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Chemistry, mineralogy and alteration intensity of hydrothermal altered Mt Unzen conduit rocks (Shimabara/Japan)

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Investigations were carried out on hydrothermally altered coherent dacitic dykes samples from (USDP-4) drill core at Mt Unzen stratovolcano (Shimabara/Japan). XRF, XRD, EMPA, C-O-isotope, hot-cathode CL and SEM analysis led to insights concerning chemistry, mineralogy, and intensity and type of alteration as well as the origin of carbonate-precipitating fluids. Additionally a textural characterization of the occurring replacement features in the volcanic conduit rocks was performed. The occurrence of the main secondary phases such as chlorite, pyrite, carbonates, and R1 (Reichweite parameter) illite-smectite and kaolinite group minerals indicate a weak to moderate propylitic to phyllic hydrothermal alteration. The dacitic samples of the dykes show different hydrothermal alteration features: (i) carbonate and chlorite pseudomorphs after hornblende as well as core and zonal textures due to replacement of plagioclase by R1 illite-smectite as well as kaolinite group minerals, (ii) colloform banded fracture fillings and fillings in dissolution vugs, and (iii) chlorite, R1 illite-smectite as well as kaolinite group minerals in the groundmass. Late chlorite veins crosscut precipitates of R1 illite-smectite as well as kaolinite group minerals. Carbonates in fractures and in pseudomorphs after hornblende comprise iron-rich dolomite solid solutions ("ankerite") and calcite. Isotopic values indicate a hydrothermal-magmatic origin for the carbonate formation. The chlorite-carbonate-pyrite index (CCPI) and the Ishikawa alteration index (AI), applied to the investigated samples show significant differences (CCPI=52.7–57.8; AI=36.1–40.6) indicating their different degree of alteration.
According to Nakada et al., 2005, the C13 to C16 dykes represent the feeder dyke from the latest eruption (1991–1995) whereas C8 represents an earlier dyke feeder dyke from an older eruption. Weakest alteration, which was obtained in samples C16-1-5 and C13-2-5, correlates with the alteration degree of the pristine dome rocks. The highest CCPI value was determined for sample C14-1-5 and the highest AI value was determined for sample C15-2-6. The degrees of alteration do not indicate highest alteration of the samples C8-1-2 and C8-2-1 from the older dykes.