# NEOTECTONIC EVOLUTION AND GEOMORPHOLOGIC OBSERVATION OF TAIWAN-ARC COLLISION IN TAITUNG

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## Abstract

Numerous faults of Taitung demarcate three main domain in this study area. There are the 坪頂 table land which we call Funky blob, 高台 table land, and Peinanshan from north to south.

We will discuss the structural evolution and geomorphologic observation respectively and the relationship among them in this report. Furthermore, we can reconstruct the geologic history of this area.


## Introduction

Taiwan, a active arc-continent collision suture zone, offers an opportunity to observe the fast change of geomorphology and neotectoics.

What we try to understand is the structural evolution of oblique collision from Luzon arc in this area. How the Peinan table land formed? Why the width of Longitudinal Valley shortening? How the faults system running here?

But, In fact, reconstructing the evolution of Taitung, a collision belt between Eurasia Plate and Phillipine Sea Plate, is difficult. Because the landform what we see can't represent completely the whole results of the structural motion after eroding and uplifting as time goes by.

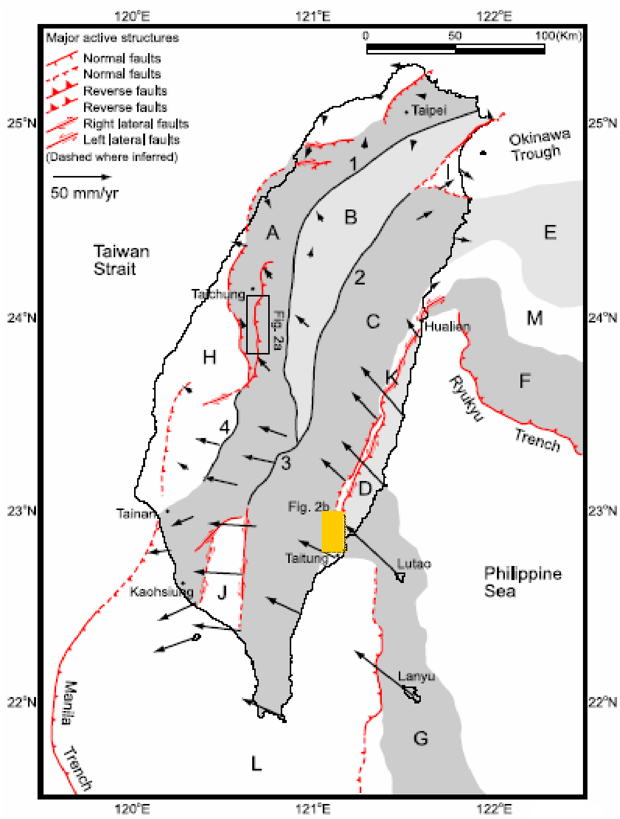



**Fig.1**.orange square is the study area.

This area, part of Taitung, where we study for eight days long is a collision belt of Longitudinal Valley in East Taiwan. There are two major faults form the suture zone in this area: one is Central Mountain Range Fault and the other one is Longitudinal Valley Fault. They are in the west and east side respectively. And we also know this convergent zone causing the 成功 and 池上 earthquake before. From the focal mechanism, we see the Longitudinal Valley Fault is a thrust fault dipping the east. Is it still active now? Or the reason of the Beinan table land? That is why we work in the field.

So, in this report we discuss the structural evolution and geologic history to try to explain the landform forming, the rate of uplifting, and other questions of geology by geomorphology.

## Geomorphologic analysis

Fig2 is the whole area picture. We can judge where the faults go by the different attitude of displacement. So, at the beginning, here are two major faults at least. But which one is the first one? Which one is still active? Which one causes the table land uplifting? It is the problems we need to solve.

