Published in 1881 “The Formation of Vegetable Mould through the Action of Worms, with Observations on their Habits” was Charles Darwin’s last scientific book in which he elaborated on the significance of earthworms in the history of the Earth through their impact on soil formation. Very similarly, the world’s largest ecosystem in areal coverage - the seafloor - is inhabited by diverse burrowing organisms which continuously rework and irrigate the sediment - a process referred to as bioturbation. The use of novel sensors allows us to peek into the seafloor and to link the activities of burrowing organisms to their biogeochemical impact with unprecedented spatial-temporal resolution. 2-D imaging of oxygen uncover the extremely dynamic and spatially heterogeneous redox conditions in the presence of bioturbating organisms. Porewater pressure measurements reveal the spatial extent of biologically driven porewater flow. Redox oscillations on time scales of minutes and bioadvective transport of porewater over tens of centimeters challenges the view of sediments as being diffusion dominated steady state systems. In this seminar I want to give a sense of this dynamism and complexity and discuss some of the implications for the function of benthic systems.