

CIDOC CRM_{BA}
A CRM EXTENSION FOR
BUILDINGS ARCHAEOLOGY
INFORMATION MODELING

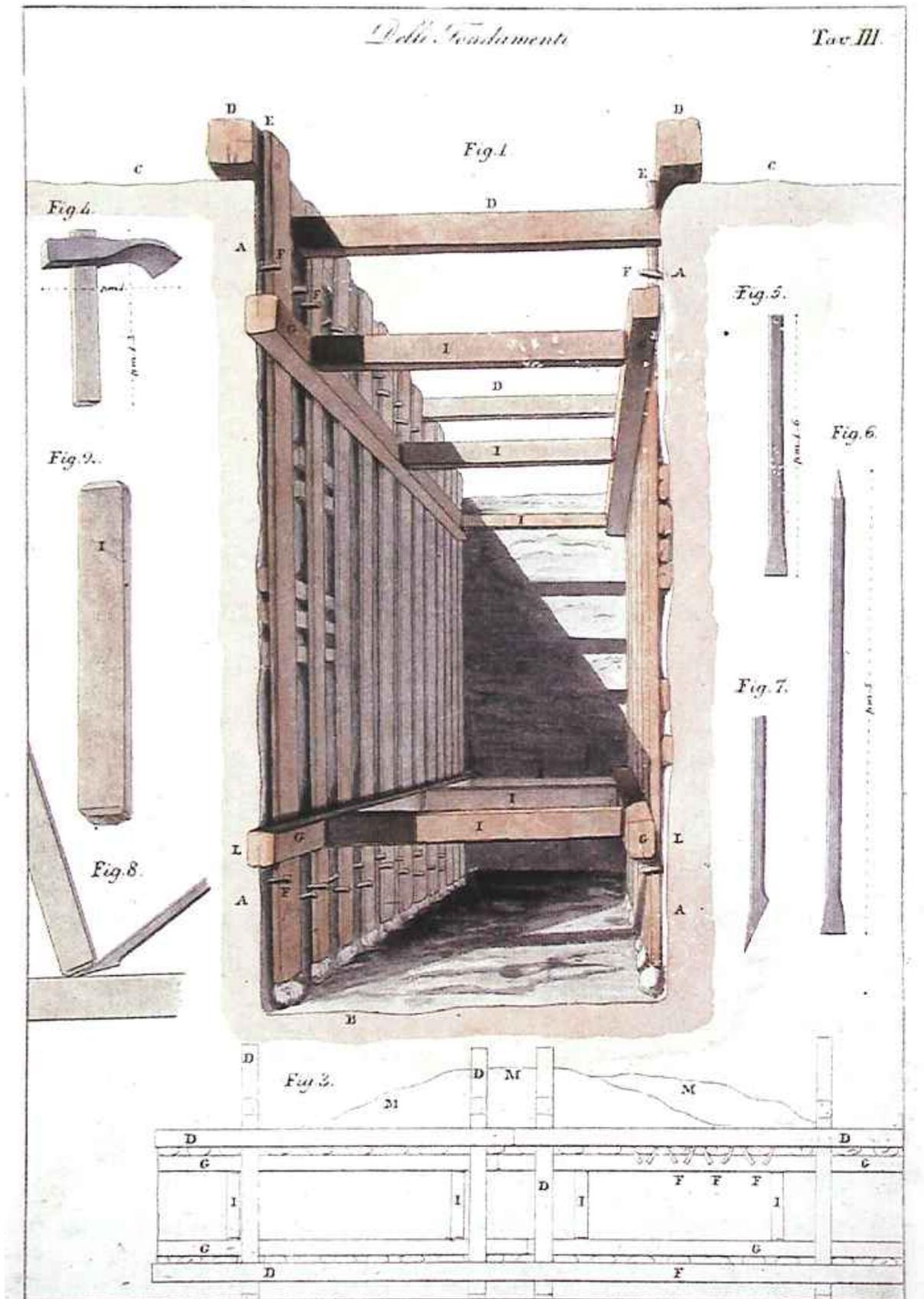
BY
Paola Ronzino
PIN, VASTLAB, Italy

CIDOC CRM SIG, 32nd joint meeting
Oxford University e-Research Centre
11-02-2015



Outline

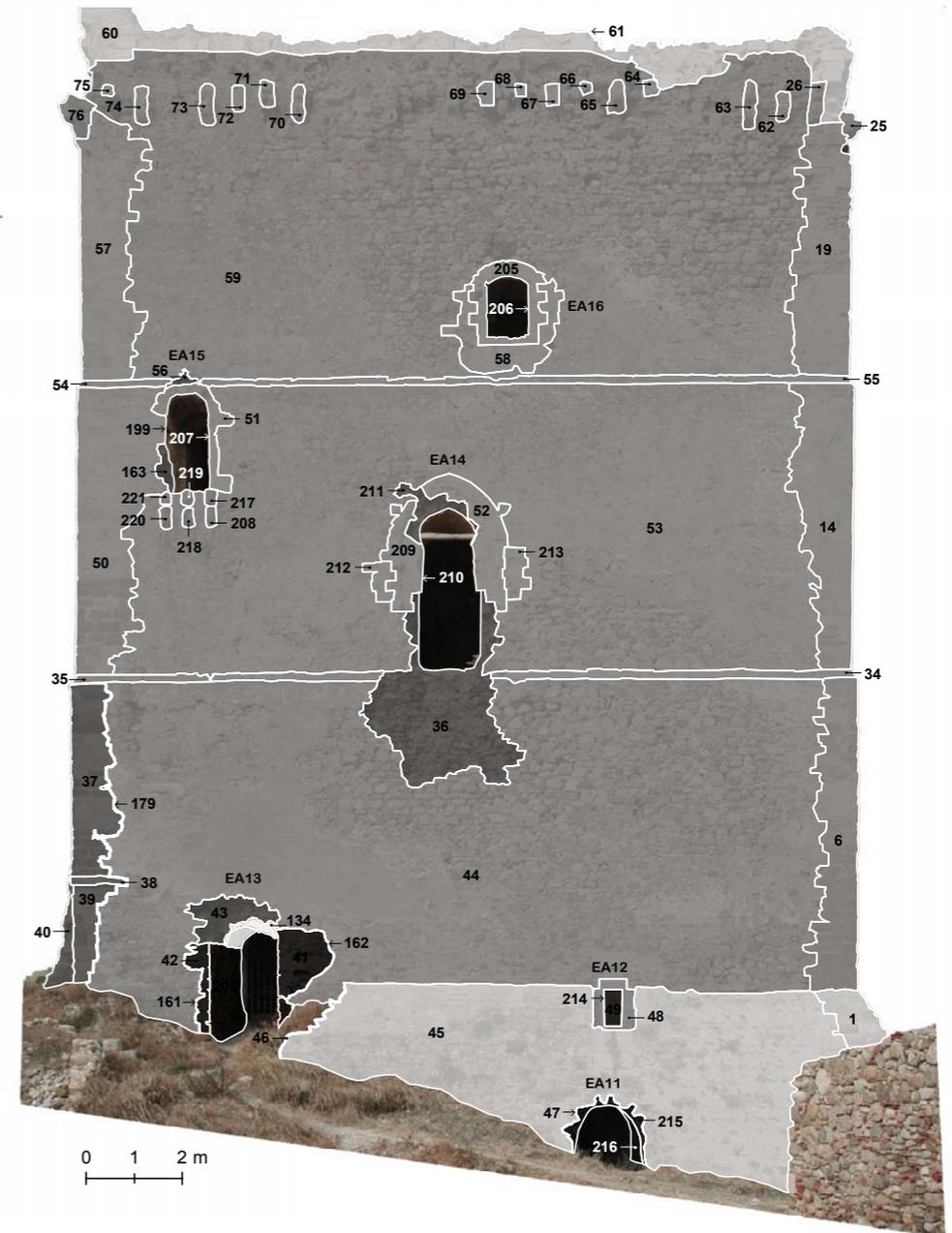
- Research aims
- Research methodology
- Introduction of CRMBA
 - Classes and properties definition



Picture from Valadier G., *L'architettura pratica dettata nella scuola e cattedra dell'Insigne Accademia di San Luca dal Prof. Accademico Signor Cav. Giuseppe Valadier data alla luce dallo Studente d'Architettura Civile Giovanni Muffati Romano*, voll.5, Società Tipografica, Roma, 1828-'39.

Research aims

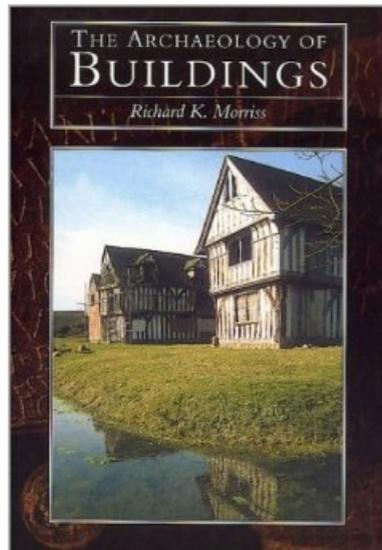
- Facilitate the discovery of and reasoning on archaeological resources through the definition of new concepts required to describe the complexity of historic buildings
- Make explicit the relations between building components, functional spaces, topological relations and construction phases through time and space
- Provide a contribution to the datasets interoperability issue using CIDOC CRM, by developing an extension “CRMBA”, tailored to document archaeological buildings



- 1 (XIV secolo)
- 2 (XVI secolo)
- 3 (XIX secolo)
- 4, Fase I (post 1900-ante 1950)
- 4, Fase II (post 1976)
- 4, Fase III (post 1976)

A. Fiorini, 2008. *Archeologia dell'architettura*

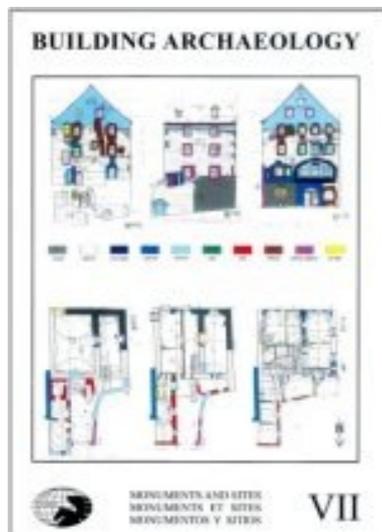
Buildings Archaeology



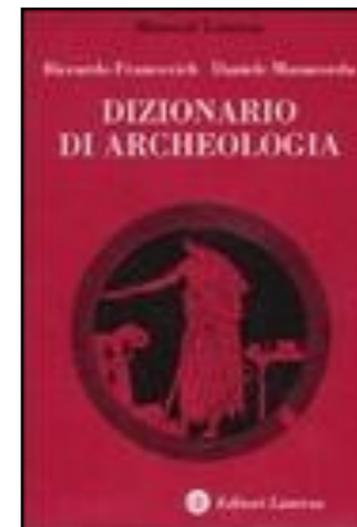
Morriss, R.K., 2004. *The Archaeology of Buildings*, Stroud, Gloucs, UK: Tempus.



Brogiolo, G. Pietro, 1988. *Archeologia dell'edilizia storica*, Como: New Press.



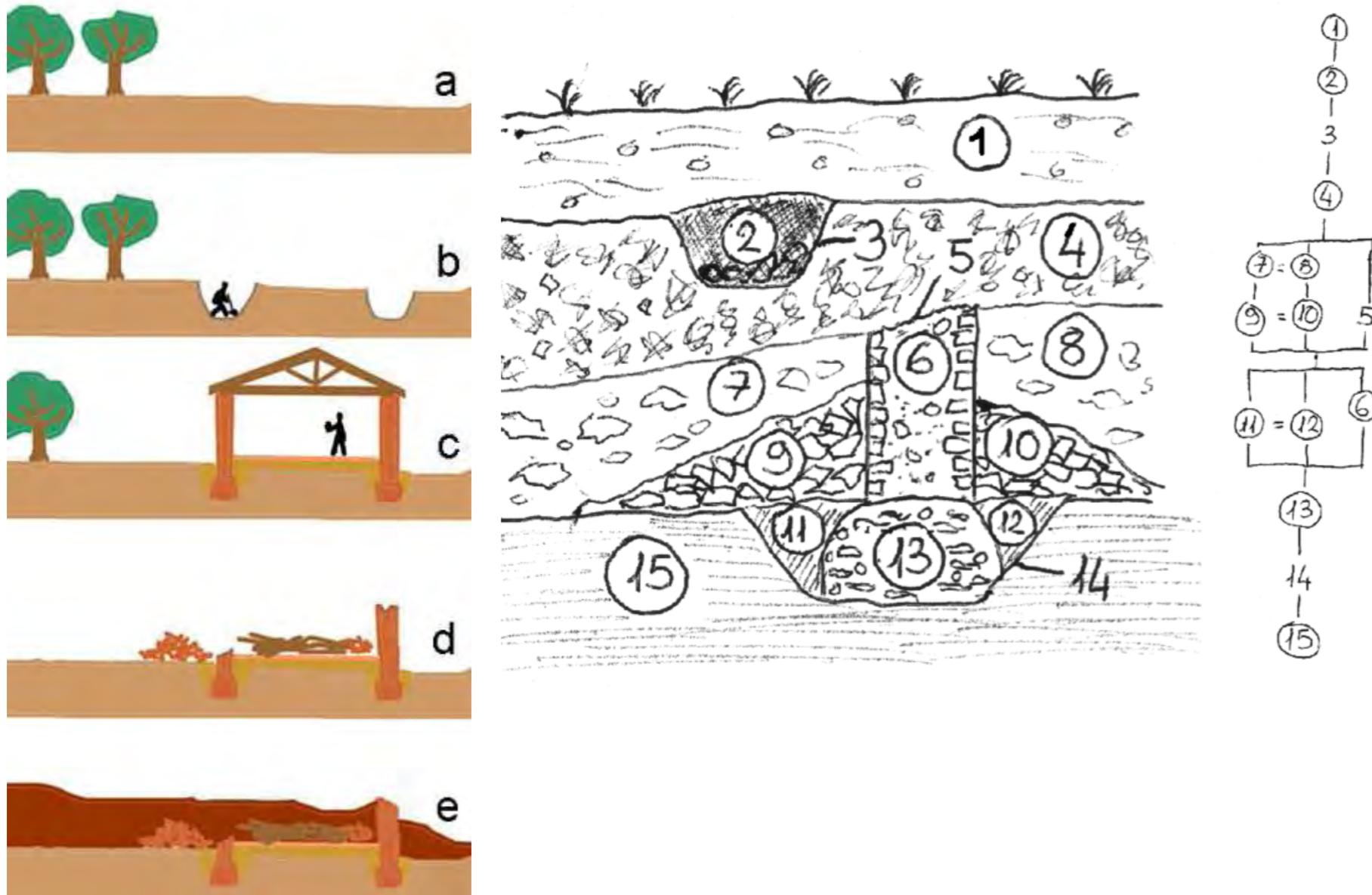
Schuller, M., 2002. *Building Archaeology*. In *Monument&Site*. ICOMOS.



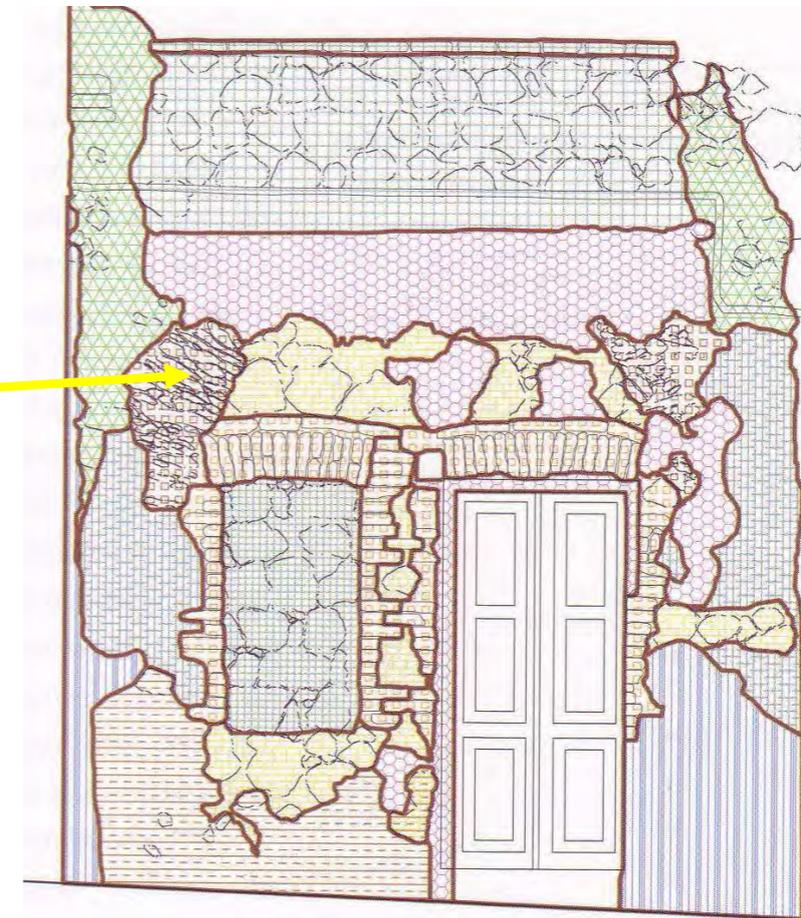
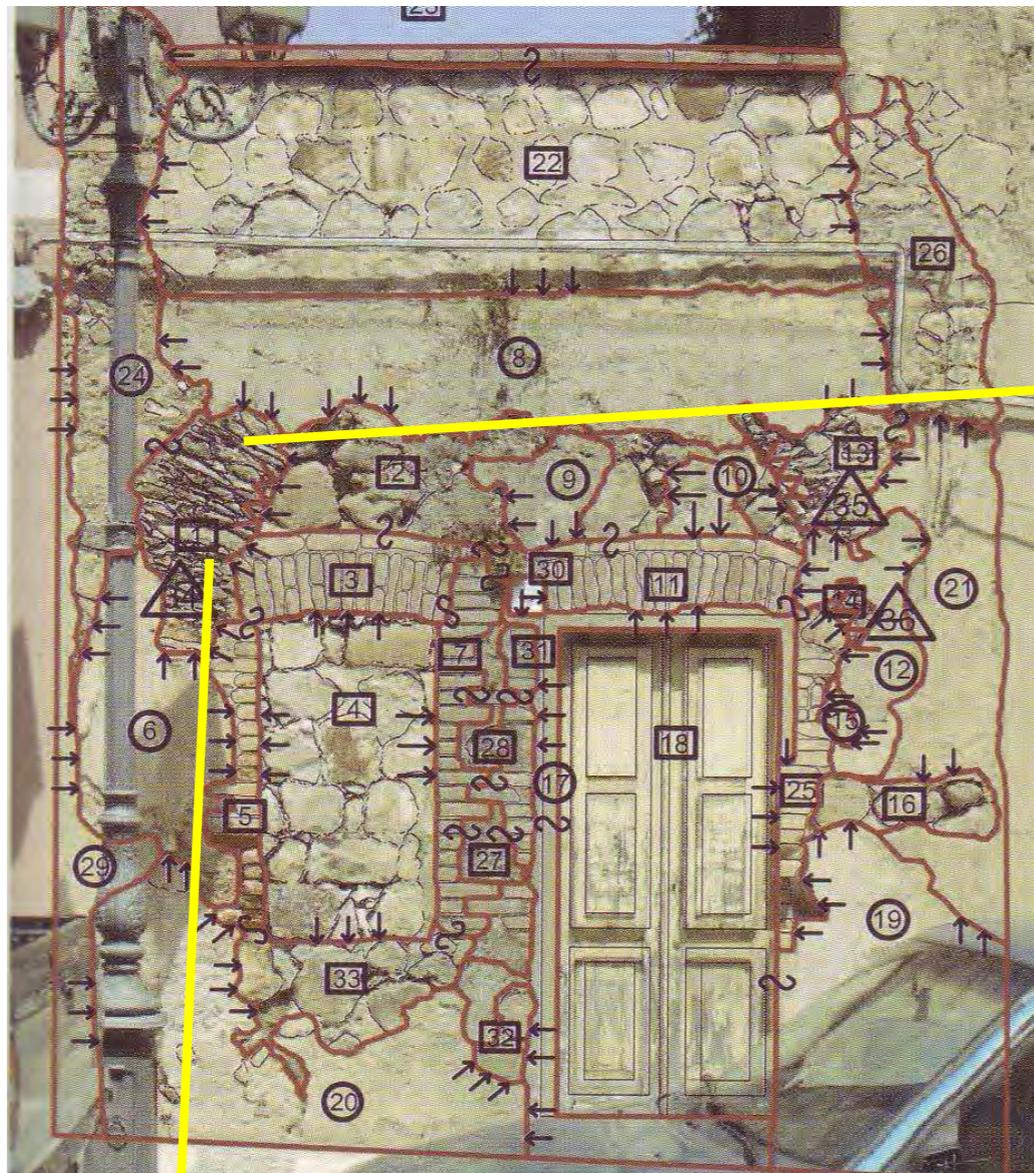
Parenti, R., 2009. *Architettura, archeologia della* R. Francovich & D. Manacorda, eds. *Dizionario di Archeologia. Temi, concetti e metodi*, pp.39–43.

