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HIGH CHARACTERIZATION OF THE VADOSE ZONE DYNAMICS IN CARBONATE FORMATION (OLIGOCENE AQUITAIN LIMESTONE, FRANCE)

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The study of the spatial evolution of water content in porous materials as rainwater passes through the vadose zone is of a scientific interest as it affects (Binley et al., 2001; Walker et al., 2001): i) the retention of pollutants within the pore-system of the rock mass in the near surface zone; ii) the change of physico-chemical properties of the porous materials, including dissolution and cementation; iii) the degradation of the mechanical properties of porous materials due to variations and the amplitude of water content, iv) the context of underground nuclear waste sites.

For all spatial scales, from pore through local and field, to watershed, the interaction of the land surface with the atmosphere will be one of the crucial topics in hydrology and environmental sciences over the forth coming years. The recent lack of water in many parts of the world shows that there is an important need to acquire the knowledge on vadose zone dynamics (Parlange and Hopmans, 1999).

This contribution reports an experimental study of the evolution of water content conducted over two periods : an annual hydrological cycle between April 1996 and April 1997; four hydrological cycles between 2001 and 2005 in three abandoned underground quarries (Gauriac-Thau, Gauriac-Maison Franche and Saint Germain-La-Rivière) in the unsaturated Aquitanian Oligocene formation located in the north of Dordogne, France. The experiments were focused on the spatial distribution and evolution in time and depth of the water content in the limestone underground quarries. The effective precipitation (Peff) was considered to be the source of the water in the

pores of the investigated vadose zone and was used as the entrance signal of the analysed system. The effective precipitation is the difference between the precipitation water (P) and evapotranspiration (ETr) following the relationship Peff = P- ETr. The local topography is essentially flat and horizontal. Hence, the streamflow is neglected at the studied scale. The water flows mainly from the surface to the ground water level through the porous pillars.

The porous network is only represented by a matrix pore network because the fracturing network is plugged up with impermeable red clays (Cerepi and Humbert, 2002). More than 98 core samples have been removed from the pillars as well as from boreholes drilled from the surface through the rock cover immediately above the mine pillars in order to analyse petrophysical properties.