Press Releases

March 31, 2014
Revised on November 21, 2014
(Figure 5 and Figure 6 replaced)
JAMSTEC

What drives plate motion?
~ New Discovery of Driving Forces of Plate Motion ~

The Plate Dynamics Research Program at the Institute for Research on Earth Revolution, Japan Agency for Marine-Earth Science and Technology (JAMSTEC: Asahiko Taira, President) has been promoting researches on the oceanic plate structures in order to understand the dynamics of the Earth's interior.

The Plate Dynamics Research Group, led by Program Director Shuichi Kodaira, recently conducted a large-scale research on structure of crust and the upper mantle beneath the Pacific Plate, 100-700 km from the southeast coast of Hokkiado, using an active source seismic survey system and ocean-bottom seismometer, and found the direct evidence that mantle flow drove plate motion when oceanic plates were formed at a palaeo-spreading centre.

This achievement provides clues to answer a long-standing question on plate tectonics, “what drives plate motion?” Further research, including a direct verification using the scientific drilling vessel *Chikyu* to drill into the mantle, is expected to bring a significant progress on geosciences.

This result has been published in the electronic version of *Nature Geoscience* on March 31 (Japan time).

Title: **Seismological evidence of mantle flow driving plate motions at a palaeo-spreading centre.**
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1. Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Figure 1 : Location of seismic profiles

