

The evolutionary history of the Taipei Basin

Speaker: Shao-Chen Hsu

Date: 2012/11/01

References

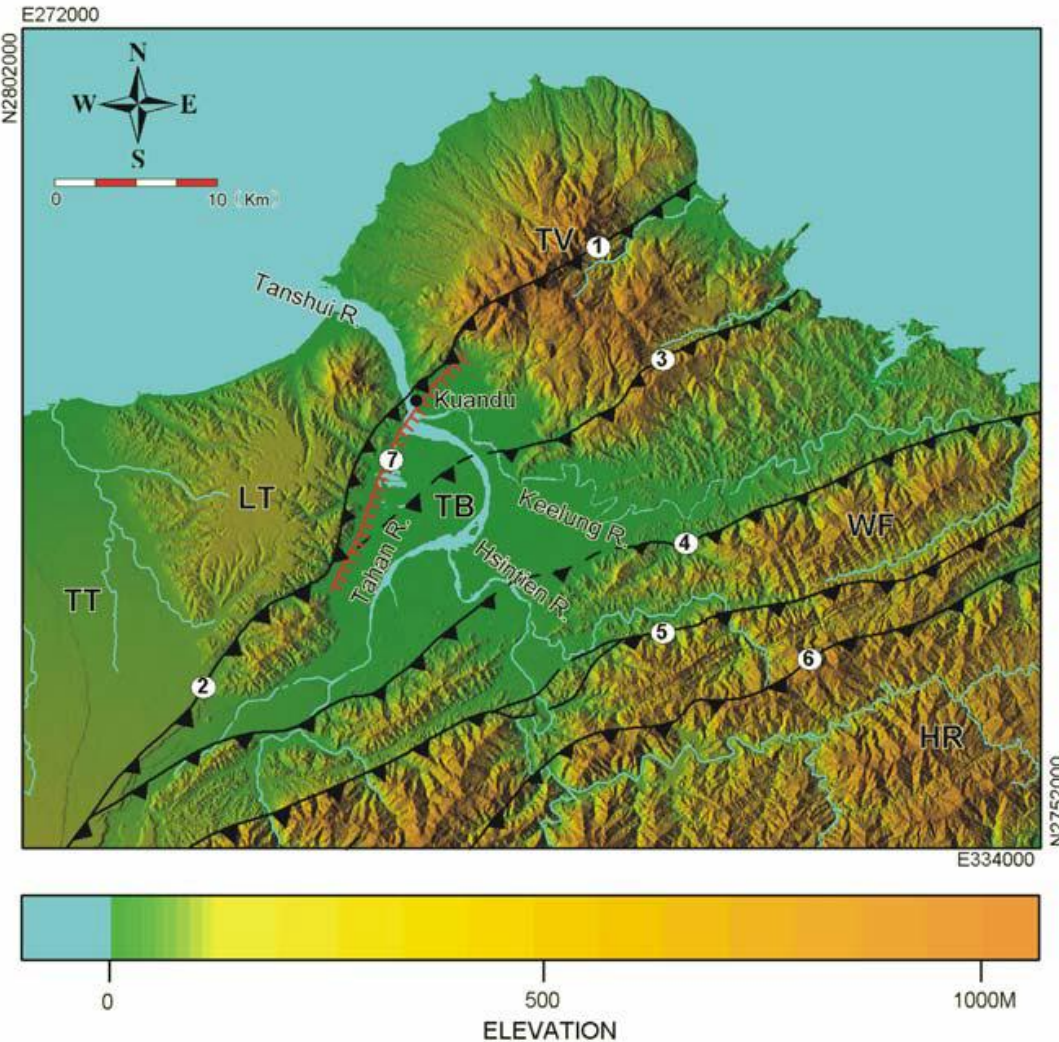
Teng, L.S., Lee, C.T., Peng, C.-H., Chen, W.-F., Chu, C.-J., 2001. Origin and geological evolution of the Taipei Basin, northern Taiwan. *Western Pacific Earth Sciences* 1 (2), 115–142.

Song, S.-R., Chen, T.-M., Tsao, S.J., Chen, H.-F., Liu, H.-C., 2007. Lahars in and around the Taipei basin: Implications for the activity of the Shanchiao fault. *Jour. Asian Ear. Sci.*, 31, 3, 277-286.

Outline

1. Introduction
2. Geological setting
3. Data and results
 - Stratigraphic records
4. Evolutionary history
5. Discussions
6. Conclusions

Introduction



TV: Tatun volcanoes

TB: Taipei Basin

LT: Linkou Tableland

WF: Western Foothills

Fig. 1.

How ?

Deguchi (1912) thought the Taipei basin was formed by the collapse of the subsurface vacancy left by the Tatun volcanic eruptions.

Makiyama (1933)

Tan (1939) : **Shangjiao Fault.**

Lu *et al.* (1994) thought the Taipei Basin related to the continuing bending of the crescent Taiwan mountain belt.

Lee *et al.* (1999) interpreted the Taipei Basin as a divergent fault wedge basin.

