Earthquake Prediction in China

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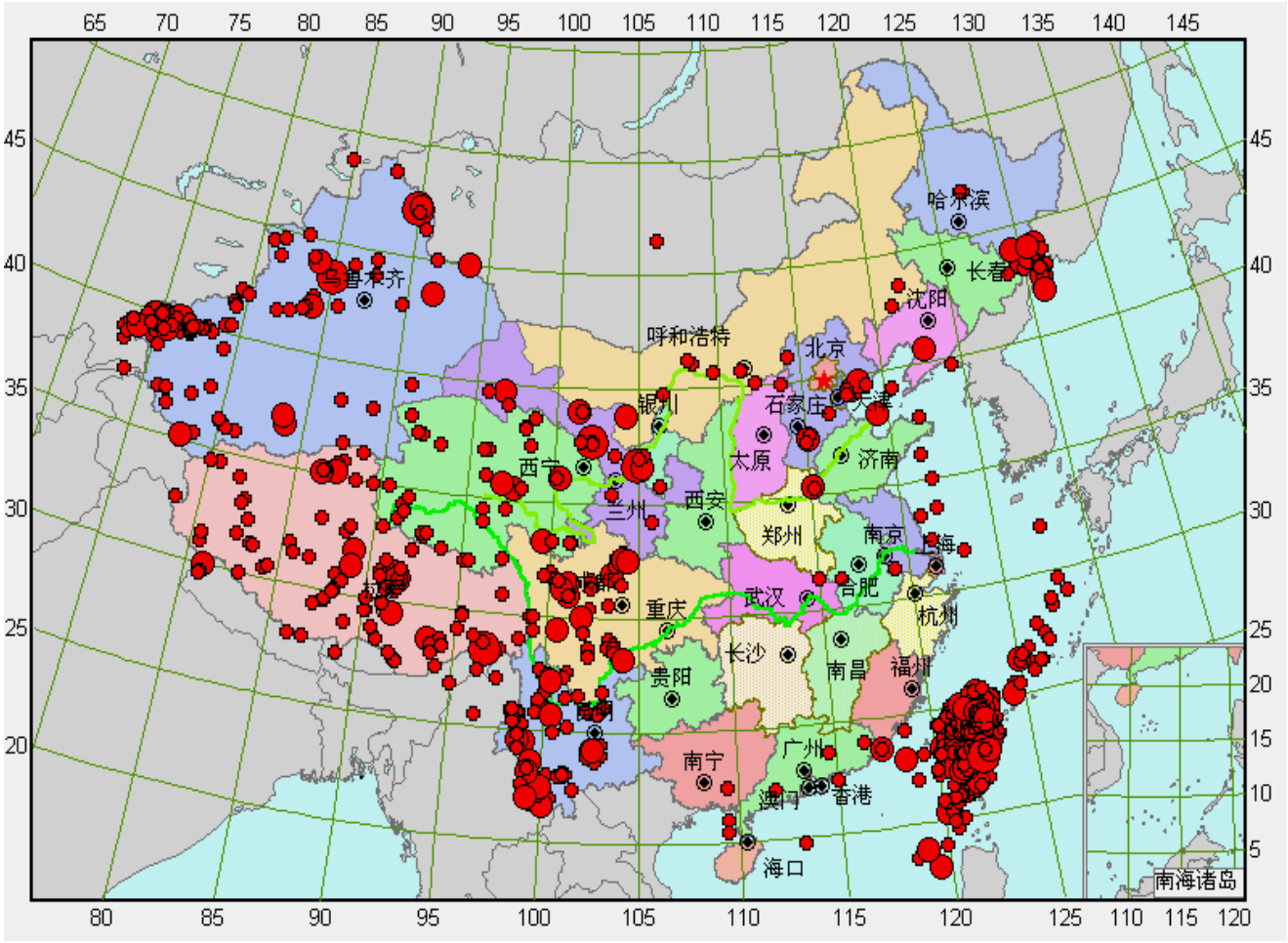
Outline

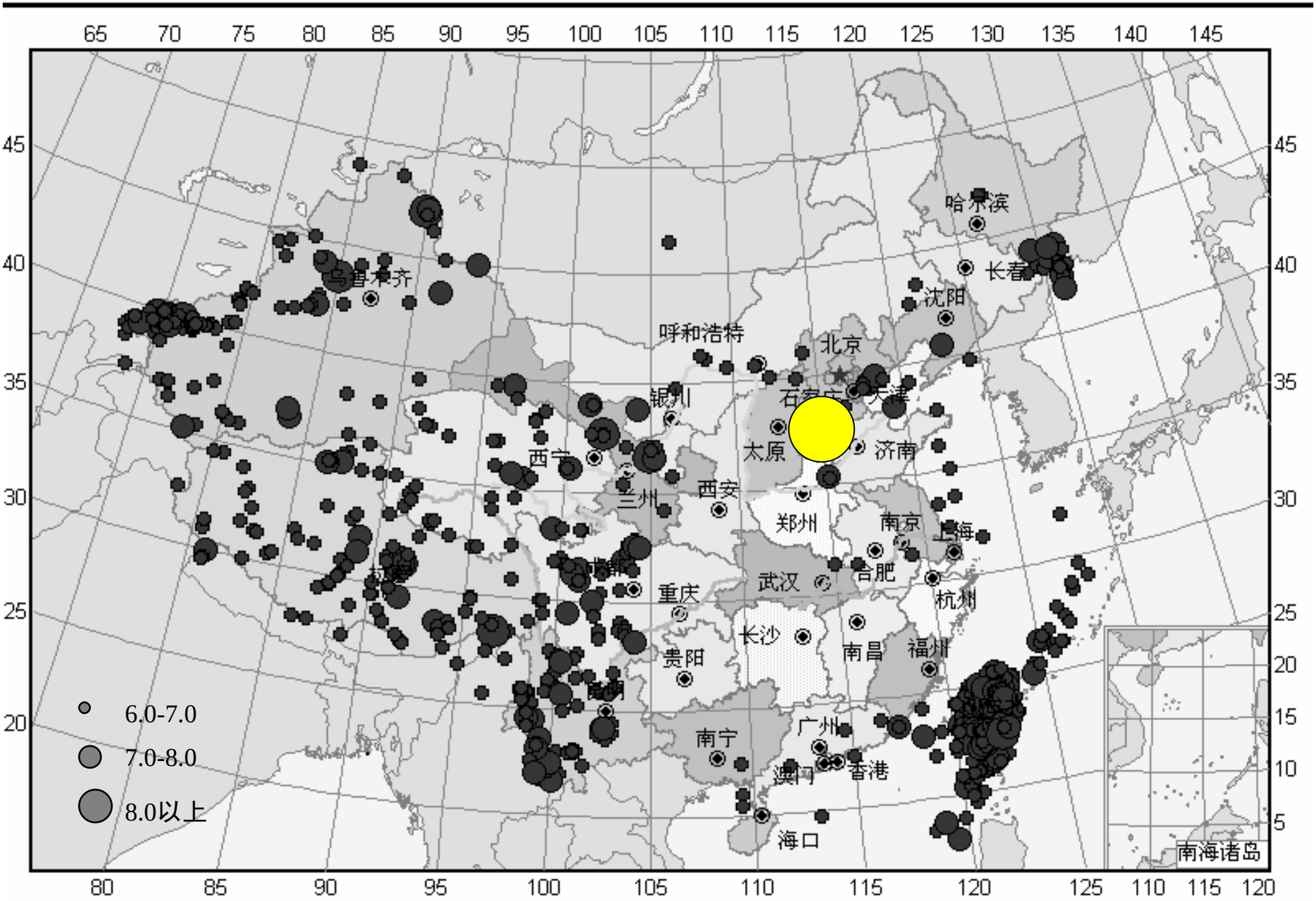
- Earthquake Prediction
- Study on the Mechanics of Earthquakes
- Historical Earthquake
- Seismic Hazard in North China

Earthquake Prediction



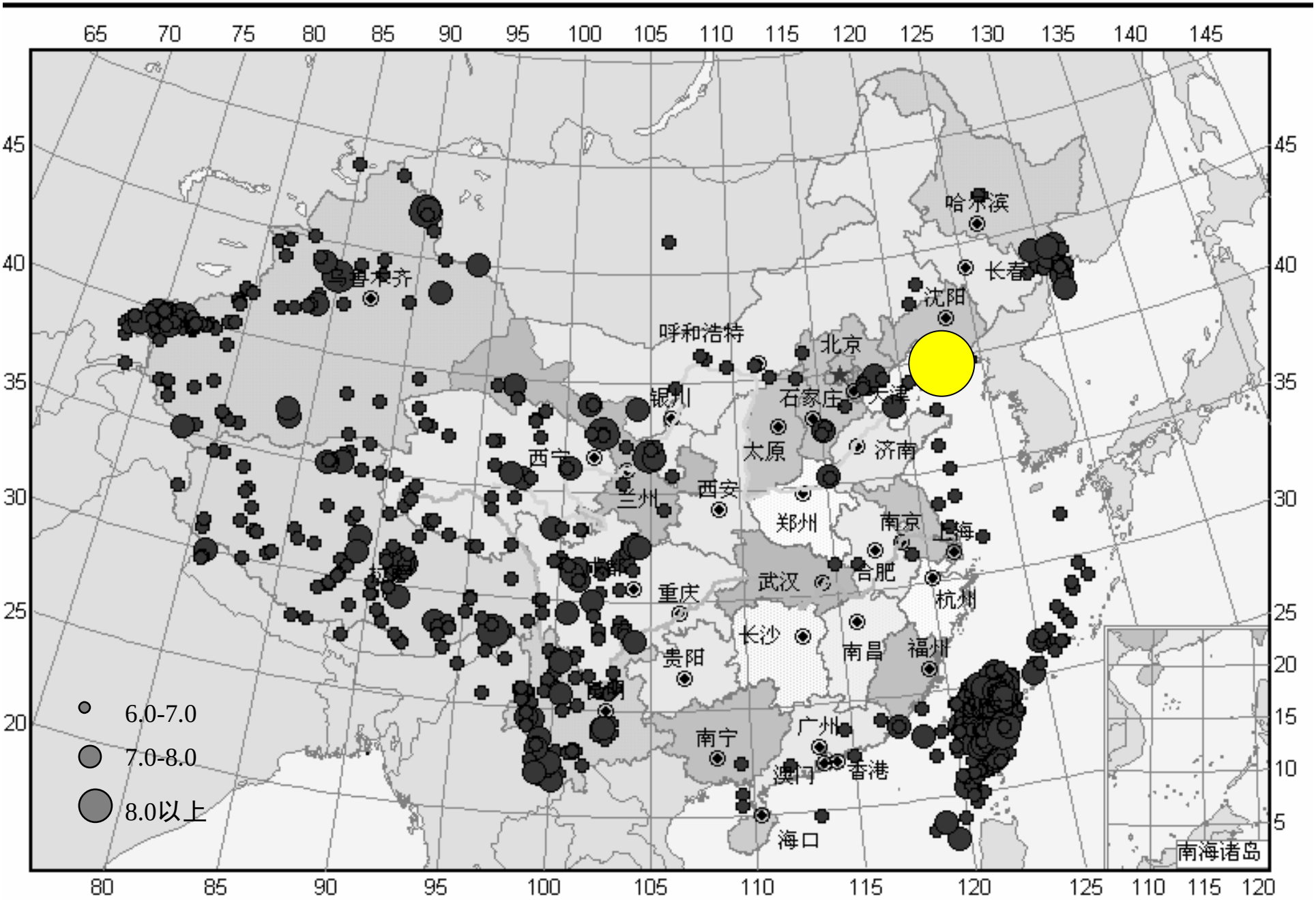
Earthquakes (Ms>6) in China in the 20th Century
(from China Earthquake Administration)

