



Book of the Dead Project:

A new approach to Digital Editions of Ancient Manuscripts
using CIDOC-CRM, FRBRoo and RDFa



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* Funded by the Andrew W. Mellon Foundation

* Hosted by the Collections Directorate, British Museum



Background

- The Egyptian Book of the Dead is a funerary text:
 - consists of a number of codified **spells**;
 - often illustrated by a stereotypical set of **vignettes**;
 - represented on **papyri** and **linens** buried with the dead;
 - developed by a number of geographically diverse **traditions/schools**.



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The British Museum



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Book of the Dead

From Wikipedia, the free encyclopedia

We'll come back to that

For other uses, see [Book of the Dead \(disambiguation\)](#).

There was no single or canonical *Book of the Dead*. The surviving "papyri" contain a varying selection of religious and magical texts and vary considerably in their "illustration". Some people seem to have commissioned their own copies of the *Book of the Dead*, perhaps choosing the spells they thought most vital in their own progression to the afterlife. The *Book of the Dead* was most commonly written in hieroglyphic or hieratic script on a papyrus scroll, and often illustrated with vignettes depicting the deceased and their journey into the afterlife.

Actually, in their very (textual) content



Malcolm Mosher

- Mosher's first volume concentrates on Spells 1-16
 - collects the variants into **versions** representing the traditions;
 - provides an aggregate **translation**, paragraph by paragraph, with annotation of internal variability (e.g. late/early);
 - relates the versions to identified **museum objects**;
 - illustrates each spell with **vignettes** and original text **fragments**.



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Malcolm Mosher



Dr. Malcolm Mosher: Egyptologist to Senior
Software Designer



In 1982, while working on the requirements for his Egyptology PhD, Malcolm landed a job with Tandem. He worked on a variety of projects until 1988 when he was assigned to RDF



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[...]

Remote Duplicate Database Facility,

a disaster recovery program that monitored changes made to a database on a local primary system and replicated those changes to a database on a remote backup system.



British Museum

- As one would expect, the BM has some of these objects:





British Museum RDF

- ... and publishes these in RDF: (as in the W3C standard for data publication, Resource Description Framework)

collection.britishmuseum.org/resource?uri=http://collection.britishmuseum.org/id/object/YCA2067