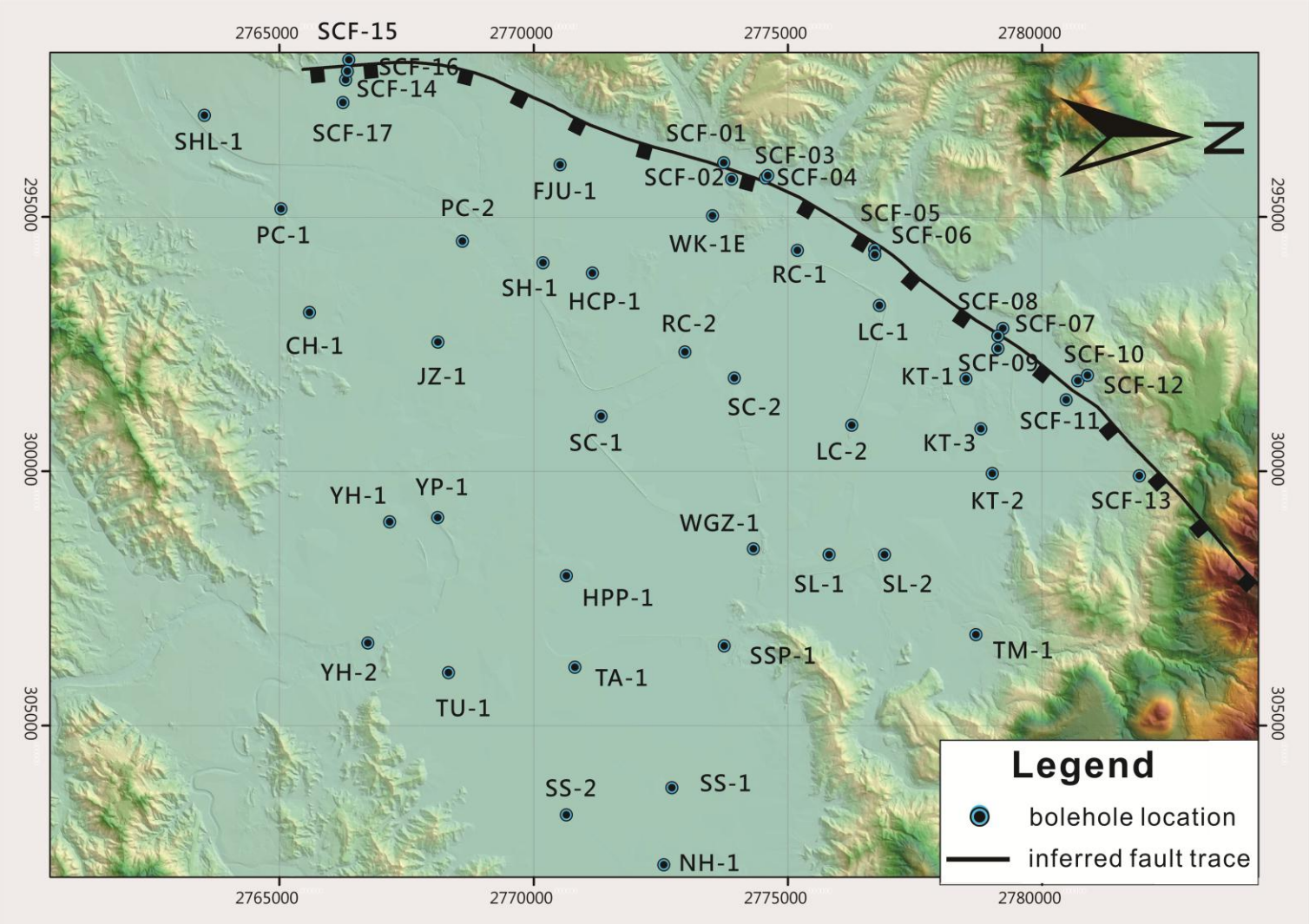
In the past 15 years, the Taipei Basin undertook a series of deep drilling projects.

- Arguments

- Sha
- Hsir
- Link

These synthe

They s chrono



sive

Outline

1. Introduction
2. Geological setting
3. Data and results
 - Stratigraphic records
4. Evolutionary history
5. Discussions
6. Conclusions

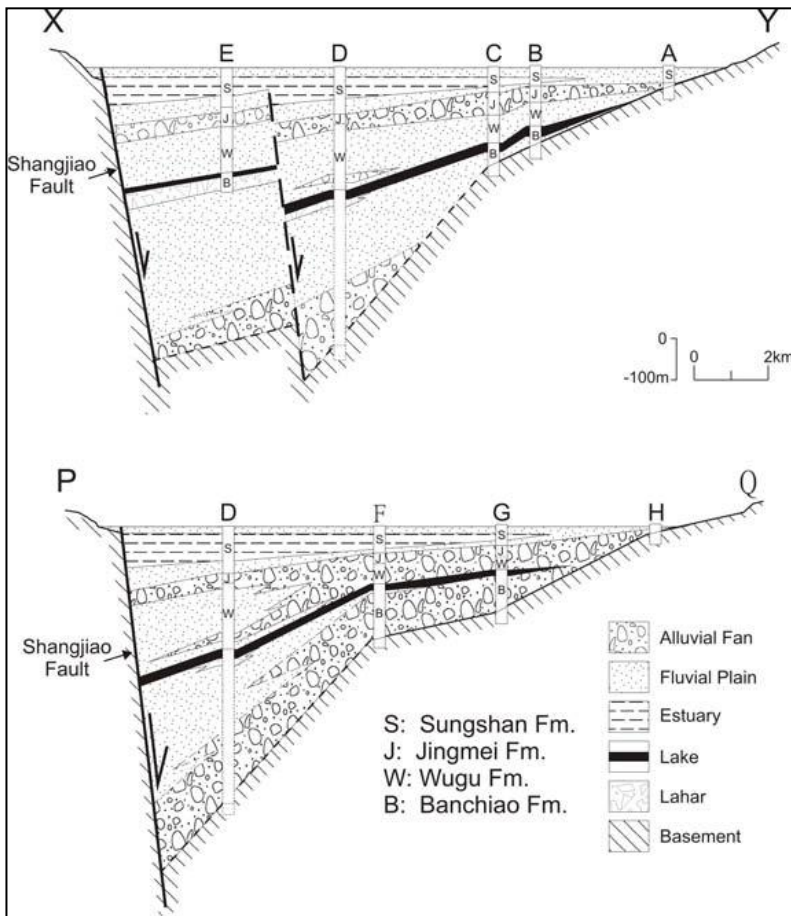


Fig. 4.

Geological setting

ary

of
level,
stics.

Taipei Basin is a half-graben.

