Spatial Cognition in Historical Geographic Texts and Maps:
Towards a cognitive-semantic analysis of Flavio Biondo's “Italia Illustrata”

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with

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Content

- Theoretical framework:
  Cognitive Semantics & Digital Humanities
- Text sources
- General Workflow
- Text analysis
- Spatial construals
- Spatial Role Labeling
- Researching historical maps
- Ontological anchoring and enrichment
- Future steps

Problem statement

- *Common sense conceptualizations of geographic concepts and relations in ancient and early modern texts and maps*
  - *Analytic* methods of cognitive computational linguistics
    Corpus construction, annotation, and parsing
  - > Formal two-level representation
    - (Cognitive) linguistic
    - Conceptual – general semantics
  - Interpretation and evaluation
  - Long term goal: *Synthetic*
    Reconstruction of cognitive maps / sketches

Research

Research Projects of the Institute

- Historical spaces in texts and maps (Biondo-Project)
- Rome Contemporary
- Heinrich Wölfflins Gesammelte Werke
- ArsRoma
- Lineamenta
- Roma communis patria

Research of the Academic Staff

Associated Projects

Emeriti

Historical spaces in texts and maps – A cognitive-semantic analysis of Flavio Biondo's "Italia Illustrata"

In the research of Department III (Michalsky), questions about the historical understanding of social space and its change in the so-called long Middle Ages play a central role. The study of the relations between historical maps and texts aims to explore the historical understanding of space and the knowledge associated with it by taking up approaches from cognitive linguistics. Cognitive maps depict culture-specific spatial knowledge and practices. This knowledge is represented in different ways, which change historically through different processes and practices.
The epistemological focus is therefore framed by the following questions:

Which forms of knowledge represent spatial relations?
How can spatial transformation processes be represented and analyzed?
What is the connection between culture-specific practices and cognitive representations?
And what is the relationship between texts and maps?

In order to approach this complex of questions, this project combines cognitive-semantic parameters such as toponyms, landmarks, spatial frames of reference, geometric relations, gestalt principles and different perspectives with computational linguistic analysis methods according to our "Common Sense Geography" approach. Using new text and map markings and corpus-specific quantitative methods, historical texts are processed and reinterpreted.

Historical spaces in texts and maps (Biondo-Project)

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Spatial Cognition in the Renaissance

- **Flavio Biondo (1392—1463): *Italia Illustrata***
  - 1474 (Incunabula) + 1559 (Basel), Pontari (ms.edition, Latin)
- Clavuot 1990: “Topographically ordered historical account”
  - Systematic presentation of Italy’s historical cultural landscapes
  - Antiquarian interest: Cultural development as rejuventation of the ancient civilization
  - Links between the discovery of antiquity – literature, historical sites, buildings – and the present
- *Focus:* Spatial objects and relations (Common Sense Geography)
  - Epistemological/logical modelling
  - Contemporary maps: text-image relations

Cognitive linguistics and Gestalt theory

- Mental models are based on universal cognitive mechanisms and Gestalt-theoretical principles (!)
  – cf. “Primary theory” (Smith/Mark 2001)
- Particularly relevant: spatial division of *figure* and *background* in identifying and locating objects
- Spatial relations are represented through grammatical markers and semantic fields
- From representational viewpoint: Mental models store information on events and objects of the external world, especially
  - for orientation in space and references to places, for topological and geometrical knowledge

General Workflow

- New raw Latin–English parallel text (Biondo); interlinear word-to-word linguistic glossing
- *Automatic* **preparatory** text processing
  - word lists, frequency counts, concordances, clusters, POS and semantic tagging
- Dependency parsing (en)
- *Semiautomatic* Named Entity Recognition (NER) (+ definite descriptions): Places , persons, events
- Spatial Role Labelling (*brat*) (… machine learning??)
  - Parallel Latin text annotation
- Interpretation

The Reality with Ancient Greek and Latin as well…

- NLP pipeline (© F. Mambrini)

NLP Process	Ancient Greek?
Chunking	
Lemmatization	
POS-tagging	
Syntactic parsing	
Word-sense disambiguation	
Co-reference resolution	
Semantic role annotation	

- Therefore we have to use translations

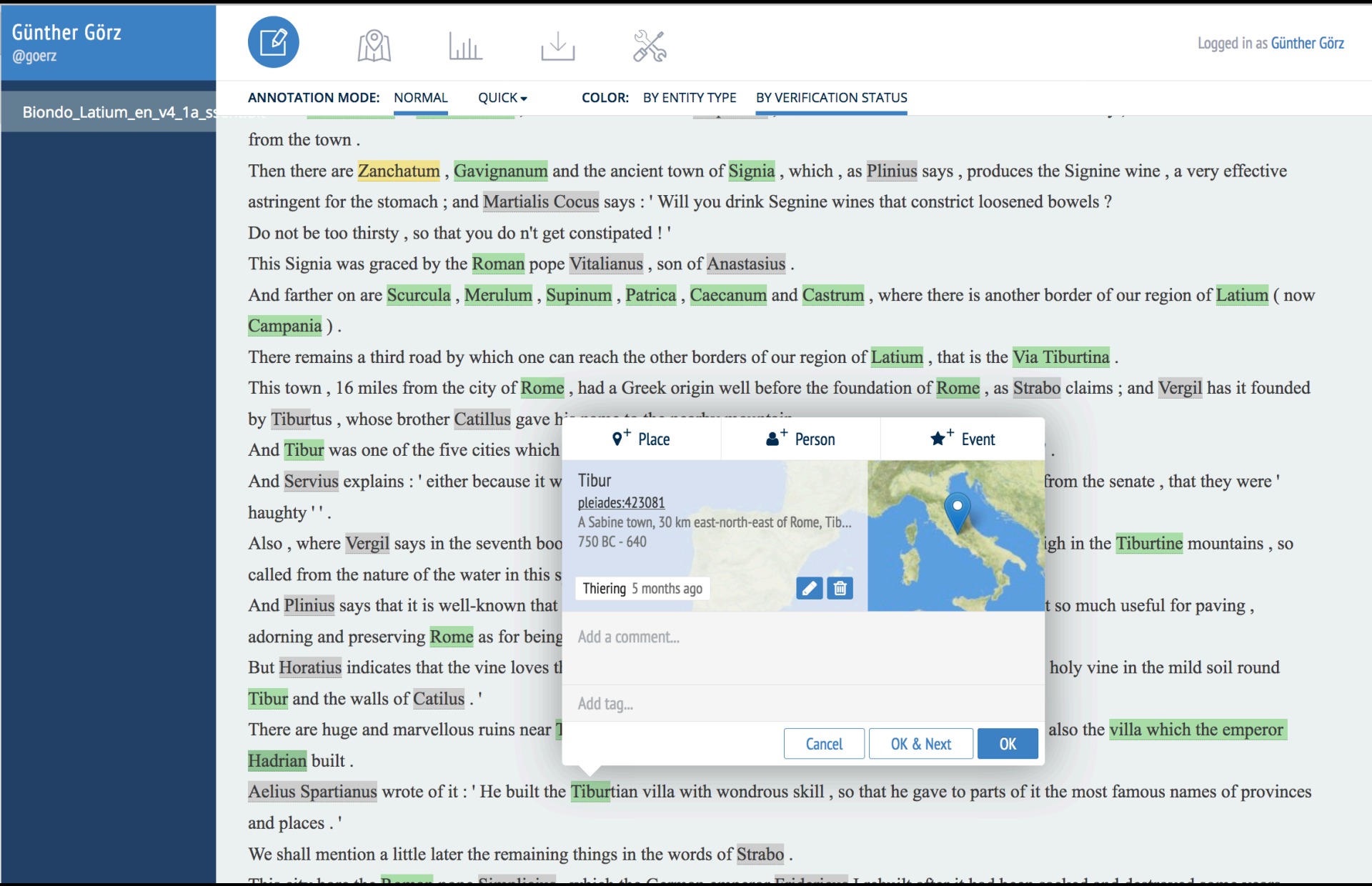
Text analysis (1)

