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Shipboard Micropaleontologist (radiolarian specialist) on IODP Drilling Vessel Joides Resolution, Expedition 349

South China Sea-Tectonics

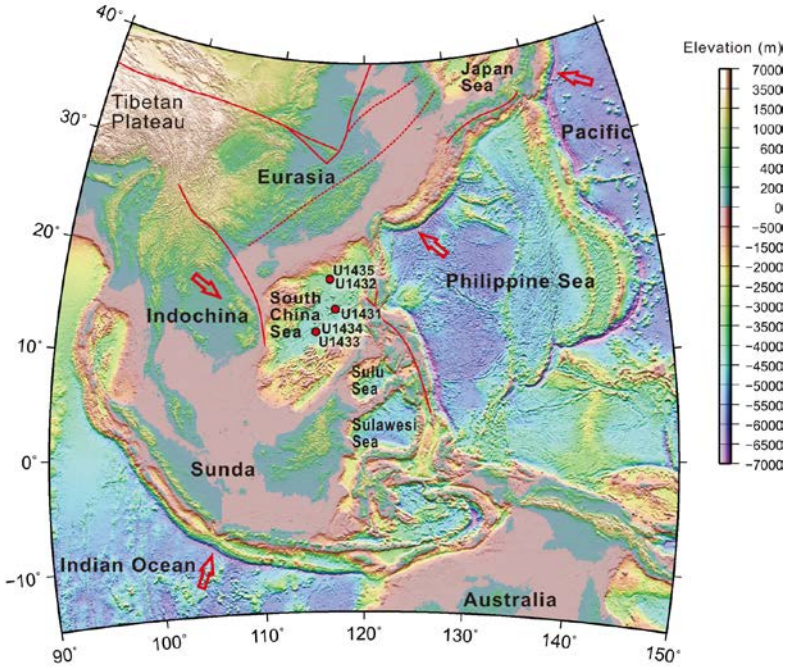
Between January 26th (Hong-Kong) and March 30th 2014 (Keelung, Taiwan) I had the opportunity to participate the IODP 349 Expedition in the South China Sea as radiolarian specialist. Although it was an expedition with interest in the tectonic evolution of this marginal sea, biostratigraphy was a crucial tool to meet some of the objectives of the project.

Joides Resolution at Hong-Kong

Why the South China Sea?

The South China Sea is a marginal Sea located in the Western Pacific, south of China and between the Philippines in the east and Vietnam in the west. The sea is situated at the junction of the Eurasian, Pacific, and Indo-Australian plates. This region has been extensively subject of multiple studies hypothesizing about the mechanisms and timing of the opening of the different parts (sub-basins) of the South China Sea. It is suggested that it began to form during the Oligocene (~32 million years ago) and stopped spreading during the early Miocene (~16 million years ago). The only way to test these age estimates is to drill into the South China Sea basement to obtain samples of fresh basalt and sediment lying directly on top of basement.

For this purpose, during Expedition 349 we drilled five sites in the deepest parts of the basin to recover the igneous rocks that will validate the tectonic models proposed for this region. Three of these sites (U1431, U1433, and U1434) were cored near the fossil ridge to study ages of cessation of spreading (youngest). The two remaining sites (U1432 and U1435) are located proximal to the northern continent/ocean boundary, and would give information about when it started to open (oldest).



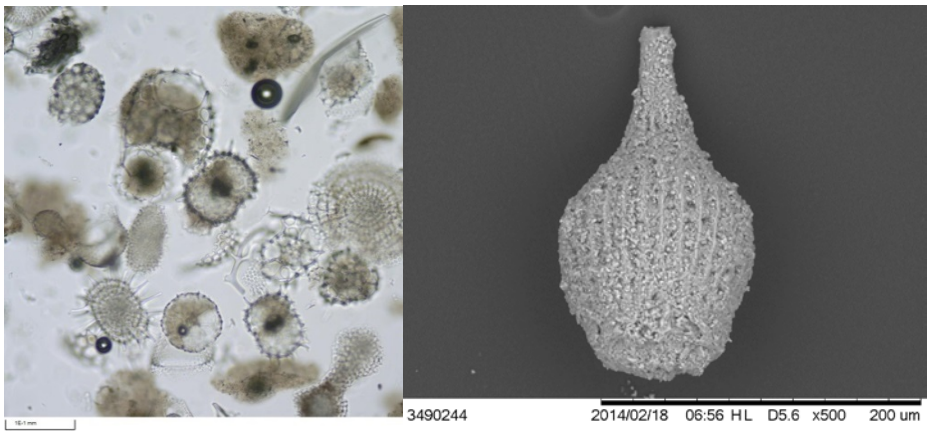
Topography and bathymetric map the South China Sea, showing the location of the drilling Sites.