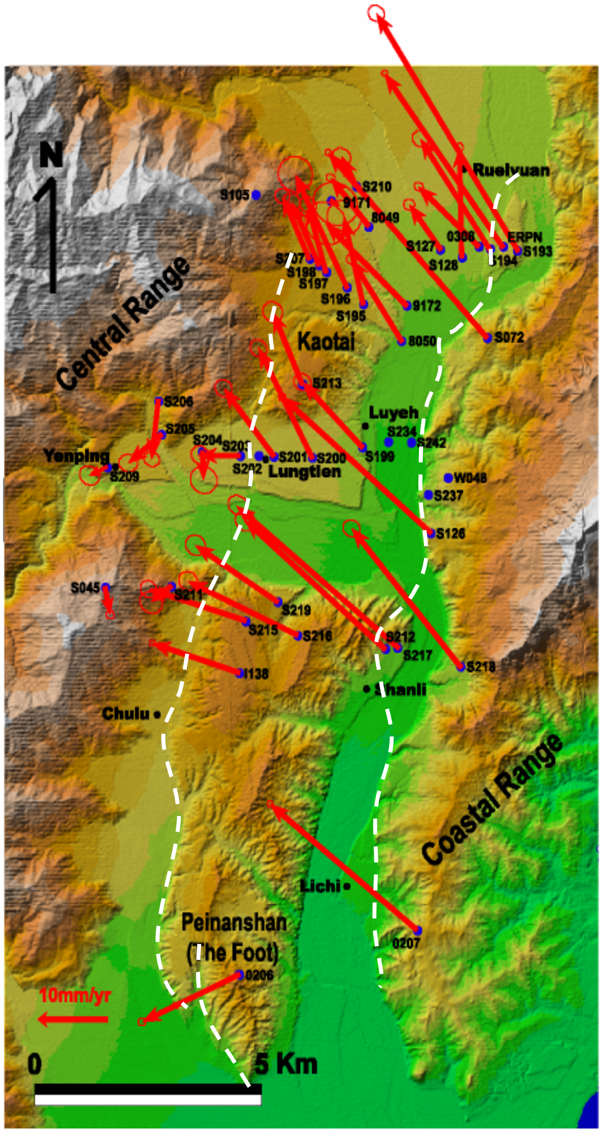



**Fig.2**.the GPS data of this area from 2001 to

### • Peinanshan

In 40meter DEM, we saw a obvious anticline and syncline in the north of Peinanshan but not clear in the south. There are three main scarps facing north-east with a strange shape as similar as a structural scarp on the anticline. If we want to know what these features mean, more observation in the field we need.

So, on the first day, we go up along the road to check the landform of Peinanshan. On the road, a nearly N-S anticline can be tracked easily. When we go through the hinge of anticline, there are three scraps appearing. What makes them appear? Three possibilities are: 1.pelaochannel, 2.normal fault, 3.revers fault. And we find the several significant evidences on the surface. The first is the back-tilted on the surface of terraces. The second is the strange small ridge on the edge of terraces. And the third is a normal fault with a small offset on the south side of the Luyeh River, Peinanshan's northern foothill. Although the normal fault is small, it represents the divergent environment in this area at least. It is possible on a axial section of anticline.

The feature, back-tilted, is also a structural characteristic. And the reverse fault is hard to explain the second feature, a ridge on the edge of terraces, how to form. So we suppose the terraces are the secondary structures of the anticline causing the small strange ridge, a horst formed by normal faults.

