

Data Criticism:

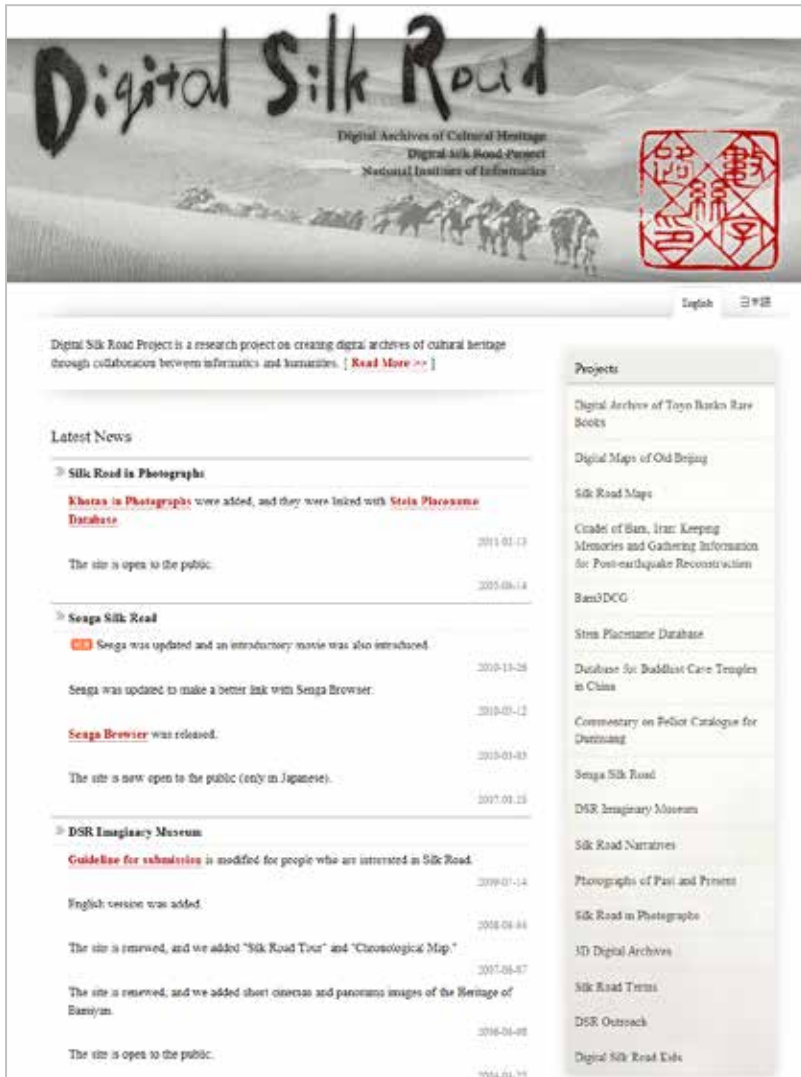
A methodology for the quantitative evaluation
of non-textual historical sources
with case studies on Silk Road maps and photographs

Asanobu KITAMOTO, National Institute of Informatics

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/>

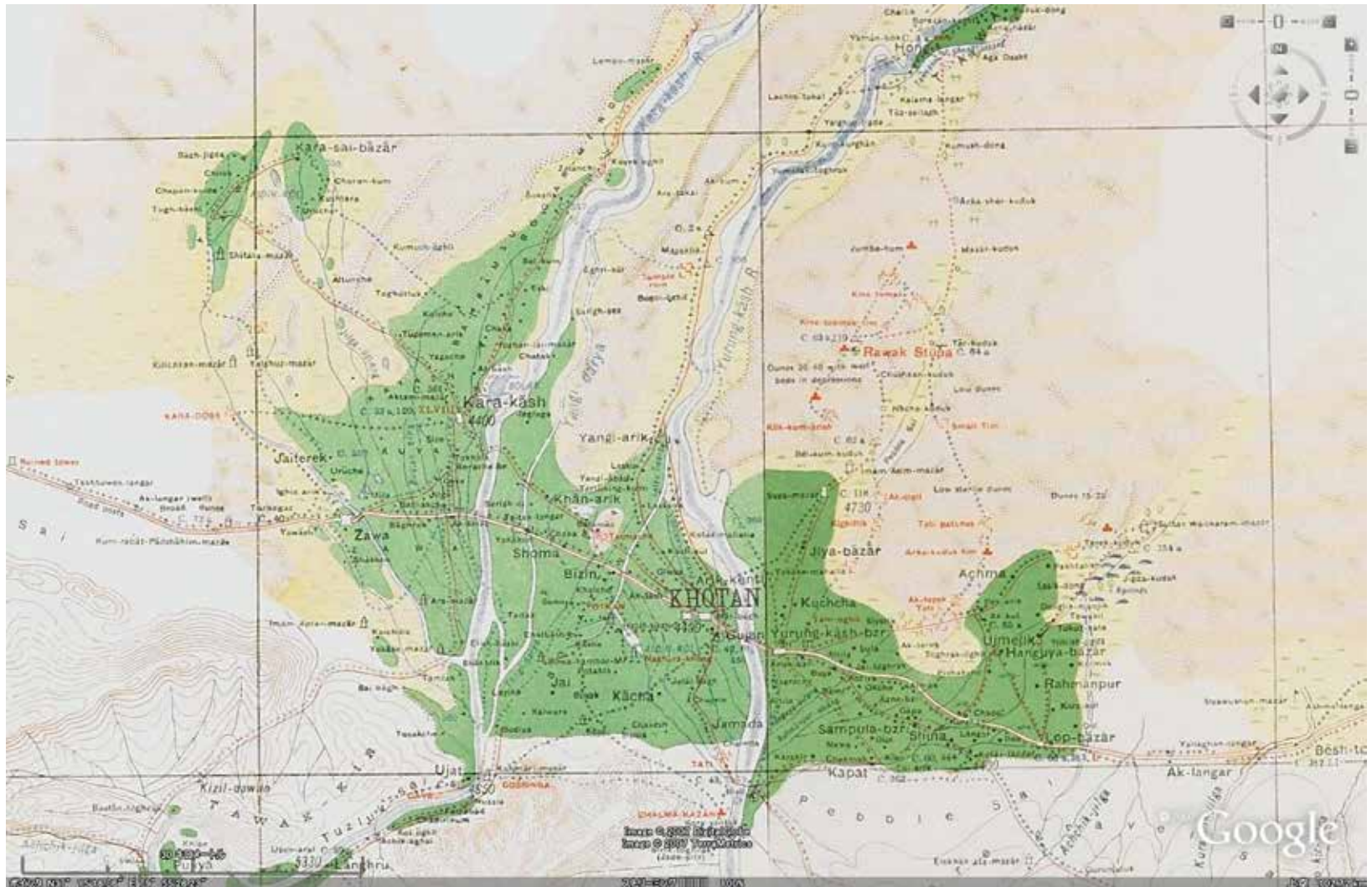


Toyo Bunko Rare Books

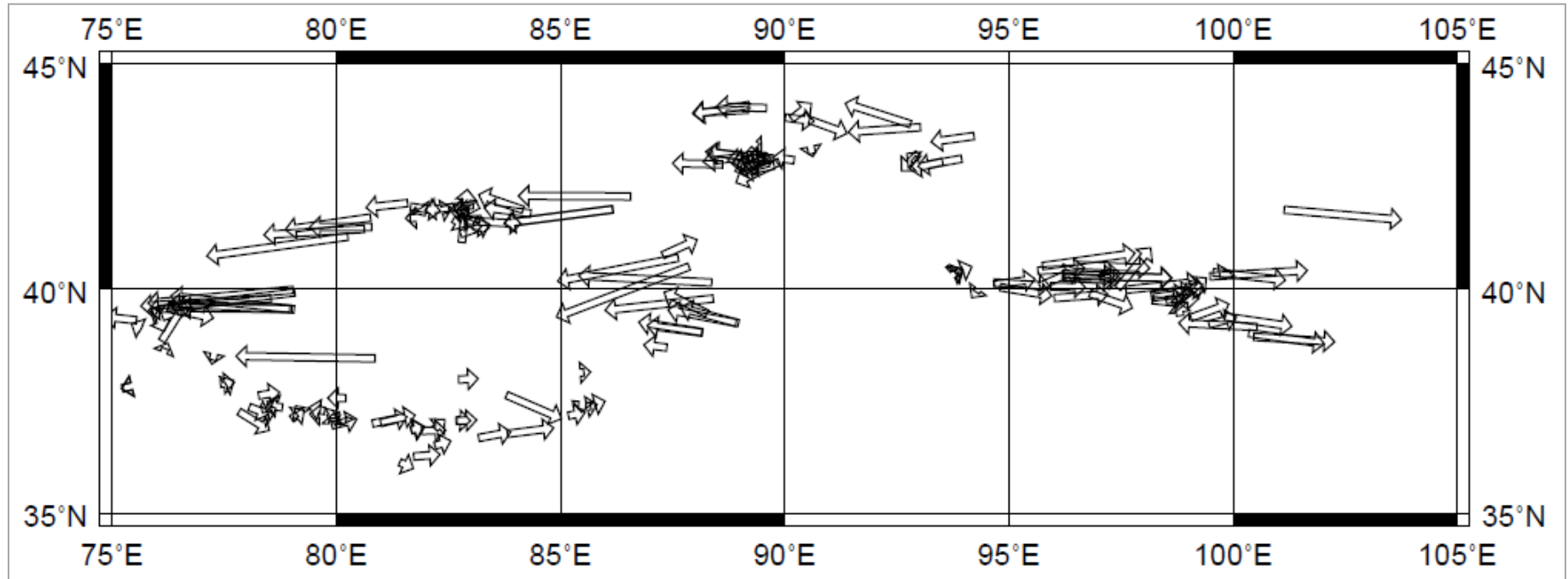
- Digitization of 203 books, 59358 pages.
- Collection of relevant academic references.
- Manual input of captions and TOCs.
- OCR for full-text search (with errors).

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

[Q] A Map can be Used as Fact?

