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Deep drilling of LIPs

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Abstract

The large igneous provinces were formed by massive and episodic volcanisms and may represent periodic activities in the deep Earth, while its origin and impact on the Earth's environment and life remain largely unknown. I would propose a deep drilling of the Ontong Java Plateau to obtain samples of crustal rocks to elucidate the origin of the OJP and an impact on the environment, particularly via a possibility of massive degassing of CO_2 during the plateau formation. The topic may be related to WG2.2 (Mantle flow and interactions with lithosphere).

Origin and environmental impact of the Ontong Java Plateau

The Ontong Java Plateau (OJP) is the largest Large Igneous Province (LIP), which arises an average of 2000 m above the seafloor over an area of 1.6×10^6 km^2 in the western Pacific. Because of its size and instantaneous emplacement, the formation of the OJP had a large impact on the global environment. There has been an intensive discussion on origin of the OJP. Some studies propose that a large head of mantle plume rising from the deep mantle causes rapid episodes of massive basaltic flooding (e.g., Larson, 1991) and others favor a "shallow origin" model in which the OJP formed near a fast-spreading ride by passive asthenospheric upwelling (e.g., Korenaga, 2005). All such models still remain speculative, partially because crust and mantle structure beneath the OJP is not well resolved and also because the petrological structure of the OJP has not been understood due to insufficient rock samples. We have recovered only the uppermost 0.2-0.9 km of the crust as thick as 30 km by drillings. Many of the OJP petrological and geochemical studies have relied upon the samples taken from a part of the Solomon islands, which is exposed above sea level due to collision of the OJP and the Solomon islands. It is desirable to obtain samples by a deep drilling of the main body of the OJP. We plan to perform an ocean bottom observation project with active and passive OBS experiments to determine the crust and mantle structure beneath the

OJP in the next few years. It is a good time to plan a deep drilling in the OJP because detailed information of crust and mantle structure will be available in a few years. The seismic structure will be useful to select drilling sites and the collaborative research of seismology, petrology and geochemistry based on the rock samples obtained from the deep drilling should improve our understanding on the origin of the OJP. It has been known that the OJP was emplaced almost simultaneously with the OAE and global warming. It suggests a massive release of CO_2 during the OJP (and other LIPs) emplacement, although it remains to be proved. Careful analyses of CO_2 contained in crustal samples by the deep drilling could provide a key to understand the possible impact of the LIPs emplacement on the Earth's environment and life.

References

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