

Mississippian rocks and WNW–ESE-striking faults in Spitsbergen





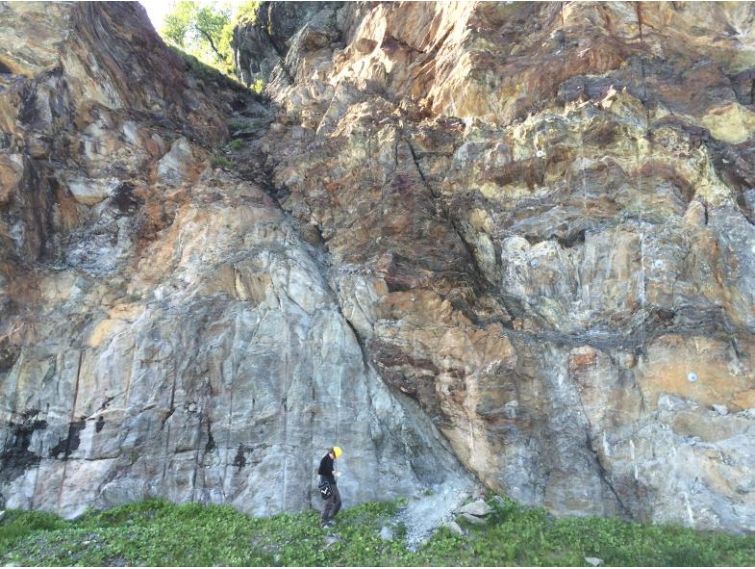



ARCEX
Research Centre for
Arctic Petroleum Exploration





Goals



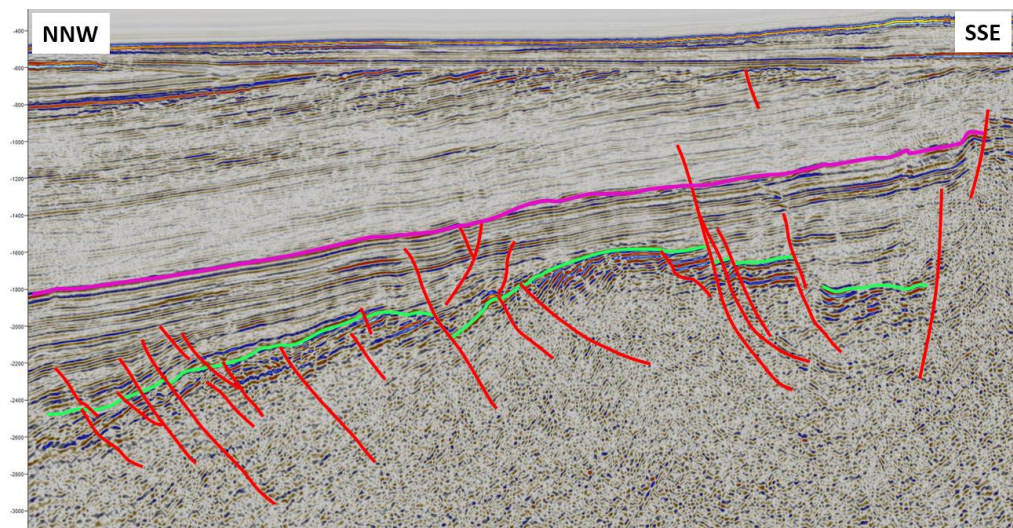
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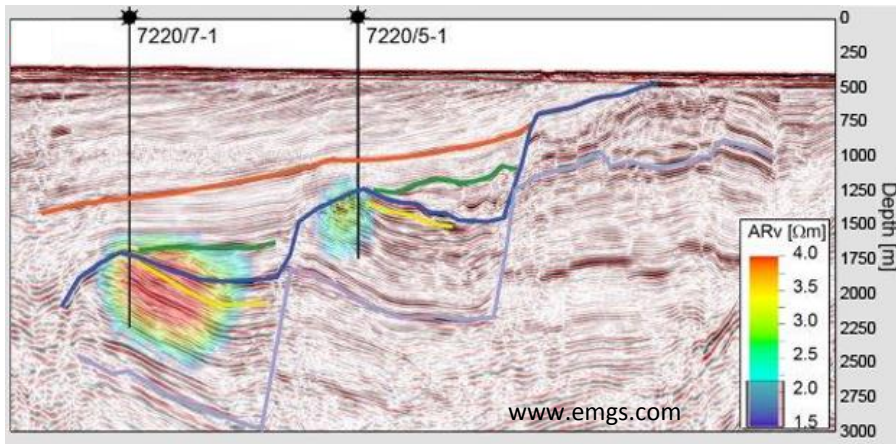
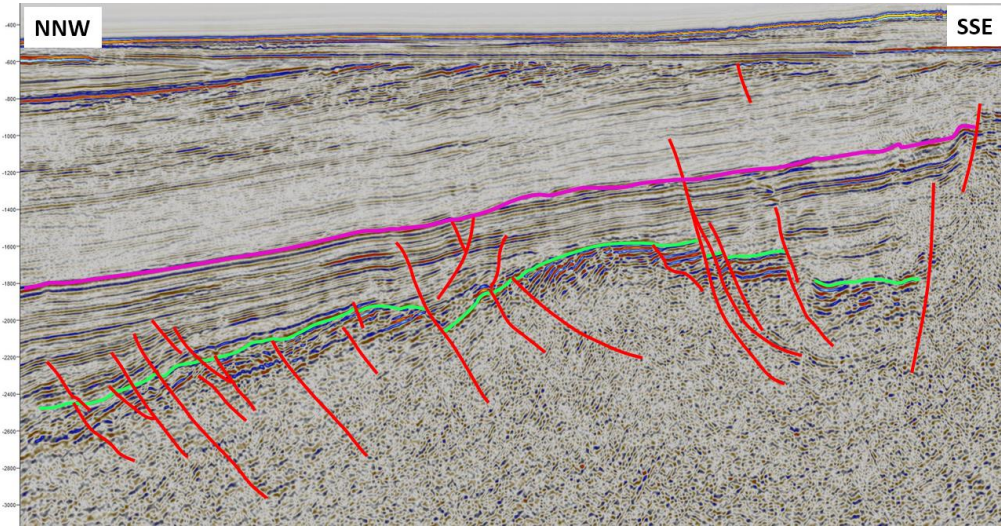
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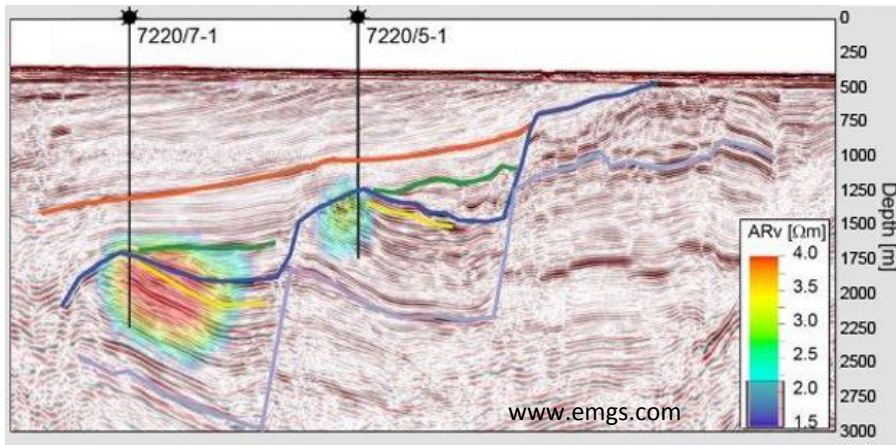
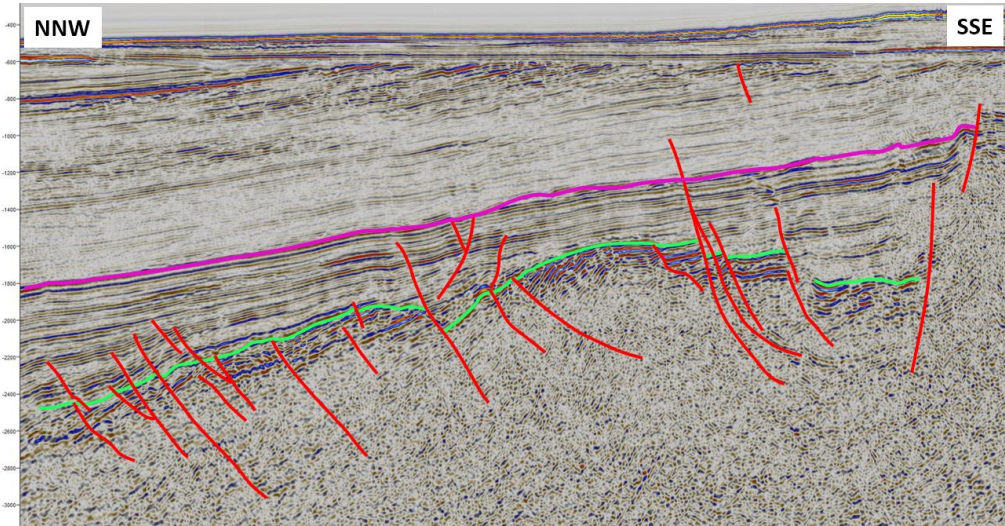


