

I. INTRODUCTION

- In southern Taiwan, mud volcanoes are common near the axis of faults and anticlines in the Coastal Plain and Western Foothills, where the geology is dominated by the 3-5-km-thick Gutingkeng mudstone formation, late Miocene to Pleistocene in age. Previous researchers reported the possibility of a southwest striking right-lateral strike-slip fault in the Holocene Coastal Plain based on InSAR and GPS data (Fig 1). The inferred fault trace is associated with a topographic scarp and with the presence of the Gunshuiping mud volcano (Yanchao, Kaohsiung) (Fig 2).
- This leads us to investigate the kinematics of the active fault during the Holocene and its relation with the formation of the mud volcano. Since that allows us to have a better understanding of mud volcanoes as an indicator of tectonic activity.

We consider two possible scenarios for the formation of mud volcanoes

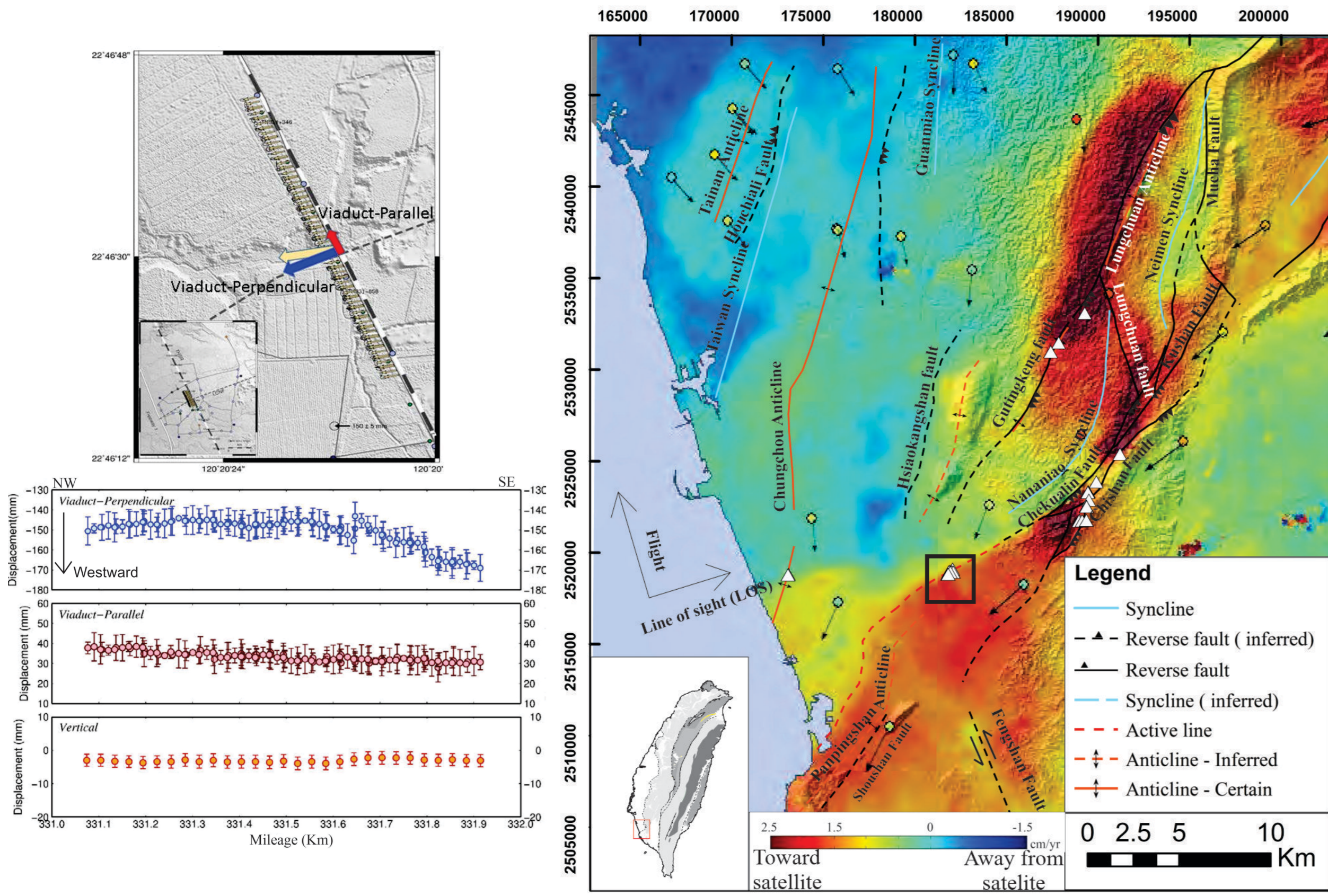
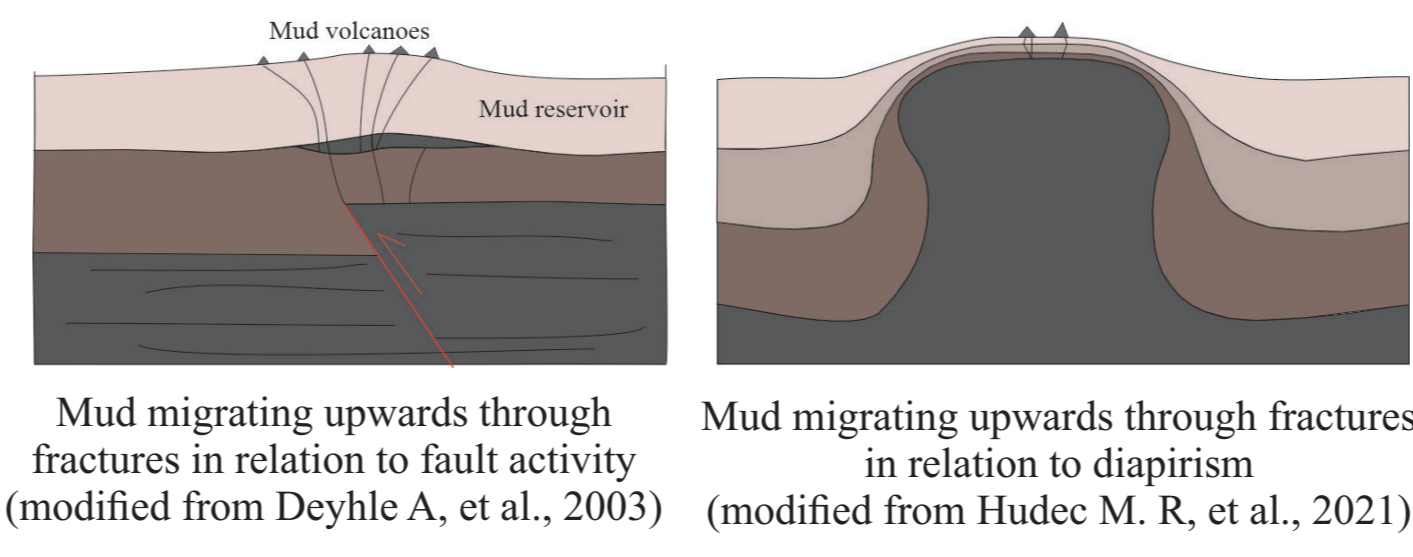