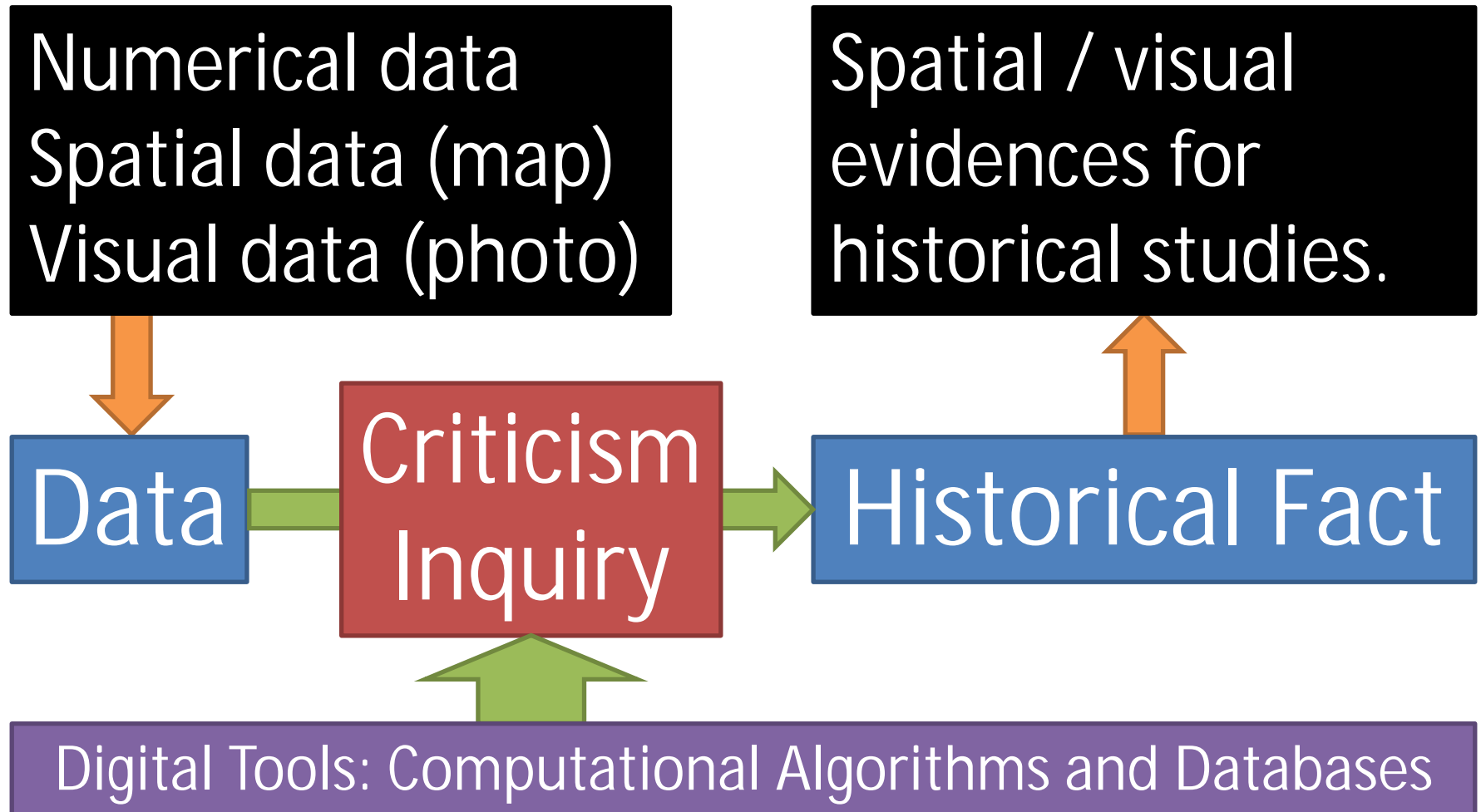


Evaluation of the Map



- Error is bigger along longitude than latitude (limitation of survey technology at the time).
- Error tends to be accumulative.

[A] It should be Criticized



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.

Case Studies on Data Criticism

1. Qianlong Map (Beijing)

- Massive geometric correction.
- Discovery of mis-arrangement.

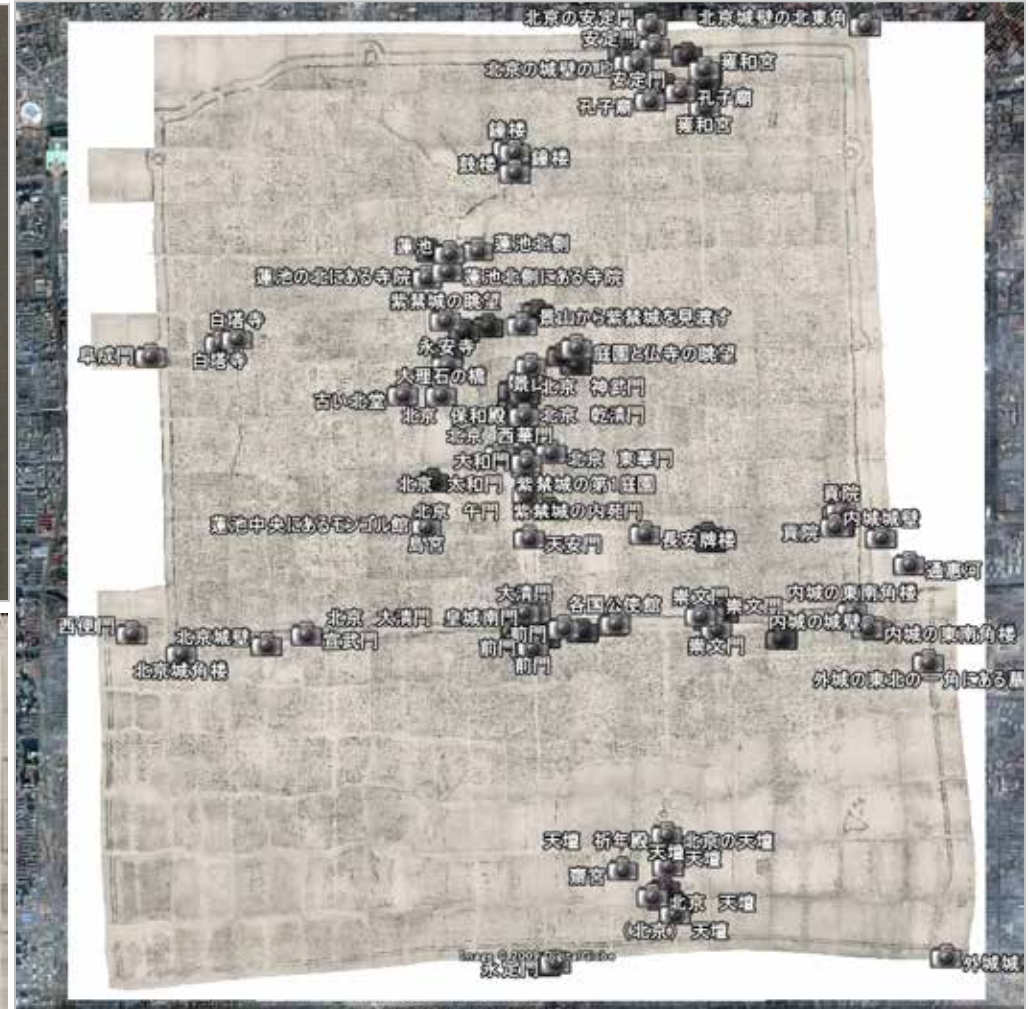
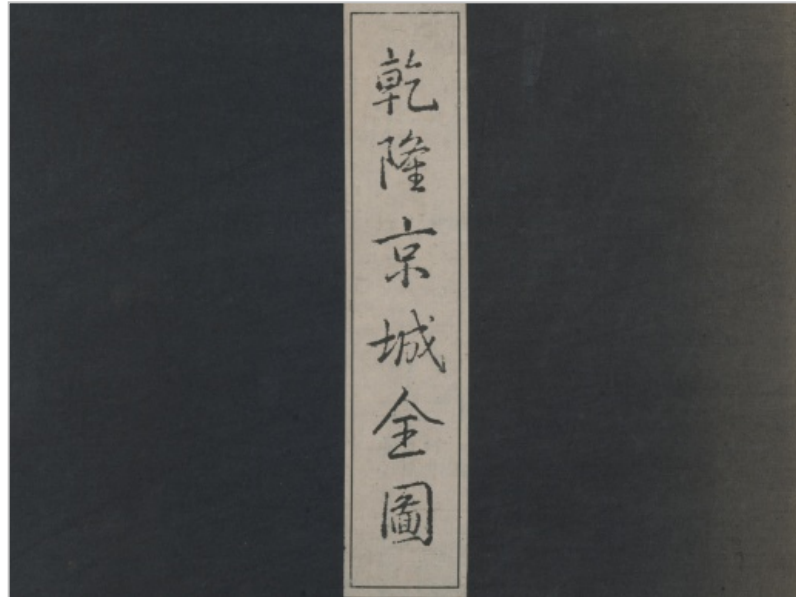
2. Stein Map (Silk Road)

- Maps and photographs as evidence.
- Identification of “missing” ruins.

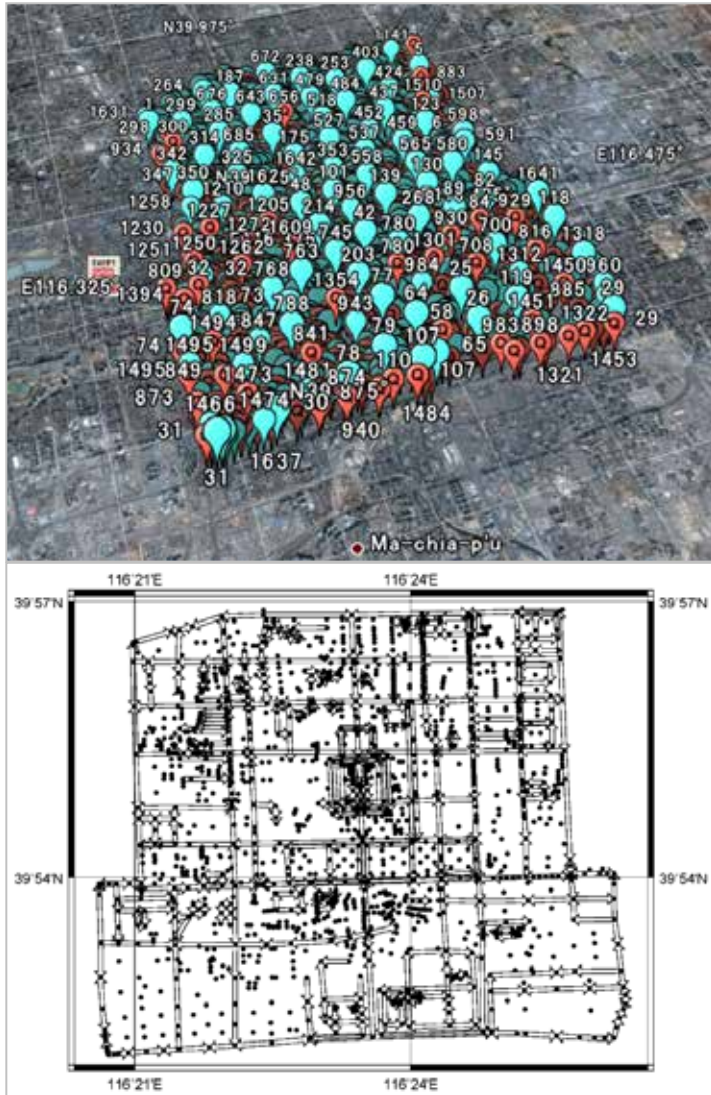
3. Grünwedel Map (Gaochang)

- Interpretation of topological maps.
- Rediscovery of the value of “untrusted” sources.