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YCA2067 RDF Rank

RDF Search and Explore

Source: http://collection.britishmuseum.org/id/object/YCA2067



Subject (39) Predicate Object All

Download in: JSON | RDF | **N3/Turtle** | N-Triples

Named Graph All Language English Inference Explicit only



equivalent to

Statements in which the resource exists as a subject

Predicate	Object
rdf:type	ecrm:E22 Man-Made Object
ecrm:P45 consists of	thes:x11412
ecrm:P51 has former or curr...	http://collection.britishmuseum.org/id/person-institution/62925
bmo:PX has main representat...	http://www.britishmuseum.org/collectionimages/AN00376/AN00376013_001_1.jpg
ecrm:P12i was present at	http://collection.britishmuseum.org/id/object/YCA2067/find
ecrm:P52 has current owner	thesidentifier.the-british-museum
ecrm:P128 carries	http://collection.britishmuseum.org/id/object/YCA2067/title/1
ecrm:P70i is documented in	http://collection.britishmuseum.org/id/bibliography/8850

```

$ curl -LH "Accept:text/turtle" http://collection.britishmuseum.org/id/object/YCA2067
<http://collection.britishmuseum.org/id/object/YCA2067> rdfs:seeAlso <http://collection.briti
22_Man-Made_Object ;
ecrm:P45_consists_of idThes:x11412 ;
ecrm:P51_has_former_or_current_owner <http://collection.britishmuseum.org/id/person-ins
bmo:PX_has_main_representation <http://www.britishmuseum.org/collectionimages/AN00376/
ecrm:P12i_was_present_at <http://collection.britishmuseum.org/id/object/YCA2067/find> ;
ecrm:P52_has_current_owner id:the-british-museum ;
ecrm:P128_carries <http://collection.britishmuseum.org/id/object/YCA2067/title/1> ;
ecrm:P70i_is_documented_in <http://collection.britishmuseum.org/id/bibliography/8850> ;
ecrm:P90_has_current_keeper id:the-british-museum <http://collection.britishmuseum.org
ecrm:P30i_custody_transferred_through <http://collection.britishmuseum.org/id/object/YC
ecrm:PL15_identified_by <http://collection.britishmuseum.org/id/object/YCA2067/origo
067/codex16> ; <http://collection.britishmuseum.org/id/object/YCA2067/otherids> <http://coll
ecrm:P24i_changed_ownership_through <http://collection.britishmuseum.org/id/object/YCA2
ecrm:P49_has_former_or_current_keeper <http://collection.britishmuseum.org/id/person-in
ecrm:P49_forms_part_of <http://collection.britishmuseum.org/id/collection/salt-collect
bmo:PX_object_type idThes:x8255 ;
bmo:PX_condition ""Papyrus Survey;
Condition Details:
Papyrus: Fractured, loss
Black ink
Pigment (Flaking)
Backed: brown paper
Checked for loan USA 1988
Mount Details:
Sandwich: glass, perspex
Binding: cloth, self adhesive tape
Object Priority: B
Mount Priority: C
Overall Condition: C
Curatorial condition comment:
good"" ;
bmo:PX_curatorial_comment ""Published;
Cleopatra's Egypt, Brooklyn 1988, pp.235-236 [126] = = Kleopatra, Mainz 1989, pp. 290-292 [120
bmo:PX_display_wrap "Found (n) : Egypt :2" ; "uses technique : painted :"; "Acqui
" ; "Acquisition date : 1823 :"; "Production Period / Culture : Ptolemaic :"; "Consists
sociated Person (Named in Inscription) : Tasheretenin :"; "Bibliographic reference :; Brook
: frame" ; "Dimension Length :; 80.00cm :; frame" ; "Inscription note :; Book of the Dead: jud
bmo:PX_physical_description "Book of the Dead of I3-srt-n-mwv multicoloured vignettes;
ecrm:P108i_was_produced_by <http://collection.britishmuseum.org/id/object/YCA2067/produ
ecrm:P43_has_dimension <http://collection.britishmuseum.org/id/object/YCA2067/height/1>
2067/length/1> ;
ecrm:P48_has_preferred_identifier <http://collection.britishmuseum.org/id/object/YCA206
ecrm:P65_shows_visual_item <http://collection.britishmuseum.org/id/object/YCA2067/inscr

```



British Museum SPARQL

- ... allowing querying in SPARQL (the W3C standard for querying RDF)

collection.britishmuseum.org/sparql



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SPARQL Query

Query:

```
1 PREFIX ecrm: <http://erlangen-crm.org/current/>
2 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
3
4 SELECT (COUNT(DISTINCT ?object) AS ?count)
5 {
6   ?object ecrm:P128_carries/rdfs:label "Book of the Dead"
7 }
```

Results for your query (1) - [Edit query](#)

count

1496

(N.B.: this is quite a crude query to achieve a broad estimate)



British Museum SPARQL

- ... allowing querying in SPARQL
- so we can (somewhat) answer that earlier question:

```
1 PREFIX ecrm: <http://erlangen-crm.org/current/>
2 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
3 PREFIX skos: <http://www.w3.org/2004/02/skos/core#>
4
5 SELECT DISTINCT ?material (COUNT(DISTINCT ?object) AS ?count)
6 { ?object ecrm:P128_carries/rdfs:label "Book of the Dead" ;
7         ecrm:P45_consists_of/skos:prefLabel ?material }
8 GROUP BY ?material
9 ORDER BY DESC(?count)
```

Results for your query (40) - Edit query

material	count
papyrus	1116
linen	145
glazed composition	56
wood	30
steatite	24
limestone	22
basalt	22
sycomore fig wood	15
gold	14
acacia wood	11
bitumen	11
serpentine	10
plaster	8
jasper	7
calcite	5
leather	5

(N.B.: again, this query could be refined)

No more SPARQL, I promise...