1966/03/08


65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145
45 40 35 30 25 20
80 85 90 95 100 105 110 115 120 125 110 115 120
5 10 15 20
哈尔滨
长春
沈阳
北京
呼和浩特
银川
石家庄
天津
太原
济南
西宁
兰州
西安
郑州
南京
上海
合肥
武汉
杭州
重庆
长沙
南昌
福州
贵阳
南宁
广州
澳门
香港
海口
南海诸岛
6.0-7.0
7.0-8.0
8.0以上

周恩来总理视察邢台地震现场工作
Premier Zhou Enlai inspected on-the-spot disaster relief work in the Xingtai Seismic areas.

1975/02/04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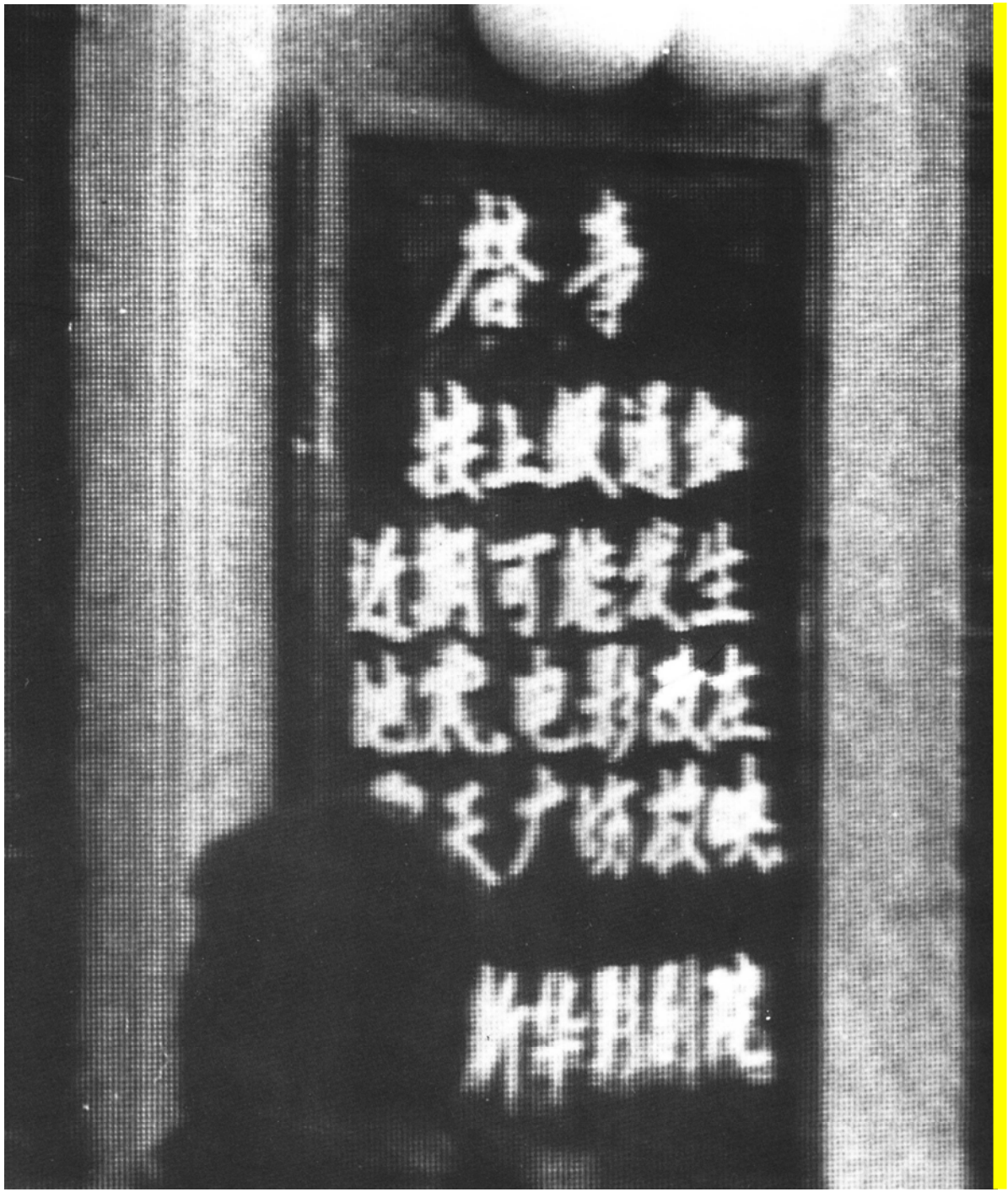
澳门
香港
海口
南海诸岛
6.0-7.0
7.0-8.0
8.0以上

Precursors observed before the 1975 Haicheng earthquake:

- Changes of geomagnetic field intensity
- Change of gravity field and ground deformation
- Abnormal behavior of animals
- Foreshock sequence: statistical significant as evaluated by the IASPEI Commission on Earthquake Prediction in 1987
- Abnormal change of ground water and geothermal as well as geo-chemical measurements



- State Seismological Bureau of China was built in 1976.

- China Earthquake Administration

The Annual Consultation Meeting

- Organized by the China Earthquake Administration
- Summarizing the characteristics of the seismic activities
- Giving suggestion for the trend of the earthquake occurrence


一九八九年度全国地震趋势会商会

机密★一年

中国地震趋势预测研究

（2003 年度）

中国地震局分析预报中心

地震出版社

Problems to be solved in the Consultation Meeting:

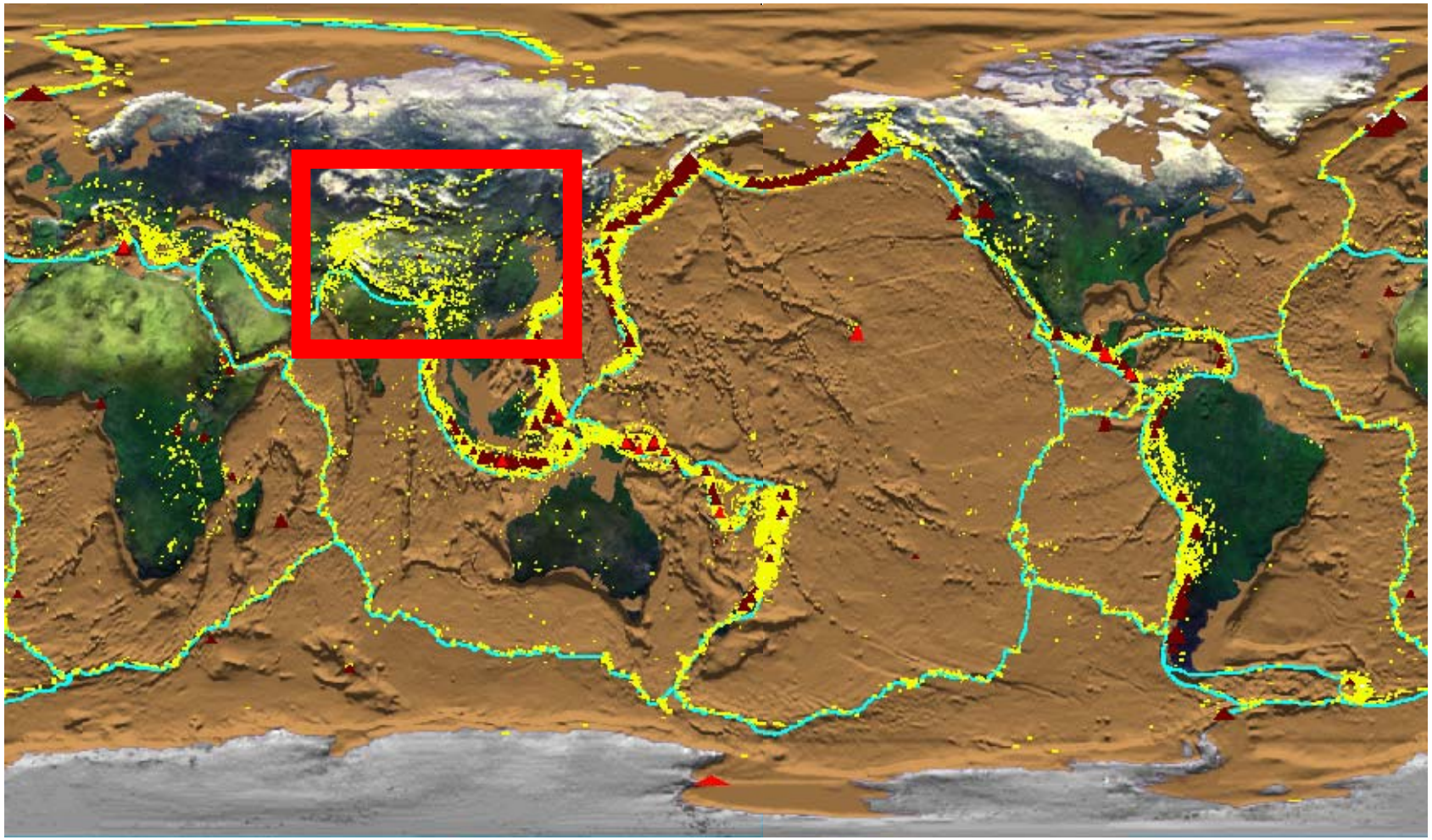
Earthquake prediction defined in an alternative form

- Is the present time seismically active or inactive ?
- Will there be any M>7 earthquakes occurring in the west or any M>6 earthquake occurring in the east during the coming year ?
- In the next year, which areas seem to be likely to have a M>5 earthquake ?

