Mineral chemistry of peridotite xenoliths from the Sverrefjell volcano, western Spitsbergen: Implications for mantle metasomatism

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Mantle xenoliths entrained in the Quaternary Sverrefjell volcano from Spitsbergen were studied for their petrography and mineral chemistry. The suit of mantle xenoliths consists of spinel lherzolites, spinel harzburgites and websterites. The textures of all three rock types range from protogranular to porphyroclastic. Clinopyroxenes show highly variable mantle normalized REE patterns but can be classified into four major groups showing: a) LREE depleted to flat patterns (La_N/Ce_N 0.39-1.39; Ce_N/Yb_N 0.29-1.87; Sm_N/Yb_N 0.75-1.43), b) spoon-shaped REE patterns (La_N/Ce_N 1.64-2.20; Ce_N/Yb_N 3.56-7.74; Sm_N/Yb_N 1.21-2.80), c) highly enriched LREE and fractionated LREE/HREE patterns (La_N/Ce_N 0.83-1.04; Ce_N/Yb_N 10.04-11.60; Sm_N/Yb_N 2.21-3.29) and d) highest La_N/Ce_N ratios and relatively enriched MREE patterns (La_N/Ce_N 2.57-2.85; Ce_N/Yb_N 1.43-1.55; Sm_N/Yb_N 1.37-1.51). Group C and D clinopyroxenes are considered to have reequilibrated by metasomatic processes. Group C clinopyroxenes show trace element signatures produced by reaction of carbonate-rich fluids. Major element compositions of group d clinopyroxenes are clearly distinct from those of others. They show lower Mg# (87-89), and higher Al_2O_3 (6.56-6.79 wt %) and TiO_2 (0.65-0.68 wt %) compared to those of other groups (Mg# (90-93), and higher Al_2O_3 (4.30-6.33 wt %) and TiO_2 (0.10-0.68 wt %). Group d clinopyroxenes are found in websterites. Mineral chemistry of olivines (Mg#, 87-88) and orhopyroxenes (Mg#, 88-89) from the websterites show also a correlation with compositions of clinopyroxenes. The websterites from the Sverrefjell volcano appear to have produced by interaction of peridotite with metasomatic melt which was probably silicate enriched. Further investigation for metasomatic sources produced group C and D clinopyroxenes will be performed by Sr-Nd-Pb isotope studies for whole rock and mineral separates.