Introduction of New Seismic Ground Motion Parameter Zonation Map of China and Case Study Analysis in Lanzhou Region

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Report Outline

1. **Progress of China New Seismic Zonation Map**
2. **Case Study Analysis in Lanzhou Region**
3. **Some Ideas for Next Generation Seismic Zonation Map**

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1. **Progress of China New Seismic Zonation Map**
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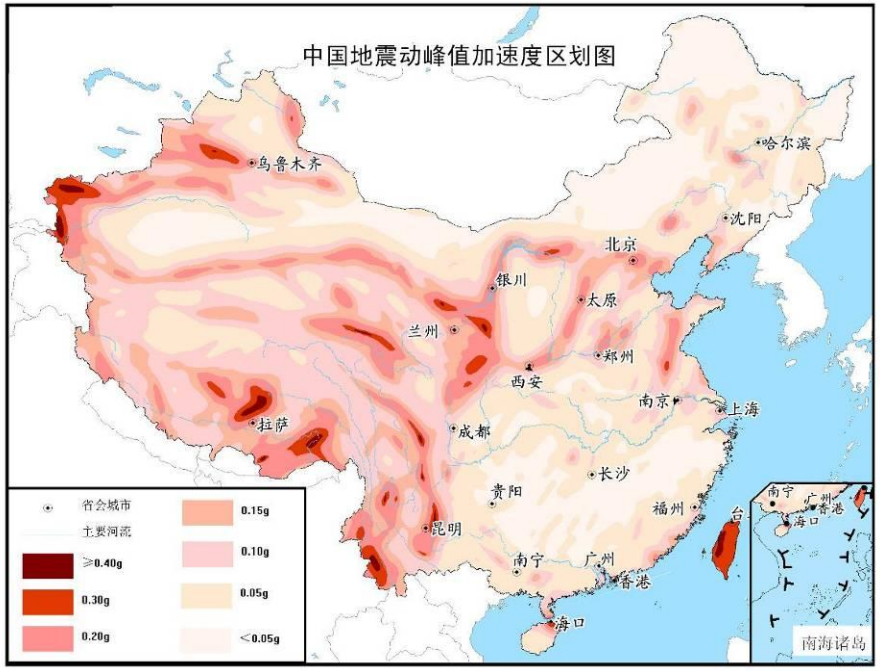
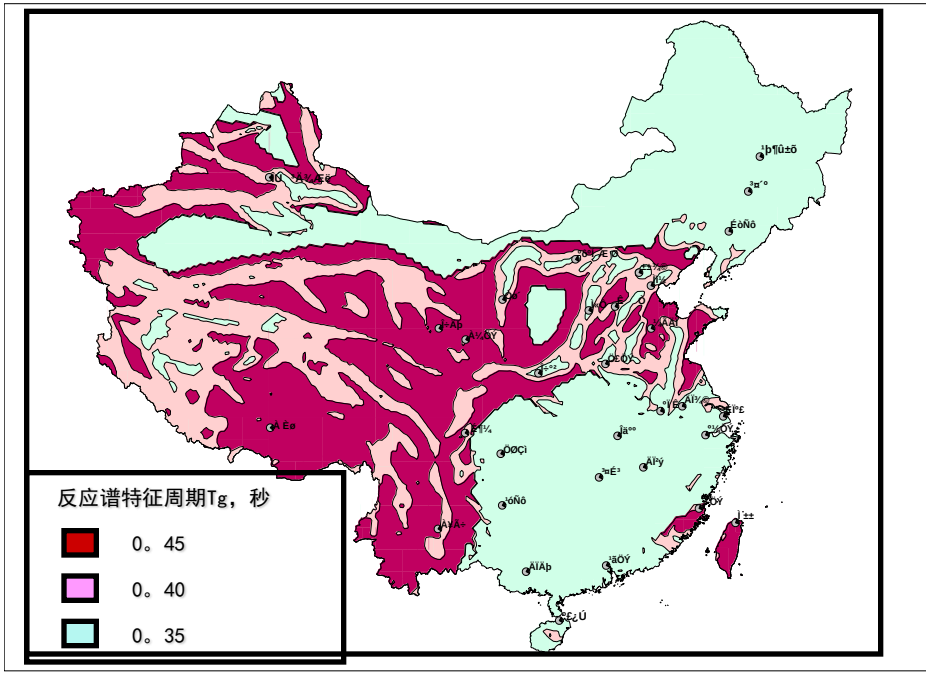
- **The new seismic zonation map, called the fifth generation seismic map of China, or the second seismic ground motion parameter zonation map, is to accomplish the compiling work and will be issued in the end of this year (2012)**
- **The first seismic ground motion parameter zonation map was issued in 2001, which is the current map**

