Review of Roland Nádaskay PhD Doctoral Thesis: "*Analysis of depositional controls and provenance of the Upper Paleozoic and Mesozoic deposits and its implication for tectonosedimentary evolution of the northern Bohemian Massif*"

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Because Chapters 2 and 3 are already published, I mainly read these chapters with attention to the scientific ideas presented. In the Introduction and Chapter 1, I identified any grammatical/typo errors as well as questions about the content.

Introduction:

The introduction provides a thorough, detailed and well documented overview of the geologic history of the Bohemian Massif region. The geology of this region is complex, and involves numerous episodes of tectonism, deformation, volcanism and sedimentation. The thesis reports nearly 250 million years of this history with great clarity and supported by detailed figures. I have no immediate familiarity with the area, but I learned a great deal from this Introduction of this thesis.

Minor editorial notes are made in the reviewed copy of the manuscript. Mainly these are to suggest more clear wording. I had only these few comments to raise.

1. Is there any indication of how much of the ~3km removed overburden from the Lusatian block is now sequestered in the Lusatian Basin?
2. I was unclear regarding the evidence for the Mastrichtian fluvial system that is depicted in Fig. 12 flowing toward the northeast along the northern boundary of the Bohemian Cretaceous basin. What supports the idea that the trace of the fault controlled the orientation of the fluvial system?
3. Laying out the Cretaceous paleogeography in the Introduction would have been helpful for context.
4. Though the thesis focuses on Cretaceous and earlier history, what is the nature of any post-Cretaceous overprint that may have modified the geologic record? An exhaustive treatment of this isn't needed- I just don't have the background in that area to understand it without explanation.

Chapter 1

Chapter 1 presents very detailed sedimentological analysis of syntectonic Permian deposits in the Krkonoše Piedmont Basin. This work is very clearly described, and interpreted with solid use of references to support the proposed model of a fluvio-lacustrine system with intermediate discharge rate and high-groundwater table.

I made a few minor editing suggestions. There appeared to be erroneous numbers that occurred sporadically throughout the text that should be removed.

I have a few suggestions to improve presentation of the sedimentological data:

1. The facies descriptions often do not discriminate bar deposits from bedform deposits. These can be challenging to differentiate, but often the key observation is in the orientation and geometries of the bedding planes. If bedding contacts are (sub)horizontal and (sub)parallel and contains laminated sediment, this is consistent with facies deposited by a bedform. If bedding contacts are inclined and/or the contacts are largely concordant with the bedding plane, this is more likely to indicate a barform.
    a. I understand that the bars/bedforms are better discriminated using architectural element analysis; because of this, I found it less clear to try to follow the assignment of sedimentation process in an environmental context (e.g., transverse channel bar) in the facies section because the unique interpretation really relied on the facies associations that were laid out in the Facies Associations section. It might be easier for the reader to follow along with your results and interpretations if the environment of deposition isn't commented upon until the Facies Association section.
2. You have very impressive data to characterize the single-storey fluvial channels in these deposits. I know there is a lot to report, but it seems it may be worth the trouble to treat these 3 variants separately facies associations in the text since they include different facies at different proportions and occur with varying frequency in the stratigraphy. I think simply adding some subheadings to the Sandstone channel fill (CHs) section to clearly distinguish the variants would be helpful to the reader.
3. The "Tb" abbreviation is used on page 82 but isn't really defined/described outside of the caption. I think this is part of my confusion that I lay out in my comment 1 above. The bar deposits are key to identifying channel morphology and inferring flow characteristics, so I like that these are identified or defined, but the Tb deposits need to be clearly included and describe in the text.
4. I struggled to match photos of stratal architecture to field localities, and suggest using the numbers shown in Figure 3 to link photos to the field locality where the observations were made.

I have a few questions regarding interpretation of the sedimentological data.