Figure 1. (a) The displacement of GPS continuous station along Taiwan High Speed Rail (THSR) in the northeast side of Gunshuiping area from October 2015 to June 2018 with the reference point is KMM in 2Kimen, Taiwan (Chao, 2019). (b) InSAR line-of-sight velocity field based on ALOS images (Pathier et al., 2014)

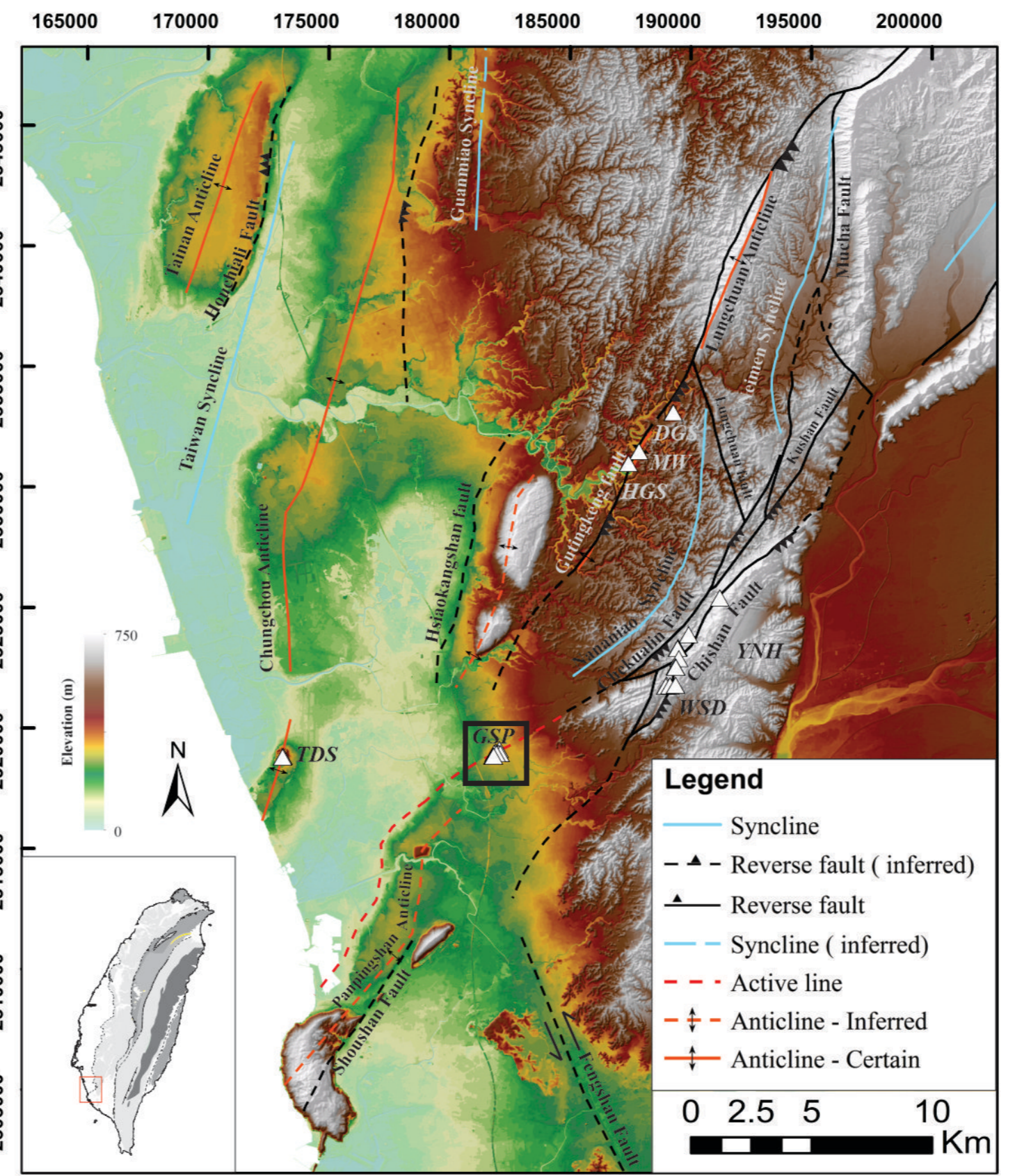


Figure 2. Geological and inferred active structures of the southwestern Taiwan, black rectangle indicates Gunshuiping area

