



## Archaeology Research Grant Report

Name of Grantee:	Paul Duffy
Title of Project:	Quarrying the Past: Petrographic analysis of Dublin's Medieval building stone
Amount and year awarded:	€1,600 in 2020

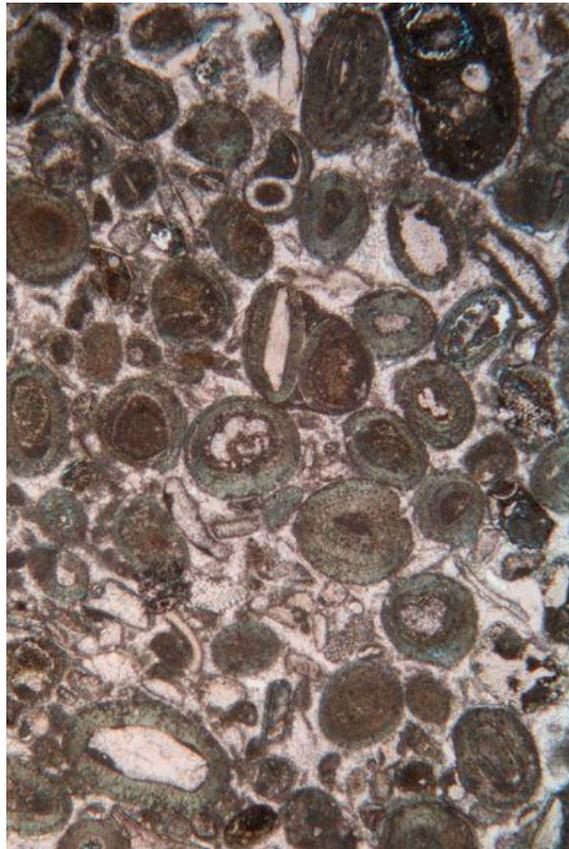
<p>Summary of report:</p>	<p>This project sought to expand upon the current knowledge of the nature and origin of Medieval imported stone employed for decorative carving in medieval buildings in Dublin. To this end, 24 samples were obtained from a variety of foundations across the city, supplemented by several samples from potential source quarries in Ireland, Britain and France.</p> <p>These samples were prepared for thin section analysis at MK Factory laboratory in Germany before being subjected to petrographic analysis using a polarising microscope by Prof Sara Pavia at Trinity College Dublin.</p> <p>The composition and microstructures of the samples from the source quarries were studied first in order to provide a baseline against which the worked stone could be compared. The other stone was then compared to these and to each other and eight of these were confirmed as Dundry, two of Bath stone and one of Caen stone.</p> <p>The correspondence between the sandstones is far from clear and the fact that only a single sample from a prospective source quarry could be obtained for the study limited the range of comparison that could be carried out. Samples 7 and 8 from Aungier Street matched the Carrickleck quarry sample in some respects, though it was not a clear correspondance.</p> <p>Samples 5 and 6 from Thomas Street contained more carbonate cements than the Carrickleck quarry while sample 4, also from Thomas Street differed significantly from the Carrickleck sample.</p> <p>Important information for the importation of limestone into Ireland from the 12th to 14th centuries was obtained by the study. Further work is needed on the sandstones however and more potential source quarry material will be needed in future in order to create a baseline against which this sandstone can be compared.</p>
<p>Please outline the objectives of the Project:</p>	<p>The principal objective of this project was to identify the nature and origin of imported stone employed for decorative carving in medieval buildings in Dublin. Specifically, this study sought to confirmation via petrographical analysis of long-held assumptions regarding the prevalence of Dundry Stone in Dublin. By examining alternative source quarries of similar type stone, it was hoped to broaden the picture and increase the precision in identifying imported limestone during this period.</p> <p>In addition it was hoped that petrographical analysis of a range of sandstones not native to Dublin would help to suggest an area of provenance for this medieval building stone which appears to replace imported limestone from the 15th century onwards.</p> <p>A secondary objective of the project was to identify whether the changing sources of stone employed in later gothic building and remodelling identified at several sites, can shed light on changing patterns of patronage and fluctuations in colonial fortune.</p>



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Please describe the methodology used in conducting the research:

The selection of the samples was informed by the availability of material and the range of material represented in each assemblage. Several source samples from quarries were also obtained.



The 24 samples were sent to MK Factory in Dusseldorf, Germany for thin section preparation.

1. The sample is cut with a water-cooled diamond saw, signed and then dried in a furnace at 45 degree heat to remove moisture.
2. The dried sample is put in an aluminium box.
3. The sample is impregnated with coloured epoxy-resin in a vacuum exsiccator.
4. The resin is allowed to set before the aluminium box is removed from the sample.
5. The bottom of the sample is ground to create a fresh, flat surface.
6. The new surface is lapped for 45 minutes with a suspension of silicon carbide powder of 9  $\mu\text{m}$  and water and the surface is cleaned after lapping.
7. The glass slides for the thin section are lapped with the same fraction of SiC.
8. The sample is then adhered to the glass slide with epoxy resin and kept in place with a squeezer block until hard.
9. The glass surface is cleaned and signed with a diamond-pen or similar.
10. The resulting slide will comprise 250  $\mu\text{m}$  or less of rock on the glass.
11. The thin section will be lapped up to a thickness of 30  $\mu\text{m}$  (or less) on the lapping machine (LP 50 auto, LOGITECH).
12. The thin section is covered coverglass of 150  $\mu\text{m}$ , and composed of an ultra-violet resin (cyan acrylate).
13. The thin section is cleaned with alcohol.



