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Preface

Rocks generated under extreme pressure and temperature conditions: Mechanisms, concepts, models

Growing evidence for occurrences of rocks formed under extreme ultrahigh-pressure (UHP) and/or ultrahigh-temperature (UHT) conditions require interdisciplinary efforts for understanding geological processes related to their origin and appearance at the Earths' surface. As a part of these efforts a special cross-disciplinary session "Exhumation of rocks metamorphosed under extreme conditions. UHP and UHT complexes: mechanisms, rates, models" was organized for the EGU 2005 meeting in Vienna. This session brought together people from a broad spectrum of disciplines spanning metamorphic and magmatic petrology, geochemistry, geochronology, and numerical geodynamic modeling. Such cross-disciplinary petrological–geodynamic sessions related to the origin of UHP and UHT rocks and bringing together "observers", "experimentalists" and "modelers" were repeated organized in the following EGU2006 and EGU2007 meetings and have now become a tradition. We celebrate this tradition here in a petrological–geodynamic special volume that summarizes latest results, concepts, and models concerning rock-forming processes at extreme conditions and includes new data on *P–T*–time–deformation paths, cooling/exhumation rates, laboratory experiments, and numerical geodynamic modeling. Our goal is to present provocative examples of cross-disciplinary studies conducted by authors from different communities and covering the broadest possible spectrum of problems related to the origin of rocks formed under extreme *P–T* conditions. Half of the papers in this volume were prepared by petrologists and half by numerical modellers. Twelve petrological–geodynamic studies collected in this volume address a range of scales from microscopic to global and plate tectonic processes providing cross-disciplinary coverage of extreme rock type origin problems. These studies include:

(1) Fluid–rock interaction and trace-element mobilization in subducting slabs based on natural data and presented by T. John and co-authors.
(2) Small-scale melting recorded by mineral inclusions trapped at high-temperature ultrahigh-pressure conditions discussed by A. Perchuk and co-authors on the basis of the laboratory experiments.
(3) Causes of metamorphic heterogeneities within a high-pressure unit investigated by R. Bousquet on the basis of case study of the Entrelor area (Western Alps).
(4) Polymetamorphism and the pressure–temperature record of two high-grade metamorphic events involving near-isobaric heating episodes analyzed by L. Perchuk and co-workers on the basis of structural–petrological–geochronological analysis conducted for the Central Zone of the famously controversial Limpopo high-grade terrain (South Africa).
(5) Pressure–temperature–time dynamics of ultrahigh-pressure complexes from intra-oceanic subduction zones analyzed by M. Krebs and co-authors by direct comparison with fossil petrological evidence from the Rio San Juan Complex, Dominican Republic, and numerical geodynamic modelling results.
(6) Genetic relations between deeply subducted tectonic melanges and the origin of large batholiths associated with subduction discussed by A. Castro and T. Gerya addressed by a novel combination of laboratory and numerical experiments.
(7) The expected influence of non-lithostatic pressure on tectono-metamorphic processes is analyzed by

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N. Mancktelov with analytical and numerical models.

(8) Mechanisms of continental convergence, related pressure–temperature conditions, and the role of over-pressure in subduction/collision environment investigated numerically by E. Burov and P. Yamato.

(9) The implications of stress and pressure variations in subducting slabs for petrologically recorded pressures and temperatures analyzed numerically by A. Babeyko and S. Sobolev.

(10) Variations in plate tectonics on the early Earth and its implications for the origin of ultrahigh-pressure rocks investigated by J. Van Hunen and co-workers by using systematic numerical modelling of subduction-related processes.

(11) Generation of ultrahigh-pressure high-temperature conditions by the "hot channel effect" during initiation of collision modelled numerically by T. Gerya and co-authors.

(12) Styles of post-subduction orogeny and the tectono-metamorphic consequences for high-pressure and high-temperature metamorphic complexes modelled numerically by Faccenda and co-workers.

We hope that this petrological–geodynamic volume will be of interest to people from geosciences, who are involved in the problematic origin of rocks generated at extreme conditions.

T.V. Gerya*
J.A.D. Connolly
Department of Geosciences, Swiss Federal Institute of Technology - Zurich (ETH-Zurich), 8092 Zurich, Switzerland
*Corresponding author. Fax: +41 44 6331065.
E-mail address: taras.gerya@erdw.ethz.ch (T.V. Gerya).

L.L. Perchuk
Department of Petrology, Moscow State University, 119899 Moscow, Russia