

Using UAV and drilling to detect Quaternary activity of the  
Zhuzishan West Piedmont Fault, provides insight into the structural  
development of the Wuhai Basin and Northwestern Ordos Block,  
China

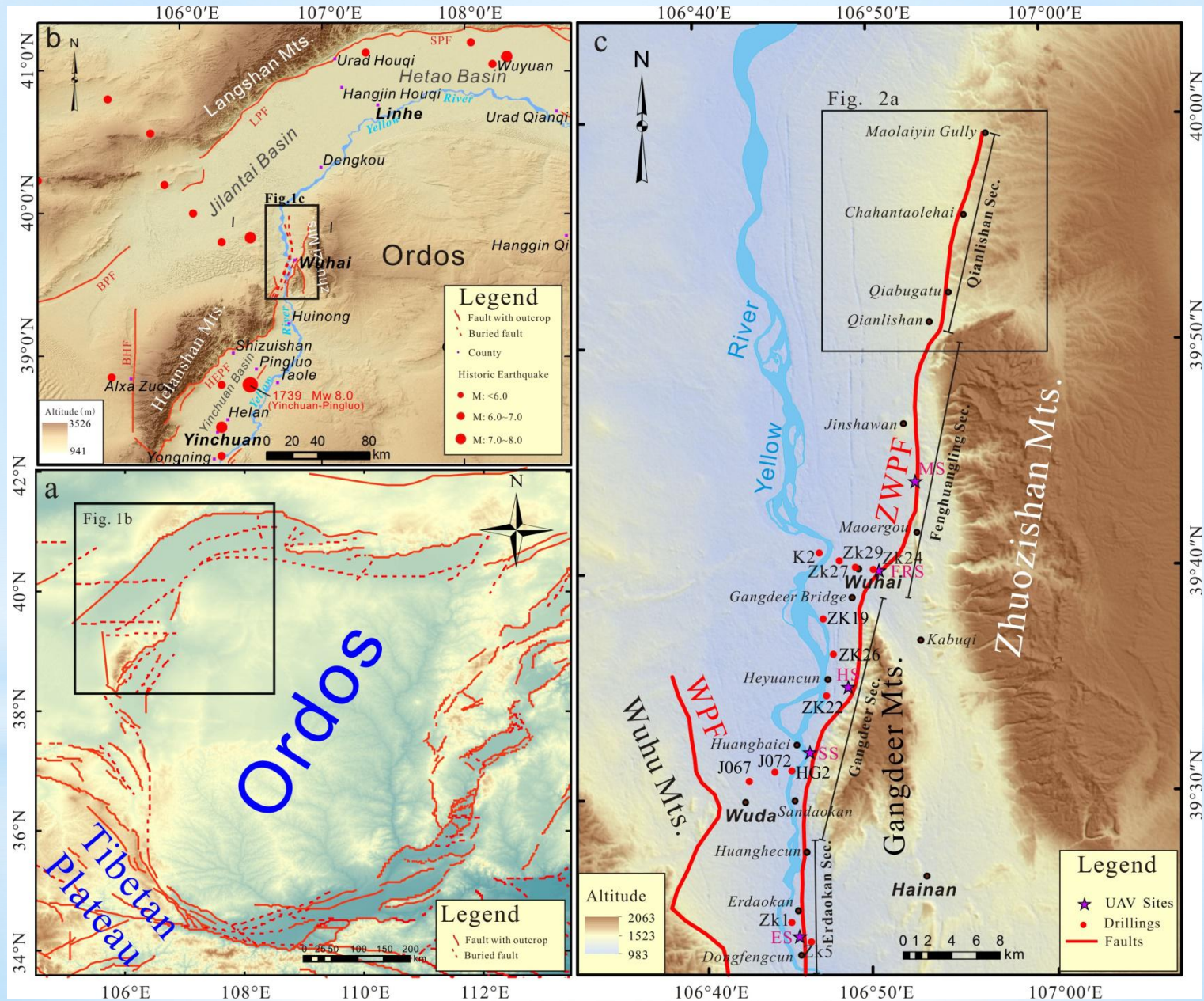
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**Related publication:** Liang Kuan, Ma Baoqi, Li Dewen, Tian Qinjian, Sun Changbin, He Zhongtai, Zhao Junxiang, Liu Rui, Wang Jinpeng, 2019. Quaternary activity of the Zhuzishan West Piedmont Fault provides insight into the structural development of the Wuhai Basin and Northwestern Ordos Block, China. *Tectonophysics*, 754: 56-72.

