

Interactive comment on “Neoproterozoic and post-Caledonian exhumation and shallow faulting in NW Finnmark from K/Ar dating and p/T analysis of fault-rocks” by Jean-Baptiste P. Koehl et al.

Anonymous Referee #1

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The paper by Koehl et al., presents the results of several K/Ar determinations of rocks in Finnmark Northernmost Norway. The results are placed in the context of a comprehensive structural evaluation. The work is generally well written and comprehensive. However, the text is excessively long and could reasonably be expected to be shorted to make the salient points more accessible to the readership. I do think this work has the potential to make a very useful contribution to the journal however I have some critical comments the authors may wish to consider and prepare a revision to address. The ages are distinct from other high temperature and Ar/Ar texturally constrained results from Finnmark which illustrate the importance of Caledonian processes. Much better evaluation of the results in the context of these other geochronometers is needed.

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Specifically, why are the ages so different, is it simply due to different fabrics being dated, a different closure temperature of the system and mineral, or are secondary alteration processes at play? It is trivial to address this question but is needed to place the work in the current regional context. The reported ages may very well be correct but then more detail is required to put them in the context of post Caledonian process (in the main). More evidence is required to demonstrate that the clay minerals all formed at the same time and that they have not been subsequently modified with later fluid movement on the “dated” structures. For example, more SEM and EBSD textural work would be a distinct advantage in addressing how many different fabrics are associated with each of the sampled structures. What is the potential of fine fraction feldspar modifying the K/Ar results? Is there evidence of significant fluid alteration on these structures? I am somewhat concerned with the number of references to unpublished works that are cited as “submitted” (e.g. Koehl et al., Davids et al.,). I do not think it acceptable to heavily rely on such currently unpublished work so I would suggest that a summary of the salient points in those unpublished works is presented in this paper so all the evidence for statements in this work is available to readers. Other minor points Line 16: sentence structure I think you mean “during the opening of”. . . . Line 34: replace “which” with “whose” Line 50; you probably should mention the timing of collisional phases as constrained this region prior to discussing post-Caledonian extension. See Kirkland et al., 2006, The structure and timing of lateral escape during the Scandian Orogeny: A combined strain and geochronological investigation in Finnmark, Arctic Norwegian Caledonides, which discusses the constraint on the timing of the collisional phase (431-428 Ma). Line 65: you need to present the evidence or at least discuss (if it is already published) the evidence for Timanian deformation in northern Finnmark. More discussion on the rationale for a 30°C/km geotherm is needed. There are some regional thermobarometry studies that point to the peak P-T conditions which may be relevant assist in placing constraints on the retrograde thermal pathway. There are some sections of the text that need rewritten, for example evaluating the results against an unpublished (e.g. submitted) model (e.g. TKFZ development) by the same

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authors and coming to the conclusion that the previous unpublished model is wrong seems odd to me. You already know it doesn't work with your data. Line 105-115; I would have thought it relevant to discuss the results on basement metamorphism as provided by pseudosection thermobarometry, as it is likely to be some of the most accurate P-t constraints in the region and at least provides some constraints for subsequent processes. — Gasser et al., 2015; D. Gasser, P. Jeřábek, C. Faber, H. Stünitz, L. Menegon, F. Corfu, M. Erambert, M.J. Whitehouse Behaviour of geochronometers and timing of metamorphic reactions during deformation at lower crustal conditions: phase equilibrium modelling and U–Pb dating of zircon, monazite, rutile and titanite from the Kalak Nappe Complex, northern Norway. — Kirkland et al., 2016: C.L. Kirkland, T.M. Erickson, T.E. Johnson, M. Danišík, N.J. Evans, J. Bourdet, B.J. McDonald, Discriminating prolonged, episodic or disturbed monazite age spectra: An example from the Kalak Nappe Complex, Arctic Norway, *Chemical Geology*, Volume 424, 2016, Pages 96-110,.

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