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	<p>Once the thin sections were received, each thin section was analysed with a polarising microscope. Polarised-light microscopy has been widely applied to heritage materials for the assessment of composition, to diagnose damage and to identify their source.</p> <p>The polarizing microscope, also known as petrographic microscope, is an established tool in archaeology, geology and material science which can be used to identify sources of raw materials and to attribute stone and ceramic artefacts to their geological source.</p> <p>The technique of examining rocks in thin section using a polarising microscope was developed in the mid-19th century: it was found that a slice of rock, if ground sufficiently thin, becomes transparent, and thus amenable to microscopic examination. This technique was applied in the late 19th century to archaeological problems, however, its first notable success in archaeology came later, when the 'blue stones' from Stonehenge were traced to a source in South-west Wales.</p> <p>As with conventional microscopes, the objective enlarges the image and the eye piece magnifies the object further. However, the petrographic microscope differs in that it is equipped with two polaroids: a polarizer and an analyser, fitted above and below the specimen to examine specimens with transmitted polarized light using a light source below the stage. Minerals are identified by studying their optical properties, a graduated rotational stage allows angles to be measured and approximately twelve optical properties can be determined.</p>
<p>Please outline the findings of your research and/or milestones achieved:</p>	<p>The petrographic analysis succeeded in confirming that the stone from the 14th century Saint Mary's Abbey gatehouse, the stone from the c. 13th century precinct and church of the Abbey of Saint Thomas the Martyr, and a stone from Saint Peter's Church all came from the quarries at Dundry near Bristol. Ex-situ column capitals from Saint Patrick's Cathedral were also shown to come from Dundry which now allows this assemblage of pieces to be attribute to the medieval period and not to the 19th century renovation.</p> <p>The identification of the stone from the 13th century Chapter House of Christ Church Cathedral as coming from Bath is significant. This finding illustrates that different sources of stone were being drawn upon by the masons of Dublin and further work may allow comment on whether stone types can be aligned to date ranges for various structures.</p> <p>The correspondence between the sandstones however was more difficult to confirm and the fact that only a single sample from a prospective source quarry could be obtained for the study limited the range of comparison that could be carried out. Samples 7 and 8 from Aungier Street matched the Carrickleck quarry sample in some respects, though it was not a clear correspondence. Samples 5 and 6 from Thomas Street contained more carbonate cements than the Carrickleck quarry while sample 4, also from Thomas Street differed significantly from the Carrickleck sample.</p> <p>Further work is needed such as the comparison of the specimens in this research with the relevant materials from other petrographic studies from Dublin, however, this project has resulted in the creation of a small collection that will be made freely available to other researchers. It is intended to grow this collection over the coming year to include samples from potential source quarries in the Cavan/Monaghan area as well as from prospective source quarries for sandstone in Fingal and Egryn in Wales.</p>
<p>Please provide details of the</p>	<p>As the report has just been finalised, no opportunity for publication has yet been pursued, however several papers will be submitted detailing the results over the coming months (these are detailed below).</p>



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<p>dissemination of the outcomes from this project:</p>	<p>However, during the course of the project I delivered a lecture to the Royal Society of Antiquaries on the subject of this project, I also gave talks to the Heritage Society in December 2020 and I will be addressing the Trinity College Archaeological Society in the first week of February as well as a class of architecture students at TU Dublin in coming days - all on the subject of the medieval architecture and building material of Medieval Dublin.</p>
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<p>How will you continue to communicate the results of your project and what are your publication plans?</p>	<p>Over coming months, myself and Prof Sara Pavia will be preparing a paper on this project for submission to Proceedings of the Royal Irish Academy: Archaeology, Culture, History, Literature. I will also be preparing a paper for submission to the Friends of Medieval Dublin in the hopes that I can present on the subject should this year's Symposium go ahead. Separately Sara is preparing a paper for submission to the journal Archaeometry and I will submit a shorter, public interest piece to Archaeology Ireland. In addition, I will avail of both my employer's (IAC Archaeology) and my University (Leicester) social media pages to further disseminate findings.</p>
<p>How did the award enhance your professional development?</p>	<p>This project allowed me to reach out and form a working academic relationship with Prof Sara Pavia of Trinity College Dublin. During the course of the work, I collaborated with Prof Laurent Dujardin of Roehampton University, Prof emeritus Roger Stalley of TCD, and Dr Timothy Palmer of Aberystwith University. This project has enabled me to forge international links which will be very useful in advancing this line of study over coming years.</p>



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	<p>The project has also exposed me to thin section analysis and has improved my ability to identify stone types by sight - a skill that will be instrumental in discovering more medieval assemblages from excavations in Dublin City.</p>
<p>What plans (if any) do you have to further this project?</p>	<p>I plan to publish on the results of the Quarrying the Past project, as outlined above. Further, this study will be built upon as I progress through my PhD at Leicester University and I intend to continue to grow the collection of thin section reference slides with a view to establishing provenances for all of the exotic medieval building stone of Dublin.</p>