The field observation in Peinanshan area

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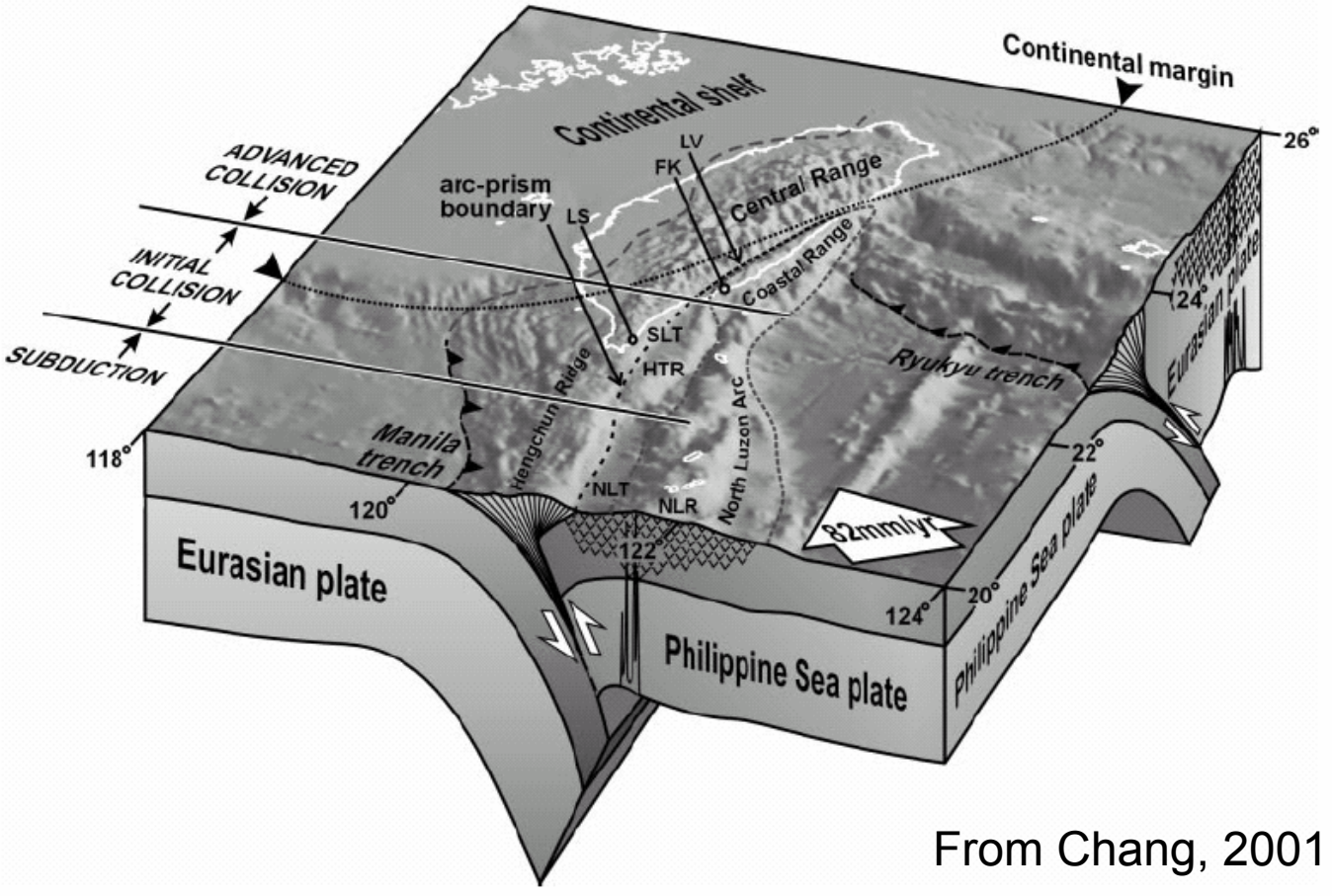
Outline

- Geological Setting
- Region
  - Peinen Shan
  - Gaotai
  - Funky Blob (Rueiyuan)
  - Coastal Range
- GPS observation
- Discussion
- The Neotectonic History

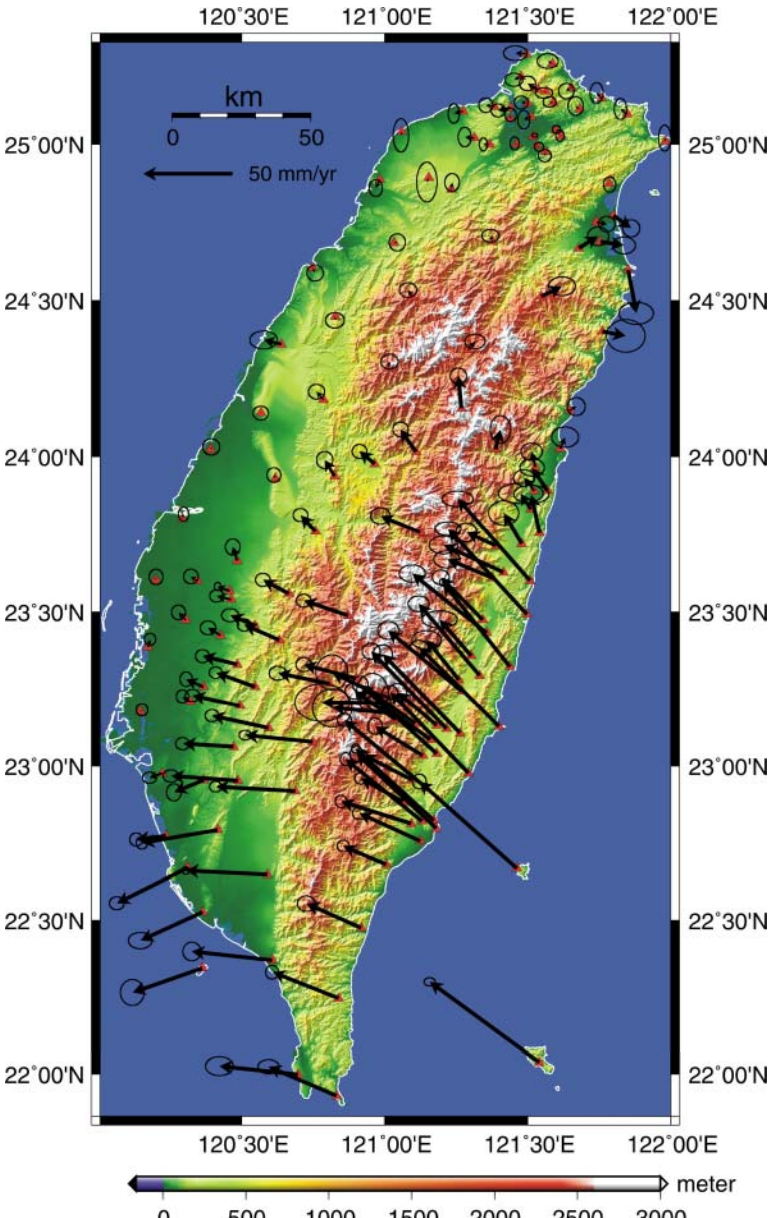
Geological setting in Taiwan



From Chang, 2001

Taiwan is located on the boundary between the Philippine Sea Plate (PSP) and the Eurasian Plate (EP). The Philippine Sea Plate is subducting beneath the Eurasian Plate at the Ryukyi trench and overriding the crust of the South China Sea at the Manila trench. In the north, the Philippine Sea Plate subducts beneath the Ryukyu Arc, but in the south the South China and Eurasian Plate subducts beneath the Philippine Sea Plate.

The GPS observation in Taiwan

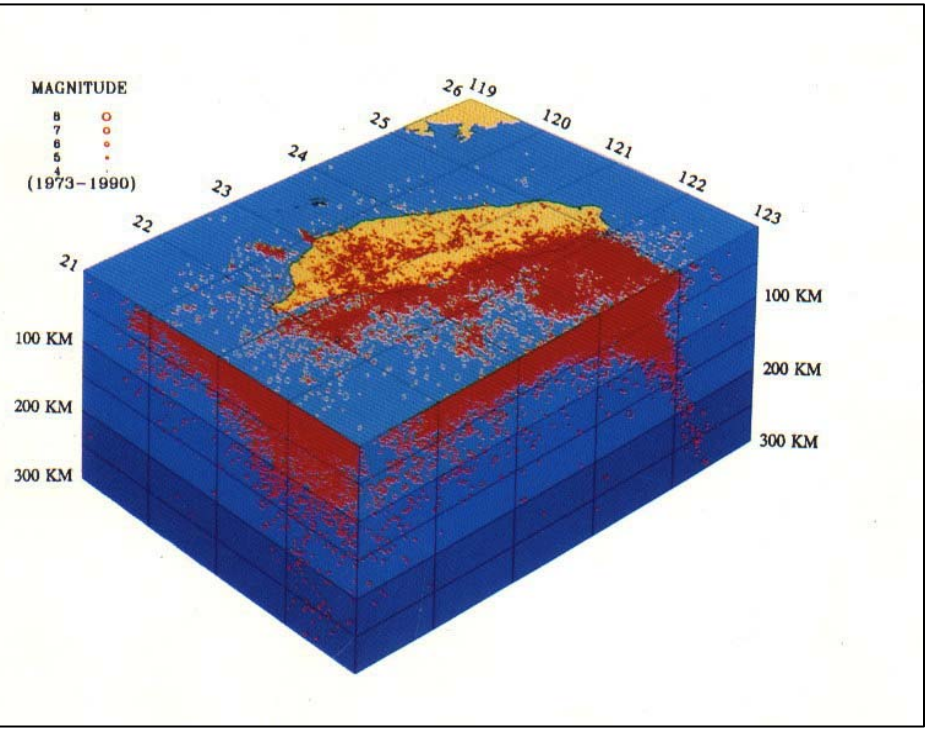


- The GPS vectors reveal that a counterclockwise distribution and west-decaying property.

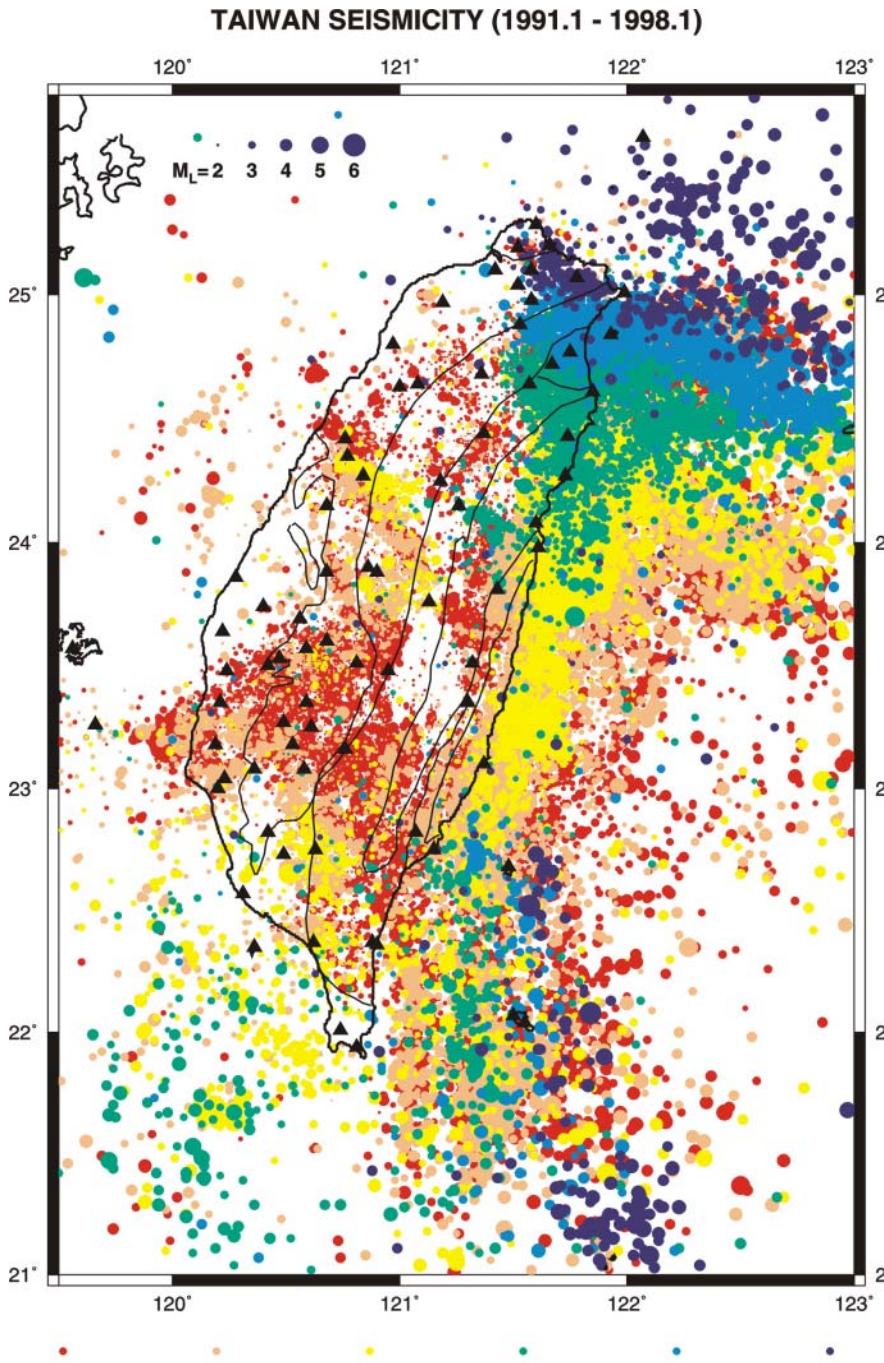
- But in the southwestern Taiwan the decay of the vectors are not as quickly as them in central Taiwan and an obviously rotation, we call this phenomenon as "**tectonic extrusion**".

- The Philippine Sea Plate is about 78 mm/yr in 310^{o} relative to Ponghu island collision to Eurasia Plate.

