



Research Programme
- Short Call 2022 –
- Final Report -

Lead Applicant Name	Una Farrell
Host Organisation name	Trinity College Dublin
Project Title	Digitization of Trinity Geological Museum Collection
Contract Number	2022-sc-024

This report covers the period 1st December 2020 to project end date (31/10/2023)



Research Programme - Short Call 2022 – Final Report

1. (a) Project information:

Final project report

Executive summary

The Trinity College Dublin Geological Museum (TCDGM) houses over 250,000 geological and paleontological specimens of scientific, cultural, and historic value. The first specimen in the collection dates to 1777, and the collection grew significantly from the early 1800s onwards (Wyse Jackson, 1992). In 2014 the Museum was moved to the “Trinity Technology and Enterprise Centre” near Grand Canal Dock, where it is not easily accessible. It had no digital record of its holdings.

Digitizing museum collection data has several demonstrated applications and advantages: it brings visibility and awareness to collections, highlights specimens that can be used for research, outreach and education, provides remote access, helps promote conservation, improves collection management practices, and even small collections can add valuable contributions to the global dataset, allowing for studies of environmental change on geological timescales (Allmon et al. 2018; Lieberman and Kimmig, 2018; Marshall et al., 2018; Nelson and Ellis, 2019; Popov et al., 2021).

We have installed the first online digital database at the museum using Arctos, a collaborative collection management system which accommodates a range of collection types. Data from 1133 fossil and mineral specimens, from four collections of scientific and historical significance, are now openly accessible through Arctos. Palaeontological data can also be accessed through the Global Biodiversity Information Facility (GBIF). The TCD Geological Museum is the first Irish institution to contribute Irish fossil data to GBIF and data from our collection have been part of 590 download events since release in May 2023. Workflows and protocols, scanned catalogues, conference presentations, and illustrated summaries of the digitized collections are also available on the TCD Geological Museum website.

- (i) Results, scientific/engineering targets reached beyond the state of the art and conclusions (please include additional information in Section 3 below)

Collection Management Database

We joined the Arctos community in January 2023. Arctos’ data model allows for a thorough and accurate documentation of collection data, and links information across a diverse network of natural history collections. The strengths of the database include strict adherence to data standards, customizable data entry and search pages, links to external resources (e.g. the classifications of Hey, Nickel-Struntz or Dana for mineral names), server space for media attachments, streamlined export to central data portals, and a very active and helpful community (**Error! Reference source not found.**).





Collaborative Collection Management System

-  Active, responsive community
-  Shared resources: agents, taxonomy, geography, media, publications, projects.
-  Export to Global Biodiversity Information Facility
-  Affordable
-  No IT support or server space needed
-  Accommodates rocks, fossils and minerals

Filters

423 Open 6,299 Closed

Author Label

Need Help with Arctos Error

Error Explanation Error Messages

#6975 opened yesterday by campmic

Feature Request - New transaction role: Outside institution

Enhancement Function-Transactions

Priority-High (Needed for work)

#6969 opened 2 days ago by KatherineInALanderson Needs Discussi...

Feature Request - New transaction field: Purpose of loan

Enhancement Function-Transactions

Priority-High (Needed for work)

#6968 opened 2 days ago by KatherineInALanderson

Agent Split Request - C. Thompson

Function-Agents

#6965 opened 3 days ago by DerekSikes Needs Docume...

deleting Media

#6962 opened 3 days ago by dustymc Needs Discussi...

Feature Request - removing "usage: citation no loan" report from the public view

Enhancement

Priority-Normal (Not urgent)

#6956 opened last week by ufarrell Needs Discussi...

Code Table Request - new event attribute: data management history

Function-CodeTables

Priority-High (Needed for work)

#6955 opened last week by Jegerlewick 4 of 8 tasks Needs Discussi...

agent zero media creation

#6954 opened last week by dustymc Active Develop...

Code Table Request - new biostratigraphic zone: Tropidostoma

Function-CodeTables

Priority-High (Needed for work)

#6953 opened last week by Jegerlewick 6 of 8 tasks Needs Discussi...

Figure 1: The reasons we chose Arctos (L), and an example of the activity on Arctos GitHub from Nov 2023 (R) - requests can be made through GitHub for code table additions, bug fixes, suggestions for new features etc. Response time from the Arctos team and other users is very fast. Nevertheless, as a new collection, it is necessary to budget time for additions that require approval, in particular almost all Irish and UK stratigraphic names are new to the system, and require a single code table request for each term.



Workflows and Protocols



Figure 2: Generalized workflow adopted in the TCDGM

A simplified version of the TCDGM workflow is illustrated in Figure 2. In practice some aspects occurred episodically throughout, such as updating the database (adding e.g. agents, projects, citations, accessions, new taxonomy, new lithostratigraphic names), conservation, and quality control.

The TCDGM collection documentation is quite complex, and sometimes contradictory, which is unsurprising given the age of the collections. Labels associated with specimens do not always tell a complete story. Therefore, we found it most practical to adopt the image-first approach, in order to easily compare specimens and labels to scanned collection documents (catalogue pages, catalogue cards, collector notes). This also meant that work could continue outside of the collection space.

