Geophysical Research Abstracts,
Vol. 10, EGU2008-A-01480, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-01480
EGU General Assembly 2008

Piping and soil – subsoil water dynamics

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Piping erosion is a relatively common process in semi-arid environments with poorly consolidated materials. In these areas (mainly badlands) the formation and evolution of pipes can be explained by a combination of factors: 1. Geo-structural characteristics impressed in fine materials; 2. Physic-chemical material properties; 3. Climatic conditions; 4. Hydraulic gradients.

This study revise the piping development focused on the hydraulic load transmitted mainly across the fissures that do exist on weakly consolidated sediments.

Thus we must know the dynamic of the moisture fronts in the soil-subsoil system, keep in mind that these soils are tiny and the hydric profile it is developed mainly in the C/R horizons. Therefore we carried out soil moisture monitoring on deep profiles using a neutron moisture probe on several points placed on areas with piping development on Murcia and Granada (Spain): the former on tectonized burdigalien marls, the latter on subhorizontal pleistocene silts and gravel sequences.

We check that the depth of the moisture fronts is shallow, with strong seasonal oscillations that are related with the pedogenic response to rainy/dry periods. Moisture temporal oscillations at depth greater than 1 m are very light, and do not justify strong hydraulic loads on depth levels. Consequently piping development needs preferential

paths to obtain hydraulic circulation, especially for the moderate to large pipes.

These paths can be established by the fractures of tectonic nature (jointing), or by fissures near the talus, as a consequence of the instability of these scarps, or both of them. These fractures appear as discontinuity plains more o less developed on size at the beginning of the process, and usually are vertical: they can provide inlets into the bedrock for the infiltration of water that will act preferably on the intersection of these plains (vertical lines), traces which are the precursor of the pipes.

The water percolation generates strong hydraulic pressure on the depth of these traces, capable to surpass the formation pressure and breaking the rock. The proximity of these plains to the talus provides points of weakness and so outlets where to release the hydraulic pressure and subsequently the water accumulated. Occasionally these plains show calcite infillings on their initial stages. These underground erosive forms progress from bottom upwards, and are originated and implemented at the first stages by the water pressure and finally by conventional erosion when these forms are open out.