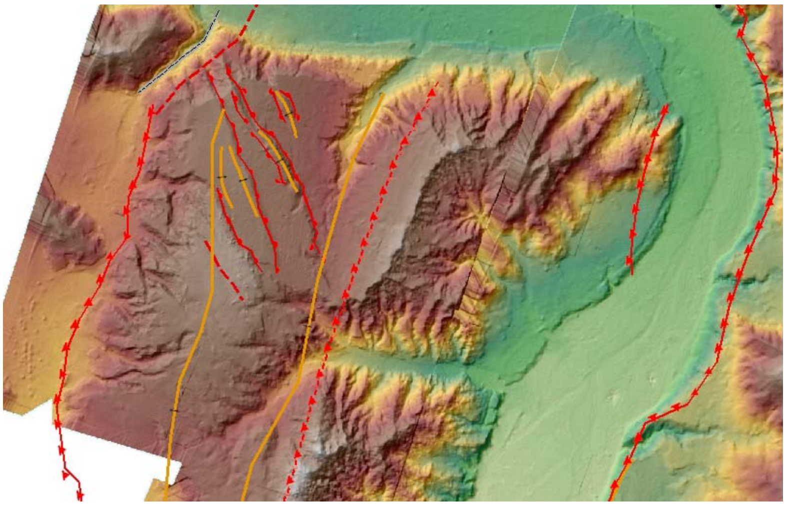


Fig.3

Then we across the canyon, N-S direction in the syncline, from the west side to the east side in the afternoon, we found the old laterite and Peinanshan conglomerate on the eastern side of canyon, the middle part of the mountain, and eastern slope of Peinanshan respectively. Because of the laterite always formed on the top of strata, we know the bedding here must be a high angle west-dipping. So the Peinanshan conglomerate below the terrace gravel exposed. A syncline was sure. The northern part of Peinanshan is composed of the west-anticline and the east-syncline. But how are they formed?

Eventually, we think the northern region of Peinanshan is Fig.4.

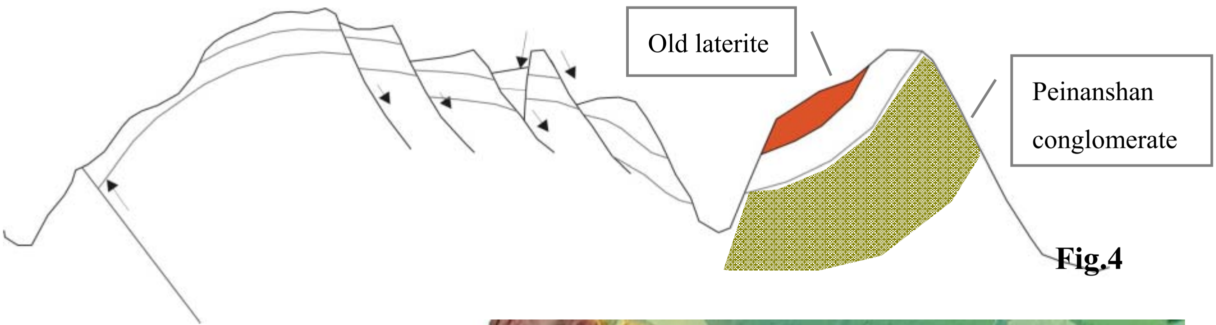



Fig.4

So, the three main scrap (1, 2, 3) should be the same terraces separated by the motion of normal fault (Fig.5).

But, in the south, we can't find the syncline any more. Why the syncline disappear?

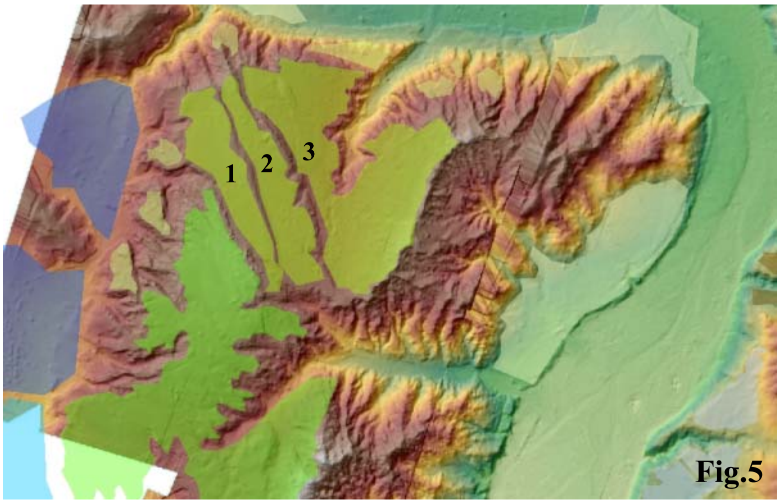



Fig.5

That is what we survey on the last days.