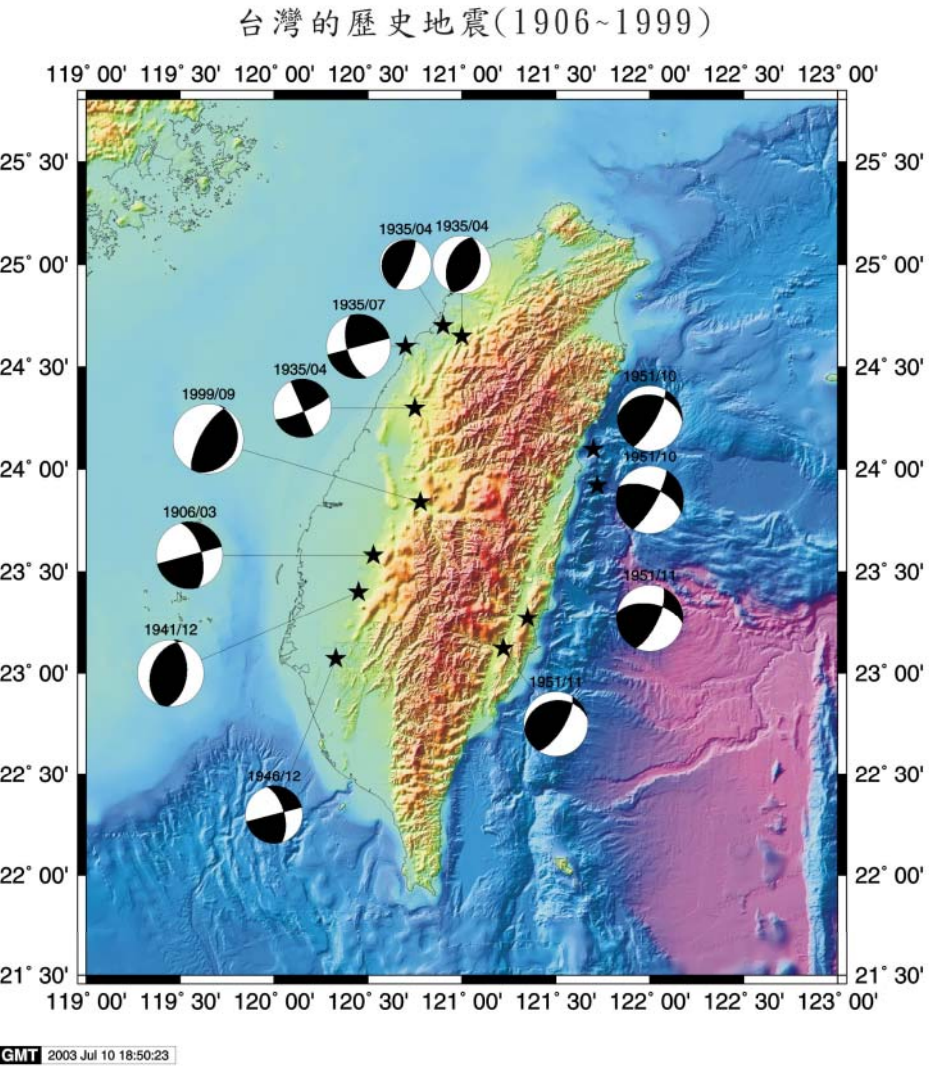
The Earthquakes distribution in Taiwan

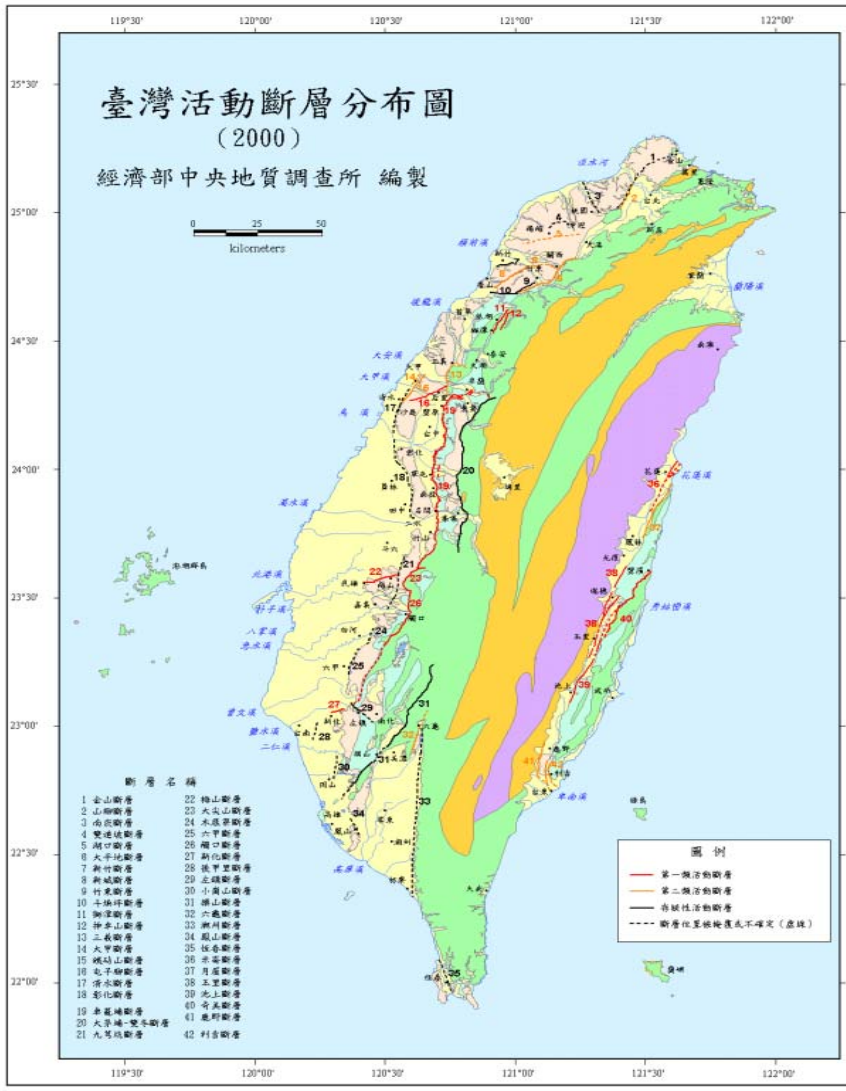


Data from Sinica



The history earthquakes since 1900





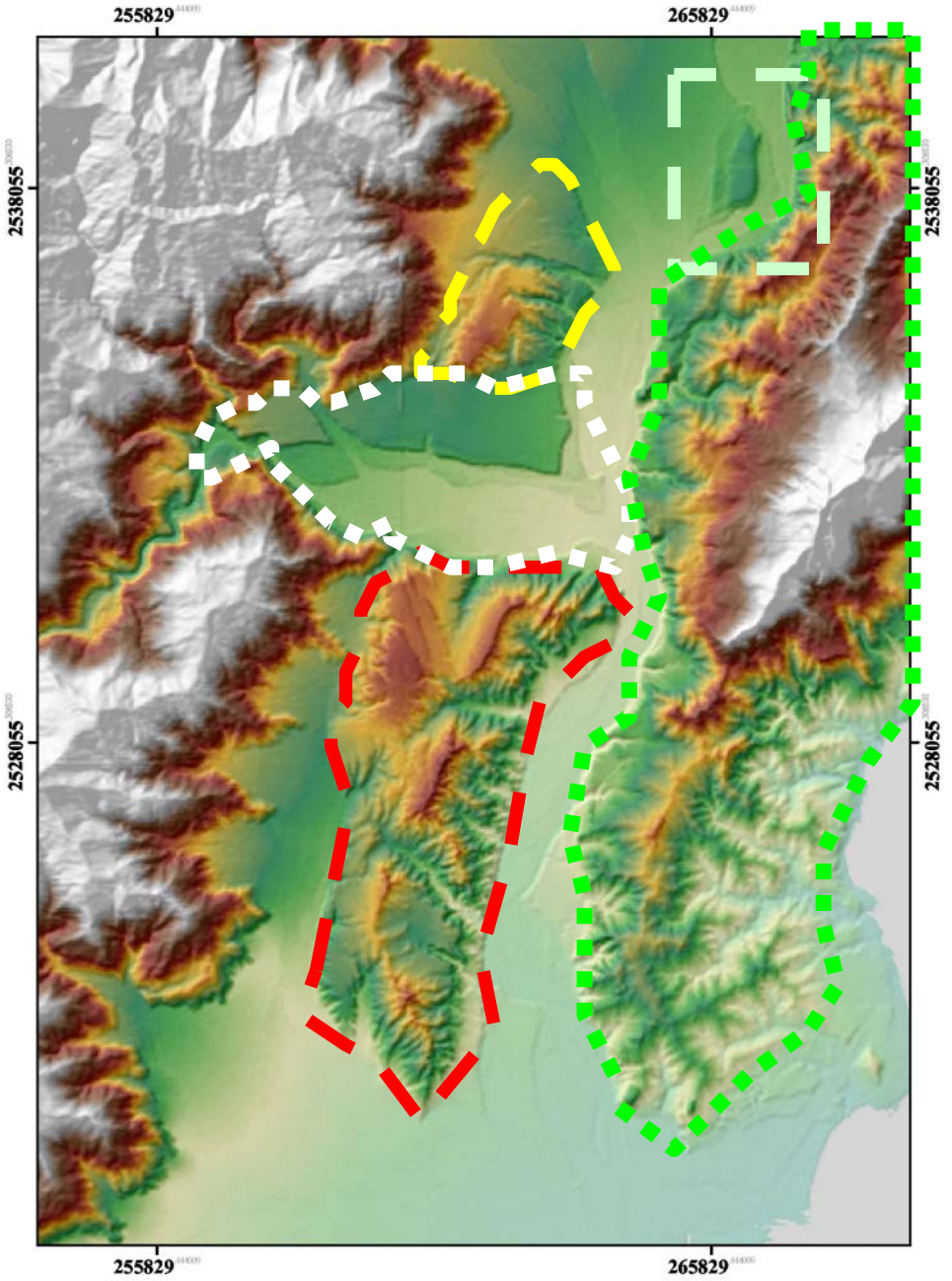
From Cheng, 1995 and CWB

The Longitudinal Valley

- Fault-
  - Longitudinal Valley Fault
    - Yuli Fault
    - Chihshang Fault
    - Chimei Fault
  - Central Range Fault (?, not sure the fault trace)
  - Luyeh Fault

Observation Area

- Peinanshan- in the southern part of the study area
- Luyeh Terrace
- Gaotai
- Funky Blob (Rueiyuan)



Funky Blob

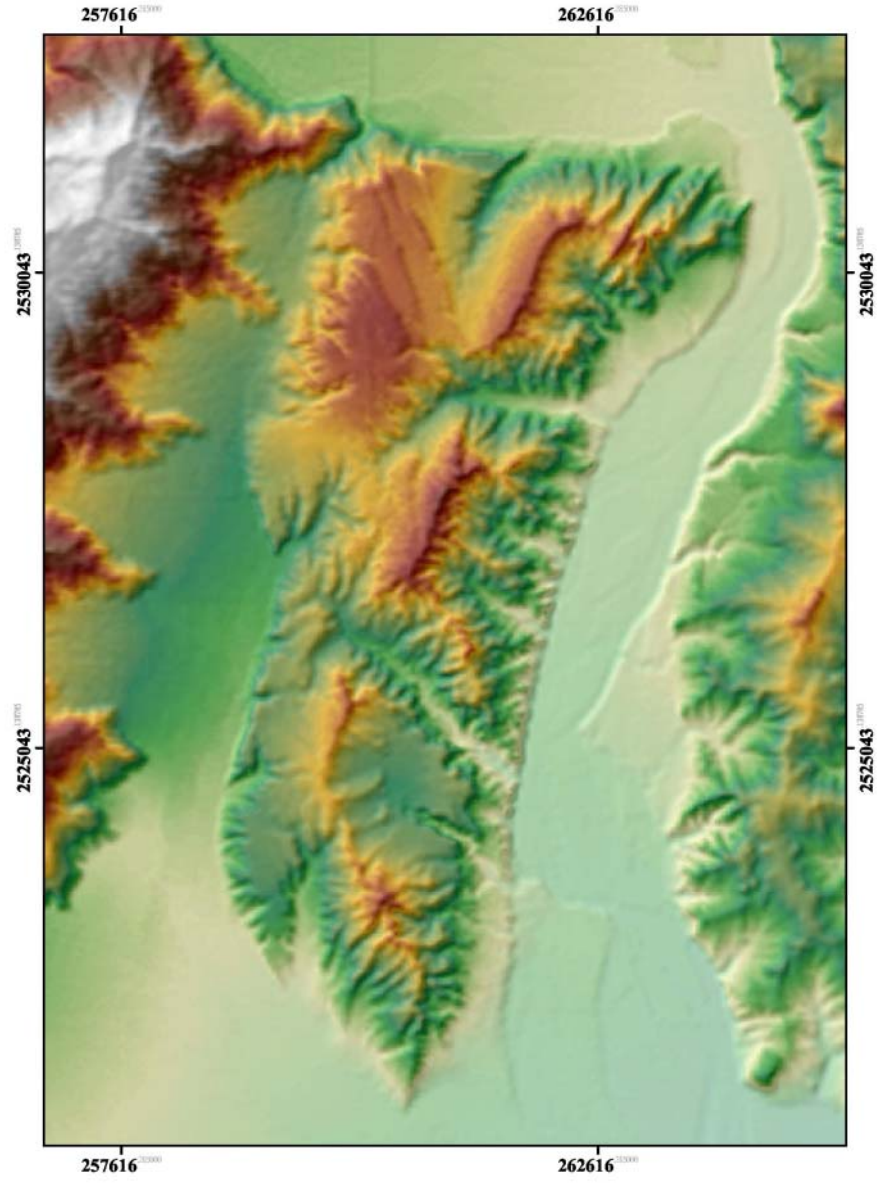
Gaotai

Peinanshan

Luyeh Terrace

Coastal Range

Peinanshan



Composition

Peinanshan Conglomerate (PSC)

Modern Terraces

Lichi Melange

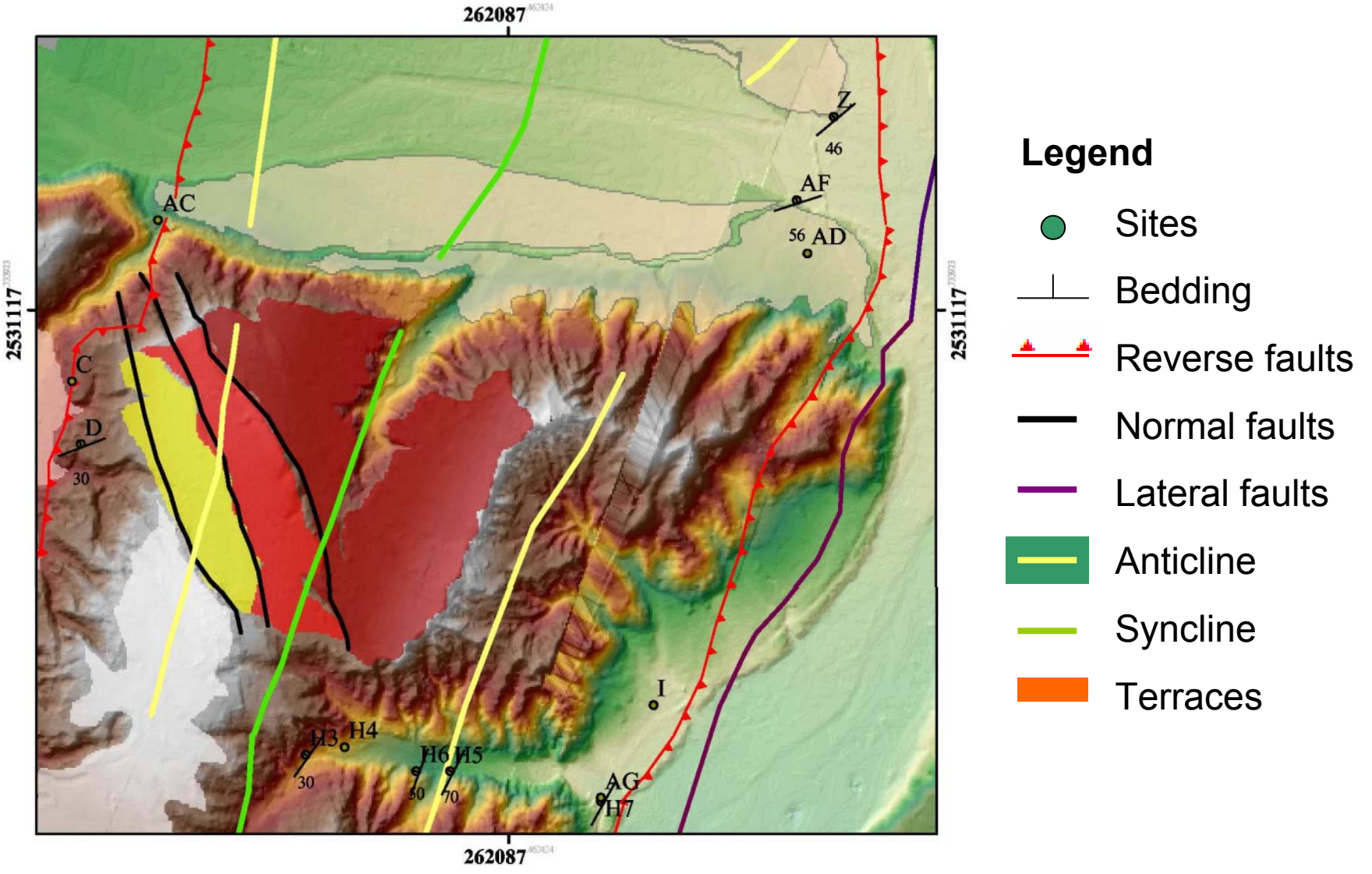
River

most rivers are E-W direction

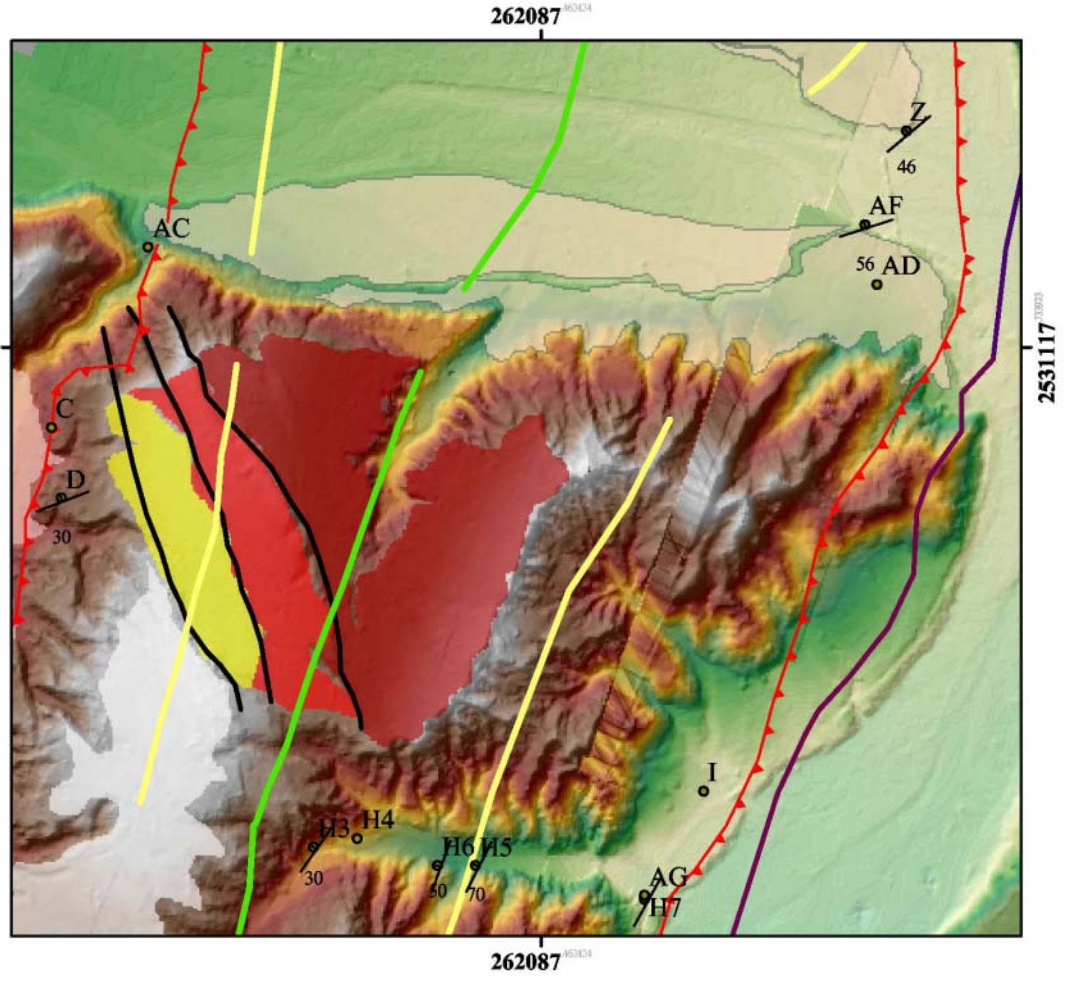
Fold

There is a couple of syn-, anticline in northern part of Peinanshan.

Northern part of Peinanshan

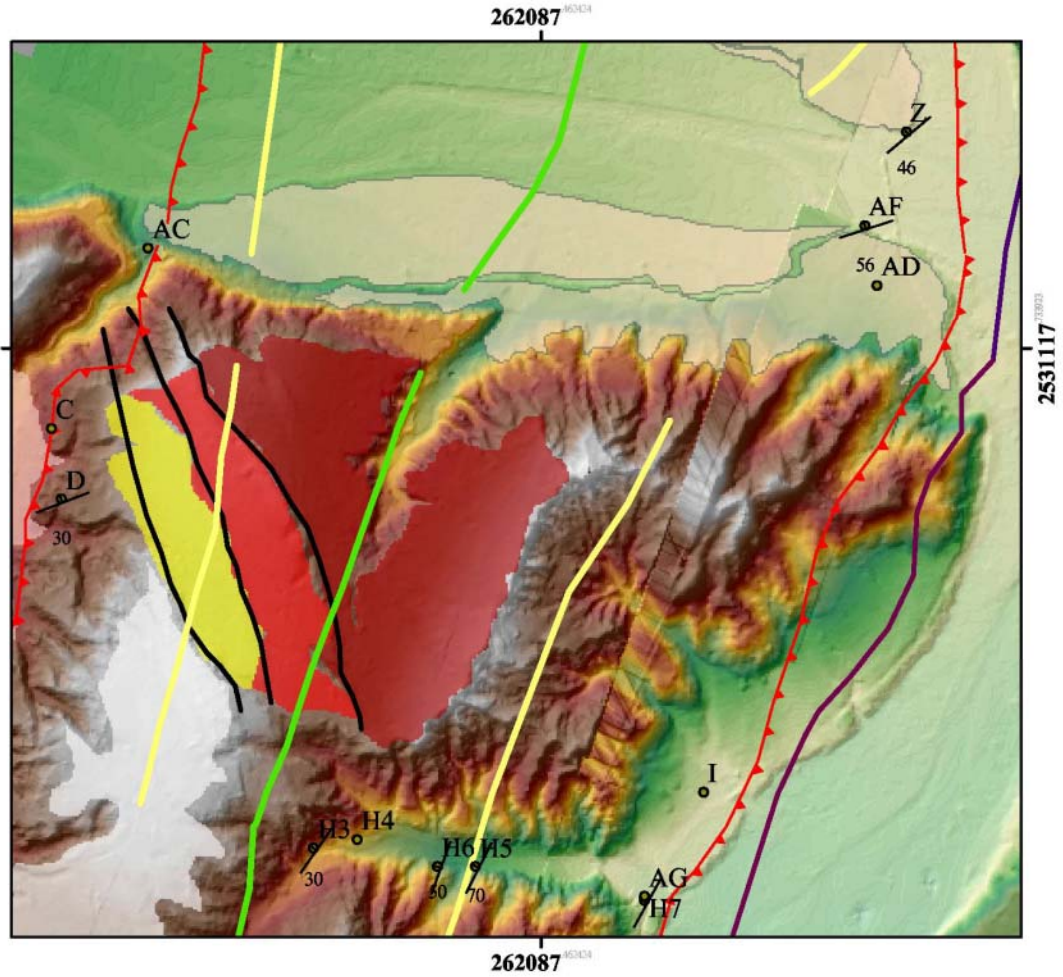


Northern part of Peinanshan



In the Northwestern part of PS, we found 3~4 terraces, but the bedding of these terraces are tilted from West to East with the different elevations.

