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Endogene Dynamik

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Review of the habilitation thesis of RNDr. Petr Jerabek, entitled "Flowing crust in the context of micro-scale observations".

Dr. Jerabek has submitted a thesis which I have been asked to review. I have met Dr. Jerabek in the spring of 2016 on the CETEG conference in Predna Hora, in the middle of one of his research field areas, the Vepor unit, and attended a field trip that he guided. I had not known Dr. Jerabek before and had no collaboration or joint publications together with Dr. Jerabek.

The thesis is subdivided in two chapters, entitled "Aspects of crustal flow in convergent orogenic settings", and "Effects of metamorphic transformations on rheology of rocks". The texts of chapter 1 and 2 are concise, short introductions into these research fields. The first chapter is accompanied by 7 papers dealing with the structural and metamorphic evolution of the Vepor unit in the Western Carpathians. The second is also accompanied by 7 papers about microstructures, textures, deformation mechanisms and reaction kinetics, dealing with rocks from various area including the Vepor unit again but also the Caledonides in Scandinavia and the Variscides in Brittany. Two of these papers were already listed as accompanying publications of chapter 1, so that the total number of papers is 12. All the articles have been published in international peer-reviewed journals, mostly high-ranked journals. In 5 of

the articles, Dr. Jerabec is the first author, in the remaining 7, a coauthor. All papers appeared between 2007 and 2016. In the following, I will focus on the first-author papers.

The first paper, about "Microstructural-deformation record of an orogen-parallel extension in the Vepor Unit, West Carpathians", deals with field structural geology, strain analysis using recrystallized quartz aggregates, microstructures and textures of quartz and plagioclase, and quartz grain-size paleopiezometry. The wide spectrum of applied methods is impressive. The conclusion is that the Cretaceous orogen-parallel extension of the Vepor Basement was one of bulk pure shear, whereas previous authors (e.g. Plasienka et al. 1999) had seen it more as an asymmetric extension with dominantly top-east shear sense.

The second paper ("Alpine burial and heterogeneous exhumation of Variscan crust...") uses, among other methods, garnet microanalysis and thermodynamic modelling to determine the metamorphic conditions of garnet growth in the Vepor unit. The second, Alpine generation of garnet shows increasing pressure. Dr. Jerabek concludes from this observation that orogen-parallel stretching in the Veporicum occurred during increasing pressure, i.e. burial. This is remarkable because in most cases, pressures decrease during orogen-parallel extension. The connection between garnet growth and microstructures of the orogen-parallel extension is crucial for this question. This connection is documented but not very clearly. I am not totally convinced of this point. The pressure increase might also have occurred before the stretching. The third paper ("Polymetamorphic evolution of pelitic schists...") uses phase equilibrium modeling and U-Th-Pb monazite dating to document Permian high-T-low-P metamorphism between the Variscan and the Alpine metamorphism. In the fourth paper ("Inverse ductile thinning via lower crustal flow..."), Dr. Jerabek develops the model of "Inverse ductile thinning" in order to account for the pure-shear kinematics and pressure increase during orogen-parallel stretching in the Vepor Unit. This model is very elegant.

The second chapter of the thesis, "Effects of metamorphic transformations on rheology of rocks", is accompanied by one additional first-author publication of Dr. Jerabek ("Microstructure and texture evolution during growth of magnesio-aluminate spinel at corundum-periclase interfaces..."). This is an experimental study where periclase and corundum where compressed and heated to 1250 to 1350 °C and the

growth of magnesio-aluminate spinel was observed at the contact between the two materials. The very interesting microstructures and textures developing in the reaction rim and in the old material are studied using electron backscatter diffraction. The paper is of a very high methodological and scientific level. My only criticism is that the link between the results and geological processes is not very clear. I am sure that the process is important for deformation in the lithosphere but the introduction of the paper does not do much to explain this importance. On the other hand, the two papers about rocks from the Scandinavian Caledonides and the one about the Armorican Shear Zone, coauthored by Dr. Jerabek, make a clear link between deformation mechanisms and tectonic processes. These papers show the great potential of combining a physical chemistry approach with the study of shear zones in rock.

In summary, I am impressed by the width of Dr. Jerabeks methodological expertise. He is a truly interdisciplinary scientist – both an excellent field geologist and an expert of physical and chemical processes governing the deformation of crystalline materials. This combination at such a high level is rare. Together with the students he has supervised, he has made major progress in the understanding of deformation in the deep crust. He applies the various methods with great skill and also has the originality of thinking that is necessary to develop new, unconventional hypotheses to explain regional tectonic processes. He is also a very good and enthusiastic teacher as I have seen myself on the field trip he guided. I recommend without any reservations that the Faculty of Science accepts the habilitation thesis and appoints him as an Associate Professor.

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