Early Eocene latitudinal temperature gradient estimated from siderite clumped isotope thermometry

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The Eocene (56-34 My) is the youngest period of earth’s history when CO₂ concentrations in the atmosphere (600-1500 ppm) reached levels close to those predicted for future emission scenarios. Paleoclimate data from this interval can, therefore, be used to understand the effects that anthropogenic emissions will have on the climate system. Here, we present clumped and oxygen isotope measurements of siderite samples collected along a North-South transect in the North American Continent. These siderites formed in soils under water-saturated conditions and provide a record of both soil temperature and the δ¹⁸O composition of meteoric waters, which can be used to unravel paleoprecipitation amounts. Soil temperatures and meteoric water δ¹⁸O values were estimated using an internally derived calibration constructed with synthetic siderite samples precipitated in the presence or absence of iron reducing bacteria. Our data provide an estimate of the latitudinal temperature gradient during the early Eocene and offer a test dataset for models of the earth’s hydrologic cycle during greenhouse conditions.