



entities

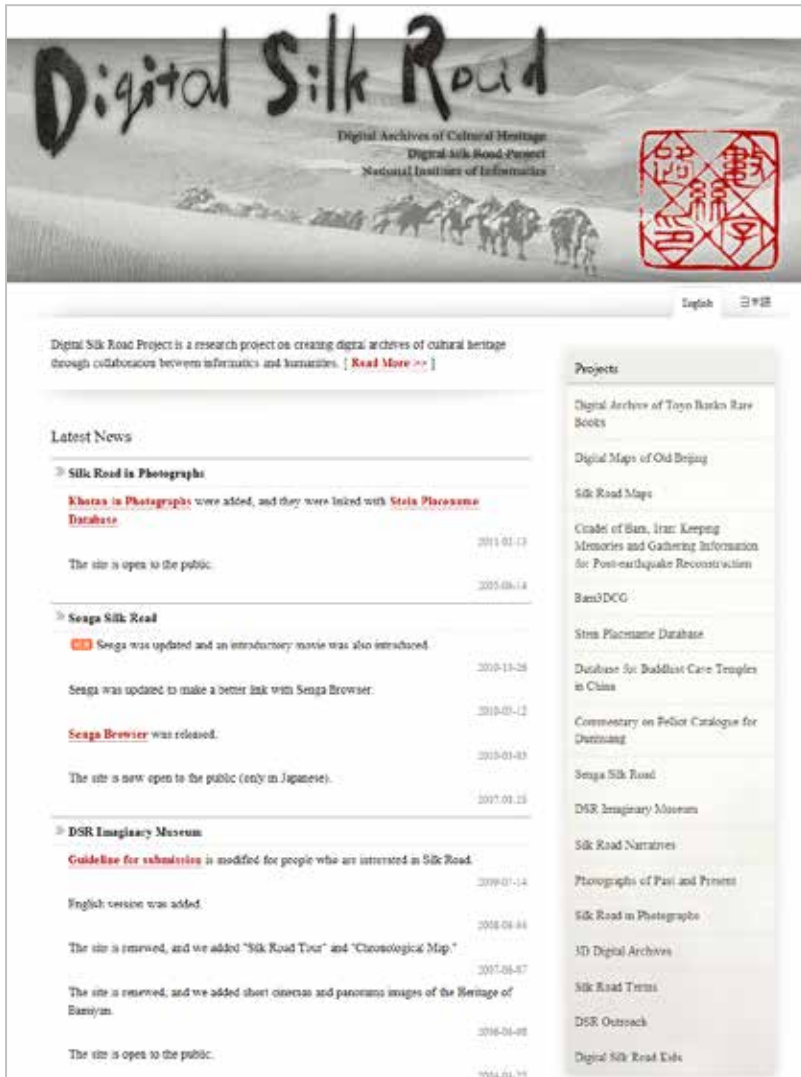
Finding common geographic features in
old maps and photographs for
reconstructing historical landscape – a
data criticism approach for Silk Road ruins

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Yoko NISHIMURA, Toyo Bunko

<http://dsr.nii.ac.jp/>

Digital Silk Road Project



- Started in 2001.
- **Digital Humanities:** Collaborative work among informatics + humanities scholars.
- Databases and digital resources are **publicly accessible on the Web.**

<http://dsr.nii.ac.jp/>

国立情報学研究所 - デジタル・シルクロード・プロジェクト
『東洋文庫所蔵』貴重書デジタルアーカイブ

デジタル・シルクロード・東洋文庫アーカイブ

書籍リスト 画像リスト シリーズリスト ポリキュムリスト 日本語 (jpn) 中国語 (chi) 英語 (eng)

ページ検索 タイトル

シルクロードに関連する基本文献史料として著名な貴重書203冊 (総ページ数: 59,358ページ) を、高精細スキャンとOCR処理によりデジタルアーカイブ (画像データベース) として公開しています。 (お問い合わせ) (ニュース)



2013/12/10

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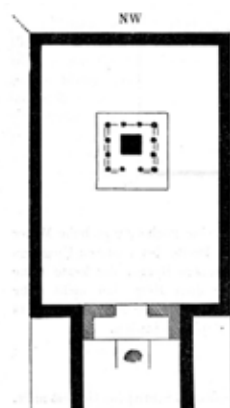
Toyo Bunko Rare Books

- Digitization of 203 books, 59358 pages.
- Collection of relevant academic references.
- Manual input of captions and TOCs.
- OCR for full-text search (with errors).

<http://dsr.nii.ac.jp/toyobunko/>

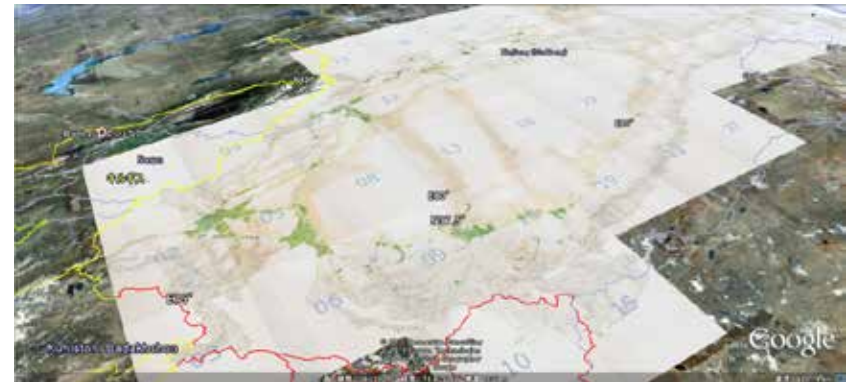
Dealing with Many Types of Data

Text



die obere sich wie eine in eine niedrigere 3,10 m tiefe Plattform eingepaßte Bank darstellt (auf der Skizze schraffiert) und die Mitte offen läßt. Vor dieser großen Unterstufe liegt der Rest eines mächtigen Sockels, in welchem ein tiefes Loch sich zeigt: hier hat also wohl eine große Statue oder eine Fahne gestanden. 12 m nach innen zu vom S.-Rand der Plattform des Hauptbaues, 5,50 m von den Seitenmauern und 7 m vor der Rückmauer, erhebt sich eine niedrige, 8 m ins Geviert betragende Stufe, auf deren Mitte ein jetzt zerstörter, 2 m großer, viereckiger Sockel steht; um diesen Sockel geht ein Gang herum, vorne und an den Seiten je 1,50 m breit, hinten aber nur 90 cm breit. Dieser Umgang ist nach außen von einer Mauer umgeben, welche durch zwölf kleine Stäben in kleine Abteile geteilt ist, von denen der mittlere der Frontseite den Eingang bildet. Auf der Rückseite ist dies aus zwei Eck- und zwei Mittelsäulen bestehende System sehr zerstört. Vor den sechs Interkolumnien der Seiten und den zwei Interkolumnien neben dem Eingang sind je noch Sockel für Statuen erhalten: auch mancherlei dekoratives Bei-

Map



Photograph



Y
1904(Le Coq, 1913, Tafel. 70, I)