The current (first) seismic ground motion parameter zonation map of China

Consists of two maps and one table

Two maps：peak ground acceleration map and spectral characteristic period map

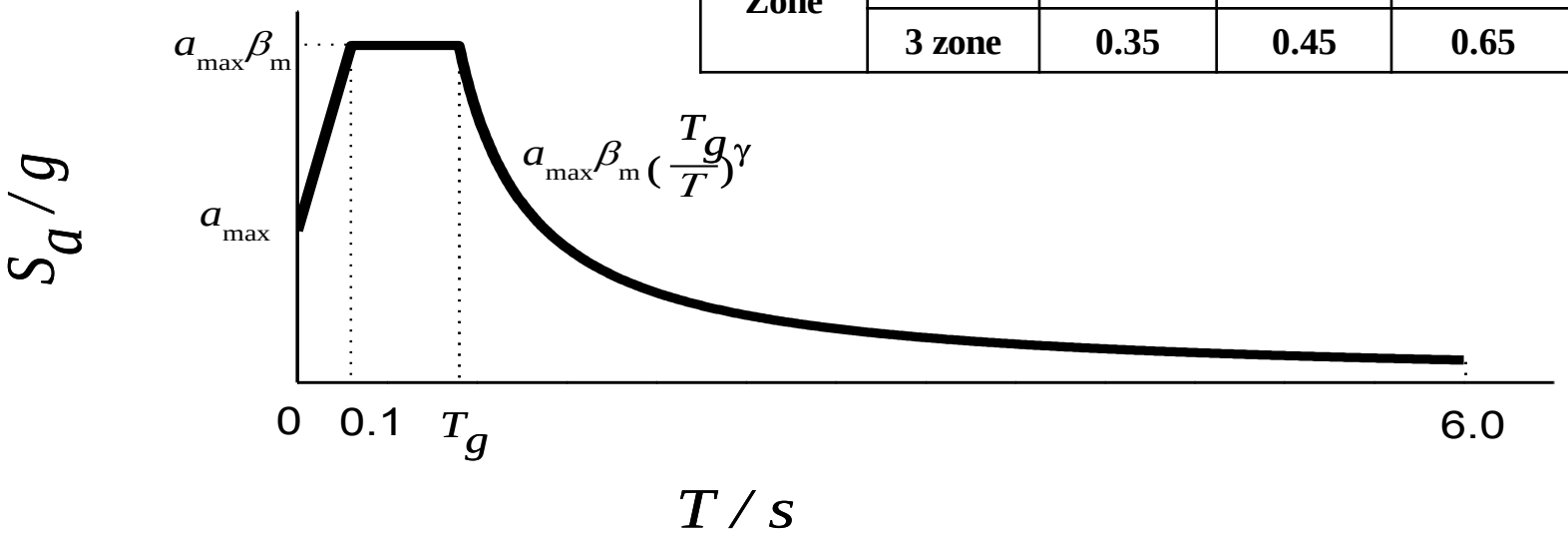




The current (first) seismic ground motion parameter zonation map of China

One table：for adjustment of spectral characteristic period Tg with site types

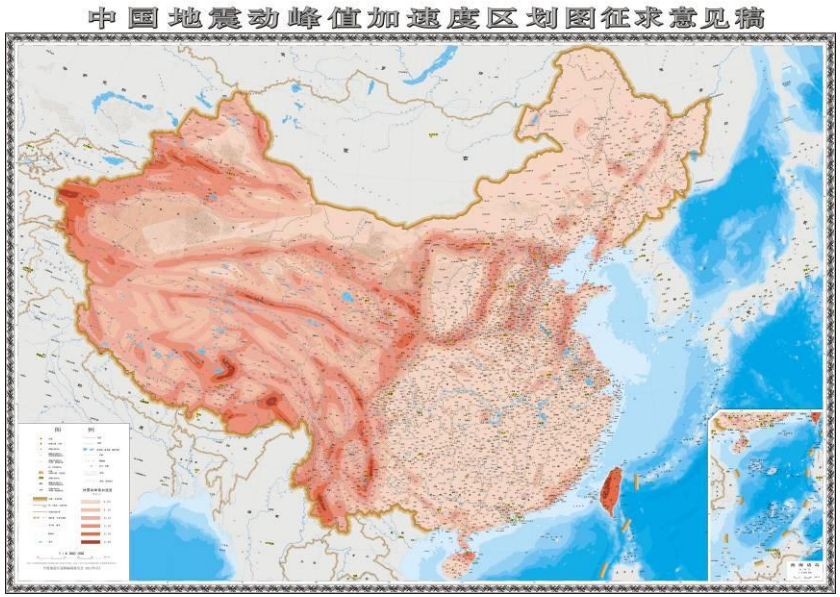
Characteristic period Tg（s）		Site type			
		I	II	III	IV
Tg Zone	1 zone	0.25	0.35	0.45	0.65
	2 zone	0.30	0.40	0.55	0.75
	3 zone	0.35	0.45	0.65	0.90

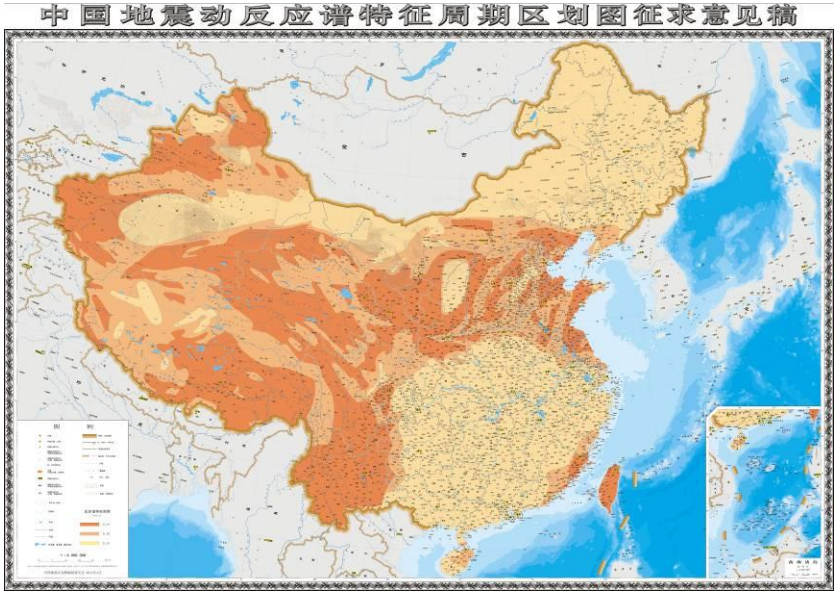


New Seismic Ground Motion Parameter Zonation Map of China (2012)

Consist of two maps and two tables

Two maps： peak ground acceleration map and spectral characteristic period map





New Seismic Ground Motion Parameter Zonation Map of China (2012)

Two tables：for adjustment of peak ground acceleration and spectral characteristic period Tg with site types

Site type	*PGA*(g) for site type II					
	≤0.05	0.10	0.15	0.20	0.30	≥0.40
I_0	0.72	0.74	0.75	0.76	0.85	0.90
I_1	0.80	0.82	0.83	0.85	0.95	1.00
II	1.00	1.00	1.00	1.00	1.00	1.00
III	1.30	1.25	1.15	1.00	1.00	1.00
IV	1.25	1.20	1.10	1.00	0.95	0.90

Tg（s）	Site type				
	I_0	I_1	II	III	IV
1 zone	0.20	0.25	0.35	0.45	0.65
2 zone	0.25	0.30	0.40	0.55	0.75
3 zone	0.30	0.35	0.45	0.65	0.90

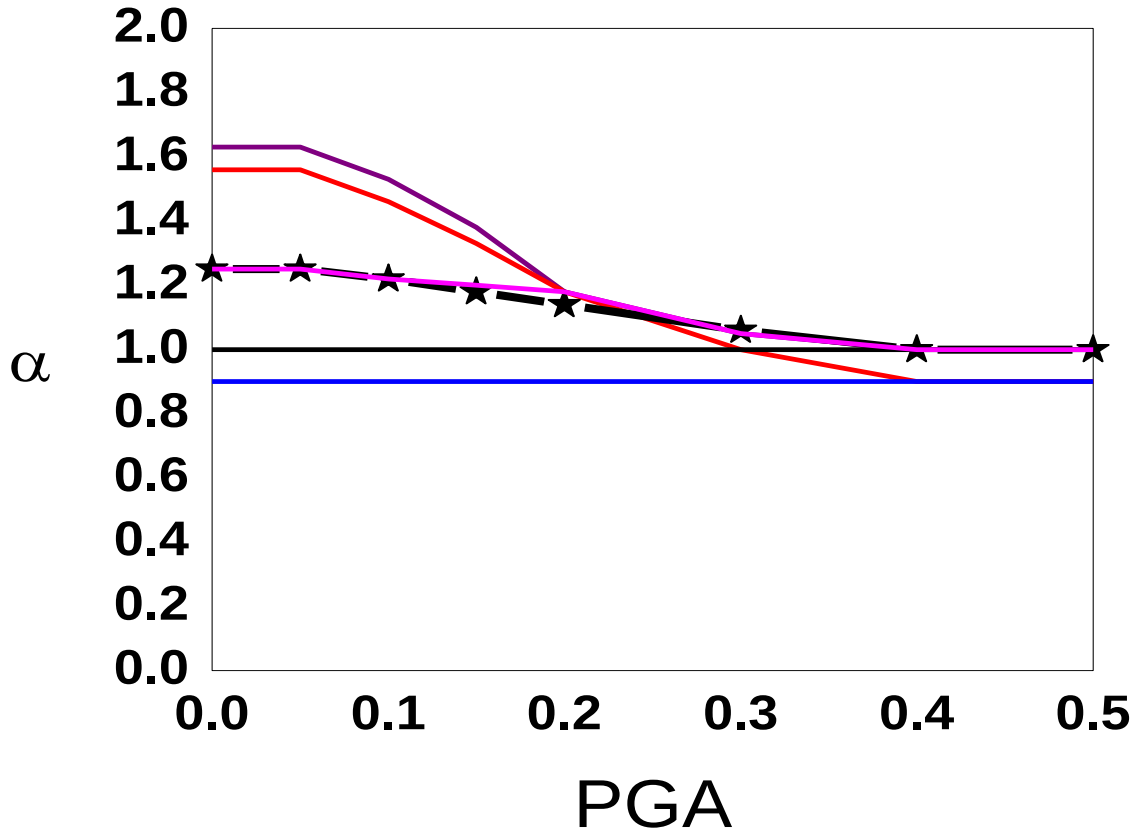
New Seismic Ground Motion Parameter Zonation Map of China (2012)