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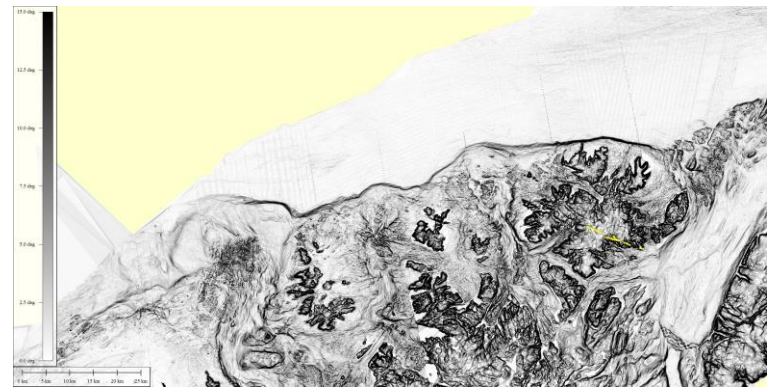


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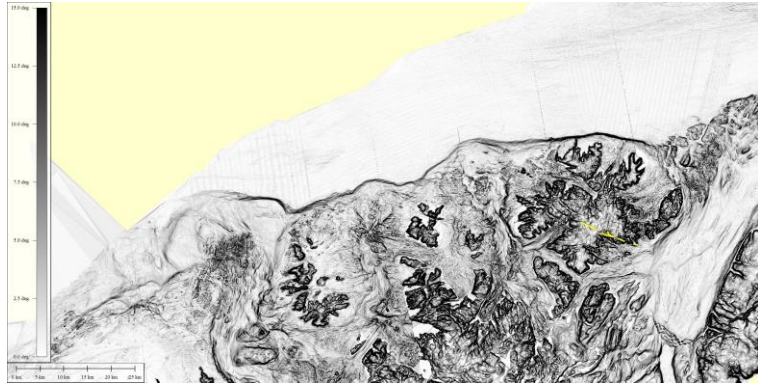