British Museum 'Terminology'

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- From a given starting point, e.g.:

collection.britishmuseum.org/resource?uri=http://collection.britishmuseum.org/id/person-institution/54974

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Osiris RDF Rank

RDF Search and Explore

Osiris

Either from this ID

or by text search

(plus a bit of work)

Source: http://collection.britishmuseum.org/id/person-institution/54974

Subject (9) Predicate Object All

Download in: JSON | RDF | N3/Turtle | N-Triples

Named Graph All Language English Inference Explicit only

Statements in which the resource exists as a subject.

Predicate	Object
rdf:type	ecrm:E21 Person , skos:Concept
ecrm:P3 has note	Ancient fertility god; lord of Duat, or the underworld, and judge of the dead; consort of Isis (q.v.) and father of Horus (q.v.). Titles/Epithets (recorded in inscriptions as) - Ruler of the Sacred Land, King of the Gods and Foremost of the Domain of the Bee.
bmo:PX_gender	http://collection.britishmuseum.org/id/thesauri/gender/male
bmo:PX_nationality	http://collection.britishmuseum.org/id/thesauri/nationality/Egyptian
bmo:PX_profession	http://collection.britishmuseum.org/id/thesauri/profession/deity
ecrm:P131 is identified by	http://collection.britishmuseum.org/id/person-institution/54974/appellation/1
skos:inScheme	thesIdentifier:person-institution

“Follow your Nose”

- We can easily (without SPARQL) find interesting relationships:

Osiris RDF Rank

Source: <http://collection.britishmuseum.org/id/person-institution/54974>

Subject Predicate **Object (100 of 1619)** All

Named Graph All Language English

Statements in which the resource exists as a object.


Subject	Predicate
http://collection.britishmuseum.org/id/object/YCA23977	ecrm:P62 depicts
http://collection.britishmuseum.org/id/object/YCA23978	
http://collection.britishmuseum.org/id/object/YCA2041	
http://collection.britishmuseum.org/id/object/YCA2256	
http://collection.britishmuseum.org/id/object/YCA69134	
http://collection.britishmuseum.org/id/object/YCA2242	
http://collection.britishmuseum.org/id/object/YCA57764	
http://collection.britishmuseum.org/id/object/YCA57860	
http://collection.britishmuseum.org/id/object/YCA63146	
http://collection.britishmuseum.org/id/object/YCA20618	
http://collection.britishmuseum.org/id/object/YCA20619	
http://collection.britishmuseum.org/id/object/YCA20620	
http://collection.britishmuseum.org/id/object/YCA5542	
http://collection.britishmuseum.org/id/object/YCA59055	
http://collection.britishmuseum.org/id/object/YCA59056	

then here

Clicking here

YCA23978 RDF Rank

Source: <http://collection.britishmuseum.org/id/object/YCA23978>



Subject (47) Predicate Object All

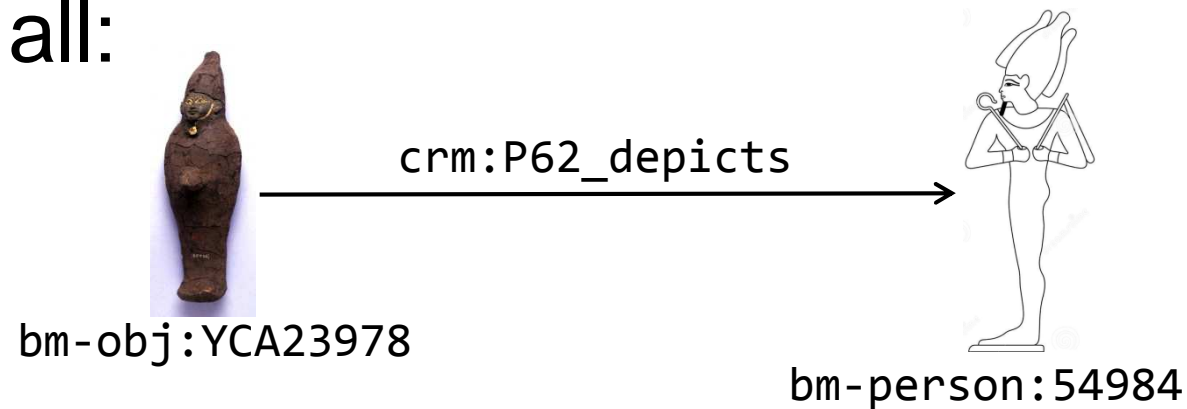
Named Graph All Language English Inference Explicit only

