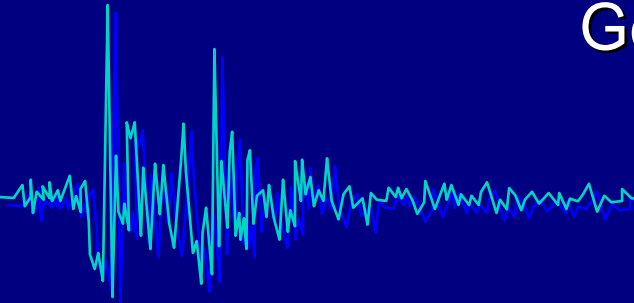


2008 Wenchuan Earthquake

Geological and geotechnical Perspectives

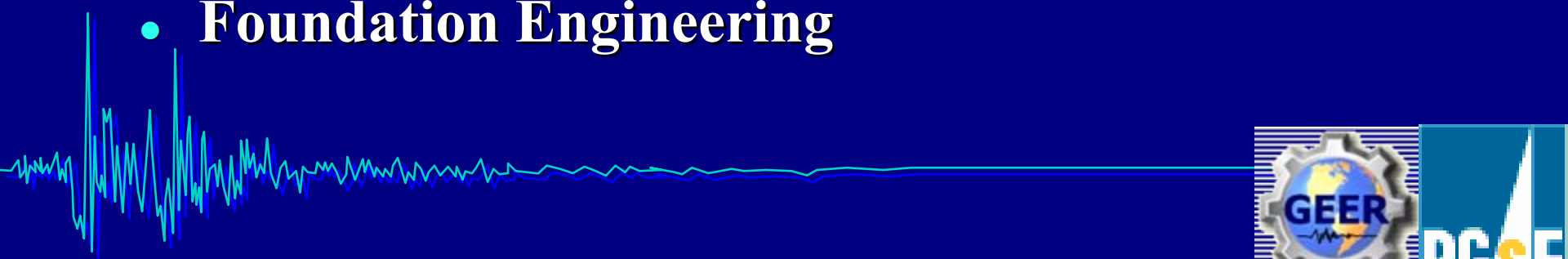
Joseph Sun

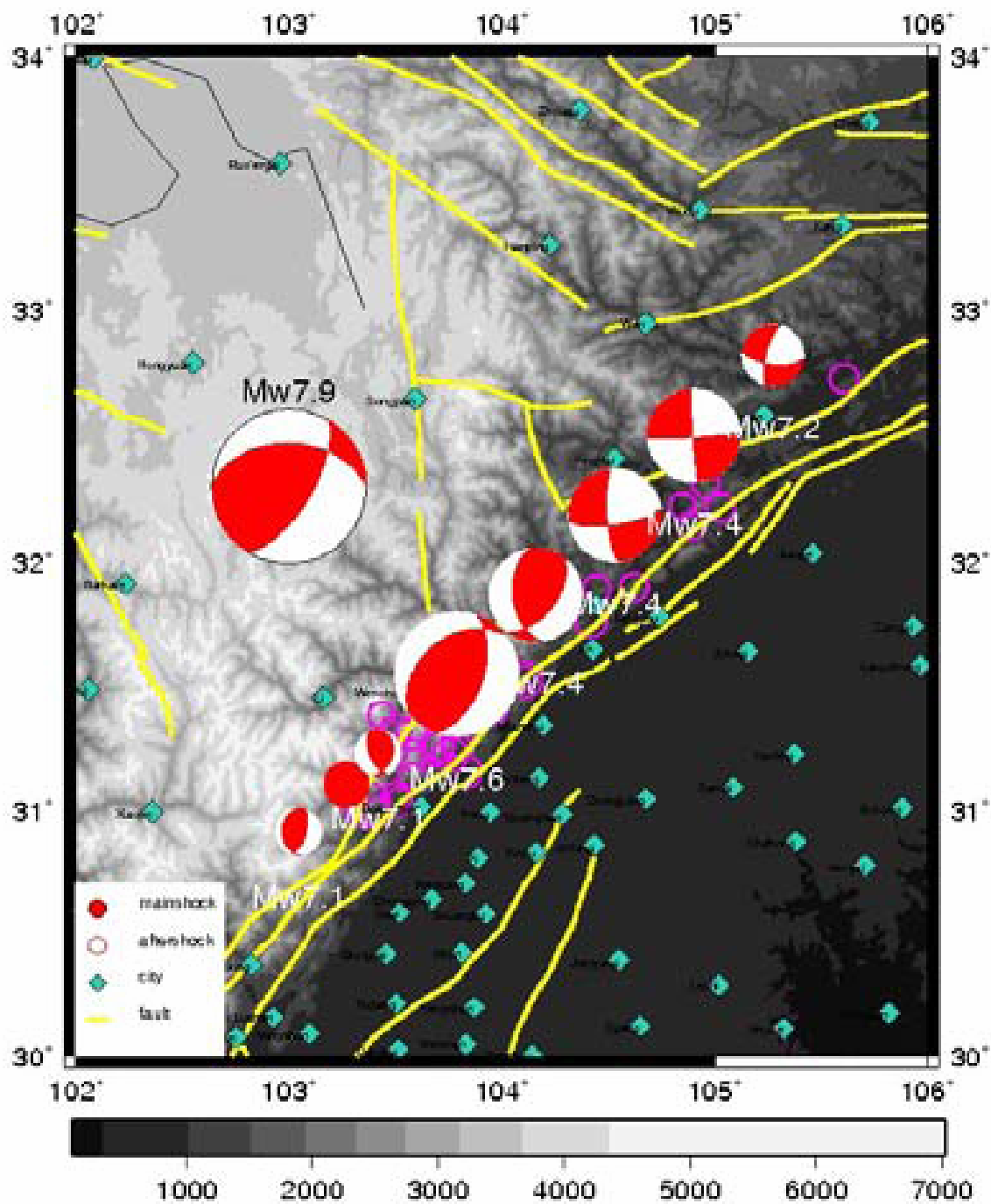
Geosciences Dept, PG&E
August 18, 2008



Presentation Outline

- **Seismic Source Characterization**
- **Fault trace**
- **Landslides / Debris Dams**
- **Liquefaction**
- **Earth Retaining Systems**
- **Dams and Reservoirs**
- **Foundation Engineering**