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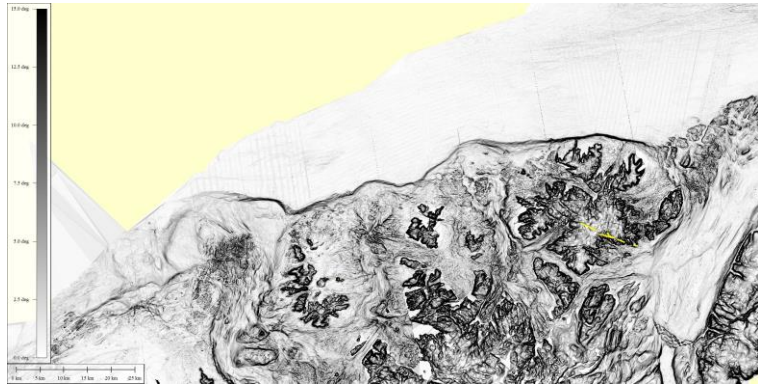
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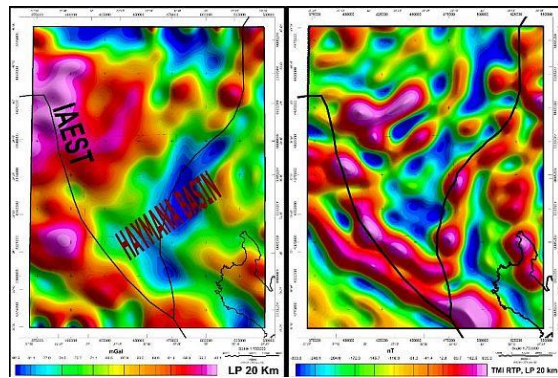
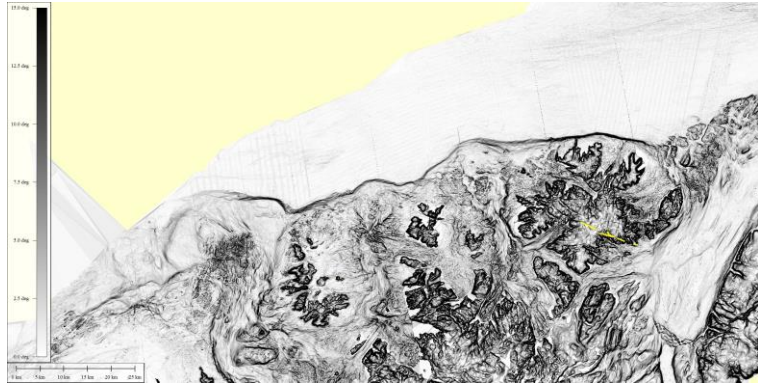
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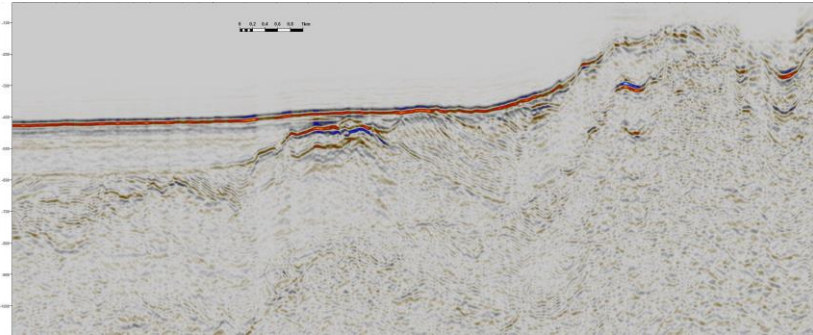
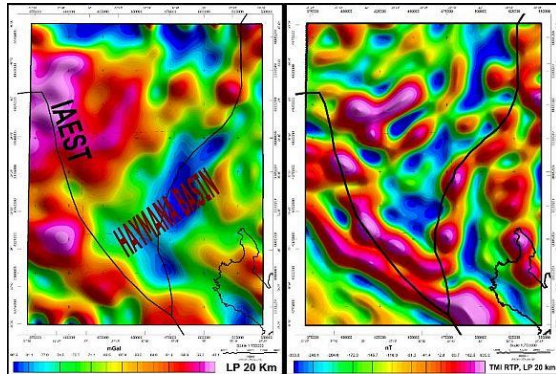
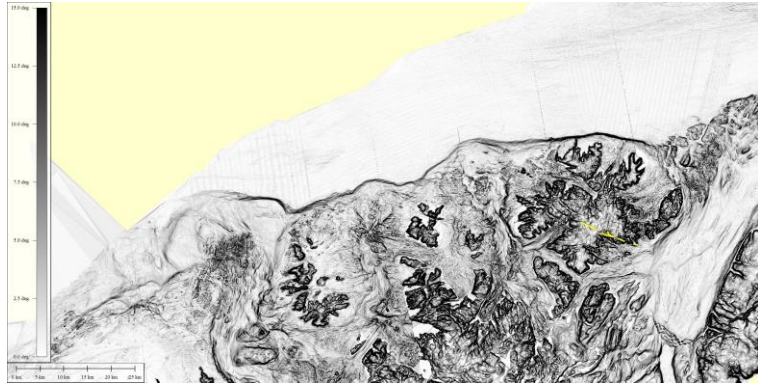
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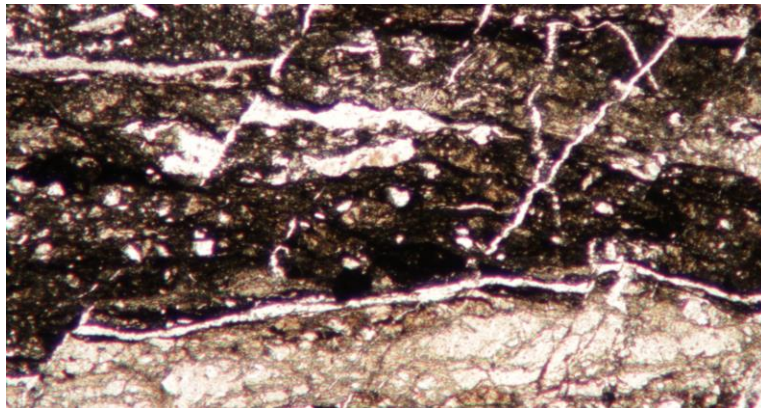
