



GSI Equipment Call Projects

In 2021 Geological Survey Ireland awarded eight small scale equipment grants through a competitive call to academic groups. These items have now been purchased and fitted by the host institute. To access any of the facilities below, please contact the named project lead.

Project title/Equipment: Fourier Transform Infrared Spectrometer for the characterisation of geologic and environmentally-relevant materials and rocks.

Description of equipment purchased: The purchased equipment is a Nicolet Summit Fourier Transform Infrared (FTIR) Spectrometer designed for the characterisation of geologic and environmentally-relevant materials and rocks. It includes a LightDrive Optical Engine technology to analyse samples using a single-point source with non-migrating hotspot. The instrument has an interferometer with KBr/Ge coated beamsplitter and dynamic alignment (wavelength range 8,000-350 cm⁻¹) and includes a solid-state, temperature controlled diode laser and a high performance deuterated triglycine sulfate (DTGS) detector.

This FTIR comes a single unit and includes the following sub-components:

- An OMNIC Paradigm Desktop Software for material characterization.
- An iD1 Transmission Accessory to accommodate gas or liquid transmission cells, thin film or pellet holders, gas cells and cuvettes up to 10 cm.
- An Everest Diamond ATR Accessory for material identification and verification need.
- An AR Diamond Crystal Plate for Smart iTX/iD7/Everest Attenuated Total Reflection.
- A 22-inch High-Definition Monitor.
- A Wireless Keyboard and Mouse.



Location and information on how other researchers can access it/collaborate

The FTIR instrument has been installed in the Earth Surface Research Laboratory ([ESRL](#)), a research facility established by GSI and TCD in 2019 to provide state-of-the-art bulk-rock geochemical analyses for the research community in the island of Ireland. Any researcher can access the equipment for free or at a discounted rate (see website). The ESRL is located in Unit 6 Trinity Technology and Enterprise Centre, Dublin 2. The FTIR is run through the ESRL. The technicians are fully trained and are able to measure samples and also train frequent users, manage bookings and organise maintenance.

Anyone based on the Island of Ireland can apply to use the FTIR instrument via the ESRL facility access. This also includes international researchers who are collaborating with researchers based in Ireland. There are three main access routes by which projects requiring FTIR measurements can access ESRL facilities:

A) Unfunded pilot/short projects (small or pilot projects that require less than 24 hr of analysis time). Applications can be submitted at any time and are approved by the ESRL Director. Free analyses are offered to users without funding (e.g., undergraduate students).

B) Unfunded open call projects (larger projects that require more than 24 hr of analysis time). Applications are submitted in bi-annual open calls and will be reviewed by the ESRL Scientific Advisory Committee.

C) Projects with grant funding. Applications are submitted at any time and the feasibility/suitability of the proposed analysis will be checked by the Director (<24 hrs analysis time) or the Scientific Advisory Committee (>24 hrs analysis time). Analyses are free for GSI-funded projects. Non-GSI projects are charged at a rate agreed with the Director prior to commencement of work. International projects must include the ESRL or a researcher based on the Island of Ireland as a collaborator.

Leader: Dr Juan Diego Rodriguez-Blanco, Trinity College Dublin

Award amount: €20,828.26

Project title/Equipment: Polishing system for laser ablation ICP-MS and SEM samples (pucks/mounts).

Description of equipment purchased: The instrument is a polisher and grinding machine (LaboPol-30) with automated specimen holder and doser (LaboForce-100 and LaboDoser-100). It is designed primarily for grinding and / or polishing up to six 25mm diameter pucks at once.

The LaboPol-30 grinding/polishing machine has variable speed (50-500 rpm) and can take 230, 250, or 300 mm diameter grinding/polishing disks (TCD uses 250 mm). It comes with a manual splash guard and bowl liner. The LaboForce-100 is a semi-automatic rotator for six samples (up to 40 mm in diameter) and the LaboDoser-100 is a dosing unit for automatic delivery of diamond suspensions to the polishing zone.

During the purchasing stage, we successfully negotiated with Struers to include a set of free polishing consumables as detailed in the attached quote. This included a MD Allegro grinding disc, MD-Nap polishing cloths, lubricant and diamond polishing suspensions (1 and 6 micron).