II. GEOLOGICAL SETTING

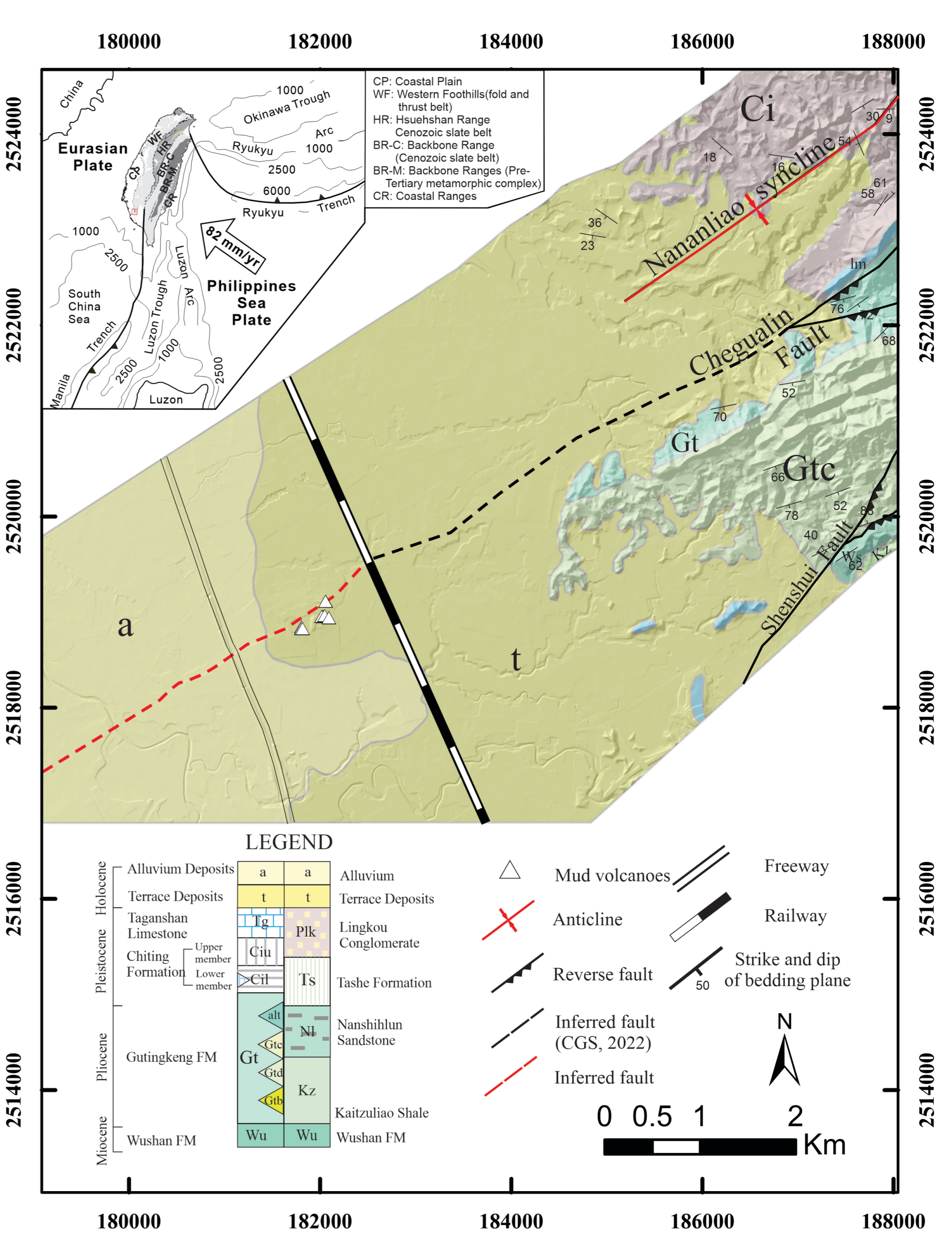


Figure 3. Geologic map showing the location of research area (black rectangle) in Yanchao, Kaohsiung, Taiwan (modified from Central Geological Survey)