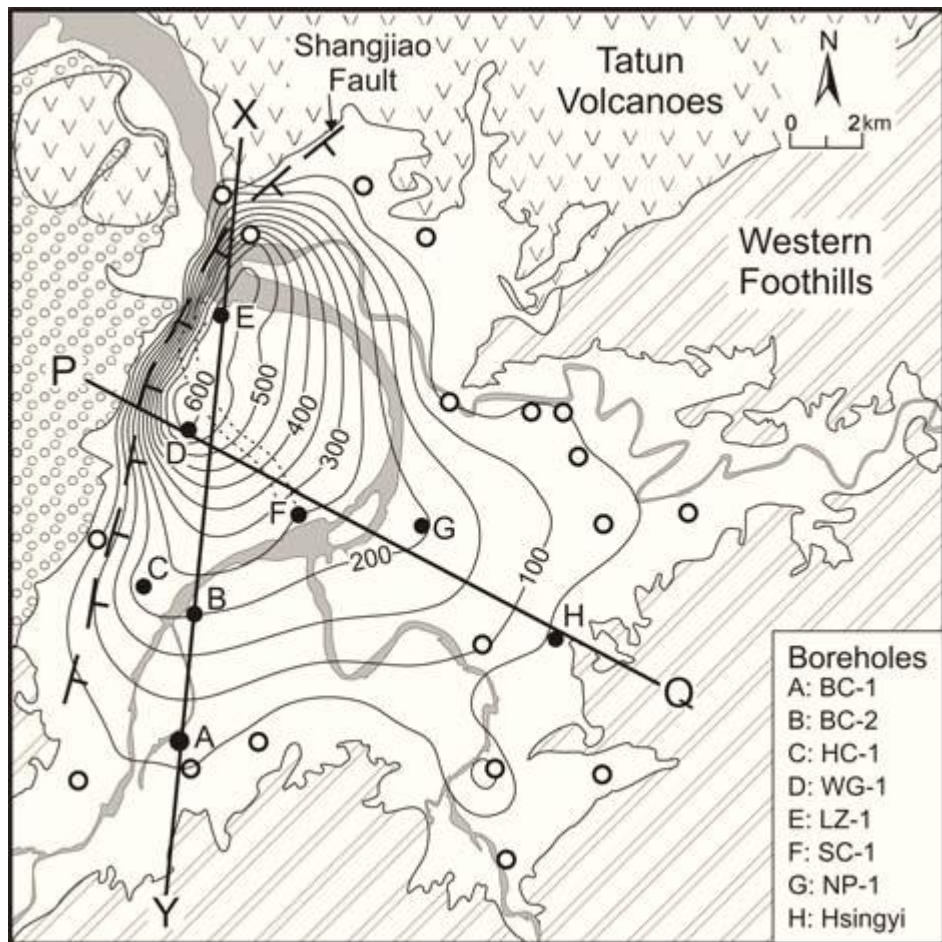
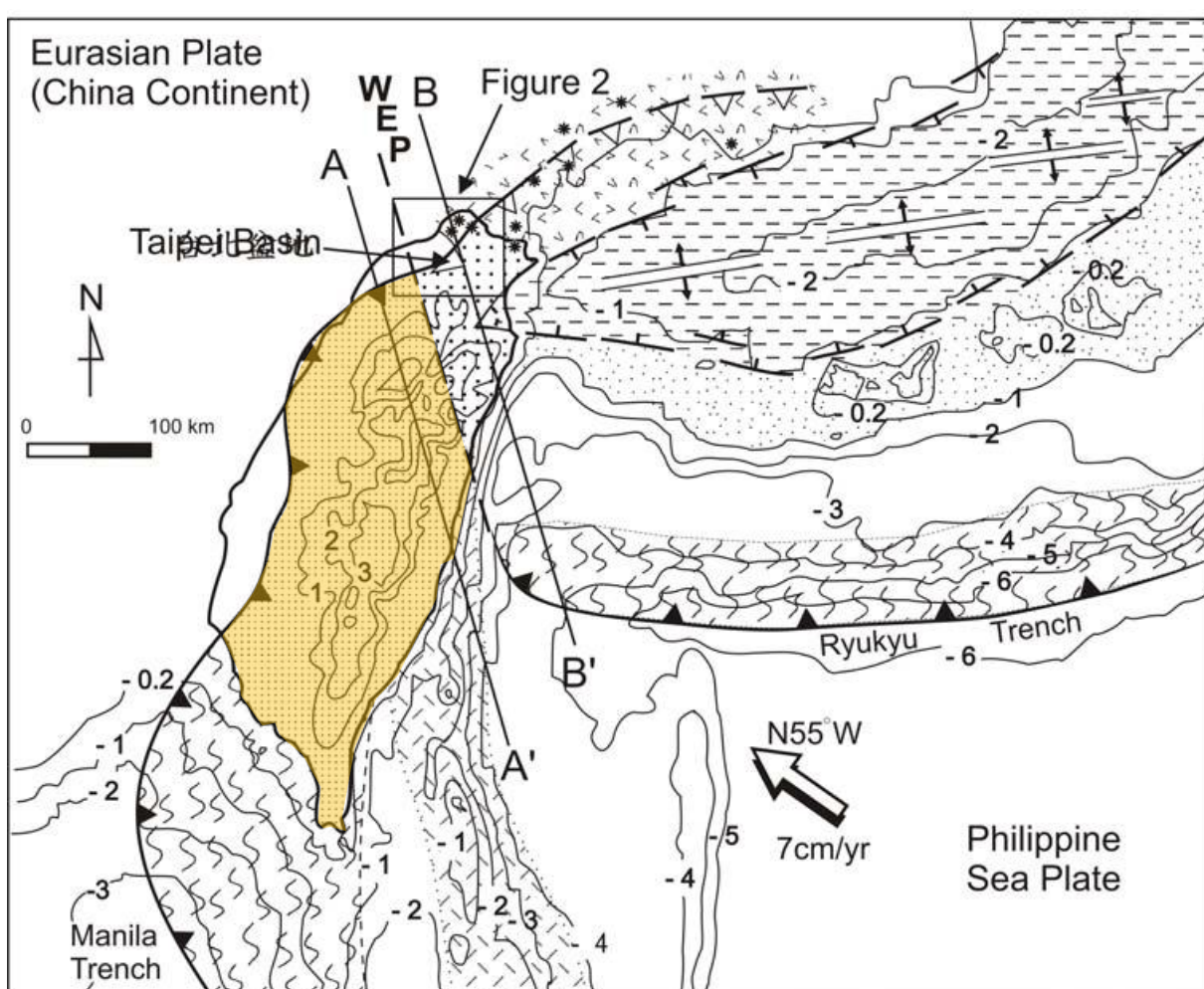


Fig. 3.






Collision between the Luzon arc and the China continent.

Taipei Basin is located in the collapsing orogen of northeastern Taiwan.






 Active Deformation Front
  Inactive Deformation Front

WEP: Surface project of Western edge of Subducted Philippine Sea Plate

Luzon Arc System

-  Collision Orogen
-  Accretionary Wedge
-  Volcanic Arc

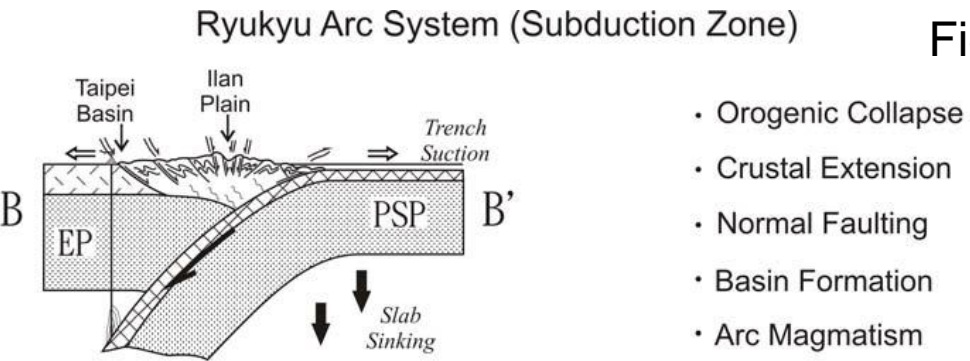
Ryukyu Arc System

-  Volcanic Arc
-  Non-Volcanic Arc
-  Okinawa Trough
-  Collapsing Orogen
-  Accretionary Wedge

Why ?