A single drawer of mineral specimens took approximately one hour to photograph and image processing (re-naming, rotating, cropping, re-sizing etc.) took at least the same additional time. The quality of the camera (mobile phone) and lighting worked reasonably well in most cases, but was not good enough for smaller specimens. Improving the photographic set-up is now a priority.



Figure 3: Images in Arctos. Uploaded image for TCD 30186 (L) and a specimen search (R) with thumbnails of images.

Image files were renamed with the catalogue number (and a sequential number suffix if multiple images per specimen). Image names from a folder could then be copied directly into a spreadsheet, removing the need to type the catalogue numbers again. Taxon names were not added to the image file name in order to save time – firstly, to reduce typing, and secondly because we found too many edits were needed at the end of the databasing process when new information had come to light.

For the most part, data were assembled in spreadsheet templates before bulk-loading into the database. In collections with shared collectors and/or localities, this prevented repetition and resulted in a cleaner, more consistent dataset. In other cases, data entry as a single record was faster and more appropriate. For example, we used this method when preparing to send out a loan for an outreach event, or for one-off “specimen highlights” (see below). Entering a single record is also a good way to get familiar with the different data fields in a more intuitive way. Step-by-step protocol for data entry is available on the website: <https://trinitygeologicalmuseum.com/collections/database/>.

Pilot datasets

Four collections were targeted to test digitization protocols (Table 1). A [project](#) was set up in Arctos which ties together all data from this grant project. Each collection has also been given a legacy accession number.

Table 1: Targeted collections

Collection	Accession	Arctos collection	Geol. Age	#Specimens
Joly	2023-01	TCDGM:Mineral	Phanerozoic	793
Holland	2023-02	TCDGM:Paleo	Silurian	279
Griffith	2023-03	TCDGM:Paleo	Carboniferous	2
Portlock	2023-04	TCDGM:Paleo	Ordovician/Silurian	13

The Joly and Holland collections are the largest and most thoroughly digitized. Specimens from the Griffith and Portlock collections have been entered into the database, and related documents have been scanned. However, there is more work to be done 1) in the case of the Portlock collection an additional 300+ specimens have been identified in the catalogue. The information has been entered into a spreadsheet for upload but their location in the physical collection has yet to be verified and 2) in the case of the Griffith

collection many of the specimens lack catalogue numbers and further work is required to fully understand their history. Details of all four collections and their current status can be searched and explored online through [Arctos](#) and on the [TCD Geological Museum website](#). Here we present a summary of the two largest collections.

1) Joly Collection

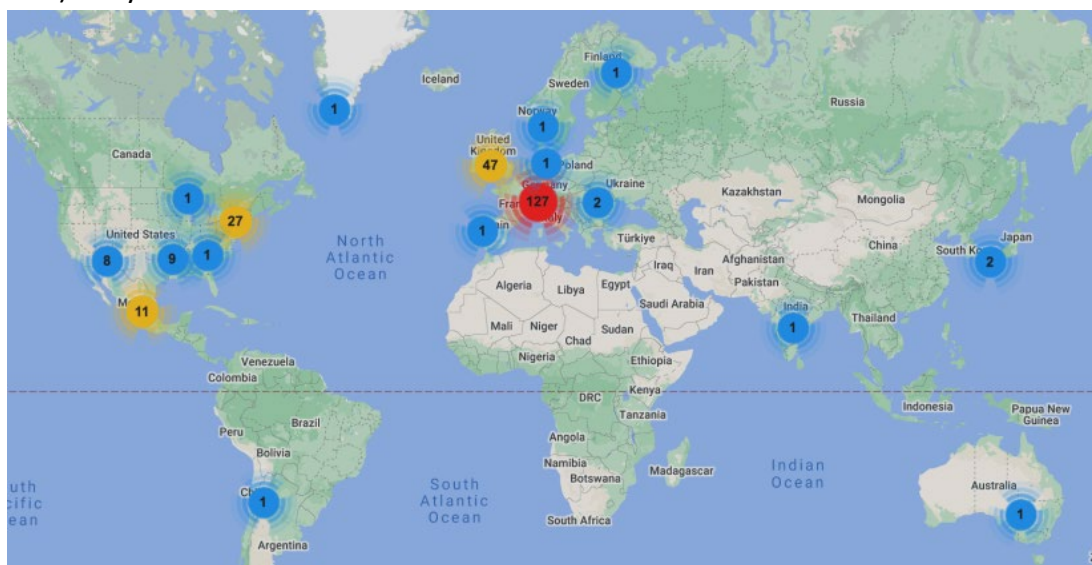


Figure 4: Georeferenced localities for the John Joly Collection.

The Joly collection was originally understood to consist of 282 minerals listed in his personal handwritten catalogue. However, about 800 minerals and some rock specimens are listed under “Joly Collection” in the museum collection catalogue (see [website](#) for discussion).

