Calculated P-T paths for the blueschist-facies metapelites from the Ile de Groix (France)

STEPHEN CENTRELLA[12]* MICHEL BALLEVRE[2], P AVEL PITRA[2] AND PHILIPPE YAMATO[2]

[1] Inst. für Mineralogie, University of Münster, Corrensstrasse 24, 48149, Münster, Germany (*correspondence: s_cent01@uni-muenster.de)

[2] Géosciences Rennes, UMR 6118, Université de Rennes 1, 35042 Rennes, France

For a long time, the "Ile de Groix" has been the subject of many studies because it shows blueschist-facies rocks of Palaeozoic ages which are quite uncommon along the Variscan belt. Despite all these studies, there are still uncertainties on (i) whether peak P-T conditions vary or not across the island and (ii) how variations in the amount and causes of retrogression could control the apparent spatial zonation of the metamorphism. In order to check the different potential hypotheses, a detailed study of four samples of garnet-bearing metapelites has been performed.

In all samples, garnet preserves a growth zoning (core to rim bell-shaped decrease of Mn, increasing XMg), which, associated with the inclusions and the matrix minerals, allow to define the successive mineral parageneses. Calculated pseudosections using Thermocalc allow to define the prograde part of the P-T path, culminating in the eastern part at 22.5 kbar and 525°C. Decompression is nearly isothermal until the equilibrium between garnet and matrix was reached at 16.5 kbar and 515°C. A different P-T path is deduced for the western part of the island, where garnet growth zoning displays a more complex pattern, with bell-shaped Mn in the cores, but Mn-rich overgrowths observed in some samples. These patterns cannot result from differences in bulk-rock chemistry, but evidence differences in P-T paths.

Pressure-induced phase transitions in coesite

ANA ČERNOK[1]*, TIZIANA BOFFA BALLARAN[1], RAZVAN CARACAS[2], NOBUYOSHI MIYAJIMA[1], ELENA BYKOVA[1], VITALI PRAKAPENKA[3], HANNS-PETER LIERMANN[4] AND LEONID DUBROVINSKY[1]

[1]Bayerisches Geoinstitut, Universität Bayreuth, Universitätsstrasse 30, D-95440 Bayreuth, Germany (Ana.Cernok@uni-bayreuth.de *presenting author)

[2]Centre National de la Recherche Scientifique Laboratoire de Geologie de Lyon (LGLTPE) UMR 5276 Ecole Normale Supérieure de Lyon 46, allée d'Italie, 69364 Lyon, France

[3]Center for Advanced Radiation Sources, The University of Chicago, Argonne National Laboratory, Building 434A, 9700 South Cass Ave, Argonne, IL 60439, USA

[4]Photon Sciences, Deutsches Elektronen-Synchrotron (DESY), Notkestraße 85, 22607 Hamburg, Germany

High-pressure behavior of coesite was studied using diamond-anvil cells with neon as the pressure transmitting medium and applying *in situ* Raman spectroscopy and single crystal X-ray diffraction up to pressures of ~55 GPa. The experimental observations were complemented with theoretical computations of the Raman spectra under similar pressure conditions. We find that coesite undergoes two phase transitions and does not become amorphous at least up to ~ 52 GPa. The first phase transition (coesite I to coesite II) occurs at ~ 23 GPa and the second transition (coesite II to coesite III) occurs at ~ 35 GPa.

The *ab initio* calculations give an insight into the initiation mechanism of the first phase transition. Based on the unstability of phonon modes we imply that the phase transition is displacive in nature and related to shearing of the four-membered rings of SiO_4 tetrahedra upon compression. The transition to the lowest-symmetry phase, coesite III, is possibly a first order phase transition which leads to a very distinct structure. It was previously widely accepted that coesite undergoes pressure-induced amorphization at significantly lower pressures (30 GPa) and none of the metastable high-pressure polymorphs has been reported. We are currently analyzing crystallographic data of the high-pressure metastable polymorphs coestie II and coesite III.

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