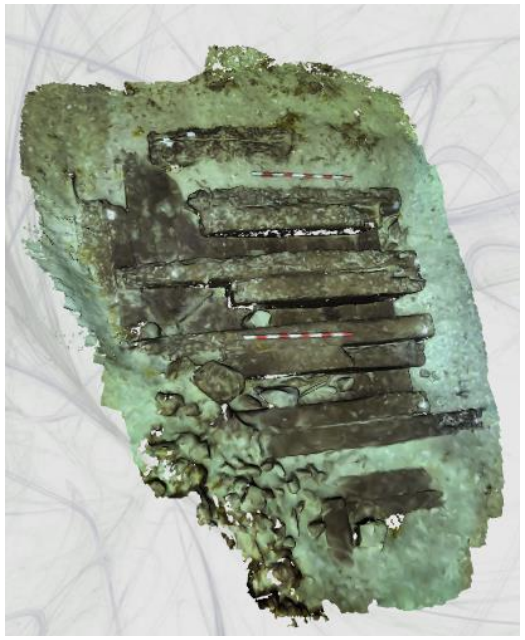

Preservation Best Practices 3D Methods and Workflows: Photogrammetry Case Study (Repository Perspective)

Kieron Niven
Digital Archivist, Archaeology Data Service

13th August 2018

Same basic structure but:

- From the perspective of a repository:
  - What do we need to know about a photogrammetry project and the associated data
  - How this should be deposited, structured, archived

- Largely looking at **Photogrammetry**...

- Many of the points are equally applicable to other data types (laser scan, CT, etc.)

ARCHAEOLOGY DATA SERVICE

Planning Phase

- Engage with project at point of start up / data creation - advise on suitable formats and metadata
- Aim to exploit exports and tools for recording metadata.
- Not always possible (legacy projects). Relevant project documents, reports, methodology, process, etc. Should also be archived to describe as much as possible of the project design, creators, and intentions.
- Data should be linked to wider context through IDs, DOIs, references (external documents, creators/source of data, monument ids, museum ids, etc.)

Planning Phase

- Planning phase is the most important phase
- Both ‘Purpose’ and ‘Audience’ will influence what is recorded, how it’s recorded, and what are produced as final deliverables (e.g. LOD, opportunist/planned, subsequent file migrations, limited dissemination options).

Planning Phase

ACCORD: Project documentation.

Specific project aims and collection methodology

ACCORD: Archaeology Community Co-production of Research Data

Stuart Jeffrey, Alex Hale, Cara Jones, Mhairi Maxwell, Siân Jones, 2017

Introduction
Overview
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Data copyright © ACCORD project unless otherwise stated

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Resource identifiers

ADS Collection: 1963
DOI:https://doi.org/10.5284/1042733
How to cite using this DOI

Arts & Humanities Research Council

Downloads

ACCORD Project Documents

	Technical Guidance Sheet	PDF	153 Kb
	Project Information Sheet	PDF	104 Kb
	Participant Information Sheet	PDF	136 Kb
	Consent Form	PDF	105 Kb
	ACCORD Blog - September 2013 to June 2015	PDF	4 Mb

ads ARCHAEOLOGY DATA SERVICE

Planning Phase

ACCORD project:

Object-level and image documentation (multiple levels)

