

# Data Criticism:

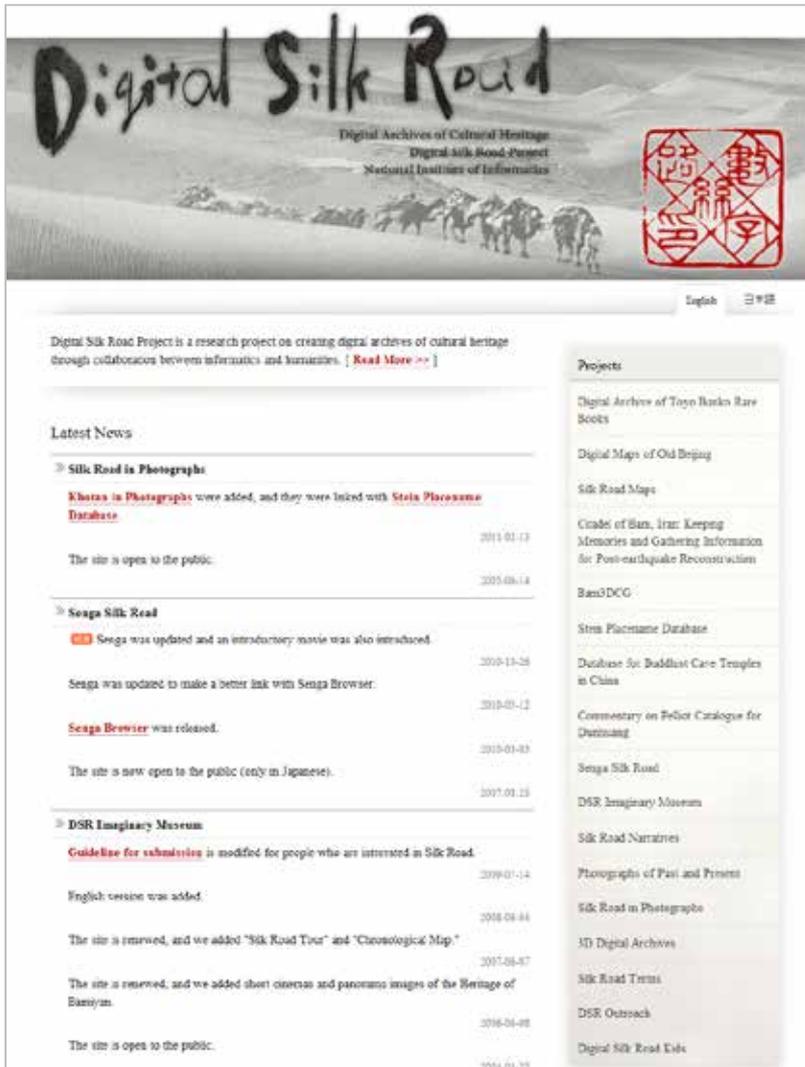
A methodology for the quantitative evaluation  
of non-textual historical sources  
with case studies on Silk Road maps and photographs

