The alkali silica reaction of different natural aggregates in cement mortars

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An alkali silica reaction study has been performed on cement mortars containing silicate aggregate from four different locations, each type of aggregate having its own geological history and containing minerals with different crystal lattice arrangements. The alkali silica reaction was initiated by exposing the test specimens to NaOH using the method described in ASTM C 1260. By means of SEM and EDS analyses it was found that the composition of the gels on the different types of aggregate does not vary much, but that there are significant differences in the morphology and quantity of the gel, and in the degree of diffusion of alkalis into the silicate grains (Figures A and B).

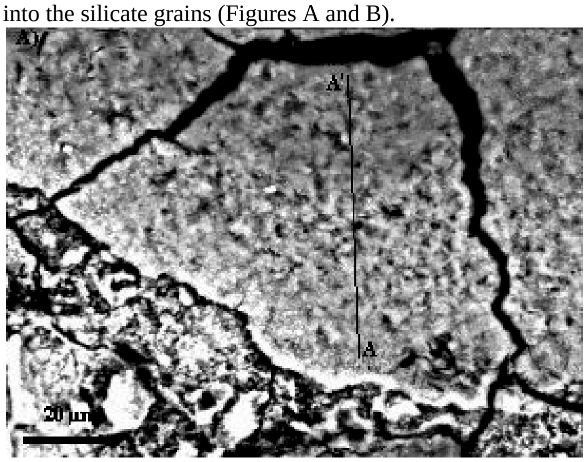
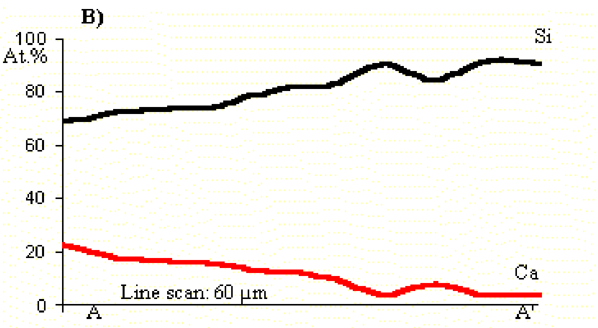


Figure A) BEI image of degradated quartz fragment with marked line scan profile. B) Elemental line scan for Si and Ca indicates diffusion of Ca in the quartz crystal.



Element partitioning and chemical zoning in minerals from garnet peridotites

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Garnet peridotite xenoliths provide the deepest insights into the mantle. By investigating mantle peridotites we can track mantle composition and mantle fertility through time. Trace elements are particularly important in the interpretation of mantle history, especially for crystallisation and melting processes. However, discrepancies exist between experimental data and those collected from natural rocks and minerals. These result possibly from inhomogeneity of the natural minerals, lack of textural control (analysis of grain separates) or incomplete equilibration of the experimental products.

We present first results of a study aimed at resolving these problems and at determining trace element partioning between garnet and clinopyroxene (cpx). Textural evidence, detailed petrography and in-situ analytical methods are used to understand the several factors possibly controlling trace element behaviour in garnet peridotites of different age, P-T history, whole rock composition and tectonic environment. Samples from the Vitim volcanic field (Baikal region) and from different kimberlite mines in the Kaapvaal craton (South Africa) have been investigated.

Textural evidence for refertilisation in garnet peridotites from the Kaapvaal craton may be the predominant occurrence of cpx in particular areas, reflecting cpx-ol-opx veins or possible layering in the mantle. However, electron microprobe analyses show that cpx found in these vein-like areas has the same major and trace element composition compared with cpx found adjacent to garnet, thus not indicating disequilibrium.

Electron microprobe profiles across grains from the Siberian samples exhibit zoning only in the outermost microns for Fe, Ti, Cr and Na in cpx, and Cr and Fe in olivine and garnet. The cpx-grains are often characterised by a recrystallised, mosaic rim. First ion probe analyses of the Kaapvaal cpx show zonation for L- and MREE.

The strong element variation in some samples suggests that whole grain data from the literature have to be treated with caution because they may be influenced by the chemical composition of the altered rims.