Study on the Mechanics of Earthquakes

This figure shows the global distribution of seismic activity.
Most of the earthquakes are related to plate boundaries.

However, when considering the territory of China, …



Most of the earthquakes are NOT related to plate boundaries !

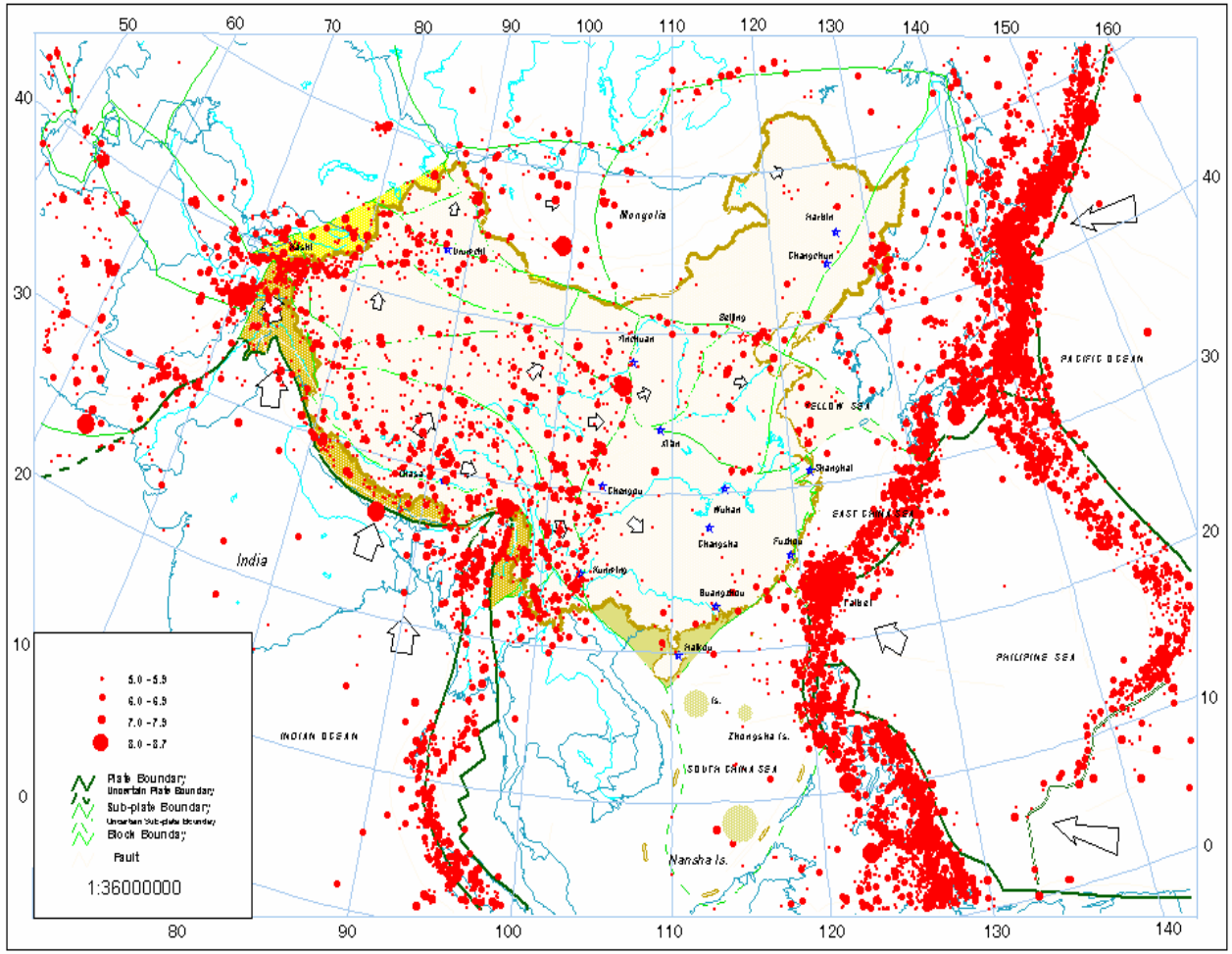
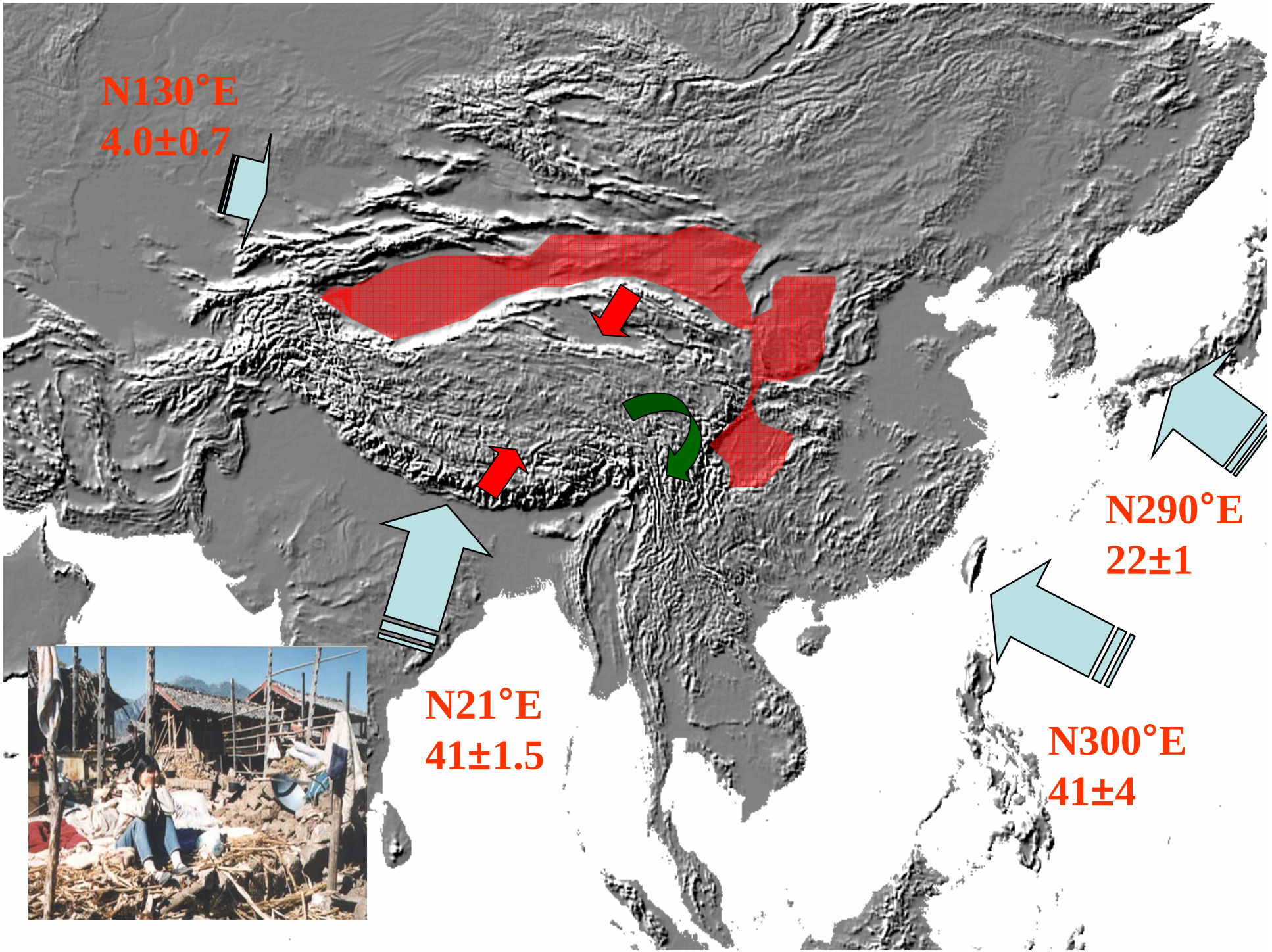
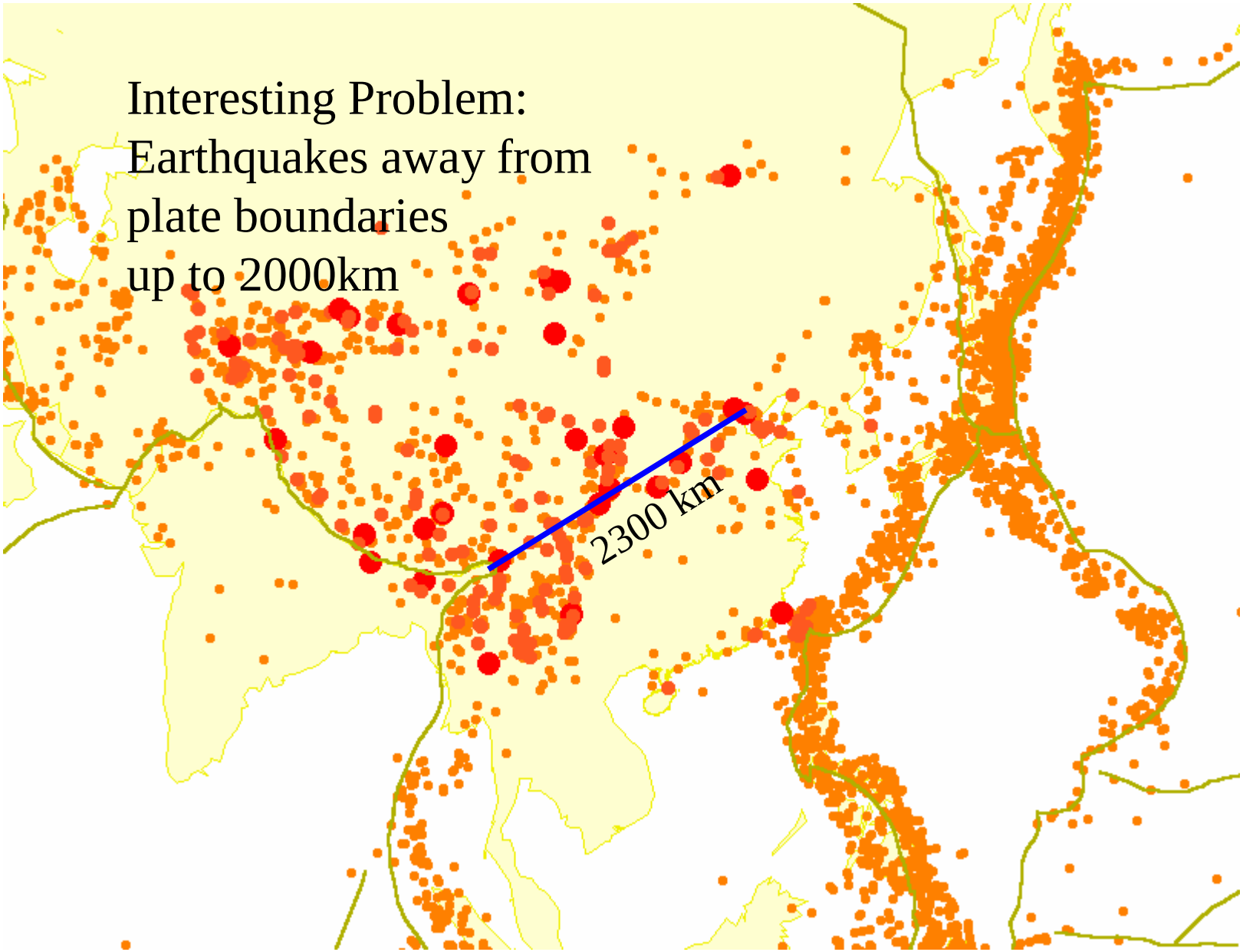
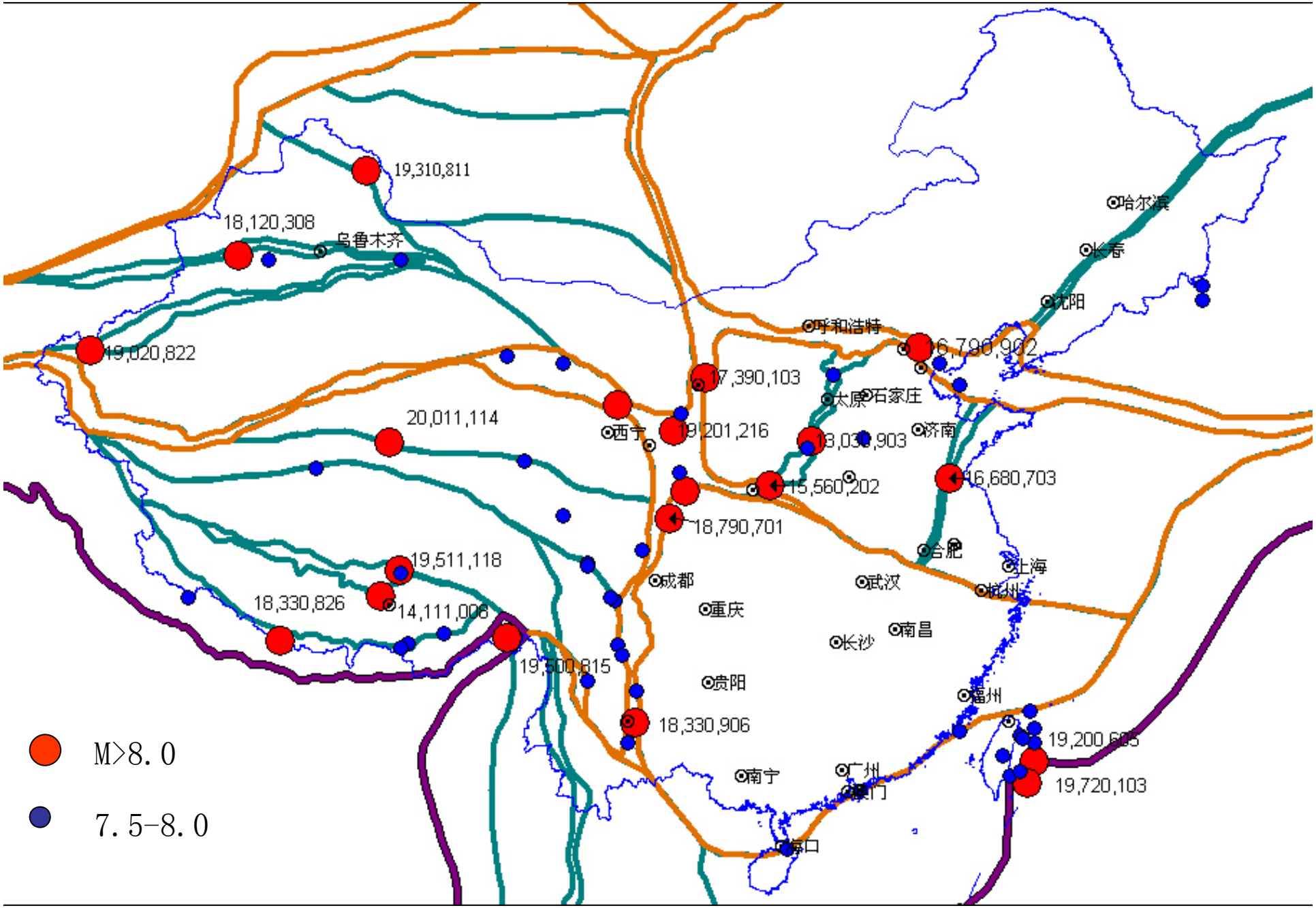