Furthermore, there is a anti-, synform on the Northern part, which suggested a couple of anti-, syncline

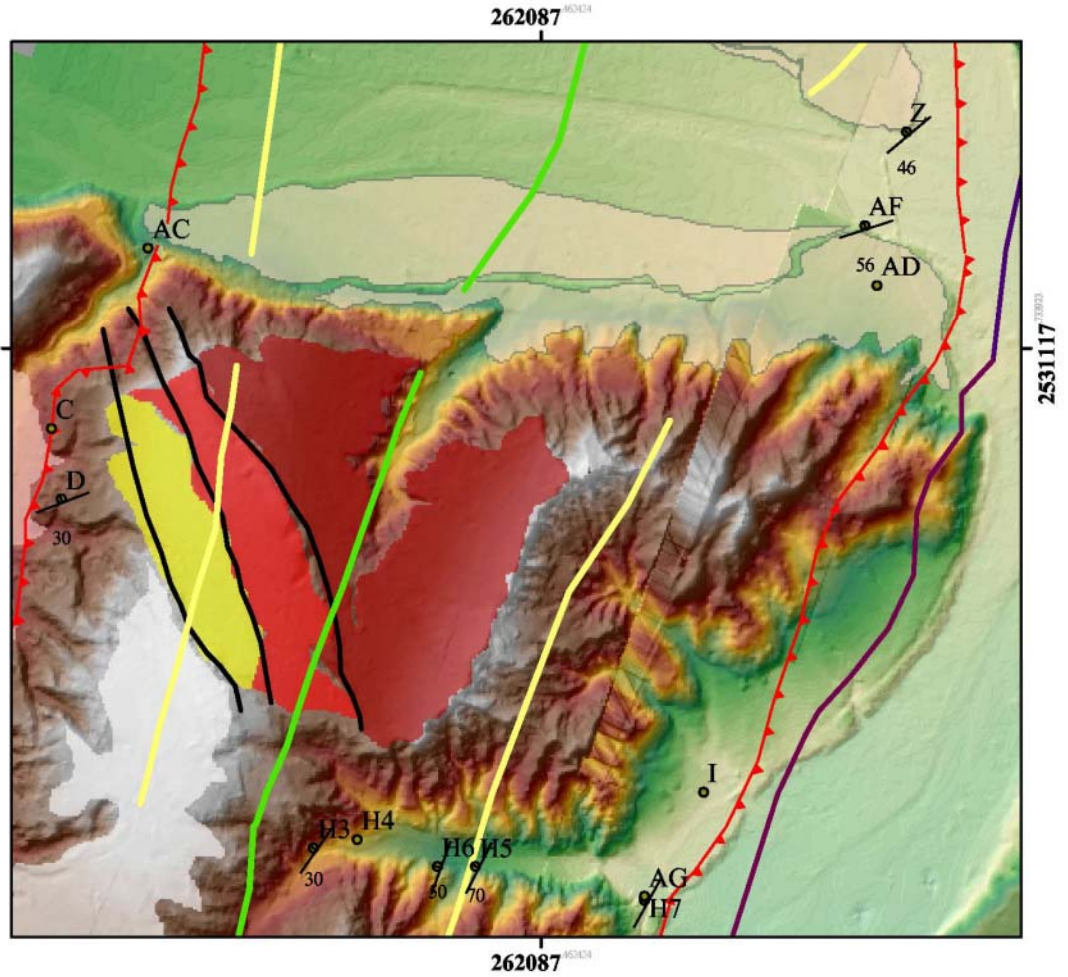


Bedding

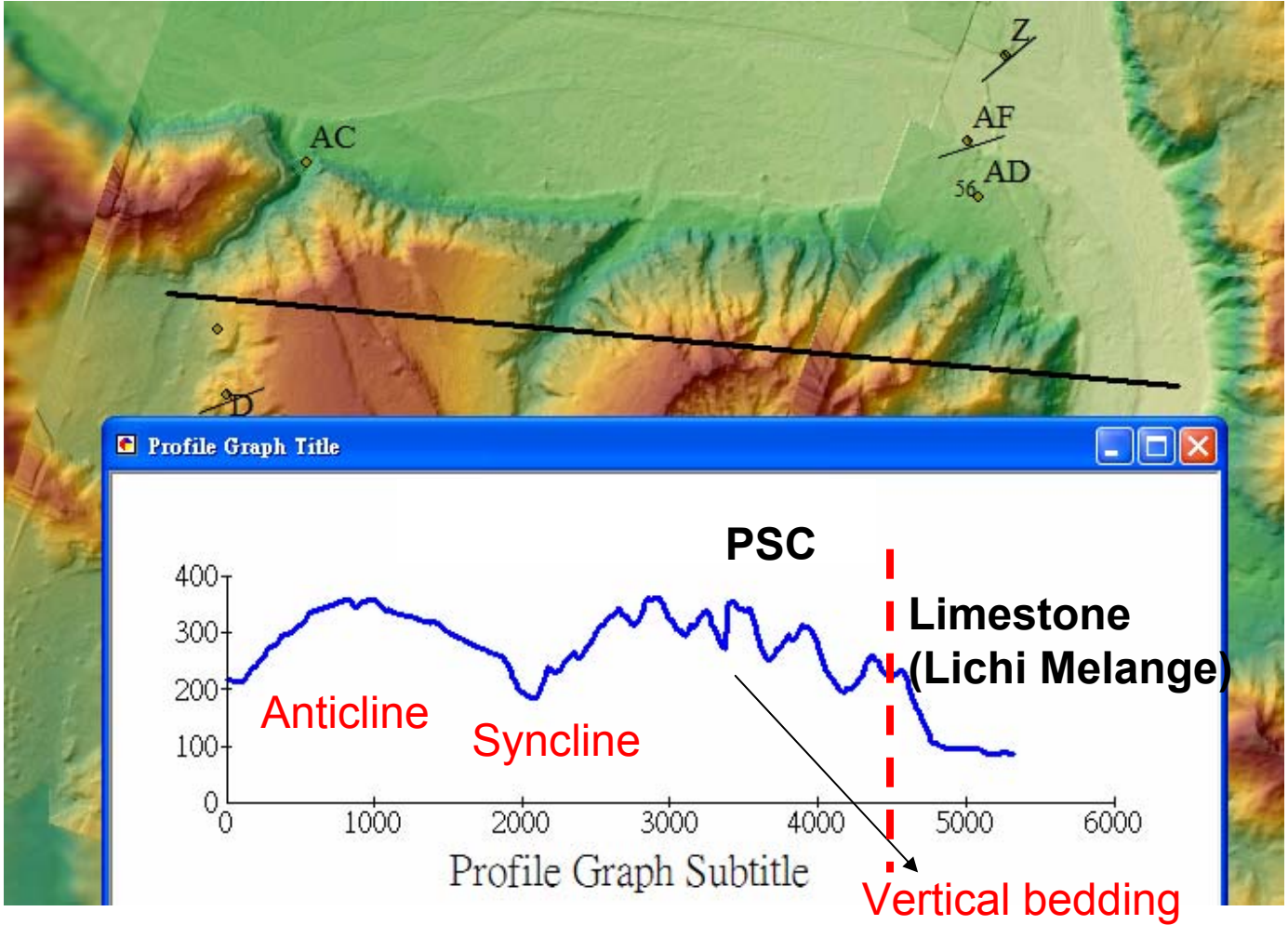
-In the northeastern part, the topography indicates a vertical bedding.

-The outcrops in the E-W direction river also reveals the vertical bedding.

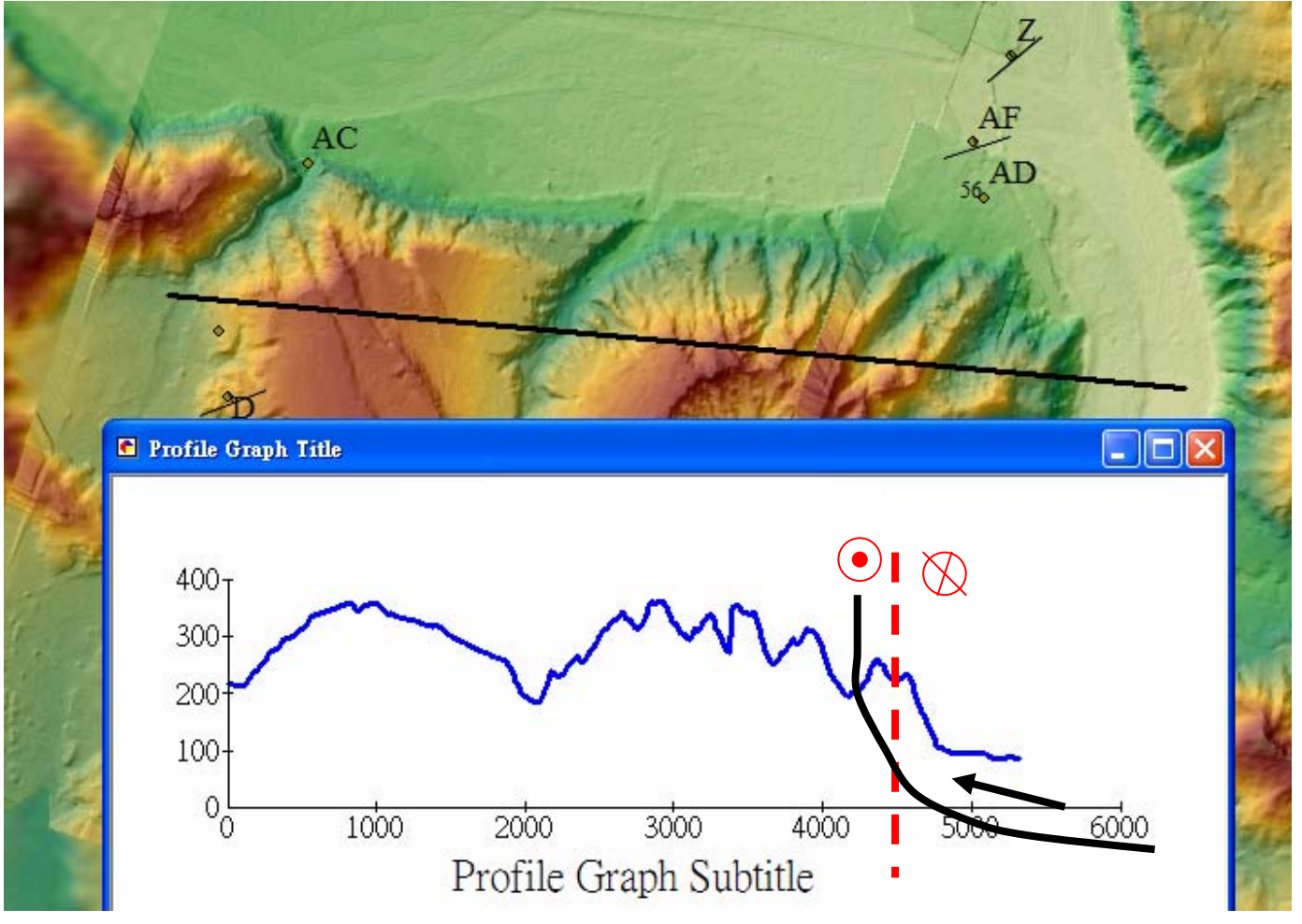
-The bedding is generally tilting to West in eastward.



-In the East most area (near the railway), there is a contact between Limestone (Lichi Melange) and PSC.

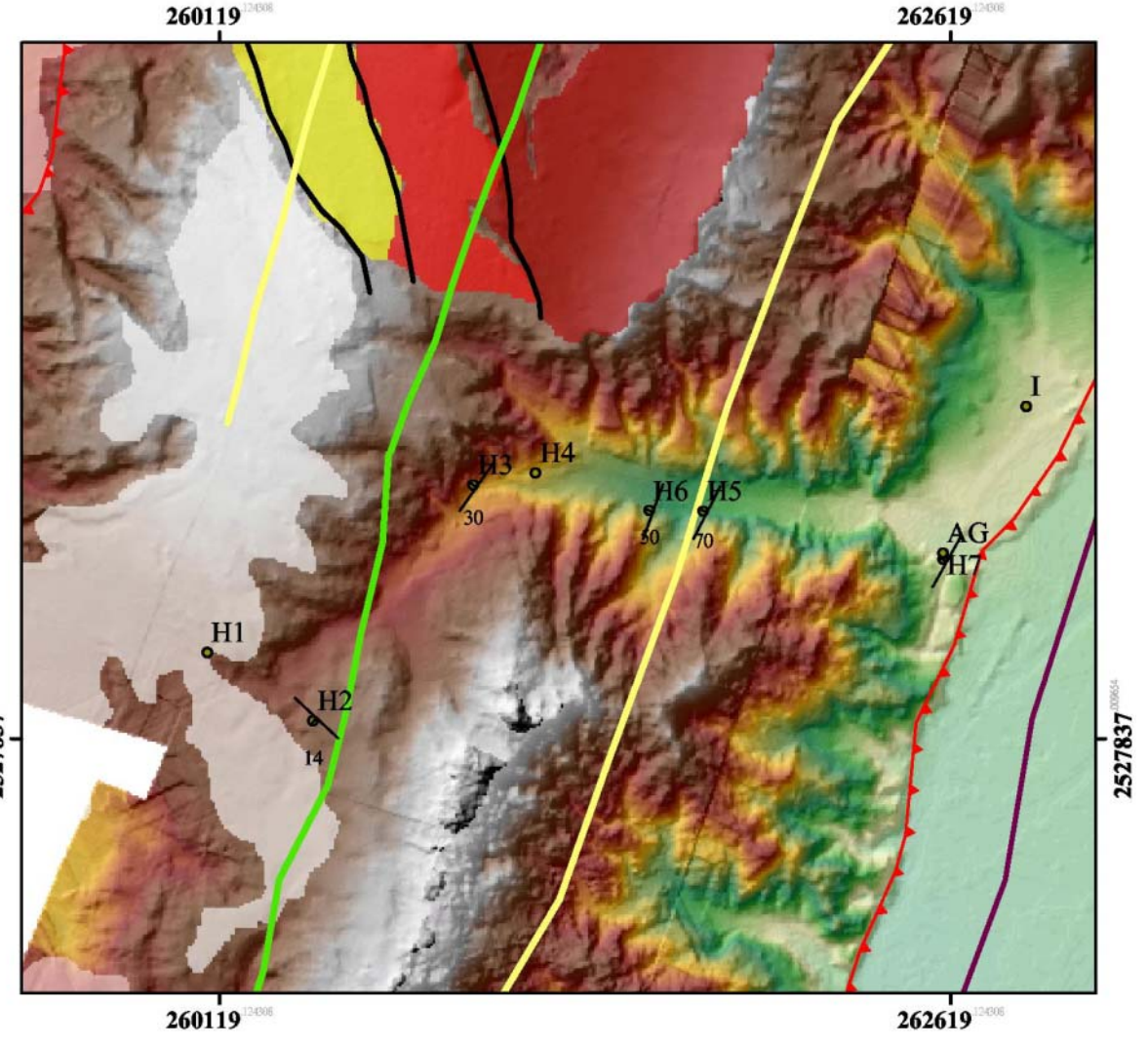


From the profile of the northern part, clearly there exists anticline in western edge and syncline in the middle part, and on the eastern edge of Peinanshan, the bedding of the PSC is vertical, which indicates a huge structure activity.



