

Seismic experiments investigating plate dynamics of the Challenger Deep region of the Mariana trench

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Along the 2,500-km-long Mariana trench, its southern section is associated with the greatest ocean depth, trench relief, flexural bending, normal faulting, as well as the formation of the extremely deep basins of both the Challenger and Sirena Deeps. Our analyses also revealed that the southern segments of the Mariana trench might be subjected to the greatest tectonic loading and pervasive extension by normal faulting. To further investigate the fundamental mechanisms of trench dynamics, we recently conducted seismic experiments on the Mariana trench near the Challenger Deep region. We carried out both active source experiments to illuminate the across-trench variability in crustal and upper mantle velocity structures, as well as passive seismic experiments to reveal the deeper mantle structure and earthquake characteristics. The experiments were conducted on board R/V Shiyan3 using an array of ocean bottom seismometers (OBS) down to the ocean depth greater than 8,000 m. Preliminary results revealed strong seismic activities in this region. The experiments will provide critical new constraints on the subduction zone dynamics, earthquake characteristics, interaction between the subducting and overlying plates, and mechanisms of trench segmentation.