

Preface of the special section on the Yap Trench

Towards the understanding from sea surface to hadal zone—A multidisciplinary study of the Yap Trench

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The water column in the open ocean can be divided into epipelagic (photic), mesopelagic, bathyal, abyssal and hadal zones by depth. In recent years, more and more research has been focusing on the marine environment below photic zone, especially the deep ocean. Oceanic trenches are considered as the deepest part of the ocean, providing ideal places for studying the physical, chemical, biological, and geological aspects of the marine environment from sea surface to the deep sea floor. However, limited by the high difficulty to access and high cost in exploration, our understanding about oceanic trenches is still limited. Recently, with the development of series of manned and unmanned submersibles, we now have more opportunities to study the trench area.

In this special issue, we introduce our newest discoveries at the Yap Trench. The Yap Trench is located in the Northwest Pacific Ocean, close to the Yap Islands. Although the deepest point of the trench is 8 527 m, not as deep as the Mariana Trench, this trench is a link between the Mariana Trench and the Palau Trench. The north of the Yap Trench is at the junction of three plates: the Pacific Plate, the Philippine Plate and the Caroline Plate. The south of the trench is between two plates, the Philippine Plate and the Caroline Plate. Because of the significant difference between its northern and southern region, the Yap Trench forms a special environment with unique physical, chemical, biological and geological features. With the help of the Chinese submersible Jiaolong, which is so far the world's deepest diving

manned research submersible, we employed two research cruises for the Yap Trench in 2016 and 2017, reaching as deep as 6 796 m. Through these two cruises, we wanted to answer questions like: How is the deep water in the Yap Trench connected to the surrounding area, or is it isolated? Is the abyssal and hadal zone of the trench a changing environment? Which factors and processes control the formation and feature of the sediment in the trench?

From the paper by Liu et al. (2020), we learn the basic physical characteristics of the hadal water, turbulent mixing in the near-bottom zone, and the geostrophic flows in different regions of the trench. These features are important for understanding the water movement in the region and they are also helpful in explaining the chemical characteristic of the water and the distribution of some marine organisms.

Dissolved organic carbon is important food supplement for marine organisms and plays vital role in the global carbon cycle. Carbohydrates are important components of marine organic carbon, affecting marine food chains and the metabolism of plankton. From the paper by Guo et al. (2020), we can know the basic characteristics of carbohydrates in the sea water of the Yap Trench.

Sediment can provide the most valuable information on the chemical and geological features of the abyssal and hadal zone. By studying the organic carbon

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loadings and the preservation capacities of sedimentary organic carbon (Li et al., 2020), the sediment lipid profiles (Yan et al., 2020), the major and trace sediment elements (Huang et al., 2020), and the magnetic properties of the sediment (Chen et al., 2020), we can find the sediments in the Yap Trench come from various sources and the main source varies significantly in different regions. Data from different aspects all show terrestrial, volcanic, biological, and authigenic sources of the sediment in the trench.

As research in the trench, especially the abyssal and hadal zone progress, more distinct features of the deep sea may be revealed, while simultaneously more and more underlying principles will emerge. Though some of our data are preliminary, we hope this series of publication will help to stimulate further research on deep sea including the hadal zone by providing fundamental information and insight into both the common and the unique features of the Yap Trench. Ultimately, we will know more about this under-explored area on earth.

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