PAIRED CARBON ISOTOPE DATA FOR CARBONATE AND ORGANIC MATTER FROM EARTH'S OLDEST CARBONATE PLATFORM (2.94 GA RED LAKE, ONTARIO, CANADA)

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Autotrophic photosynthesis increases carbonate alkalinity and stimulates the precipitation of carbonate minerals in aqueous environments. However, the early Archean rock record is generally carbonate-poor, and the most ancient examples of carbonate-depositing environments on Earth remain little explored. Here we provide an expanded dataset of major element, trace element, and stable isotope compositions of carbonate and organic matter determined from multiple industry drill cores transecting the 2,940 +/- 2 Ma to 2,925+/- 3 Ma Ball assemblage, Red Lake Greenstone belt, N. Ontario, Canada (dates from [1]). The drill cores capture a stratigraphic thickness of over 200m of stromatolitic calcite and dolomite, making this deposit the earliest known large accumulation of carbonate on the planet. Deep-water facies in the east (BIF, chert, shale) are overlain by carbonates showing pervasive microbial fabrics, while in the west carbonates showing few microbial textures were deposited on and interbedded with abundant siliciclastics. Trace element data, as well as the stable isotope composition of C and O in carbonates, are consistent with precipitation from Archean seawater. While the carbon isotopic composition of carbonates show only minor variations, paired measurements of organic carbon show significant variation, including atypically carbon isotope compositions reaching as light as -10 permil. The organic carbon isotope data show a bimodal distribution, suggesting that this platform records contributions from multiple organic carbon sources, providing important insight into the possible carbon fixation strategies that characterized the primitive photosynthetic bacteria responsible for deposition of this ancient carbonate platform.