Objective of the research:

Changes in soil water content, water flows and consequent rise in pore water pressure, are well-known factors of hillslope instability. Apart from the subsurface flow conditions, the water-soil interaction and the chemical nature of interstitial water are expected to play a key role in the triggering mechanisms of slope failure. The main questions to investigate within this post-doctoral project are:

1) What is the origin of water in clay-rich landslides?
Water chemistry can be used as a technique to investigate the flow origin assuming that geochemical modelling is taken into account in the soil-water interaction. Encouraging results were obtained at the Super-Sauze landslide developed in clay-shales (de Montety et al., 2007) but this first investigation, based solely on thermodynamics, demonstrated that kinetics should also be considered. This analysis should now be improved by including data from other landslides developed in similar lithology. The use of additional geochemical tracers is required such as 88Sr/86Sr which is not affected by physico-chemical processes.

2) What is the impact of the interstitial water chemistry on hillslope stability?
The ionic strength of pore water has a direct impact on the efficiency of the Van der Walls bonding between clay mineral layers (Moore, 1991; Moore and Brundsden, 1996; Di Maio, 1996). Diluted waters are considered to make clay assemblage unstable by weakening these forces. But observations at Super-Sauze showed that the most active parts of the landslide are those where the groundwater is the most mineralized. This question is still to address from field and laboratory experiments to characterize the effects of physico-chemical conditions (landsliding susceptibility due to chemical criteria) and the hydrological conditions (landsliding susceptibility due to mechanical criteria).

3) What is the role of chemical erosion on the water flow processes?
Transfer of sediment is usually attributed to surface overland flow, though there are increasing evidences of the role of subsurface flow on erosion processes (Bryan and Jones, 1997). Chemical erosion due to material alteration may significantly contribute to the sediment exportation or at least it may prepare the soil to erosion processes and change the soil hydraulic properties. At Super-Sauze and Draix landslides, the oxidation of a large abundance of sulphide is thought to contribute greatly to sediment erosion, as shown in the Mackenzie catchment (Calmels et al., 2007). Sulphur isotopes and oxygen isotopes of sulphate will be used to characterize the sulphur origin and identify the oxidation mode (aerobic, anaerobic).

The candidate will have to explore the 3 above mentioned questions by using:
- Hydrochemical data in French and Italian experimental sites (Super-Sauze, Draix, Ca'Lita, and possible others),
- Geochemical data (available data at Super-Sauze, Draix, required data at Ca'Lita)
- Laboratory experiments (relation between chemical alteration and hydraulic properties, role of pore water concentration)
- One year of hydrochemical survey at Super-Sauze and Draix.

References:

**Location:** The work will be carried out at University of Avignon & Pays de Vaucluse (France), Research Laboratory EMMAH ,(Environnement Méditerranéen et Modélisation des Agro-Hydrosystèmes). Regular stays at University Paris VI (Insitut de Physique du Globe de Paris, Research Group Geochemistry and Cosmochemistry) and University of Besançon (Laboratory Chrono-Environnement) will be scheduled over the contract duration. For the field data analysis and the fieldwork, collaboration with University of Strasbourg (Institut de Physique du Globe de Strasbourg, Research Group Experimental Geophysics) and University of Modena e Reggio Emilia (Department of Earth Sciences) are planned.

**Supervision:** The Post-doc project will be formally supervised by Dr. Vincent Marc (EMMAH), Prof. Jérôme Gaillardet (IPGP) and Dr. Catherine Bertrand (Geosciences-Besançon)

**Requirements:** Recently obtained Ph.D in earth/soil sciences, with a focus on hillslope hydrology. Experience in geo/hydrochemistry, and hydrological modelling is important.

**Starting date:** February – March 2010 (some flexibility is possible).

**Conditions of employment:** The appointment will be given in reference to the French rules of CNRS. The fellowship duration is 12 months at a rate around 2800 € gross per month.

**Contact persons:** Interested persons should contact and send their application (curriculum vitae, short statement of research interest and addresses of three referees) to Dr. Vincent Marc (vincent.marc@univ-avignon.fr). Selection of the applicant will be performed on a competitive basis.

Please note that the official **application deadline is 2010, January 15.**

More informations about :


EMMAH : [http://www.avignon.inra.fr/les_recherches_1/liste_des_unites/emmah_environnement_mediterraneen_et_modelisation_des_agro_hydrosystemes](http://www.avignon.inra.fr/les_recherches_1/liste_des_unites/emmah_environnement_mediterraneen_et_modelisation_des_agro_hydrosystemes)
