Geophysical Research Abstracts
Vol. 15, EGU2013-1136, 2013
EGU General Assembly 2013

Micromorphology of selected relict slope deposits from Serra da Estrela, Portugal

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Serra da Estrela is the highest mountain in Portugal (1,993 m ASL) and part of the Iberian Central Cordillera. The mountain has a strong relief and a lithological diversity with several types of granitoids and metasediments. Most of the western plateau area was glaciated during the Last Glacial Maximum and its morphology is dominated by glacial landforms. Vieira (2004) produced a detailed geomorphological map of Serra da Estrela and described several sites showing stratified slope, head and debris-flow deposits. Based on the geomorphological analysis of the relationships between glacial and periglacial evidence, a first relative chronology was presented. However, a detailed and systematical sedimentological analysis has not been conducted before and absolute ages are also lacking. Micromorphology analysis has proven to be of considerable value in the interpretation of mountain soils and sediments. Such interpretation depends on identifying diagnostic features, indicating factors as the presence or absence of permafrost, thickness of the active layer, ice segregation and the operation of processes of mass-wasting. In this study, micromorphology was used to answer questions concerning the composition, structure, origin and depositional processes of relict slope deposits. Micromorphology allowed a systematic description of the physical characteristics of the sediments. Lamination and sorting, when preserved, are good evidence for overland flow. Features due to deformation (folds, boudins, coatings and tails due to the rotation of clasts) are associated with sliding. Other mass-movements such as debris flows, earth flows, and to a certain extent, dry grain flows may be characterized by similar microscopic facies, typically a poorly sorted, porphyric material. Porosity gives evidence for both liquefaction (debris flows) and frost-induced mass-movement (solifluction).
The relict slope deposits of the Serra da Estrela show an increase in cryogenic micromorphological features with altitude. Above 1100-1200 m, solifluction microstructures become frequent and very well-developed, evidencing frost-induced mass movement. Below this altitude solifluction processes were less frequently observed, and with poorly developed microfeatures. Debris-flow and run-off processes occur in a wider altitudinal range and are controlled by local topographical and geomorphological conditions.