Pressure dependence of partition coefficients between olivine and peridotite melt

TAKAMASA IMAI[1]*, EIICHI TAKAHASHI[1],
TOSHIHIRO SUZUKI[2] AND TAKAFUMI HIRATA[1]

[1]Earth Planet. Sci, Tokyo Institute of Technology, Tokyo 152-8551, Japan (*correspondence: imai.t.ac@m.titech.ac.jp)
[2]IFREE, JAMSTEC, Kanagawa 237-0061, Japan

In order to understand the crystallization process of global magma ocean, precise knowledge on the element partitioning at various pressures is essentially important. We have determined PC-IR (partition coefficient, ionic radius) diagram for 32 elements between olivine and peridotite melt at 2, 5, 10, and 14 GPa. Two types of starting materials were prepared from a fertile peridotite KLB-1 [1] with different levels of trace elements. High-pressure melting experiments were performed using a piston-cylinder apparatus and a multi-anvil apparatus at the Magma Factory, Tokyo Inst. of Technology. Chemical analyses were performed using EPMA (JEOL-8800) for major and minor elements and LA-ICP-MS for trace elements (ArF excimer laser and a quadrupole mass spectrometer, 30 μm laser beam, NIST610 glass standard). Partition coefficients were calculated and were plotted on the PC-IR diagram. The results of this study are in general agreement with previous studies on similar compositions (analysis by EPMA [2]; by SIMS [3]) except that the shape of the peaks and pattern of the parabolas were tightly constrained in the present study. PC-IR diagram for trivalent cations between olivine and peridotite melt was tightly constrained for the first time with 14 elements (including 8 REE). The partition coefficient for Al increases with pressure (D_{Al}= 0.012 at 2 GPa, 0.048 at 14 GPa) while that for all other trivalent cations decreases with increasing pressure (e.g., D_{Y}=0.0077 at 2 GPa, 0.0019 at 14 GPa). The pressure effect on the PC-IR diagram cannot be explained simply by the lattice strain model [4] but requires some additional factors. Increase in D_{Al} may be explained by the combination of two types of substitutions (Mg^{2+}, Mg^{2+}) ↔ (Na^{+}, Al^{3+}) and (Si^{4+}, Mg^{2+}) ↔ (Al^{3+}, Al^{3+}). Decrease in D values for other trivalent cations implies that the latter type of substitution is the dominant mechanism.

[1] Takahashi (1986) *J. Geophys Res.* **91**, 9367-9382. [2] Suzuki and Akaogi (1995) *Phys. Chem. Minerals* **22**, 411-418. [3] Taura *et al*. (1998) *Phys. Chem. Minerals* **25**, 469-484. [4] Blundy and Wood (1994) *Nature* **372**, 452-454.

Tethys-wide occurrence of Lower Aptian *Lithocodium-Bacinella* facies: Shoalwater expression of basinal OAE1a black shales

A.IMMENHAUSER[1]*, S. HUCK[1], N. RAMEIL[1],
U. HEIMHOFER[1], T. KORBAR[2], T.D. WIECZOREK[1]
AND C. KUNKEL[1]

[1]Ruhr-University Bochum, Germany
(*correspondence: adrian.immenhauser@rub.de)
[2]Geological Survey of Croatia, Zagreb, Croatia

Lithocodium aggregatum and *Bacinella irregularis* are now extinct microencrusters of unknown taxonomic origin that thrived in (sub)tropical platform environments. During parts of the Early Aptian, these organisms experienced bloom periods and temporarily replaced rudist-coral assemblages as the dominant framework builders. Within the limitations of geological time resolution, this "out-of-balance" shoalwater facies seems to be coeval with the OAE1a-related black shale deposition in oceanic basins but the triggering environmental factors that caused this mass occurrence remain insufficiently understood. Having previously established the OAE1a-synchronous nature of *Lithocodium-Bacinella* facies across the Arabian Platform in Oman [1], recent work focuses on OAE1a time-equivalent exposures in Croatia, France and Portugal. Time correlation is based on high-resolution carbon-isotope stratigraphy supported by Sr-isotope stratigraphy focussing on selected rudist shell material. It is not the mere presence of *Lithocodium-Bacinella* as such that is of interest here – *Lithocodium-Bacinella* co-existed with many other neritic organisms throughout much of the Mesozoic – but the transient mass occurrence of these microencrusters and the coeval demise of the dominant mid-Cretaceous framework-builders (rudists and corals). Obviously, the transient dominance of *Lithocodium-Bacinella* facies is but one of the known responses of neritic platform systems to factors that also caused OAE1a. From other Tethyan localities, platform drowning [2] or the presence of bituminous limestones [3] have been reported. An improved comprehension of the effects of C-cycle perturbation on neritic palaeo-ecosystems is instrumental in understanding anoxic events to their full extent.

[1] Immenhauser *et al*. (2005) *Sedimentology* **52**, 77-99. [2] Weissert *et al*. (1998). *Palaeogeography, Palaeoclimatology, Palaeoecology* **137**, 189-203. [3] Heldt *et al*. (2008) *Palaeogeography Palaeoclimatology Palaeoecology* **261**, 246-260.