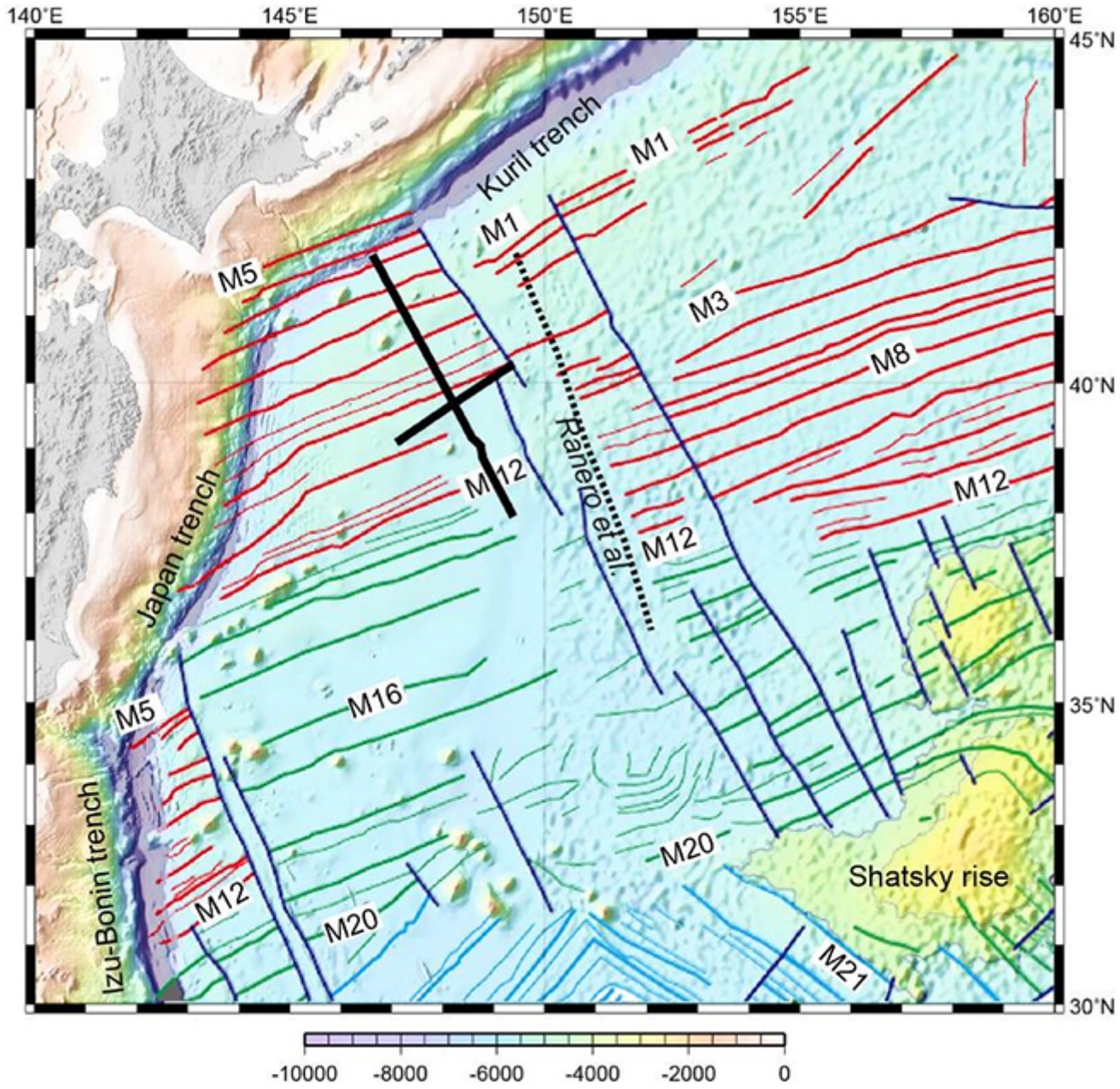


Figure 2: Expansion of Pacific Plate (according to Nakanishi et al. (1989)). The top side shows north. (a) 151 million years ago (b) 148 million years ago (c) 139 million years ago (d) 123 million years ago