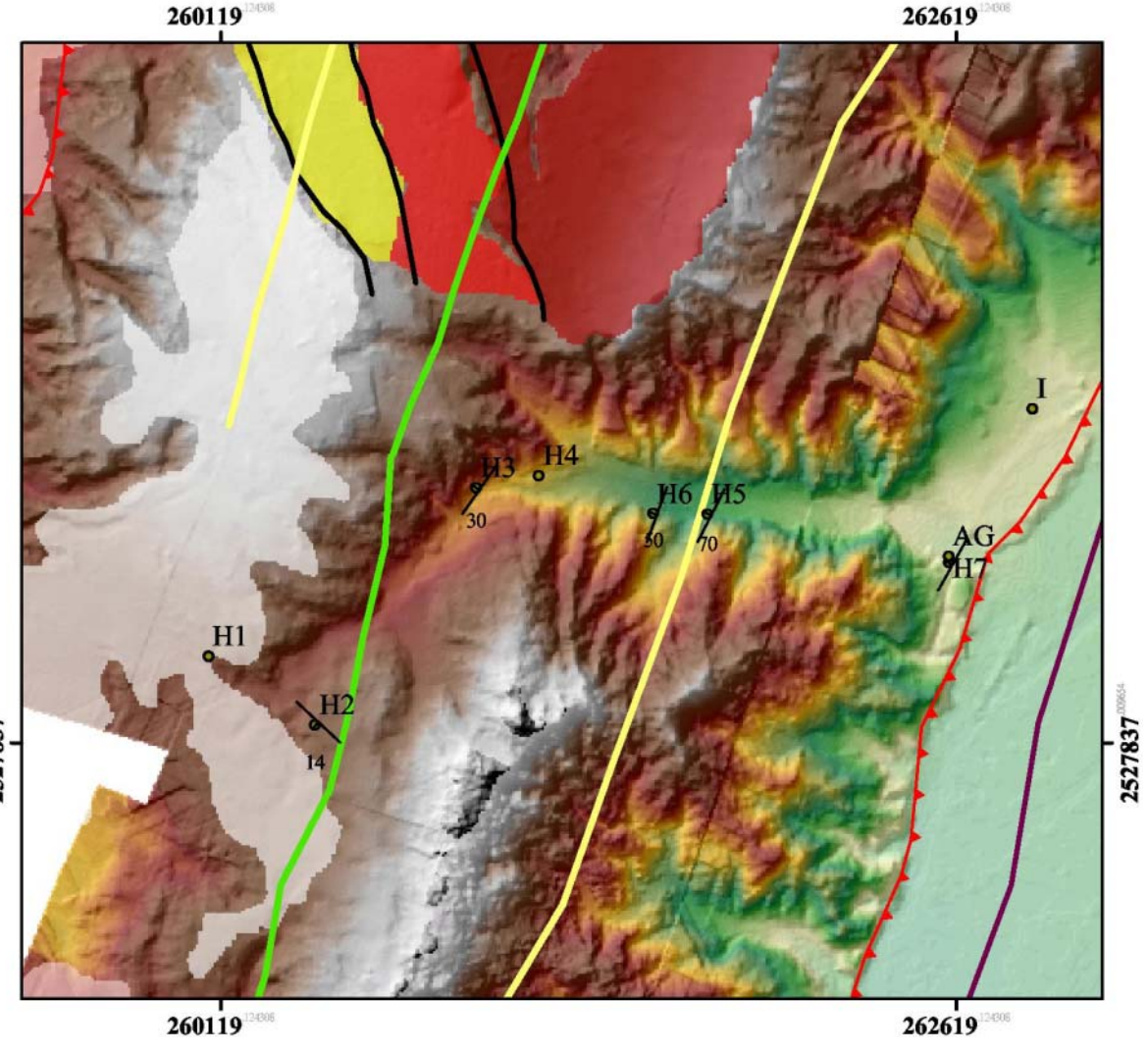
Fault- We infer that there exists an east dipping thrust near the contact. The activity of this fault can

Middle part of Peinanshan

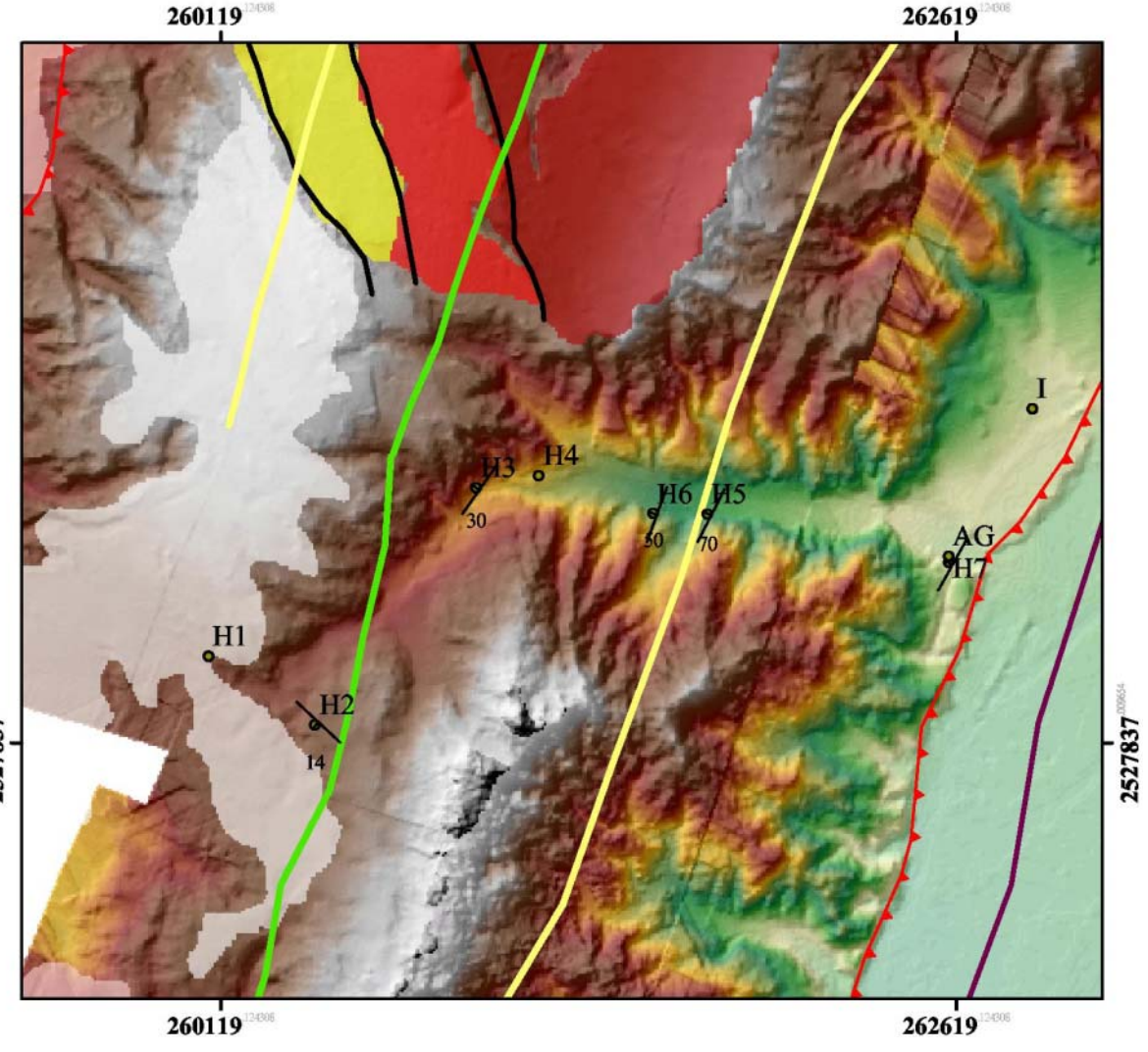


-The sequence here from the upper part to lower part is Modern lateral terrace to PSC, and the dipping here is gentle Eastward.

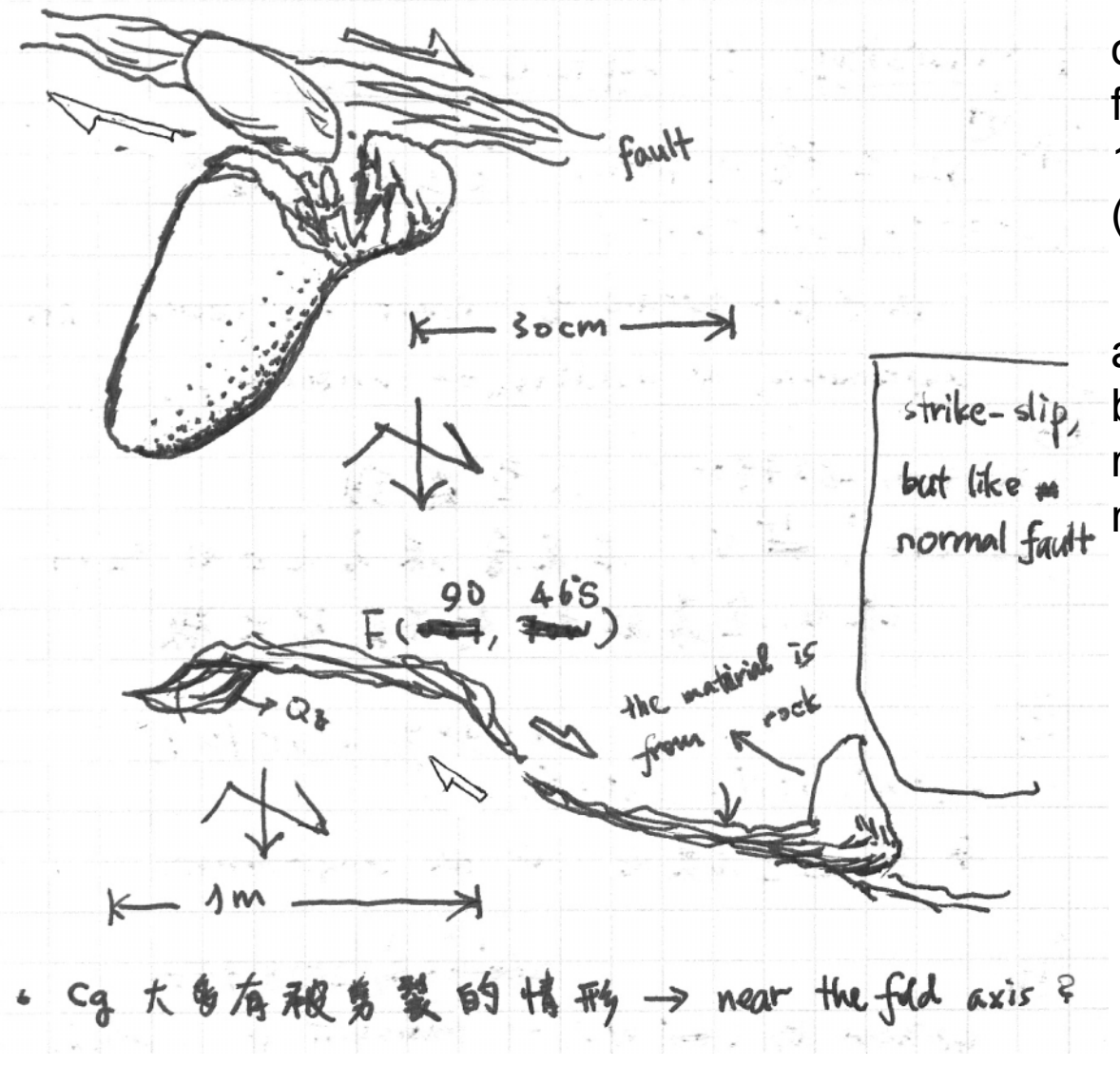
- The dipping in the west part of this river (H4) is about horizontal, and in the middle part (H5,H6) is about 24~30^{o}E, and in H7 becomes nearly vertical.



-In H5 site, there is a small normal fault with ~1.5m offset. There is a significant offset with a single rock, and another rock rock is cracked by the impaction of another rock, which indicates the shear sense of the fault.



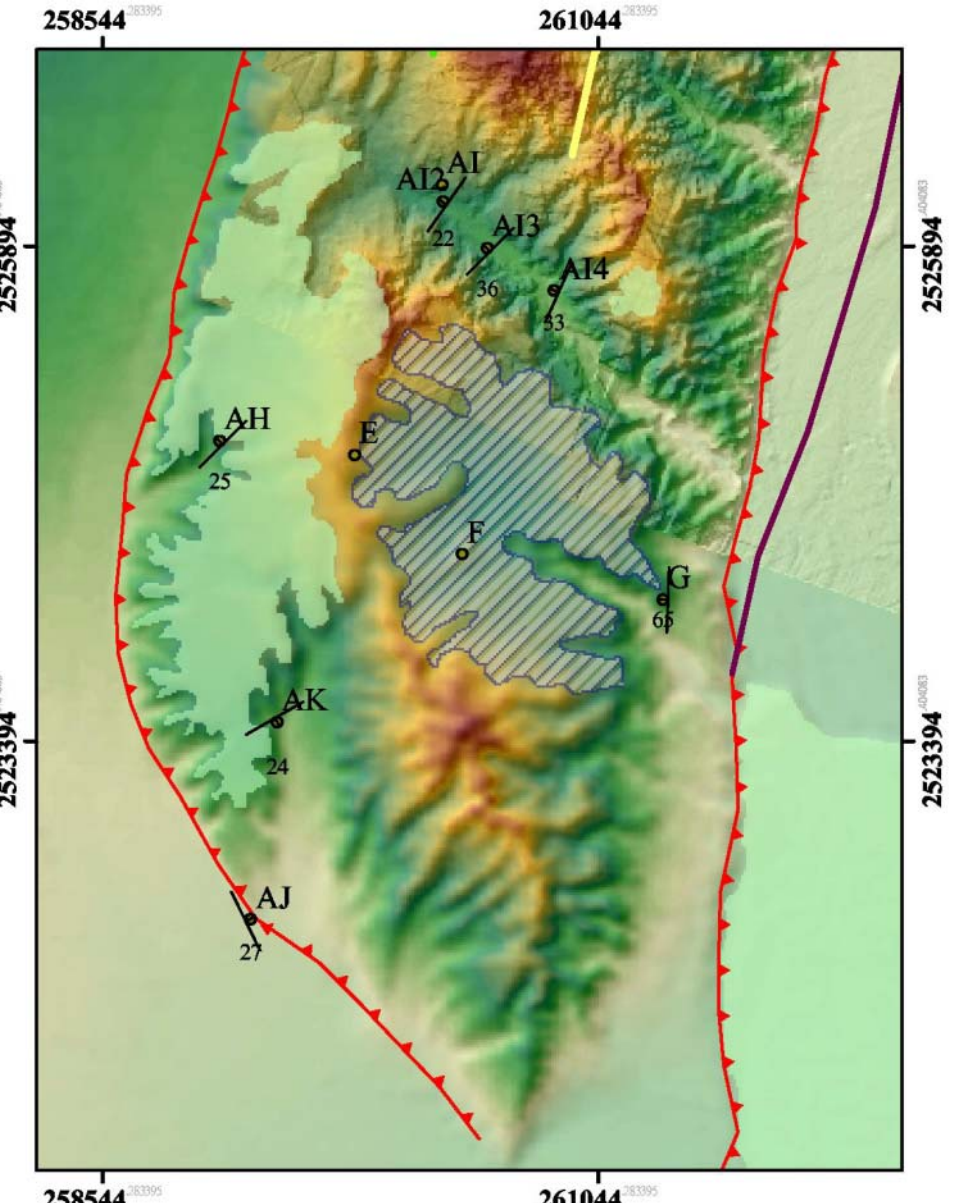
- In the western part of Peinanshan (Menon high tableland) the sequences are almost been lateralized, and some of those later



- In site H6, we found an outcrop with a minor normal fault. The offset is about 1.5m and the fault plane is (090^{o},46^{o}S).

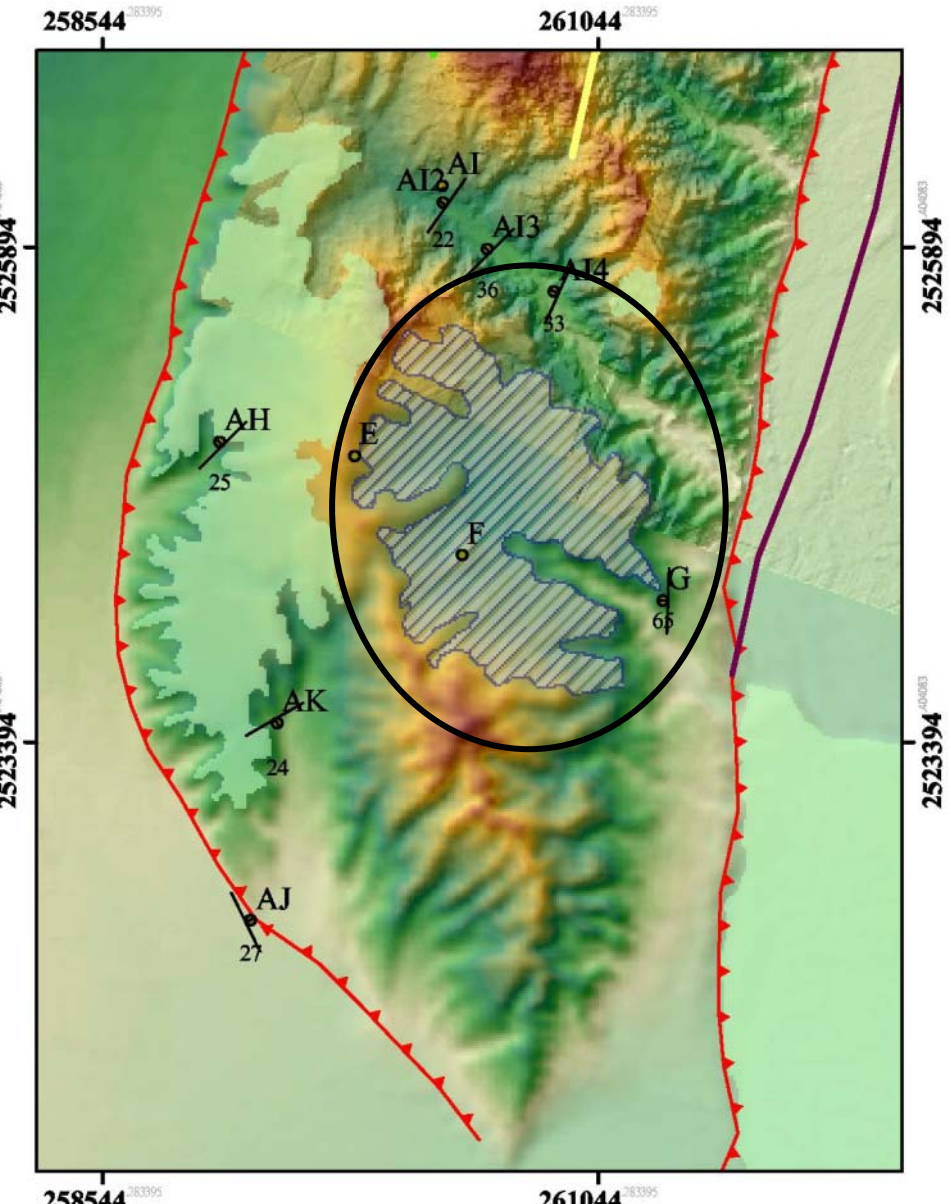
- Near the minor fault, we also found a single rock broken by another small rock in the normal direction motion.