- **What is the difference for the new map?**

- **The main difference should be the table for adjustment of peak ground acceleration with change of site types**
- **In effect, it is to consider the influence of site condition on ground motion**

  and also the nonlinear properties of site condition

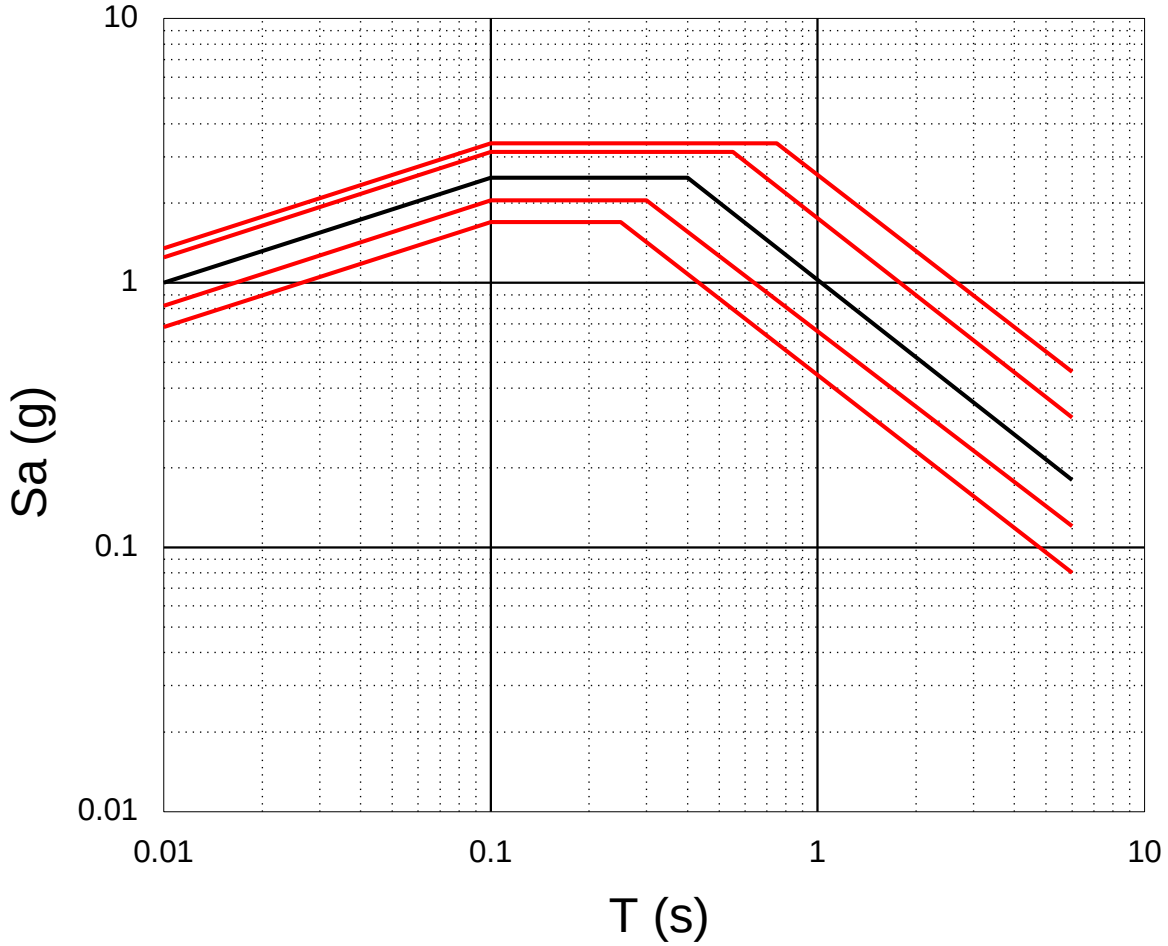
The curves for adjustment of PGA with site types



Site type	*PGA*(g) for site type I					
	≤0.05	0.10	0.15	0.20	0.30	≥0.40
I_0	0.90	0.90	0.90	0.90	0.90	0.90
I_1	1.00	1.00	1.00	1.00	1.00	1.00
II	1.25	1.22	1.20	1.18	1.05	1.00
III	1.63	1.53	1.38	1.18	1.05	1.00
IV	1.56	1.46	1.33	1.18	1.00	0.90

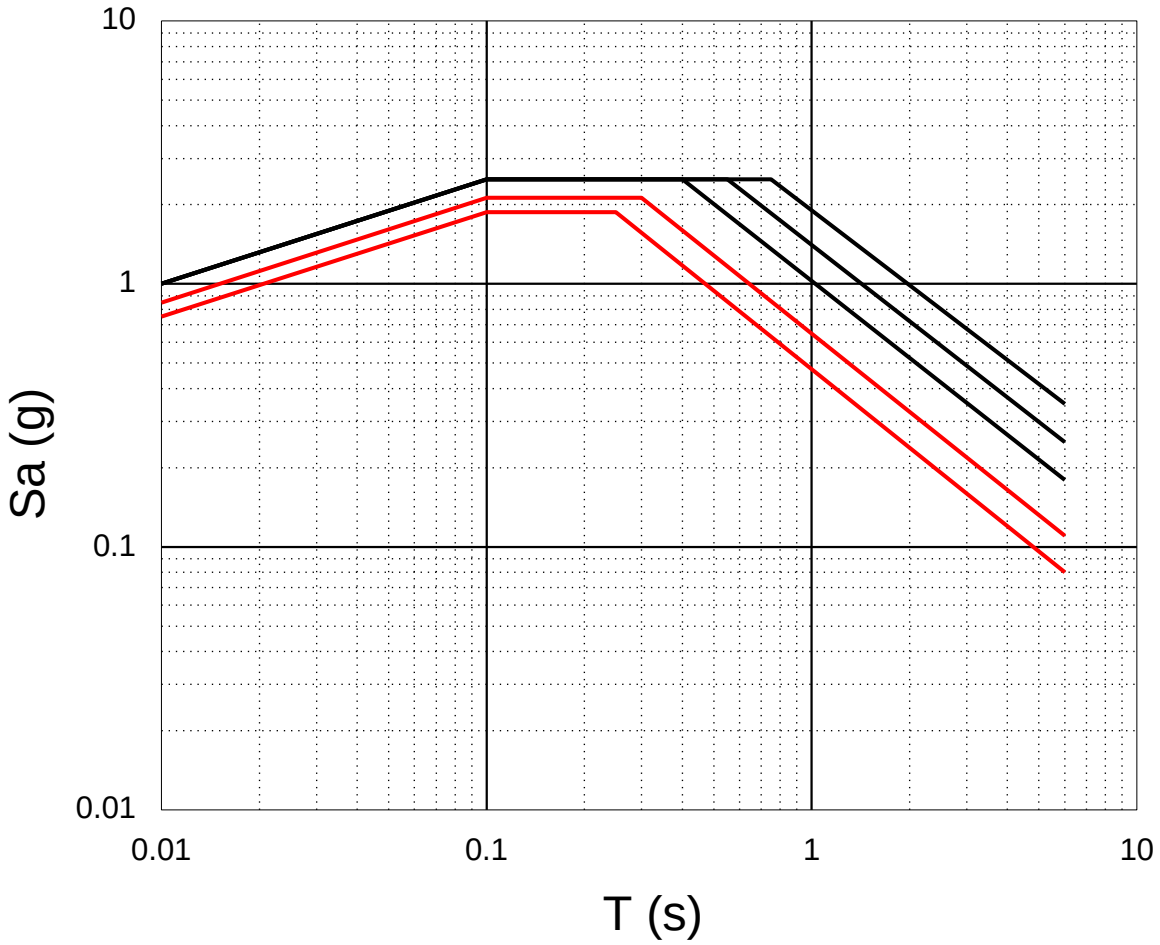
◆ The curves for adjustment of Sa with site types