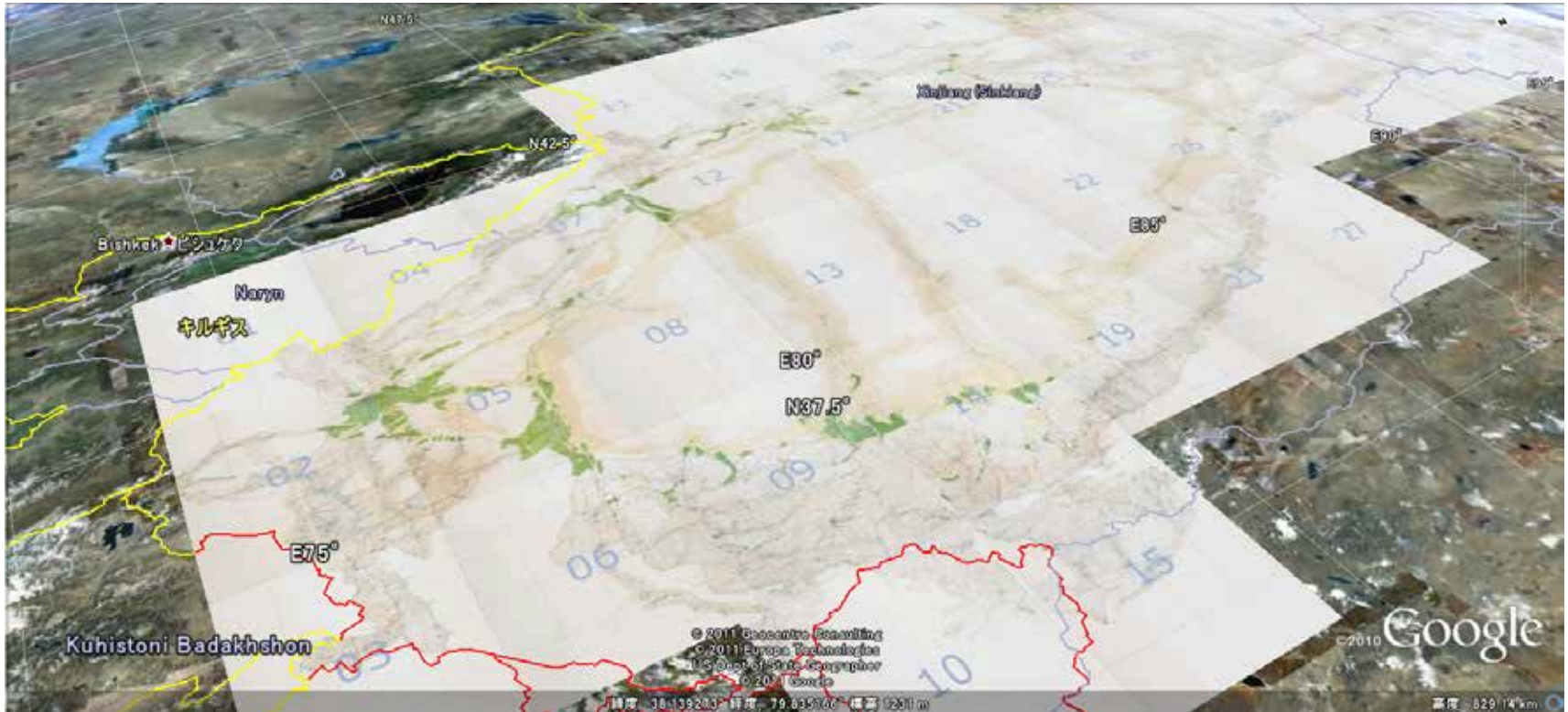
Gazetteer

<p>Abāb-langar, habit., 14. B. 3. Abād (of Ak-su), market-town, 12. A. 3. Abād (of Kara-yulghun), vill., 12. B. 1. Abād (of Karghalik), vill., 5. C. 4. Abād (of Kāshgar), vill., 5. A. 2. Abād (of Turfān), vill., 28. C. 3. Abād (of Yārkand), vill., 5. C. 2. Abād-jilga, valley, 12. B. 2. Abdal, vill., 30. B. 2. Abdalkash-mazār, shrine, 14. C. 3. Abdul-ghafūr-langar, loc., 10. C. 1. Abdul-rahmān-jilga, valley, 9. A. 4. Abshak-bēl, Pass, 2. B. 1. Aeh-tāgh, hill and vill., 7. C. 2. Acha-dong (of Chizghān), hill, 19. C. 3. Acha-dong (of Yārkand R.), loc., 7. D. 4. Acha-kuduk, loc., 7. D. 4. Acha-shipang, loc., 22. D. 4. Achak-aghzi, loc., 5. A. 4. Achal (of Ak-su), vill., 12. A. 3. Achal (on Charchak R.), loc., 21. C. 2.</p>	<p>Aechik-bulak (of Turfān), spring, 28. B. 4. Aechik-bulak (of Yai-döbe), spring, 4. C. 4. Aechik-daryā, river, 21. A. 2. Aechik-dawān, pass, 9. B. 3. Aechik-jilga (of Duwa), valley, 9. B. 3. Aechik-jilga (of Kara-tāsh), valley, 2. D. 3. Aechik-jilga (of Khotan), valley, 9. C. 3. Aechik-jilga (of Sampula), valley, 14. A. 3. Aechik-jilga (of Tawak-kēl), loc., 14. A. 1. Aechik-köl, lake, 15. D. 1. Aechik-kuduk (of Kapa), well, 23. A. 1. Aechik-kuduk (of Kuruk-tāgh), well, 28. C. 4. Aechik-kuduk (of Marāl-bāshi), well, 5. D. 2. Aechik-otan, loc., 7. C. 2. Aechik-su, loc., 31. A. 4. Aechik-tügemen, loc., 5. D. 2. Achi-tāgh, hill, 32. B. 1. Achik-aghzi, loc., 9. D. 3. Achma (of Hanguya), vill., 14. A. 2.</p>
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Platform for Linking Entities

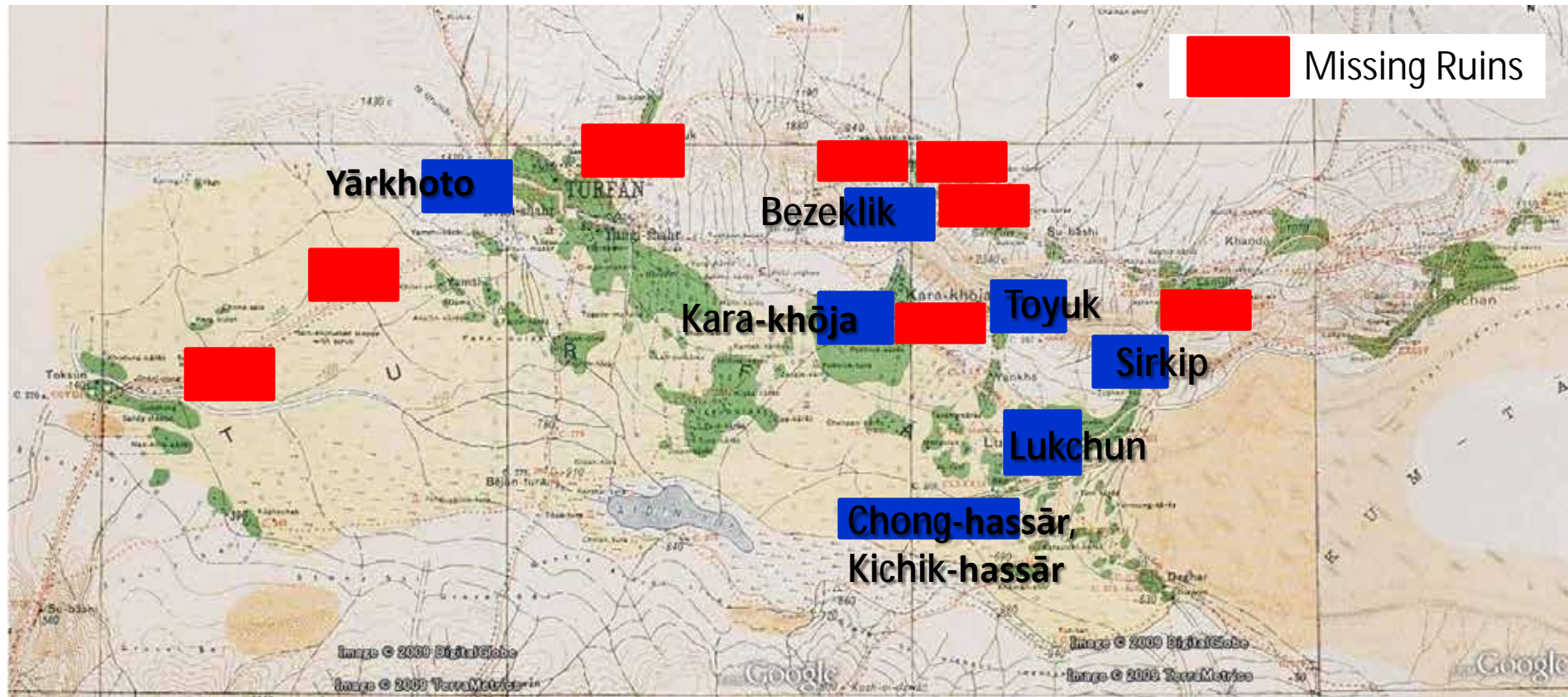
- An **entity** (a geographic feature) may have different representations in **historical sources**.
- **[Question]** How to identify and link them?
- **[Answer]** Data criticism approach – critically “read” data to reconstruct historical facts.
- **[Problem]** Error, variation, and different conceptualization; such as location error, name variation, different definitions, ...

Stein Map (Silk Road)



- Stein's map "Innermost Asia" was registered and displayed on Google Earth satellite images.

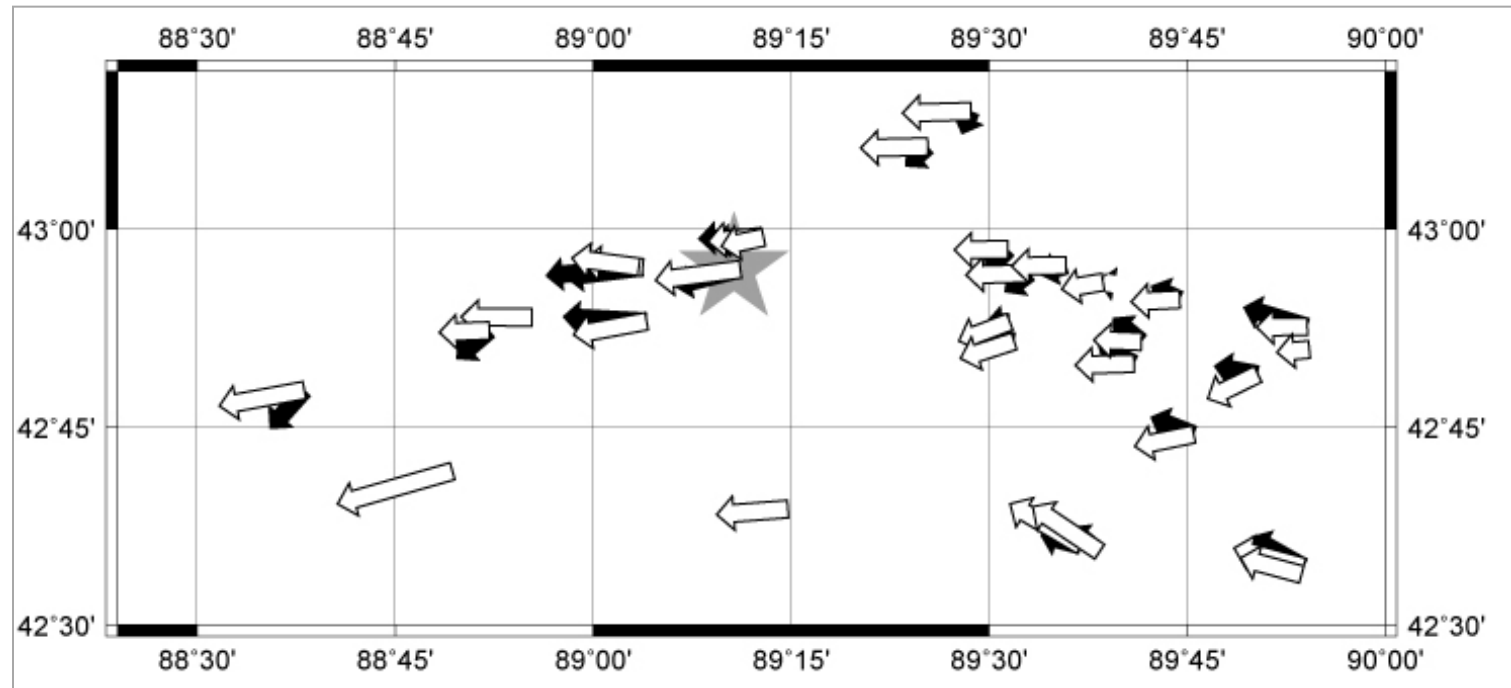
Problem of “Missing” Ruins



Oi-tam, ruined fort
 Bögan-tura
 Buluyuk (Shipang, Sassik-bulak, Kazma)
 Murtuk-ruins

