



INSTYTUT NAUK GEOLOGICZNYCH

pl. M. Borna 9
50-204 Wrocław | Poland

tel. +48 71 321 10 76

fax +48 375 93 71

sekretariat.ing@uwr.edu.pl | www.ing.uni.wroc.pl

Wrocław, 19.08.2020

The Christopher Barnes' dissertation is a neat collection of three published manuscripts linked by a common theme "constraining ages of metamorphic (U)HP rocks by diverse (meticulous) methods". These are interesting manuscripts and it is clear that the presented approach and interpretations of obtained ages required much work, time, and knowledge. Each paper focuses on one locality: Vaimok Lens and Tsäkkok Lens in Scandinavian Caledonides and Vestgötabreen in Svalbardian Caledonides. Dating of these rocks was not trivial, each studied locality had its challenges such as multiple deformation events, complex grains, and methodological hardships. Despite that, the authors put up convincing stories that were a pleasure to read. I am thoroughly grateful for this as it made my task easier. As I said in my previous Ph.D. thesis reviews (I can't repeat everything it is like saying the same joke twice), I think my task is not to judge publications themselves. They are good enough to be published and they were already read, corrected, and commented on by multiple people; co-authors, reviewers, and editors. I know that it is almost impossible to avoid some mistakes (as in Figure 3 in publication [A3] the hammer is in Fig. 3b not 3a and also authors repeat the sentence about hammers twice in the figure caption, but is it important? I think not, it only shows that authors know the importance of a scale in the field photos). Could I find more similar mistakes, probably yes, but they did not diminish any enjoyment of reading of the three presented papers and that is important. I liked all three publications, I got the general picture, thank you. However, liking or not the publications is still not my job here. My task is to judge if the work done by the Ph.D. candidate as a part of a larger team of co-authors was sufficient to consider him a full scientist, ready to plan, work and thrive on his own without the help or burden of supervisors. All the formal necessities are fulfilled i.e. Christopher is the leading scientist in each of the publications (50 % or more of so-called contribution) and he is identified as a person responsible for overall planning and completing the research with other people being his supervisors or contributing to a particular part of the projects like structural or mineral analyses or fieldwork. All of the mentioned roles I deem necessary and the contribution justified (lonely filed work is bad for geologist's health

and may cause severe depression). All contributions are properly identified in the attached forms and signed with different pen colors to make any administration happy. More important than the percentage of contribution is the fact that Christopher is the corresponding author of all three publications. This indicates that he knows the whole painful way how the publication evolves from the very first drafts to the final wrap-up package ready for reading and applause. I have some inside knowledge that proves that Christopher's publications were constantly improving. I saw the [version_2] of Figure 9 in the publication no. [A1] and the [version_final] is much better. Being able to revise, polish, rewrite, redraw e.c.t. work once done is one of the most important assets of a good scientist. And lastly, it is also very important to be able to put one's work in a larger context. Christopher passes this test with a well-written introduction that sums up all three publications. Most figures in the introduction are taken from the publications themselves but put together to show one general direction the publications aimed to achieve. Also, conclusions, implications, and future directions provide general insight into the problem of enigmatic metamorphic evolution of the studied area and show how all three manuscripts pushed our regional knowledge forward. Summarizing I have no doubts that Christopher should be awarded his Ph.D. degree as he proved to be the brain and the boss behind all the publications. Clearly, he knows what he writes about because he can summarize the general achievements and remaining gaps in the knowledge. He has been also able to prepare a summary figure for introduction only based on all his three publications and twenty-one references, all of them about dating rocks in his study area or its proximity. This gives Christopher bonus points as it shows that dating the UHP rocks in Caledonides has been undertaken for over thirty years and adding new knowledge to such densely dated areas requires vast studies of previous works to squeeze in with something convincingly new and interesting (Christopher did it). Another aspect is (worth more bonus points) the diversity of the approaches. A person not familiar with Christopher's work may assume that Christopher has taken a rock in the first area and dated it, then took similar rock 200 km to the south and dated it as well and then went to Svalbard and dated the third locality there. Nothing farther from the truth. In the three publications, I appreciated different approaches Christopher planned to obtain the most robust ages possible. As I said the task was not easy and probably answer he got not as unambiguous as he dreamt at the beginning, but it is trying and changing approaches that count more (even if you get balder or have more grey hair in the process whatever applies to you). In between the first and second publications, Christoph changed laboratories because the first one was not good enough to measure small monazite grains. In the third

publication, a strong structural aspect was added so that samples were cleverly chosen in the framework of evolving structural context. Again it shows that Christopher was the main person responsible for publications and the ideas presented within, he chose different team each time with only two constants being supervisors Jarosław Majka and David Schneider, however, I am more than sure that Christoph will be able to proceed without their help in the future.

I think my opinion is clear and my job is done, I am sure that we have future dr. Christopher Barnes, in front of us. However, I am also willing to test his knowledge a bit here and ask some additional general questions, so that he can prove his worth also in more stressful conditions of public defense (with the principal stress component – telling his reviewer that she is actually wrong – for the record, I don't mind).

My first question pertains to the obtained ages and Christopher's approach to the errors he got and how they affected his interpretations. I admit I have not looked into source publications, in this case, Root and Corfu 2012 and Mørk et al. 1988. And I also admit that the latter is rather old and age determinations went a hundred miles forward since that time. However, if the errors are considered the monazite and zircon ages from Vaimok are within error and also overlap with the ages obtained in both publications. Christopher acknowledges errors in his interpretations but concludes that his data are more consistent with Root and Corfu (op cit) zircon ages than the Mørk et al. ones. I would like to hear more reasoning behind this confidence.

My second question is a more scientific approach to the philosophical first question. Christopher says that Sm-Nd ages of garnet are overestimated because the garnets were not in equilibrium. Could the Ph.D. candidate present a thought experiment supporting this interpretation? What could have gone wrong and at which point of metamorphic evolution to introduce disequilibrium in garnets which ended up with ages older than the expected ones?

And the third question about Vaimok Lens (apparently my favorite paper), if there is high Sr in zircon (an element completely incompatible in zircon structure), that probably indicates feldspar inclusions. With feldspar, we have common Pb, but no correction was done, how it could have affected the obtained ages?

The fourth question is for Vestgötabreen and is more regional. According to the thesis, the Lower Unit comprises phyllites, but some serpentinite bodies are also indicated in the geological map. They are not mentioned, but they are not that large bodies, however at SE and NE borders of the Unit rather sizeable magnesite rocks crop out. Why these are not mentioned as a part of the story and could they be mentioned at the defense, please?

And finally the fifth question, I wouldn't like to leave the Tsäkkok locality without any. For both sets of structures S1 and S2 the oldest deconvoluted age is ca. 490 Ma and in both cases, Christopher interprets it to represent extraneous ^{40}Ar . Is it not suspicious to get so similar ages for structurally and chemically different micas? Isn't there the chance that the age group is meaningful?

I am looking forward to all the responses and seeing Christopher in the action. I also hope that Christopher continues with his innovative ideas in the future as there is still plenty to be done. I wholly recommend him as a new doctor to join the scientific community and I am awaiting more of his work. I hope that he will remember his time in Poland fondly.

A handwritten signature in blue ink, appearing to read "Adam Pochman". The signature is fluid and cursive, with a prominent initial 'A' and a long, sweeping tail.