Southern part of Peinanshan



Checking

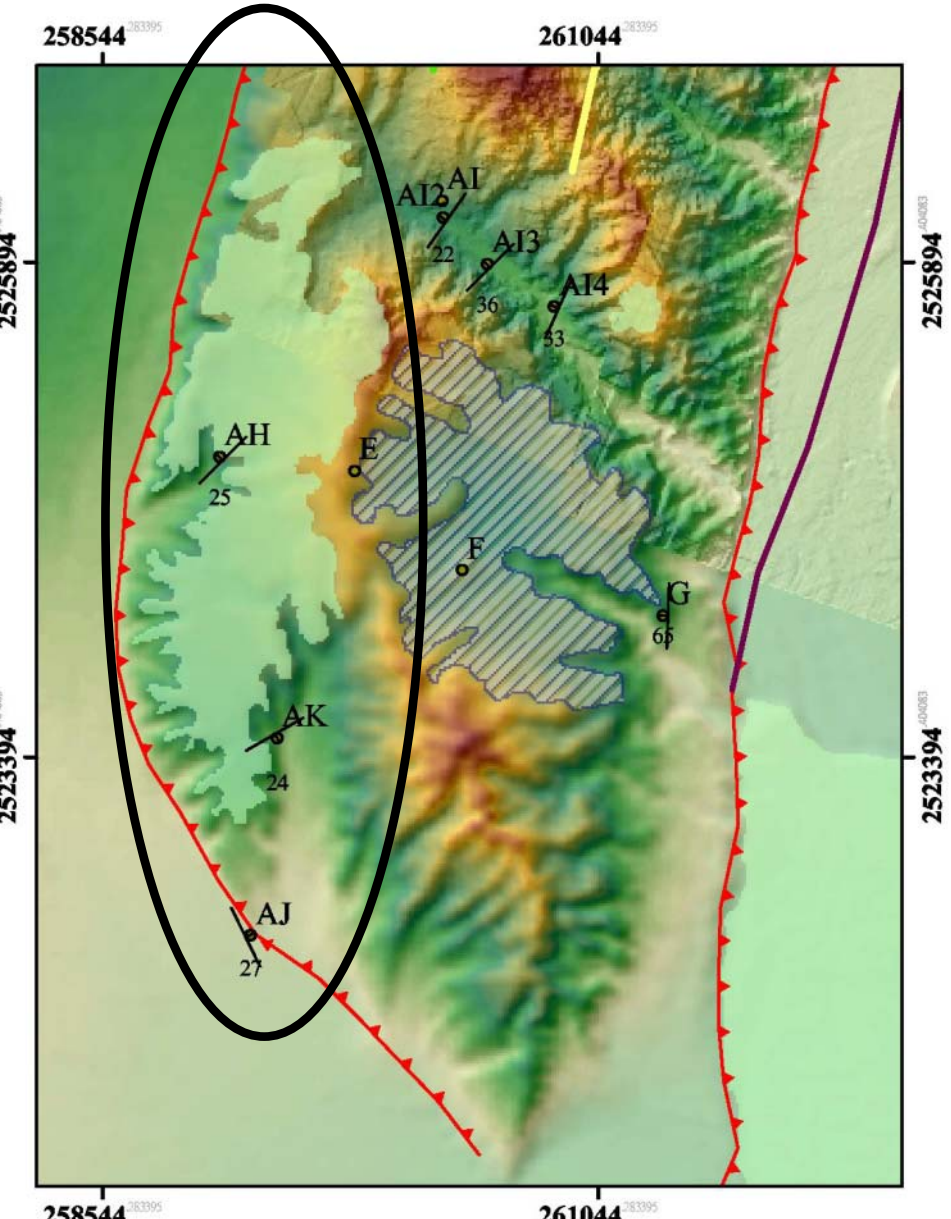
- Landslide area
- Terraces
- River valley
- Faults



Landslide area

- In the southern part of Peinanshan, the topography indicates a “landslide area”. This landslide area flows toward east.

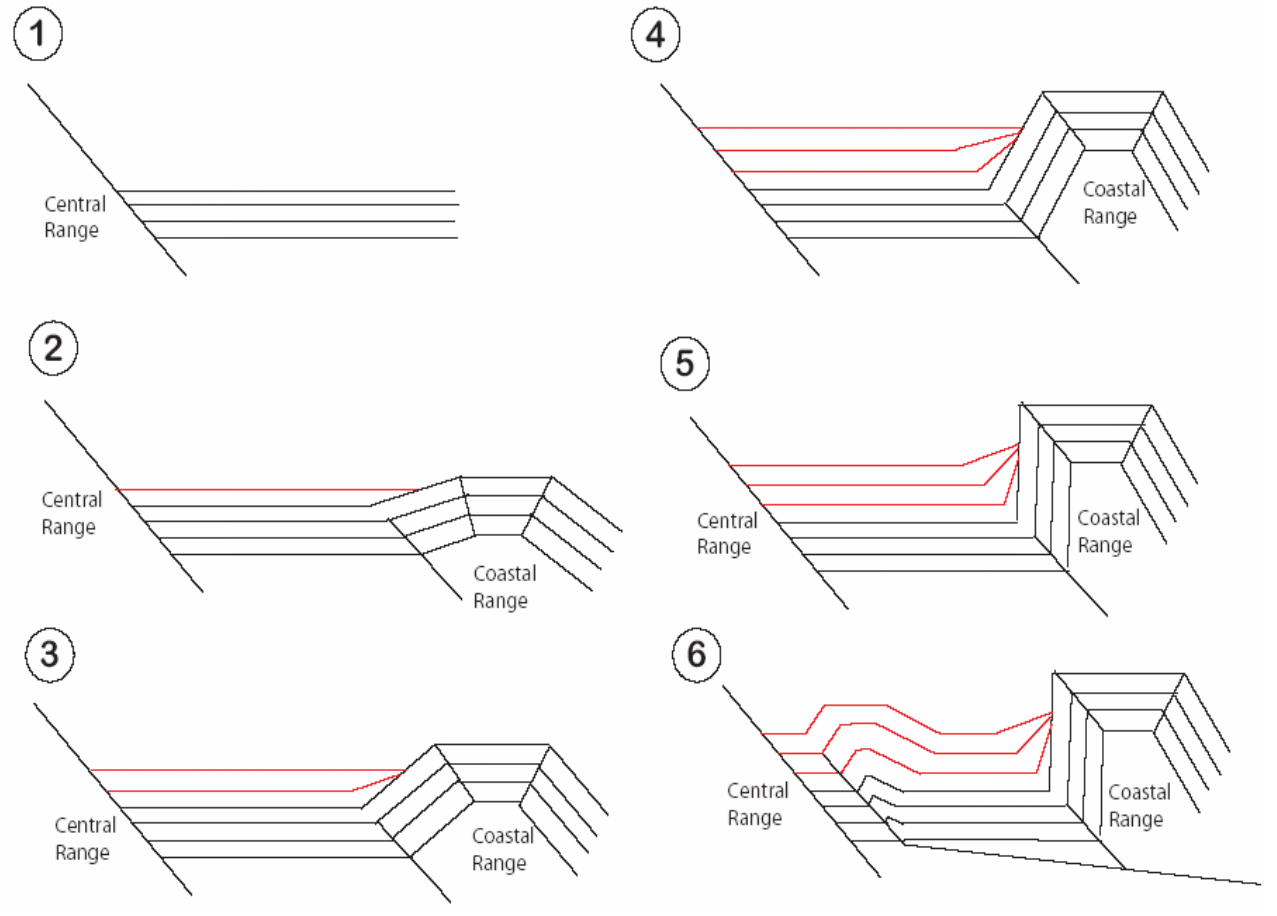
- There is a small ridge (F) in the landslide area, the sequence in this ridge is the PSC, but the orientation does not like the result of landslide but the extension of the major ridges (vertical bedding) in the northern part.



Western area

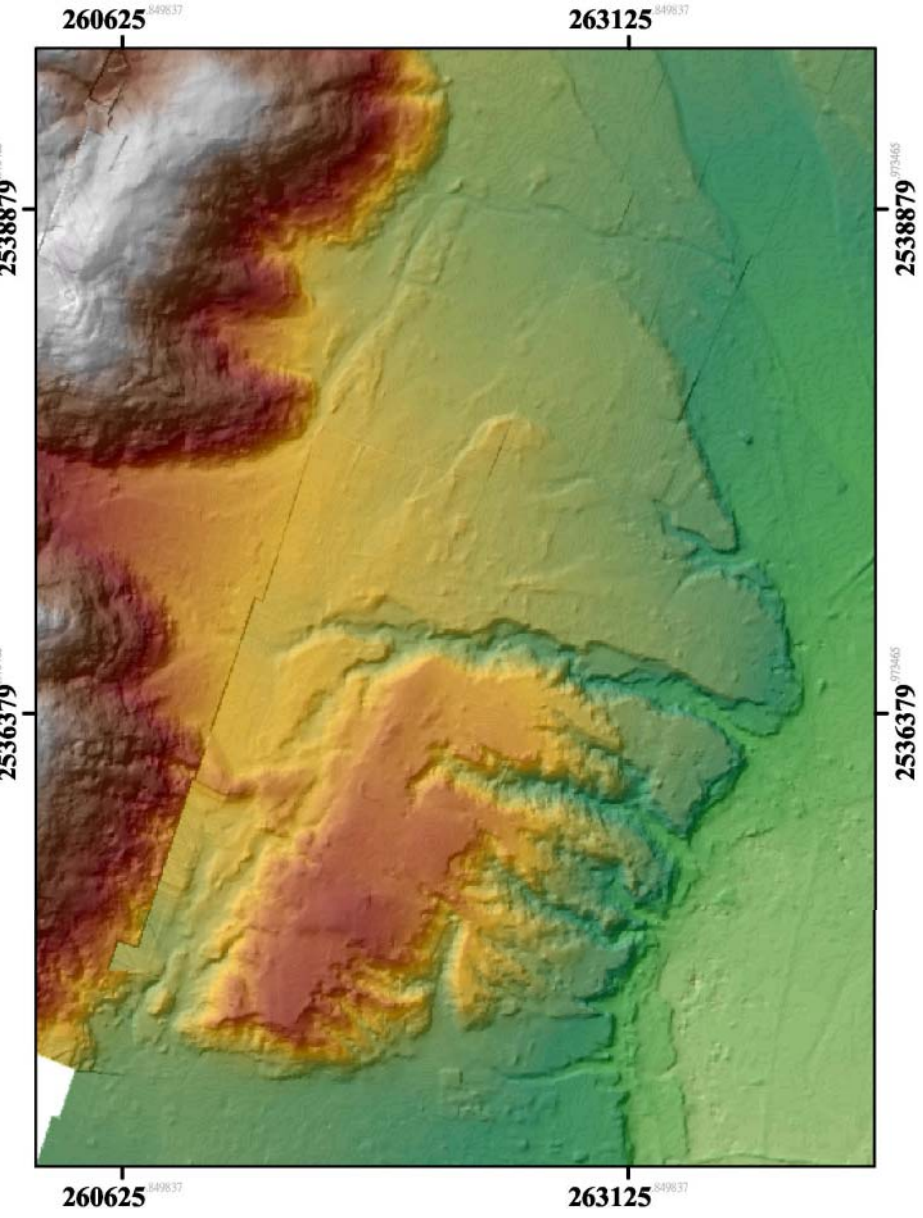
- A west tilting terrace(?, not sure), with a north and south dipping.

The possible tectonic history of Gaotai area



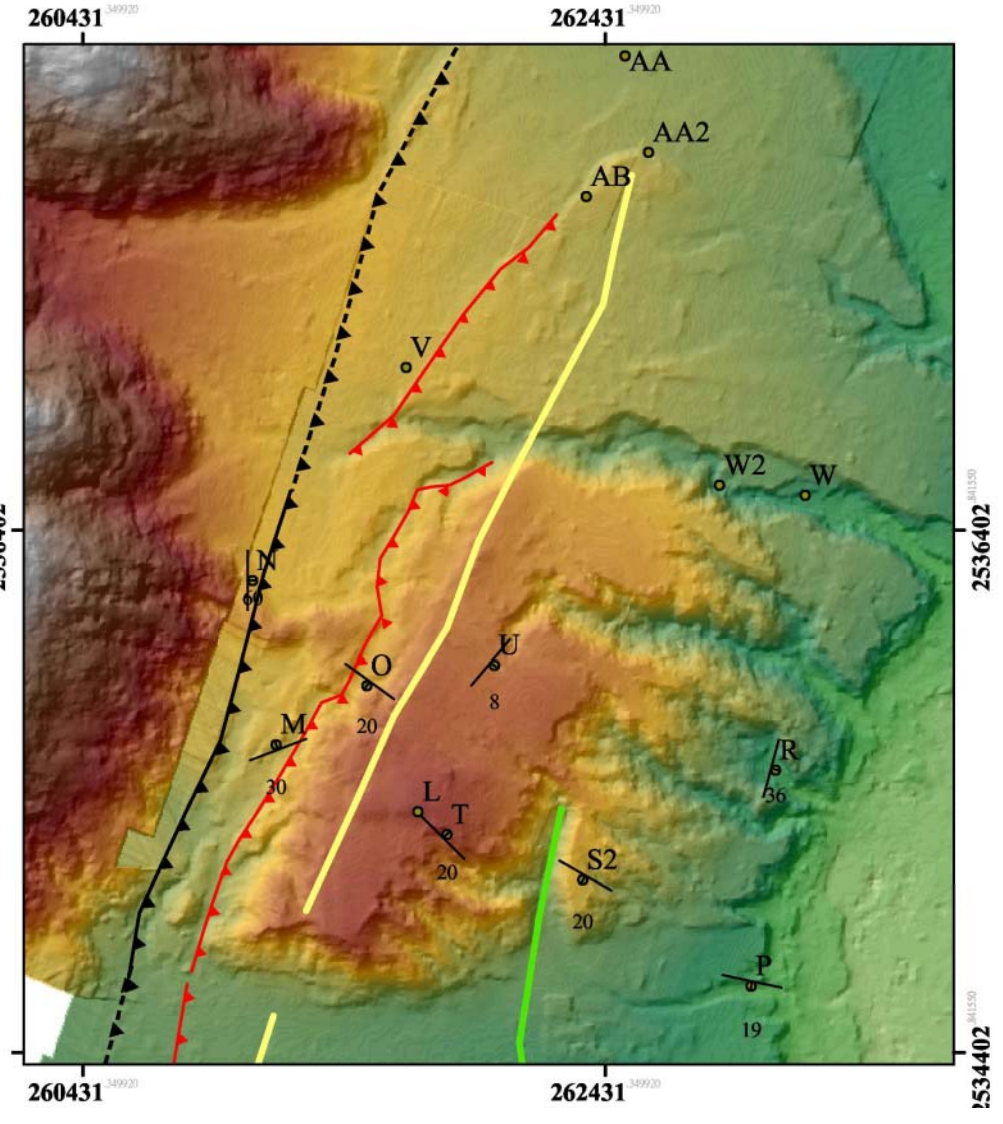
- Base on this model, we infer that the uplift of Peinanshan is the collision of Coastal Range, as the Cartoons above.

Gaotai



-The northern part of this area, Gaitai is located on the north of the Lungtien Terrace.

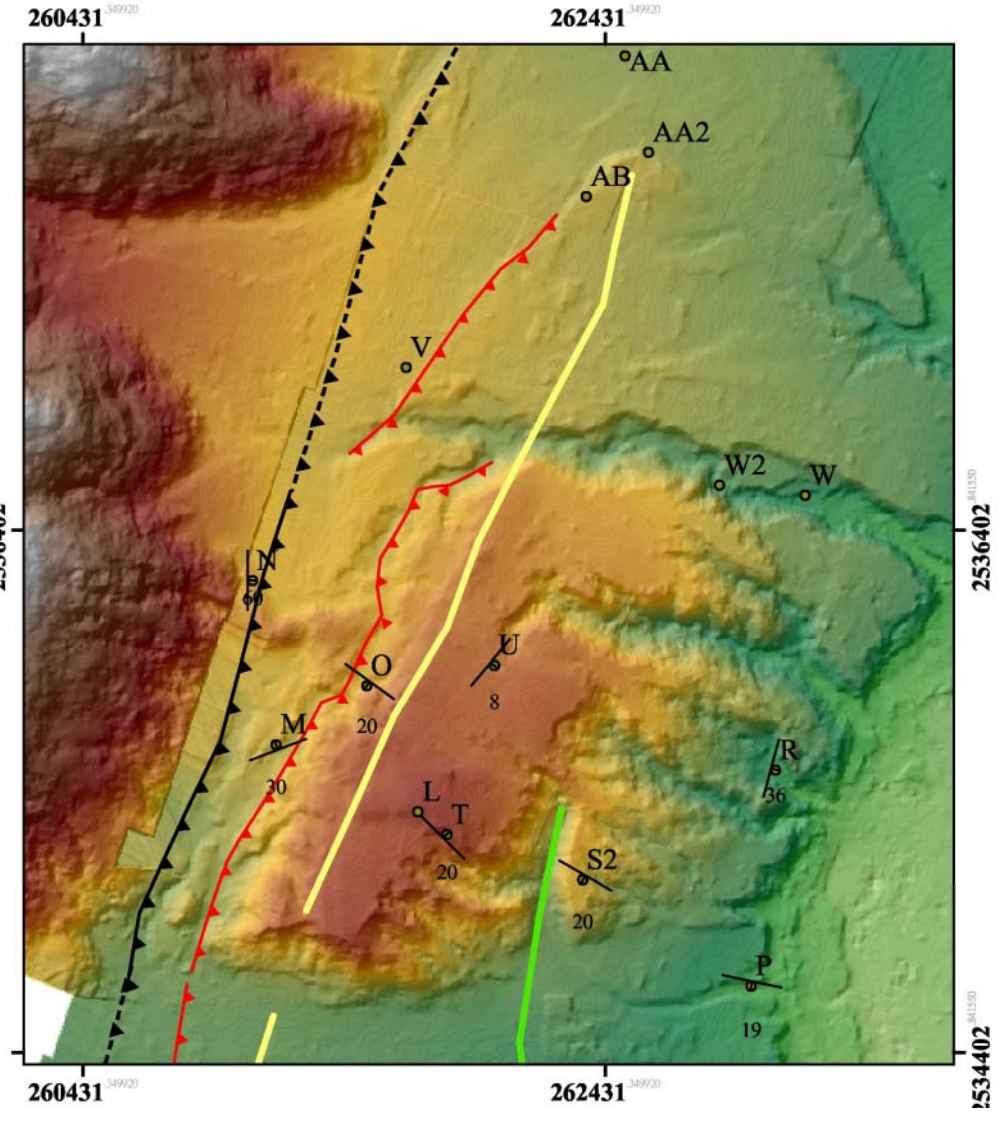
- The N-S profile of Gaotai area reveals a gentle dip to north topography.



Bedding

- The bedding in this area is a little eastward dipping.

- In the western edge there exists a N-S direction valley, and some small ridge in this valley.