Buildings Archaeology is the study of the archaeology of buildings, of the physical remains of the past and its material culture. Within Buildings Archaeology the building is itself an archaeological resource and the evidences for its archaeological interpretation are contained within it (Morriss 2004, Schuller 2002, Mannoni 1998, Parenti 2009, Brogiolo 1988)

Archaeological Stratification



Stratification of the standing structures

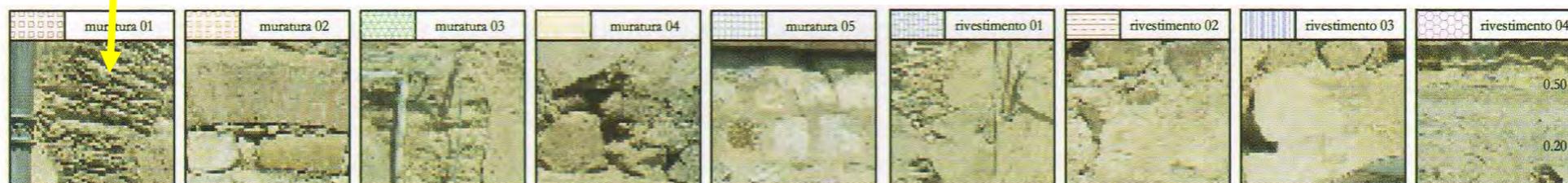


Unità stratigrafiche

□ murarie (USM)

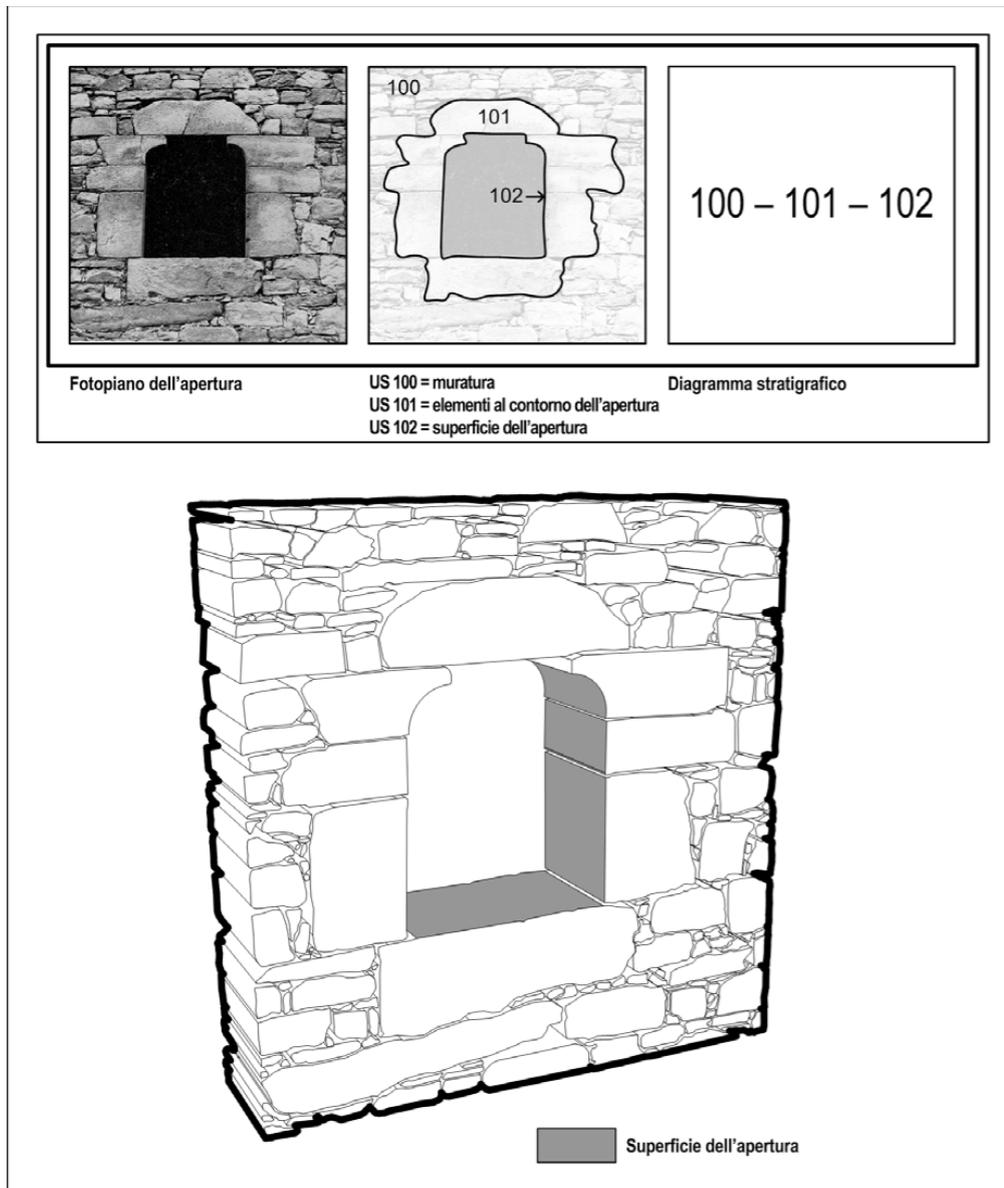
○ di rivestimento (USR)

△ negative o di taglio (USN)

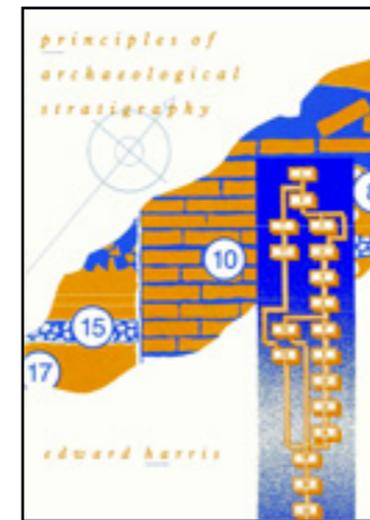


Fiorino D.R: Criteri per la datazione delle strutture: l'analisi stratigrafica delle strutture murarie e il diagramma di Harris

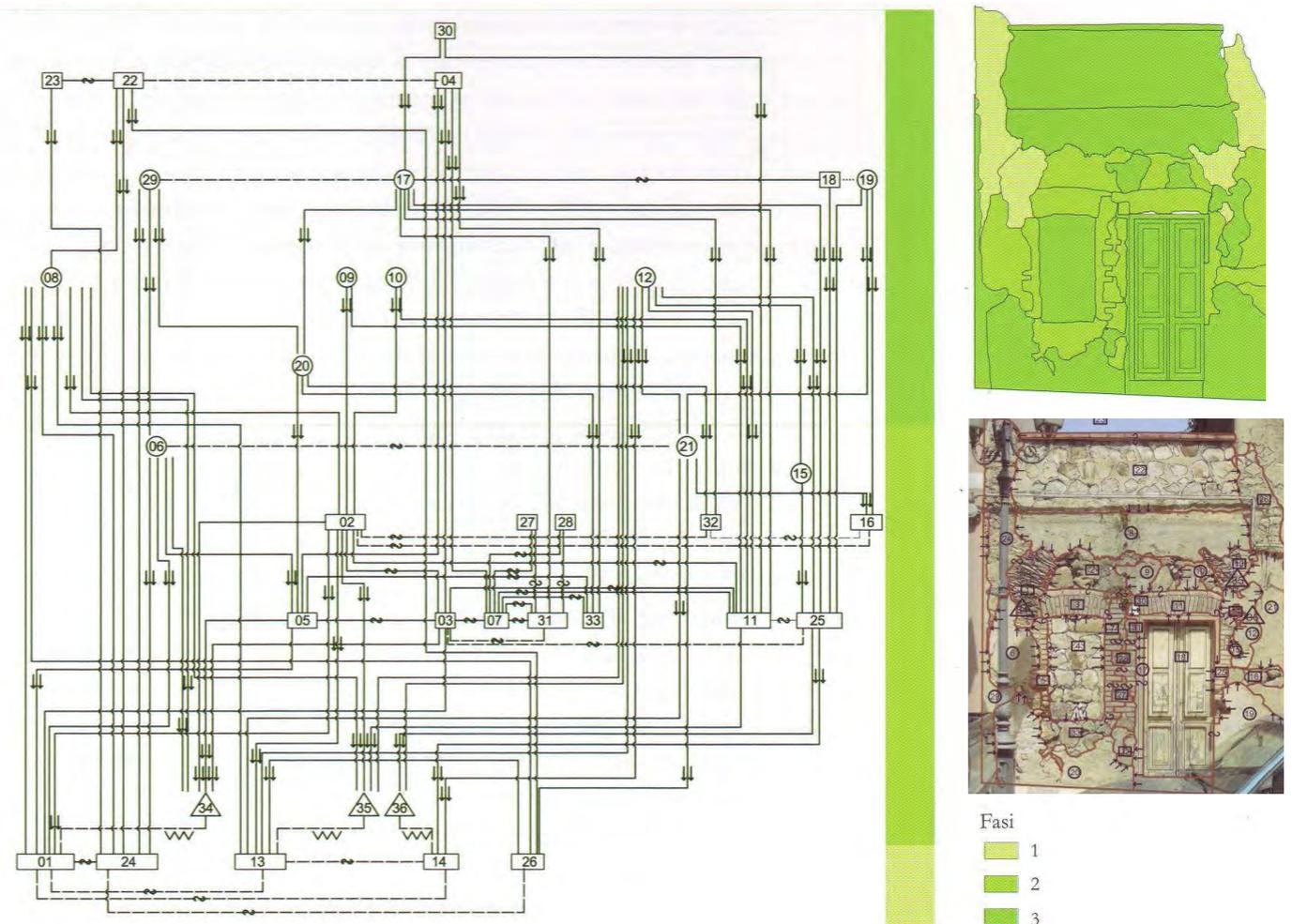
Representation of Physical Relations



A. Fiorini, 2008. *Archeologia dell'architettura*



Harris, E.C., 1989. *Principles of Archaeological Stratigraphy*, 2nd ed. London & New York: Academic Press.



Research Methodology

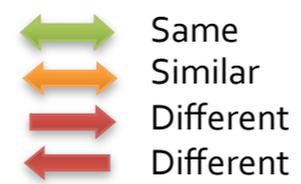
Cross-walk mapping

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z | AA | AB | AC | |
|----|------------------------------------------|---|------------------------|---|---|---|---|---|---|---|---|---|------------------------|---|---|---|---|---|---|---|---|---|-------------------------------------------------|---|----------------------------------|---|----------------------------------|----|---------------------------------------------------------------------------|--|
| 1 | EU-CHIC | | ICCD MA-CA v. 3.00 | | | | | | | | | | ICCD A v. 3.00 | | | | | | | | | | MIDAS | | CARARE | | CARARE V.2 | | CRM | |
| 2 | | | RELAZIONI | | | | | | | | | | RELAZIONI | | | | | | | | | | | | | | | | | |
| 3 | | | STRUTTURA COMPLESSA | | | | | | | | | | STRUTTURA COMPLESSA | | | | | | | | | | | | | | | | | |
| 4 | | | Livello | | | | | | | | | | Livello | | | | | | | | | | | | | | | | | |
| 5 | | | Codice bene radice | | | | | | | | | | Codice bene radice | | | | | | | | | | | | | | | | | |
| 6 | | | Codice bene componente | | | | | | | | | | Codice bene componente | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | Qualifier of relationship | | | | | | | | | | | | | | | | | | | | | | RELATED TO | | Relations/Source of the relation | | Relations/Source of the relation | | E22 Man-Made Object P46 is composed of E22 Man-Made Object P1 is identifi | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | Primary Reference Number All Information Groups | | Relations/Target of relation | | Relations/Target of relation | | E22 Man-Made Object P46 is composed of E22 Man-Made Object P2 has type | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 32 | Cross-refe Originator of reference | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 33 | Reference number | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 34 | Cross-refe Reference number | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 | Originator of reference | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 36 | Start date of recording event | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 37 | End date of recording event | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 38 | Cross-reference to environmental records | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

- ICCD schema
- MIDAS heritage standard
- CHICEBERG
- CARARE
- 3D ICONS
- LIDO
- SDAPA

More than 300 fields covered by ICCD form

More than 700 fields with meaning



Results

- Many of these standards can guarantee a rich documentation
- Fundamental aspects as yet unexplored
 - parthood relations between part of and the whole building
 - the possibility to relate different Stratigraphic Units to each other and the building they are part of
 - analysis of the topological relations of the spaces
- MA/CA form of the Central Institute of Cataloguing and Documentation is the most complete

| CATEGORY | EU-CHIC | MA/CA | MIDAS | CARARE/ 3D ICONS |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Asset id | Unique reference n. of asset | Codice univoco | Primary Reference n. | ID |
| Heritage Asset | - Type of Heritage asset - Name of heritage asset | - Definizione tipologica - Denominazione | - Monument Type - Material - Heritage Asset Name - Artefact Name Type | -HA/Characters/heritage asset type -HA/Appellation/name - HA/Characters/heritage asset type |
| Structure | Structural material: - Foundation - Wall/pillars - Interstore structure - Roof Finishing material: - Foundation - Wall/pillars - Interstorey structure - Roof | - Spazi/suddivisione interna - Impianto strutturale - Pianta - Fondazioni - Strutture verticali - Strutture orizzontamento - Copertura - Scale - Pavimenti e pavimentazioni - Elementi decorativi | - Evidence - Representation Source - Construction Method - Material - Material Component - Note - Material Name - Associated Goods | - HA/description - HA/construction method - HA/Characters/materials |
| Conservation/restoration | - Current physical condition - General condition - Condition of critical elements - Major Risks - long-term environmental impact - Sudden environmental impact Anthropogenic impact | - Stato di conservazione - Riferimento alla parte - Indicazioni specifiche | - Modification State - Condition - Condition Statement - Completeness - Condition Date - Agent of Damage - Vulnerability Level - Buffer Zone Width Environmental | - HA/Conditions/condition - HA/Conditions/Condition assessment - HA/Conditions/Condition date - HA/Conditions/reasons |

Mapping of MA/CA form to CIDOC CRM

Scheda



| CD - CODICI | |
|------------------------------------------------|---------------------------------|
| TSK - Tipo scheda | MA/CA |
| LIR - Livello ricerca | C |
| NCT - CODICE UNIVOCO | |
| NCTR - Codice regione | 20 |
| NCTN - Numero catalogo generale | 00194930 |
| ESC - Ente schedatore | S09 |
| ECP - Ente competente | S09 |
| OG - OGGETTO | |
| OGT - OGGETTO | |
| OGTD - Definizione | insediamento |
| OGTT - Precisazione tipologica | villaggio nuragico |
| OGTA - Livello di individuazione | sito localizzato e circoscritto |
| OGTN - Denominazione e numero sito | Nuraghe Genna Maria |
| LC - LOCALIZZAZIONE GEOGRAFICO-AMMINISTRATIVA | |
| PVC - LOCALIZZAZIONE GEOGRAFICO-AMMINISTRATIVA | |
| PVCS - Stato | ITALIA |
| PVCR - Regione | Sardegna |
| PVCP - Provincia | CA |
| PVCC - Comune | Villanovafornu |
| GP - GEOREFERENZIAZIONE TRAMITE PUNTO | |
| GPL - Tipo di localizzazione | localizzazione fisica |
| GPD - DESCRIZIONE DEL PUNTO | |

The MA/CA form is used to catalogue archaeological heritage:

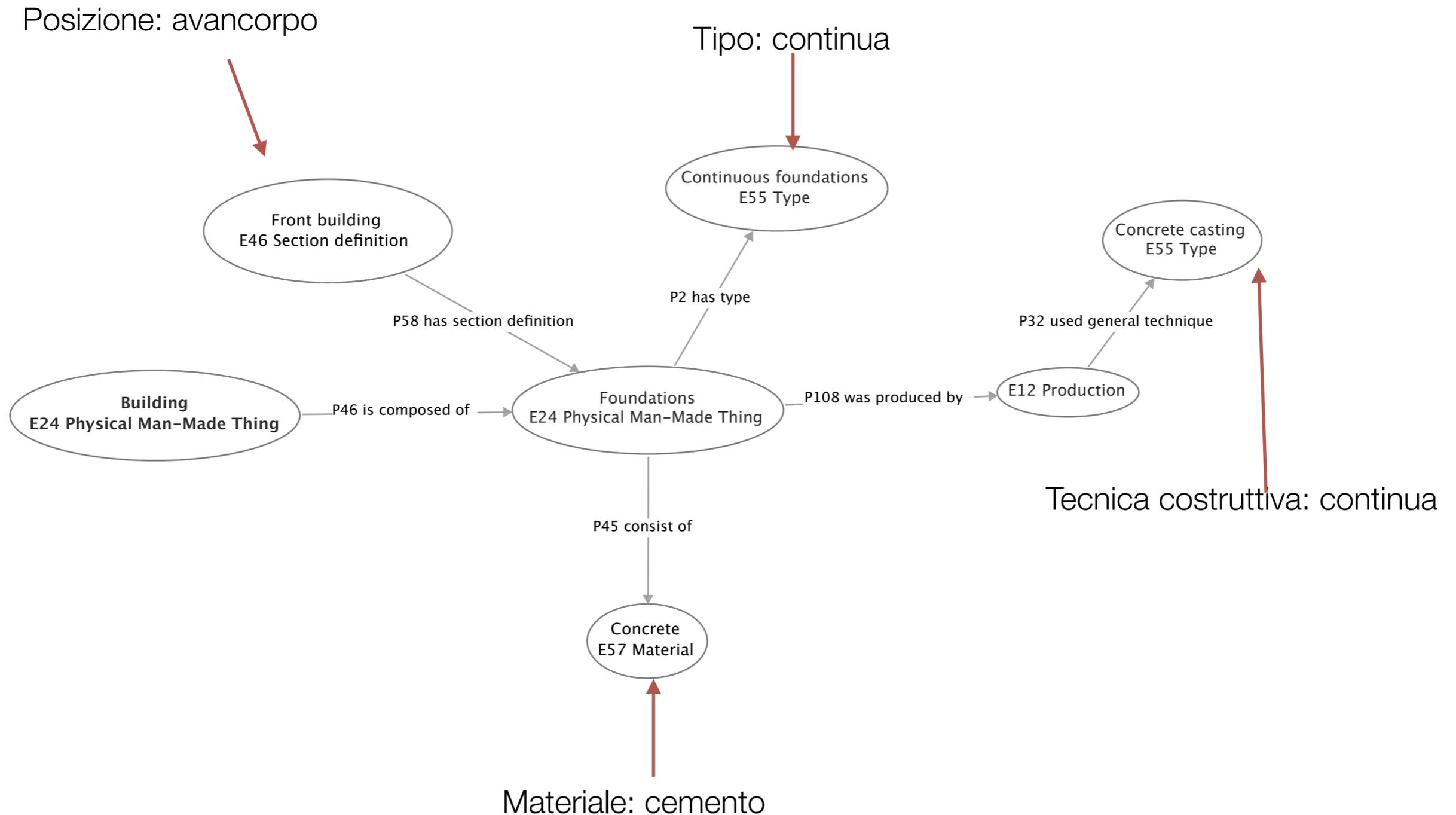
- a single monument
- a monumental complex formed by a group of constructions or buildings

Includes more than 300 fields (identified by a unique letter code and a name)

Is composed of 20 sections:

CD-AC – Codes; RV – Relationships; OG – Object; LC – Current Location; CS – Cadaster; LS – Historic Location; GP-GL-GA – Georeferencing; RE – Way of discovery; DT – Chronology; AU – Cultural Definition; RO – Reuse; MT – Technical Data; CO – Conservation; RS – Restoration; DA – Analytical Data; MC – Samples and Analyses; TU – Legal status; DO – Sources; AD – Data Access; CM - Compiler; AN – Notes

Result of the mapping



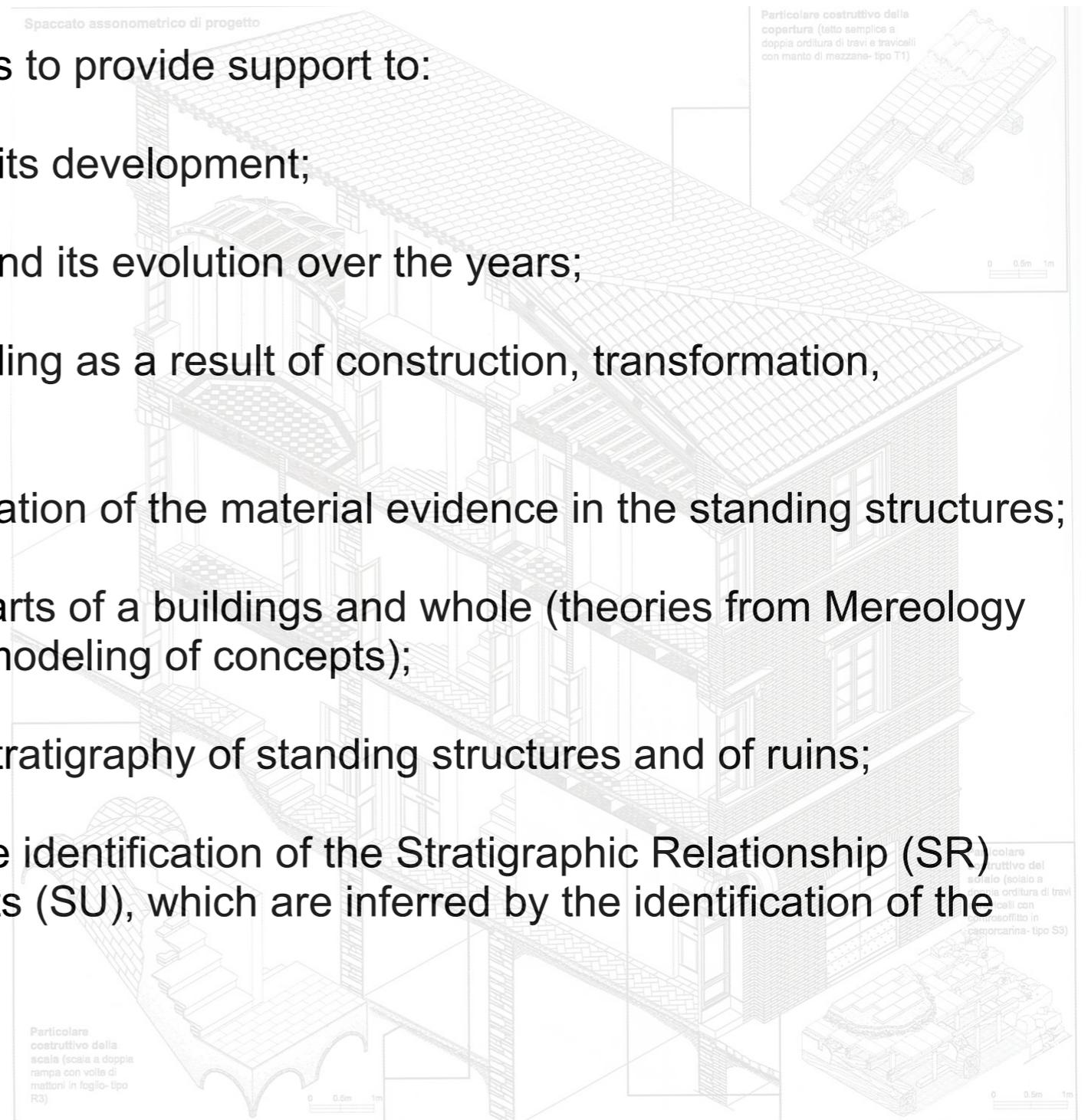
Foundations, storeys and walls, stairs, roof, open spaces, marks, inscriptions and emblems

CIDOC CRM_{BA}

CIDOC CRM extension for Buildings Archaeology information modeling

The goal of the CRMBA conceptual model is to provide support to:

- understand the building structure and its development;
- recognize the functions of a building and its evolution over the years;
- identify the various phases of the building as a result of construction, transformation, modification and reuse;
- support the investigation and interpretation of the material evidence in the standing structures;
- understand the correlation between parts of a buildings and whole (theories from Mereology and mereo-topology used to support modeling of concepts);
- recognize, analyse and interpret the stratigraphy of standing structures and of ruins;
- support the dating process through the identification of the Stratigraphic Relationship (SR) between the various Stratigraphic Units (SU), which are inferred by the identification of the Stratigraphic Interfaces (SI).



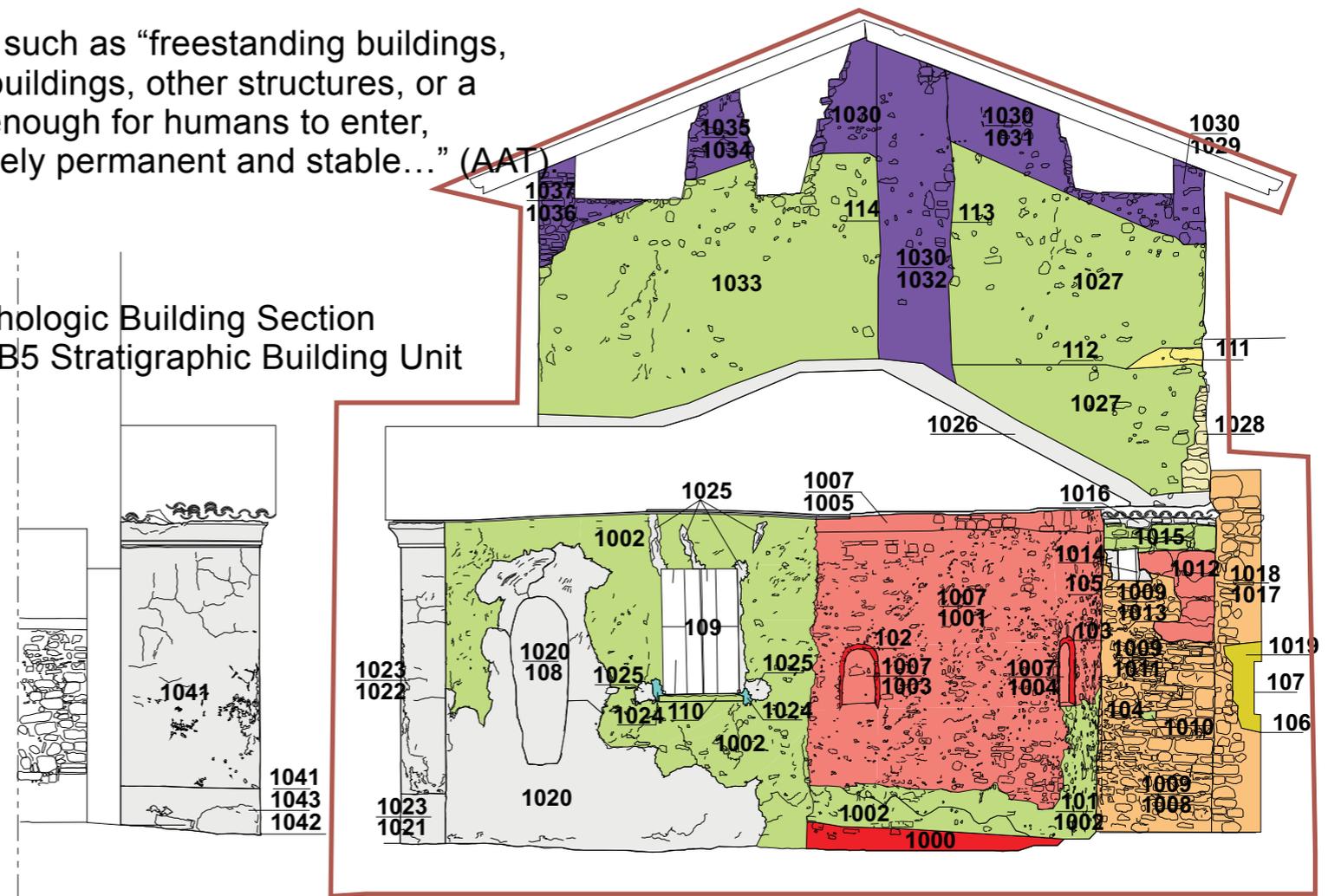
B1 Built Work

Subclass of: E24 Man-Made Object
 Superclass of: B2 Morphologic Building Section

Scope note: This class comprises man-made objects such as “freestanding buildings, components of buildings, complexes of buildings, other structures, or a man-made environment, typically large enough for humans to enter, serving a practical purpose, being relatively permanent and stable...” (AAT)

Examples: The Bishop’s Palace
 The ruins of Loropéni
 The Coliseum

Properties: BP1 has section (is section of): B2 Morphologic Building Section
 BP2 is constituted by (is constituent of): B5 Stratigraphic Building Unit



Macario F., Stratigraphy of Capiate Castle, Internal report distributed during the course on “Tecniche di Stratigrafia Muraria” 2007-2008

The term “Built Work” is borrowed from the AAT thesaurus. It refers to “...freestanding buildings, components of buildings, complexes of buildings, other structures, or a man-made environment, typically large enough for humans to enter, serving a practical purpose, being relatively permanent and stable...” (AAT).

B2 Morphological Building Section

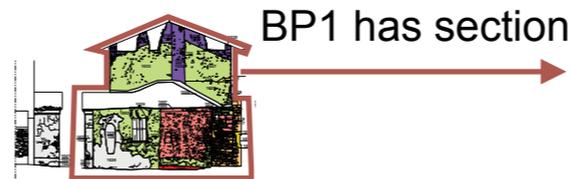
Subclass of: E24 Man-Made Object
B1 Built Work

Superclass of: B3 Filled Morphological Building Section
B4 Empty Morphological Building Section

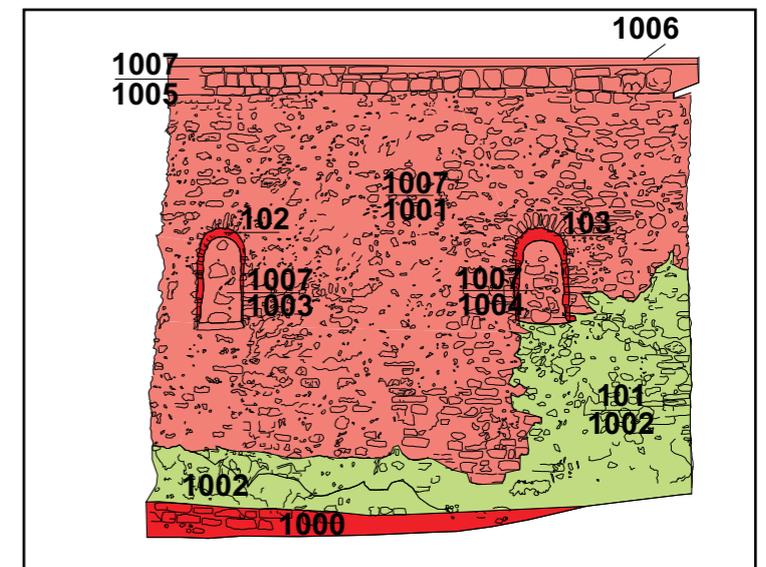
Scope note: This class comprises man-made objects that constitute a built work. It is a geometric feature with volume and occupies (P159) a Spacetime Volume (SP8). A Morphological Building Section can be identified with isolated elements (e.g. wall) or functional unit (e.g. room) that are connected and articulated amongst each other

Examples: The western wall of Cathedral
The corner tower
The battlements of the palace perimeter

Properties:
BP1 is section of (has section): B1 Built Work
BP4 constituency is terminated by (terminates the constituency): E80 Part Removal
BP5 constituency is initiated by (initiates the constituency): E79 Part addition
BP11 is connected to: B2 Morphological Building Section
BP16 is connected through: B2 Morphological Building Section
BP12 has function (is function of): B6 Function
BP2 is constituted by: B3 Filled Morphological Building Section
BP2 is constituted by: B4 Empty Morphological Building Section