Yoghan-tura
 Chikkan-köl
 Bedaulat's town, Bēsh-kāwuk, Kosh-gumbaz
 Yutōgh

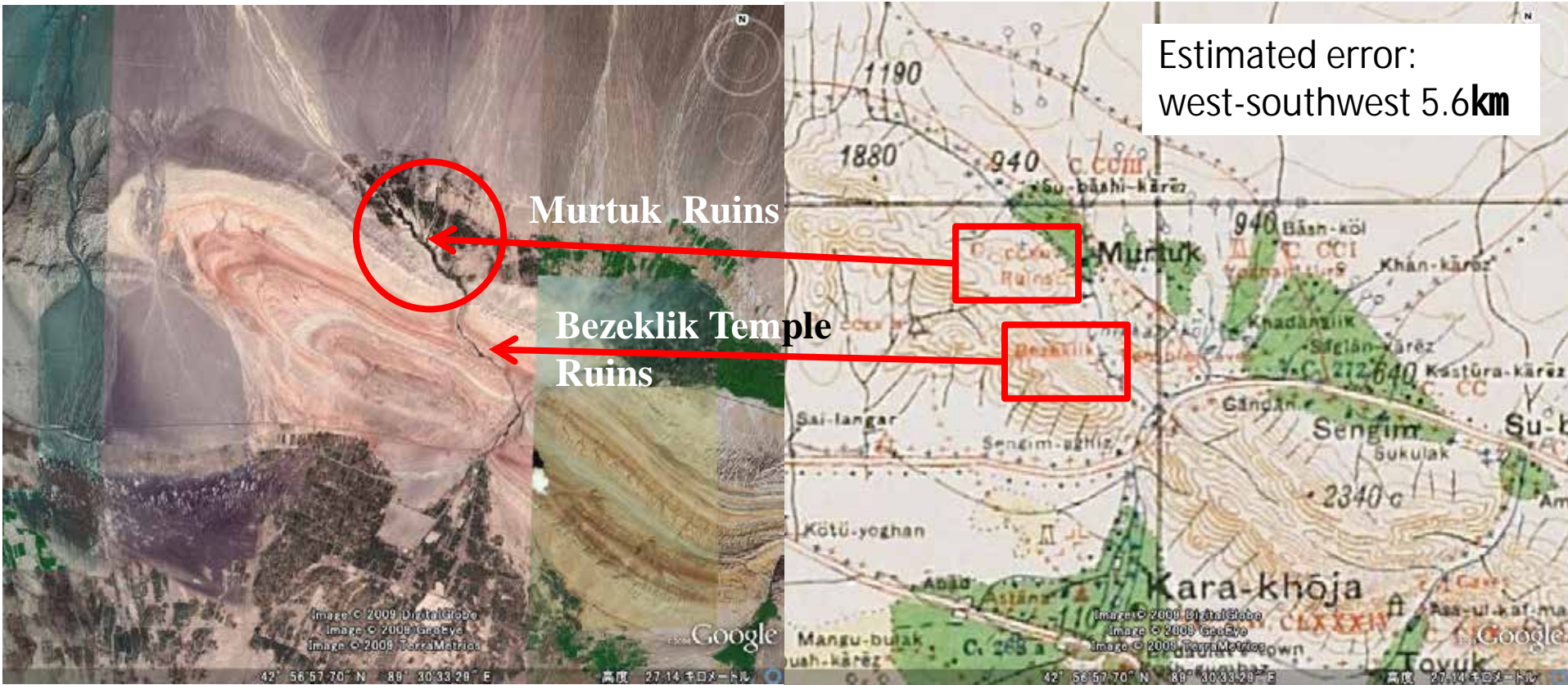
Error Distribution in Turfan



Error Distribution in Turfan Basin / White: Innermost Asia / Black: Serindia

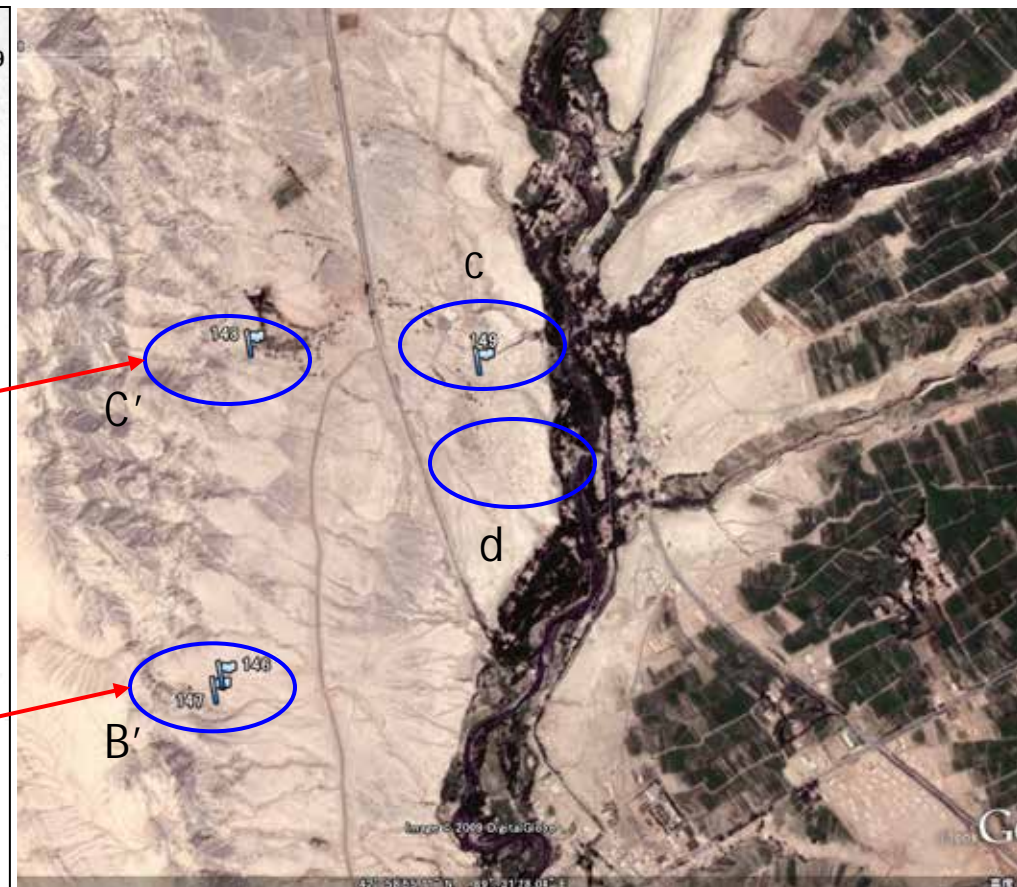
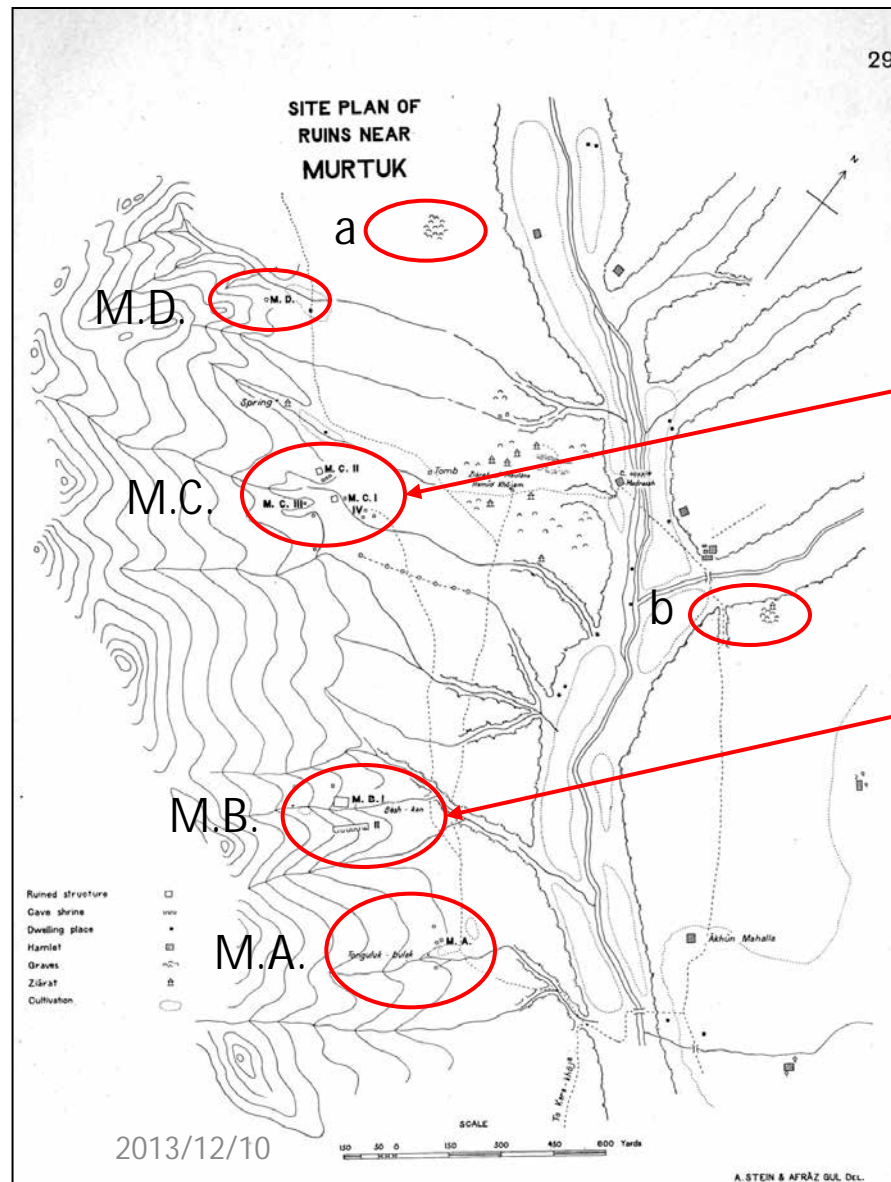
- Some ruins were reported by 20th expeditions, but are missing in recent survey reports.