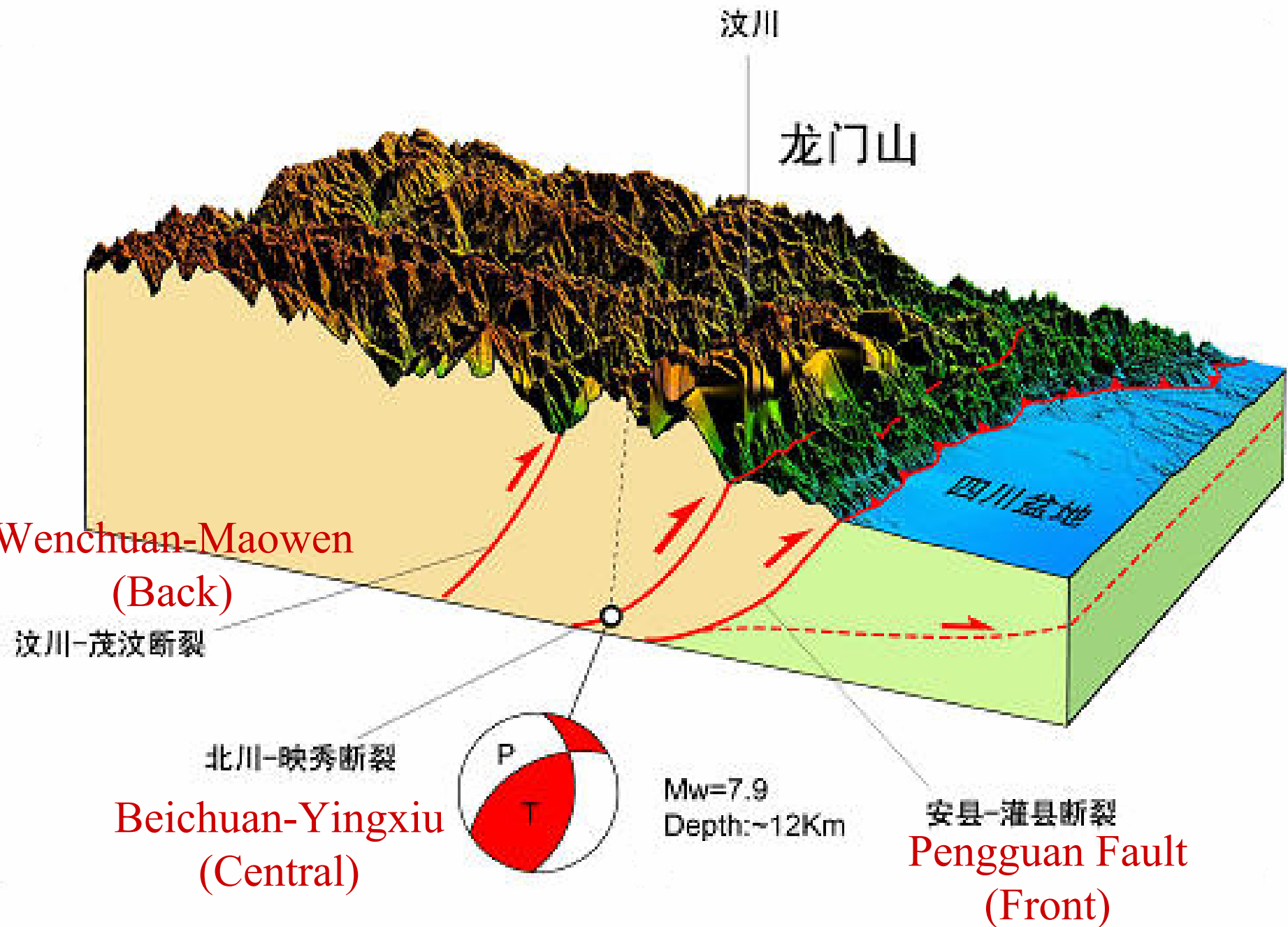




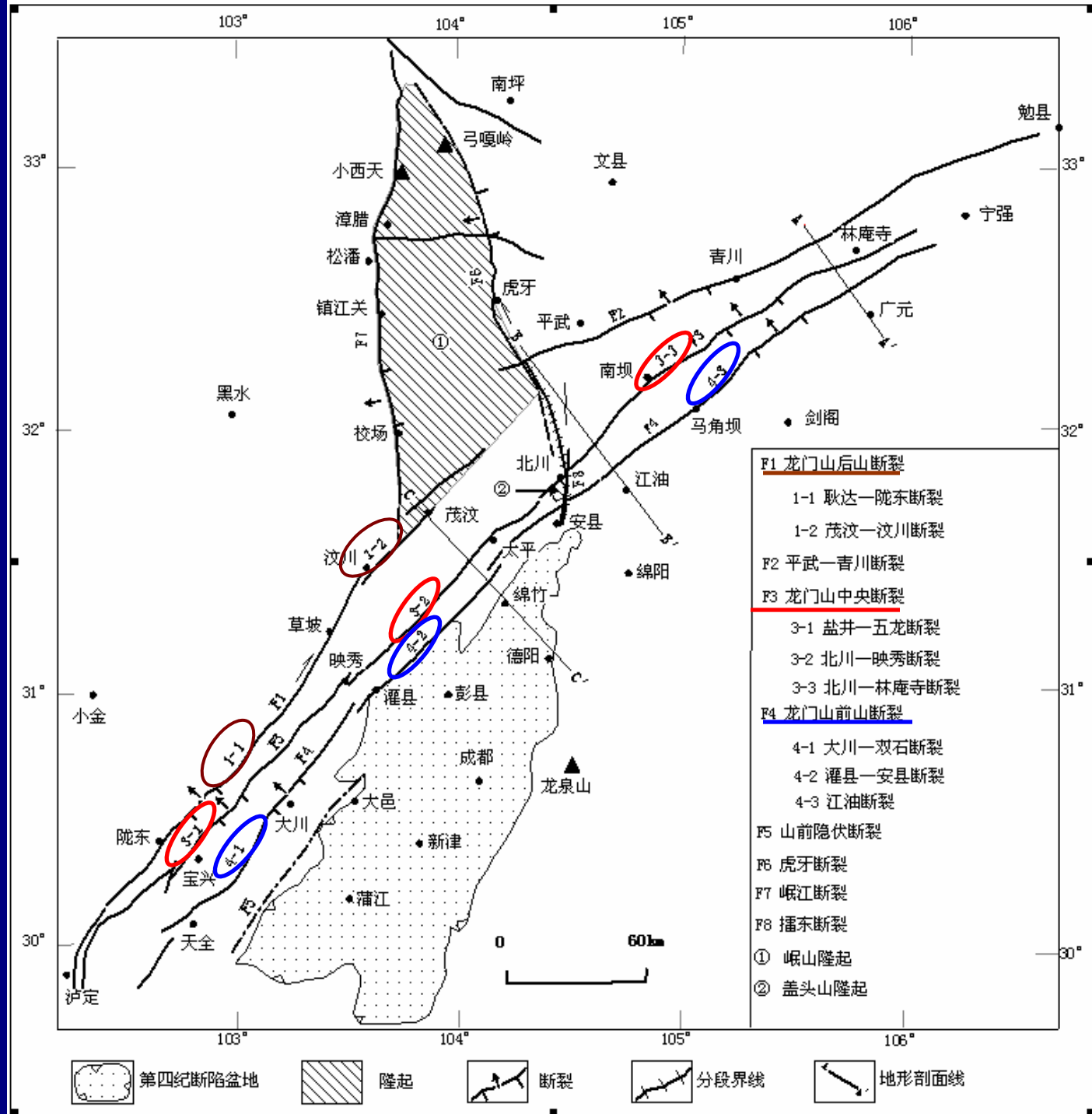
GPS measurements (Yellow arrows) in West Sichuan, China



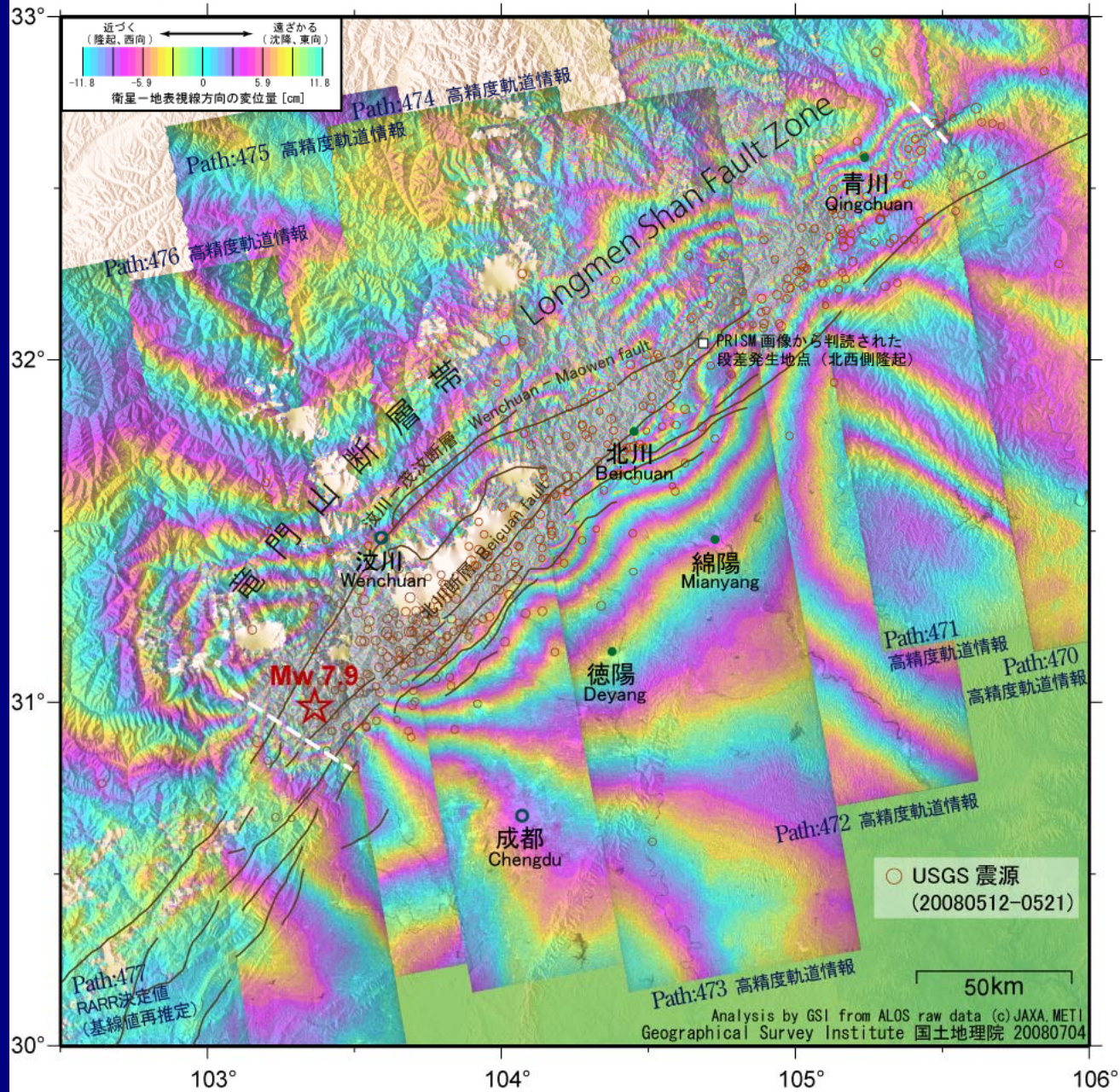
MIT scientists were involved in the first GPS measurements in this area, with involvement continuing until recently. Velocities are plotted relative to Chengdu in the South China reference frame. Uncertainties are < 2 mm/yr. A scale is given in the lower-right corner.



