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Solid Earth
Discussions

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.

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General comments:

This is an interesting contribution to the Proterozoic and Palaeozoic, geological and faulting development of northwestern Finnmark and north Troms, northern Norway. Over the last half century, this part of the Norwegian Caledonides has witnessed great advances in our knowledge of the basic geology through detailed bedrock mapping aided by simultaneous stratigraphical and sedimentological studies. Other research investigations have focused on the geochemistry and dating of mafic dykes, low-grade and high-grade metamorphism, provenance studies, and the petrology and dating of

plutonic complexes in the famous Seiland Igneous Province and Honningsvåg Igneous Suite. The principal faults, and their trends and general evolution, are also well known, as seen from the geological maps on different scales and from descriptions of faults and fault-rocks in several publications, in some cases aided by satellite-sensor (e.g. Landsat) imagery. What has been largely lacking, with just a couple of exceptions, until now, is a study of the mineralogy of gouges and cataclasites in the cores of the many mapped faults; and, moreover, an attempt to date the mineral species that reside in these diverse fault-rock products. The manuscript in question here, by Koehl and colleagues, is therefore a very welcome addition to our knowledge of faulting in this part of Norway; one might say, another small "brick in the wall" of northern Norwegian geoscience. I would support its publication, subject to comparatively minor revisions as set out below.

The manuscript is generally well written, but my ex-editorial eyes spied a mixture of British and American English, in this case mostly Am-Eng, though with a disregard for some aspects of Am-Eng syntax. This is a job for the Editor to sort out. I do not know the rules of Solid Earth on this matter. Perhaps there are no defined rules to help authors? But as a Euopean publication, SE is closer to Britain than the USA; and in this case all three authors are European. Personally, I do know that the Norwegian Journal of Geology follows British-English. Quite possibly the SE is open to both language variants as long as there is complete consistency in any one manuscript? In this Koehl et alia ms, however, there is no consistency.

Specific comments

Here, I list a variety of comments by reference either to page numbers or in most cases to actual lines as numbered in the manuscript. Firstly, however, there are couple of general points relating to small errors or inconsistencies that appear on almost every page.

Page 1, and throughout the ms. The temporal adjectives Early, Mid and Late should

be capitalised (e.g., Mid Neoproterzoic). The authors are inconsistent on this point.

Several pages. Composite adjectives should be hyphenised, e.g, greenschist-facies rocks, but not when writing . . . The rocks were metamorphosed in greenschist facies.

Page 1, line 12 (also p.9, line 273 and p. 10, line 286). The correct term is 'Raipas Supergroup' (there are several groups within the Raipas Supergroup).

Page 2, line 53. Write Late Devonian. Then add reference to Guise & Roberts 2002 (NGU Bulletin).

Page 3, line 67. " . . ..fault complex, the age of which is yet uncertain (Zw. . . .". Then on line 69 " . . . onto the eastern Finnmark Platform where . . ." Next, on line 87 "cross-cutting".

Page 4, line 102. After 1983, add reference to Torgersen et al. 2015Âÿ NJG Vol 95. Then, after 1985, add reference to the classical paper by Gayer et al. 1987, Trans.Royal Soc.Edinburgh. Note the spelling of Ramsay, not Ramsey.

Page 4, line 104. Elvevold was not the first to write about the SIP. Many publications by Robins and students/colleagues. Here you can add Robins & Gardner 1975, Earth Planet.Sci.Letters 26. Page 4, Line 105. Again, Robins should be mentioned, in front of Corfu. Add Robins 1998, Geol. Mag. 135, 231-244.

Page 4, Lines 108-110. Here you need to achieve a balance between the two main interpretations for the Kalak. In line 108, write . . . " . . .is thought by some workers to represent . . .". Then, add a new sentence after (Kirkland et al. 2008). "However, others have provided robust evidence for a Baltican origin (e.g., Roberts & Siedlecka 2012, Zhang et al. 2016)."

Page 4, line 111. "to amphibolite-facies . . . . composed of psammites, . . . " (Note – psammites are metamophosed sandstones, so the prefix 'meta' is not required.). Then on line 112, Ramsay, not Ramsey. On line 113, add Robins & Gardner 1975 before Elvevold. On line 118, add Robins 1998 before Corfu.

Page 5, line 125. You should add Lippard & Roberts 1987 before Bergh.

Page 5, line 142. Should Nasuti et al. 2015 be 2015a ? Line 149, shows not show; then on line 150 thrusts not thrust.

Page 6, line 156. " . . .are juxtaposed against amphibolite-facies . . . " Then, line 174 " compositions and with the results of . . ." On line 180, "brittle faults that we encountered . . ."

Page 7, line 193. The Ksienzyk reference is not in the References. The very last word on this line should be 'whose', not which.

Page 7, lines 206-207. "have been shown to be a sensitive . . . . . .low-grade . . ." Then, the end of this sentence . . . . . "in clastic sedimentary rocks." These are not unconsolidated sediments but lithified sedimentary rocks.

Page 8, line 230. "Synkinematic illite commonly grows . . ." Do not use adverbs of time in cases like this – e.g often, frequently, occasionally. There are many such examples in this manuscript. Line 242, " . . thus causing coarse fractions . . . " Line 245 " and, thus, yield rebust . . . ."

Page 9, line 247. contrary, not contrarily. Next line . . . . "is unlikely". Next line temperatures. Line 256, counterparts should be one word. Line 272 Raipas Supergroup. Also on next page, line 286.

Page 10, line 294. "accommodated a vertical displacement of >5-6 m." Line 305/6 "The northern fault accommodates . . ."