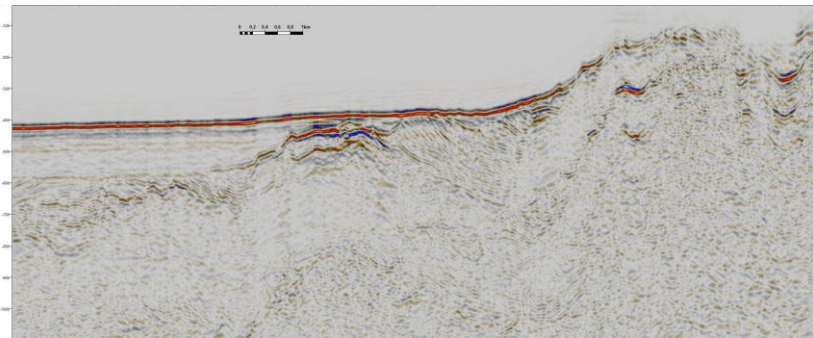
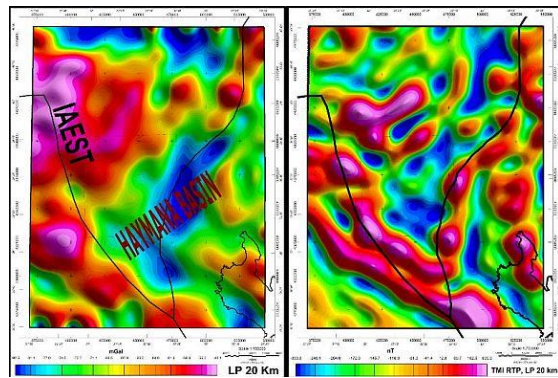
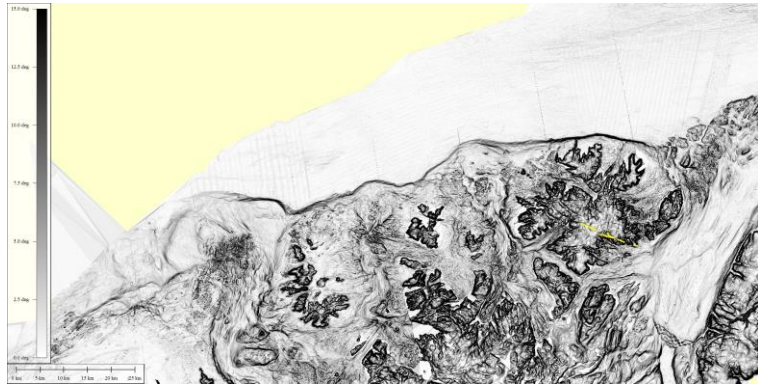
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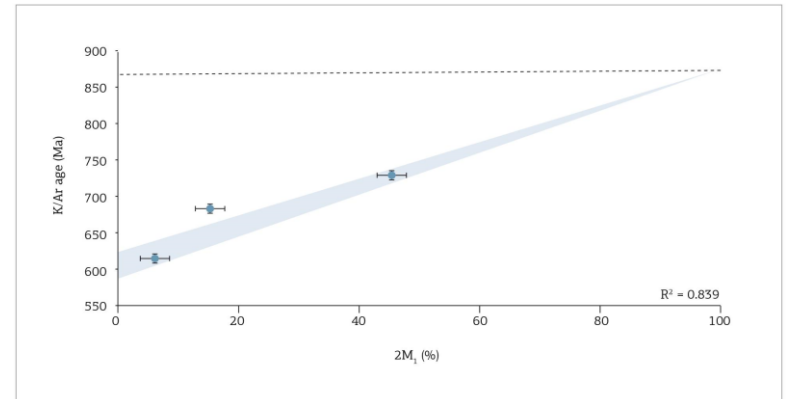
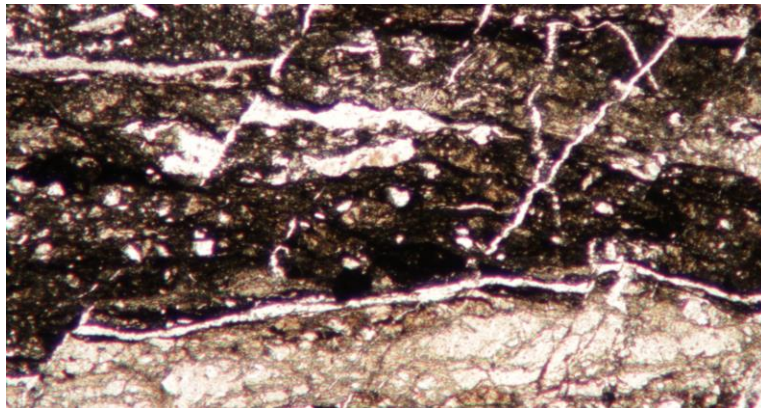
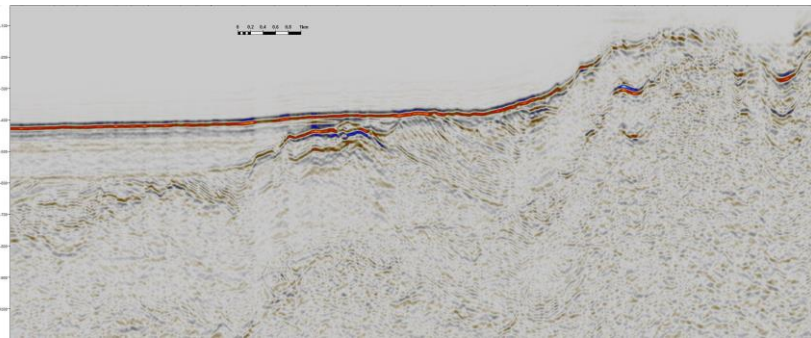
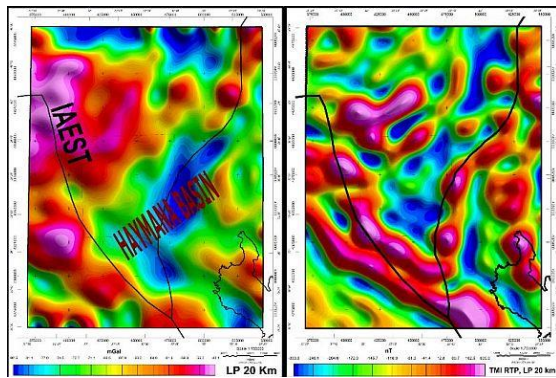
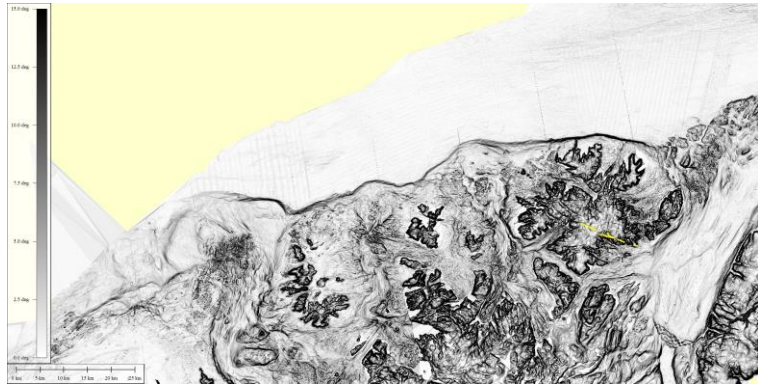
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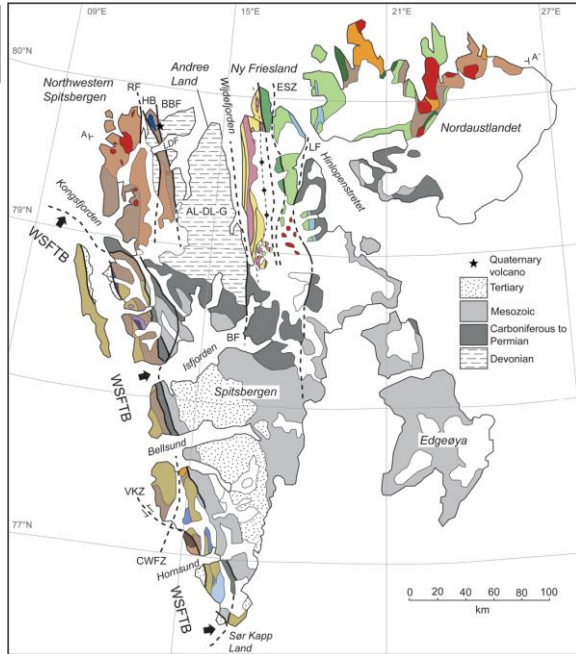


