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Geochemistry of lacustrine limestones from the White River Group of South Dakota, USA and their implications for understanding the Eocene-Oligocene Transition

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The Eocene-Oligocene Transition (EOT) was a period of climatic and environmental change marking Earth's shift from a greenhouse state into the icehouse state that continues into the present day. Within the midcontinent of North America proxy records have produced conflicting interpretations of environmental change across the EOT with the degree of temperature changes based on these records ranging from no change to an 8 ^{o}C decrease of mean annual temperature. Similarly, proxy records have also been interpreted to indicate increasing aridity, while others suggest little to no change. Reconciling these conflicting records has key implications for our understanding of this important period of Earth's history, as well predicting the terrestrial response to modern climate change. The White River Group of the Great Plains region of North America provides one of the most complete terrestrial records of the EOT in the world. While primarily comprised of siliciclastic deposits, lacustrine limestones occur as a minor constituent throughout the White River Group within formations spanning the EOT. However, despite having long been recognized, these limestones have previously received only limited research including a total lack of geochemical measurements. In this study, we provide the first geochemical measurements (stable isotopes, trace elements, and mineralogy) from the lacustrine limestones of the White River Group representing eight discrete locations. We observe both intra- and inter- formation variability in the geochemistry of these units highlighting the dual influence of local and regional scale processes on these parameters and, in turn, their interpretation as paleoenvironmental proxies. Preliminary results indicate variability in redox sensitive elements including Mn, As, and U as well as nutrient associated metals including Cu, Zn, and V indicating the potential for these deposits to record changes in paleoredox conditions and paleoproductivity. Collectively, these results provide a framework for future geochemical studies of lacustrine limestones of the White River Group to reconstruct the terrestrial response to the EOT.