Production and preservation of organic matter in a late Triassic intraplatform basin

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The organic geochemistry of the Upper Norian-Lower Rhaetian Kössen Formation, rich in immature, marine organic matter (OM) has been studied on 120 samples, taken from the Rezi 1 core well, drilled in W Hungary. Rock-Eval pyrolysis was performed on all samples and about half of them was chosen for organic petrographic description and measuring of the sulphur (S) content. Organic sulphur content was also determined on numerous samples.

At least 80% of the kerogen consists of liptinite of predominantly algal origin. The common presence of benthic foraminifera and the well developed lamination throughout the section together suggest suboxic bottom water. On the basis of the TOC and HI values, three intervals can be differentiated within the Kössen Formation (Fig. 1.). In the lower interval, built up from laminated limestones and calcareous marls the kerogen is dominated by planktonic algae with considerable amounts of algal mats. TOC, HI and S range between 1.3 and 10.3%, 254 and 999 mg HC/g TOC, and 1.0–2.5%, respectively. Kerogen C/S ratio is low, ranging between 5.8 and 10.0. In the middle interval, consisting of laminated marls and clay marls the bulk of the kerogen is formed by both planktonic algae and algal mats in alternations. TOC, HI and S range between 0.3–14.6%, 93–794 mg HC/g TOC, and 0.4–3.5%, respectively. The organically richest samples contain high amount of fish scales. Kerogen C/S ratio is high, ranging between 8 and 92. Siltstones of the upper interval, showing strong terrestrial signature, are beyond the scope of this study.

The lower and the middle intervals contain mostly Type IIS and Type II kerogen, respectively. The striking differences in average T_{max} values (407 and 421°C) between the two intervals of clearly very similar maturities are related to differences in kerogen type. According to Bordenave *et al.* (1993), up to the oil window the T_{max} value of Type II kerogen exceeds by about 15°C that of the Type IIS kerogen. Although both intervals are characterised by predominantly algal kerogen deposited under probably suboxic conditions, HI values are significantly higher in the lower interval, more rich in carbonates where intense natural sulphurisation, permitted by the probably high TOC/Fe ratio caused an early termination of sulphate reduction and a better preservation of OM.

TOC content and HI increase upward in the lower interval then, after a drastic decline both parameters display a rapid increase followed by a more gradual decrease in the middle interval. Since neither water depth nor bottom water oxygenation changed dramatically during deposition of the Kössen

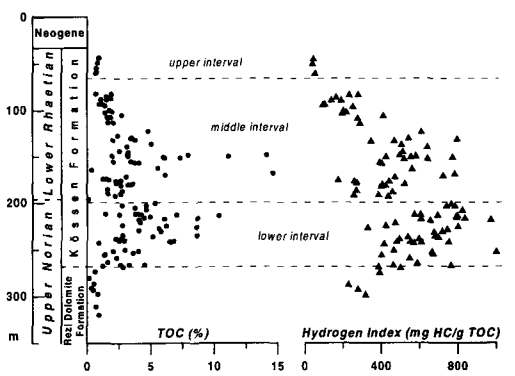

FIG. 1. Variation of the TOC content and Hydrogen Index with depth.

Formation the strong parallel variations of TOC and HI reflect important variations in OM production. In case of non-bioturbated sediments productivity can be assessed by calculating original C_{org} (TOC_{or} = TOC+sulphur) content of the sediment and taking the rate of sedimentation and water depth into account (Vető *et al.*, 1997). Variation of TOCor with depth gives a picture similar to that of the TOC (Fig. 2).

The resulting productivity values (Fig. 2.) are similar for those prevailing in low and medium productivity areas of present-day oceans. Due to evident uncertainties in the evaluation of rate of sedimentation and water depth the numerical values give only an idea on the order of magnitude but relative changes of productivity seem to be realistic (e.g. highest productivity has been obtained for the sediments characterised by high amount of fish scales, witnessing about a flourishing planktonic life).

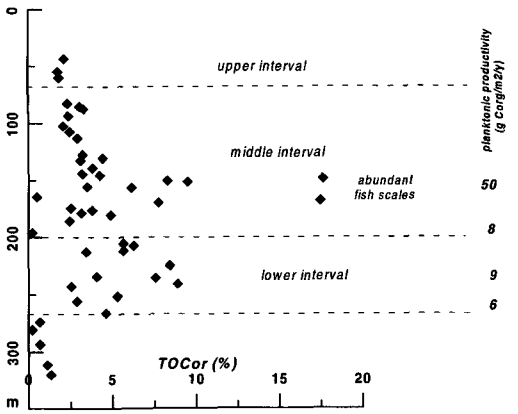

FIG. 2. Variation of the original C_{org} content (TOC_{or}) with depth.

Conclusions

The high amount of hydrogen rich OM in the Kössen Formation is the result of restricted, low-oxygen environment rather than that of the high productivity.

The upward transition from Type IIS to Type II kerogen is the result of the upward increasing clastic input, diluting the carbonate matrix and preventing an intense incorporation of sulphur into OM.

The strong stratigraphic variations in TOC content and HI are the result of an important variation of productivity during deposition of the Kössen Formation.

Acknowledgements

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