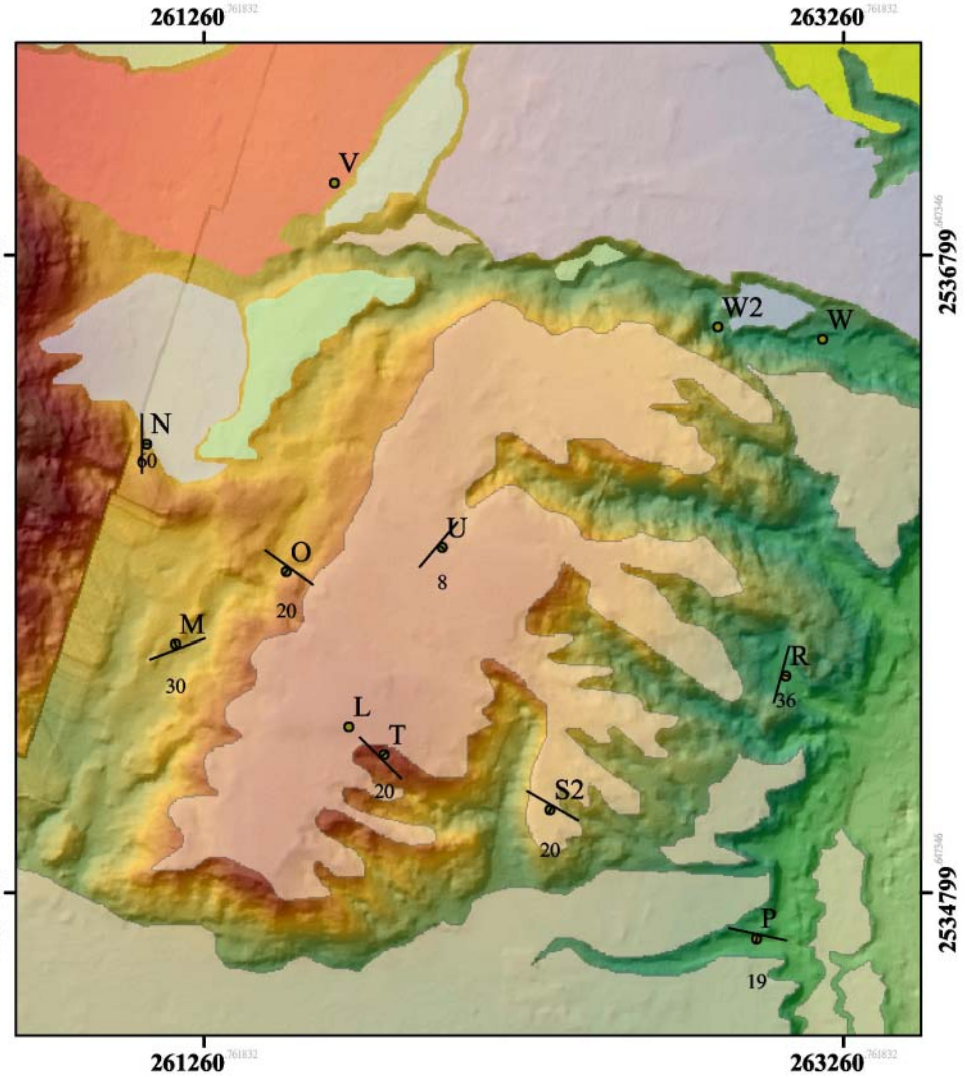


Folds

- From the distribution of bedding of this area and the bedding, we infer that there is an anticline structure (the yellow line).

Faults

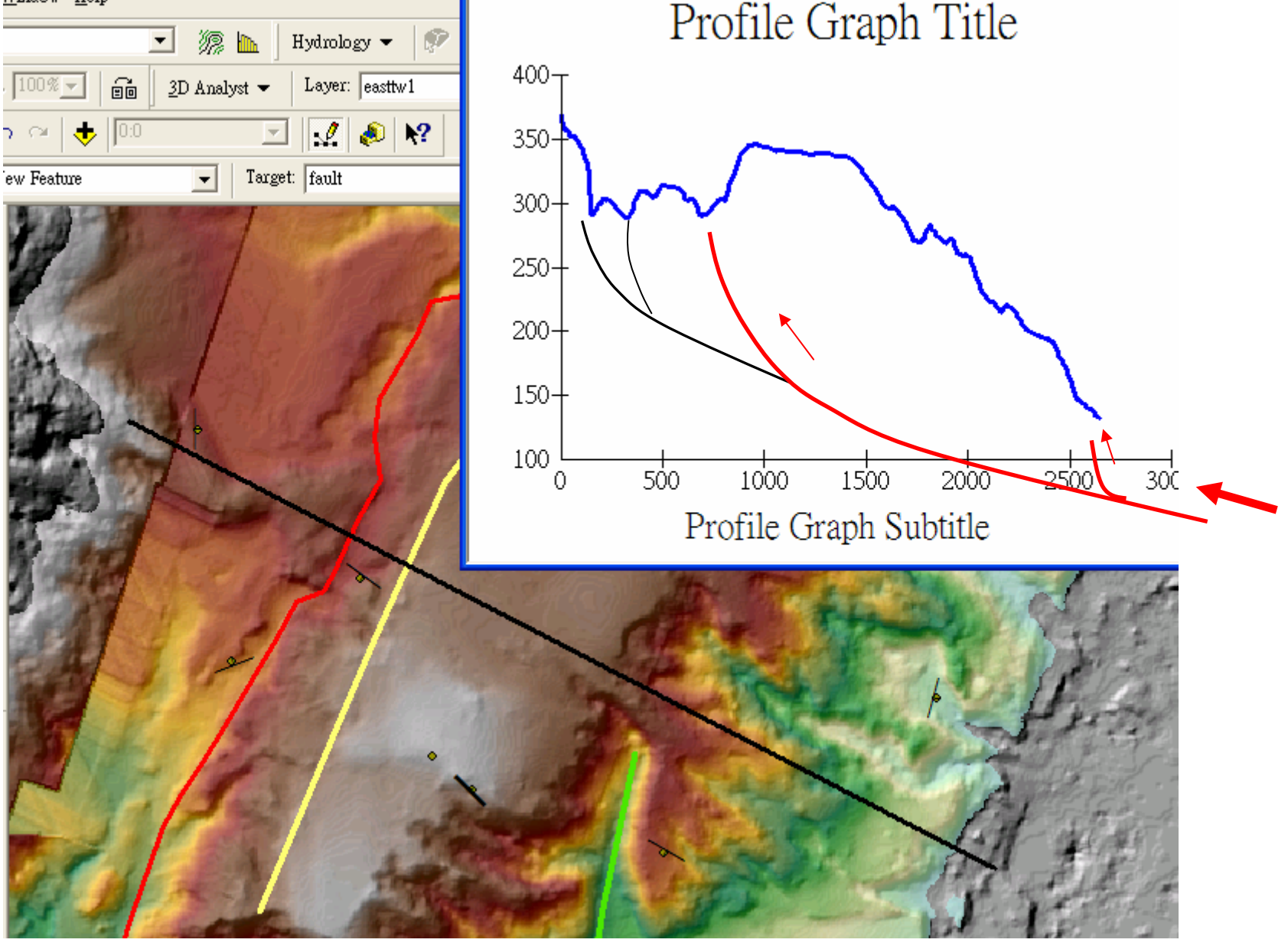
- We prefer that a series of reverse faults exist here, and the age of this faults are younger from west to east. Therefore the activity of the western fault is quite low now.



Terraces

-We consider that the surface of Gaotai was one part of the fluvial fans of Luyeh River and Lulau River.

- The east dipping terrace in Gaotai area also indicates the anticline here.


Hydrology
3D Analyst
Layer:
easttw1
Target:
fault
Profile Graph Title
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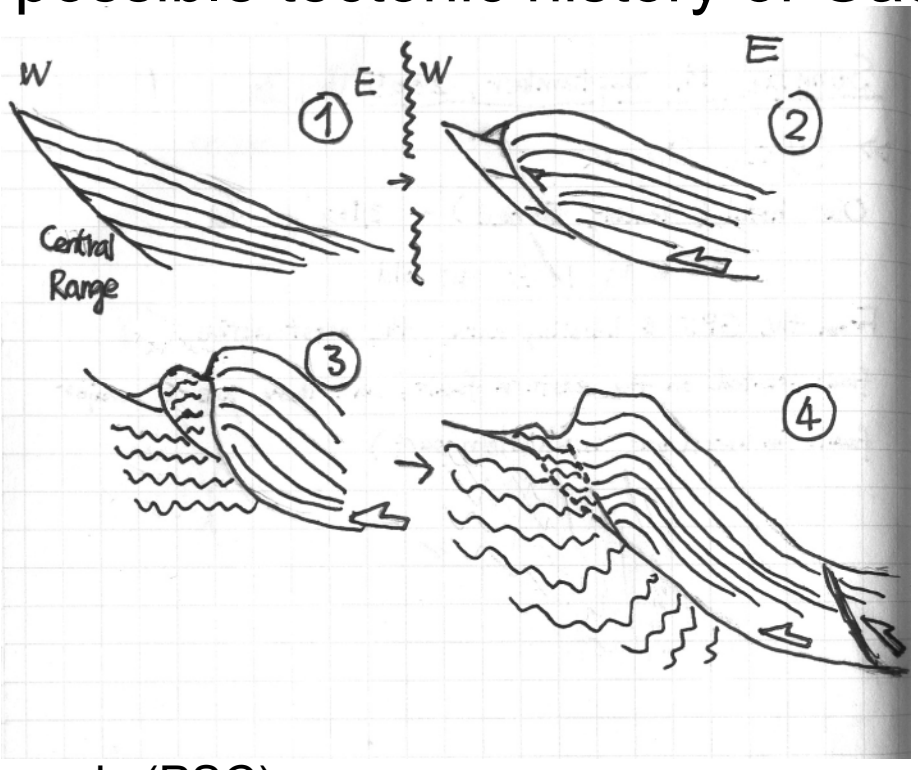
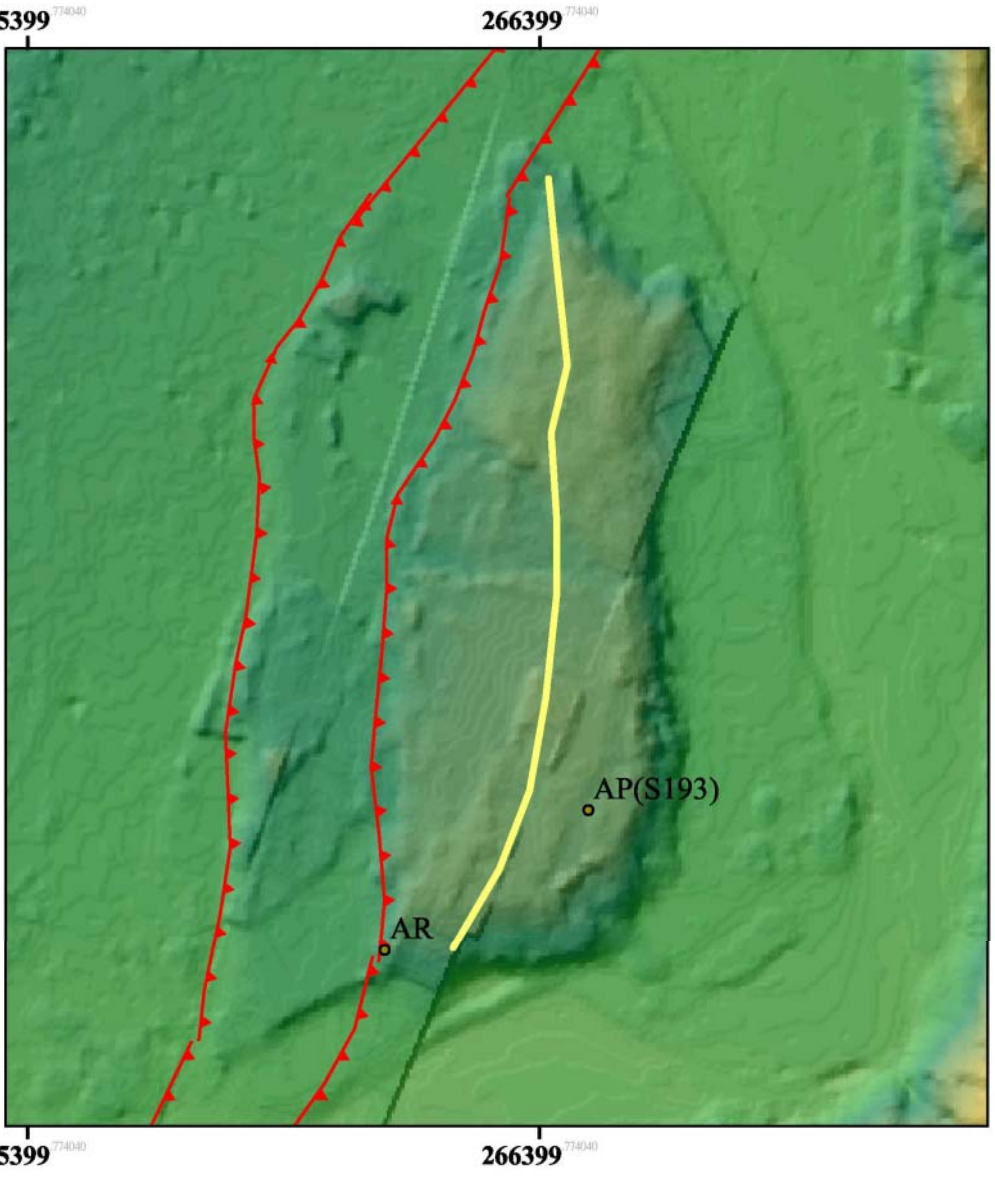
The possible tectonic history of Gaotai area



1. The original deposis (PSC).
2. The beginning of the collision of PSP and PSC.
3. The continuous of 2., but the 1st fault is inactive because it cannot overcome such lots of stress and folds, thus developed another new fault.
4. The 2 faults in western edge of Gaotai also cannot overcome the stress, than developed another fold, and another new fault beneath the eastern side of Gaotai.

Funky Blob

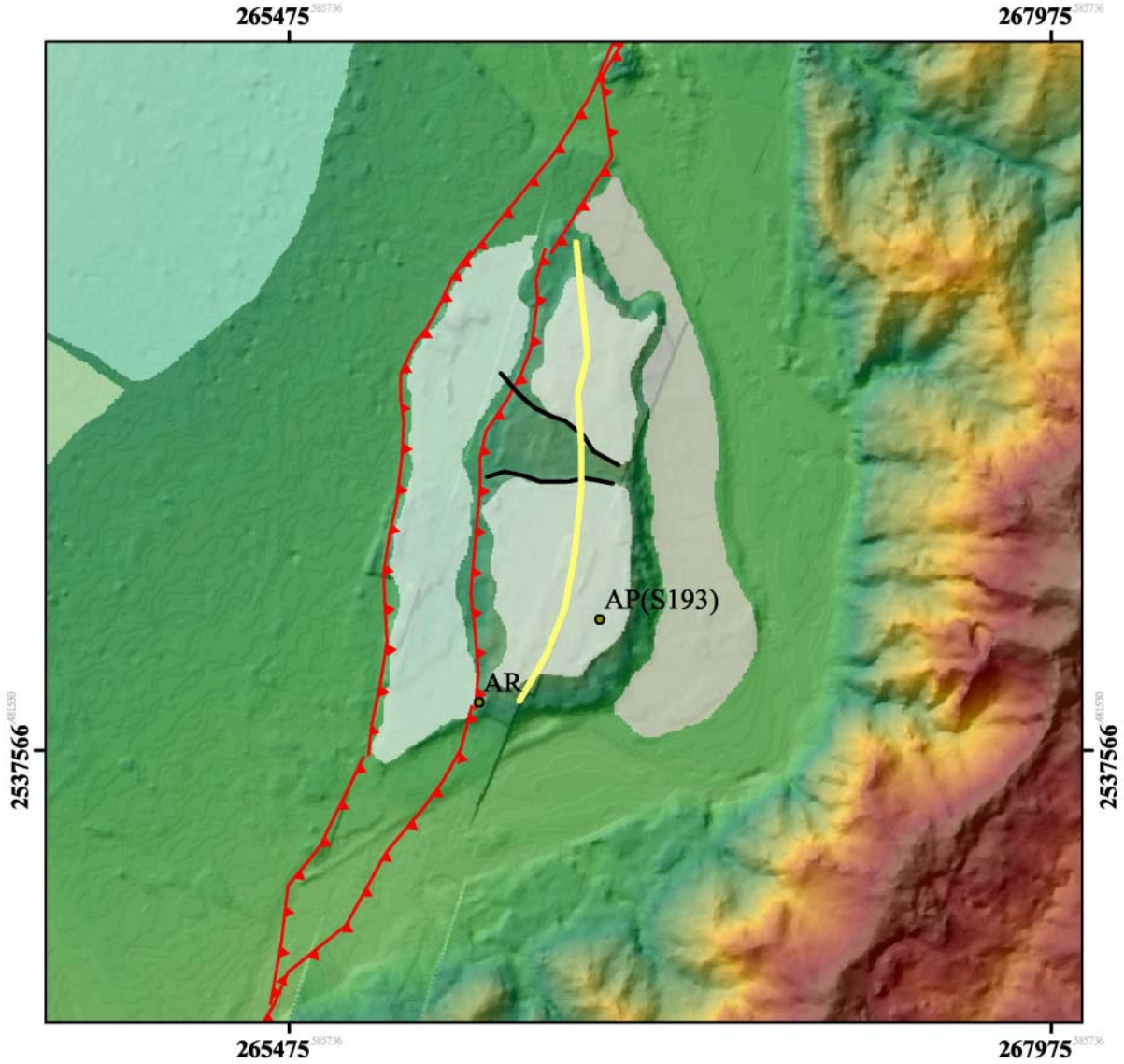


Faults

- By the examination of the topography in this area, we infer two parallel, dipping to east reverse faults in the western part of Funky Blob.

- We found a scarp of LVF at site AR, which cut through the Lichi Melange and modern cong. terrace, and an about N10^{o}W strike shear zone.

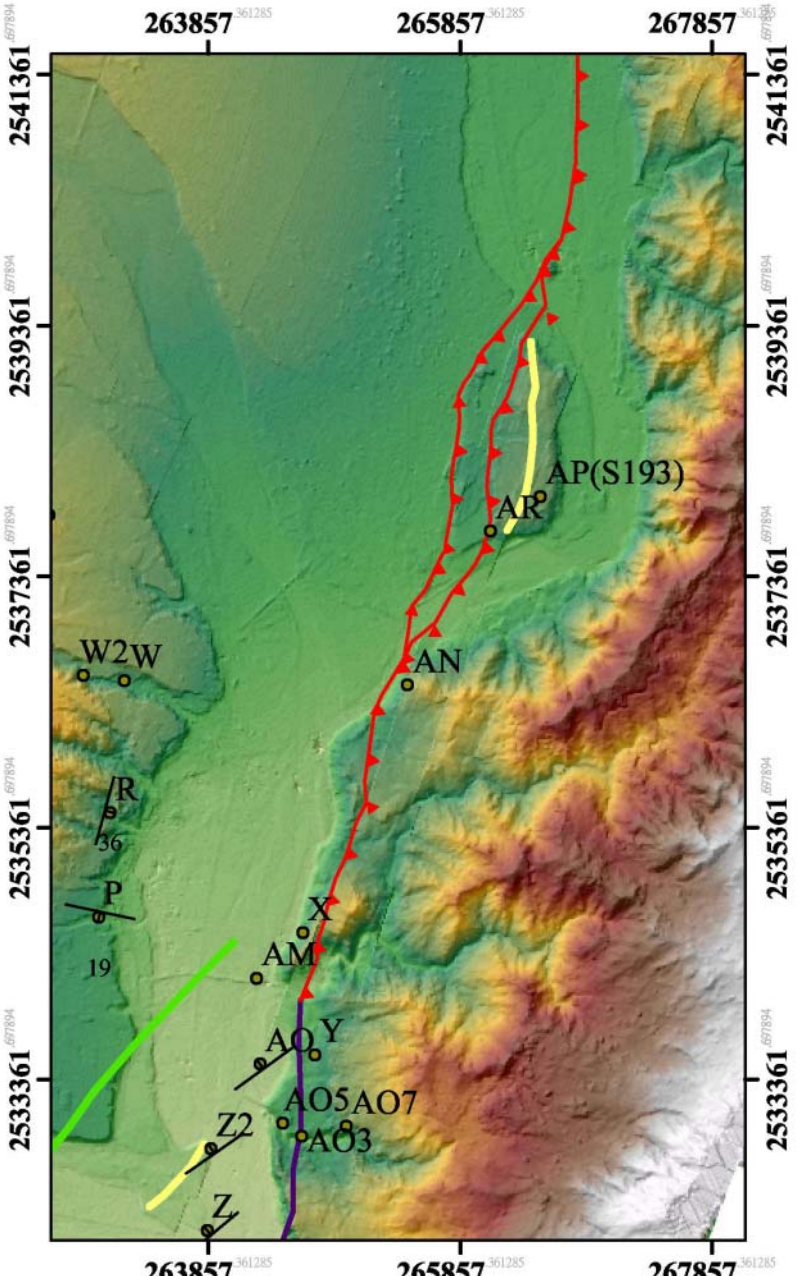
- Near AR, the offset of this terrace is about in lateral~10m, vertical~4m by the LVF, therefore we consider this is the reason of the left lateral fault.