1. Qianlong Map (Beijing)



Massive Geometric Correction



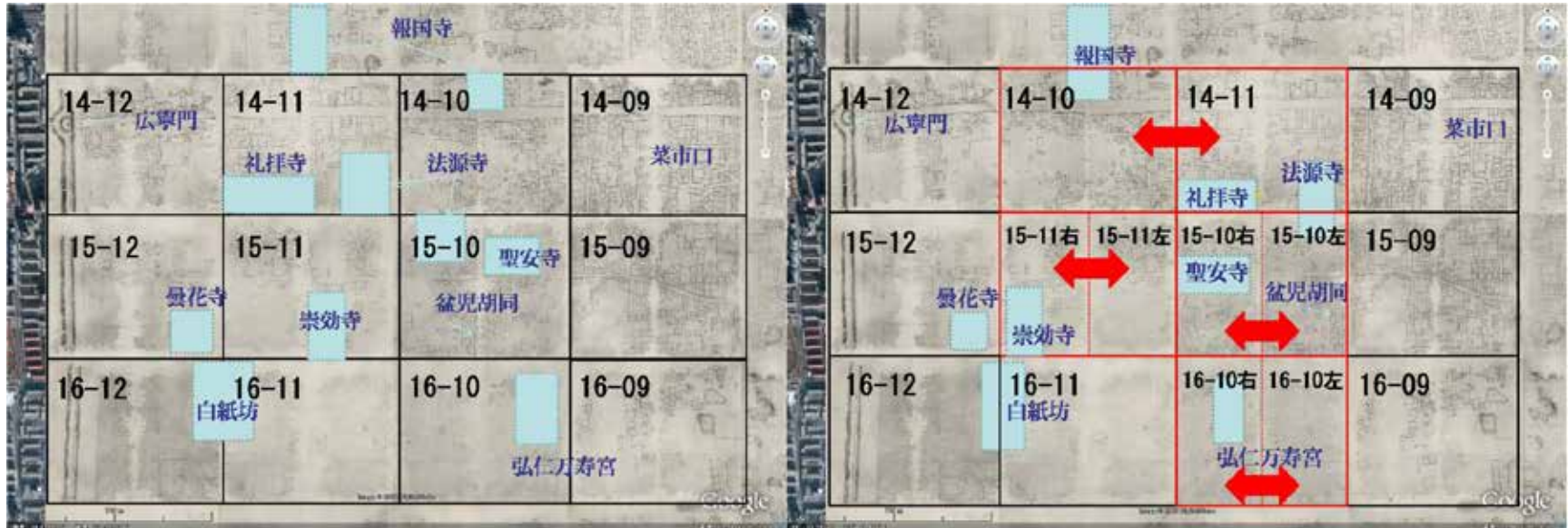
Huge size = W 13 m x H 14 m

Many sheets = 203 sheets in total

Massive pixels = 29 billion pixels

- **Control points + lines:**
We proposed a new geometric correction.

