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Review on the dissertation thesis from Marine Jouvet

"Assembly of the Saxothuringian orogenic wedge: the Variscan P–T–t record of the metasediments of Erzgebirge, Bohemian Massif"

The text of the thesis is written in a good scientific English language. The thesis consists of two main parts: (i) considering the structural information and pressure-temperature (PT) conditions of the investigated metasediments, and (ii) reporting and discussing new geochronological data for these rocks. The thesis starts with a PREFACE (20 pages) that includes four sections: "Introduction", "Structure of the Thesis", "Geological setting", and "Methods and mineral abbreviations". This division was slightly confusing for me because two sections ("Introduction" and "Geological setting") contain geological information and could be combined in one section if the structure of the thesis would have been explained in the early beginning. The "Introduction" gives a general introduction to the Erzgebirge, its relation to the Saxothuringian domain and its tectonic situation as a tectonic wrench. Here, different – sometimes even contrasting – tectonic models from the literature are explained. Based on this general information, the specific questions of the thesis are defined. However, to answer these complex questions a multidisciplinary approach is necessary that combines field and structural geology, petrology, geochemistry, phase equilibria modelling (to calculate PT conditions) as well as dating (to get age information for these processes). For dating, monazite U-Pb geochronology by LASS-ICP-MS (Laser-Ablation Split-Stream Inductively Coupled Plasma Mass Spectrometry) and $^{40}Ar/^{39}Ar$ geochronology on muscovite was applied. The monazite dating was combined with concentration measurements of Rare Earth Elements (REE) from the same volume of mineral. The latter information was used to better understand the formation conditions of different monazite generations. Table 0.1 gives an overview what methods have been applied for each sample and also provides a summary of the PT- and dating results.

Part I of the thesis ("New constraints on the tectonometamorphic evolution of the Erzgebirge orogenic wedge, Saxothuringian Domain, Bohemian Massif"; 36 pages) was already published as an article in the Journal of Metamorphic Geology (Jouvent et al., 2022). Samples were collected explicitly in the Western Erzgebirge at the transition between phyllites and micaschists. The article gives a detailed description of the structural evolution of the samples.

Finally, the PT evolution of the samples was calculated by applying pseudosection modelling with THERMOCALC. The derived PT paths for the different rock units were then interpreted in an accretionary wedge model where the investigated samples represent the frontal part of the wedge.

Part II ("Assembly of the Saxothuringian orogenic wedge: geochronology") is divided into four sections ("1 - Introduction", 2 - "Orogenic wedge formation and zoning: evidence from monazite U-Pb geochronology", 3 – "orogenic wedge exhumation and reactivation: evidence from mica $^{40}Ar/^{39}Ar$ geochronology", 4 – "Implications for the wedge dynamics"; altogether 63 pages). The study aims to link the obtained ages to specific stages of these metamorphic rocks (prograde, peak, retrograde) and uses therefore the results from part I. Based on the structural work the study hopes to overcome the problem of "contradicting ages". I agree that this is a nice and very interesting approach. However, for such a discussion the age uncertainties should be considered in more detail (see details later: in questions). I would like to see a more detailed description and explanation (at least for a few samples) how these different ages for up to four different stages (e.g. M1-M2 matrix, …) from one sample were calculated since single LA-ICP-MS ages show large analytical scatter. The monazite dating results are related with their REE pattern and discussed together with literature data (Fig. II.11). This allows an assignment to three defined stages (peak p ages = subduction; peak T ages = exhumation; "younger" ages = reactivation) where different dating methods on different minerals were compared (Fig. II.11). I welcome that Marine Jouvent made such a compilation and discussion, but again I want to point on the importance of considering age uncertainties. Similar to monazite dating, the results from mica Ar/Ar dating are also compared to literature data and discussed. Based on the new results, a new assumption was proposed (imbrication of the Kateřina-Reitzenhein parautochthonous unit) to explain the spatial alternation of old and young ages.

In summary, this thesis is a very detailed study that combines field and structural geology, petrology, geochemistry, phase equilibria modelling, and geochronology. All methods, samples, and results are described in detail. All analyses were performed at a high-quality international level (state of the art). All relevant literature studies are cited and included in the discussion. The discussion brings new ideas for the evolution of this orogenic wedge from the Erzgebirge (e.g. older outer wedge, younger inner wedge; and other ideas) and finally results in a new model for the temporal and spatial evolution of different rock units of the Erzgebirge (e.g. Fig. II.12). Therefore, I highly recommend this thesis for the defence.

Specific comments and questions:

- I could not understand what is the "Elstergebirge" and why it was mentioned (p.23). Is it important for this study?
- "eight samples … were selected for monazite dating" (p. 71): in the figure (II.Ia) I found only 6 samples and in the Table (II.1) I found only 7 samples
- For monazite dating of micaschist samples the monazites are often classified as "inclusions in garnet rim I" and/or "inclusion in garnet rim II". I could not find (or have overseen?) how these different zones were distinguished. It would be nice to have a better description or even a special figure that shows these different rims and how these rims were classified to group I or group II.

- "The $^{40}Ar/^{39}Ar$ geochronometer was used on fourteen samples" (p.97). I found only 12 samples in your Table.
- I wonder that all your samples contain monazites (e.g. Table II.2). We tried to find several times in gneisses (especially in orthogneisses) monazite, but could not find. Are you sure that all samples should contain monazite? (This is probably more a personal question from me).
- Is it possible that the younger Ar/Ar ages (330 Ma event) are closer related to boundaries between different rock units (probably more sheared) and that older ages survived only at greater distances to such zones?
- Should all tectonic activity end in metasediments before intrusion of Variscan plutons/ volcanites "before magmatic activity" (p. 134)?
- Age uncertainties: for U-Pb monazite dating you recorded 2 sigma and in brackets even propagated uncertainties as 2%. For Ar/Ar dating you use 1 sigma as uncertainty. Why did you use these different uncertainties, what do they mean and what is a propagated uncertainty? What are primary and secondary standards/ reference materials? Why do we need primary and secondary standards/reference materials? Why secondary standards have sometimes slight shifts of their ages compared to certified ages?

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