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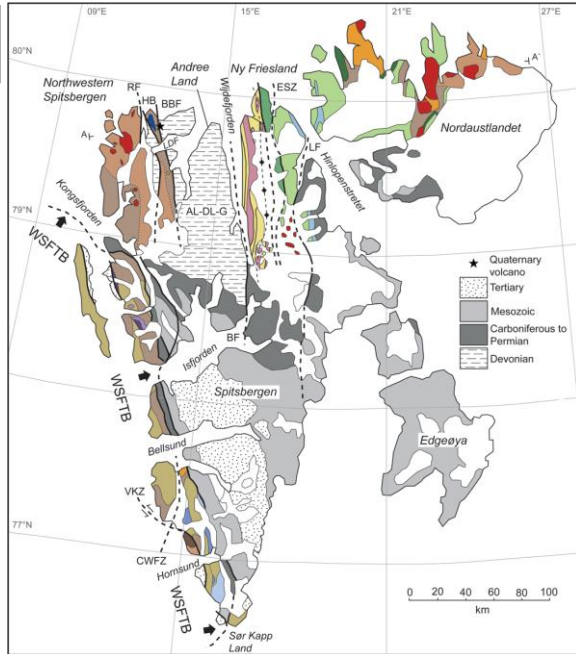
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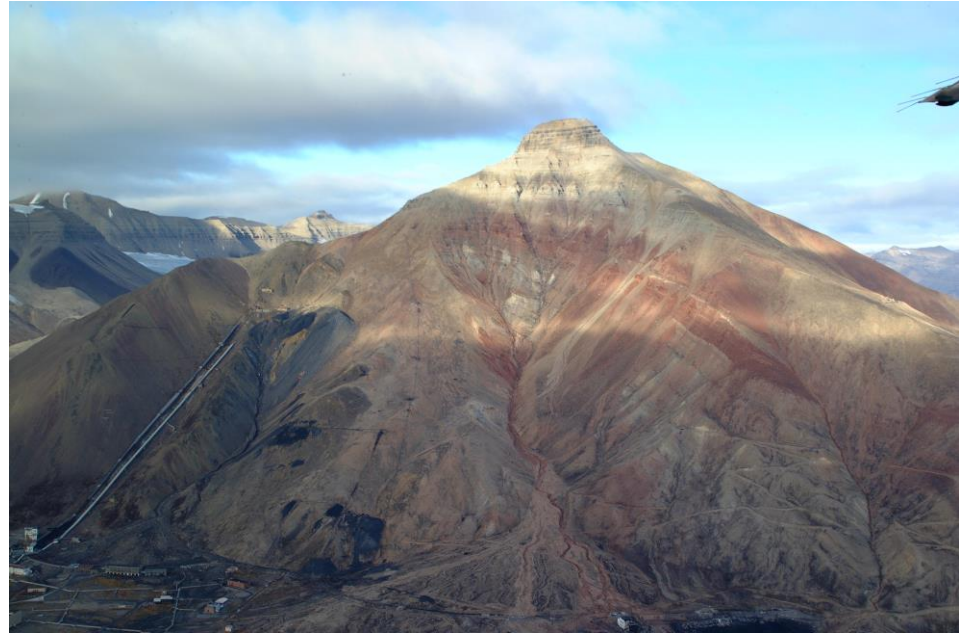


