Feature and evolution of metamorphic fluids during continental collision

B. FU[1], J.L.R. TOURET[2] AND Y.-F. ZHENG[3]

[1] School of Earth Sciences, James Cook University, Townsville, QLD 4811, Australia (bin.fu@jcu.edu.au)
[2] Musée de Minérologie, Ecole des Mines, 75006 Paris, France (jtouret@ensmp.fr)
[3] School of Earth and Space Sciences, University of Science and Technology of China, Hefei 230026, China (yfzheng@ustc.edu.cn)

In the past three decades, fluid inclusions in granulites and eclogites have been intensively studied. In general, CO_2 predominates in granulites, against N_2 and H_2O in eclogites. Examples from the Triassic Dabie-Sulu orogenic belt in eastern China also show no difference in fluid regime between high- and ultrahigh-pressure eclogites, but significant distinction between granulites, granulitized eclogites and eclogites. Typically, a complete fluid history has been well preserved in granulitized eclogites and garnet clinopyroxenites (e.g., Weihai & Huangweihe): from early N_2 and high-salinity brines at eclogite-facies, to CO_2 at granulite-facies and finally low-salinity fluids at retrograde amphibolite-facies conditions. While some of the H_2O can be considered to originate from hydroxyl exsolution during exhumation, the origin of CO_2 – internally or externally-derived – is still unclear. Electron microprobe results show that solid needles or rods abundantly in clinopyroxene (formerly supersilicic) are SiO_2±$NaAlSi_3O_8$ in composition, but no Laser Raman spectra indicate a structure corresponding to quartz or albite. Thus, the solid phase that commonly contains CO_2±CH_4 inclusions is believed to be glass. It may represent remnants of melt inclusions, formed during granulite-facies overprinting.

Based on SEM-EDX and laser Raman techniques a solid phase, ferropyrosmalite [$(Fe, Mn)_8Si_6O_{15}(OH, Cl)_{10}$, where Fe >> Mn] has been identified in CH_4-bearing, multisolid brine inclusions in coesite-bearing eclogites. Ferropyrosmalite may result from retrogression of clinopyroxene in the saline fluid at low temperatures after trapping. Laser ablation ICP-MS results show large amounts of Na, K, Mg, Ca, Mn, Fe, Sr, Ba and Pb in the brine.

Fluid inclusions in quartz veins within high- and ultrahigh-pressure eclogites and gneisses indicate that late low-salinity fluids are ubiquitous, whereas relics of early fluids are either Ca- and Na-rich or nearly pure waters. In particular, high-salinity brines have been preserved in high-$\delta^{18}O$ quartz veins and host rocks (i.e., high-$\delta^{18}O$ eclogites and gneisses), whereas very low-salinity fluids occur in low-$\delta^{18}O$ equivalents. It appears that the extent of meteoric-hydrothermal alteration to their protoliths before the Triassic subduction has exerted a primary control on the fluid salinity and $\delta^{18}O$ value.

Discovery of ubiquitous 50 nanometers carbon particles in the atmosphere

FENGFU FU[1], KAZUO WATANABE[1], SADAYO YABUKI[2] AND TASUKU AKAGI[3],

[1]Department of Environmental Sciences, JAERI, Tokai, Ibaraki 319-1195, Japan (fengfu@acl.tokai.jaeri.go.jp)
[2]Division of Surface Characterization, RIKEN, Wako, Saitama 351-0198, Japan
[3]Faculty of Agriculture, Tokyo University of Agriculture and Technology, Fuchu, Tokyo, Japan (akagi@cc.tuat.ac.jp)

Elemental carbon (EC) aerosols in the atmosphere have been observed by scientists, since EC aerosols are reported to absorb sunlight, heat the air, and eventually contribute to global warming (Jacobson, 2001). The morphology of EC particles will affect their optical properties, therefore the study on morphology is very important when studying the warming effect of EC aerosols. The aim of this study is to observe the difference in the morphology of EC particles of different sizes in the atmosphere.

Different sized aerosols were collected at 10 m latitude in JAERI (Japan Atomic Energy Research Institute, Tokai-mura, Ibaraki, Japan, N: 36.30, L: 140.29) and in RIKEN (Wako, Saitama, Japan, N: 35.50, L: 139.29) with an Andersen type air sampler. EC particles in different-sized aerosols were separated by chemical process, and morphologies of them were observed in detail with SEM.

The results of this study showed that most of EC particles in the atmosphere is 50 nanometers spherical particles (Fig. 1), and the 50 nanometers carbon ball aggregate with other aerosols or themselves to form bigger aerosols of different sizes in the atmosphere. The 50 nanometers spherical carbon particle was found different from fullerene reported by Utsunomiya et al. (2002). All EC particles showed the same ratio of carbon and oxygen (O/C) independent of their size and morphology.

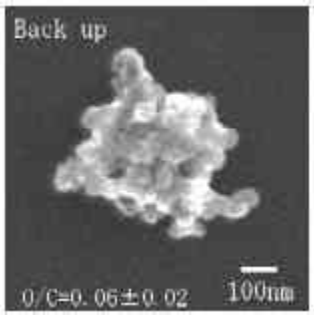

Fig. 1: The SEM image of EC particles separated from the aerosols collected on back-up stage of an Andersen air sampler.

Acknowledgment

This work was supported by the JSPS.

References

Jacobson M. Z. *Nature* 409, 695-697 (2001).
Utsunomiya S. et al. Environmental Sciences and Technology 36, 4943-4947.