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Production of organic acids in organic rich rocks exposed to sCO2

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Using a high-pressure autoclave, we exposed coal samples from the Wilcox group in Texas, USA to a two-phase system of supercritical carbon dioxide and water. The conditions of the reaction were consistent with reservoir conditions at 1000m depth, 60C and 100 bars. Using a high-pressure steel coil sampling tube, we obtained separate samples of the CO2-rich phase and the aqueous phase in order to assess the relative partitioning of organic acids. Organic acids from the sampling tube were rinsed with either water or acetone and accumulated in an aqueous solution, then derivatized by esterification with propanol and sulfuric acid. Derivatized samples were extracted with hexane and analyzed by GC-MS. In addition to high concentrations of organic acids in both phases, we find that the aromatic acids are found preferentially in the CO2-rich phase, whereas the mono and di-acids are preferentially found in the aqueous phase. This partitioning is likely pH dependent. In addition to short chain and aromatic acids, we found several metabolic acids. The origin of these metabolic acids is either lysed dormant cells found within the coal samples or perhaps an adsorbed microbial-derived acid fraction within the coal. Our experiment is unable to distinguish the origin of these acids and future work will attempt to differentiate between a microbial origin, a CO2-coal chemical reaction origin, and an adsorbed acid origin.