Removing Location Errors



Based on error information of maps, our guess about the location of Murtuk Ruins is represented as

Matching Entities



Stein's map and satellite images for the same area. Each source reports different ruins due to different conceptualization.

Photographs as Evidence



伯西哈石窟(烏江不拉克仏塔)



烏江不拉克烽火台

2013/12/10



305. RUIN, M.B. I, AT MURTUK IN COURSE OF CLEARING.

Murtuk Ruins (M. B. I)



303. RUINED SHRINES, M.C., AT MURTUK, TURFAN.

Murtuk Ruins (Ruined Shrine M. C. I)

PNC 2013

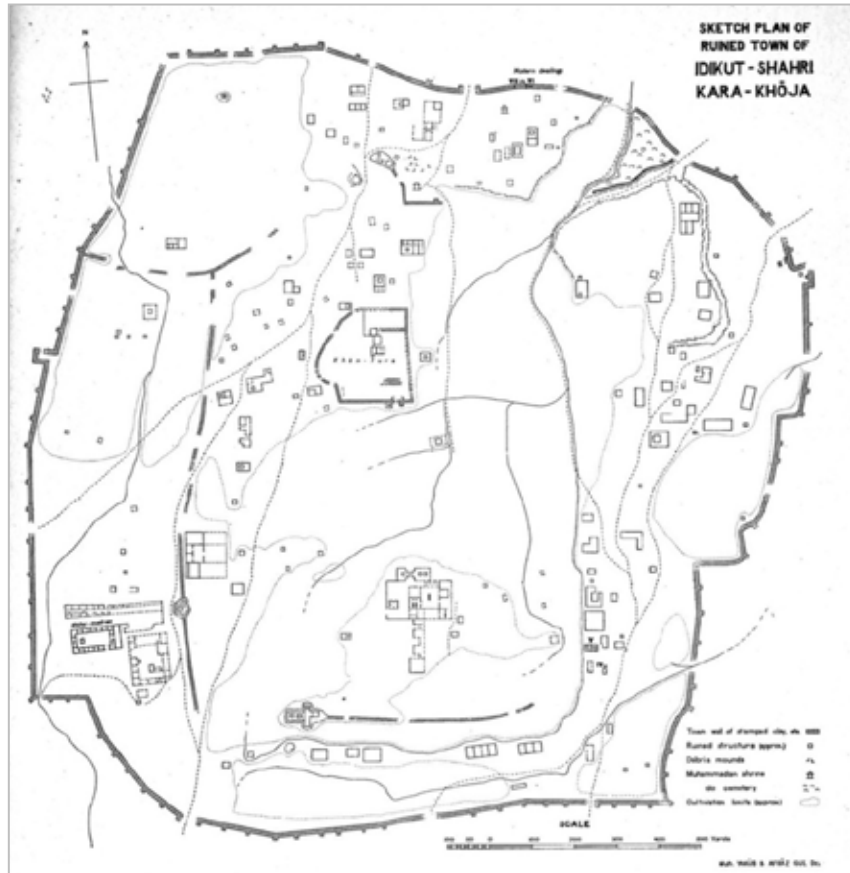
11

Grünwedel Map (Gaochang)

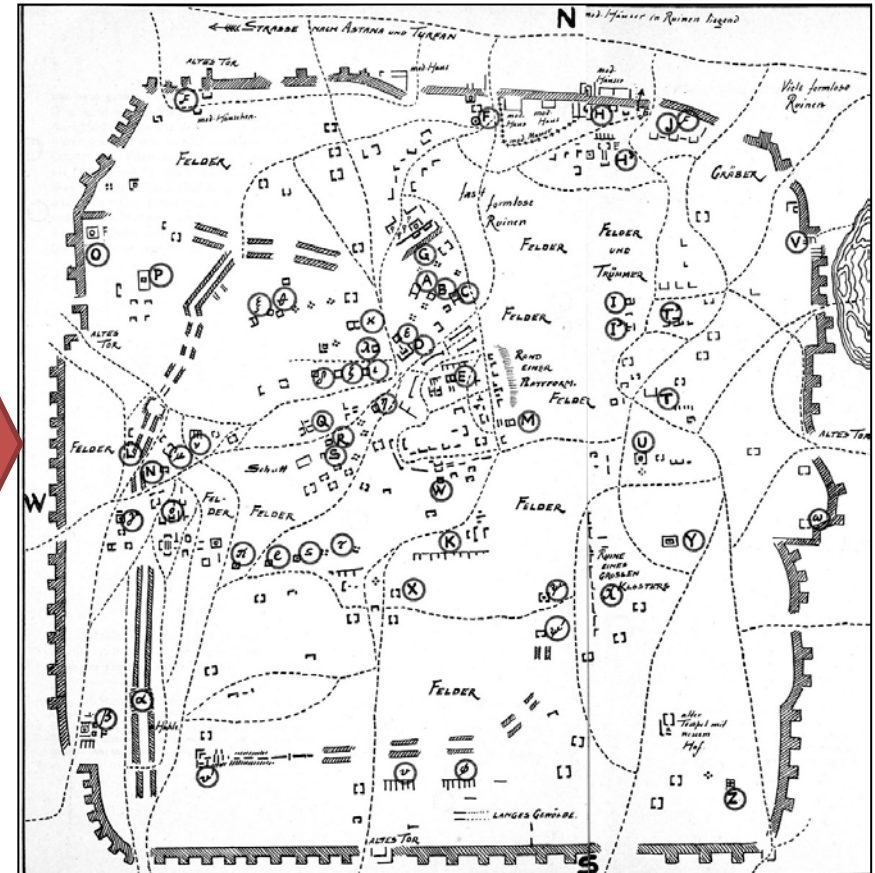


How to use the previously “untrusted” map?

Inconsistencies in Gaochang Maps



Aurel Stein

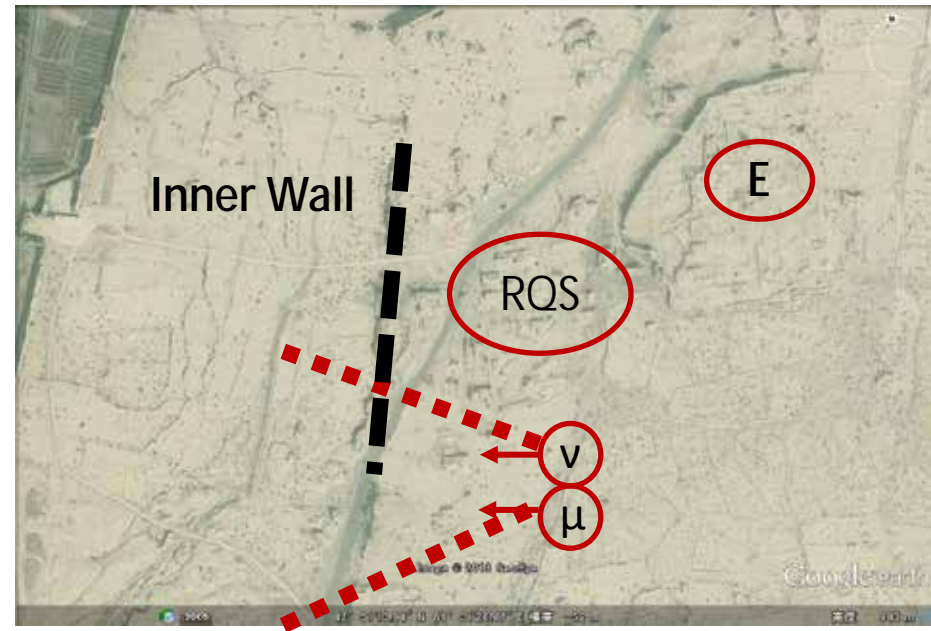
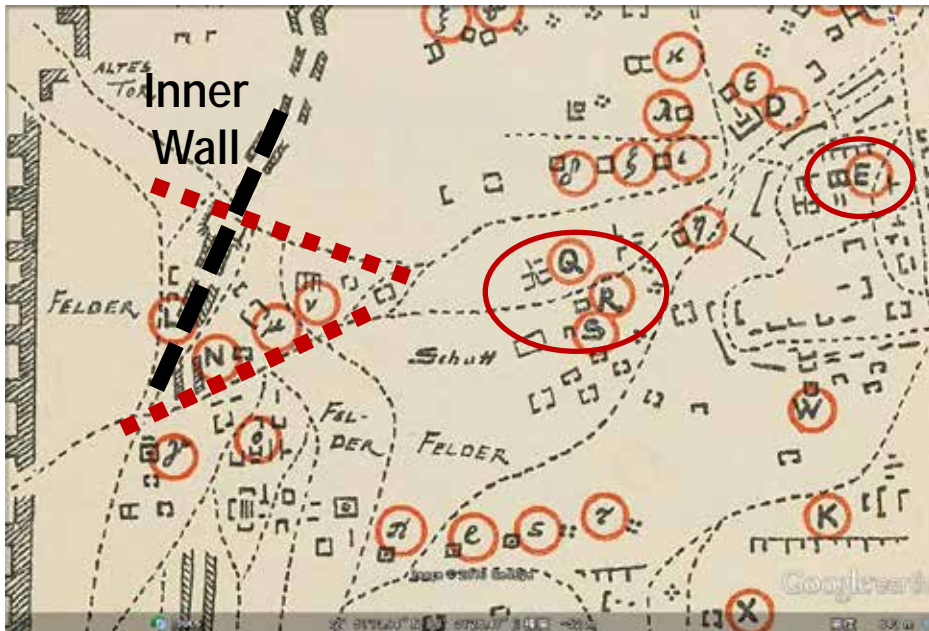


Albert Grünwedel

[illegible]

