Geophysical Research Abstracts,
Vol. 11, EGU2009-1307, 2009
EGU General Assembly 2009

Omphacite textures and eclogite exhumation: Examples from the Tauern Window (Austria) and the Western Gneiss Region (Norway)

K. Neufeld
(kai.neufeld@risoe.dk)

It is lively debated how eclogites find their way from deep to mid-crustal levels during exhumation. Different exhumation models for high-pressure and ultrahigh-pressure rocks were suggested in previous studies, based mainly on field observations and less on microstructural studies on the exhumed rocks. The development and improvement of electron microscopy techniques allows it, to focus interest on direct investigations of microstructures and crystallographic properties in eclogites. In this case, it is of importance to study the applicability of crystallographic measurements on eclogites for exhumation processes and to unravel which processes affect eclogite textures.
Previous studies suggested a strong relationship between deformation and lattice preferred orientation (LPO) in omphacite but it is still unclear if the deformation is related to the exhumation of eclogites.
This study is focused on the questions which processes affect omphacite LPO and if textural investigations of omphacite are applicable for studying eclogite exhumation. Therefore, eclogites from two examples in the Alps and in the Caledonides were collected systematically and investigated with respect to omphacite LPO by using the electron backscattered diffraction (EBSD) technique. Omphacite textures of the Tauern Window (Austria) and the Western Gneiss Region (Norway) were studied to compare lattice preferred orientation with field observations and suggested exhumation models from previous studies. The interpretation of omphacite textures, regarding the deformation regime is mainly based on numerical simulations in previous studies.
Omphacite LPO patterns of the Eclogite Zone are clearly independent from any kind of exhumation process. The textures were generated during omphacite growth on the prograde path of eclogite development until metamorphic peak conditions.
Field observations in the Eclogite Zone show that kinematics in garnet mica schist, surrounding the eclogites, strongly indicate an extrusion wedge geometry, including top-N thrusting at the base and a top-S normal faulting with a sinistral shear component at the top of the unit. The different shear sense on both sides of the unit does not affect the omphacite textures in any way.
Omphacite LPO of the Western Gneiss Region can not be connected with any exhumation model. The textures were probably generated during the metamorphic peak and reflect the change from subduction to exhumation.
Eclogite Zone and Western Gneiss Region differ significantly in size and metamorphic conditions. While the Eclogite Zone is characterized by constant P-T conditions (600-650°C, 20-25 kbar), the Western Gneiss Region contains a wide P-T range from high- to ultrahigh pressure conditions (400-800°C, 20-35 kbar). In contrast to this, the omphacite textures of both units are very similar. This means that omphacite LPO is independent from P-T conditions and therefore from burial depth. Further, in both units, omphacite LPO is independent from grain and subgrain size as well as from any shape preferred orientation (SPO) on grain and subgrain scale.
Overall, LPO patterns are generated on the prograde part of omphacite development. Therefore, textural investigations on omphacite regarding exhumation processes will only work by integrating crystallographic data into geologic model which is based on structural field observations.