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Prof. Ing. Shah Wali Faryad, CSc.
předseda komise pro obhajobu disertační práce doktorského studijního programu Geologie
Přírodovědecká fakulta UK
Albertov 6
128 43 Praha 2

Vážený pane předsedo,
na základě Vaší žádosti ze dne 16.4.2019 zasílám posudek disertační práce Mgr. Víta Peřestého. Bohužel se nebudu moci obhajoby zúčastnit, nicméně věřím, že můj posudek napomůže jejímu zdárnému průběhu.

Se srdečným pozdravem,

Prof. Jiří Konopásek, PhD.
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Assessment of the PhD thesis „**The role of deformation partitioning on the tectonic evolution of the superstructure-infrastructure transition in the Teplá-Barrandian domain**" submitted by Mgr. Vít Přestý

The PhD thesis of Mgr. V. Přestý presents his research at the western margin of the Teplá–Barrandian Domain in the Bohemian Massif. The thesis consists of an introductory part (Preface) summarizing the general geological context and scope of the PhD project, as well as methodology of work, which included extensive fieldwork, sampling and collection of structural data, petrological modelling and geochronology. The body of the thesis consists of three research articles that summarize the results. Two of them are published in journals of high international standing (Journal of Metamorphic Geology and Lithos) and one manuscript is currently submitted to International Journal of Earth Sciences.

As I cannot be present at the thesis defence, after a brief summary of each of the papers I am adding some comments/questions that can be read during the examination and discussed with the candidtae.

Article 1: **Metamorphic inheritance of Rheic passive margin evolution and its early Variscan overprint in the Teplá-Barrandian Unit, Bohemian Massif**

In this article, the candidate and his co-authors disprove a long-living interpretation of pre-Variscan metmorphism in the Teplá–Barrandian Domain as Late Neoproterozoic in age. Detailed field structural observations coupled with metamorphic studies and geochronology allowed estimates of metamorphic conditions and dating of the early metamorphic event in that area. The M1 metamorphism, dated as Cambrian-Ordovician (c. 485 Ma) suggests LP-HT apparent geothermal gradient consistent with rifting-related metamorphism. Superimposed M2-D2 metamorphic event suggests conditions typical for continental collisional zones and this event was dated as Devonian (c. 375 Ma). Final stage of tectonometamorphic evolution (M3-D3) suggests decompression due to detachment-associated exhumation.

Points for discussion:

1) Hajná et al. (2010, 2011) interpret the Neoproterozoic rocks of the TBD as an accretionary wedge, whereas you interpret all the pre-Variscan record as rifting-related. Is there any chance that there is a record of Late Neoproterozoic deformation/ metamorphism in TBD, or the rifting affected undeformed/unmetamorphosed Neoproterozoic sedimentary rocks?

2) All the P-T estimates were done only by using compositional variables for garnet or staurolite. Did you also look at compositional isopleths for other mineral phases (X_{Mg} for biotite, X_{An} for plagioclase etc..)? Did they fit the garnet/staurolite compositional variables? And if not, can you make some comment about the possible discrepancies and their bearing on robustness of your PT estimates?

Article 2: **Combined Lu-Hf and Sm-Nd geochronology of the Mariánská Lázně Complex: New constraints on the timing of eclogite- and granulite-facies metamorphism**

This work brings new P–T–t-D data for mafic eclogites and their retrograde varieties in the Mariánská Lázně Complex at the western edge of the Teplá–Barrandian Domain in the Bohemian Massif. The authors document peak HP metamorphic conditions at ca. 25 kbar and 650–750°C followed by decompression and partial melting at ca. 14–18 kbar and 800 °C. The tectonometamorphic study is completed by Lu–Hf and Sm–Nd dating of metamorphic garnet, which shows timing of crystallization of eclogite-facies mineral assemblage at ca. 390 Ma, and its overprint ca. 15 my later. In this work, the candidate was responsible for collection and interpretation of structural data, as well as for final formulation of the tectonic model. The data presented in this article nicely complement the previous work presented above and complete the story of the Devonian tectonometamorphic evolution of the TBD.

Points for discussion:

As the candidate contributed only with structural data and correlation of the results with the data from the overlying geological unit, my questions will be directed to the interpretation of the data.

