The Chaochou active fault in southern Taiwan: Characteristics and geomorphological significance as a reverse fault

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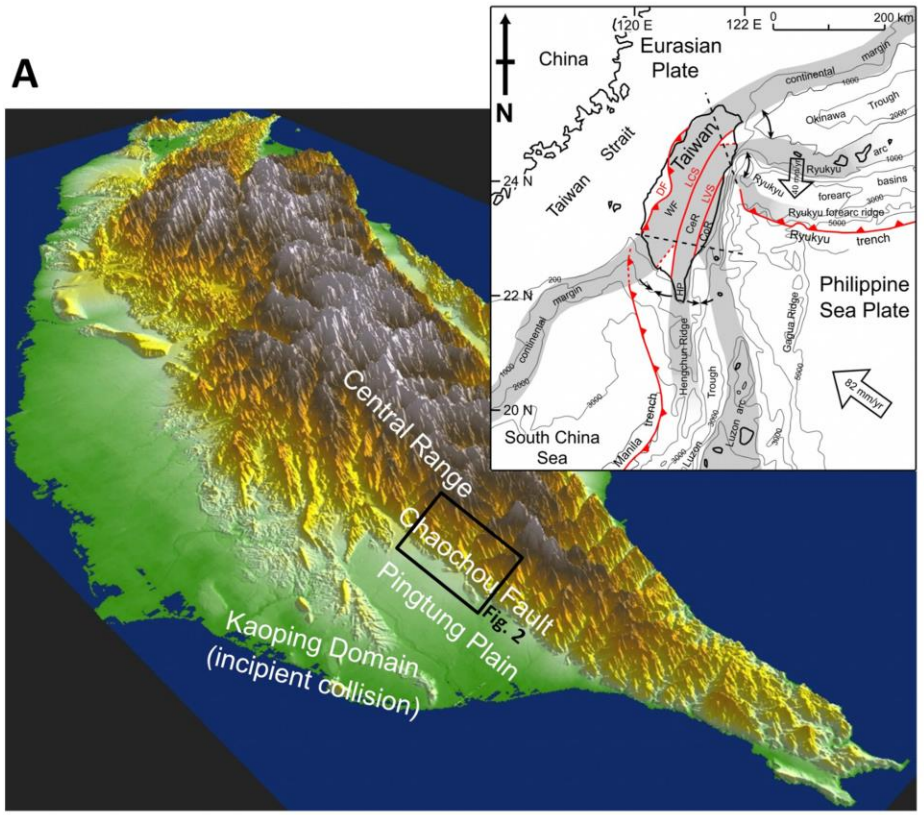
Introduction

- Earthquakes from fault movement can cause landslides and tsunamis, posing threats to people and property.

- Reverse faults with **low dip angles (<30˚)** are less noticeable, so they often don't receive enough attention before major earthquakes.

