

Supercritical fluids from downgoing slab beneath volcanic arcs: Critical endpoints in sediment – H₂O and high Mg andesite – H₂O systems

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Subduction zone magmatism is triggered by addition of slab-derived component into overlying mantle wedge. Whether this component is aqueous fluids from dehydration or partial melts of subducting oceanic crust remains an open question. Based on our high-P and high-T radiography experiments at SPring-8 [1], we suggest surprisingly shallow pressures of critical endpoints between aqueous fluids and high-Mg andesite (2.9 GPa, 87 km depth) or sediment (2.5 GPa, 75 km depth). We also carried out a test using albite with 50 and 64 wt% H₂O at SPring-8; we see two fluids with 50 % H₂O at 1.4 GPa and with 64 % H₂O at 1 GPa while one single fluid with 50 % H₂O at 1.7 GPa and with 64 % H₂O at 1.4 GPa. These indicate the critical endpoint in albite and H₂O system located at 1.55 GPa, which is consistent with the previous studies [2]. This simple test guarantees an ability of the present X-ray radiography method to determine the critical endpoints in silicate melts and aqueous fluids within an uncertainty of plus/ minus 10 % relative or 0.15 GPa.

We suggest that slab-derived fluids should be supercritical fluids at the top of subducting slab beneath the volcanic arcs. Under relatively hot conditions, dense liquid-like supercritical fluids are input from dehydrating slab to the overlying mantle wedge. Such dense supercritical fluids produce double magmatism in hot subduction zones by their separation into aqueous fluids and hydrous melts: basalt and sanukite or basalt and adakite [3]. The sanukite and adakite can be produced by reaction of the melt and mantle, while basalt through fluid-induced partial melting of mantle.

[1] Mibe *et al.* (2004) *GCA* **68**, 5189, (2007) *JGR* **112**, B03201. [2] Shen & Keppler 1997 *Nature* **386**, 710, Stalder *et al.* (2000) *Am Miner* **85**, 68. [3] Tatsumi & Ishizaka (1982) *Lithos* **15**, 161, Yogodzinski & Kelemen 1998 *EPSL* **158**, 53.

Long-term observation of organic aerosols in the western North Pacific in 2001-2009

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Introduction

The western North Pacific is located at the outflow region of Asian dusts and their precursors. A rapid industrial development in China and East Asian countries for last two decades may have seriously changed the air quality of the North Pacific. However, long-term trend of atmospheric composition has not been studied in this region although many campaigns had been conducted. To understand atmospheric transport of organic aerosols over the western North Pacific, we collected marine aerosols on weekly basis at a remote island, Chichijima (27°04'E; 142°13'N), in 2001-2009 using a high volume air sampler and pre-combusted quartz filter. The island is located in the boundary of westerly and trade wind regimes. The aerosol samples were analyzed for dicarboxylic acids, ketoacids and dicarbonyls employing butyl ester derivatization followed by GC determination, as well as total carbon (TC) and nitrogen, water-soluble organic carbon (WSOC) and OC/EC.

Results and Discussion

Homologous series of saturated diacids (C2-C11) were detected with a predominance of oxalic (C2) acid followed by malonic (C3) and succinic (C4) acids. Unsaturated diacids, including maleic (M), fumaric (F), phthalic acids, were also detected together with ketoacids and dicarbonyls. Concentrations of total diacids fluctuated significantly in a range of 10-600 ngm⁻³ with winter/spring maximum and summer minimum. The maximum can be explained by a combination of enhanced emissions of polluted aerosols and their precursors in Asia and the intensified transport by westerly over the North Pacific in winter/spring. C3/C4 concentration ratios maximized in summer, indicating more oxidation of longer-chain diacids and other precursors to shorter diacids. Azelaic acid (C9) showed a sharp increase relative to other diacids in summer, suggesting an enhanced sea-to-air emission of unsaturated fatty acids followed by photochemical oxidation in summer. On the other hand, M/F ratios decreased from winter to summer as a result of photochemical isomerization of cis to trans configuration. We also discuss trends of long-term increase in the concentrations of diacids and related compounds as well as TC and WSOC for the period of 2001 to 2009.