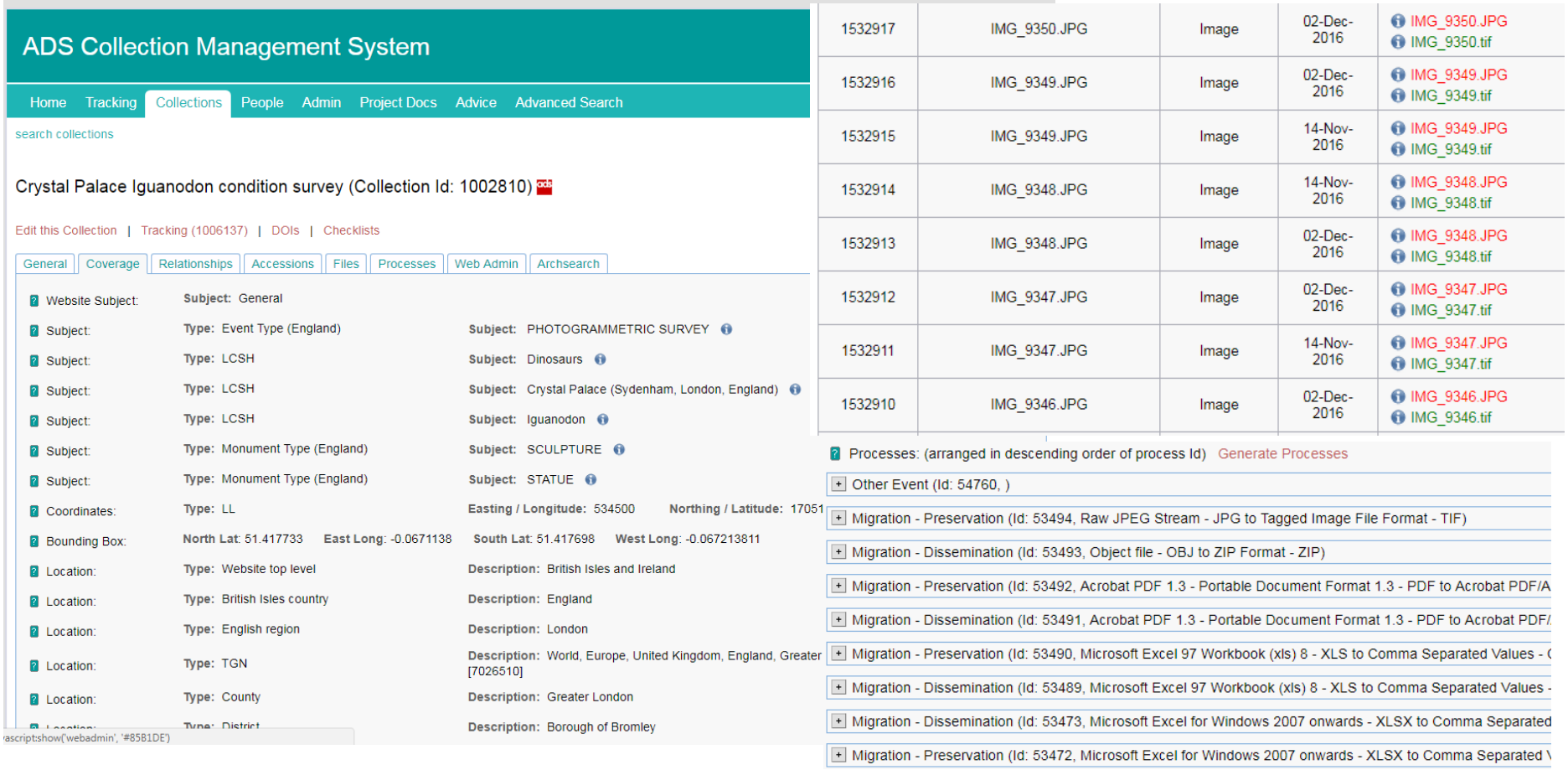
	Project	Sub-Project	File Name	Description	Subject	Subject Conditions	Creators	Date Created	Last Date Modified	File Size	File Name of Original Images Used in Processing (in zip file)	Capt
1	ACCORD	How Old Are Yew	Castlemilk_PG_KingoftheCastle.obj	3D photogrammetric model processed in Agisoft Photoscan at high resolution of the King of the Castlemilk sculpture, Kenny Hunter, 1999.	King of the Castle Sculpture, Kenny Hunter, 1999	Bright sunny late afternoon, dry, clear sky/ Sunny and clouds, dry, mid morning	Jean Devlin (How Old Are Yew), Susan Casey (How Old Are Yew), Daniel McGivern (How Old Are Yew), Alexandrina Anderson (How Old Are Yew), Mhairi Maxwell (Digital Design Studio, Glasgow	03/10/2014	17/02/2015	92,035 KB	Castlemilk_PG_KingoftheCastle_Ito469.zip	Photo
2	ACCORD	How Old Are Yew	Castlemilk_PG_KingoftheCastle.mtl	Descriptor visual polygon file exported from the 3D photogrammetric model of the King of the Castlemilk sculpture, Kenny Hunter, 1999.	King of the Castle Sculpture, Kenny Hunter, 1999	Bright sunny late afternoon, dry, clear sky/ Sunny and clouds, dry, mid morning	Jean Devlin (How Old Are Yew), Susan Casey (How Old Are Yew), Daniel McGivern (How Old Are Yew), Alexandrina Anderson (How Old Are Yew), Mhairi Maxwell (Digital Design Studio, Glasgow School of Art), Stuart Jeffrey (Digital Design Studio, Glasgow School of Art), Richard Bolton (How Old Are Yew).	03/10/2014	17/02/2015	1KB	Castlemilk_PG_KingoftheCastle_Ito469.zip	Photo
3	ACCORD	How Old Are Yew	Castlemilk_PG_KingoftheCastle.jpg	Texture file exported from the 3D photogrammetric model of the King of the Castlemilk sculpture, Kenny Hunter, 1999.	King of the Castle Sculpture, Kenny Hunter, 1999	Bright sunny late afternoon, dry, clear sky/ Sunny and clouds, dry, mid morning	Jean Devlin (How Old Are Yew), Susan Casey (How Old Are Yew), Daniel McGivern (How Old Are Yew), Alexandrina Anderson (How Old Are Yew), Mhairi Maxwell (Digital Design Studio, Glasgow School of Art), Stuart Jeffrey (Digital Design Studio, Glasgow School of Art), Richard Bolton (How Old Are Yew).	03/10/2014	17/02/2015	2,728 KB	Castlemilk_PG_KingoftheCastle_Ito469.zip	Photo

