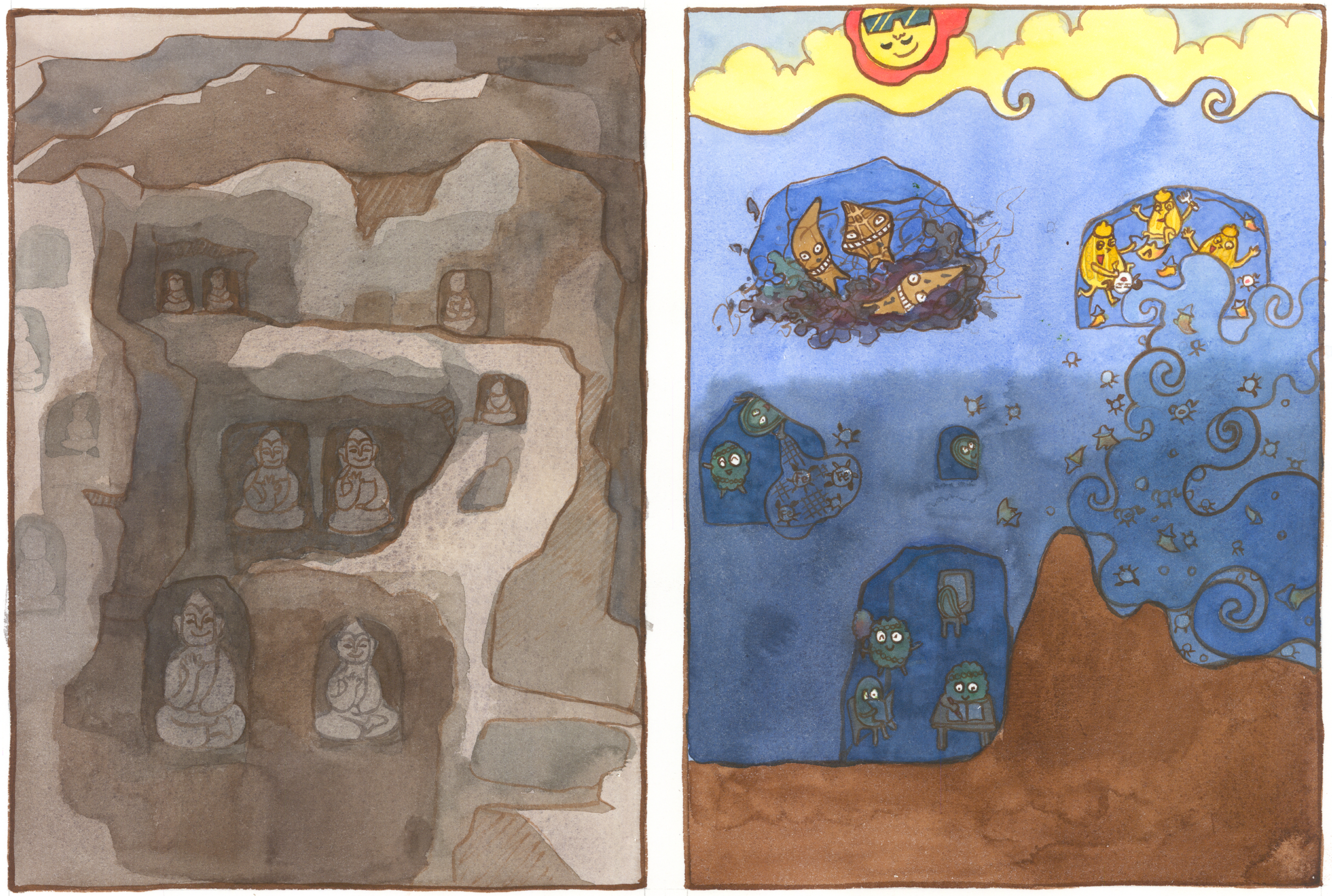
海洋科普實驗室

看漫畫學海洋

Learning Oceanography by cartoons

The Ecological Niches of Phytoplankton:

In order to understand material cycling in the ocean and on the planet, it is essential to know the distribution of phytoplankton and its controlling factors. Relatively large sinking particles generated in surface waters sink faster than relatively smaller particles, so they have higher probability to reach deeper ocean water. There, they are decomposed by bacteria into inorganic nutrients. The composition of sinking particles is associated with phytoplankton groups. For example, diatoms are relatively both big and heavy. After death or being grazed by zooplankton and formed into fecal pellets, they have a higher likelihood of generating larger sinking particles. It can be the opposite circumstance for prokaryotic phytoplankton. Unless aggregated, these relatively small particles tend to stay suspended in the surface water and are internally cycled.



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Physical and chemical environmental conditions are major factors regulating organism growth and abundance. There are two key physical factors regulating the growth and distribution of phytoplankton in the ocean: first is temperature, second is light intensity. Generally, the higher the temperature and/or light intensity, the faster phytoplankton reproduce and grow. Therefore, at high latitudes, such as the northern and southern polar regions, the physical factors of temperature and light intensity may become seasonal limiting factors for phytoplankton reproduction. Compared to chemical factors, physical limiting factors have relatively predictable temporal regularity. In tropical and subtropical open ocean regions, water temperatures are high and light illuminates the surface. However, primary production rates are relatively low in the euphotic zone of the open ocean, mainly due to relatively low nutrient inputs. Marine phytoplankton are usually present in relatively deep water. For example, in the Western Philippine Sea adjacent to Taiwan, phytoplankton are mainly present at 100-120 meters below the surface. Can you imagine what light intensity is like at that depth? Even though light is scarce, nutrients are in even shorter supply. This is because at this depth, nutrients are just barely diffusing or being transported up from even deeper water. The most important chemical factor is the available amount or supply rate of nutrients (or food). Additionally, the requirements and capacities to obtain different essential nutrients differs among various phytoplankton groups.

For example, the prokaryotic phytoplankton *Prochlorococcus* is able to grow under extremely low light conditions. *Synechococcus* requires a large amount of iron and possesses specific abilities to acquire iron in extremely low dissolved Fe oceanic surface water. Various kinds of phytoplankton grow in their own unique environmental conditions, referred to as Ecological Niches. The original meaning of niches comes from shrines, where statues of Gods are placed. The statues of idols range from big to small, and each are given their own space according to size.