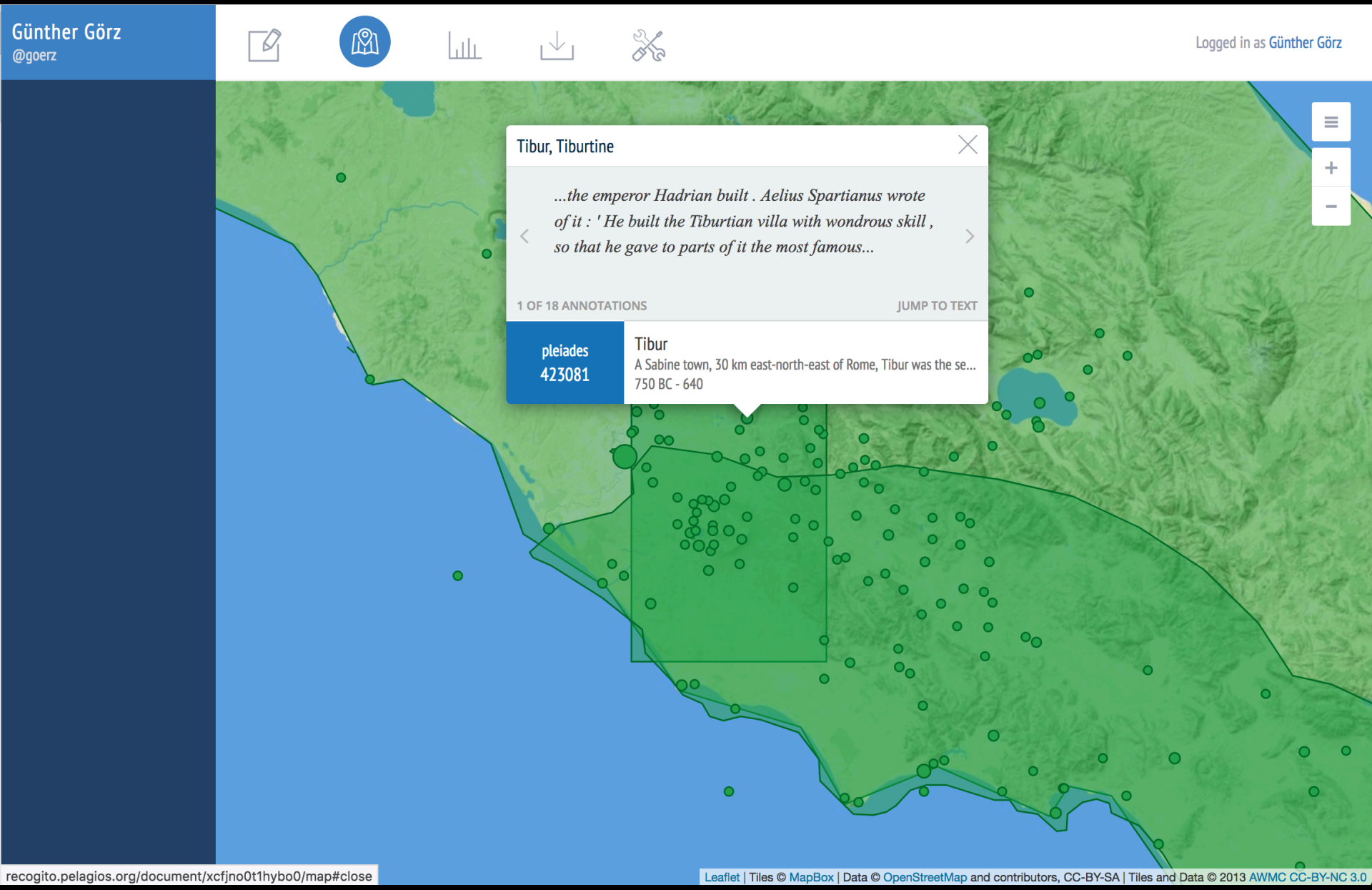
- Text basis: Greek/Latin with English translation (CL)
  - insufficient editions – need for reconstruction
  - parallel texts: sentence level synchronisation
- Basic text analysis
  - word lists, frequencies, POS-Tagging, concordances, semantic tagging
  - Tools: antconc, Voyant, KWIC, wmatrix (Lancaster), Collatinus, command line scripts
- Dependency parsing of raw text (Stanford parser)
  - PennTB tagging, constituent trees, dependency relations
  - where necessary, manual correction of dependency structures

Text analysis (2)

- Named Entity Recognition
  - in raw text with Recogito2
  - Pleiades gazetteer – … need for local add-ons
  - Export of TEI, CSV, RDF, GeoJSON
  - Comparison with Edinburgh Geoparser results (yet outdated Pleiades gazetteer)
- TEI markup: semantic anchoring (see below: ontologies)
- Visualization of recognized places in modern map (Recogito2)
  - virtual trip: verse/sentence numbers as pseudo time

Recogito 2 (Pelagios Commons)




Günther Görz
@goerz
Logged in as Günther Görz
Tibur, Tiburtine
...the emperor Hadrian built . Aelius Spartianus wrote of it : ' He built the Tiburtian villa with wondrous skill , so that he gave to parts of it the most famous...
1 OF 18 ANNOTATIONS
JUMP TO TEXT
pleiades
423081
Tibur
A Sabine town, 30 km east-north-east of Rome, Tibur was the se...
750 BC - 640
recogito.pelagios.org/document/xcfjno0t1hybo0/map#close
Leaflet | Tiles © MapBox | Data © OpenStreetMap and contributors, CC-BY-SA | Tiles and Data © 2013 AWMC CC-BY-NC 3.0

Tibur

a Pleiades place resource

Creators: L. Quilici, S. Quilici Gigli
Contributors: DARMC, R. Talbert, Sean Gillies, Tom Elliott, Jeffrey Becker

Last modified Jul 29, 2016 09:27 AM — History

tags: dare:ancient=1, dare:major=1, dare:feature=major settlement

A Sabine town, 30 km east-north-east of Rome, Tibur was the seat of the Tiburtine Sibyl.

Canonical URI for this page:
`https://pleiades.stoa.org/places/423081`

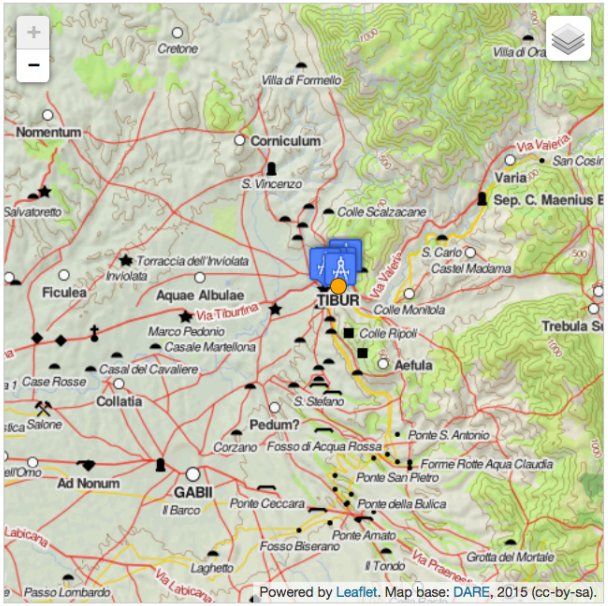
Representative Point (Latitude, Longitude):
41.9640957667, 12.79687455

Locations:
- DARMC location 18942 (750 BC - AD 640)
- OSM location of Temple of the Sibyl (330 BC - AD 300)
- location of Temple of Vesta (330 BC - AD 300)
- location of Sanctuary of Hercules Victor (330 BC - AD 300)
- location of Tempio della Tossa (30 BC - AD 300)
- location of Anfiteatro di Bleso (30 BC - AD 300)

Names:
- *Tibur* (750 BC - AD 640)

Makes a connection with:
- Via Tiburtina (Attested dates needed)

Has a connection with:
- Untitled (Attested dates needed)
- Roman bridges at Tibur (Attested dates needed)



Show place in AWMC's Antiquity À-la-carte, Google Earth, or Pelagios' Peripleo.
Show area in GeoNames, Google Maps, or OpenStreetMap.

Place type:
settlement, amphitheatre, amphitheater, temple, sanctuary, shrine, monument, tomb (deprecated), temple

References:

Evidence:
- TP 4B5 (Talbert 1306)

See Further:
- BAtlas 43 D2 Tibur
- Liv. 34.35
- Liv. 9.30
- Mari, Z. 1983. Tibur. (Forma Italiae Regio 1, Vol. 17). Florence: Olschki.
- New Pauly, Tibur

Search

Search Site | Search

Advanced Search...

Photos

This place has no portrait photo. One from the list of related photos could be suggested for the Pleiades Places group on Flickr.

