Geochemical characterization of Lower Jurassic organic-rich facies, offshore Ireland

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Exploration of the Slyne Basin and Goban Spur, offshore Ireland, has provided significant hydrocarbon discoveries. During exploration of the Slyne Basin, Lower Jurassic intervals were identified to be viable hydrocarbon source rocks of regional significance. Stable carbon isotope chemostratigraphy can characterize organic-rich facies and trace changes in the various hydrocarbon sources, from continental environments and atmosphere to oceans and organisms. In marine environments, and particularly in epeiric sea settings, these processes are governed by the complex interplay of local (different carbonate producers, transgressive–regressive cycles) and/or global (worldwide preservation of organic matter, variation of continental weathering, input of volcanogenic light CO_2) mechanisms.

In this study, we have analysed 34 core and cuttings samples from wells 18/25-1, 27/13-1 and 62/7-1 encompassing the Lower Jurassic. The selected samples were analysed by Continuous Flow–Isotope-ratio Mass Spectrometry (carbonates) and Elemental Analysis-Isotope-ratio Mass Spectrometry (organic matter) to determine $^{13}C/^{12}C$ ratio and calculate $\delta^{13}C$, along with bulk elemental geochemistry by X-ray fluorescence, for example in well 18/25-1, $\delta^{13}C$ values in carbonates varies from -5.16 ‰ to +2.22 ‰ in well 18/25-1 while $\delta^{18}O$ values range from -9.06 ‰ to -3.35 ‰. XRF shows all samples to be predominantly shale lithology, stretching to wacke. A negative isotopic excursion is identified in the samples, indicating the expression of the Toarcian Oceanic Anoxic Event. The $\delta^{13}C$ values determined in the carbonate-free fraction presents less variation: a negative trend of -6.65 ‰ is observed in well 18/25-1 followed by a generally positive trend of +2.71 ‰ (-28.23 ‰ to -25.52 ‰). The obtained data were integrated with pre-existing Total Organic Carbon, pyrolysis Rock-Eval and Vitrinite Reflectance data to evaluate the origin of organic matter and the potential to produce hydrocarbon. The ongoing investigation will discern the palaeoenvironmental conditions that lead to this organic-rich facies offshore Ireland.

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