# Establishing provenance links between onshore and offshore sedimentary basins of southern Ireland: a detrital mica and zircon isotopic study.

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## 1. Background

Orogenesis and associated uplift, weathering and erosion fundamentally control sediment transport, deposition and basin development. Geochronological and thermochronological techniques are useful in assessing sediment source-to-sink routes, recycling events and help further constrain depositional ages of strata. This study aims to establish the source of offshore basin fill in the Mesozoic South Porcupine, North Celtic Sea and Fastnet Basins; providing a tectonostratigraphic model for hydrocarbon exploration.

## 2. Aims and Methods

Aims:

- To determine the provenance of sediments in offshore southern Ireland sedimentary basins
- To establish processes of exhumation and erosion in the Dingle and Munster Basins

For each of the five sedimentary basins, the following analytical tools will be employed:

- SEM-CL for detailed grain analysis followed by LA-ICP-MS zircon U/Pb and mica Ar/Ar dating.
- Detailed petrographic investigation – interbasin comparison and sediment characterisation

## 3. Sampling

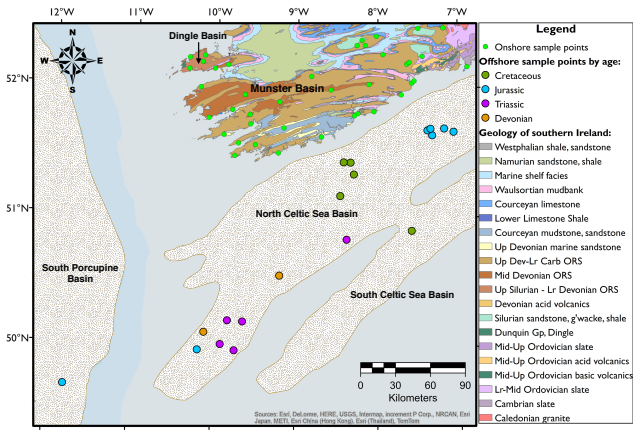


**Figure 1.** Geological map of southern Ireland showing distribution of onshore and offshore samples. Onshore basement geology supplied by Geological Survey of Ireland.

A total of 40 samples were taken across the Dingle and Munster Basins and their distribution can be seen in Figure 1. Sampling focused on medium to coarse-grained sandstone and pebbly-sandstones, collected from stratigraphically constrained field locations. One such location is shown in Figure 2.

Offshore sampling targeted coarse-grained sandstones where available with the aim of producing an even geographic and stratigraphic spread within the Porcupine, North Celtic Sea and Fastnet Basins. Approximately 20 samples were taken from historic oil and gas exploration wells stored at the Petroleum Affairs Division core shed in Dublin. Short sample descriptions are shown in Table 1.