0 other related photos...

Use this tag in Flickr to mark depictions of this place's site(s):

`pleiades:depicts=423081`

or this one to mark objects found here:

`pleiades:findspot=423081`

Related Content from Pelagios

Tibur

Epigraphic Database Heidelberg (51);
iDAI.objects (32);
University of Graz (4);
Fasti Online (1)

Pelagios Datasets

Recogito 2 Download Options

Logged in as Günther Görz

Annotations

CSV
Download annotations as a data table for importing into spreadsheet software or a GIS.

CSV

RDF
Download annotations and document metadata as RDF, encoded using Open Annotation and Dublin Core.

JSON-LD RDF/Turtle RDF/XML

Places

GeoJSON
Confirmed geo-located places in the document as a GeoJSON FeatureCollection.

GeoJSON

KML
Confirmed geo-located places as KML file, for viewing in Google Earth.

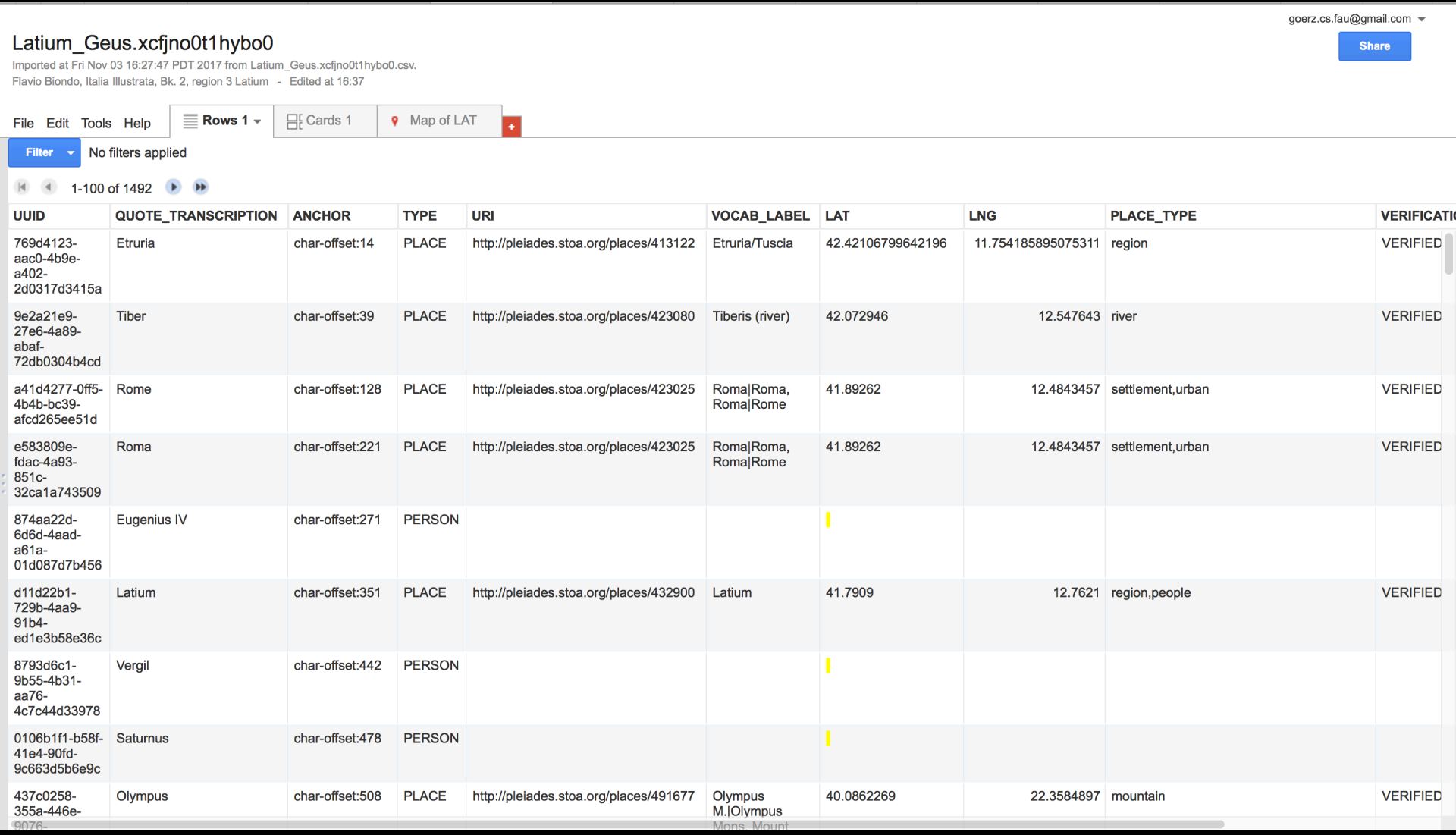
KML

Annotated Document

TEI
Annotated text in a basic TEI/XML serialization. Note: only place name annotations are included at the moment. Also, overlapping annotations are filtered out as TEI does not support them.

TEI/XML

Table (CSV) of Annotations for Latium



goerz.cs.fau@gmail.com

Share

Latium_Geus.xcfjno0t1hybo0

Imported at Fri Nov 03 16:27:47 PDT 2017 from Latium_Geus.xcfjno0t1hybo0.csv.
Flavio Biondo, Italia Illustrata, Bk. 2, region 3 Latium - Edited at 16:37

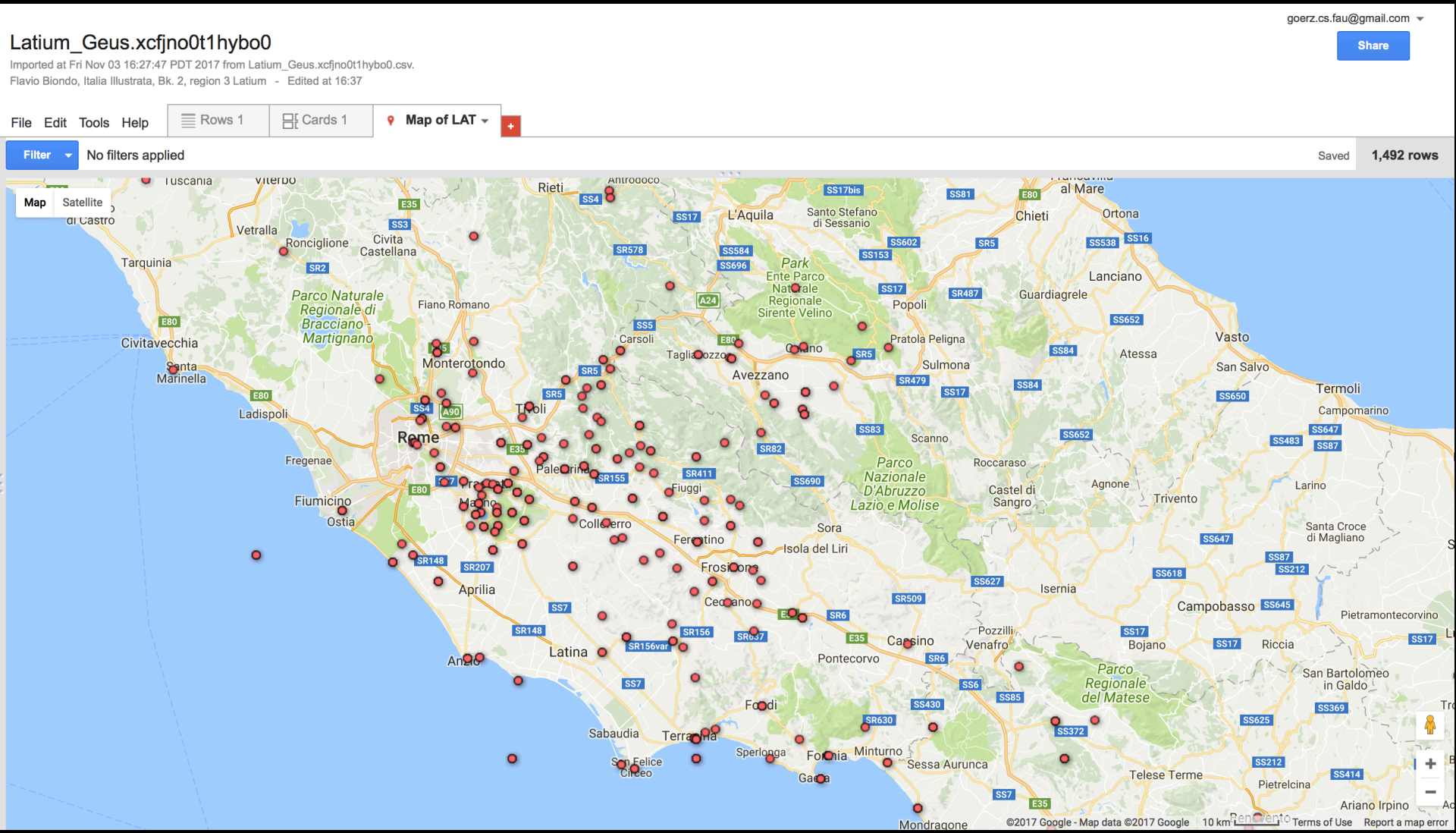
File Edit Tools Help | Rows 1 | Cards 1 | Map of LAT