0.10g



The curves for adjustment of Sa with site types

0.20g



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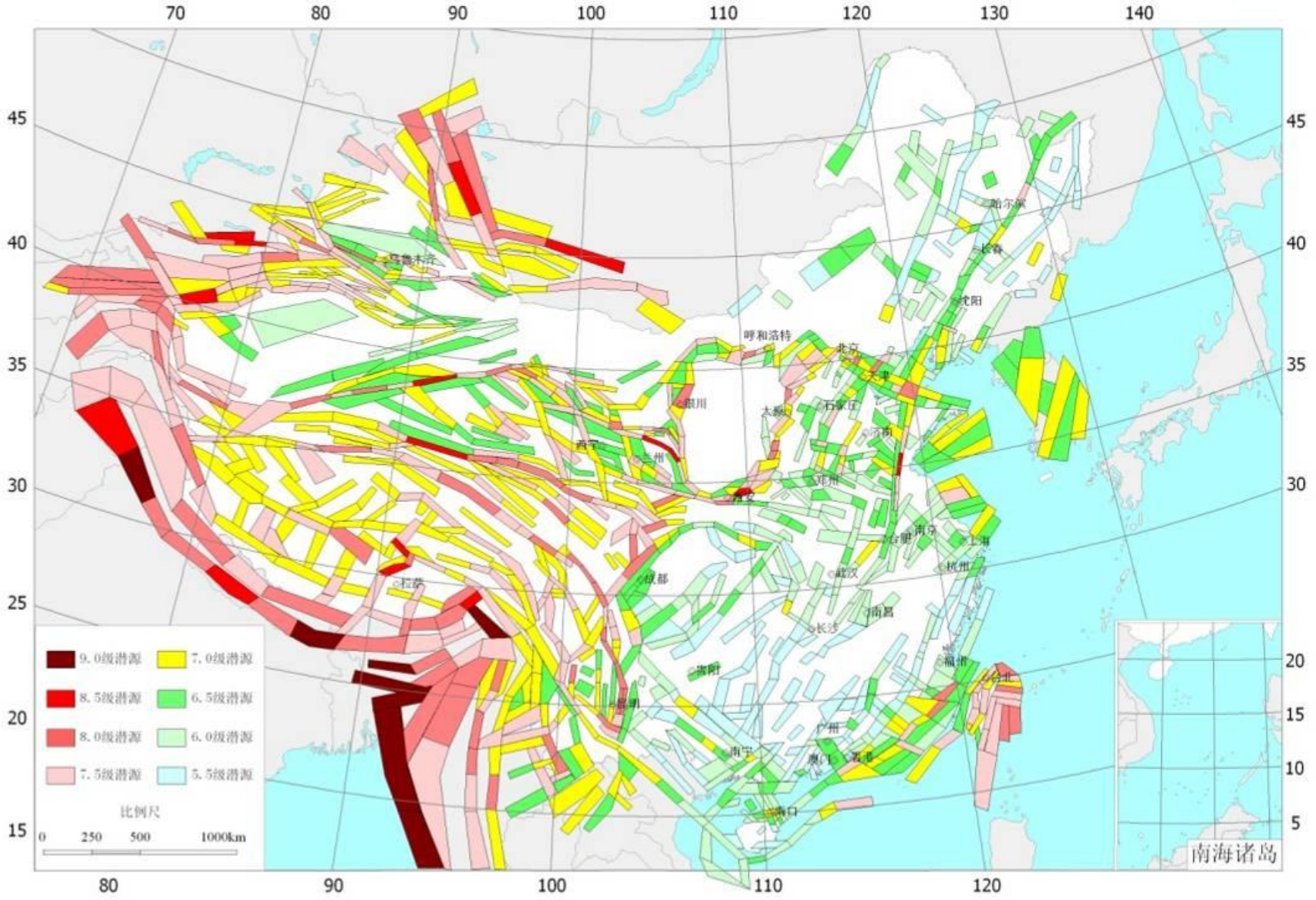
