# Cyclic variation of the organic carbon isotope ratio ($\delta^{13}C_{org}$) and the total organic carbon (TOC) within the Barnett Shale (Texas, USA): An indication of 2nd order sea level change in the Mississsippian

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Seven wells covering approximately 100 km along the NNE-SSW of the Fort worth basin (Texas, USA), were selected for the measurement of total organic carbon (TOC) as well as organic carbon isotope ratio ($\delta^{13}C_{org}$) of the Mississippian Barnett shale. The TOC and $\delta^{13}C_{org}$ value of 98 rock cuttings ranges from 1.3 to 6.2%, and -23.9 to -29.7 $^{0}/_{00}$ (mean - 27.4 $^{0}/_{00}$), respectively. If we assume $\delta^{13}C_{org}$ value of two end members i.e. marine and continental organic matter, to be -22 and -30 $^{0}/_{00}$, respectively, our study indicates the dominance of continental type organic matter within the study area of the basin. The systematic variation of TOC and $\delta^{13}C_{org}$ of each well reveals that the Barnett shale is characterized by three major cycles. Each cycle is characterized by unusual inverse correlation between TOC and $\delta^{13}C_{org}$. These cycles can be correlated with the 2nd order global sea level curve. The study suggests that each sea level rise was tied with decreasing value of $\delta^{13}C_{org}$ (more continental type organic matter) and increasing value of TOC. This indicates that each sea level rise (resulted from deglaciation possibly due to increased $P_{CO2}$ level) caused basin anoxia resulted from either reduced haline circulation or basin restriction due to increased tectonic activity along the Ouachita thrust. Therefore, the TOC and $\delta^{13}C_{org}$ cycles within the Barnett Shale were the results of complex interplay among $P_{co2}$, basin anoxia and tectonic activities. The $\delta^{13}C_{org}$ cycles can also be used as stratigraphic markers within the Barnett Shale of the Fort Worth basin.