Geophysical Research Abstracts, Vol. 8, 10091, 2006
SRef-ID: 1607-7962/gra/EGU06-A-10091

Low rate of compaction relative to decompaction as mechanism for spontaneous focusing of pervasive porous flow

Y. **Podladchikov** (1), J.A.D. Connolly (2)

(1) PGP, University of Oslo, PO Box 1048-Blindern, Oslo, 0316 Norway, (2) Earth Sciences Department, ETH, 8092 Zurich, Switzerland (yuripo@fys.uio.no, www.fys.uio.no/˜yuripo)

We propose that a mechanical flow channeling instability, which arises because of peculiarities of long-term creeping behavior of the porous rock matrix, facilitates spontaneous segregation and transport of porous fluids. Creeping response of porous rocks is documented from room up to melting temperatures and for various rock types. To characterize this complex and poorly understood creep response of porous rocks we treat the ratio of the matrix effective viscosity (the ratio of stress over creep rate) during decompaction to that for compaction as a free parameter, R. Experiments and theoretical considerations suggest this parameter can be very small. In the extreme case of zero cohesion between solid particles it may be equal to the ratio of porous fluid viscosity over viscosity of the shear viscosity of the solid grains. Numerical simulations with R<<1 reveal that solitary pipe-like porosity waves initiate from miniscule flow perturbations. The waves develop with spacing on the compaction length scale. Degree of fluid focusing and related amplification of compaction driven fluid fluxes strongly increase with decreasing R. The waves grow by drawing fluid from the background porosity, but leave a wake of uncompacted porosity that localizes subsequent flow. Wave growth is approximately self-similar but too slow to explain the entire spectrum of fluid transport in rocks. However, waves may both provoke the elastic response necessary to nucleate, and localize the fluid necessary to sustain, more effective mechanisms for segregate fluid transport such as hydrofracturing, vents, dikes and sills formation.