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Yoko NISHIMURA, Toyo Bunko

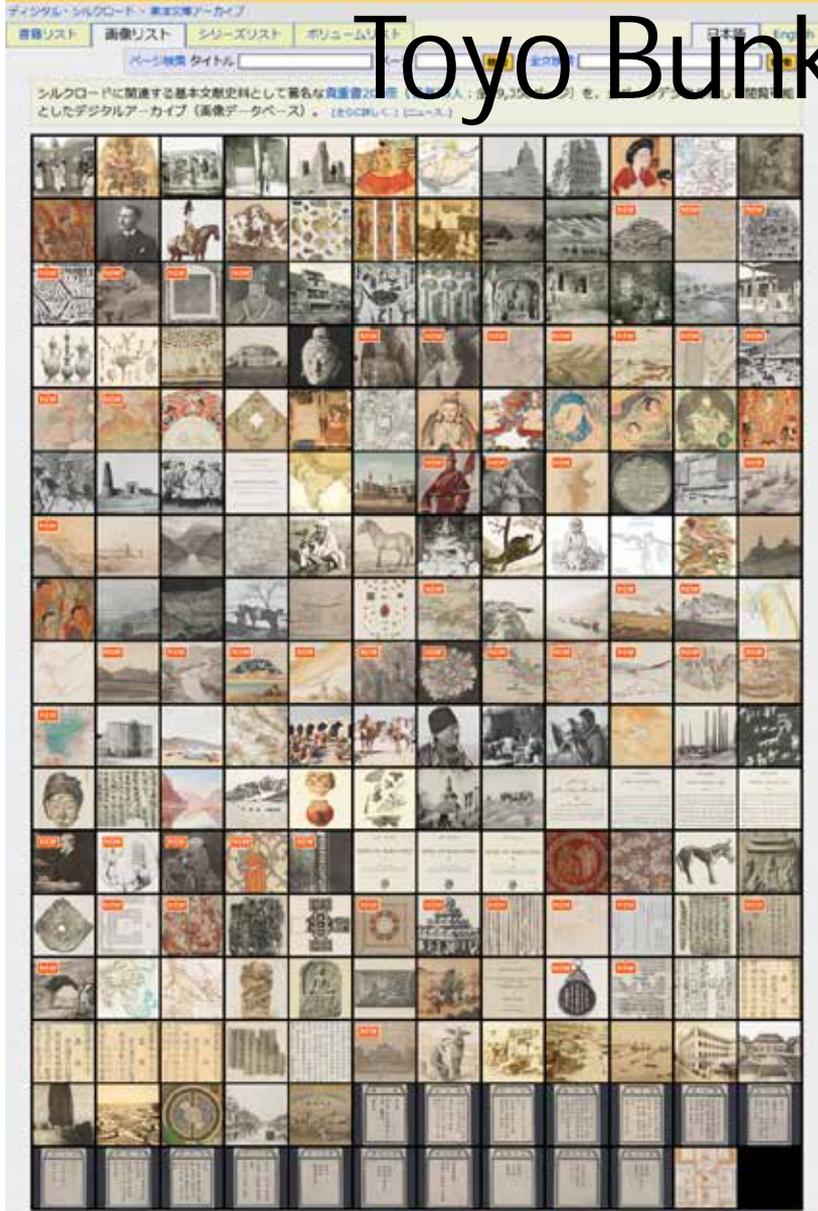
<http://dsr.nii.ac.jp/>

# 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.**

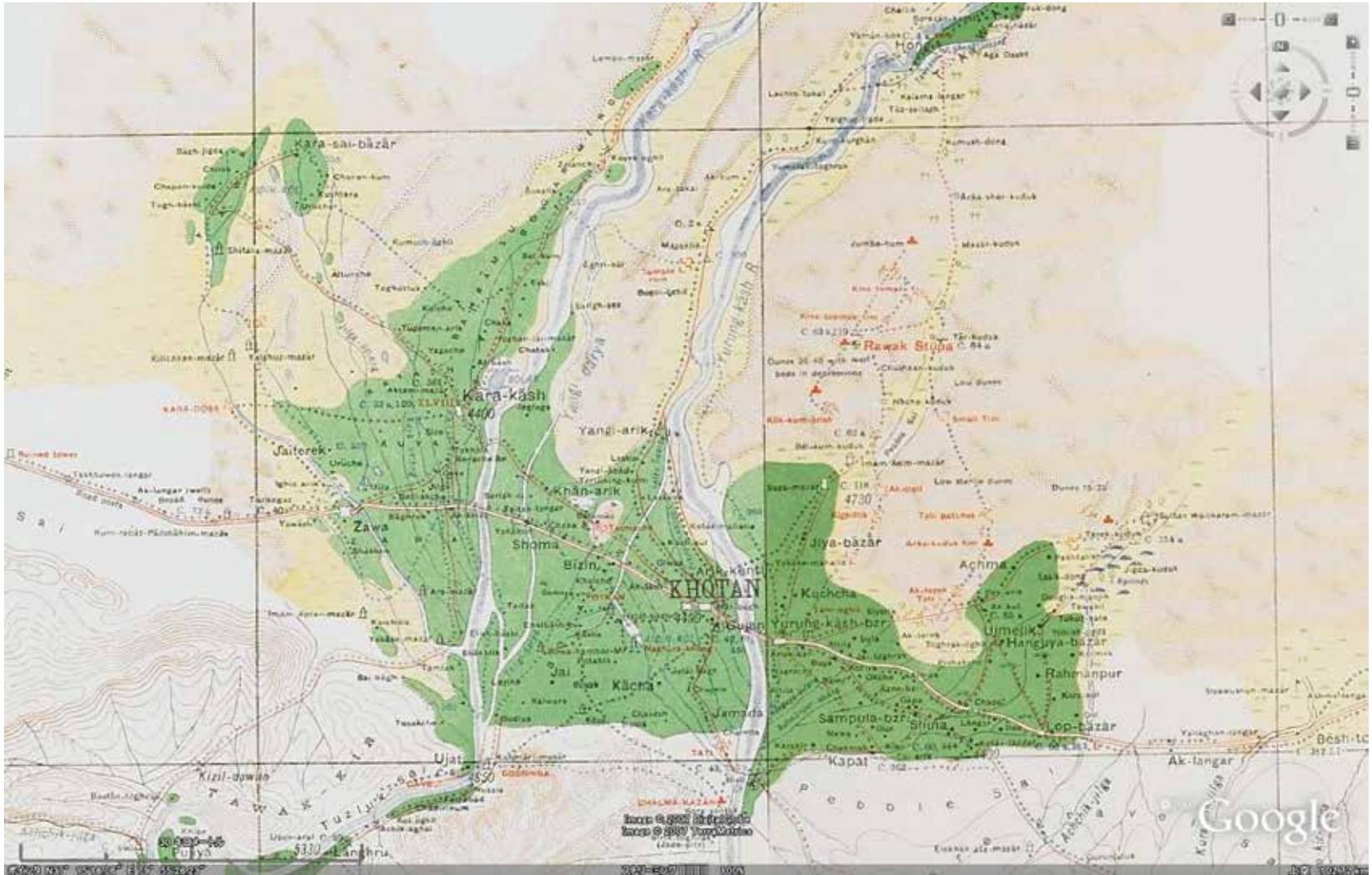
<http://dsr.nii.ac.jp/>



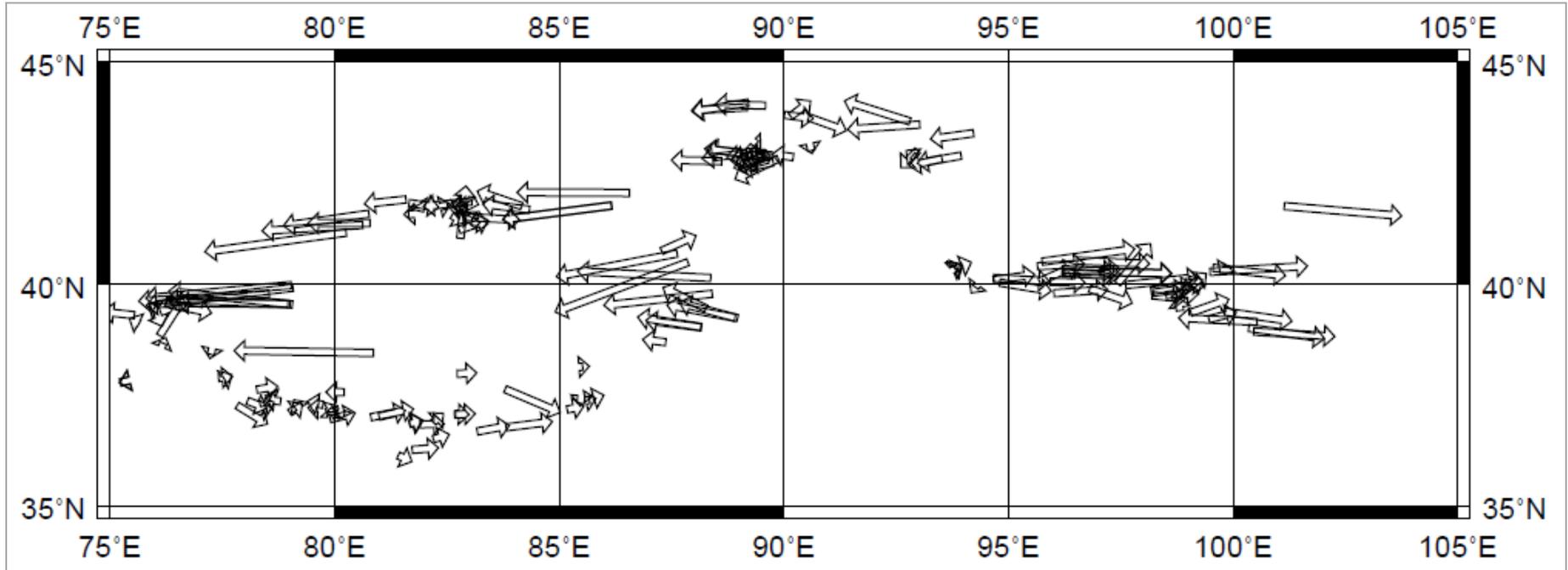
# Toyo Bunko Rare Books

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

# [Q] A Map can be Used as Fact?

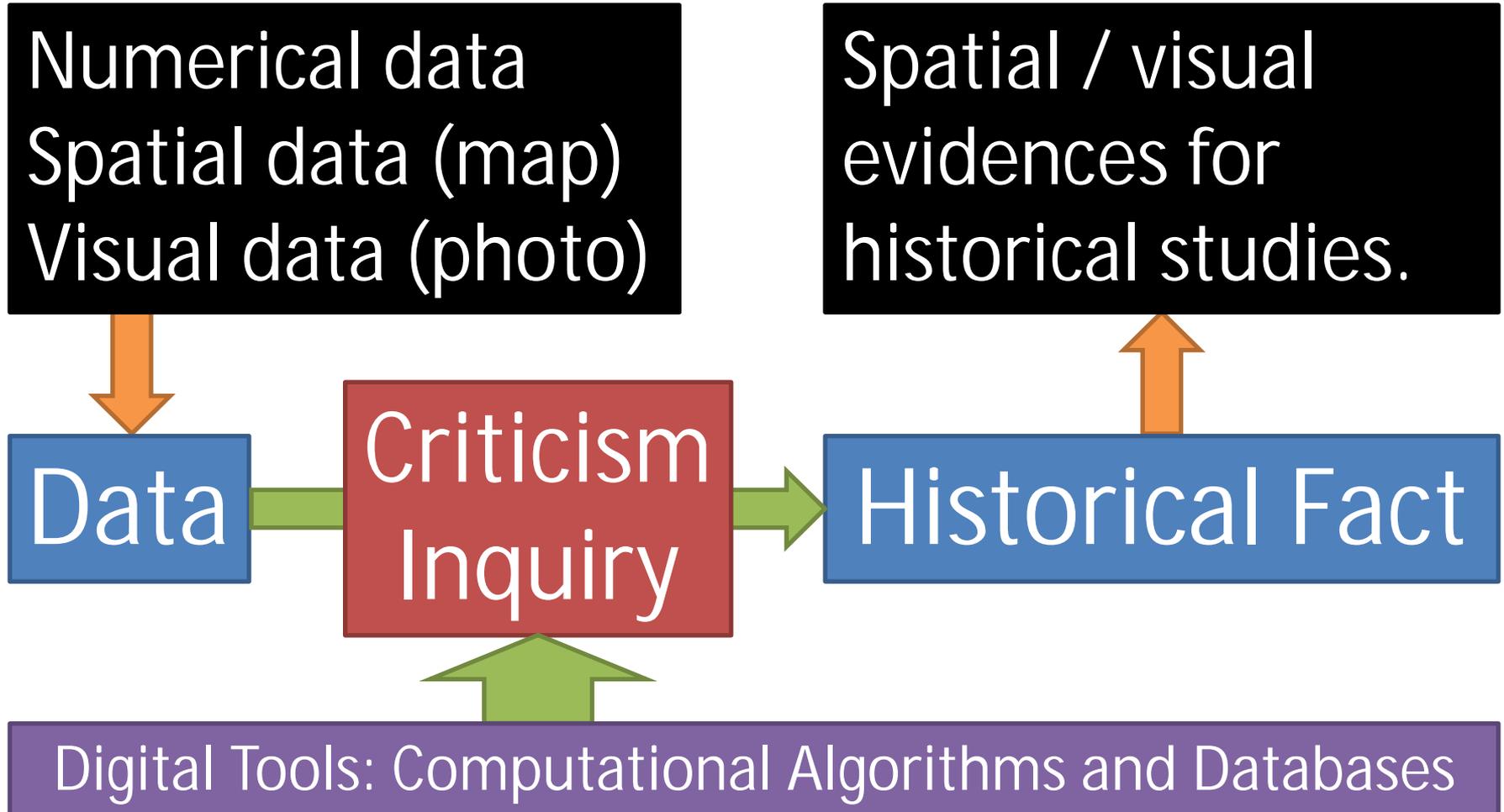


# Evaluation of the Map



- 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.

