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A submarine canyon as the cause of a mud volcano — Liuchieuyu Island in Taiwan

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Abstract

In this paper, based on 3.5 kHz, UNIBOOM and conventional seismic data, we propose a model for the creation of Liuchieuyu Island, a near-shore mud volcano off the southwestern coast of Taiwan. In support of this model, we also discuss the relationship between a nearby submarine canyon (Kaoping Submarine Canyon) and the mud diapirs and mud volcanoes in the region. Seismic data suggest that Liuchieuyu was originally a mud diapir with a thick, continuous accumulation of sediments on its upper surface. This sediment load or overburden prevented unconfined growth of the underlying mud diapir, while simultaneously acting as a seal that trapped gas and formed a high-pressure zone. However, Kaoping paleo-canyon eroded these overlying sediments, and the overburdening pressure was reduced. In consequence, the mud diapir rose up to the sea floor to become a mud volcano, the uppermost part of which is present-day Liuchieuyu Island. The formation of this island in the path of the paleo-canyon also diverted the channel of the canyon to its present location.

Keywords: Taiwan; Seismic reflection; Submarine canyon; Mud volcano

1. Introduction

In the early Pliocene, the paleoenvironment of the offshore area of southwestern Taiwan was deep marine (Covey, 1984). Large amounts of mud and silt derived from the Penglai orogeny were deposited in this region during that time, and in the Pliocene, a thick fine-grain sediment sequence was formed. However, as the arc-continent collision developed, the depositional environment in this area became shallow marine and deltaic, and the compressive tectonic forces of this still-active collision together with the unbalanced sediment load combined to trigger the mud diapirism in this region. Disturbance of the very young sedimentary strata on top of several mud diapirs suggests that they are still active (Chow et al., 1996).

Liuchieuyu Island, which is about 12 km off the southwestern coast of Taiwan (Fig. 1), is the only mud volcano in this offshore area to have emerged above sea level, even though there are many mud diapirs nearby. The island is located opposite the mouth of the Kaopinghsi River, and next to the Kaoping Submarine Canyon. Its northeast–southwest axis is about 5 km long, and its maximum width in the

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