Along 台 9 road, we tried to measure whole the beddings from north to south in the Peinanshan (Fig.6). The east-dipping was gone southward. The other northern anticline extended to south unclearly. How is this situation going?

Maybe here was already a big anticline for a long time. Then the stress transferred westward to create another thrust fault causing the north-west anticline later. when the anticline created, the secondary structure, normal faults, was forming on the axis. And the stress continue going northward to built the 高台 table land(Fig.7).

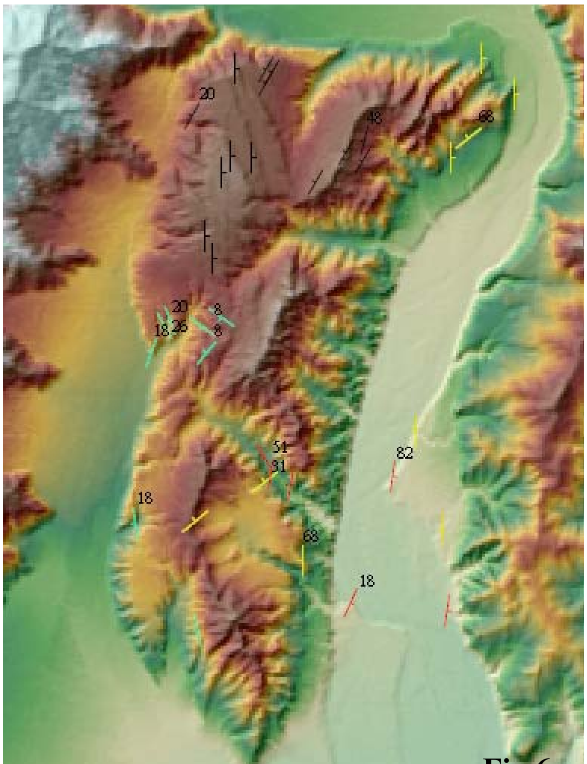


Fig.6

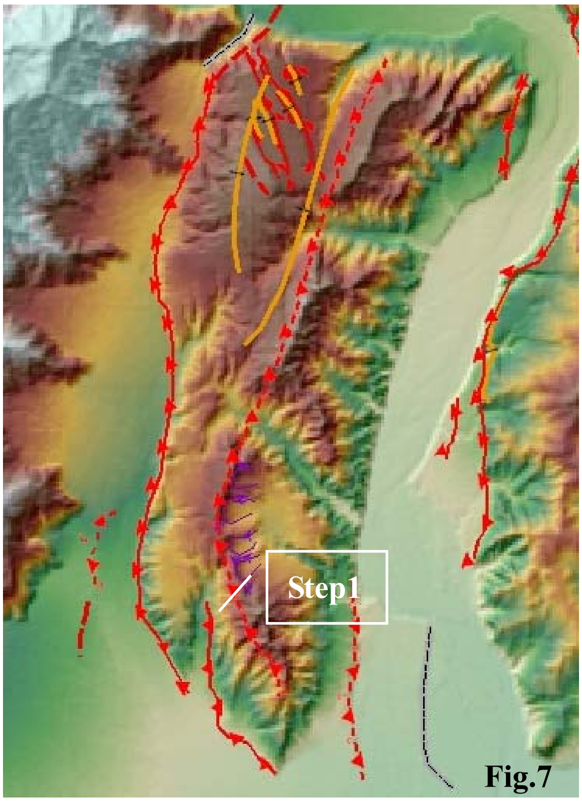



Fig.7

・高台 table land

When we in the classroom, we can see the main anticline on 龍田 terrace can be connected to the table land anticline system and a ridge parallel the direction of valley. We want to know the relationship among the table land, 龍田 terrace and the ridge in the valley. So, on the third day, we went northward from Peinanshan to 高台 table land and check the ridge in the valley. On a GPS spot where we stand looking southward, the rige is composed of two structural scarps like Fif.8.