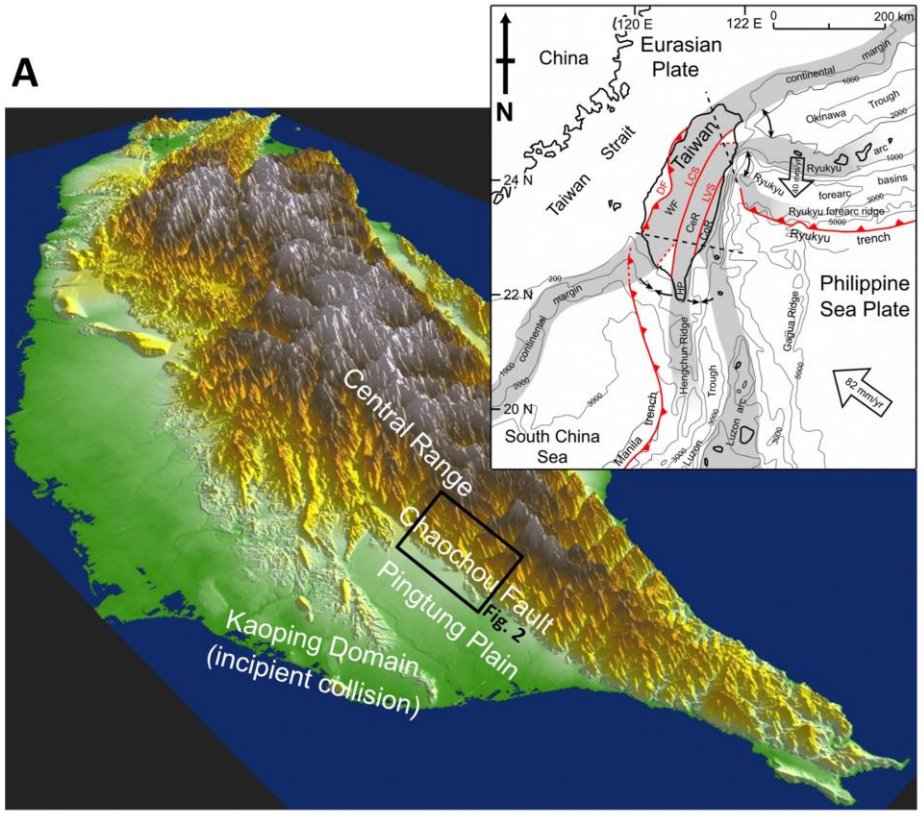
  Example: Chi-Chi earthquake caused by the Chelungpu Fault.



Shyu et al., 2005

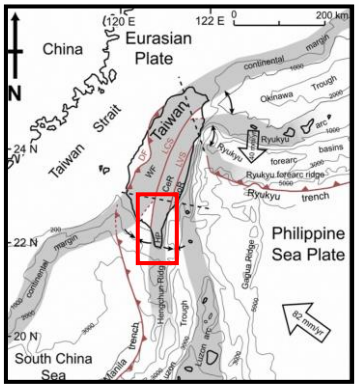
Introduction

- The Central Geological Survey classifies active faults into two categories based on recent offset and future recurrence potential.
  - **Category I active fault**: Faults active during the Holocene (within the past 10,000 years).
  - **Category II active fault**: Faults active during the Late Pleistocene (within the past 100,000 years).
- The Chaochou Fault is classified as a **category II active fault**, located in southwestern Taiwan, and is a high-angle thrust fault.

