



Wrocław, 22 May 2011.

Review of the PhD thesis of Mgr. Radmila Nahodilová,
“High-pressure partial melting and its relationship to the granulite facies metamorphism:
implications for the origin of felsic high-PT granulites in the Bohemian Massif, Central Europe”,
on the request of the Dean of the Faculty of Science, Charles University in Prague,
Czech Republic

1. Introduction

The PhD thesis reviewed has been prepared at the Faculty of Science, Charles University in Prague, under supervision of Prof. Shah Wali Faryad and Dr. David Dolejš. The thesis comprises: (a) the Dissertation Volume and (b) the English and Czech Summary (separate booklet).

The PhD Dissertation consists of three publications:

1. Nahodilová R., Faryad S.W., Dolejš D., Tropper P., Konzett J., 2011: High-pressure partial melting and melt loss in felsic granulites in the Kutná Hora complex, Bohemian Massif (Czech Republic). *Lithos*, doi:10.1016/j.lithos.2011.03.017.
2. Faryad S.W., Nahodilová R., Dolejš D., 2010: Incipient eclogite facies metamorphism in the Moldanubian granulites revealed by mineral inclusions in garnet. *Lithos*, 114: 54-69.
3. Verner K., Žák J., Nahodilová R., Holub F., 2008: Magmatic fabrics and emplacement of cone-sheet bearing Knížecí Stolec durbachitic pluton (Moldanubian Unit, Bohemian Massif): implications for mid-crustal reworking granulitic lower crust in the Central European Variscides. *International Journal of Earth Sciences*, 97: 19-33.

The three publications represent a set of complementary works devoted to high-pressure partial melting in eclogite-granulite facies conditions, and based on case studies in the Bohemian Massif.

2. Thesis assessment

2.1. Technical and editorial remarks

The PhD Dissertation Volume (104 pp.) is clearly and logically structured and it comprises: (a) Introduction, (b) copies of the three publications, each heralded with a short summary, and (c) General conclusions. The Summary Booklet (32 pp.) contains comprehensive English and Czech summaries.

It should be noted that on p. 2 of the Summary Booklet, it is written: “This thesis consists of six papers...:” and this statement is followed by a list of the three publications mentioned above, and “Appendix (Complementary Section)” listing three other publications co-authored by R. Nahodilová, and all published in *Journal of Geosciences*. The latter three papers have not been attached to the Dissertation. Thus, it is not clear whether the complementary papers are formal part of the thesis or just listed to document scientific achievements of the PhD Candidate. The papers and the complementary texts are written in English. The language and technical layout of the papers published in the high-level international journals are, not surprisingly, of

high quality. Also the complementary materials are thoroughly edited and their language is, in general, correct and understandable. However, a few minor language mistakes are found in several places, e.g. on pages 6, 7, 10 and 102 – in General Conclusions of the Dissertation Volume.

2.2. Scientific merits

The three publications of the thesis focus on various aspects of high-pressure melting in felsic granulites. This topic is of interest to high-grade metamorphic petrology but also to related fields of geological sciences, including basic problems of deep-crustal processes, e.g. subduction and exhumation of deeply buried crustal materials. These general problems can be well investigated using the unique examples of granulites exposed in the Bohemian Massif.

As to the methods used, the research problem undertaken, is not trivial. The methods applied combined conventional petrography with modern thermodynamic modelling and experimental petrology. This is a lot as for a PhD project.

The three papers of the thesis have been published as peer-reviewed regular papers in recognized international journals and this fact, directly, can be taken as a proof of the sound scientific level of these studies. Thus, there is no need to provide here a detailed evaluation of the merits and editorial level of these papers. Below, only a short and general review of these publications is given.

Paper 1 deals with the granulites of the Kutna Hora Complex. These rocks preserve mineral assemblage being evidence of the transition from early eclogite to granulite-facies conditions, as well as discordant leucocratic veining interpreted as evidence of melt loss during the decompression path. Based on detailed petrography, mineral chemistry, thermodynamic modelling and phase-equilibrium experiments, the PT conditions of HP-melting were assessed. The presence of partial melts at the transition between the eclogite and granulite-facies conditions facilitated attainment of equilibrium at peak T and elimination of any potential relics of early HP phases, such as phengite and omphacite. In contrast, such relics are preserved in adjacent mafic granulites that escaped partial melting.

Paper 2 describes inclusions in garnets from felsic and mafic granulites from the Moldanubian zone, e.g. Ti-rich muscovite and columnar-shaped inclusions of K-feldspar+kaolinite+opaques. The latter are interpreted as resulted from incipient melting of muscovite, at c. 2.2 GPa and 900-1000°C. The relics interpreted as representing the early eclogite-facies conditions are in line with the presence of omphacite inclusions in adjacent mafic granulites.

Paper 3 describes the Knížecí Stolec durbachitic pluton in the Moldanubian zone, but it also provides PT estimates for the formation of the mantling granulites. The durbachite pluton was emplaced into the granulite body that was already juxtaposed against the mid-crustal metamorphic rocks.

Summing up, the results of the studies presented in the thesis provide new insight into the progressive PT metamorphic paths of the Bohemian granulite complexes, with early amphibolite facies, through eclogite facies, to granulite facies conditions. An important event on that path, between the eclogite and granulite facies, was HP partial melting. The presence of partially molten domains in felsic granulites in the continental root of the Variscan Orogen is suggested to have exerted major rheological control on the incorporation and immersion of lenses of mafic and ultramafic rocks and their extrusion via exhumation channel to the middle crust.

The PhD Candidate contributions to the multi-authored publications have not been formally declared. However, she is the first author in the most important Paper 1, which proves her leading role in the research and in preparation of this publication.

3. Concluding remarks

The PhD thesis reviewed comprises a set of three original and high-quality publications, dealing with intriguing problems of PT paths of very high-grade metamorphic rocks, running through eclogite and granulite facies conditions. Special attention is paid to the HP partial melting of felsic rocks, at the transition between the eclogite and granulite facies. The results extend our knowledge about the petrogenesis of granulites and eclogites, and highlight the dynamics of the crustal processes during orogeny. They would also have a significant impact on regional geological interpretations.

The three papers are co-authored, but Radmila Nahodilová is the senior author in Paper 1, which is the most important contribution to the thesis. The methodology applied in the research is wide and adequate to the scientific aims of the studies, and conventional petrological methods are supported by thermodynamic modelling and phase-equilibrium experimental studies.

Summing up, the overall assessment of Mgr. Radmila Nahodilová dissertation is high and I am, as a reviewer, definitely convinced that the presented work fulfils the criteria necessary for obtaining the PhD degree and it is suitable for the defence. Thus, I recommend the Doctor degree to be granted to the Applicant, after her successful defence of the thesis.



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