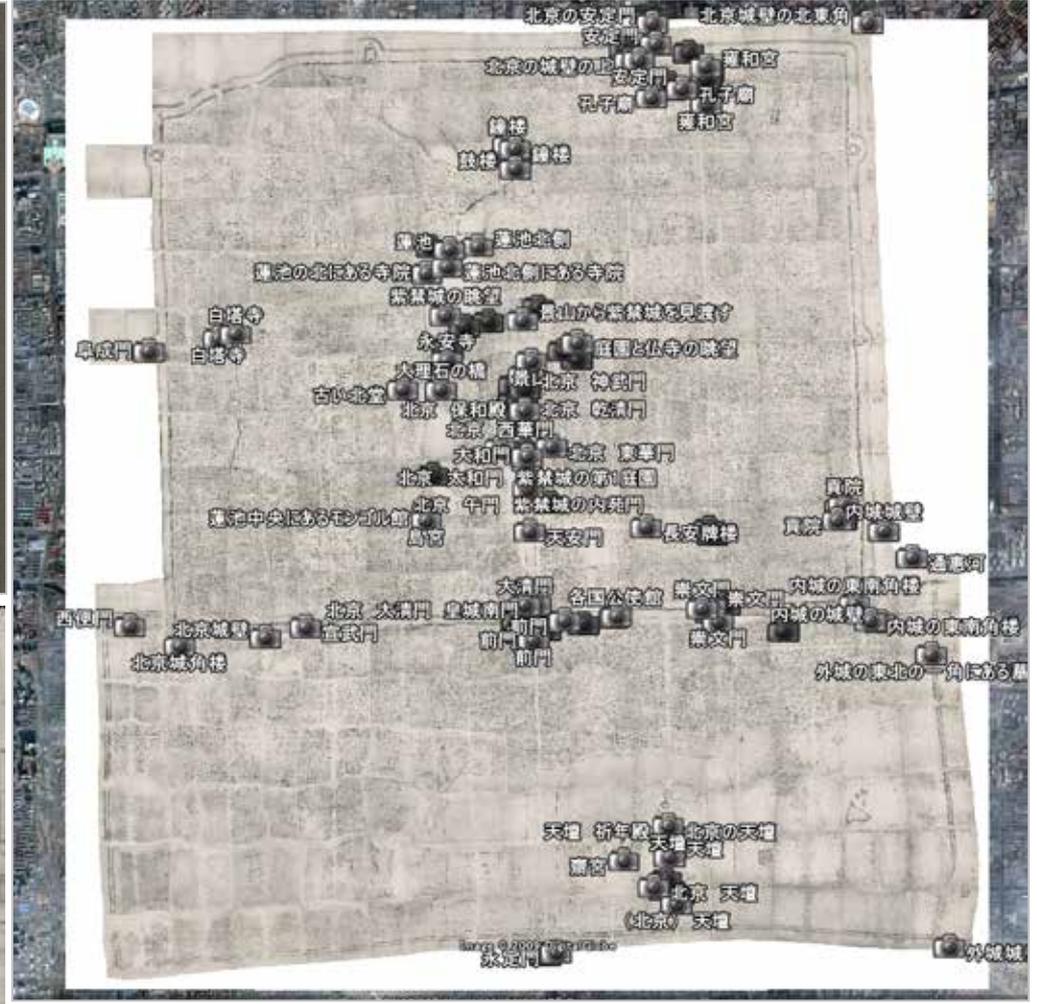
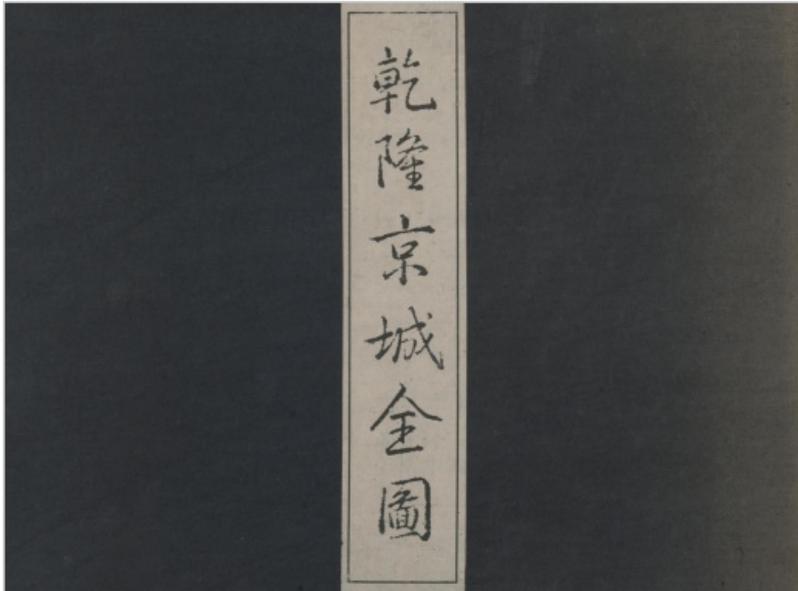
## 2. Stein Map (Silk Road)

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

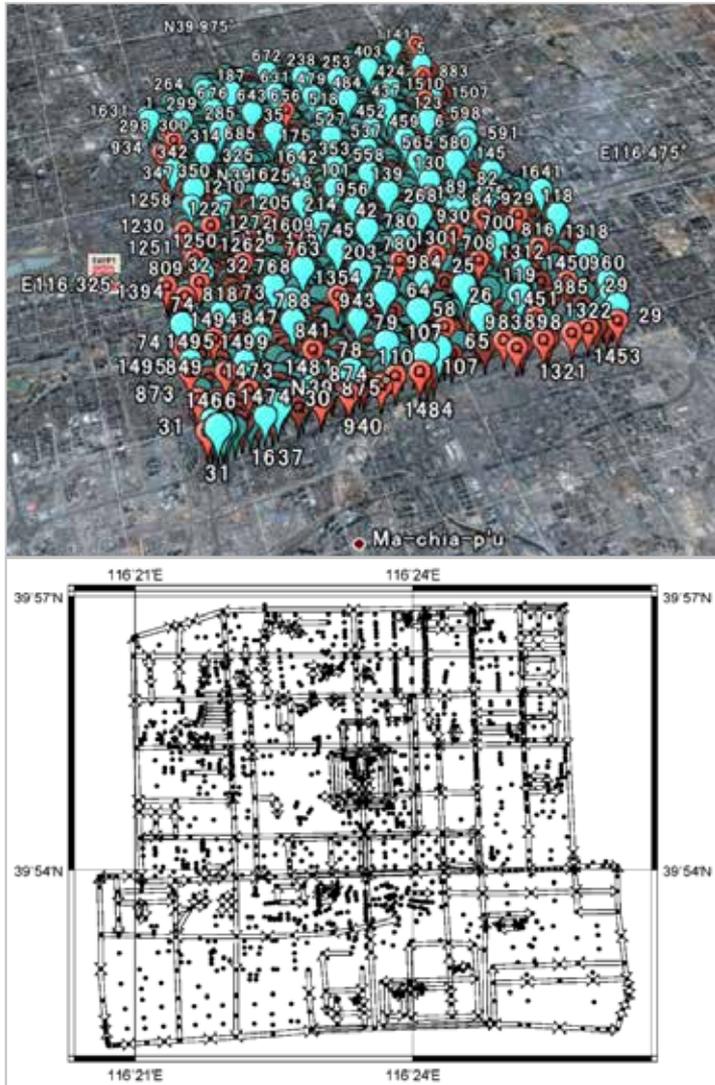
## 3. Grünwedel Map (Gaochang)

