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Soil creep as factor of landscape change

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Many erosion models assume that soils are transported grain-by-grain, and thus calculate loss and deposition according to parameters such as bulk density and average grain size. However, there are indications that clay-rich soils, such as the widespread Red Mediterranean Soils or Terrae Rossae, behave differently. This is illustrated by a case study of historic landscape changes in Jordan, where evidence for soil creep as main process of soil movement was found in the context of ancient cemeteries. Due to a dominance of smectites, the Red Mediterranean Soils in this area shrink and form cracks during the dry period. Because of the cracks and underlying limestone karst, they can swallow strong rains without high erosion risk. However, when water-saturated, these soils expand and can start creeping. Buried geoarchaeological features like small water channels on formerly cleared rocks suggest that soils can move a few cm uplslope when wet, and buried graves illustrate that soil creep can create new level surfaces, sealing cavities but not completely filling them. Such processes seem associated with slumping and earth flows as instable rocks might collapse under the weight of a creeping soil. While it is very difficult to measure such processes, landscape archaeology offers at least an indirect approach that could be suited to estimate the scale and impact of soil creep. Analogies with modern rainfalls, including record levels of precipitation during the winter 1991/1992, indicate that similar levels of soil moisture have not been reached during times of modern instrumental rainfall monitoring. This suggests that very strong deluges must have occurred during historical periods, that could potentially cause tremendous damage to modern infrastructure if happening again.