B2 Morphological Building Section



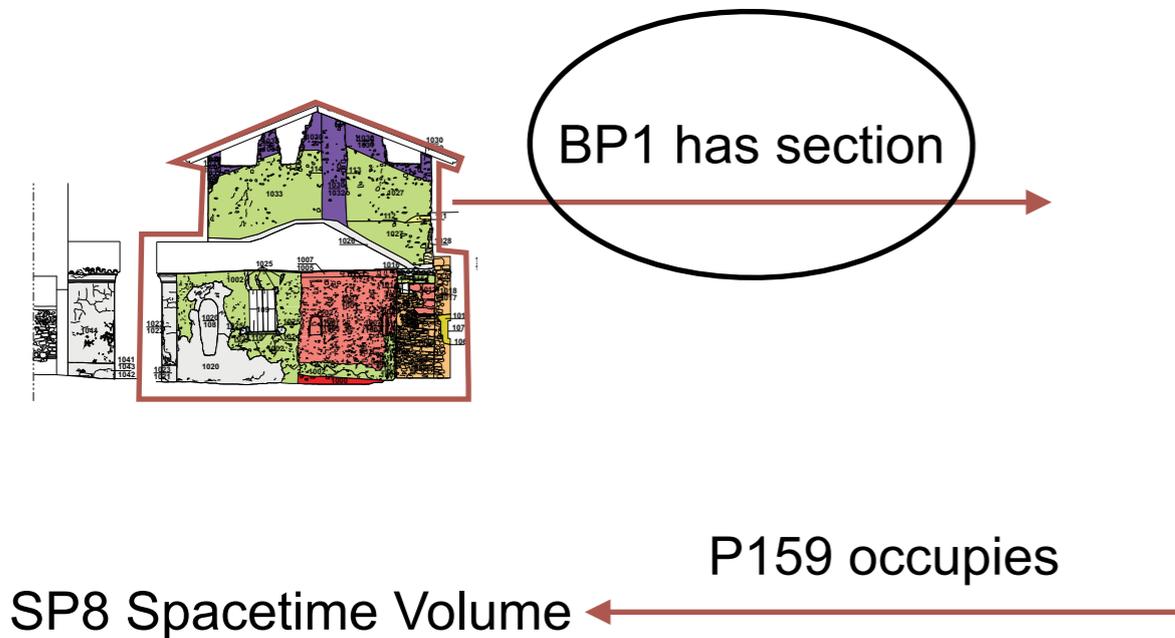
P159 occupies



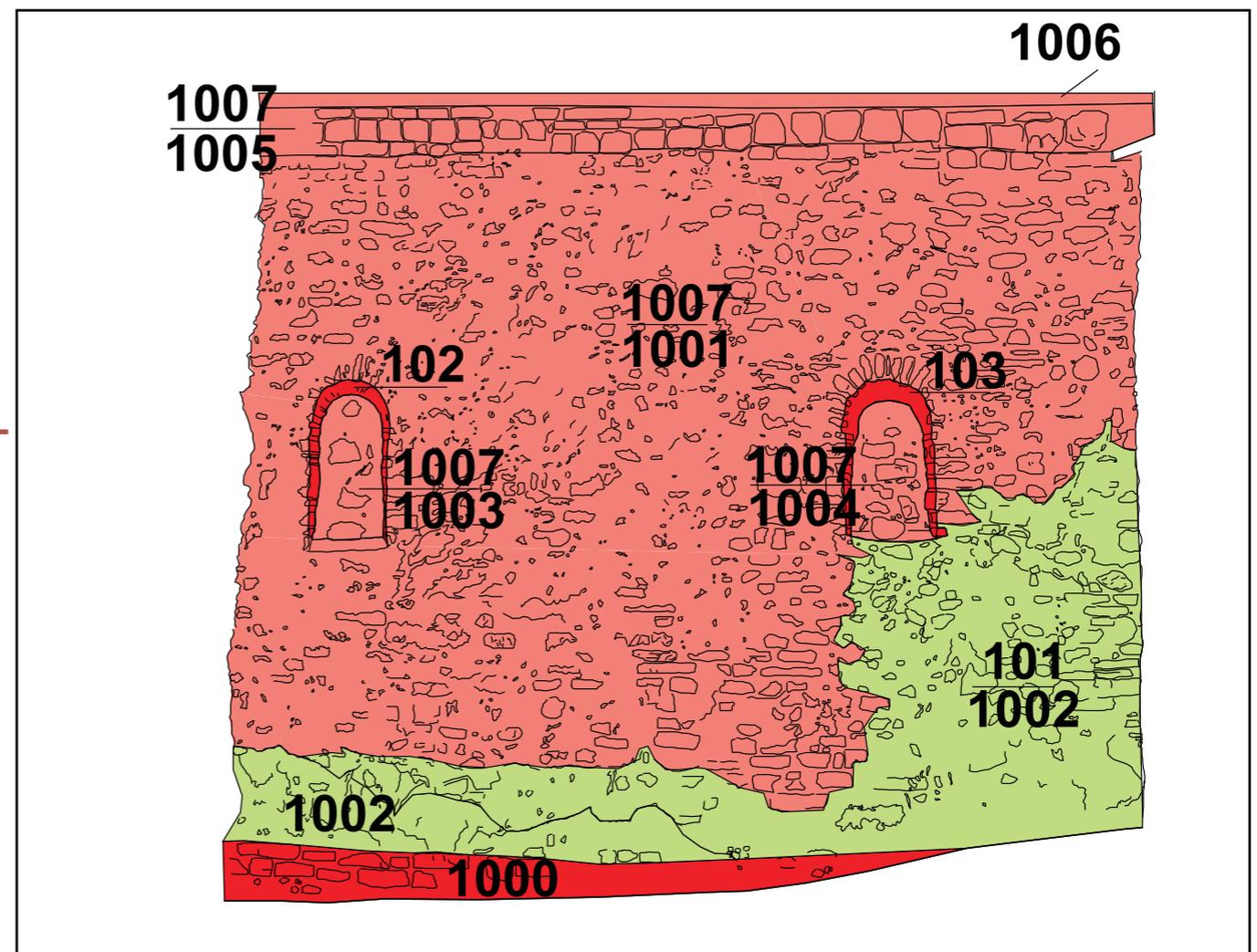
SP8 Spacetime Volume

The B2 Morphological Building Section is a sub-class of E24 Physical Man-Made Thing. It is a geometric feature with volumes that occupy a defined space in a time period. This class represents the parts a Built Work can be fractioned into. The SP8 class comprises 4 dimensional (possibly fuzzy) point sets (volumes) in physical space-time, regardless of its true geometric form

B2 Morphological Building Section



B2 Morphological Building Section



BP1 is section of (has section)

Domain: B2 Morphological Building Section

Range: B1 Built Work

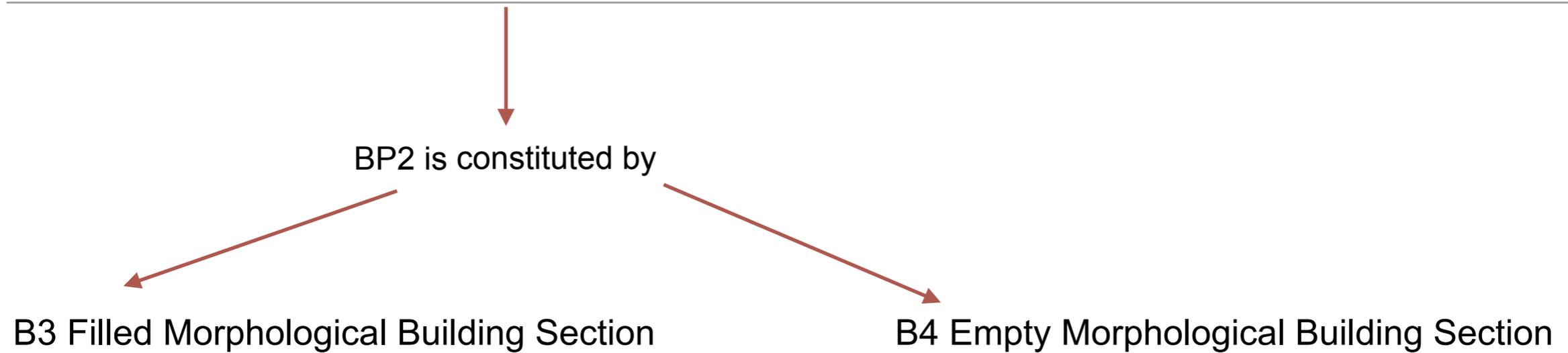
Quantification: many to one (0,n:0,1)

Scope note: This property is used to link the Morphological Building Sections that are part of a Built Work

Examples: The great hall (BP1 is section of) the Bishop's Palace

The B2 Morphological Building Section is a sub-class of E24 Physical Man-Made Thing. It is a geometric feature with volumes that occupy a defined space in a time period. This class represents the parts a Built Work can be fractioned into. The SP8 class comprises 4 dimensional (possibly fuzzy) point sets (volumes) in physical space-time, regardless of its true geometric form

B2 Morphological Building Section



Mentnafunangann, 2009, L'impluvium dell'atrio di Villa San Marco a Stabiae

B2 Morphological Building Section

BP2 is constituted by

B3 Filled Morphological Building Section
Filled Morphological Building Section

B4 Empty Morphological Building Section

BP8 is adjacent to

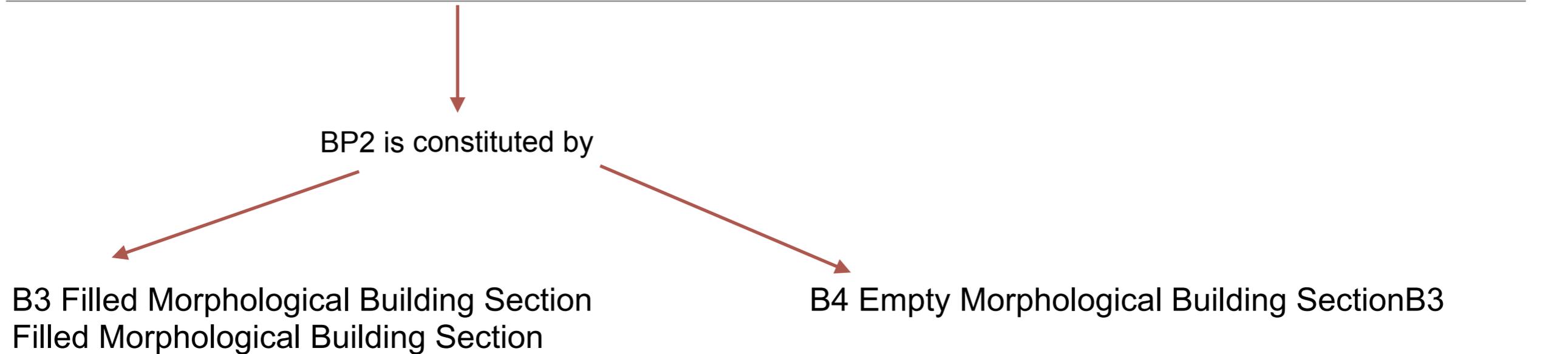
B4

B3



- Subclass of: E24 Man-Made Object
B1 Built Work
B2 Morphological Building Section
- Scope note: Empty Morphological Building Section is a constituent of Morphological Building Section. If it is adjacent to a Filled Morphological Building Section it can define a functional space.
- Examples: The intercolumniation of a portico The Gate of Felicity of Topkapı Palace
- Properties: BP2 is constituent of (is constituted by): B2 Morphological Building Section
BP8 is adjacent to: BP3 Filled Morphological Building Section

B2 Morphological Building Section



Subclass of: E24 Man-Made Object
B1 Built Work
B2 Morphological Building Section

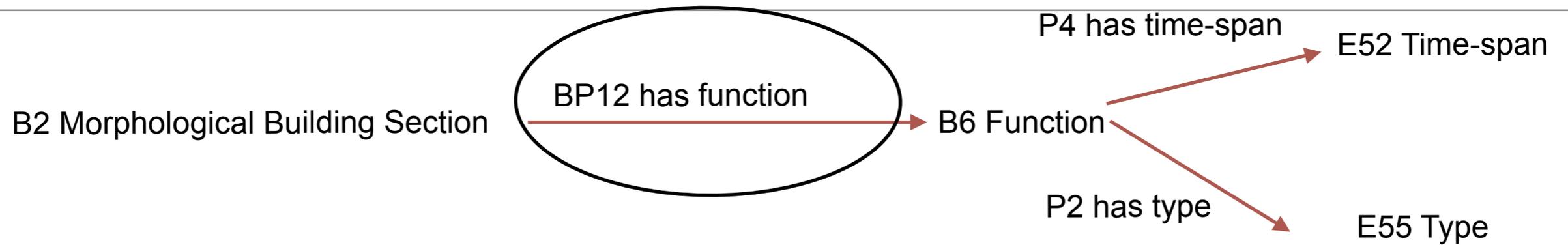
Scope note: Filled Morphological Building Section is constituent of a Morphological Building Section filled with matter.

Examples: The ionic column of the portico

Properties: BP2 is constituent of (is constituted by): B2 Morphological Building Section
BP8 is adjacent to: BP4 Empty Morphological Building Section



B6 Function



BP12 has function (is function of)

Domain: B2 Morphological Building Section

Range: B6 Function

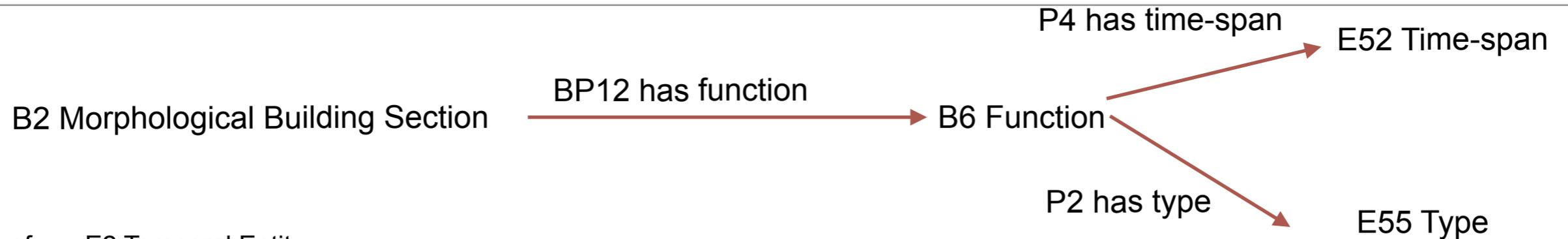
Quantification: many to many (0,n:0,n)

Scope note: This property describes the function of a Morphological Building Section within a Built Work.

Examples: The sacristy (BP12 has function) to store precious objects of the Bishop



B6 Function



Subclass of: E2 Temporal Entity
 Scope note: This class comprises the various functions a Morphological Building Section has within the building.
 The B6 Function has type (P2) E55 Type, which can be populated with the following list of terms:

- **Statics**, the ability of architectural elements to safely resist all actions a building is likely to face across time (e.g. weight loads on walls, foundations, arches, pillars, elevations, interstorey structures and so forth)
- **Affordance**, borrowed from perceptual psychology (Gibson 1976), is used as a conceptual framework to understand the relationship between form and function of an element (e.g. floors that afford the occupant's weight or furniture, as well as windows afford the transmission of lights),
- **Protection**, every element that provides passive protection from environmental and human activities (e.g. plaster, parapet, revetment, ceiling eaves, coating)
- **Decoration**, something added to a building to improve its appearance (e.g. mouldings, inscriptions, mosaics, frieze etc.).

Examples: The battlement is a notched parapet built on top of a wall, with alternating merlons and crenels for decoration or defence

Properties:
 BP12 is function of (has function): B2 Morphological Building Section
 P2 has type (is type of): E55 Type
 P4 has time-span: E52 Time-span



B5 Stratigraphic Building Unit

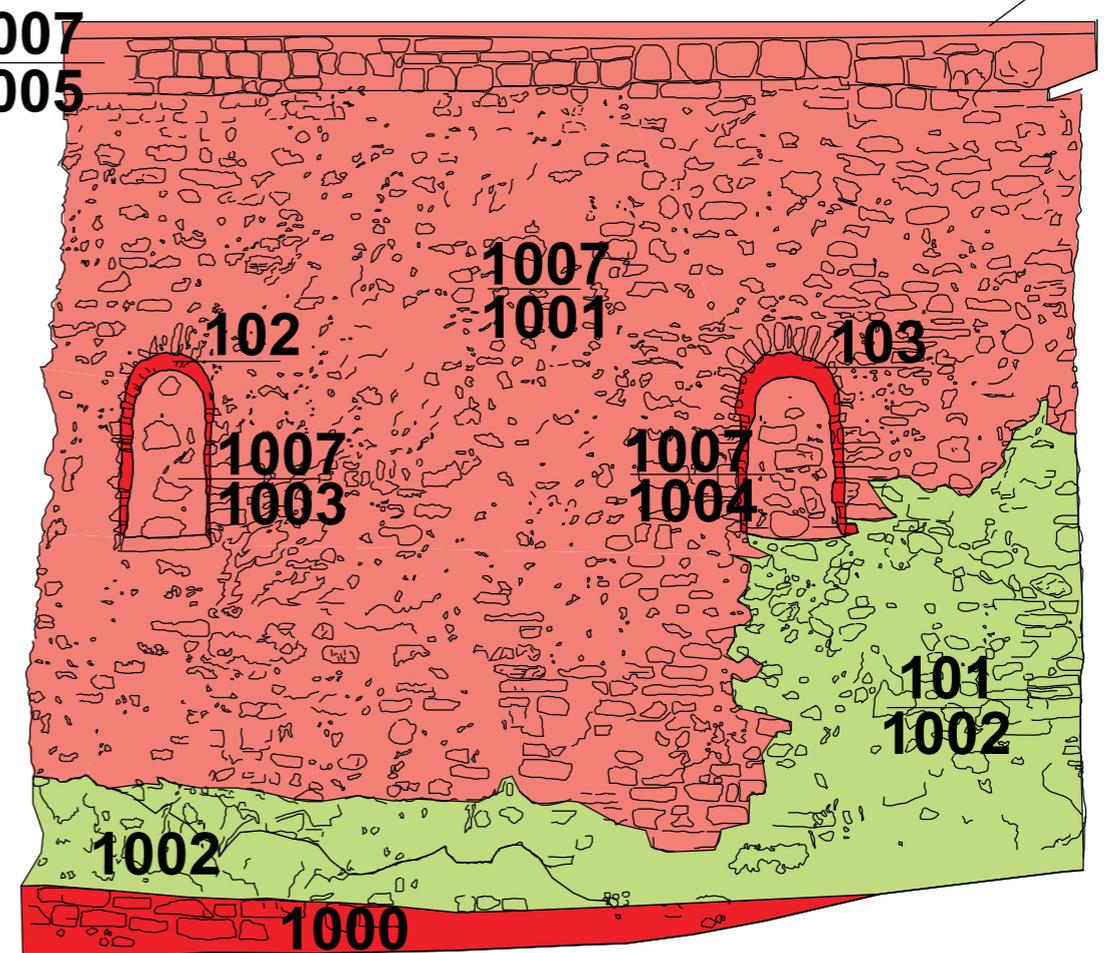
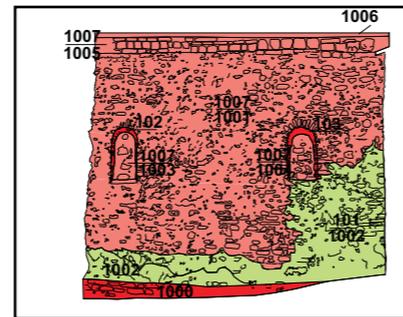
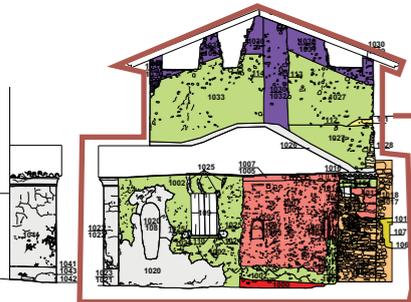
B1 Built Work