Location of the Longmenshan fault zone and its segmentation



四川省の地震に伴う地殻変動 SAR 干渉画像集約図



陰影図はSRTM3-DEMを使用。

これらの干渉画像は、電波伝搬遅延が不均一である影響を受けています。

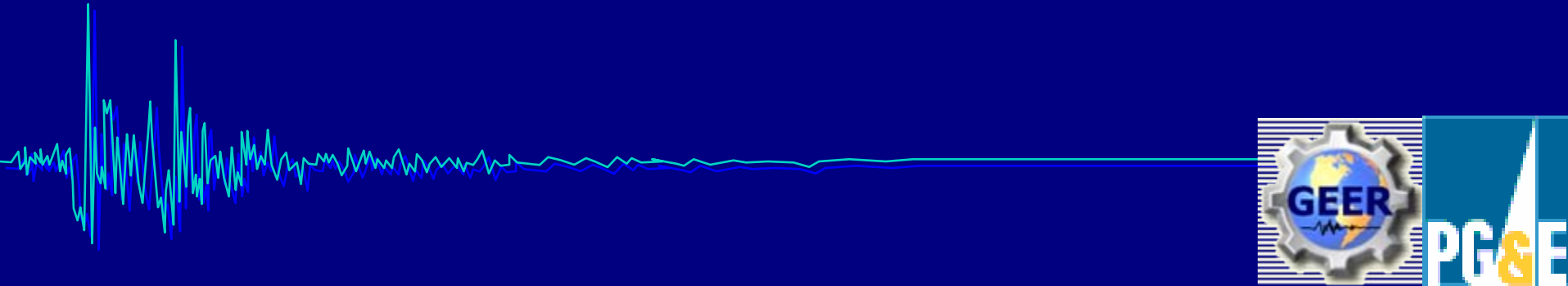
断層トレースの出典は以下のとおり

Densmore, A. L., M. A. Ellis, Y. Li, R. Zhou, G. S. Hancock, and N. Richardson (2007),

Active tectonics of the Beichuan and Pengguan faults at the eastern margin of the Tibetan Plateau, *Tectonics*, 26, TC4005, doi:10.1029/2006TC001987

2008 Wenchuan Earthquake

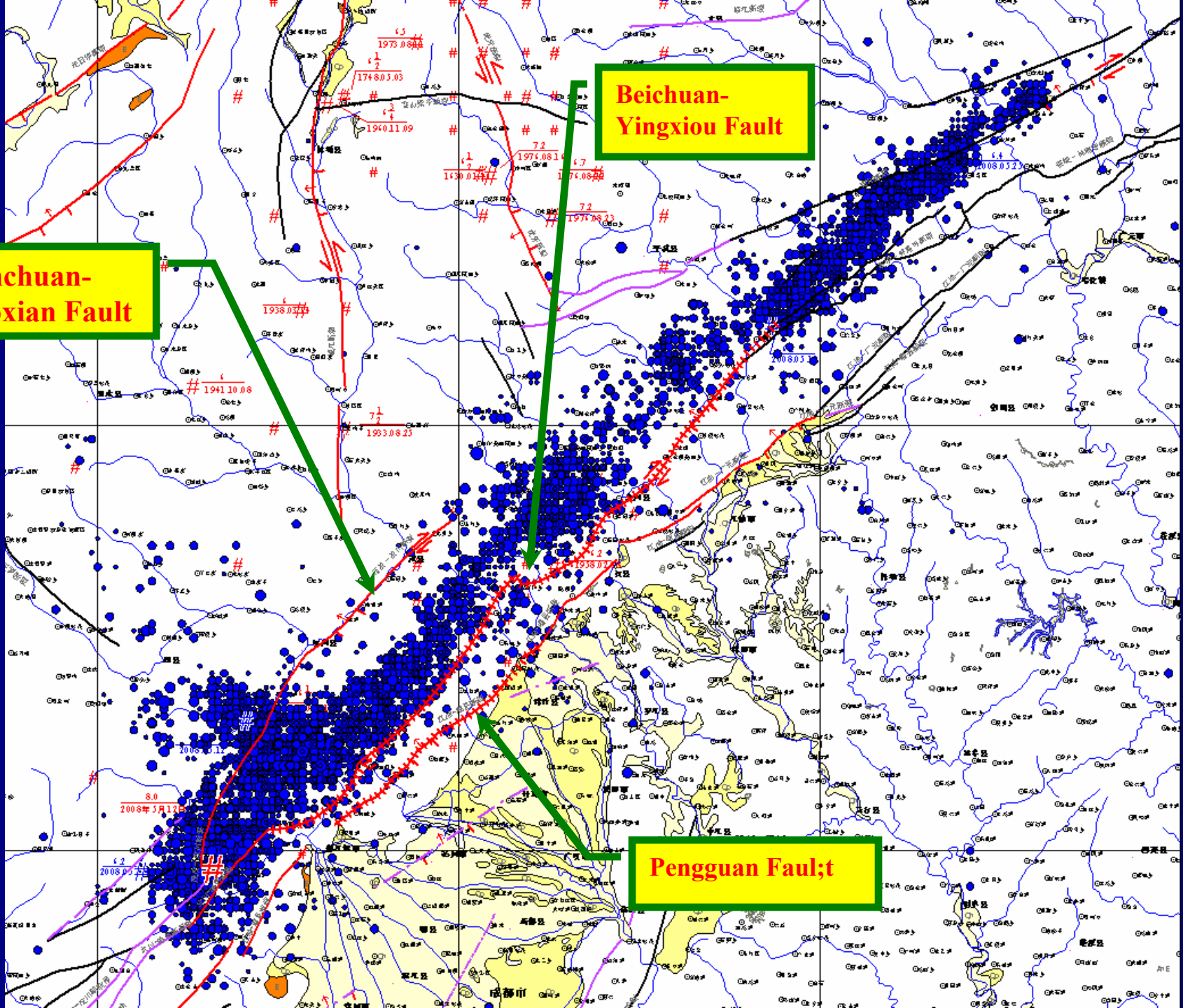
Fault Traces



**Wenchuan-
Maoxian Fault**

**Beichuan-
Yingxiou Fault**

Pengguan Fault;



8.0
2008年5月12日

6.2
2008年5月12日

6.5
1975.08.04

6.1
1974.03.03

6.3
1940.11.09

7.2
1974.08.14

6.7
1974.08.22

7.2
1974.08.22

6.7
1938.03.23

6
1941.10.08

7.1
1933.08.23

6.2
1938.11.17

6.0
2008.03.12

成都市



Maximum Offset of 5.6 m Southwest of Beichuan (Photo from CEA)