Fig. 3 Epicentral distribution of the earthquakes in and around China (1900 to 1998, M>=5.0)


N130°E
4.0±0.7
N290°E
22±1
N21°E
41±1.5
N300°E
41±4


Interesting Problem:
Earthquakes away from
plate boundaries
up to 2000km
2300 km

Block tectonics explaining the earthquakes in China

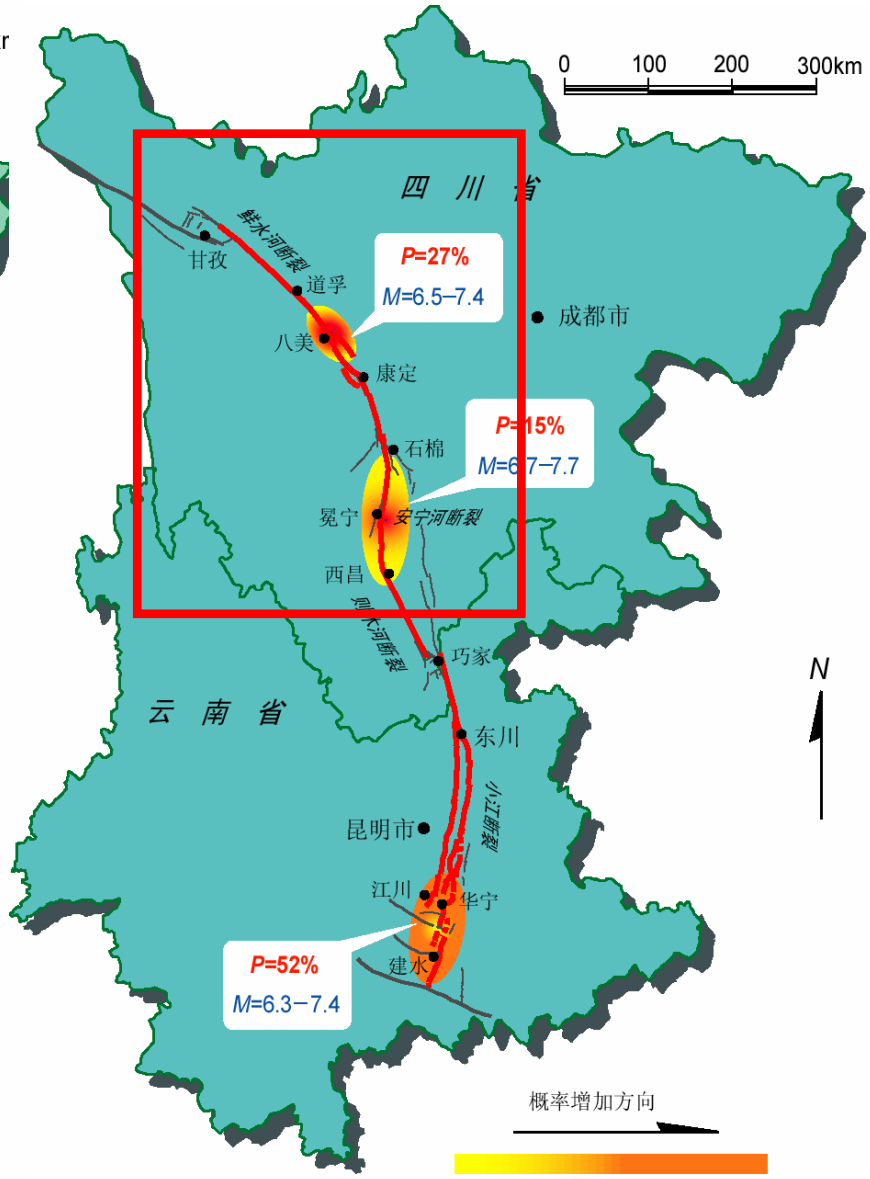


Project
“Continental Dynamics
and Continental Earthquakes”
supported by MOST
organized by CEA

Earthquake dynamics at the block boundary

- Tectonics
- GPS
- Geophysical exploration
- Seismology
- Fault mechanics
- Numerical simulation

Earthquake Hazard 2005—2015



Trend of the Earthquake Prediction

- From the empirical estimation to the understanding of the mechanics of the earthquake occurrence.

