SCG10-10 会場:101B 時間:5 月 22 日 16:45-17:00

# なぜ島弧地殻の超深度掘削が必要なのか？
# Why we need drill deep into the oceanic arc crust?

田村 芳彦[1*], 巽 好幸[2]
Yoshihiko Tamura[1*], Yoshiyuki Tatsumi[2]

[1] 海洋研究開発機構地球内部ダイナミクス領域, [2] 神戸大学
[1]IFREE, JAMSTEC, [2]Kobe University

The continental crust, the most differentiated end-member of the components of solid Earth, is andesitic in overall composition (e.g. Rudnick & Gao, 2003). Thus, it is widely thought the continental crust has been created, or at least recycled, in subduction zones for the last ˜3.5 Ga (eg. Taylor, 1967, Rudnick, 1995). However, how andesite is generated, the so-called ’andesite problem’, has long been a central question of igneous petrology.

At first glance, intra-oceanic arcs do not appear to be the right place to study the production of andesitic magmas, because (1) modern magmatism at the intra-oceanic Izu-Bonin-Mariana (IBM) arc is bimodal, with basalt and rhyolite predominating (Tamura & Tatsumi, 2002); and (2) turbidites sampled during Ocean Drilling Program (ODP) Leg 126 in the Izu-Bonin arc, which range in age from 0.1 to 31 Ma, are similarly bimodal (Gill et al., 1994), suggesting that the bimodal volcanism has persisted throughout much of the arc’s history. Moreover, such bimodal magmatism is not unique to the Izu-Bonin arc, with the 30-36.5 degrees S sector of the Kermadec arc, another example of an intra-oceanic arc, also exhibiting it (Smith et al., 2003; 2006; Wright et al., 2006). So why and how do we study the intra-oceanic arcs to solve the ’andesite problem’?

Closer inspection of the IBM arc remarkably reveals the presence of a significant volume of middle crust with seismic velocities of 6.0-6.8 km/s throughout the entire arc (Calvert et al., 2008; Kodaira et al., 2007a,b; Kodaira et al., 2008; Kodaira et al., 2010; Takahashi et al., 2007; Takahashi et al., 2008; Takahashi et al., 2009). This is remarkable because these velocities are characteristic of a wide range of intermediate-felsic plutonic/metamorphic rocks (Christensen & Mooney, 1995; Behn & Kelemen, 2003, Behn & Kelemen, 2006) and are similar to the mean velocity of andesitic continental crust, such material would not be expected to be present on the basis of the bimodal volcanism. Moreover, this crust is presently thickest beneath basaltic volcanoes and thinnest beneath rhyolitic volcanoes (Kodaira et al., 2007), which is another enigma.

One possible way to understand this phenomenon is to investigate arc crustal sections exposed on land in order to examine the relationship between volcanic and plutonic rocks and the generation of andesitic magmas, as exposed arc crustal sections typically include middle crust composed of diorite to tonalite to granodiorite (e.g. Kawate & Arima, 1998; Busby et al., 2006; DeBari & Greene, 2011). However, in the IBM arc, remnants of this old crust have never been found at the northern end of the arc, where it is colliding with the Honshu arc (Izu collision zone) (e.g. Tani et al., 2010; Tamura et al., 2010). Tamura et al. (2010) suggest that IBM arc middle crust in the collision zone was partially melted during the collision and then intruded into the overlying upper crust of the Honshu and IBM arcs. This resulted in the complete loss of chronological information, original mineralogy and possibly their original composition, and thus any information related to their original source. Similarly, any continental crust we observe on the surface of the Earth will have experienced deformation, metamorphism, and been otherwise processed, perhaps several times from its creation in subduction zones to the present day, thus overprinting, resulting in the loss of, key information that can provide clues to its genesis.

’Ultra-Deep Drilling into Arc Crust’ is the best way to sample unprocessed juvenile continental-type crust in order to observe the active processes that produce the nuclei of new continental crust, and to examine the nature of juvenile continental crust being generated at intra-oceanic arcs.

キーワード: oceanic arc, continental crust, collision zone, ultra-deep drilling, Chikyu