

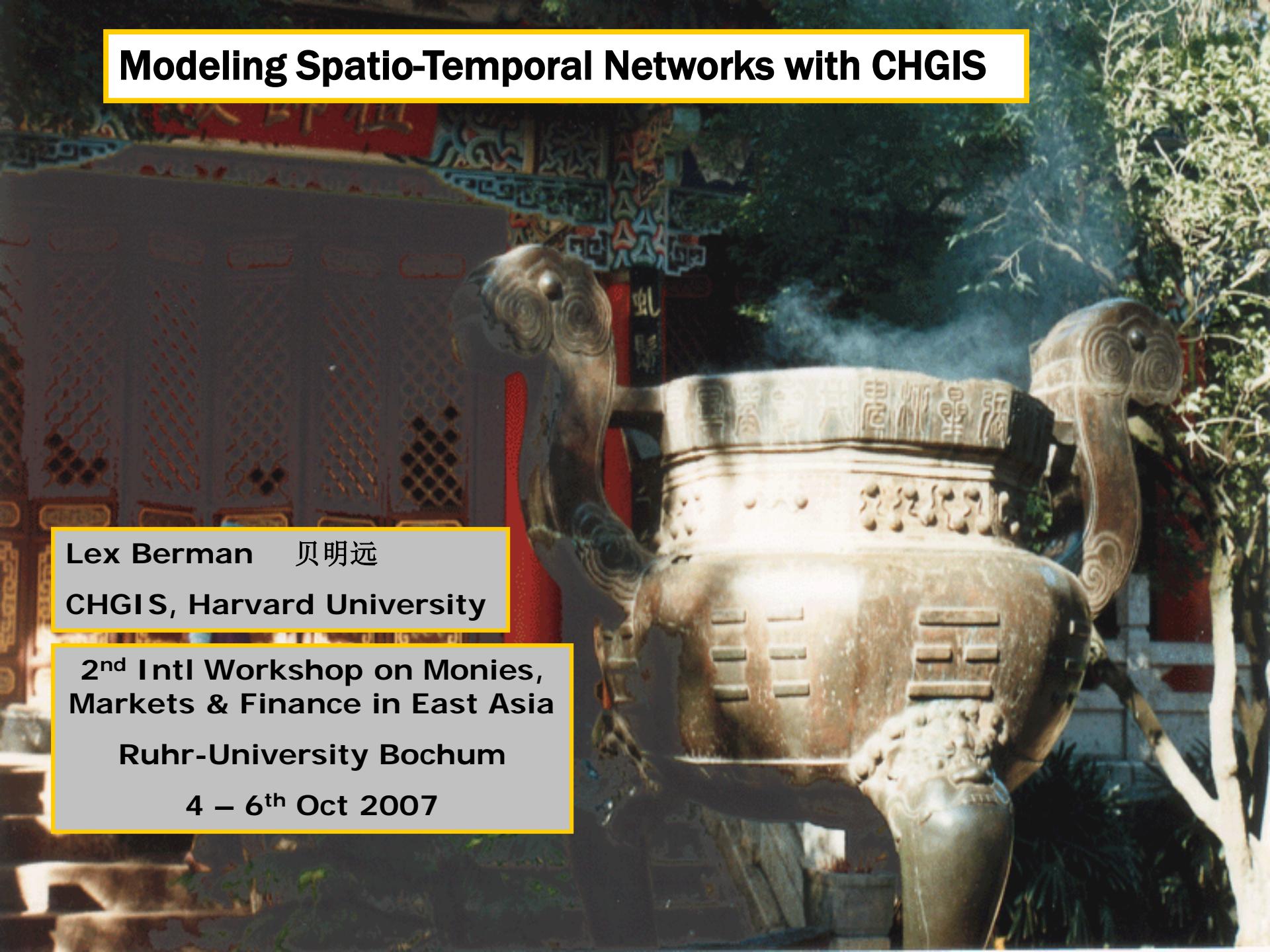
Modeling Spatio-Temporal Networks with CHGIS

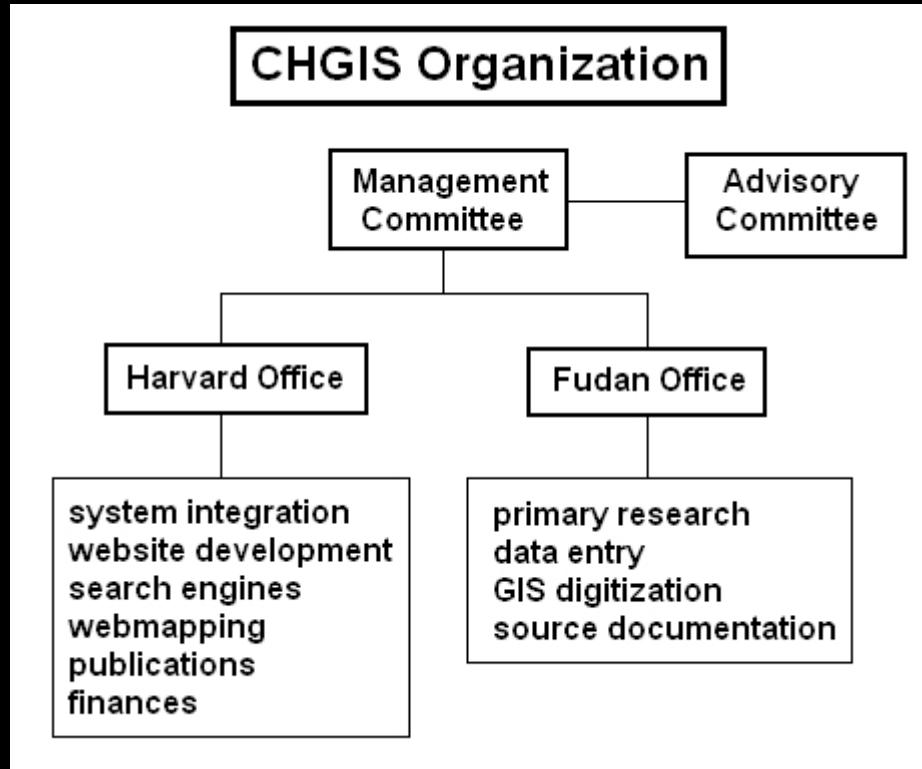
Lex Berman 贝明远
CHGIS, Harvard University

2nd Intl Workshop on Monies,
Markets & Finance in East Asia

Ruhr-University Bochum

4 – 6th Oct 2007





Funded By:

Henry R. Luce Foundation (2001 – 2004)

National Endowment for the Humanities (2005 – present)

placename

admin unit, populated place, natural feature, religious site, archaeological site, trade route, place where an event occurred, etc

feature type

city, village, mountain, temple, ruin, trade route, etc

footprint

latitude and longitude for each feature

valid date

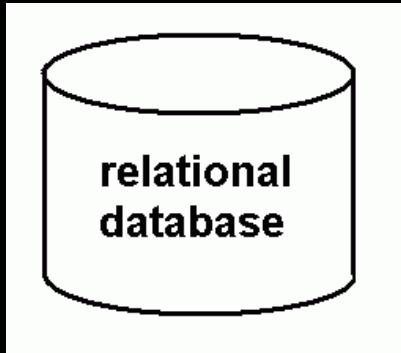
date or range of time for which this record is valid

source note

citation of data source, commentary on feature

core elements of a digital gazetteer

digital gazetteer



placename

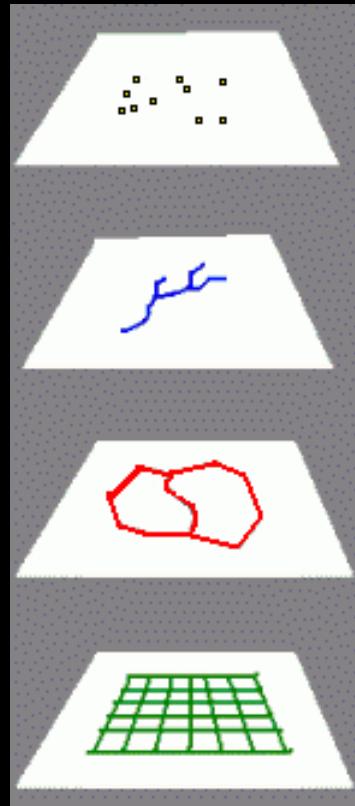
feature type

coordinates

valid date

source note

GIS layers



spatial objects

CHGIS = gazetteer database + GIS layers

秦始皇

222 BCE

清宣统

1911 CE



POINT Features:

- National Capitals
- Province Capitals
- Prefecture Capitals
- County Capitals
- Towns & Villages

POLYGON Features:

- National & Regime Boundaries
- Province Boundaries
- Prefecture Boundaries
- 1911 County Boundaries

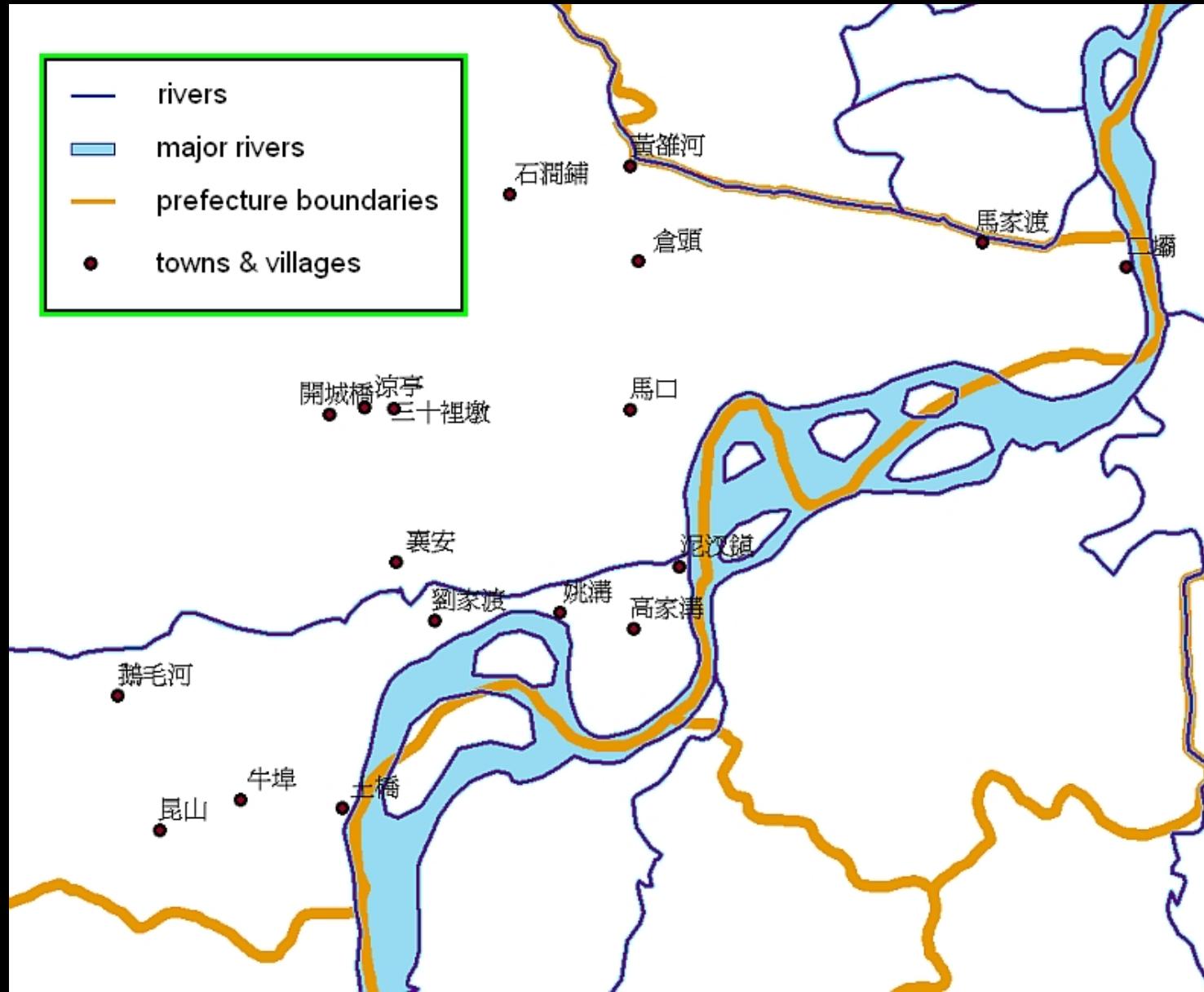
scope: a base GIS of Chinese admin divisions