Statements in which the resource exists as a subject.

Predicate	Object
rdf:type	ecrm:E22_Man-Made_Object
ecrm:P45 consists_of	thes.x10355 , ... thes.x10638 thes.x10892 thes.x11119 thes.x11593
ecrm:P51 has_former_or_curr...	http://collection.britishmuseum.org/id/person-institution/52951
ecrm:P62 depicts	http://collection.britishmuseum.org/id/person-institution/54974
bmo:PX has_main_representat...	http://www.britishmuseum.org/collectionimages/AN00422/AN00422867_001_I.jpg
ecrm:P12i was_present_at	http://collection.britishmuseum.org/id/object/YCA23978/find

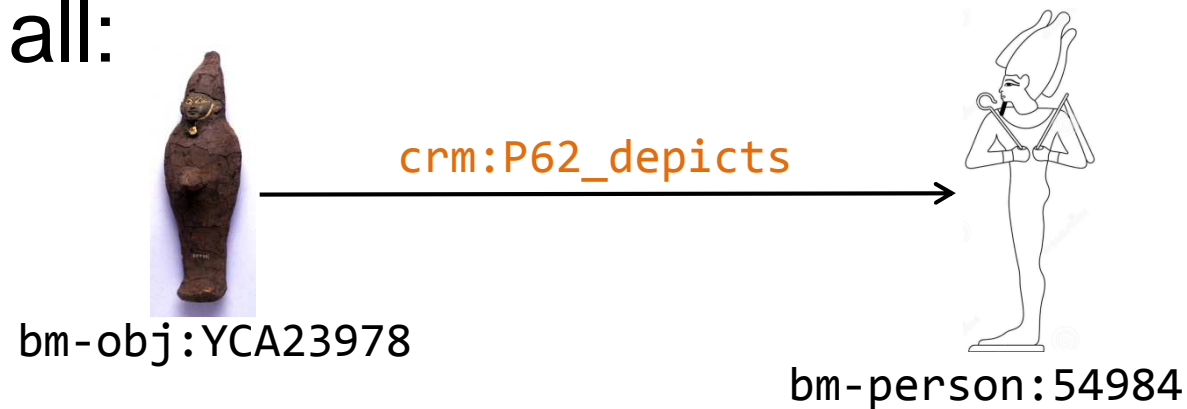
CIDOC-CRM

- Modelling these relationships is what RDF is for after all:



CIDOC-CRM

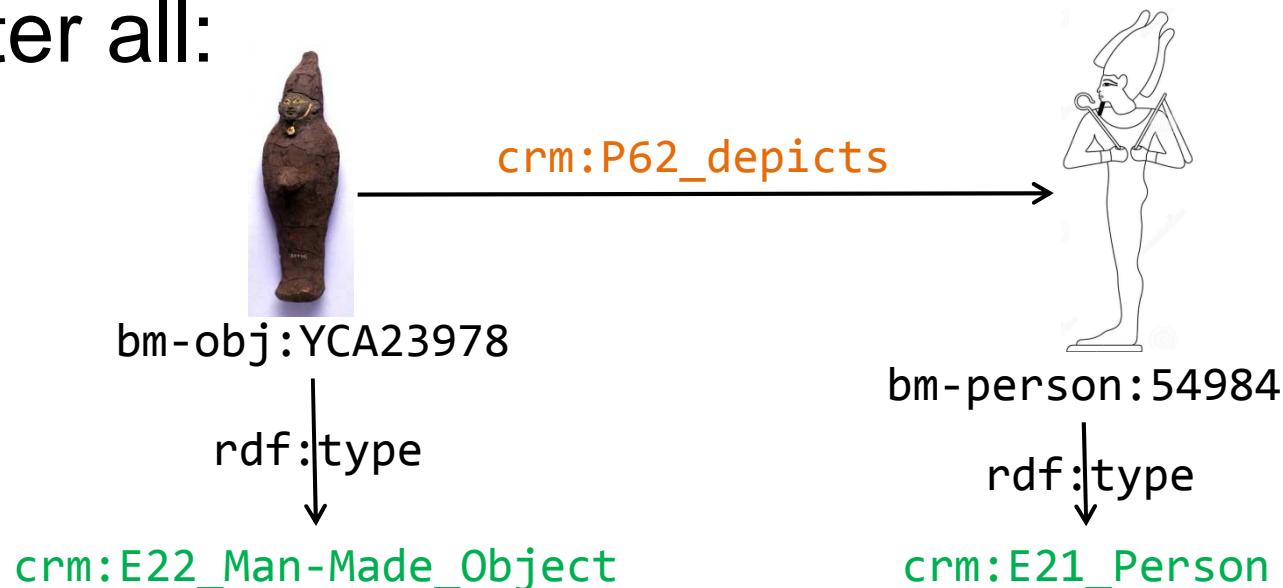
- Modelling these relationships is what RDF is for after all:



- The CRM ontology defines:
 - **properties** to provide a shared conceptualisation of kinds of relationship

CIDOC-CRM

- Modelling these relationships is what RDF is for after all:

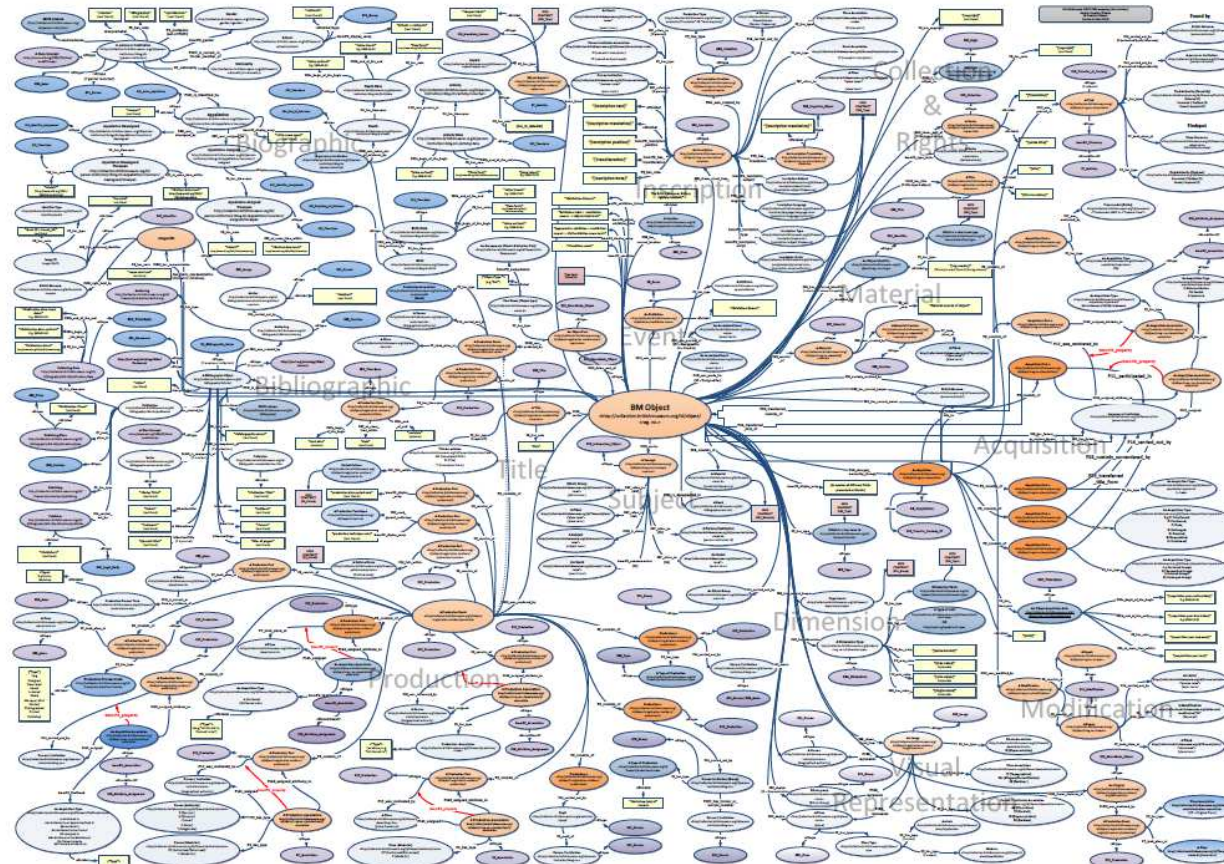


- The CRM ontology defines:
 - **properties (Pn)**, a shared conceptualisation of kinds of relationship
 - **classes (En)**, a shared conceptualisation of kinds of resources



CIDOC-CRM @ BM

- Ultimately we can use these classes and properties to build a rich model of our data:





Requirements beyond CRM

- CRM provides a good model for the objects
- In order to model Mosher's conceptual structure, however, we need to model:
 - the wholly conceptual 'Book of the Dead';
 - the decomposition into spells, paragraphs, etc.;
 - Mosher's (whole) volume;
 - Mosher's conception of coherent versions/traditions;
 - Mosher's translations;
 - the relationships to vignettes;
 - spell (original) texts, vignettes, and their relationship to the objects that carry them.



FRBRoo

- FRBRoo:
 - is a sister ontology to CRM and natural used in combination with it;
 - like CRM, takes an ‘object-oriented’ approach to formalising a foregoing Entity-Relationship model;
 - models precisely these implied classes (Fn) and relationships (Rn) –
 - **Works** are the product of **Expressions**, which are made physically available through **Manifestations**



ResearchSpace

- ResearchSpace
 - provides a collaborative research environment;
 - provides a number of tools to facilitate this –
 - search and browse,
 - data annotation,
 - image annotation, (and many others);
 - integrates RDF from multiple sources (per project);
 - without explicit SPARQL, etc.



ResearchSpace Search

- Semantic search based on terminology, not just free text:

The screenshot shows the ResearchSpace search interface. At the top, there is a navigation bar with 'ResearchSpace' and a search icon. Below this is a secondary bar with 'Dashboard', 'Forum', and a 'Sentence Search' tab. The main search area contains the text 'Find all objects with images' followed by a search input field containing 'Osiris'. A dropdown menu is open below the input field, listing several search results:

- Osiris [BM Person/Institution]
- Pataikos [BM Person/Institution]
- Ptah-Sokar-Osiris [BM Person/Institution]
- Temple of Osiris Abydos [BM Place]
- Ptah-Sokar [BM Person/Institution]
- Osiris-Canopus [BM Person/Institution]

A tooltip is visible over the 'Pataikos' entry, containing the text: 'Ancient fertility god; lord of Duat, or the underworld, and judge of the dead; consort of Isis (q.v.) and father of Horus (q.v.). Titles/Epithets (recorded in inscriptions as) - Ruler of the Sacred Land, King of the Gods and Foremost of the Domain of the Bee.'

At the bottom left, there are tabs for 'Past Searches' and 'Saved Searches', and a link for 'Search result name' and 'Search details'.