Terraces

- We infer that these terraces were cut by the LVF, and been uplifted in different elevation by two reverse faults.

Coastal Range

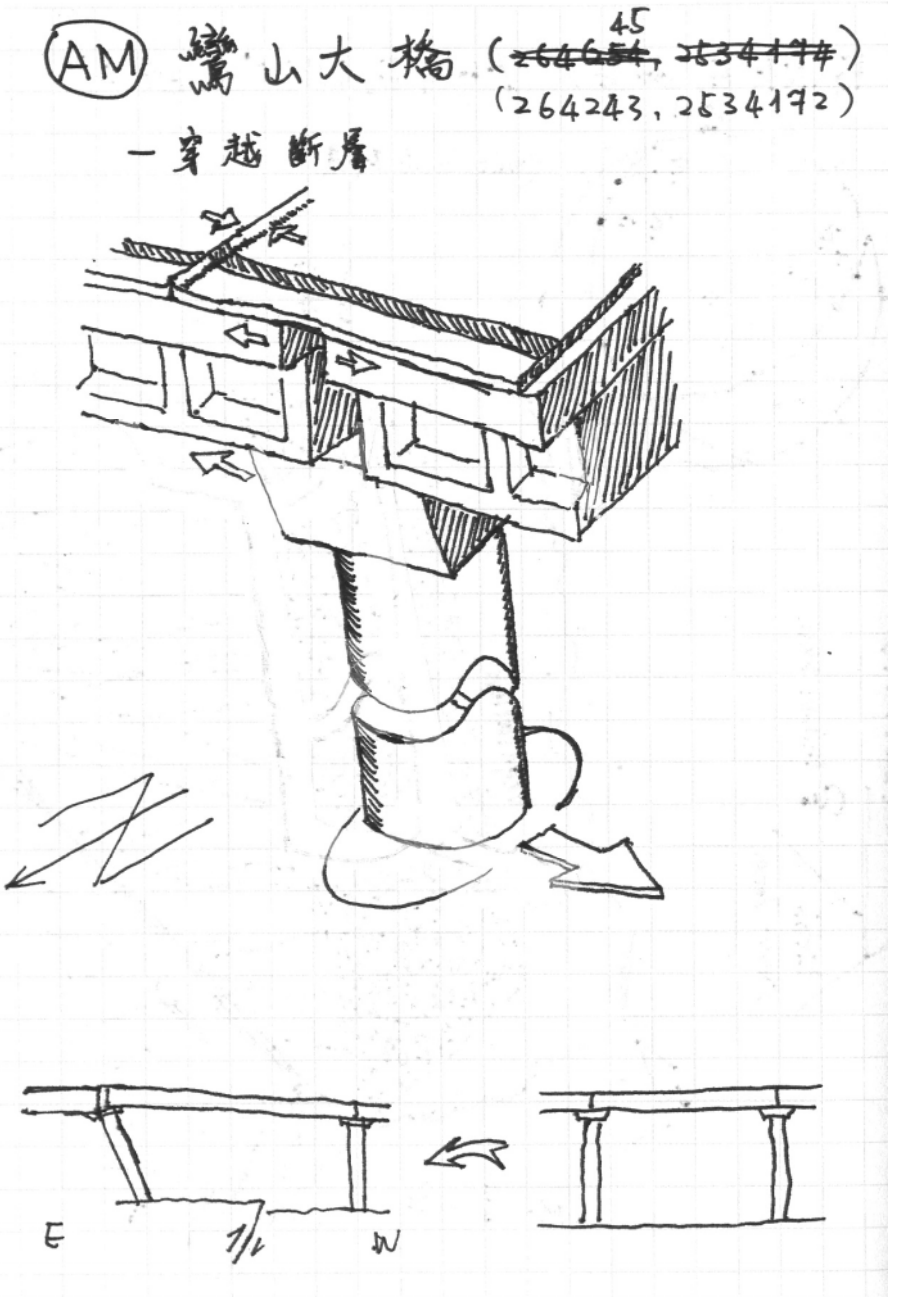


Faults

- The LVF is a N-S direction fault, and splitting to 2 reverse faults in Funky Blob.

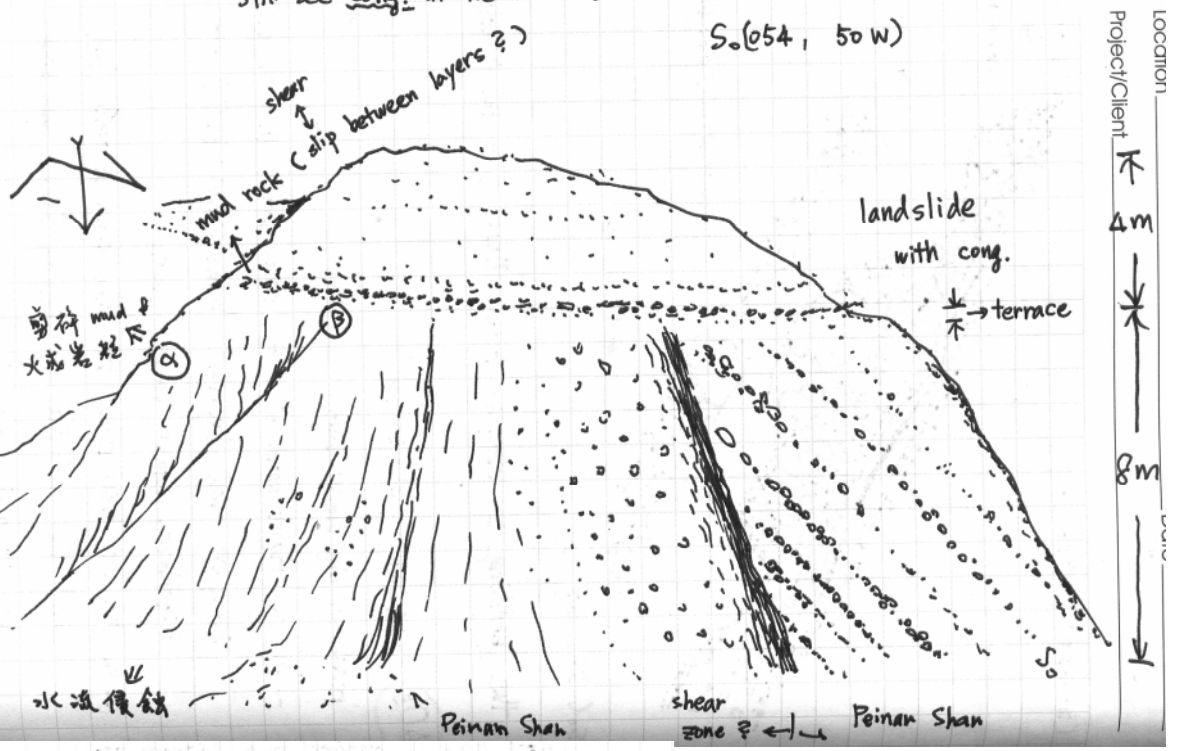
- In site AN, the sequence is Lichi Melange and we consider that the LVF is further west to AN.

- In site AO3, there is an boundary of Lichi Melange and PSC, so we connect these fault to “LVF”.

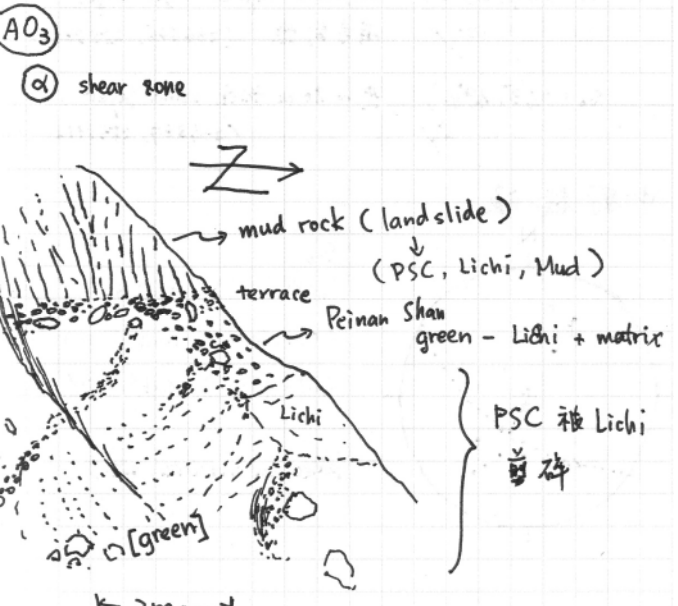


- In site AM, we found some small creeping (~5cm) in the LoanShan Bridge. The possible mechanism is that this is the result of the reverse fault (LVF?) cutting through this area.

- The lower figures show the motion of this fault.

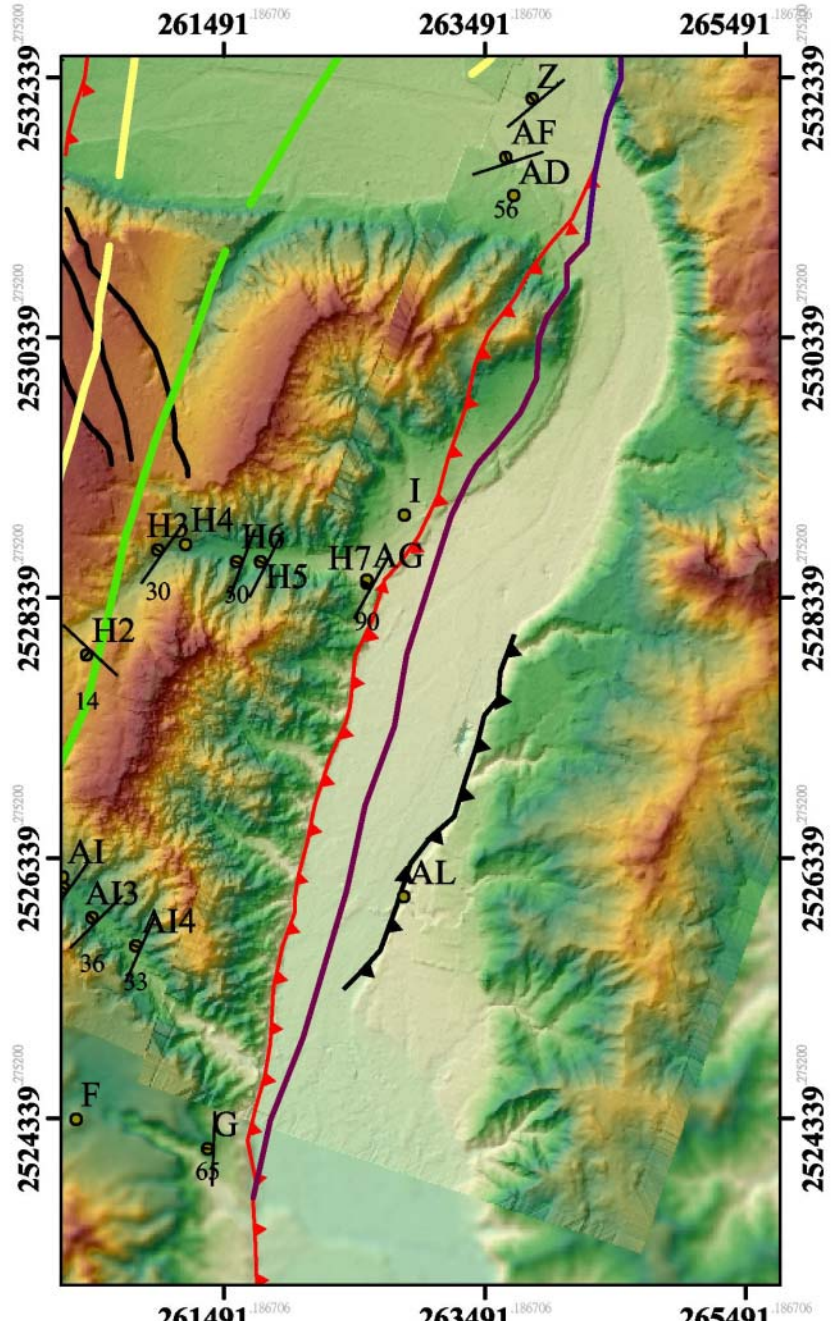


- In site AO3, there is a ~N-S direction shear zone cutting through the (054°, 50°W) bedding PSC.



In α, there is a contact of the landslide, PSC, shear zone and Lichi melange. And the most obvious phenomena is the fragments of PSC cutting by Lichi melange.

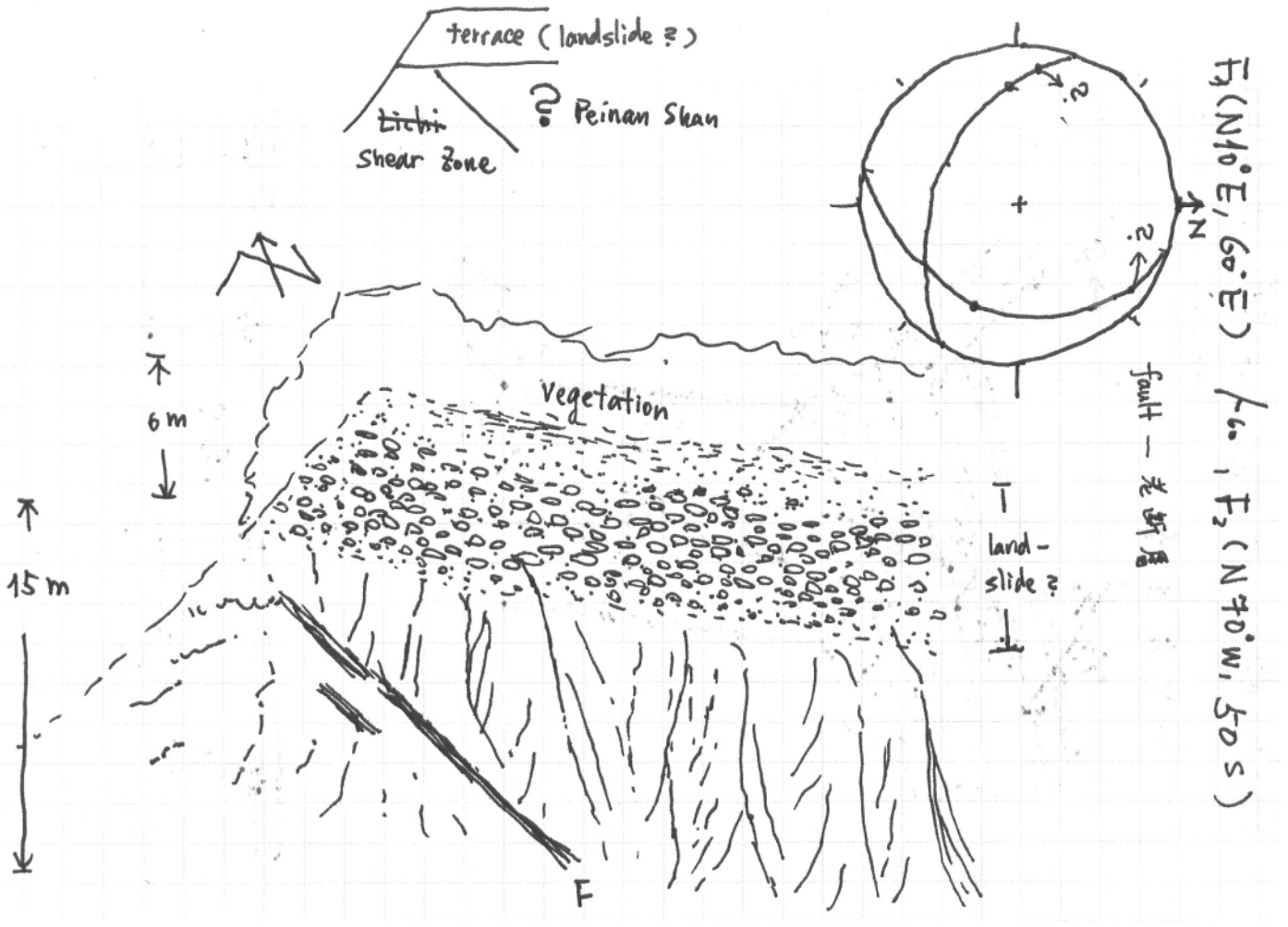
The modern landslide and the thin terrace deposit also be cut through by the shear zone and thicker after the uplift, by the dating data we know the age of terrace is ~5,000 yrs, so the fault in this area maybe still active.



Faults

- In the northeastern part of Peinanshan we plot reverse fault in PSC, and a left lateral fault in the contact of limestone and PSC.

