SO265

SHATSKY EVOLUTION

1. Weekly Report

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R/V SONNE cruise SO265 is the central activity of the research project "Shatsky Evolution" that is funded by the Federal Ministry of Education and Research and conducted by the GEOMAR Helmholtz Centre for Ocean Research Kiel in collaboration with international partners.

The goal of the project is the geological investigation of the Shatsky Rise, a vast, submarine volcanic mountain range in the northwest Pacific that stretches over an area as large as Germany, Austria and Switzerland combined. The highest peaks of the Shatsky Rise tower up to 3 km above the surrounding 5-6 km deep abyssal plain. Even with these enormous dimensions, Shatsky Rise doesn't rank among the very largest of these volcanic plateaus in the world's oceans.

Clearing port in Yokohama: As nice as seafaring can get!

The Pacific Ocean is not so pacifying anymore....

The cause for the origin of volcanic plateaus is still debated. According to the generally accepted theory, which is also used in geology textbooks, these large-spread volcanic provinces form above mushroom-shaped blobs of upwelling material in the Earth's mantle, so-called mantle plumes. These plumes slowly transport material from deeper (hotter) parts of the mantle up to the base of the Earth's tectonic plates where the material melts (because of decompression) and then fuels widespread volcanism on plate above. Recently, evidence is mounting that marine volcanic plateaus could also have formed at mid-ocean spreading centers, which crosses all the worlds ocean basins. At these spreading centers, the tectonic plates are constantly torn apart and new magma from the upper mantle ascends through the cracks and eventually seals them with solidifying lava thereby creating new oceanic crust. It is quite conceivable that the upper mantle below certain areas of a spreading center at certain times could have had a different chemical composition e. g. making it more easy to melt.

This would cause a greatly enhanced magma production and could lead to the formation of a thick volcanic plateau. The debate regarding the cause of oceanic plateau formation nearly divided the Earth science community into two camps, those who defend the classical model (origin by mantle plumes ascending from the deep mantle) and those who propose alternative "plate-based" concepts (e.g. shallow formation at spreading centers).

Why did we choose to investigate Shatsky Rise? Previous research revealed that this particular volcanic plateau bears characteristics of both plume and spreading center formation. Therefore, we want to test the model that Shatsky Rise was formed by interaction of a spreading center with a mantle plume that coincidentally (?) ascended directly beneath it. The results of our investigation will provide an important contribution to the question of how marine volcanic plateaus are formed in general. In addition, our research will produce basic data on the relationship of magmatic, volcanic and tectonic activities and their impact on the environment, the Earth's climate and the marine eco-system.

Who are "we"? Besides the ships 29 highly skilled crew, we are 21 scientific cruise participants from six different countries and eight international research institutions. After loading our two equipment containers and embarkation of all scientists, the vessel left Yokohama (Japan) in the afternoon of August 27 with fine weather and begun its 4-day transit to our first planned sampling location on the northern Shatsky Rise. During transit the weather conditions deteriorated and the forecast for our planned first working area predicted wind speeds and swell highs that would drastically limit our operational options. Therefore, we decided to switch towards a more southerly located alternative working area on the central Shatsky Rise for which the weather forecast looked more promising. After arrival, we firstly conducted a water sound profile by running the CTD-Probe (conductivity, temperature, depth) down to 2000m water depths. These data are used to calibrate the ships-own multibeam echosound system, which calculates water depths based on the travel time of reflected sound waves and produces colorful relief maps of the seafloor in "real time"(more on that in the next report). Thereafter, we successfully conducted two dredge hauls (an effective method to recover rocks from the seafloor) and then continued our transit to northern Shatsky Rise where weather conditions had improved in the meantime. By the end of the first week, we had conducted seven dredge hauls, with six of them returning the desired volcanic rock samples.

All cruise participants are doing well and send greetings to everybody at home.

Jörg Geldmacher and the scientific party of SO265