Historical Earthquake

Collections of historical archieves

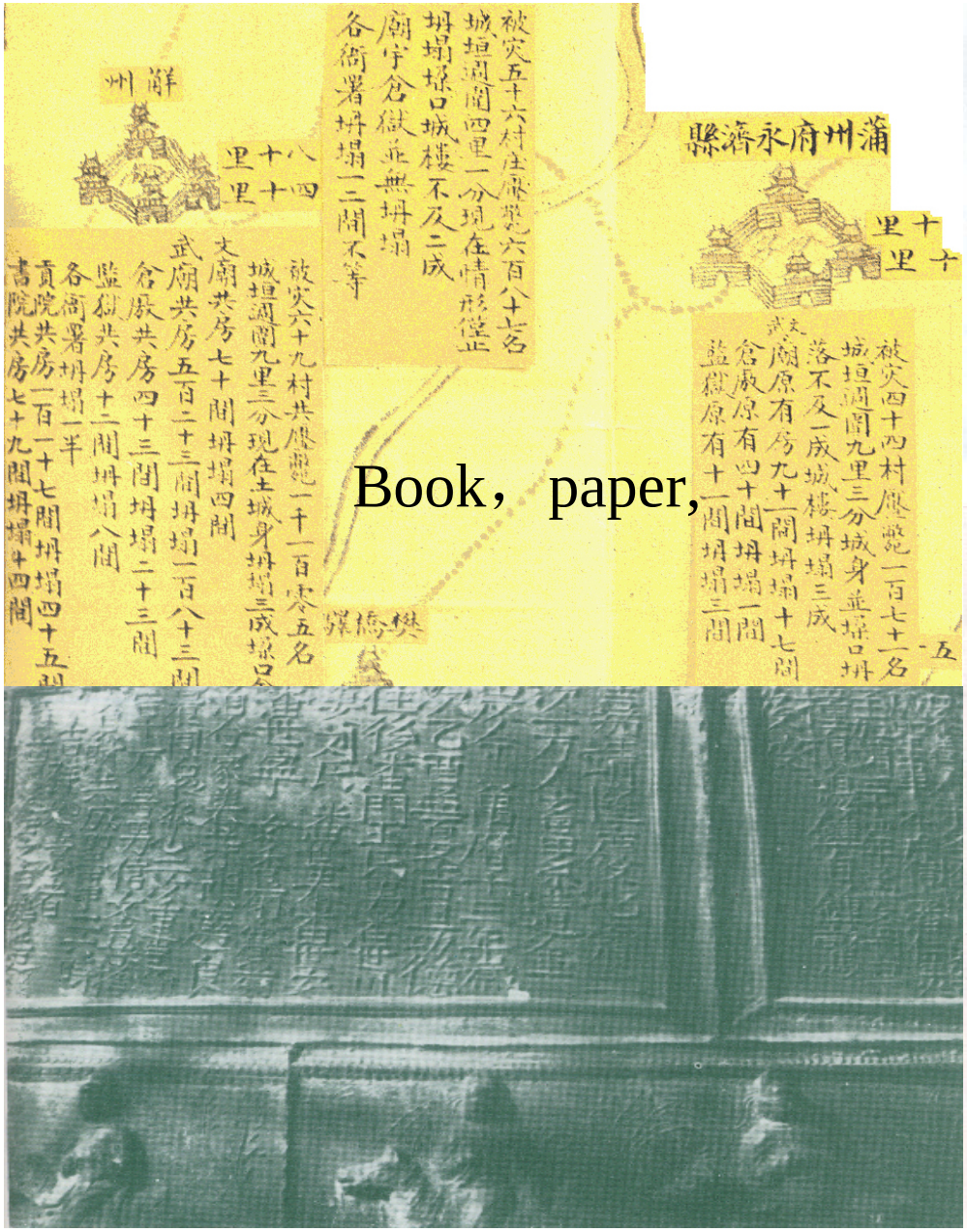
Long history and culture traditions

From Ying Dynasty (16-11 cent. B.C.), there were official historians appointed by governors to record earthquakes.

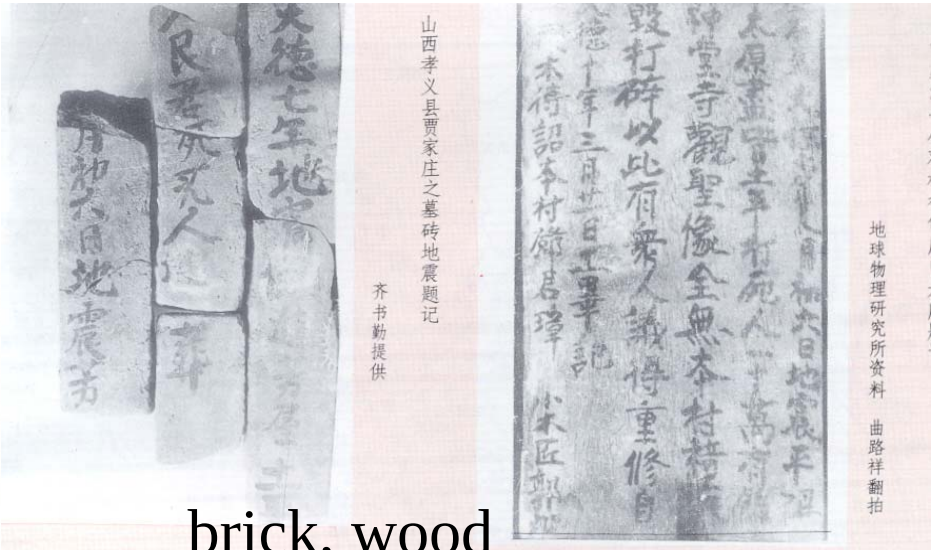
Archieves of governments:

Center governments, provinces,

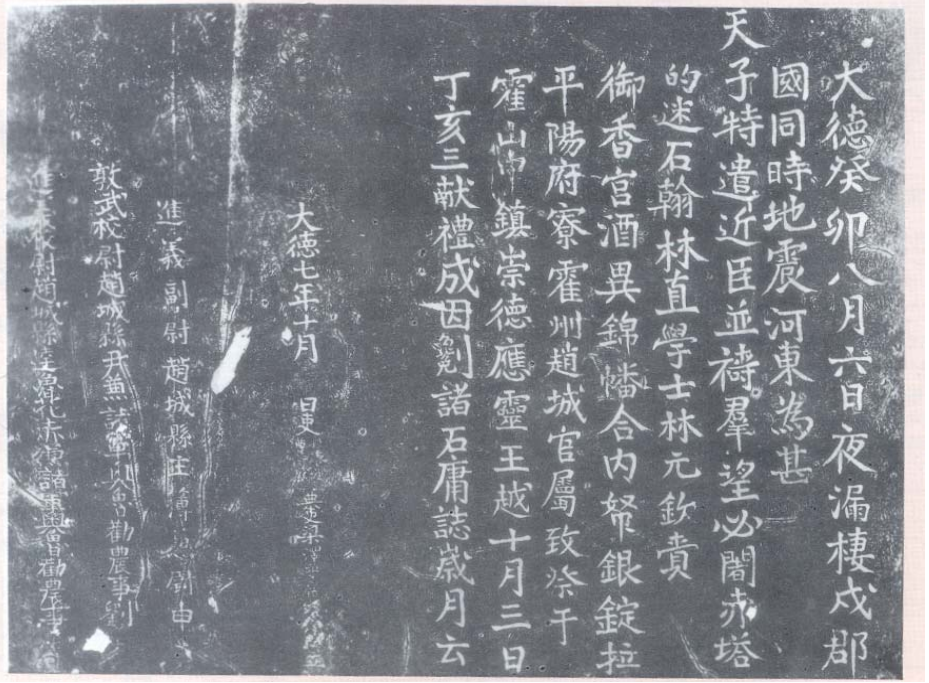
canton, counties.



