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Morphological and seismic characteristics of the Kaoping Submarine Canyon

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ABSTRACT

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SeaMARC II side-scan sonar images and swath bathymetry plus 6-channel seismic reflection profiles reveal details of major canyons in the submarine portion of the Taiwan collision belt. The Kaoping Submarine Canyon is the largest of these, extending over 240 km from the mouth of the Kaoping River across the accretionary wedge to the Manila Trench. Morphological features and structural settings vary along the course of the Kaoping Submarine Canyon, defining three sections. The first section extends southwest from the mouth of the Kaoping River, cutting across the shelf and upper slope roughly perpendicular to local bathymetric contours, to about 22°03'N, where the canyon turns sharply southeast. From this point, the second section of the canyon follows the trace of a major thrust fault, paralleling local structure to 21°35'N, at which point the canyon turns southwest again. Over the third section the canyon meanders, cutting through low-relief fault-bend anticlines and distributing orogenic sediments in intervening slope basins, to where it joins the Manila Trench. Seismic profiles reveal that this canyon, which forms a major sediment conduit between the Taiwan mountain belt and the Manila Trench, has a complicated evolutionary history, and that its development has been controlled strongly by accretionary structural processes.

Introduction

The origin and evolution of submarine canyons, which play an important role in transporting sediment to the deep sea, have long been controversial. After over 50 years of investigation of numerous submarine canyons all over the world, Shepard (1981) concluded that submarine canyons are of composite origin and may well result from long periods of formation. Most of the well-studied submarine canyons are located along passive continental margins, such as the Congo Submarine Canyon (Shepard and Emery, 1973), the Wilmington Submarine Canyon (McGregor et al., 1982), submarine canyons in the Bering Sea (Carlson and Karl, 1988) and the Mississippi Canyon (Goodwin and Prior, 1989). Their evolutions may be quite different from those located along tectonically active margins. For example, Nagel et al. (1986) suggested that besides commonly mentioned eustatic and erosional processes, tectonic processes could have been instrumental in the origin and evolution of the Ascension Submarine Canyon system, located along a strike-slip continental margin off central California. The Kaoping Submarine Canyon, which lies over the active accretionary wedge off southwest Taiwan, is likewise heavily influenced by tectonic processes.

The existence of a major submarine canyon at the mouth of the Kaoping River (then called Shimotamsui River) was first reported by Yabe and Tayama (1928). Ma (1947) compiled a bathymetric chart showing the distribution of submarine valleys around southern Taiwan and discussed their geological significance. Due to limited deep-water soundings, the submarine canyon that

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