FATES Program: The Source-to-Sink Research in Taiwan

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A multidisciplinary research program in Taiwan called 'Fate of terrestrial substances in the Kaoping Submarine Canyon' (FATES-KP) whose goal is to investigate the source, pathway, transport, and fate of sediments in a river-sea system consisting of a small mountainous river (Kaoping River) and the adjacent submarine canyon (Kaoping Submarine Canyon) on a wave-dominated micro-tidal coast in a tectonic setting and monsoon climate off southern Taiwan. The source area of Kaoping River (KPR) is located in the southern part of the Central Mountain Range of Taiwan at about 3997 m above sea level, which is only about 90 km from the river mouth. The physical and chemical weathering rates for the KPR watershed are significantly higher than the world averages. The efficiency of the river to deliver terrestrial substances and the effectiveness of the submarine canyon to trap these signals makes the system an ideal natural laboratory to study source-to-sink related scientific issues.

The canyon is a two-way conduit for terrestrial and marine substances between Taiwan orogeny and South China Sea basin. Most of the suspended particles in the canyon interior are lithogenic. As particles settle through the canyon, some transformation takes place that alters the physical and geochemical nature of the particles. Subsequently, the size-composition of suspended particles shows a downward fining trend as the percentage of clay-to-fine-silt-sized particles rises from being less than 25% at the upper rim to being higher than 75% near the bottom of the canyon. As a result, the substrate of the canyon is composed largely of mud. Parallel to this trend is the downward decrease of concentrations of particulate non-lithogenic substances such as TOC and Polycyclic Aromatic Hydrocarbon (PAH). Non-lithogenic particles such as TOC, PAH, and benthic and planktonic foram tests show greater size affinity at the upper rim than at the bottom of the canyon possibly due to resuspension, lateral entrainment from the walls, and along-canyon transport near the bottom of the canyon.

The $^{210}Pb_{ex}$ activities from core-top sediment taken from the canyon and shelf-slope regions suggest two sedimentation regimes. Outside the canyon, the formation of strata is due to the settling of suspended sediment. Inside the canyon sedimentation pattern is at a non-steady state because sediment erosion, transport, and mass movement caused by typhoons and earthquakes affect the strata formation. In brief, turbidity currents and mass flow might be the primary mode of sediment transport in the Kaoping Submarine Canyon.