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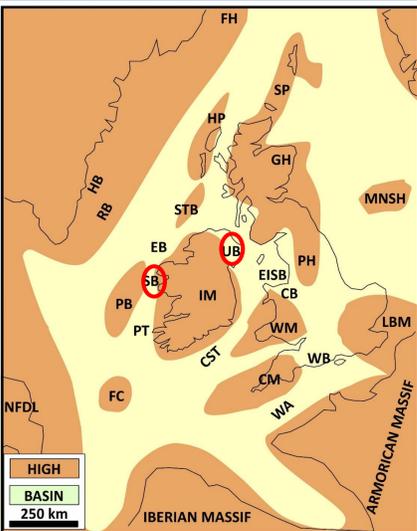
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Introduction



This project aims to investigate the provenance of Middle-Upper Triassic sandstones in the Slyne Basin, offshore western Ireland and the Ulster Basin, northern Ireland. Ongoing investigations of Permo-Triassic basins along the NE Atlantic margin aim to better understand large-scale drainage patterns throughout the Mesozoic, to better predict sand distribution across these basins, and to potentially identify links between basins on the Atlantic conjugate margins. There exists a detailed understanding of the palaeodrainage of many Triassic basins across much of Britain due to the abundance of proven and exploited hydrocarbon reservoirs on and offshore. Peripheral basins such as the Slyne Basin, offshore west of Ireland, are less well understood. These basins contain reservoir sandstones often of high quality and therefore need to be further assessed to allow for de-risking of ongoing hydrocarbon exploration.

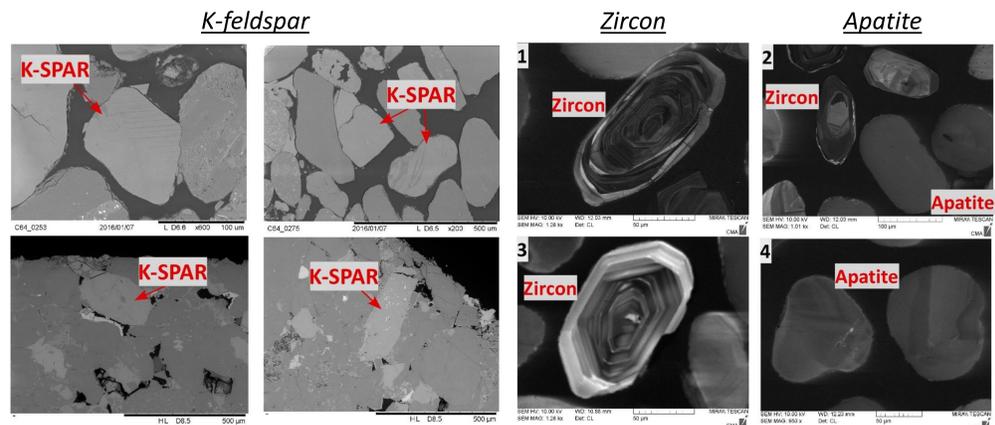
Palaeogeographical reconstruction of Triassic Basins on the NW European margin, Slyne Basin and Ulster Basin are circled in red

Methodology - Multi-Proxy Approach

This study utilises a combination of three provenance techniques, U-Pb zircon and apatite geochronology and Pb isotopic analyses of K-feldspar.