Location and information on how other researchers can access it/collaborate: The system is housed in the fission track laboratory in the Department of Geology, Museum Building, Trinity College Dublin. For access and further information, any potential users should email Prof. David Chew (chewd@tcd.ie).

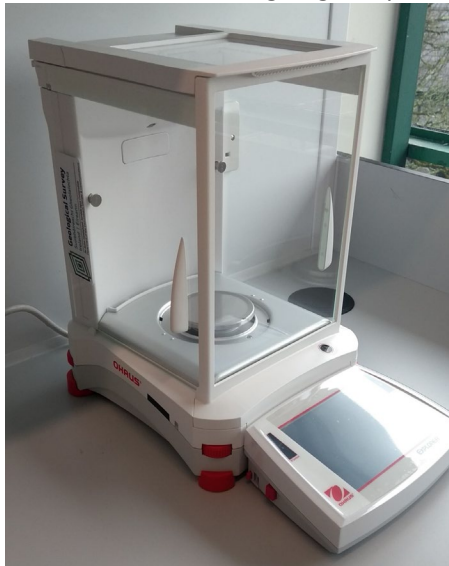
Leader: Prof. David Chew, Trinity College Dublin

Award amount: €19,442.86

Project title/Equipment: The Irish Cosmogenic Nuclide Facility (ICNF): Growing Ireland's capacity for cutting-edge cosmogenic nuclide geochronology

The Irish Cosmogenic Nuclide Facility is the first such clean laboratory facility in the Republic of Ireland devoted specifically to cutting-edge cosmogenic nuclide (CN) geochronology. Based in the Martin Ryan Institute at NUI Galway and managed by Geography's *Palaeoenvironmental Research Unit* (PRU), this new facility will enable the PI and partners at UCD and TCD, in addition to Ireland's growing community of CN geochronology practitioners, to convert pure mineral separates (e.g. quartz, feldspar, pyroxene) into targets for accelerator mass spectrometry (AMS). Currently, there is no capacity for this stage in Ireland and samples must be prepared abroad either in collaborating institutions or commercially. Capitalising on the recent construction of our clean lab space in the Martin Ryan Institute, part of the host institution's 2020-2025 strategy to prioritise research on *Ocean, Freshwater, and Terrestrial Ecosystems* and to foster *Climate Action*, we purchased for following equipment for the lab, with GSI funding, that are central to the production of AMS targets.

Microbalance, for weighing samples and carrier to 0.01mg resolution.



Centrifuge, for the precipitation and concentration of beryllium-hydroxide samples.



MilliQ water system, used in all steps of cosmogenic nuclide geochemistry.



In addition, we purchased the following items that are vital to the ICNF (photos overleaf):

Binder oven, for drying beryllium-hydroxide samples prior to combustion.

Water pump, to bring the pressure up to a requisite level for the MilliQ system (this 2nd-floor lab has relatively low water pressure).

Teflon ware, in which quartz samples are dissolved and subsequent conversions occur.

Dowex ion chromatography resin & columns, for anion and cation exchange.

Binder oven.



Teflon ware



Water pump.



Location and information on how other researchers can access it/collaborate

All equipment purchased as part of this award is housed in 302 Martin Ryan Building on the University of Galway campus. This clean room space is managed by the discipline of Geography and, once fully functional, prospective collaborators are encouraged to contact the lab manager, Gordon Bromley, via email (Gordon.bromley@universityofgalway.ie).

Leader: Dr Gordon Bromley, National University of Ireland, Galway

Budget: €21,893.00

Project title/Equipment: Raising capability to determine the carbonate chemistry of Aquatic systems.

Description of equipment purchased: An AS-ALK2 total alkalinity titrator system, developed by Apollo Sci. This system consists of two high precision digital pumps (adjustable from 1 to 25 mL) for precise delivery of reagent and sample solutions (Kloehn, USA), a research quality pH meter (Fisher Thermo Orion, USA), and combination glass pH electrode (Orion, USA). A laptop PC is also included as part of the data acquisition unit. AS-ALK2 is designed for both laboratory and shipboard use accommodating small sample volume (1 – 25 mL) at exceptional precision ($0.1\% / \pm 1\text{--}2 \mu\text{mol/kg}$ or better). The titrator is fully automated with standardization and sample analysis. AS-ALK2 provides Gran titration for alkalinity determination of both seawater and brackish waters in about 8 minutes per sample and has been tested in a variety of aquatic conditions such as in river and lake waters, coastal and open ocean waters, sediment porewater, and groundwater. Full temperature control is provided on all liquids. Water jackets are used to surround the digital syringes for temperature control. To ensure high-quality data, a water bath is used to help maintain a constant temperature throughout the titration analysis.