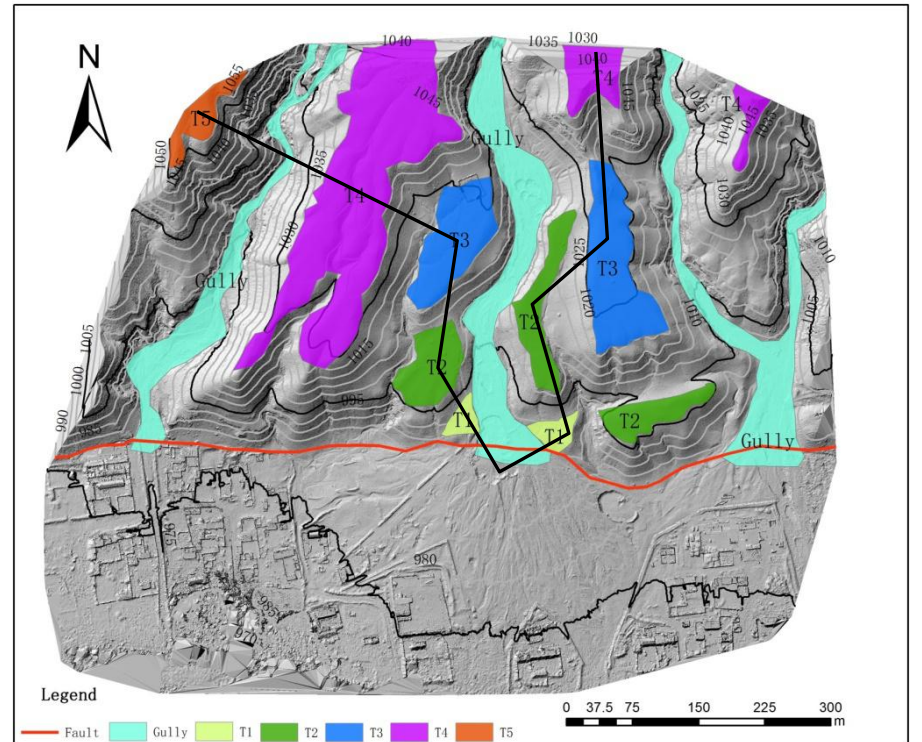
# 1 Regional tectonic setting





## 2 Study methods

### UAV measurement



Device: A PHANTOM 4 RTK UAV

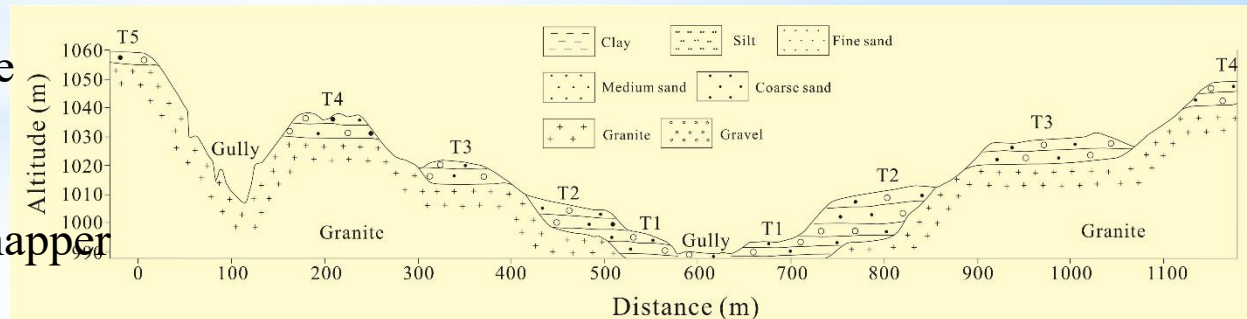
(Chinese Dajiang Company)

Controlling software: Altizure

Flight height: 80-100m

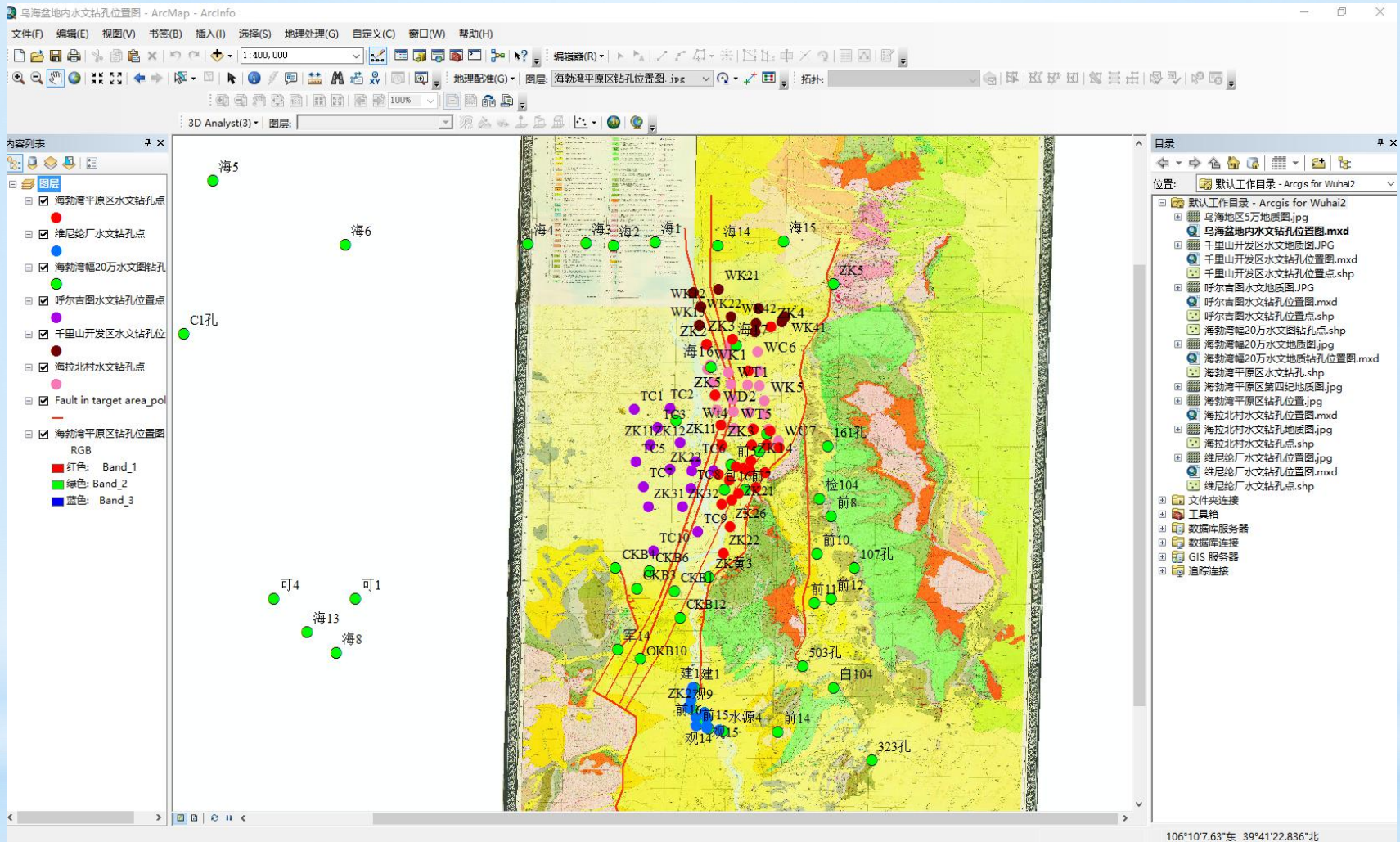
Overlap rate: >70%

Processing software: Pix4Dmapper



## 2 Study methods

### Drillings



118 holes drilled from previous publications, including borehole location, depth, elevation, and detailed stratigraphic descriptions. 12 of the boreholes showed clear, uniform lacustrine intervals.