Although the expedition was focusing in the tectonic evolution of the South China Sea, and therefore, good recovery of basaltic rocks for geochemical and petrological analyses were desired, soft sediments filling the basin had a lot of valuable information as well. These sedimentary rocks are mostly formed from the remains of organisms that lived in the ocean, died and fell to the seafloor, and then became fossilized, as well as sand, silt and clay that enter the oceans through rivers. Studying these sediments provides a better understand how climate has evolved in the southeast Asia region since the South China Sea started to open, and micropaleontological analyses provides accurate age control of the sediments.

Microfossils: tiny watches trapped in the sediment

I joined the Expedition 349 as micropaleontologist (radiolarian specialist); together with other six scientists specialized in nannofossils and planktonic foraminifera. I was the only radiolarian specialist, since this group of siliceous microfossils is not as abundant as the calcareous ones, but they are very important when the later have problems of preservation and/or dissolution. Our task on board was to analyse the core catcher samples (the latest core section) and determine the age of the core based on the microfossil assemblages. All core catchers were analysed. The first cores were coming to the surface quite fast, because the sediment was very soft, and we heard very often the ‘core on deck’ announcement. The rhythm of coring went down when the sediment became harder (compacted) and we had to shift to different coring system (from advanced piston core to rotary core barrel).

Biogenic silica became scarcer when we drilled deeper, and many cores were barren of radiolarians. Biostratigraphy had to relay on planktonic foraminifera and calcareous nannofossils, supported by magnetostratigraphy. Radiolarians became again important in the deeper sections of sediments, just underlying the oceanic crust. In two sites, located in the East and Southwest Subbasins, we found red claystone above basaltic basement. Age of this unit was very important because it would provide the age of cessation of seafloor spreading of the two subbasins. Fortunately, although there were not calcareous microfossils, radiolarians were common, and provided biostratigraphic control of the unit. As the preservation of radiolarians was not very good, we had to pick some specimens and observe them under the Scanning Electron Microscope (SEM) that is on board. Based on the identified species, we could determine that the preliminary cessation age of spreading in both subasins is around early Miocene (16-20 Ma), although further post-cruise radiometric dating of basement basalt from these sites will refine the age range. For more information, visit http://publications.iodp.org/preliminary_report/349/index.html



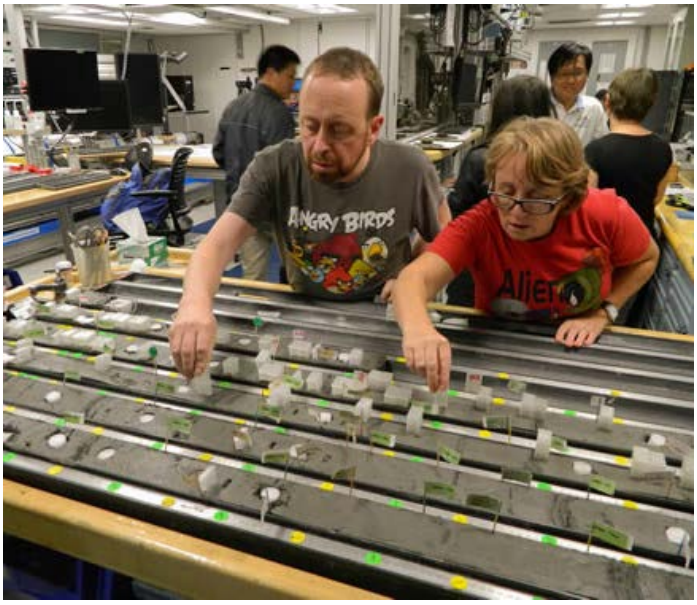
Pleistocene (left, light microscope) and Miocene (right, SEM) radiolarians

