Preliminary estimation of scavenging rates in the Guadalete estuary (Bay of Cádiz, Spain) based on U-Th disequilibrium series

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Several samples were taken along salinity gradient in the Guadalete River estuary (SW Spain), with the aim of estimating the scavenging rates and residence times of U and Th. Scavenging processes can be quantified from the measurements of members of the U-Th series, such as ^{234}Th and ^{238}U, based on the differences in the geochemical behaviour with respect to sorption on to particulate matter. We analyzed the dissolved and particulate ^{234}Th in a suite of water samples. Our results show that the dissolved U is conserved in the estuarine mixing zone. Using a simple box model for the particulate and dissolved ^{234}Th, the calculated scavenging rate constant k and the residence time τ in the lower salinity samples are 0.96±0.28 d^{-1} and 1.01±0.28 d, respectively. At intermediate salinity, these values are 0.74±0.11 d^{-1} and 1.30±0.11 d, respectively. Scavenging rates and residence times from samples in the surrounding Bay of Cádiz, are 0.56±0.08 d^{-1} and 1.69±0.08 d, respectively. A comparison of these values indicate that there is active scavenging (lower residence time) at low salinity region compared to high salinity region towards the sea. Furthermore, these results imply high scavenging rates in the Guadalete River estuary as well as short residence times, as is normally the case in estuarine areas.

Biogeochemistry of Devonian shale gas resources of the Midwest USA: Antrim and New Albany Shales

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To better understand the role of subsurface microbial communities in natural gas generation in shales, we have pursued comparison of the aqueous geochemistry, gas isotope geochemistry, organic geochemistry, and microbial ecology in two US gas shale formations. Both formations exhibit key geochemical/isotopic indicators of methanogenesis, including high concentrations of HCO_3^-; $\delta^{13}C$ values of HCO_3^- between 10-33 ‰; low concentrations of SO_4^{2-} and CH_3COO^-; and a strong co-variance of H_2O and CH_4 δD values. These indicators reach more extreme values in the Antrim compared to the New Albany, suggesting greater overall microbial gas generation and/or a more active microbial community in the Antrim. Analysis of extractable hydrocarbons from shale core samples also reveal that biodegradation is much less severe in the New Albany compared to the Antrim. 16S rRNA partial gene sequences from production waters of both formations include both Archaea and Bacteria. Phylogenetic analyses suggest different microbial communities occur both between and within the two formations, yet all exhibit broadly similar functions of bacterial fermentation of hydrocarbons accompanied by predominantly hydrogenotrophic methanogenesis.