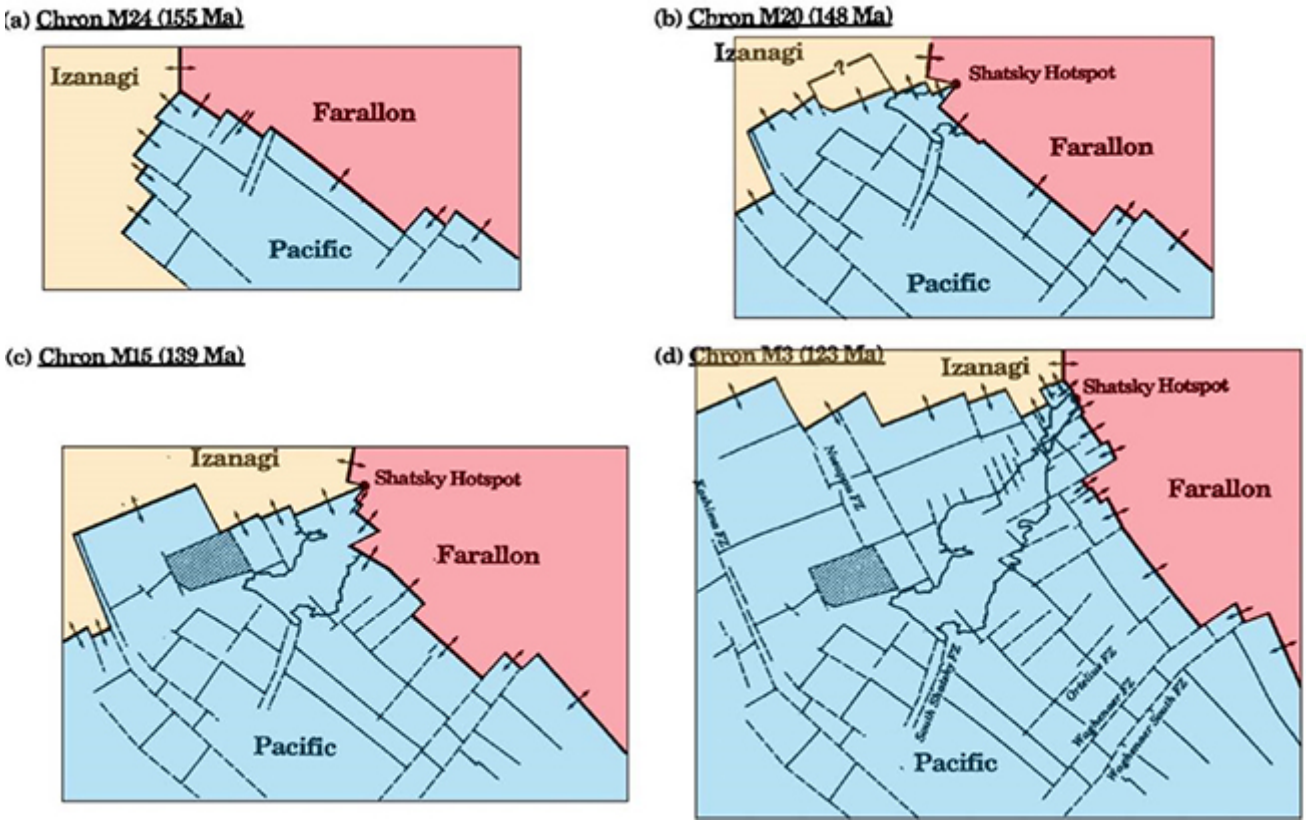


Figure 3: Seismic velocity structures
Above: Structure along the longitudinal profile.
Below: Structure along the transverse profile.
The detail of part of the longitudinal profile outlined in the above is shown in the figure 4.

