臺灣西南部車瓜林斷層之變形機制及變形行為

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摘要

車瓜林斷層為東北-西南走向的逆滑斷層，斷層跡主要分布於泥岩為主的古亭坑層中，許多研究皆指出此斷層具有潛移的活動性；車瓜林斷層的活動使位於其斷層跡上的國道 3 號高架橋產生破壞，斷層跡推測向西南延伸至國道一號，未來該區也計畫設置科學園區，因此了解車瓜林斷層的活動形式有其重要性。本研究參考前人對車瓜林斷層帶內的岩體單元分類，分別於斷層露頭及岩心採取樣本，包括淺灰色泥岩、灰色泥岩、黃色破碎泥岩及黑色破碎泥岩；樣本以光學及掃描式電子顯微鏡、X 光粉末繞射進行微組構及礦物組成分析，嘗試了解斷層帶的變形機制及岩體單元礦物組成，並且推論斷層可能的活動形式。

光學顯微鏡觀察結果顯示斷層岩中的黑色條帶有礦物顆粒變形、破碎及優勢排列現象，透過掃描式電子顯微鏡觀察顯示，黑色條帶與基質相比有粒徑細化且伊萊石呈優勢排列，因此認為黑色條帶為斷層作用下透過壓碎作用產生，可做為岩體單元變形程度的指標，進而推論黑色破碎泥岩為車瓜林斷層的主要滑動面。全岩粉末 X 光繞射指出黏土礦物相對豐度隨變形程度提高而增加，且以伊萊石增加幅度最明顯；黏土礦物 X 光繞射則指出，淺灰色、黃色及黑色破碎泥岩樣本中存在膨潤石，透過伊萊石疊型及化學指標說明樣本中的伊萊石主要為碎屑源，因此推論黏土礦物增加主要由斷層作用造成；與黃色破碎泥岩相較之下黑色破碎泥岩中伊萊石豐度增加，膨潤石豐度則減少，顯示在斷層作用下以生成伊萊石為主，基於前人對膨潤石-伊萊石礦物相轉變的研究，推論車瓜林斷層同時也具有瞬間錯移引致地震的潛能。

關鍵字：車瓜林斷層、微觀構造、礦物組成

Deformation mechanism and behavior of the Chegualin active fault in SW Taiwan

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Abstract

The Chegualin fault is an active fault striking NE-SW, with the fault trace mainly distributed in the Gutingkeng formation. The creeping movement of the fault caused damage to the viaduct of highway No.3. Furthermore, the fault trace was speculated to extend to the southwest. Greenfield of Ciaotou science park also sits nearby the fault trace. Therefore, it is important to understand the faulting behavior of the Chegualin fault. This research adopts samples from the fault outcrop and rock core including light gray mudstone from the wall rock and gray mudstone, yellowish mudstone, and black mudstone from the fault zone. An Optical microscope and SEM were used to observe the microstructure of the samples. XRD was performed to develop the mineral assemblages. Based on these methods, this research attempts to understand the deformation mechanism and faulting behavior of the Chegualin fault.

Mineral grains were found fractured and bent in the black bands within the fault rocks under microscope observation. Through SEM observation, most of the clay fabrics in the matrix are randomly oriented. In contrast, the black bands are characterized by the preferential alignment of clays and quartz grains with shape-preferred orientation. Grain size reduction can also be observed in the black bands. These occurrences suggest that the black bands were formed by cataclasis during the faulting. Moreover, we can use black bands as deform parameters and conclude that the black mudstone is the principal slip zone of the Chegualin fault. The whole rock XRD patterns indicate that the content of clay minerals increase with the increasing deformation intensity, especially illite. The smectite was found in the light gray mudstone, yellowish mudstone and black mudstone. Based on the illite polytype and illite chemistry index, the origin of illite is detrital. This Suggests that the enrichment of clay was mainly caused by the faulting. Compared with yellowish mudstone, the content of illite increases and smectite decreases in the Black mudstone. This reveals that during faulting the illite-smectite reaction tends to form illite. Based on the previous research about illite-smectite reaction, we infer that the Chegualin fault also has potential to create seismic-slip.

Keywords: Chegualin fault, Microstructures, Mineral component