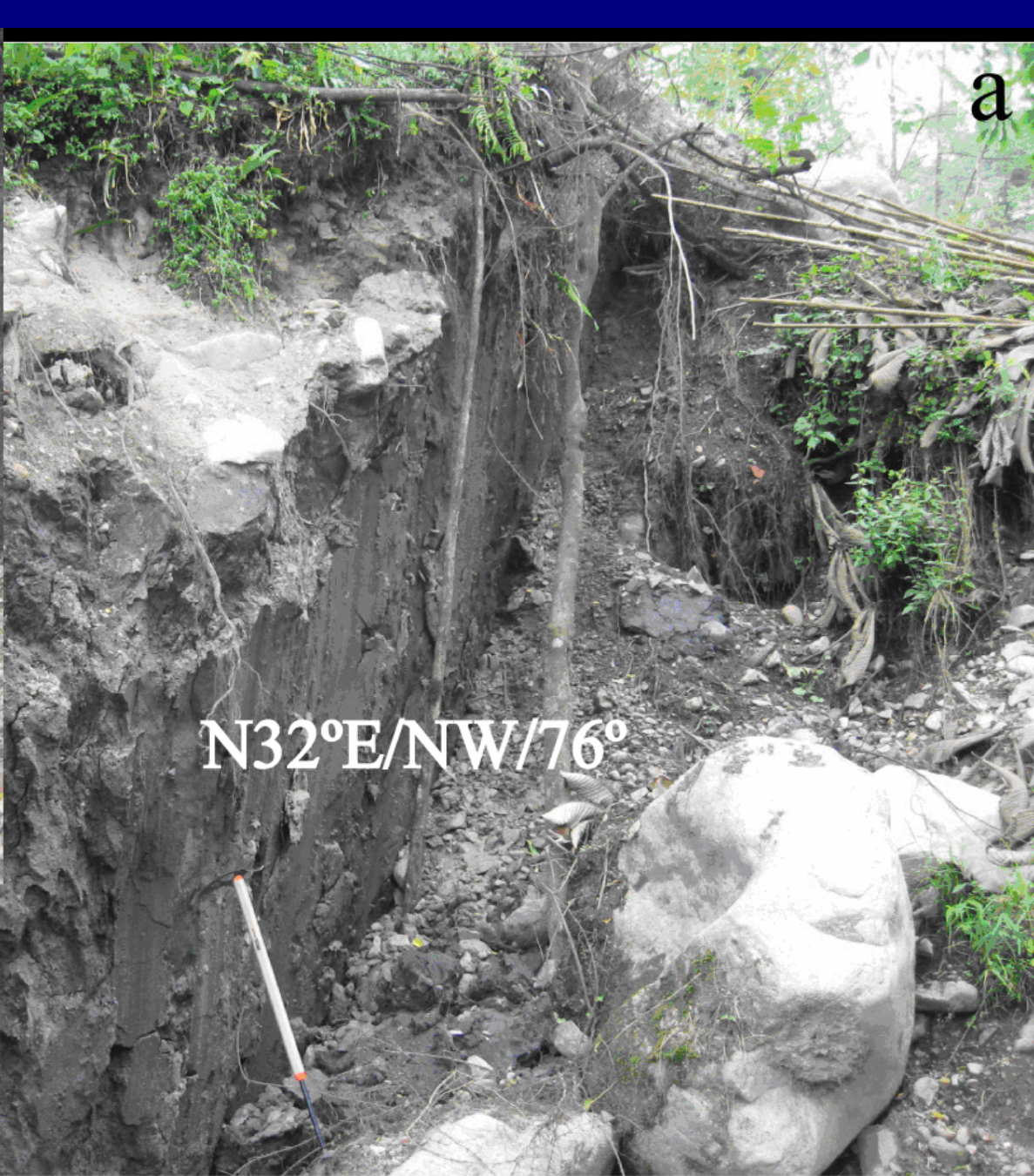
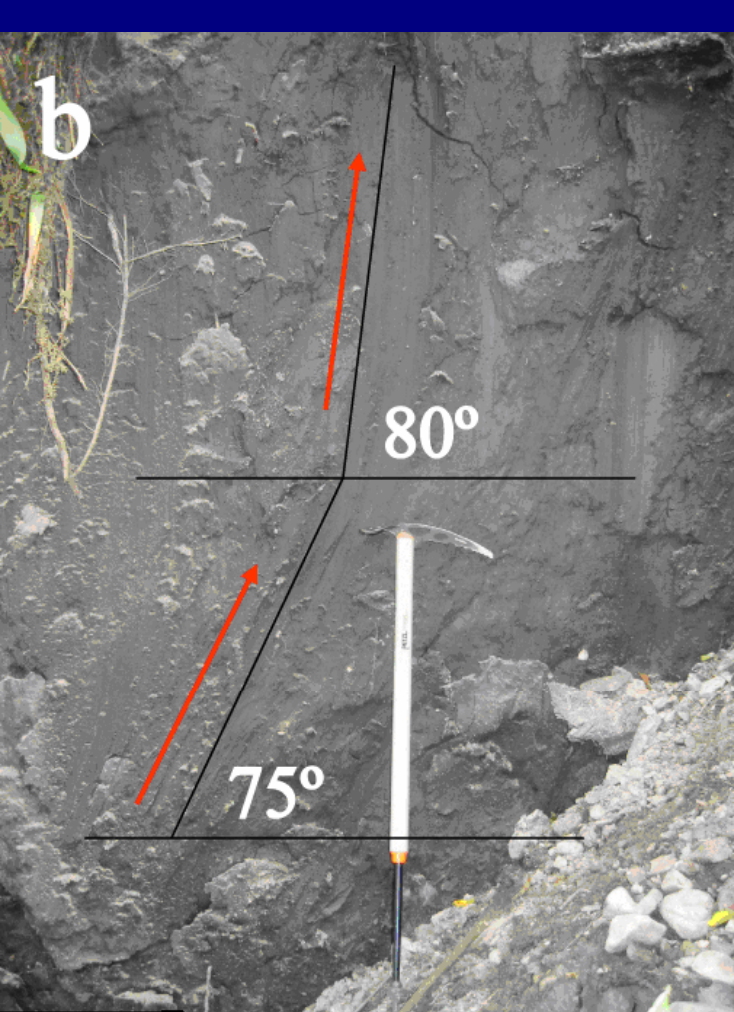




Photo by J.H. Deng





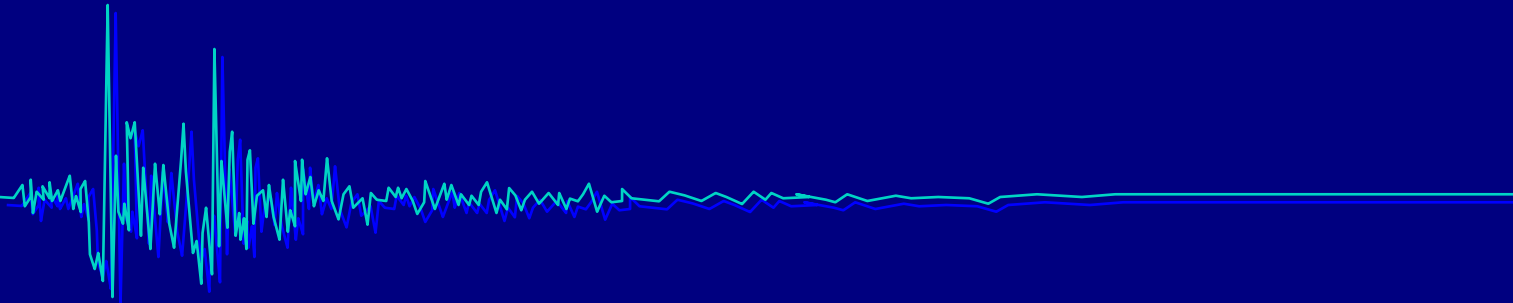
Fault offset near Xiaoyudong bridge (Courtesy of B.G. Zhou of IGCEA)



Offset of Pengguan Fault Near Bailu (Courtesy of Prof. K.C. Tsai)

