Active Structures at the Toe of the West Foothills in Southwestern Taiwan, Tainan

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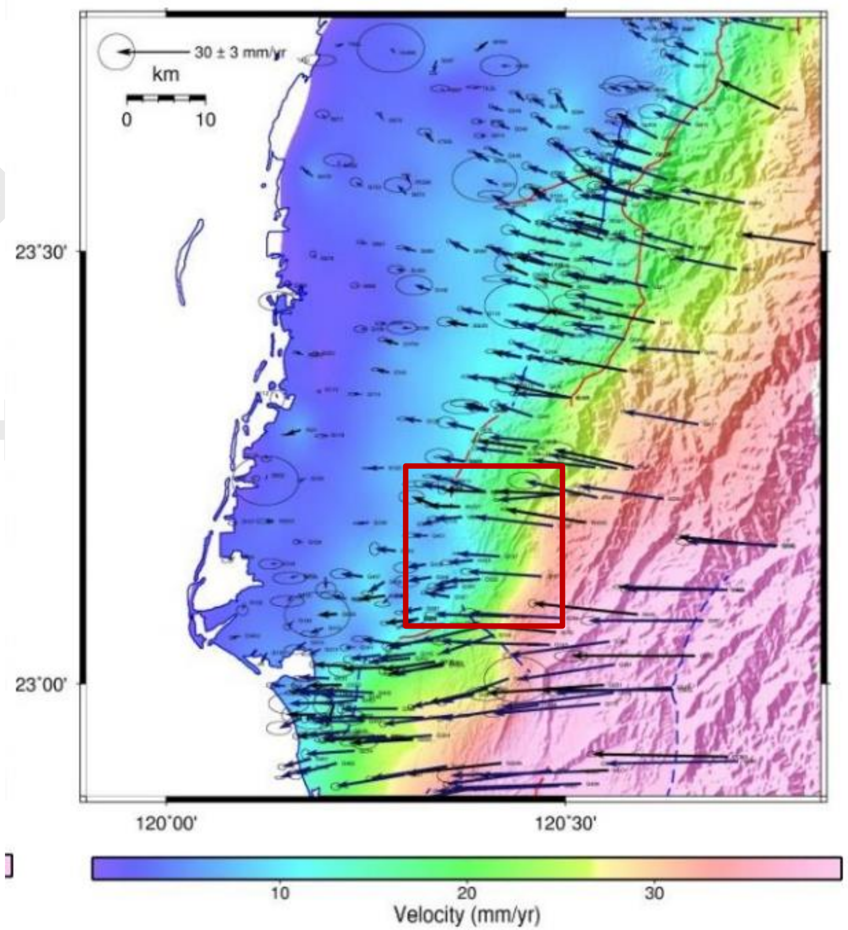
Date: 03/18