## 2 Study methods

### Calculation of fault vertical slip rate

$V_v$ : vertical slip rate of the fault

$H_f$ : altitude of the top of the lacustrine layer on the footwall (by UAV measurement)

$H_h$ : altitude of the top of the lacustrine layer on the hanging-wall (by drillings)

$T$ : the age of the layer top (by OSL)

OSL:  $69.6 \pm 7.2$  ka

$H_f$  and  $H_h$  are calibrated by 1:25,000 topography map

$$V_v = \frac{H_f - H_h}{T}$$



Lacustrine layers outcrop in the footwall

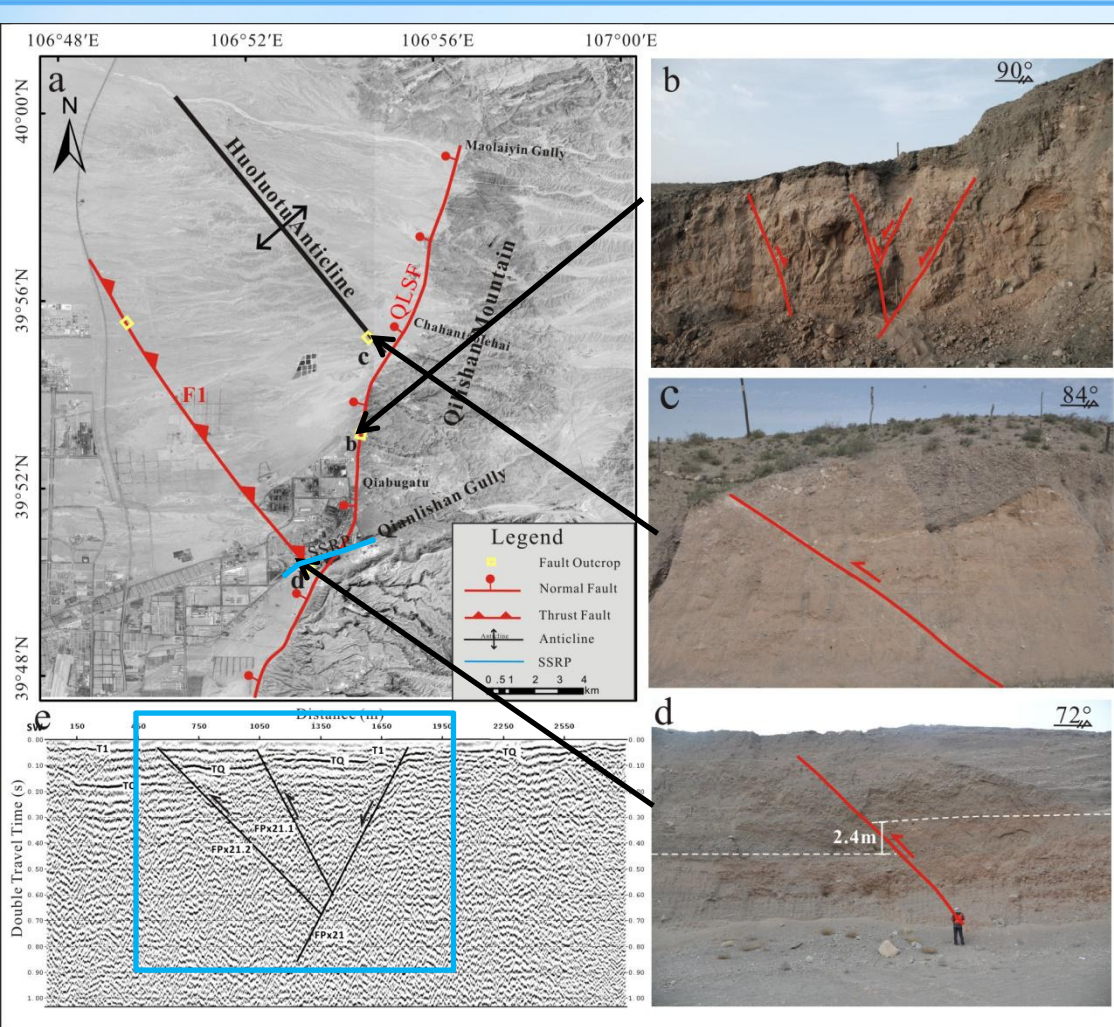


Lacustrine layers in the drillings (hanging-wall)

