# Dependence of the external and surface morphologies of matrix olivine particles on growth condition

J. YAMADA, H. KOBATAKE1, J. NOZAWA AND K. TSUKAMOTO

Graduate School of Science,Tohoku University, (yamadajy@ganko.tohoku.ac.jp)
[1]Institute of Multidisciplinary Research for Advansed Materials, Tohoku University

We have synthesized olivine particles from silicate vapor to study the growth mechanism of the matrix olivine in meteorites like Allende chondrite.

These matrix olivine particles in primitive meteorites were found to exibit various morphologies and surface microtopographs [Nozawa *et al*., 2007 this conference]. Since morphologies involve a lot of information about the growth condtions, we have experimentally tried to reproduce the morphologies and surface microtopographs to compare these morphologies with the natural one.

Forsterite melt droplets were prepared in a graphite cell (45×20×30 mm) in a vacuum chamber (Ar, 100 Pa). A 100W of $CO_2$ laser was employed to heat a forsterite polycrytalline spherule for melting in <100 sec. There is a temperature and gas concentration gradient along the graphite plate. The former and the latter were measured respectivly by a thin ($\phi$=0.1mm) thermocouple and by measuring the thickness increase interferometry druing the experiment. The forsterite crystals were characterized by TEM, FE-SEM, AFM and DICM. The latter two have been employed to observe the surface microtopographs.

As the temperature T, decreased and thus the supersaturation, $\sigma$ of the vapor increased, the forsterite morphology changed from a bulky type ($T$=1000-1450ºC, $\delta$ <9) to a platy type ($T$=700-1000℃, $\delta$ =9-17 (Fig.1)) , then to a columnar needle shape ($T$=500-820ºC, $\delta$ =13-25), and finally to a droplet type ($T$<500ºC, $\delta$>25). Various 2-dimentional islands with the step height of 0.3 nm-few nm were observed: rectangular growth islands with a smooth-edge step ($T$=1200-1500ºC, $\delta$<2), islands with a rough-edge step ($T$=900-1200ºC, $\delta$=3-10), and a droplet type ($T$<800ºC, $\delta$>16). These external and surface morphologies have been compared with natural matrix olivines.

In colusion, these external and surface morphologies are comparable to those of matrix olivine observed in the matrix of Allende meteorite. Therefore, these olivine are concluded to be formed at 2000ºC followed by rapid cooling in ~10 s. down to 700ºC.

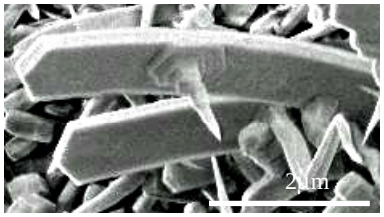


Fig.1. Platy type forsterite crystal grown at $T$=700ºC, $\delta$=9.

# Particle fluxes and scavenging of radionuclides in the western Northwest Pacific Ocean

MASATOSHI YAMADA AND JIAN ZHENG

Nakaminato Laboratory for Marine Radioecology, National Institute of Radiological Sciences, Hitachinaka, Ibaraki 311-1202, Japan (m_yamada@nirs.go.jp; jzheng@nirs.go.jp)

## Introduction

$^{230}$Th, $^{210}$Pb and Pu are particle-reactive radionuclides and they are therefore removed from the water column by a scavenging process. Because of substantial input of terrigeneous materials from riverine input and atmospheric input of continental dust, and the relatively high primary productivity, the western Northwest Pacific margins may be important for removal of reactive radionuclides by scavenging (Yamada and Aono, 2006). The objectives of this study are to measure the activities of $^{210}$Pb, $^{230}$Th and $^{239,240}$Pu in settling particles in the western Northwest Pacific margin and to discuss the removal of reactive radionuclides by scavenging and particle transport processes on the margins of the western Northwest Pacific Ocean.

## Materials and methods

A mooring of three conical time-series sediment traps was deployed at two sites in the western Northwest Pacific Ocean for nine months. The analytical procedure for $^{210}$Pb, $^{230}$Th and $^{239,240}$Pu was essentially the same as that described by Anderson and Fleer (1982). A double-focusing sector-field ICP-MS instrument was used for the determination of the Th and Pu isotopes in settling particle samples (Zheng and Yamada, 2006).

## Results and discussion

Total mass fluxes, $^{210}$Pb fluxes, $^{230}$Th fluxes and $^{239,240}$Pu fluxes showed large seasonal variations and their weighted mean fluxes tended to increase with depth, with an especially large increase near-bottom. The ratios of the observed $^{210}$Pb fluxes to the $^{210}$Pb deficiency fluxes in the near-bottom traps ranged between 1.22 and 2.63. The mean total $^{230}$Th fluxes at the near-bottom traps were 4.2–6.7 times higher than that expected from production in the overlying water column. The high fluxes of particulate $^{210}$Pb, $^{230}$Th and $^{239,240}$Pu collected by the near-bottom traps reflect a combination of enhanced scavenging of dissolved $^{210}$Pb, $^{230}$Th and $^{239,240}$Pu by the high fluxes of particles in the region, as well as the lateral redistribution of particulate matter itself by downslope gravitational settling and by alongshore transport by currents.

## References

Anderson, R.F. and Fleer, A. P., (1982). *Anal. Chem.* **54**, 1142-1147.

Yamada, M. and Aono, T., (2006). *Mar. Geol*. **227**, 1-12.

Zheng, J. and Yamada, M., (2006). *Talanta* **69**, 1246-1253.