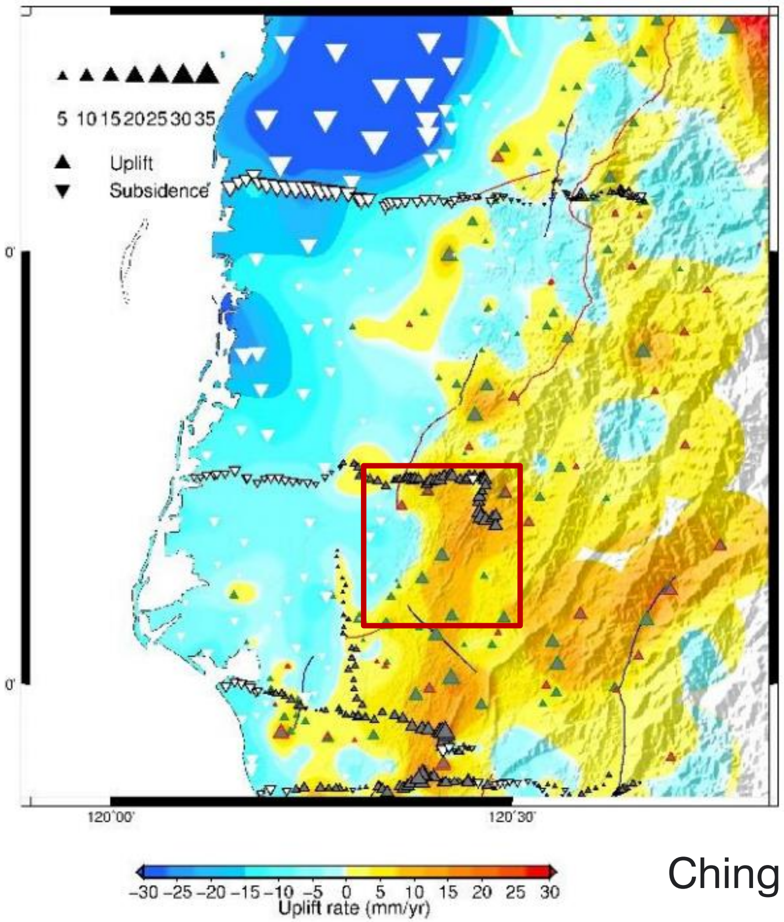
Introduction

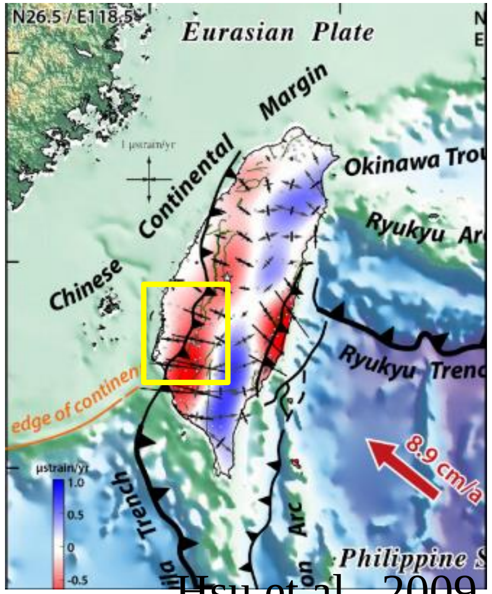
GPS Velocity

+ Horizontal



+ Vertical



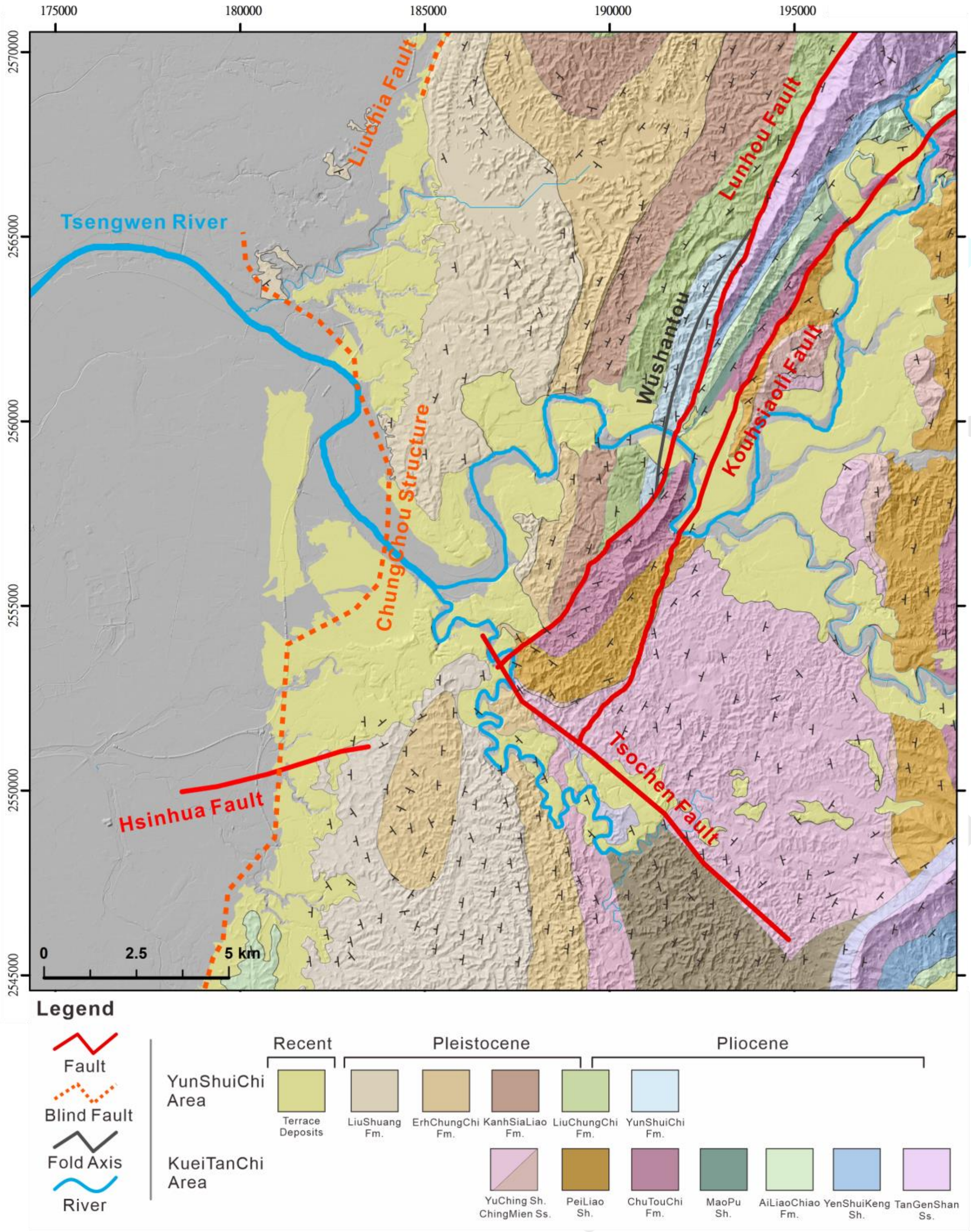


Hsu et al., 2009

Ching et al., 2018

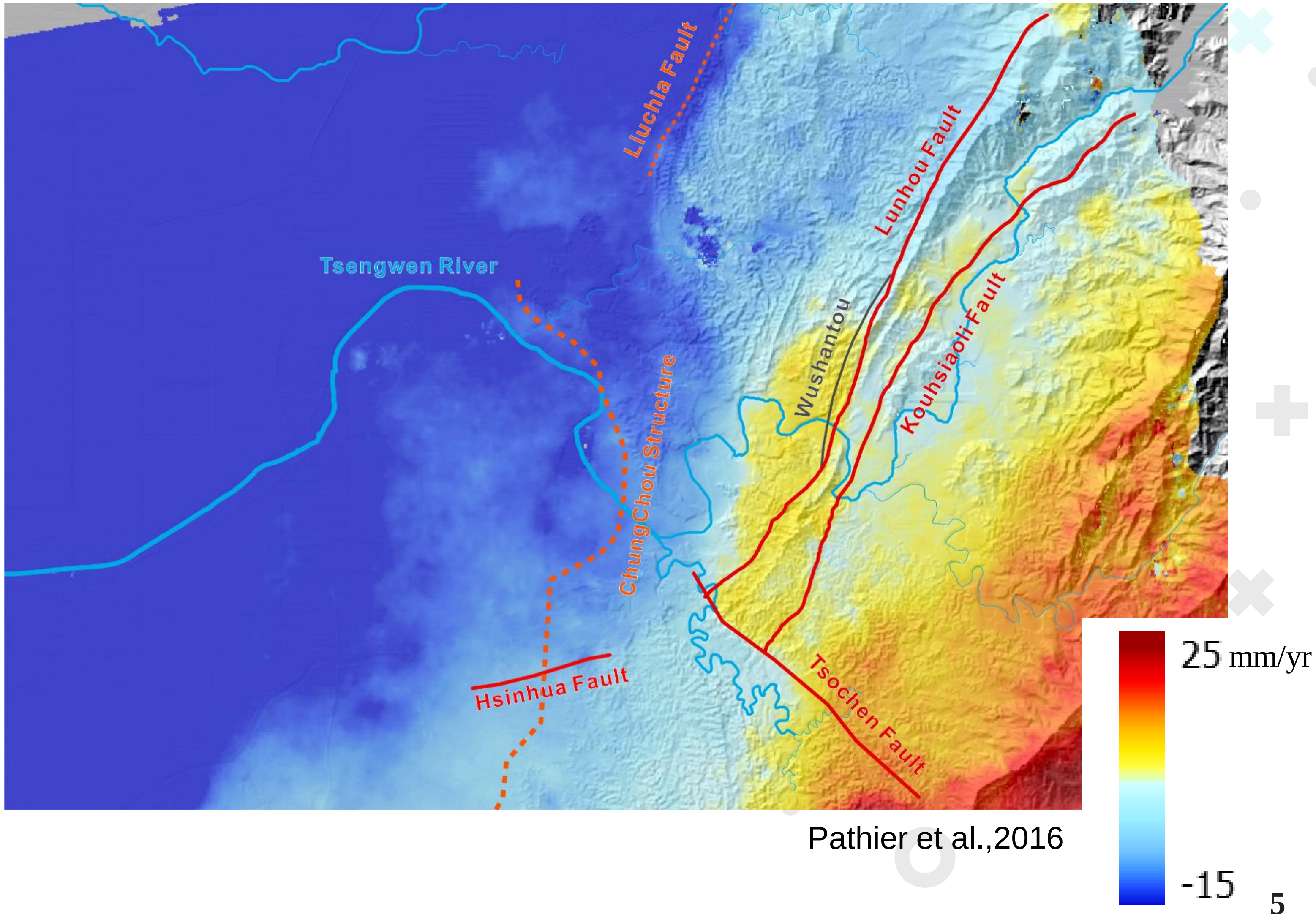
Geological Setting

- From West of Wushantou Anticline, the age of the formations change from Pliocene to Pleistocene.
- The dip angle from West of Wushantou Anticline to East becomes gentle .
- According to previous studies, there would be blind structures at the toe of the foothills.



Current Deformation in Southwestern Taiwan

+ The deformation in southwestern Taiwan extends beneath the populous plain.
+ It is important to understand them well for seismic hazard assessment.
+ We are interested in geometry of the structures and their shortening rate.



Pathier et al.,2016

Aims of the Study

+ Structural Geology

- Deep Boreholes
- Seismic Reflection Line
- Biostratigraphy
- Surface Geology

+ We want to determine the geometry, shortening rate of these structure.