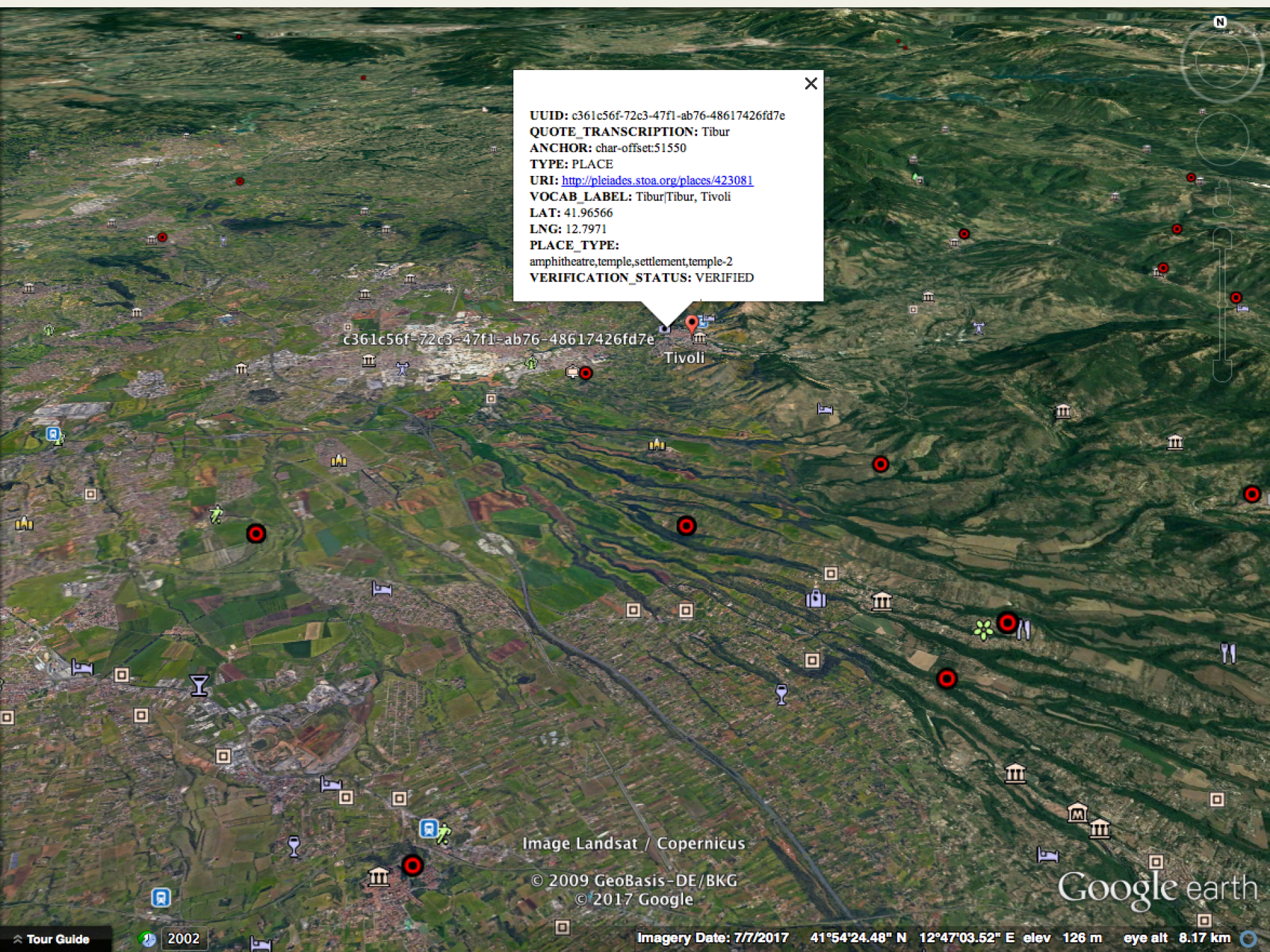
Filter | No filters applied

1-100 of 1492

UUID	QUOTE_TRANSCRIPTION	ANCHOR	TYPE	URI	VOCAB_LABEL	LAT	LNG	PLACE_TYPE	VERIFICATI
769d4123-aac0-4b9e-a402-2d0317d3415a	Etruria	char-offset:14	PLACE	http://pleiades.stoa.org/places/413122	Etruria/Tuscia	42.42106799642196	11.754185895075311	region	VERIFIED
9e2a21e9-27e6-4a89-abaf-72db0304b4cd	Tiber	char-offset:39	PLACE	http://pleiades.stoa.org/places/423080	Tiberis (river)	42.072946	12.547643	river	VERIFIED
a41d4277-0ff5-4b4b-bc39-afcd265ee51d	Rome	char-offset:128	PLACE	http://pleiades.stoa.org/places/423025	Roma|Roma, Roma|Rome	41.89262	12.4843457	settlement,urban	VERIFIED
e583809e-fdac-4a93-851c-32ca1a743509	Roma	char-offset:221	PLACE	http://pleiades.stoa.org/places/423025	Roma|Roma, Roma|Rome	41.89262	12.4843457	settlement,urban	VERIFIED
874aa22d-6d6d-4aad-a61a-01d087d7b456	Eugenius IV	char-offset:271	PERSON						
d11d22b1-729b-4aa9-91b4-ed1e3b58e36c	Latium	char-offset:351	PLACE	http://pleiades.stoa.org/places/432900	Latium	41.7909	12.7621	region,people	VERIFIED
8793d6c1-9b55-4b31-aa76-4c7c44d33978	Vergil	char-offset:442	PERSON						
0106b1f1-b58f-41e4-90fd-9c663d5b6e9c	Saturnus	char-offset:478	PERSON						
437c0258-355a-446e-	Olympus	char-offset:508	PLACE	http://pleiades.stoa.org/places/491677	Olympus M.|Olympus Mons, Mount	40.0862269	22.3584897	mountain	VERIFIED
9076-									

Map View of the Latium Table




UUID: c361c56f-72c3-47f1-ab76-48617426fd7e
QUOTE_TRANSCRIPTION: Tibur
ANCHOR: char-offset:51550
TYPE: PLACE
URI: http://pleiades.stoa.org/places/423081
VOCAB_LABEL: Tibur|Tibur, Tivoli
LAT: 41.96566
LNG: 12.7971
PLACE_TYPE:
amphitheatre,temple,settlement,temple-2
VERIFICATION_STATUS: VERIFIED
c361c56f-72c3-47f1-ab76-48617426fd7e
Tivoli
Image Landsat / Copernicus
© 2009 GeoBasis-DE/BKG
© 2017 Google
Google earth
Tour Guide
2002
Imagery Date: 7/7/2017 41°54'24.48" N 12°47'03.52" E elev 126 m eye alt 8.17 km

Spatial Construals and its Spatial Parameters

- Gestalt principles of Figure–Ground (TRAJECTOR-LANDMARK) asymmetries;
  trajectory/path of TR and LM
- OBJECT CLASSIFICATIONS, mental rotations, 2,5/3-D sketch, geometrical dimensions
- FRAMES OF REFERENCE (relative; intrinsic; absolute)
- TOPONYMS
  (place / city names, buildings, bridges, churches, fountains, walls, streets, squares, rivers, hills, gates, memorials, temples, sites, regions, etc.)