B2 Morphological Building Section

BP1 has section

BP2 is constituted by

B5 Stratigraphic Building Unit

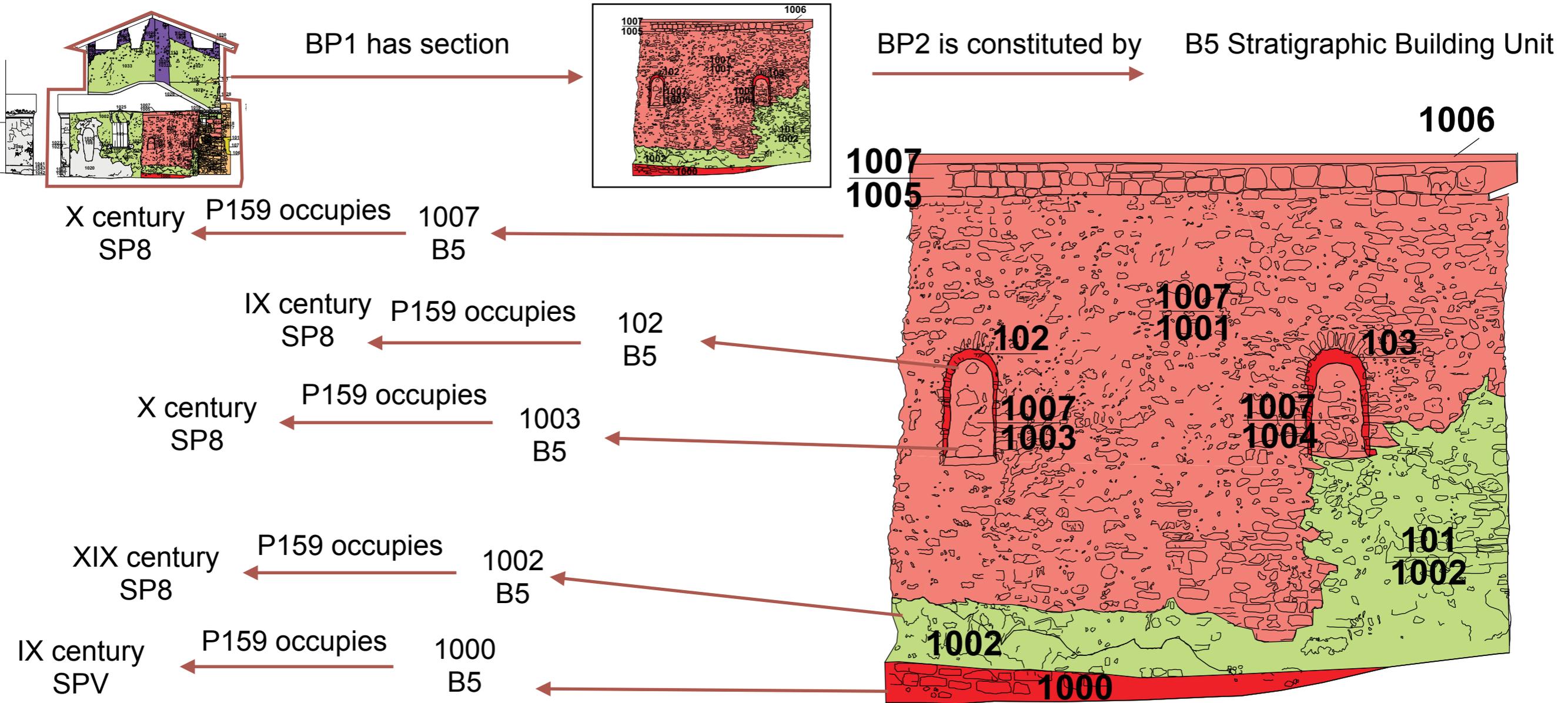


- Subclass of: E26 Physical Feature
A8 Stratigraphic Unit
- Scope note: The Stratigraphic Building Unit is the minimal construction unit of a built structure. It can be referred to a single wall or to the various architectonic components that constitute the Morphologic Building Section. When the SBU coincide with the MBS then the two entities are equal (BP15) and the SBU is (BP2 is constituent of) a B1 Built Work.
- Examples: The fresco decoration of the great hall
- Properties:
- BP2 is constituent of (is constituted by): B1 Built Work
 - BP7 is bounded by (bounds): B5 Stratigraphic Building Unit
 - BP8 is adjacent to (has adjacent): B5 Stratigraphic Building Unit
 - BP9 cuts (is cut by): B5 Stratigraphic Building Unit
 - BP10 is filled by (fills): B5 Stratigraphic Building Unit
 - BP13 is specific object used by (used specific object): E12 Production
 - BP14 is specific object re-used by (re-used specific object): E12 Production
 - BP15 is equal to: B2 Morphological Building Section

B5 Stratigraphic Building Unit

B1 Built Work

B2 Morphological Building Section



B5 Stratigraphic Building Unit (SBU), a sub-class of A8 Stratigraphic Unit, which are identified by matter and represent the minimal construction unit of a built structure. Depending on the level of accuracy we want to reach in our documentation, a Stratigraphic Building Unit can refer to a single wall (in this case we say that a Morphological Building Section *BP15 is equal to* SBU), to various architectonic elements, or to the smallest components of the whole structure. The Stratigraphic Building Unit represents a single evidence of activity: e.g. the presence of mortar, vestments, *emplekton*, plasters, or the discontinuities on a wall due to successive days of work or due to alternation of types of masonry and other materials

B5 Stratigraphic Building Unit

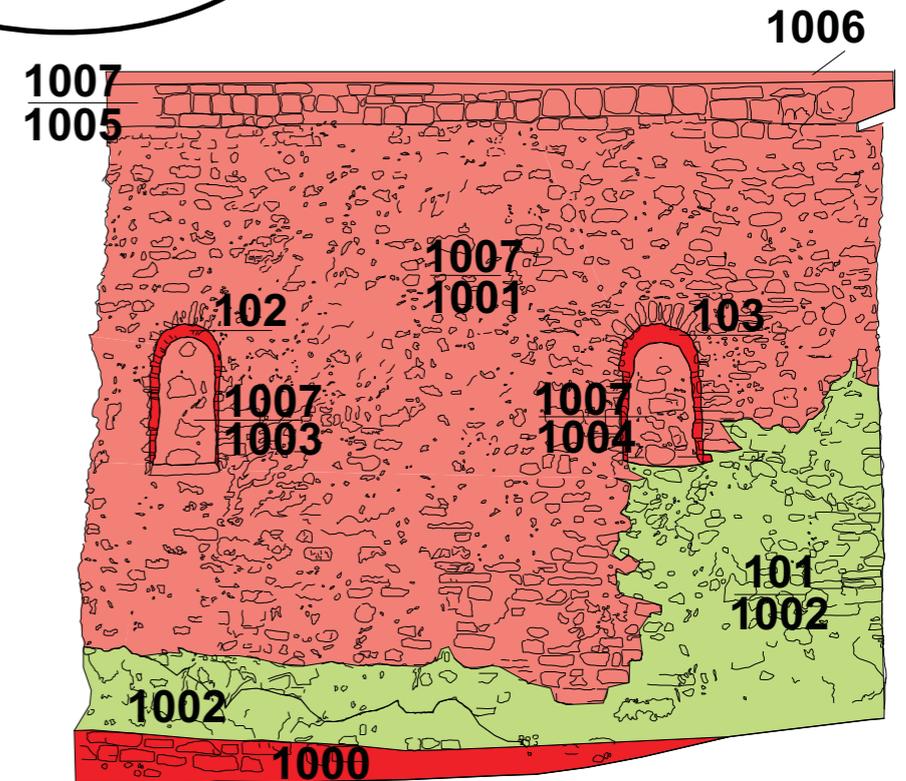
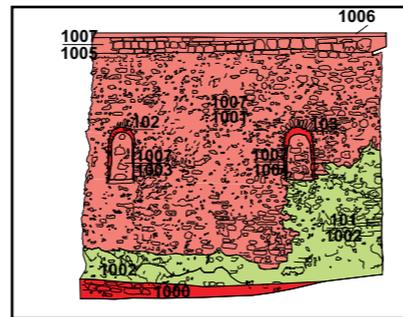
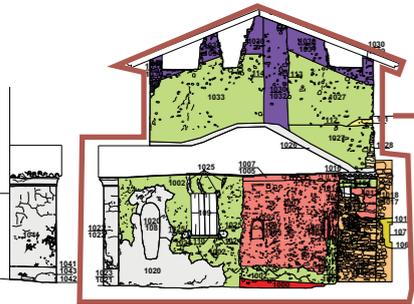
B1 Built Work

B2 Morphological Building Section

BP1 has section

BP2 is constituted by

B5 Stratigraphic Building Unit



BP2 is constituent of (is constituted by)

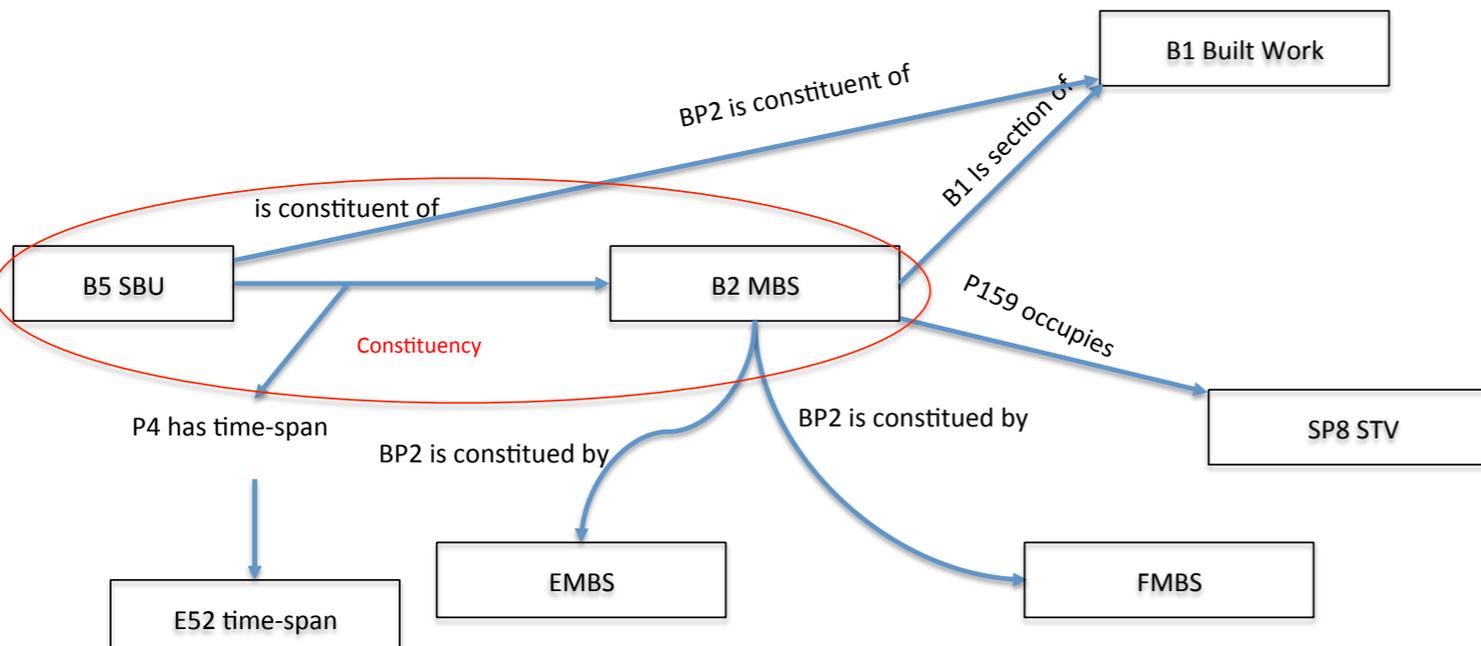
Domain: B5 Stratigraphic Building Unit

Range: B1 Built Work

Quantification: many to one (0,n:0,1)

Scope note: This property describes the relation between a Morphological Building Section (e.g. a wall) and any Stratigraphic Building Section. When the SBU and the MBS are equal we can use the shortcut: B5 SBU (BP2 is constituent of) B1 Built Work.

Examples: The fresco of the great hall (BP2 is constituent of) the northern wall



The constituency of a Stratigraphic Building Unit is a sub-class of E2 Temporal Entity (with fuzzy boundaries in spacetime) and has a duration in time (P4 has time span). The term "constituency" is used here (as it is in the ontology discourse) with the meaning of "the status of being a constituent".

B5 Stratigraphic Building Unit

BP15 is equal to

Domain: B5 Stratigraphic Building Unit

Range: B3 Filled Morphological Building Section

Quantification: many to many (0,n:0,n)

Scope note: This property is used to relate a Stratigraphic Building Section with a Morphological Building Section when the former is equal to the latter.

Examples: The northern wall (BP 16 is equal to) the SBU “northern wall”.

Wall A
B3 Filled Morphological Building Section



BP15 is equal to



B5 Stratigraphic Building Unit



B5 Stratigraphic Building Unit

BP3 is spatial temporary equal to

Domain: SP8 Spacetime Volume

Range: SP8 Spacetime Volume

Quantification: many to many (0,n:0,n)

Scope note: This property is used to relate the Spacetime Volume of two entities (Morphological Building Units and Stratigraphic Building Section).

Examples: The STV of the plaster that completely covers the wall surface (BP3 is spatial temporary equal to) the STV of the masonry.