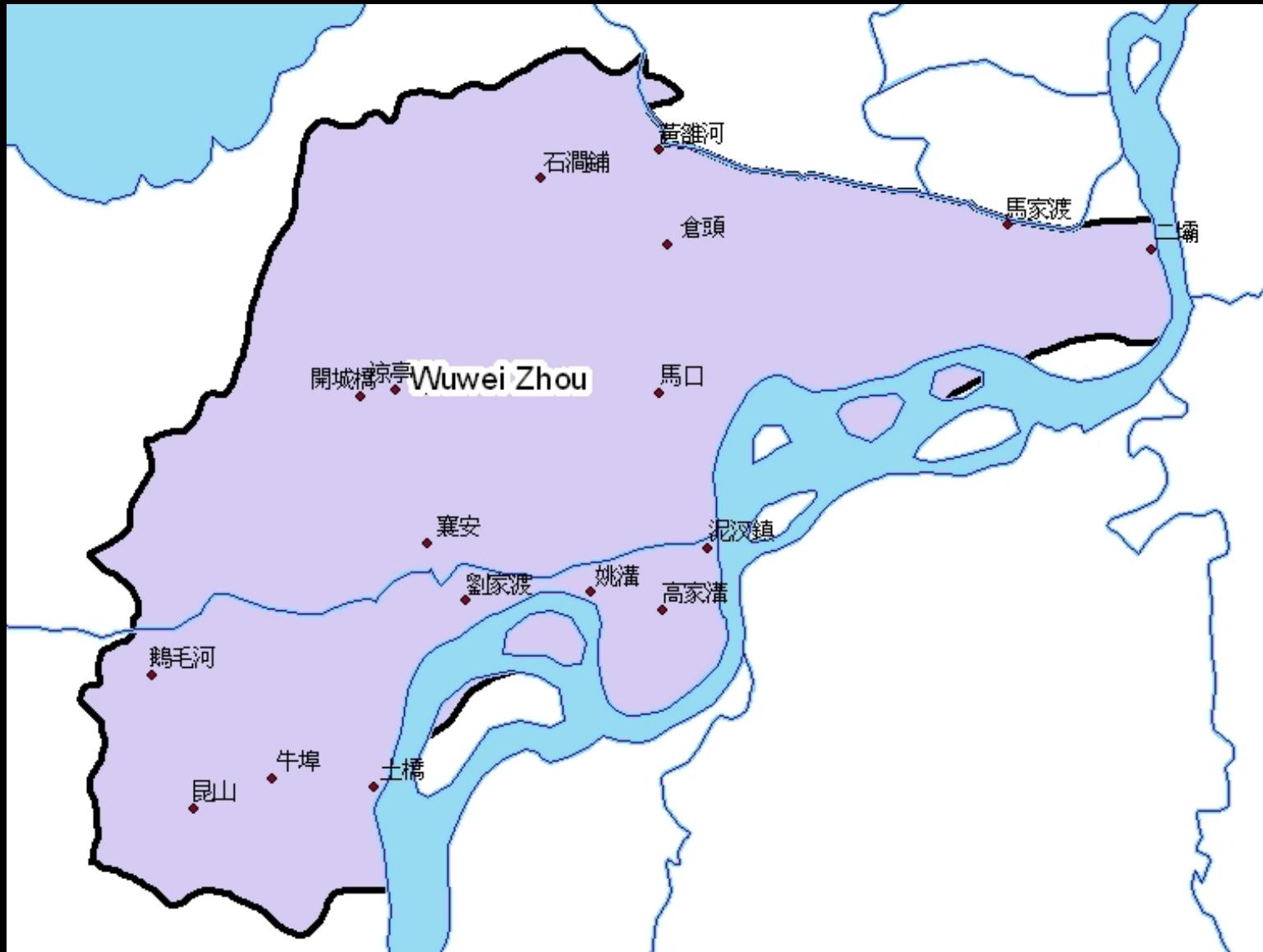
Reference layer: 1820 Qing Dynasty



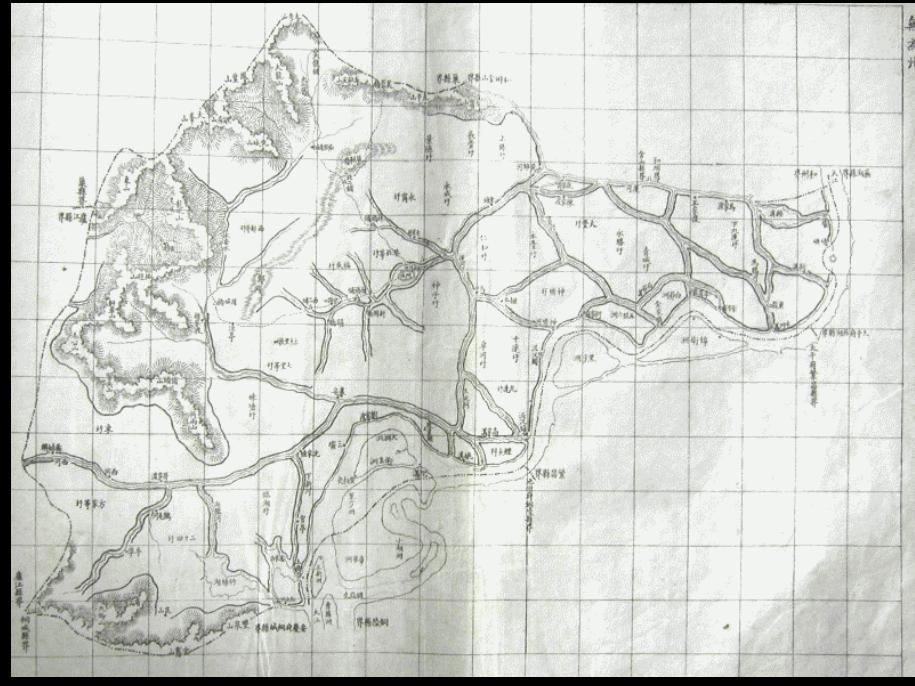
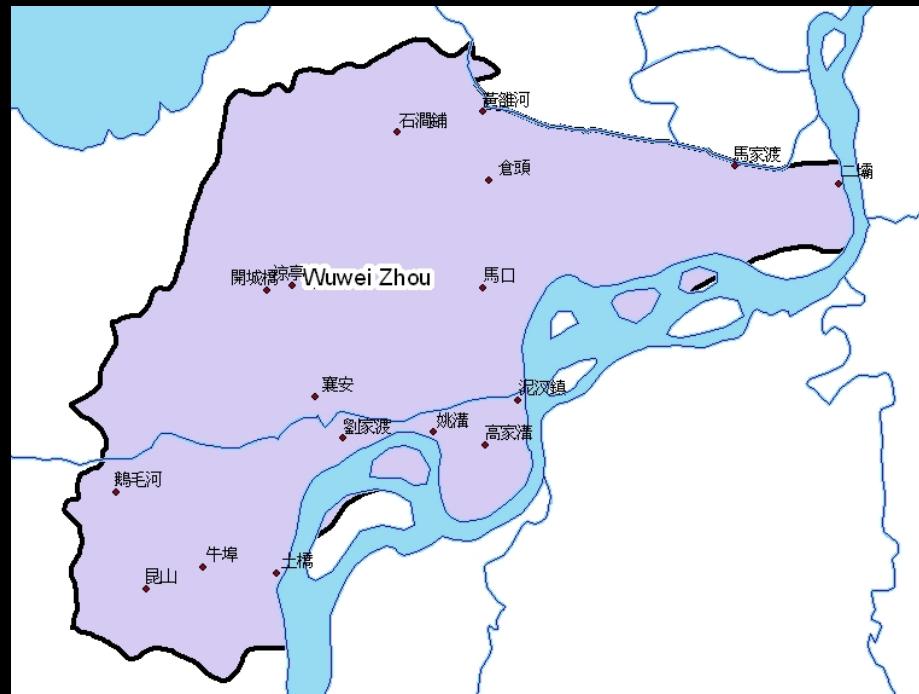
Digitization process: maps scanned



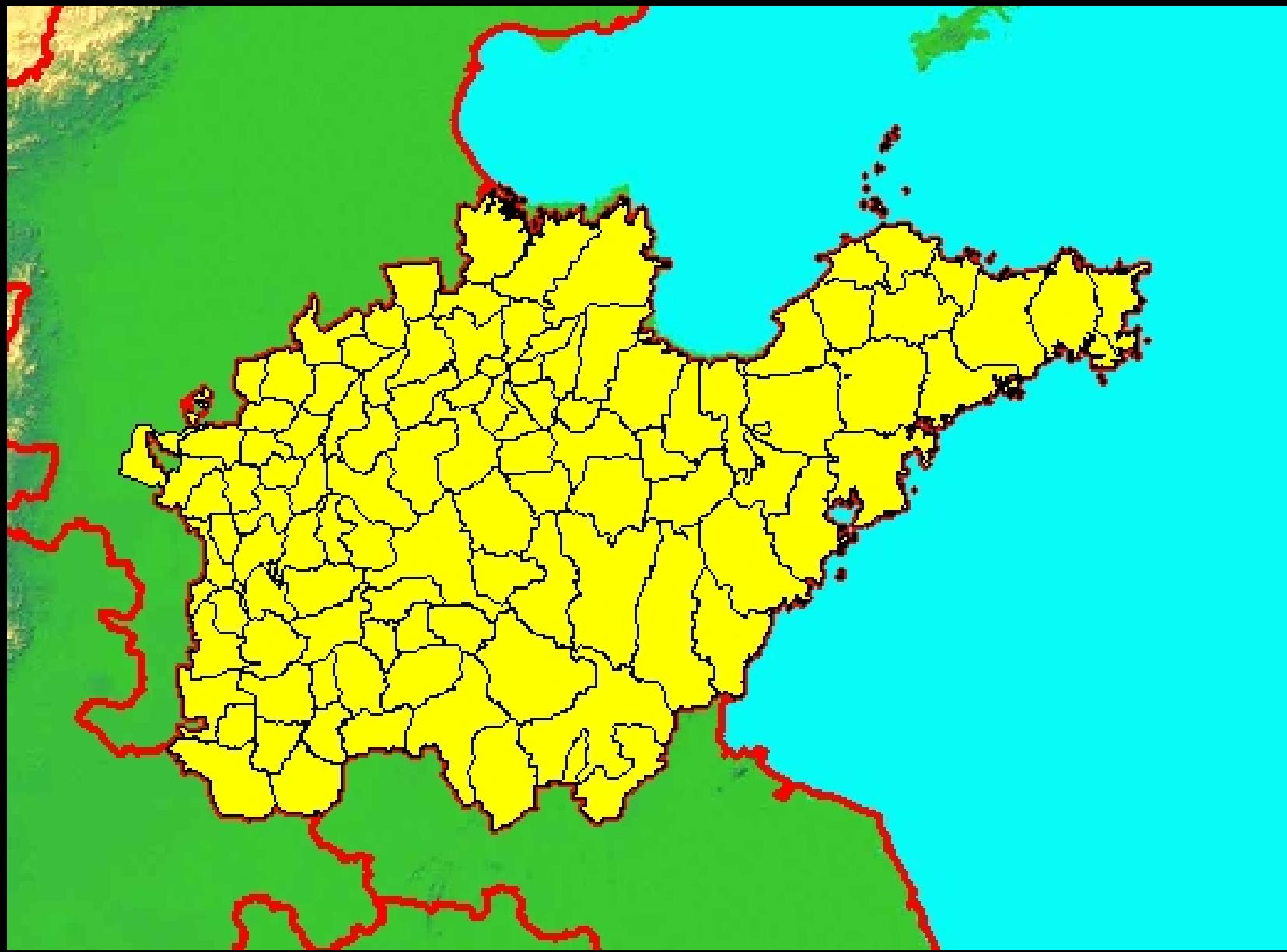
Digitization process: town points entered