Fig. 5.

Taipei Basin sits on the frontal part of the collapsing orogen with arc magmatism in the north.



Flip of Subduction at WEP

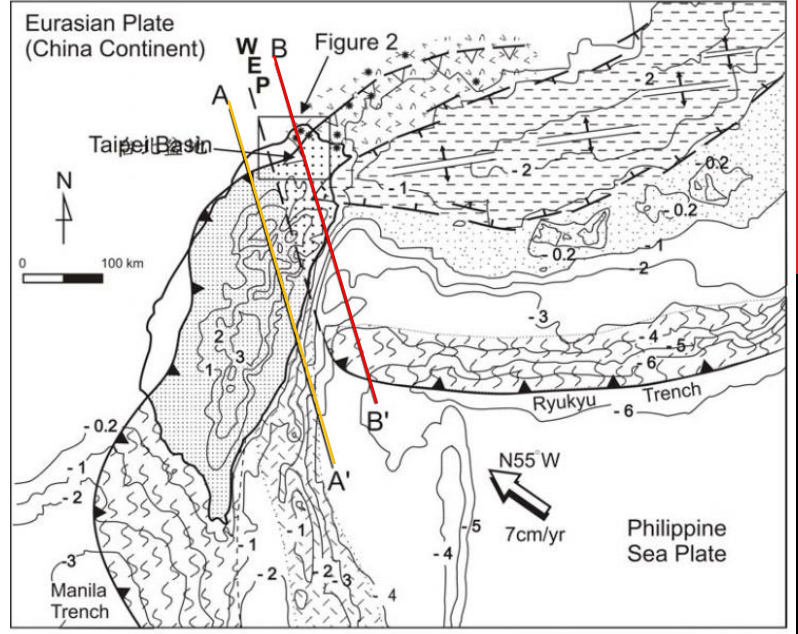
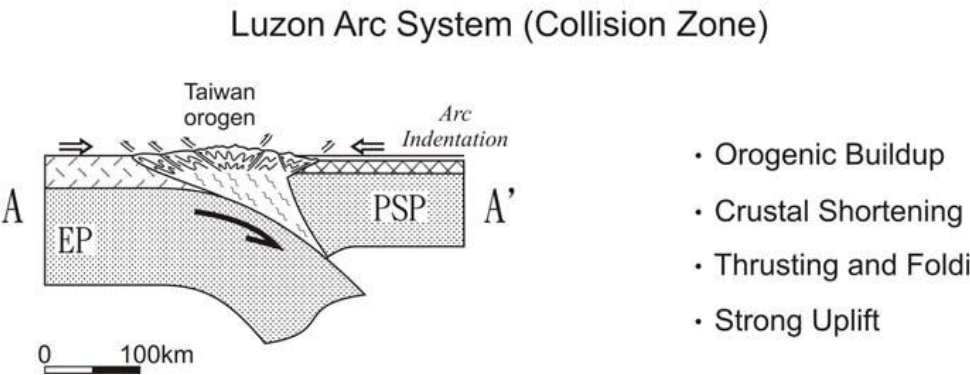
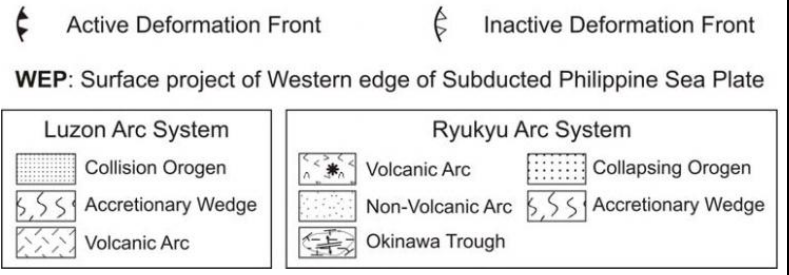


Fig. 5.



Before the subduction polarity flipped, the Basin was part of the rising orogen.

Fig. 6.

Outline

1. Introduction
2. Geological setting
- 3. Data and results**
 - Stratigraphic records
4. Evolutionary history
5. Discussions
6. Conclusions

Data and results

- Stratigraphic records

(1) Linkou Tableland:

- Linkou Formation in the east.

- Tananwan Formation in the west.