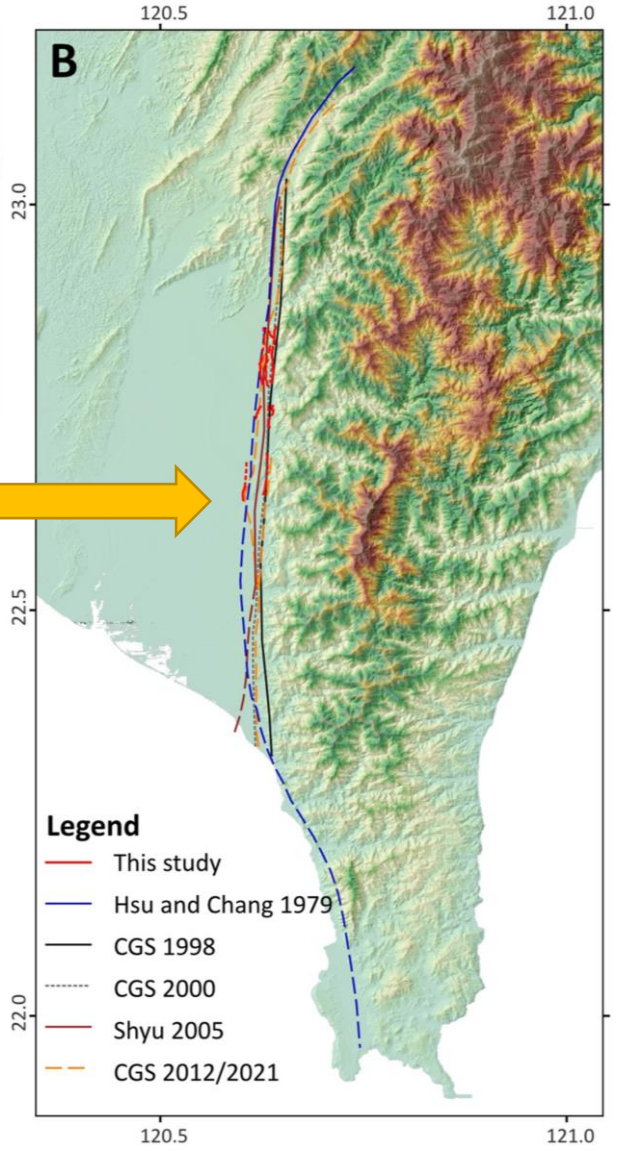


Shyu et al., 2005

Chaochou Active Fault



A single fault surface trace mapped by each study



- The Chaochou fault's **activity time** and **displacement** have not been deeply explored.
- With updates to the classification system, the **categorization of the Chaochou Fault is also changing**.
- The fault **location** identified in each study is **different**.

- **Identifying the fault**
- **Estimate vertical slip rate**
- **Dating the formation time of the landform**

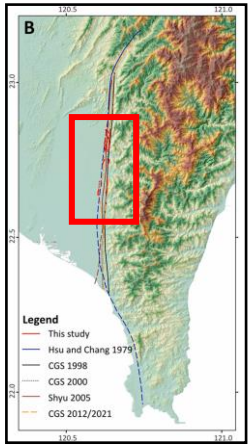
Methodology

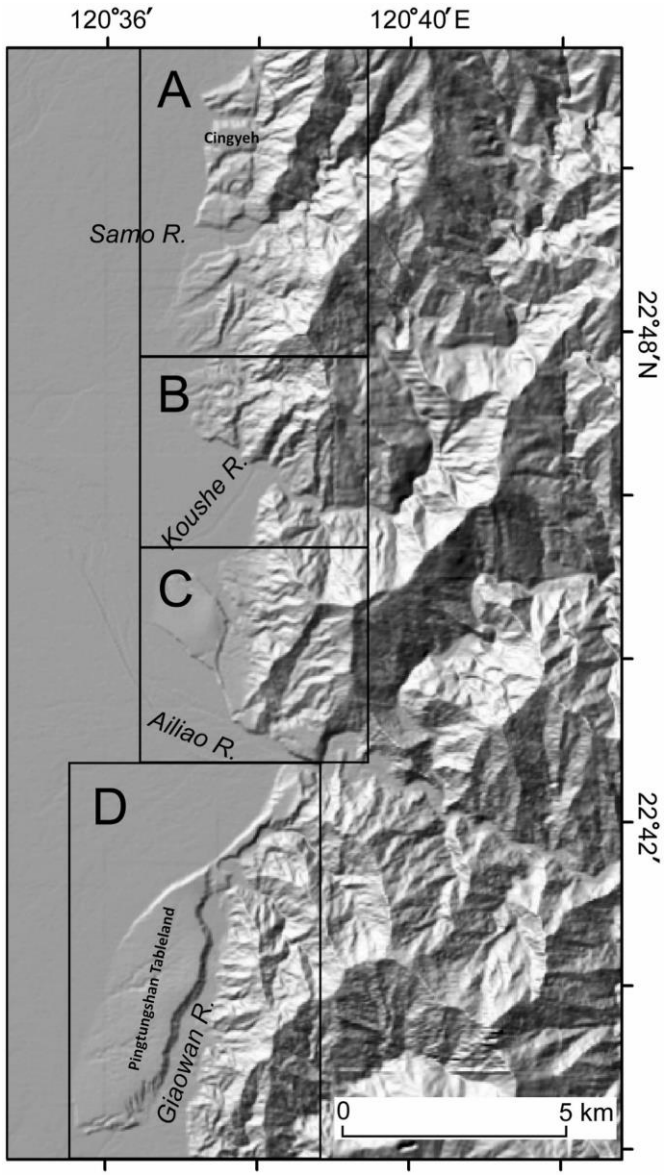
- Large-scale maps of terraces and faults
  - High-resolution aerial photographs
- RTK profile data

