Geophysical Research Abstracts
Vol. 12, EGU2010-8639, 2010
EGU General Assembly 2010

Compositional evolution of nepheline in alkaline rocks from Messum Complex,

Simon Blancher, Philippe d'Arco, Michel Fonteilles, and Marie-Lola Pascal
UPMC Univ Paris 06 and CNRS, UMR 7193, ISTeP, 75005 Paris, France

Nepheline can be described as a four end-member solid solution between Ne (NaAlSiO4), Ks (KAlSiO4), An (Ca1/2□1/2AlSiO4) and Qz (□Si2O4), where □ is a vacancy in the structure. Few studies have explored its compositional variations, considered by most authors to be small and hardly related to magmatic evolution.

In the Messum complex, an alkaline silica-undersaturated series is well exposed from theralites to nepheline-diorites, nepheline-monzonites and nepheline-syenites. This wide range of nepheline-rocks allows to follow an evolution of nepheline composition through the evolution of parageneses. In theralites, olivine, titanaugite and plagioclase are cumulus phases on which pargasite grows. Then, nepheline and diopside appear at the expense of plagioclase and pargasite. In nepheline-diorites, pargasite replaces olivine and titanaugite, and plagioclase becomes more sodic. Next, in nepheline-syenites, alkali feldspar appears, plagioclase then pargasite disappear, and diopside becomes enriched in acmite-content up to 15%. Nepheline is present at all stages of this magmatic evolution. Its own evolution can be correlated with that of feldspars. In theralites, nephelines in equilibrium with a calcic plagioclase are calcic (15% An). The An-content decreases progressively with the An-content of plagioclase, down to 2% in plagioclase-free rocks. Variations in the Ks end-member are small, in the range 10 to 16%, first increasing until alkali feldspar appears, then decreasing as the alkali feldspar evolves towards albite. Qz and Ne contents increase regularly from theralites (3 and 68%, respectively) to syenites (7 and 75%).

This nepheline-series is crosscutted by more alkaline dykes, nephelinites and peralkaline syenites. In nephelinites, the paragenesis resembles that of theralites, except for the absence of plagioclase. Peralkaline syenites contain acmite and unmixed alkali-feldspar. These chemical/mineralogical differences are accompanied by differences in the nepheline compositions, less calcic than in the nepheline-series (less than 5% An in nephelinite, virtually 0% in peralkaline syenites) and more potassic (between 16 and 20% Ks).

In the Ne-Ks-Qz-An tetrahedron, all these nepheline microprobe analyses lie on or close to the "Barth plane", defined by Dollase and Thomas (1978) as representing natural nephelines and characterized by the relation K+□=0.25 in the structural formula. This plane extends between the three corners Ne75Ks25, Ne75Qz25 and Ne50An50. The evidence for a late enrichment in Ne75Qz25, inconsistent with Hamilton (1961) experiments which imply a decrease of silica content with decreasing temperature, further substantiates the problem of the nepheline composition from nepheline syenites already pointed by several authors (e.g., Dollase and Thomas, 1978).

Dollase, W.A., Thomas, W.M. (1978) The crystal chemistry of silica-rich, alkali-deficient nepheline. Contrib. Mineral. Petrol. 66, 311-318.