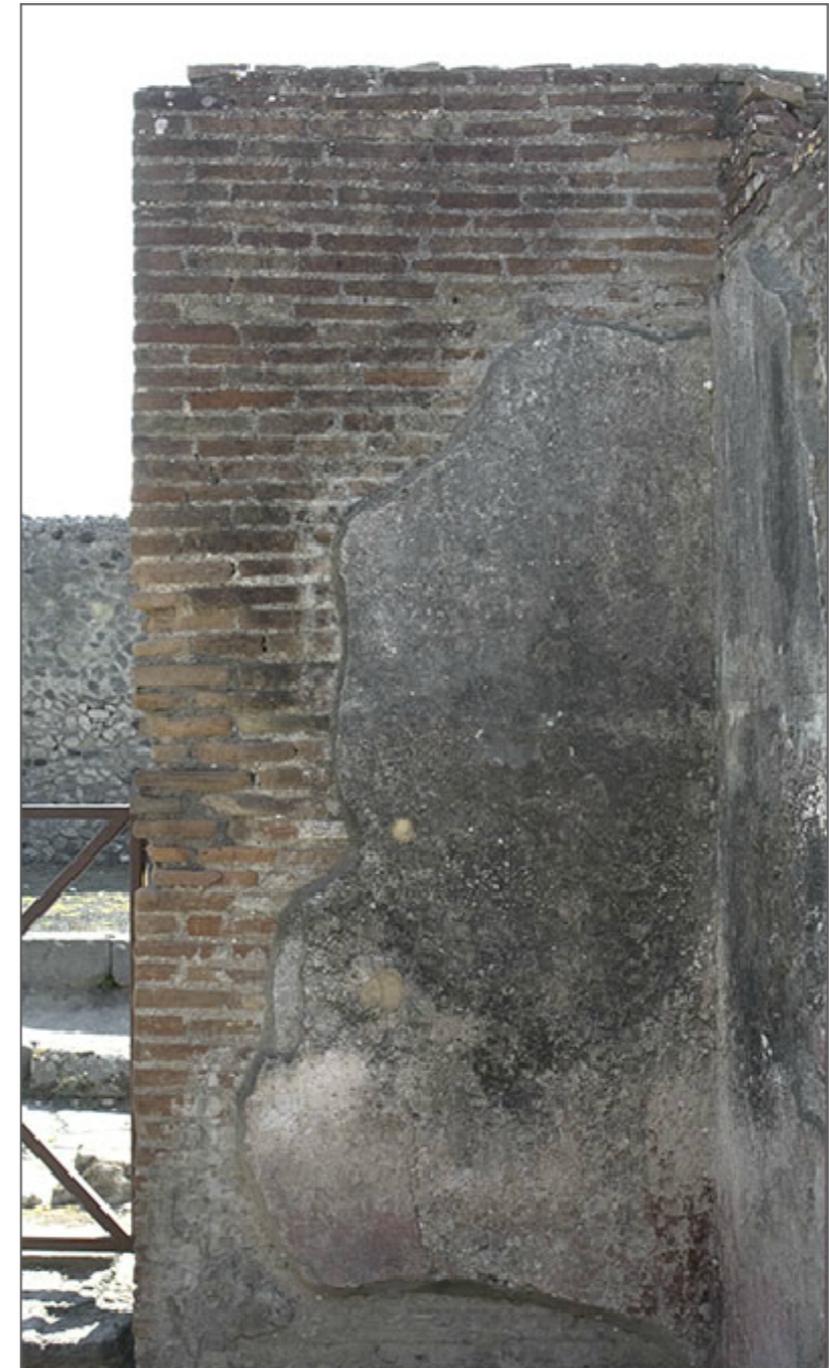
SP8 Spacetime Volume



BP3 is Spatial Temporary equal to

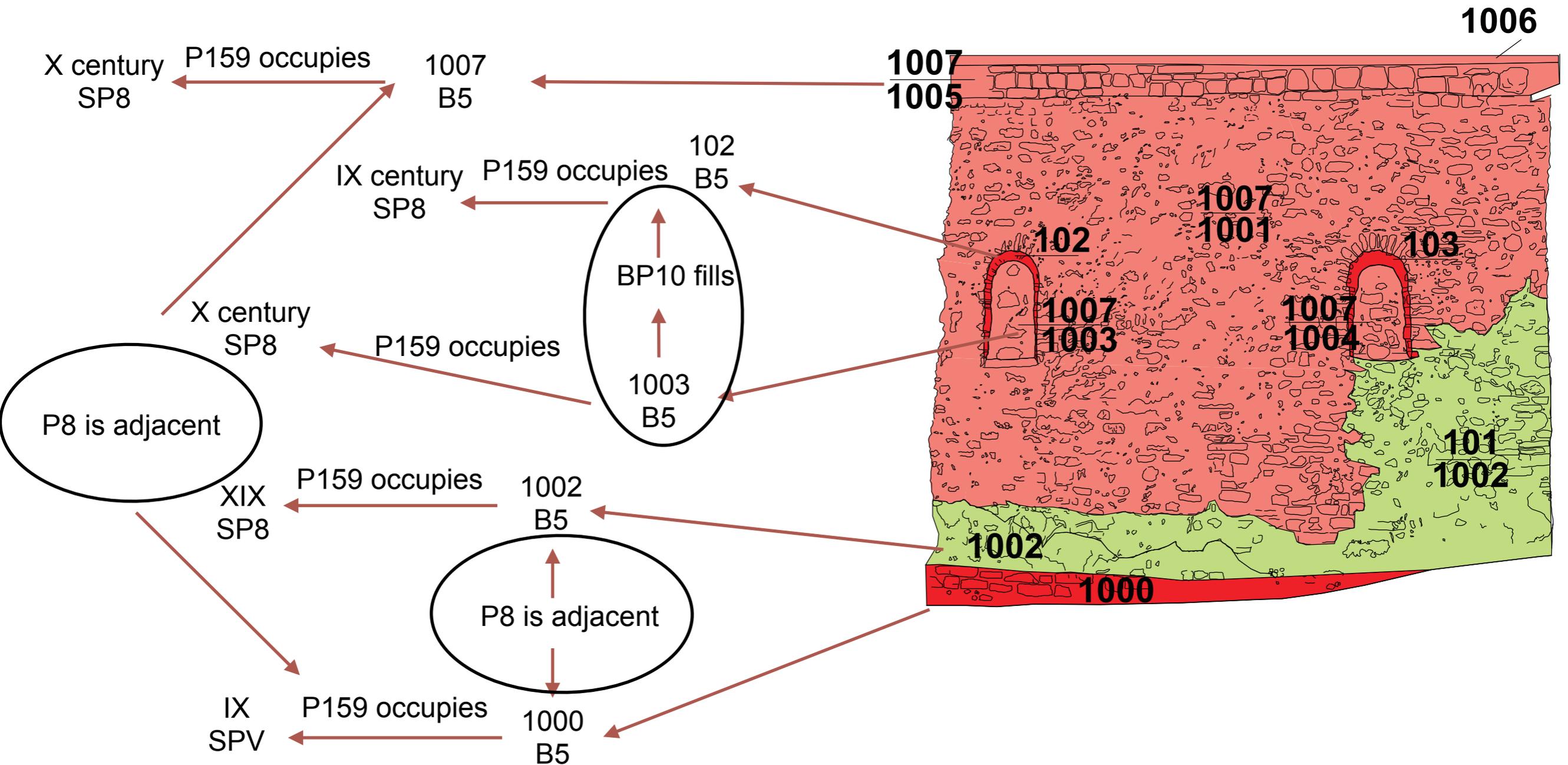


SP8 Spacetime Volume



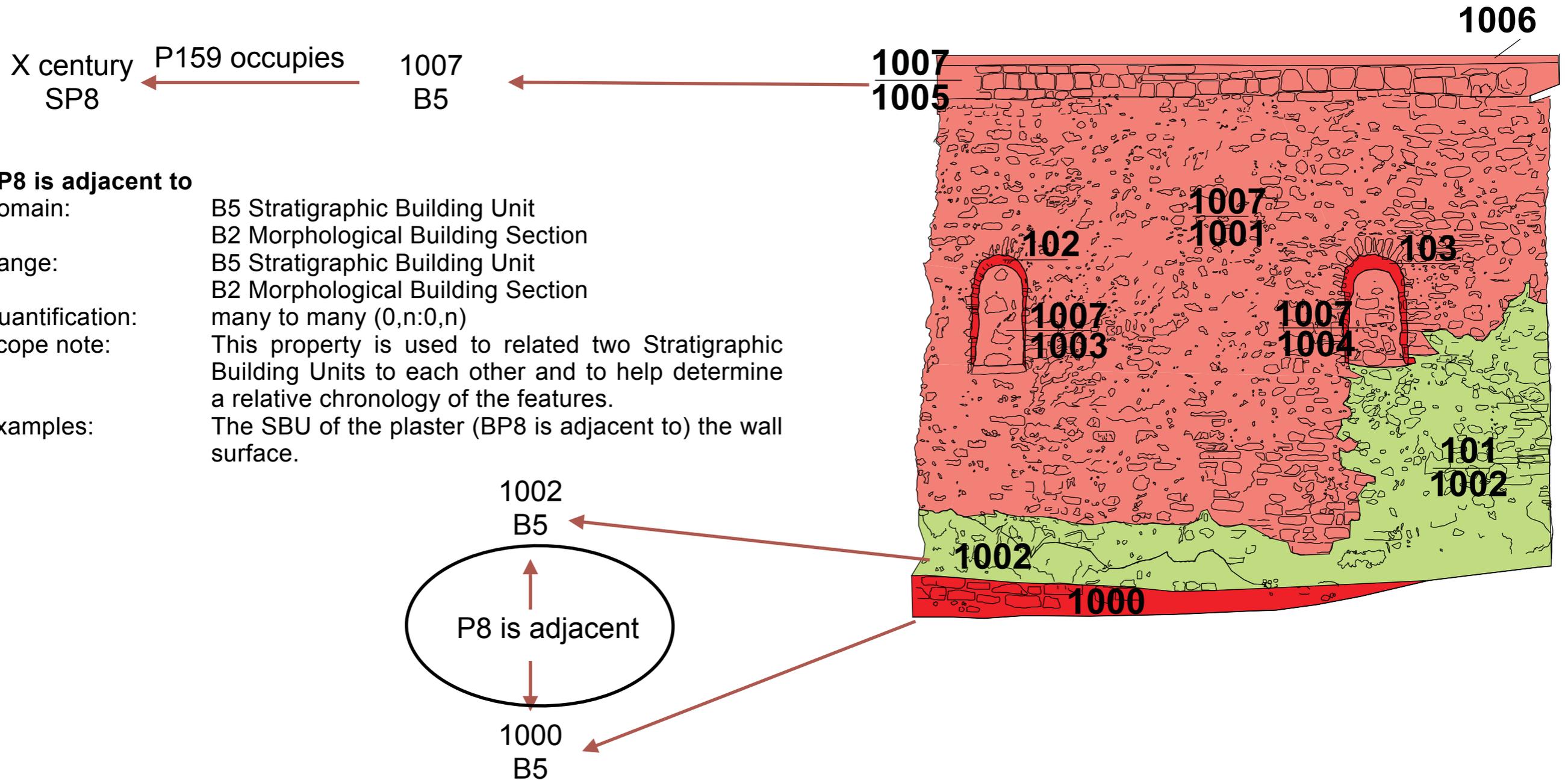
Hans Thorwid, The south corner of insula V 1, Pompeii

B5 Stratigraphic Building Unit



B5 Stratigraphic Building Unit (SBU), a sub-class of A8 Stratigraphic Unit, which are identified by matter and represent the minimal construction unit of a built structure. Depending on the level of accuracy we want to reach in our documentation, a Stratigraphic Building Unit can refer to a single wall (in this case we say that a Morphological Building Section **BP15 is equal to** SBU), to various architectural elements, or to the smallest components of the whole structure. The Stratigraphic Building Unit represents a single evidence of activity: e.g. the presence of mortar, vestments, *emplekton*, plasters, or the discontinuities on a wall due to successive days of work or due to alternation of types of masonry and other materials

B5 Stratigraphic Building Unit



B5 Stratigraphic Building Unit (SBU), a sub-class of A8 Stratigraphic Unit, which are identified by matter and represent the minimal construction unit of a built structure. Depending on the level of accuracy we want to reach in our documentation, a Stratigraphic Building Unit can refer to a single wall (in this case we say that a Morphological Building Section **BP15 is equal to** SBU), to various architectural elements, or to the smallest components of the whole structure. The Stratigraphic Building Unit represents a single evidence of activity: e.g. the presence of mortar, vestments, *emplekton*, plasters, or the discontinuities on a wall due to successive days of work or due to alternation of types of masonry and other materials

B5 Stratigraphic Building Unit

BP10 is filled by (fills)

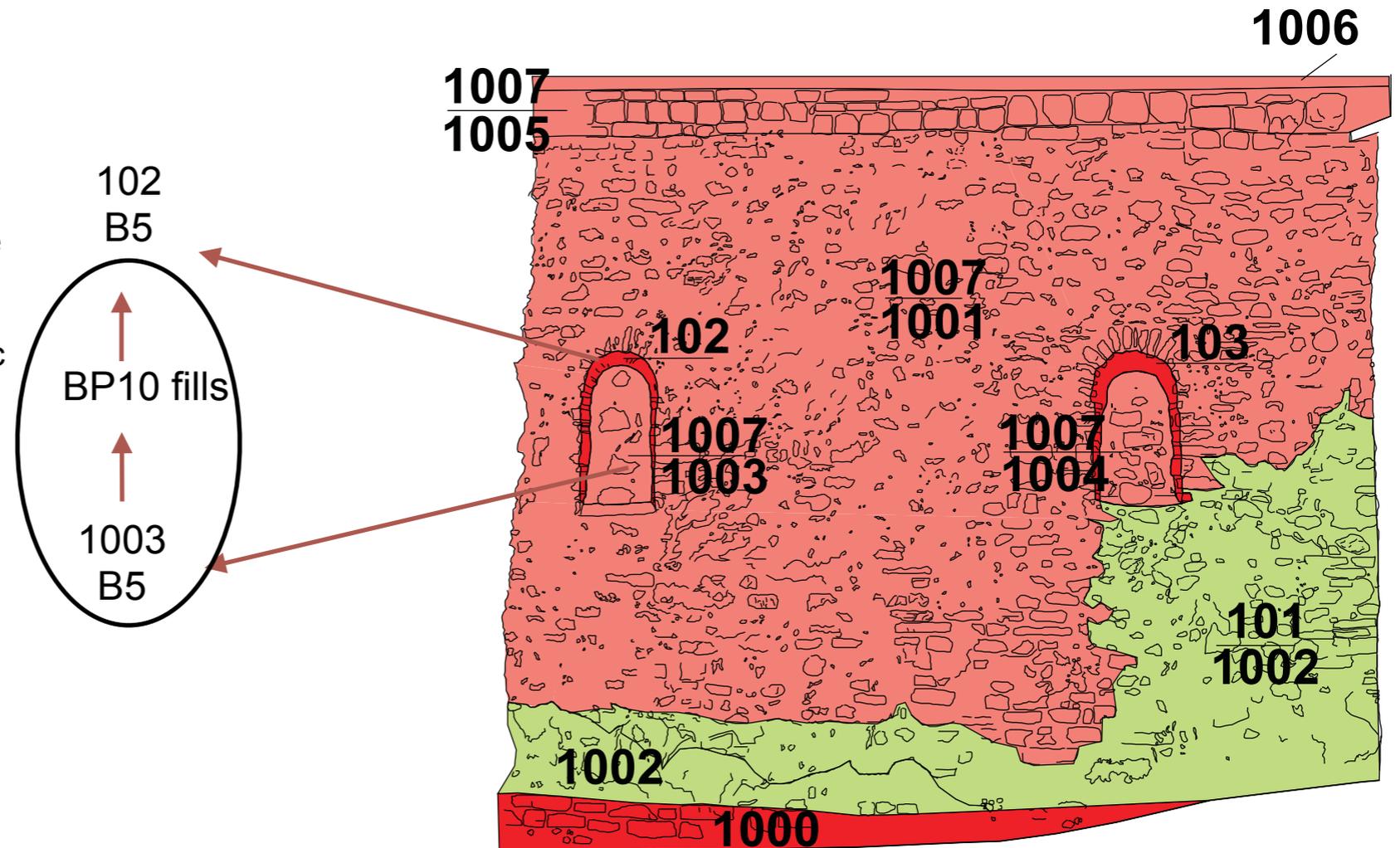
Domain: B5 Stratigraphic Building Unit

Range: B5 Stratigraphic Building Unit

Quantification: many to many (0,n:0,n)

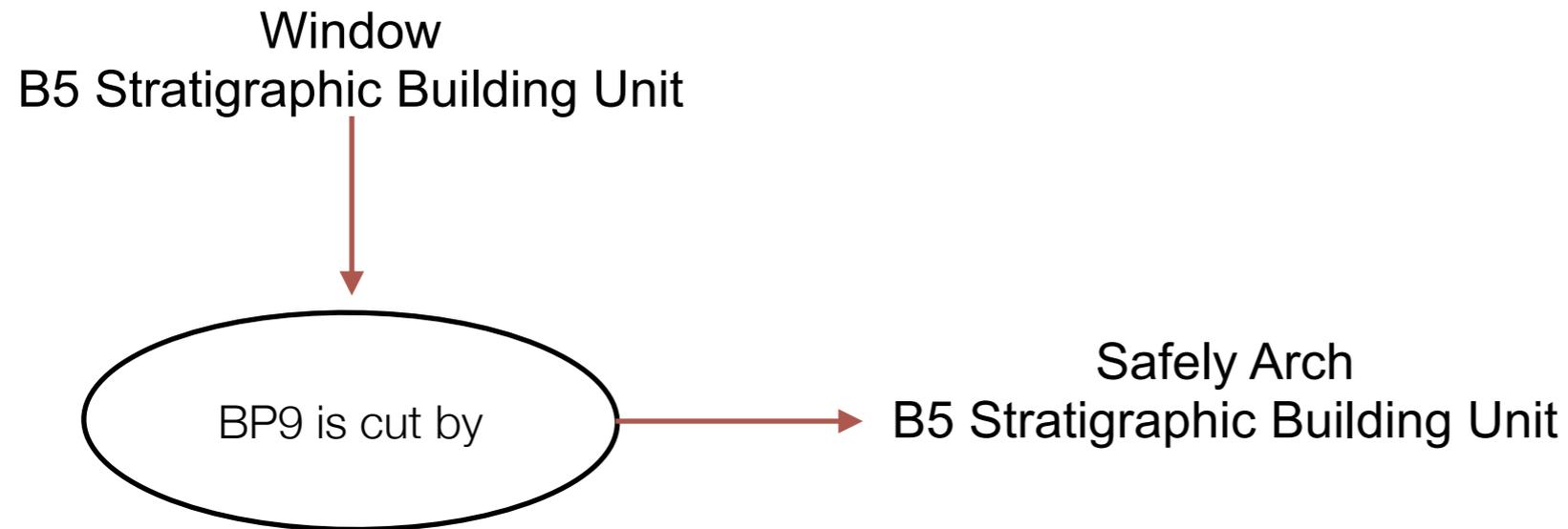
Scope note: This property identifies the instance of a Stratigraphic Building Section that was filled with matter, initiating the existence of a new Stratigraphic Building Interface.

Examples: The breach on the eastern wall (BP10 is filled by) bricks.



B5 Stratigraphic Building Unit (SBU), a sub-class of A8 Stratigraphic Unit, which are identified by matter and represent the minimal construction unit of a built structure. Depending on the level of accuracy we want to reach in our documentation, a Stratigraphic Building Unit can refer to a single wall (in this case we say that a Morphological Building Section *BP15 is equal to* SBU), to various architectural elements, or to the smallest components of the whole structure. The Stratigraphic Building Unit represents a single evidence of activity: e.g. the presence of mortar, vestments, *emplekton*, plasters, or the discontinuities on a wall due to successive days of work or due to alternation of types of masonry and other materials

B5 Stratigraphic Building Unit



BP9 cuts (is cut by)

Domain: B5 Stratigraphic Building Unit

Range: B5 Stratigraphic Building Unit

Quantification: many to many (0,n:0,n)

Scope note: This property identifies the instance of a Stratigraphic Building Section that was cut by another of new formation, due to an activity occurred to the building.

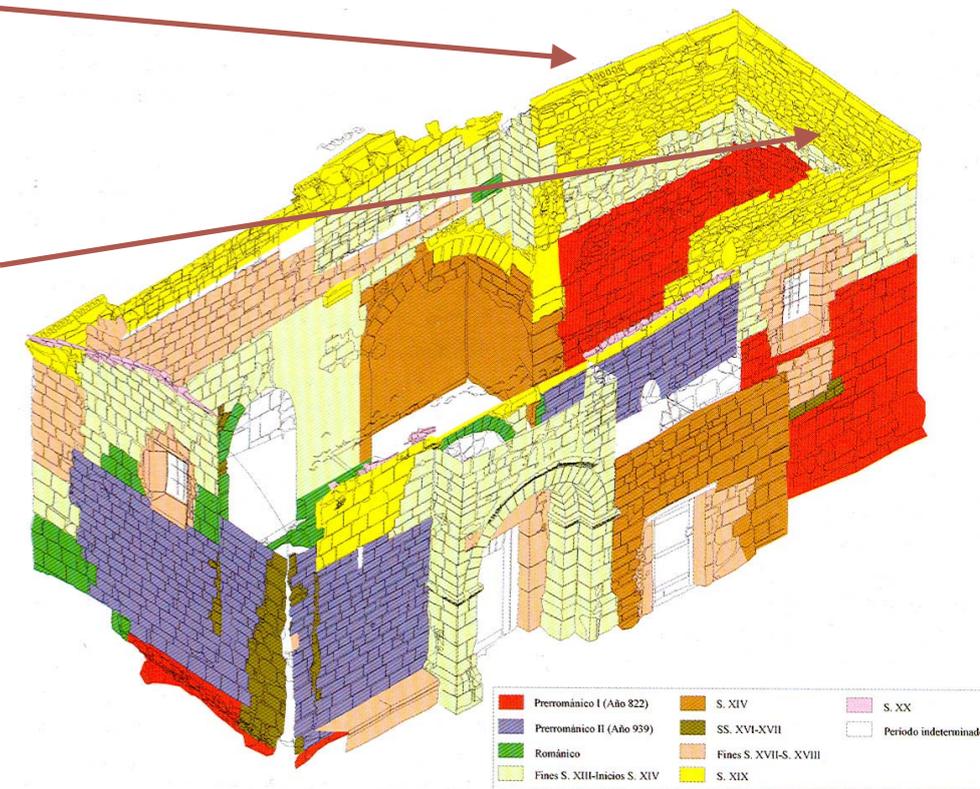
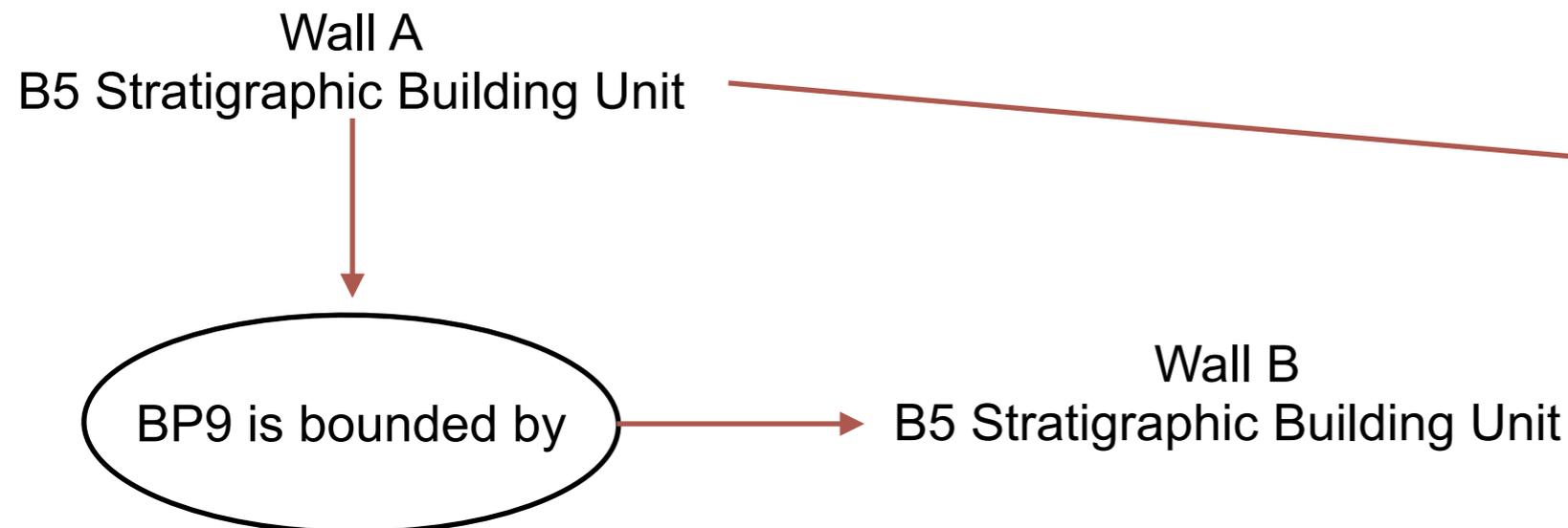
Examples: The breach (BP9 cut) the southern wall façade



Leslie, 2014, Church of S. Michael Archangel, Pontorno, Tuscany

B5 Stratigraphic Building Unit (SBU), a sub-class of A8 Stratigraphic Unit, which are identified by matter and represent the minimal construction unit of a built structure. Depending on the level of accuracy we want to reach in our documentation, a Stratigraphic Building Unit can refer to a single wall (in this case we say that a Morphological Building Section *BP15 is equal to* SBU), to various architectonic elements, or to the smallest components of the whole structure. The Stratigraphic Building Unit represents a single evidence of activity: e.g. the presence of mortar, vestments, *emplekton*, plasters, or the discontinuities on a wall due to successive days of work or due to alternation of types of masonry and other materials

B5 Stratigraphic Building Unit



BP7 is bounded by (bounds)

Domain: B5 Stratigraphic Building Unit

Range: B5 Stratigraphic Building Unit

Quantification: many to many (0,n:0,n)

Scope note: The Stratigraphic Building Units that constitute a Morphological Building Section are related to each other through a physical relation that help in determine a relative chronology of the various features. This property is used when two Stratigraphic Building Units are contemporary; therefore they belong to the same construction phase.