This system is specifically built and tested for shipboard use (Figure 1). The advantage of measuring samples during a survey is that the water does not have to be poisoned with hazardous mercuric chloride to stop algal growth. Further, the immediate analysis affords the best quality data as long-term storage can be an issue (e.g., glass stoppers not sealed properly, degassing).

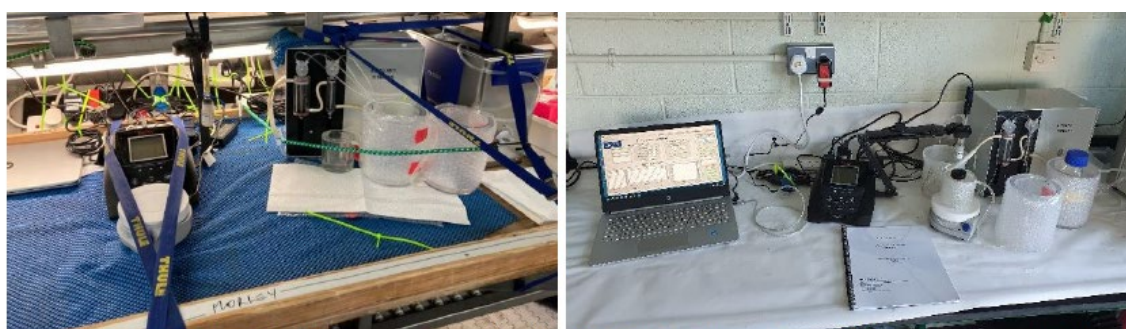


Figure 1. On the left: the AS-ALK2 System is secured on the RV Celtic Explorer during LABSEA mission to the Labrador Sea. On the right: Here the system is shown in LAB 327 in the MRI Building at the University of Galway

Location and information on how other researchers can access it/collaborate: The system is currently set up for use in LAB 327 of the Martin Ryan Marine Sciences Building at NUI Galway and is affiliated with the Centre for Ocean Research and Exploration (COREx) and the Ryan Institute (Figure 1). All researchers are welcome to use the equipment upon request, contact Dr Audrey Morley.

