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Organic matter and heavy metals transport from land to deep sea via deep-sea submarine canyons in Toyama Bay

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Transport of organic matter to the deep sea is generally limited by surface biological production, but it has been shown that in some areas, submarine canyons function as transport pathways, resulting in high biomass and biodiversity.

In Toyama Bay, several submarine canyons have reached in the coastal area, creating favorable fishing grounds, but only a few detailed studies have been conducted on the transport of materials into the area. In this study, in order to clarify the dynamics of organic matter as a nutrient source for deep-sea marine ecosystems, surface sediments were collected in May 2021 and 2022 along multiple cross-sections of deep-sea submarine canyons located in Toyama Bay.

In this study, both $\delta^{13}C_{OC}$ and TN/TOC ratios, measured to estimate the sources of different organic matter, were lower near the estuary and within the submarine canyon, indicating that a high proportion of organic matter of terrestrial origin is also present in the submarine canyon tens of kilometers from the coast.

The elemental compositions measured as tracers of river sediments indicate that Cr and Ni are abundant in the central part of the submarine canyons, while K is abundant near the coast. Comparison with the elemental composition of coastal sediments measured in the past around Toyama Bay suggests that these elements were transported from the Hime River and Kurobe River, respectively. Sediments containing high concentrations of these elements are coarser grained than the adjacent sediments, suggesting transport by gravity flow.

These results suggest that submarine canyons are an important transport pathway for organic matter to the deep sea of Toyama Bay. While providing a source of nutrients and heavy metals to the deep sea, there is concern that increased intensive rainstorm in the future will encourage excessive these land originated materials accumulation.