2008 Wenchuan Earthquake

Landslides



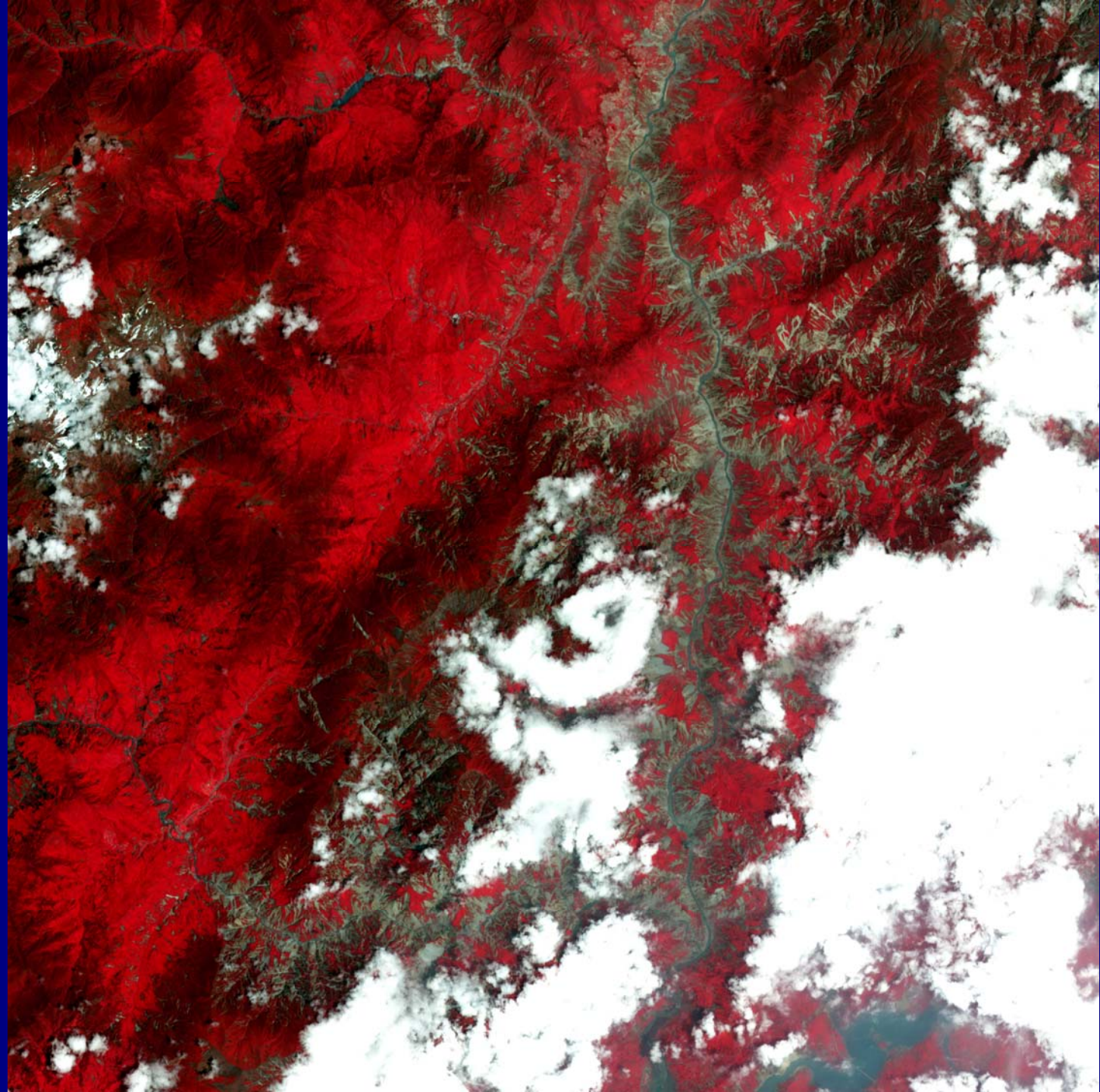
NASA Images



February 19, 2003



May 23, 2008





XINHUANET



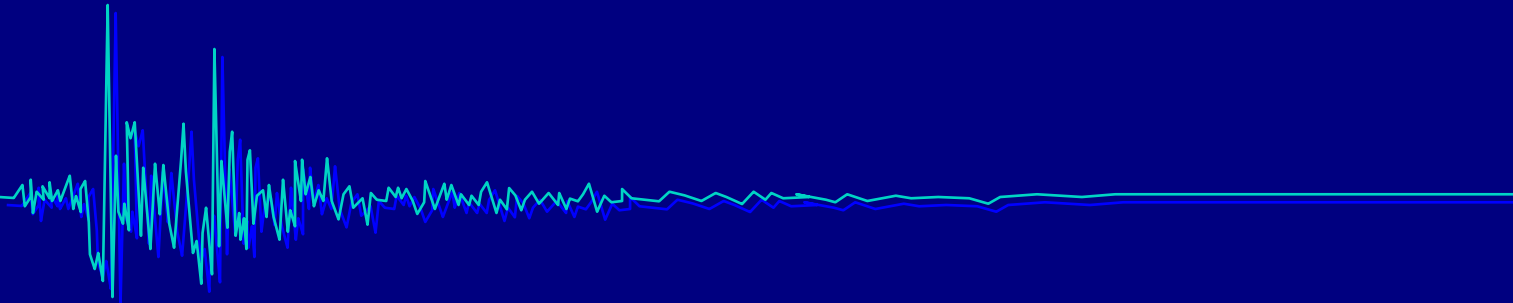




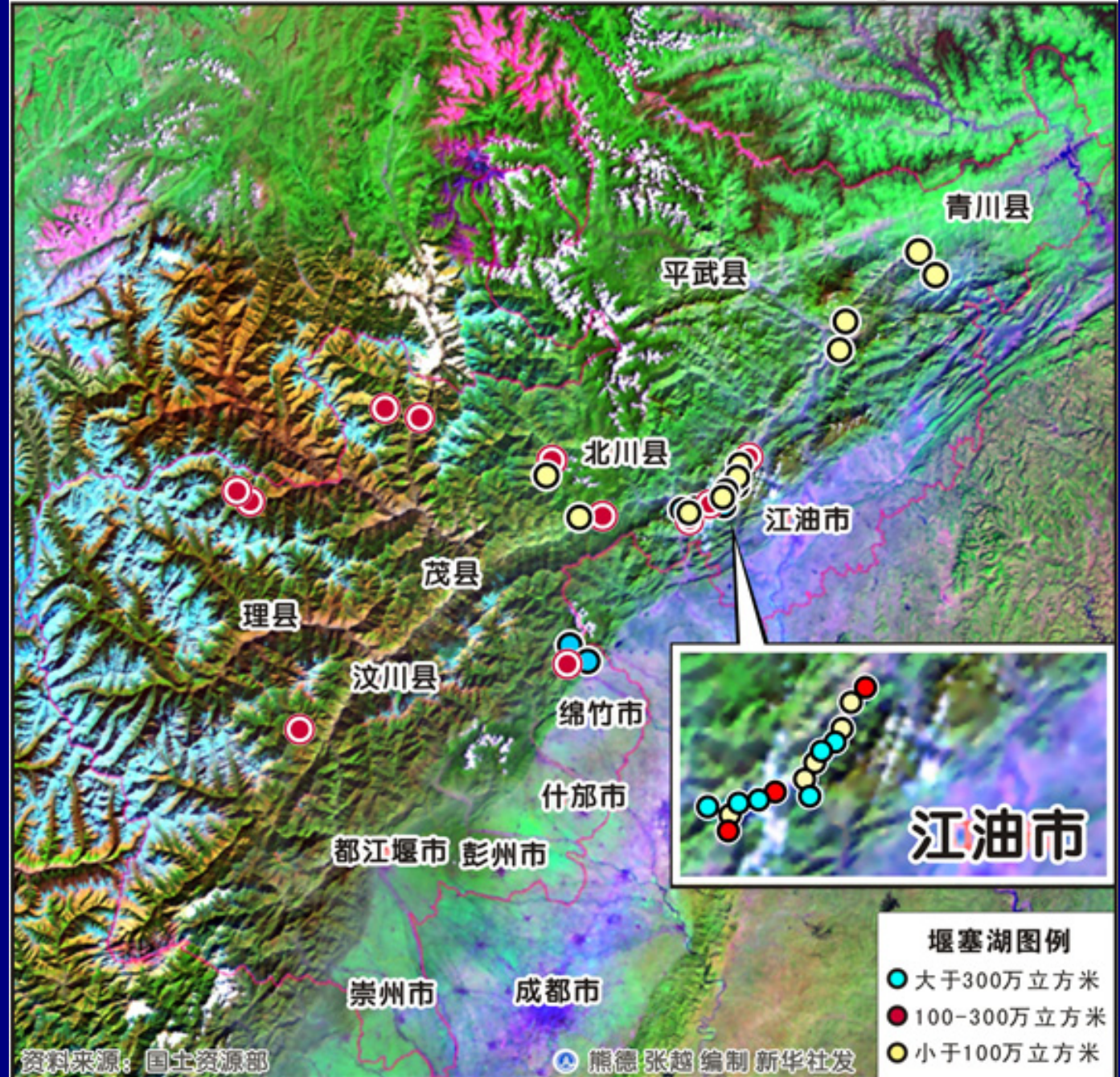


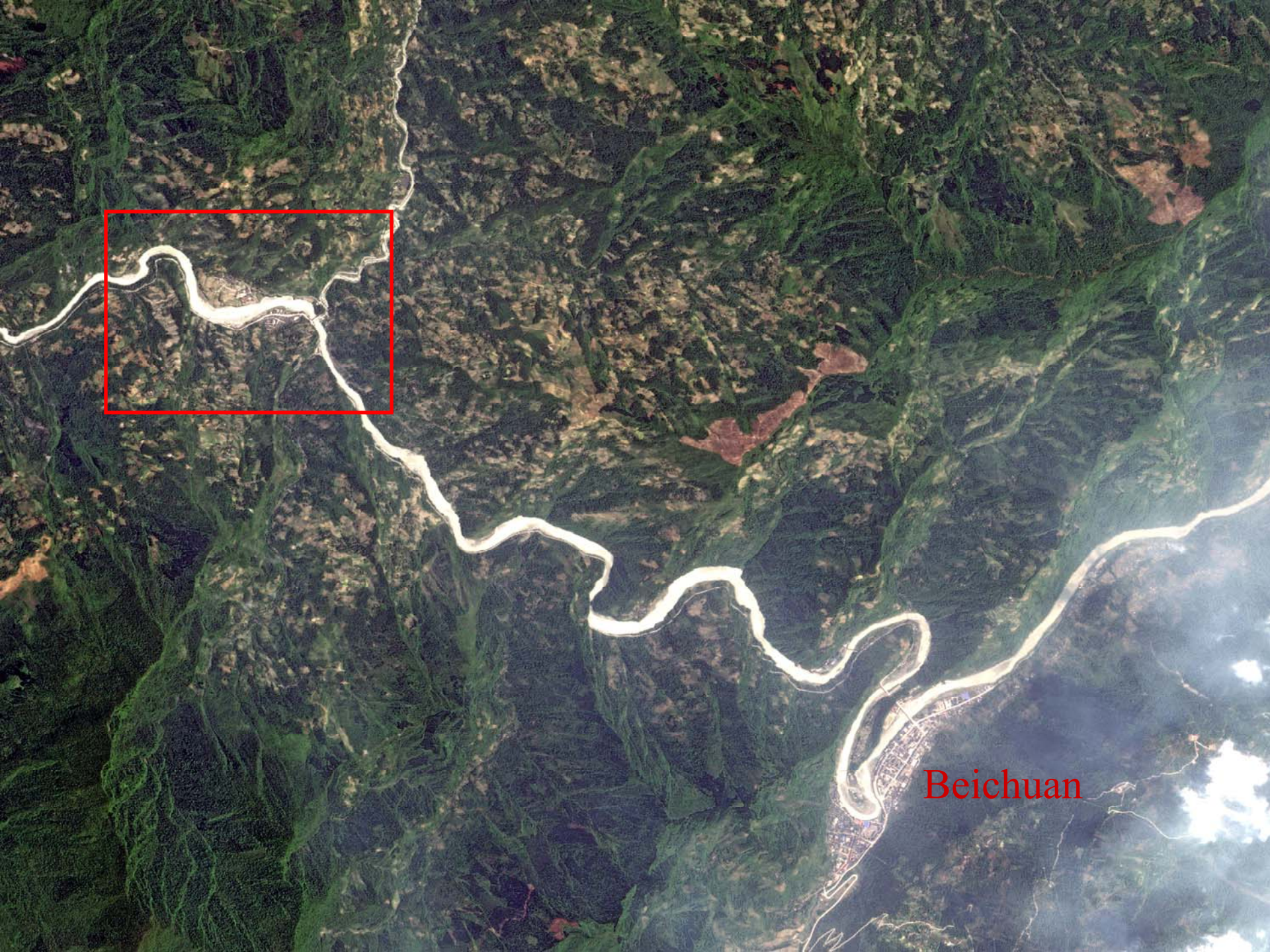
2008 Wenchuan Earthquake

Debris Dams

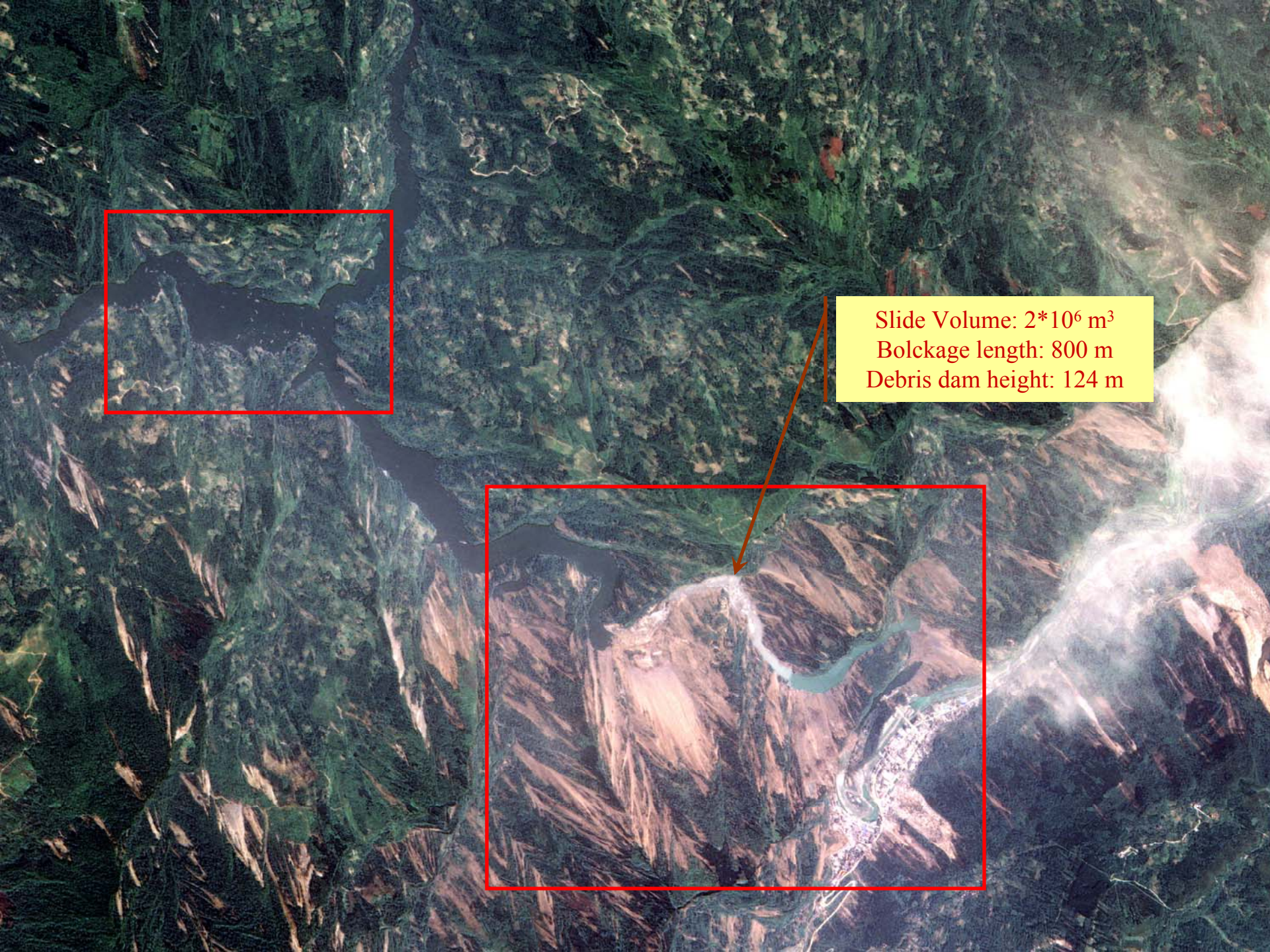