Spatial Construals and its Spatial Parameters

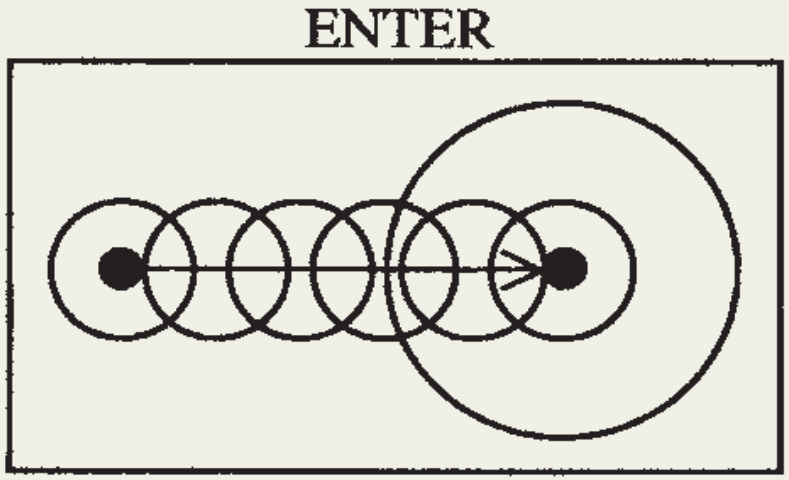
- LANDMARKS
- DISTANCES (scale, scope, size),
  encoded in adjectives, adverbs, verbs but mostly in adpositions and case systems
- METRICAL SYSTEMS
  (verbal systems such as posture verbs, classificatory verbs and case systems)
- PERSPECTIVE
  (bird's eye, hodological, vectorial perspective)
- ELEMENTS OF COMMON SENSE KNOWLEDGE
  (traveller reports, myths etc.)

Spatial Construals and its Spatial Parameters

- MOTION EVENT: SOURCE = Point of departure of TR
- PATH/TRAJECTORY = Movement of TR from SOURCE[$TR_{(X)}$] to GOAL[$LM_{(Y)}$]
- GOAL = GOAL of TR'S movement to $LM_{(Y)}$; often a container such as a room, city, town, church etc.
- DISTANCE = $proximate_{1[PROX]}$, $medial_{2[MED]}$, $distal_{3[DIST]}$ between TR and LM
- PROFILE = TRAJECTOR'S specification of LANDMARK
- Conceptualization of spatial structure: Static concepts include a REGION, LOCATION, and dynamic concepts include PATH and PLACEMENT of TR

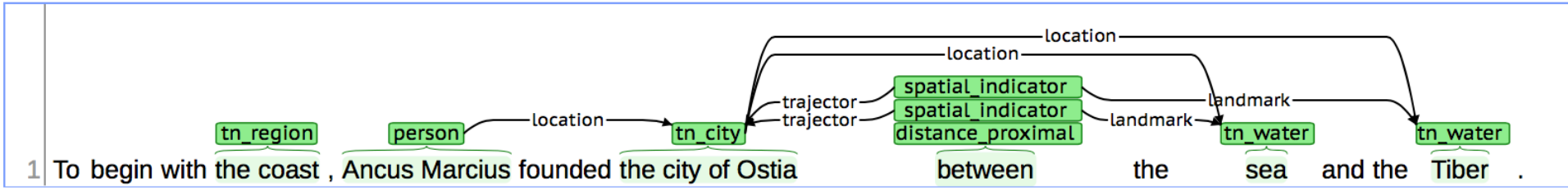
Spatial Construals (Heuristic Diagrams)

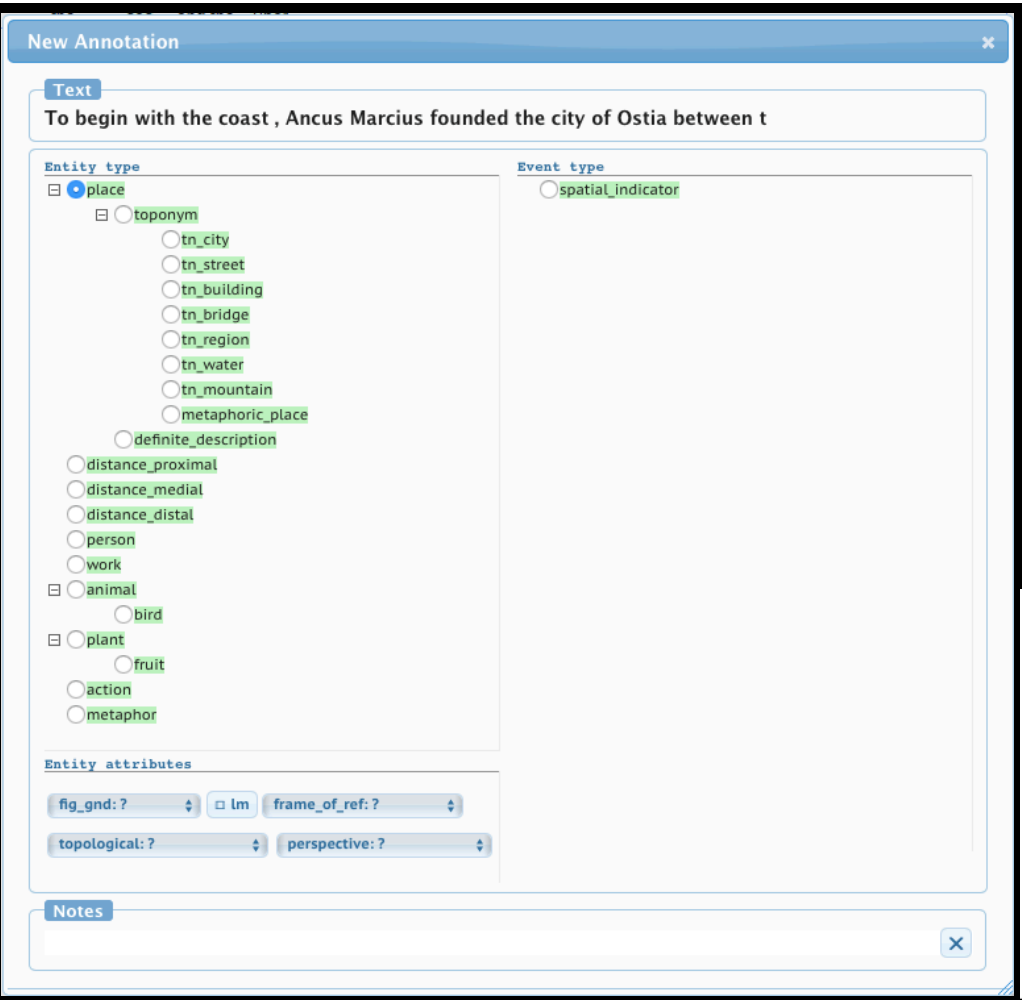
- Diagrams as depictional representations



Spatial Role Labeling in a Cognitive Linguistic Framework

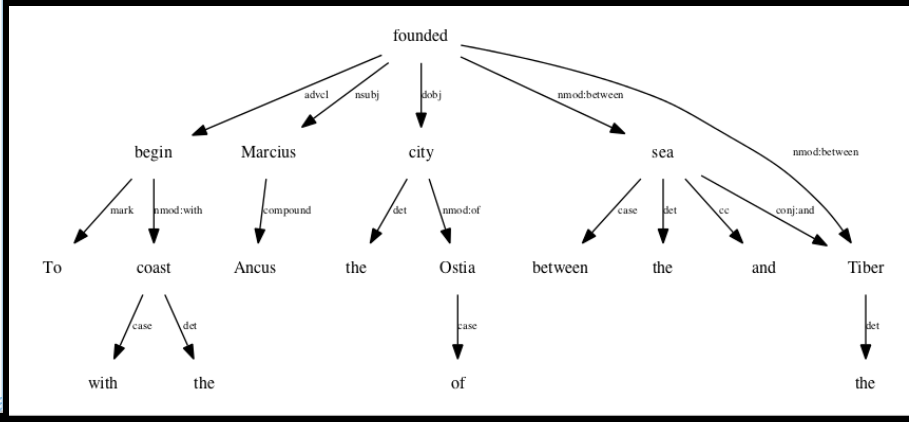
- Definition of a *brat* "configuration" (taxonomy)
- Annotation sentence by sentence with *brat*, manually
- Parallel text: transfer to Latin
- XML/RDF export
  - to be combined with dependency relations
  - information integration with NER results
- **Evaluation and Interpretation**
  - Evaluation of the use of prototypical functions with lemmata (Latin/English) in order of frequency
  - Specially: Landmarks, toponyms, frames of reference, perspectives





brat

Dependency tree (Stanford Parser)



