

## 利用地質剖面探討初鄉活動斷層構造特性

報告者：張中威

指導教授：黃文正 老師

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### 摘要

初鄉斷層位於台灣西部麓山帶車籠埔斷層與雙冬斷層之間，呈東北-西南走向的活動斷層，西南側併入車籠埔斷層，東北側向雙冬斷層延伸。1999 年台灣中部的集集地震，車籠埔斷層沿線形成約 100 公里的地表破裂，根據同震地表 GPS 資料顯示，跨初鄉斷層的地表同震位移方向有顯著差異，然而未有報導指出初鄉斷層跡沿線有同震的地表變形。根據台灣機率式地震危害度分析，指出初鄉斷層在未來 50 年內有高達 37% 的機率發生規模 6 的地震，為了解初鄉斷層再活動風險，須建立初鄉斷層的三維構造幾何模型，然而，過往研究對於初鄉斷層的幾何形貌有所爭議，且在幾何上難與車籠埔斷層模型連接。因此，了解初鄉斷層與周圍構造之間的幾何關係對於地質模型至關重要。

本研究前期將使用前人地質圖資，搭配地質鑽探與震測資料，參考前人的構造模型、集集地震同震 GPS 位移向量及地震資料，建立東西向的五條地質剖面，觀察初鄉斷層與相鄰構造的關係。根據本研究地質剖面，初鄉斷層由北向南漸變向西擴展，錯距由北向南漸增，南段與車籠埔斷層相連接於深度約 8 至 9 公里的底滑脫面；1999 年集集地震時，車籠埔斷層沿深部底滑脫面滑移，並在淺部以錦水頁岩為弱面滑動，造成車籠埔斷層整體上盤抬升，包含初鄉斷層，因此初鄉斷層沿線並沒有相對於斷層上下盤的地表變形。

**關鍵字：**初鄉斷層、地質模型、地質剖面

# **Determination of Structural Characteristics of the Chusiang Active Fault Using Geological Cross-Sections**

Presenter : Chung-Wei Chang

Advisor : Prof. Wen-Jeng Huang

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## **Abstract**

The Chusiang fault in Taiwan's western foothills is located between the Chelungpu fault and the Shuangtung fault. It strikes northeast to southwest, extending northeastwards to the Shuangtung fault and southwestwards merging into the Chelungpu fault. During the 1999 Chi-Chi earthquake, the surface rupture of the Chelungpu fault extended over 100 km. The coseismic GPS data shows that the horizontal displacement direction has changed significantly across the Chusiang fault. However, there are no reports of relative uplift or surface ruptures along the Chusiang fault trace. According to Taiwan's Probabilistic Seismic Hazard Analysis, there is a 37% chance that the Chusiang fault will cause a magnitude 6 earthquake in the next 50 years. To understand the risk of the Chusiang fault reactivation, it is necessary to construct a geological model. However, previous studies have debated the geometry of the Chusiang fault and it is difficult to connect with the Chelungpu fault model geometrically. Therefore, it is critical to understand the geometric relationship between the Chusiang fault and the surrounding structure for the geological model.

The early stage of this study combined geological maps, boreholes, seismic reflection profiles, previous structural models, coseismic GPS displacements, and earthquake events. This data was used to construct five east-west geological cross-sections to understand the relationship between the Chusiang fault and surrounding structures. According to the geological cross-sections, the displacement of the Chusiang fault gradually increases from north to south, and the southern section is connected with the Chelungpu fault at the detachment, which has a depth of about 8 to 9 kilometers. During the 1999 ChiChi earthquake, the Chelungpu fault slipped along the deep detachment. At the shallow subsurface, it slid along the Chinshui shale and uplifted the whole hanging wall of the Chelongpu fault, including the Chusiang fault. Therefore, there is no relative uplift and surface ruptures along the Chusiang fault.

**Keywords:** Chusiang fault, geological model, cross-section