III. METHODOLOGY

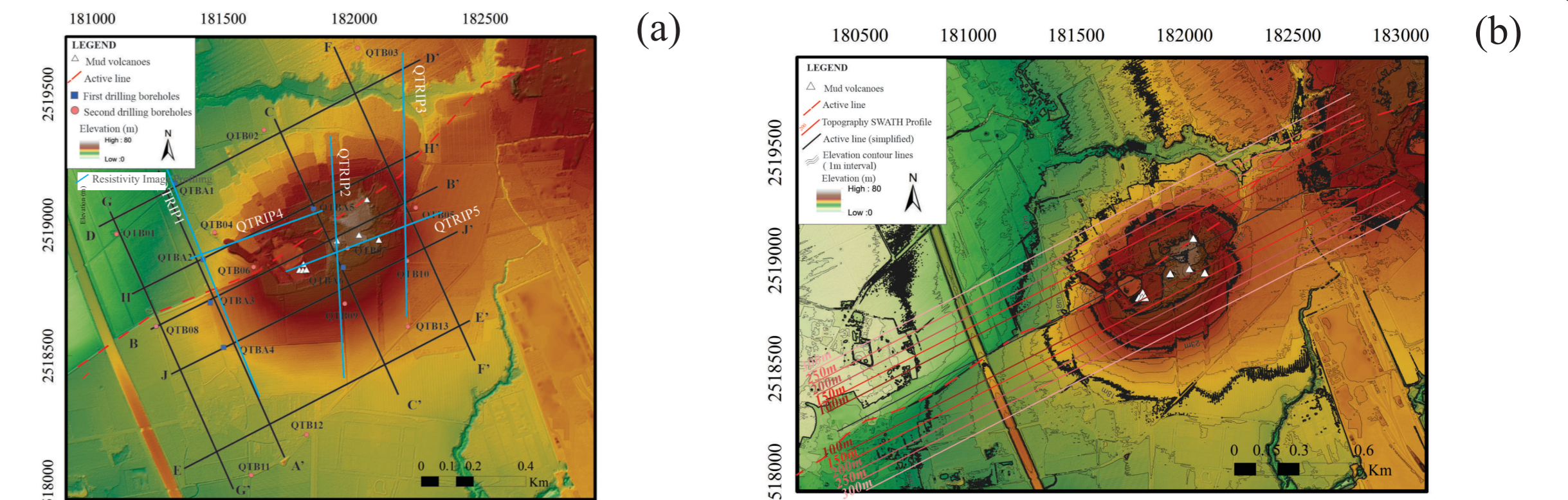