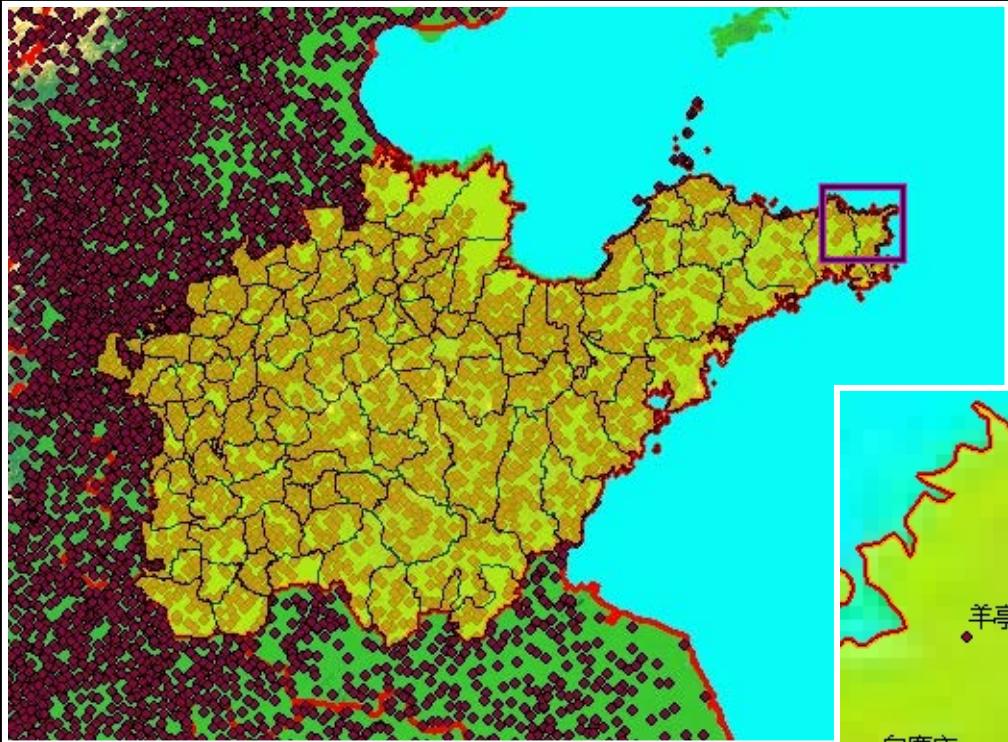
Digitization process: boundary entered



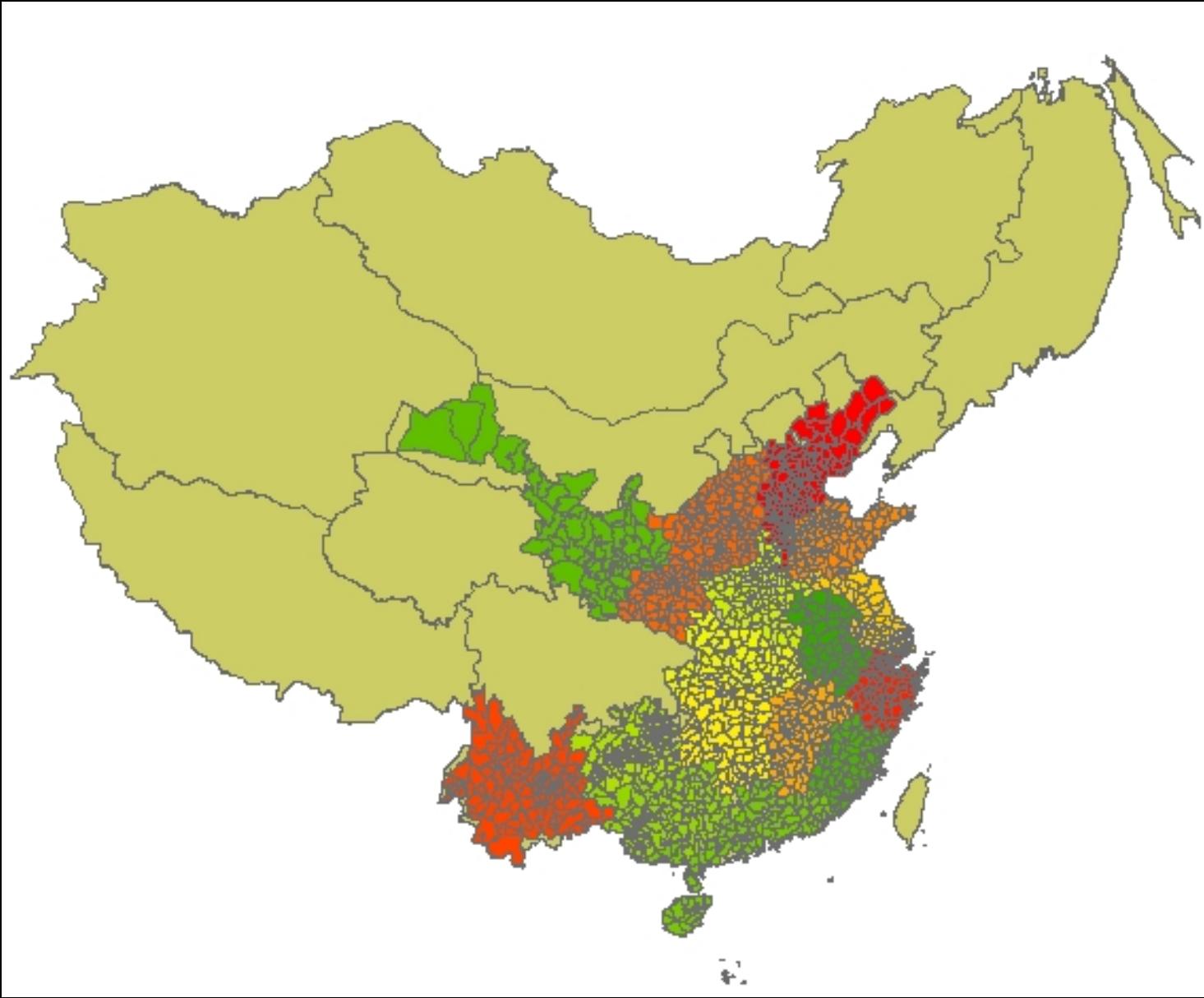
Comparison of historic map with CHGIS data



Example: Shandong 1911 county boundaries

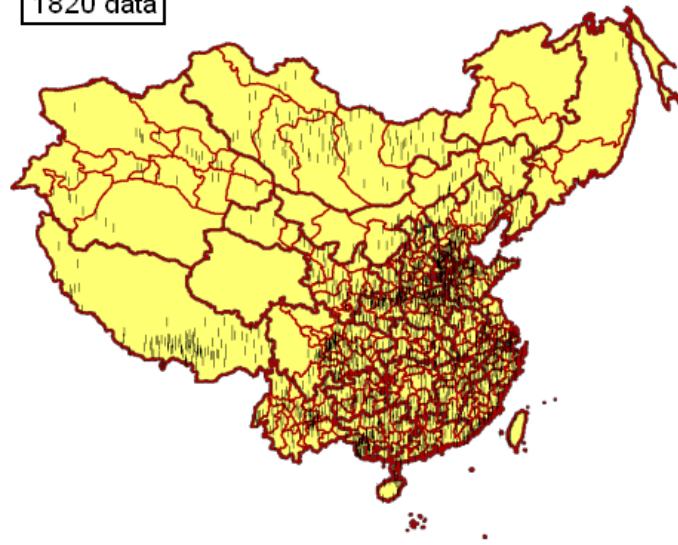


Example: Shandong with Town points

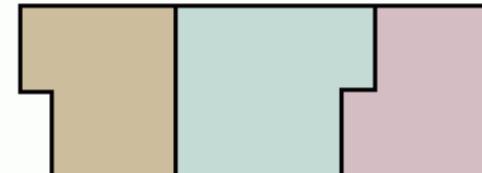
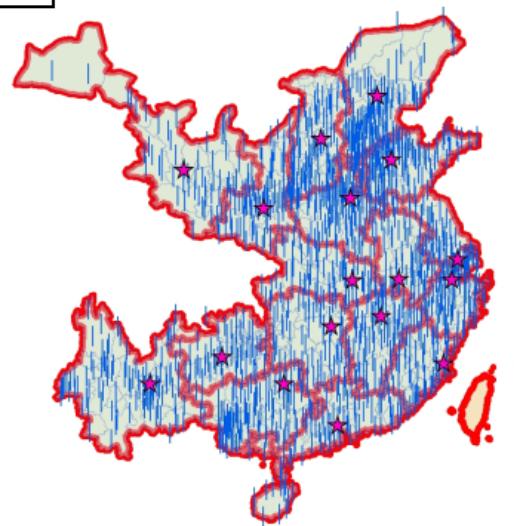


Currently complete 1911 county boundaries

1820 data



1911 data



time slice at time 16



time slice at time 11



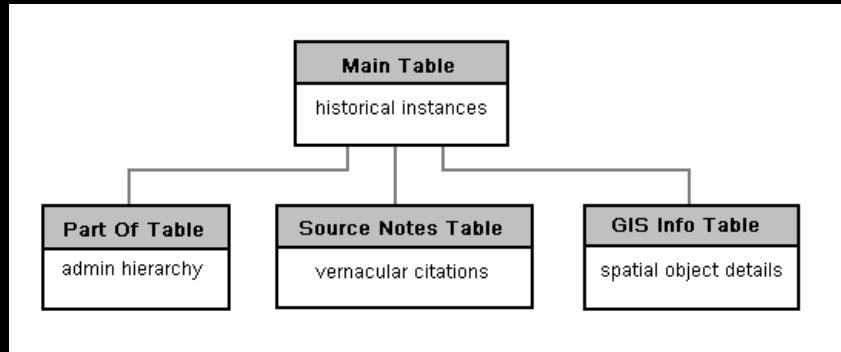
time slice at time 6



time slice at time 2

Time Slice data = specific year of validity

Data Model



Name Change

name_py	name_ft	beg_chg_type	end_chg_type	beg_yr	end_yr
Chongde Xian	崇德縣	更名	更名	1369	1661
Shimen Xian	石門縣	更名	数据下限	1662	1911

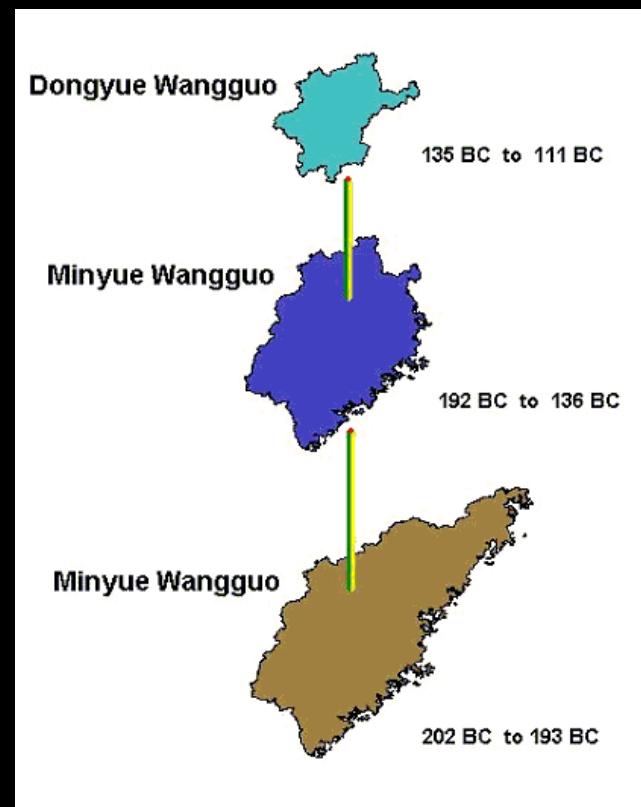
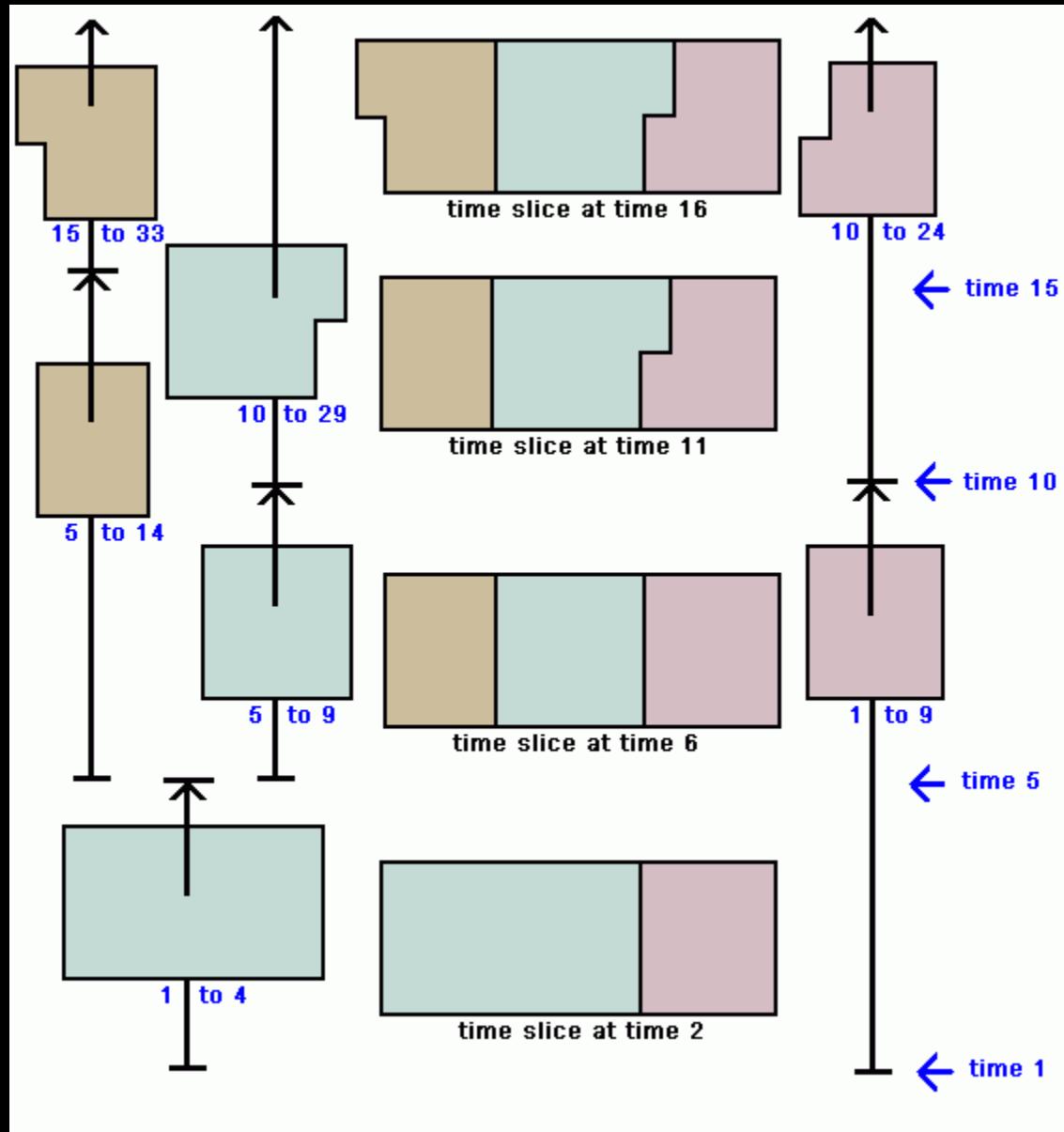
Unit Change

name_py	name_ft	beg_chg_type	end_chg_type	beg_yr	end_yr
Chongde Xian	崇德縣	新建	更名	939	1294
Chongde Zhou	崇德州	更名	更名	1295	1368
Chongde Xian	崇德縣	更名	更名	1369	1661