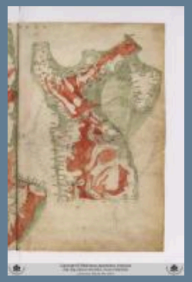
Researching Contemporary Maps

- Debate about the role of map use
- Map analysis from the viewpoint of map production
  - based on texts (!)
  - Cognitive-semiotic aspects… (MacEachren: “How Maps Work”)
  - Image processing: enhancement … readability
- Maps of Italy
  - Paulinus Minorita (14th CE), 6 further maps of Italy (15 CE); also Tabula Peutingeriana
  - Ptolemaic maps (ca. 20 traditional and “novae” − mostly after 1450!)
  - Portolan charts before 1450 (max. 10)

Maps (2)

- Toponym (+ ethnonym) transcription with Recogito2, CSV (RDF, GeoJSON) export
  - Processing of tables; comparison 
- Investigation of movement along coast lines, streets, rivers, ... and comparison – differences in Biondo chapters
- Coordinate grid: further cartometric / qualitative markup?
- Evaluation with contemporary maps and (modern) geo-visualisation (Recogito2, Fusion Tables, Google Earth,…)
- **Comparison text – image**
  - toponyms – antique and modern, paths?)
  - Formal Ontology…

Günther Görz
@goerz



Paulinus_Minorita...

Logged in as Günther Görz

Paulinus Minorita: Chronica magna: De mapa mundi - ITALIA (South)