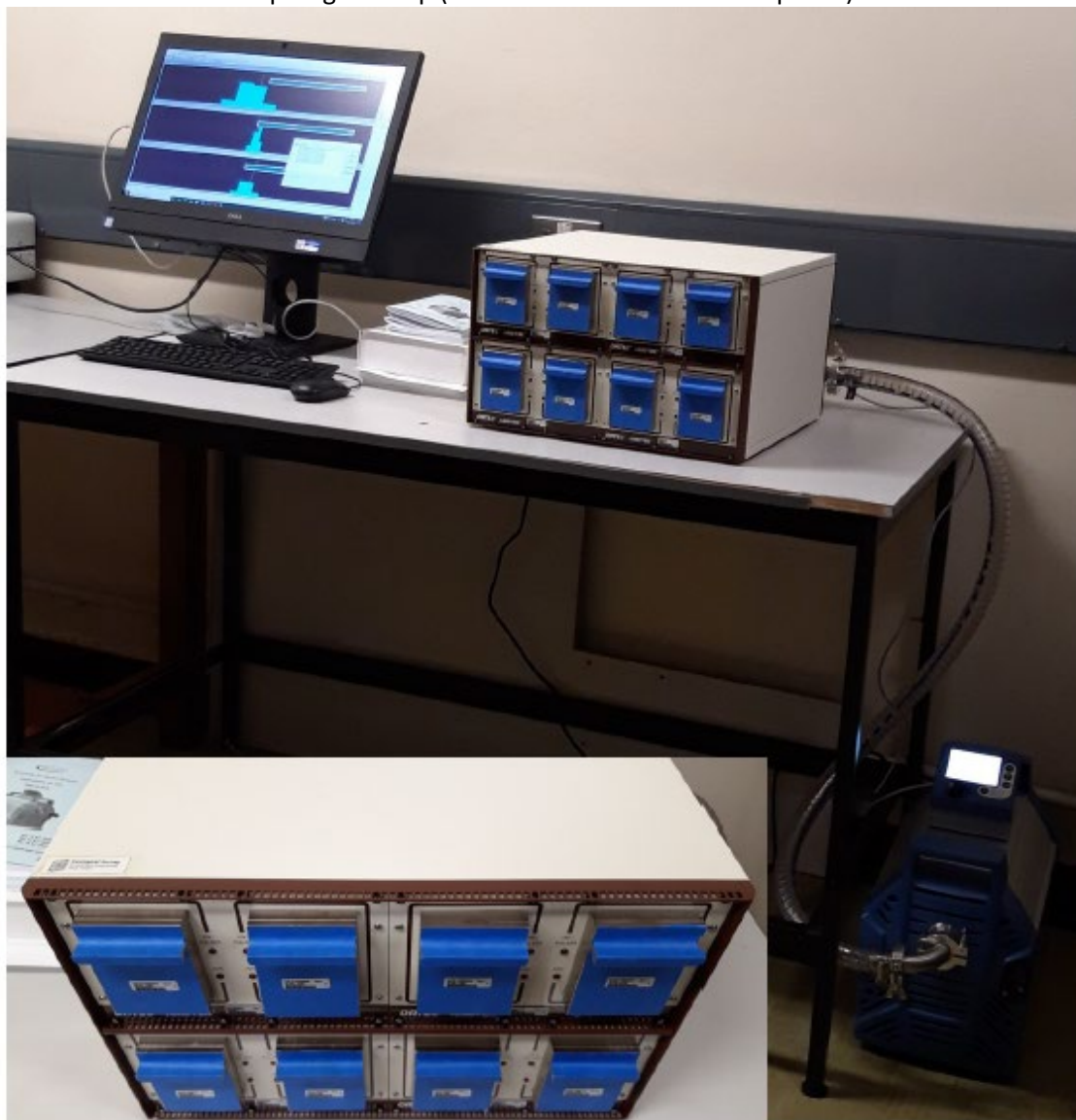
Leader: Audrey Morley, National University of Ireland, Galway

Award amount: €20,966.00

Project title/Equipment: Pb-210 alpha counter

Description of equipment purchased: The following items were purchased:

- An Ortec Modular alpha spectrometer with 8 chambers (grey/brown module in inset)
- 8 450mm ultra detectors for the alpha suite
- Sample tray assembly
- Alphavision software (shown in action on screen of PC)
- MV10NT Vario Diaphragm Pump (located on the floor in main photo)



Location and information on how other researchers can access it/collaborate:

The alpha-counting equipment has been placed in the basement of the 14CHRONO Laboratory, 42 Fitzwilliam Street, Queen's University Belfast, Belfast BT9 6AX.

Access to the alpha counting equipment will be provided to external collaborators on a non-profit basis. Researchers and research students across the island of Ireland will be able to make use of the equipment while paying for consumables (glassware, chemicals, silver condensation plates, standards; c. £50 per sample) as well as for technician time if required.

Dr Lisa Coyle-McClung (LCM), one of 14CHRONO's technicians, has been tasked to operate the equipment as well as to prepare the sediment samples for measurement.

Currently we are setting up a preparation system to handle sediment samples. Given the need for a polonium tracer for calibration of the sediment ^{210}Pb measurements as well as owing to the required usage of HF and other strong acids, for now the preparation of sediment samples will be handled by LCM.

In case potential users do already have proven experience with relevant laboratory techniques, after discussions with LCM, the building's Safety Officer Mr David Brown and 14CHRONO Director Dr Maarten Blaauw (MB), and after receiving further tailored training by LCM, they could be given permission to use the equipment under guidance from LCM (with reduced charges for technician time). Otherwise users will be charged for technician time.

Dr Blaauw will provide assistance with and training in the Bayesian analysis of the ^{210}Pb data, including possible combination with other types of chronological data. Although this numerical assistance will be provided at no cost, co-authorship or acknowledgement in resulting publications would be appreciated. If relevant, potential users of the alphacounting equipment are welcome to request receiving hands-on training in the pretreatment for ^{14}C analysis of their sedimentary samples within the 14CHRONO laboratory. This will enable reduced user costs for ^{14}C dating.