Book， paper,



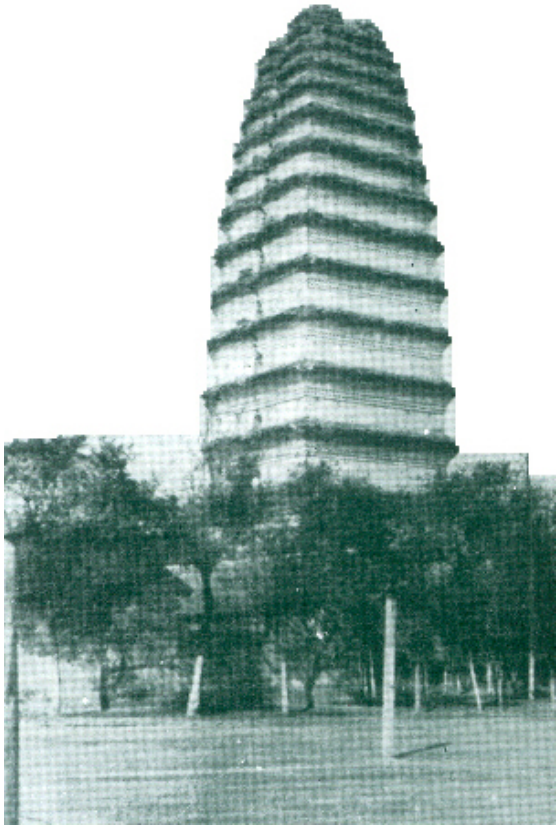
brick, wood



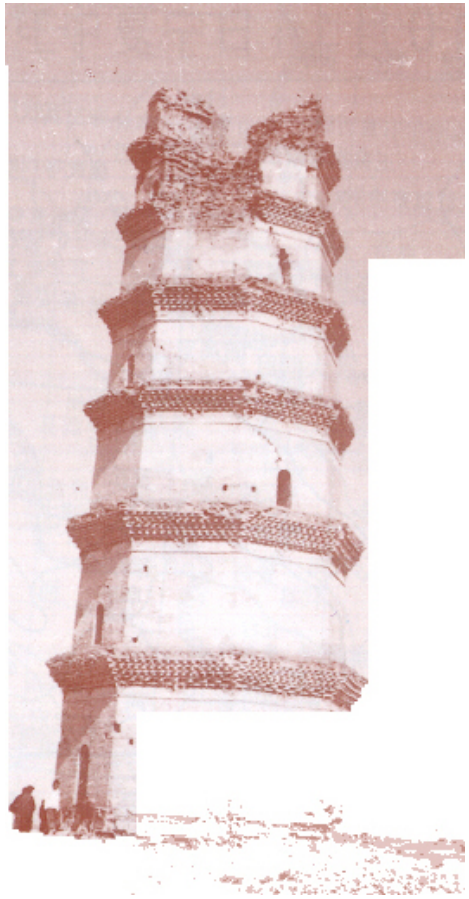
Found in metal utensils

carved stone and bone of animal

Get information from



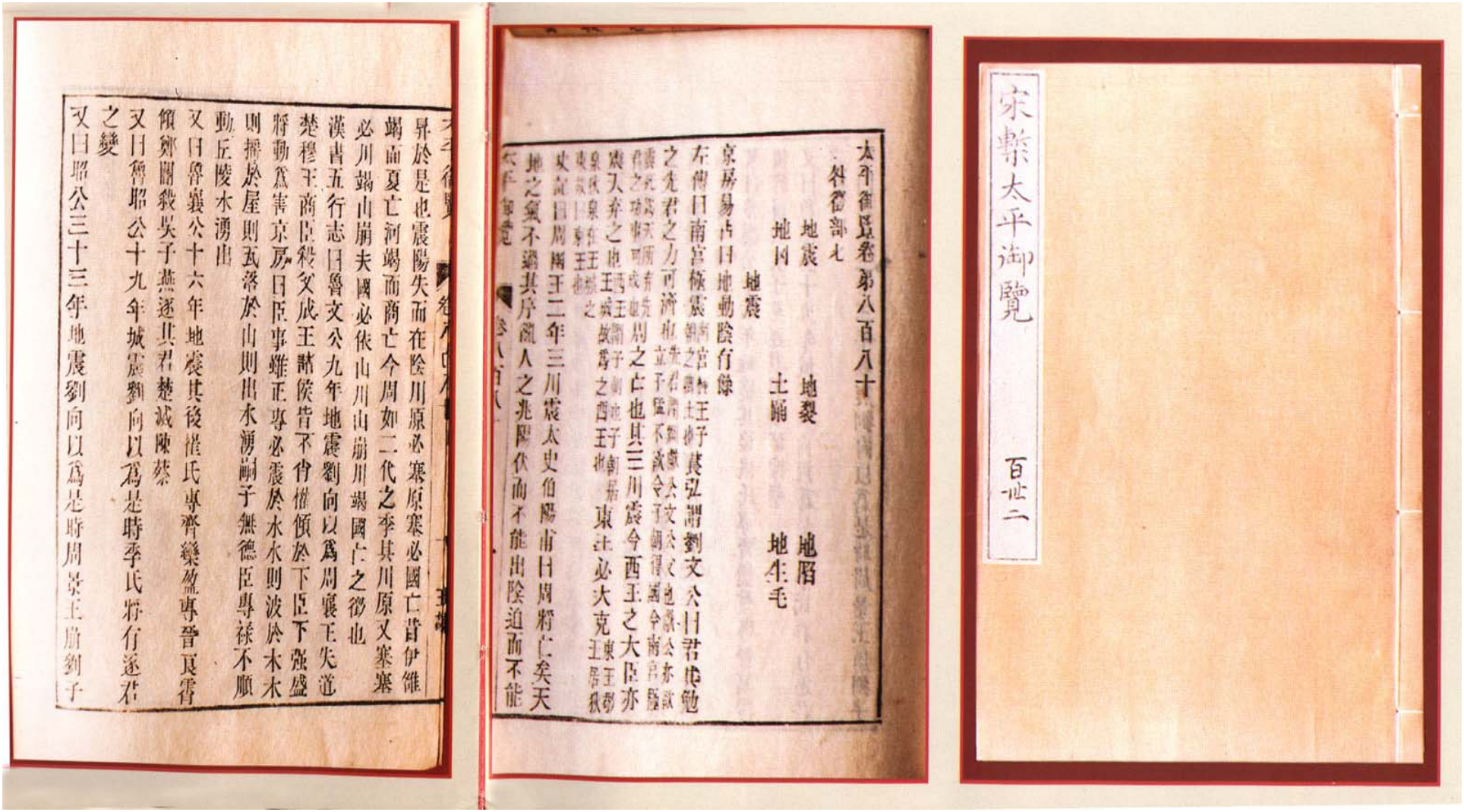
1487, Xian, M6.3



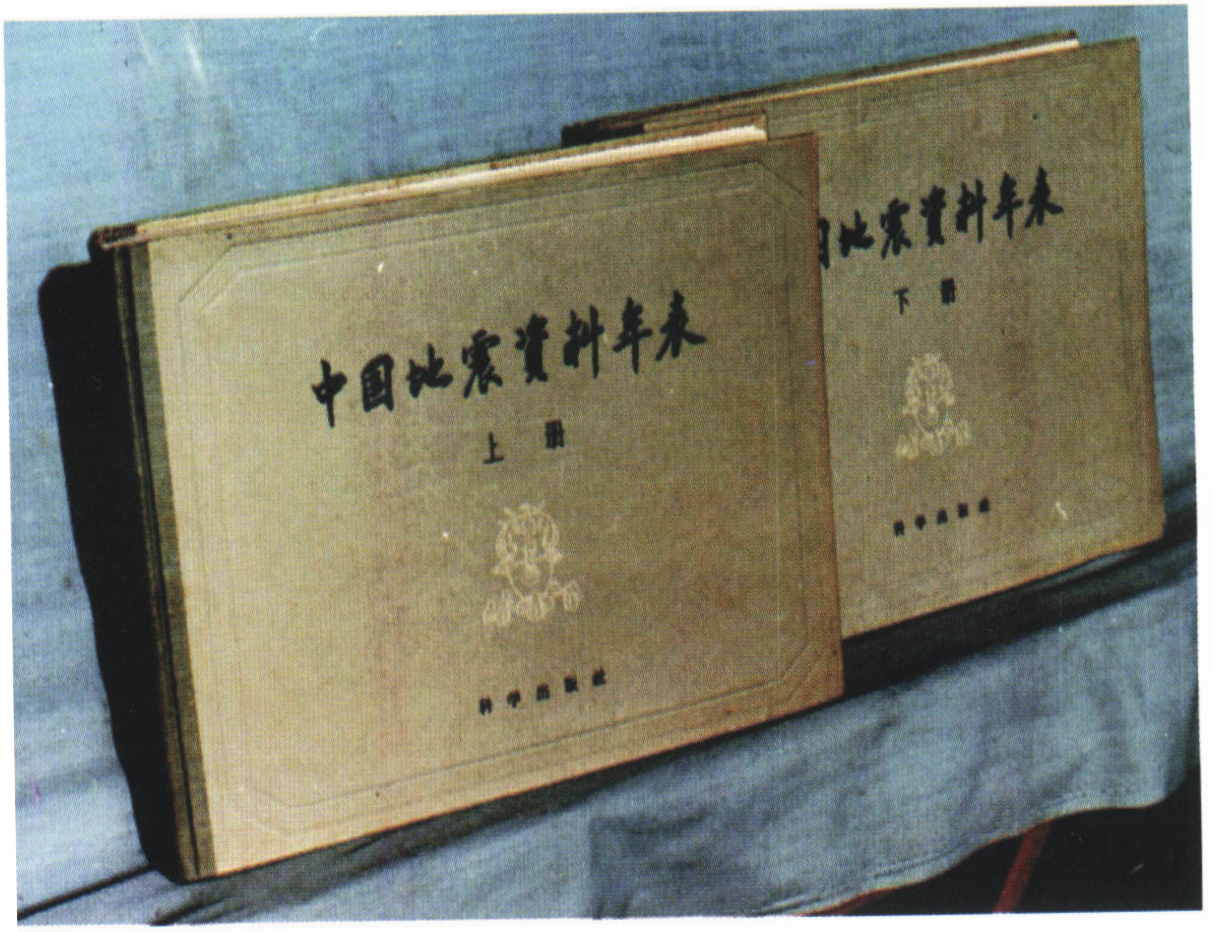
1709, Gansu,M7.5

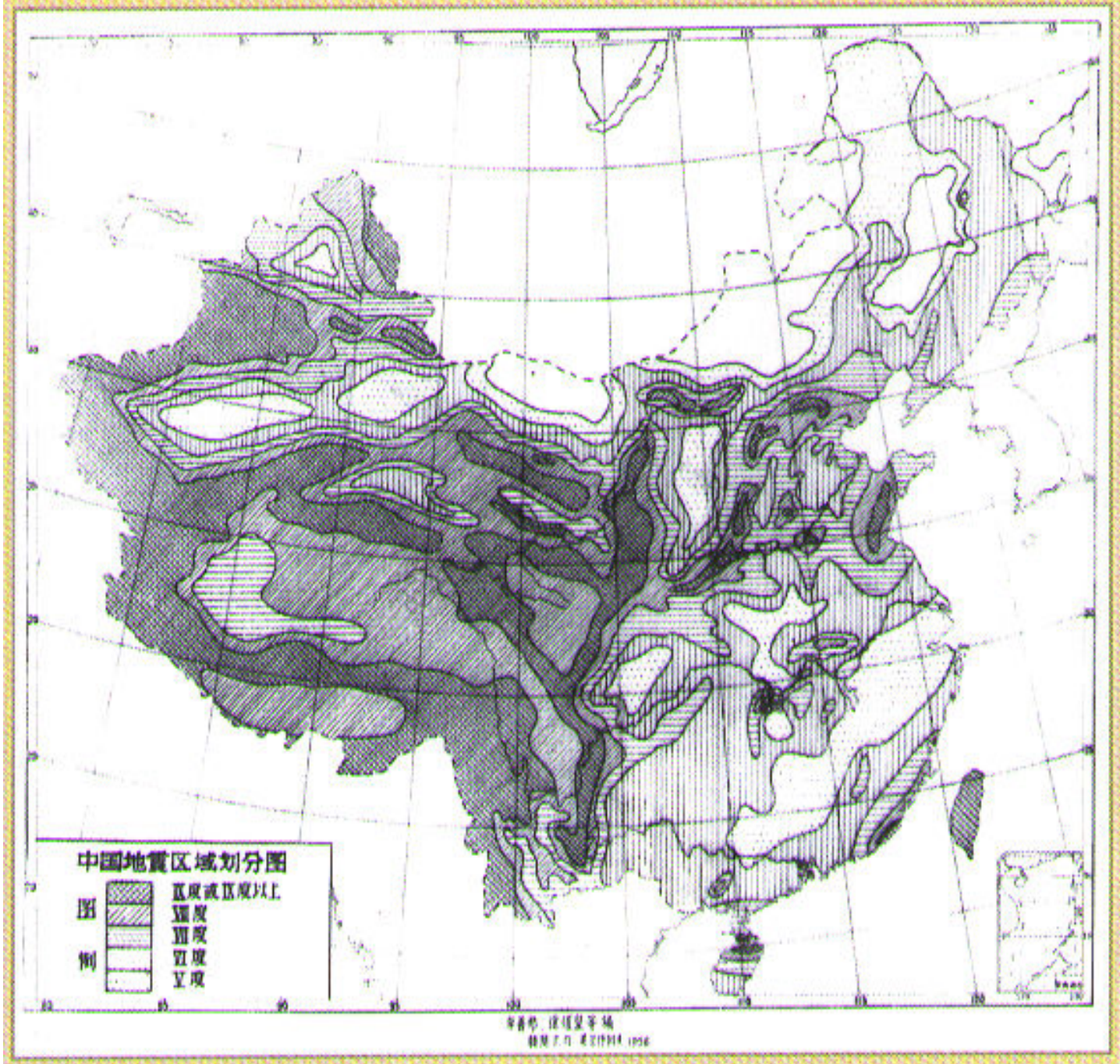
1902, Xinjiang, M8

Earthquake catalogue in China in the Song Dynasty (700 years ago)