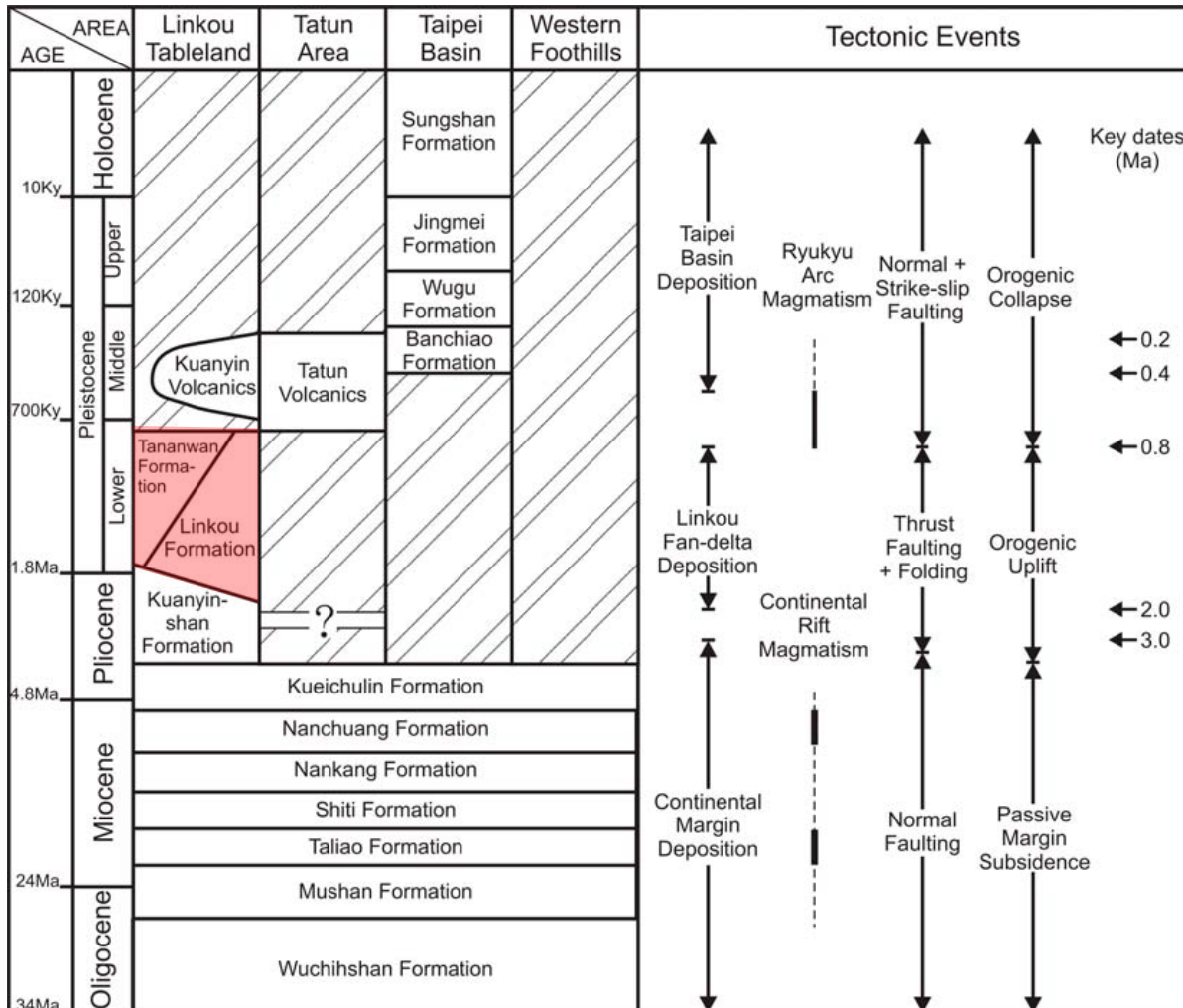
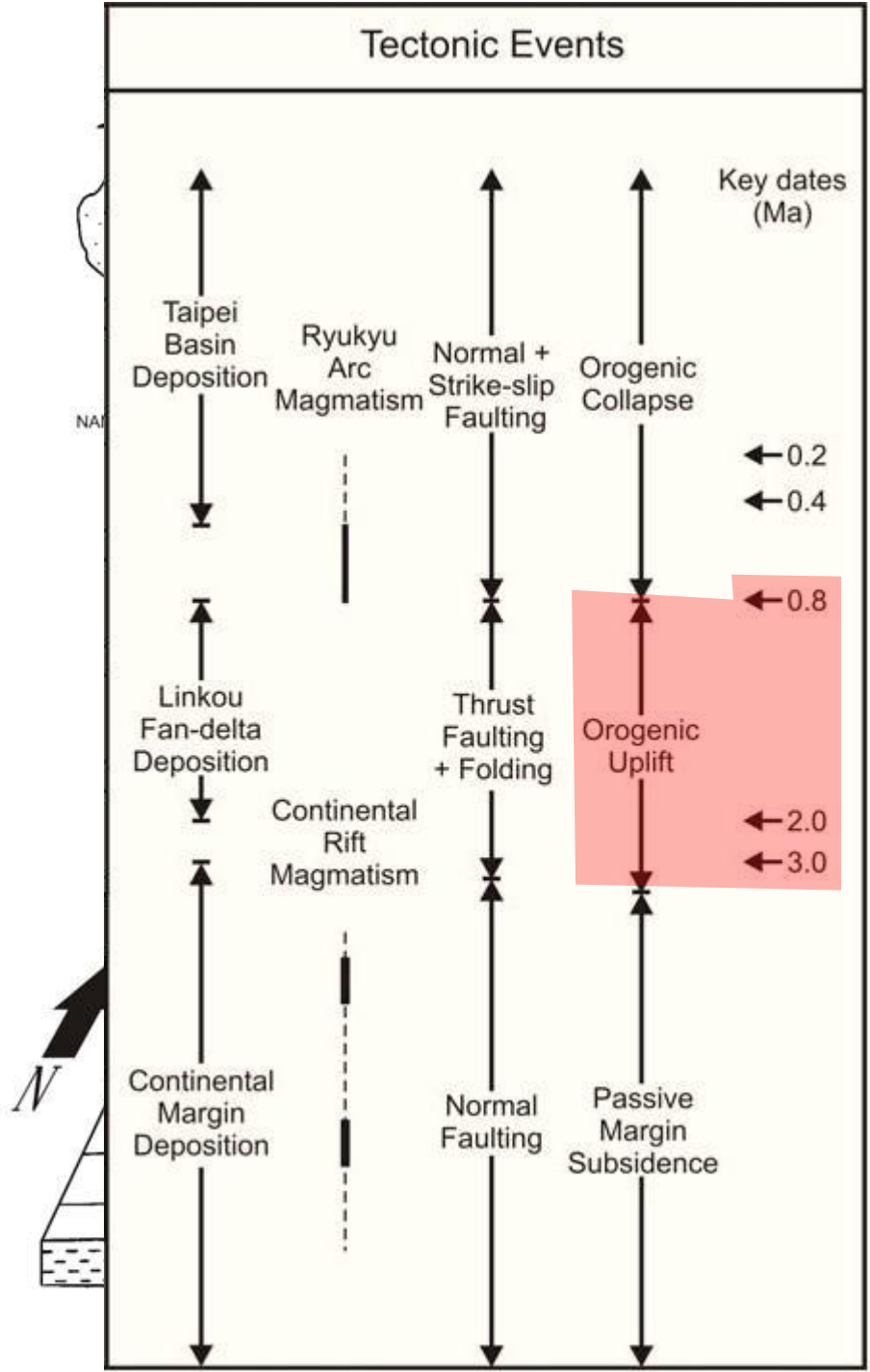


Fig. 7.

According to Chen and Teng (1990), the Linkou-Tananwan strata were accumulated in a fan delta system.

Magnetostratigraphic analysis:
Orogenic uplift in the Taipei Basin, was initiated at about 3 Ma and terminated at around 0.8 Ma.



(2) The ages of the Tatun volcanics:

From fission-track and K-Ar dates, the ages of the Tatun volcanics range from **0.8** to **0.2** Ma.

