Diagenetic History of Large Enigmatic Carbonate Concretions Woodford Shale Criner Hills Area Oklahoma

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The origin of carbonate concretions has long been a mystery. These structures result from diagenetic processes in the host sediment and appear to record a long depositional and geochemical history. In south-central Oklahoma, large carbonate masses (1 to 3 meters diameter) in the Woodford Shale were only studied briefly during the 1990s. A significant opportunity exists to revisit these structures, which may provide important information on Woodford sedimentation and subsequent burial diagenesis.

The purpose of this research is to identify the depositional origin and diagenetic evolution of the carbonate masses using techniques such as lithology, stable (C, N, S and O) isotope geochemistry, trace metals, cathodoluminescence microscopy, and fluid inclusion microthermometry.

Our preliminary results show that, on their surfaces, the carbonate masses contain coarse calcite crystals, phosphate nodules, chert layers and apparent bedding on the largest masses. Internally, we observe an iron oxide stained matrix with possible growth layers. Thin section petrography reveals a poikilotopic microcrystalline matrix containing radiolaria, *Tasmanites* and sparse organic particles, which are possibly pre-oil bitumen. Well-preserved siliceous microfossils, including radiolaria and triaxon spicules, occur in the phosphate nodules within the limestone masses. Solitary rugose corals, bivalves, conodant elements and *Laevigatosporites sp*. fossils were also observed within the matrix. Diagenetic dolomite is present throughout the matrix rimming replaced radiolaria or *Tasmanites* and filling fractures. Vugs are lined with isopachous cement and filled with blocky calcite showing aggrading neomorphism. A calcitic and hematitic rhind lining the perimeter of the masses displays concentrically zoned crystals, which include an erosional surface followed by uninterrupted zonation lines.

The masses appear to be preserving the precompactional fabric of the host sediment, with complex diagenetic alteration. Petrographic data points to possible diagenetic alteration of the masses in the phreatic zone, as well as subaerial exposure. Both petrographic and geochemical results suggest changes in water chemistry during formation of the carbonate masses.