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

# 1. Qianlong Map (Beijing)



# Massive Geometric Correction



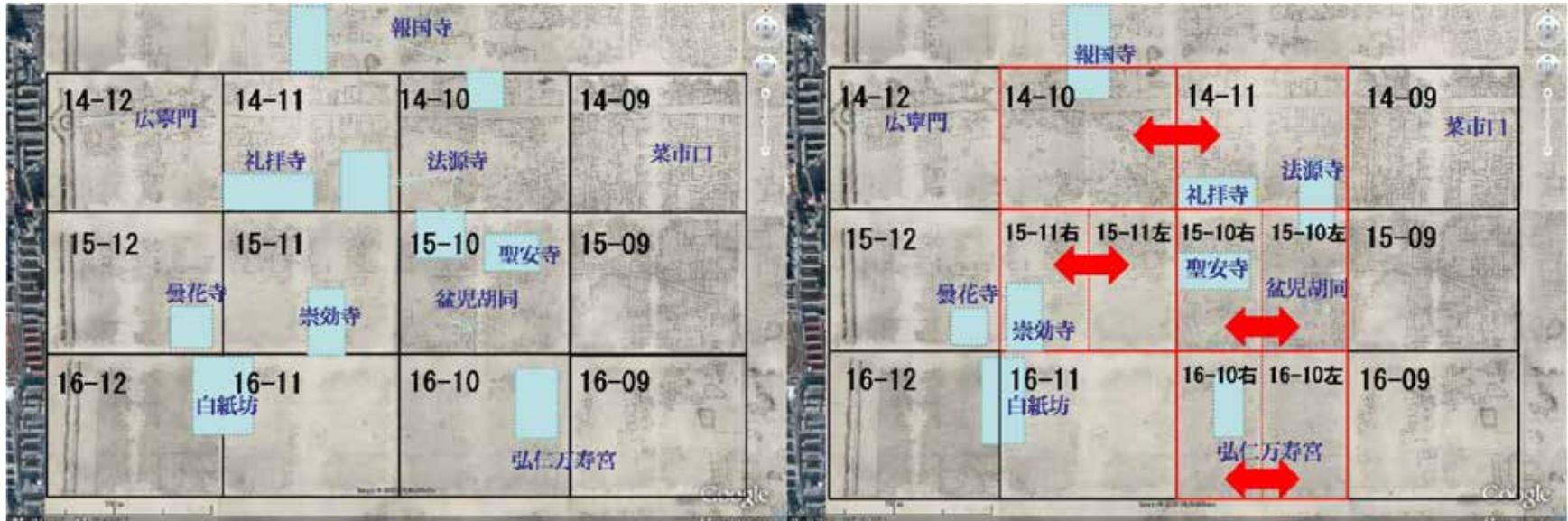
**Huge size** = W 13 m x H 14 m

**Many sheets** = 203 sheets in total

**Massive pixels** = 29 billion pixels

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

# Discovery and Digital Survey



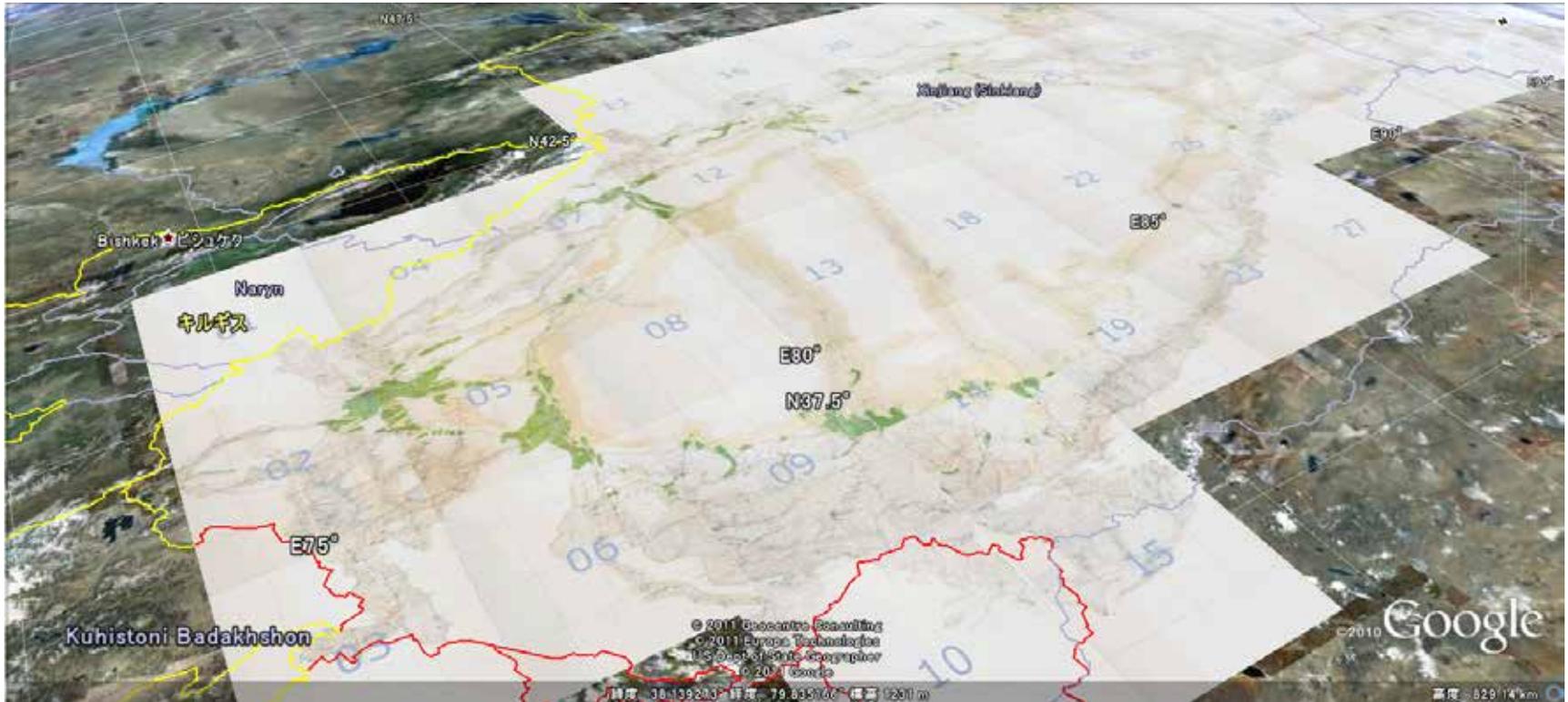
2013/9/20

- **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

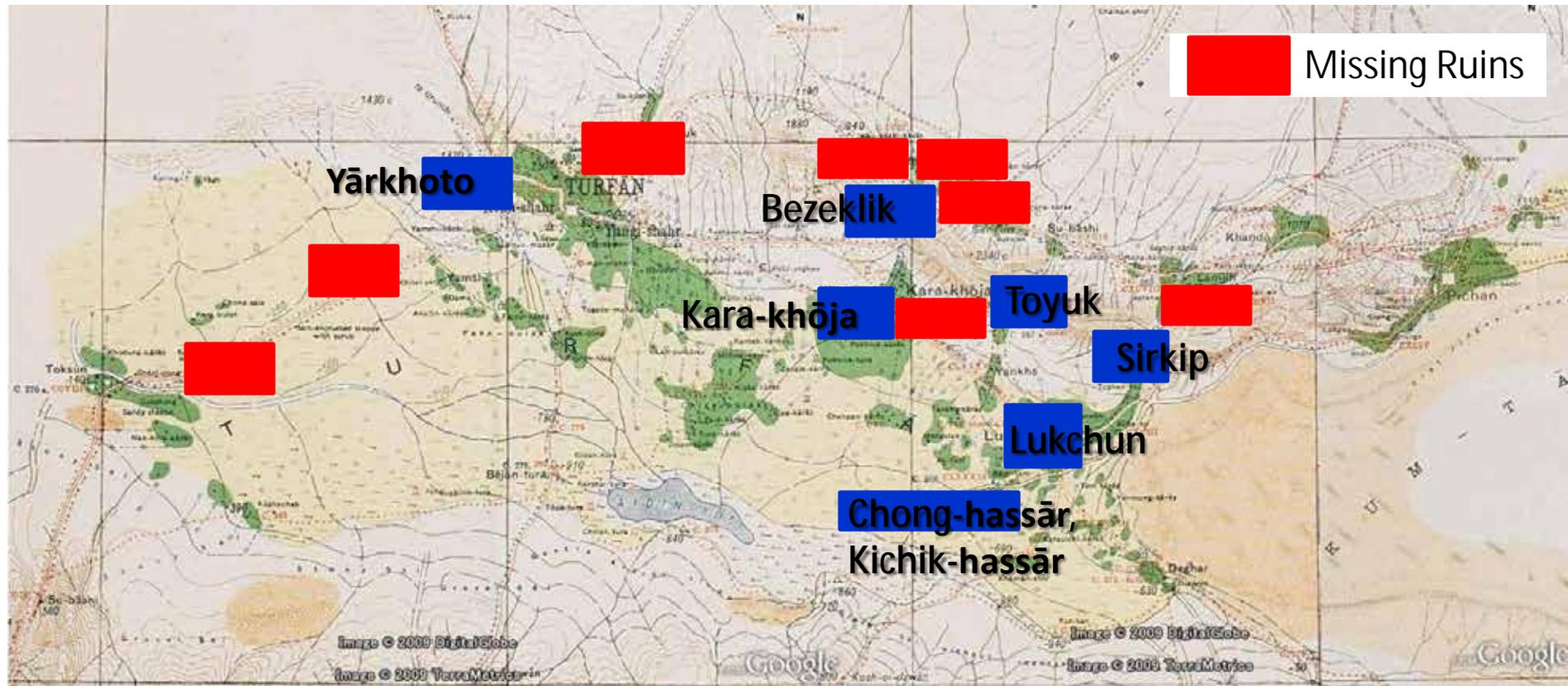
11

## 2. Stein Map (Silk Road)



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

