Change of Fe species and increase of its solubility during long-range transport of Asian dust

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Iron (Fe) is an essential micronutrient and has been identified as a limiting factor for phytoplankton growth in high-nitrate low-chlorophyll (HNLC) regions of the ocean. In the North Pacific, one of the HNLC regions, transport and deposition of mineral dust from Asia can be one of major sources of Fe. In the atmosphere, Fe can be found and transported in a variety of chemical forms, both water-soluble and -insoluble. It is generally believed that only the soluble fraction of iron can be considered as bioavailable for phytoplankton. Only a part of Fe entering the ocean can be dissolved in the seawater. However, large uncertainties exist in the estimates of bioavailable Fe deposited from the atmosphere, owing to widely range of Fe solubility in seawater. Photochemical processes and the uptake of secondary acids and/or organics can increase the solubility and bioavailability of iron in dust particles, which is an important pathway for the fertilization of remote oceans with subsequent climate impacts. Although it has been suggested that atmospheric processes can change the solubility of Fe as it moves from the source to the deposited area in oceans, it is not clear the actual chemical processes affecting Fe species in the mineral dusts. Thus, it is strongly suggested that the bioavailability of Fe is influenced by its solubility, or chemical species of Fe contained in Asian dust. To assess the biogeochemical impact of the atmospheric input, attempt was made to identify the Fe species by XAFS, which were also used to speciation of S and Ca in aerosols [1, 2]. Moreover, leaching experiments were conducted for the natural dust samples with thorough information of Fe species contained in the dust As a result, we found that original iron species near the source (western China) are clay minerals (illite and chlorite), which were transformed into ferrihydrite formed during long-range transport to eastern China and Japan by atmospheric chemical processes. Moreover, iron in the dust becomes more soluble after the transport due to the formation of ferrihydrite. Our findings demonstrate that ferrihydrite secondary formed during the long-range transport is a significant source of soluble Fe species, which can control phytoplankton growth in the North Pacific.

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Petrological characteristics of Boninite, Chichijima Island, Japan – Vertical petrological diversity of Boninite pillow lava

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Chichijima, Ogasawara Islands is the place where boninite has been exposed most voluminously all over the world. Moreover, it is type locality of boninite. Boninite is high-magnesian andesite (HMA) which is a primary andesite basis of its high Mg, Ni and Cr content, directly derived from mantle [1]. We did detailed research and sampling of boninite based on geological map of Chichijima (Umino and Nakano (2007)) and clarified and classified petrographic characteristics of boninite. We here report the Bulk chemical composition, mineral assemblege and mineral chemistry of Boninite pillow lava. This is preliminary report of systematic chemical study about Boninite based on pillow lava sequence.

Uminio (1986) classified aphyric boninite from Chichijima into five types: (I) olivine (ol) + clinoenstatite (cen) + bronzaite (brz); (II) ol + brz; (III) brz; (IV) brz + pigeonite (pig) + augite (aug); (V) cen + brz [2].

We can classified the type (II) of Umino (1986) divided into four types by phenocryst and micro-phenocryst assemblage [3]. They are Type AI (phenocryst: (ol) / brz $\geqq 1$ and micro-phenocryst: brz / clinopyroxene (cpx) $\geqq 1$), Type AII (phenocryst: ol / brz $\geqq 1$ and micro-phenocryst: brz /cpx < 1), Type BI (phenocryst: ol / brz < 1 and micro-phenocryst: brz / cpx $\geqq 1$) and Type BII (phenocryst: ol / brz <1 and micro-phenocryst: brz / cpx < 1). It has been understood that the above four types rock appears in respective height of the pillow lava bed.

Bulk chemical composition and mineral (olivine, pyroxenes and chromian spinel) chemistry also different depending on the height of the pillow lava bed.

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