The specimens with the most complete and straightforward information are 72 minerals that Joly bought from the mineral dealer A. E. Foote, which came with labels attached with the mineral name and locality. Other significant subsets included 122 minerals from Switzerland, bought by Joly on his travels in the late 1800s, and specimens from colleagues K. D. Doyle (13) and William Ferguson (9). There were 140 unique mineral identifications, the most common are listed in Table 2. 375 specimens have no identification (blank labels/catalogue). These were entered as “Mineral”, such that they can be easily found later and given further attention.

Table 2: Most common mineral types in the Joly Collection.

Mineral	Count	Specimens
Quartz	69	
Epidote	16	
Garnet Group	20	
Anatase	11	
Fluorite	11	
Rutile	11	
Vesuvianite	10	



2) Holland Collection

The Charles H. Holland collection from the Silurian Dingle Peninsula comprises specimens associated with Holland, 1988 (*"The fossiliferous Silurian rocks of the Dunquin inlier, Dingle Peninsula, County Kerry, Ireland"*), in addition to type specimens from Bassett, Cocks and Holland, 1976 from the same region.

There are at least two generations of collecting events 1) Holland's collections from field seasons starting around 1967 with numbers in the 20000 and 30000 range and, 2) an earlier set with numbers in the 15000s range, related to collections at Geological Survey Ireland (Figure 5). The bulk of those specimens are listed in the TCD catalogue as "returned to GSI in 1985". Strangely, the few that remain in the TCD collection have less information in the catalogue than those that were returned.



Figure 5: Specimens at the Geological Survey Ireland collections with TCD and GSI numbers.

The Holland specimen labels had information about the geologic formation, but no detailed localities (simply "Dingle Peninsula"). The majority of the specimens catalogued are brachiopods (Figure 6). However, note that many slabs are rich in a diversity of invertebrate fossils. In some cases, multiple identifications (each with an individual catalogue number) were made per slab, but in most cases they have not all been identified. The original faunal list from Holland 1988 is also available on the website in spreadsheet form.

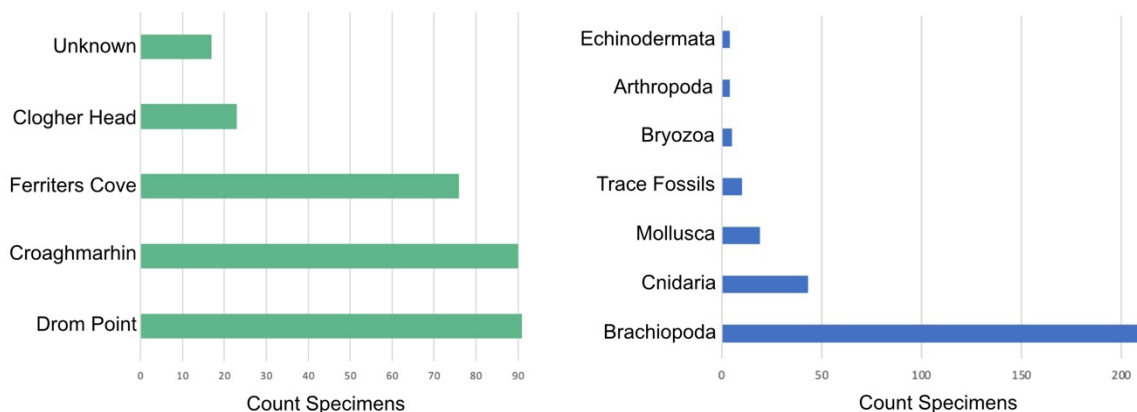


Figure 6: Summary of Holland Collection Specimens by geological formation (L) and taxonomy (R)



Dissemination

Global Biodiversity Information Facility (GBIF)

In addition to Arctos, paleontological specimens can be found through the GBIF portal (Figure 7), which has an excellent interface for searching and data visualization.