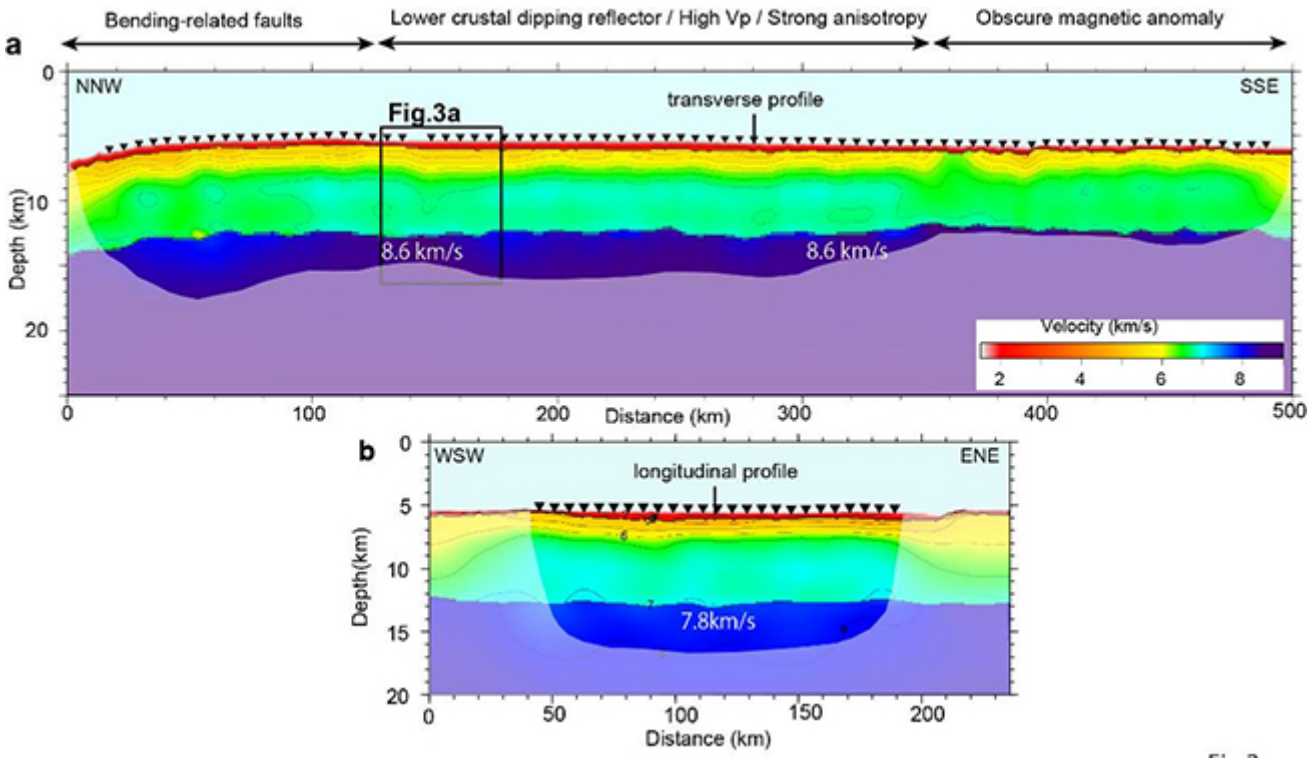


Figure 4: Detail

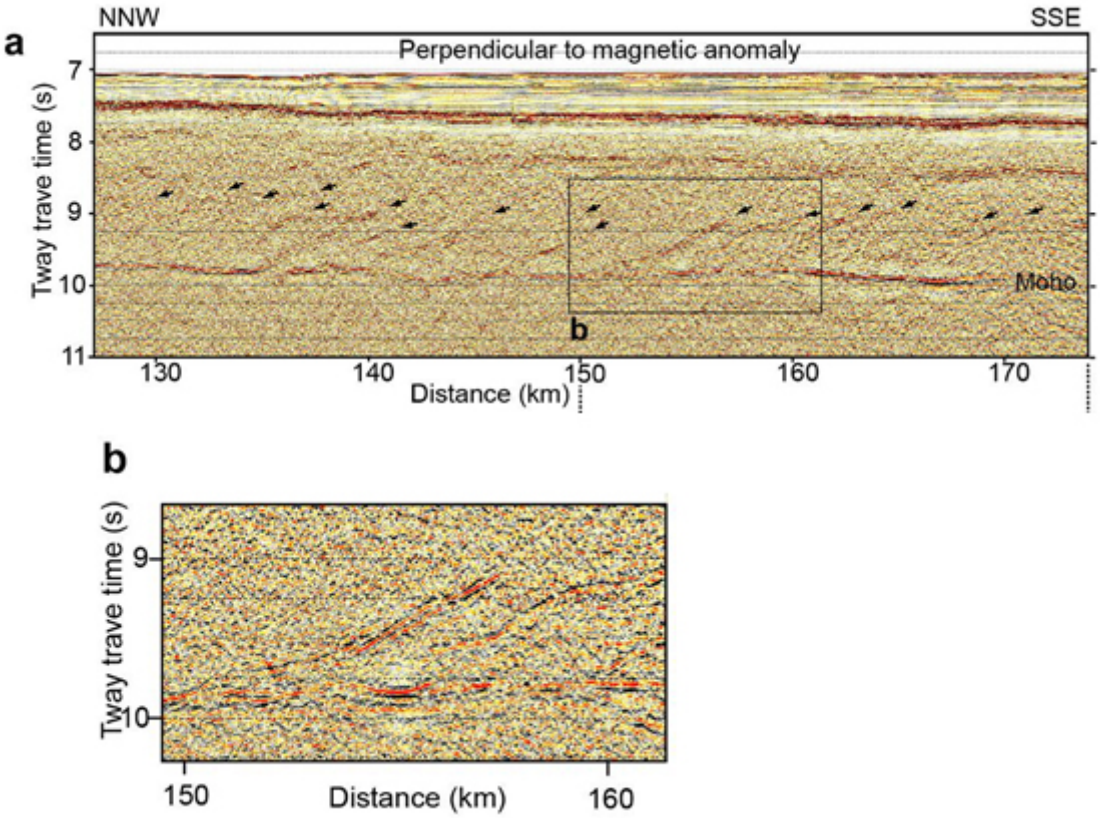


Figure 5: An example of Riedel shears confirmed at Darfield, New Zealand (Canterbury) in 2010. This photo originally appeared as Figure 2. on Quigley et. al. Geology 2012, 40.
For the purpose of explaining the research result, the original photo has been mirror-reversed and rotated with some revisions and additions.
R shows the direction of Riedel shear, and R' shows the direction of conjugate Riedel shear.

