Assessing the Impact of Intermediate Storage on Sandstones in a Passive Margin Basin

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ABSTRACT

The composition of clastic sediment supplied to a basin is controlled by a range of processes including weathering, mixing and recycling. These processes occur during transport or intermediate storage and may result in the modification of the sediment, with less stable minerals more easily weathered than others (e.g. feldspar, apatite). These factors can impact the distribution and quality of potential reservoir sandstone in the terminal part of the sedimentary system. There is also a clear link between the nature and duration of any storage and sea level fluctuations within a basin. For example, it is expected that during highstand, sediment will be stored on the delta plain whereas during low sea level, the entire shelf area can be bypassed resulting in direct deposition into the deep water system. For this reason, sediment comprising a specific facies may have experienced different types or durations of storage. This study uses provenance tools to move towards a better understanding of the impact of storage (hinterland or shelf) prior to final deposition in a passive margin sedimentary basin. The well-studied Carboniferous [Serpukhovian-Bashkirian] Clare Basin, western Ireland, is being used as a test case, with high-resolution logging and sampling possible on extensive coastal outcrops. For example, the Bashkirian Tullig Cyclothem comprises biostratigraphically well-constrained sequences representing cyclical deltaic progradation. The detrital signal in these sequences can be interrogated in order to assess any link between sandstone composition and facies that could be the result of intermediate storage. In order to achieve this, quantitative analysis of heavy minerals and framework grains, using advanced imaging techniques, will be combined with a multi-proxy provenance approach (U-Pb in zircon and apatite). Due to the variable stability of mineral grains, some indices (e.g. apatite - tourmaline) will be sensitive to prolonged weathering, and if the source of the sediment can also be constrained, this should yield information about potential storage. These data will also help better reconstruct the palaeogeography of the Clare Basin during the Carboniferous, for which there are currently two contrasting models. Following this rigorous testing, the study will be expanded to help correlate and constrain the distribution of poorly-understood Lower Cretaceous and Cenozoic potential reservoir sandstone intervals in the basins offshore western Ireland.