If not specified during planning then unlikely (if not impossible) to get certain types and levels of metadata

Ingest is where it all begins (for us):

- Specify ingest file formats (limit diversity and future migration, ease metadata capture)
- Aim to ingest as much metadata and contextual info as possible. Recorded on a number of levels:
  - Collection level (people, funders, rights, dates, assoc. publications, etc.)
  - File level (name, description, caption, terms, etc.) e.g. photogrammetry exif data. OBJ descriptive metadata.
  - Technical metadata (file size, type, processing, relations)

ADS Collection Management System:



Ingest - Files

PIP: Planning deposition (files):

Ideally, repositories should be aiming to:

- Preserve and disseminate data ‘in perpetuity’
- Ingest & preserve **raw data** (TIF or JPG images as captured, no proprietary formats) and **processed data** (OBJ)
- Any control information (any reference data which is then processed by the software)
- Where needed, ingest **intermediate datasets** (pointclouds, cleaned data)
- Either ingest or create **dissemination versions** of data
- All processes are documented (CMS)

Metadata at Ingest:

Two main categories of metadata used at ADS:

User supplied and **repository created**. Repository generated includes: file checksums, identification, path, etc. (the things that allow us to manage any files on our system)

Majority at **ingest** is user supplied (Collection-level, dataset-level, technical acquisition and processing-level)

Use in-house standards and data-specific options (exif, processing reports from software, etc.).

Ingest - Metadata

Metadata at Ingest:

Variety of metadata displayed alongside the archive material

Project dates	Created From	14-DEC-2016
	Created To	10-MAR-2017
	First Released	22-NOV-2017
	Intervention Date From	14-DEC-2016
	Intervention Date To	10-MAR-2017
Data types available	3D Model	3 objects
	Image	886 objects
	Spreadsheet	2 objects
	Text	2 objects

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Stephen Gray
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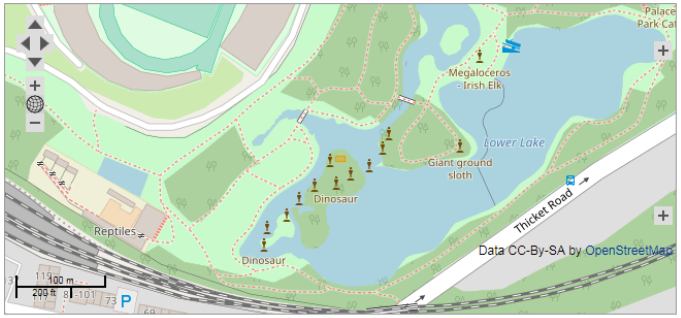
Send e-mail enquiry

Resource identifiers

ADS Collection: 2810
DOI:https://doi.org/10.5284/1045778
How to cite using this DOI