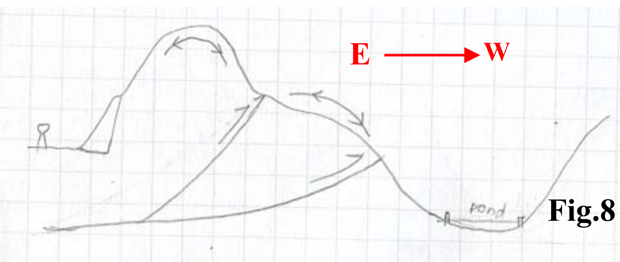



Fig.8

That told us. The 高台 table land is possible to be formed by thrust fault, not a simple fold.

And, when we track the main

anticline of 高台 northward, the main anticline was separated to several oblique small ones a little turns to east, and disappearing further. These evidences all support the stress transition. The thrust fault through the Ruyeah River from Peinanshan to north and encounter the root of Central Mountain Range. Harder material makes the fault change its direction and disperse the stress. That is why the anticline was separated to several ones. Then the fault disappears. Maybe it jump to north or transfer the stress to eastern funky blob.

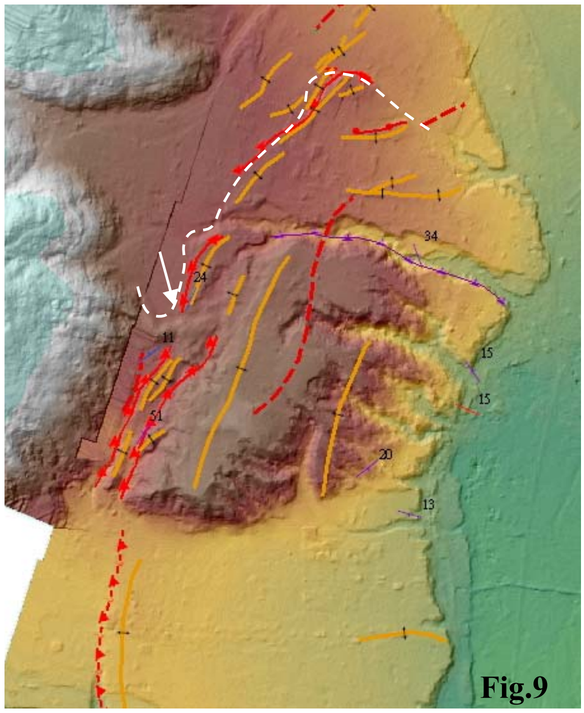


Fig.9

However, another interesting thing is that we find a thick pure soil profile where the white arrow point out in Fig.9. It means there is a structural event occurred before and stopped the stream power to form a quiet environment such as lake, the deposited side of meander and so on.

And I think that's why the edge of fan and the position of terrace are unnatural (white dashed line). That must be uplifted by thrust fault after alluvial fan forming. It is another evidence of the structural raising.