汶川地震灾区部分堰塞湖分布示意图





Beichuan



Slide Volume: $2 \cdot 10^6 \text{ m}^3$
Bolckage length: 800 m
Debris dam height: 124 m





省道302

省道302

唐家山

北川羌族自治县

曲山镇

石梁坡

龙潭峡

黄竹坝

大水村

大水湾

小水湾

旧官山

磨盘湾

龙尾

王家岩

新街村

安子坪村

葛家湾

沈家台

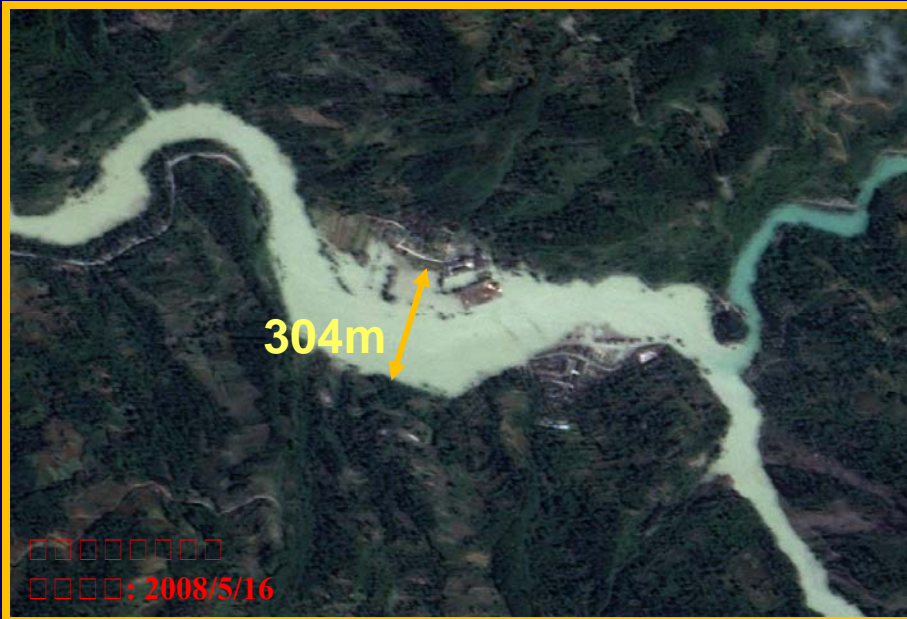
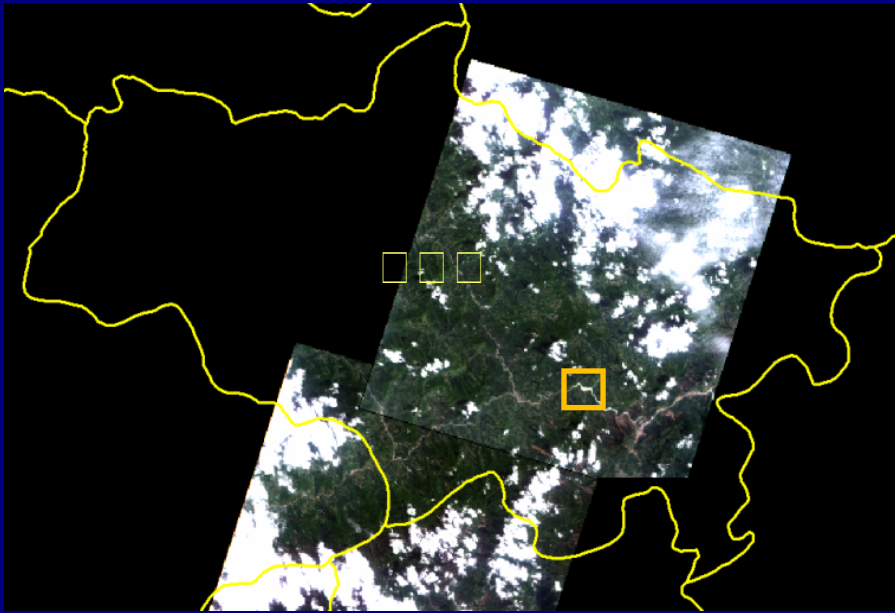
梨山沟

