The uranium/organic carbon relationship: A comparison of Devonian and modern systems

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Uranium and total organic carbon (TOC) concentrations typically display a predictable linear relationship in black shales and thus uranium (U) contents, as inferred from gamma logs, are often used as a proxy for organic richness [1]. Research has shown, however, that some organic-rich shales display uncharacteristically low U concentrations despite having consistently high concentrations of organic carbon [2].

In this study we investigate the U/TOC relationship in two Devonian Woodford Shale cores from the midcontinent region of the United States. The Woodford shale is characterized by high TOC values of up to 12 wt.% [3] while the investigated cores show variation in U contents ranging from 7.6 ppm to 77.1 ppm within the Woodford interval. To describe the mechanisms and/or processes that lead to the observed decoupling of U and TOC in the shale, we further analyzed samples from a modern analogue for a high organic carbon depositional system, the Namibian continental margin. These margin sediments exhibit two distinct zones, each with unique U/TOC ratios. Below anoxic bottom water, on the shelf mudbelt depositional center, uranium is enriched in the sediment with (unusually) high values of over 150 ppm and TOC contents around 10 wt.%. The slope sediments underlying oxic bottom waters (below the oxygen minimum zone) were less enriched in uranium (15 ppm) while maintaining relatively high TOC content of 7 wt.%.

Comparing the uranium content, as well as other trace metal inventories, of the ancient Woodford shale with the modern Namibian margin sediments will provide a window into the depositional and diagenetic processes that took place in the Devonian marine environment. This comparison may provide a better understanding of the pathways of uranium incorporation into sediment and benefit our interpretation of the depositional and diagenetic processes at play in shale depositional systems.

[1] Spirakis (1996) *Ore Geology Reviews* **11**, 1-3, 53-69. [2] Lüning & Kolonic (2003) *Journal of Petroleum Geology* **2**, 153-174. [3] Comer (1991) *Report of Investigations* No. **201**.