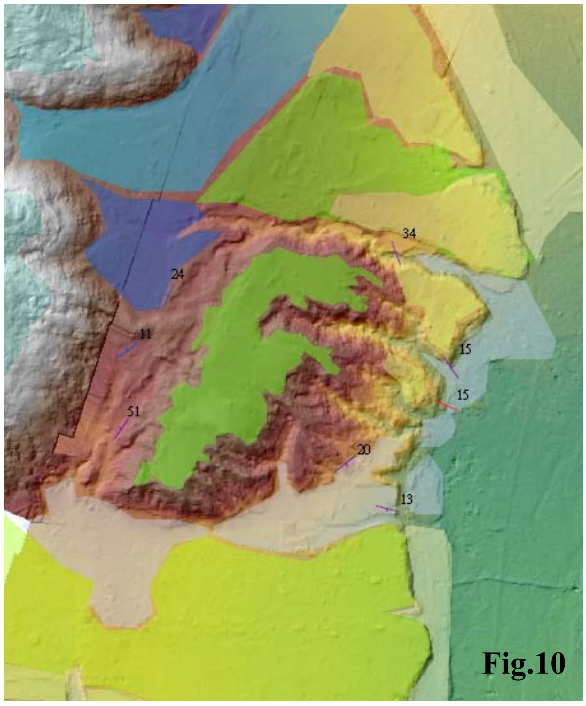


Fig.10

So, in the 高台, we define the terrace all the same one on the top of table land by the same direction of imbrication and several periods of terrace and alluvial fan(Fig.10).

- 坪頂 table land ( Funky blob)

In the DEM, 坪頂 table land is a strange blob beside Coastal Range. What we saw with computer is two clear terraces standing on the edge of a huge alluvial fan. There are two main scarps facing west, three anticlines parallel and a small scarp facing east on the top.

It means several things. One, maybe it is a basement, harder than what's surrounding. Two, a structural behavior was here. If a fault was here, is it a thrust, normal or strike-slip fault? Is it connected to Longitudinal Valley Fault? Three, It's just cut by fluvial power. But why the river chose this way higher than fan? That's what we want to know in the field.

When we worked in the field on second day, we knew the distribution of strata which is Lichi Melange on the base covered by river gravel and found the massive, giant, hard, old sandstone coming from Lichi Melange possibly on the spot6. There is a big profile, man-made for engineering, we found on the spot11. A obvious strike-slip fault there. By these evidences, we can infer Lichi Melange was too ductile and soft to be a basement stopping the erosion of river and the landform dominated by tectonics. so track along the strike-slip fault, we can find the same terrace displaced by a uplifting and strike-slip offset. But the offset was caused by one, two events or more, it is still a problem just focusing this area.

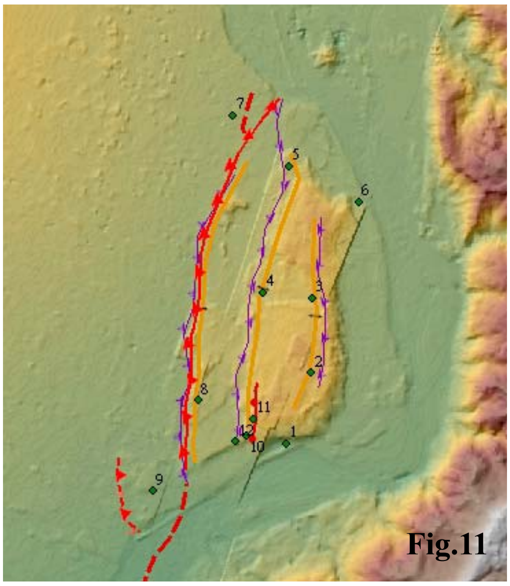


Fig.11

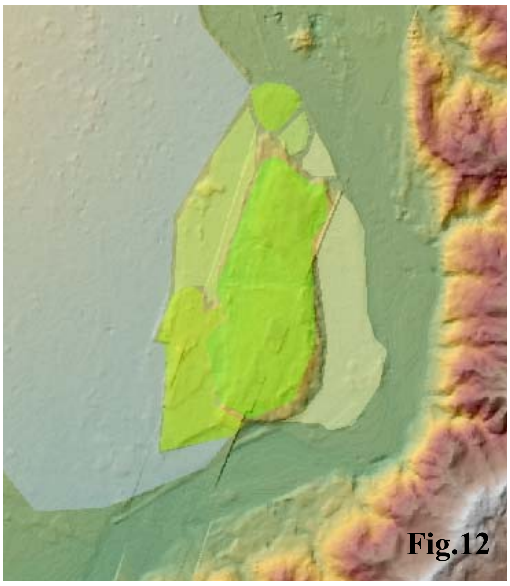


Fig.12

I think we need to put every part together to figure out the neotectonic evolution here.

