

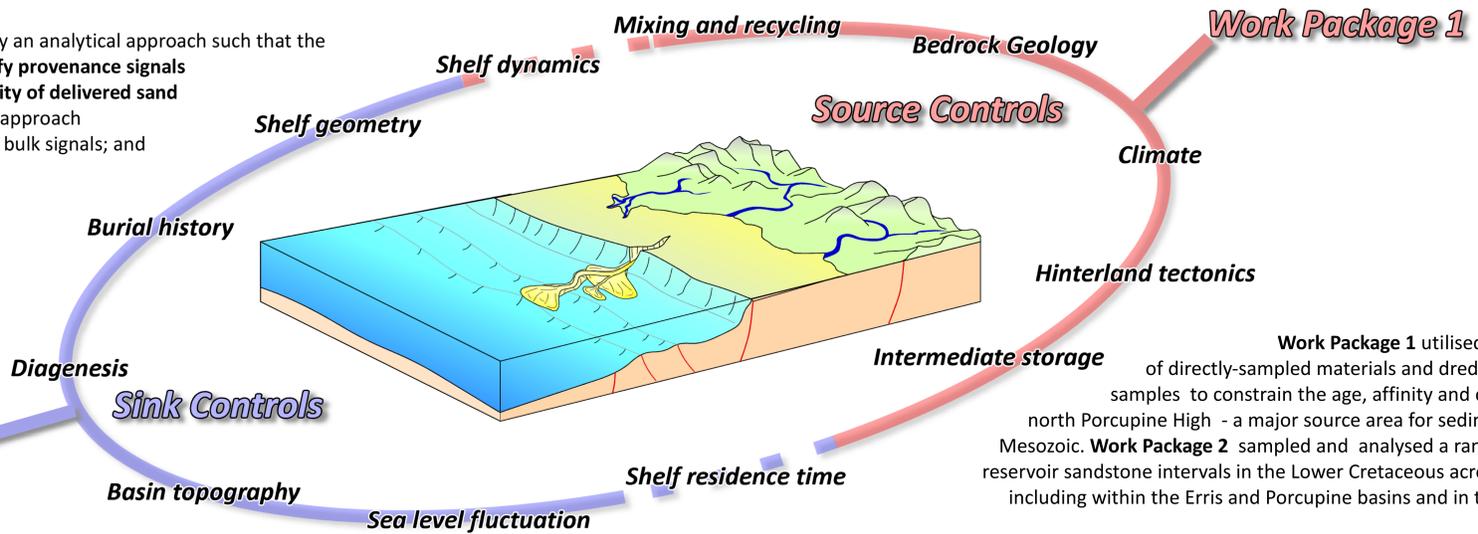
Sourcelands, sand provenance and supply to North Atlantic margin basins during the Lower Cretaceous

Aron Barry, Kerry Sun, Shane Tyrrell, Earth and Ocean Sciences, School of Natural Sciences, NUI, Galway
David Chew, Nathan Cogné, Department of Geology, Trinity College Dublin, Dublin 2, Ireland
Patrick M. Shannon, J. Stephen Daly, UCD School of Geological Sciences, University College Dublin, Dublin 4
Andy Morton, HM Research Associates, and CASP, University of Cambridge

Introduction: "Source to Sink" analysis and palaeodrainage reconstruction

The aim of this project was to create a detailed palaeodrainage (= "Source to Sink") model for the Lower Cretaceous system in NE Atlantic margin basins. Improved knowledge of the nature and evolution of sedimentary dispersal systems can help predict reservoir sandstone distribution and quality; insights which can genuinely de-risk exploration prospects. Critical to any assessment of provenance and sediment delivery is an understanding of the exact nature, position and uplift history of the contributing basement blocks.