磨坪子

杨木沟

茶坝村

牙坝

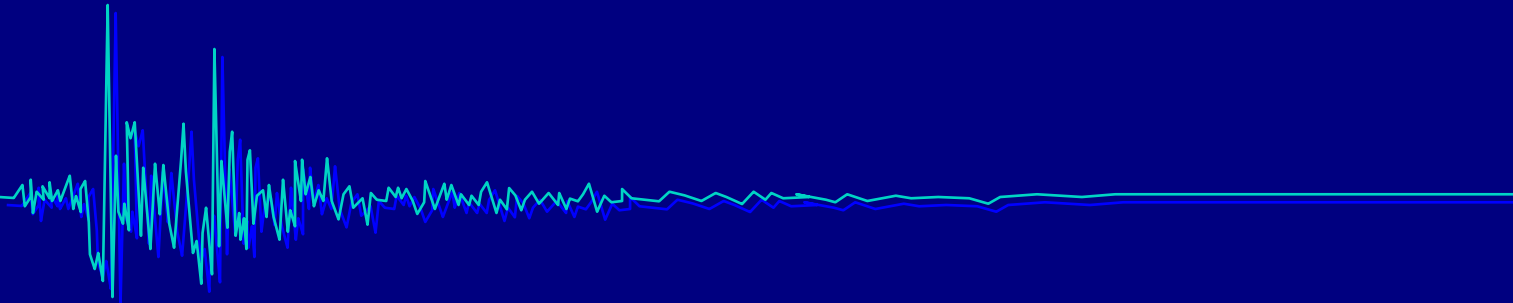






2008 Wenchuan Earthquake

Slope Retention System











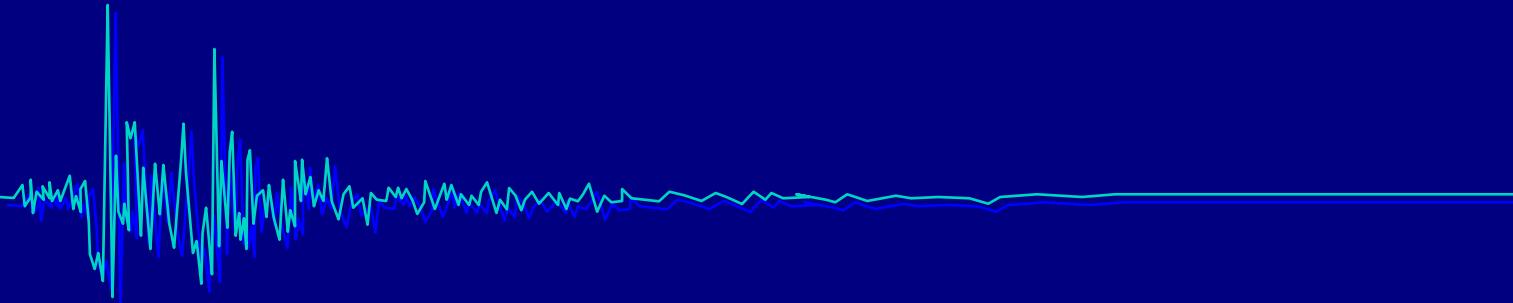






2008 Wenchuan Earthquake

Liquefaction



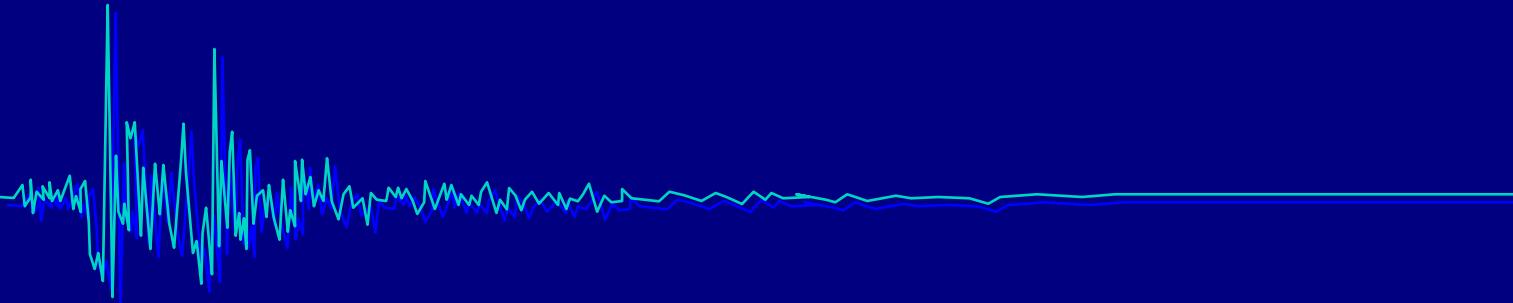






2008 Wenchuan Earthquake

Performance of Zipingpu Dam and Appurtenant Structures





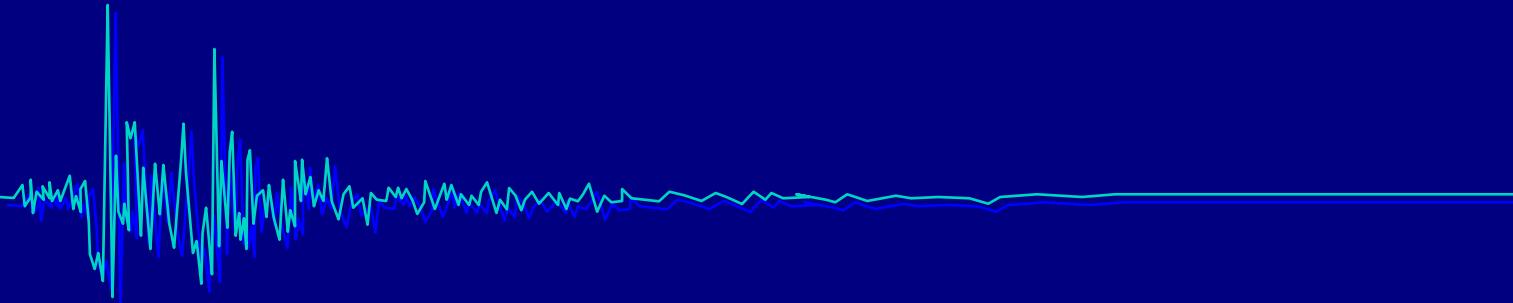






2008 Wenchuan Earthquake

**Performance of Embankment Dams
Built in 1950's and 1960's by the
Farmers Work Force**

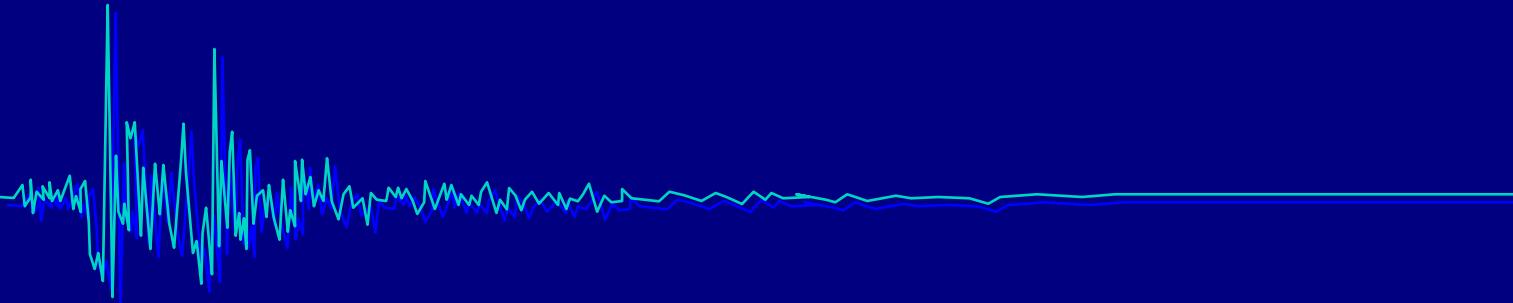






2008 Wenchuan Earthquake

Tunnels





HITACHI

□ □ □ □ □ □ □ □ □ □

□ □ □ □ □

XINHUA NET



白云顶隧道

抗震救灾展雄风

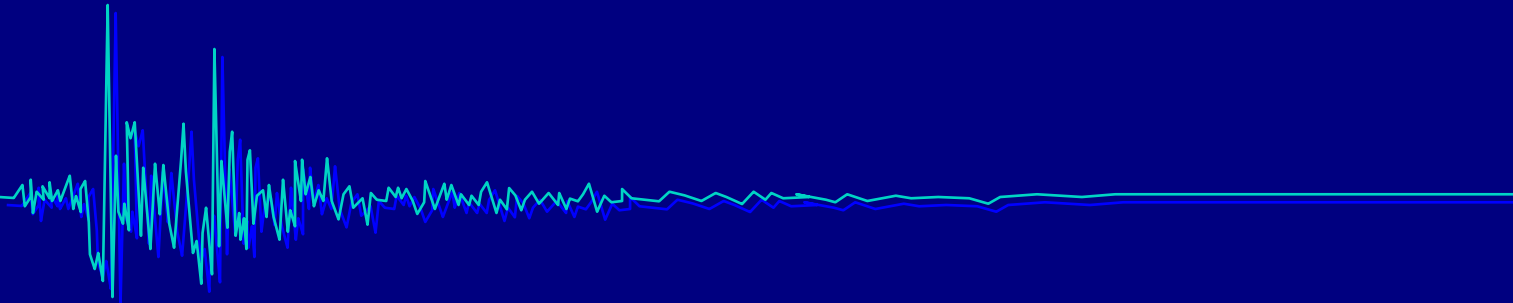