## Conclution

So, when we put things in order, we can conclude a model below. In southern Longitudinal Valley, the stress will transfer to north-west because of the oblique collision between Eurasia Plate and Phillipine Sea Plate. But the Central Mountain Range was a old, stable block, it stopped the collide move ahead and let the stress disperse and jump to turn north-east in north of 高台. We can't see the motion of fault with eyes in this area. Maybe they disperse and disappear or transit eastward to become a part of Longitudinal Valley Fault to be a strike-slip component of LVF. That needs to do field-work northward.

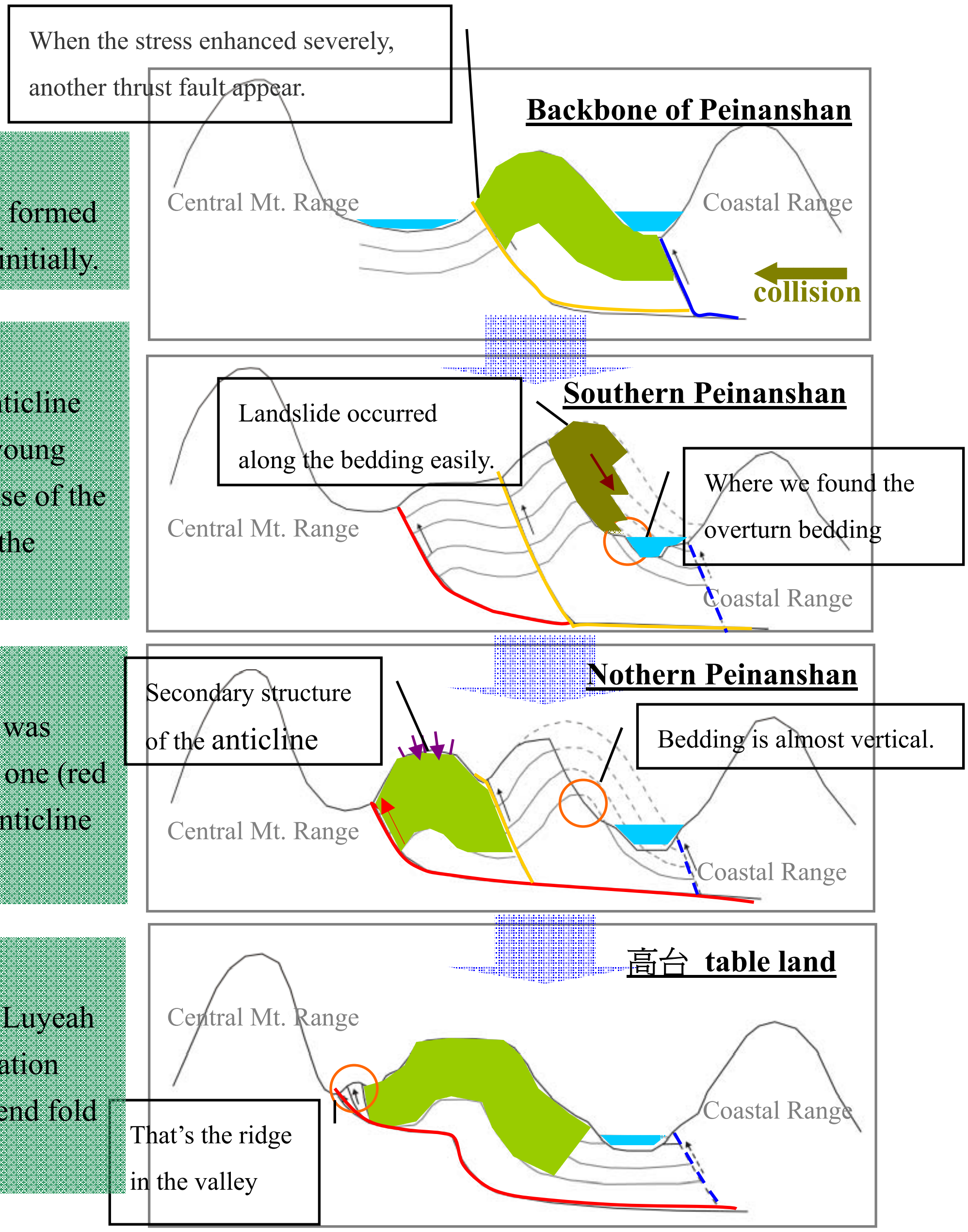
→ **Peinanshan to 高台**

**Step1:**
Southern Peinanshan was formed by a branch fault of LVF initially.

**Step2:**
Eastern limb of former anticline was cut by river and the young anticline was small because of the wide space to develop in the south.

**Step3:**
In the north, the structure was dominented by the young one (red fault) to create the main anticline we see today.

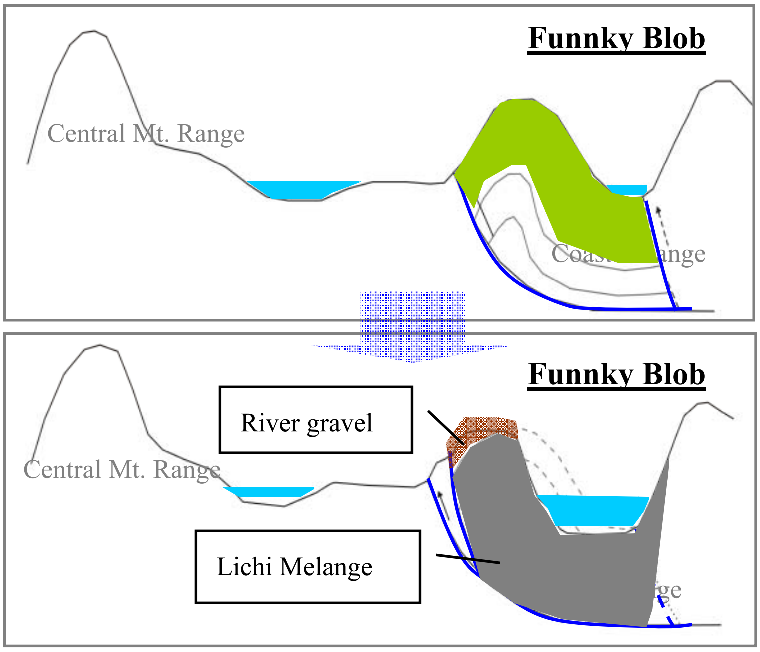
**Step4:**
When the fault across the Luyeah River, it became a propagation fault and created a fault bend fold called 高台 table land.




→ **Funnky Blob**

**Step1:**
Where the LVF separated to two fault in 坪頂 formed a anticline.

**Step2:**
We know the blue dashed line was the original LVF inactive. The new one was pass through 坪頂 to uplift Funnky Blob and transfer to strike-slip mainly. Then the erosion rate of river was almost same with uplifting rate.



According to this model, we can presume the LVF was still active. Longitudinal Valley is like a weak section of plate collision, and the fault stress transfers easily. So we see the process of LVF is: blue fault (the old Coastal Range Fault)→ yellow fault (causing the main anticline in the southern part of Peinanshan)→ red fault (causing the young anticline which we see now in northern Peinanshan and 高台 table land) in this study area. As time goes by, when the stress westward to the root of Central Mountain Range, it was stopped and turned the direction to north-east gradually.

So we suppose these main thrust faults in this area all belong to LVF dipping east. The Central Mountain Range Fault dipping west was not clear here. Maybe it didn't break up to ground here or not be found by us.

In short, this area is going to be active because of the suturing of southern LV. although the fault can't go westward more, more secondary structure of this convergent environment and Central Mountain Range Fault will be the potential factors in the future.