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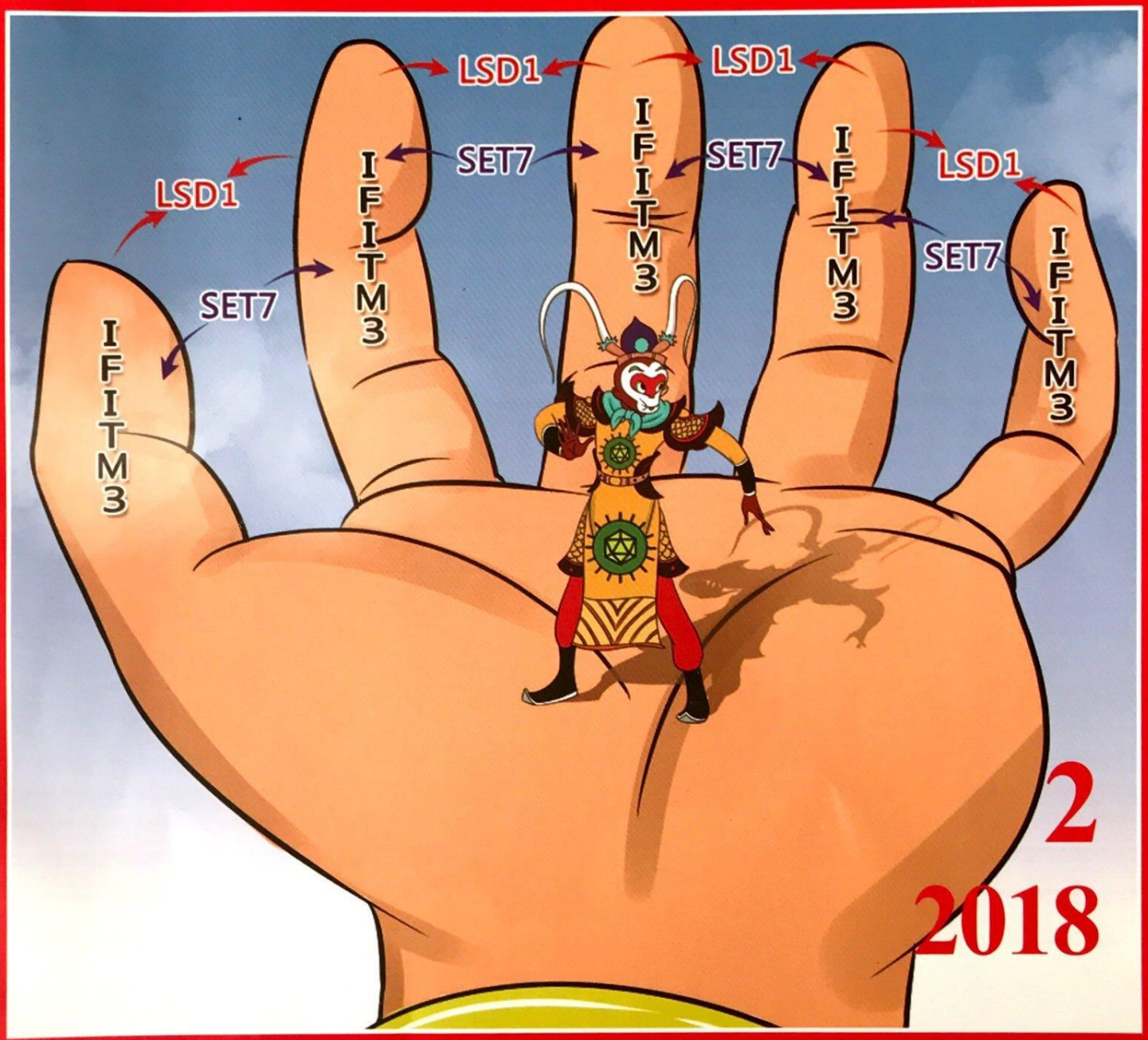

NATIONAL NATURAL SCIENCE FOUNDATION OF CHINA

Seismological evidence for a localized mushy zone at the Earth's inner core boundary

With the support by the National Natural Science Foundation of China and Chinese Academy of Sciences, the research group led by Prof. Wen LianXing (温联星) at the Laboratory of Seismology and Physics of Earth's Interior, University of Science and Technology of China, reported the first seismological evidence for a localized mushy zone at the Earth's inner core boundary (ICB). The study was published in *Nature Communications* (2017, 8: 165).