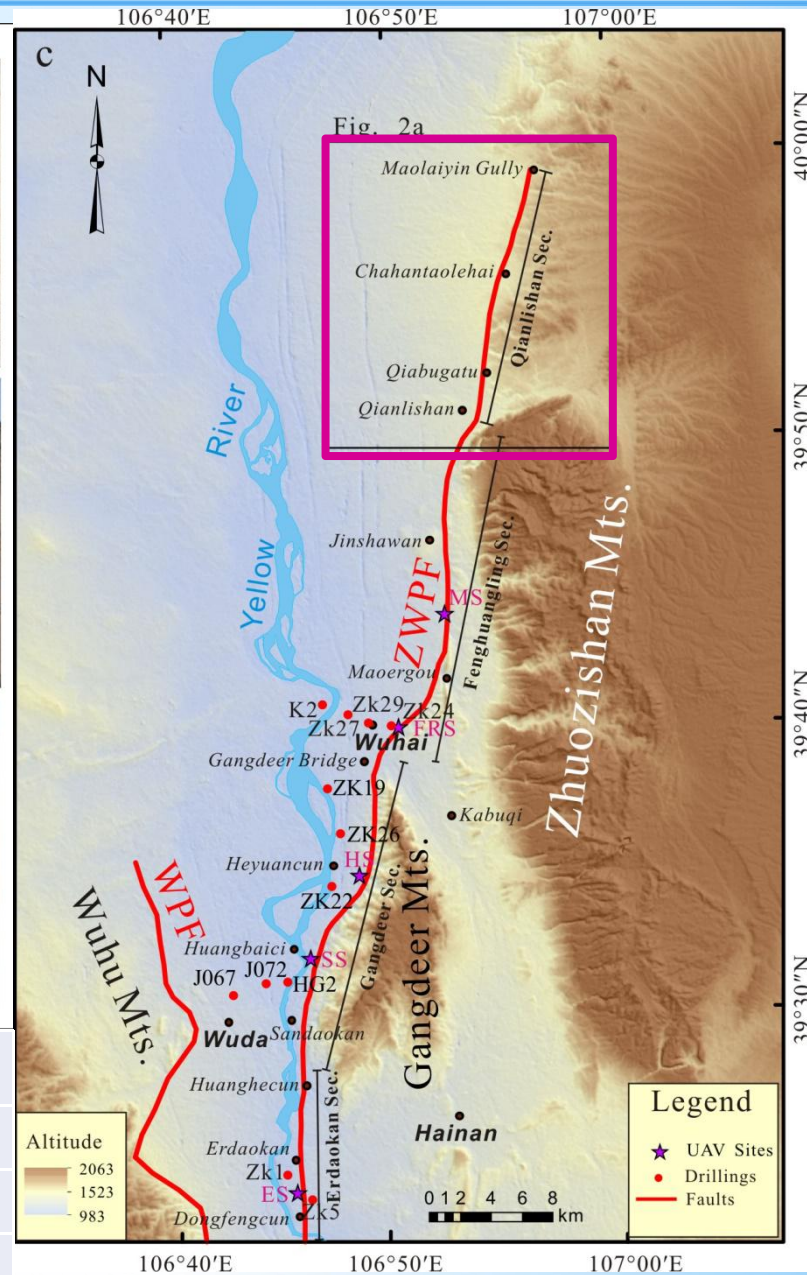


3 Date and Rasult

Geological features of the Qianlishan section



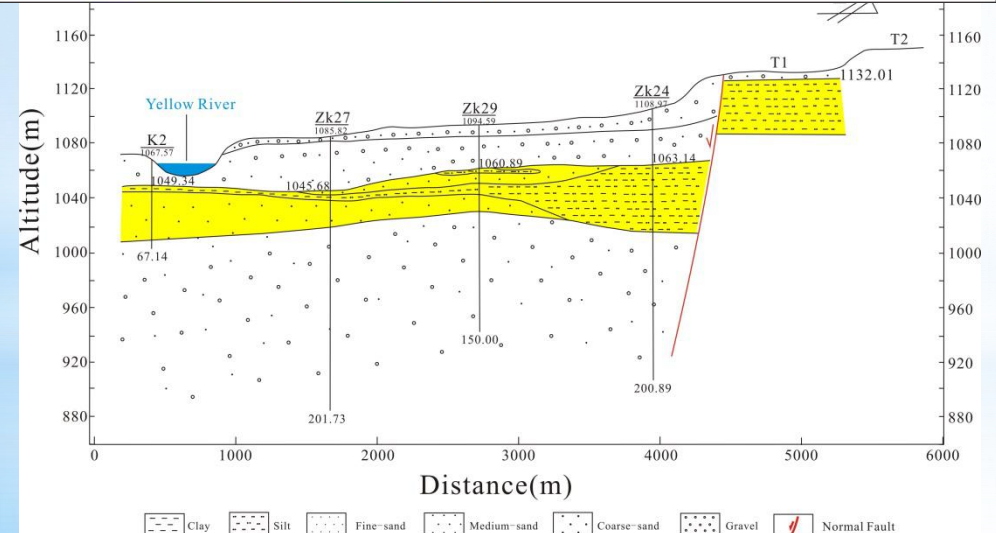
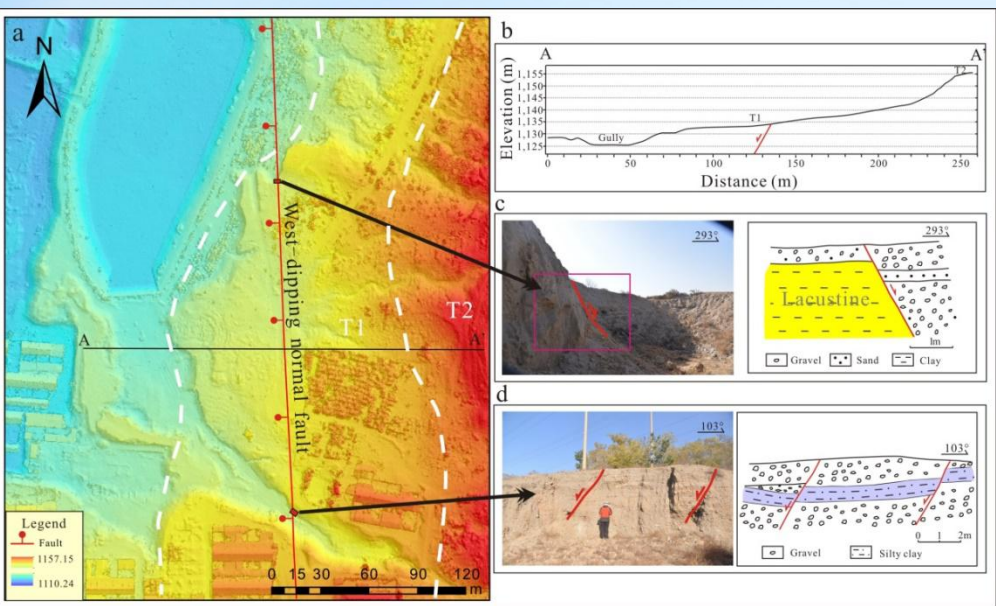
No.	Depth (m)	Offset (m)	Fault Type	Tilt Direction	Reliability
FPx21	14-17	2-4	Normal	SW	Reliable
FPx21.1	14-17	2-4	Thrust	NE	Reliable
FPx21.2	14-18	3-4	Thrust	NE	Reliable



