

High-precision U-Pb CA-ID-TIMS geochronology of tonsteins and constraints on the origin of Jurassic coal succession in Ordos Basin, China

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The Ordos Basin in north-central China is a large Mesozoic continental basin with an approximate surface area of 250,000 km² and abundant economic coal reserves. The well-developed, successive, coal seams of the Jurassic Yan'an Formation can be correlated across the Ordos Basin and provide an extraordinary record of Jurassic terrestrial paleoenvironments during an important period of global climate change. Age constraints on the Yan'an Formation, however, have been generally poor and its biostratigraphic age ranges from Early to Middle Jurassic; it overlies the Triassic (and older) strata via an unconformity.

Several tonsteins intercalated with the Ordos coal-bearing strata provide a unique opportunity for high-resolution radioisotope geochronology of the coal seams, as well as temporal correlation to the Jurassic time scale. Our high-precision U-Pb zircon geochronology by the CA-ID-TIMS method from the tonstein beds of the Yan'an Formation show that the coal accumulated during the Aalenian stage of the Middle Jurassic, with the bottom coal seam deposited shortly after Toarcian-Aalenian boundary. The early Aalenian was concomitant with a large-magnitude, relatively abrupt, cooling of the climate, which may have caused the southern boundary of the mid-latitude, warm and humid climate zone to shift southward in China and facilitated coal deposition in the Ordos Basin.

Our preliminary geochronologic results from the Yan'an Formation are consistent with the Milankovic forcing of the cyclic coal sedimentation. The possible interrelationship between orbitally forced climate and coal deposition in the Ordos Basin calls for further detailed investigations.