+ Geological Cross-sections

+ Holocene Deposits

- River Terraces
- Shallow Boreholes

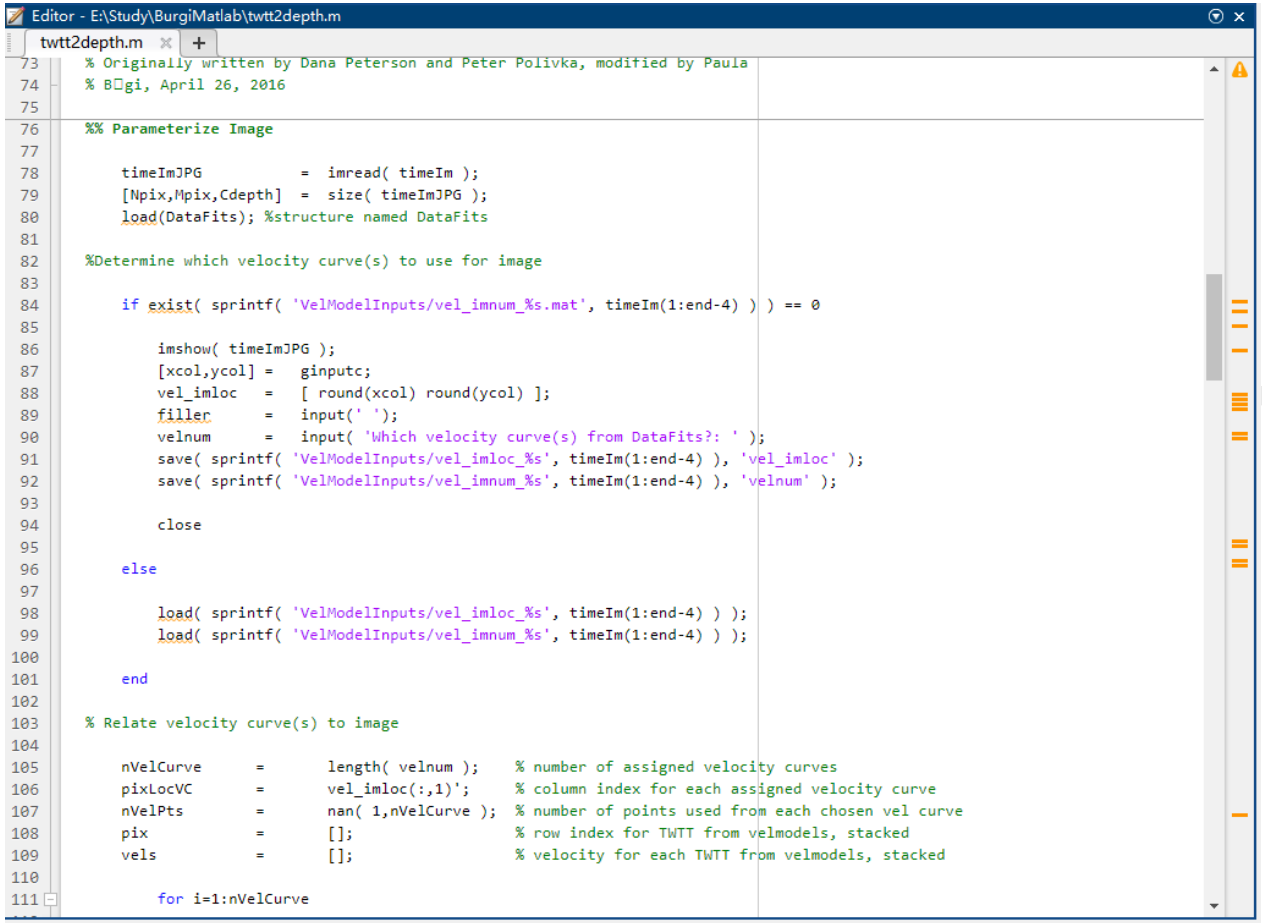
+ History of the Deformation

Methods

Seismic Reflection Lines

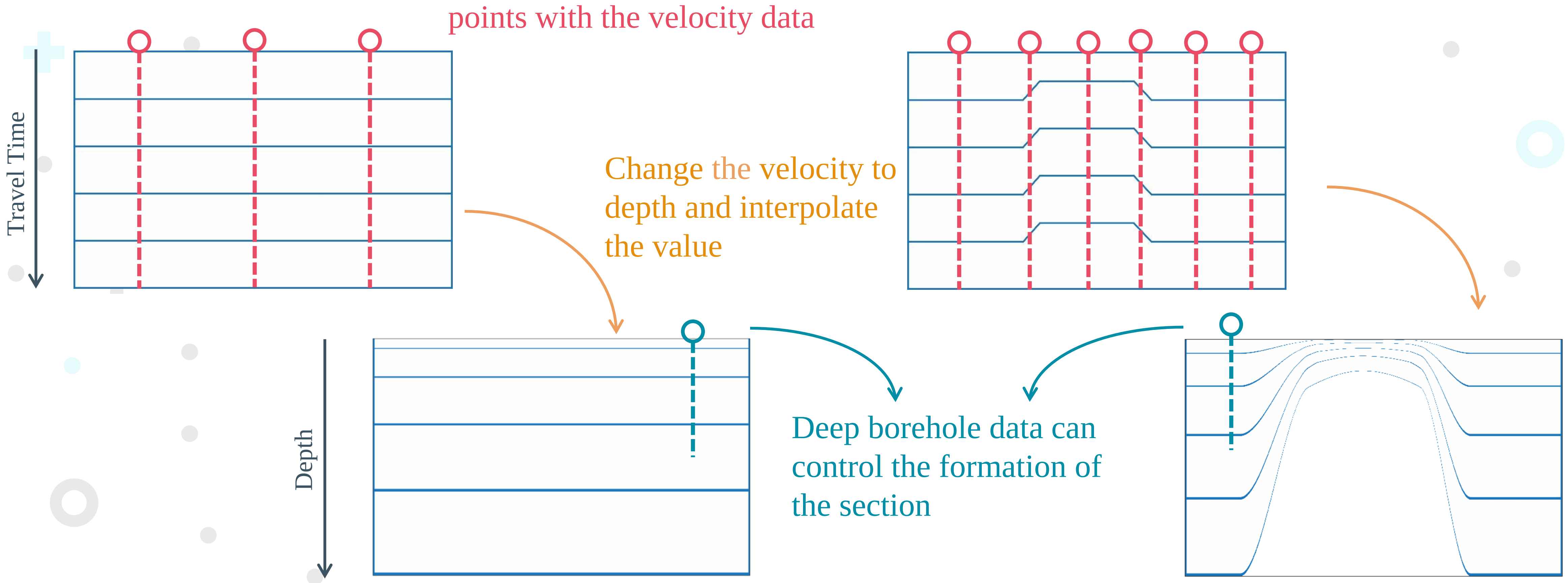
- The original seismic reflection lines data format is travel time. We need to transform it from time to depth

- Using the Matlab code (Burgi et al., 2021) to solve this problem



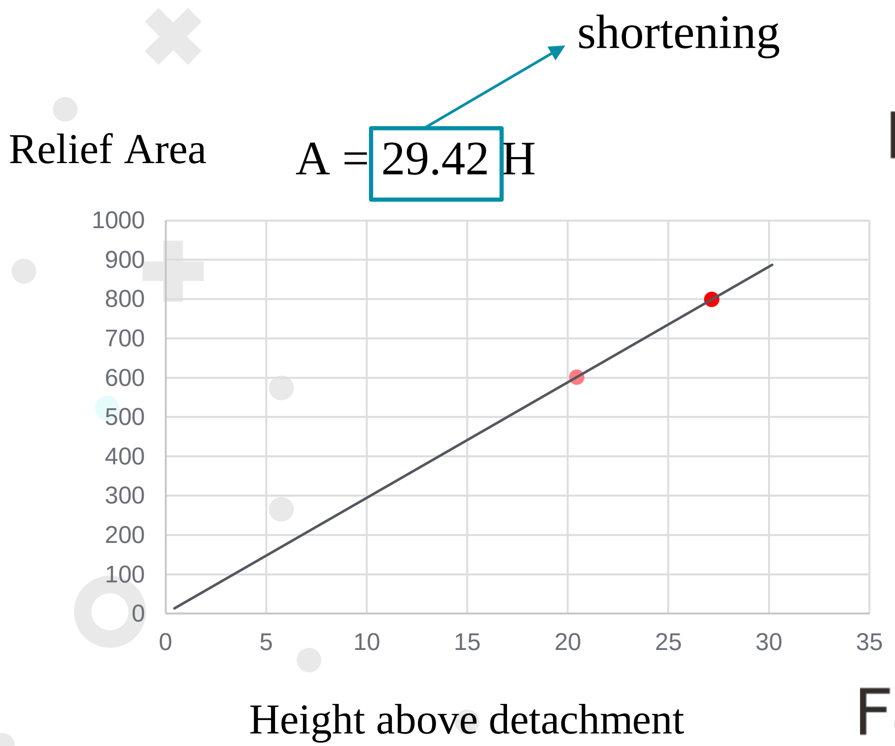
Seismic Reflection Lines

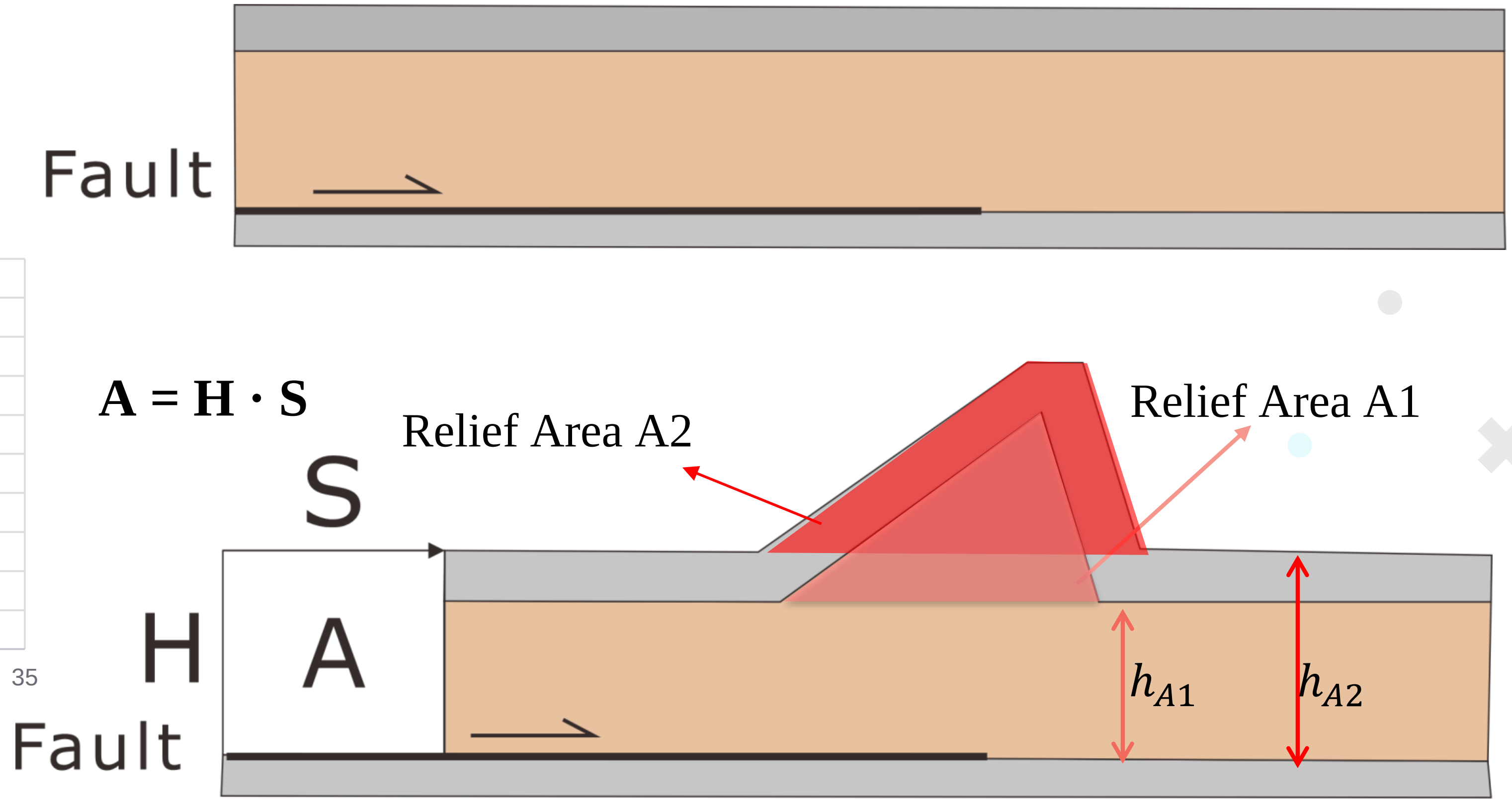
+ Using the velocity curve to transform the seismic line from travel time to depth



Relief Area Analysis

+ We can find the deformed layers from the seismic lines and use the relief area of different layers to calculate the shortening.