Examples: The northern wall of the great hall (BP7 is bounded by) the eastern wall of the great hall.

| | | |
|------------------------------|------------------------|-----------------------|
| Prerrománico I (Año 822) | S. XIV | S. XX |
| Prerrománico II (Año 939) | SS. XVI-XVII | Periodo indeterminado |
| Románico | Fines S. XVII-S. XVIII | |
| Fines S. XIII-Inicios S. XIV | S. XIX | |

A. Fiorini, 2008. *Archeologia dell'architettura*

B5 Stratigraphic Building Unit (SBU), a sub-class of A8 Stratigraphic Unit, which are identified by matter and represent the minimal construction unit of a built structure. Depending on the level of accuracy we want to reach in our documentation, a Stratigraphic Building Unit can refer to a single wall (in this case we say that a Morphological Building Section **BP15 is equal to** SBU), to various architectonic elements, or to the smallest components of the whole structure. The Stratigraphic Building Unit represents a single evidence of activity: e.g. the presence of mortar, vestments, *emplekton*, plasters, or the discontinuities on a wall due to successive days of work or due to alternation of types of masonry and other materials

B5 Stratigraphic Building Unit

BP6 is inferred by (infers)

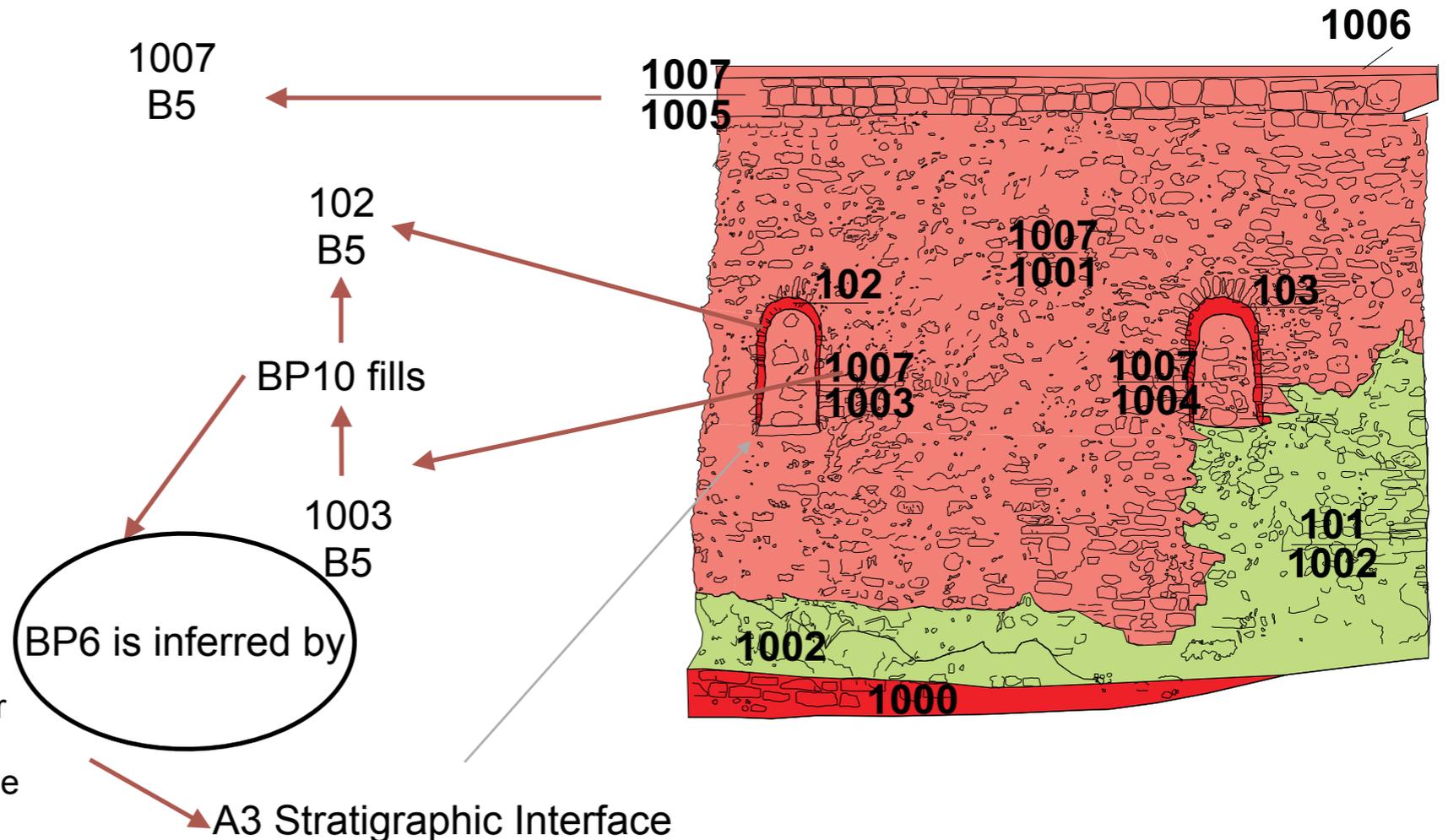
Domain: E12 Production
E11 Modification

Range: A3 Stratigraphic Interface

Quantification: many to many (0,n:0,n)

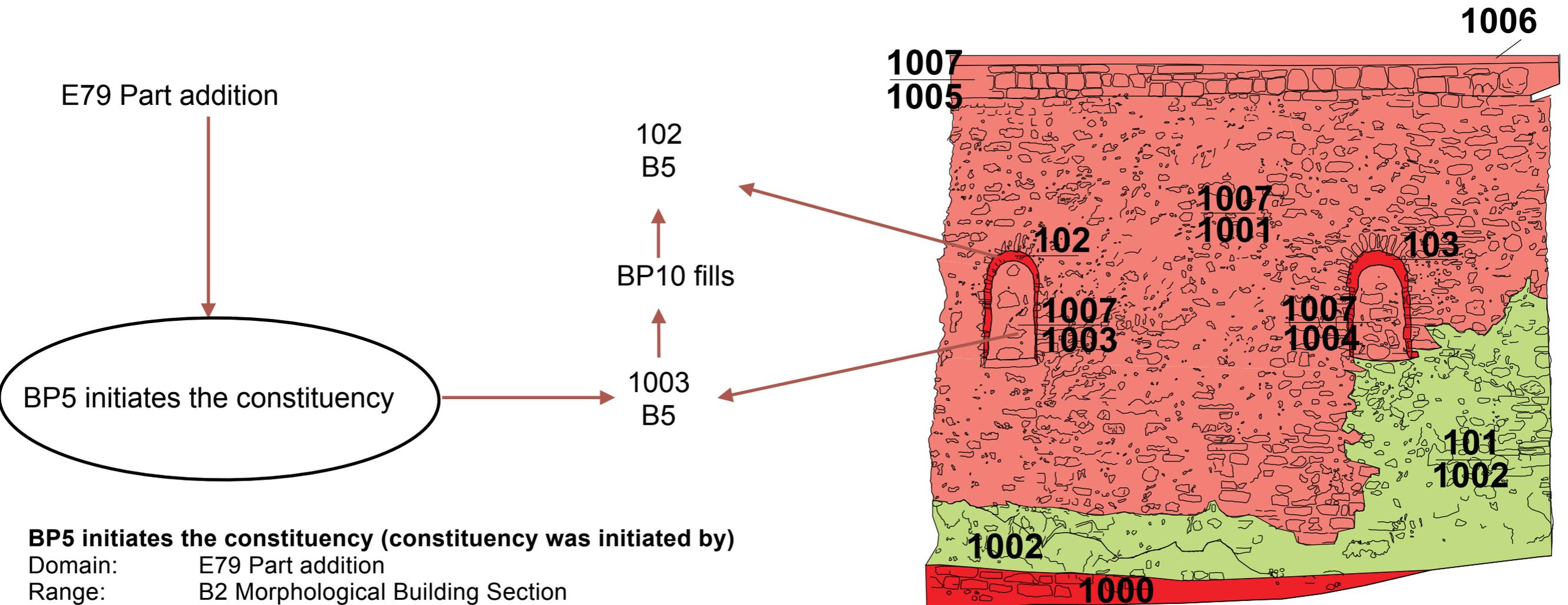
Scope note: The production of new substance initiates the constituency of a SBU with a Filled Morphological Building Section. The traces left by a production activity (with the addition of new substance or after the matter removal) are visible trough the Stratigraphic Interface, which enable to infer about the various activities on the MBS.

Examples: The second construction phase of the wall (BP6 is inferred by) the presence of a mortar joint on the wall surface.



B5 Stratigraphic Building Unit (SBU), a sub-class of A8 Stratigraphic Unit, which are identified by matter and represent the minimal construction unit of a built structure. Depending on the level of accuracy we want to reach in our documentation, a Stratigraphic Building Unit can refer to a single wall (in this case we say that a Morphological Building Section **BP15 is equal to** SBU), to various architectonic elements, or to the smallest components of the whole structure. The Stratigraphic Building Unit represents a single evidence of activity: e.g. the presence of mortar, vestments, *emplekton*, plasters, or the discontinuities on a wall due to successive days of work or due to alternation of types of masonry and other materials

B5 Stratigraphic Building Unit



BP5 initiates the constituency

BP5 initiates the constituency (constituency was initiated by)

Domain: E79 Part addition

Range: B2 Morphological Building Section

Quantification: many to many (0,n:0,n)

Scope note: This property is used to describe the beginning of the constituency of a Stratigraphic Building Unit with a Morphological Building Section. This starts when substance is added to a Morphological Building Unit.

Examples: The painting of the fresco on the northern wall (BP5 initiates the constituency) of the painting to the wall.

B5 Stratigraphic Building Unit (SBU), a sub-class of A8 Stratigraphic Unit, which are identified by matter and represent the minimal construction unit of a built structure. Depending on the level of accuracy we want to reach in our documentation, a Stratigraphic Building Unit can refer to a single wall (in this case we say that a Morphological Building Section **BP15 is equal to** SBU), to various architectural elements, or to the smallest components of the whole structure. The Stratigraphic Building Unit represents a single evidence of activity: e.g. the presence of mortar, vestments, *emplekton*, plasters, or the discontinuities on a wall due to successive days of work or due to alternation of types of masonry and other materials

B5 Stratigraphic Building Unit

E80 Part Removal



BP4 terminates the constituency

BP4 terminates the constituency (constituency was terminated by)

Domain: E80 Part removal

Range: B2 Morphological Building Section

Quantification: many to many (0,n:0,n)

Scope note: This property is used to describe the constituency (being part of) of a Stratigraphic Building Section with a Filled Morphological Building Section. The constituency ends when an entity (FMBS) is diminished by matter.

Examples: The removal of the fresco (B5 SBU) from the northern wall (BP4 terminates the constituency) of the fresco to the wall (B2 FMBS).



Leslie, 2014, Church of S. Michael Archangel, Pontorno, Tuscany

B5 Stratigraphic Building Unit (SBU), a sub-class of A8 Stratigraphic Unit, which are identified by matter and represent the minimal construction unit of a built structure. Depending on the level of accuracy we want to reach in our documentation, a Stratigraphic Building Unit can refer to a single wall (in this case we say that a Morphological Building Section **BP15 is equal to** SBU), to various architectonic elements, or to the smallest components of the whole structure. The Stratigraphic Building Unit represents a single evidence of activity: e.g. the presence of mortar, vestments, *emplekton*, plasters, or the discontinuities on a wall due to successive days of work or due to alternation of types of masonry and other materials

B5 Stratigraphic Building Unit

BP13 used specific object (was specific object used by)

Domain: E12 Production

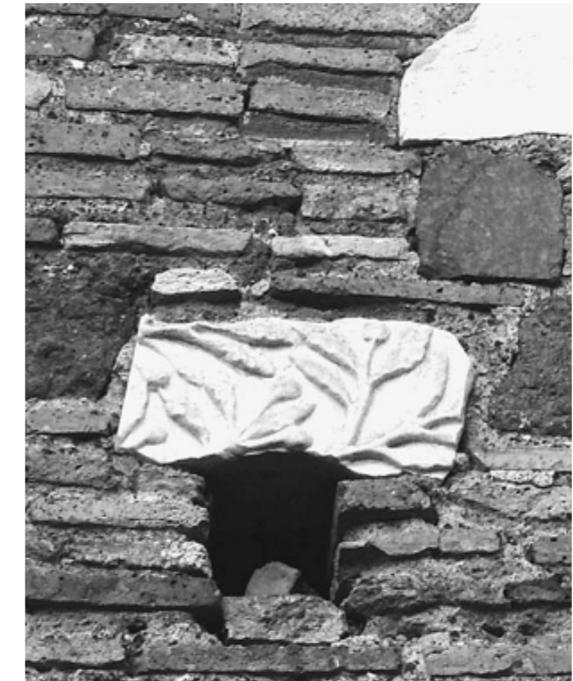
Range: B5 Stratigraphic Building Unit

143

Quantification: many to many (0,n:0,n)

Scope note: This property is used to describe an instance of a physical object that is used in the production of new substance that constitutes the Morphological Building Section (i.e. a Stratigraphic Building Section)

Examples: The construction of the new façade (BP13 used specific object) the staircase.



Esposito, D., 2008, Selezione e posizione degli elementi di reimpiego nelle tessiture murarie. Osservazioni su alcuni esempi in area romana fra XII e XIV secolo

BP14 re-used specific object (was specific object re-used by)

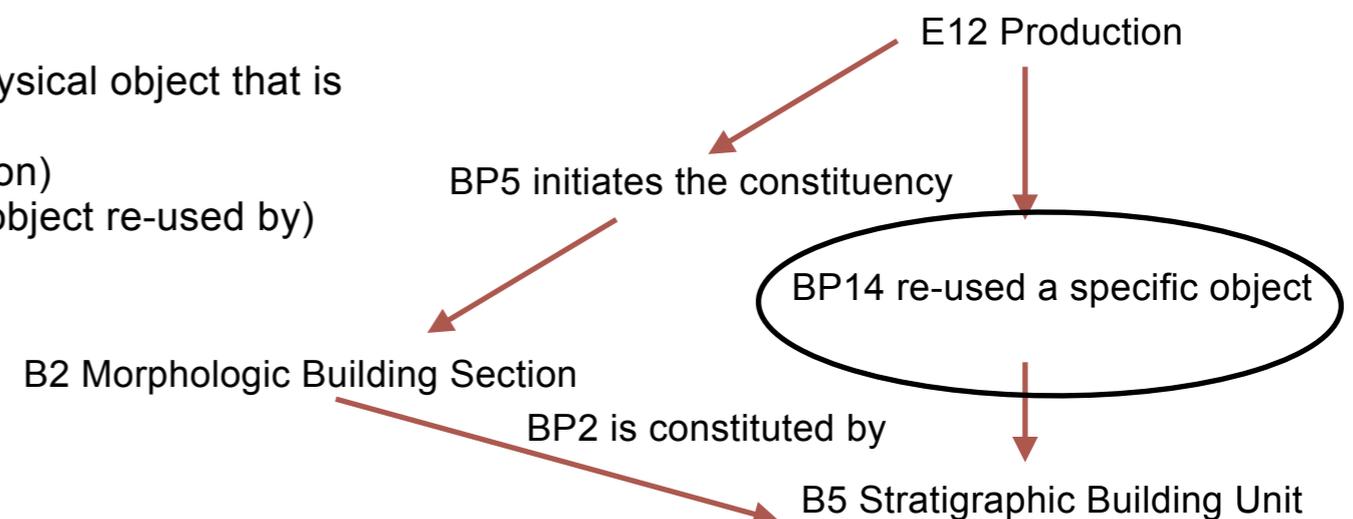
Domain: E12 Production

Range: B5 Stratigraphic Building Unit

Quantification: many to many (0,n:0,n)

Scope note: This property is used to describe an instance of a physical object that is re-used in the production of new substance that constitutes the Morphological Building Section (i.e. a Stratigraphic Building Section)

Examples: The stones of the Roman theatre (BP14 was specific object re-used by) the construction of the fountain.