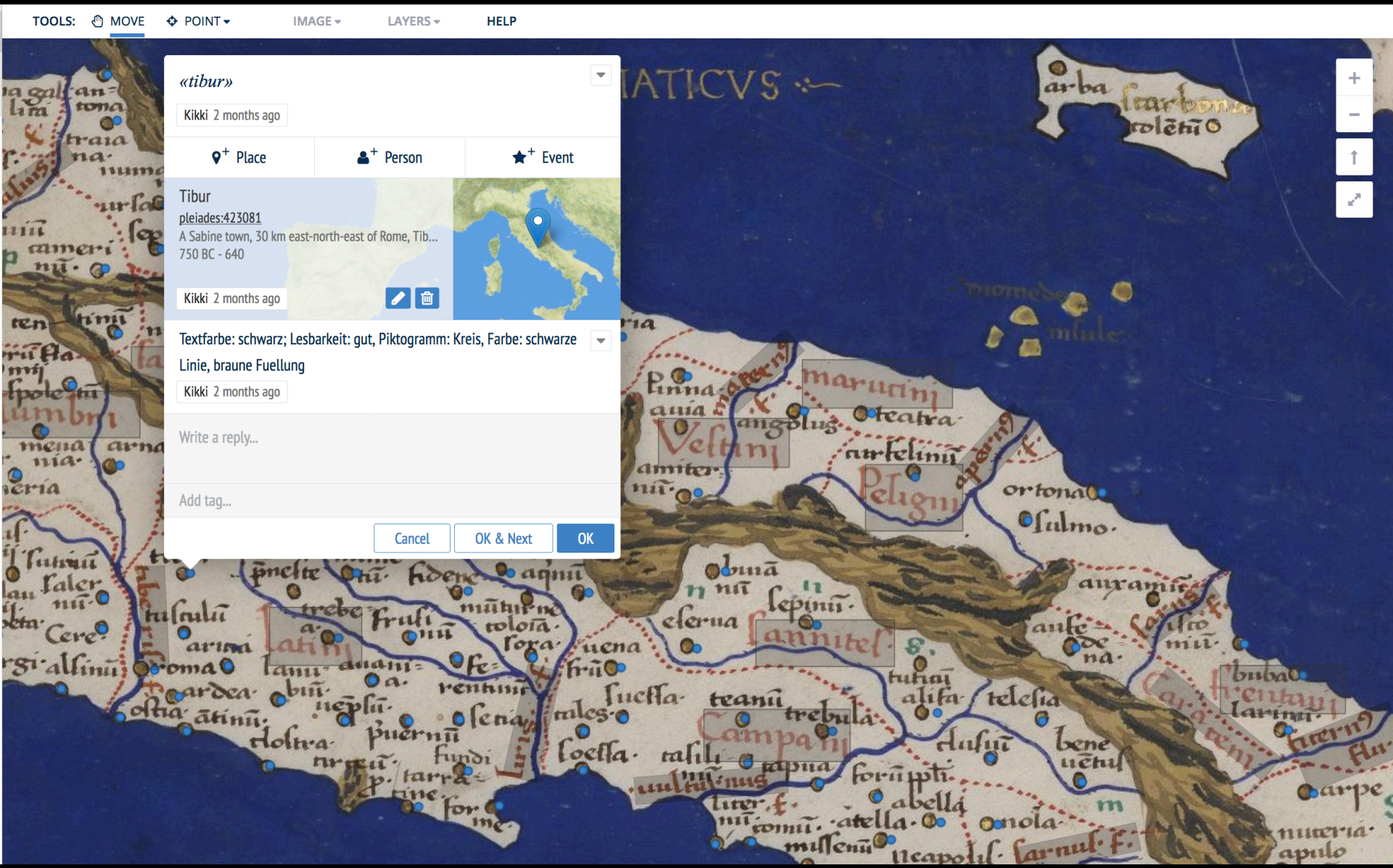
1334 - 1339

digi.vatlib.it

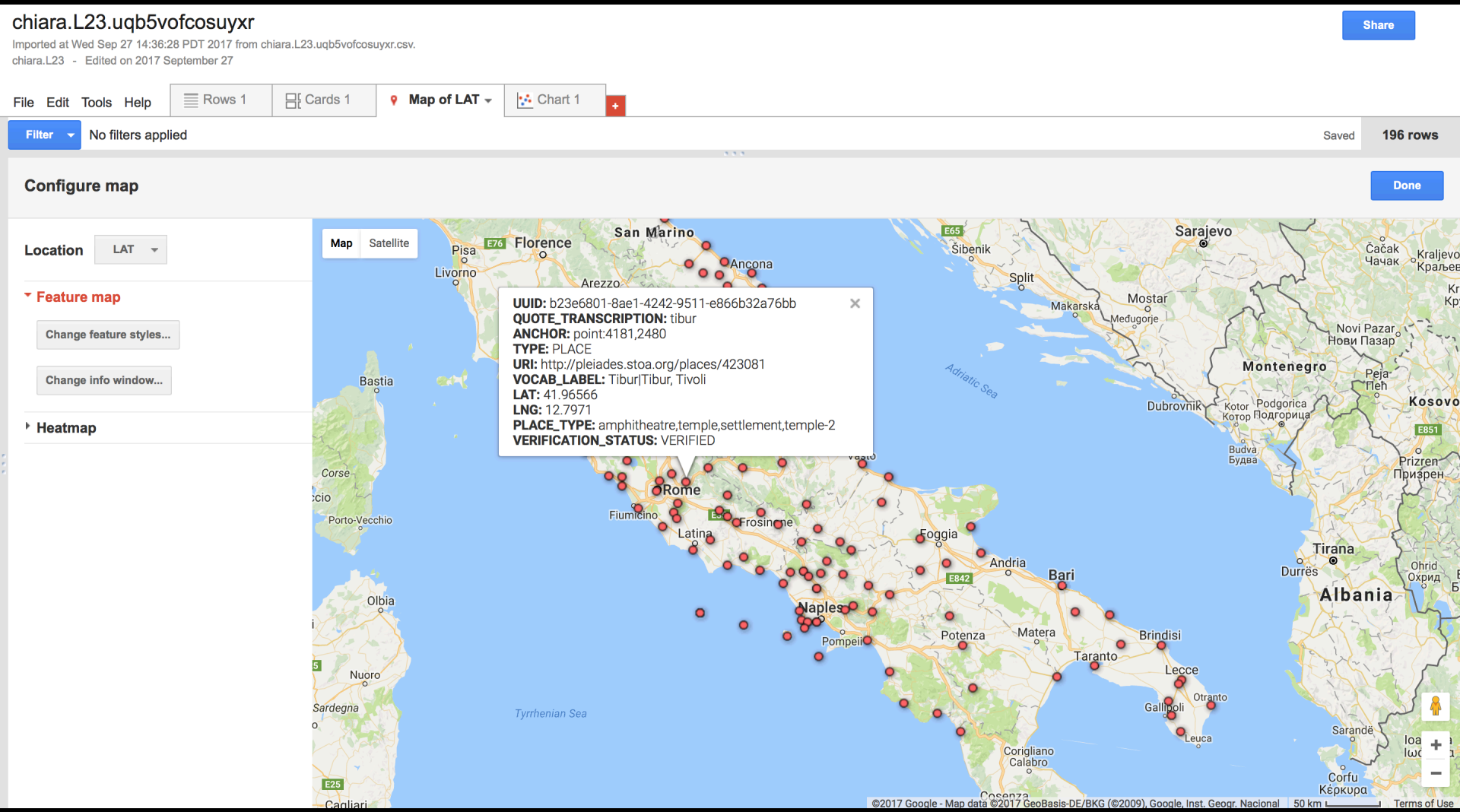
90 Annotations · No Other Contributors

TOOLS: MOVE POINT IMAGE LAYERS HELP

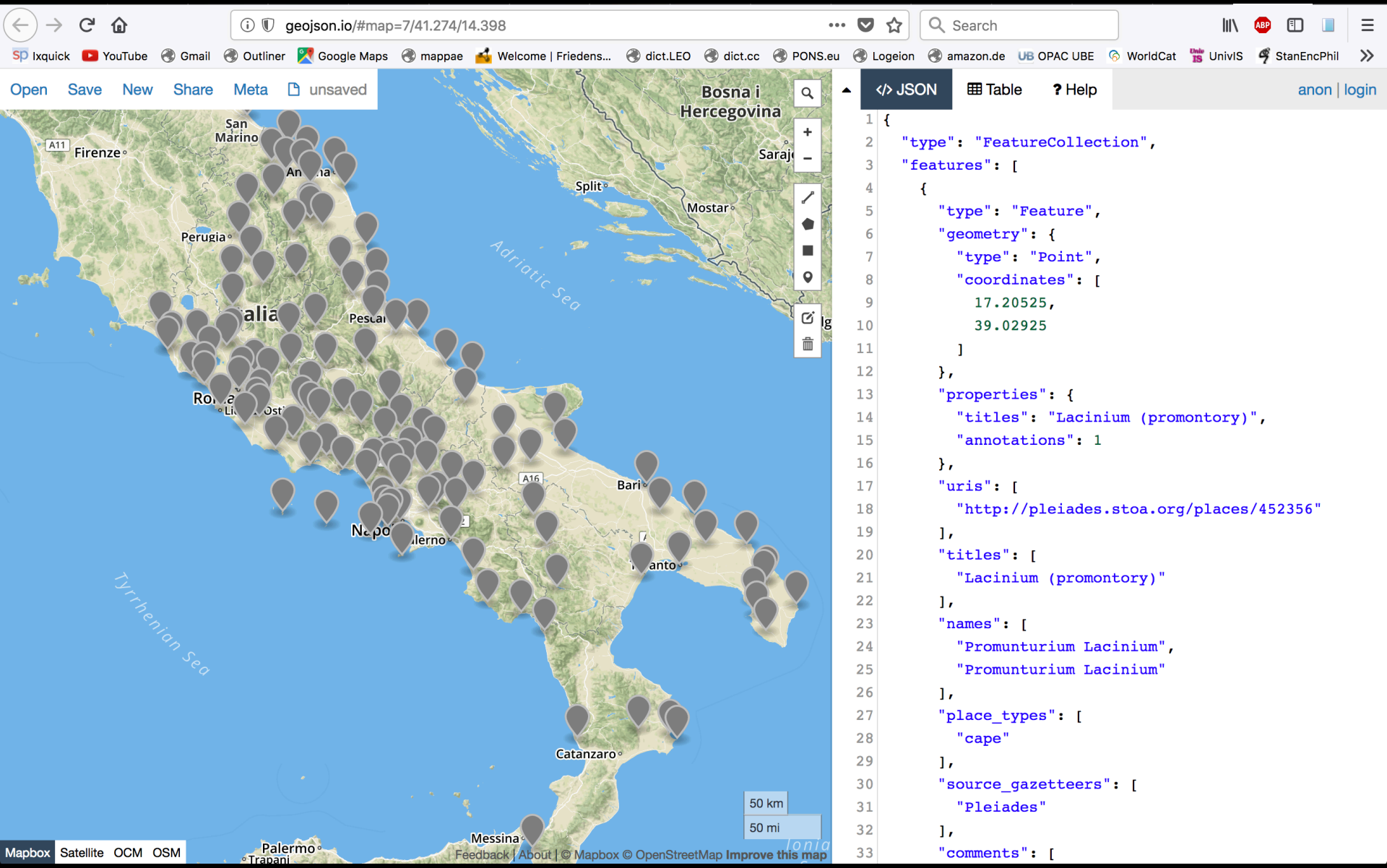
Recogito 2 – Map Annotation



Map View of Table Ptolemaeus L23



GeoJSON – Mapbox View

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{
  "type": "FeatureCollection",
  "features": [
    {
      "type": "Feature",
      "geometry": {
        "type": "Point",
        "coordinates": [
          17.20525,
          39.02925
        ]
      },
      "properties": {
        "titles": "Lacinium (promontory)",
        "annotations": 1
      },
      "uris": [
        "http://pleiades.stoa.org/places/452356"
      ],
      "titles": [
        "Lacinium (promontory)"
      ],
      "names": [
        "Promunturium Lacinium",
        "Promunturium Lacinium"
      ],
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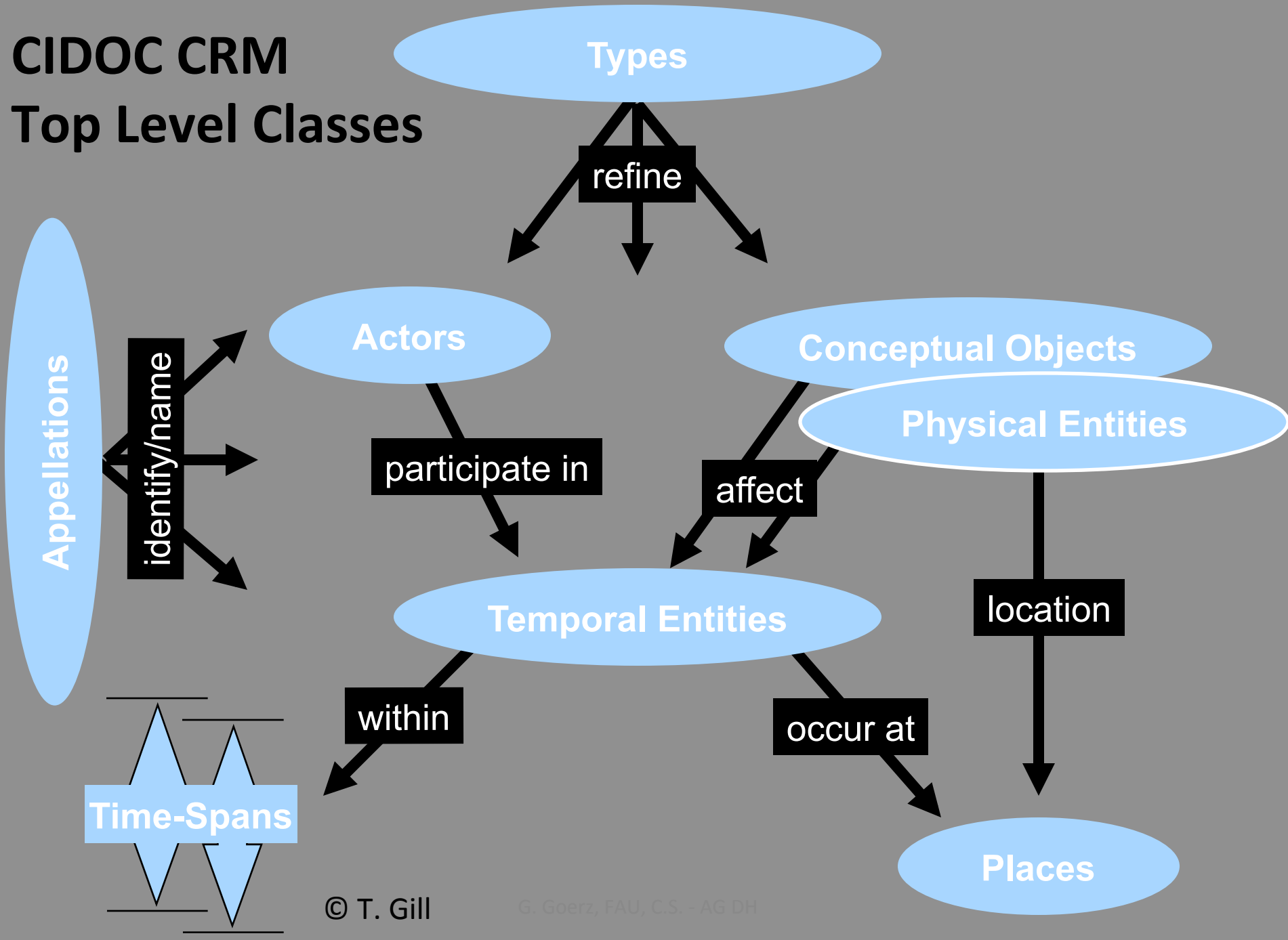
        "cape"
      ],
      "source_gazetteers": [
        "Pleiades"
      ],
      "comments": [
```

Ontological Anchoring / Enrichment

… lavori in corso 

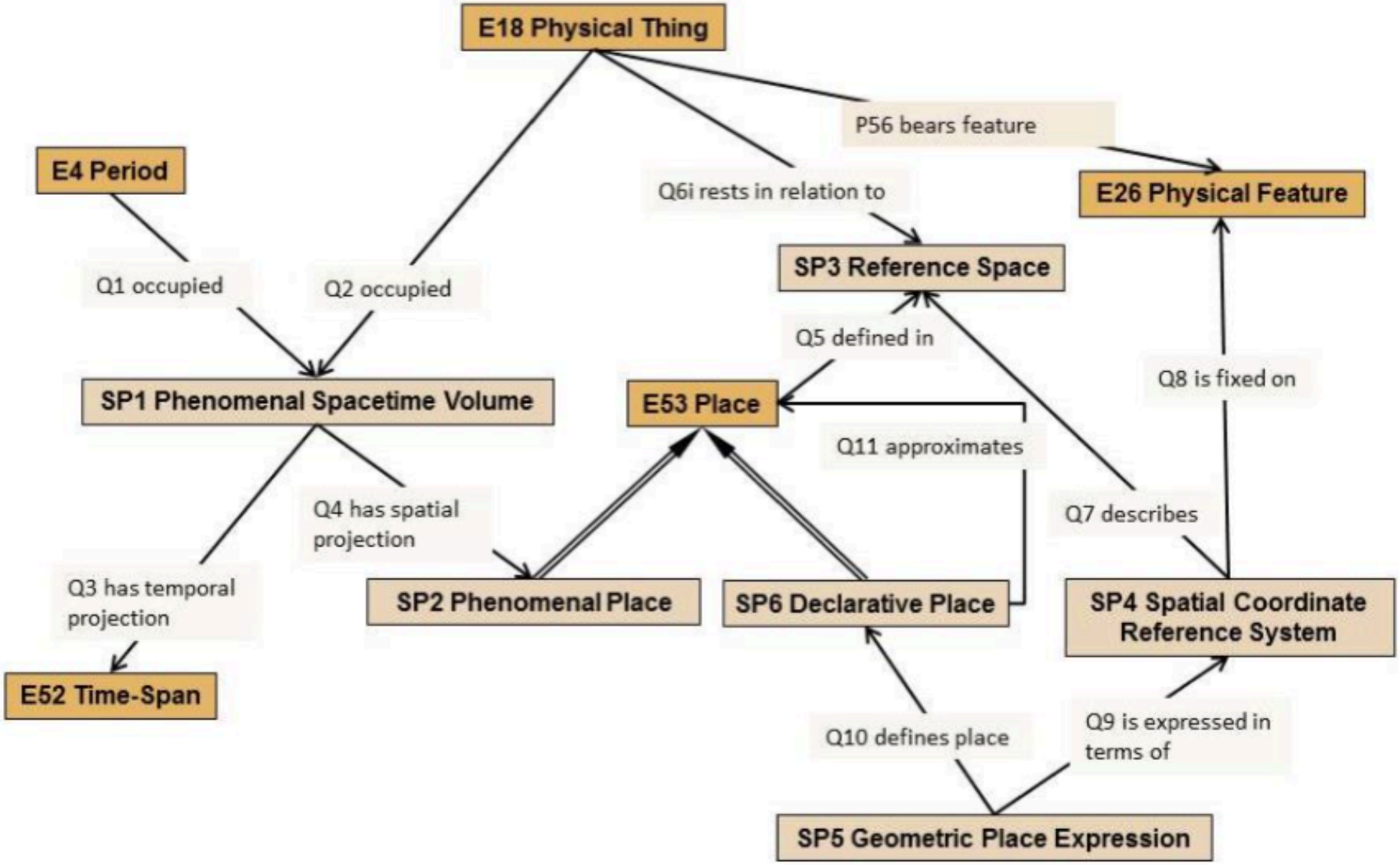
- “Formal ontologies”: knowledge modelling
- Relation to text (TEI) markup => *methodological levels*
- Semantic modelling with reference ontology
  CIDOC CRM (ISO 21127) plus CRMgeo extension
  - CRM **event-based**, linguistic-pragmatic approach
  - Question of deep domain modelling: *preference* of CRM, flat domain ontology with assignment of technical terms from thesauri (actually “Pleiades vocabulary”)
  - Use of authority files (AAT, Pleiades…, GND …)
- Creation of instances as networks of triples:
  [*subject, predicate, object*] (RDF / Triple store)
- Publication as Linked Open Data (LOD)

CIDOC CRM
Top Level Classes



© T. Gill

CRMgeo Classes and Properties



Generation of Instances (RDF Triples)

- via XML-Transformation (Sebastian Rahtz, Oxford (+))
- Definition of transformation rules
  - Mapping TEI markup to CRM instances as RDF descriptions (triples)
- Transformation of markup in TEI file, e.g. *placeName*, into CRM instances *E53_Place* in the form of RDF triples
  - "And <placeName ref=http://pleiades.stoa.org/places/423081 n="0aef99b3-c5c9-4187-acb8-43670c16b11e">Tibur</placeName> was one of the five cities ..."