Crystal Palace Iguanodon condition survey



Location	World region	British Isles and Ireland
	British Isles country	England
	English region	London
	County	Greater London
	District	Borough of Bromley
	Place	Crystal Palace Park
	TGN	World, Europe, United Kingdom, England, Greater London, London Borough of Bromley [7026510]
Grid reference	Latitude Longitude	170516 534500
Grid reference	Latitude longitude bounding box	51.417733 -0.067213811 -0.0671138 51.417698
Subject	Event Type (England)	PHOTOGRAMMETRIC SURVEY
	Library of Congress Subject Headings	Dinosaurs
	Library of Congress Subject Headings	Crystal Palace (Sydenham, London, England)
	Library of Congress Subject Headings	Iguanodon
	Monument Type (England)	SCULPTURE
	Monument Type (England)	STATUE
Period	MIDAS	Modern
	Period (England)	VICTORIAN
Project dates	Created From	14-DEC-2016
	Created To	10-MAR-2017
	First Released	22-NOV-2017
	Intervention Date From	14-DEC-2016

Processing Metadata:

Photogrammetry metadata should cover:

- Capture (camera details, control, survey details)
- Processing (either documented or as a software report)

We retain embedded or sidecar data but both require documentation to (a) flag up they exist and (b) their relationship to the data file(s) as, if not clear, this data could be lost during future migrations.

Ingest - Metadata

Processing Metadata:

Many photogrammetry packages allow metadata exports documenting creation and processing.

(PhotoScan, Pix4D reports)

Processing Parameters

General	
Cameras	19
Aligned cameras	19
Markers	4
Coordinate system	OSGB 1936 / British National Grid (EPSG::27700)
Point Cloud	
Points	1,003 of 3,059
Reprojection error	0.466569 (0.952276 max)
Effective overlap	7.00588
Alignment parameters	
Accuracy	High
Pair preselection	Generic
Key point limit	40,000
Tie point limit	1,000
Constrain features by mask	Yes
Matching time	2 minutes 1 seconds
Alignment time	1 seconds
Optimization parameters	
Parameters	f, b1, b2, cx, cy, k1-k3, p1, p2
Optimization time	0 seconds
Dense Point Cloud	
Points	4,282,655
Reconstruction parameters	
Quality	Medium
Depth filtering	Aggressive
Dense cloud generation time	16 seconds
Model	
Faces	370,263
Vertices	186,105
Texture	6,048 x 6,048, uint8
Reconstruction parameters	
Surface type	Arbitrary
Source data	Dense
Interpolation	Enabled
Quality	Medium
Depth filtering	Aggressive
Face count	859,961
Processing time	4 minutes 4 seconds
Texturing parameters	
Mapping mode	Generic
Blending mode	Mosaic
Texture size	6,048 x 6,048
UV mapping time	12 seconds
Blending time	42 seconds
Orthomosaic	
Size	6,108 x 6,224
Coordinate system	OSGB 1936 / British National Grid (EPSG::27700)
Channels	3, uint8
Blending mode	Mosaic
Reconstruction parameters	
Surface	Mesh
Enable color correction	No
Processing time	1 minutes 29 seconds
Software	
Version	1.2.6 build 2834
Platform	Windows 64 bit

Quality Report

Generated with version 1.2.88

Important: Click on the different icons for:
- Help to analyze the results in the Quality Report
- Additional information about the feature

For additional tips to analyze the Quality Report, click here.

Summary

Project	Ashnott
Processed	2014-Nov-21 13:58:55
Camera Model Name	Canon(A)IS125HS_4.3_4608x3456 (RGB)
Average Ground Sampling Distance (GSD)	3.33 cm / 1.31 in
Area Covered	0.3568 km² / 35.6783 ha / 0.1378 sq. mi. / 88.2085 acres
Image Coordinate System	WGS84
Ground Control Point (GCP) Coordinate System	OSGB 1936 / British National Grid
Output Coordinate System	OSGB 1936 / British National Grid
Processing Type	full aerial nadir
Feature Extraction Image Scale	1
Camera Model Parameter Optimization	optimize externals and all internals

Quality Check

Images	median of 46761 keypoints per image	✓
Dataset	169 out of 169 images calibrated (100%), all images enabled	✓
Camera Optimization	0.56% relative difference between initial and final focal length	✓
Matching	median of 12676 matches per calibrated image	✓
Georeferencing	6 GCPs (6 3D), mean error = 0.019 m	✓

Preview

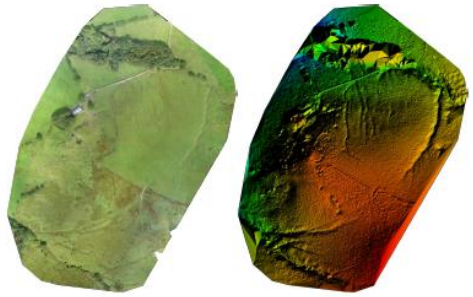


Figure 1: Orthomosaic and the corresponding sparse Digital Surface Model (DSM) before densification.

