Petrographic and geochemical analysis of black shales as a tool for assessing the role of bioturbation for cementation patterns and fracture-susceptibility in shale gas reservoir facies

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Effective production of gas from low-porosity shale has proven to be challenging since gas is either adsorbed to kerogen and clay minerals or is stored as free gas within unconnected micro-pores. In result, shale-gas reservoirs are commonly reliant upon hydraulic fracturing to connect porous silt-rich layers within organic-rich mudstone facies. On the effect of burrowing on mineralogical transformations of unstable components in black shales is up to date surprisingly little known.Through grain-selective, deposit-feeding bioturbating organisms degrade unstable sedimentary components (i.e., clay minerals, organic matter) in their guts, while leaving the majority of quartz grains inert. In theory, this process results either in a deleterious effect on permeability (e.g. clogging of pores with clays and/or mineral grain coatings) or may enhance net permeability (e.g., through excretion of clay-free grains back into the sediment matrix). With this project, we plan to understand the link between infaunal sediment processing and mineral transformation in fine-grained, organic-rich sediments and the concomitant implications for cementation and fracturability in black shale successions. Burrowing exerts an important control on reservoir quality. This is because of its potential for creating 1) fluid flow conduits in otherwise impermeable mudstone 2) increasing the formation rate of solid-state pore-water precipitates such as carbonate or pyrite, 3) weakness zones which increase fracture susceptibility in otherwise ductile media. This research aims to improve reservoir characterization before exploitation is undertaken and provides a robust basis for more efficient production of shale gas reservoirs.