

## Calibration of the Late Triassic time scale: U-Pb zircon ages from the Chinle Formation

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Reconstructing geologic history critically depends on geochronologic constraints that are both precise and accurate, and that can be intercalibrated with bio-, chemo-, magneto- and cyclostratigraphic records. The calibration of the Late Triassic, lasting c. 30 Ma, is exceptionally fragile because there is a lack of radioisotopic dates. Volcanic zircons contained in Late Triassic fluvial sandstones offer the unique opportunity to construct a chronostratigraphic framework that can then be applied to calibrating the global tempo and mode of major biotic events, including the origin and early diversification of dinosaurs, the potential effects from the Manicouagan impact at c. 215.5 Ma, and faunal turnover at or near the Triassic-Jurassic boundary.

We present preliminary CA-TIMS U-Pb zircon ages from tuffaceous sandstones within the Chinle Fm. of western North America. An age of c. 219 Ma (with 0.1% uncertainty) from the lower portion of the Chinle Fm. suggests that previous global biostratigraphic correlations of the Chinle Fm. are untenable, and that many traditional 'late Carnian' terrestrial assemblages may be mostly or wholly within the Norian. Additional ages from younger Chinle Fm. units constrain the late middle Norian faunal turnover (previously considered to be the Carnian/Norian boundary). The interpretation of these ages is compromised by the fact that (1) the zircons are from redeposited sedimentary units and (2) even local correlations of the Chinle Fm. are ambiguous due to the lack of continuous outcrop. We are planning to address the latter limitation by recovering the complete sedimentary succession of the lower ¾ of the Chinle Fm. and underlying Early to Middle Triassic Moenkopi Fm. in a c. 500 m drill core (part of the Colorado Plateau Coring Project that is currently under review). U-Pb zircon ages (that must be considered maximum ages) from a series of stacked sandstones within the core integrated with magnetostratigraphy from the same site, will allow us to develop a robust chronostratigraphic framework that can be correlated locally and also with records of that period from other parts of the world.

## Formation and stability of monohydrocalcite

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Monohydrocalcite (CaCO<sub>3</sub>·H<sub>2</sub>O; MHC) is rare mineral found as modern sediment in saline or alkaline lake [1]. It is metastable with respect to calcite and aragonite. The formation of MHC favors at low temperature in natural environment. But the reported solubility product of MHC doesn't support the natural occurrence of MHC [1, 2]. In order to provide the more reliable solubility date of MHC, solubility measurement of MHC were conducted between 5 and 25°C.

Synthesized MHC was added to pre-heated or cooled electrolyte solutions containing trace amount of phosphate that is inhibitor for the MHC transformation. The suspensions were stirred and bubbled with high purity CO<sub>2</sub> gas at constant temperatures. The suspensions were filtered through the membrane. Calcium concentrations of filterates were measured by ion chromatography. Solubility product of MHC were calculated by Geochemist's Workbench [3] based on CO<sub>2</sub> partial pressure and calcium concentrations.

The solubility of MHC slightly increased with temperature increase. A significant difference was admitted between solubility products 5 and 25°C. MHC is stable at lower temperatures. The temperature dependence of MHC solubility was opposite in sign to that of earlier study [2] which becomes increasingly soluble at lower temperatures. The ion activity products of several MHC discovered lake waters were oversaturated with MHC by using measured solubility of MHC from this study.

[1] Hull, H. & Turnbull, H.D. (1973) *Geochim. Cosmochim. Acta* **37**, 685–694. [2] Kralj, D. & Brecevic, L. (1995) *Colloid Surf. A* **96**, 287–293. [3] Bethke, C.M. (1998) *The Geochemist's Workbench Users Guide*, 184p. Univ. Illinois.