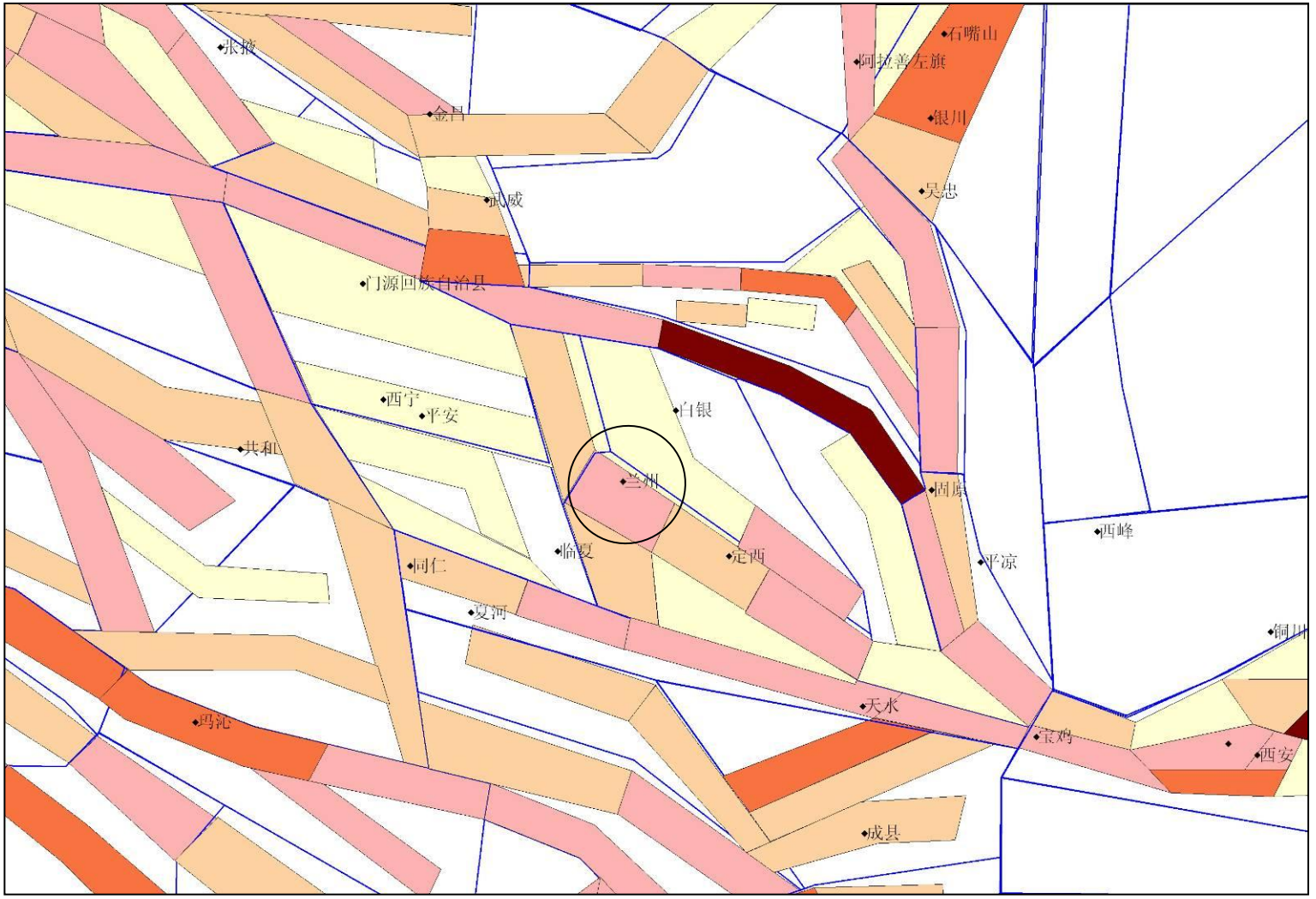
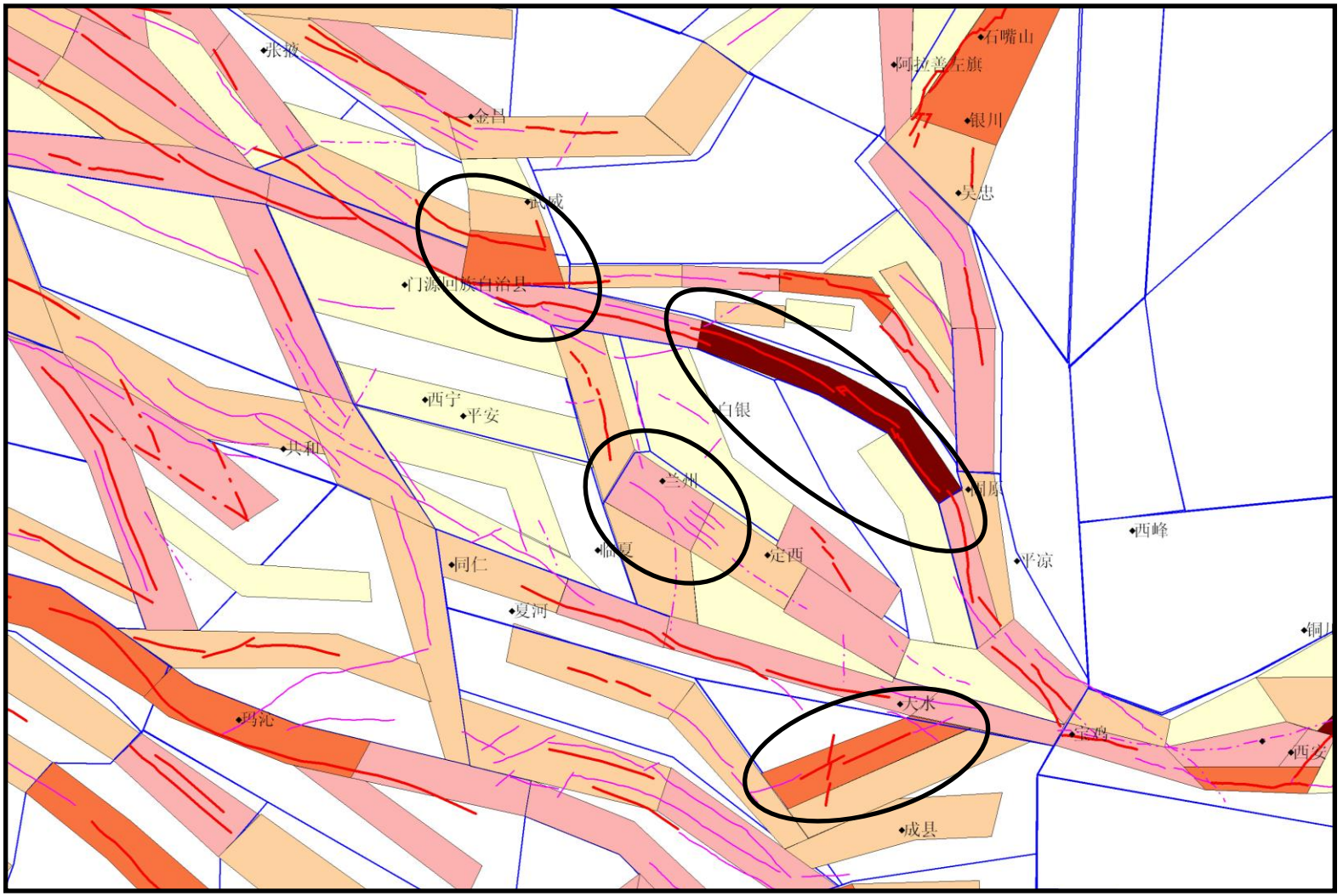
The map of potential seismic sources in China