Identifying the fault and estimate vertical slip rate

- OSL dating

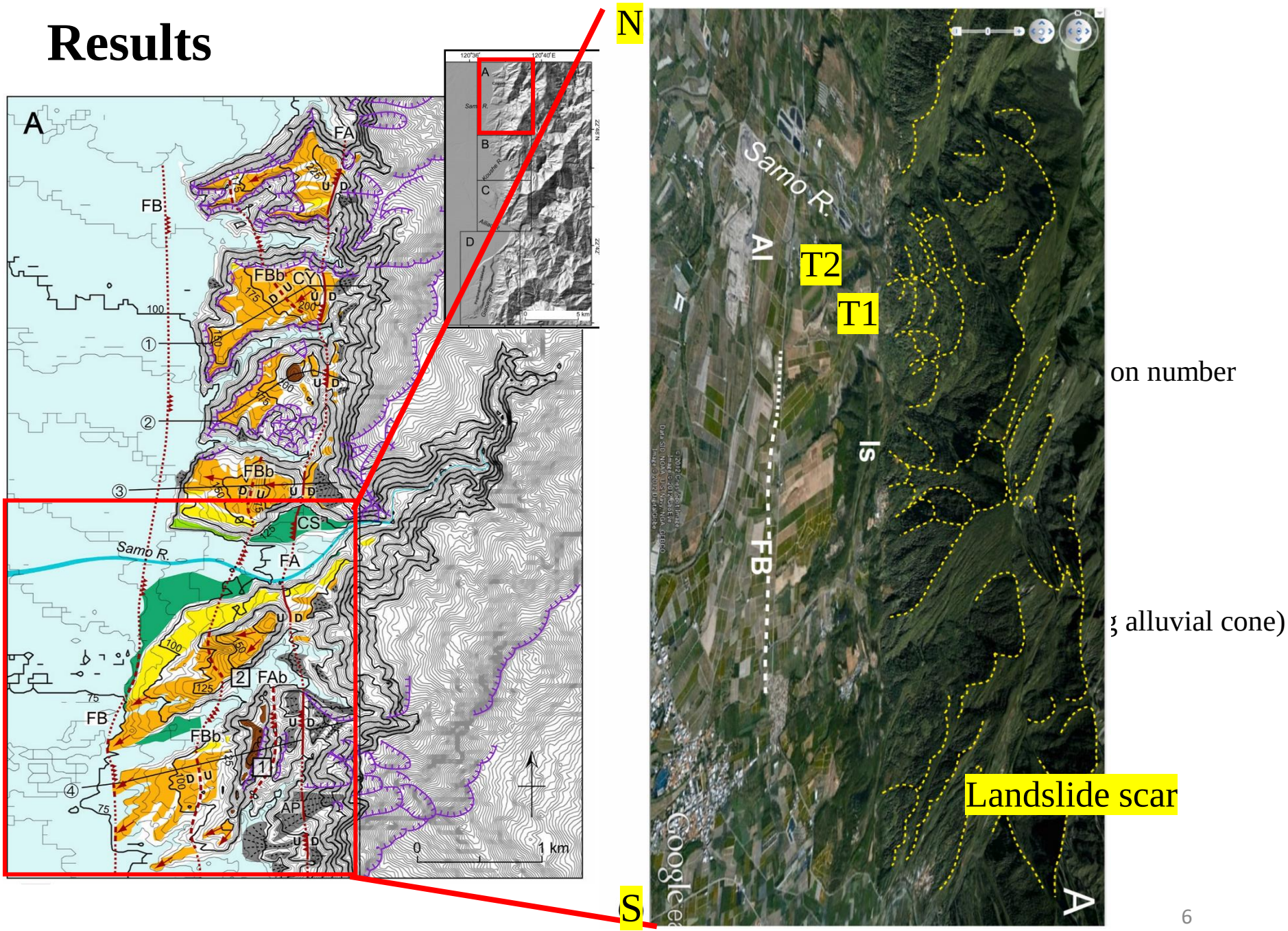
Dating the formation time of the landform





The areas A, B, C, and D represent different study sections.