(3) Borehole data:

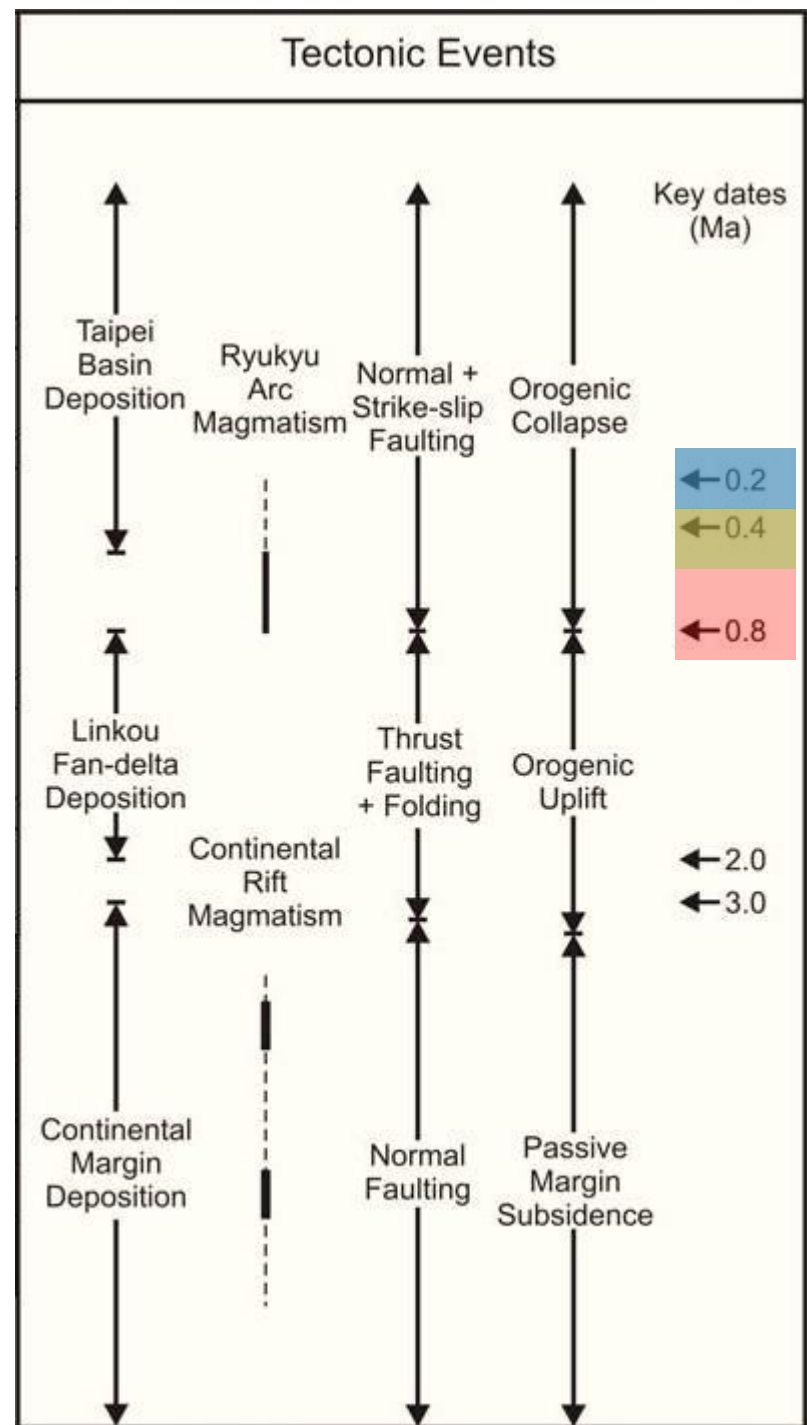
- WG-1

Chen *et al.* (1995) obtained an Ar-Ar age of **0.4** Ma from a volcanoclastic layer in the lower part.

(4) Lahar and lacustrine mud:

The mud usually forms in deep anoxic lakes of humid tropical areas.

- **A dammed-lake event, about 0.2 Ma.**



(5) Jingmei Formation:

About 30 ka, the Tahan River diverted to the Taipei Basin.

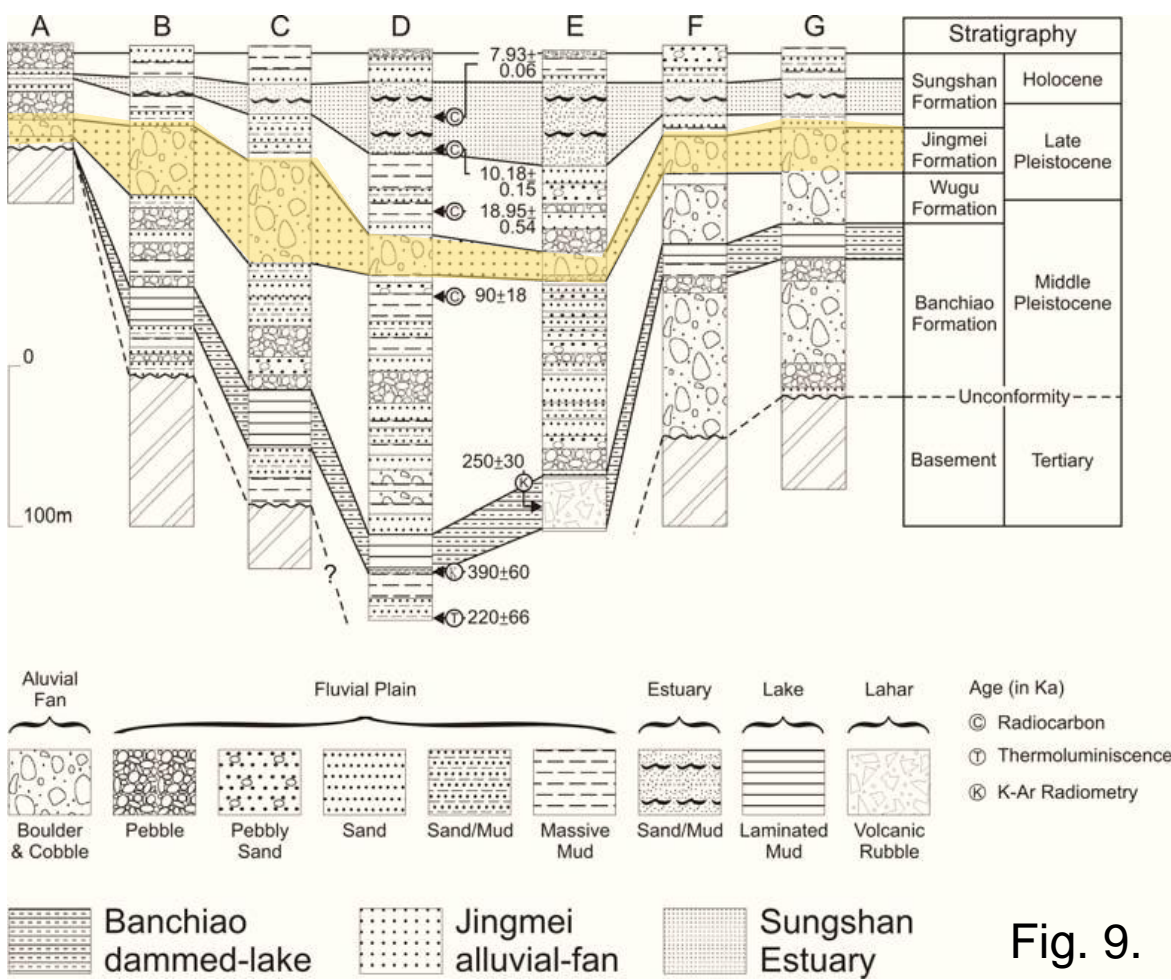
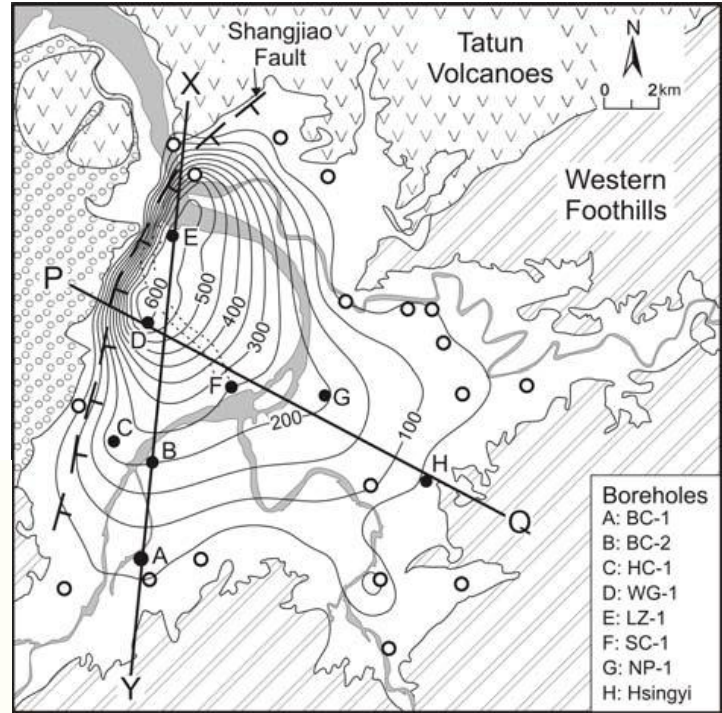