1) What is your interpretation of the original setting of the MLC rocks? Is it a piece of the subducted Saxothuringian Ocean, or is it a part of the TBD lower crust?

2) In the discussion you state that the early vertical AMS foliations (do they correspond to your SEcl?) in eclogites (and also in other rocks) is compatible with the steep S2 in the overlying TCC. Does this fabric originate at the metamorphic peak, i.e. MEcl? If yes, do you think it's plausible that the same type of deformation takes place simultaneously at levels corresponding to 25 kbar (MLC rocks) and 10 kbar (TCC rocks?). Or is the MLC first exhumed and then overprinted by D2?

3) You also say that: „*It is ... increasingly evident that the MM was obducted over the Saxothuringian basement as a single thrust sheet prior to the tectonic evolution of MLC...*" The same I read in the „Geodynamic implications" chapter. The problem with such model is that a) if I remember well, then the Münchberg Massif deforms Carboniferous rocks underneath, and b) we know from the age of the eclogites in the Erzgebirge that after the exhumation of the MLC the subduction was re-established and continued up to ca. 340 Ma (see also Konopásek et al., 2019). So, „...*prior to the tectonic evolution of MLC*...", the Saxothuringian basement was probably far away. Can you comment on that?

4) In the „Geodynamic implications" chapter you also say*: „The stacking of eclogite sheets was followed by continuous thickening of the nappe pile together with the hanging wall TBD schists and gneisses; culminating in melting of the whole complex still under compression. Contemporaneous melting of the stacked system resulted in heating of the MLC eclogites to granulite-facies conditions. Subsequent extensional thinning in the upper plate enabled rapid exhumation of the MLC along extensional detachments in the Mid-Devonian (Peřestý et al., 2017).* " The first sentence seems to imply that the eclogites melt at the peak P, but that's not what your data say. Or did I understand something wrong? Does the "*stacking of eclogite sheets*" take place at peak P, or during early exhumation? Please comment.

Article 3: **Restoration of early-Variscan structures exposed along the Teplá shear zone in the Bohemian Massif - constraints from kinematic modelling**

This manuscript represents a direct continuation of the candidate's paper from 2017. It is a detailed description of structural evolution of the whole study area accompanied by a numerical kinematic model for transition from the pure shear-dominated horizontal D2 shortening towards the D3 extensional shearing. The "reference" model successfully reproduces development of L3 lineation orientation, as well as rotation of the S2 fabric and increasing dip angle of S3 during increasing D3 strain. On the contrary, the main discrepancy between the field and model data is seen in higher scatter of the field data in the southern part of the area than what the model predicts. In any case, the reference model confirms the interpretation that the change in orientation of S2 fabric and L3 intersections in different parts of the study area can be attained during a single progressive deformation event. In the discussion, the authors explain that the "reference model" does not represent a unique solution and discuss possible variations of the model parameters and their effect on final structural pattern of the study area.

Points for discussion:

First of all, I can see that my points 2) and 4) related to the Collett et al. paper are much better explained in this manuscript. As I am not an expert in structural analysis, I have only two more general questions/comments related to this manuscript:

1) When I used to work in the MLC and TCC in the past, I was always wondering if there is any record (structural or metamorphic) of the Carboniferous tectonometamorphic events, which are so dominant (or even the only ones) in the underlying Saxothuringian Domain. Can you please comment on that?

2) What is "Hypogymnia physodes" (Fig. 39)?

Conclusion

Large part of the research presented in the PhD thesis was already published, or is close to publication. It is a pleasure to see how the candidate evolved from a bachelor student who used to be notoriously late in the classes and either slept during, or constantly disrupted, the lectures, into a more or less independent researcher. It is evident that the

candidate gained considerable skills in field and theoretical structural geology, microstructural observations and petrology, as well as a solid overview over modern geochronological methods. On top of that, he has proven that he is able to integrate field and laboratory data into a meaningful tectonic model and communicate his research in form of scientific articles. From my experience, the amount and quality of work presented in the thesis is easily comparable with PhD projects at other European universities.

For this reason, I can suggest the committee without hesitation to accept the thesis, and grant Mgr. Vít Přestý the PhD title.

In Tromsø, 23.5.2019

Prof. Jiří Konopásek, PhD