Rapid Sediment Transfer from a High-Standing Island to the Deep Sea: Evidence from Clay Mineral Assemblage

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The watersheds of small mountainous rivers (SMRs) have the highest denudation rate in the world, and their role in global sediment and carbon cycle has caught increasing concern in the past two decades. Of these active high-standing islands, Taiwan stands out for its extreme rates of uplift and denudation (5~7 mm yr-1), a surpassing high sediment yield (~9,500 t km-2 yr-1), and the uppermost efficiency of sediment delivery from the mountain highest (~4,000 m) to the ocean deepest sites (> 5,000 m). As the largest river in Taiwan (3,257 km2), Gaoping River (GPR) annually carries 7.4 km3 of water and 1,100 Mt of suspended sediment into the sea. Most of them are flushed on land and dumped into the Gaoping Submarine Canyon (GPSC) by the ways of episodic hyperpycnal flow and turbidity current, concentrating on a few hours or days during typhoon strikes in each wet season. Characterized by its huge amount and high efficiency of sediment delivery, Gaoping dispersal system has been extensively studied through multi-disciplinary methods in the recent decade to unravel the complex processes and mechanisms governing sediment transport from source to sink, and strata formation on the active continental margin. Here we present the results of clay mineral analyses on the surface and short-core sediments collected from the Gaoping river-sea system. The high consistency of clay-mineral compositions within the system mirrors weak weathering process and relatively homogenous parent rocks in the drainage basins. It is further attested by lower values of illite crystallity and illite chemical weathering index, both denoting a weak chemical weathering regime. Besides the main sediment dispersal pattern along the submarine canyon, we reveal another important sediment-routing path, parallel to the contour line along the lower continental slope. It is further demonstrated that the contour-parallel sediment redistribution is controlled by the ocean circulations of SCS warm currents and Kuroshio branch currents. It is attested for the first time from the sedimentary records the decadal variability in the Kuroshio intrusion.