Fig. 3.



(6) Sungshan Formation:

The Basin was invaded by marine transgression and became a **brackish-water bay** in early Holocene time.

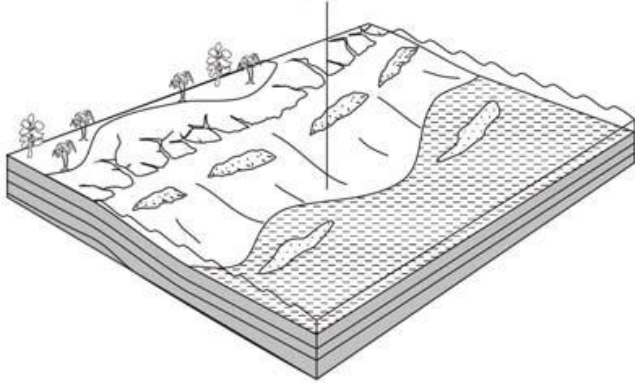
Fig. 9.

Outline

1. Introduction
2. Geological setting
3. Data and results
 - Stratigraphic records
4. Evolutionary history
5. Discussions
6. Conclusions

Evolutionary history

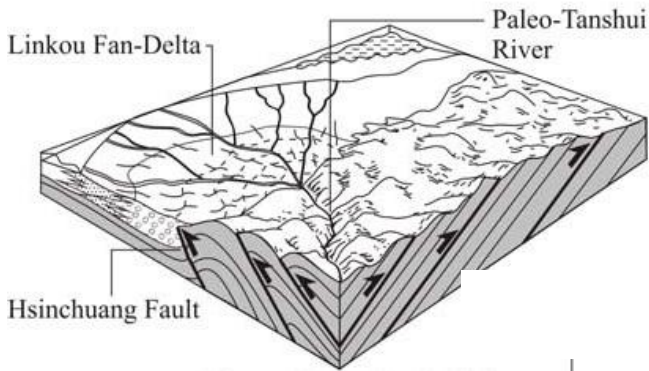
Future Taipei Basin Area



A. 6 Ma

- Passive continental margin
- Coast-shelf deposition
- Slow subsidence

- Passive continental margin



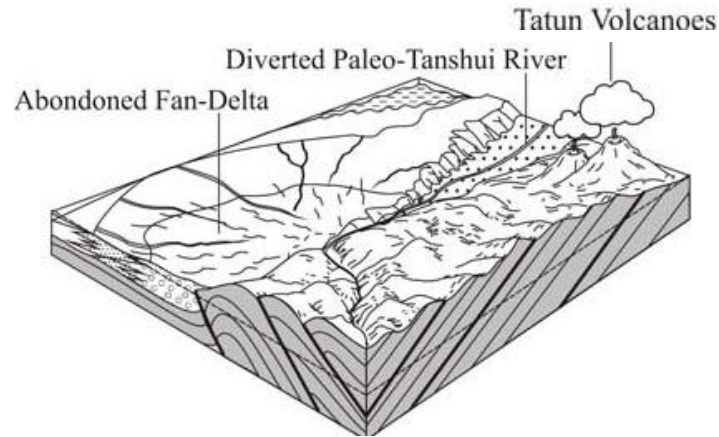
B. 2 Ma

- Mountain building
- Thrusting and folding
- Linkou Fan-Delta deposition

- Collision orogeny reached the climax.
- Linkou tableland **thrust** by the Hsingchuang Fault.

Fig. 12.

- Collisional orogeny ceased.
- Tatun volcanism commenced.
- Deposition of the Linkou fan-delta ceased.



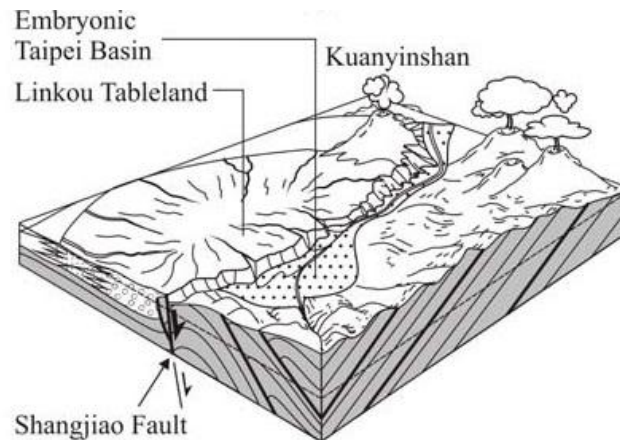
C. 0.8 Ma

- Orogenic collapse initiated
- Tatun volcanism began
- Paleo-Tanshui River diverted
- Linkou fan-delta abandoned

Unknown why.