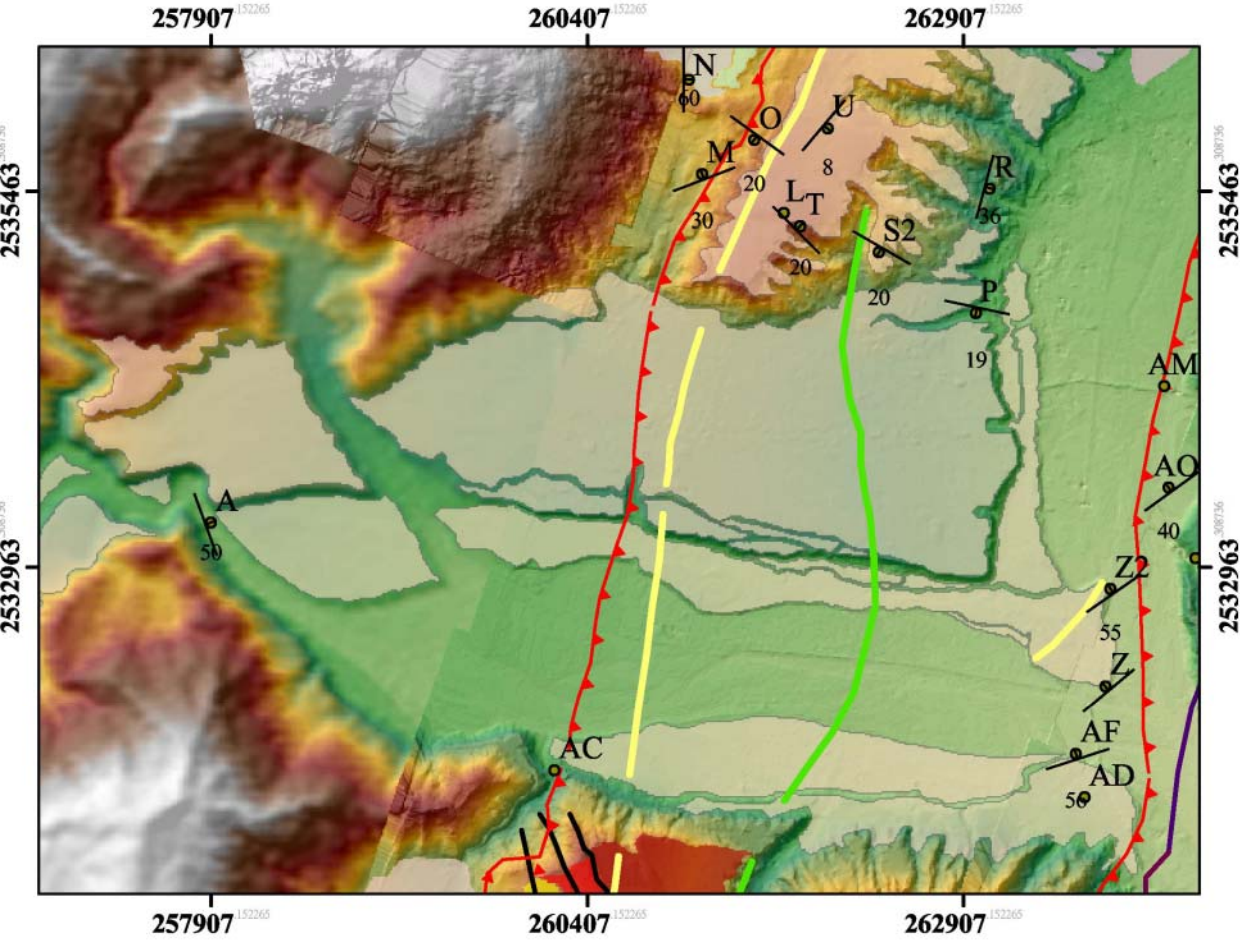
- In site AL the sequence is composed by the Lichi Melange and modern terrace. The shear zone does not cut through the modern terrace, so we consider that is a inactive fault.



- In site AL we found a shear zone (composed by Lichi melange and fragments of PSC) near PSC (?), and the modern cong. Terrace (landslide) was cover upon these structure. The landslide is ~6m thick, and the shear zone and PSC are ~15m thick.

- Because the fault zone doesn't cut through the landslide, so we infer that this is an inactive fault.

Luyeh Terraces



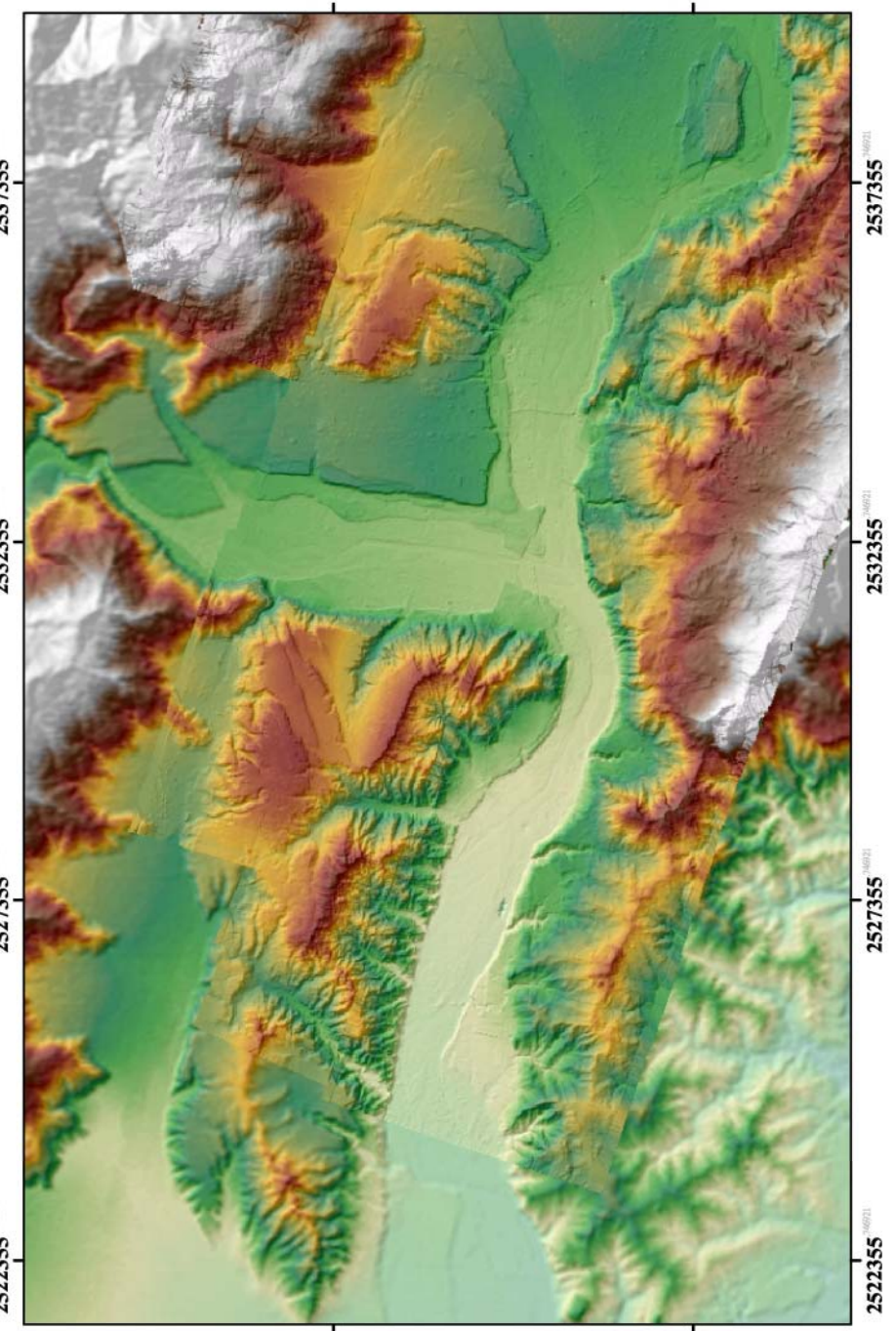
Luyeh Terrace

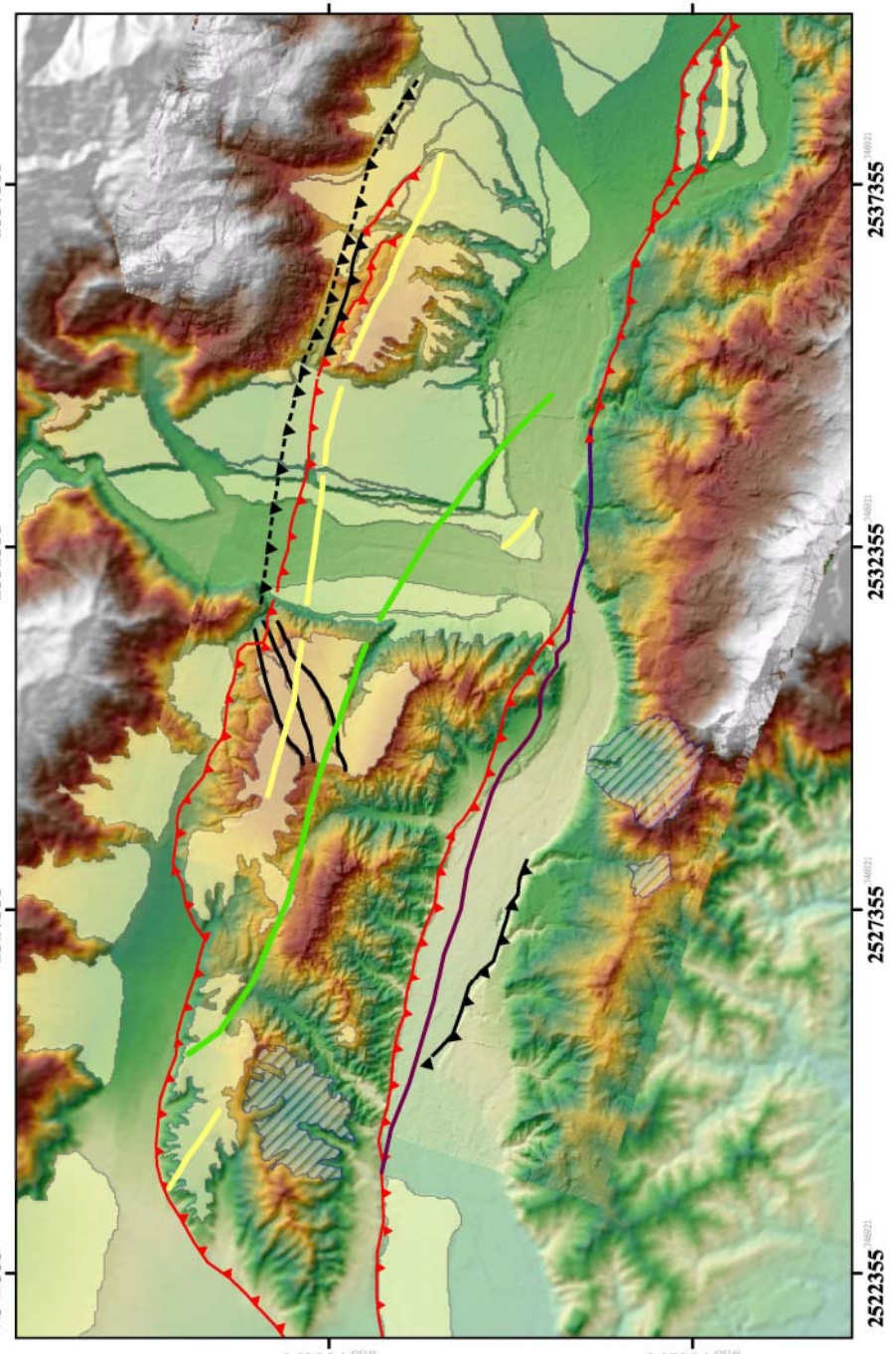
Lungten Terrace

Luyeh River

Discussion

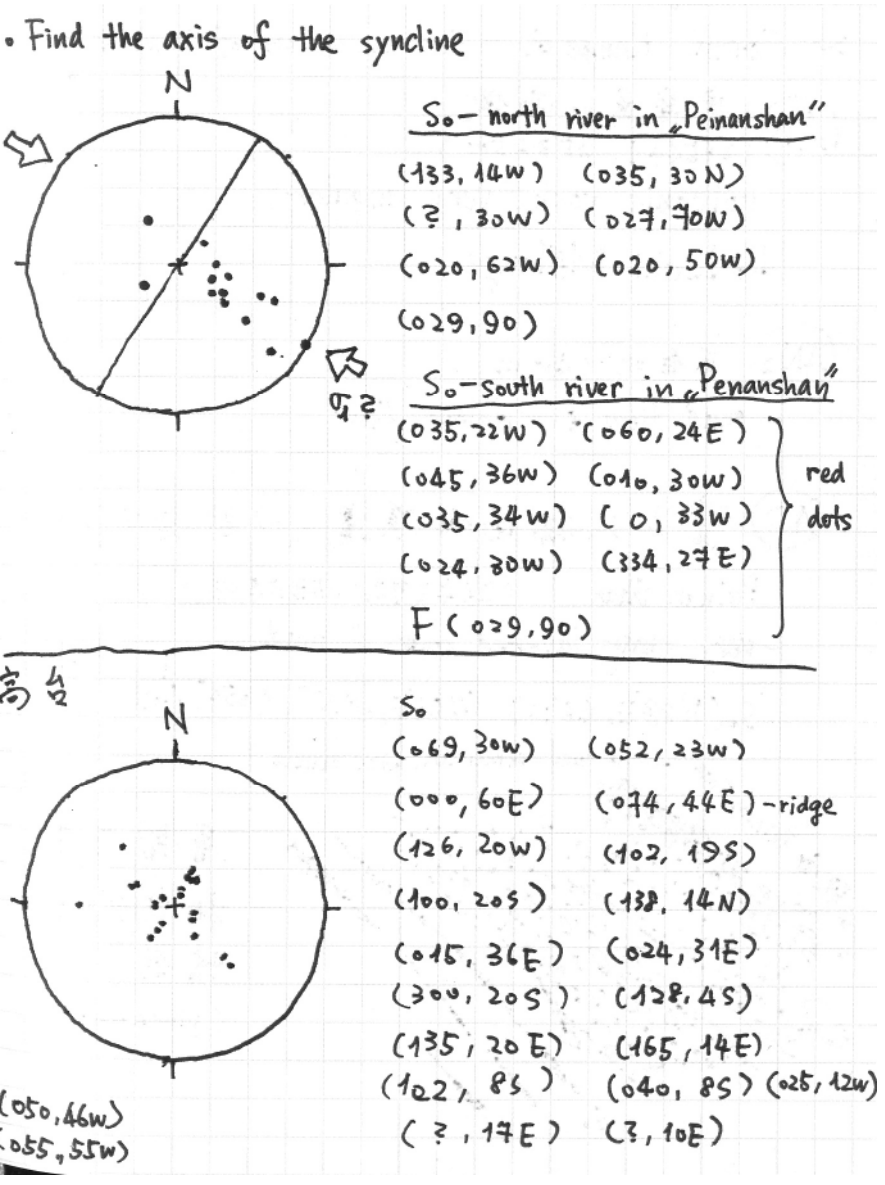
Study area





Legend

- Active reverse faults
- Normal faults
- Lateral faults
- Inactive reverse fault
- Anticline
- Syncline
- Terraces
- Landslide



The bedding analysis in Gaotai and Peinanshan

Gaotai

- The beddings have two groups, one is about N30^{o}E, and another one is about E30^{o}S.

Peinanshan

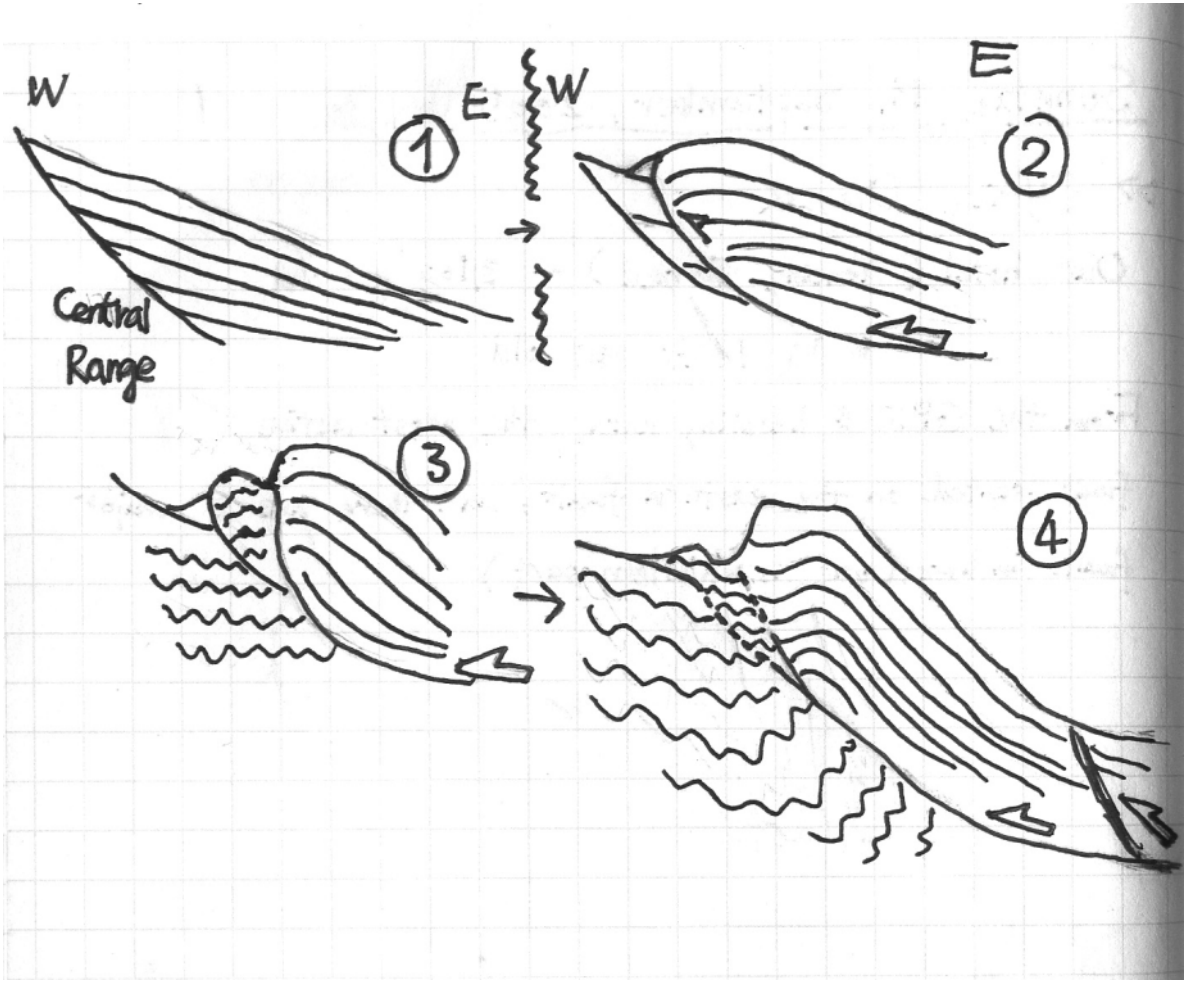
- The beddings are almost on N45^{o}E, and by the fault recording in AG, we infer that the σ_1 is in SE-NW direction.

By the analysis of these beddings, there is one similar direction along N30^{o}E, and by the similar sequence (PSC), we consider that these 2 area underwent the same paleostress and the same collision history.

The 2nd group bedding distribution in Gaotai may be another period of stress, which was younger than the 1st group.

The neotectonical history

Gaotai area



The neotectonical history

Peinanshan area