1. An alternate interpretation of Facies Gt is channel thalweg given the large clast size, poor sorting, and convex-up erosional base.
2. The identification of "distributary" channel includes the implication that the channel is formed from the bifurcation of a single channel into 2 or more channels, which usually occurs in either distributive fluvial systems or delta systems. However, the description seems to indicate reference to deposits by a small single channel that crossed an area of the floodplain before it was occupied by the main channel. This does not seem to meet the criteria for a distributary channel.
3. How thick are the individual sedimentary beds produced by hyperconcentrated flows? The Unconfined channel section indicates <0.5m, but I wasn't clear if that was the interval thickness or the thickness of individual beds that would represent 1 flow. That seems to be very thick-

hyperconcentrated flow deposits outside of alluvial fan settings generally are much thinner than this in my experience.

4. In the lacustrine deposits, the observation of symmetrical wave ripples is used to indicate water depth of a few meters; water this depth is unlikely to develop strong longshore current that is suggested to be responsible for the asymmetrical ripples. Longshore current is proportional to wave period, and because of their lower fetch, lakes tend to have short/small wave periods and so induce little longshore current.
5. One consideration that might be interesting to investigate more closely is the discharge of water versus the discharge of sediment. The sedimentology from my assessment seems to be consistent with a high rate of sediment discharge (hyperconcentrated flows, high sand/mud ratio, low sinuosity channel). This sediment discharge, combined with high accommodation creation, may explain the lack of palosols in these deposits. A high water table and humid environment in the Permian would otherwise lead to forested regions/swamps/mires, but a high influx of clastic material would prevent peat formation and deposition.

Chapter 2

Chapter 2 presents a thorough, multi-method stratigraphic analysis of Cretaceous deposits in the Bohemian Cretaceous Basin. I don't have the expertise to comment on the paleontology work but this very nicely was integrated with the geochemistry and provenance analysis.

One suggestion for future consideration would be to assess any contribution of biogenic silica by looking for samples with elevated Si/Zr in a cross-plot. It could be helpful to get a handle on any Si diagenesis which may have had a role in influencing the radiogenic isotopic compositions observed in the samples.

I had one other though regarding the radiogenic Sr isotopes- I recall some work suggesting that some Cambrian carbonates are characterized by very high radiogenic Sr isotope ratios. Is there any possibility that erosion of Lower Paleozoic section in the area during the Cretaceous could have produced riverine water a higher concentration of Sr 87/86 isotopes with a higher ratio than the model you considered?

One final question I had was regarding fusain abundance- was there any relationship between fusain occurrence/abundance and sea-level cyclicity? This could be an interesting linkage between eustacy and climate conditions resulting in carbon export to the basin.

Chapter 3

Chapter 3 presents a large-scale, comprehensive overview of the tectono-sedimentary evolution of the northern Bohemian Massif. I particularly liked the treatment of the heavy mineral data in this study as it clearly distinguishes a provenance signature for the Jurassic strata that indicates potentially greater contribution from 1st cycle sediment influx generated under strong chemical weathering conditions.

The detrital zircon data were well presented for the samples analyzed. There is a clear difference demonstrated in the source of Permian sediments, which show a significant component of Caledonian

and Paleoproterozoic zircons. Then, with increased uplift during the Mesozoic, additional input was derived from erosion of Variscan rocks along with younger Precambrian rock, which is interpreted to represent erosion of overburden that has been fully stripped from the Bohemian Massif. The similarity between Jurassic and Cretaceous samples supports the inversion model indicated by other geologic data. It does seem from the overall elevated ZTR index, that this history may have involved either long transportation distances during the Mesozoic (which would be consistent with the exotic source model) or perhaps a more complicated history of erosion and resedimentation leading to final. I think that the model depicted in Figure 13 does a fantastic job of illustrating the complex interplay of sediment source area and basin evolution through time. It's extremely well done. Some detrital thermochronology work would be fantastic to test this model and provide additional information to elucidate this complexity.