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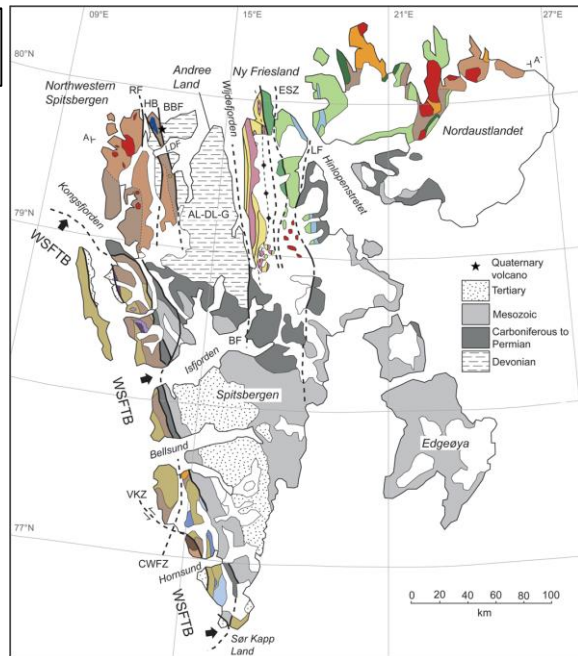


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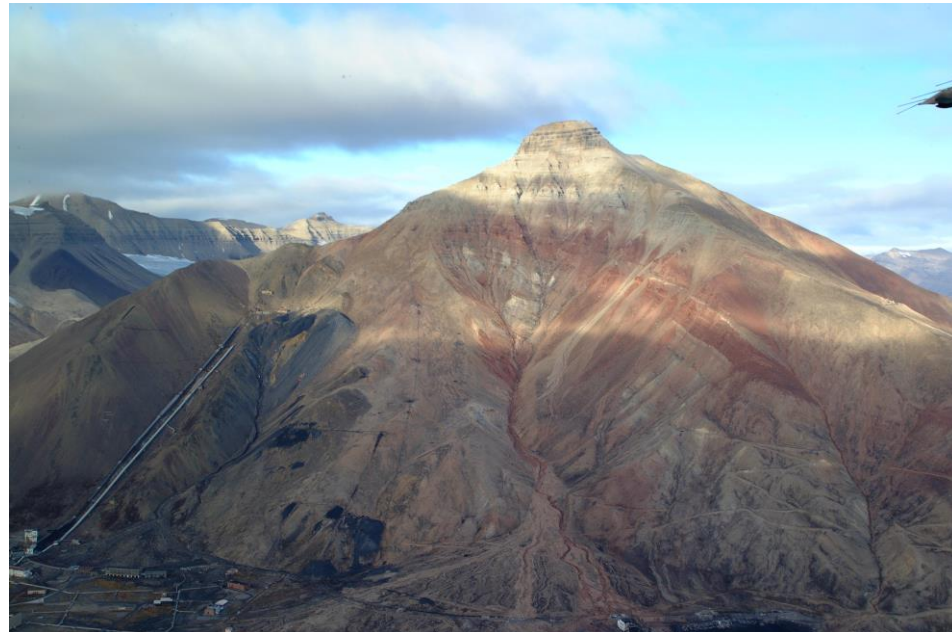


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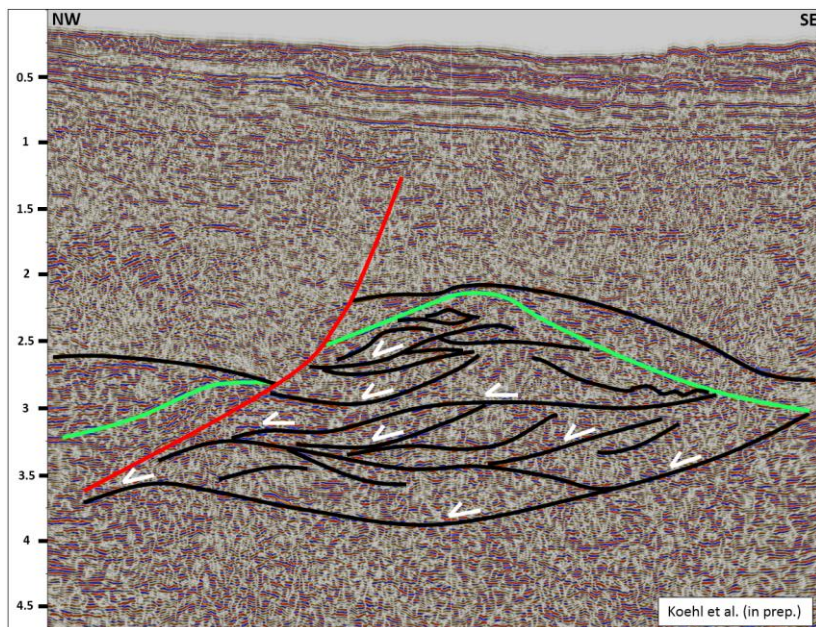
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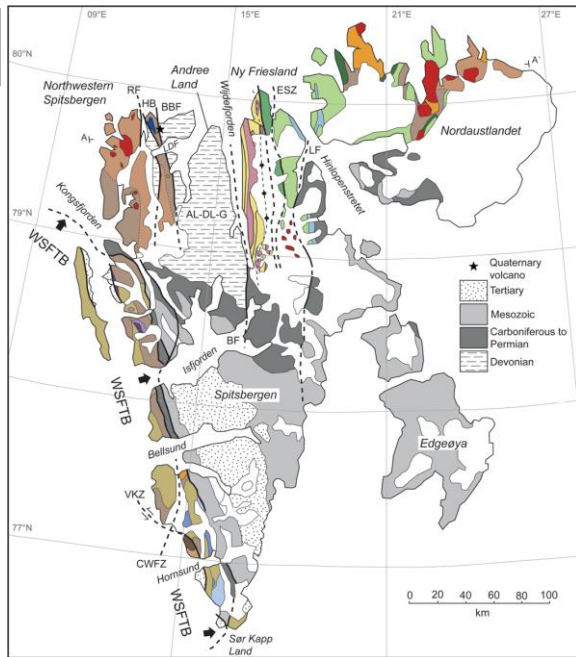


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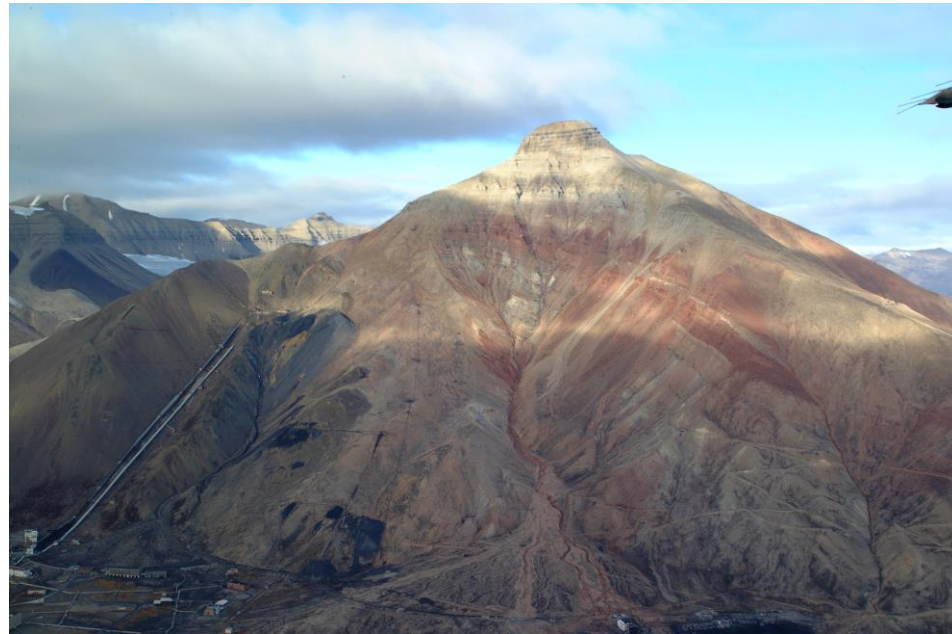