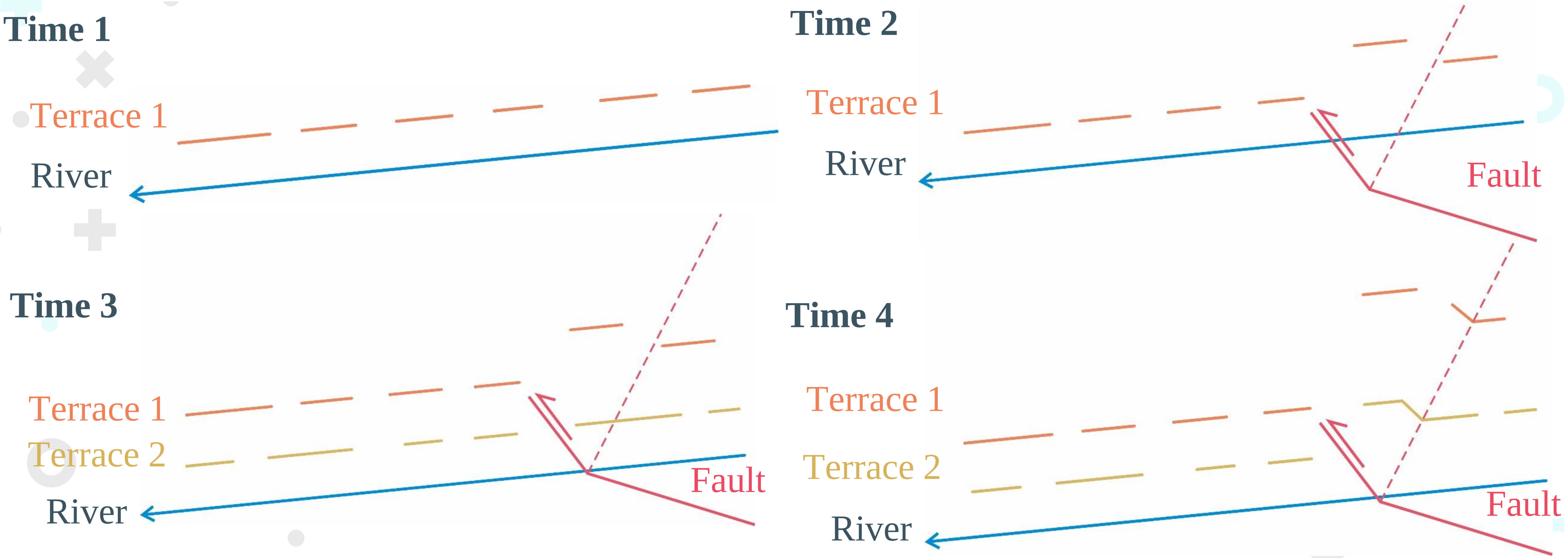




Redrawn from Shaw et al., 2004

River Terraces

+ Using the terraces for which we have dating data and comparing their height above the river bed allows us to quantify the deformation.



River Terraces

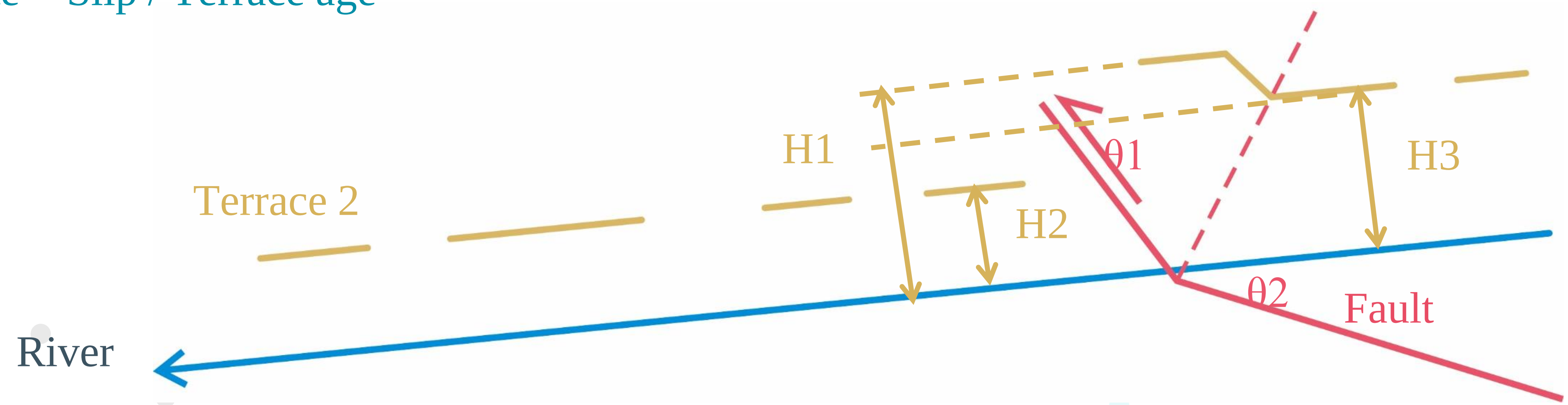
+ Based on the dating data and the height of the terraces, we can calculate the uplift .
+ If we have the orientation of the fault, we can also calculate the shortening .

H1-H2 = Uplift

Uplift = Slip× Sin θ

Slip Rate = Slip / Terrace age

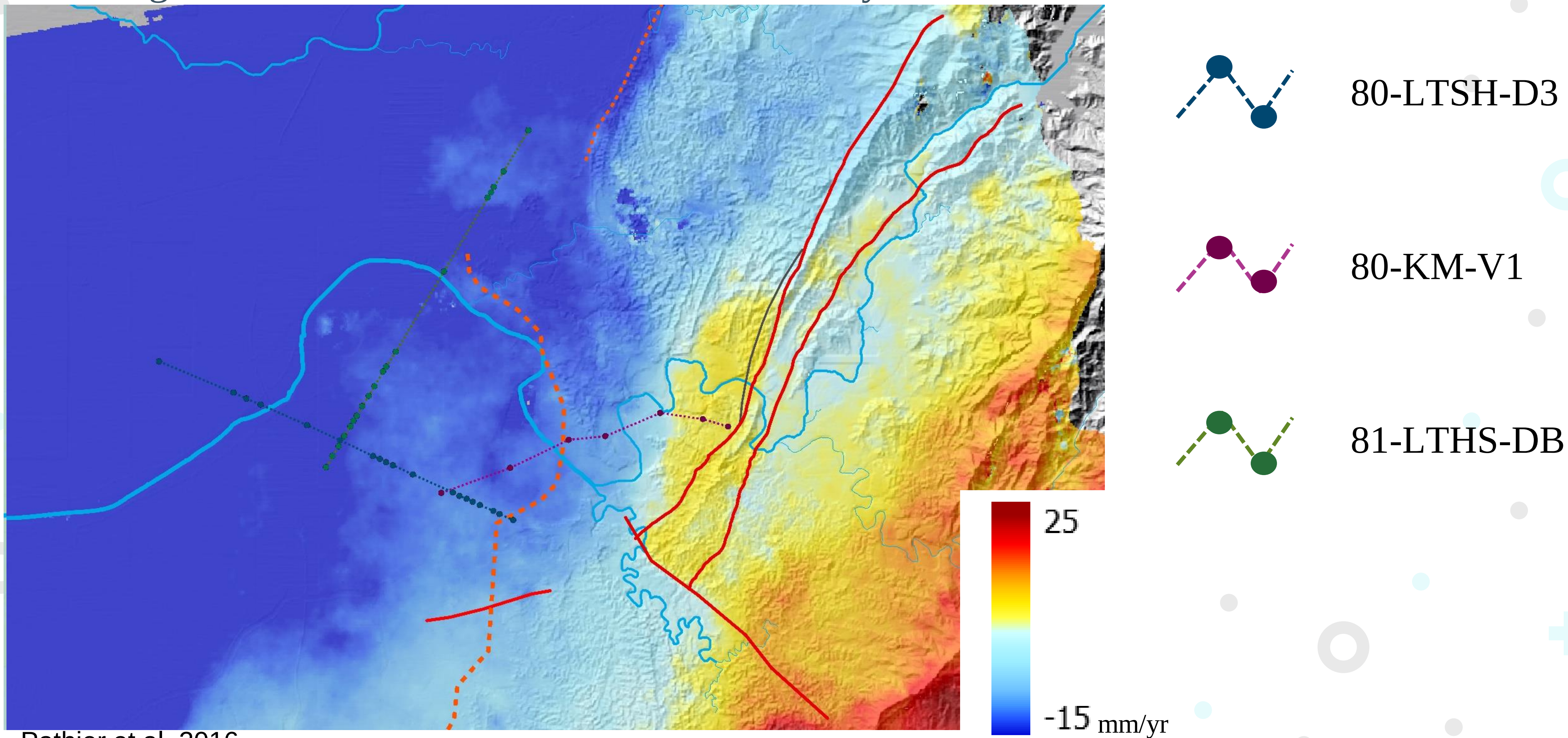
Slip= (H1-H2)/Sin θ1
= (H3-H1)/Sin θ2



Results

CPC Seismic Reflection Lines

+ We get three seismic reflection lines at our study area.



