Tectonic and Climatic Controls on Facies Distribution in the Jurassic Walloon Coal Measures, Surat Basin, Australia

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Abstract

The Walloon Coal Measures of the Surat Basin, eastern Australia were deposited during the Oxfordian (Upper Jurassic) at a high latitude (<75oS). New precise dates for accumulation of the strata reveal new insights into the relative roles of tectonism and climate on the vertical distribution of sedimentary facies within the formation. The formation is up to 500m thick and consists of fluvial and lacustrine strata with coal beds. Although coal constitutes 5% of the formation, coal beds are thin (mostly <0.4m) and laterally discontinuous (most coal beds can be correlated for <5km). This creates problems for effective exploration and production in what is the largest coal bed methane play in Australia. Numerous volcanic tuffs interbedded with coals in the formation provide a unique opportunity to examine variations in subsidence rates through time with high resolution. Zircons from six volcanic tuffs have been dated from one vertical section using the CA-TIMS method to an error margin of <100kyr. The formation can be split into four units of differing subsidence rates. There is a marked decrease in the percentage of sandstone (between 0.5 and 0.3) between the units that were deposited under low subsidence rates compared to those deposited under high subsidence rates. By contrast, the percentage of coal between the units is constant and, furthermore, the thickness of coal beds is essentially the same throughout the formation. This implies that the subsidence rate was not a critical factor in determining the nature of coal/peat accumulation. The thin nature of the coal beds is most likely related to frequent fluctuations in climate with intermittent episodes favourable for peat accumulation. Alternatively, frequent base level changes, related to changes in relative sea level, may have created intermittent conditions suitable for peat accumulation. Other high-latitude coals, such as those in the Cretaceous of Arctic Canada and Antarctica are also thin and it is suggested that the sensitivity of such latitudes to global climate change may be a causal mechanism.