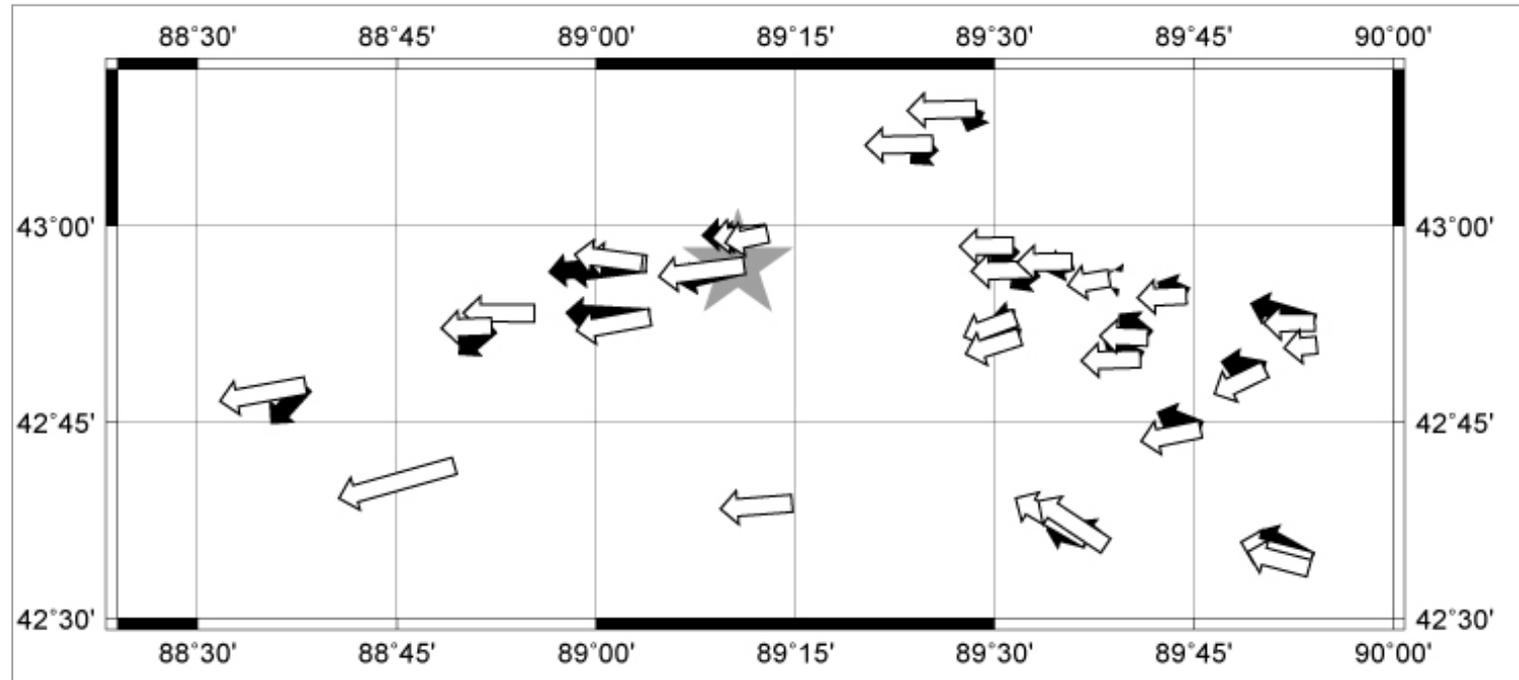
# Problem of "Missing" Ruins



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

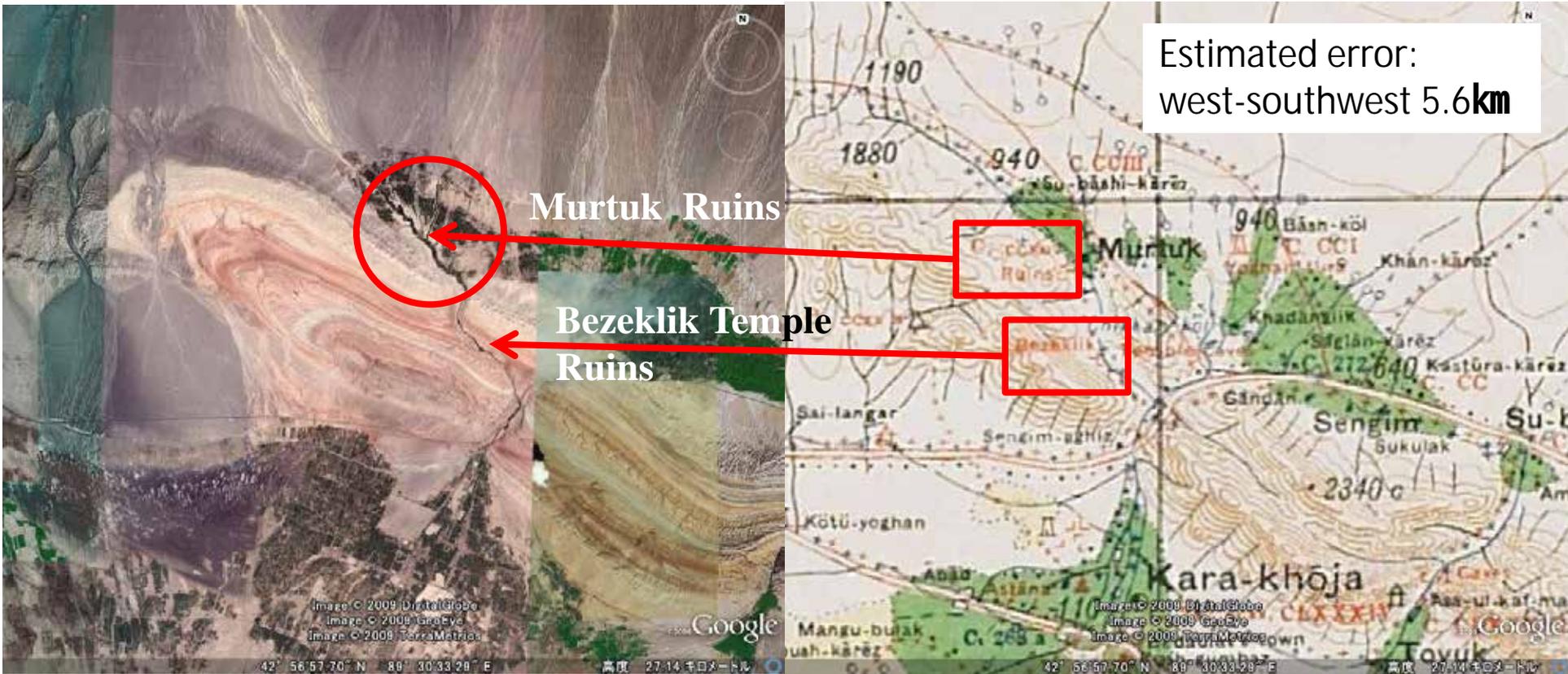
# Error Distribution in Turfan



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

- Some ruins were reported by 20<sup>th</sup> 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

143

烏江不拉克故城

149

烏江不拉克古墓

伯西哈石窟  
Murtug  
Anlage 2

146  
147

2013/9/20

Image © 2009 DigitalGlobe

IADH 2013

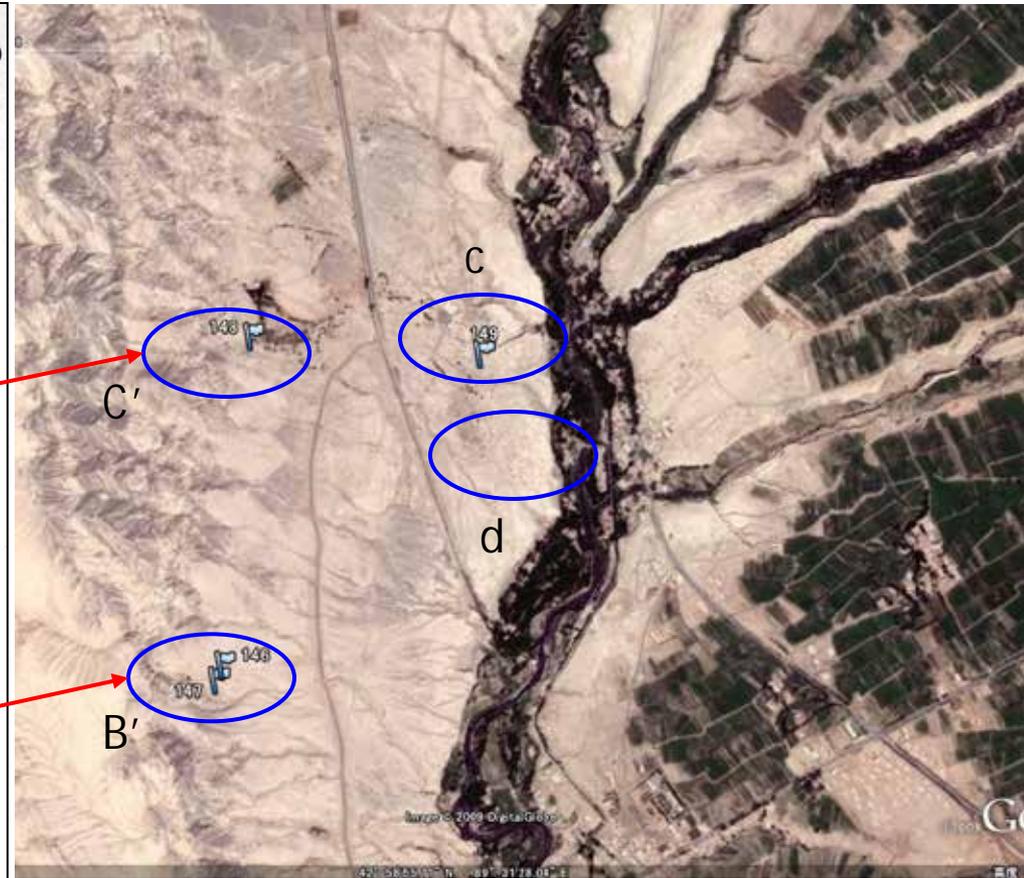
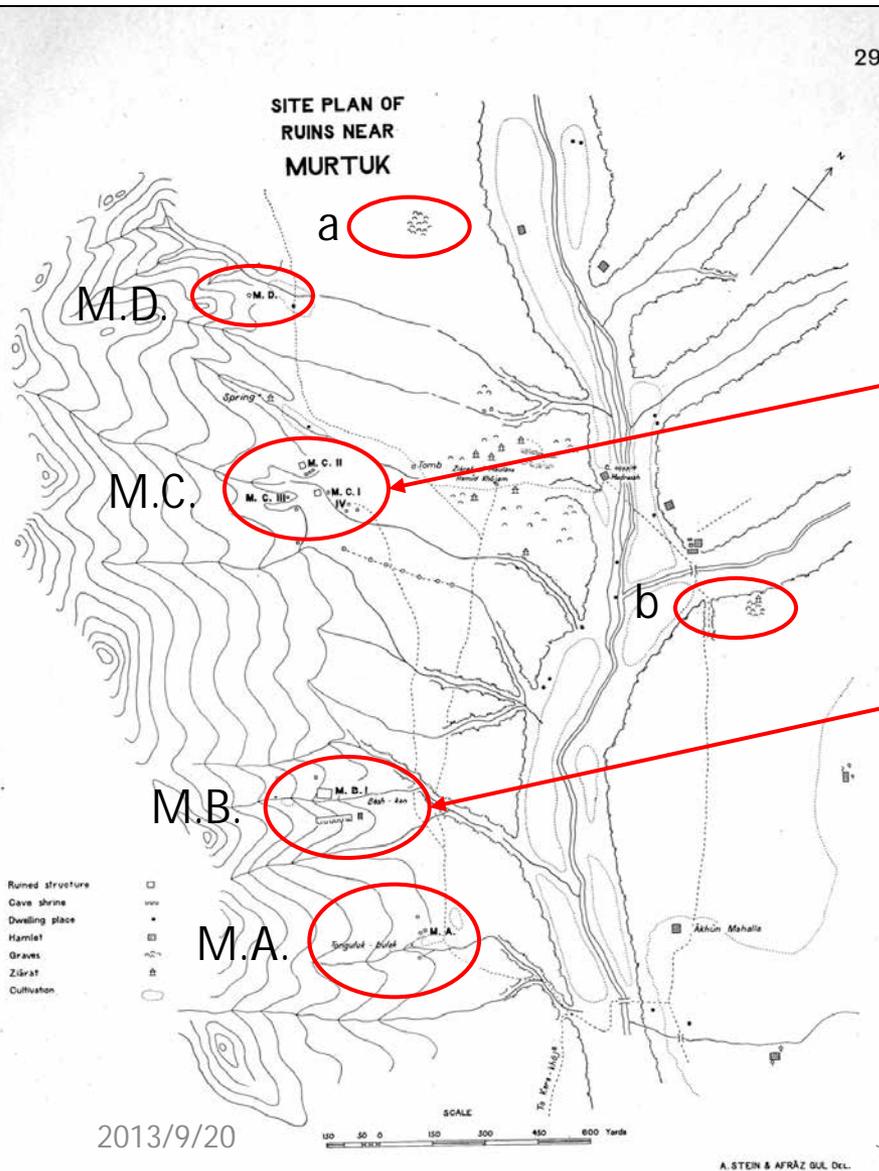
2009 Google 16