ResearchSpace Search

- Semantic search using explicit (but possibly abstracted) relationships:

The screenshot shows the ResearchSpace search interface. At the top, there is a navigation bar with 'ResearchSpace' and tabs for 'Dashboard', 'Forum', and 'Osiris'. Below this is a search bar with the text 'Find all objects with images' and a dropdown menu currently showing 'about' and 'Osiris'. A dropdown menu is open, listing various semantic relationships: 'created/modified by', 'influenced by', 'owner/keeper', 'all owners/keepers', 'about', 'met', 'date interval', 'identified by', and 'keyword'. At the bottom left, there are links for 'ast Searches' and 'Saved Searches', and a section for 'earch result name' and 'earch details'.



ResearchSpace Search

ResearchSpace

Dashboard Forum Osiris and papyrus

Find all objects with images

about Osiris and made of papyrus

7 Results

List Thumbnails Timeline

Object Type
7 papyrus

Creator
7 (missing this field)

Places
7 (others)

sorted by: Title; then by...



[YCA39611 Fragment of funerary papyrus, with vignettes...](#)
 papyrus: YCA39611 Fragment of funerary papyrus, with vignettes...; **Material:** papyrus; **Technique:** painted



[YCA62412 Book of the Dead of Panedjem II; sheet 1...](#)
 papyrus: YCA62412 Book of the Dead of Panedjem II; sheet 1...; **Material:** papyrus; **Technique:** painted



[YCA63209 Book of the Dead of Penmaat; sheet 1; deceased...](#)
 papyrus: YCA63209 Book of the Dead of Penmaat; sheet 1; deceased...; **Material:** papyrus; **Technique:** painted



[YCA67306 'Book of the Dead', Papyrus of Ani \(sheet...](#)
 papyrus: YCA67306 'Book of the Dead', Papyrus of Ani (sheet...; **Material:** papyrus; **Technique:** painted



ResearchSpace Data Annotation

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- Data annotation allows us to question and add new relationships, *e.g.*:

The screenshot displays the ResearchSpace web interface. At the top, there is a navigation bar with the ResearchSpace logo and a menu containing 'Dashboard', 'Forum', 'Osiris and papyrus', and 'YCA62412 Book of the Dead of Panedjem II; sheet 1;...'. Below the navigation bar, the main content area is titled 'YCA62412 Book of the Dead of Panedjem II; sheet 1;...' and has three tabs: 'Object Details', 'Annotations', and 'Relations'. The 'Annotations' tab is selected. On the left side, there is a 'Basic' dropdown menu and a 'Museum Object' section with the description: 'Book of the Dead of Panedjem II; sheet 1; Hieratic text; full colour offering-vignette with Hieroglyphic text above.' Below this, there are sections for 'Preferred identifier' (YCA62412), 'Identifiers' (EA10793.1, 118176, Sheet 1, 1960.1210.1.1), and 'Add annotation' buttons. On the right side, there is a 'Related Content' section with the heading 'Images' and three image thumbnails: a full page of hieroglyphs, a rolled-up scroll, and a framed document.



ResearchSpace Data Annotation

The British
Museum

- Data annotation allows us to question and add new relationships, *e.g.*:

The screenshot displays the ResearchSpace web interface. At the top, there is a navigation bar with tabs for 'Dashboard', 'Forum', 'Osiris and papyrus', and 'YCA62412 Book of the Dead of Panedjem II; sheet 1;...'. Below this, the main content area shows the object details for 'YCA62412 Book of the Dead of Panedjem II; sheet 1;...'. The 'Annotations' tab is selected, and a 'New Annotation' dialog box is open. The dialog box contains the following fields:

- Title:** papyrus YCA62412 Book of the Dead of Panedjem II; sheet 1;... depicts: Osiris
- Referred value:** Osiris (with radio buttons for Yes, No, and None)
- Suggested value:** Ra

The dialog box also features a rich text editor with bold, italic, underline, and list icons, and a 'Add topic...' field with an 'Add' button. Below the dialog box, there are 'Save' and 'Cancel' buttons. On the right side of the interface, there are two images: a photograph of a rolled-up papyrus scroll and a photograph of an open book with hieroglyphic text.



