行政院國家科學委員會專題研究計畫 成果報告

台灣西南海域大陸與海洋相互作用特性--台灣西南海域大地構造形貌及沉積物散佈研究

研究成果報告(精簡版)

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附件一

行政院國家科學委員會補助專題研究計畫 □X 成果報告 □期中進度報告

台灣西南海域大陸與海洋相互作用—總計畫及子計畫--：台灣西南海域大地構造形貌及沈積物散佈研究

計畫類別：□ 個別型計畫　　□X 整合型計畫
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共同主持人：
計畫參與人員：　張日新

成果報告類型(依經費核定清單規定繳交)：□X 精簡報告　□完整報告

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□出席國際學術會議心得報告及發表之論文各一份
□國際合作研究計畫國外研究報告書一份

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執行單位：台灣大學海洋研究所

中　華　民　國　96 年　10　月 22　日

一、中文摘要：

台灣西南區域沈積物的散佈系統主要由兩部份組成：(一)陸上的流域(drainage)盆地及(二)外海的接收海洋盆地。其邊界為今日的海岸線，即最終基準面(ultimate base level)。控制陸源沈積物輸送到外海主要的機制是海水面變化。由平面來看，台灣西南區域沈積物的散佈系統主要包含五個地形環境單元：(一)高屏溪流域盆地，(二)狹窄的高屏陸棚，(三)廣闊的高屏陸坡、(四)高屏海底峽谷及(五)馬尼拉海溝最北端。高屏溪流域盆地面積約三千二佰伍拾平方公里，為一小型的過度充填的前陸盆地，主要接受來自台灣西南區域造山帶的沈積物。高屏海底峽谷由高屏溪口開始向西南伸展，切過狹窄的高屏陸棚及廣闊的高屏陸坡最後併入馬尼拉海溝最北端，全長約二佰六十公里。台灣西南區域沈積物的散佈系統的特徵包括河口--海底峽谷的連結，狹窄的陸棚以及在海底峽谷頭部頻繁的高密度流事件。

以區域性源—匯的觀點，高屏溪流域盆地是主要的沈積物源頭，狹窄的高屏陸棚是路過不停帶，廣闊的高屏陸坡是沈積物暫時的匯集處而馬尼拉海溝是最終的沈積物匯集區。震測剖面顯示高屏陸棚外部及高屏陸坡上部產生崩塌沈積物，由重力下滑搬運至高屏陸坡下部，充填了一些位於泥貫入体間的小凹陷或小盆地。

現今高屏溪的沈積物大多在洪泛時期以高密度流的方式傳輸到高屏海底峽谷，暫時堆積在峽谷頭部。如果以十年及百年的尺度考量，堆積在峽谷頭部的沈積物終究被下坡沈積物流搬運到峽谷下段。目前高屏海底峽谷可視為台灣西南區域造山帶沈積物輸送到馬尼拉海溝的主要管道。震測剖面顯示高屏海底峽谷中的可能濁流強烈地侵蝕下切高屏陸坡，並且把堆積在峽谷頭部的沈積物，搬運到峽谷的中段及下段。峽谷的中段是沈積物路過不停帶，而峽谷的下段，可能是沈積物匯集處或是沈積物的管道，取決於在峽谷演變歷史中，當時堆積與侵蝕作用相對的強弱力量。高屏海底峽谷的長度及谷軸坡度與亞馬遜海底峽谷截然不同，這種強烈的差異性意味著高屏海底峽谷是一個活躍的沈積物輸送管道，台灣西南陸源沈積物的最終宿命就是匯集在馬尼拉海溝。