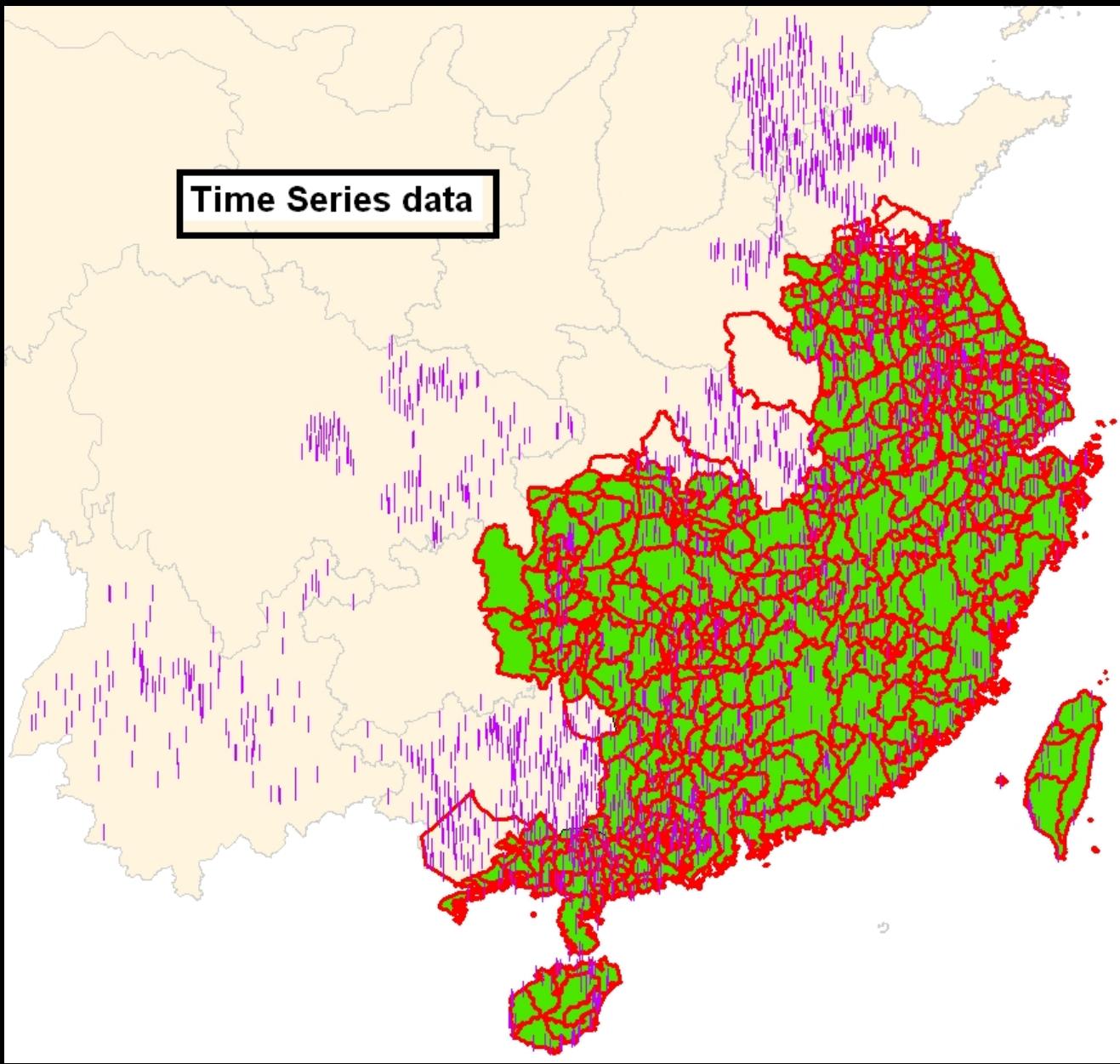
Location Change

name_py	name_ft	beg_chg_type	end_chg_type	beg_yr	end_yr
Lin'an Xian	臨安縣	更名	迁移治所	978	1261
Lin'an Xian	臨安縣	迁移治所	数据下限	1262	1911

Time Series = instances with ranges of time

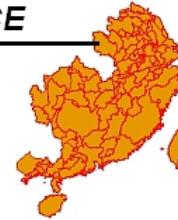


Time Series in GIS layers



Time Series current progress

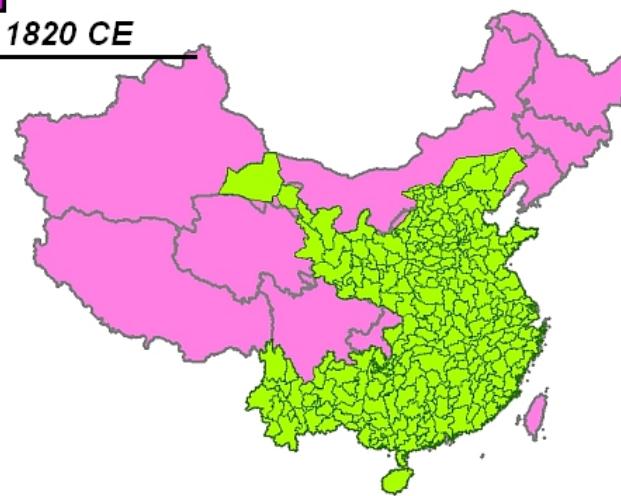
 222 BCE to 1911 CE



 1911 CE



 1820 CE



CHGIS – Version 4 datasets

大清一統志

Da Qing yitongzhi.

[Qing National Gazetteer]

中國①寺院

Yajima, Genryo. *Chugoku no ji'in.*

[Temples of China]

Tōhoku Daigaku Fuzoku Toshokan , 1966. [1941]

Buddhist temple gazetteer sources

崇聖寺

在太和縣西北蒼山十六峰之下。寺有七樓八殿三塔高十餘丈。凡十六級。唐開元中建今名三塔寺。

寺觀感通寺
詒菴製由天
文山詩凡十
年十二
十六入八
六峯中中
級之賜國
朝和太廟
唐下僧三
開寺無建
元有極明
中七鑄太
院十年廟
建碑祖相
今八山有傳
名殿門御漢
三三崇聖寺
塔塔摩騰高
宏聖十縣在
蘇太法之北
和蘭半

昭忠祠
正祠廟此
在按鄧人
本太郭川立
之耕種。唐
廟定北兵巡
嘉慶之民林
光庭建世傳
嘉靖間州兵
備趙州有蜀
波羅入灣村
蒙氏時有東
治東南

祠于仲伸至
鮮祀于仲伸
之。凡通大
懼。有征旱
設度祈禱輒
致書引咎。願
不聽儒生歸所
生。張州姓
儒生歸所浮
情懶所浮志
者沒於此後人
相傳家詔聞
仲立

三堂廟
建峯廟
在鄧川傳
建世傳在趙
州有蜀波羅
入灣村唐時
人唐時人

昭文祠
在太和縣
太和縣治東
南

正民人以兵
備副使林俊
立兵備道之。
三

三

卷	聖	寺
220	267	265
224 六峰	27 御行の北朝外	69 諸具治東
太和吳翁山十		
唐·開元中	宋·熙寧中	宋·政和。
今名·三慈寺。ヒ横八段三名あり。	明·洪武令里建	

今名、三塔寺。七樓八殿三塔あり	2270	崇聖寺
六峰	2274	大和県葛山十唐、開元中

Chugoku no ji'in (Yajima Index)

建今名三塔寺

在太和縣西北蒼山十六峰
之下。寺有七樓八殿三塔高
十餘丈。凡十六級。唐開元中

崇聖寺

今名三塔寺。七樓八殿三塔あり

崇

聖

寺

2220

224

六峰

大、和縣蒼山十

唐、開元中

Name:	崇聖寺
Temple ID:	2220
Site ID:	224
Location:	大和县苍山十六峰
Established:	唐开元中
Notes:	今名三塔寺，七楼八殿三塔

Comparison of contents - Yitongzhi & Yajima

223	麗江府
224	大理府
225	楚雄府
226	楚雄州
227	楚雄府
228	楚雄州
229	永昌府
230	武定州
231	元江州
232	鎮

224

大理府

2219

S

2229

)

site_id	site_ch	site_alt	site_rom	chgis_id
217	曲靖府	曲靖府	Qujing Fu	9757
218	临安府	臨安府	Linan Fu	9765
219	澄江府	澄江府	Chengjiang Fu	9760
220	广南府	廣南府	Guangnan Fu	9762
221	开化府	開化府	Kaihua Fu	9766
222	昭通府	昭通府	Zhaotong Fu	9747
223	普洱府	普洱府	Puer Fu	9767
224	大理府	大理府	Dali Fu	9753
225	楚雄府	楚雄府	Chuxiong Fu	9754

Name:	崇圣寺
Temple ID:	2220
Site ID:	224
Location:	大和县苍山十六峰
Established:	唐开元中
Notes:	今名三塔寺，七楼八殿三塔

georeferencing temple records, Yajima sites

child_id	child_rom	child_utf	child_utf	abeg_yr	end_yr	parent_utf	parent_rom	parent_id
1547	Langqiong Xian	浪穹县	浪穹縣	1820	1820	大理府	Dali Fu	9753
1553	Yunlong Zhou	云龙州	云龍州	1820	1820	大理府	Dali Fu	9753
1555	Yunnan Xian	云南县	云南縣	1820	1820	大理府	Dali Fu	9753
1556	Dengchuan Zhou	邓川州	鄧川州	1820	1820	大理府	Dali Fu	9753
1557	Binchuan Zhou	宾川州	賓川州	1820	1820	大理府	Dali Fu	9753
1558	Taihe Xian	太和县	太和縣	1820	1820	大理府	Dali Fu	9753
1623	Zhao Zhou	赵州	趙州	1820	1820	大理府	Dali Fu	9753
22347	Emaoding	鹅毛顶	鵝毛頂	1820	1820	大理府	Dali Fu	9753
22350	Shijing	师井	師井	1820	1820	大理府	Dali Fu	9753
22391	Liuku	六库	六庫	1820	1820	大理府	Dali Fu	9753
22408	Xiajiangzui	下江嘴	下江嘴	1820	1820	大理府	Dali Fu	9753
22409	Shangjiangzui	上江嘴	上江嘴	1820	1820	大理府	Dali Fu	9753
22411	Nuodengjing	诺邓井	諾鄧井	1820	1820	大理府	Dali Fu	9753
22412	Yunlongjiuzhou	云龙旧州	云龍舊州	1820	1820	大理府	Dali Fu	9753
22413	Fengyuxiang	凤羽乡	鳳羽鄉	1820	1820	大理府	Dali Fu	9753
22422	Caojian	曹涧	曹澗	1820	1820	大理府	Dali Fu	9753
22424	Shimenjing	石门井	石門井	1820	1820	大理府	Dali Fu	9753
22425	Laowo	老窝	老窩	1820	1820	大理府	Dali Fu	9753
22426	Jianganchang	箭杆场	箭桿場	1820	1820	大理府	Dali Fu	9753
22429	Xiaguan	下关	下關	1820	1820	大理府	Dali Fu	9753
22430	Shangguan	上关	上關	1820	1820	大理府	Dali Fu	9753
22431	Shi'erguansi	十二关司	十二關司	1820	1820	大理府	Dali Fu	9753
22433	Binjuzhai	宾居寨	賓居寨	1820	1820	大理府	Dali Fu	9753
22434	Midi	密滴	密滴	1820	1820	大理府	Dali Fu	9753
22435	Xizhou	喜洲	喜洲	1820	1820	大理府	Dali Fu	9753
22436	Midu	弥渡	彌渡	1820	1820	大理府	Dali Fu	9753
22437	Hongyan	红岩	紅巖	1820	1820	大理府	Dali Fu	9753
22440	Midian	米甸	米甸	1820	1820	大理府	Dali Fu	9753
22744	Shundangjing	顺荡井	順蕩井	1820	1820	大理府	Dali Fu	9753
22747	Dingxiling	定西岭	定西嶺	1820	1820	大理府	Dali Fu	9753

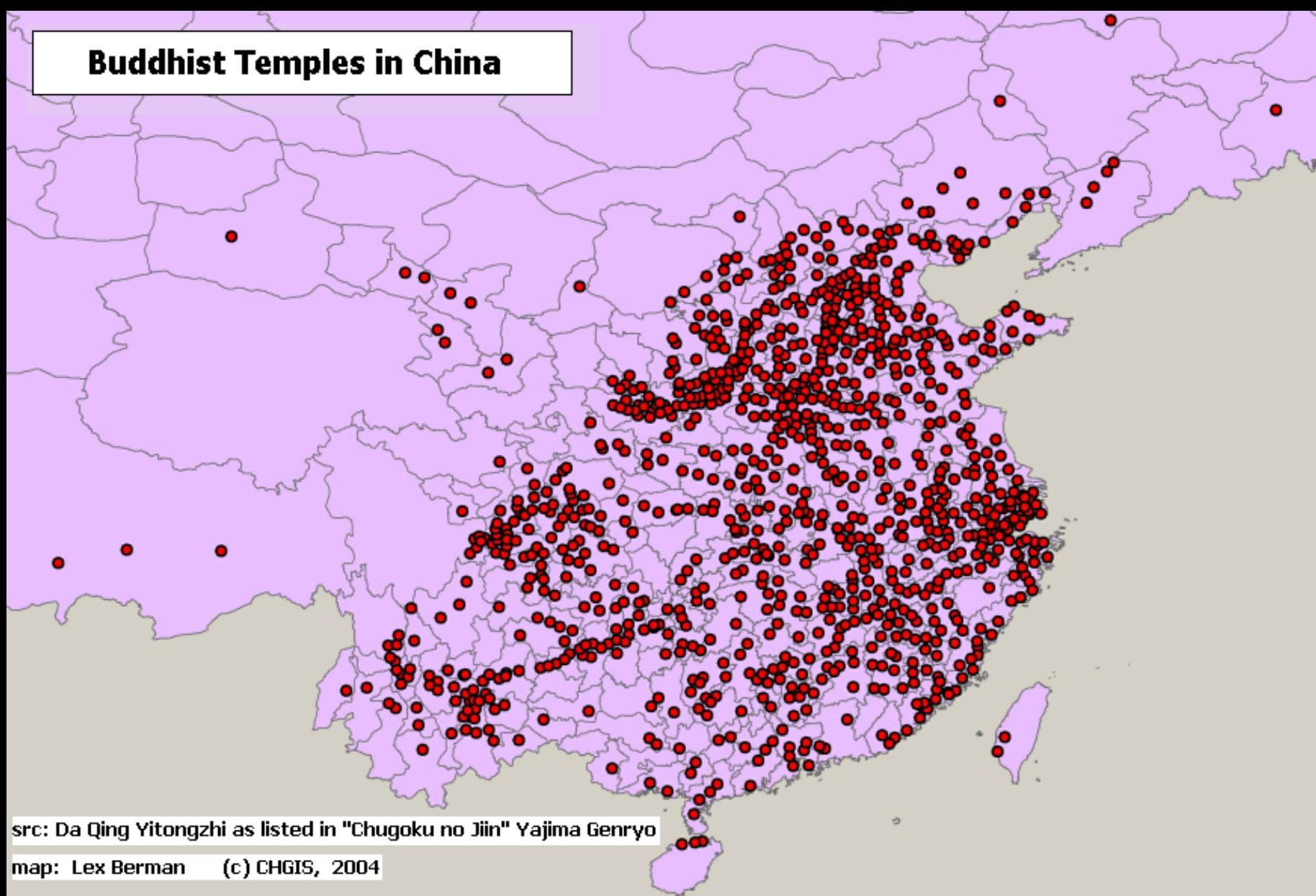
georeferencing temple records, CHGIS tables