Discovery and Digital Survey



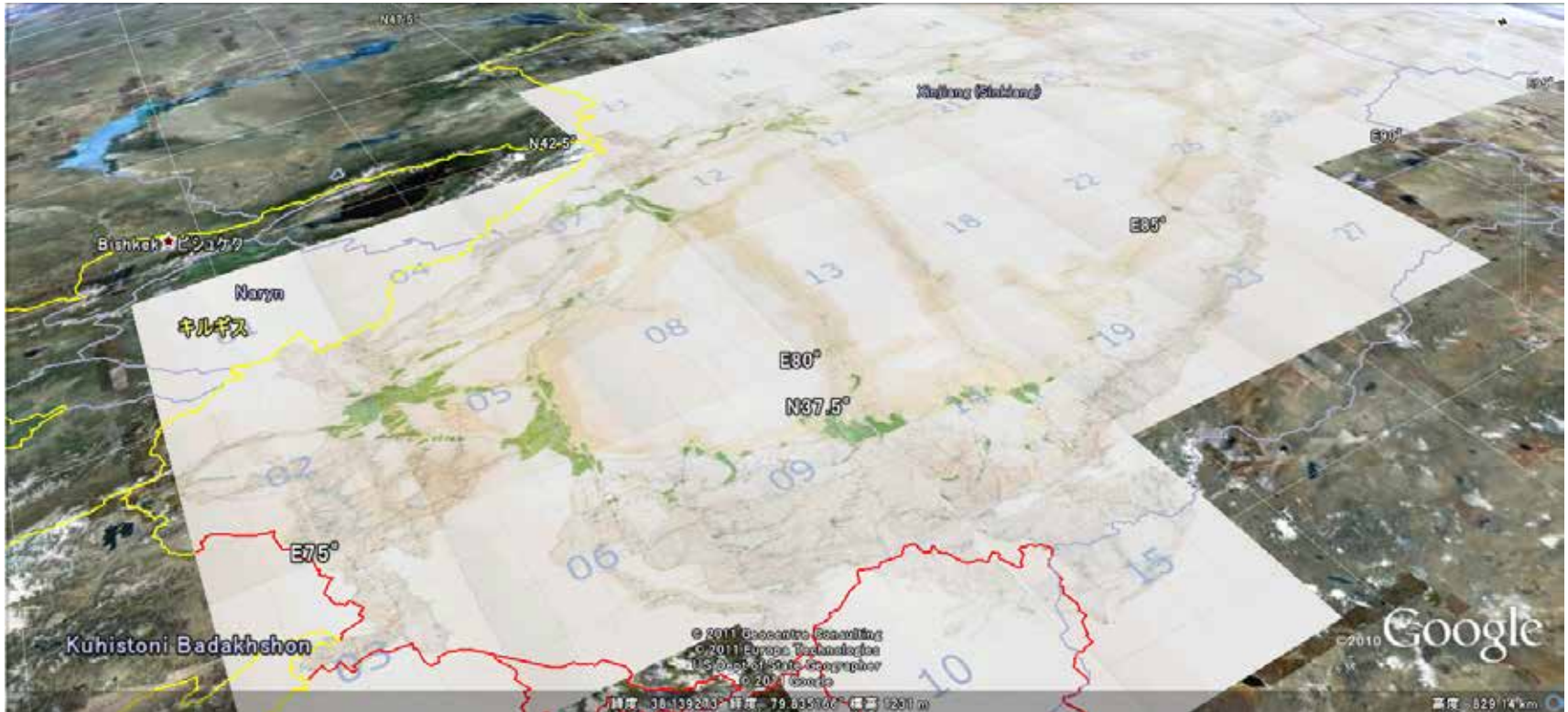
2013/9/20

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

JADH 2013

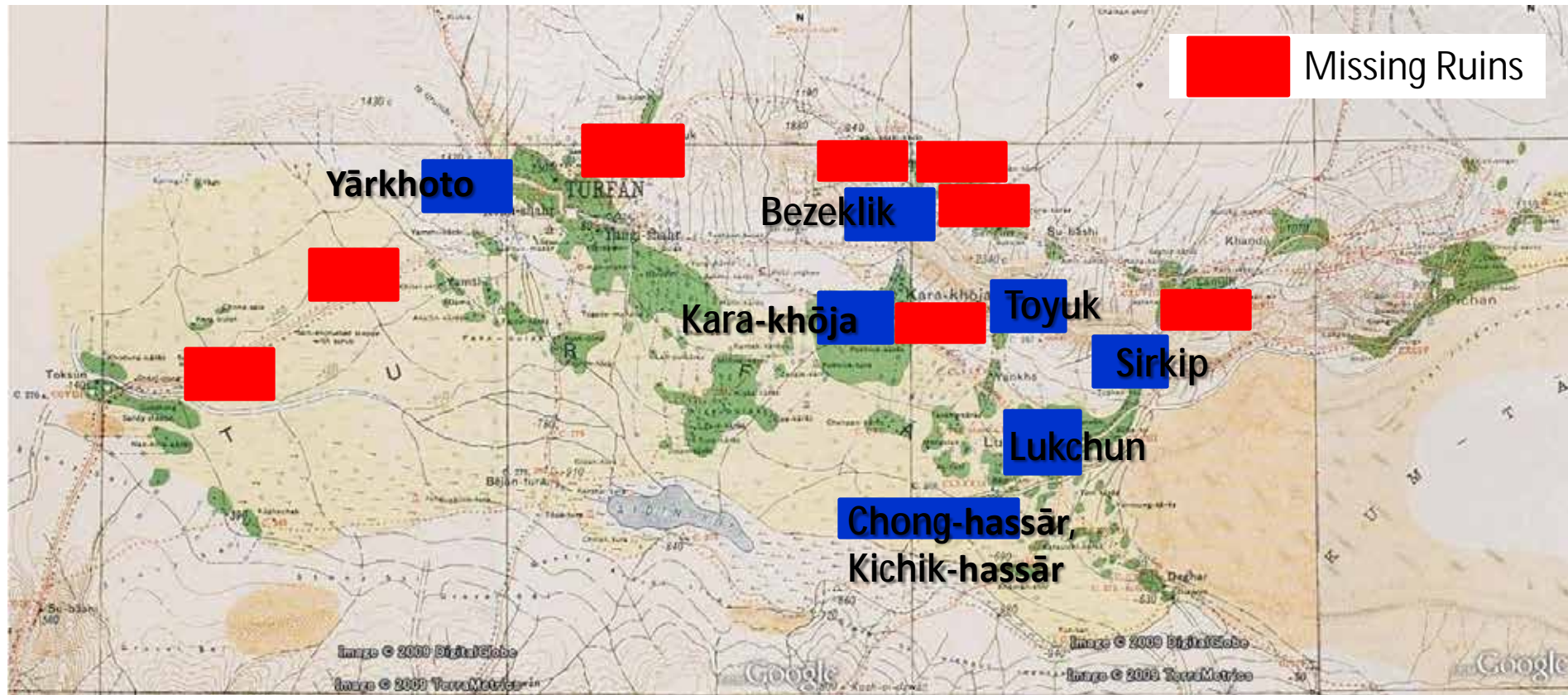
11

2. Stein Map (Silk Road)



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

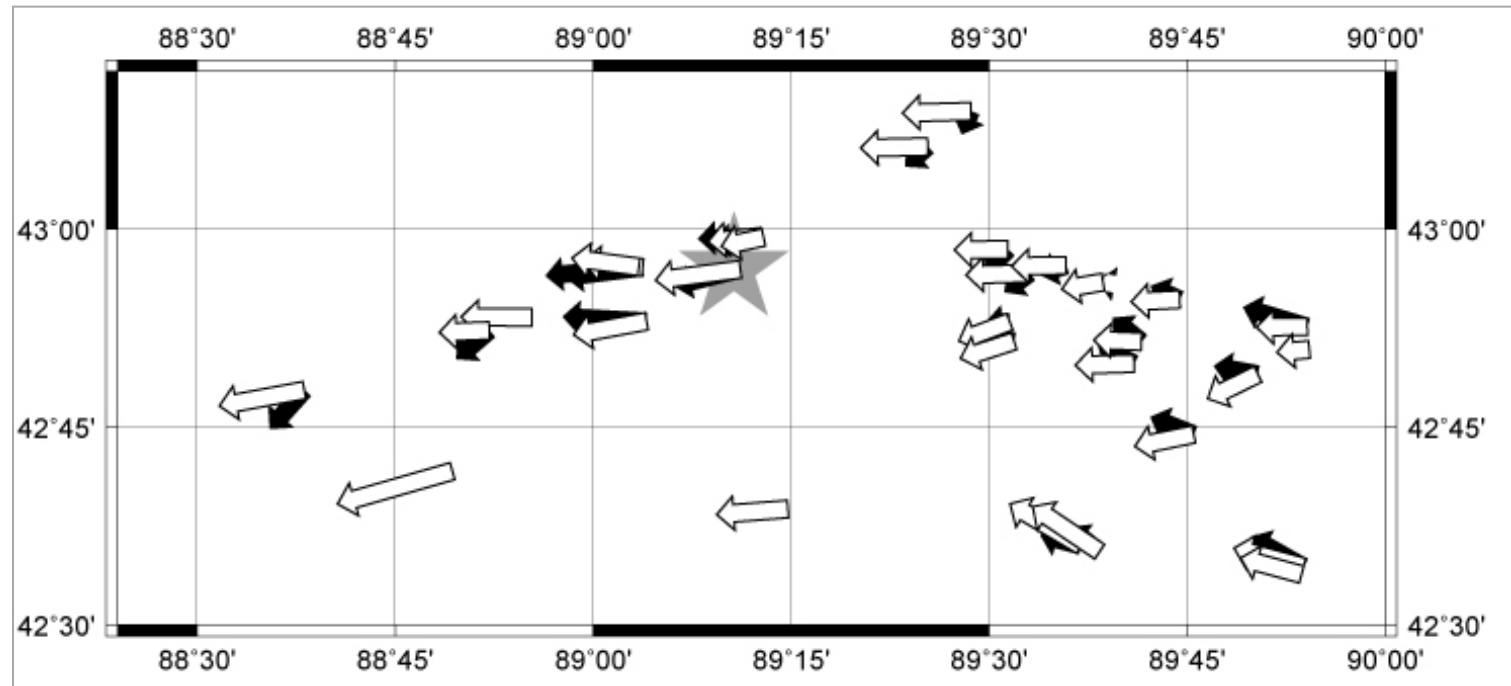
Problem of “Missing” Ruins



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

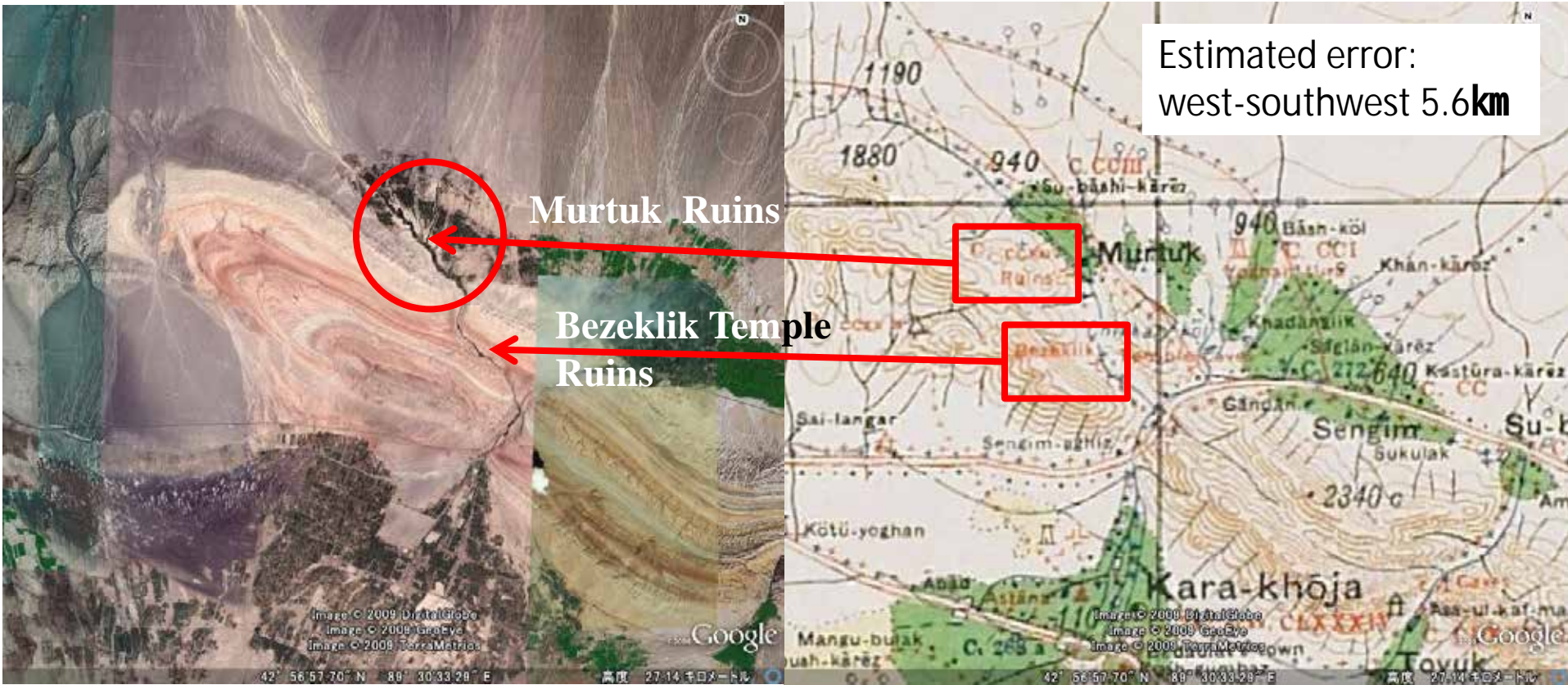
Error Distribution in Turfan



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

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

Locating “Murtuk Ruins”



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

Wujiang-bulak (烏江不拉克)