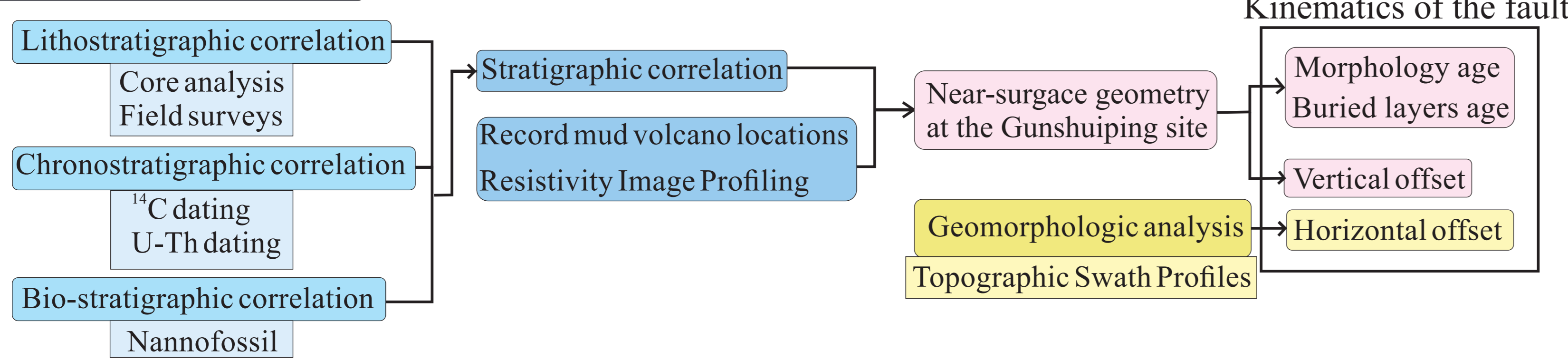
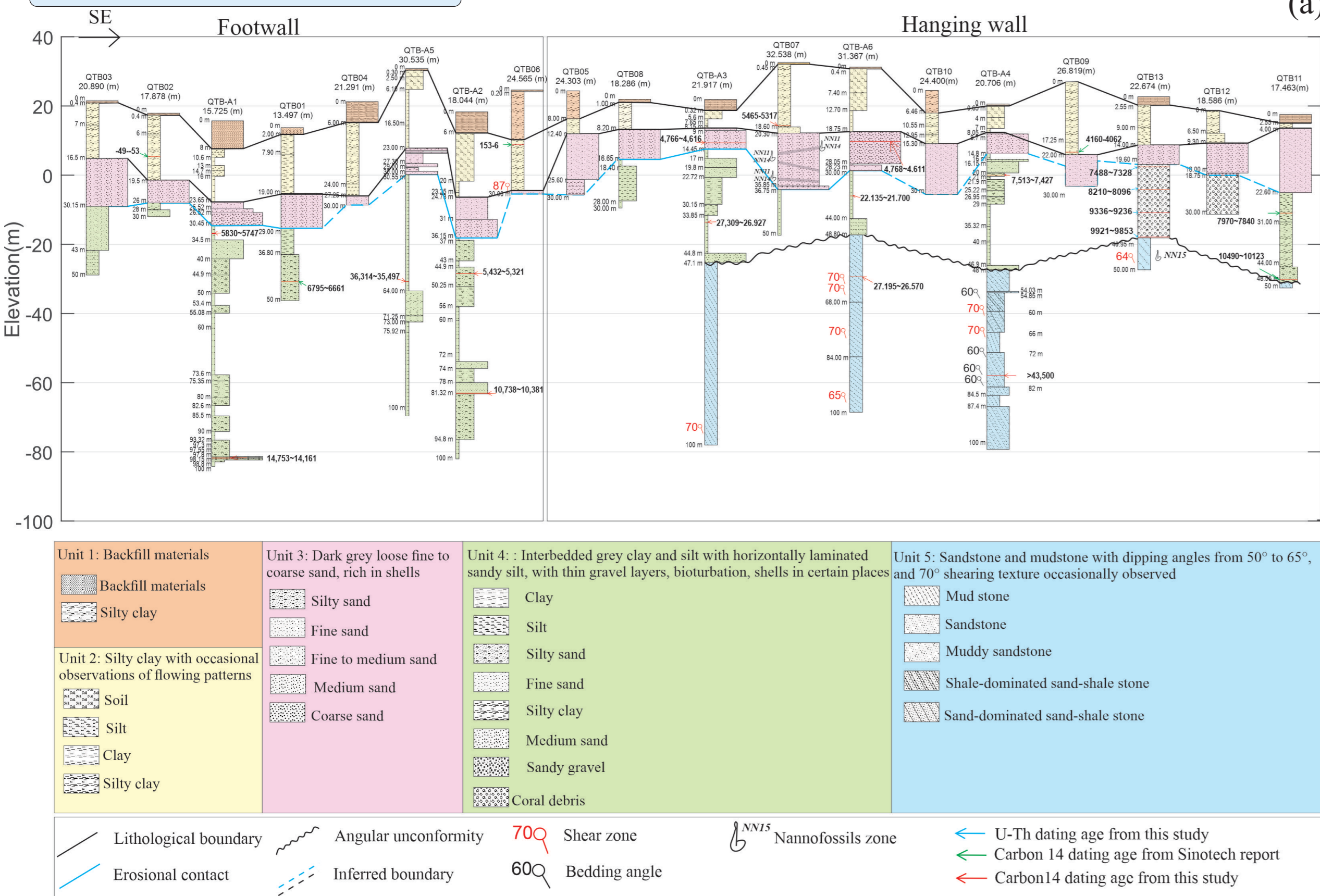