Name:	崇圣寺
Temple ID:	2220
Site ID:	224
Location:	大和县苍山十六峰
Established:	唐开元中
Notes:	今名三塔寺，七楼八殿三塔



georeferencing temple records, map view

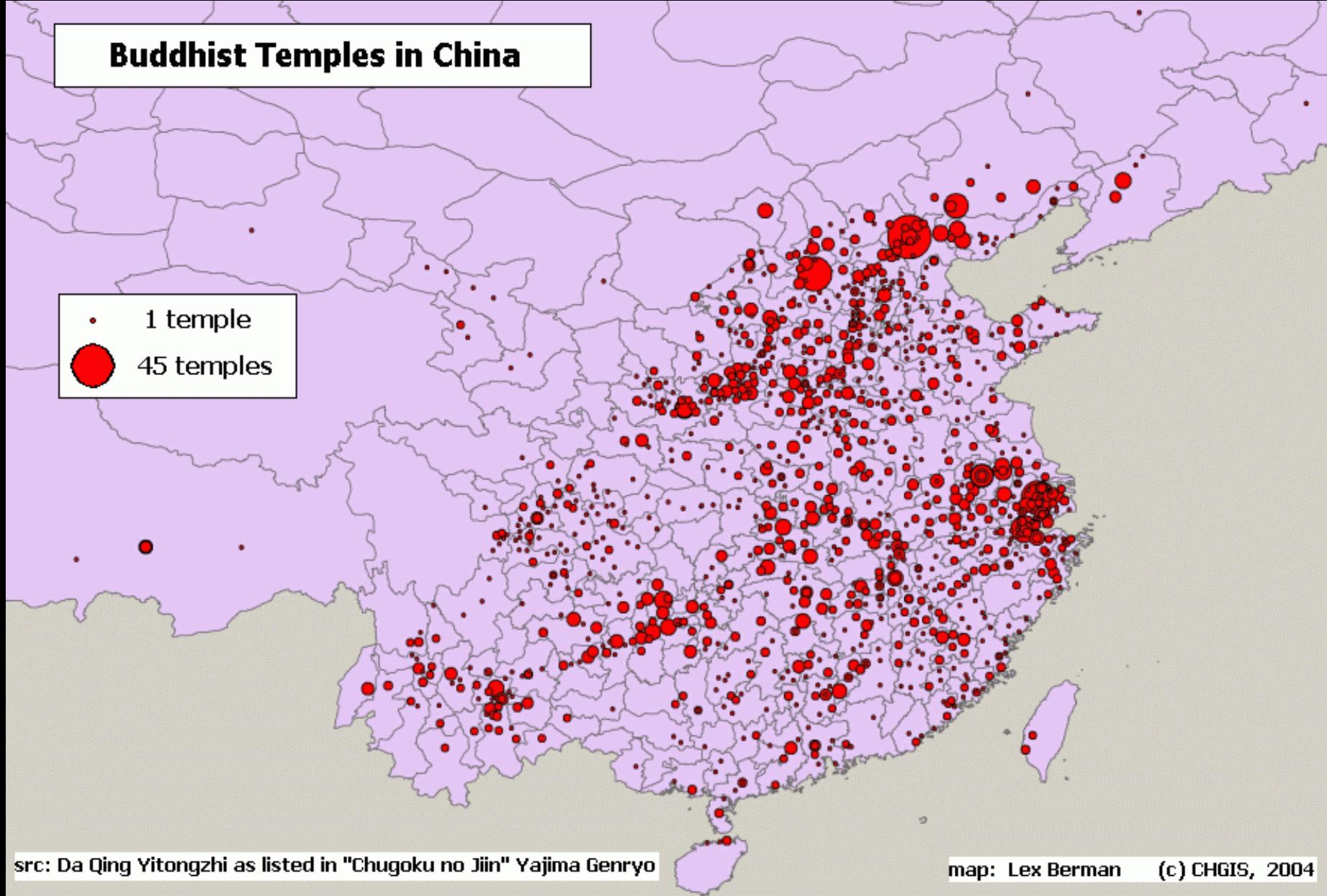
Buddhist Temples in China



overview of temple locations

Buddhist Temples in China

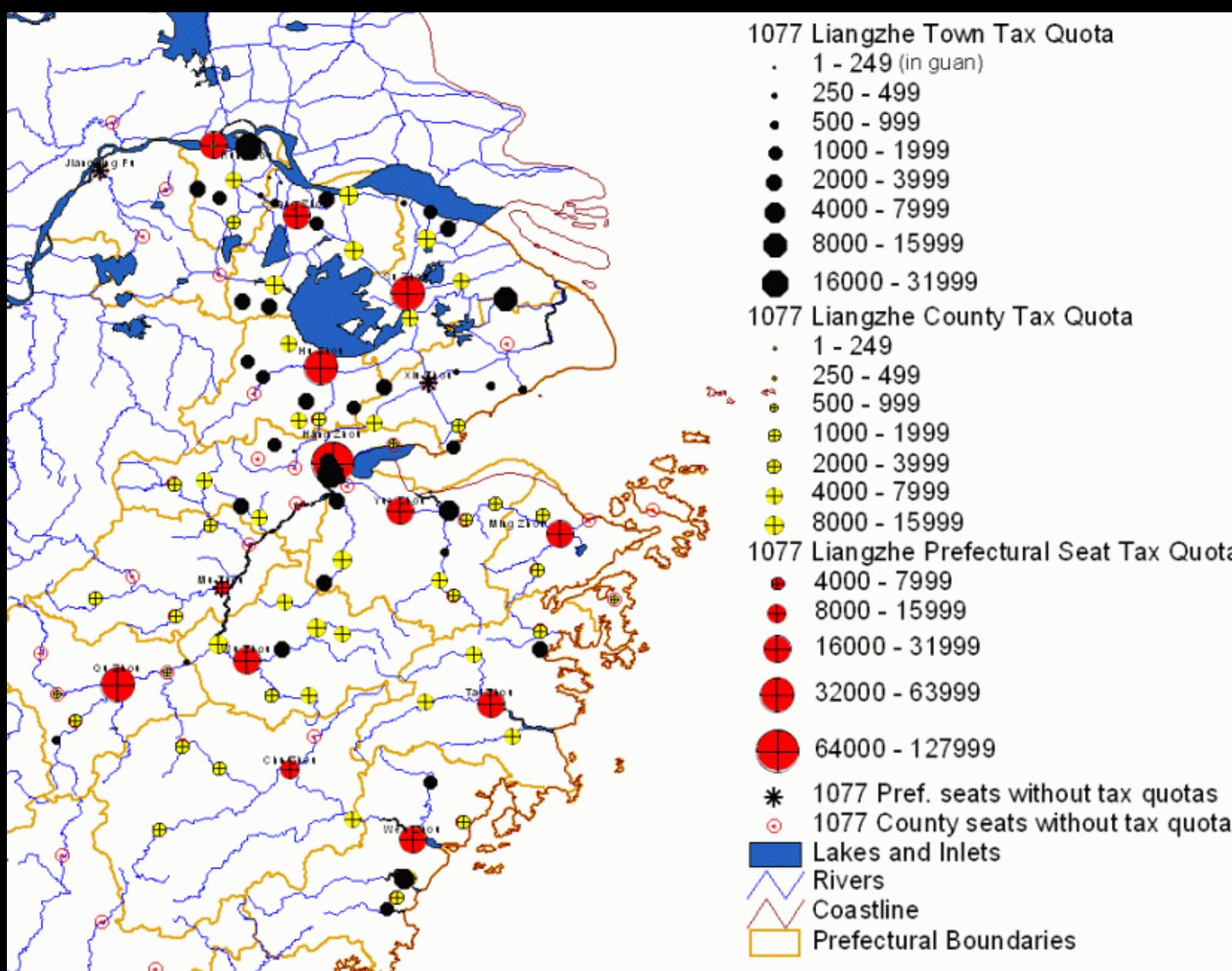
• 1 temple
● 45 temples



src: Da Qing Yitongzhi as listed in "Chugoku no Jiin" Yajima Genryo

map: Lex Berman (c) CHGIS, 2004

density of temples at each location

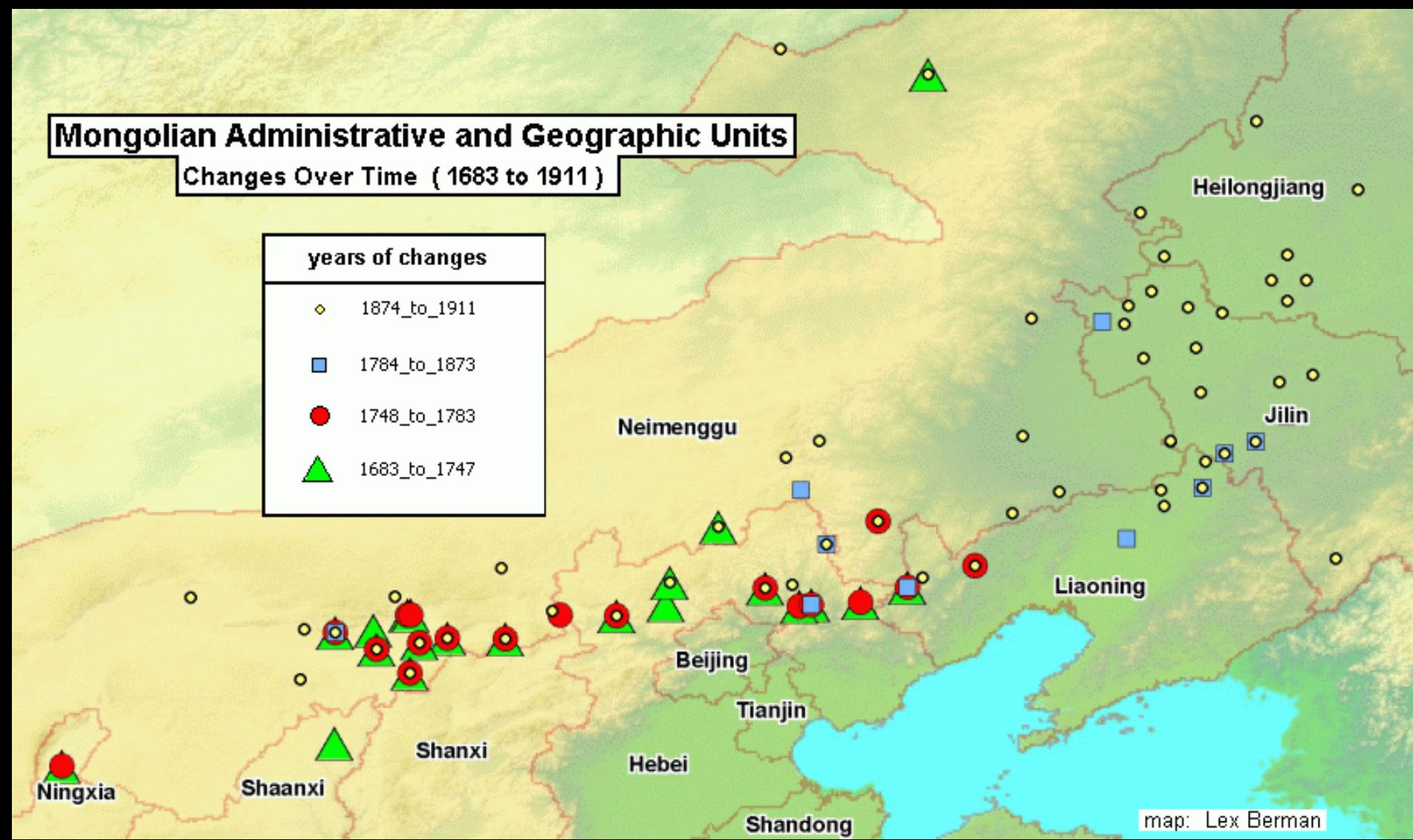


Example: Song tax statistics

Mongolian Administrative and Geographic Units

Changes Over Time (1683 to 1911)

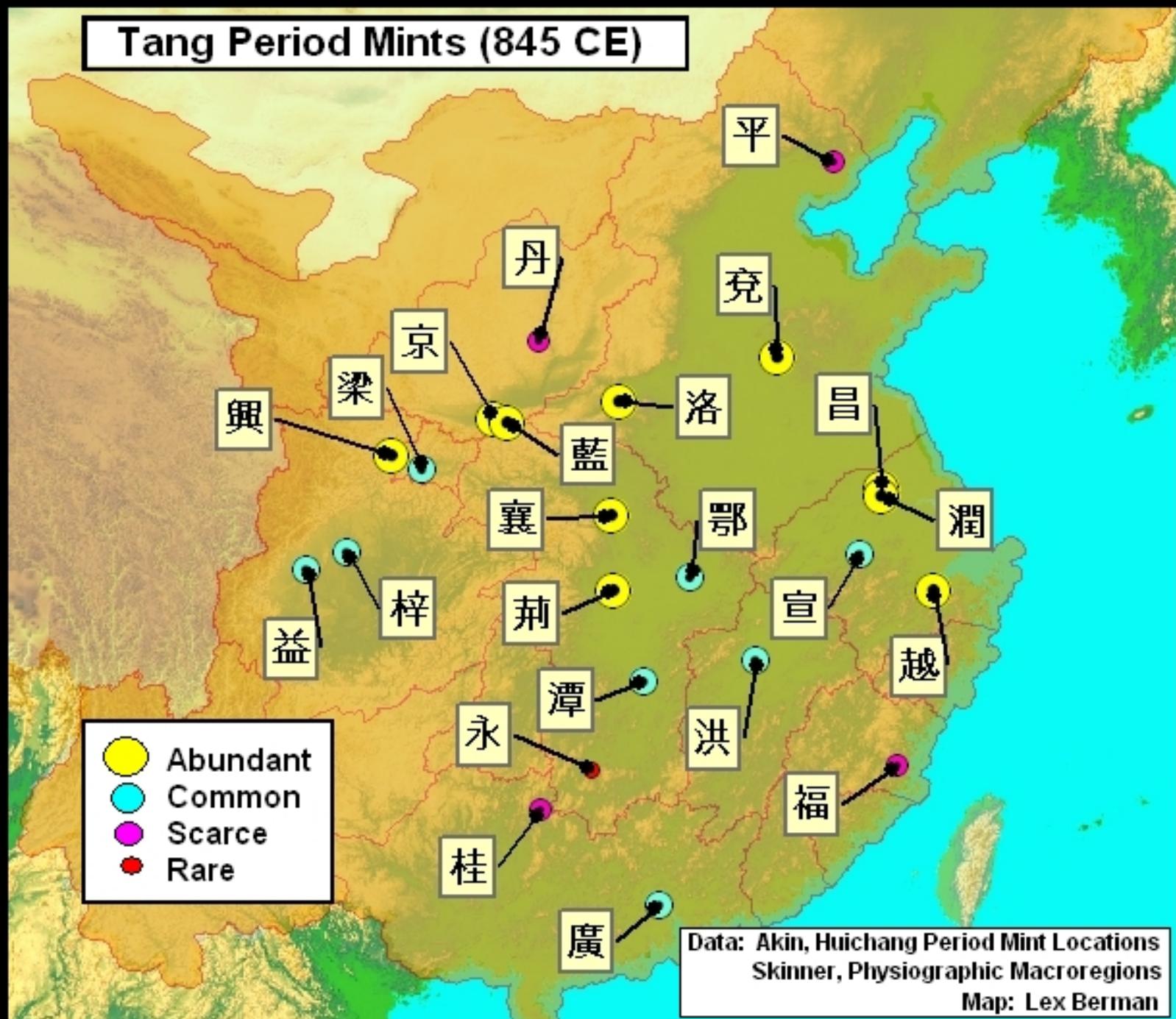
years of changes
○ 1874_to_1911
□ 1784_to_1873
● 1748_to_1783
▲ 1683_to_1747

