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Seismic evidence of the lithosphere-asthenosphere boundary beneath the Tonga area, southwestern Pacific

Huihui Cui^{1,2}, Yuanze Zhou^{1,2*} and Youlin Chen³

¹Key Laboratory of Computational Geodynamics, Chinese Academy of Sciences, Beijing 100049, China.

²College of Earth Science, University of Chinese Academy of Sciences, Beijing 100049, China.

³Advanced Technology Division, Array Information Technology, Greenbelt, Maryland 20770, USA.

Corresponding Author: Yuanze Zhou, Email: yzzhou@ucas.ac.cn; yzzhou@gmail.com.

Abstract

We study the lithosphere-asthenosphere boundary (LAB) in the Tonga subduction zone using four deep focal events recorded by the Capital Seismic Network (CSN) of China and the Northeast China Extended Seismic Array (NECESSArray). The existence and depths of the LAB beneath the Lau Ridge are clearly revealed by the linear slant stacking of observed *sP* precursors (*sdP*). As illustrated by the reflected points of robust *sdP* phases from LAB, the depth of LAB in the northern Lau Ridge is about 63 km with a range of 63 to 64 km, in the northwest is about 77 km with a range of 76 to 78 km and in the south is about 72 km. The uncertainty of determined depths is no more than 4 km given the effects of the picking errors of arrival times and velocity heterogeneities. Our results suggest that the oceanic lithosphere of the Lau Ridge is thinner in the northern part than in the northwestern and the southern parts. According to the previous geodynamic and petrological studies, the oceanic lithospheric thinning in the northern Lau Ridge should be related to the strong erosion of the active mantle convection in the back-arc mantle wedge with the enrichments of

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