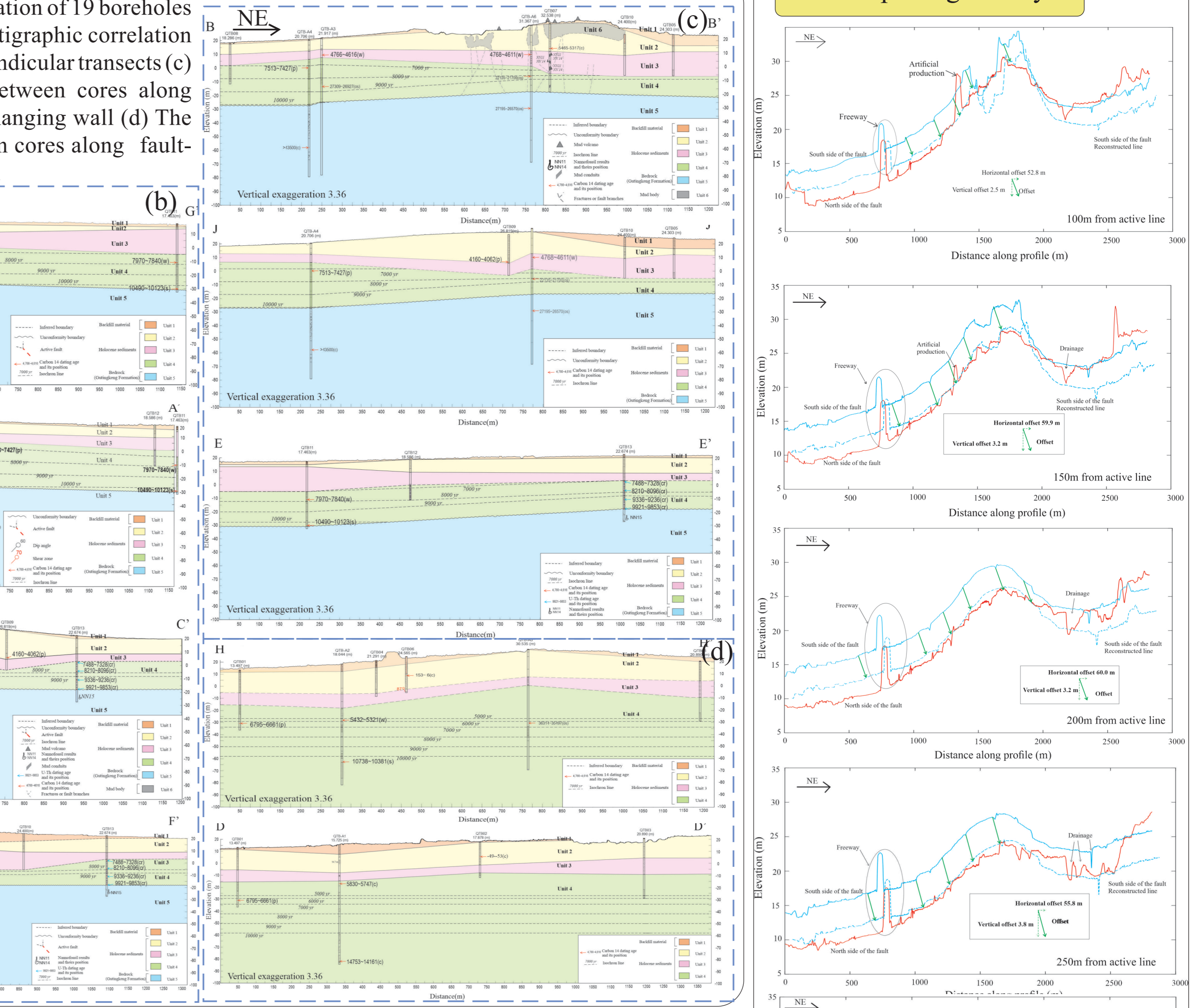
Figure 4. (a) Location of boreholes, RIP and stratigraphic correlation profile (b) The distribution of Topographic swath profiles along the mud volcanoes area

