Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Microbial transport through porous media: The importance of the microscale PIETRO DE ANNA, YUTAKA YAWATA, ROMAN STOCKER, RUBEN JUANES, Massachusetts Inst of Tech-MIT — Bacteria play a key role in a plethora of subsurface processes, from geothermal energy, to enhanced oil recovery, to bioremediation. These large-scale consequences arise from microscale interactions within the highly heterogeneous subsurface environment. In particular, flow generates strong chemical gradients at the pore-scale and we hypothesized that, by actively responding to these microscale gradients, bacteria significantly change their transport properties at the macro-scale. We tested this hypothesis using video microscopy of Bacillus subtilis in microfluidic replica of porous media. We found that the bacteria's motility and chemotaxis resulted in a two-fold increase in their ability to spread in the pore volumes, as a result of active migration out of micro-pockets of stagnant fluid. These findings illustrate that microscale flow heterogeneity has strong implications for the transport of biota through the subsurface, and thus likely for the biogeochemical processes they mediate.

Pietro De Anna
Massachusetts Inst of Tech-MIT

Date submitted: 30 Jul 2014 Electronic form version 1.4