

Reconstructing the Carboniferous paleogeography of the northeast Atlantic margin using provenance tools

BÉBHINN ANDERS^{1,2}, MARTIN NAUTON-FOURTEU^{1,2,3}, SHANE TYRRELL^{1,2,3}, JOHN MURRAY^{1,3}, AND JOHN R. GRAHAM⁴

1. *Earth and Ocean Sciences, School of Natural Sciences, National University of Ireland Galway, Galway, Ireland*

2. *Sediment Origins Research Team (SORT), School of Natural Sciences, National University of Ireland Galway, Galway, Ireland*

3. *Irish Centre for Research in Applied Geosciences (iCRAG), O'Brien Centre for Science (East), University College Dublin, Belfield, Dublin 4, Ireland*

4. *Department of Geology, Trinity College Dublin, Dublin 2, Ireland*

Reconstruction of Upper Paleozoic paleogeography of the Northeast Atlantic region can help to constrain possible prerift links between the conjugate margins. The broader region comprises a geologically complex assemblage of blocks and belts that have been affected by multiple orogenies since the Paleoproterozoic. Provenance analysis can help to identify these events, as the sedimentary rock archive preserves a detrital record reflecting the nature and composition of these ancient landscapes. Carboniferous sedimentary rocks in basins onshore Ireland and Britain form an important part of this archive, representing large- to medium-scale rivers and associated deltaic systems deposits. They potentially drained and sampled a wide portion of the NE Atlantic region and consequently provide a means to better constrain potential source lands.

To investigate these concepts, this study targeted the Mullaghmore Sandstone Formation (MSF), which occurs in the North West Carboniferous Basin (NWCB; onshore northwest Ireland). The MSF is a Mississippian fluvial/deltaic deposit, generally interpreted as the product of regional lowstand. Provenance analysis was conducted through high-resolution sampling and a multi-proxy approach, using optical microscopy, scanning electron microscopy, U–Pb zircon and Pb-in-K-feldspar analysis. Recovered grains show a range of detrital ages, corresponding to several regional orogenic events. Preliminary results indicate paleoflow from the north/northwest, with mixed sediment supply from sources including Greenland, northwest Scotland, offshore Ireland highs, and with minor input from Caledonian rocks. It is now apparent that the Rockall Bank, Porcupine High, and Stanton Banks were significant sources of the sediment supplied to the NWCB.

This study has also revealed important information on contemporaneous sedimentary processes, such as longshore drift and shelf mixing, which can directly affect the source signal. The MSF is ideally placed to test this: cycles of various facies packages are clearly evident and spatial variations in the provenance signal can be investigated from exposed sections in different parts of the basin. Zircon geochronological data show that channelized sediments have a more unimodal signal in comparison to shoreface facies, which have a mixed signal. This illustrates the importance of understanding the sedimentological context of any sample being investigated using provenance tools.