圖像取得日: 2005年6月29日

42° 58' 55.00" N, 89° 31' 28.04" E

高度: 8654.21 m

# 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.

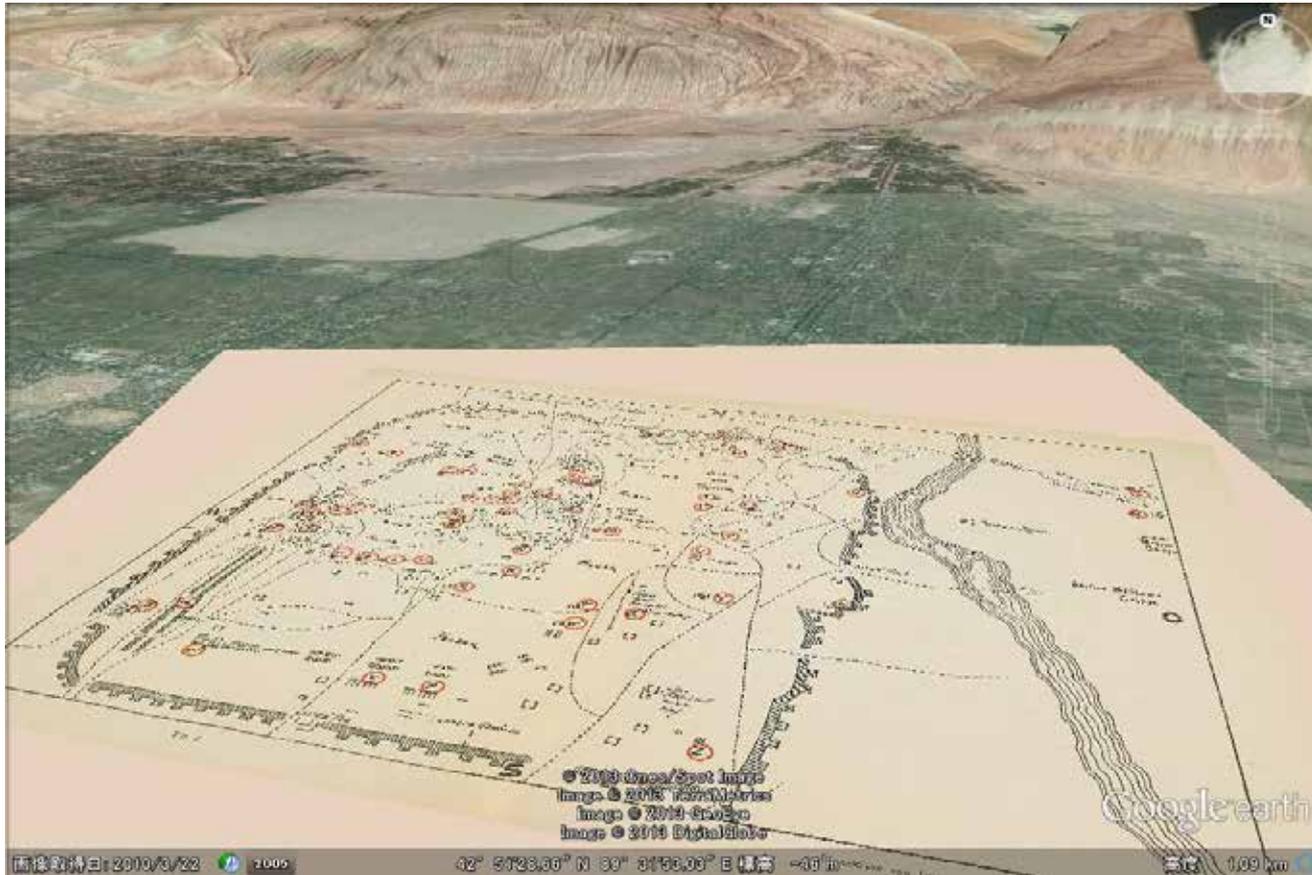
Murtuk Ruins (M. B. I)



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

Murtuk Ruins (Ruined Shrine M. C. I)

# 3. Grünwedel Map (Gaochang)



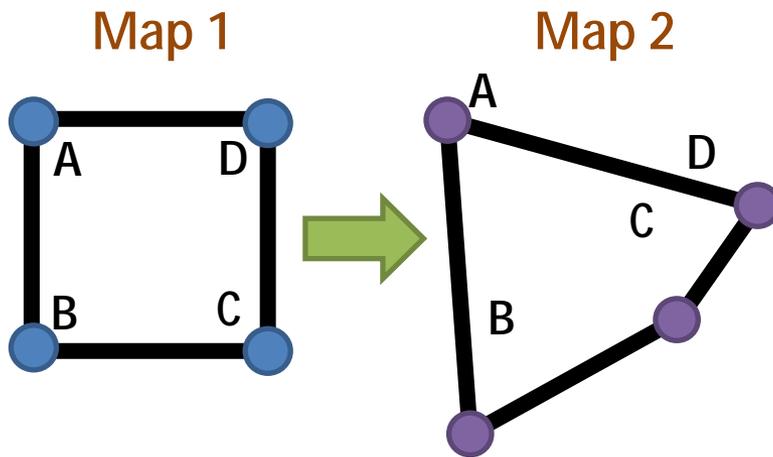
How to use the previously “untrusted” map?



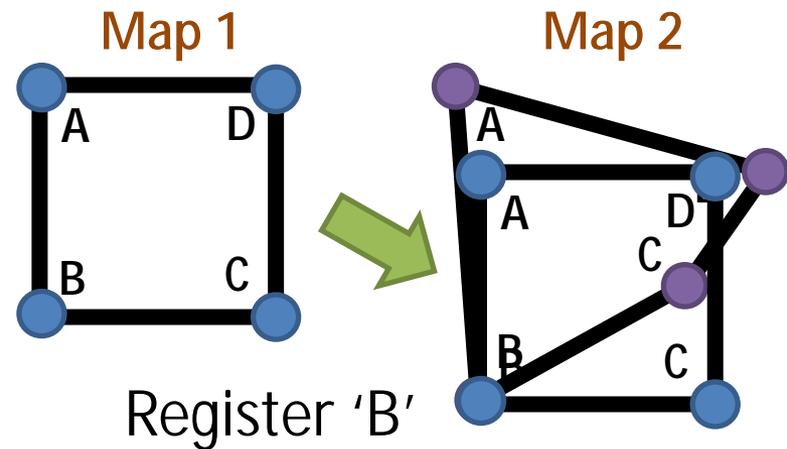


# Two Methods for Map Registration

## Geometric Correction



## Single-Point Registration



- All points are registered.
- Shapes are distorted.

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

# Mapping (Map+Pinning)

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

The screenshot shows the 'MAPPING' website interface. At the top left, the title 'MAPPING' is displayed with a red pin icon, followed by the subtitle 'Interactive georeferencing by pinning old maps'. Below this is a breadcrumb trail: 'Digital Silk Road > Database of Ruins in Silk Road > Mapping'. The main area is a topographic map of the Turfan region in Xinjiang, China. A blue pin is placed on the site of Kara-khoja. A white popup window is open over the pin, containing the following information: 'kara-khoja', 'Registrant:yoko', 'Location:42.831,89.464', 'Error:-0.02,-0.064', '5.69km', and '高昌故城'. The map includes various geographical features, place names, and a scale bar at the bottom left. The website's navigation and utility elements are visible at the top and right.