Results

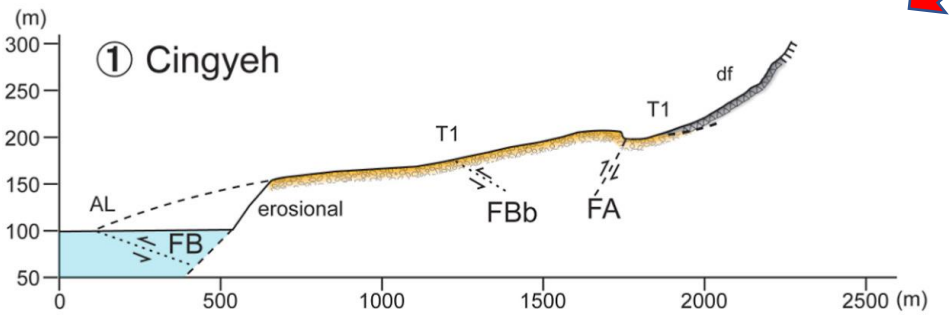


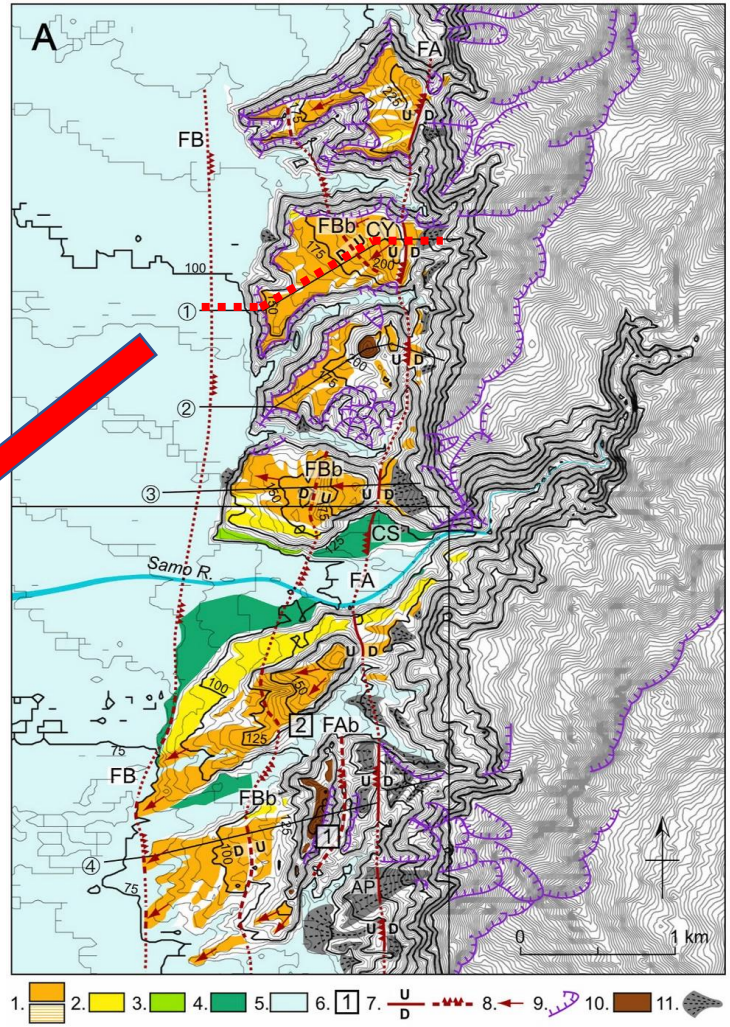
on number

ɜ alluvial cone)

Chaochou active fault zone

- Major Faults (FA, FB)
  - **FA**: High-angle reverse fault (facing east towards the Central Range).
  - **FB**: Low-angle reverse fault (between the terraces and alluvial plains).
  - **FBb**：A secondary fault of FB.

