Geophysical Research Abstracts
Vol. 17, EGU2015-4626, 2015
EGU General Assembly 2015

Phosphorus contents in garnet from an ultrahigh pressure, high-temperature eclogite of the Saxonian Erzgebirge

Željka Žigovečki Gobac, Hans-Joachim Massonne, and Thomas Theye
Universität Stuttgart, Institut für Mineralogie und Kristallchemie, Stuttgart, Germany (zeljkazig@yahoo.com)

In the central Saxonian Erzgebirge, ultrahigh pressure rocks occur close to the Saidenbach reservoir. Among these rocks there are eclogites which have experienced metamorphic temperatures in excess of 1000°C (e.g., Massonne, 2013, Elements 9, 267-272). As a result of these high temperatures, the garnet was chemically homogenized with respect to a former growth zonation. Such kind of zonation can be deduced from inclusion minerals such as kyanite, phengite, and (clino)zoisite in garnet cores which point to metamorphic temperatures somewhat below 700°C. In order to test this view of a former prograde zonation in garnet, the content of phosphorus, a presumably much less mobile element at high temperatures compared to the common divalent cations, was determined in this mineral. Concentrations of P in mm-sized garnet in thin sections of eclogite were analyzed by a CAMECA SX100 electron microprobe (EMP). Different instrumental conditions, ranging from beam currents of 50 to 100 nA and counting times of 100 to 600 s on both peak and background at an acceleration voltage of 15 kV, were used in order to find the optimal way to determine this concentration in addition to the concentrations of the common elements at significantly shorter counting times. The interference of the CaKβ 2nd order and PKα 1st order peaks was considered by test measurements on standard material. The calculated detection limit for our P measurements was found to be around 13 ppm at the highest beam current and counting time. Several chemical profiles through a more or less concentrically zoned garnet grain were determined by spot analyses. These measurements on a high temperature eclogite from the Saidenbach reservoir yielded relatively low P contents in the core region of garnet of approximately 150 ppm and a significant increase towards the garnet rim. Maximum P contents were found to be around 350 ppm. In the core of garnet small apatite crystals were included whereas in the matrix no phosphate could be detected. Thus, we assume that, in principle, higher P contents could have been introduced in garnet at the highest metamorphic temperatures reached if the P reservoir, apatite, would not have been consumed before.
Our study has shown that measurements with the EMP result in a reliable determination of P contents in garnet with relatively low errors. Furthermore, we conclude that phosphorus is a suitable element to at least quantitatively deduce the temperature evolution of garnet. This conclusion with respect to temperature and not to pressure resulted from a literature survey, but further studies are planned to confirm and quantify the temperature dependence of the P introduction in garnet.