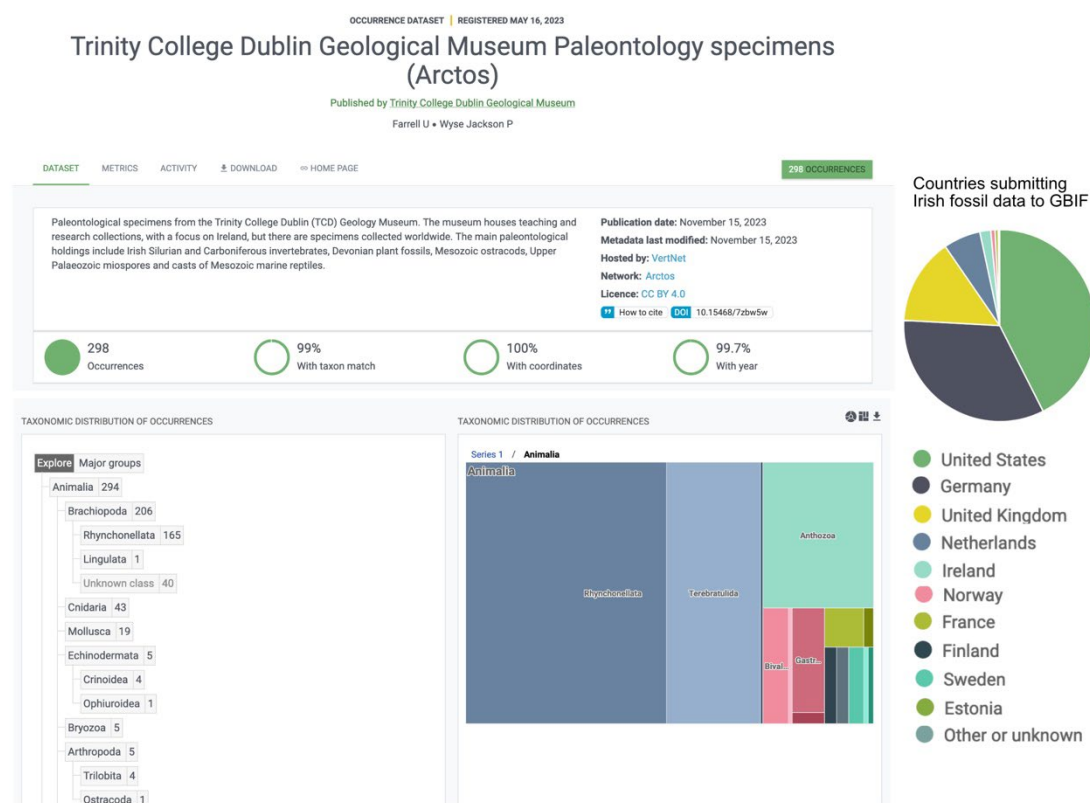


Figure 7: TCD Geological Museum data in GBIF. We are the first Irish institution to submit Irish fossil data (R), albeit still a small proportion of the total.

Website

Pages were added to the [TCDGM website](#) with a) scanned catalogues and spreadsheets, b) descriptions of each of the digitized collections (Figure 8), c) protocols for data entry and georeferencing resources.



John Joly Collection

Type	Mineral
Geological Age	Unrecorded
Location	Global (incl. Switzerland, Mexico, USA, Canada, UK...)
Donation Date	1933
Specimen Records	https://arctos.database.museum/search.cfm?guid_prefix=TCDBGM%3AMineral&accn_number=2023-01



Georeferenced localities from database of Joly Mineral Collection (Berkeley mapper via Arctos)



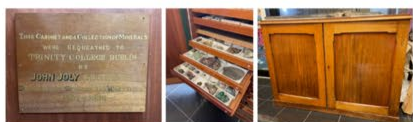
Prof. John Joly, 1900

Joly a large number of North American minerals, including the fluorescent Franklinite and Autunite.

The collection contains few Irish specimens. Represented are some zeolite minerals from the Giant's Causeway, and some beryl crystals from the granite of the Dublin Mountains, where Joly liked to walk and relax.

The collection was housed in a purpose built cabinet, which Joly kept at home. It was a personal collection and not used in research. The specimens were bought on account of their beauty and the excellence of their crystals.

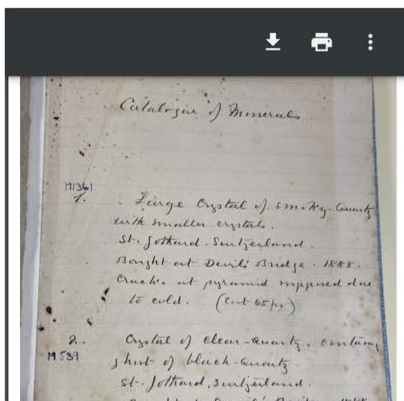
On his death in 1933 the collection and cabinet were bequeathed to the College and were placed in the Geological Museum. Subsequently the specimens were removed and dispersed within the general mineralogical holdings, while the cabinet was used by a staff member for general storage. In 1989 the cabinet was recovered and the collection has been restored to its original state.



John Joly cabinet. Plaque: "This cabinet and a collection of Minerals were bequeathed to Trinity College Dublin by John Joly ScD, F.T.C.D., F.R.S. Professor of Geology and Mineralogy 1867-1933"

Collection Documents

John Joly's mineral catalogue of 282 specimens is handwritten in a blue cursive hand. The catalogue numbers have been added (handwritten in blue ink) at a later date. The catalogue contains information for all specimens. Additional links to TCD M-numbers have been made since, but some specimens have yet to be found in the collection. Note that the last page of this catalogue appears to be written in a different hand.



Joly Catalogue - Minerals

DOWNLOAD

Joly Label Styles



Joly catalogue numbers

Joly catalogue numbers correspond to the catalogue above, come in two main styles - round stickers with larger numbers and a smaller rectangular type. All are handwritten in brown or black ink.