「吐魯番地区文物普查資料匯編」『新疆文物』1988-3 (普查)
「吐魯番地区遺跡調查報告」『アジア史研究』29号, 2005

烏江不拉克烽火台

烏江不拉克故城

烏江不拉克古墓

伯西哈石窟
Murtug
Anlage 2

2013/9/20

Image © 2009 DigitalGlobe
JADH 2013

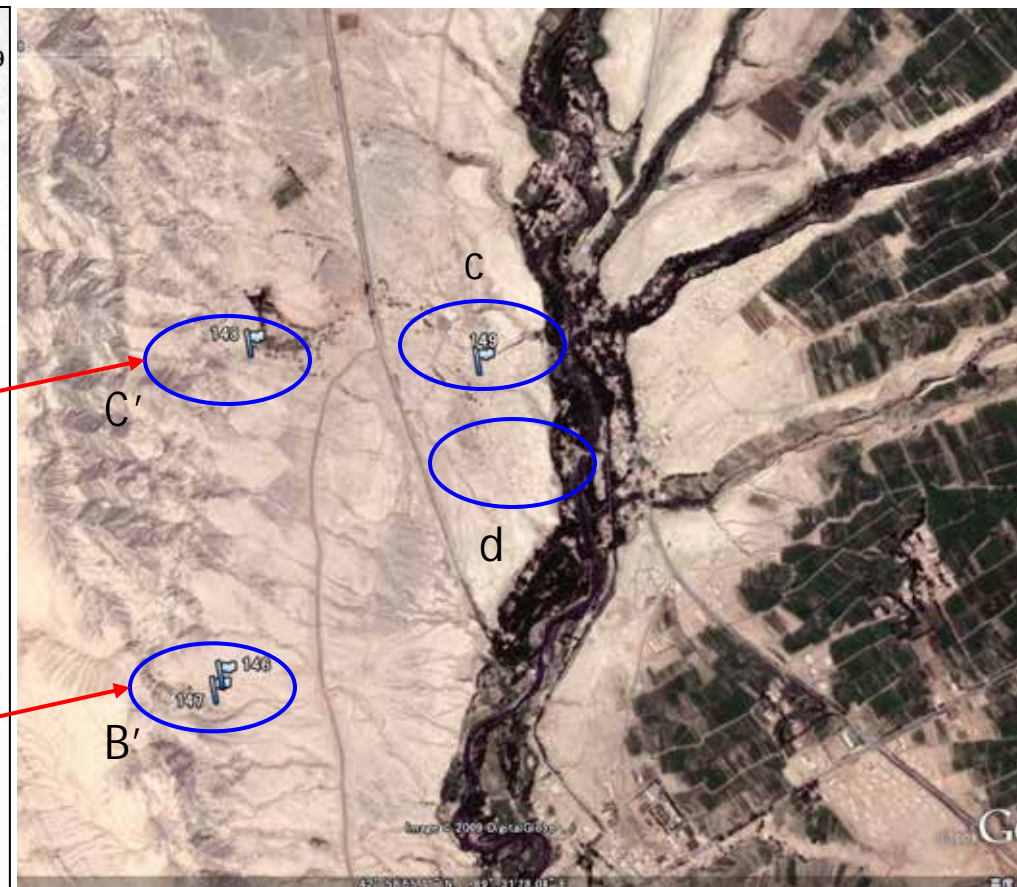
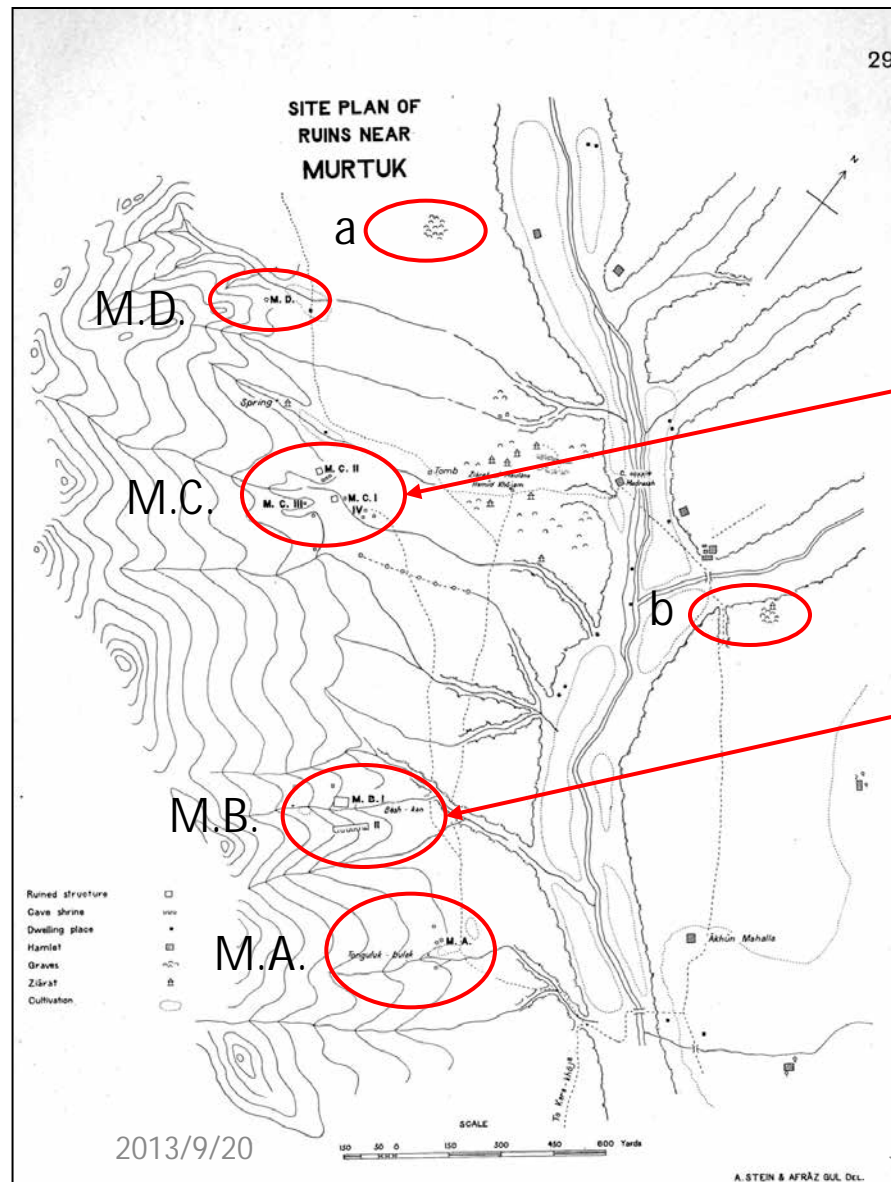
2009 Google
16

圖像取得日: 2005年6月27日

42°58'55.11"N 89°31'28.04"E

高度 8654.21m

Murtuk Ruins (Stein, 1915)



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

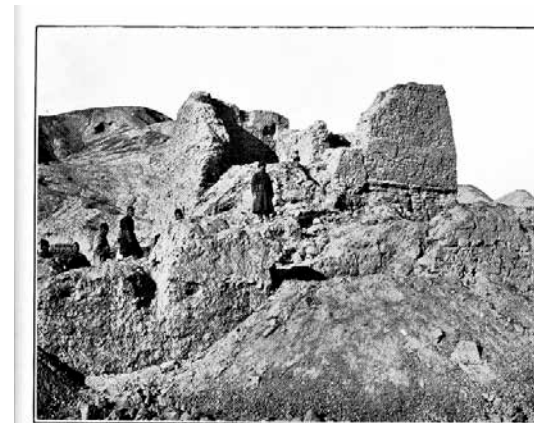
Photographs as Evidence



伯西哈石窟(烏江不拉克仏塔)



烏江不拉克烽火台



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

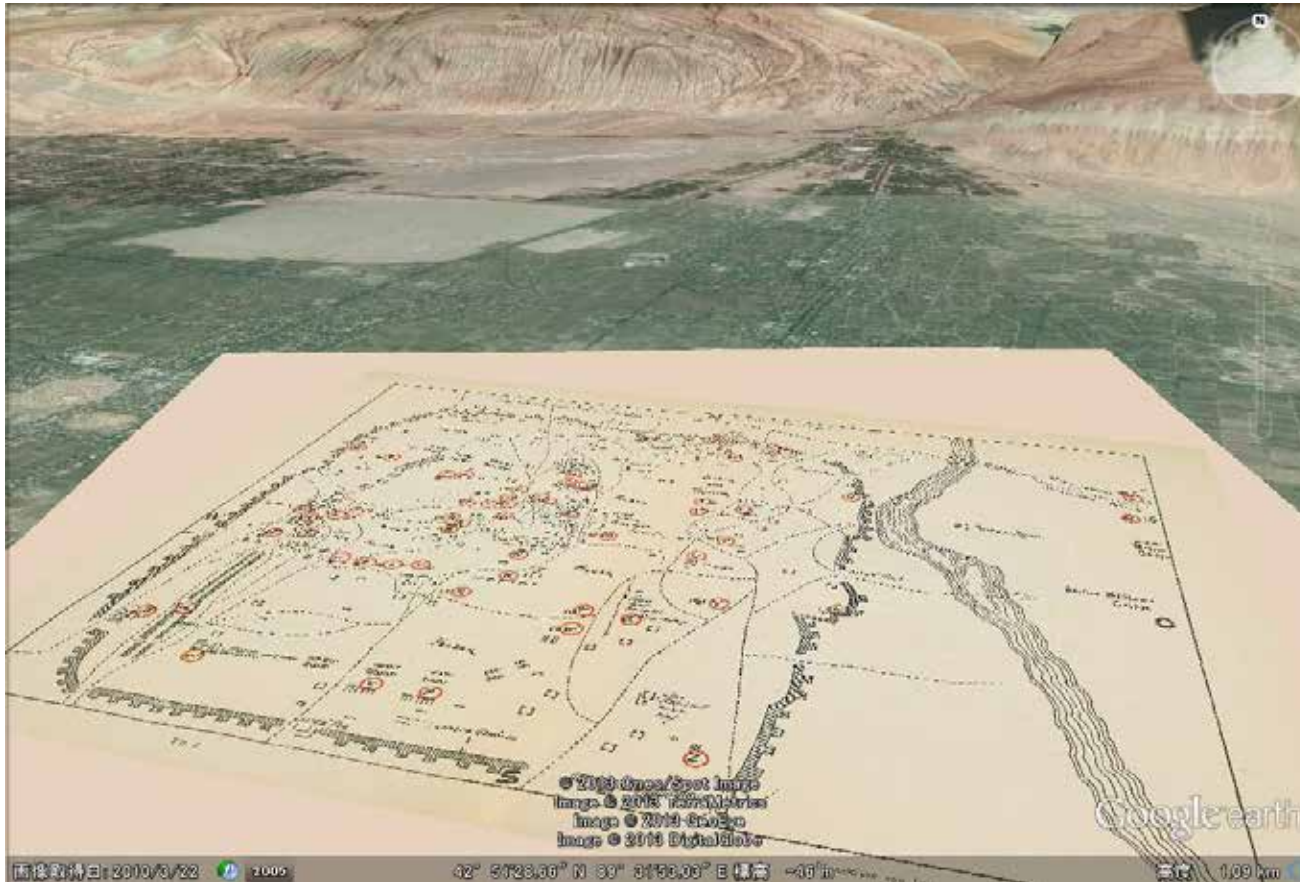
Murtuk Ruins (M. B. I)