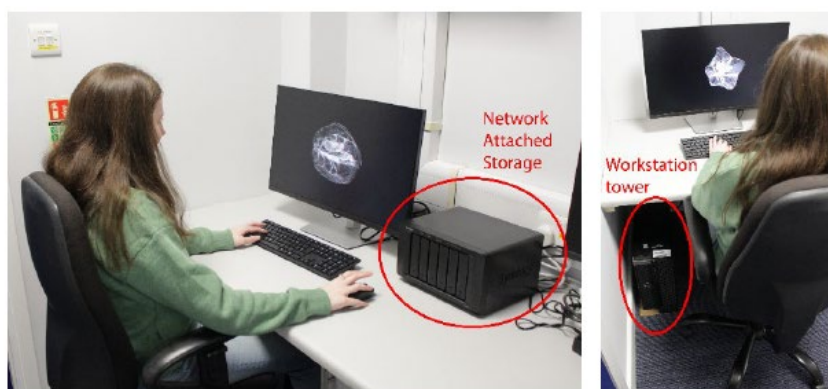
Leader: Dr Maarten Blaauw, Queen's University Belfast

Award amount: €25,000.00

Project title/Equipment: The first dedicated visualisation workstation for 'virtual geoscience' in Ireland.

Description of equipment purchased: The proposed workstation was designed to visualise the 3-dimensional surface and volume data of geoscientific objects on all scales. To this end, the funds supplied by GSI have facilitated the purchase of a dedicated desktop computer with extraordinary graphics capabilities, large in situ digital data storage, and video/image visualization software. The workstation comprises:

- 1) A workstation tower (Dell Precision 5820 Tower XCTO Base), including an Nvidia RTX A6000, 48GB graphics processor;
- 2) a wireless keyboard and mouse (Dell Pro);
- 3) two 27" monitors (Dell P2722H);
- 4) a Network Attached Storage (NAS) server (Synology Disk Station DS1621+);
- 5) two 12Tb NAS hard disks (Seagate IronWolf Pro ST12000NE0008);
- 6) two 4Tb external hard disks (Seagate One Touch); and
- 7) two annual subscriptions for Adobe Creative Cloud (with Educational Institute Discounts).



With this combination of hardware and software, users can visualize a broad range of visual data sets, and produce 2-dimensional surface and 3-dimensional volume renderings. Ostensibly, the workstation is designed for use with geoscientific data, although the versatility inherent in this setup lends itself to any basic or applied 3-dimensional data set; Descriptions provided will be published on the GSI website. e.g., medicine, engineering, archaeology, etc.

The equipment is housed in the Virtual Tomography Laboratory, UCC, Butler Building

Leader: Chris Mays, University College Cork

Amount awarded: €17,804.00

Project title/Equipment Enhancement of Environmental Geoscience Lab.

Description of equipment purchased: The Proteus Multi-Parameter Water Quality Sensor is an award-winning, patented, multi-parameter, real-time sensor platform to accurately and reliably measure BOD, COD, TOC and Coliforms (total, E. coli or faecal) in permanent and temporary applications. It is the world's first scientifically proven real-time sensor for measuring BOD that can measure a wide range of water quality, environmental and industrial applications. The Proteus sensor has been designed for its ease of use, reliable data and economical operation. The major benefit to the sensor is that it includes a vast array of parameters for in-situ detection, thus increasing the scope of current research and the variety of further research.

Location and information on how other researchers can access it/collaborate: The Proteus Instruments sensor is stored in the Environment and Health Lab in the Environmental Research Institute in University College Cork. Details of the equipment were shared internally with all relevant parties (those working in the area of water research) e.g. ERI. A user log was established which documents the signing in and out of the sensor and also allows for block booking of the instrument for temporal fieldwork. We are also currently in the middle of establishing a research website for those involved in water research in UCC and the Proteus Sensor will be listed as available equipment to attract further collaboration potential.



Leader: Dr Jean O'Dwyer, University College Cork

Award amount: €21,703.00

Project title/Equipment: Expansion of ICARUS Palaeo Research laboratory.

1) Furnace: Nabatherm Ashing Furnace

Status: This requires complex ducted install so will be installed in the new PaleoLab
Description: The furnace has a 15L capacity and a flap door. It has a maximum temperature of 1100°C, and is therefore suitable for determining the organic, inorganic and carbonate content of sediments.