The map of potential seismic sources in Lanzhou region

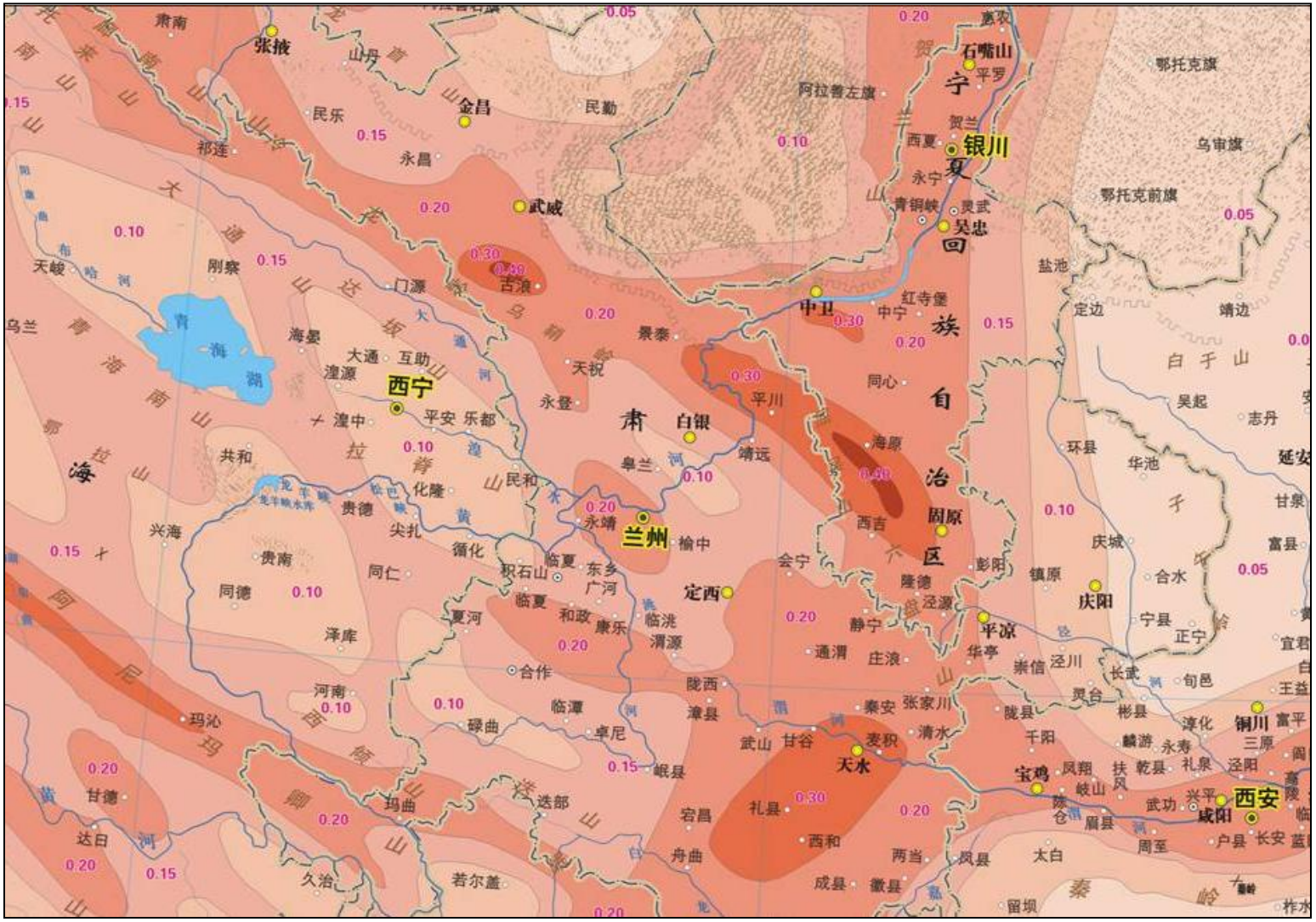


Potential seismic sources and active faults

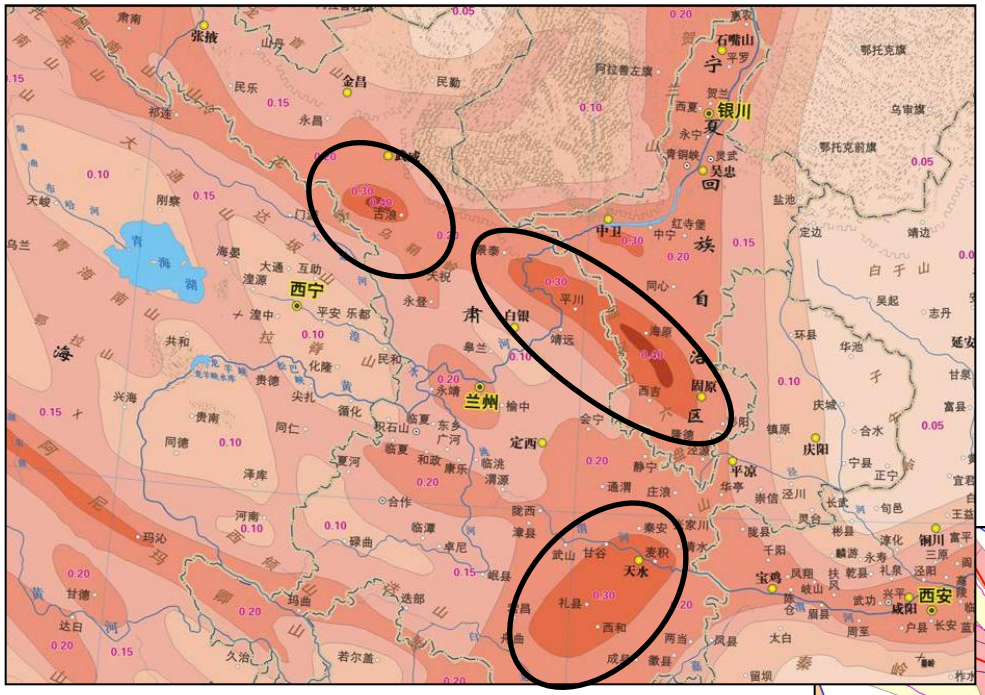


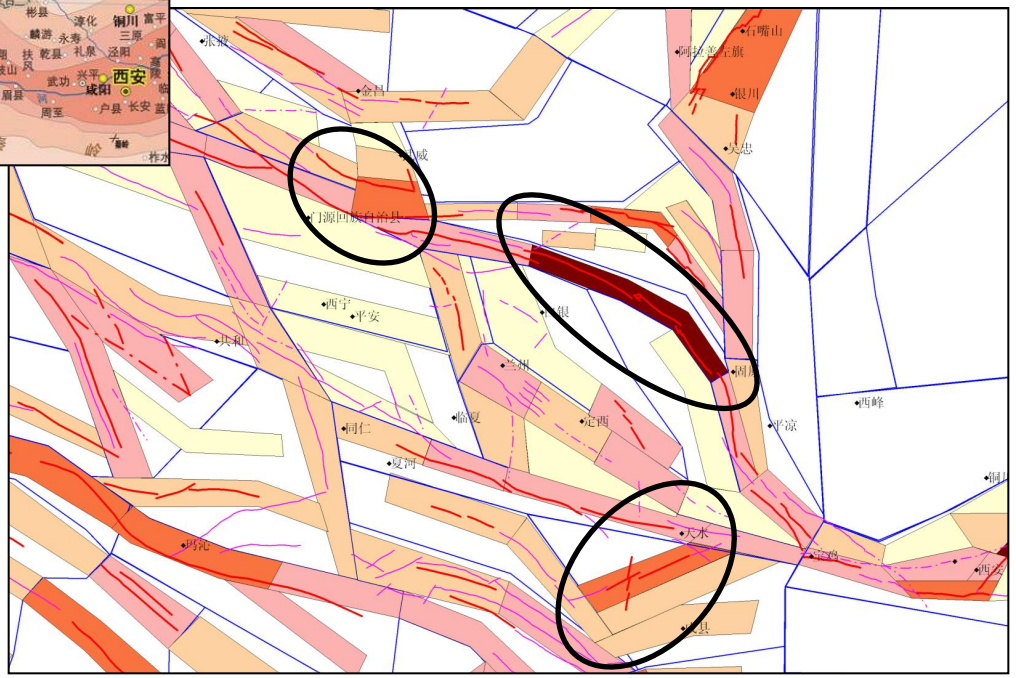
Source areas with high upper magnitude (such as 8.0, 8.5)
Strong back ground source area (M7.5) in Lanzhou region