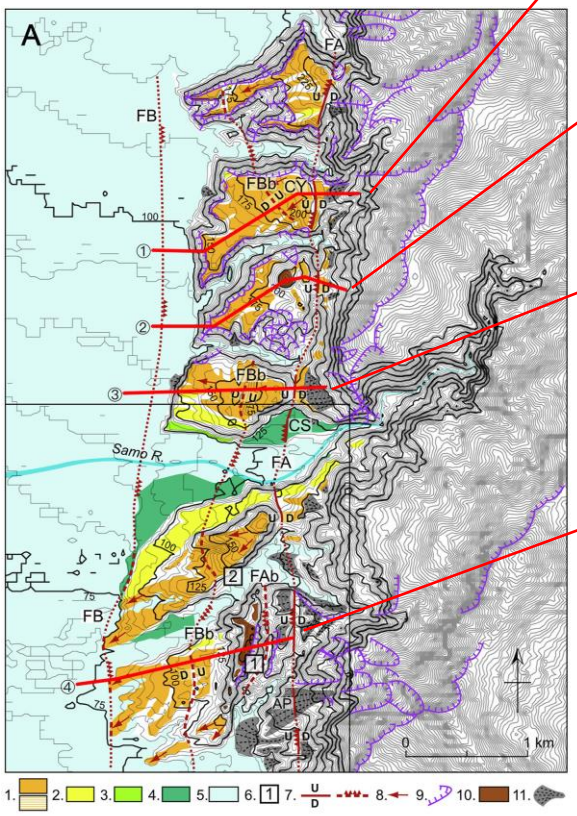


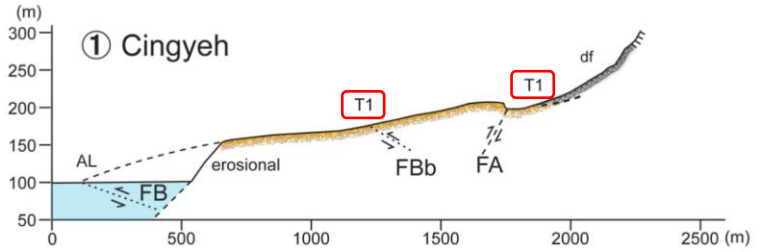


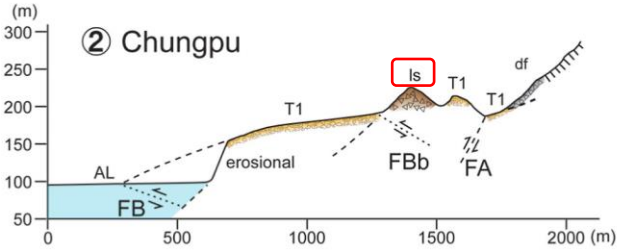
Chaochou active fault zone

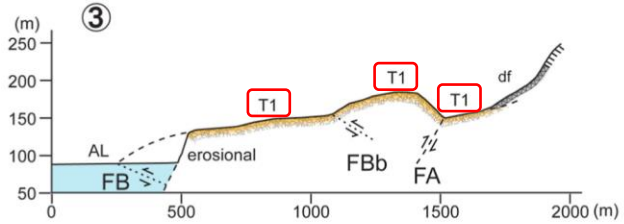
- Deformation of FA can be seen on the T1, T2, and T4 terraces.
- The sequence of tectonic events