2) Centrifuge

Status: Available and ready for research in ISCORF

Description: The Ohaus Centrifuge Multi FC5816 has rotor swing out arms holding 4x 250ml volume canisters. These can be adapted to different sample sizes as it has racks for 50ml and 15ml samples that can be placed in the canisters, as well as screw caps to prevent spillages.



3) Large fridge: Nisbets Polar G-Series Upright Double

Status: This will soon be located in a temporary lab space.

Description: This large fridge has a capacity of 1200 litres and internal dimensions of 138.6 (H) x 122 (W) x 65.3 (D) cm. It comes with six sturdy adjustable shelves and three floor shelves to maximise storage capacity. It will be used to store sediment cores up to 1m in length.

4) Wet Tile Saw

Status: In use in ISCORF

Description: A Flexovit TT180BM Water Cooled Tile Cutter is a lightweight tabletop tile saw with removable water tray, guide rail, tilting table for mitre cuts, and a diamond blade. Cutting depth is 34mm. It is primarily used for sectioning stalagmites, either cutting them in half, or to into more stable, easy to sub-sample sections.



5) Flex LE 12-3 Wet Polisher

Status: Main unit is available and ready for research in ISCORF.

Description: The Flex LE-12-3 is a variable speed wet feed polisher designed for polishing wet stone. It comes with a variety of polishing pads of different speeds. At ICARUS it is primarily designed for polishing calcite stalagmites after sectioning. High polish calcite surfaces allow for more visible and distinct internal layering and therefore more precise subsampling for isotope, trace element and geochronology analyses.



6) Dremel MultiTool

Status: In use in ISCORF

Description: The Dremel 3000 corded multi-tool serves multiple purposes in the ICARUS lab, included attachments for cutting, grinding, sanding, and polishing. The primary purpose in the lab is for sub-sampling stalagmites when chips are required rather than powder (e.g. for U/Th geochronology), and for use in preparing tree-ring cores.



7) Sherline MicroMill

Status: In storage for installation into new Paleo Lab

Description: A Sherline 18" NexGen Benchtop Mill with CNC controller, stepper motors and stepblock hold down set. The Sherline Micromill is used primarily for milling and drilling powder samples from stalagmites. Our version comes with the extended 18" mill base for additional travel and therefore milling of longer samples.

8) Bosch Gas25L Wet & Dry Dust Extractor

Status: In use in ISCORF

Description: A mobile, compact dust extractor that meets class "L" dust extraction, the Bosch Gas25L is used for keeping the lab clean and tidy and preventing cross contamination of samples. Will work on both wet and dry spills.

9) 2 Arm Gooseneck Light Guide

Status: Awaiting install of Sherline Micromill as part of regular use but is available where needed for other purposes. e.g. Illumination under microscopes

Description: A fibre optic 2 arm gooseneck light guide is ideal for providing additional light when working on high-precision tasks in the lab, primarily for milling with the Sherline Micromill but it can be used throughout the lab, for example, providing extra illumination when working under microscopes or with the Dremel Multi-tool.

10) Stereo Microscope

Status: In use in ISCORF and to be taken on fieldtrips for use by students on projects and in the evenings.

Description: Euromex EduBlue stereo microscope allows for quick and easy 3D assessment of materials under both reflected and transmitted light. Dual objectives allow for 10x and 30x magnification.



11) 4l Water Bath

Status: Available and ready for research.

Description: A Nickel Electro Clifton Unstirred Thermostatic Bath designed for immersion of flasks, bottles and racks in a temperature-controlled environment. In the lab, the water bath supplements several wet chemistry applications.



Location and information on how other researchers can access it/collaborate: Details will be added to the ICARUS website once final installation is complete.

It was expected that by the end of 2022 we would have the final palaeo lab completed, however this outcome was not achieved because of delays with building work elsewhere on campus. The plans for the palaeo lab space also became more ambitious during 2022, with the decision to create a palaeo teaching laboratory, suitable for welcoming school groups, as well as a research space for use by visiting researchers. While this change will be very beneficial in the long term, it caused some delays. It is anticipated that the refitting of the new labs will be completed within 2023. In the meantime, research is ongoing and much of the purchased equipment is in use in the existing ISCORF lab and a temporary lab elsewhere in the geography department.

Leader: Dr Lisa Orme/Dr Nick Scroton, Maynooth University

Budget: €25,500.00