Development of Goto Submarine Canyon

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Submarine canyon system is extensively developed in the continental shelf of East China Sea. Katsura (1975) suggested that some of these canyons are related to tectonic block boundaries, which are formed at the opening of the Japan Sea. Goto Submarine Canyon is one of them located at the northernmost edge of the Okinawa Trough. Goto Submarine Canyon has NW strike, though prevailing fault-related lineaments are NNE or ENE trending, parallel or sub-parallel to the axis of the Okinawa Trough. We had detailed survey of the Goto Submarine Canyon in NT08-18 Cruise, in order to examine our hypotheses that Goto Submarine Canyon can be generated in close relation with the rifting of the Okinawa Trough, according to our on-land field survey in Goto Islands. Main objective of this cruise is (1) acquiring high-resolution topographic data by SEABAT and (2) observing the lithology and detailed structure of the canyon slope using HYPER DOLPHIN.

According to detailed topographic survey by Seabat, Goto Submarine Canyon is less sinuous valley which has about 50 km of length, 3-5 km of width and about400 m of relief in the survey area. It is quite unique because it does not appear to have tributary valleys, distributary channels and levees. Its valley floor is flat and relatively wide compared with other canyons reported in continental slopes.

We had detailed submersible observation in the canyon using HYPER DOLPHIN in NT08-18 cruise. Two dives at one of crossing-canyon cliffs were conducted. The cliff shows step-like profile composed of some small terraces which have less than 15 m of relief. Each terrace is consist of some smaller steps which yield horizontal bedding planes of sandstones and mudstones cemented by carbonates. They are well exposed on the flank of steps. Some steps overhang presumably because of erosion due to strong bottom currents. Upper surface of terraces are flat and covered with thin bed of unconsolidated sand and mud. They overlie sandstone, siltstone and mudstone cemented by carbonate with thin coating of black material, which is possibly manganese.

Some sand chimneys are discovered on the flat area on terrace surface. They all are lying on the ground and covered with soft corals. Each sand chimney has 10 - 30 cm in diameter and looks to have been broken into several pieces whose length are less than 1 m. Chimneys consist of carbonate-cemented fine sand and silt, and show bioturbated bedding planes. Its surface is thinly coated by black material. No chemosynthetic biological communities and gas bubbles were recognized around chimneys.

These observations imply concentrated seepage of hydrocarbon and suggest that chimneys were formed within sediments. They were exposed by intensive erosion, fallen down on the ground and broken into several pieces. These observations suggests that selective erosion of relatively easily eroded strata results in formation of steps and overhangs.

Interpretting MCS reflection profiles, thin or little channel fill deposit is recognized in the canyon floor. Slopes of the canyon shows erosional truncation. Though buried channels are interpreted in some profiles, the Canyon is much larger than any other (buried) channels in this area.

We identified some fault-related structures in the canyon. On some profile, we interpreted two faults at the northern slope which corresponds to two lineaments in the Upper Canyon. On the other profile, a buried fault with northward-dipping strata is interpreted beneath the southern slope.

Interpretations above suggest that Goto Submarine Canyon is strongly influenced by fault activity in its origin and development. Some profiles showed that the Goto Submarine Canyon is along fault, whose strike is possibly NW.

These interpretation suggests structural control of gross topography of Goto Submarine Canyon. On the other hand, submarine observation suggests that smaller topography of the canyon is controlled by selective erosion.