

Deep-sea microorganisms acquired during Jiaolong expedition

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On the afternoon of August 9, 2023, the Chinese scientific investigation vessel *Shenhai Yihao* (Deep Sea No.1) carrying the deep-sea manned submersible "Jiaolong" (Flood Dragon) and the expedition team, returned to the wharf of National Deep Sea Center of Qingdao, marking the successful completion of "China Ocean 80th voyage", stage I. "Jiaolong" is the China's first deep manned submersible that can dive to a depth of over 7,000 m. It has the greatest depth range of any manned research vehicle in the world.

Huaiwei Liu and Kun Liu, two researchers from the State Key Laboratory of Microbial Technology (SKLMT) of Shandong University, participated in the voyage. This is the first time that Shandong University and SKLMT carry out the deep sea expedition with "Jiaolong" submersible (Figure 1A and 1B). On the day of return, Shengying Li, executive deputy director of SKLMT, made a special trip to the wharf to join the "welcome back" ceremony. The voyage started on June 16, 2023 and lasted 55 days.

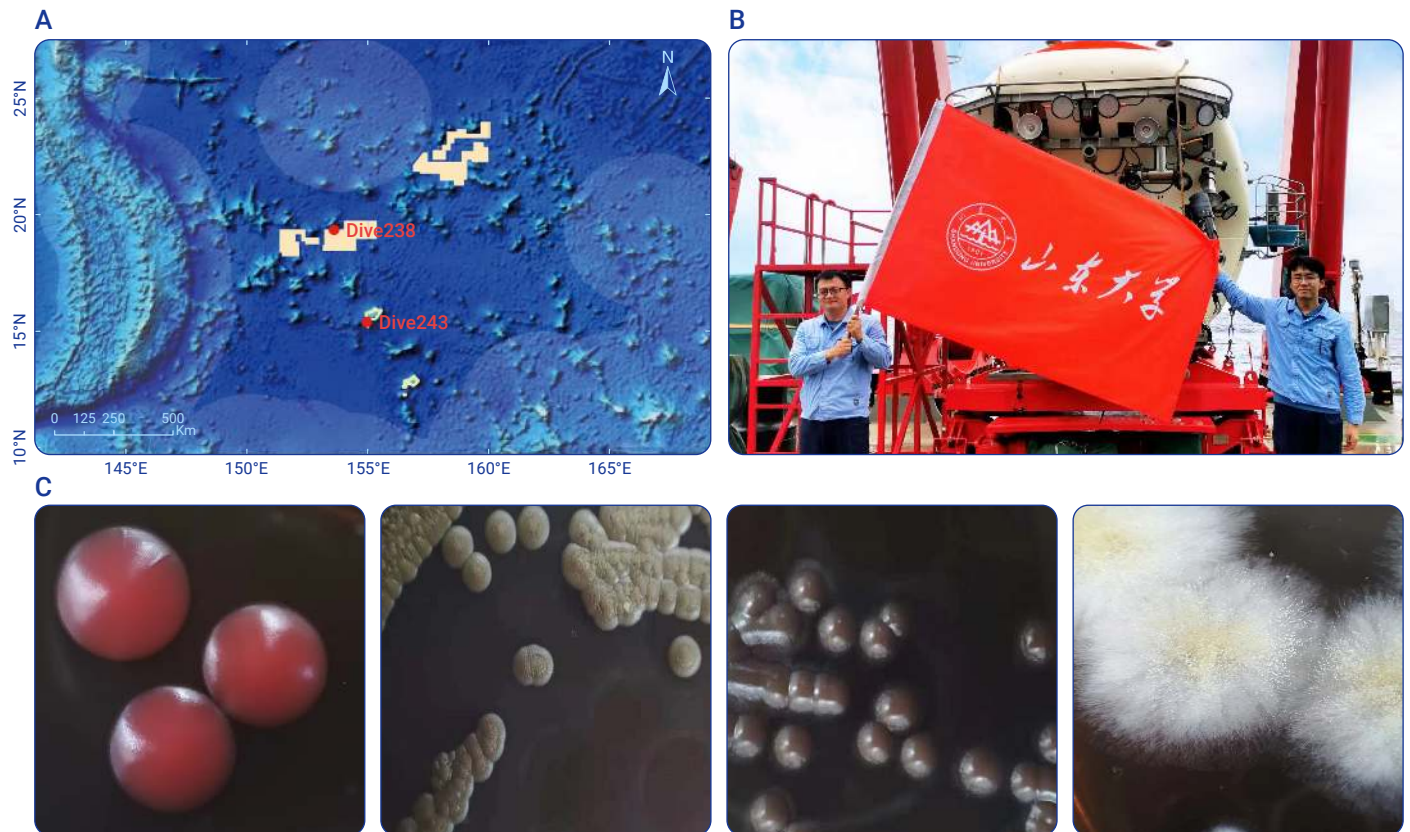


Figure 1. The State Key Laboratory of Microbial Technology participated in the China Ocean 80th voyage (A) Red dots are locations of 238th and 243rd dives. Light yellow and light green districts are exploration areas of "Jiaolong" submersible (B) Huaiwei Liu and Kun Liu with "Jiaolong" submersible. (C) Strains isolated on board by Huaiwei Liu and Kun Liu during the voyage.

This expedition is a joint effort between SKLMT and the National Deep Sea Center. Together, they investigated the geology, biodiversity and microbial resources of the deep sea in the Western Pacific Ocean. Scientists applied "Jiaolong" submersible to explore and take samples from deep sea. Two researchers of SKLMT also carried out deep diving operations. Kun Liu dived 5076 meters in the 238th dive of "Jiaolong" and Huaiwei Liu dived 2466 meters in the 243rd dive (Figure 1A and 1B). Both of them completed the observation and recording of seabed environments. They also retrieved valuable deep-sea organisms and sediment samples. More than 200 species of bacteria, yeasts and filamentous fungi were isolated from deep sea habitats by these two researchers (Figure 1C).

After sailing on the ocean for nearly two months, they obtained many valuable experiences. Here are the feelings and gains of the two researchers. "The