2013/12/10

Topological Interpretation



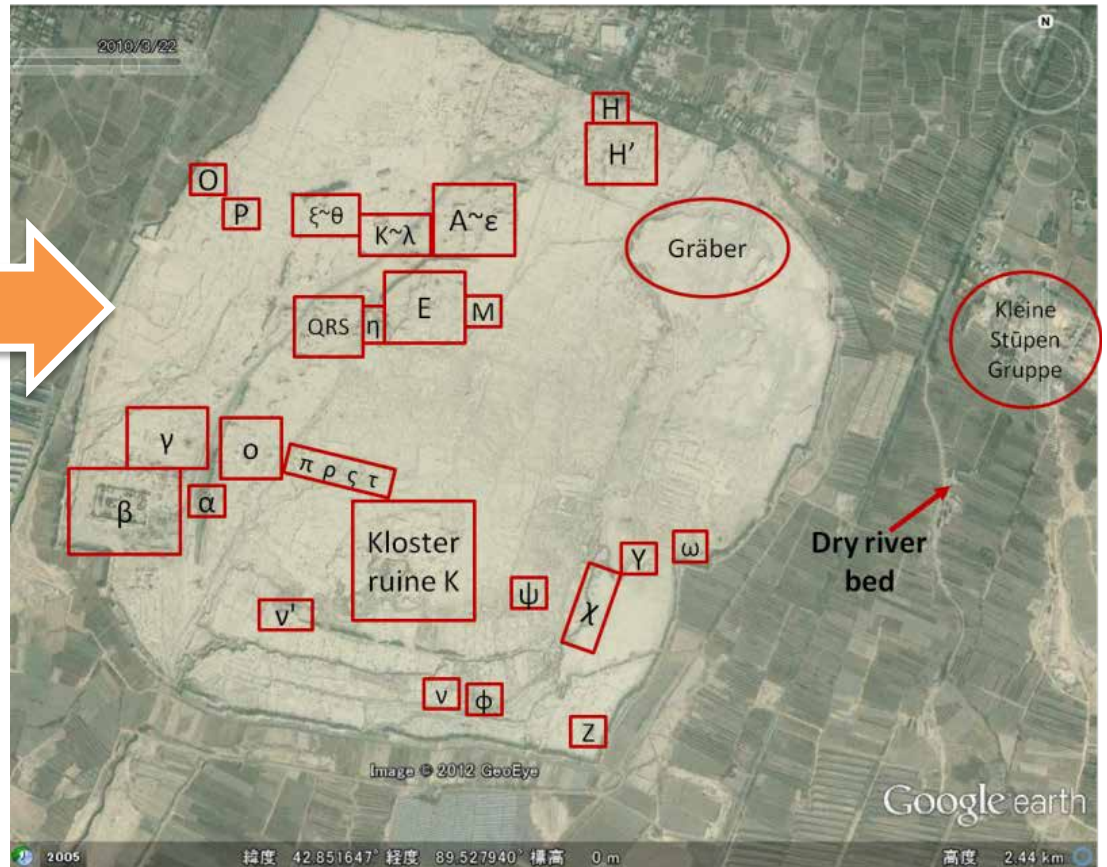
Where is v and μ ?
We have multiple candidates...

Search for a road in north of γ and ϕ , and a road between the inner wall to the wall gate.

Hypothesize the location of v and μ (to be verified later).

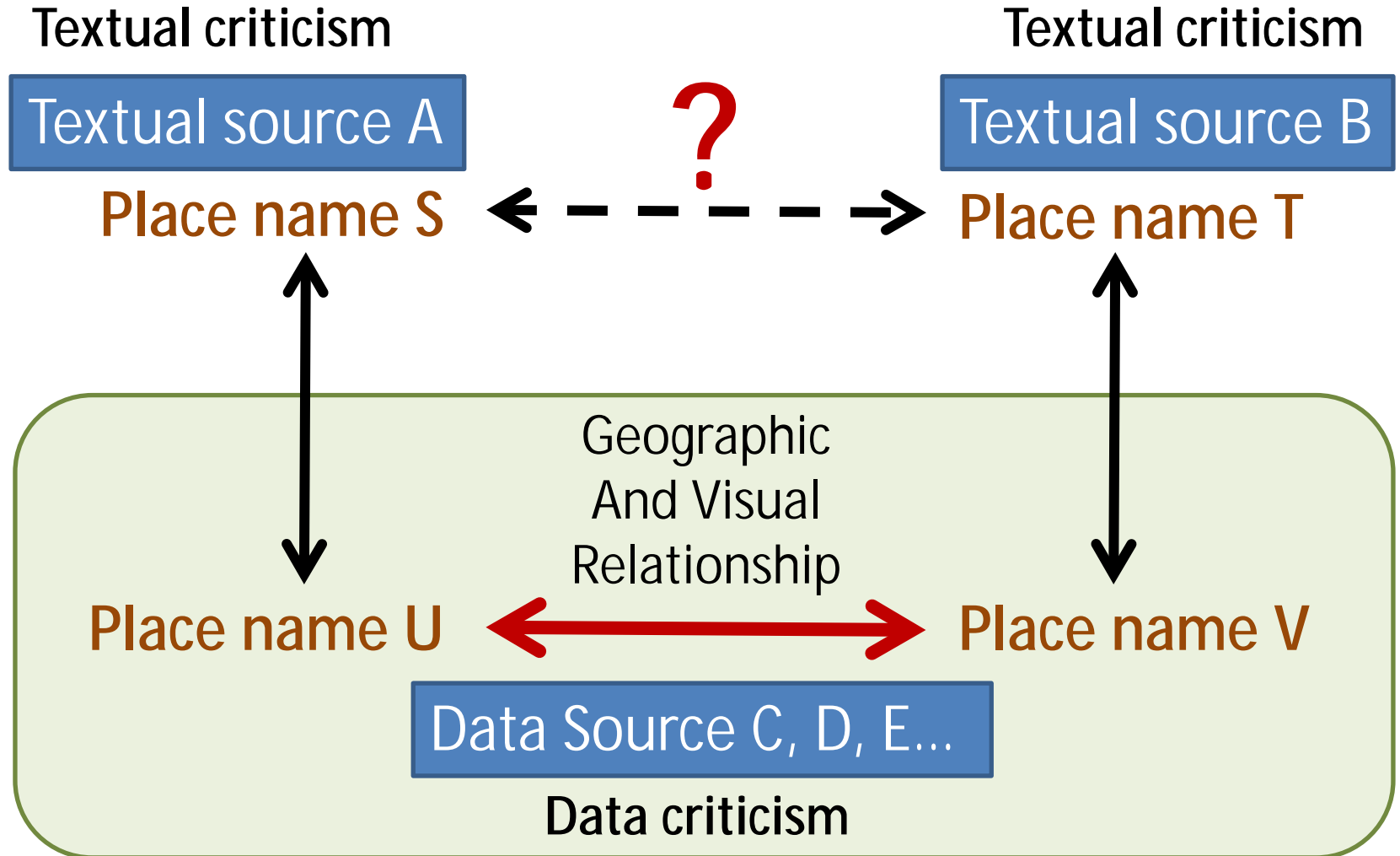
Maps designed for navigation purposes should preserve the topology, not to get lost when visiting there again.

Most Ruins are Identified



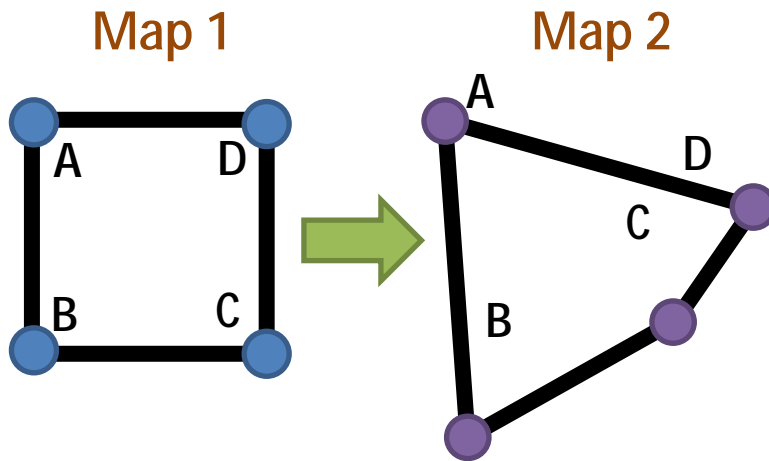
Linking expedition results to recent surveys may lead to new interpretations.