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

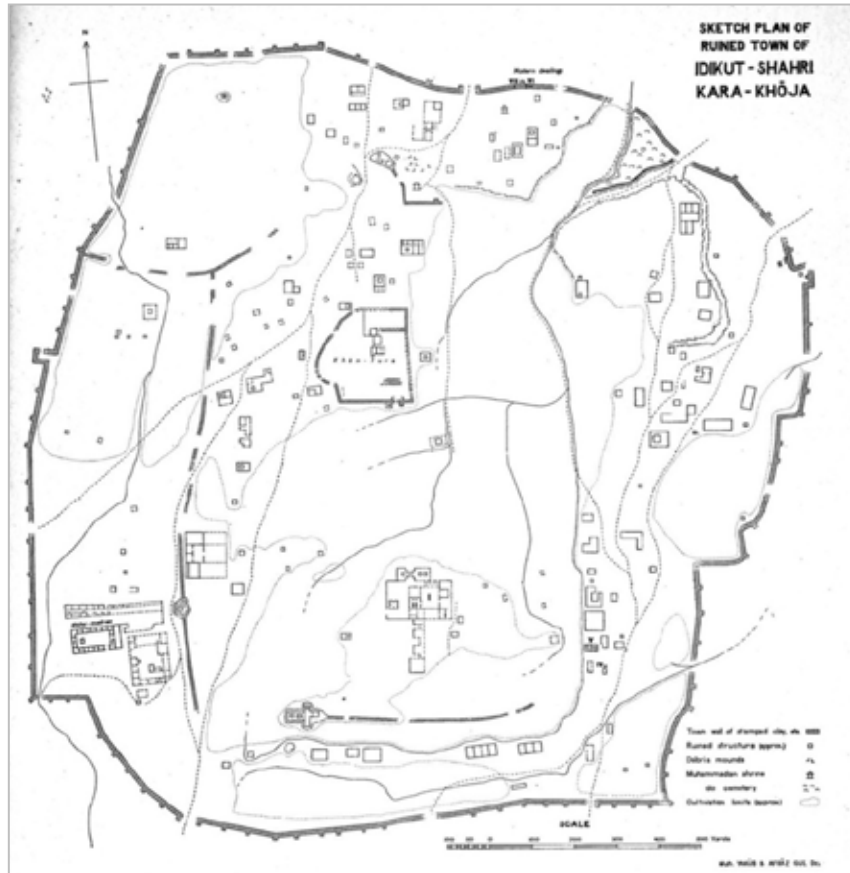
Murtuk Ruins (Ruined Shrine M. C. I)

3. Grünwedel Map (Gaochang)

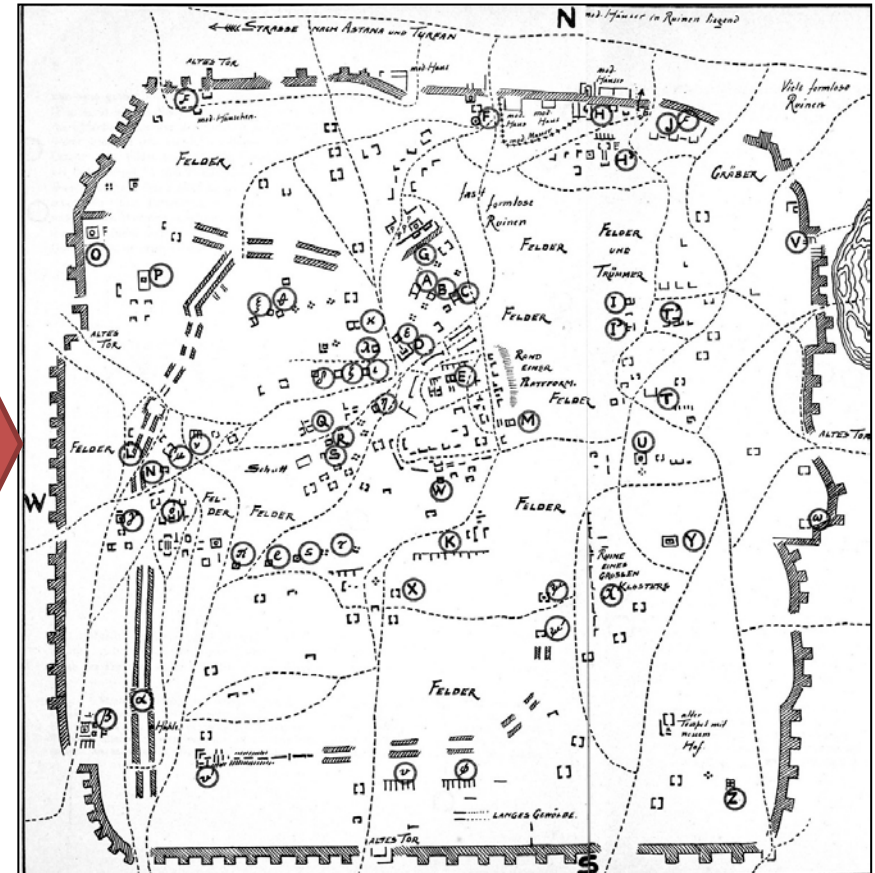


How to use the previously “untrusted” map?

Inconsistencies in Gaochang Maps



Aurel Stein



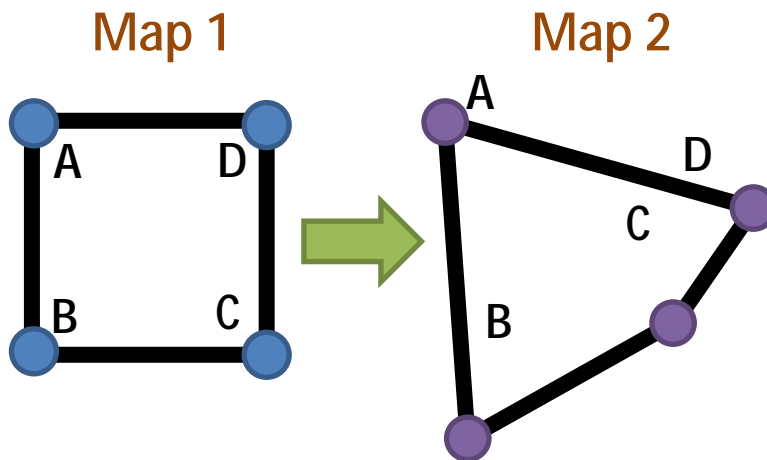
Albert Grünwedel

[illegible]

2013/9/20

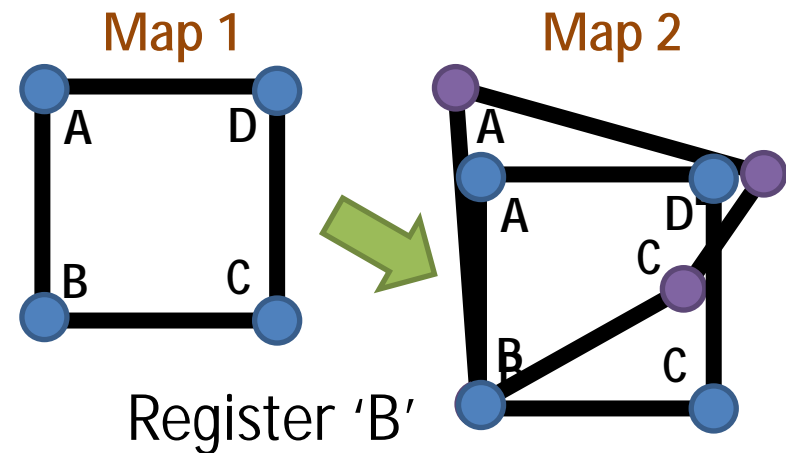
Two Methods for Map Registration

Geometric Correction



- All points are registered.
- Shapes are distorted.

Single-Point Registration



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

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

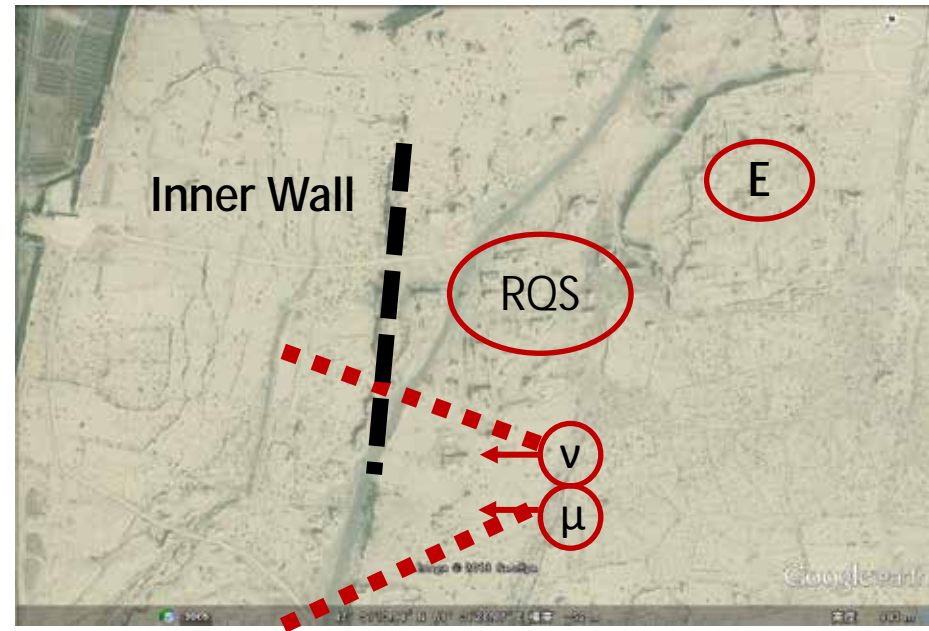
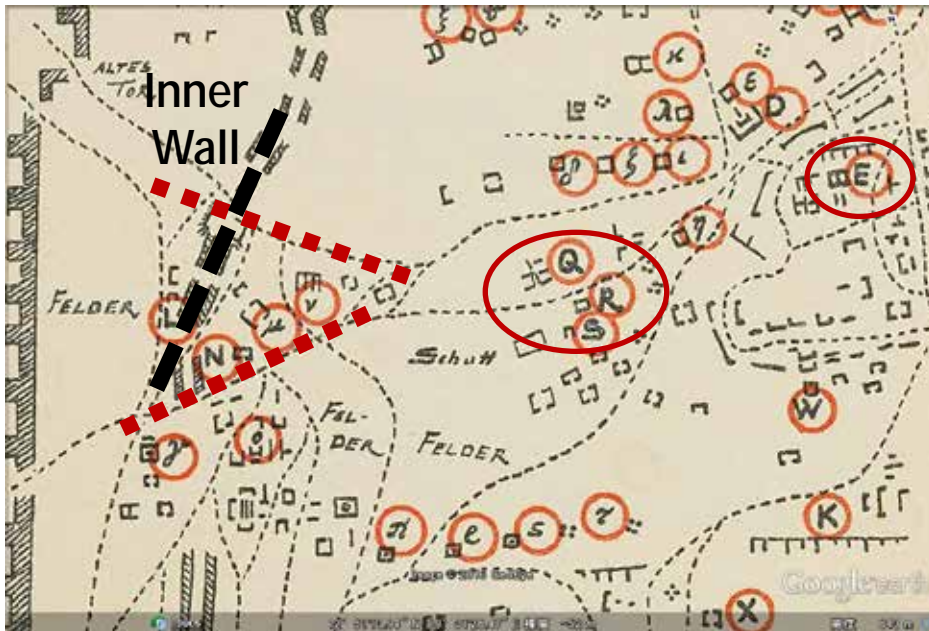
Map Satellite