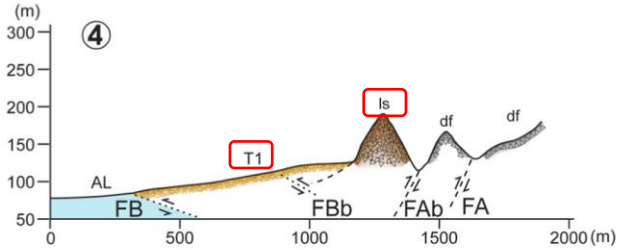
Landslide → T1 Terrace → FA and FB

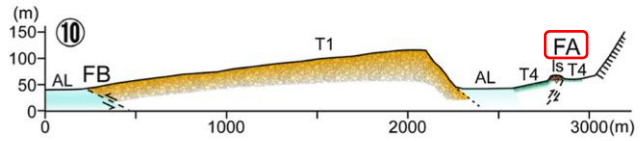












Results

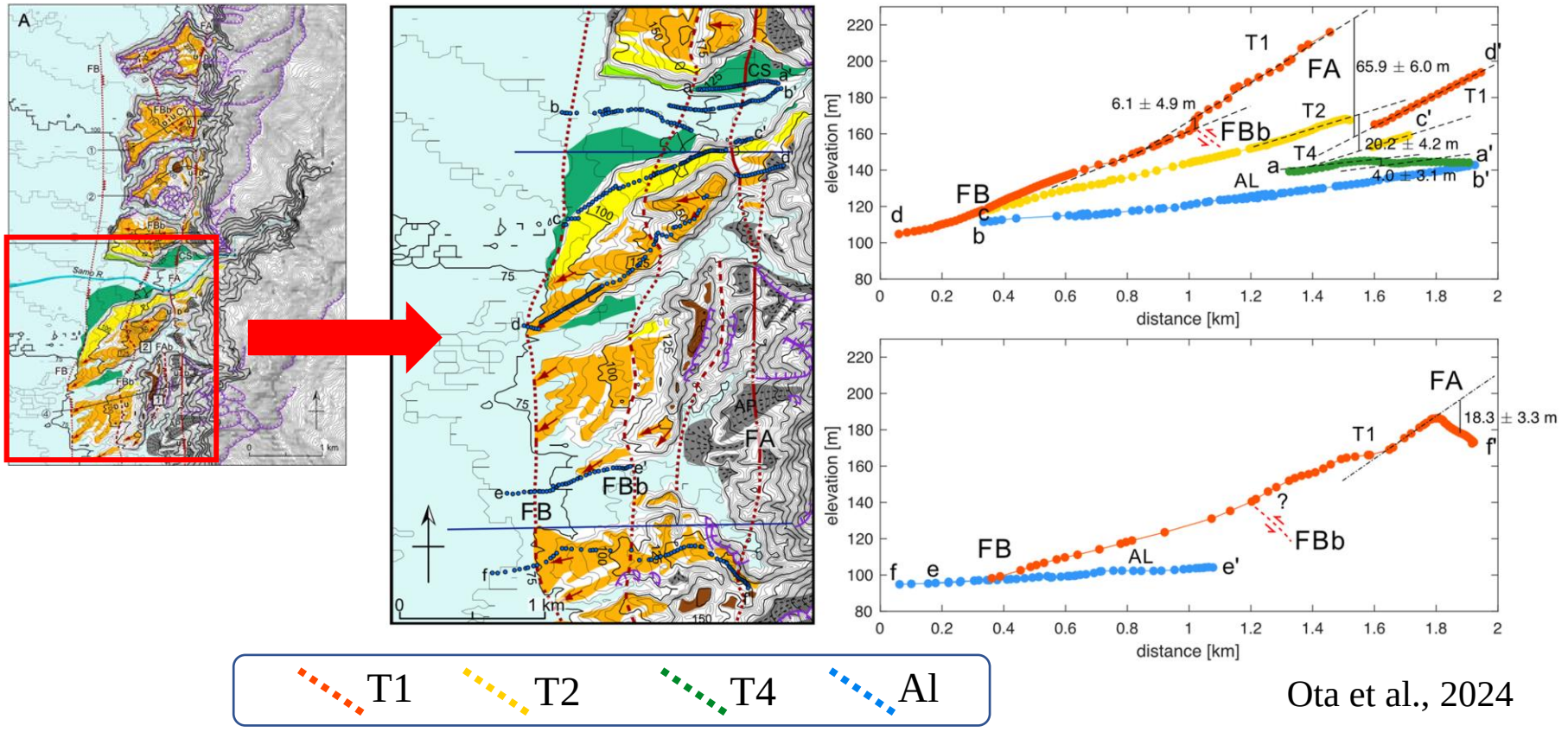
■ Dating

Terrace/Landform	Method	Age Estimate	Notes
Landslide blocks	**Degree of weathering** and **stratigraphic relationship**	**50ka (Roughly estimated)**	Most weathered, older than T1
T1	**OSL**	**35.3±4.3 ka**	Sample from cliff, eastern edge of Pingtungshan Tableland
Younger terraces(T2, T3, etc.)	Radiocarbon (C-14) dating method	Younger than T1	Lacks lateritic soil From previous study