Living onboard

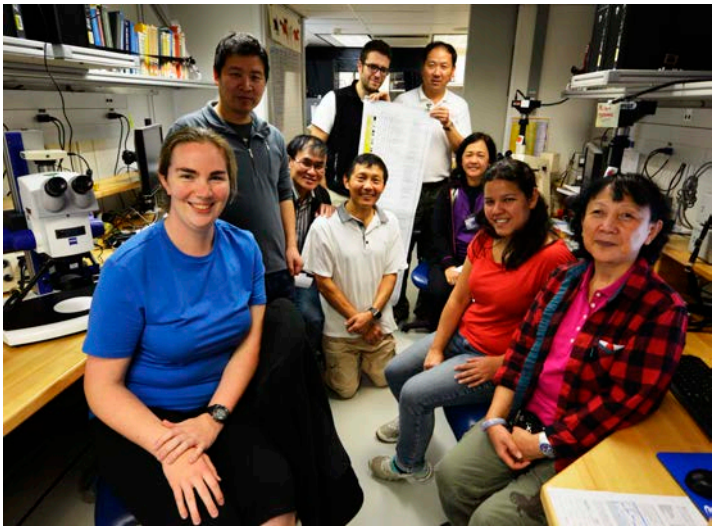
The Joides Resolution is like a small floating village (more than 100 crew members), with and awesome laboratories perfectly equipped, and with excellent technical staff that keeps everything running smoothly. Although working shifts (12h/day, 7 days a week) were quite intense, life onboard is quite comfortable. Gym, library and movie room allowed us to relax during the little spare time we had, while excellent food and accommodation kept us very happy! And of course, the priceless sunsets at the South China Sea, help us our minds to evade from any worry.

Sunset at the South China Sea

I really appreciate my stay on the Joides Resolution. I learnt a lot, not only about biostratigraphy and related to my field, but also about other techniques (sedimentology, geochemistry, microbiology, etc.). It was always a pleasure to visit other labs or colleagues to exchange ideas. Besides the scientific part, what I find most valuable is the excellent team. During the expedition, we had a couple of very hard moments, but people were able to recover and support each other to overcome the difficulties. All together made my participation in the expedition very valuable from the scientific and personal point of view. Thanks Swiss IODP for giving me this unique opportunity (I hope not the last!).

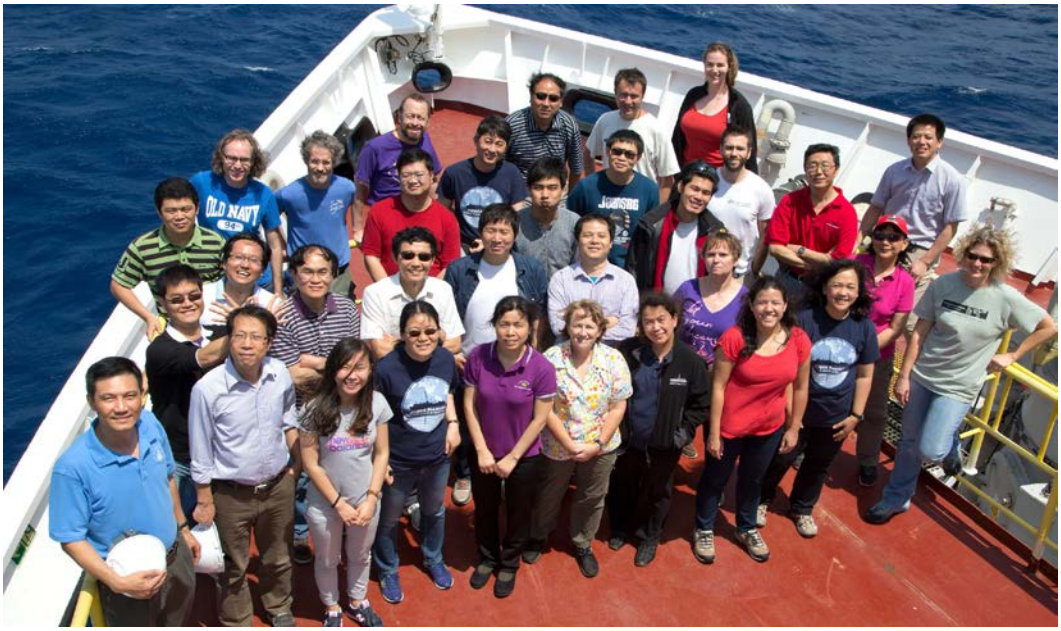


Sampling madness time!



Paleo-team (microfossils and magnetostratigraphy)

Live video events with an high-school from Spain



Scientist family picture