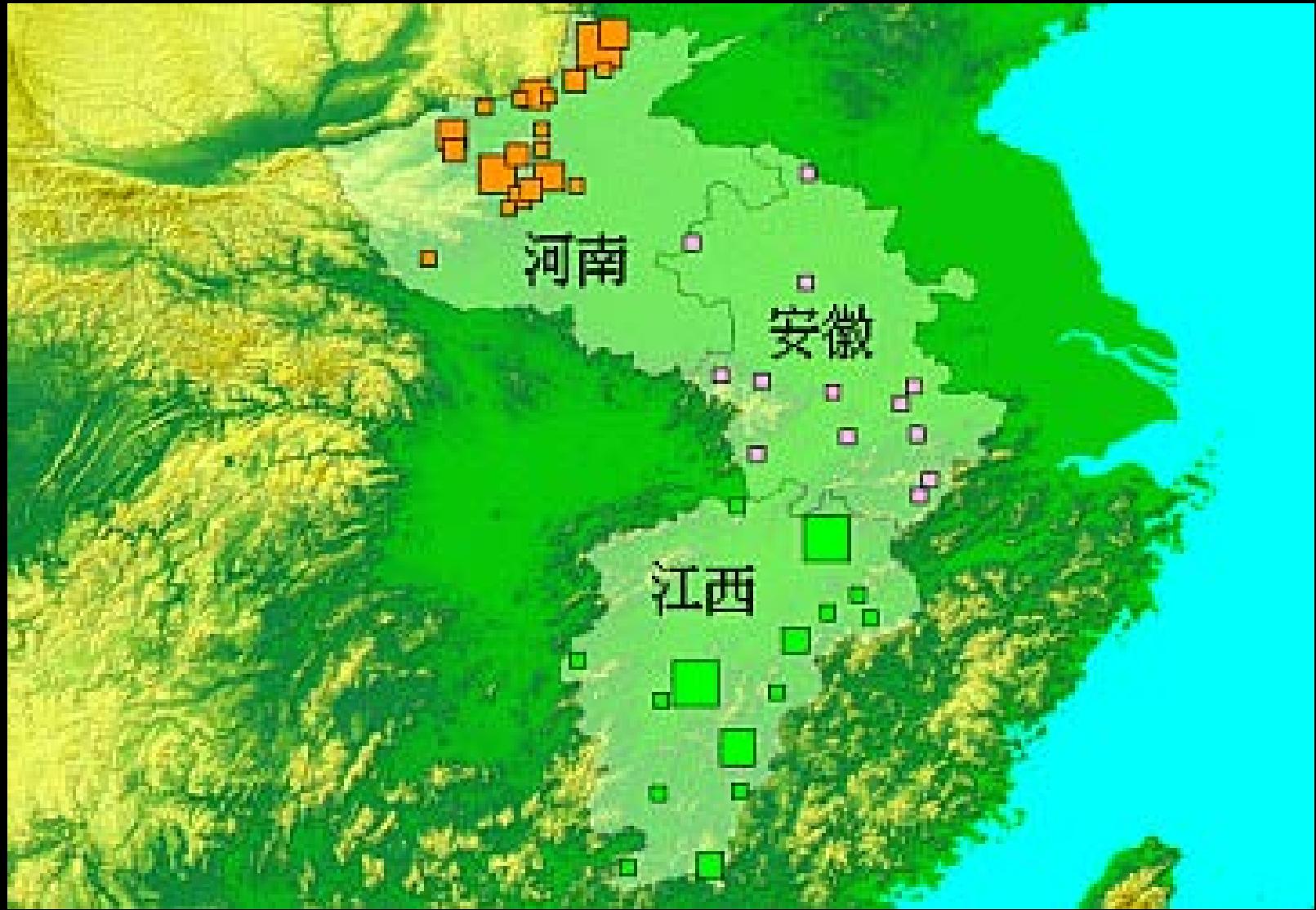


map: Lex Berman

Example: Mongolian Administration over time

Tang Period Mints (845 CE)

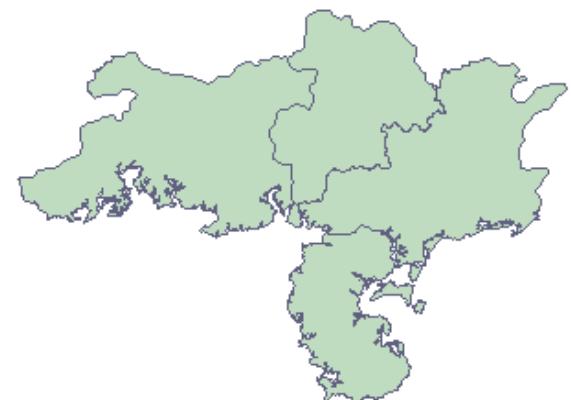




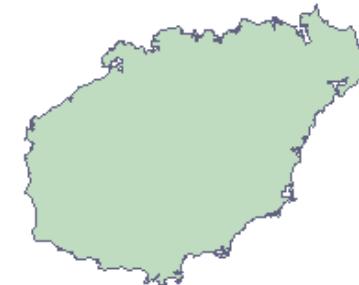
Example: distribution of ceramic kilns



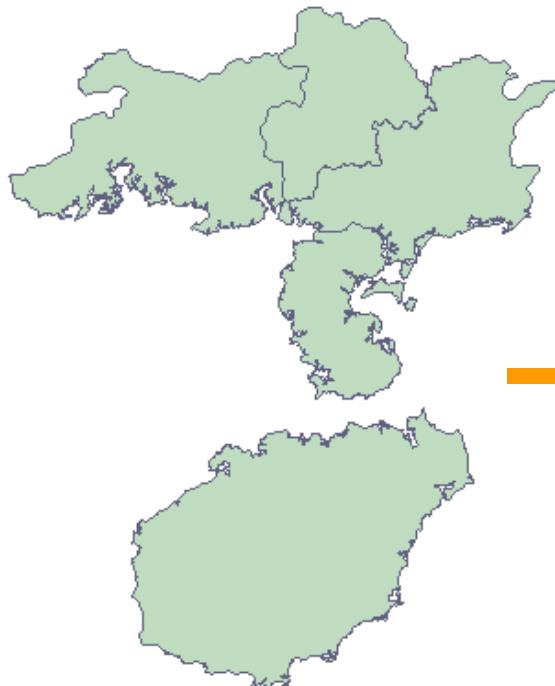
select area of
interest



convert to
“shapefile”



Associating data values with polygon features



export attribute data for focus area to TEXT file

Character_	Pinyin_nam	Prov_ch	Prov_py_na	System_id
郁林州	Yulin Zhou	廣西	Guangxi	1923
高州府	Gaozhou Fu	廣東	Guangdong	2047
雷州府	Leizhou Fu	廣東	Guangdong	2050
廉州府	Lianzhou Fu	廣東	Guangdong	2058
瓊州府	Qiongzhou Fu	廣東	Guangdong	2060

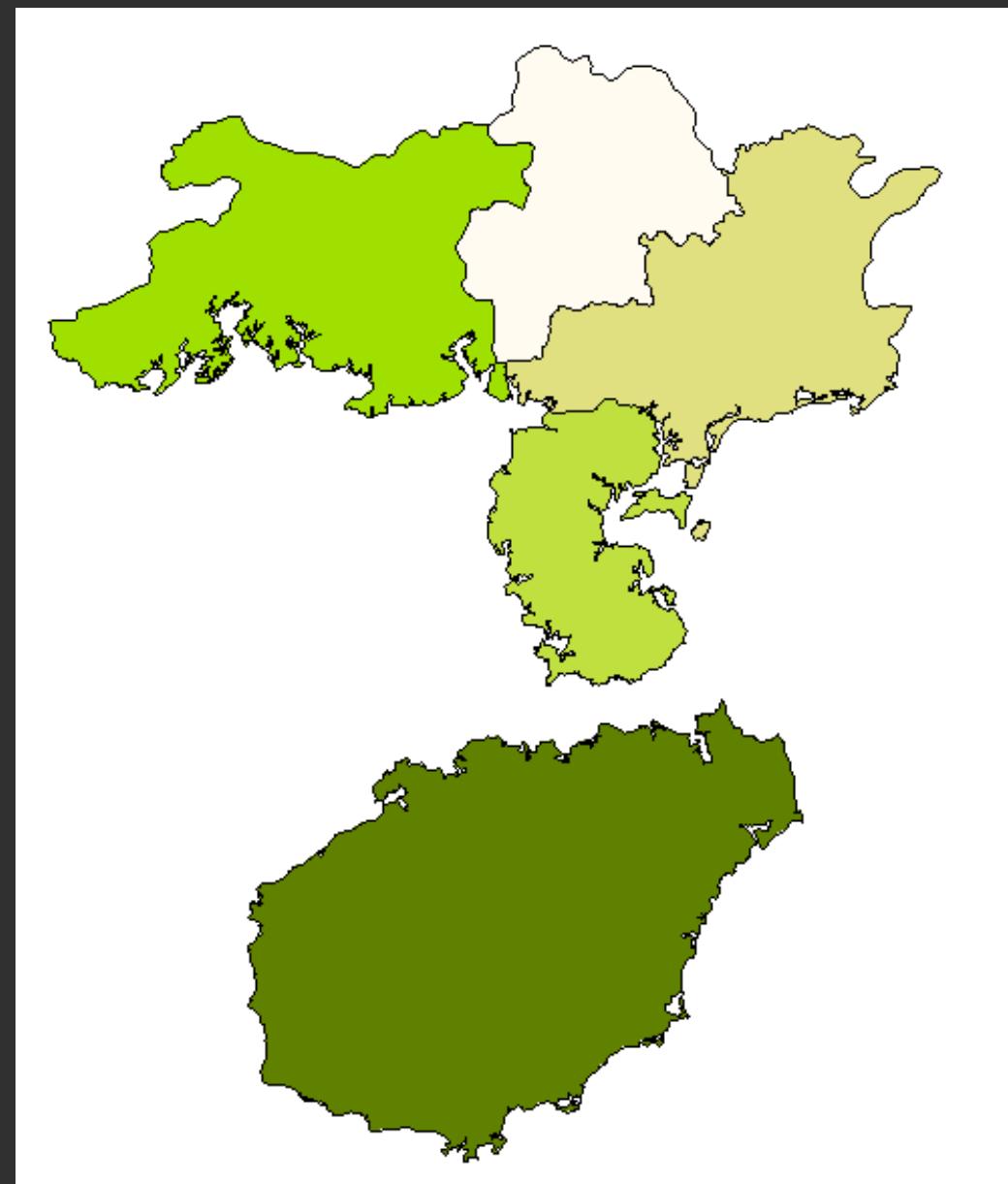
add a new column to the TEXT file

Character_	Pinyin_nam	Prov_ch	Prov_py_na	System_id	NEW
郁林州	Yulin Zhou	廣西	Guangxi	1923	
高州府	Gaozhou Fu	廣東	Guangdong	2047	
雷州府	Leizhou Fu	廣東	Guangdong	2050	
廉州府	Lianzhou Fu	廣東	Guangdong	2058	
瓊州府	Qiongzhou Fu	廣東	Guangdong	2060	

enter new values in the new column, then REJOIN to original GIS focus area shapefile