Deliverables

Dissemination:

- Key to engage and see how people need access to the data
- Issues with giving access to raw data
  - Large no. of images (and in knowing how people want to access them, granularity of access vs. use)
  - Large file sizes
- Online viewing (and basic manipulation) of models now commonplace (ADS uses 3DHOP, many use Sketchfab) – Increased user expectations?

Deliverables

ACCORD

Photogrammetry - Bressay Manse
Preview

3D PDF Files
(Using multi-volume ZIP files)

Bressay Manse 3D	ZIP 001	100 Mb
	ZIP 002	97 Mb

OBJ files
(Using multi-volume ZIP files)

Bressay Manse 3D	ZIP 001	100 Mb
	ZIP 002	46 Mb

Photographs
Records 1 - 50 of 756
Pages: 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | > >>

	Bressay_PG_Manse_001.jpg	JPG	12.21 Mb
	Bressay_PG_Manse_002.jpg	JPG	11.56 Mb
	Bressay_PG_Manse_003.jpg	JPG	12.95 Mb

Crystal Palace Iguanodon

Downloads

Please select the part of the archive you wish to view from the list below:

- **Reports**
  Crack report and thesis by India Carpenter
- **Spreadsheets**
  Spreadsheets containing the crack data from 2016 and 2017
- **Photogrammetry**
  - **Photogrammetry metadata**
    Metadata associated with the photogrammetry files, including the files used for calibration
  - **3D Models**
    3D Models of the whole Iguanodon, the Iguanodon leg 2016 and the Iguanodon leg 2017
  - **Images**
    Images used to created the 3D models, divided into 10 sections
    - **A - Head and Neck**
      1692 images in 109 multi-volume ZIP files
    - **B - Body**
      1927 images in 136 multi-volume ZIP files
    - **C - Tail and Belly**
      1591 images in 48 multi-volume ZIP files
    - **D - Front Leg Left**
      1025 images in 68 multi-volume ZIP files
    - **E - Front Leg Right**
      661 images in 45 multi-volume ZIP files
    - **F - Back Leg Right**
      1411 images in 92 multi-volume ZIP files
    - **G - Back Leg Left**
      1057 images in 70 multi-volume ZIP files
    - **H - Plinth Front Feet**
      2856 images in 248 multi-volume ZIP files
    - **I - Plinth Back Feet**
      486 images in 38 multi-volume ZIP files
    - **J - Plinth Tail**
      703 images in 26 multi-volume ZIP files

Downloads

A - Head and Neck

back to contents

1692 images in 109 multi-volume ZIP files

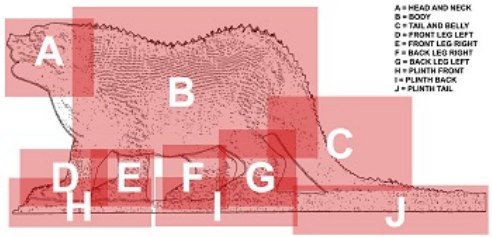


Image metadata (Image Group)	CSV	1 Kb
Iguanodon Body Plan	JPG	836 Kb
Image metadata (Head and Neck)	CSV	69 Kb

	001	100 Mb
	002	100 Mb
	003	100 Mb
	004	100 Mb
	005	100 Mb
	006	100 Mb
	007	100 Mb
	008	100 Mb
	009	100 Mb
	010	100 Mb
	011	100 Mb

