Evidence of Ferruginous Redox Conditions in the Water Column of Mississippian Barnett Shale Using the Iron Speciation Method

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9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

Mississippian aged Barnett shale located in FortWorth Basin of Texas is a kerogen type II shale gas with low sulphur content, formed under normal saline marine and anoxic conditions. Barnett shale is highly laminated and contains carbonate. Despite the established geochemical characteristics, not much is known about the ferruginous conditions of the water column of Barnett shale. Iron is an important element in the earth crust and its enrichment in the water column during sediment deposition is given as ferruginization. In the context of the research, the water column chemistry of 24 samples from approximately 50m depth interval of Barnett shale was studied to investigate ferruginous redox conditions using iron proxies and correlating the result with Total Organic Carbon (TOC). The various iron pools include highly reactive iron (FeHR) and total iron (FeT). Highly reactive iron is grouped into iron carbonate (Fecarb), iron oxalate (Feox), iron magnetite (Femag), iron present as acid volatile sulphur (FeAVS) and iron pyrite (Fepy). Samples were extracted according to method developed by Poulton & Canfield (2005) and analyzed using Atomic Absorption Spectrophotometer. TOC was analyzed using LECO Analyzer. The ratio of iron pyrite to highly reactive iron (FePY/ FeHR) was used as a proxy to delineate ferruginous zones from euxinic zones within the analyzed depth. FePY/ FeHR ranged from 0.61-0.91. From the 24 samples examined, 11 samples showed ferruginous conditions and were less than 0.6, while the remaining 13 samples showed euxinic conditions at greater than 0.7. TOC ranged from 0.31-6.67 and did not have any direct correlation with the redox conditions.