The detailed Earth's ICB features are the key to the understanding of the solidification of the inner core and the associated release of the thermal and compositional energy that generates the Earth's magnetic field. At the ICB, a mushy zone was proposed to exist many decades ago, in which both solid and liquid are present. However, while a mushy zone would carry particularly important information about the energy release associated with the inner core solidification, no seismic evidence for its existence had ever been reported. Their study presented the first seismic evidence for the existence of a 4—8 km thick mushy zone at the ICB. It further noted that the mushy zone only exists in a localized region beneath southwest Okhotsk Sea, while the neighboring regions of the ICB are characterized by a sharp boundary.

These findings suggest the existence of lateral variations of outer core composition and driven force of the Earth's magnetic field. In the current state of the Earth's core, the outer core composition is close to eutectic in most regions resulting in a sharp ICB and the solidification of the inner core in those regions releases only latent heat; however, in some localized regions, deviation from the eutectic composition exists resulting in a mushy zone and the solidification of the inner core releases both latent heat and compositional energy. Their findings also indicate that a global mapping of the mushy zone at the ICB is crucial to the understanding of the driven force of the Earth's magnetic field.

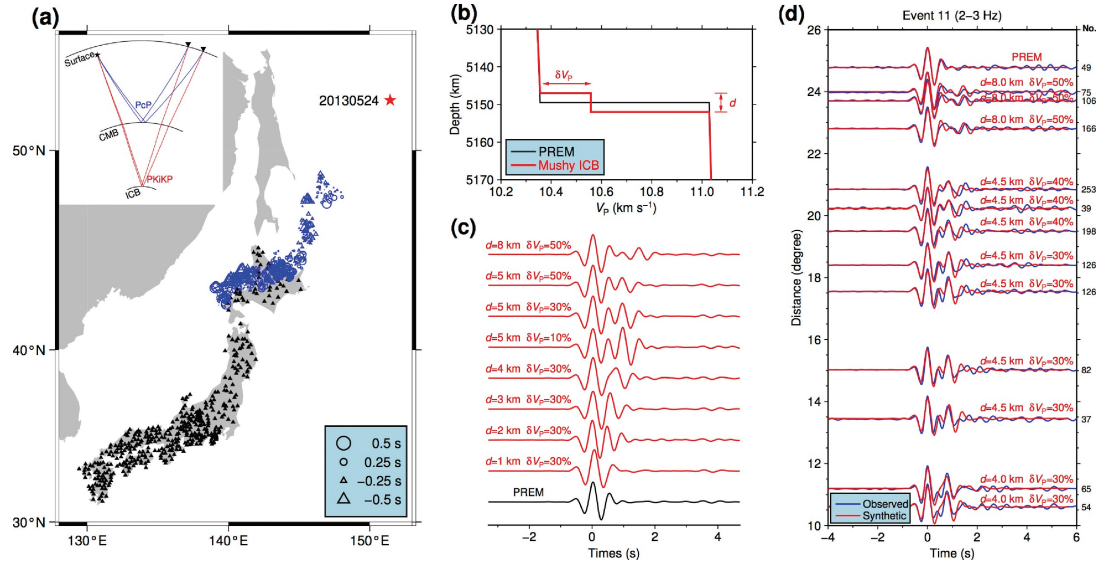

Figure (a) Geographic location of inner core boundary (ICB) regions with a localized mushy zone. (b) Mushy ICB model represented by two parameters: d, the thickness of the layer, and δV_P, percentage compressional velocity jump of the top layer with respect to PREM velocity jump at the ICB. (c) Synthetic seismograms for a series of mushy ICB models. (d) Comparisons of observed PKiKP waveforms, which sample the mushy ICB region beneath southwest Okhotsk Sea and synthetic seismograms of the best-fitting mushy ICB models.