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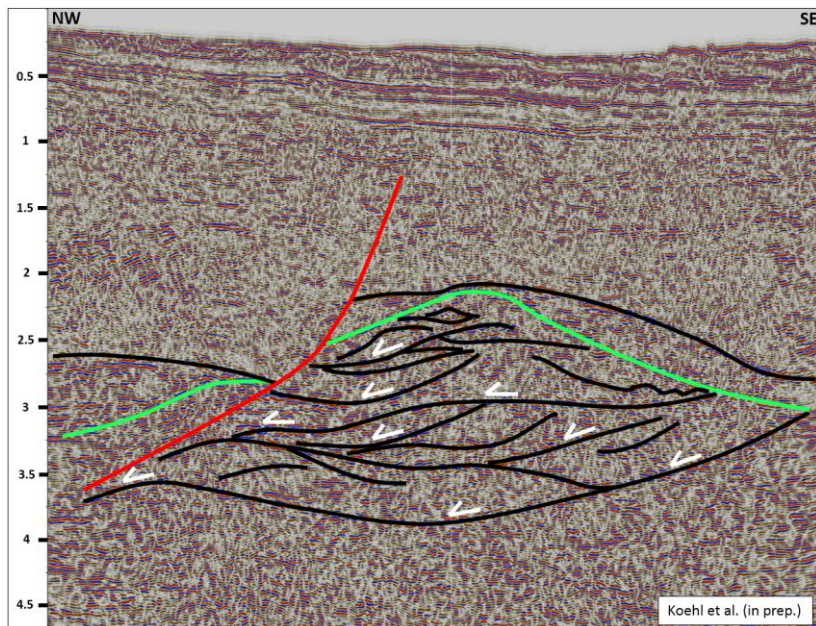
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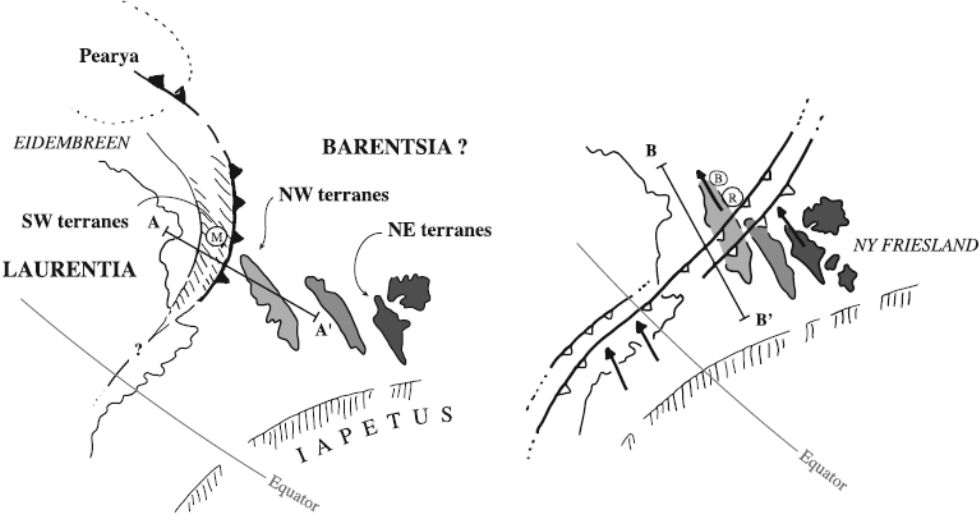


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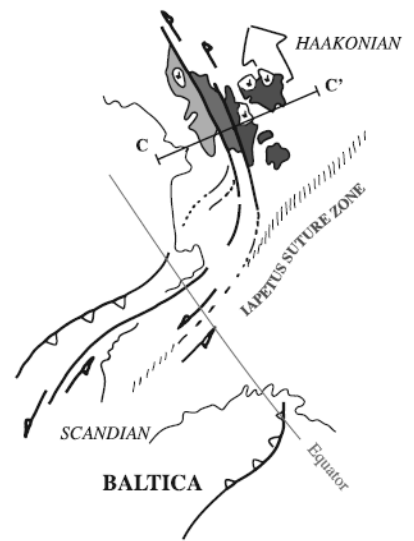
The Svalbard Archipelago is made of three terranes accreted together during the Caledonian Orogeny showing dominantly N–S-trending fabrics, folds and faults.