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

Topological Interpretation



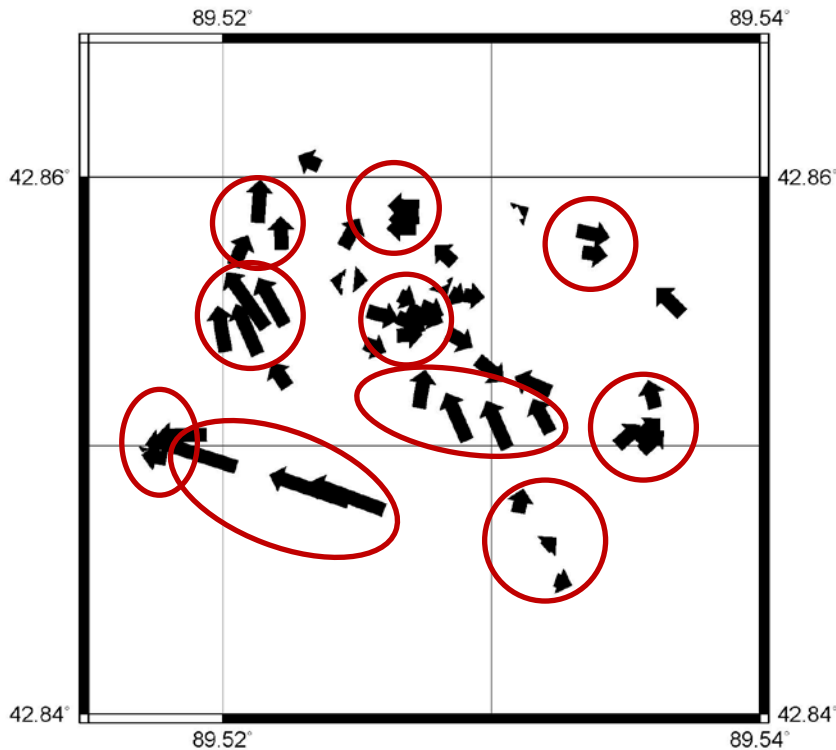
Where is v and μ ?
We have multiple
candidates...

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

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

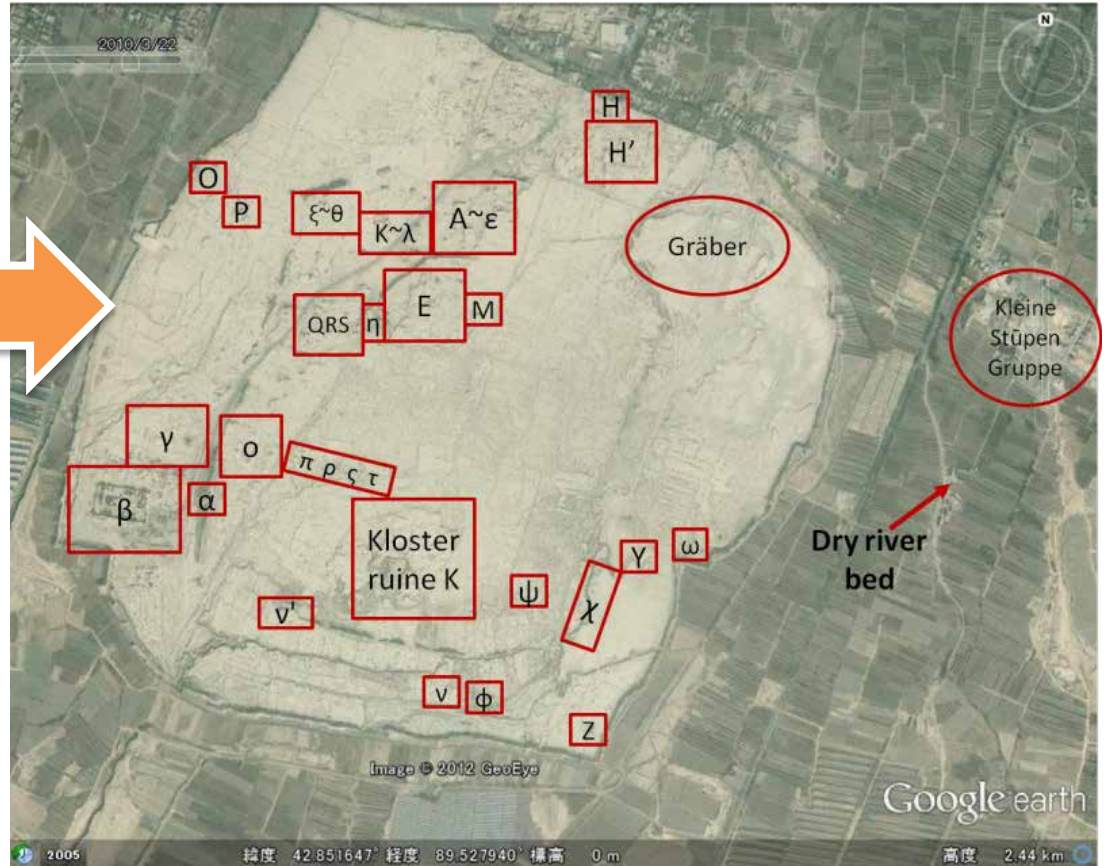
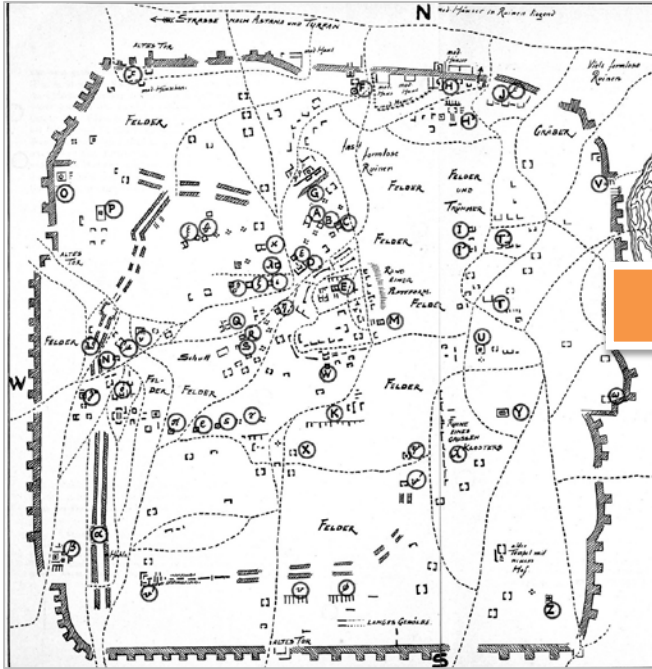
Maps designed for navigation purposes should preserve
the topology, not to get lost when visiting there again.

Error Distribution in Gaochang



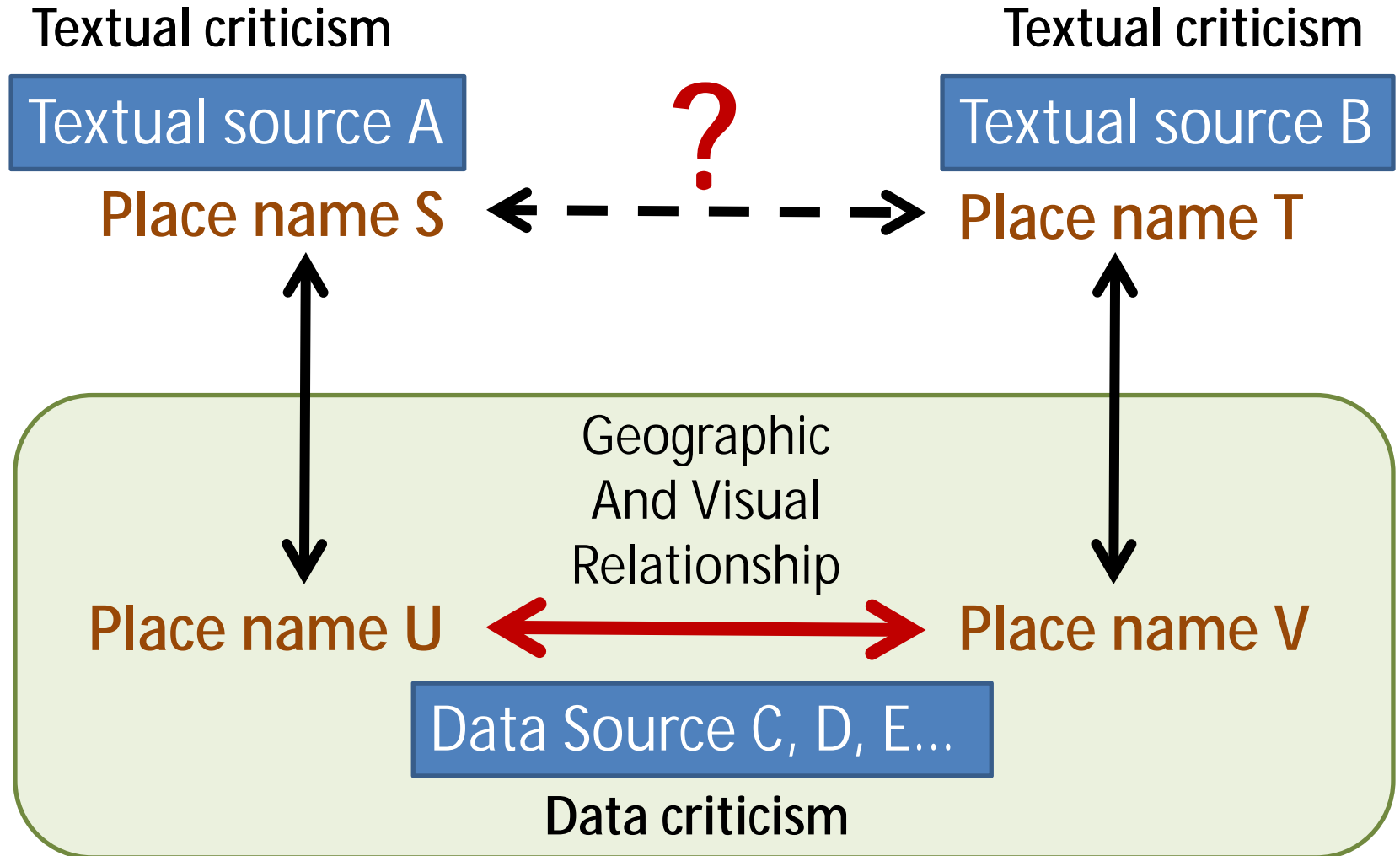
- Composed of several regions with different error patterns.
- Grouping may be related to the table of contents.
- “Topology” is the key for reasonable interpretation.