關鍵字：沈積物散佈、山地河流、海底峽谷、河口--峽谷連結、台灣

二、Abstract：

The sediment dispersal system in southwestern Taiwan margin consists of two main parts: the subaerial drainage basin and the offshore receiving marine basin. In plan view, this sediment dispersal system can be further divided into five geomorphic units: (1) the Kaoping River drainage basin, (2) the Kaoping Shelf, (3) the Kaoping Slope, (4) the Kaoping Submarine Canyon and (5) the Manila Trench in the northernmost South China Sea. The Kaoping River drainage basin is a small (3650 km^2), tectonically active and overfilled foreland basin, receiving sediments derived from the uprising Central Range of Taiwan with a maximum elevation of 3952 m. The Kaoping Canyon begins at the mouth of the Kaoping River, crosses the narrow Kaoping Shelf (~10 km) and the Kaoping Slope, and finally merges into the northern termination of the Manila Trench over a distance of ~260 km. The SW Taiwan margin dispersal system is characterized by a direct river-canyon connection with a narrow shelf and frequent episodic sediment discharge events in the canyon head.

In a regional source to sink scheme, the Kaoping River drainage basin is the primary source area, the Kaoping Shelf being the sediment bypass zone and the Kaoping Slope being the temporary sink and the Manila Trench being the ultimate sink of the sediment from the Taiwan orogen. It is inferred from seismic data that the outer shelf and upper slope region can be considered as a line source for mass wasting deposits delivered to the lower Kaoping Slope where small depressions between diapiric ridges are partially filled with sediment or are empty.

At present, recurrent hyperpycnal flows during the flood seasons are temporarily depositing sediments mainly derived from the Kaoping River in the head of the Kaoping canyon. On the decadal and century timescales, sediments temporarily stored in the upper reach are removed over longer timescales probably by downslope eroding sediment flows within the canyon. Presently, the Kaoping Canyon serves as the major conduit for transporting terrestrial sediment from the Taiwan orogen to the marine sink of the Manila Trench. Seismic data indicate that the Kaoping Canyon has been eroding the Kaoping Slope intensely by presumed hyperpycnal flows and transporting sediments from the canyon head to the middle and lower reaches of the canyon. The middle reach is a sediment bypass zone whereas the lower reach serves as either a temporary

sediment sink or a sediment conduit, depending on relative prevalence to deposition or erosion during canyon evolution. Contrast differences in channel gradient and travel length between the Kaoping and Amazon sediment dispersal systems suggest that the Kaoping River-Canyon system is an active sediment dispersal system for transporting terrestrial materials to the deep sea. The fate of the Kaoping River sediment is the northern Manila Trench.

Keywords: Sediment dispersal, mountainous river, submarine canyon, river-canyon connection, Taiwan

三、前言與研究目的：

本計畫預期在整合型計畫中負責研究區域內之海底地形、淺部地層構造、沈積物及海底峽谷的分佈及特性，這些結果將有助於瞭解板塊表面的特徵，尤其是其中的馬尼拉海溝向北延伸的各種地質現象釐清。目前國際的焦點在 Source to Sink，也就是說，臺灣西南部的造山帶沈積物，如何堆積在西南海域，這些淺海至半深海的沈積物特性，如何反映板塊聚合的初期碰撞效應，特別值得分合作研究。本年度計畫的重點在這個項目。

四、研究方法：

本計畫的執行，主要收集高屏陸坡之深部岩層的多頻道反射剖面(multi-channel seismic reflection profiles)，用來了解地層架構及區域構造變形作用。同時也收集台灣西南海域的高屏陸坡表層的高變頻反射剖面(CHIRP 剖面)，可以觀測到海床細部的地形起伏，高屏陸坡海床的地貌因此可以描繪出來。在高屏海底峽上段，採取表層沈積物樣本。本計畫整合海洋地質及海洋地球物理資料，配合沈積物源頭-匯集系統的觀念，及台灣西南區域沈積物的散佈系統的架構，進行綜合解釋。計畫主持人曾於 2006 年 9 月中旬赴美參加由 NSF 主辦的 Source to Sink Workshop，為期五天的研討會，獲益匪淺，對計畫收集到的資料詮釋，有直接的效果。

五、結果與討論：

本計畫研究部份結果已口頭發表於今年海洋學成果發表大會。並結合上一年度的研究成果，寫成一篇論文，投稿 Journal of Marine System (SCI 期刊)，已被接受，可能在 2008 年刊出。

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