Linking Entities Across Sources

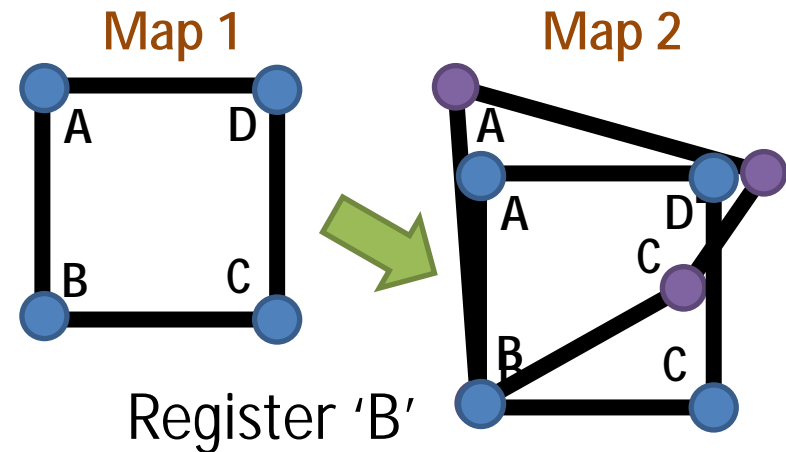


Registration of Maps

Geometric Correction



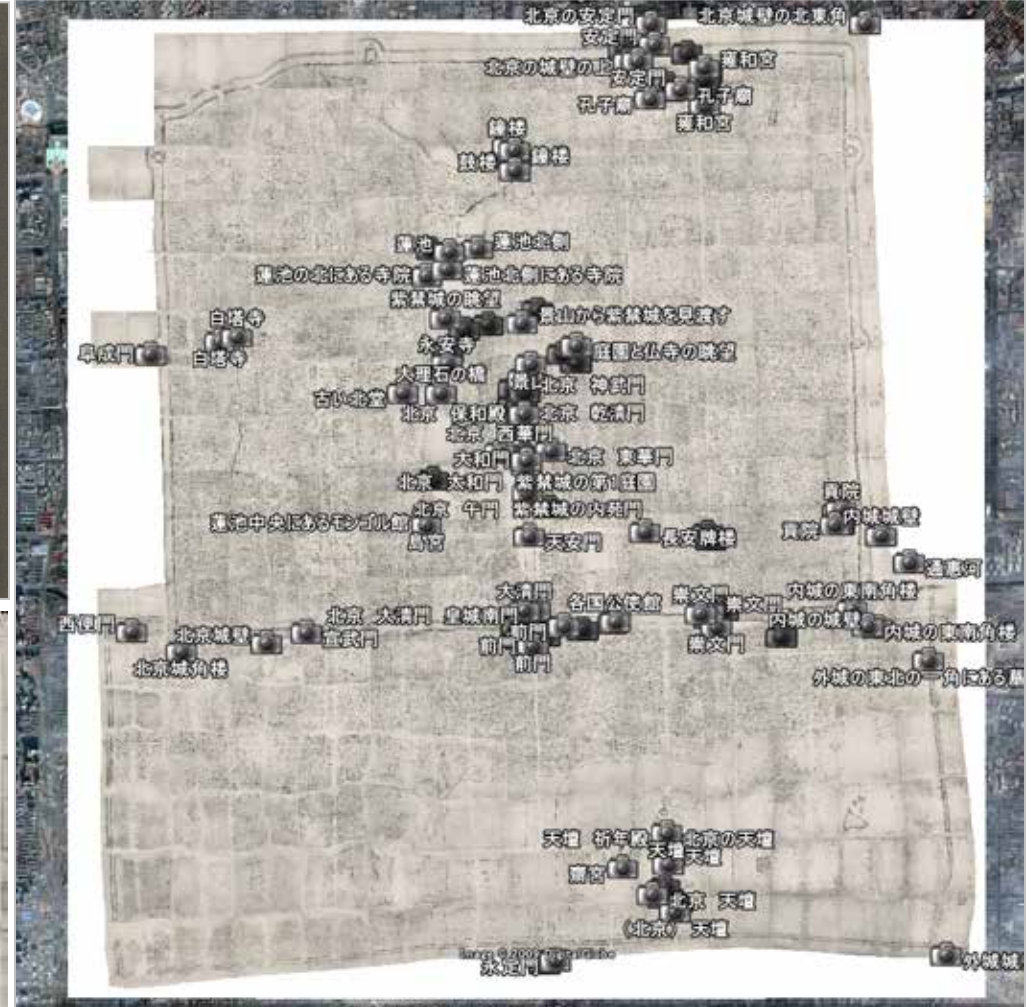
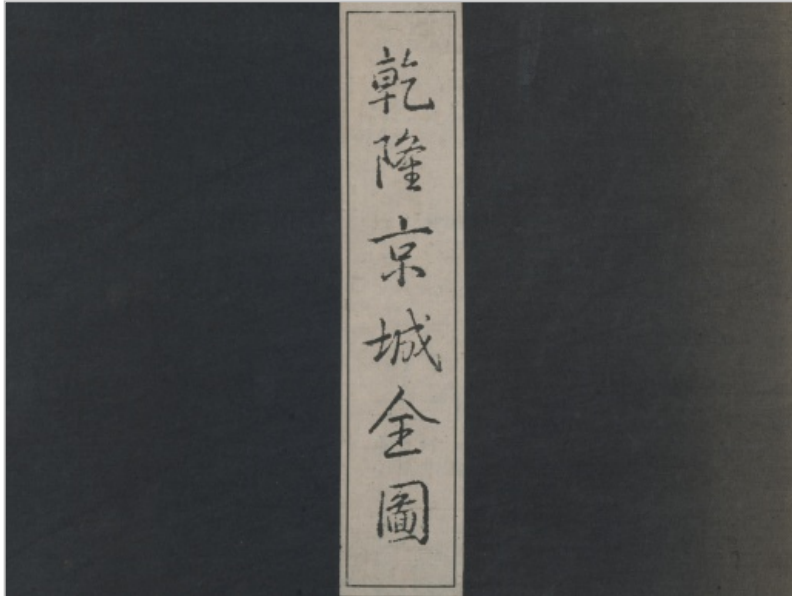
Single-Point Registration



- All points are registered.
- Shapes are distorted.

- Single point is registered (but no other points).
- Shapes are not distorted.

Qianlong Map (Beijing)



Massive Geometric Correction



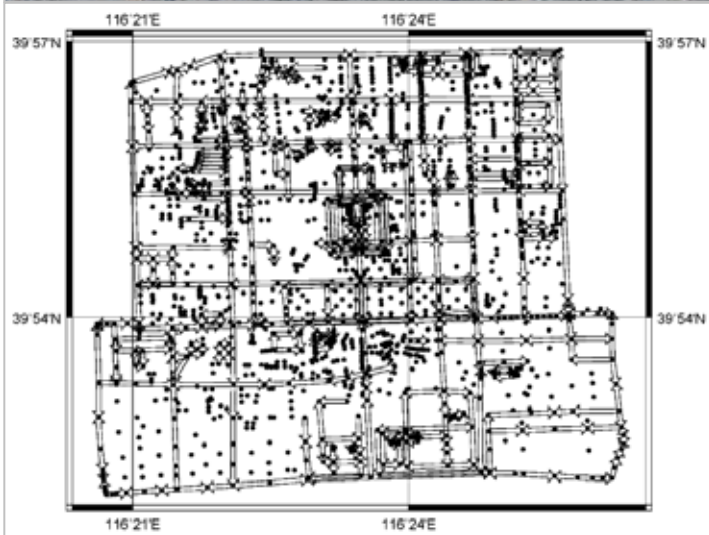
Huge size = W 13 m x H 14 m

Many sheets = 203 sheets in total

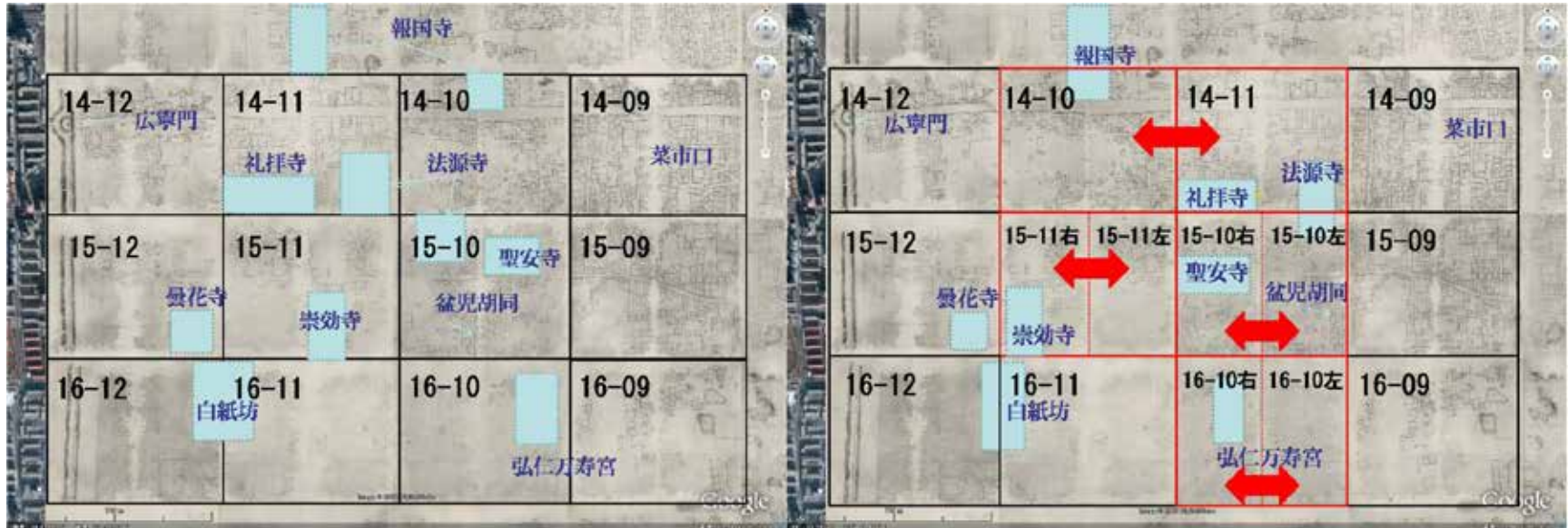
Massive pixels = 29 billion pixels

- Control points + lines:**

We proposed a new geometric correction.



Discovery and Digital Survey



- **Discovery:** 5 sheets have misarrangements due to improper reconstruction in the past.
- **Digital Survey:** Place-names were checked to make a comprehensive gazetteer.

Mapping (Map+Pinning)