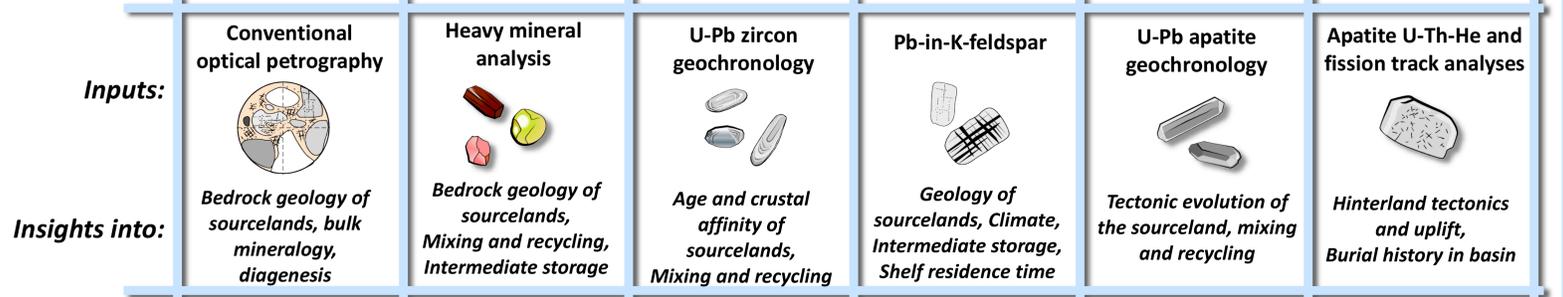
A key aim of this project was to employ an analytical approach such that the processes and factors which can modify provenance signals and impact on the character and quality of delivered sand can be identified and quantified. This approach is based on examining/investigating 1) bulk signals; and 2) signals in individual minerals with contrasting behaviour in the sedimentary environment



Work Package 1 utilised a combination of directly-sampled materials and dredged near-in-situ samples to constrain the age, affinity and character of the north Porcupine High - a major source area for sediment during the Mesozoic. Work Package 2 sampled and analysed a range of potential reservoir sandstone intervals in the Lower Cretaceous across a wide area, including within the Erris and Porcupine basins and in the Goban Spur.

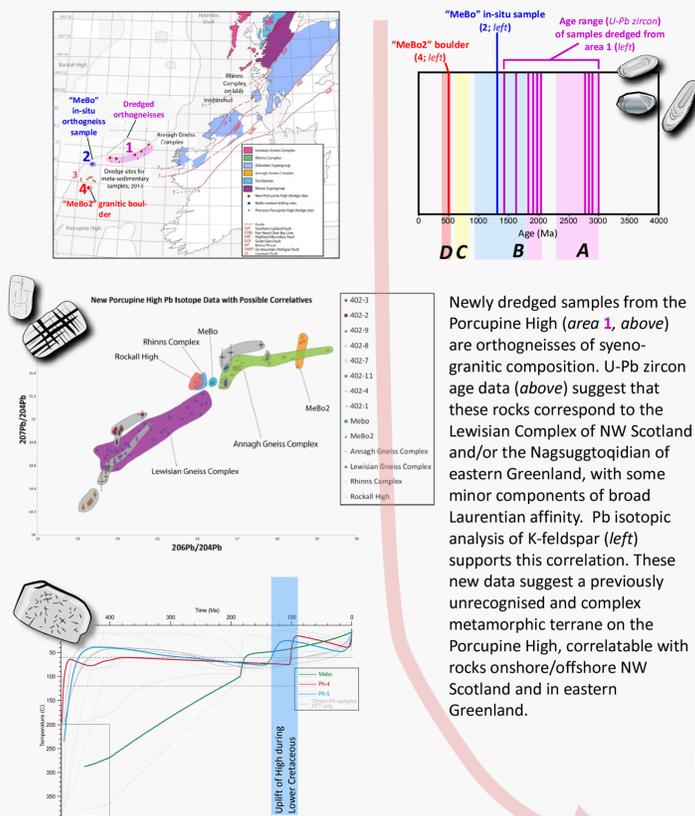
Approach: toward integrated, multiproxy provenance analysis

An integrated approach is being utilised in order to 1) refine of radiometric age and Pb isotopic basement map of the NE Atlantic Margin; 2) characterise heavy mineral populations in potential sourcelands and in the basins; 3) identify and correlate bulk provenance trends in sandstones; 4) assess of sand modification processes and controls during transport; 5) Determination first-cycle supply and sediment pathways into Mesozoic basins; and constrain exhumation histories for potential basement source blocks.