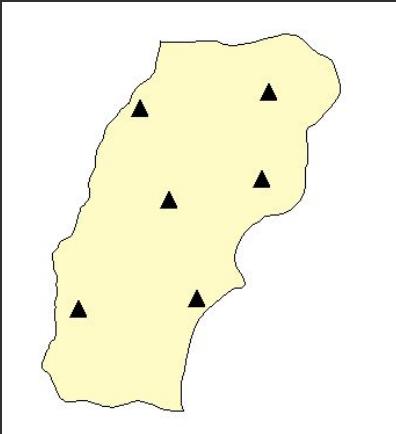
join new data values to GIS attribute table

create chloropleth
map based on your
data

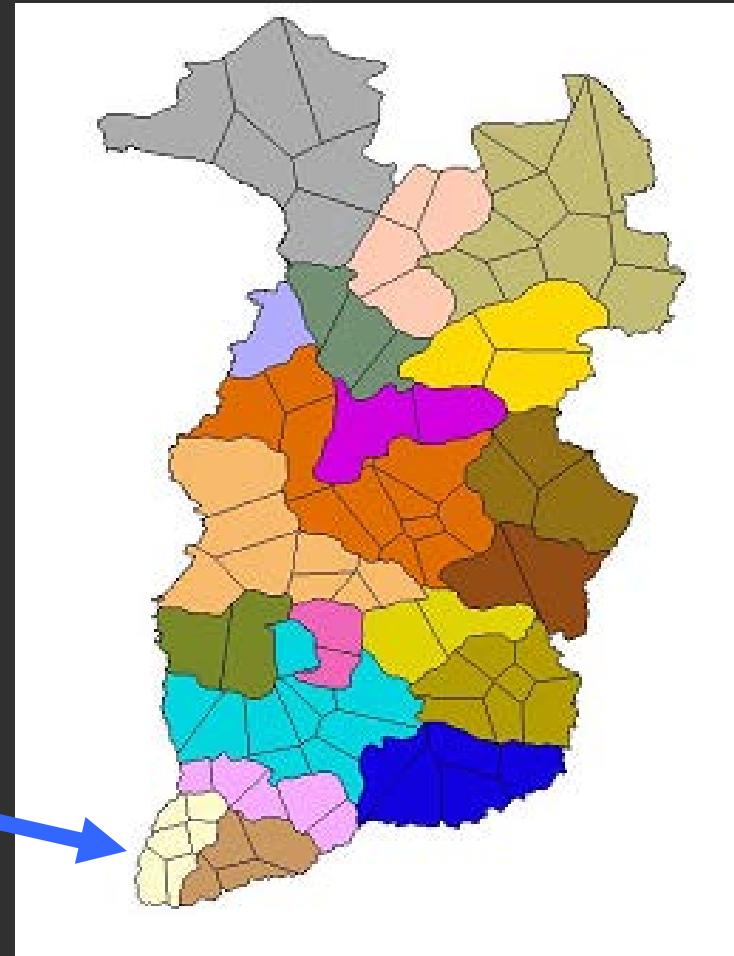


Thematic map based on new data values

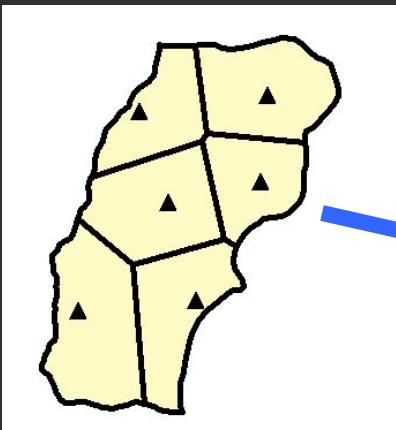
center points + outer boundary



aggregation of Thiessen boundaries

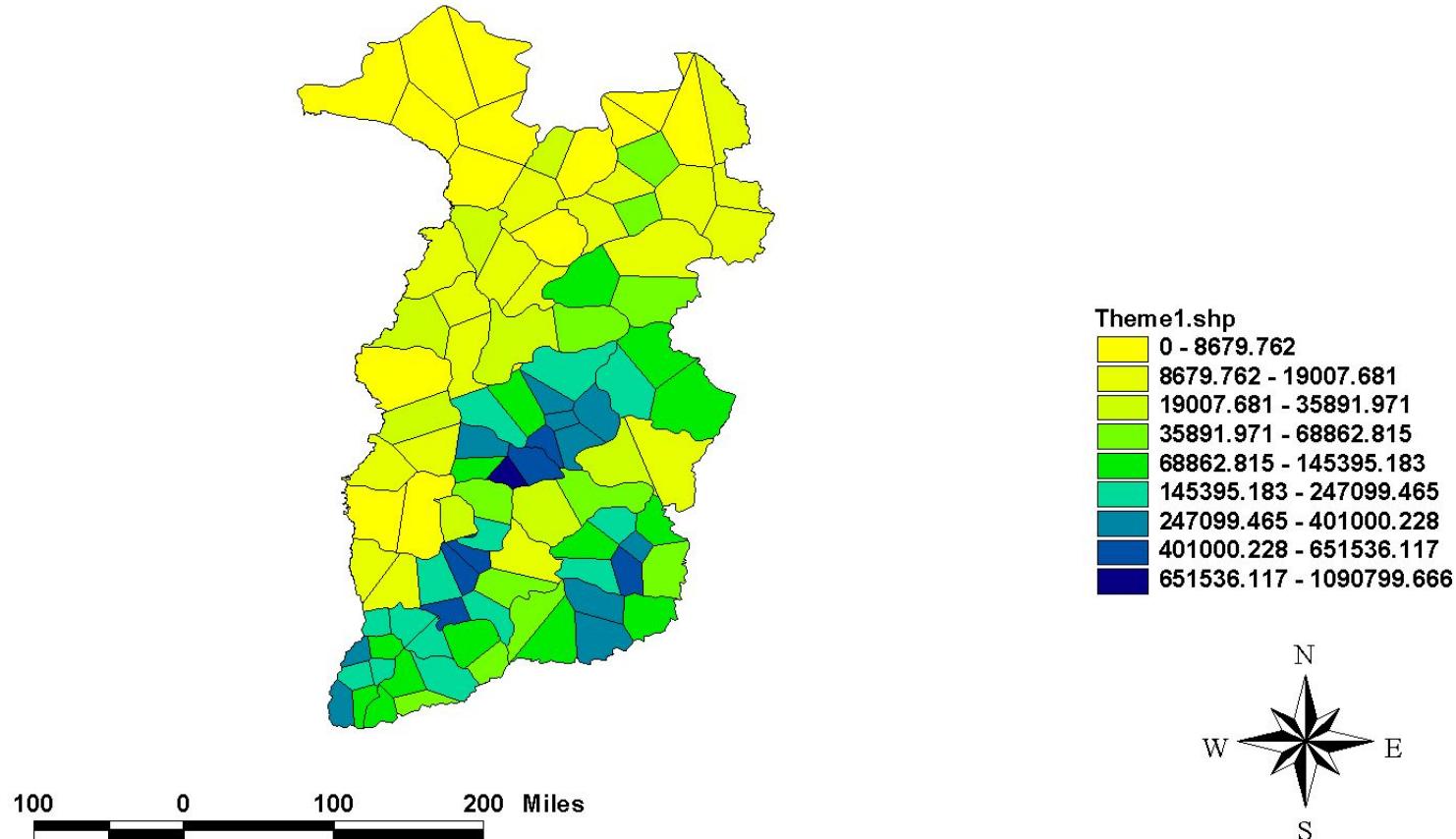


Thiessen Polygons based on points



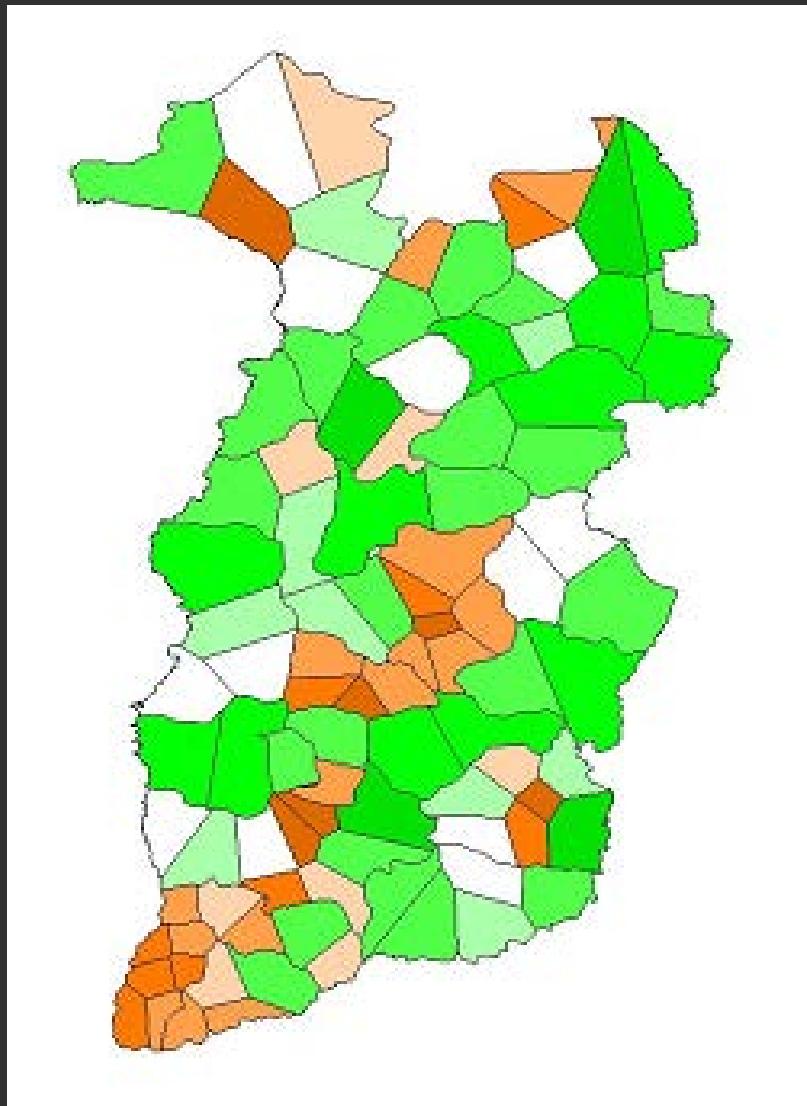
Thiessen polygons generated from points

Ding Population (1820) normalized by area

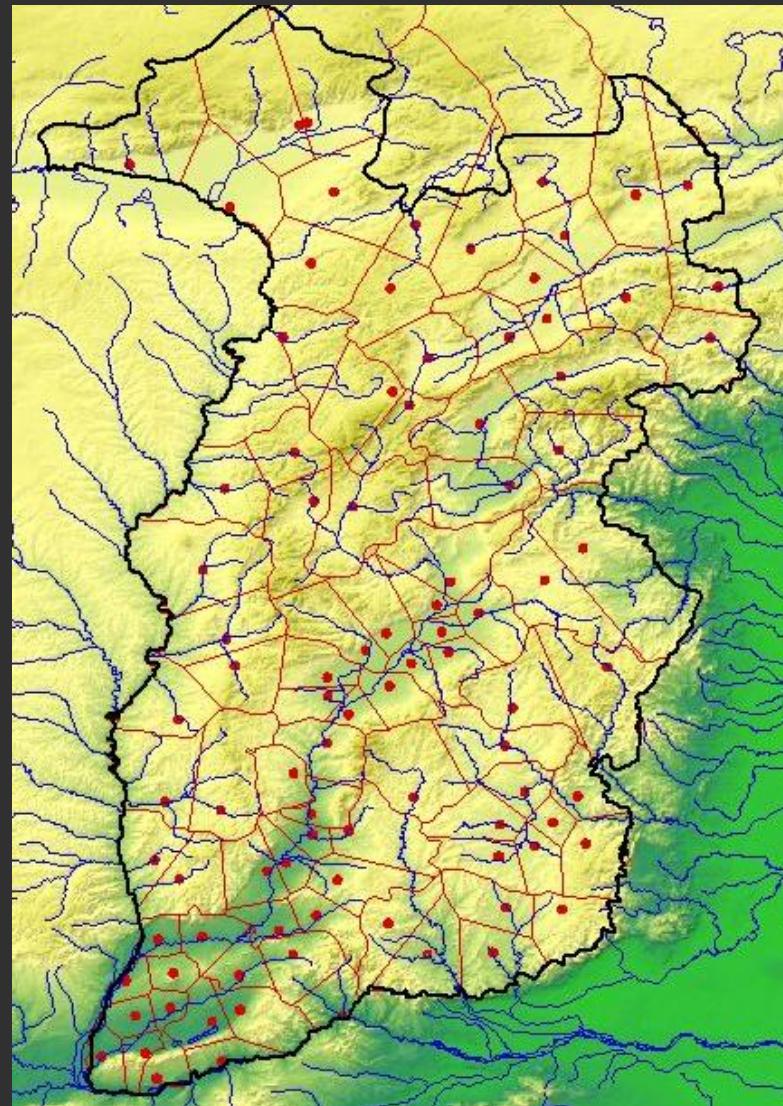


population distribution – normalized by area

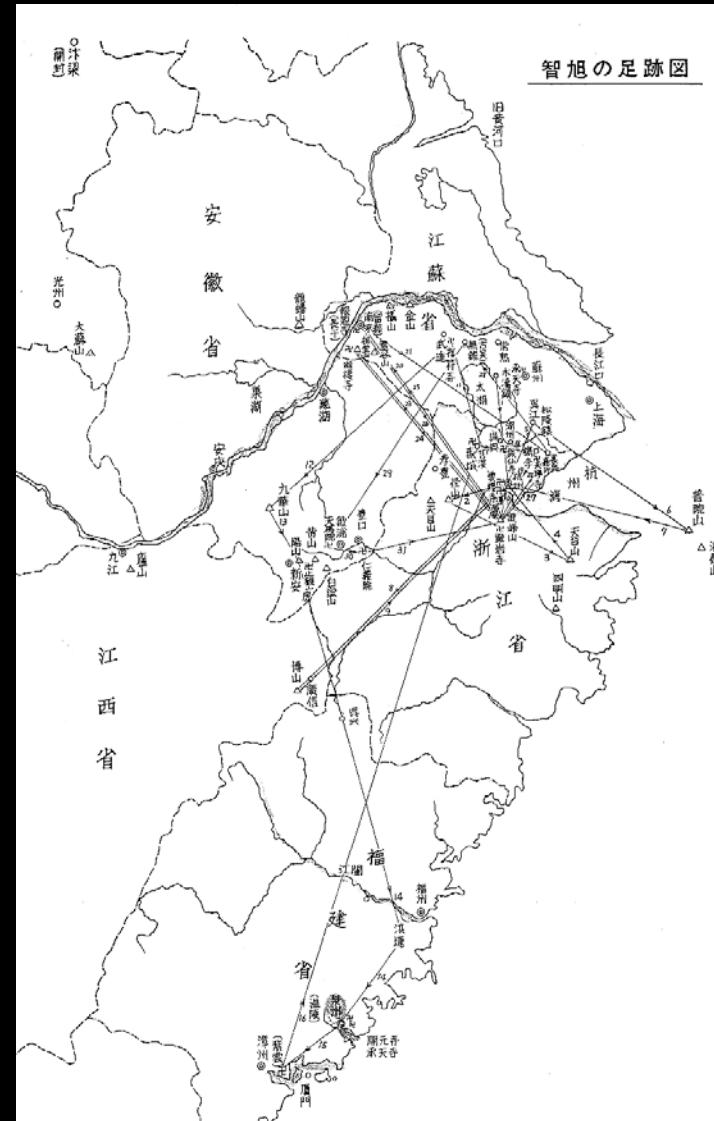
Male Population (1820) normalized by area