**Figure 2.** Dune-bedded aeolian sediments of the Galtymore Formation.

**Table 1.** Well number and sample intervals for offshore Porcupine, North Celtic Sea and Fastnet basins.

| Well | Sample Type | Interval | Lithology | Age |
|---|---|---|---|---|
| 48/18-01 | CHIPS | 850 m - 1160 m | mudstone, sandstone and conglomerate | Cretaceous |
| 48/19-01 | CHIPS | 3950' - 4920' | light grey sandstone and interbedded claystone | Cretaceous |
| 48/24-04 | CORE | 3276' - 3323.2' | grey, fine-grained sandstone | Early Cretaceous |
| 48/28-01 | CHIPS | 4600' - 5420' | white, fine-grained sandstone | Early Cretaceous |
| 49/09-02 | CORE | 2460' - 2496' | dark grey, fine-grained, well sorted, poorly consolidated sandstone | Early Cretaceous |
| 49/09-03 | CORE | 7854' 6" - 7874' 44" | creamy white, fine-grained, well sorted sandstone | Upper Jurassic |
| 49/09-04 | CHIPS | 1612 m - 1717 m | interbedded sandstone and mudstone and minor conglomerate | Middle to Late Jurassic |
| 49/10-01 | CORE | 6246' - 6282' | Light brown, pebbly, conglomerate | Upper Jurassic |
| 49/14-03 | PETROGRAPHIC | 11151.95' - 11160.05' | light brown, pebbly, poorly sorted sandstone | Upper Jurassic |
| 49/14-03 | PETROGRAPHIC | 11188' - 11190.58' | light brown, pebbly, poorly sorted sandstone | Upper Jurassic |
| 49/15-01 | CHIPS | 3630' - 4100' | creamy grey, medium- to coarse-grained, mod. sorted sandstone | Upper Jurassic |
| 55/30-01 | CHIPS | 1015-1260m | fine to very coarse santstone + claystone | Lower Cretaceous |
| 55/30-01 | CHIPS | 2600-2755m | conglomerate, silty-shale, sandstone, volcanics | Devonian |
| 56/15-01 | CHIPS | 7370' - 7550' | very fine-medium grained sandstone | Triassic |
| 56/15-01 | CHIPS | 8200' - 8335' | Old head sandstone equivalent | Devonian |
| 56/21-02 | CHIPS | 3380 - 3440 m | white to pink fine-coarse sandstone | Triassic |
| 56/22-01 | CHIPS | 3500 - 3846' | fine-coarse sandstone, with woody coal | Lower Cretaceous |
| 56/22-01 | CHIPS | 6900 - 7460' (EOH) | red fine-medium grained sandstone | Triassic |
| 56/26-02 | CHIPS | 1220 - 1380 m | sandstone, interbedded siltstone | Cretaceous |
| 56/26-02 | CHIPS | 3102 - 3136m (EOH) | orange medium grained sandstone, some siltstone | Triassic |
| 57/09-01 | CHIPS | 7780-8040' | claystone and interbedded sandstone | Triassic |
| 58/03-01 | CHIPS | 3258' - 3910' | interbedded claystone and fine-grained sandstone | Early Cretaceous |
| 62/07-01 | PETROGRAPHIC | 10237.4-10237.5' | white fine-medium grained sandstone | Jurassic |
| 62/07-01 | CHIPS | 10200-10350' | white fine-medium grained sandstone | Jurassic |
| 63/10-01 | CHIPS | 2856-2910m | fine-med grained, mod-sorted sandstone | Early Jurassic - Sinemurian |
| 64/02-01 | CHIPS | 2150 - 2220 m | pink/red medium-coarse grained sandstone | Triassic |

Photomicrographs of selected onshore and offshore samples are shown in Figure 3. Examples of the targeted minerals to be dated are shown in Figure 3.2 and 3.4.

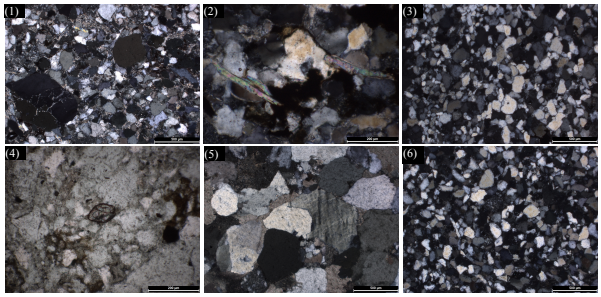


**Figure 3.** (1) XPL image from sample 210514-01, showing rounded, poorly sorted quartz. (2) Sample 130514-01 from east Cork displaying large muscovites. (3) XPL imagine of sample AK0401 from west Cork displaying compacted sublitharenite. (4) PPL image of a subrounded detrital zircon grain from well 49/14-03. (5) XPL imagine of sub-rounded quartz and feldspar from well 49/14-03. (6) Sub-rounded, poorly sorted quartzarenite from 62/7-01 well.

## 4. Summary

A total of 60 samples in the Munster, Dingle, North Celtic Sea, Porcupine and Fastnet Basins were collected. The samples have been processed and shipped to Amsterdam to begin separation and analysis. Data should return for processing and reduction by the end of November, 2014. This is further summarised in Figure 4.

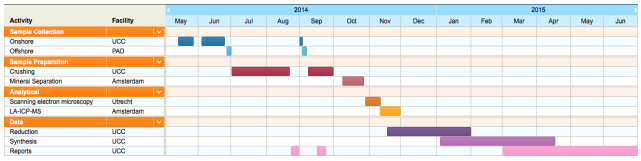


**Figure 4.** Gantt chart of completed and to-be completed tasks.

## 5. Acknowledgements

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