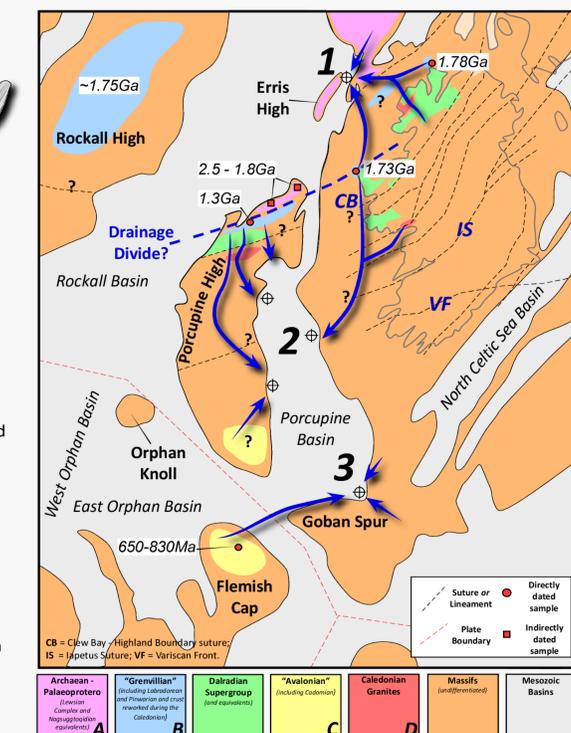


Results and Interpretation

The Source: new data on regional basement

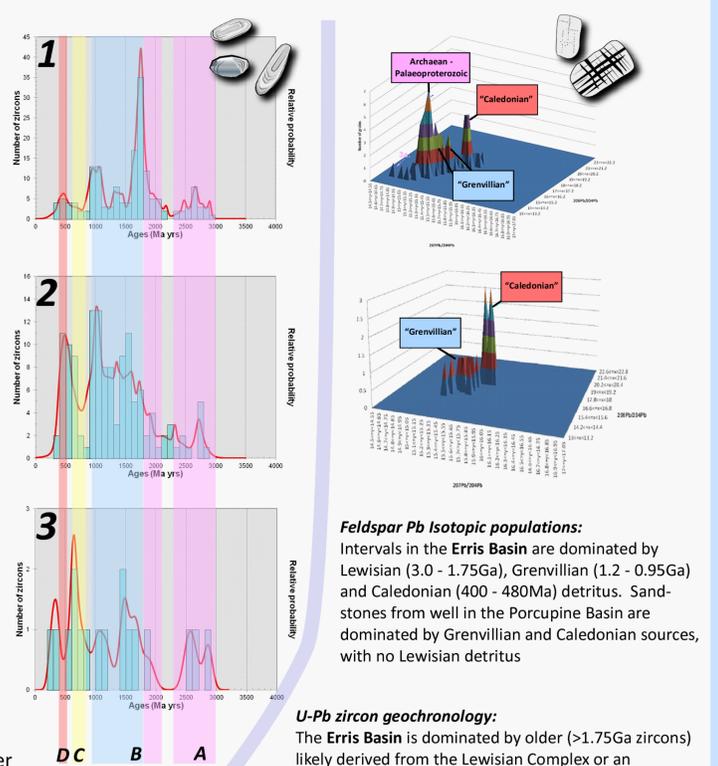


Newly dredged samples from the Porcupine High (area 1, above) are orthogneisses of syeno-granitic composition. U-Pb zircon age data (above) suggest that these rocks correspond to the Lewisian Complex of NW Scotland and/or the Nagsugtoqidian of eastern Greenland, with some minor components of broad Laurentian affinity. Pb isotopic analysis of K-feldspar (left) supports this correlation. These new data suggest a previously unrecognised and complex metamorphic terrane on the Porcupine High, correlatable with rocks onshore/offshore NW Scotland and in eastern Greenland.



Lower Cretaceous (Aptian) reconstruction of the North Atlantic (after PAD 2006) showing the position of basins, offshore crustal blocks, major sutures and lineaments and broad crustal/basement affinity based on new (left) and published basement data. Also shown are possible sediment dispersal pathways and drainage divides based on new provenance data (right).

The Sink: new detrital data from the basins



Feldspar Pb Isotopic populations: Intervals in the Erris Basin are dominated by Lewisian (3.0 - 1.75Ga), Grenvillian (1.2 - 0.95Ga) and Caledonian (400 - 480Ma) detritus. Sandstones from well in the Porcupine Basin are dominated by Grenvillian and Caledonian sources, with no Lewisian detritus

U-Pb zircon geochronology: The Erris Basin is dominated by older (>1.75Ga zircons) likely derived from the Lewisian Complex or an equivalent, the Porcupine Basin by Caledonian and typical "Laurentian" ages and the Goban Spur comprises 600 - 800Ma aged grains potentially derived from the Flemish Cap or an equivalent.

Heavy mineral assemblages: HM assemblages are typical of derivation from passive margin continental crust. Variations in mineral indices occur in all wells and could indicate changing provenance. Apatite is sparse or absent implying chemical weathering during storage.

Integrated palaeodrainage model for the Lower Cretaceous

Acknowledgements

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