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Reducing marine and warm climate conditions during the Late Cretaceous, and their influence on organic matter enrichment in the oil shale deposits of North Jordan

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Abstract

Late Cretaceous oil shales, located in the Yarmouk sub-basin (North Jordan), were analysed using techniques of organic and inorganic geochemistry, coupled with a microfossil study. Results of this study were used to reconstruct the paleoenvironmental and paleoclimatic conditions during the Late Cretaceous and to investigate their influence on organic matter enrichment of the oil shale deposits. The analysed oil shales have high TOC and S_{total} content values in the ranges of 2.11-12.85 wt.% and 1.83-8.81 wt.%, respectively. The high S_{total} content and its relation with TOC values indicate that the sulfur is associated with organic matter and that the oil shales were deposited in a marine environment under reducing conditions. This is shown by petrographic observation and supported by biomarker distributions. The microscopic investigation indicated that the oil shales contain abundant liptinitic materials (i.e. alginite and amorphous organic matter) and planktonic foraminifera. The presence of these sapropelic materials and planktonic foraminifera assemblages further suggests a marine origin. Biomarker distributions are also known to reflect dominantly marine plankton/algal and microorganisms source input. Water column stratification and low oxygen (reducing) conditions are indicated by narrow Pr/Ph values, relatively high V/Ni elemental ratios and the presence of gammacerane. Reducing conditions contribute to preservation of organic

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