Earth in Motion Through the Borehole Window

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The present knowledge of the solid Earth dynamics is largely built on remote-sensing observation data colleceted from the land surface or space combined with numerous lab experiments and modelings. On the other hand, scientific ocean drilling has been providing ground-truthing samples from the boreholes. Linking the two approaches is critically important for testing and verifying scientific ideas as exemplified by the hallmark DSDP achievement of verifying seafloor spreading in the beginning of the ocean scientifc drilling history. After nearly half a century, there still remains a wide gap between the two approaches in terms of the time and space resolutions and extents. To understand the “Earth in Motion,” both approaches must advance to narrow the gap, since the target Earth is one. The remote-sensing community has evolved now that their sensor networks can be extended to seafloor and also to take advantage of the quiet borehole environment to capture the weak signal from below. Such signals include seismic, geodetic, thermal, or biological. The other direction in this effort is to achieve sampling from deeper into the mantle, for which *Chikyu* was designed and built. It is important that both the remote-sensing and ground-truthing communities benefit from the capabilities of *Chikyu.* First and foremost, the sampled rocks will ground-truth and bring unexpected discoveries on the physico-chemical framework of seafloor spreading. At the same time, we can utilize the deep vertical borehole into the mantle as an observatory, away from the atmosphere, ocean and crust to be the most sensitive station to mantle signals from local to global sources. We will show that a moderate modification to the current *Chikyu* specifications incorporating newly developing drilling technologies will enable us to conduct this grand experiment.

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