Identification of Most Ruins

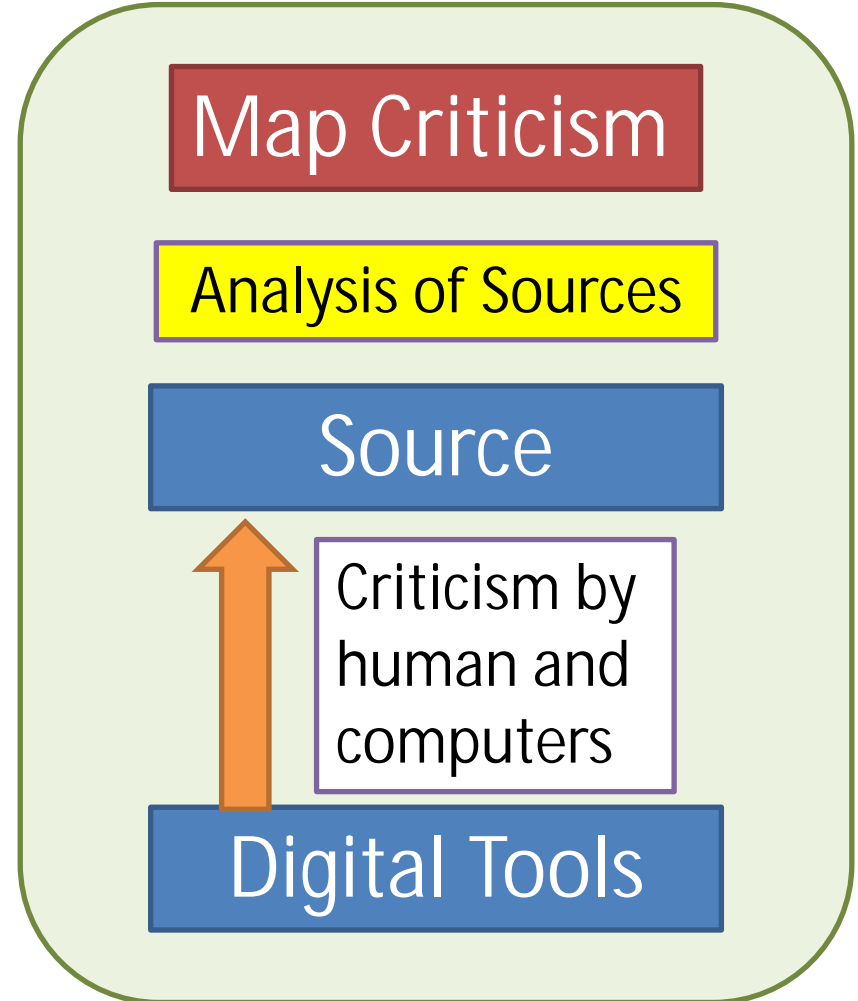
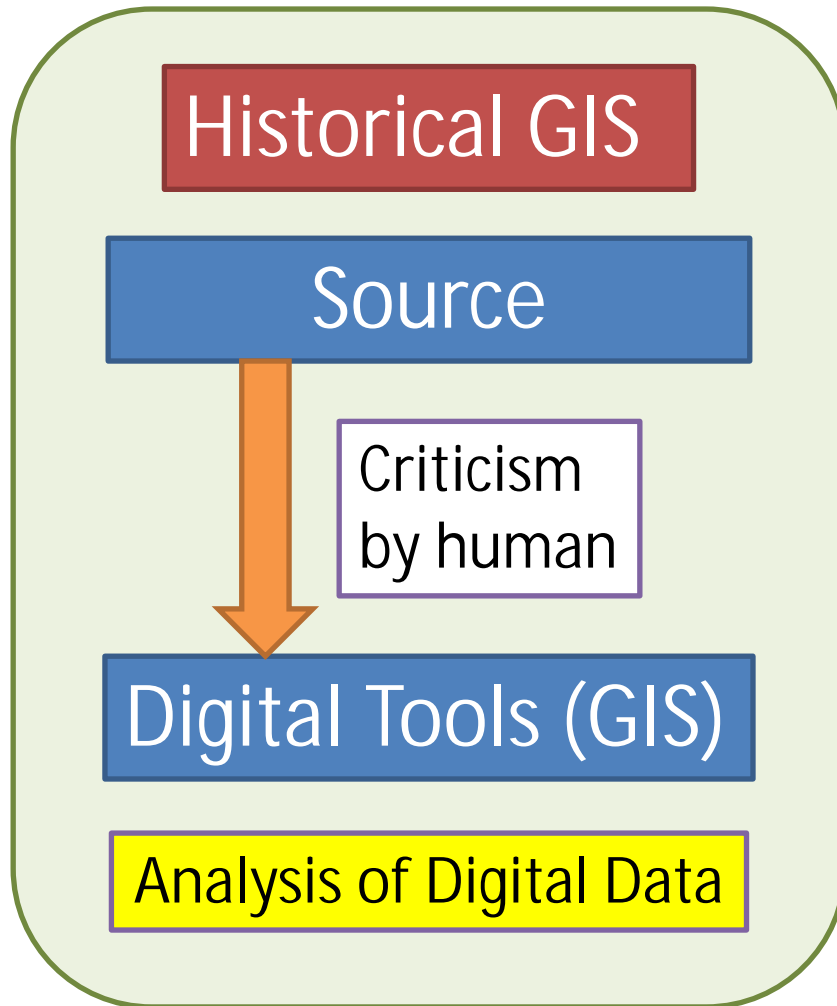


Linking expedition results to recent surveys may lead to new interpretations.

Linking Entities Across Sources



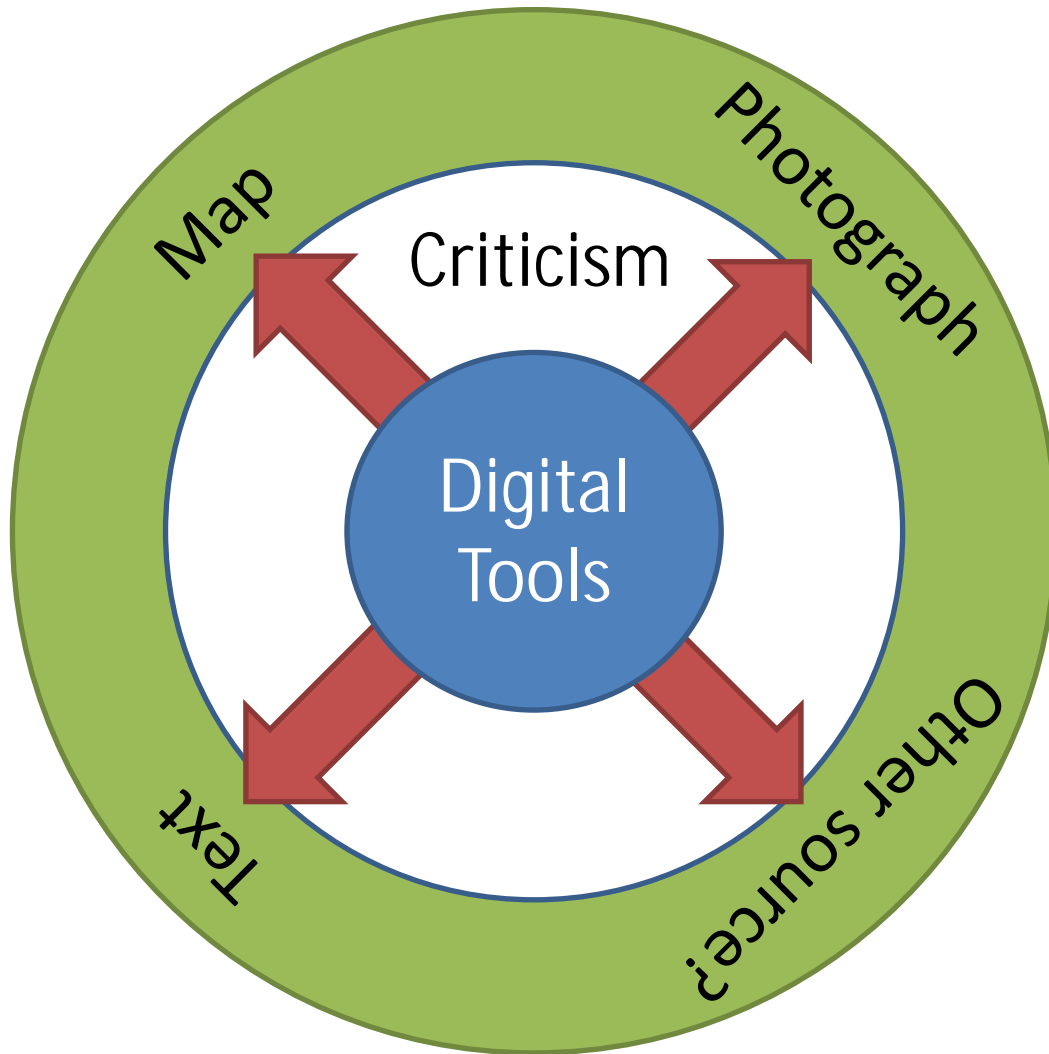
Historical GIS and Map Criticism



Our Contribution

1. We proposed a basic strategy for the criticism of spatial / visual sources, especially maps.
2. Digital tools to be added into methodological commons in the area of data criticism.
3. Data criticism (or inquiry) can increase the value of previously “untrusted” sources.
4. Integration of visual and textual sources may lead to the discovery of new historical facts.

Data Criticism for Other Sources?



- Computational algorithms and databases help criticism and inquiry.
- Similar ideas can be applied to textual criticism?

Digital Silk Road Project



数字
丝绸之路

- 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:

Asanobu KITAMOTO : kitamoto@nii.ac.jp