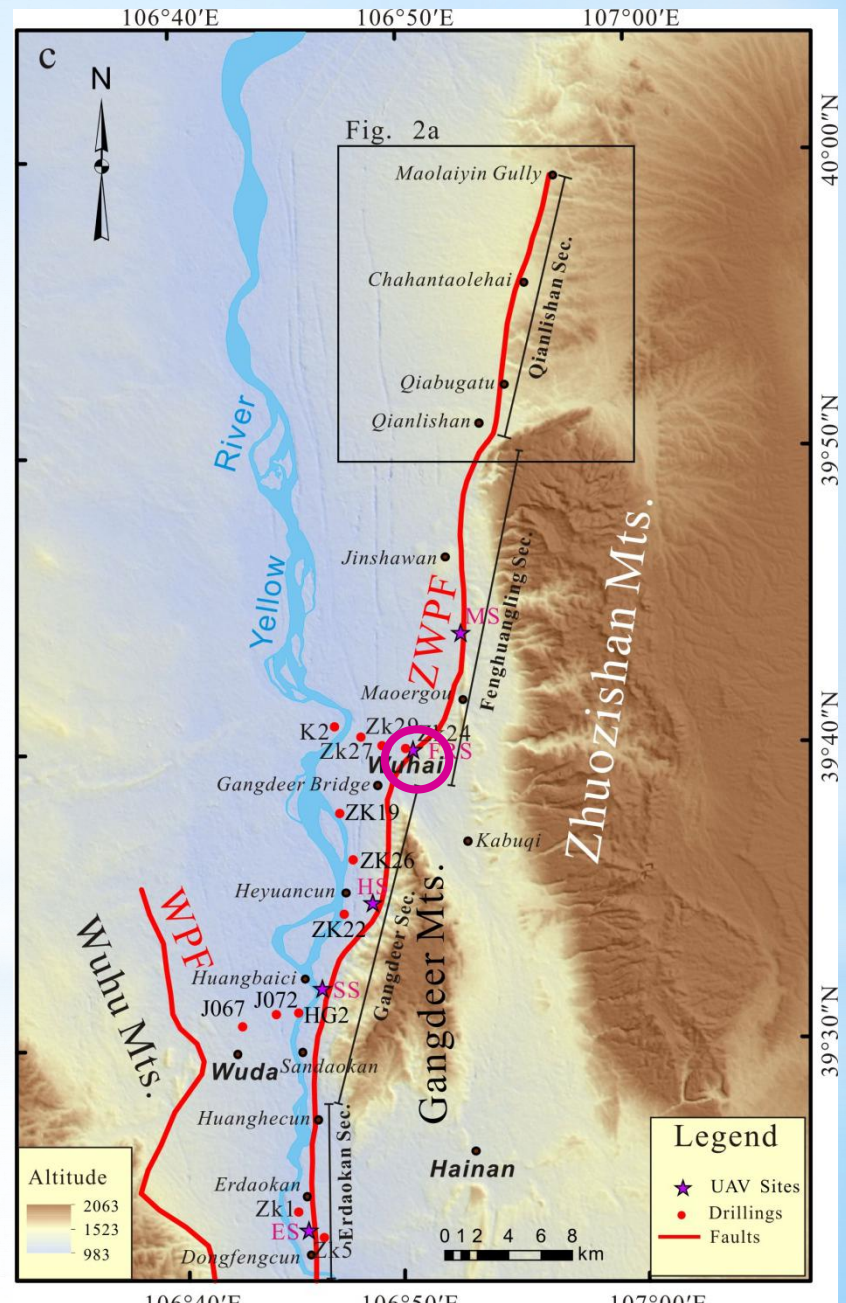


### 3 Date and Rasult

### Geomorphology of the southern Fenghuang Ridge Site (FRS).



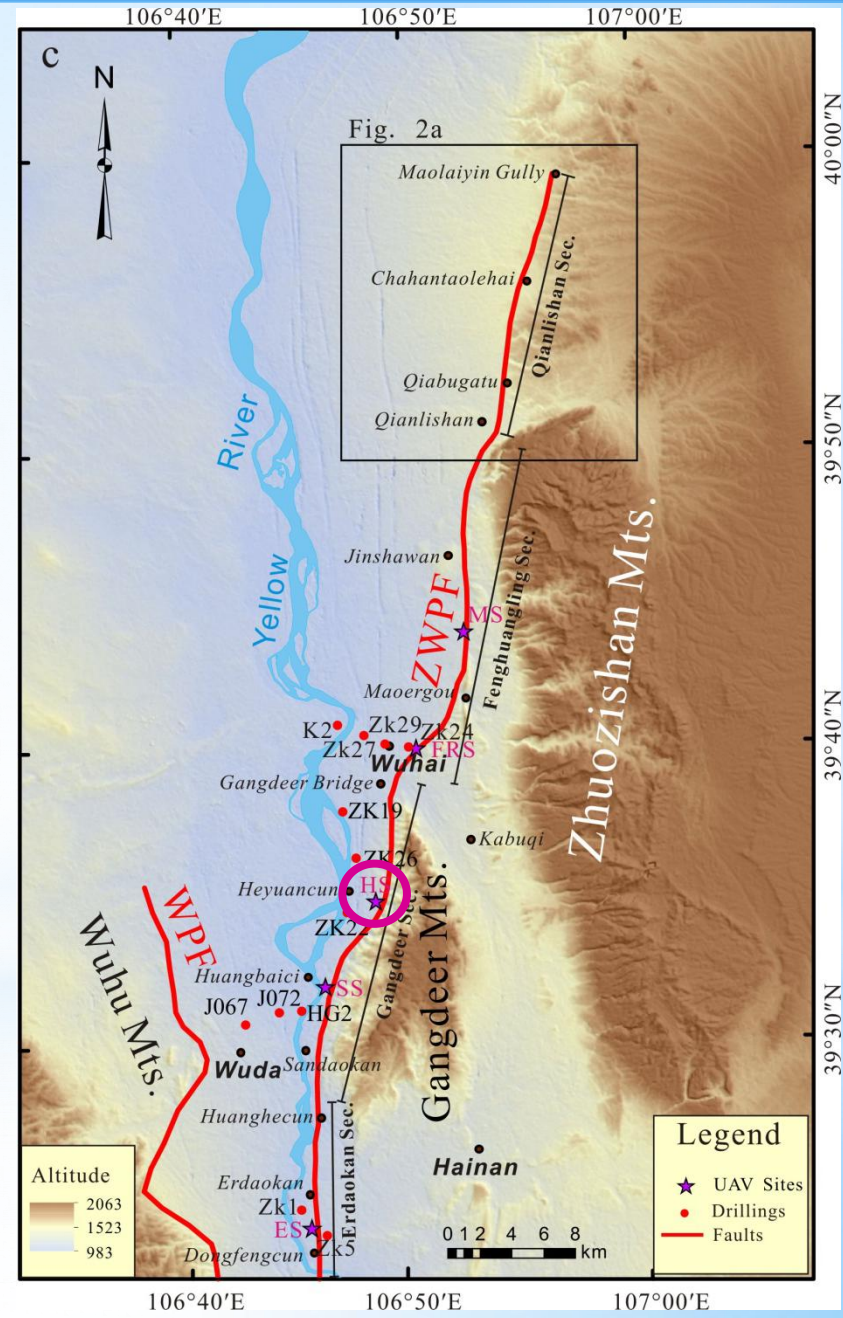
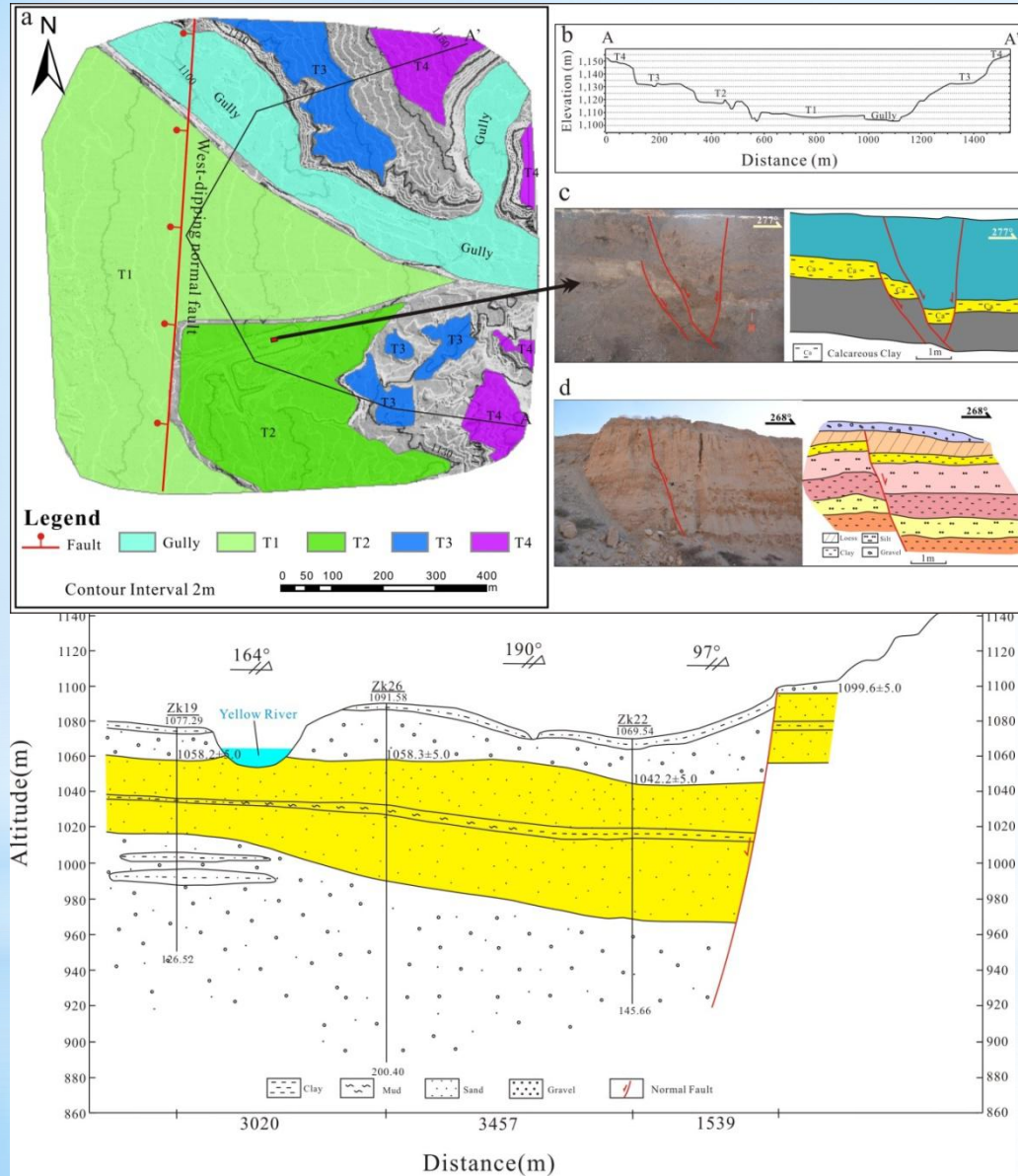
Lacustrine strata have a vertical drop of  $68.7 \pm 8.4$  m, the vertical slip rate of the is about  $1.0 \pm 0.2$  mm / a.