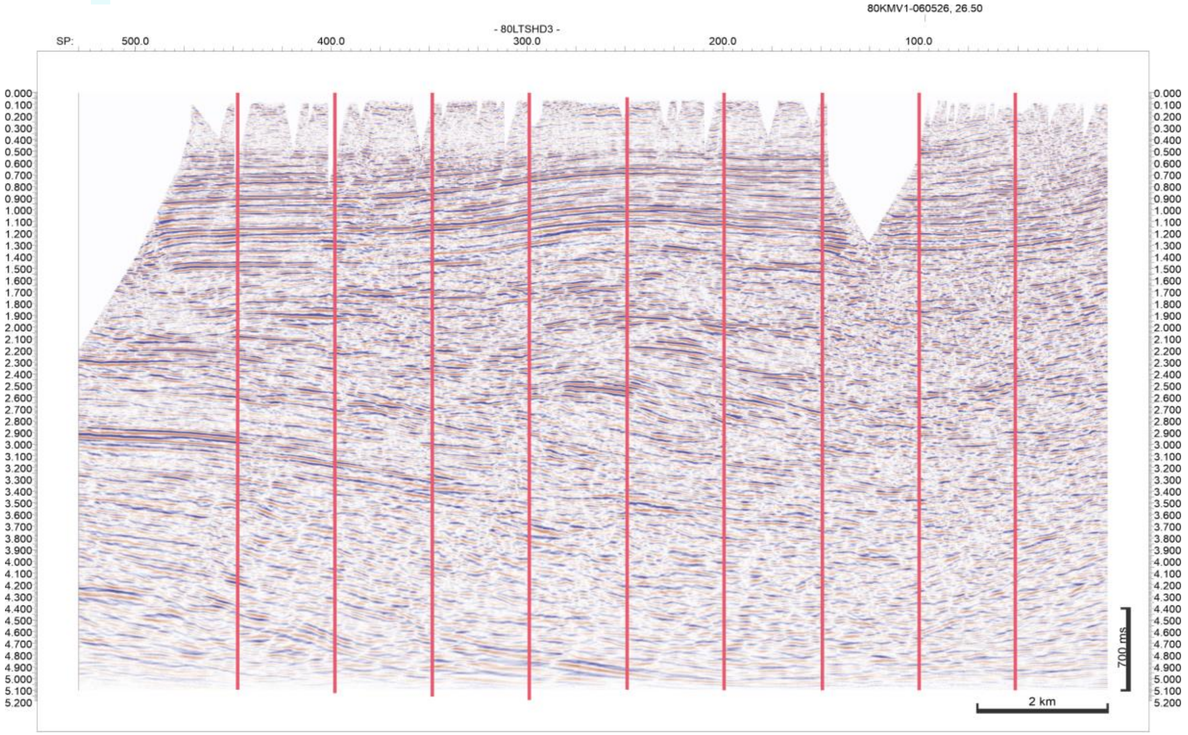
Pathier et al.,2016

CPC Seismic Reflection Lines

- Transformed travel time to depth and tried to draw the layer to quantify the deformation

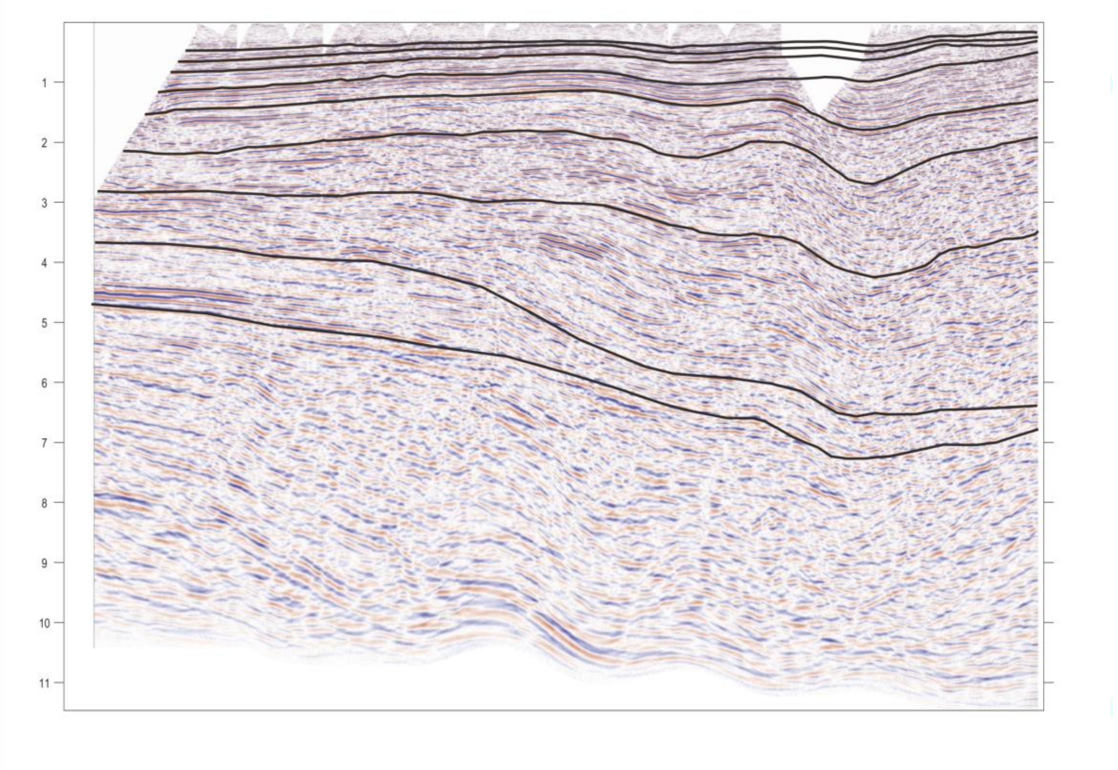
- **Travel Time**

Points with velocity data



80-LTSH-D3

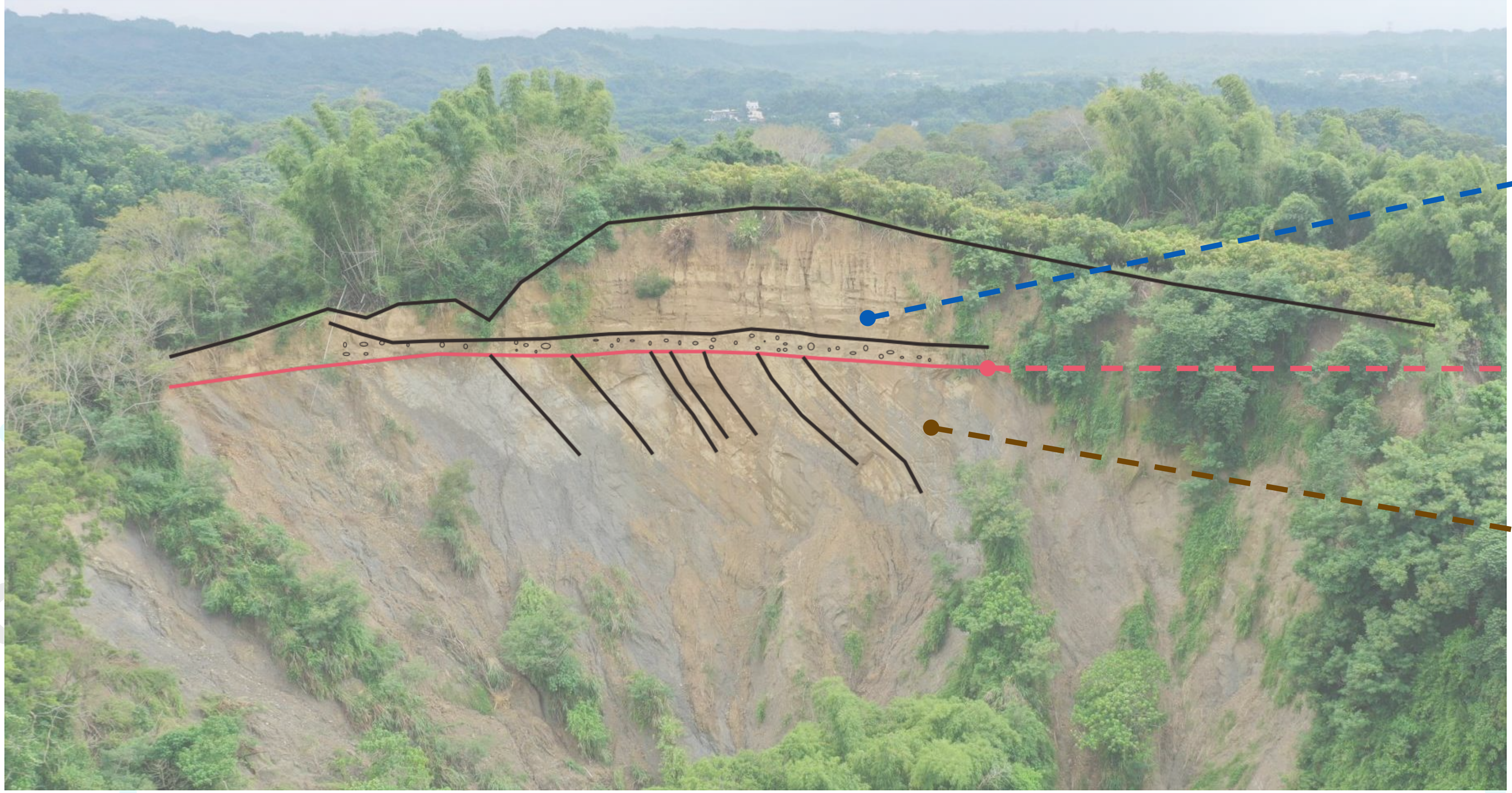
- **Depth**



Tsengwen River Terraces

+ Finding the strath and collecting the dating samples in the river deposit.