<http://dsr.nii.ac.jp/digital-maps/mapping/>

Mapping
Interactive georeferencing by pinning old maps

Digital Silk Road > Database of Ruins in Silk Road > Mapping

日本語 | English | 简体中文

Map Satellite

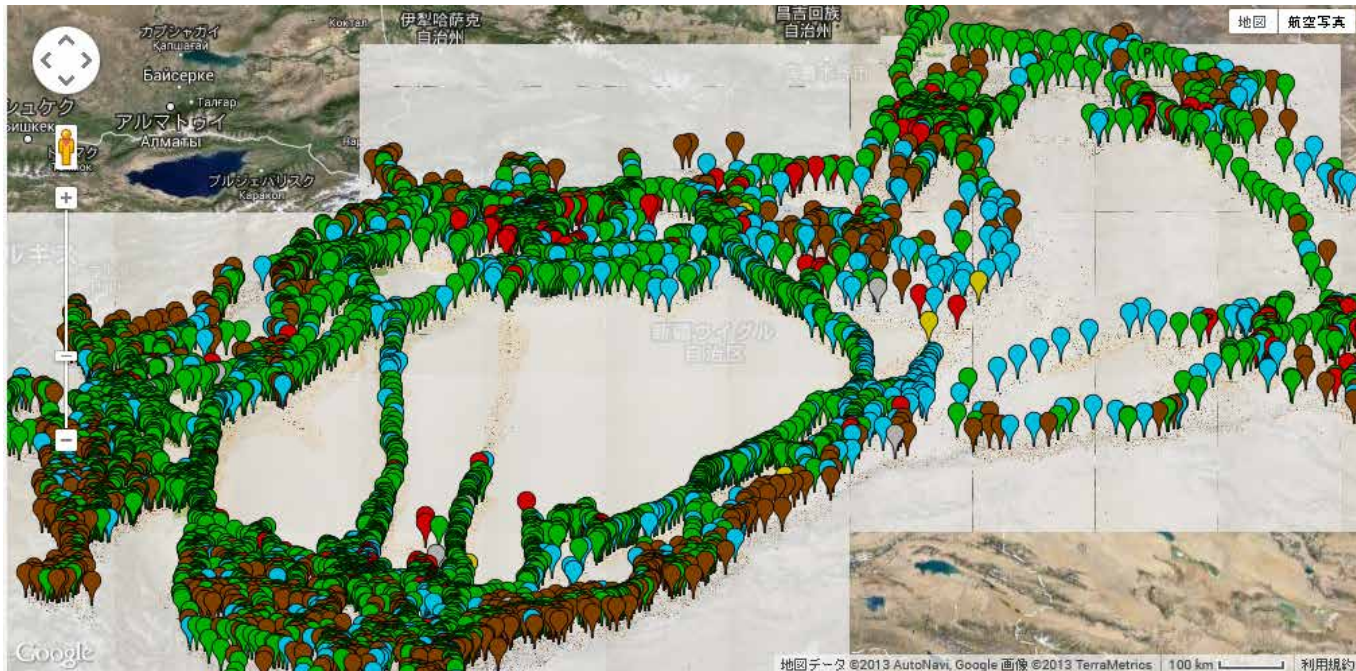
Inmst Asia

kara-khoja
Registrant:yoko
Location:42.831,89.464
Error:-0.02,-0.064
5.69km
高昌故城

Map data ©2013 Old Map: National Institute of Informatics "Digital Silk Road"
Map data ©2013 AutoNavi, Google Imagery ©2013 TerraMetrics - Terms of Use

Stein Placename Database

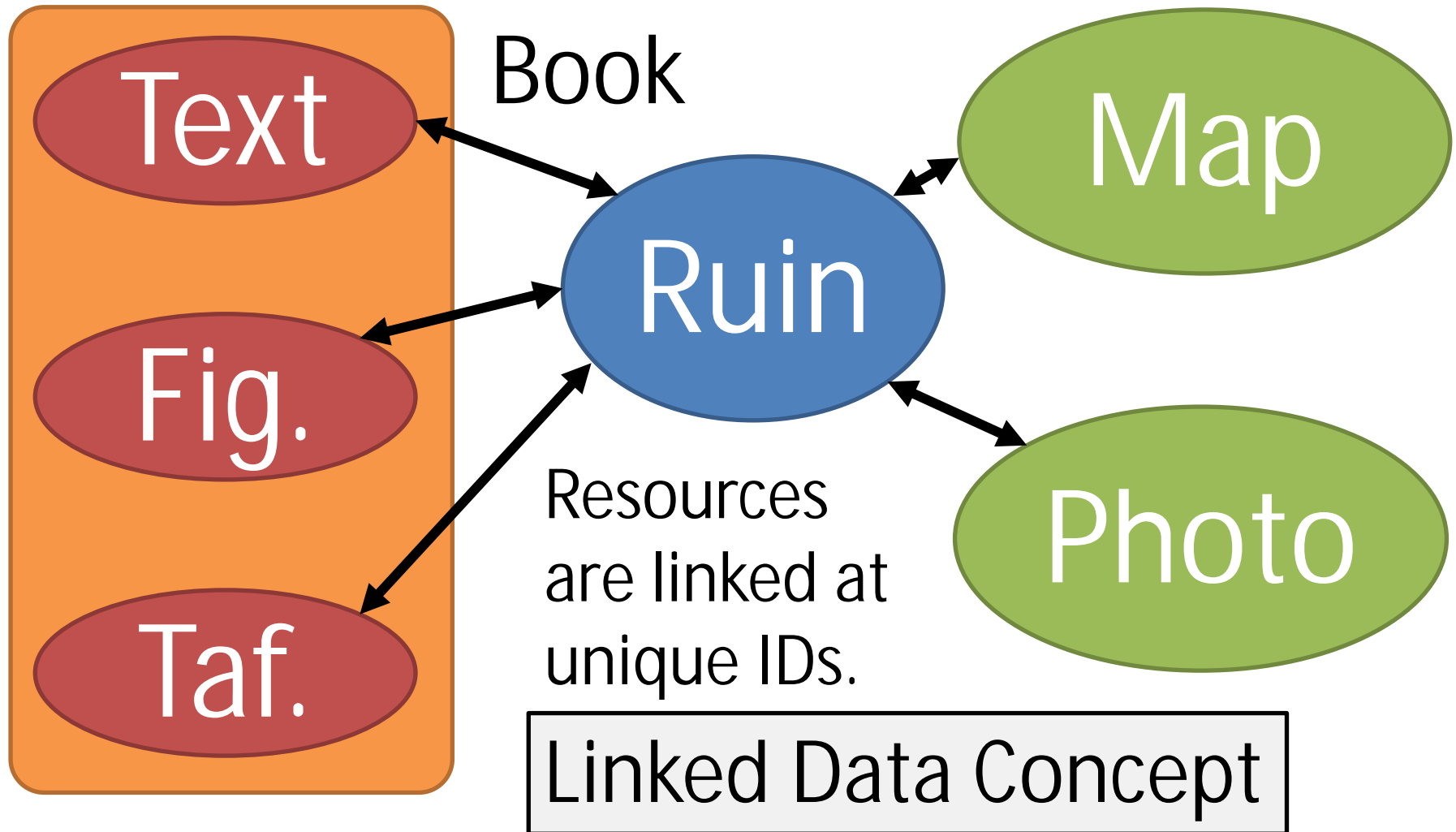
<http://dsr.nii.ac.jp/digital-maps/stein/place-names/>



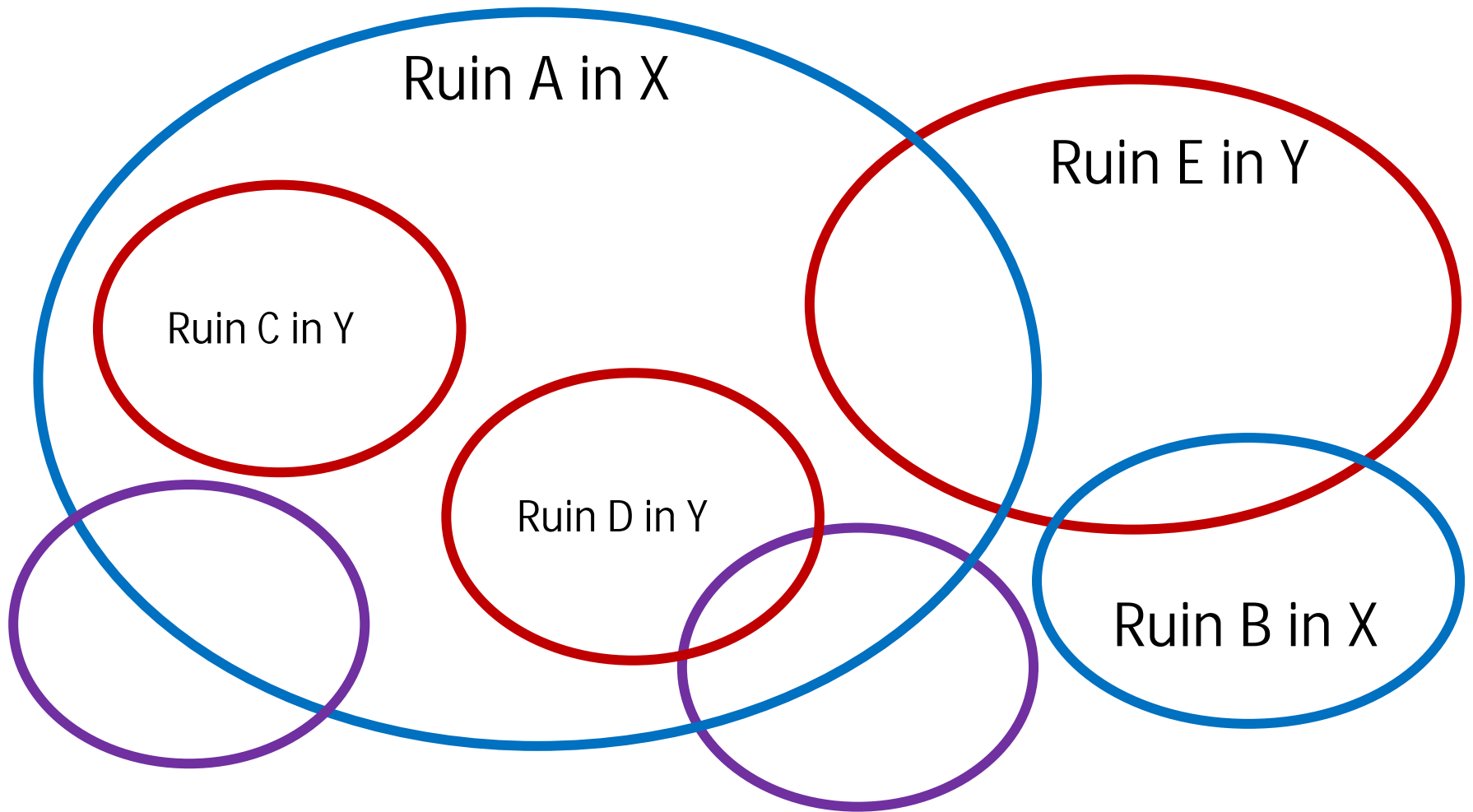
- Unique IDs for about 5500 ruins in Silk Road.
- Locations on multiple maps are compared and evaluated on the “mappinning” tool.