B5 Stratigraphic Building Unit (SBU), a sub-class of A8 Stratigraphic Unit, which are identified by matter and represent the minimal construction unit of a built structure. Depending on the level of accuracy we want to reach in our documentation, a Stratigraphic Building Unit can refer to a single wall (in this case we say that a Morphological Building Section **BP15 is equal to** SBU), to various architectonic elements, or to the smallest components of the whole structure. The Stratigraphic Building Unit represents a single evidence of activity: e.g. the presence of mortar, vestments, *emplekton*, plasters, or the discontinuities on a wall due to successive days of work or due to alternation of types of masonry and other materials

Topological relations

The basic principles of Topology are defined by the following axioms stating that the connection between two entities (C) must be reflexive and symmetric:

$$Cxx$$

Reflexivity

$$Cxy \text{ } Cyx$$

Symmetry

'C' expresses not only the relation of external connections between two disjoint entities that share a common boundary, but also the relation of connections that may hold between any two entities that share at least one boundary. In this sense, mereological overlap also qualifies as connection (Varzi 2007):

$$Oxy =_{df} \exists z(Pzx \wedge Pzy)$$

Mereological Overlap



Henrik Boman, Plan of V 1,3, Pompeii

Mereology is the theory of the parthood relation (Varzi, A.C., 2014. Mereology. Stanford Encyclopedia of Philosophy)

There is a sort of bridging principle between Mereology and Topology that is expressed by the intuition that no matter how P (parthood) and C (connectedness) are characterized, they must be related in a way that a whole and its parts are tightly connected (Varzi, A., 2007. Spatial reasoning and ontology: parts, wholes, and locations. In M. Aiello, I. Pratt-Hartmann & J. van Benthem eds. Handbook of Spatial Logics. Amsterdam: Springer, pp. 945–1038).

Topological relations

Room A
B2 Morphological Building Section



Room B
B2 Morphological Building Section



BP11 is connected to

- Domain: B2 Morphological Building Section
- Range: B2 Morphological Building Section
- Scope note: This property is used to describe the topological relation between two Morphological Building Sections that are connected to each other.
- Examples: The great hall (B11 is connected to) the chapel.

Mereology is the theory of the parthood relation (Varzi, A.C., 2014. Mereology. Stanford Encyclopedia of Philosophy)

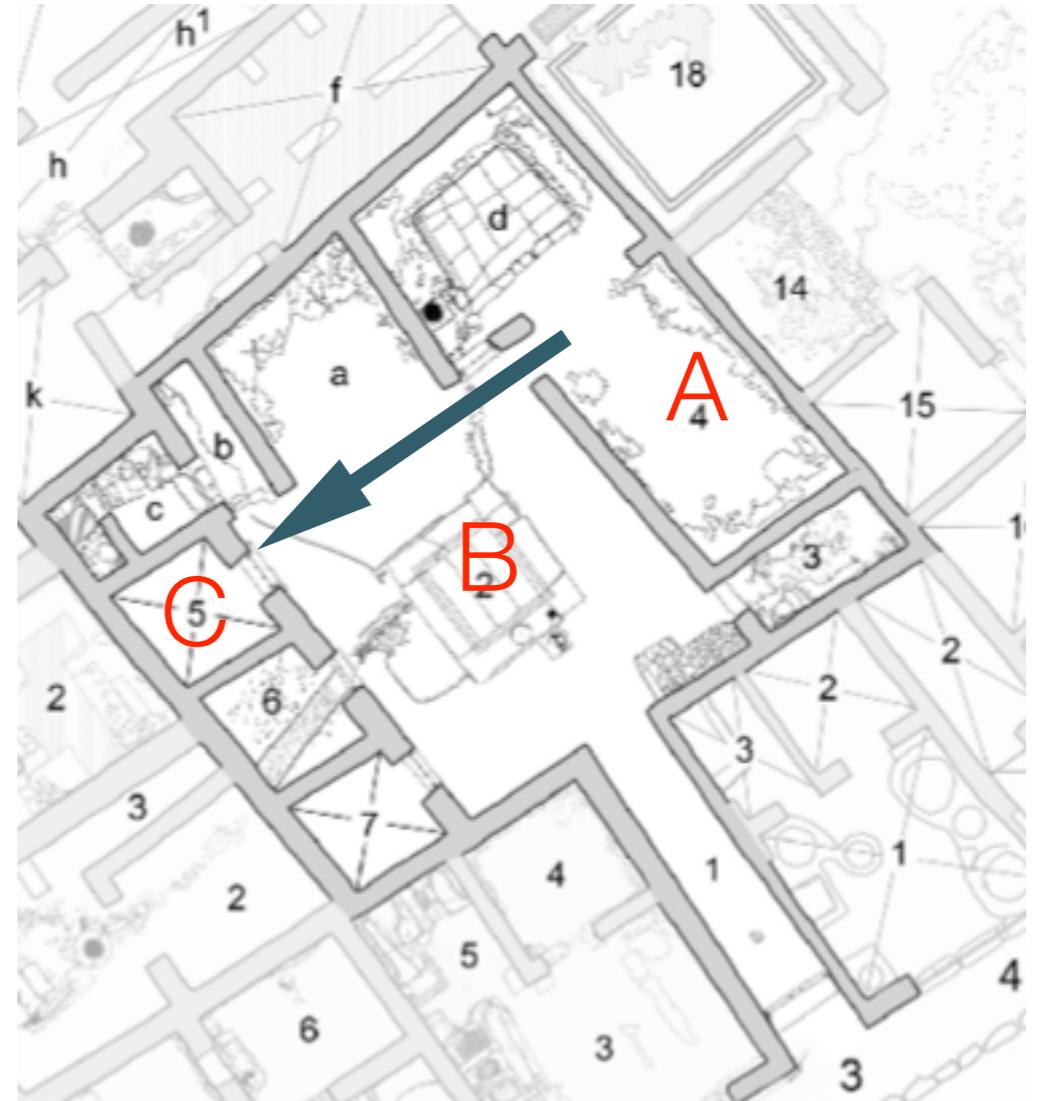
There is a sort of bridging principle between Mereology and Topology that is expressed by the intuition that no matter how P (parthood) and C (connectedness) are characterized, they must be related in a way that a whole and its parts are tightly connected (Varzi, A., 2007. Spatial reasoning and ontology: parts, wholes, and locations. In M. Aiello, I. Pratt-Hartmann & J. van Benthem eds. Handbook of Spatial Logics. Amsterdam: Springer, pp. 945–1038).

Topological relations

From the basic principles of Topology, it follows that each MCn is reflexive and symmetric, and the union of all such relations is transitive. Therefore we get the transitivity of connection by:

$$TCxy =_{df} \exists n MCnxy$$

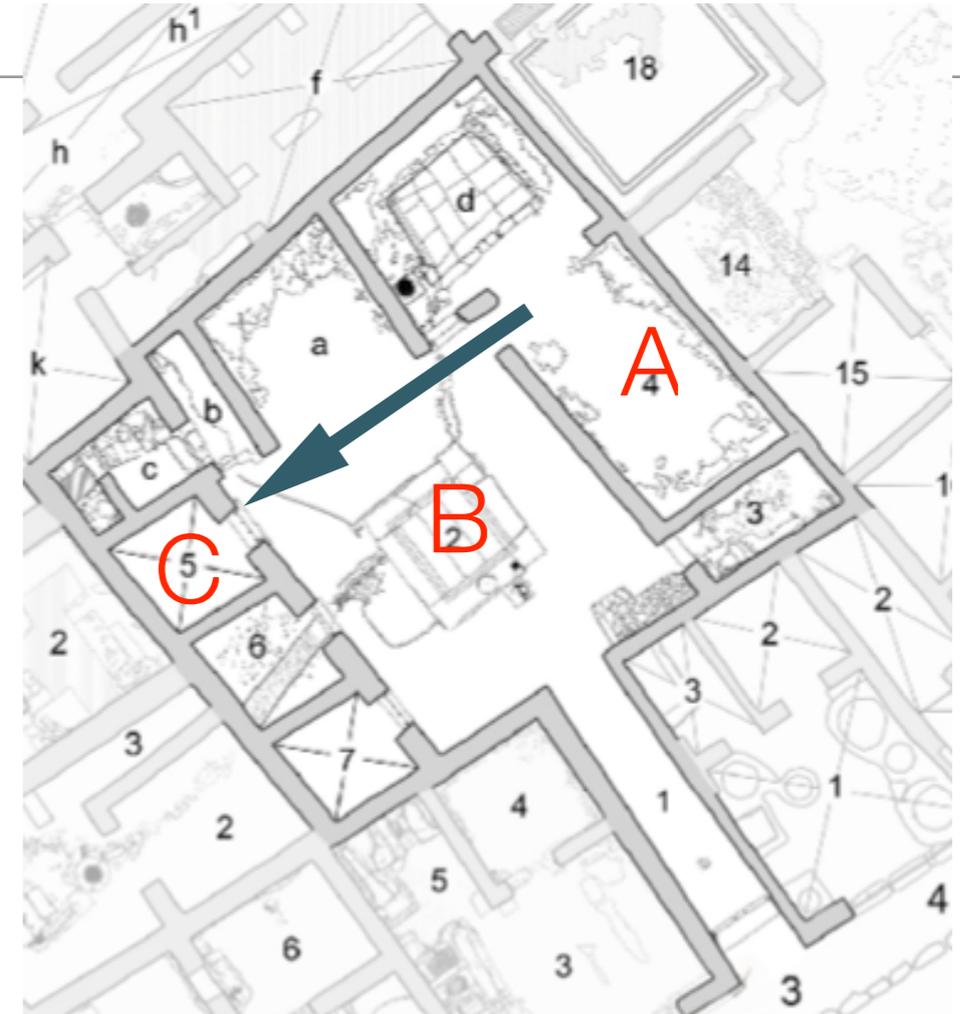
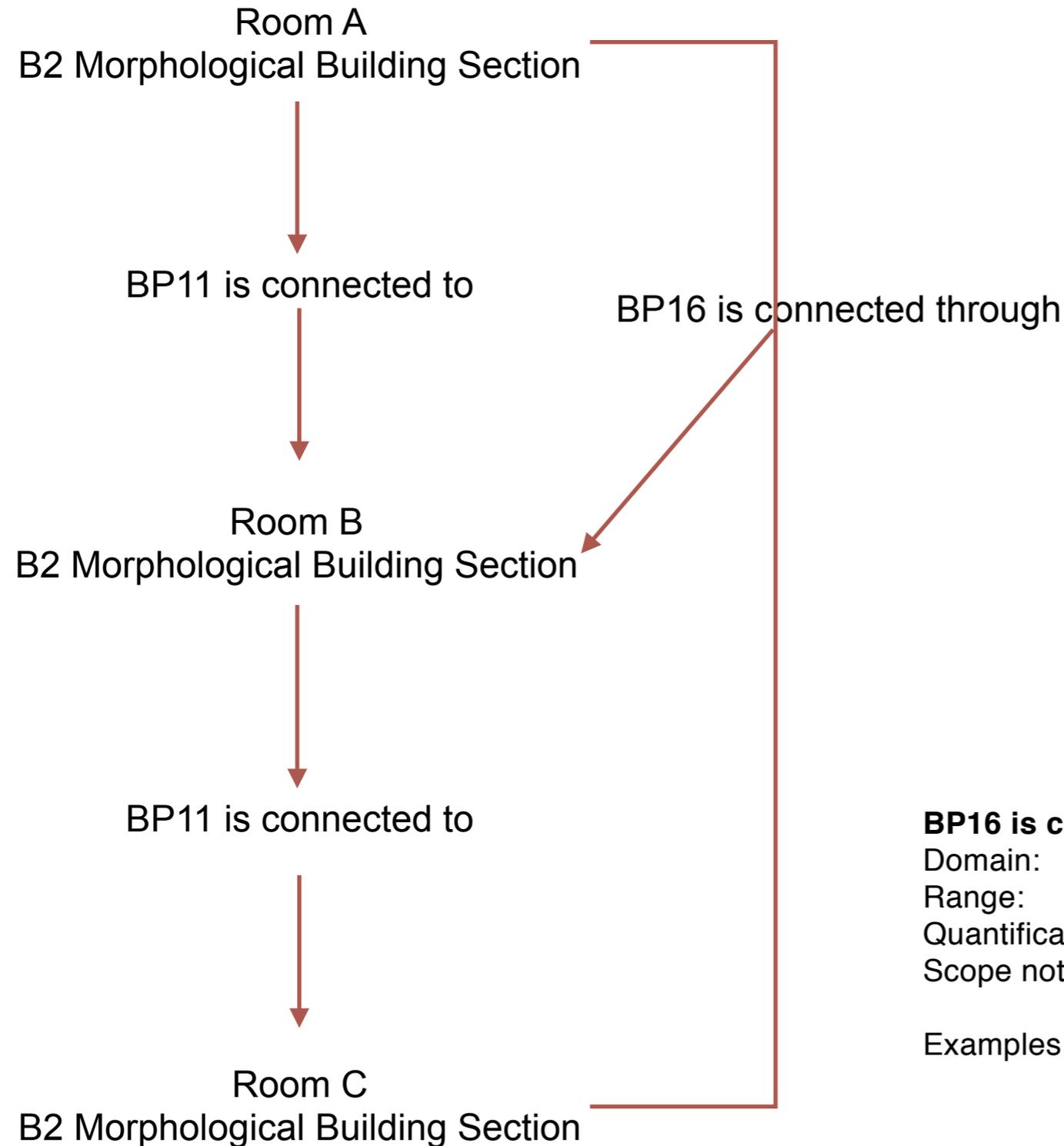
Transitive Connection



Mereology is the theory of the parthood relation (Varzi, A.C., 2014. Mereology. Stanford Encyclopedia of Philosophy)

There is a sort of bridging principle between Mereology and Topology that is expressed by the intuition that no matter how P (parthood) and C (connectedness) are characterized, they must be related in a way that a whole and its parts are tightly connected (Varzi, A., 2007. Spatial reasoning and ontology: parts, wholes, and locations. In M. Aiello, I. Pratt-Hartmann & J. van Benthem eds. Handbook of Spatial Logics. Amsterdam: Springer, pp. 945–1038).

Topological relations



BP16 is connected through

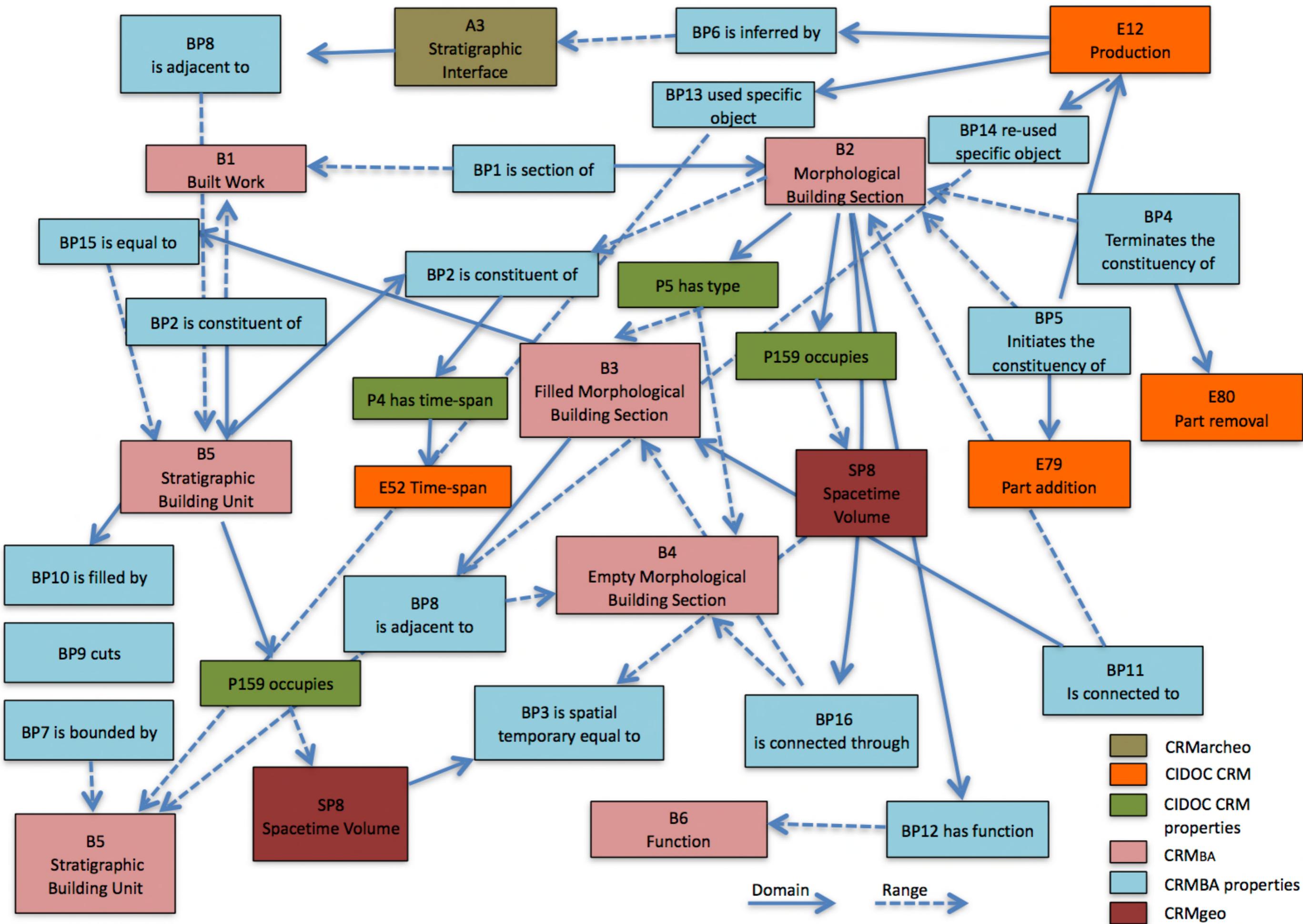
Domain: B2 Morphological Building Section

Range: B2 Morphological Building Section

Quantification: one to many (0,n:0,1)

Scope note: This property is used to the connection between two Morphological Building Sections by means of another one

Examples: The great hall (BP16 is connected through) the corridor to the sacristy.



Thank you for your attention

Paola Ronzino

p.ronzino@gmail.com
paola.ronzino@pin.unifi.it