### 3 Date and Rasult

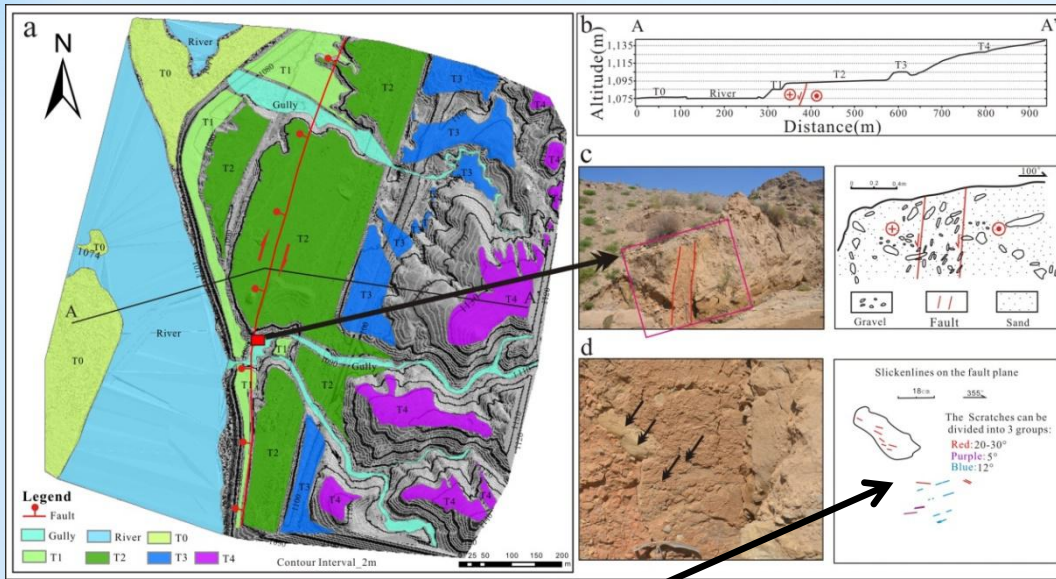
### Geomorphology of the Huanghuaxi Site (HS)