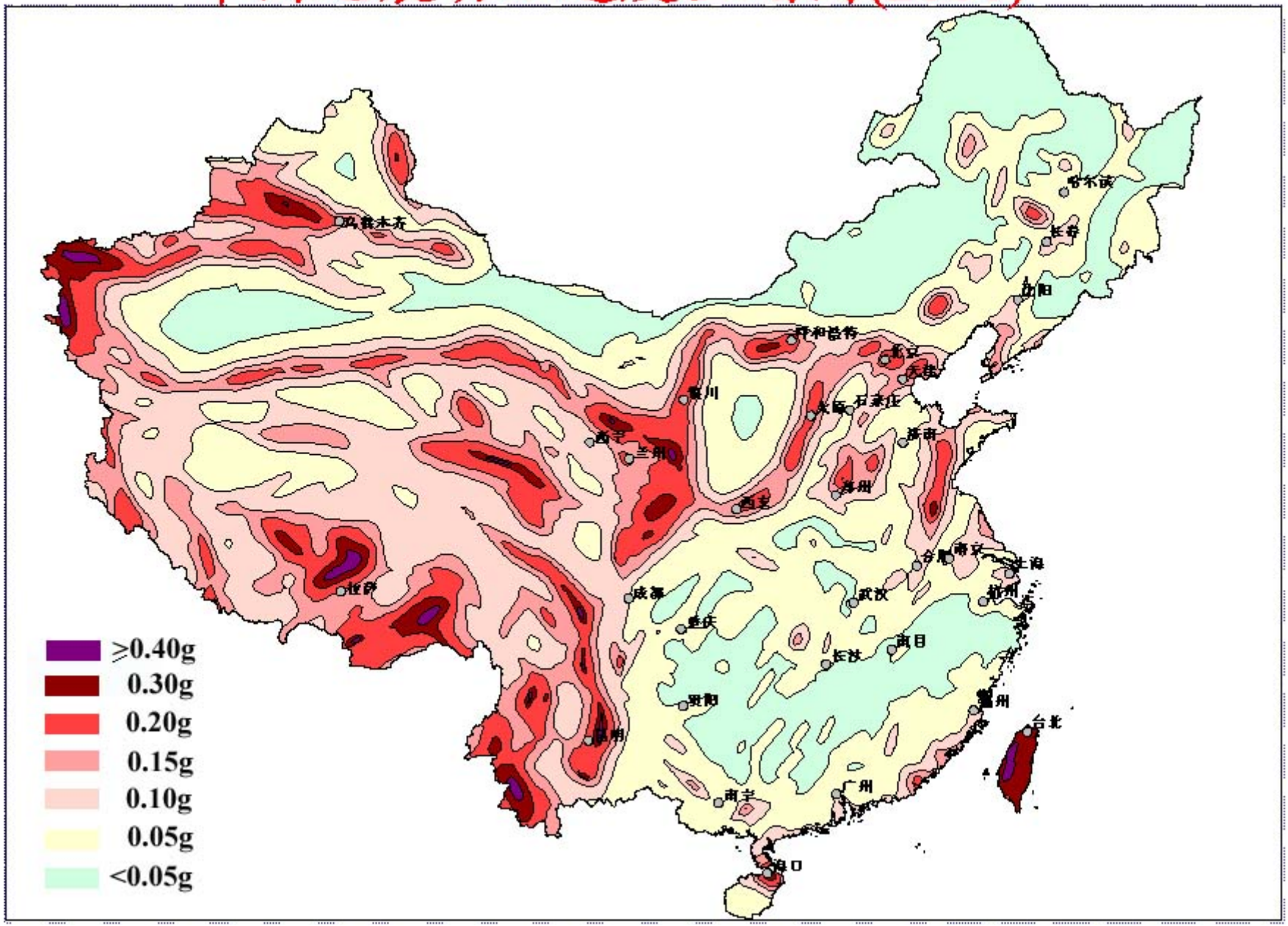
Chinese Historical Records of Earthquakes published in1956





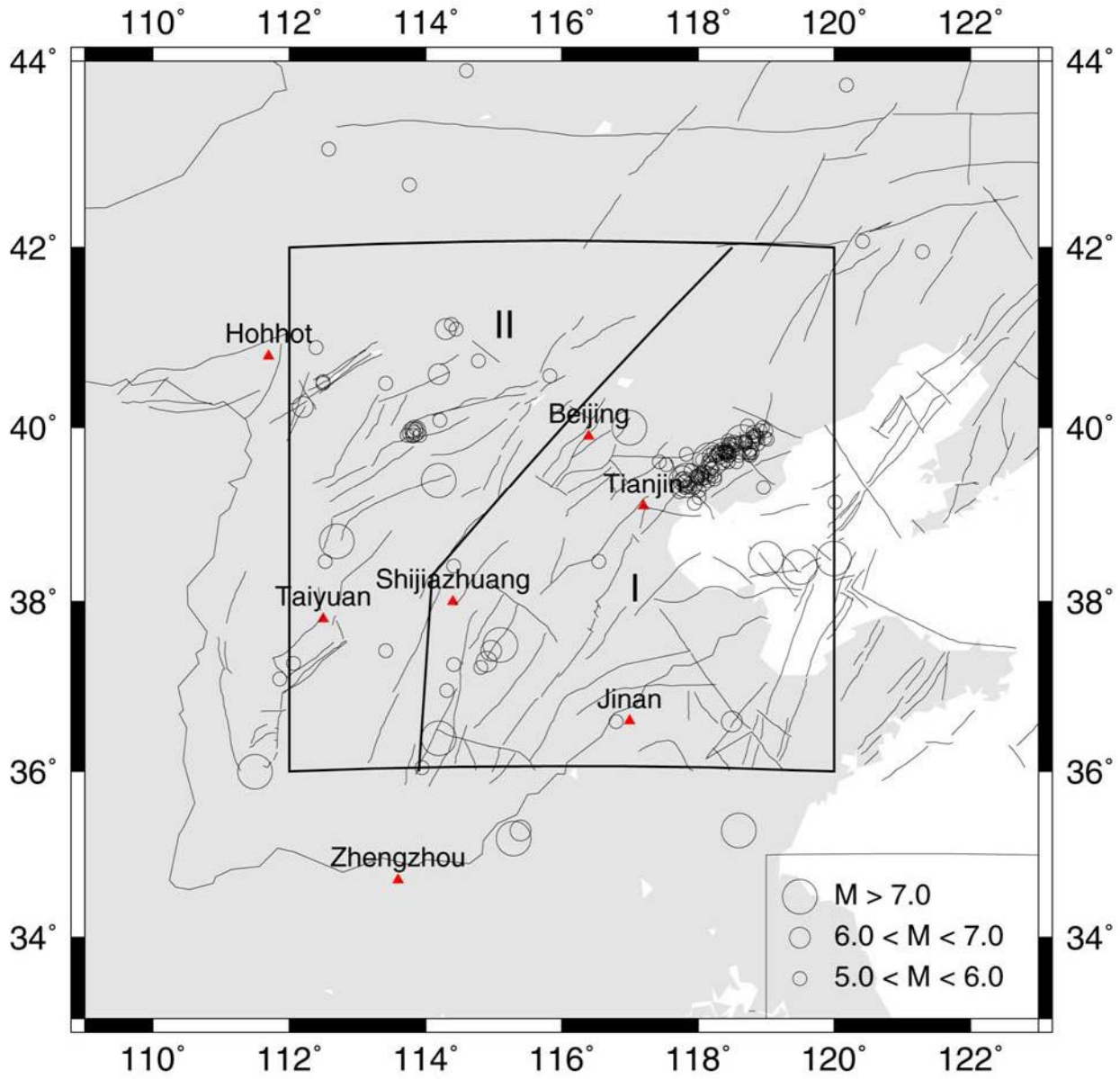
李善邦主持编制的第一幅全国地震区域划分图(1957年出版)

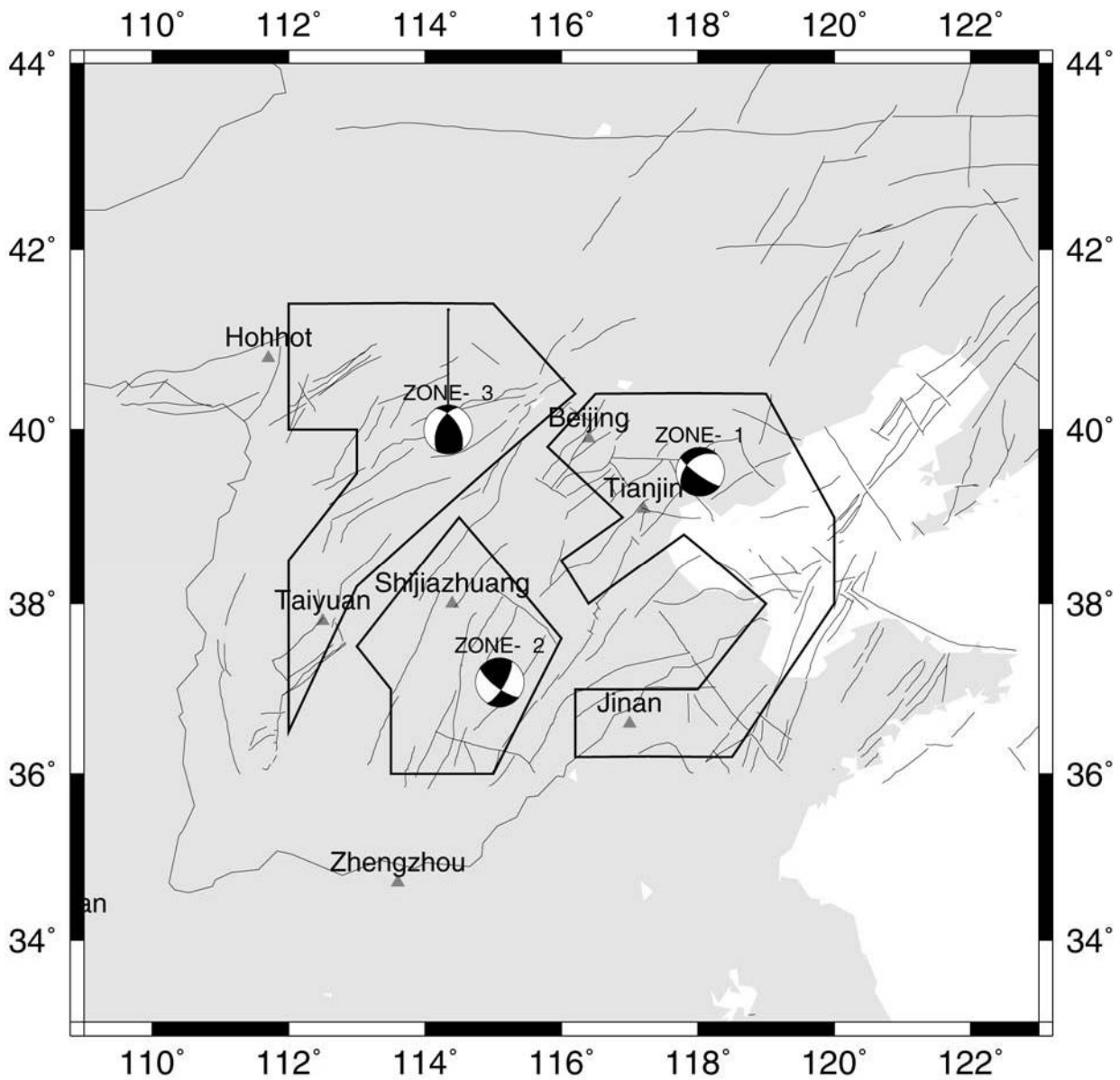
中国地震动加速度区划图(2000)