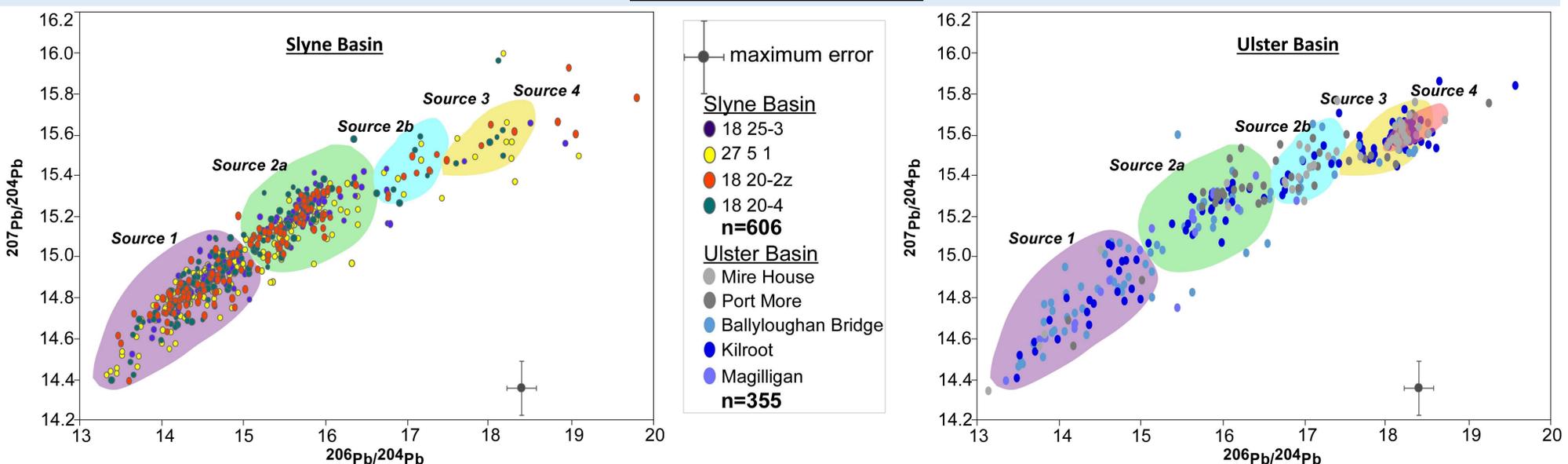
Pb isotopic analysis

U-Pb Geochronology



Results

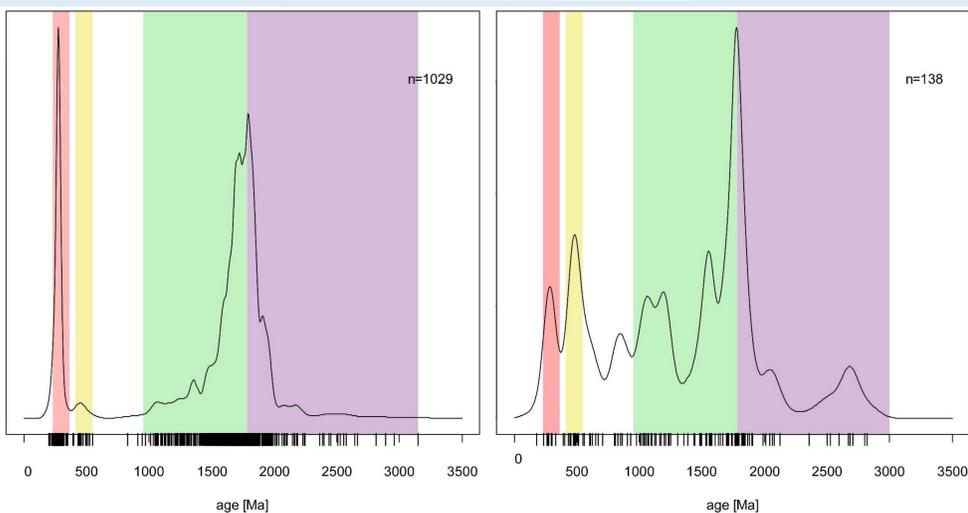
Pb isotopic analysis – K-feldspar



Pb isotopic plots ($^{206}\text{Pb}/^{204}\text{Pb}$ vs $^{207}\text{Pb}/^{204}\text{Pb}$) of targeted K-feldspar grains, from the Slyne Basin wells (left) and the Ulster Basin (right), coloured polygons represent published data for Pb crustal terranes, see legend below

>1.79Ga – Lewisian, Nagssugtoqidian | 1 - 1.79Ga – Porcupine, Rockall, Rhinns | 1.18 - 1.75Ga – Annagh Gneiss Complex | 400-500Ma – Caledonian Granites | 250 – 300Ma – Permian Volcanics | 300 - 350Ma – Variscan

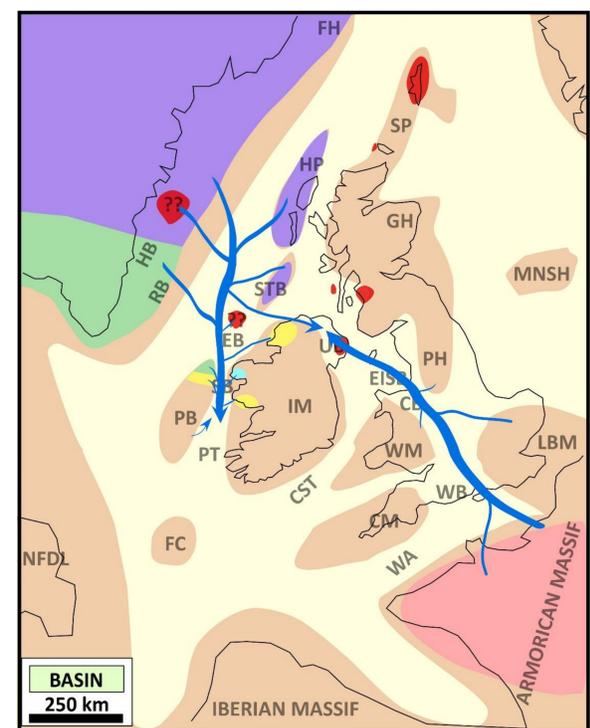
U-Pb Geochronology – Slyne Basin



Kernel Density Plots showing the U-Pb ages (^{207}Pb corrected) of detrital apatite grains (left) and detrital zircon grains (right) from Triassic sandstones in the Slyne Basin, coloured polygons refer to certain crustal affinities as in the legend above, data with >25% discordance were rejected

Provenance Interpretation

Results from the Pb isotopic analysis of K-feldspars in the Slyne Basin reveals mixed Archaean - Proterozoic sources (above). U-Pb ages of apatite and zircon grains are consistent with the sources identified by the Pb isotopic analysis of K-feldspar, however a Permian-aged population, with no clear equivalent K-feldspar, has also been detected (left). These data indicate sediment in the Slyne Basin was sourced from northern sources and from the flanks of the basin, i.e. the Irish Massif. Pb isotopic analysis of K-feldspar from the Ulster Basin also reveals a mixed Archaean - Proterozoic source, however a significant Variscan signal has also been identified, which is not seen in the Slyne Basin. This would indicate that the Ulster Basin was situated at the drainage divide between the system supplying the basins offshore W Ireland, i.e. the Slyne Basin, and the system which drained the Variscan Mountains supplying sediment to basins onshore UK, i.e. the Wessex Basin and the East Irish Sea Basin.



Palaeogeographical reconstruction of Triassic Basins on the NW European margin with coloured polygons representing various crustal source terranes, as in legend above, blue arrows indicate palaeoflow into the Slyne Basin, offshore western Ireland, from the north and into the Ulster Basin, northern Ireland, from the north and south

Conclusions

- Slyne Basin provenance dominantly from the north – Archaean-Palaeoproterozoic terranes
- Multi proxy approach uncovered previously unrecognised source – Permian volcanics
- Ulster Basin provenance shares affinity with Slyne Basin but also a strong affinity with UK basins such as EISB – location of drainage divide between two systems
- U-Pb apatite geochronology will further refine Ulster Basin provenance