Island Arc

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2014 Island Arc Award

AWARDED PAPER

Title: Dissecting large earthquakes in Japan: Role of arc magma and fluid
Authors: Dapeng Zhao; M. Santosh; Akira Yamada
References: Island Arc, 19, 4–16 (2010)

RECOMMENDATION

Dr. Zhao and the co-authors have tried to clarify causal mechanisms of large earthquakes in the Japanese Islands using high-resolution tomographic images of the crust and uppermost part of the mantle beneath the mainshock hypocenters of the large earthquakes during 1995 to 2008. They have found that the large earthquakes, as well as 164 additional crustal earthquakes, have occurred along low-velocity zones with high Poisson's ratio anomalies, which are considered to be represented by arc magma and fluid. The finding indicates that the generation of a large earthquake is not entirely a mechanical process, but is closely related to the physical and chemical properties of materials of the crust and upper mantle, such as magma and fluids, which are produced by a combination of subducting slab dehydration and corner flow in the mantle wedge. Furthermore, the authors have pointed out that the rupture nucleation zone should have a three-dimensional spatial extent and is not just limited to the two-dimensional surface of a fault as suggested by the previous studies. The outcome of this study should contribute to a better understanding of the origin and mechanisms of large earthquakes and also be indispensable for the mitigation of large earthquake-related disasters in the future.

This paper received the highest number of citations–based on the Thomson Science Index for the year 2013–amongst the entire candidate Island Arc papers published in 2010–2012. The first author has been active in the research of seismic tomography and the effects of fluids and magma on earthquakes. This paper adds to his many contributions and is a worthy receipt of the 2014 Island Arc Award.

PROFILE OF THE FIRST AUTHOR: DAPENG ZHAO

Dapeng Zhao is Professor at Department of Geophysics, Tohoku University, Sendai, Japan. He received his BSc in 1984 from Peking University, China, and his MSc (1988) and PhD (1991) from Tohoku University. He was a post-doctoral fellow at California Institute of Technology during 1992–1995, and Associate Professor during 1998–2002 and Professor during 2003–2007 at Ehime University, Japan. In April 2007, he moved to Tohoku University as a professor. His research interests are earthquake seismology, seismic tomography, Earth structure and dynamics from local to global scales, subduction zones, hotspots, mantle plumes, moonquakes and lunar interior structure. So far he has published over 200 research papers in referred international journals, which have been cited over 7300 times (H-index = 47). According to his SCI publications during 2000 to 2010, Prof. D. Zhao was selected to be one of the world Top-10 earthquake researchers by ScienceWatch (Thomson-Reuters, http://archive.sciencewatch.com/ana/st/earthquakes2/authors/). So far, Prof. D. Zhao has advised over 40 graduate students and post-doctoral researchers. Now he is an editor of Journal of Asian Earth Sciences.

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