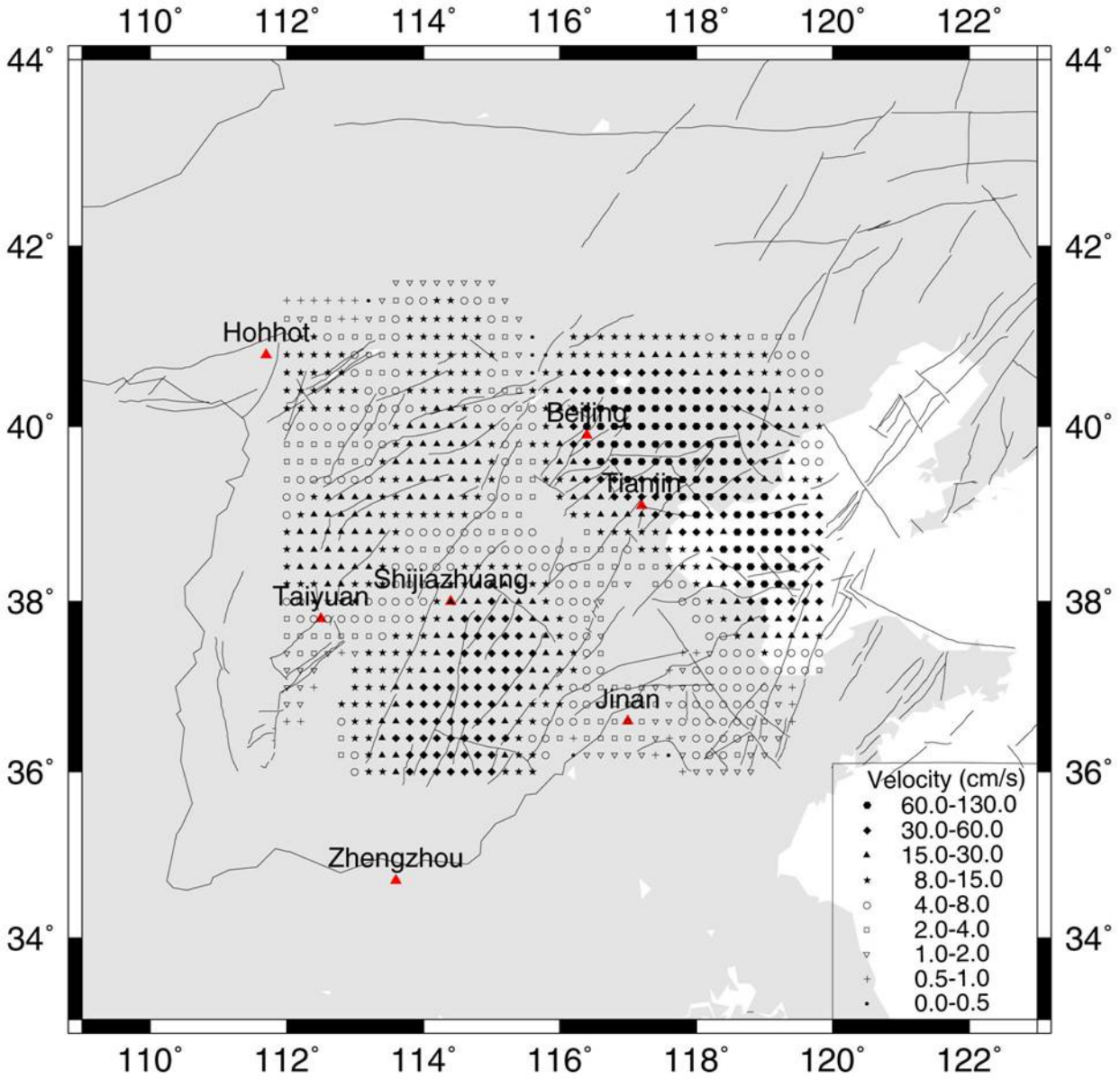


Seismic Hazard Map in North China

Epicenters in North China




110°
112°
114°
116°
118°
120°
122°
44°
42°
40°
38°
36°
34°
Hohhot
ZONE- 3
Beijing
ZONE- 1
Tianjin
Shijiazhuang
Taiyuan
ZONE- 2
Jinan
Zhengzhou


110°
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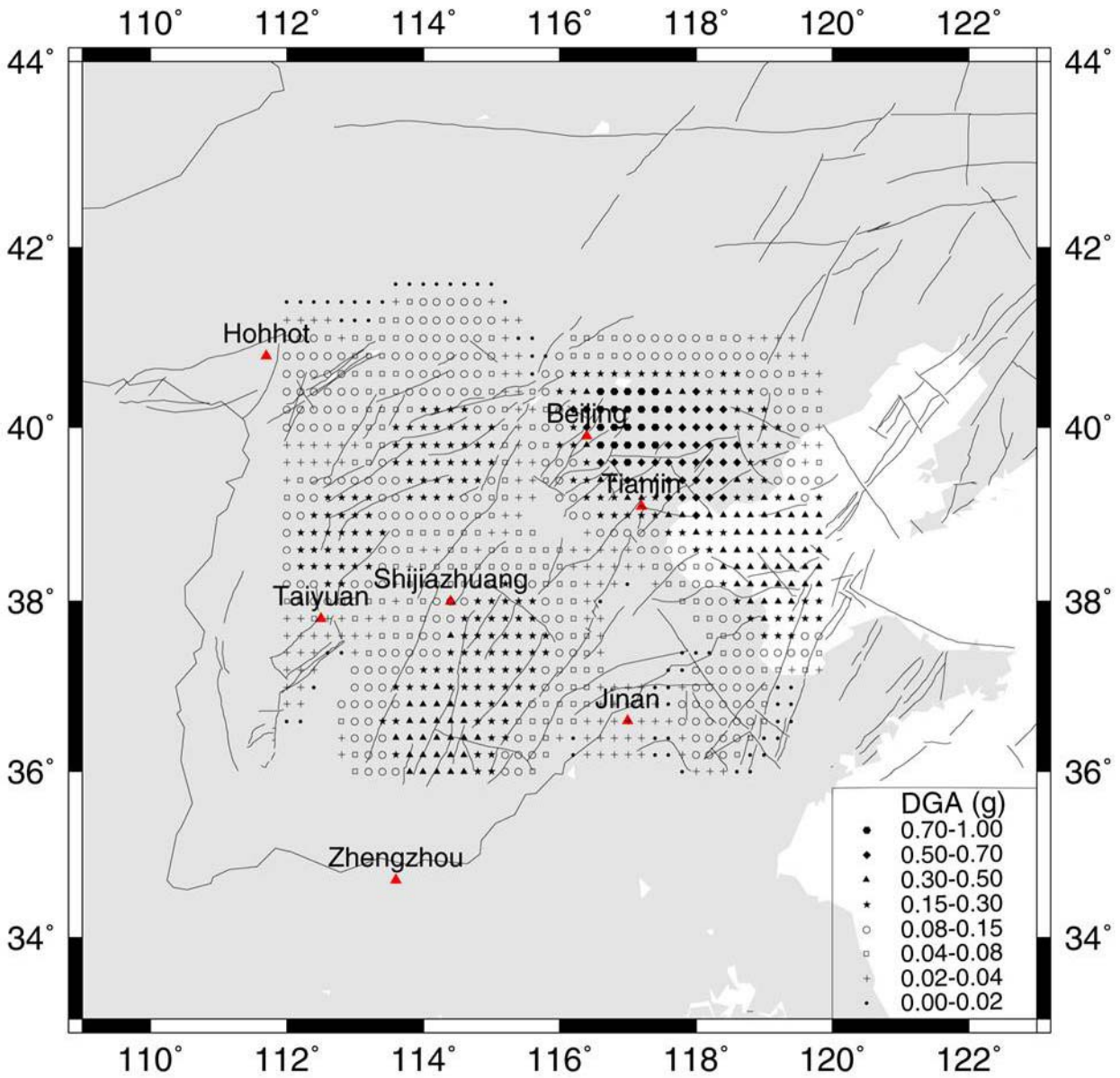
120°
122°
44°
42°
40°
38°
36°
34°
Hohhot
Beijing
Tianjin
Shijiazhuang
Taiyuan
Jinan
Zhengzhou
Velocity (cm/s)
60.0-130.0
30.0-60.0
15.0-30.0
8.0-15.0
4.0-8.0
2.0-4.0
1.0-2.0
0.5-1.0
0.0-0.5


110°
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36°
34°
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Beijing
Tianjin
Shijiazhuang
Taiyuan
Jinan
Zhengzhou
DGA (g)
0.70-1.00
0.50-0.70
0.30-0.50
0.15-0.30
0.08-0.15
0.04-0.08
0.02-0.04
0.00-0.02

Thank you!