the development of the continental interior through the Cenozoic.