Mystery Specimens



Blank John Joly Collection Catalogue Page

While the handwritten Joly catalogue lists 282 minerals, the TCD catalogue lists 282 specimens listed under "Joly Collection". Many of these specimens have no associated information - the labels and the catalogue are blank, and there are no other identifiers attached to the specimen. It seems likely that they may have been part of the original collection (there appears to be enough space in the cabinet), but for some reason Joly only made a catalogue for a subset. We continue to look for additional documentation that could shed light on how the collection was accessioned. In the meantime, unidentified minerals have been entered into the database as "Mineral", some with attached images. Seventeen have some information about locality.

Albert E. Foote Specimens

Seventy-two databased Joly specimens were bought from A. E. Foote, most in 1887. The majority were from North America - exact counts as follows:

44 United States
9 Mexico
8 Canada
4 United Kingdom
1 Brazil
1 Italy
1 Japan
1 Norway
1 Sri Lanka
1 Switzerland
1 Unknown



Specimen with multiple Foote labels and a price.

Many of the specimens have Foote labels stuck directly onto them, which include Foote catalogue numbers, identification(s), and some locality information. Many also have a price stuck to the specimen. Note that the Foote catalogue numbers relate to the mineral type, they are not unique to the specimen.

Paper labels for the Foote specimens came in a variety of shapes and styles as illustrated below. In many cases the Foote labels have been separated from the specimens.

Figure 8: Extracts from the John Joly Collection webpage. Includes A) Summary of collection B) Map of georeferenced specimens (interactive version on Arctos) C) Description of collection and its significance D) Downloadable scanned PDFs of collection documents E) Review of label styles F) Collection idiosyncracies G) Details of distinct subsets of the collection, their history and style.



Specimen Highlights

We have made templates for “Specimen Highlights” (Figure 9), which are featured in the departmental “G(e)ossip” newsletter, bringing some visibility to the collections which are housed in a separate building from staff and students.



Figure 9: A specimen highlight - gives the essential information and image with links to the full Arctos record via QR code.

Social Media

We have Twitter/X and Instagram accounts (Figure 10), where we have posted about the specimens and the project.

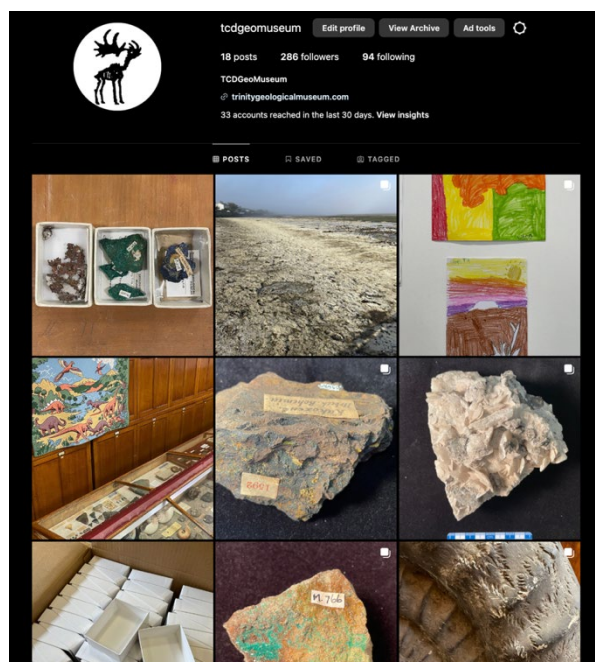


Figure 10: TCDGM Instagram page

Physical curation and conservation

Catalogues and other paper records were often stored in drawers alongside the specimens. In the process of digitization, these papers have been removed from specimen drawers and re-housed in archival folders (Figure 11A). Most were also scanned to provide a digital record and reduce the need for further handling (Figure 11B).

Specimens were also re-boxed into new archival cardboard boxes where necessary – in particular where the specimens and labels were too small for the existing boxes, or where the boxes or specimen showed signs of decay. Delicate mineral specimens were rehoused in polypropylene boxes with lids and a plastazote underlay (Figure 11D).

Label templates were designed (via [CodePen](#)), which can be directly populated with specimen data in Arctos. New labels were printed for the Charles H. Holland collection, with updated information. The labels are designed such that the catalogue numbers can be read without having to move the specimen. Old labels were placed in clear archival protective sleeves in the specimen boxes.

The Holland Collection was re-arranged in the drawers in order of catalogue number, which roughly corresponded to the geological Formation. Oversize specimens were separated and given a double height drawer. The Joly Collection has also been rearranged by number, which appeared to put related minerals next to each other and may help with identifying some of the unnamed specimens in the future.



Figure 11: Physical curation of digitized collections. A. Documents removed from specimen drawers and housed in archival file folders B. Scanned/Photographed versions available online (example: handwritten Joly mineral catalogue) C. Re-organized Charles H. Holland Collection, with new printed labels on archival cardstock. Catalogue numbers are visible without moving specimens. D. Reboxing of vulnerable mineral specimens from the Joly Collection.



(ii) Project Implementation (milestones, deliverables, project management)

The project was implemented as planned, illustrated in the original Gantt chart (Figure 12), with minor deviations. As predicted in the original proposal, the collection digitization timelines were modified as new information came to light (see above). Overall, digitization took longer than anticipated due to a) the time it took to get up and running with Arctos b) additional specimens and information that were discovered as digitization was in progress.

