High-precision Re-Os Organic-rich Shale Geochronology of Early Jurassic Shale Packages of the Western Canadian Sedimentary Basin

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The Early Jurassic contains high concentrations of organic-rich mudrocks, notably those associated with the Toarcian Ocean Anoxic Event (T-OAE) [1], suitable for refining Early Jurassic time using Re-Os organic-rich shale (ORS) geochronometry. Despite this, studies-to-date have failed to obtain high precision, geologically meaningful, ages for the Early Jurassic [2-5]. Previous shortcomings of Re-Os ORS geochronology, however, were not due to analytical limitations, but rather limitations imposed by Early Jurassic basin restriction, which was widespread by the Toarcian [6]. Basin restriction inhibits Re-Os ORS age precision by causing subtle fluctuations in seawater $^{187}Os/^{188}Os$ that manifest in the form of heterogeneous Os_i ratios in organic-rich facies [6].

Here we report the first high-precision Re-Os ages of organic-rich shale packages of the Gordondale and basal Poker Chip Members of the Lower Jurassic Fernie Formation of Northwestern Alberta, Canada of the Western Canadian Sedimentary Basin (WCSB). Our Re-Os age results bracket sediment deposition between the Late Sinemurian-Early Pliensbachian (191.18 ± 0.94 Ma & 192.0 ± 1.4 Ma) and Late Toarcian (179.39 ± 0.60 Ma) When coupled with chemo- ($^{87}Sr/^{86}Sr$ and $^{187}Os/^{188}Os$ isotopes) and bio-stratigraphy our Re-Os ages correlate with regional and global stratigraphic tie points corresponding to pivotal points of Early Jurassic time, such as the Sinemurian-Pliensbachian boundary event and T-OAE, that are otherwise weakly defined radiometrically. In addition to this, preliminary seawater Os isotope data suggest, albeit speculatively, of the possibility of a previously unidentified Os isotope excursion at the Sinemurian-Pliensbachian boundary.

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