



## **Preliminary U-Pb high-precision ages for the Late Pliensbachian Stage and an associated positive carbon isotope excursion**

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The Early Jurassic is one of the most intriguing times in Earth's history. While Ocean Anoxic Events are widely recognized and well-studied in the Cretaceous, our knowledge of Early Jurassic environmental crises is comparably poor except for the global Toarcian Ocean Anoxic Event (T-OAE). The Late Pliensbachian has recently received much attention as an additional time marker in the Early Jurassic for oceanic anoxic conditions. The Late Pliensbachian event is characterized by enhanced deposition of organic-rich sediments and minor extinctions in basins in western Europe such as the Paris Basin, France; Lusitanian Basin, Portugal; Robin Hood's Bay, UK. A positive carbon isotopic excursion of up to 3-5‰ in both wood and organic matter can be observed from the upper Margaritatus Zone (Subnodosus and Gibbosus subzones). Even though there have been considerable advances made in the understanding of the carbon isotopic composition for this period, little is known of the age, duration, and geographic extent of the carbon isotopic excursion.

To this end, we investigated the Lower Jurassic Nicely and Suplee formations in the Suplee-Izee area in East Oregon (USA). Three stratigraphic sections were sampled encompassing 95 m of sediments. The Suplee Fm. consists of tan calcareous siltstone and the Nicely Fm. is a dark mudstone with high organic content (1-3%) and many interbedded ash beds. The two formations span almost the entire Late Pliensbachian and are allocated to the Kunae and Carlottense ammonite zones. These are equivalent to the Margaritatus and Spinatum zones in western Europe where the Late Pliensbachian events have been reported.

We have dated several ash beds using U-Pb high-precision zircon geochronology, and these reveal critically needed new information on the age of the Late Pliensbachian and its duration (about 3 Ma or more). One bed at the base of the Nicely Fm yields an age of ~187.1 Ma. This horizon is from the lower part (but not the base) of the Kunae Zone. Another age is from a horizon just above beds with ammonoids indicating latest Kunae Zone is ~184.5 Ma. Thus, the zone has a duration of about ~2.5 Ma or more. The uppermost Nicely Formation yields an ammonoid fauna referable to the Carlottense Zone (or possibly basal-most Toarcian). A basal bed of the superjacent Hyde Formation yields a radiometric date of ~184.09 Ma., and also is within the Carlottense Zone (or possibly basal-most Toarcian). Finally, a minimum age of the Late Pliensbachian carbon isotope excursion is estimated at ~184.5 Ma, based on an age of an ash close to the Kunae and Carlottense contact. In summary, our ages are the first absolute ages for the Late Pliensbachian which is in need of high-precision U-Pb geochronology to understand the rate and duration of the geological and environmental disturbances that took place during that time.