summer solstice had not begun when we left, but autumn has already begun when we returned. Stage I of the China Ocean 80th expedition ended on August 9. At 3 o'clock in the afternoon, the wind at the port of the deep-sea center was not calm, but the waves were quiet, just like the sea conditions most time in the Western Pacific Ocean. As more and more people gathered at the dock, I was gradually excited, but I also was a little reluctant to go ashore, because it marked the end of my short term as a member of the China Ocean 80th expedition team. I witnessed the new record of Jiaolong's '5 dives in 5 days' and '9 dives in 10 days'; I participated in the scientific research mission of the 243rd dive; I got familiar with the working processes of box corer, rose-type multi-channel water collector, trawl net, and other samplers. Of course, the harvest was not only sailing skills, but also many much-needed samples for SKLMT to carry out deep-sea research. These



were the reasons that make me feel reluctant to say goodbye. Although the short voyage was over, the ocean will always be there, and 'deep sea No.1' will be there too, I am beginning to expect next voyage." Huaiwei Liu said

"It is my honor to participate in this in-depth cooperation between SKLMT and the National Deep Sea Center. As a member of the scientific research team, I participated in the China Ocean 80th voyage. I completed the mission and returned home after working afloat for nearly two months. Although I am now on land, the experience at sea will always be engraved in my heart. The 'Deep Sea No.1' scientific research ship is equipped with advanced equipments. The 60 members of the crew performed their respective duties perfectly. They had a clear labor division and cooperated well with each other. They showed excellent team spirit and also made me realize the difficulty of deep-sea investigation. The most valuable thing was that I dived 5076.5 meters into the deep sea, so I personally observed and felt the advancement of 'Jiaolong' submersible and the professionalism of its operation team. The deep sea is a treasure house of biological resources that needs to be developed urgently. The rich resources of microorganisms and gene banks in the deep sea can provide valuable materials for microbial studies. The ocean expedition is a kind of training for my life. The first time of sailing is over, but my story with the deep sea just begins." Kun Liu said.

Indeed, deep sea is a treasure trove full of underdeveloped resources. It can provide potential materials for new drugs development,¹ plastics degra-

ation research,² carbon neutralization management,³ global element cycle study,⁴ and so on. SKLMT will continue to tap the deep-sea microorganisms. Next, SKLMT will deepen the cooperation with relevant institutions, continue to carry out scientific research on deep-sea, and provide strong support for the national strategy of becoming a maritime power. SKLMT's research on deep sea just embarks.

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DECLARATION OF INTERESTS

The authors declare no competing interests.