Charcoal
C-14 dating

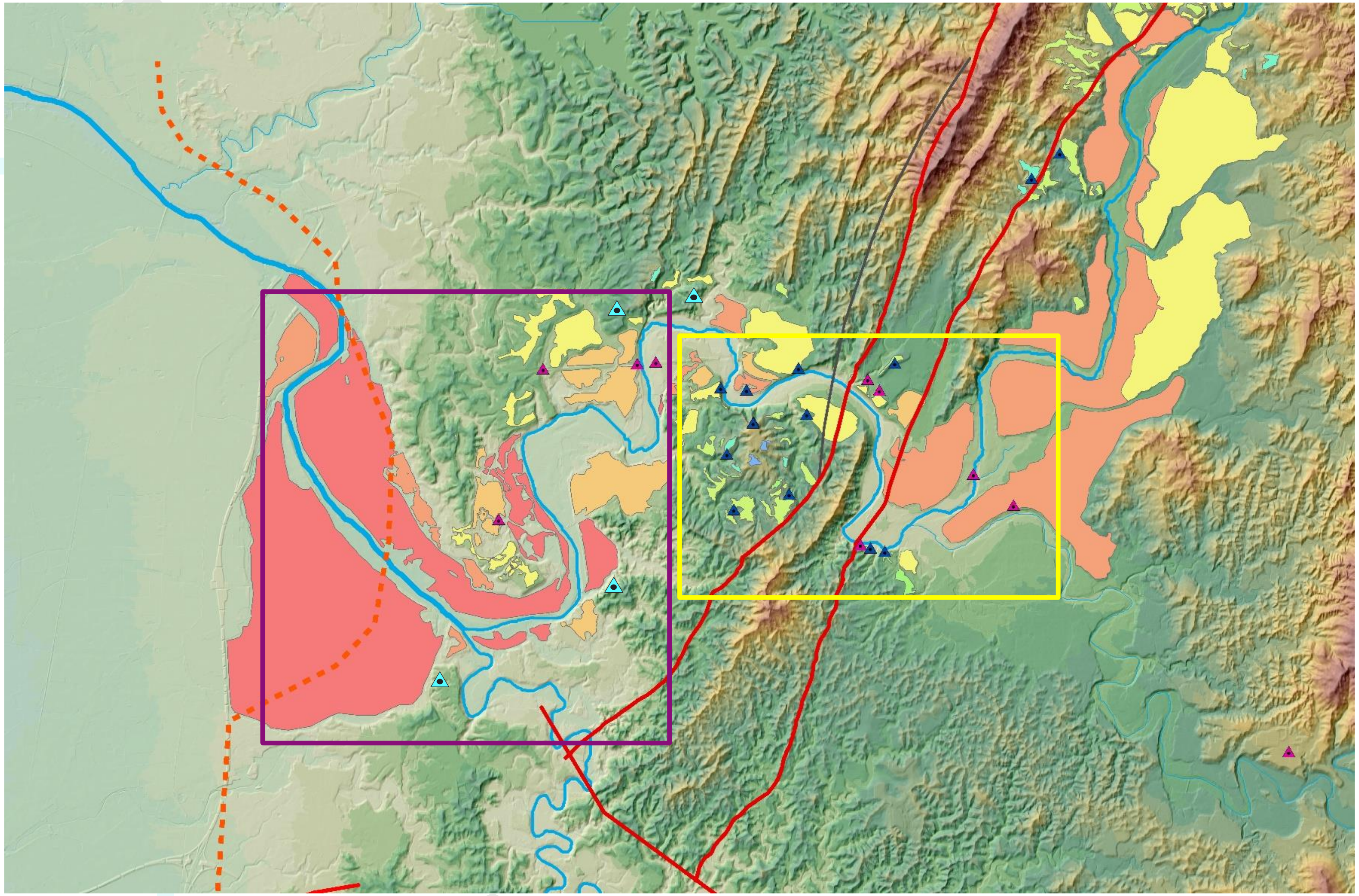


River Deposit

Strath

Bedrock

Tsengwen River Terraces

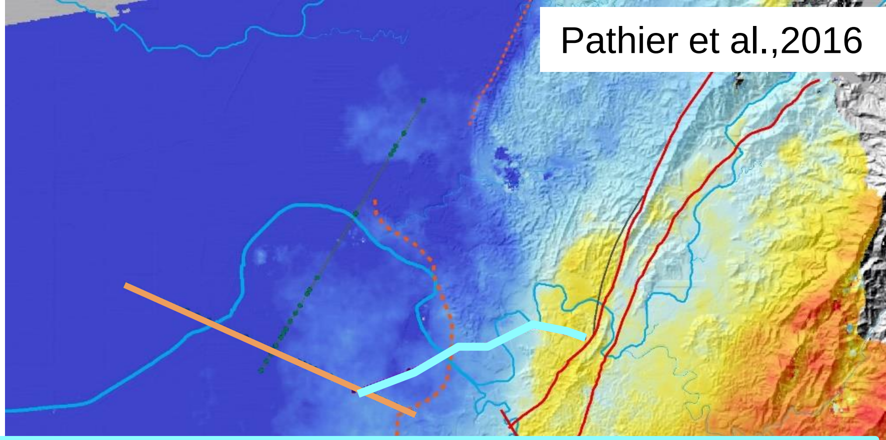


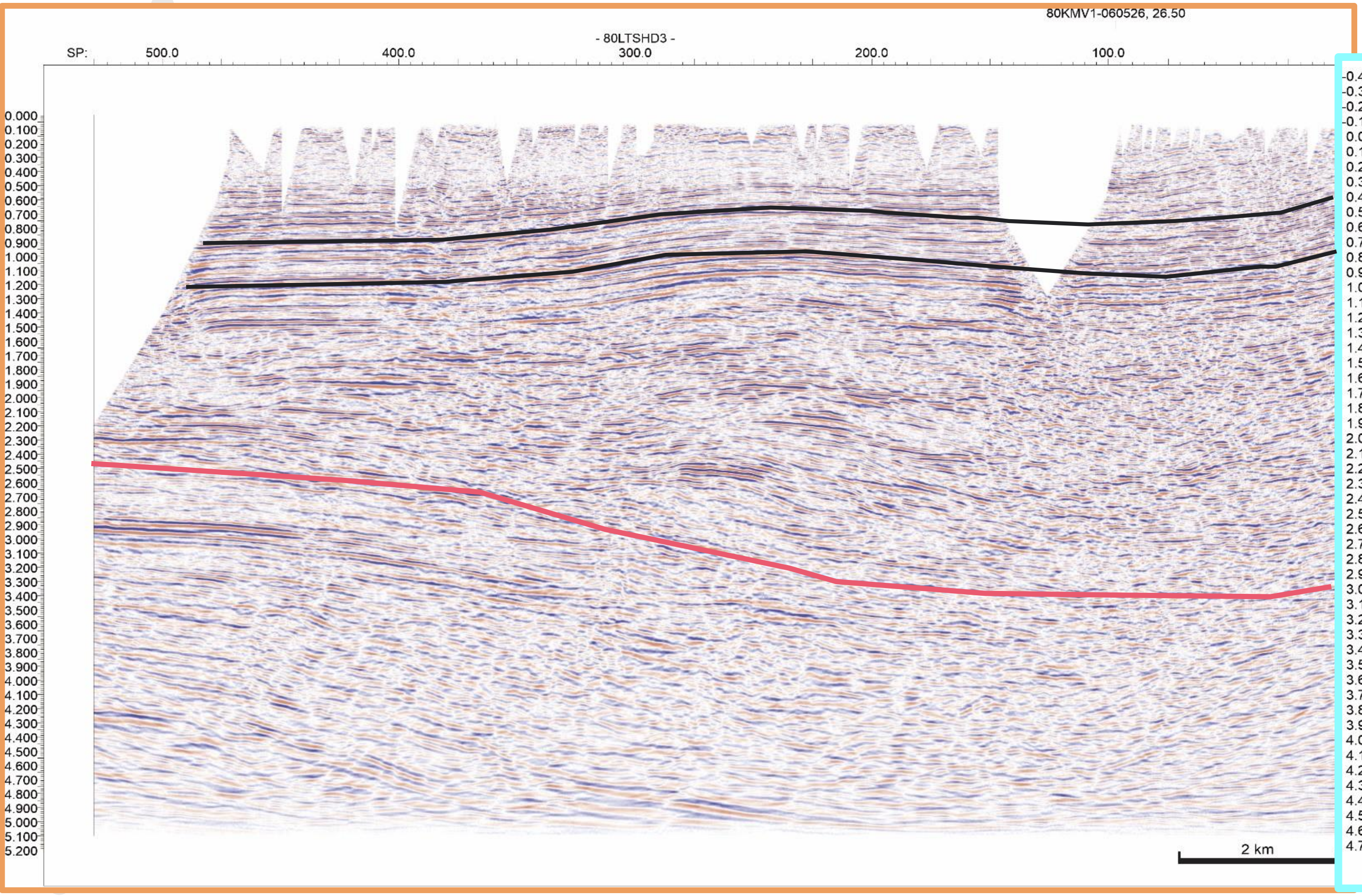
+ We classified different terraces and collected the dating samples at different terraces