- Volcanism intensified.
- Shangjiao Fault activated.

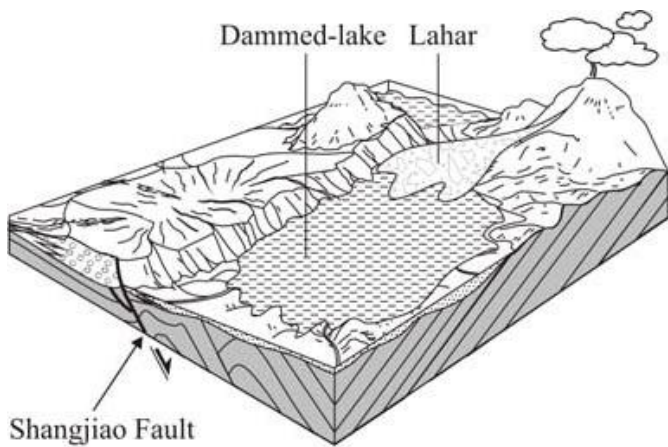
Taipei Basin deposition begins.



D. 0.4 Ma

- Taipei Basin deposition begins
- Shangjiao Fault activated
- Linkou Tableland uplifted
- Volcanism intensified

Fig. 12.

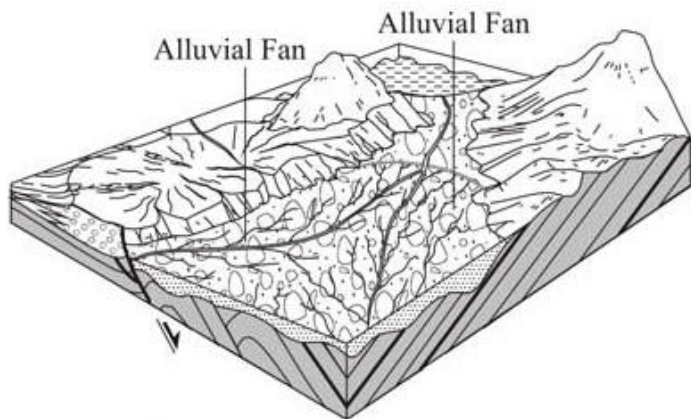


E. 0.2 Ma

- Tatun volcanism dwindled
- Taipei Basin dammed-up
- Deep lake deposition

- Tatun volcanism decreased.

Dammed lake.



F. 30 Ka

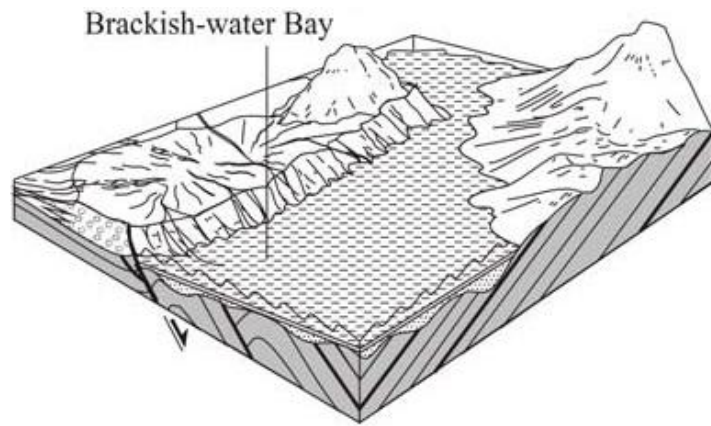
- Continued subsidence
- Tahan River diverted
- Alluvial Fans dominated

- Tahan River was diverted into the Basin.

Jingmei Formation.

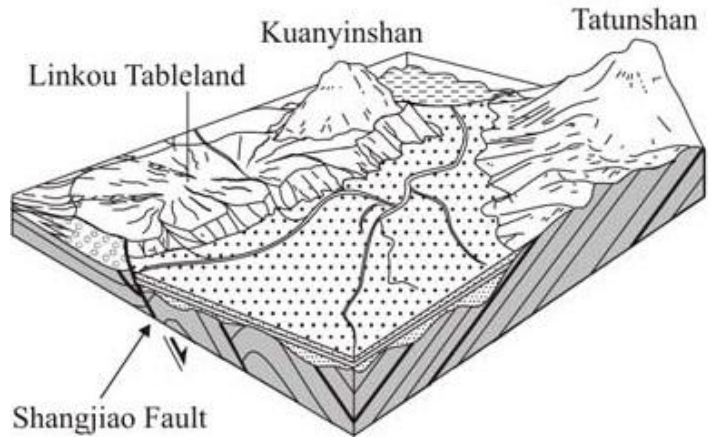
Fig. 12.

- marine transgression.



G. 6 Ka

- Continued subsidence
- Marine transgression
- Estuarine deposition



H. Present

- Continued subsidence
- Sediment progradation
- Fluvial deposition

Fig. 12.

Outline

1. Introduction
2. Geological setting
3. Data and results
 - Stratigraphic records
4. Evolutionary history
5. Discussions
6. Conclusions

Discussions

1. Makiyama (1933), **dammed lake**.

2. Tan (1939), Taipei Basin formed by the downfall of hanging wall along the **Shangjiao Fault**.

3. The gravels in the Taipei Basin are **younger** than in the Linkou gravel.

4. Modal:

The most dubious part of this model is the diversion of the Paleo-Tanshui River.

They believe that the Linkou fan-delta was abruptly deserted !

Outline

1. Introduction
2. Geological setting
3. Data and results
 - Stratigraphic records
4. Evolutionary history
5. Discussions
6. Conclusions

Conclusions

1. Taipei Basin was formed by collision between the China continent and the Luzon Arc in Pliocene-Quaternary time.
 2. About **2 Ma**, the collision orogeny reached the climax, and the Linkou tableland thrust by the Hsingchuang Fault.
 3. About **0.8 Ma**, the subduction polarity flipped in northeastern Taiwan, and the mountain range began to collapse.
- Ryukyu arc magmatism produced massive andesitic volcanics in the Tatun area.

Then, the Hsingchuang Thrust Fault was transformed into the **Shangjiao Normal Fault**.

4. About **0.4 Ma**, sediment began to accumulate in the Taipei Basin.

5. Around **0.2 Ma**, the Basin was dammed up as a deep freshwater lake by a pyroclastic flow from the Tatun volcanoes.

6. As the Tahan River was diverted into the Basin at **30 Ka**, it brought in a large amount of gravelly sediment.

7. In early **Holocene** time, the Basin was inundated by marine incursion and turned into a brackish-water bay, which was eventually filled up to its present configuration.

Thanks for your listening !