IV. RESULTS AND DISCUSSION

Stratigraphic correlation



Geomorphologic analysis

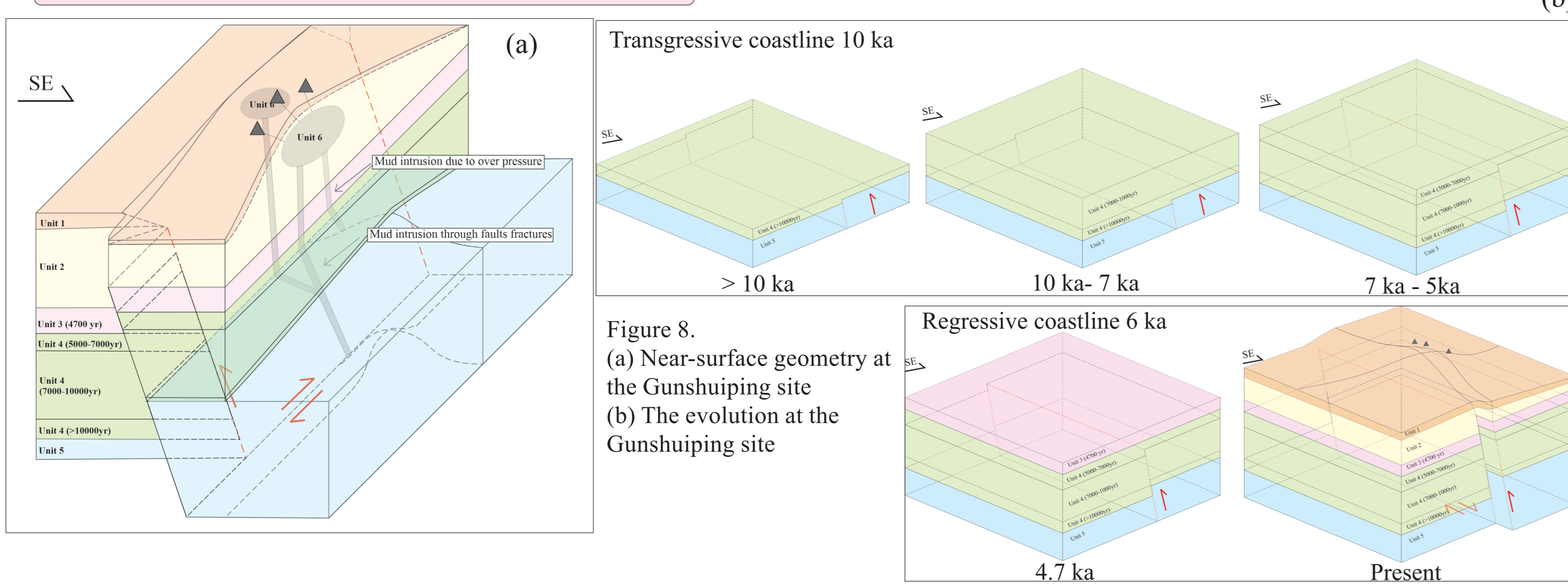


The observation that Unit 3 remains sub-horizontal in the fault-parallel sections, while the topography is dome-shaped is the remarkable point suggesting the formation of Gunshuiping mud volcanoes in relation to mud migrating upwards through faults, and fractures.

