CRMarchaeo: A CIDOC CRM extension to support archaeological excavations

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Archaeology and heterogeneity ...
Archaeological excavation

- Destructive activity!!
- Lack of documentation could cause the loss of important information forever
What is CRMarchaeo

• Extension of CIDOC CRM to support archaeological excavation process
• To facilitate the semantic encoding, exchange, interoperability and access of existing archaeological documentation
• Starting from standards and models already in use by national and international cultural heritage institutions
• Enriched by continuous collaboration with various communities of archaeologists from different countries and schools
• Relies on concepts provided by CRMsci extension
  • geological and stratigraphic principles that govern archaeological stratigraphy
  • extending and adapting these principles for archaeology
Besides others, we have analyzed

- collection databases (artifacts, numismatic etc.)
- 5 different national methods of excavation recording
- 10 different kinds of analytical investigation, including DNA, thermoluminescence etc.
- temporal gazetteers and “thesauri of periods” \((PeriodO)\)
- Archaeologists, physicists, chemists, microbiologists, biologists and other specialists
  - surprising analogy of procedures, which could be modeled as generic concepts
- **CRMarchaeo+ CRMsci**: a coherent global ontology for deep integration of scientific and cultural-historical evidence and facts, probably the most elaborate and generic currently existing for descriptive sciences
The CRMarchaeo Model

- Collaboration between many cultural heritage institutions
- Unifying efforts of many European projects
  - EPOCH, ARIADNE, PARTHENOS…
- Officially approved by CRM SIG to be formally and methodologically compatible with CIDOC CRM
- Open to every possible integration and addition that may become necessary as a result of its practical use on real archaeological problems
- Intended to be maintained and promoted as an international standard
CRMarchaeo „ancestors“: CRM EH

Appendix A: Ontological Model of Centre for Archaeology Information Domain (V9)
• Basic idea on which archaeology is based

  • “… the features of an archaeological site are to be found in the stratified context, which is investigated by an archaeological excavation”

    [Harris 1989]

• Basic elements

  • physical arrangement of archaeological stratification

  • events that led to the formation of particular stratigraphic situations

  • activities performed to reconstruct the process
CRMarchaeo entities

- Stratigraphic **genesis** and **modifications**
- **Natural phenomena** or **human intervention** that led to their creation
- **Nature** and **shape** of existing stratifications and surfaces
- Analysis of the **human remains or artifacts** found within the strata
- Analysis of relative **chronological** order in which stratification was formed
CRMarchaeo potential

• To enable interpretation of chronological sequences
  • space-time analysis of a specific site

• To enable historical reconstructions
  • identity, life, beliefs, behavior and activities of a given group of people in the past in that specific place

• To overcome the differences resulting from the application of different excavation techniques and procedures
  • different traditions and schools of archaeology
  • unified view that can express the common concepts

• integration of various methodologies
CRMarchaeo classes: physical features

• **A2 Stratigraphic Volume Unit**

• connected portions of terrain or other solid structure on, in, or under the surface of earth or seafloor exhibiting some homogeneity of structure or substance

• completely bounded by surfaces or discontinuities in substance or structure with respect to other portions of the terrain or surfaces of objects/finds

• may contain physical objects

• the internal continuity and the boundaries should be of a kind that can be attributed to a single genesis event or process
CRMarchaeo classes: physical features

• **A3 Stratigraphic Interface**

  • coherent parts of the boundary surface resulting from a stratigraphic genesis event or process
  • marks the extreme limit of the effect of a genesis or modification event, by indicating where the effect of this event ended
  • each event of creation/destruction of a deposition layer implies the creation of new interfaces
  • 2 main types of interface:
    • surfaces confining strata
    • surfaces only -> formed by the removal or destruction of existing stratifications
• **A8 Stratigraphic Unit**: comprises $S_{20}$ Physical Features that are either A2 Stratigraphic Volume Units or A3 Stratigraphic Interfaces.
Observing Physical Constellations

E55 Type “above”, “fills”, “cuts”

AP11.1 has type
AP11 has physical relation

A8 Stratigraphic Unit

A2 Stratigraphic Volume Unit (1)

A2 Stratigraphic Volume Unit (2)

A2 Stratigraphic Volume Unit (18)

A3 Stratigraphic Interface [19]

A3 Stratigraphic Interface [3]

A2 Stratigraphic Volume Unit (4)

A2 Stratigraphic Volume Unit (15)

above
fills
cuts
above
cuts
fills
Derivation of Temporal Relations

A2 Stratigraphic Volume Unit (2)

A3 Stratigraphic Interface [19]

A4 Stratigraphic Genesis Event [19]

A4 Stratigraphic Genesis Event (2)

A4 Stratigraphic Genesis Event [19]

A4 Stratigraphic Genesis Event (18)

A4 Stratigraphic Genesis Event [18]

A3 Stratigraphic Interface [3]

A4 Stratigraphic Genesis Event [3]
activities of excavating in the sense of archaeology, documented as a coherent set of actions of progressively recording and removing matter from a pre-specified location under specific rules intended to remove matter within the boundaries of a particular stratigraphic unit, or pre-declared spatial extent such as a trench results in the production of a set of recorded (documentation) data that should be sufficient to provide researchers enough information regarding the consistence and spatial distribution of the excavated segment of matter

"...And right above the Stone Age strata you can clearly see artefacts from the 'Iron Age!'"
Modeling Excavation Activities
**In situ findings**

- states of instances of *E18 Physical Things* of being partially or completely embedded at a particular position with relative stability in one or more *A2 Stratigraphic Volume Units*.
- used to document the fact of embedding generally with respect to the surrounding matter
- allows for specifying temporal bounds for which a particular embedding has been existing

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**A1 Excavation Process Unit**

- A1 Excavation Process Unit
- P9 consists of
- S19 Encounter Event
- AP17 is found by
- O19 has found object
- AP18 is embedding of
- E18 Physical Thing
- AP20 is embedding at
- AP19 is embedding in
- E3 Condition State
- E53 Place
- A7 Embedding
- A2 Stratigraphic Volume Unit
- CIDOC CRM Core
- CRMsci
- CRMarchaeo
• A9 Archaeological Excavation  **CRMarchaeo classes: activities**

• general concept intended as a coordinated set of activities performed on an area considered as part of a broader topographical, rural, urban, or monumental context

• usually under the responsibility of a coordinator, officially designated, which is legally and scientifically responsible for all the activities carried out and is also responsible for the documentation of the whole process
CRMarchaeo: Future works

- Extending the model
  - Concept of Archaeological Site/Archaeological Campaign
- Inference making mechanism (CRMinf)
- Testing the model against existing archaeological archives
  - ARIADNE Project -> item level integration
  - ICCD Italian archaeological model
  - English Heritage, ADS, DANS, DAI ...
- Would you like to contribute?
Thank you

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