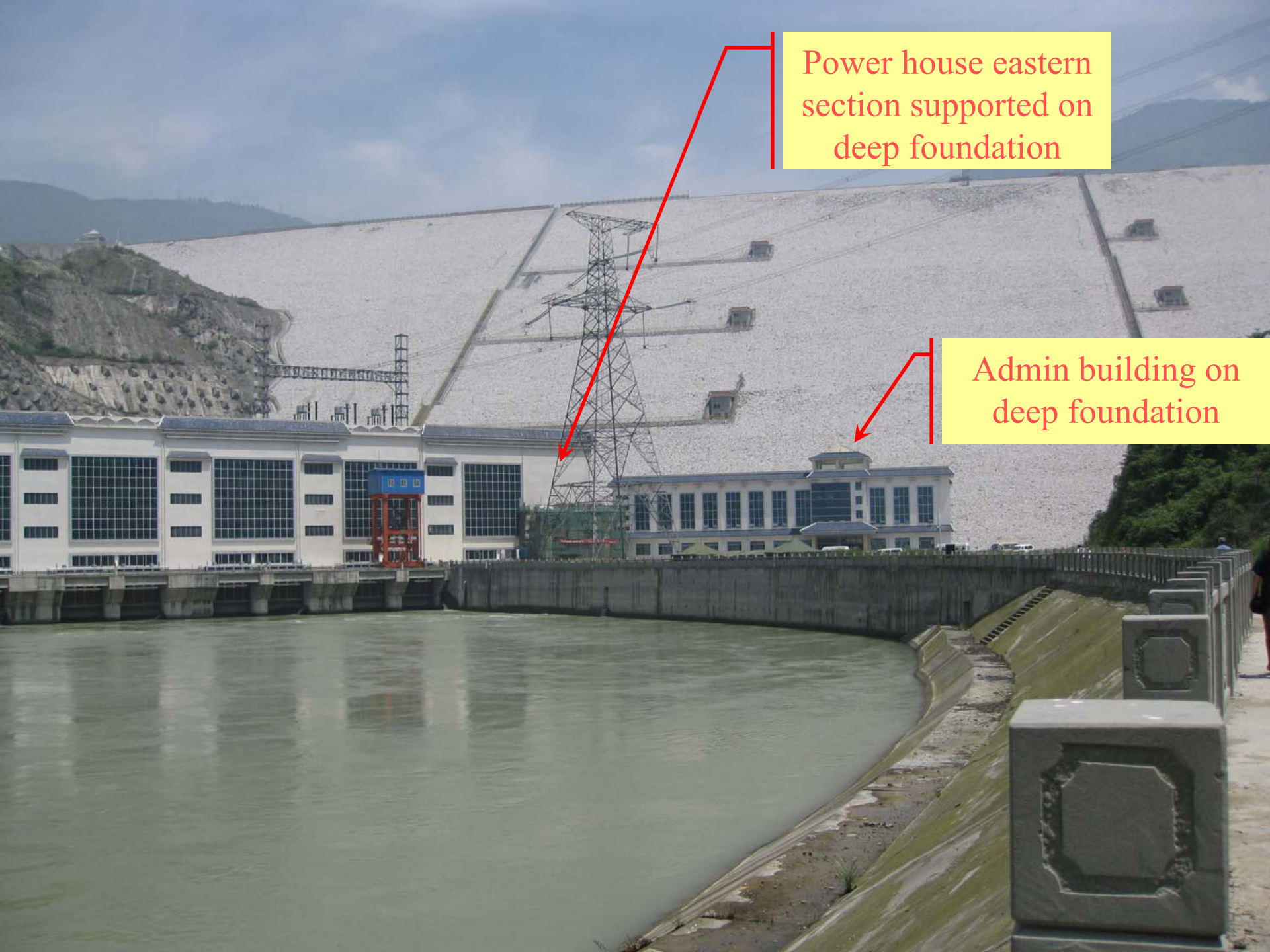
Baocheng Railroad Tunnel 109



2008 Wenchuan Earthquake

Foundation Engineering

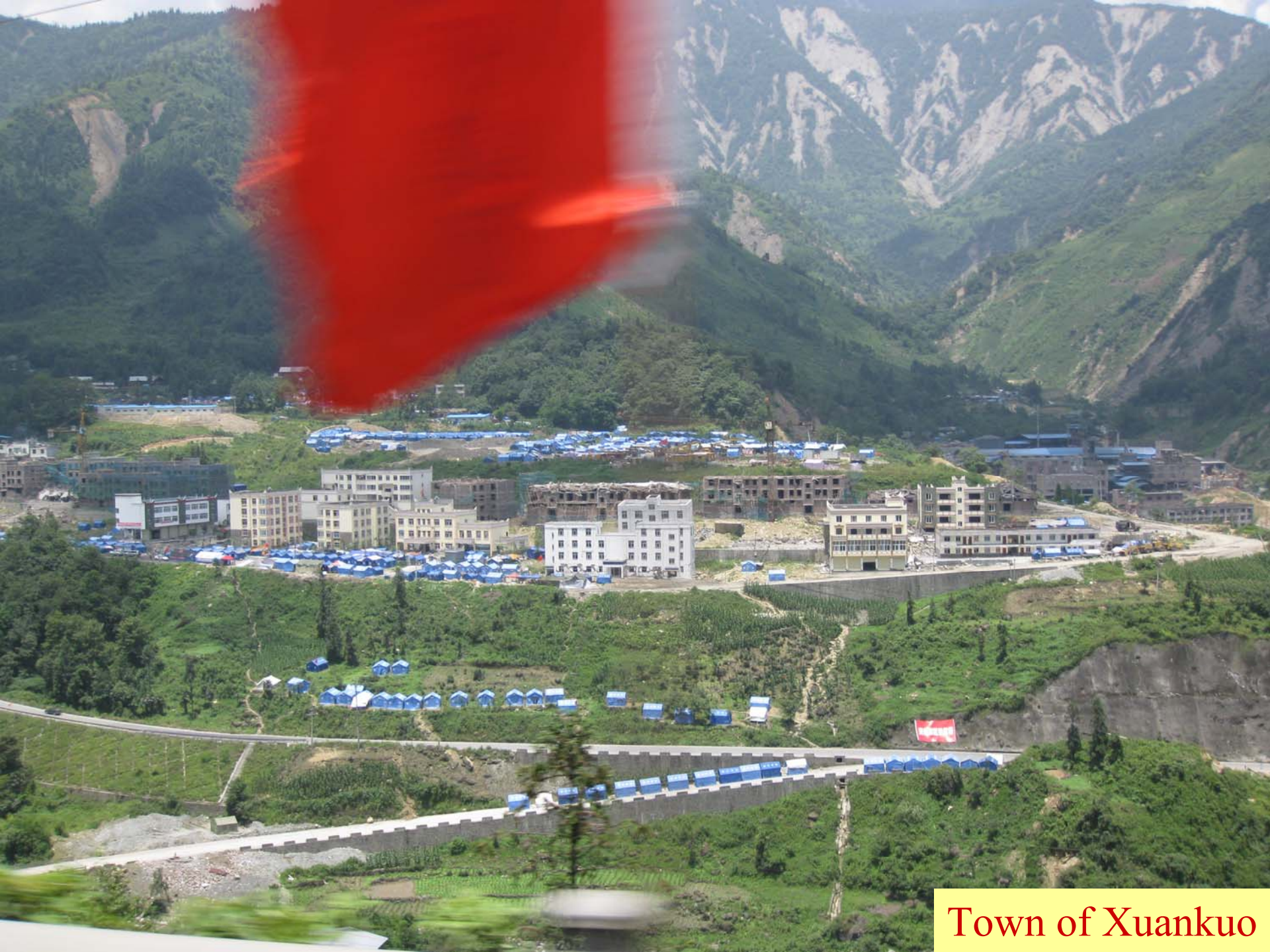




Power house eastern section supported on deep foundation

Admin building on deep foundation





Town of Xuankuo





XINHUANET

Acknowledgement

- **GEER / NSF**

- Jonathan Bray (UCB), David Frost (Georgia Tech)

- **Pacific Gas & Electric Co.**

- DCCP Long Term Seismic Program (Lloyd Cluff)

- Hydro Gen Facility Safety Program (Charles Ahlgren)

- **Sichuan Univeristy**

- Shi, Jian (Vice President)

- Deng, Jian-hui (Prof, College of Hydroelectric Eng)

- **Institute of Geology, China Earthquake Admin**

- Zhou, Ben-gan

- He, Hong-lin