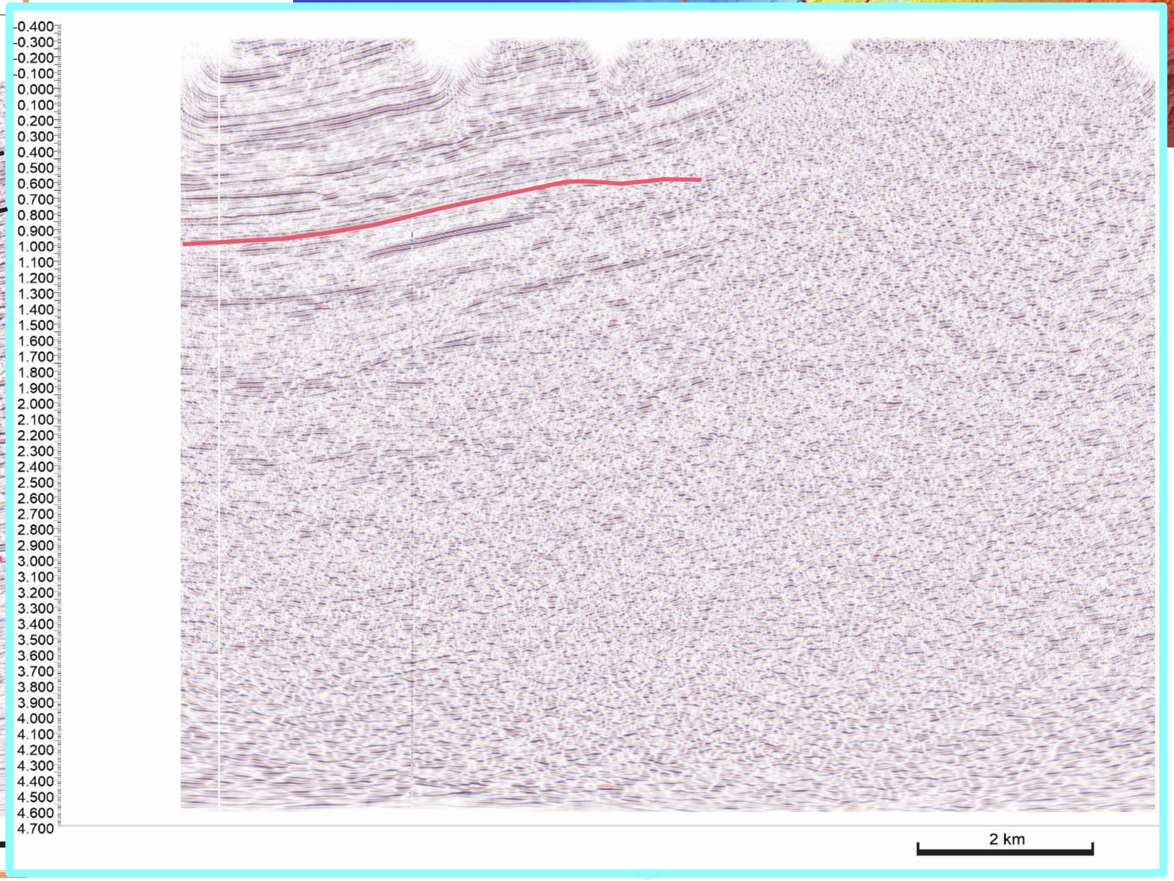
- Dating points from ML Hsieh
- Dating points from JW Shih
- Dating points from my study

Discussion

Deformation at the Plain



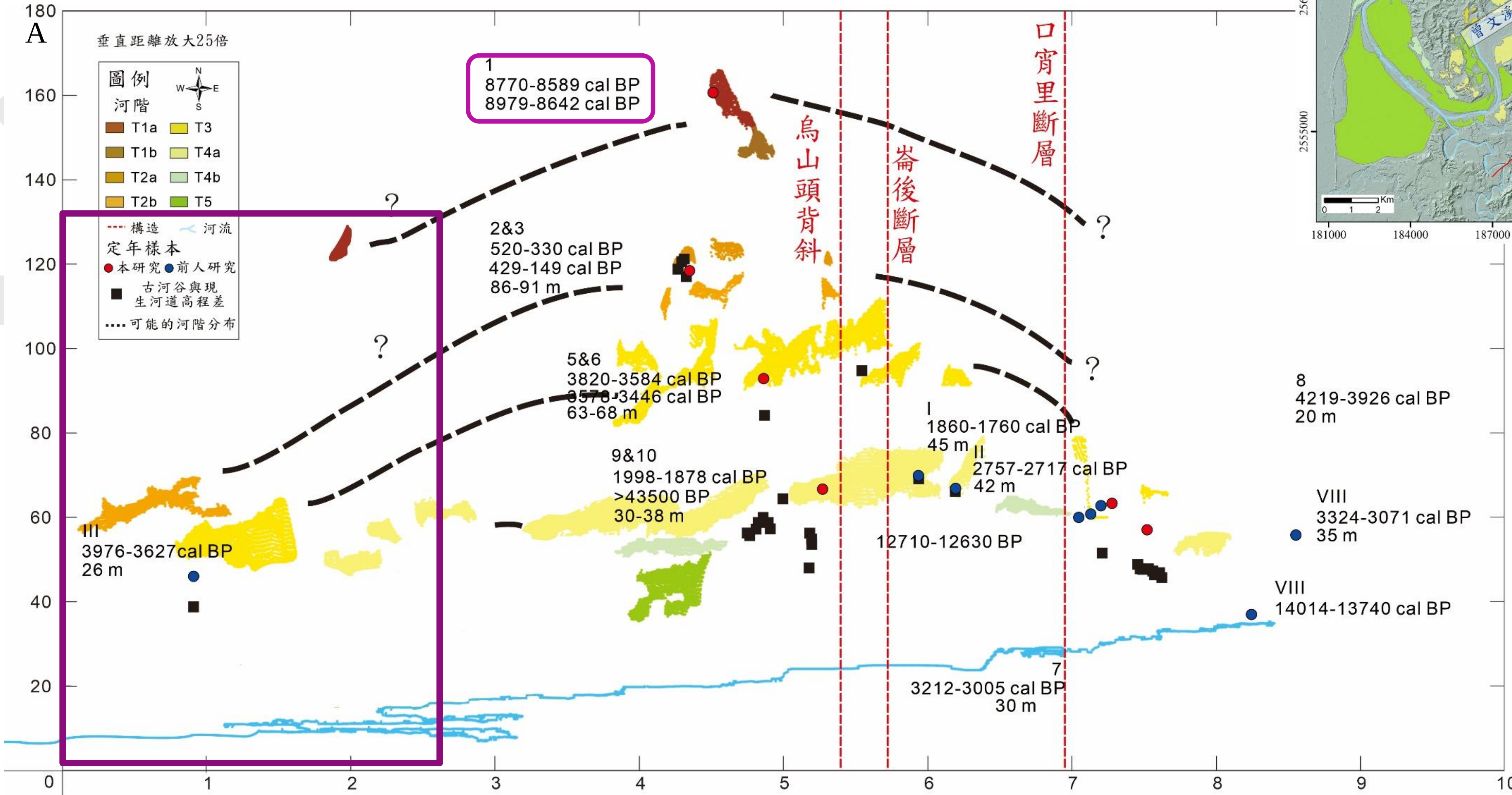


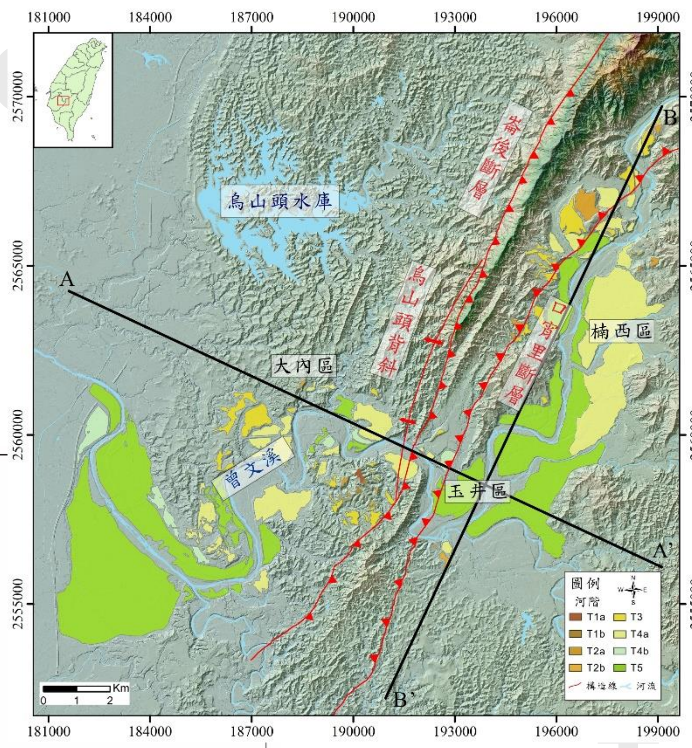


+ The seismic data can see the fold and it matches well with the InSAR data

Terraces Projection

+ From previous studies we can find out the terraces can show the deformation of the structure.

