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2010 : April 2010 - Emerging Research Fronts : Narumi Takahashi on the Crustal Growth Process

EMERGING RESEARCH FRONTS - 2010

April 2010



Narumi Takahashi talks with *ScienceWatch.com* and answers a few questions about this month's Emerging Research Front Paper in the field of Geosciences.



Article: Crustal structure and evolution of the Mariana intra-oceanic island arc

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SW: Why do you think your paper is highly cited?

The main reason is probably that the scenario of the crustal growth shown in this paper is quantitative and simple. Therefore, it is also easy to cite.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

In this paper, we discussed how crusts grow and how continental materials are generated as a target of crustal structures of the Izu and Mariana arcs in combination with seismology and petrology.

As the result of this study, we found that the Mariana arc has continental materials inside, despite the fact that it has evolved through a process of subduction between two oceanic crusts without having had any continental materials, the same as the Izu arc. In addition, the mantle velocities are commonly slow when compared with a typical mantle.

It is well known that an oceanic arc such as the Mariana arc contains various types of rocks from heavy dense materials like basalts to lighter materials like rhyolites. Using the diversities of rocks and crust/mantle structures obtained by this study, we constructed a crustal growth scenario to make continental materials and concluded that

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heavy crustal materials, which are differentiated by the generation of light continental materials, are transformed to the mantle, changing the total crustal density from heavy to light.

The structural commonalities between the Mariana and Izu arcs are a new discovery and the construction of the crustal growth model is the synthesis.

SW: Would you summarize the significance of your paper in layman's term?

Generally speaking, there may be some individuals who believe that the ground is fixed and unchangeable, whereas the ground is constantly evolving through geologic periods as part of the evolution of the planet. This paper is one of the papers which outline how continents have evolved. Without geologic change, there could have been no possibility of human life on Earth.

SW: How did you become involved in this research and were any particular problems encountered along the way?

The theme of my doctoral thesis was the study of a typical oceanic crust. The area of concentration was the Izu-Bonin region. However, the cost of conducting such seismic surveys is quite high, requiring large sources and many observatories. Therefore, the study had been stopped for a long time.

The initiative of the 2003 Mariana seismic surveys, a collaboration between the US and Japan, was begun with the US-Japan Nankai Trough 3-D seismic reflection survey in 1999. It is important to note that such studies on crustal growth are one of the scientific targets of the **IODP** (Integrate Ocean Drilling Program).

SW: Where do you see your research leading in the future?

The crustal growth process as examined by this study includes many ambiguous elements. For example, it has remained uncertain how much water content is included in subducting oceanic crust, although it is an important element in the discussion of magma generation.

As it is unknown what kind of role is played by the dense crustal materials transported in the mantle, I would like to help advance such crustal growth studies.

SW: Do you foresee any social or political implications for your research?

The study of crustal growth is still in quite a fundamental stage. I hope that the crustal growth scenario could be part of a universal one outlining the evolving process which resulted in the making of continents after the birth of our planet.

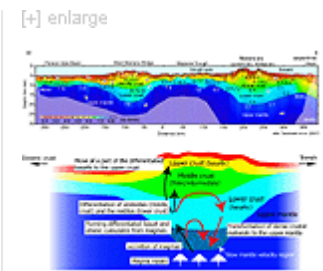
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(Top) Fig. 1 : Crustal structure cross the Mariana arc in direction of E-W (after Takahashi et al., 2007). No shaded area is resolved area in this study. Numerals are P wavespeed (km/s).

(Bottom) Fig. 2: Simple schematic figure of the crustal growth model.

Web

KEYWORDS: seismic structure; intra-oceanic island arc; crustal growth; Izu-Bonin-Mariana arc; IZU-BONIN-MARIANA;
CONTINENTAL-CRUST; CENTRAL JAPAN; ORIGIN; BASIN; MANTLE.

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