Sequence stratigraphy of the Upper Cretaceous–Eocene Belqa Group of Jordan (southern Tethys margin)

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The Belqa Group of Jordan (Upper Cretaceous–Eocene) contains a remarkable succession of sedimentary lithofacies, including chalk, sandstone, chert, phosphorite, oyster mounds and organic-rich marls deposited along the passive southern margin of the Neo-Tethys Ocean.

The Belqa Group is now outcropping in spectacular wadis where they can be studied in detail. The exceptional outcrops exposures provide unique opportunities for studying three-dimensional spatial facies variations. However, this 3D facies distribution requires robust time control and the combination of modern sequence stratigraphic concepts and high-resolution dating methods. We report the establishment of a regional sequence stratigraphic model that provides the temporal framework for further detailed sedimentological, palaeontological and geochemical studies.

Preliminary results show a stratigraphic organization in four major depositional sequences (3rd order), which are broadly in agreement with the lithostratigraphic formations. The age dating is based on new nano-fossil analyses and C/O and Sr isotope stratigraphy. A subdivision into higher-frequency sequences (4th/5th order) significatively improves the resolution of the stratigraphic framework and our understanding of spatio-temporal distribution of the sedimentary facies. The four sequences are:

1) The B1 sequence (Upper Coniacian-Santonian), characterized by a transgressive phase of chalk-rich sedimentation (coccolithophore-dominated) and a regressive phase of a prograding siliciclastics with a distal transition to the first phosphorite-chert facies. 2) The B2 sequence (Lower Campanian) also starts with a transgressive chalk dominated facies and subsequently develops into a chert-dominated marl facies (radiolarian-dominated). The chert is locally associated with thin phosphates and coquinas, as well as organic-matter rich facies in proximal marine settings. 3) The B3 sequence (Upper Campanian) is also characterized by a transgressive chalk dominated facies. The regressive phase is constituted by dm- to m-thick phosphorite beds that were deposited coevally with giant oyster banks (decameter scale). 4) The B4 sequence (Maastrichtian-Paleocene) represents a dramatic facies change to organic-rich pelagic marls, and can probably be further subdivided.

This sedimentary succession highlights both gradual and rapid changes in biogenic productivity and geochemistry. These changes are punctuated and partly driven by significant relative sea-level changes, and likely also larger scale palaeoceanographical processes that are the focus of future work.

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