Re-Os systematics in organic-rich mud rocks of the Brushy Canyon Formation, west Texas

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Several studies have illustrated the application of the Re-Os geochronometer in marine organic-rich mud rocks and its utility in the absolute dating of hydrocarbon source rock deposition as well as reconstructing the Os isotopic evolution of global seawater. The majority of these studies have focused on Os isotope stratigraphy during the Cenozoic in order to better understand temporal perturbations in the Os isotopic record as they apply to changes in global ocean geochemistry caused by paleoclimate, tectonic, or extraterrestrial processes. Few studies have focused on reconstructing the evolution of the Os isotopic composition of seawater during the Paleozoic. In addition, there is still very little known about the location of Re and Os within the organic complexes within organic-rich mud rocks.

New Re-Os geochronology of marine, organic-rich mudrocks from the Permian Brushy Canyon Formation, Delaware basin, west Texas yields a Model 3 age of 262.3 ± 4.8 Ma (1.8% age uncertainty, 2σ, n=10, mean square of weighted deviates [MSWD] = 1.7) and, within uncertainty, agrees with the expected age for this formation and represents the first direct, absolute age for Guadalupian strata in the Delaware basin. The initial $^{187}Os/^{188}Os$ = 0.49 ± 0.05 obtained by the isochron regression represents the Os isotopic composition of seawater in the Permian basin, and globally, during the Guadalupian.

Brushy Canyon samples are organic-rich with TOC values between 0.97 and 4.04% which positively correlate with both Re and Os abundances (R^2 = 0.58 and 0.91, respectively). The slope of Re/TOC and Os/TOC for Brushy Canyon samples (26 and 239, respectively) fall within the upper limit of all published Re-Os/TOC data (Re: 0-26; Os: 0-351), and are positively correlated with their respective R^2 values and possibly indicates a correlation with the rate of sediment deposition and degree of basin restrictivity.

Hydrogen Index (228-393 mg/g) and Oxygen Index (16-51 mg/g) values indicate mixed Type II/III organic matter. Rhenium and Os abundances correlate positively with HI, and S_2/S_3 and negatively with OI, all proxies for organic matter type, and provide robust evidence for the dependence of organic matter type on the abundance of both Re and Os.