Page 11, line 310 "Along strike to the northeast, we . . ." Line 312 "that cross-cuts arkosic psammites . . " Line 313 replace "made" by the word composed

Page 11, the subheading 4.1.3. This is incorrect and misleading. These brittle faults are nowhere near the TKFZ. Rephrase as follows – "Brittle faults on Porsanger Peninsula and Magerøya (samples 8, 9 & 10)"

Page 12. The very first sentence (lines 338-340) needs some rewriting, as follows – ” are widespread in the Kalak Nappe Complex on the Porsanger Peninsula and in the Magerøy Nappe on the island of Magerøya (Figure 1; cf. Koehl et al., in prep.).” This Koehl et al manus has NOT been submitted to NJG, at least not received by the editor (I have checked this). Line 343, ”Magerøy Nappe rocks on . . .” Line 348, ”Farther north, on Magerøya, sample 9 corresponds . . .”

Page 13, line 385. ” . . . /metavolcanites, gabbros and mica schists.” Line 397, ” is composed of”

Line 398 ” , commonly reworked . . .”

Page 14, line 400. ” In places, epidote-chlorite-bearing ”

Page 15, line 437. ” is composed of . . . ” Line 458, part of this sentence is unclear —” younger age in tendency compared to ..”. Authors please note: ”compare to” means to liken one thing to another, whereas ”compare with” indicates that one wishes to show the differences between one thing and another.

Page 16, line 477. Delete the words ”along the TKFZ” ! Lines 478-481, In this sentence (and in several other sentences in the ms) you give what you say are three ”ages” for the different fractions. These are just numbers or dates. You then have to interpret them as real ages of mineral-forming events.

Page 17, line 499. Delete the words ”segment of the TKFZ”. Line 502, ”suggesting that the fault . . .” Line 507, ”associated with the ”

Page 18, line 522. ” hence yielding ages younger than the actual age of faulting . . .” Lines 535-36, ”However, a minor . . . . . spectra of all . . . . . .suggests that the . . . .”

Page 19, line 576, ” . . . 3c). Subsequently, basement rocks were exhumed to a shallow . .. ”

Page 21 , lines 623/4. Do not use Ma here. Instead write . . . . ”10-75 m per mill. yrs.” and later, ”10-100 m per mill. yrs.” This crops up at many other places in the ms.

Page 22, line 652. ”at depths between 3 and 10 km.” Line 662, ”along fault segments of the LVF and faults parallel to the TKFZ, showing . . . .”

Page 23, line 676, ”suggesting that the dominant . . . ” Line 683 ”WNW-ESE-trending faults associated with the” Line 691 ”along the LVF and parallel to the TKFZ . . .”

Page 24, line 711, ”earliest indications of . . .” Line 717 ”Silurian age may reflect input from an inherited” Line 733 ” of the LVF and faults parallel to the TKFZ outlined . . .” On next page, line 743, Koehl et al., in prep.

Page 26, line 777, ” at shallow depths between 1 and 3.5 km . . .”

Page 27, lines 816/17, ”although quite commonly associated with large amounts of chlorite along fault segments of the LVF (e.g., the Talvik fault and the Sørkjosen faults . . .”

Page 28, line 831 ” . . analyses of gouge from a fault parallelling the TKFZ in . . .” Line 839, ”indicating that exposed rocks in northern . . .” Line 856, ”erosion with only a limited . . .”

Page 29, line 880, ”A reliable Mesozoic K/Ar age was obtained only for the . . . ”

Page 30, line 887 Spelling . . . scarcity, not scarsity Line 898 in prep. , not submitted Line 906, ”conjugate strike-slip faults have been reported from NW Finnmark . . . .” Line 908 This statement is incorrect. The Timanian contraction in the Late Neoproterozoic was directed towards the SW, not along the strike of the orogen.. This has been described in numerous publications.

On pages 31, 32 & 33 I have noted dozens of small errors; these will surely be picked up by the editor.

Page 38, lines 1151-53, The area covered by this forthcoming manuscript (NOT yet

submitted) seems to be comparable to that of the present contribution. How much repetition will there be, one wonders? But perhaps the authors will be describing completely different faults? – and taken mostly from the theses of E.Bergø and H.Lea ?

Brief comment on the K/Ar dating

The results are very interesting and only the second such study of dating mineral growth in gouges and cataclasites in the northwestern part of Finnmark. Many numbers/dates are given, for the three different grain-size fractions, so it is up to the authors to explain why they interpret every single number as a true age. The authors mention just "illite", sensu lato, but there are several polymorphs of illite, e.g., 1M, 1Md and 2M1, so do they know for sure which polymorph they have been analysing?

The figures

All the figures appear reasonable and acceptable, except for the incorrect placing of the TKFZ in Figure 1 and Figure 4. This error MUST be corrected. I have corresponded with the first author on an earlier occasion about this matter (in another paper of his in Solid Earth), so he knows the facts. The TKFZ is described and defined from the Varanger Peninsula, just outside the eastern limits of Figures 1 and 4, but continues WNWwards through the isthmus on the south side of the Nordkinn Peninsula (marked as NP in Figures 1 and 4). That is where the authors should write in the acronym TKFZ (in smaller capital letters).

I have not had time to control the figure captions.

Technical points

My paper copy is littered with small corrections and additions, typing errors, punctuation errors, etc. However, I leave all these to the chief editor, or even one of the desk editors.

David Roberts, Professor Emeritus, NGU, 7491 Trondheim, Norway 19 April 2018

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