THE CORRELATION OF EARLY CRETACEOUS EVENTS USING STABLE ISOTOPE RECORDS

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Carbon stable-isotope profiles through Cretaceous successions typically show consistent stratigraphic trends that provide a sound basis for high-resolution global correlation. In areas where the analysis of bulk pelagic sediments is not possible the analysis of macro fossils has provided the means to develop a carbon-isotope stratigraphy and correlate distal records (e.g. Boreal to Tethyan systems). The advantages of this approach, as demonstrated by Volgian-Valanginian belemnite isotope data derived from the Yatria River, Western Siberia, is that not only a carbon isotope stratigraphy can be developed, inferences regarding marine palaeotemperatures can be made via oxygen isotope analysis. In this example, a positive shift in carbon isotope values during the late Valanginian is correlatable with cooler temperatures, possibly exposing the effectiveness of carbon sinks and their ability to draw down atmospheric CO_2, the 'inverse greenhouse' effect. The development of detailed fossil-wood carbon-isotope stratigraphies has potentially provided a powerful method to correlate non marine or marginal marine successions with fully marine sections. Fossil-wood isotope data can also provide inferences regarding the carbon-cycle and changes in atmospheric CO_2 concentrations. Problems do exist, whereby sections containing both wood and marine carbonate are far and few between. Such approaches also rely upon detailed, robust and stratigraphically well constrained marine carbon isotope stratigraphies, which are not always available. A stratigraphic, biostratigraphic and isotopic investigation performed on early Cretaceous Crimean sections revealed a wood-based carbon isotope curve comparable to Tethyan stratigraphies. This clastic-dominated Crimean succession consisted of a series of bioturbated inter-bedded shallow-marine silty sands, claystones and some oolitic sands. A detailed study of the ammonite fauna has demonstrated that the succession can also be compared to standard Tethyan schemes. The wood carbon-isotope ratios range in the Early Valanginian from –24‰ to –22‰, and in the mid-*verrucosum* Zone values shift abruptly towards more positive values and peak at –18‰ in the lower *callidiscus* Zone. Wood carbon-isotope ratios decrease gradually through the remainder of the *callidiscus* Zone and return to pre-excursion values in the *tauricum* Zone. The structure, magnitude and timing of the terrestrial carbon-isotope curve is very similar to the marine carbonate curve for the Valanginian. A delta-delta relationship between organic matter and carbonate, indicates that there was a possibly drop in atmospheric CO_2 concentrations during the Valanginian. Nevertheless a full evaluation of such reasoning needs to be made using successions that actually contain both wood and marine carbonates. Further research has hence now focussed on the Early Cretaceous

(Valanginian–Hauterivian) interval from Khatanga River, Siberia. This section contains both belemnites and terrestrial wood fragments and therefore provides a section to determine whether the relationship for the Valanginian from Crimea is a global phenomenon. As demonstrated in other early Cretaceous sections (e.g. the Yatria River), the belemnite record from the Khatanga River, central Siberia reveals a positive carbon isotope excursion within the late Valanginian. A fossil-wood carbon-isotope stratigraphy also reveals a coeval positive carbon-isotope excursion (within the *bidichotomus* zone). The delta-delta relationship between organic matter and carbonate from the Khatanga River data is consistent with that observed in the Crimea. For this reason, the two records taken together demonstrate the dependable nature of carbon isotope stratigraphies in correlation as well as confirming inferences regarding carbon-cycling and changes in atmospheric CO_2 concentrations.

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