

Improvements in the Regional Chronostratigraphic Framework of the Niobrara Formation

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Interest in the hydrocarbon potential of the Niobrara Formation has grown significantly in recent years, largely due to the discovery of economically viable shale gas resources in several areas. As with all exploration efforts, the ability to improve predictions of reservoir and charge characteristics in frontier regions is a key goal in the overall development of the play. This study integrates three independent geochronologic techniques that refine the time scale for the Niobrara Formation and provide a means to export the time scale to different areas where geochronologic analysis is not possible. The first method is development of an astronomical time scale based on analysis of orbitally influenced bedding patterns. The second is radioisotope dating of volcanic ash beds by Ar-Ar and U-Pb methods that confirms the astronomical result. The third is creation of a detailed chemostratigraphic framework of $\delta^{13}\text{C}$ measurements that includes unique perturbations which can be traced across facies boundaries. This allows the radioisotopically calibrated astronomical time scale to be exported from the sections where it was developed to other time equivalent strata. Combined with a regional stratigraphic synthesis, the revised time scale for the Niobrara Formation makes possible improved analysis of sedimentation and accumulation rates of different facies and sedimentary components, such as organic carbon and calcium carbonate.