Kara-Khoja Placename Database

<http://dsr.nii.ac.jp/digital-maps/kara-khoja/place-names/>



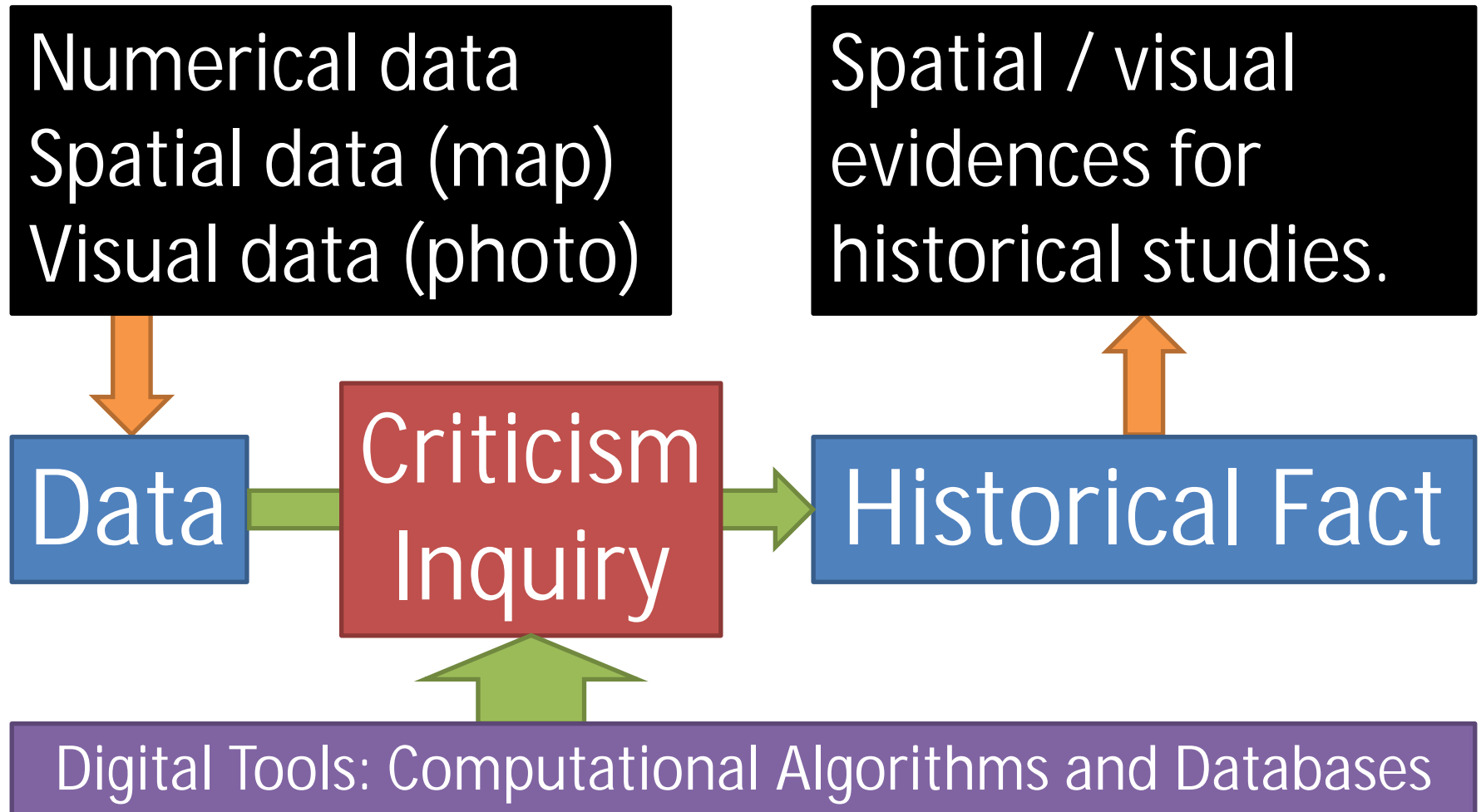
Different Conceptualization



Different Conceptualization

- Ruins are named ...
 - after local placenames.
 - after geographic features (such as river).
 - after the type of entity (such as temple).
- **Different “languages”** are used for description and communication.
- **Semiotic problem**: Articulation of the world and how entities are named is arbitrary.

Data Criticism Approach



Textual and Data Criticism

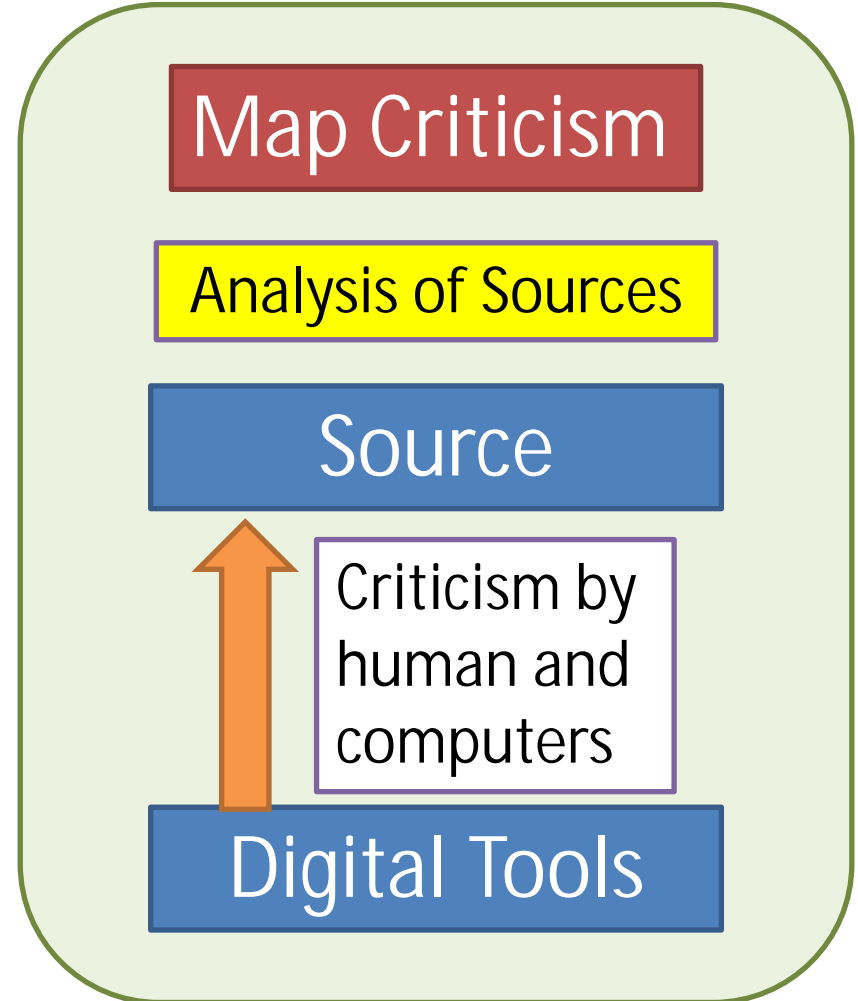
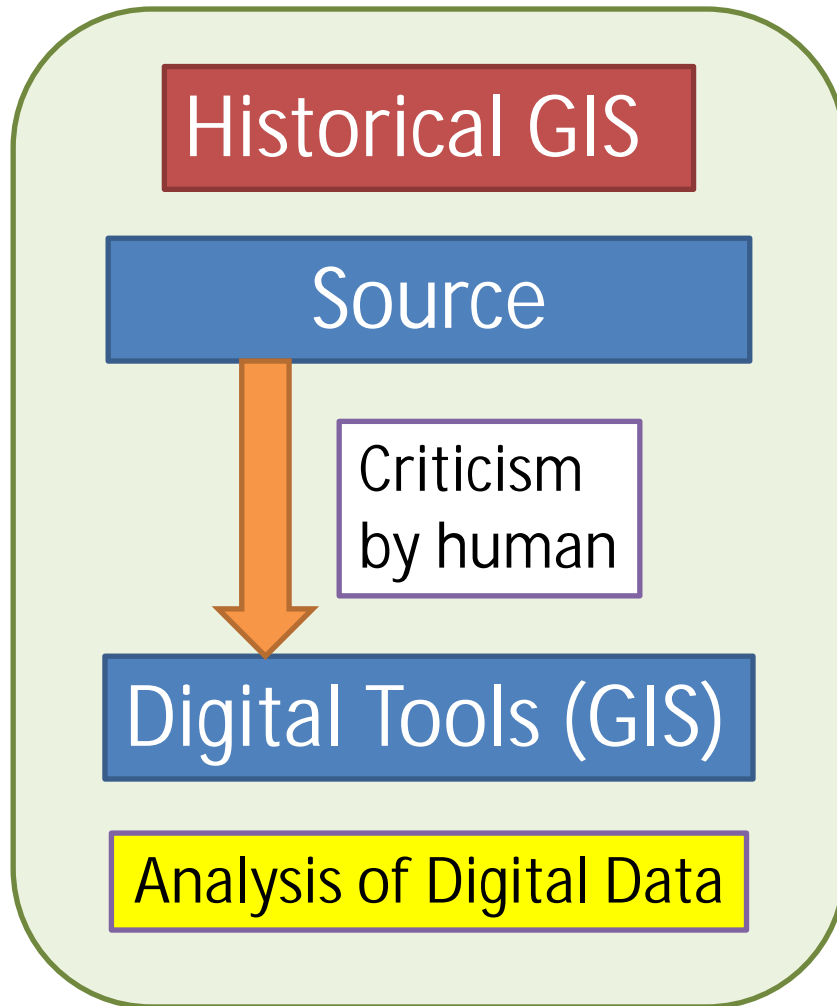
Textual Criticism

- Well developed.
- Qualitative.
- Human reading and interpretation.
- Textual media.

Data Criticism

- To be explored.
- Quantitative.
- Computational algorithm.
- Spatial and visual media or multimedia.

Historical GIS and Map Criticism



Our Contribution

1. **Data criticism approach**: How to “read” data for reconstructing facts, under error, variation, and different conceptualization?
2. **Methodological commons**: map registration, 3D visual interpretation, linked data, ...
3. **Platform for linking entities**: data editing and managing platform for linking resources and combining evidences across sources.

Digital Silk Road Project



- Website
 - <http://dsr.nii.ac.jp/>
- Toyo Bunko Digital Archive
 - <http://dsr.nii.ac.jp/toyobunko/>
- Silk Road Maps
 - <http://dsr.nii.ac.jp/geography/>

Contact:

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