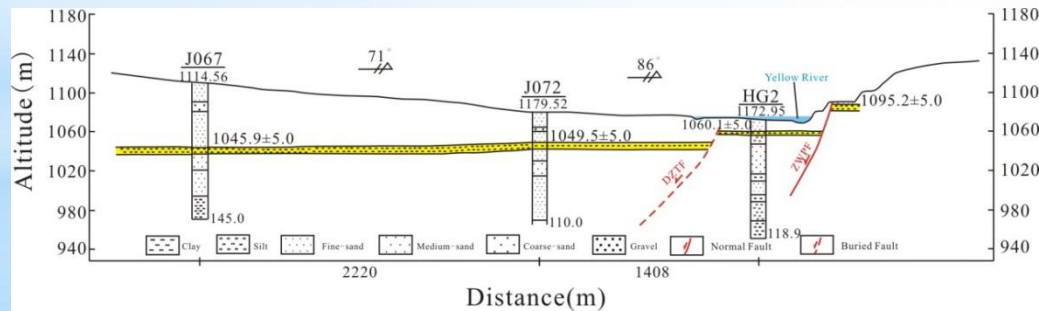


### 3 Date and Rasult

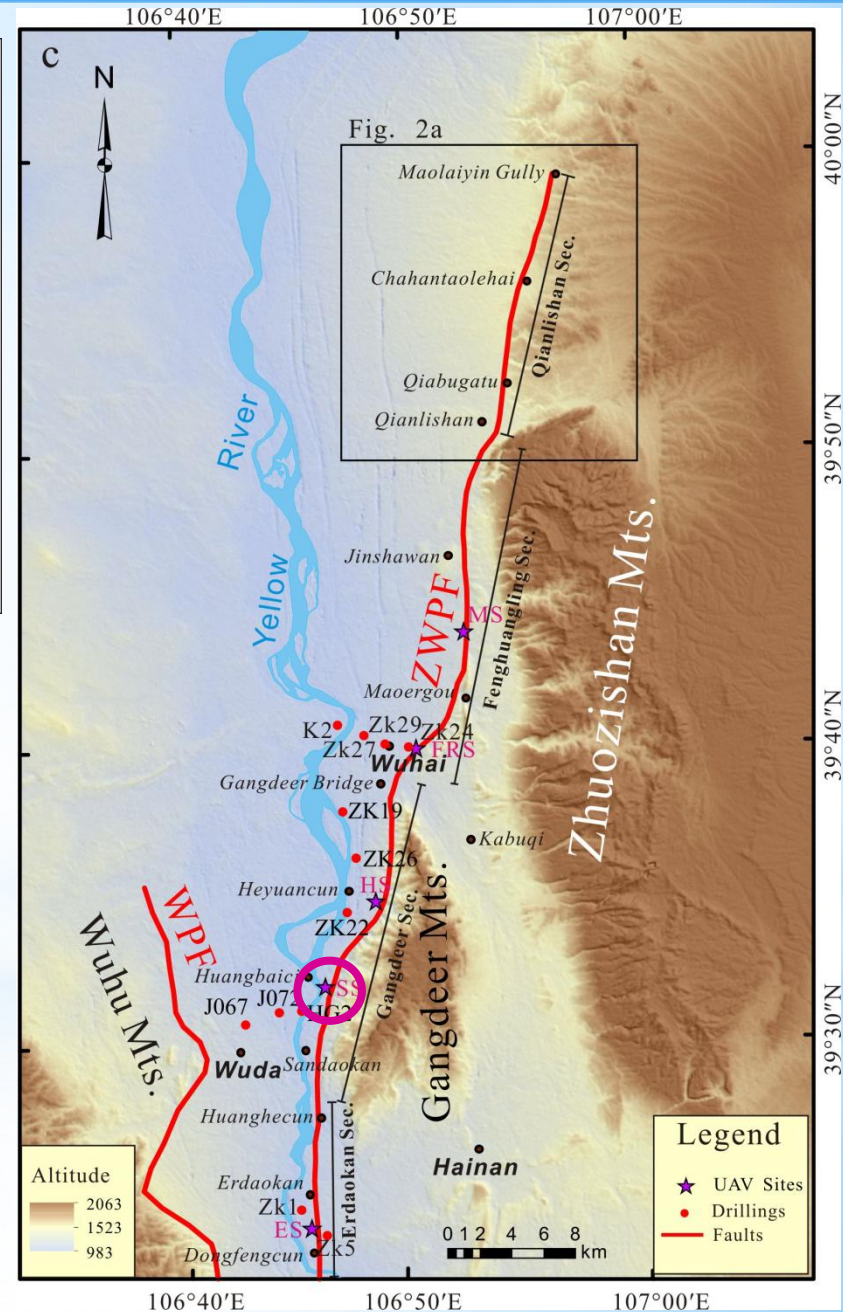
### Geomorphology of the Sandaokan Site (SS)



Three groups of slickenlines indicate the fault is a normal dextral slip fault.



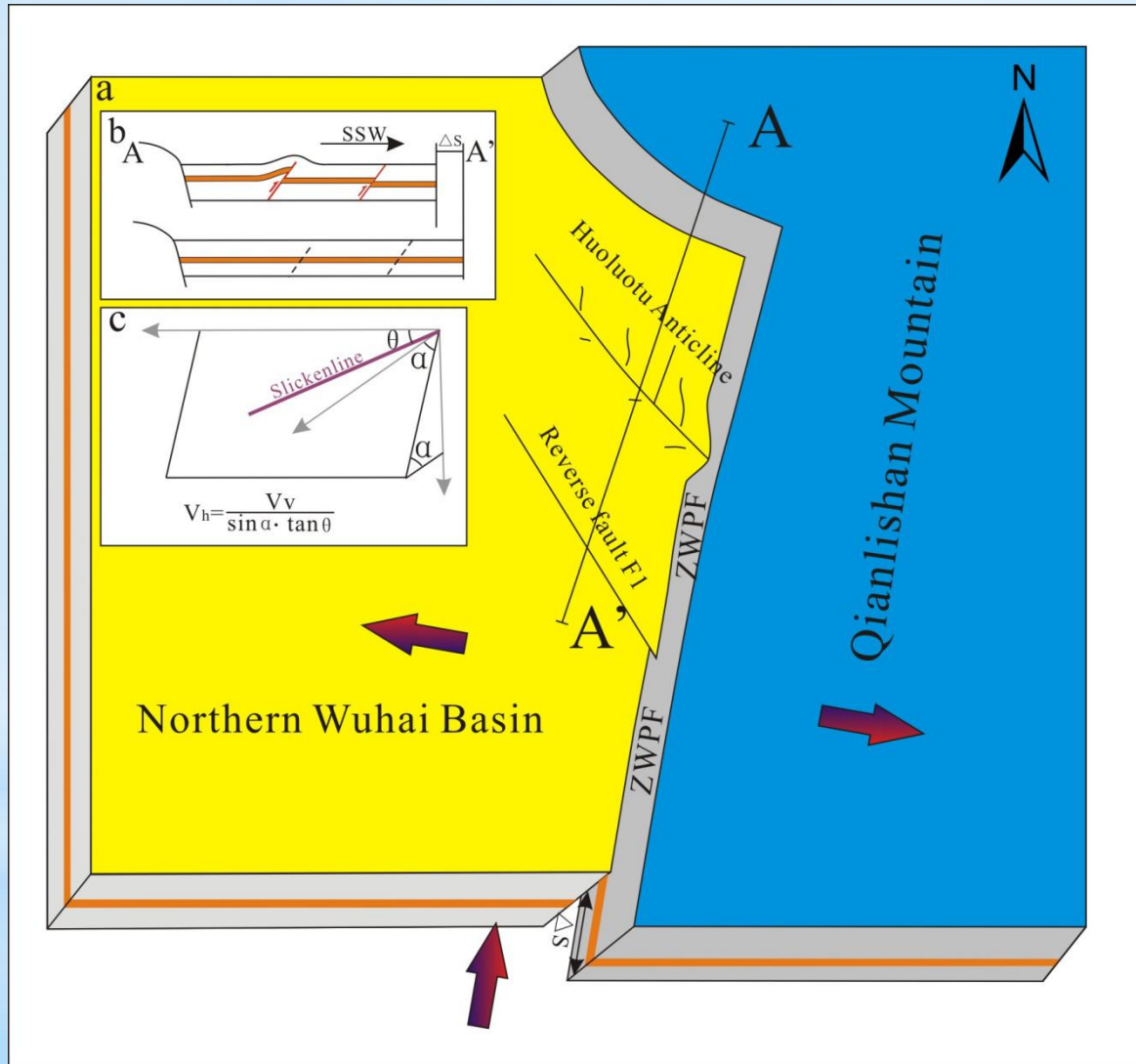
Lacustrine strata have a vertical drop of  $35.6 \pm 8.5 \text{ m}$ , the vertical slip rate of the is about  $0.5 \pm 0.2 \text{ mm / a}$ .