  - <http://pleiades.stoa.org/places/423081> a :E53_Place ;
    :P87_is_identified_by <http://www.example.com/placename/tibur> .
    <http://www.example.com/placename/tibur> a :E48_Place_Name ;
    rdf:value "Tibur" .

Future Steps

- Complete bilingual linguistic glossing of the selected texts
- Propositional and analog-depictional representations
- Translation of descriptions of spatial objects and their spatial relations extracted from the text into plausible cognitive sketch maps
  - Extraction of triples:
    [trajectory, spatial_relation, landmark]
  - Construction of spatial property graph
  - Cell matrix based generation of plausible cognitive sketch maps (see also Tobler 1979, Cellular Geography)

Formal two-level representation

- Linguistic: particular language-bound word meanings represented by semantic/logical forms
- Conceptual: abstract conceptual knowledge represented by object schemata
  - propositional AND
  - analog (depictional) representations
  - *sketches of cognitive maps* to represent and process reifications of cognitive objects on an *epistemological level*, i.e. frame of reference, topology, direction, trajectory, distance, and shape (showing the interaction of figure-ground asymmetries)
  - cf. LILOG (IBM, 1987-1992 !) and Tobler 1979

Outlook on Cognitive Maps: Reconstruction and Inference

The Cognitive Maps Approach

- "*In the last analysis all maps are cognitive maps*" (Blakemore, Harley)
- Questions in a spatial framework
  - ***where*** : naming; states/processes, direction, distance
  - ***what*** : properties
  - ***when***
- Elements of an epistemological organization of spatial knowledge :
  Description of the construction of maps by (primarily) qualitative criteria

Finally:
Spatial (qualitative) Reasoning

... as far as it contributes to the research questions

- "Cognitive maps": lifting from the cognitive to the epistemic level … combination with symbolic reasoning
- Formal (qualitative) representation of
  - (abstract) regions (cellular ?!?)
  - their relative positions
  - orientation
  - distance
- "Region Connection Calculus" (RCC-8): elementary topological theory for qualitative spatial reasoning
- Augmentations for distance and orientation
- Hybrid reasoning in combination with Description Logic inference (e.g., "Pellet Spatial" for topology)


Grazie!