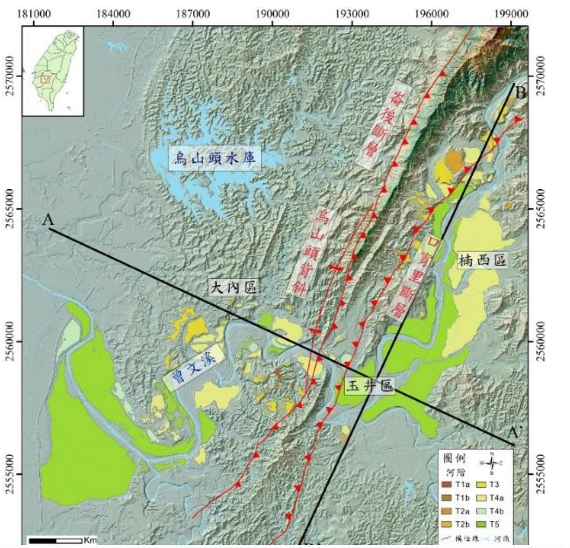


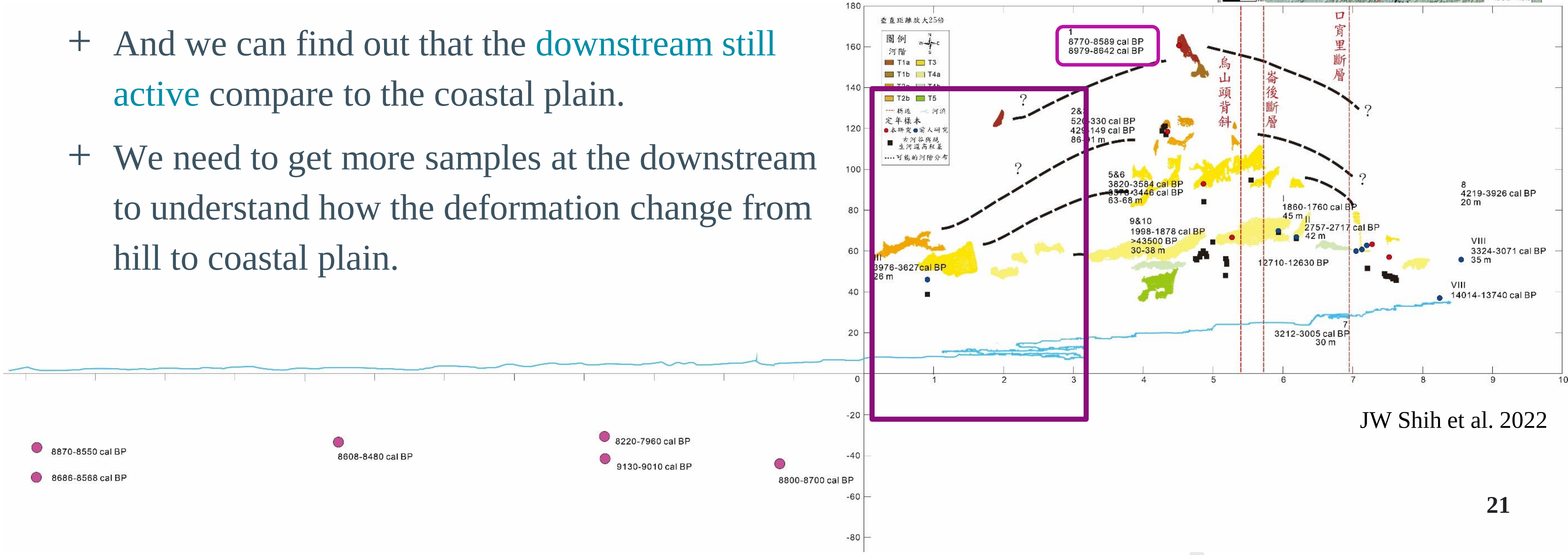


JW Shih et al. 2022

Terraces Projection

+ We correlate the shallow boreholes dating results and the terraces ages and find out that they have more than 100m different.
+ And we can find out that the downstream still active compare to the coastal plain.
+ We need to get more samples at the downstream to understand how the deformation change from hill to coastal plain.





JW Shih et al. 2022

Conclusions

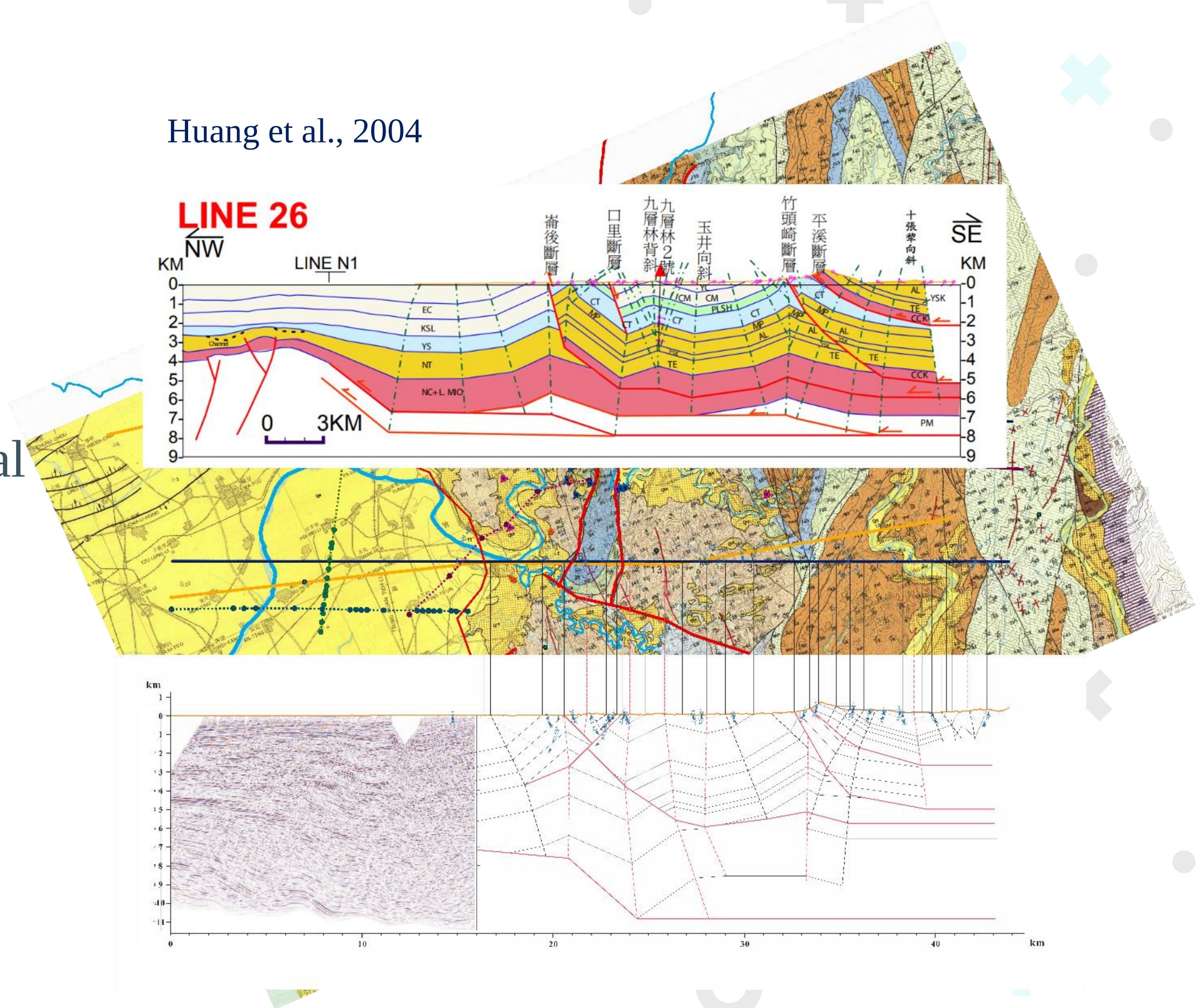
- Based on the Seismic Reflection Lines we can see that the geometry of the fold fits well with the InSAR data.
- ChungChou Structure maybe is a detachment, but not a reverse fault.
- Tsengwen River terraces and shallow boreholes in the coastal plain can show the deformation of the structures, but we need more dataing data at the downstream to correlate the terraces from upstream to downstream.

Future Works

Future Works

+ Go to field to get the more precise elevation of the strath by RTK and total station
+ Finish drawing the seismic lines
+ Combine all the data to draw the geological cross-sections and quantify the shortening

Huang et al., 2004



Thank You For Listening