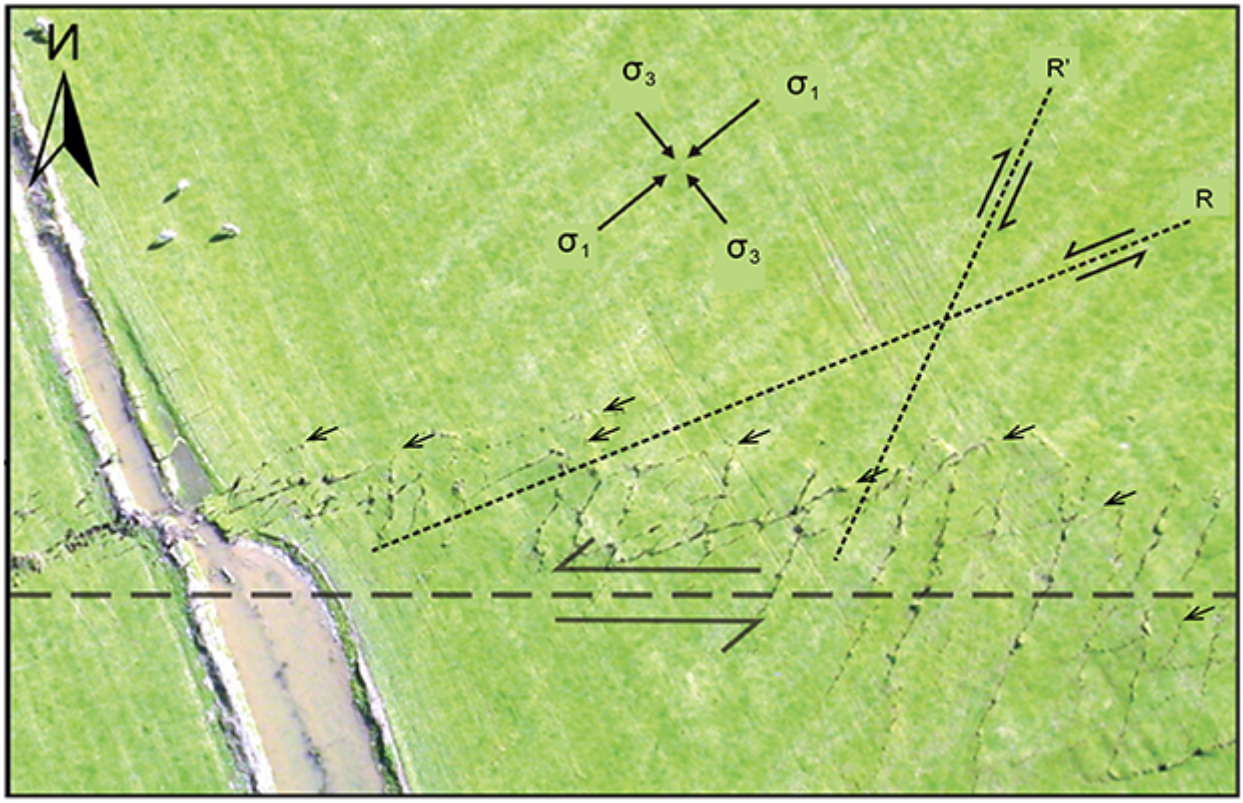
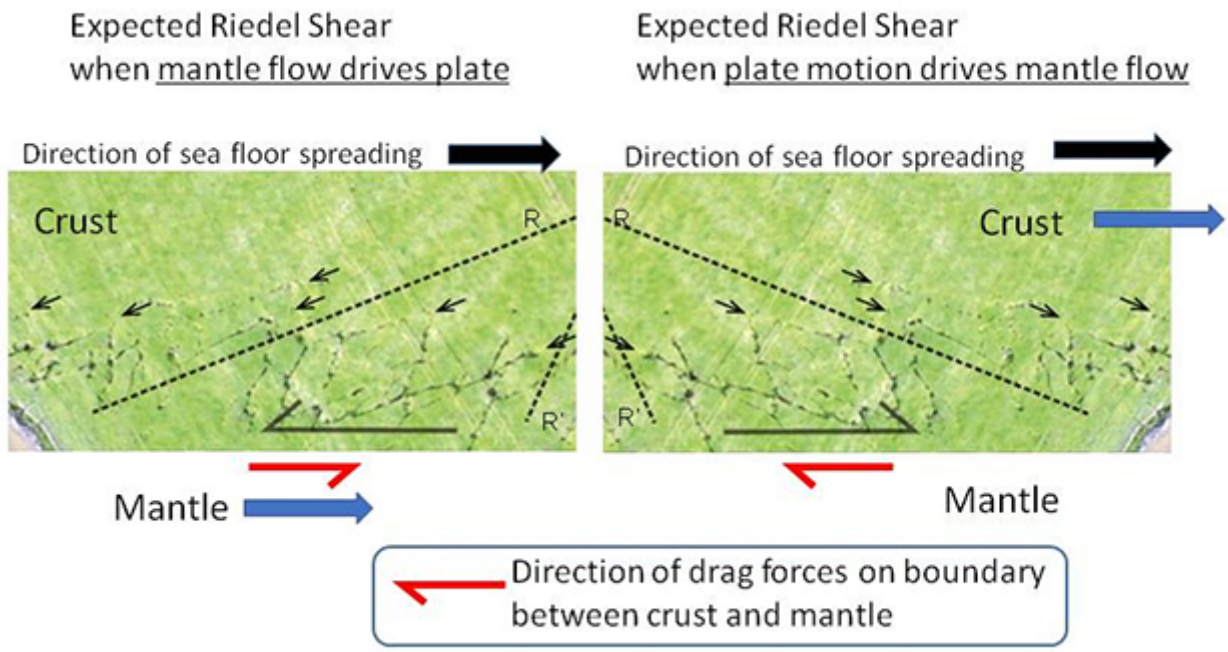
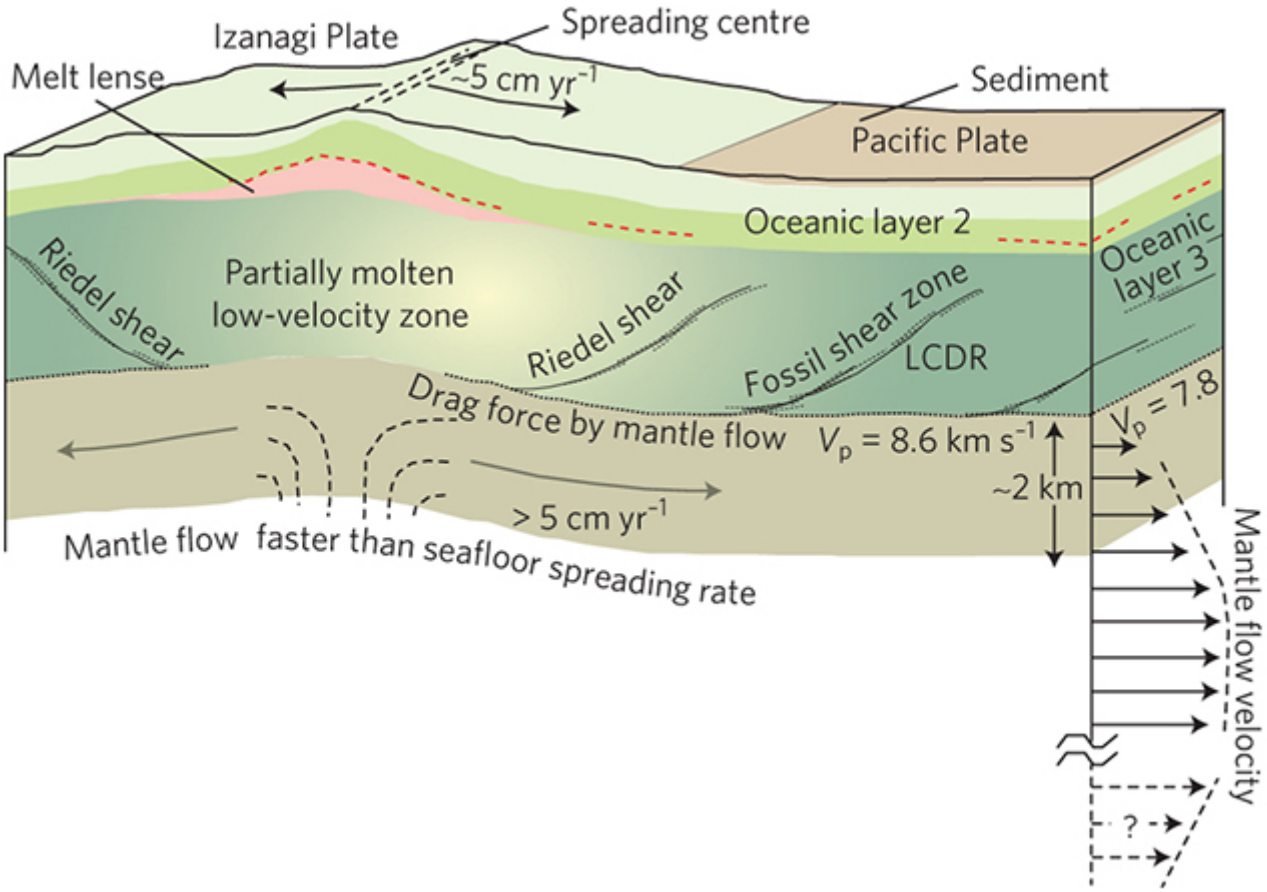


Figure 6: Riedel shears considered to be the movement of the mantle and crust



*For more accurate explanation about this study, the Figure 5 and Figure 6 have been revised. (November 21, 2014)

Figure 7: Schematic model showing the processes that form LCDRs and anisotropy in the uppermost mantle.



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