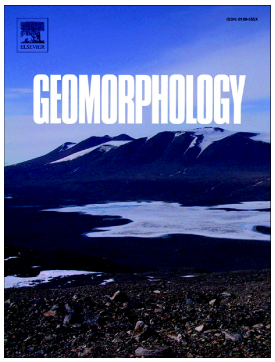

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Stress field reconstruction in an active mudslide

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Abstract: Meso-scale structures from gravitational slope deformation observed in landslides and deep-seated gravitational slope failures are very similar to those of endogenous ones. Therefore we applied palaeostress analysis of fault-slip data for reconstructing the stress field of an active mudslide in Pechgraben, Austria. This complex compound landslide has developed in clayey colluvium and shale and was activated after a certain period of dormancy in June 2013. During the active motion on June 12, 2013, 73 fault-slip traces at 9 locations were measured within the landslide body. The heterogeneous fault-slip data were processed in term of palaeostresses, the reconstructed palaeostress tensor being characterized by the orientations of the three principal stress axes and the stress ratio (which provides the shape of the stress ellipsoid). The results of the palaeostress analysis were compared to airborne laser scan digital terrain models that revealed dynamics and superficial displacements of the moving mass prior and after our survey. The results were generally in good agreement with the observed landslide displacement pattern and with the anticipated stress regime according to Mohr-Coulomb failure criteria and Anderson´s theory. The compressional regime was mostly registered at the toe in areas, where a compressional stress field is expected during previous mass-movement stages, or at margins loaded by subsequent landslide bodies from above. On the other hand, extension regimes were identified at the head scarps of secondary slides, subsequently on bulged ridges at the toe and in the zone of horst-and-graben structures in the lower central part of the main landslide body, where the basal slip surface probably had locally convexcharacter. Strike-slip regimes, as well as oblique normal or oblique reverse regimes were observed at the lateral margins of the landslide bodies. The directions of principal stresses could be used as markers of landslide movement directions. Although the multiphase strain indicators were, in general, relatively poorly preserved, the palaeostress analysis revealed several different deformation phases at some landslide parts related to different evolution episodes of the complex landslide. Palaeostress analysis based on the multiple inversion method is an affordable approach for reconstructing stress fields within landslides in soft material. This method is an inexpensive and objective tool for stress field reconstruction even in heterogeneous stress field conditions where the distinction of different faults generations may be impossible.

Keywords: Gravitational Slope Failure, Clayey Mudslide, Paleostress Analysis, Fault slip, Stress State, Landslide Superficial Displacement