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Evaluation of the Ph.D thesis by Mr. Stephen Collett

Mr. Stephen Collett prepared a detailed study on rocks of the Kabul Block and Hindu Kush to constrain the early and late P-T-t evolution related to the collision between the Indian, Eurasian and Arabian plates. Both, the Kabul Block and its northwestern Hindu Kush hold tectonic and petrologic key positions for understanding the complex history of the eastern parts of the Alpine chain. However, such classical studies in Earth Sciences need a lot of field observations and geologic methods like (micro)-structural observations, petrography, geothermobarometry and age dating. Additionally, the inclusion of actual literature is absolutely necessary to prepare state-of-the-art tectonic models.

Considering the Ph.D. thesis as a cumulate of already published manuscripts in high-rank journals including additionally an extensive Introduction chapter at the beginning as well as a Conclusion chapter at the end of the thesis, I think Mr. Stephen Collett did an excellent job. Regarding to the co-authors in the published manuscripts it can be concluded that beside his work, Mr. Collett integrated perfectly in the group advised by Prof. S. W. Faryad which is an important qualification to be successful in the field of Earth Sciences

The major focus of the thesis lies in petrological methods like mineral chemistry, thermobarometry and pseudosection modelling linked with age dating on zircons, monazite and micas to prepare a conclusive PT-t path for the studied rocks and tectonic units. Tectonic aspects like deformation stages or the presence of large-scale shear zones as well as the application of valid exhumation models for a convergent orogen have been considered and mostly discussed including actual literature. For me, this work is a classic petrologic work with high standard and the published data give an important impact for recent and/or future geological studies in the rocks of the Kabul Block but also in study areas nearby.

I will now more focus on the first study entitled: "Polymetamorphic evolution of the granulite-facies Paleoproterozoic basement of the Kabul Block, Afghanistan". This study gives necessary petrological data to dominant metamorphic events in the basement of the Kabul

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Block. Two metamorphic events, M1 granulite peak facies followed by M2 amphibolite facies overprint have been recorded by the authors and both events are explained using conventional geothermobarometry and P-T pseudosection modelling. Beside this I think the major power of this work is the petrographic and analytical work for describing the different types of rocks, which is an important basic work for the calculated data. PT data have been merged classically with recently established ages of concurrent studies (e.g. Faryad et al. 2015) to conclude in a classical P-T-t diagram (Fig. 8). For me this is a coherent study and shows the need of geochronology for a serious conclusion.

The second study entitled: "Pressure-temperature evolution of Neoproterozoic metamorphism in the Welayati Formation (Kabul Block), Afghanistan" focuses on the P-T evolution of the staurolite- and kyanite bearing micaschists of the Welayati Formation which overlies the granulite facies rocks of the first study. This study deals with comparable petrologic methods like petrography, garnet zonation patterns, classical geothermobarometry linked with Pseudosection modeling. Hence, a classic P-T evolutionary path for the micaschists is given including also the granulite facies rocks of the Sherdarwaza Formation. As result a complete P-T path to somewhat higher temperatures up to 650°C shows the importance of the M2 amphibolite facies overprint which affected the micaschists directly in the hangingwall of the granulites. Additionally, no evidence for a pre-Alpine metamorphic overprint is shown by continuous garnet zonation patterns. This comprehensive view on the metamorphic evolution of the Al-bearing micaschists is linked with tectonic implications from the literature.

The third paper entitled: "The Kabul Block (Afghanistan), a segment of the Columbia Supercontinent, with a Neoproterozoic metamorphic overprint" is a study collecting all previous data combined with necessary age data to explain the Kabul Block in a wide geodynamic context. Even though Mr. Collett is not the first author it can be seen that his studies have important implications for this multidisciplinary approach. SHRIMP age dating on zircons and on monazite as well as biotite age data constrain the tectonic evolution of the Kabul Block and allow to locate this study area in a time-scale from Archean to the early Precambrian. Important paleogeographic models have been constructed to explain orogenic events during the Rodinia and Greenville Orogeny for the Kabul Block in relation to the Tarim Block, North China Block and India for a common Paleozoic evolution. For me this is the most important paper reaching most attention for this study area worldwide.

The last paper is entitled: "Magmatism and metamorphism linked to the accretion of continental blocks south of the Hindu Kush, Afghanistan". This study area located in the north-western vicinity of the Kabul Block includes a classic petrological, geochemical and geochronological approach to explain the metamorphic evolution of Proterozoic amphibolite facies para-/orthogneisses and migmatites. The study proposes three metamorphic events which are linked with plate tectonic evolution. Especially, the third metamorphic event can be related to the collision with the Indian plate in the Eocene whereas the earlier metamorphic events are of clear Proterozoic and Pre-Carboniferous age. In this study Mr. Colletts work can be clearly distinguished from the other authors which includes at least mineral chemistry, P-T conditions by pseudo-section modelling but also the role of the Kabul-Afghan blocks during Eocene metamorphism. It can be seen that the expertise of Mr. Collett contributes a lot in this field of petrological questions.

To prepare a chapter "Conclusions" requires a coherent view about the study areas by holding always a central theme in mind. I see that Mr. Colletts contributions to the metamorphic and geodynamic evolution of the study areas in Afghanistan have an important impact for the studies of his advisor Prof. Shah Wali Faryad. I will conclude, that the excellent work of Mr. Collett is worthy for a Ph.D.thesis and I wish him all the best for his scientific future.
Evaluation: sehr gut/excellent.

With kind regards,

A handwritten signature in blue ink, appearing to read 'K. Krenn', with a long horizontal stroke extending to the right.

Priv. Doz. Dr. Kurt Krenn