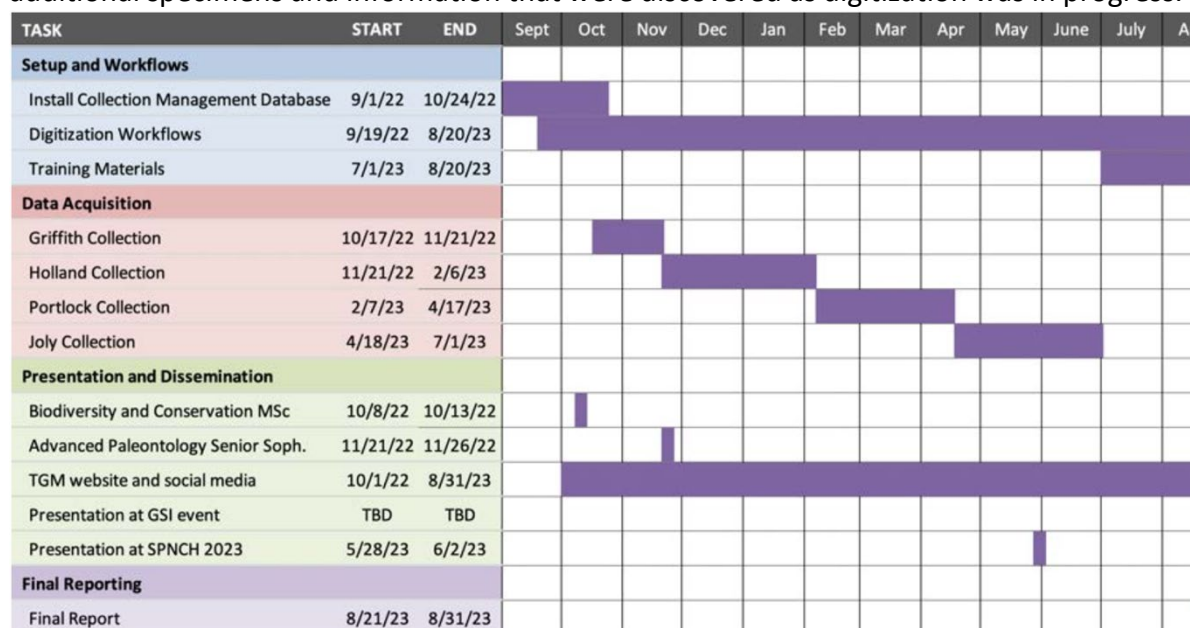


Figure 12: Gantt chart from initial grant proposal

However, this was in keeping with the primary project aim – to set up the database and gain an understanding of digitization processes. Digitization times accelerated during the project as we became familiar with Arctos, and each collection had idiosyncrasies to deal with which makes it difficult to give precise timelines. Nevertheless, we gained insight into which parts of the process are most time consuming (photography, georeferencing) and which aspects require most forward planning (e.g. addition of lithostratigraphy to code tables), as well as understanding where to look for additional documentation before digitization begins.

(iii) Outputs to date (this should include the location of datasets generated, as per GSI and NORF requirements)

Digital datasets and documentation:

Arctos Project: <https://arctos.database.museum/project/10004076>

Arctos Paleo: https://arctos.database.museum/search.cfm?guid_prefix=TCDGM%3APaleo

Arctos Mineral:

https://arctos.database.museum/search.cfm?guid_prefix=TCDGM%3AMineral

GBIF: <https://www.gbif.org/dataset/b2d306dc-da1d-46e2-9e8b-7f316fc18677>

TCD Geological Museum Website: <https://trinitygeologicalmuseum.com/collections/>

Data Entry Protocol: <https://trinitygeologicalmuseum.com/collections/database/>



Georeferencing Resources:

<https://trinitygeologicalmuseum.com/collections/georeferencing/>

Pages on the Trinity Geological Museum website for each collection:

- Joly Collection: <https://trinitygeologicalmuseum.com/collections/joly-collection/>
- Holland Collection: <https://trinitygeologicalmuseum.com/collections/holland-collection/>
- Griffith Collection: <https://trinitygeologicalmuseum.com/collections/griffith-collection/>
- Portlock Collection: <https://trinitygeologicalmuseum.com/collections/portlock-collection/>

Presentations at Society for the Preservation of Natural History Collections (SPNHC) Annual Meeting, 2023, at the 2023 HOGG (History of Geology Group) meeting at TCD, and Geoscience2023:

PPT presentation (extended version, and blog post):

<https://trinitygeologicalmuseum.com/2023/05/23/going-digital/>

Geoscience2023 Poster:

<https://trinitygeologicalmuseum.com/2023/11/16/geoscience2023/>

4th year undergraduate Advanced Palaeontology (GLU44005 Autumn 2023): Two lectures and two associated 3-hr practicals. Summary:

1) *Physical curation and conservation – at the museum.*

- a) Working in groups of 2 or 3, select two drawers from different parts of the collection, assess their contents and conservation needs, find related documentation in the collection catalogues and files.
- b) Improve the condition of as many specimens in your chosen drawers as possible within one hour (with curatorial supplies and guidance provided)
- c) Chose 2 specimens to digitize in week 2.
- d) Photograph your specimens before leaving the museum.