ResearchSpace Image Annotation

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- Given an image (associated with an object), user can
 - create a geometric outline within image
 - relate this new component resource to terminology

ResearchSpace

Forum Osiris and papyrus YCA62412 Book of the Dead of Panedjem II; sheet 1

AN00235

Image details Annotations Relations

Osiris

Osiris [BM Person/Institution]
Pataikos [BM Person/Institution]
Ptah-Sokar-Osiris [BM Person/Institution]
Temple of Osiris Abydos [BM Place]
Ptah-Sokar [BM Person/Institution]
Osiris-Canopus [BM Person/Institution]
Osiris-Ish [BM Person/Institution]

Text Annotation

- So what about annotations within text?

BD 1

Version 1' (figs. 1.1 - 1.47)

§T Beginning of the spells of going forth by day,² **raising up the glorious ones** in the necropolis,³ what is spoken on the day of burial, of entering after going forth by Osiris-N.⁴

§P Words spoken by Osiris-N.⁵



bm-person:54984

Fig. 1.1: §T of BD 1, Version 1 - BM 10558.

Fig. 1.2: §T of BD 1, Version 1 - N3281.

¹ **Saite/Memphite papyri**: **Cairo 40029**, **lahtesnacht** (much missing), **N3091**, **Nespasefy**, **Tasheret**; **BM 10558**, **MMA** (§T to midway in §8 omitted), **N3081** (only §T through §3; rest omitted). **Nicholson R85**. **Linon Bandages**: **BMFA #1** (§R omitted), **BM #71**, **BM 10809** (only §7-§9 survive; §R omitted), **E17237** (§9-§R lost), **Getty A** (§T, §P, and 99% of §1 lost, §R omitted), **Getty C** (§T omitted), **Mosher-1** (only §9 is complete), **N3057** (HG text; §4-§6 lost; remaining text), **N3058** (§T omitted), **UC32419** (only §5 through §9 survive; §R omitted). **Theban HT papyri**: **BM 10037**; **BM 10038** (much lost, §9-§R omitted); **BM #111**, **N3072**, **N3125**, **N3281**. **HG papyri**: **Milbank**, **Parma** (§6-§R omitted), **Turin 1793**. **Total Documents**: 28. I limit notes for BD 1 only to surviving text without noting what is lost. Regarding **Cairo 40029**, **Milbank**, **N3057**, **Nicholson R85**, **Turin 1793**, see comments after translation.

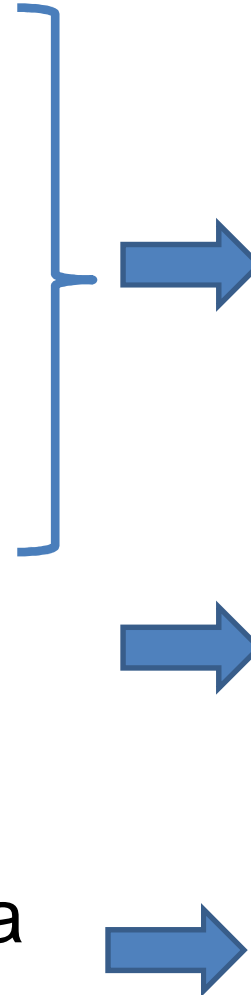


bm-id:YCA62412



Several Choices

- Stand-off mark-up
(common in NLP)
- In-place mark-up with XML tagging
 - A custom schema
 - Shoe-horning into existing schema, *i.e.* TEI
- In-place mark-up with RDFa



- Need to define semantics
- Need to process into HTML/UI
- Can derive CRM (but not FRBRoo?) semantics
- Can derive HTML/UI
- ...



RDFa

- In contrast with other approaches:
 - XHTML/RDFa *is* already HTML;
 - RDFa allows embedding of CRM, FRBRoo and any other vocabulary (classes and properties) we choose; ([Schema.org?](#) [OpenGraph?](#))
 - allows ‘distillation’ of RDF by generic means;
 - works alongside the Web model (being our target), disambiguating the hyperlinks we’d make in any case.



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- Questions?
- Rotten tomatoes?