The map of PGA for return period of 1 in 475 years



Comparison of PGA distribution and potential sources





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Some Ideas for Next Generation Seismic Zoning Map

1. **Compile seismic zonation maps with different exceeding probabilities ? Provide suitable design parameters of ground motion for different types of engineering structures**

- **The current and new seismic zontation map takes same PGA and Sa maps for different exceeding probabilities but adjusted values**
- **E.g.:**

  K2：STE/ME（PGA） 1.8～2.0

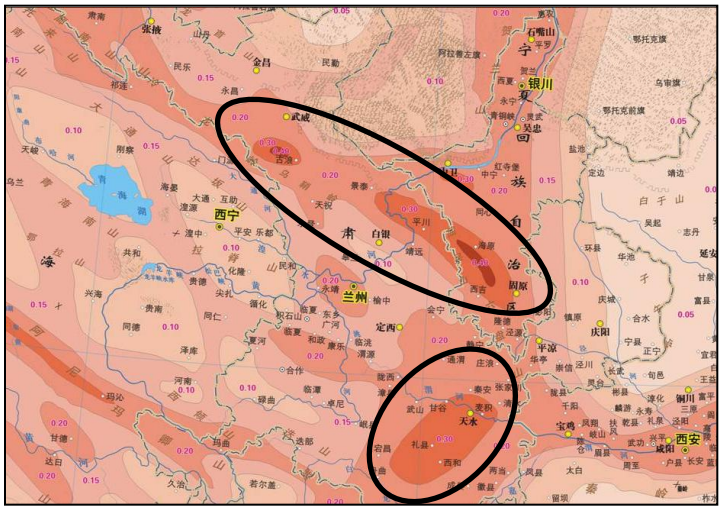
  K3：SME/ME（PGA） 1/2.8～1/3.0

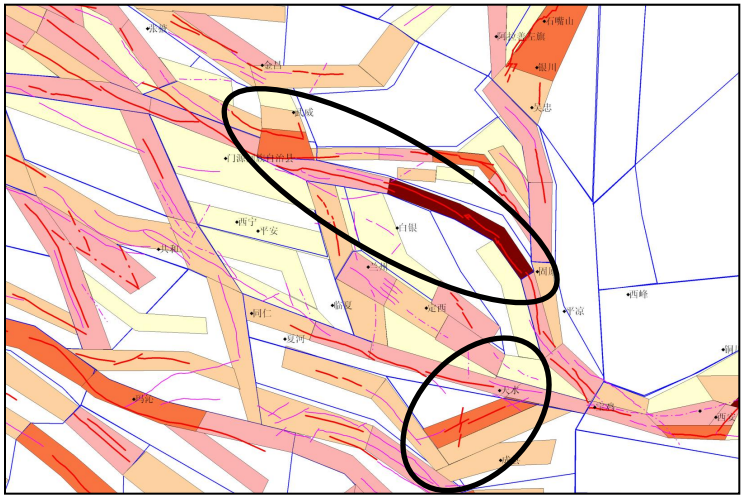
STE: strong earthquake, 2% probability of exceedance in 50 years
ME: moderate earthquake, 10% probability of exceedance in 50 years
SME: small earthquake, 63% probability of exceedance in 50 years

Some Ideas for Next Generation Seismic Zoning Map

1. **Compile seismic zonation maps with different exceeding probabilities ? Provide suitable design parameters of ground motion for different types of engineering structures**

- **Whether the same zonation map is suitable for different exceeding probabilities ?**

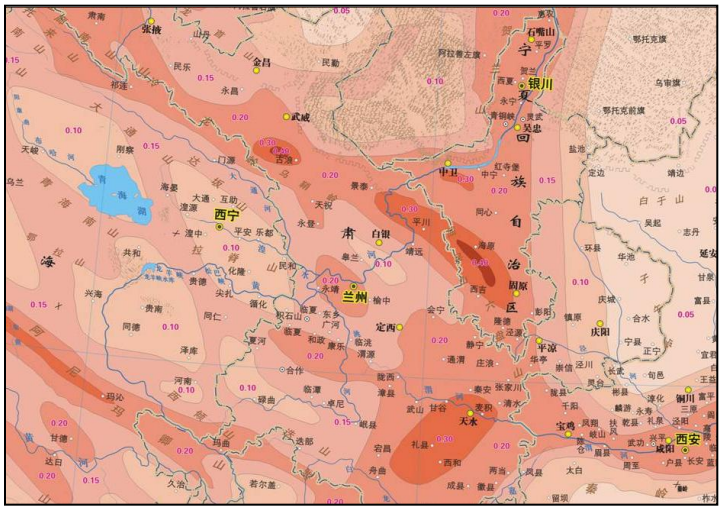


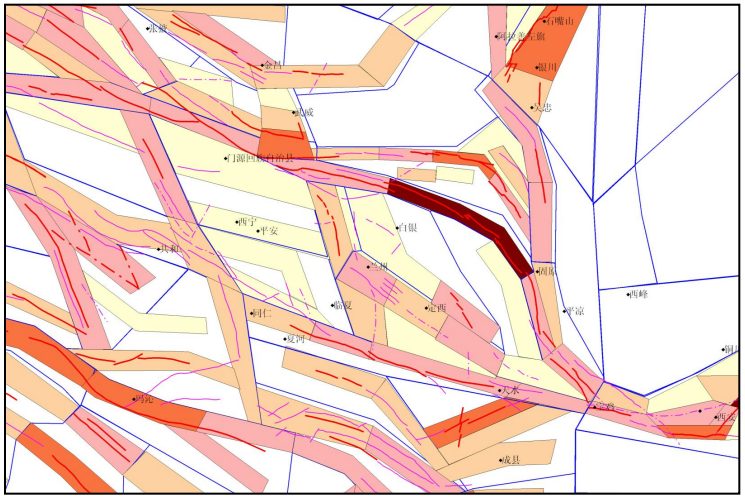


Some Ideas for Next Generation Seismic Zoning Map

2. **Compiling seismic zonation maps with different ground motion parameters，such as peak ground acceleration, peak ground velocity and spectral accelerations ?**

- **Provide suitable design parameters of ground motion for different types of engineering structures, such buildings, buried pipelines**
- **E.g., PGA and Sa are not suitable parameters but PGV**





Some Ideas for Next Generation Seismic Zoning Map

3. **Another issue discussed is how to considering the impact of the seismic potential source areas with high upper magnitude (such as 8.0, 8.5 and 9.0) on near-field ground motion in seismic zonation map compiling**