2) *Digital data – at the lab.*

- a) Review state-of-the-art with a search-and-compare exercise using a variety of existing public databases.
- b) Using a shared google sheet (based on the Arctos bulk-loading specimen template), add data for chosen specimens.
- c) Georeference localities as completely as possible within defined time (having been given an introduction to basic georeferencing protocols).
- d) Plot all localities and the review data together. If time/quality allows, upload at least one record to Arctos as demo.

(iv) Impact

- Relevance/application to GSI programmes, where applicable

The TCDGM collection includes material which is related to specimen and paper records in other Irish institutions, including Geological Survey Ireland. Arctos allows us to make



the link clear. For example, specimens from the Silurian Dingle Peninsula with old Geological Survey Ireland identifiers are searchable through our database (Figure 13)

TCDGM:Paleo:15179
Brachiopoda

Parts: fossil
Gortadoo
Ireland, Kerry
before 1976 (1967-01-01 - 1976-01-01)
Record Type: FossilSpecimen

[Comment or Report Bad Data](#)
[Request Cache Refresh \(Status: current\)](#)
[Get a DOI](#)

Identifications [Edit](#)

[1] **Brachiopoda** [Edit](#)
[Animalia](#), [Brachiopoda](#)
Identified by [Una Farrell](#) on 2023-06-29
Remarks: Label is illegible - possibly "A. tumida" (Athyris tumida)?

Attribute	Value	Determiner	Method	Date	Remark
nature of identification	features				

Agents [Edit](#)

collector
[Geological Survey Ireland](#)

Identifiers and Relationships [Edit](#) [full view](#)

Relationship/Identifier	IssuedBy	Type	More	Containers/Extras	AssignedBy	Remarks
self	3535	Geological Survey Ireland Identifier	search		Una Farrell on 2023-06-29	

Catalog Record Media

Media linked to this Cataloged Item.
Showing results 1 - 2 of 2 [Media Gallery](#)



Catalog Record/Curatorial

Record Identifier: <https://arctos.database.museum/guid/TCDGM:Paleo:15179> [copy](#)

Remarks: Formerly part of Geological Survey Ireland collection. Most of the collection returned to GSI in 1985.

Entered By: [Una Farrell](#) on 2023-06-29

Last Edited By: DBA on 2023-10-20 [More](#)

Accession: 9999 [Manage](#) or [Edit](#) -accession restricted by collection-

Figure 13: Example of a specimen with a Geological Survey Ireland identifier.

https://arctos.database.museum/search.cfm?guid_prefix=TCDGM%3APaleo&id_issuedby=Geological%20Survey%20Ireland

- Other impacts

A system is now in place for digitization to continue, as long as there are staff in the collection. We will adopt a policy of pro-active digitization, to incorporate new specimen data while the information is still fresh. Templates are provided to PhD students who have research collections to accession. The project will provide a good basis for future grant applications, opportunities will be identified within the next year.

Connections have been made with people at other institutions working on similar things e.g. UCG, UCC, Biodiversity Ireland, and the National Museum. We have been able to exchange advice and resources, and discuss potential collaborative projects. For example, a future goal is to add an improved imaging set-up to the museum which would allow us to work with Dr. Chris Mays, UCC, on photogrammetry. 3D specimens could be linked to the Arctos database. In addition, staff at the National Museum of Ireland and the Trinity College Dublin Herbarium have expressed interest in a Georeferencing Workshop, which would take place in Spring 2024.

