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The mystery of smectite content off eastern Taiwan: New evidence of volcanic material sources and transportation processes

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Huatung Basin, Gagua Ridge, Yaeyama Ridge, and Ryukyu Forearc Area are the main terrain characteristics offshore eastern Taiwan. Several submarine canyons are distributed in the basins and play an important role in sediment transportation. Regarding geographical location, Taiwan and Ryukyu Islands are the main sources of terrestrial materials, while Luzon Island, upstream of Kuroshio, is also one of the potential sources. Tectonic, typhoon, and monsoon activities intensively affect the flux of terrestrial materials into the ocean, which leads to the variation of sedimentation rates from 0.35 cm/a in the nearshore area of Taiwan to 0.06 cm/a in the Huatung Basin. All are much higher than the West Philippine Basin (5-7 mm/ka). Based on the differences in terrestrial material composition among Taiwan, Ryukyu, and Luzon, the study of clay mineral composition has become a potential tracer for identifying the source of sediments offshore eastern Taiwan. The controversy lies in the high content of smectite in the Huatung Basin. It was speculated that the main provenances of smectite may be from eastern Taiwan (Chimei Igneous Complex) and the Ryukyu Island Arc. The canyon systems developed off the eastern Taiwan transport terrestrial sediments over 150 km and deposited in the deep Huatung Basin through turbidity currents or debris flows (Lin, 2021); or the Kuroshio transport the Luzon Arc materials into this area (Nayak et al., 2021). However, both interpretations are challenged by new comprehensive data. During the NOR1-0038A cruise 2022, fist-sized pumice (~6 cm) was collected from the surface of the box core at the HT01 site in the Huatung Basin. Based on the mineral composition of the pumice, it is speculated that it was the product of the submarine volcano "Fukutoku-Okanoba" eruption in August 2020 and was brought here by currents and winds. This incident also impacted Taiwan's coast, with large amounts of pumice deposited in Taiwan's ports and beaches. The discovery of the "Fukutoku-Okanoba" pumice in the deep sea is of great significance to the source of volcanic ash or volcanic glass in sediments off eastern Taiwan. In addition, during the "Hakuho Maru" expedition from Dec. 13 to 23, 2023, large amounts of granite samples were first time collected by bottom dredge on the northern part of the Gagua Ridge, which may also be an important source of smectite. With the development of marine geological surveys in deep waters off eastern Taiwan, our understanding of various sedimentary processes and sediment source-to-sink processes offshore eastern Taiwan continued to expand.