On the Role of Osmosis for Non-Linear Shock Waves f Pressure and Solute in Porous Media

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A novel non-Osanger model focusing on non-linear mechanic and chemo-poroelastic coupling of fluids and solute in porous rocks is developed based on the modern wave theory. Analyzing in 1-D a system of two adjacent rocks with different conditions we obtain two coupled non-linear equations for fluid pressure and solute (salt or pollutants) concentration, evolving under the action of strong stress from one "source" rock towards the other rock. Their solutions allow to identify quick non-linear solitary (Burgers) waves of coupled fluid pressure and solute density, that are different from diffusive or perturbative solutions found in other analyses. The strong transient waves for low permeability porous media, such as clay and shale, are analyzed in detail. For medium and high-permeability porous media (sandstones) this model is also tentatively applied. Indeed in recent works of Alexander (1990) and Hart(2009) is supported the presence of small osmotic phenomena in other rocks where osmosis was previously ignored. An attempt to apply our model to soils in Calabria (Italy), such as clastic marine and fluvial deposits as well as discontinuous remnants of Miocene and Pliocene carbonate and terrigeneous deposits, is also discussed.