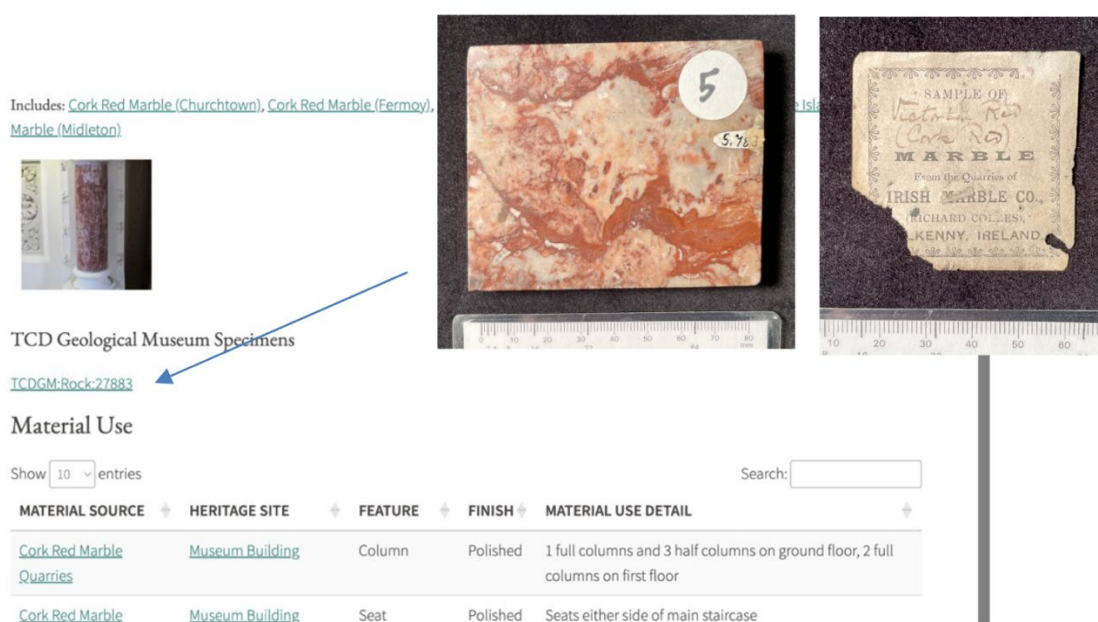
The project has also helped us identify some areas of the collection that could be useful for relatively low-cost student capstone projects. For example, a set of unidentified Joly minerals, which could benefit from further research. As digitization continues, we will be better placed to offer more project options.

This project will continue to link with STONEBUILT Ireland, a Geological Survey Ireland/OPW collaborative project. Arctos provides a complementary record of physical hand samples



that relate to the broader concept of building stone types that are recorded in that project (Figure 14).

Includes: [Cork Red Marble \(Churchtown\)](#), [Cork Red Marble \(Fermoy\)](#), [Marble \(Midleton\)](#)



TCD Geological Museum Specimens
[TCDGM-Rock-27883](#)

Material Use

Show 10 entries Search:

MATERIAL SOURCE	HERITAGE SITE	FEATURE	FINISH	MATERIAL USE DETAIL
Cork Red Marble Quarries	Museum Building	Column	Polished	1 full columns and 3 half columns on ground floor, 2 full columns on first floor
Cork Red Marble	Museum Building	Seat	Polished	Seats either side of main staircase

Figure 14: Screenshot from the STONEBUILT Ireland website, linked to Arctos records of building stone specimens

References:

Allmon, W. D., Dietl, G. P., Hendricks, J. R., & Ross, R. M. (2018). Bridging the two fossil records: Paleontology's "big data" future resides in museum collections. In G. D. Rosenberg & R. M. Clary, *Museums at the Forefront of the History and Philosophy of Geology: History Made, History in the Making*. Geological Society of America. [https://doi.org/10.1130/2018.2535\(03\)](https://doi.org/10.1130/2018.2535(03))

Bassett, M. G., Cocks, L. R. M., & Holland, C. H. (1976). The affinities of two endemic Silurian brachiopods from the Dingle Peninsula, Ireland. *Palaeontology*, 19(4), 615–625.

Holland, C. H. (1987). Stratigraphical and structural relationships of the Dingle Group (Silurian), County Kerry, Ireland. *Geological Magazine*, 124(1), 33–42.
<https://doi.org/10.1017/S0016756800015764>

Holland, C. H. (1988). The fossiliferous Silurian rocks of the Dunquin inlier, Dingle Peninsula, County Kerry, Ireland. *Transactions of the Royal Society of Edinburgh: Earth Sciences*, 79(4), 347–360. <https://doi.org/10.1017/S0263593300014346>

Lieberman, B. S., & Kimmig, J. (2018). Museums, paleontology, and a biodiversity science-based approach. In G. D. Rosenberg & R. M. Clary, *Museums at the Forefront of the History and Philosophy of Geology: History Made, History in the Making*. Geological Society of America. [https://doi.org/10.1130/2018.2535\(22\)](https://doi.org/10.1130/2018.2535(22))

Marshall, C. R., Finnegan, S., Clites, E. C., Holroyd, P. A., Bonuso, N., Cortez, C., Davis, E., Dietl, G. P., Druckenmiller, P. S., Eng, R. C., Garcia, C., Estes-Smargiassi, K., Hendy, A., Hollis, K. A., Little, H., Nesbitt, E. A., Roopnarine, P., Skibinski, L., Vendetti, J., & White, L. D. (2018). Quantifying the dark



data in museum fossil collections as palaeontology undergoes a second digital revolution. *Biology Letters*, 14(9), 20180431. <https://doi.org/10.1098/rsbl.2018.0431>

Popov, D., Roychoudhury, P., Hardy, H., Livermore, L., & Norris, K. (2021). The Value of Digitising Natural History Collections. *Research Ideas and Outcomes*, 7, e78844.
<https://doi.org/10.3897/rio.7.e78844>

Wyse Jackson, P. (1992). The geological collections of Trinity College, Dublin. *Geological Curator*, 5, 263–274.

Publications: None

3. Supplemental information/datasets (please clearly mark any sensitive or confidential information that should not be published and include a justification for the request) – None, all data available through the links above.