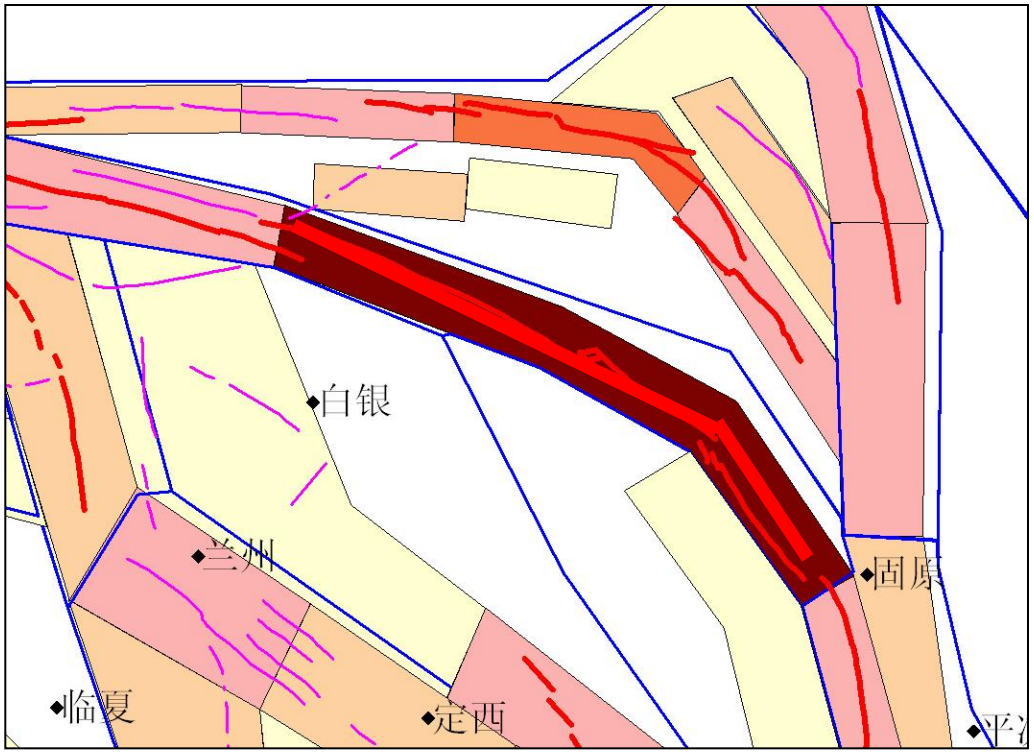
- **Comprehensive consideration of the probabilistic seismic hazard analysis method and deterministic seismic hazard analysis method was suggested to deal with the problem**

Why do we consider the deterministic method ?

Some Ideas for Next Generation Seismic Zoning Map

Why do we consider the deterministic method ?

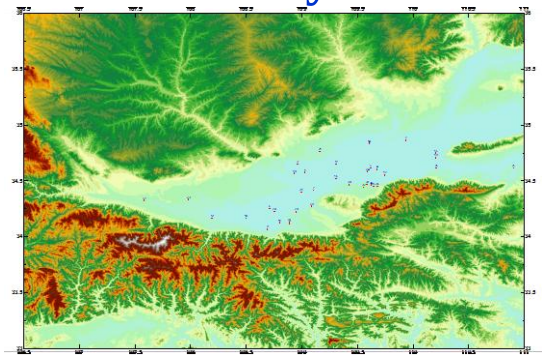
- **For a active fault with stronger seismicity, such as recurrence period of less than several thousand years, it will very much underestimate the earthquake impact on the near field ground motion**
- **Because the potential source divided reduce the probability of earthquake ocuring**

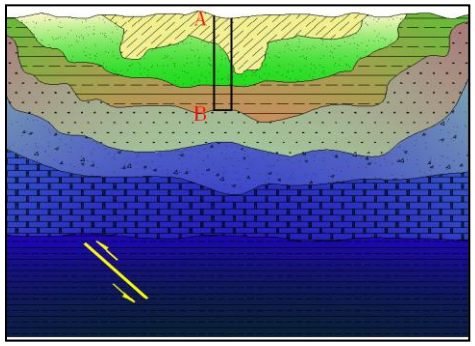


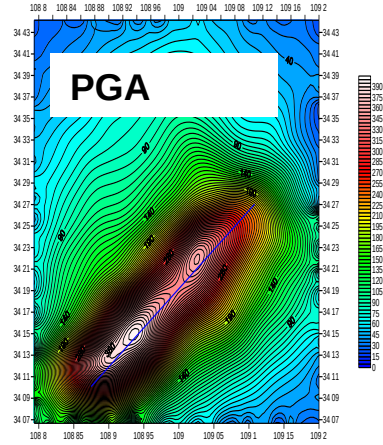
Some Ideas for Next Generation Seismic Zoning Map

3. **Another issue discussed is how to considering the impact of the seismic potential source areas with high upper magnitude (such as 8.0, 8.5 and 9.0) on near-field ground motion in seismic zonation map compiling**

- **Comprehensive consideration of the probabilistic seismic hazard analysis method and deterministic seismic hazard analysis method was suggested to deal with the problem**
- **The near-field ground motion estimation method based on finite fault source should be adopted as the deterministic seismic hazard analysis method**

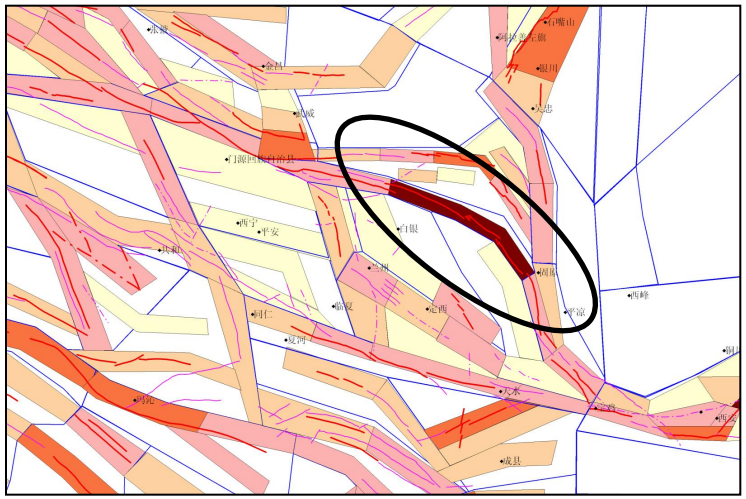


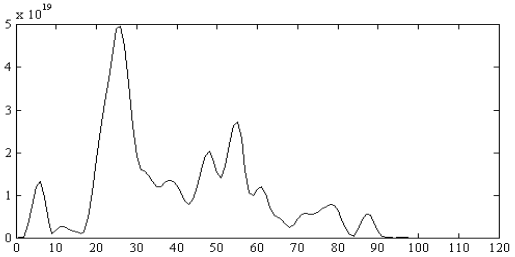


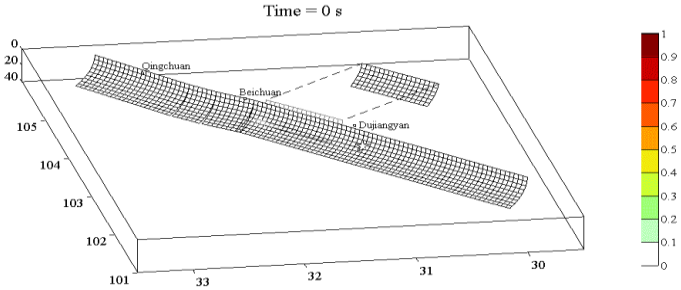


Some Ideas for Next Generation Seismic Zoning Map

- Key point is how to determine the earthquake magnitudes and source models for different exceeding probabilities
- Study the relation of the calculating earthquake magnitude and the high upper magnitude of potential source
- Also study the relation of the calculating earthquake magnitude and the exceeding probability







震源模型滑动速率的时空变化图像

Thanks !