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

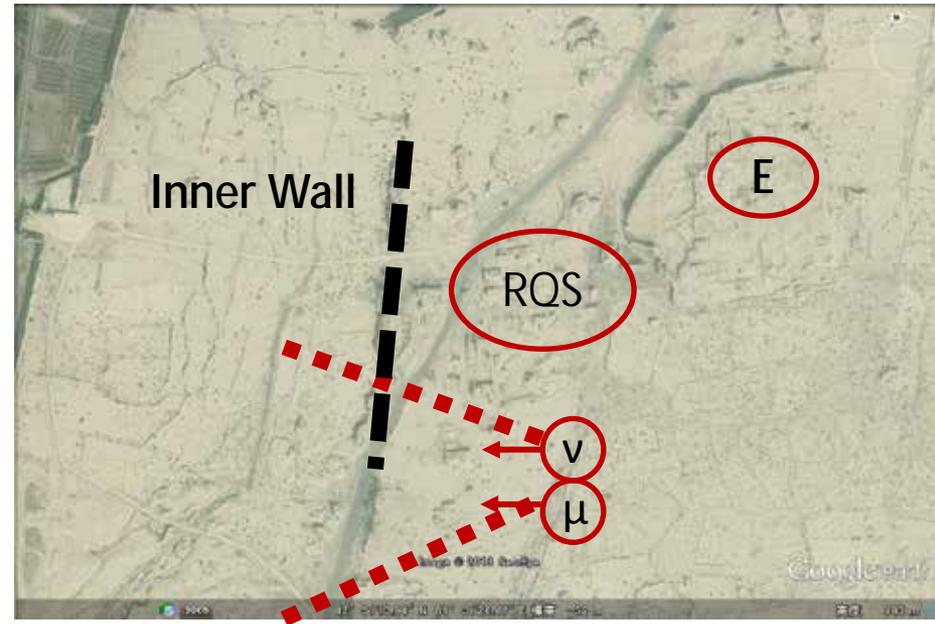
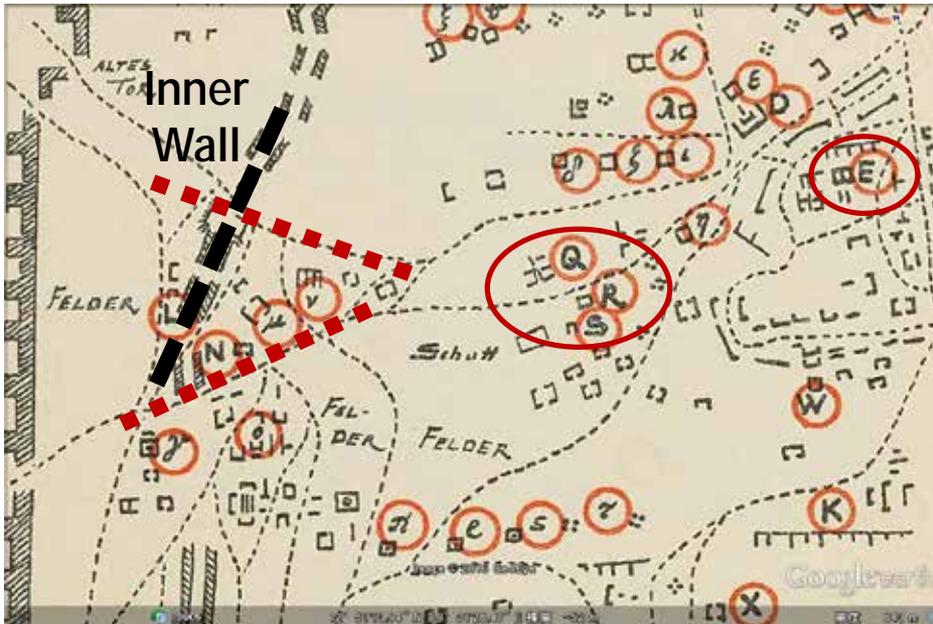
Map Satellite

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



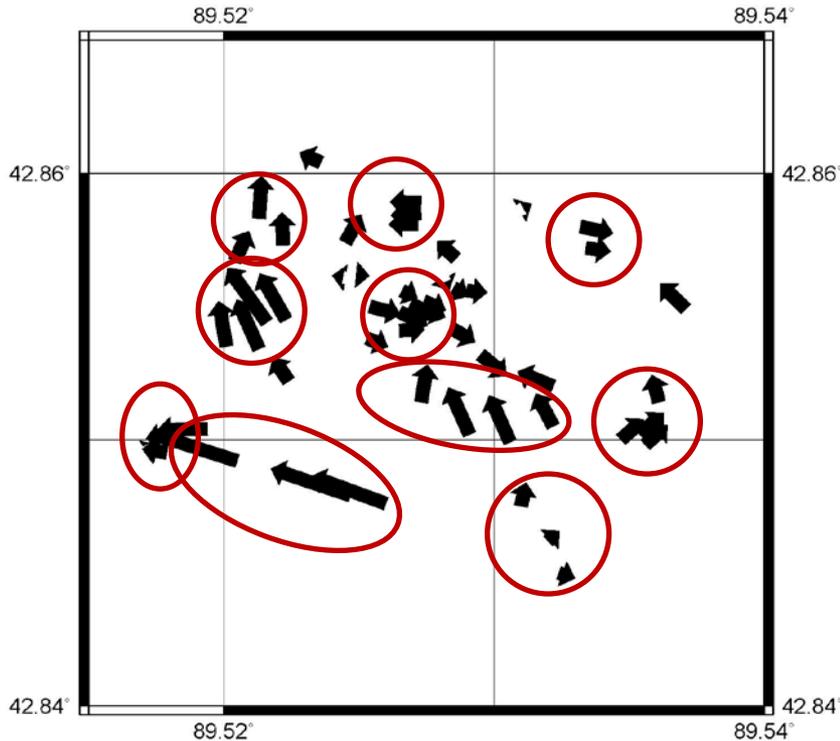
Where is  $v$  and  $\mu$ ?  
We have multiple candidates...

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

Hypothesize the location of  $v$  and  $\mu$  (to be verified later).

