



# Modern accumulation rates and a budget of sediment off the Gaoping (Kaoping) River, SW Taiwan: A tidal and flood dominated depositional environment around a submarine canyon

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## ABSTRACT

Ninety-two box cores collected during 2004–2006 from an area of ~3000 km<sup>2</sup> off the Gaoping (formerly spelled Kaoping) River, SW Taiwan, were analyzed for fallout radionuclides (<sup>210</sup>Pb, <sup>137</sup>Cs and <sup>7</sup>Be) to elucidate sedimentation rates and processes, and for the calculation of a sediment budget. The study area is located at an active collision margin with a narrow shelf and a submarine canyon extending essentially into the river's mouth. The results indicate fairly constant hemipelagic sedimentation in much of the open margin and for most of the time except in the inner shelf and along the axis of the canyon where sediment transport is more dynamic and is controlled by tidal current and wave activities constantly, and by fluvial floods or gravity-driven flows episodically. Sedimentation rates in the study area derived from <sup>210</sup>Pb and constrained by <sup>137</sup>Cs vary from 0.04 to 1.5 cm/yr, with the highest rates (>1 cm/yr) flanking the Gaoping canyon over the upper slope (200–600 m) and the lowest rates (<0.1 cm/yr) in the distal basin beyond the continental slope. The depocenter delineated from <sup>210</sup>Pb-based sedimentation rates overlaps with the area covered by a flood layer resulting from super-typhoon Haitang in July 2005. Such correspondence supports the notion that the processes operating on event timescale have bearing on the formation of the sediment strata over centennial or longer timescales.

From the distribution of sedimentation rates, sediment deposited in the study area annually is estimated to be 6.6 Mton/yr, accounting for less than 20% of Gaoping River's sediment load. The calculated budget, coupled with the presence of the short-lived <sup>7</sup>Be and non-steady-state distribution of low levels of <sup>210</sup>Pb in sediments along the canyon floor, suggests rapid transport of sediment from Gaoping River's mountainous watershed (the source) via the Gaoping (Kaoping) Submarine Canyon and adjacent channels (as the conduit and temporary sink) to the abyssal plain and the Manila Trench in the South China Sea (the ultimate sink).

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## 1. Introduction

The Gaoping (formerly spelled Kaoping) River (KPR) is the second longest river in Taiwan whose main stem meanders 171 km through a highly rugged terrain in the Central Mountain

Range, from the Jade Mountain (Yushan) at an elevation over 3000 m toward the southwest, creating the largest drainage basin (3257 km<sup>2</sup>) in Taiwan (Fig. 1). Climate in the KPR drainage basin is tropical to sub-tropical and influenced by typhoons and the annual monsoon cycle. Mean annual rainfall in the KPR drainage basin is 3046 mm, which sustains an annual river discharge of 8.5 × 10<sup>9</sup> m<sup>3</sup>. More than 70% of the basin's annual rainfall and river discharge occurs during May–September, and is closely linked with the occurrence of typhoons. Highly

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