The configuration of Unit 3 is irrelevant to the topography suggested the maximum age of the topography is the age of the base of Unit 2 (4160-4067)

The formation of this topography was formed by mud bodies near the surface and mudflow on the surface

Near-surface geometry at the Gunshuiping site



- Gunshuiping site was in the shallow marine depositional environment from 10 ka to 5 ka.
- The 4.7 ka period marked the changing of the depositional environment in Gunshuiping, which has recorded coastline regression events until now.

Vertical displacement from buried layers

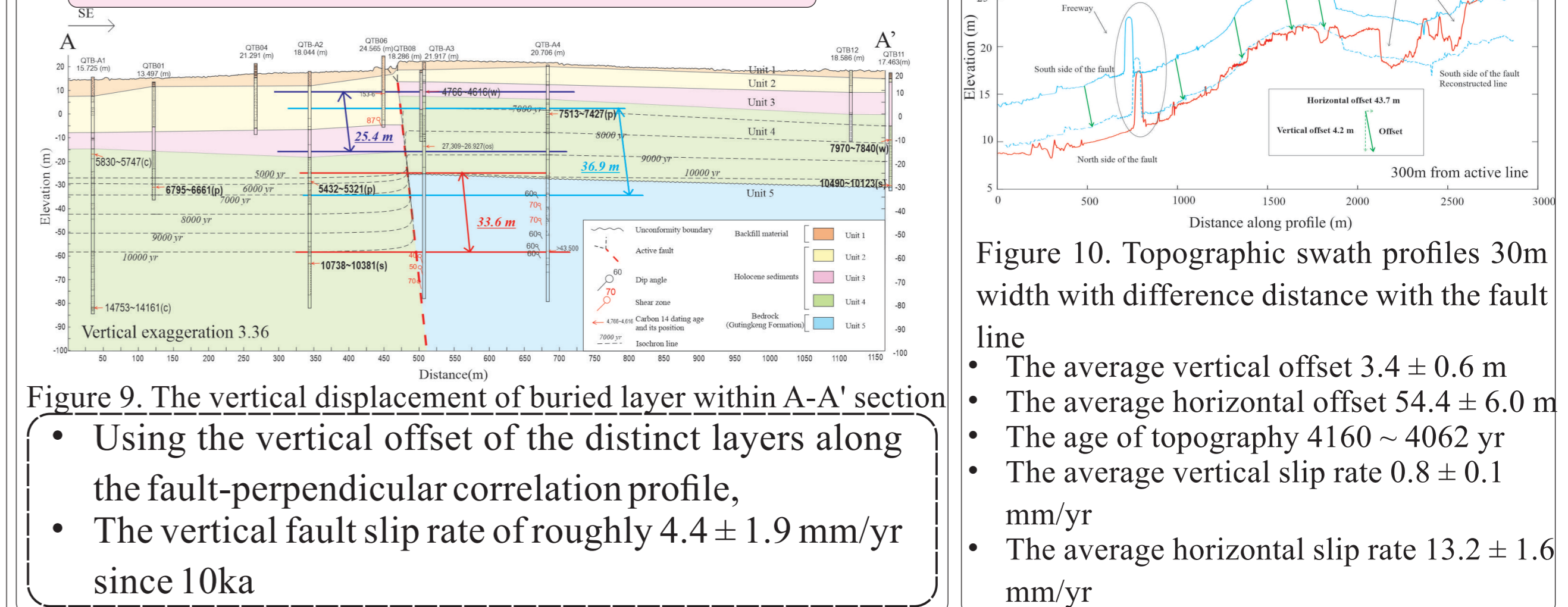


Figure 9. The vertical displacement of buried layer within A-A' section

- Using the vertical offset of the distinct layers along the fault-perpendicular correlation profile,
- The vertical fault slip rate of roughly 4.4 ± 1.9 mm/yr since 10ka

V. CONCLUSIONS

- By the evidence from Holocene strata, the formation of Gunshuiping mud volcanoes in relation to mud migrating upwards through fractures in relation to fault activity
- As a result, the maximum age value for this topography will be 4160 - 4062 years. The horizontal slip rate has values of 13.2 ± 1.6 mm/yr
- The vertical fault slip rate was determined to be roughly 4.4 ± 1.9 mm/yr since 10ka