Uncovering the Ancient Silk Road from the Dunhuang Manuscripts by Using Satellite RS and GIS

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1. Background
Silk Road and Dunhuang Manuscript
Silk Road: An International traffic route in ancient
Dunhuang Manuscripts (敦煌遗书)

《沙州都督府图经卷第三》影印本，编号P.2005.详细记录了今天敦煌到瓜州的烽驿系统

were discovered in the Mogao Caves of Dunhuang in AD1900, and now collected in the National Library of France, Code No.: P.2005
The medieval royal road to Dunhuang

Distribution of courier stations from Guazhou to Shazhou (Ancient Dunhuang). Red marks around the double-headed arrows indicate the distance traveled between one station and its neighbor based on Dunhuang Manuscript P.2005 (unit: Chinese li).
2. Method
Satellite Remote Sensing and GIS
Abstract and digitize the historic records and census data

Distance traveled and direction matrix of the CSs (unit: Chinese li).

<table>
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<th>CLY</th>
<th>JTY</th>
<th>GCY</th>
<th>CTY</th>
<th>BTY</th>
<th>HJY</th>
<th>QQY</th>
<th>Shazhou</th>
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<td>(130, -2)</td>
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<td>(40, -2)</td>
<td>(0, 0)</td>
<td>(0, 0)</td>
<td>(0, 0)</td>
</tr>
</tbody>
</table>

Shazhou | (200, -2) | (170, -2) | (145, -2) | (120, -2) | (80, -2) | (60, -2) | (40, -2) | (0, 0)  |

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Diagram showing the distance traveled and direction matrix.
• Remote sensing data

1. Data support: multi-plat multi-resolution multi-sensor

   WV-2——VHR Image——Weak & Hidden Signal ;

   ZY-3 (Resources satellite 3)——HR & Swath Width——Special features: Han Great Wall
   LS-7——Multi Spectral Information——paleochannels、vegetation

2. Techniques Support: Digital image processing
   Pan-Sharpening、Edge-detection、Segmentation、Vegetation Indices、Classification、Principal component analysis、Band math
GIS spatial analysis

Data

a) Historic Records
b) Dunhuang Manuscripts P.2005, P.5034
c) 3rd National Census Data

Buffer

c) 0-500 m
b) 500-1000 m
d) 1000-1500 m

d) Overlay

GIS spatial analysis
3. Results

New Discoveries and Field Work
New Discoveries—— Site 1

Located on the eastern margin of the Xishawo Desert.

This site is approximately 3.2 km from the Han Great Wall.

From the WV-2 VHR image of the prospective sub-area, a square-shaped mark can be seen, situated north of a pale channel.

Each side of the suspected spot was measured at ~43 m long.
New Discoveries——Site 2

Located on the northern margin of the Xishawo Desert, about 20.1 km northwest of the Ancient Bazhou ruins.

This northwestern city site is ~6.3 km from Site 1 of Lucaogou.

From the WV-2 VHR image of the prospective sub-area, an incomplete rectangular-shaped mark can be seen approximately 3 km south of the Han Great Wall, situated north of a paleochannel.
New Discoveries—— Site 3

Located on the northern margin of the Xishawo Desert, about 21.2 km northwest of Ancient Bazhou ruins.

The site of this northwestern city is ~1.3 km from “Site 2 of Lucaogou”.

From the WV-2 VHR image of the prospective sub-area, an incomplete rhombic-shaped mark can be seen approximately 2 km south of the Han Great Wall.
4. Conclusions

Medieval Royal road to Dunhuang
甘草(Gancao) has grown around Gancao CS 1000 years ago. According to the P.2005, the Gancao CS is 3km south of the Great Wall and is 13.5km northwest of the Jieting CS. Today's distance from Gancao CS to Jieting CS is 13.5km along the paleoriver. Good fitting. The Licorices have grown around Gancao CS 1000 years ago. "甘草(Gancao)" indicates "Licorice".
Site 2, 3 → Changting Courier Station 长亭驿

Changting CS beside the Changting Beacon

According to the P.2005, the Changting CS is 13.5 km west of the Gancao CS. Today's distance is 13 km from Changting CS to Gancao CS along the edge of the desert.

中记载：长亭驿，西南距沙州城120唐里，东去甘草驿25唐里，置于长亭烽之下，因烽为号。
Reconstructing the royal road to Dunhuang

Reconstruction of the royal road system to medieval Dunhuang on Landsat ETM + images
South stations of Tang Dynasty from Guazhou to Shazhou have been unlocking by previous studies (Li B C, 1993; Li Z Y, 2008):

(瓜)州城驿——悬泉堡——鱼泉驿——黄谷驿——空谷驿——无穷驿——
其头驿——东泉驿——(沙)州城驿

—Public: Where are the North stations?
—RADI: Follow me, you will get the answer.
South:
(瓜)州城驿——悬泉堡——鱼泉驿——黄谷驿——空谷驿——无穷驿——
其头驿——东泉驿——(沙)州城驿

North:
(瓜)州城驿——悬泉堡——常乐驿——阶亭驿——甘草驿——长亭驿——
白亭驿——横涧驿——清泉驿——(沙)州城驿
Thanks!

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