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

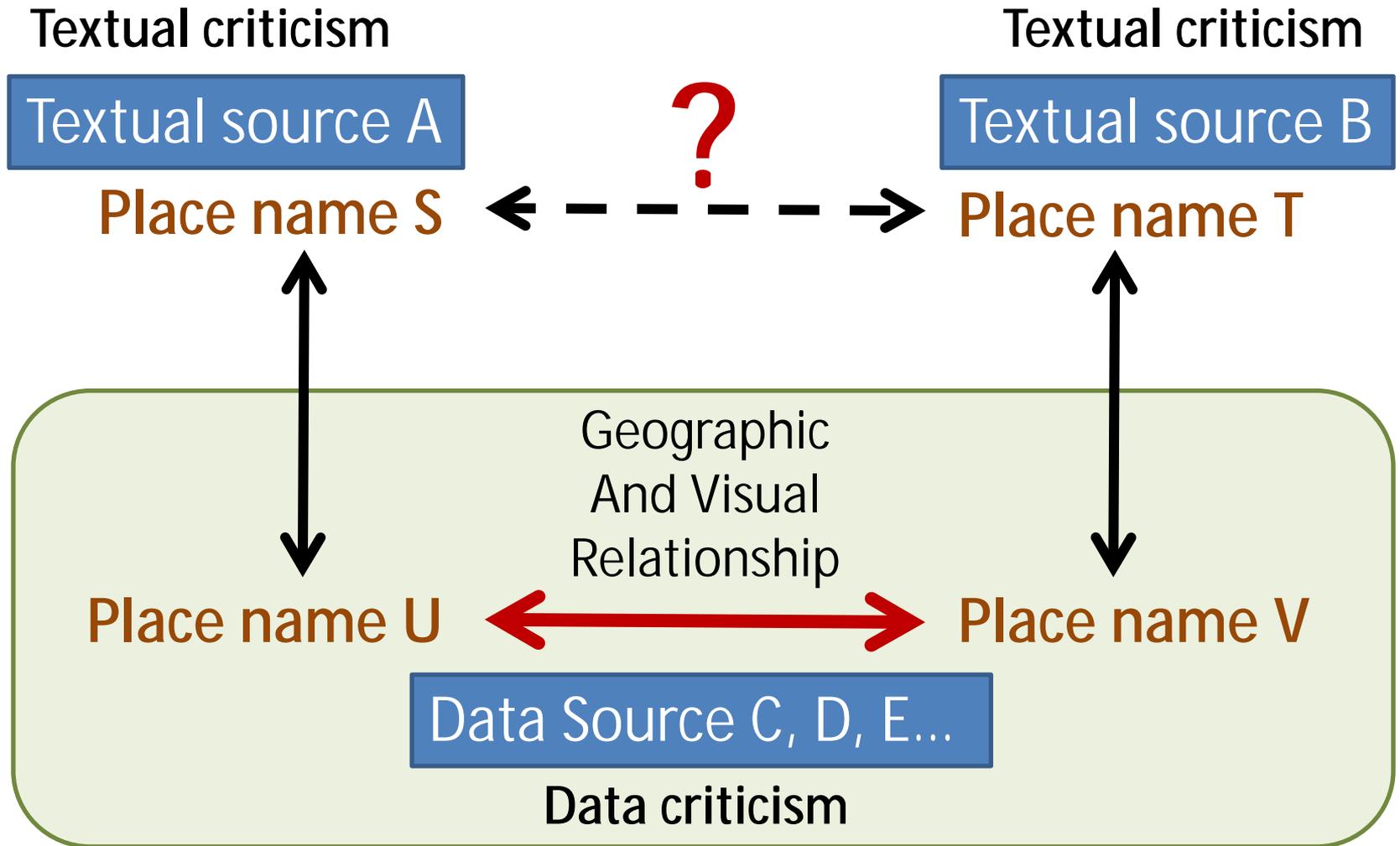
# Error Distribution in Gaochang



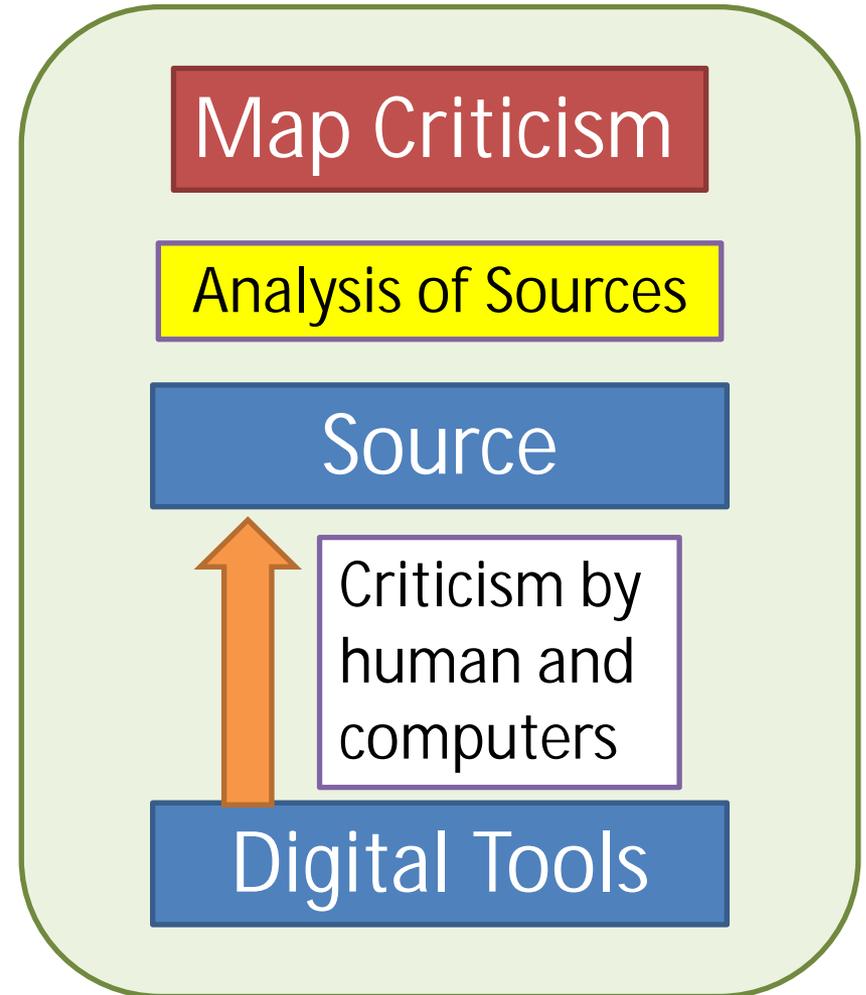
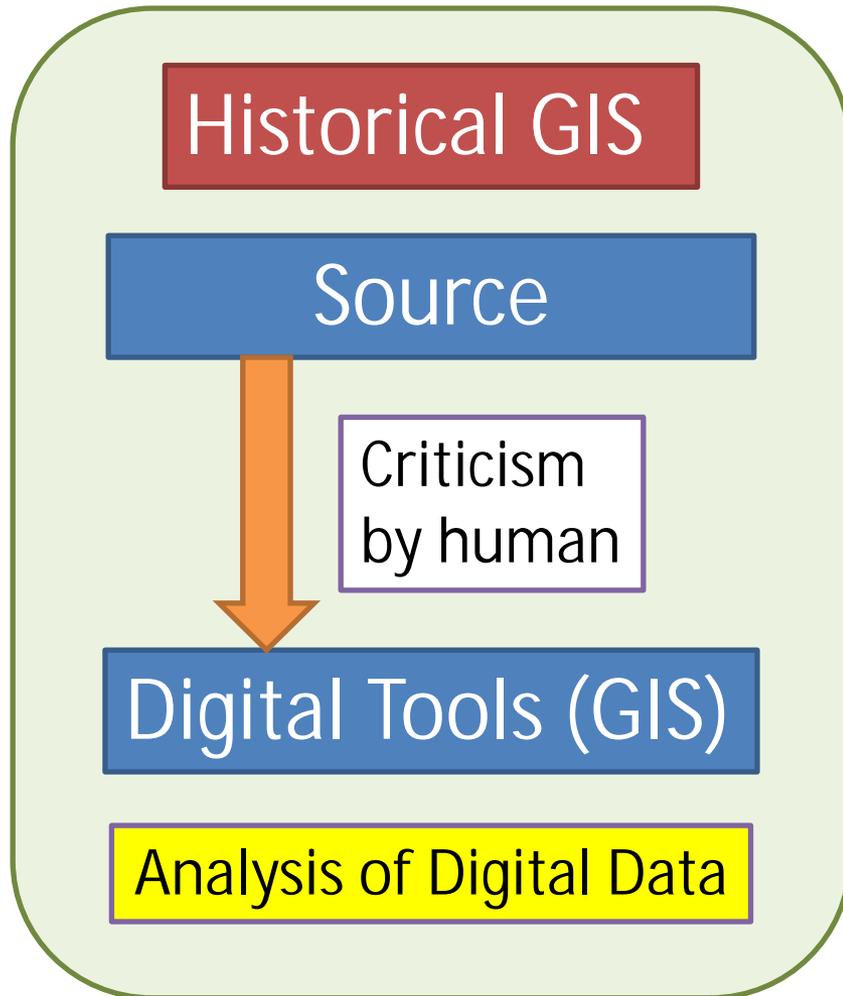
- Composed of several regions with different error patterns.
- Grouping may be related to the table of contents.
- “Topology” is the key for reasonable interpretation.



# Linking Entities Across Sources



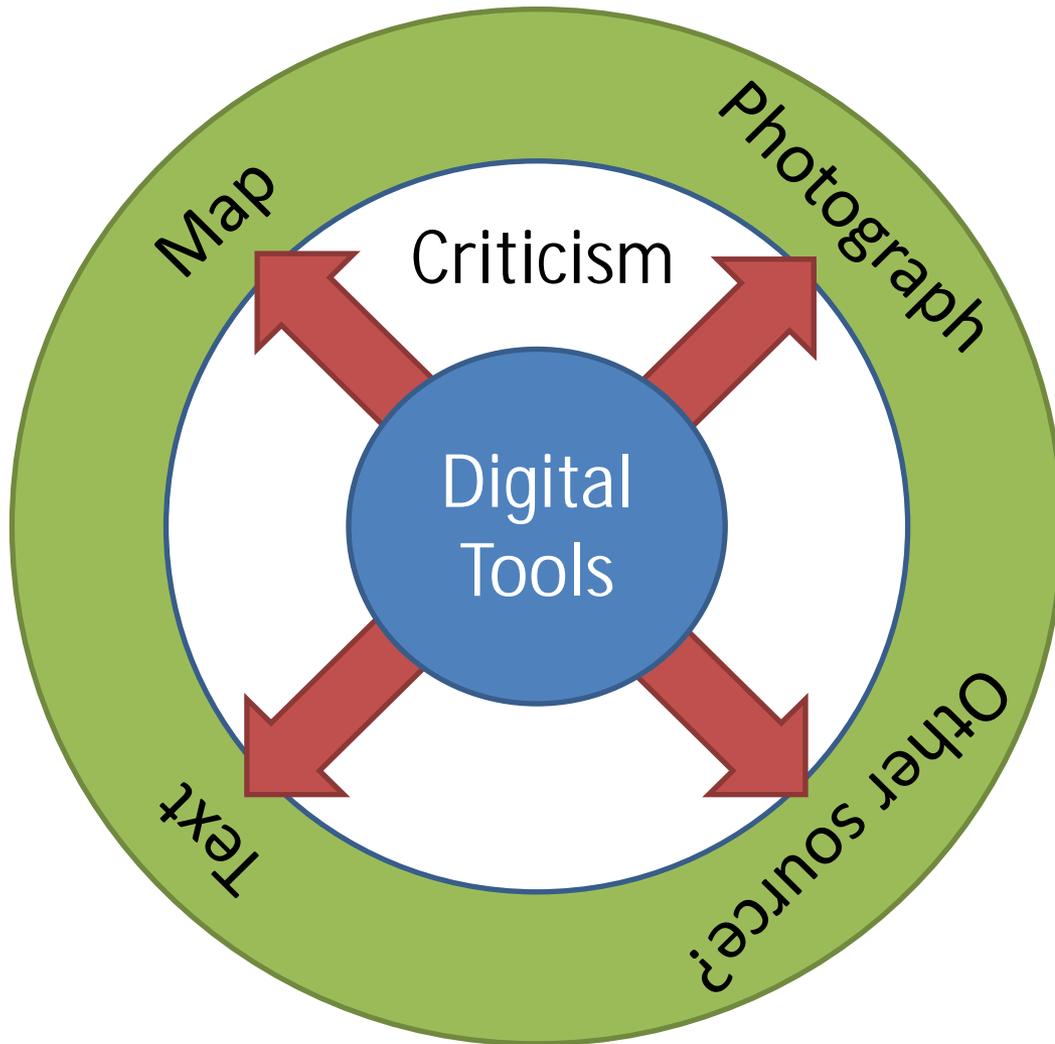
# Historical GIS and Map Criticism



# 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



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- 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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