Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SMP006-P03 会場:コンベンションホール 時間:5 月 25 日 10:30-13:00

Dunite and wehrlite crystal aggregates in basalts from West Zealandia Seamount, Southern Mariana Volcanic Arc

Dunite and wehrlite crystal aggregates in basalts from West Zealandia Seamount, Southern Mariana Volcanic Arc

Alexander Nichols[1*], Yoshihiko Tamura[1], Robert J. Stern[2], Hiroshi Shukuno[1], Akiko Nunokawa[1]
Alexander Nichols[1*], Yoshihiko Tamura[1], Robert J. Stern[2], Hiroshi Shukuno[1], Akiko Nunokawa[1]

[1]IFREE, JAMSTEC, Yokosuka, Japan, [2]University of Texas at Dallas, USA
[1]IFREE, JAMSTEC, Yokosuka, Japan, [2]University of Texas at Dallas, USA

West Zealandia Seamount, at approximately 16^o 53' N, lies behind the magmatic front of the Mariana Arc. It is part of the Sarigan-Zealandia volcanic complex, a group of mostly submarine volcanoes and parasitic cones, the highest of which are the island of Sarigan (538 m above sea level), and Zealandia Bank, which comes within a few meters of sea level. West Zealandia rises from about 2750 m below sea level to a summit depth of around 750 m and is separated from Zealandia Bank by a saddle that is as deep as 1050 m below sea level. Bathymetric surveys reveal that its summit has an unusual arcuate morphology, while radial ridges that extend for about 10 km from the summit, and may represent lava flows, mark its western and southern slopes. Sampling of the northwestern slopes from 1390-1135 m with the ROV Hyper-Dolphin during NT09-08 was undertaken in June 2009 and recovered primitive basalts, with whole rock MgO and SiO_2 contents of 10.7 wt.% and 47.9 wt.%, respectively. These primitive basalts contain dunite and wehrlite crystalline aggregates, which have been analyzed by electron microprobe (EPMA) for major elements. These analyses paid particular attention to the Ca and Ni contents of the olivine, which can be used to determine whether the aggregates are mantle xenoliths. The NiO contents of the olivine in the aggregates are too low and the CaO contents too high to be in equilibrium with mantle olivine, suggesting that the aggregates are crustal xenocrysts. With Fo_{85-91}, the olivines in the crystal aggregates contain 0.15 to 0.24 wt.% NiO, whereas at these Fo contents mantle olivines contain at least 0.28 to 0.36 wt.% NiO, respectively (Takahashi, 1986, Bull. Volcanol. Soc. Japan, 30, S17-S40). Mantle olivines are also characterized by CaO less than 0.1 wt.% (Simkin & Smith, 1970, J. Geol, 78, 304-325); the olivines in the West Zealandia crystal aggregates contain more than 0.15 wt.%. Even so, the high Fo contents of the olivines in the crystal aggregates indicate that they crystallized from a primitive melt, and in addition they contain silicate melt inclusions that may provide access to this melt, and determine whether or not it is primary. As a result, initially the volatile, and then the major and trace element concentrations in the inclusions are being measured by micro-Fourier-transform infrared spectroscopy (FTIR), EPMA and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), respectively. The H_2O contents of the inclusions range from 3.01 to 4.47 wt.%, with the exception of one inclusion that contains 1.87 wt.%. CO_2 contents range from below detection limits (60 ppm) to 809 ppm. Overall the H_2O-CO_2 systematics are generally consistent with open system degassing, although a few inclusions require closed system degassing with the initial melt in equilibrium with 5% exsolved vapor. The highest volatile contents indicate entrapment pressures of up to 296 MPa, equivalent to about 11.7 km below sea level, which, beneath West Zealandia, is around the base of the middle crust, top of the lower crust (Takahashi et al., 2007, Geology, 35, 203-206). If so, the West Zealandia crystal aggregates may represent the first ever direct samples of Mariana crust from such depths.

キーワード: olivine, clinopyoxene, crystal aggregates, melt inclusions, major elements, volatiles
Keywords: olivine, clinopyoxene, crystal aggregates, melt inclusions, major elements, volatiles