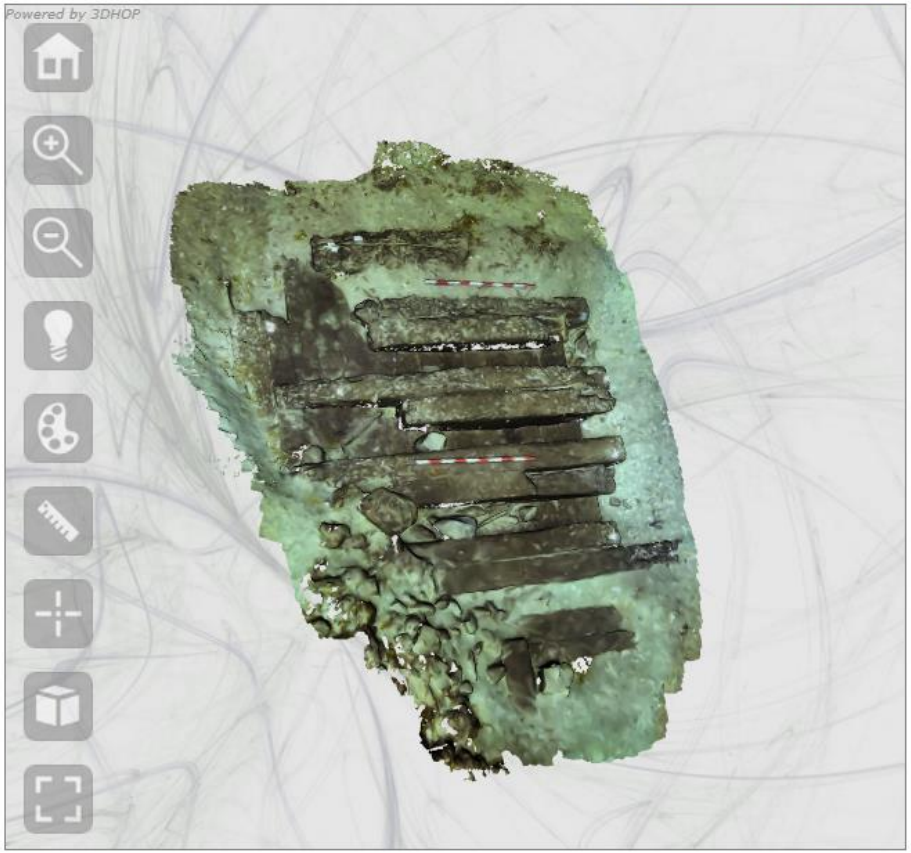
ARCHAEOLOGY DATA SERVICE

Deliverables

ForSEAdiscovery

Downloads

Photogrammetry back to photogrammetry



Metadata

Bayo Area1 ExifData	TXT	447 Kb
Bayo Area1 photogrammetry metadata	XLSX	25 Kb

OBJ files

Bayo 04 obj	ZIP	24 Mb

Source Images

A-BAY01-10-06-2015-1-MSC-P-001-018	ZIP	99 Mb
A-BAY01-10-06-2015-1-MSC-P-019-034	ZIP	95 Mb
A-BAY01-10-06-2015-1-MSC-P-035-050	ZIP	95 Mb
A-BAY01-10-06-2015-1-MSC-P-051-067	ZIP	99 Mb
A-BAY01-10-06-2015-1-MSC-P-068-083	ZIP	95 Mb
A-BAY01-10-06-2015-1-MSC-P-084-098	ZIP	95 Mb
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A-BAY01-10-06-2015-1-MSC-P-129-144	ZIP	97 Mb
A-BAY01-10-06-2015-1-MSC-P-145-160	ZIP	99 Mb
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A-BAY01-10-06-2015-1-MSC-P-176-191	ZIP	96 Mb
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A-BAY01-10-06-2015-1-MSC-P-208-225	ZIP	98 Mb
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A-BAY01-10-06-2015-1-MSC-P-262-278	ZIP	95 Mb
A-BAY01-10-06-2015-1-MSC-P-279-296	ZIP	97 Mb
A-BAY01-10-06-2015-1-MSC-P-297-315	ZIP	95 Mb
A-BAY01-10-06-2015-1-MSC-P-316-333	ZIP	98 Mb
A-BAY01-10-06-2015-1-MSC-P-334-350	ZIP	97 Mb

Long-term Management

- Key to know what you hold, especially for 3D formats
- Essential to maintain an ongoing ‘watch’ on formats – both preservation and dissemination (key repository task)
- Maintenance of online viewers and external hosts
- Maintenance and access to metadata (stored in a database or file?)
- Exit strategy for repository / external deposition:
  - How easy is it to pass on your data?
  - ...and your documentation?

ads ARCHAEOLOGY DATA SERVICE

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