## 4 Discussion

### 断层水平滑动速率估算



The slickenlines at the Sandaokan Site have pitch angles of between 25, 12° and 5°.

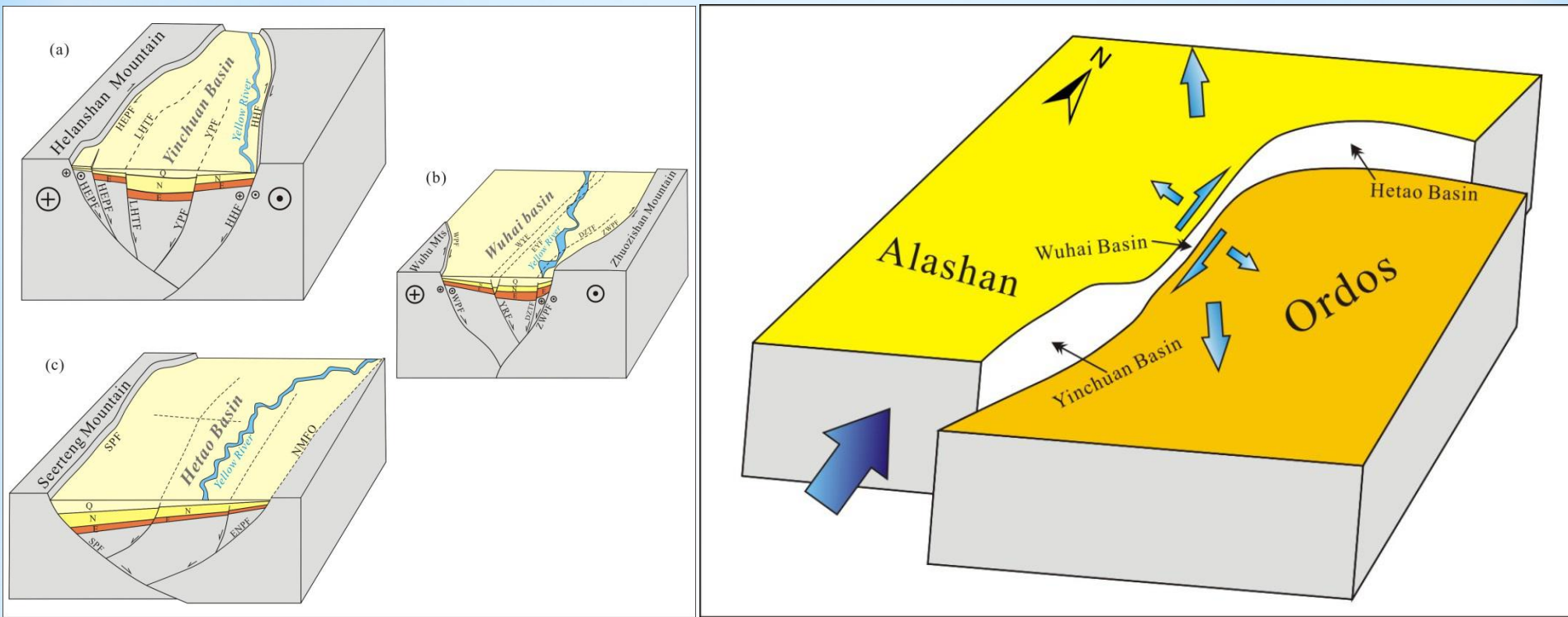
$$V_h = \frac{V_v}{\sin \alpha \cdot \tan \theta}$$

The horizontal slip rates of the ZWPF in Sandaokan Site calculated from the slickenlines were 1.1 mm/a, 2.4 mm/a, and 5.8 mm/a.



## 4 Discussion

### 鄂尔多斯西北缘构造活动模式图



1. The Wuhai Basin and Yinchuan Basin are dextral and tensional **negative flower-like structure**. The Hetao Basin is a north-deep –south-shallow **dustpan-like structure**.

2. Under **tensile stress of  $139^{\circ}$ – $319^{\circ}$**  and **S-type basins distribution**, the near N-S oriented dextral strike-slip movement on the western margin of the Ordos Block further enhances expansion of the Hetao and Yinchuan Basins through transition of the faults.



## 5. Conclusion

Table 3 Information on lacustrine layers at different sites

	Erdaokan	Sandaokan	Huanghuaxi	Fenghuang Ridge
Footwall (m)	1092.6±5.0	1095.2±5.0	1099.6±5.0	1132.0±5.0
Hanging wall (m)	1052.7±5.0	1060.1±5.0	1042.2±5.0	1063.1±5.0
Vertical offset (m)	40.1±8.2	35.6±8.5	57.5±8.5	68.7±8.4
Vertical slip rate (mm/a)	0.6±0.2	0.5±0.2	0.9±0.2	1.0±0.2

1. Vertical slip rate of the ZWPF are estimated as  $0.5\pm0.2$  to  $1.0\pm0.2$  mm/a.
2. Highest slip rates occur in the central part of the fault, declining southward.
3. The reverse faults and fold is result from the dextral strike-slip of the ZWPF.
4. The Wuhai Basin revealed to be a dextral-tensional negative flower structure.
5. Stress conditions and S-shaped distribution dominate the development of basins.