- **Landslide**: **Oldest block**
- **Estimation**: Based on published radiocarbon dating of river terrace deposits, the **youngest T4 terrace likely formed during the Holocene**.(Bonilla, 1975; Yang, 1986)

→The Chaochou Fault is identified as **a category I active fault.**

The Vertical Slip rate of

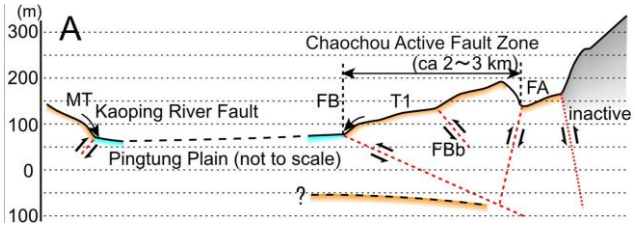


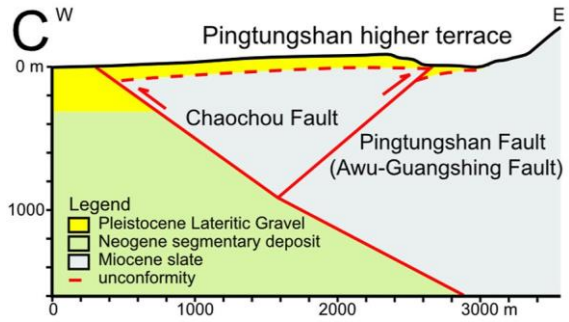
Ota et al., 2024

Old → Young

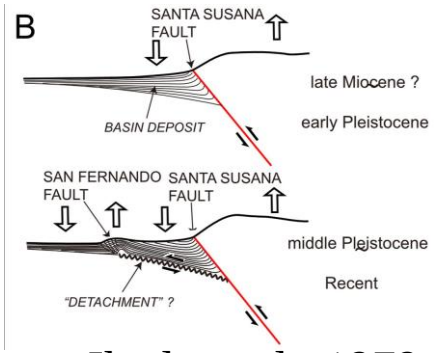
- A difference in the amount of deformation between the northern and southern sections
- The **vertical slip rate of FA** in the northern section is about **0.5–2 mm per year**, and **FB** is about **0.2mm per year**.
- The actual fault slip will be greater than the vertical displacement.

Discussion of Chaochou active fault zone





Chen et al,. 2005



Ikeda et al., 1979

- FA and FB are reverse faults likely formed under an east-west compressive stress field. We call this the "**Chaochou Active Fault Zone**. "
- Figure C differs from Figure A in that the range-facing scarp has a **higher dip angle**, and it suggests an **additional branch fault (FBb)**.
- **FB** is considered a **frontal migration fault**.
- The San Fernando Fault is similar to the Chaochou fault. However, there is no fault like FA on the San Fernando Fault in figure B.

Conclusions

- The Chaochou fault zone is composed of fault branches:
    1. Primary fault, FB dipping to the east.
    2. Its secondary fault, FBb.
    3. Its secondary fault, FA dipping to the west.
- The **slip rate of FA** in the northern section is **about 0.5–2 mm per year,** and **FB** is about **0.2 mm per year**.
- The Chaochou fault is identified as **a category I active fault.**

Thanks for your attention.

OSL

- Optically Stimulated Luminescence Dating
- Measure the last time minerals in sediment or rock were exposed to sunlight.
- Commonly used for dating sand, soil, and other sediments.

Fault Slip Rate

Monte Carlo Simulation

frontal migration fault(解釋清楚圖B)