DEM background



Thiessen polygons compared with natural features

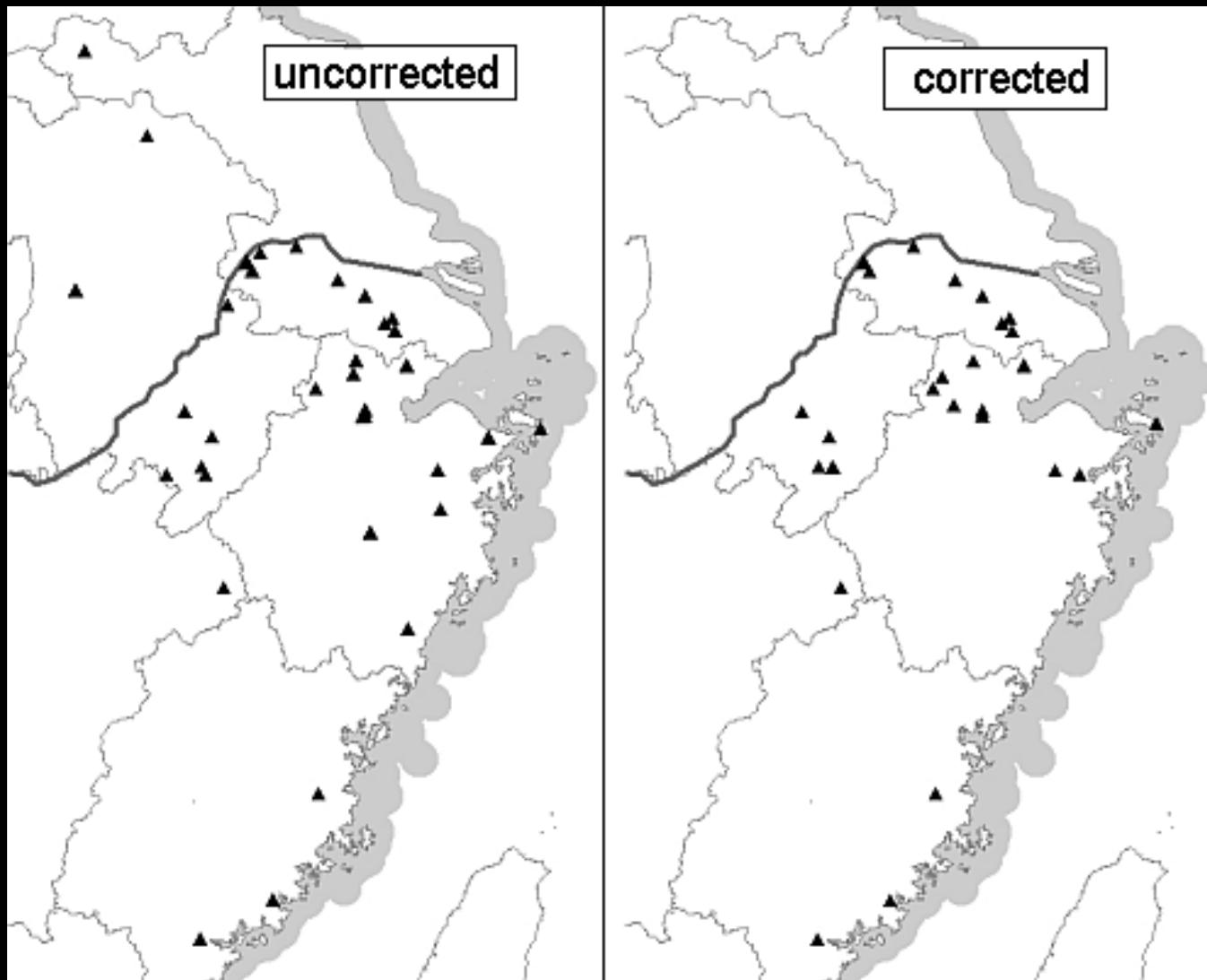


Mapping and animation of locations over time - Life of Ouyi Zhixu

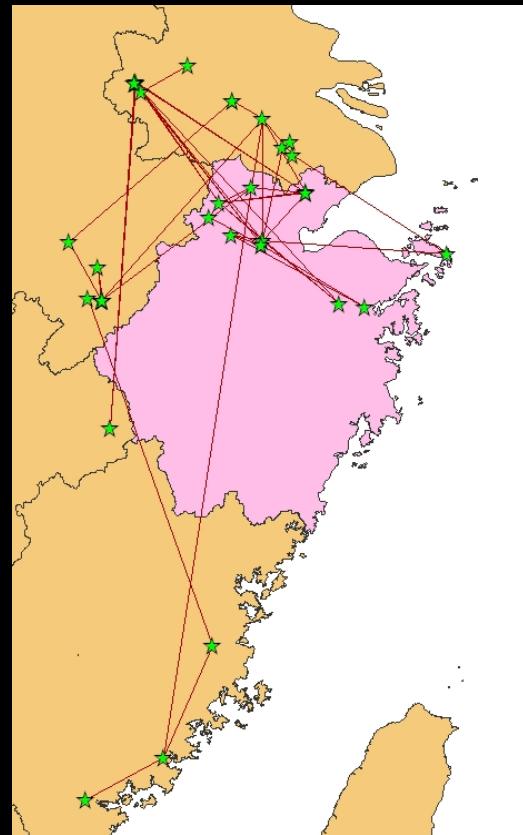
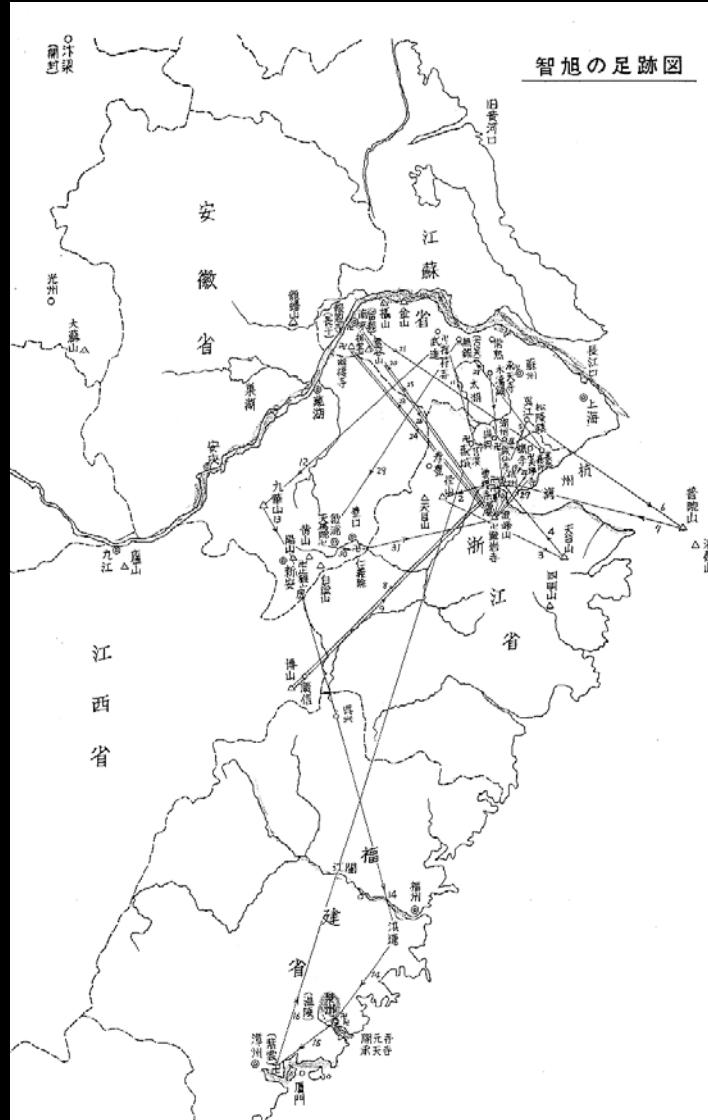
place_id	year	season	sequence	source	type_id	type_description	chrono_events_notes
ouyi_1	1599		1	autobio	1	birth	
ouyi_3	1622	summer	2	ZL.8.2.1-8, autobio	10	Yogacara (唯識論)	
ouyi_3	1622	summer	3	ZL.8.2.1-8, autobio	9	received teachings	
ouyi_2	1622	late fall	4	autobio	4	engaged in meditation	
ouyi_6	1622		5	ZL.8.2.1	25	other	first met Xinyi Dazhen 新 印慧
ouyi_6	1623		6	選佛譜序	18	divination game	傳燈[選佛圖]隨喜
ouyi_4	1623	spring	7		25	other	謁幽溪傳燈 - pay respe
ouyi_4	1623	fall	8		4	engaged in meditation	

point_id	name	name_ch	province	xian	geo_src_file	cgis_sys_id	x	y	ouyi_copy_notes
ouyi_1	Mu Duzhen	木漣鎮	Jiangsu	Wuxian	v4_1911_twn_pts	138990	120.51	31.253	birthplace
ouyi_2	Jingshan; Qi	徑山	Zhejiang	Xinchang	NIMA	nma_1922389	119.8	30.25	part of Lin'an Xian 临安
ouyi_3	Yunqi si	雲棲寺	Zhejiang	Hangzhou	v4_1911_pref_pts	120998	120.168	30.294	part of Qiantang Xian 钱塘
ouyi_4	Tiantai shan	天台山	Zhejiang	Tiantai	v4_nima_mtns_pts	nima_31788	121.333	29.5	

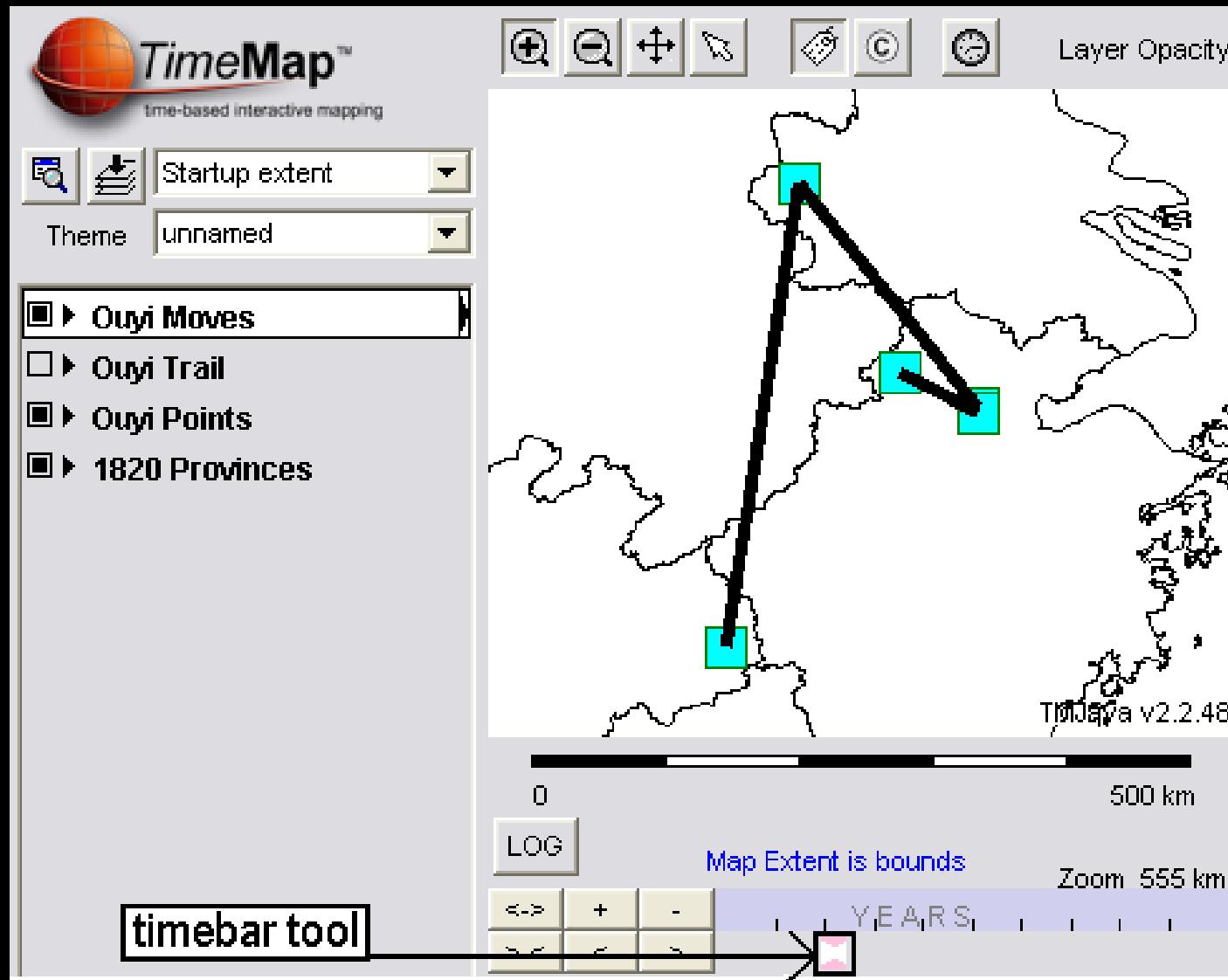
table of events with known dates & table of locations



checking and correction of possible locations



Addition of paths of movement between locations for each event



Animation of points for each event, and paths of movement

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photo: Heilongtan, Kunming, Yunnan