A- Ordovician 470 Ma

B- Silurian < 440 Ma



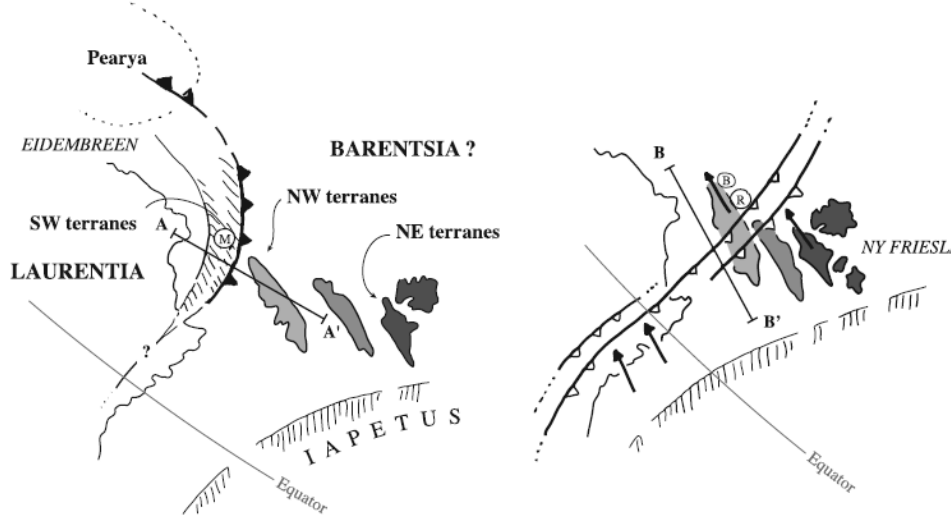
> 420 Ma



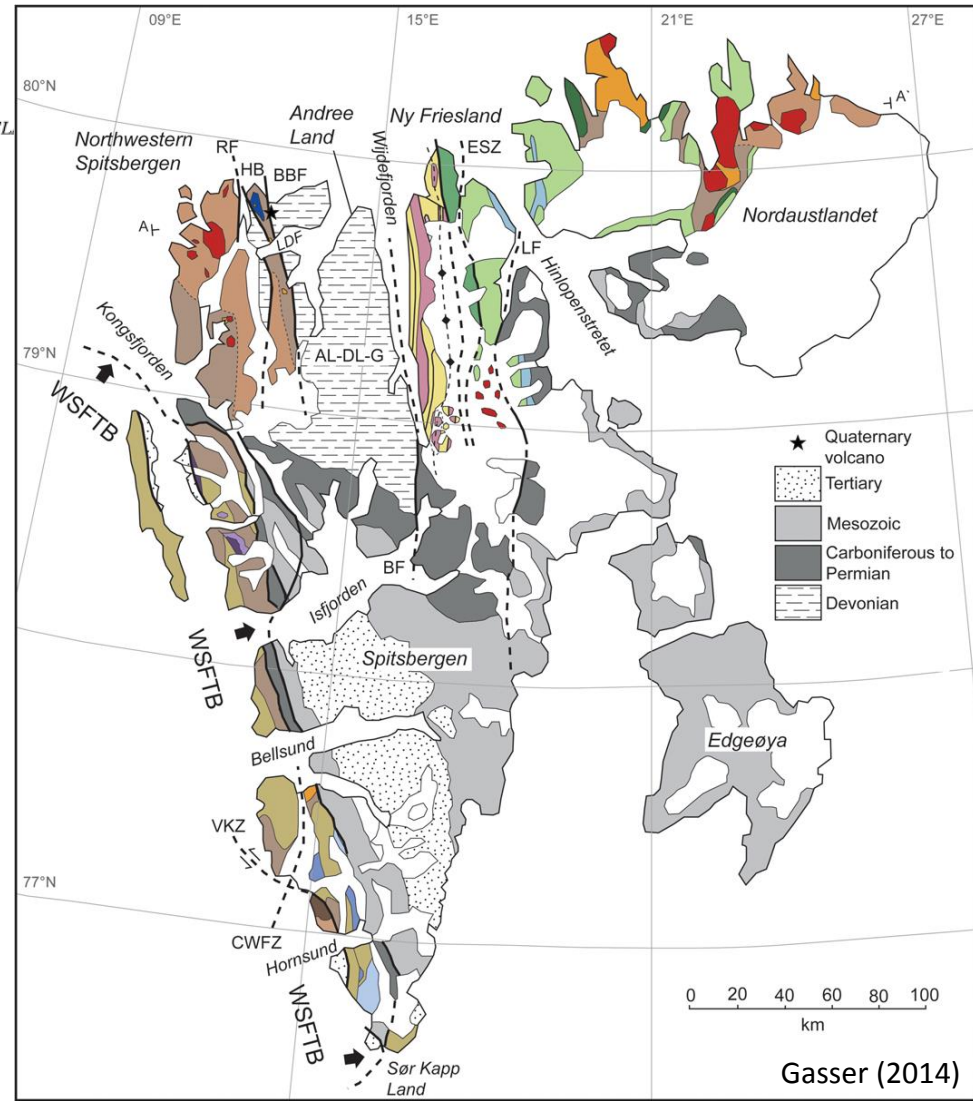
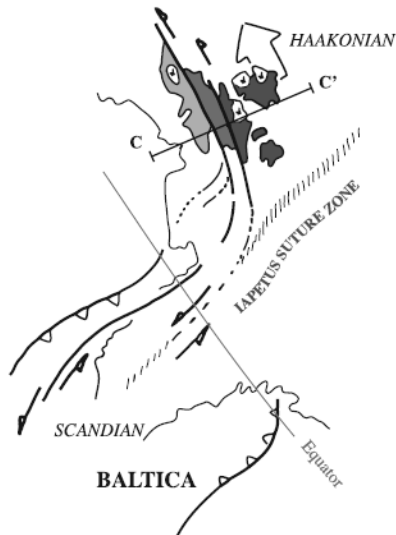
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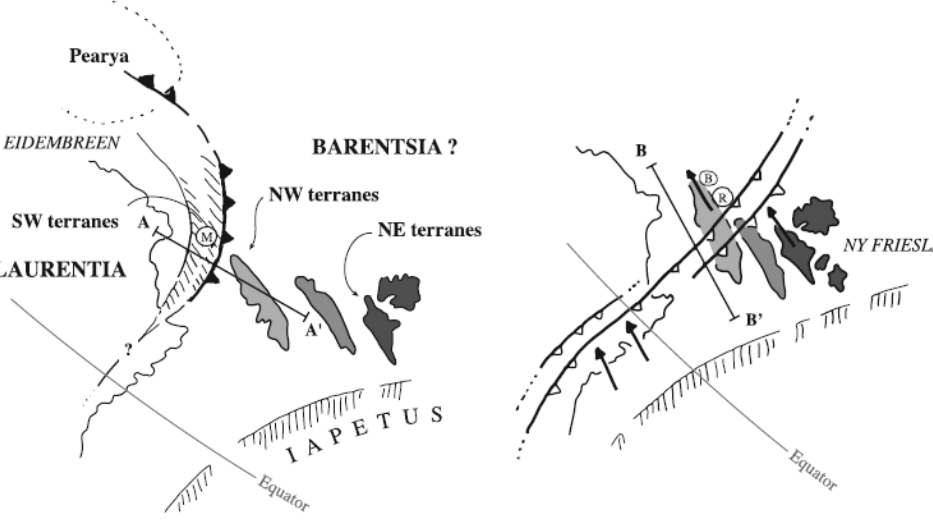


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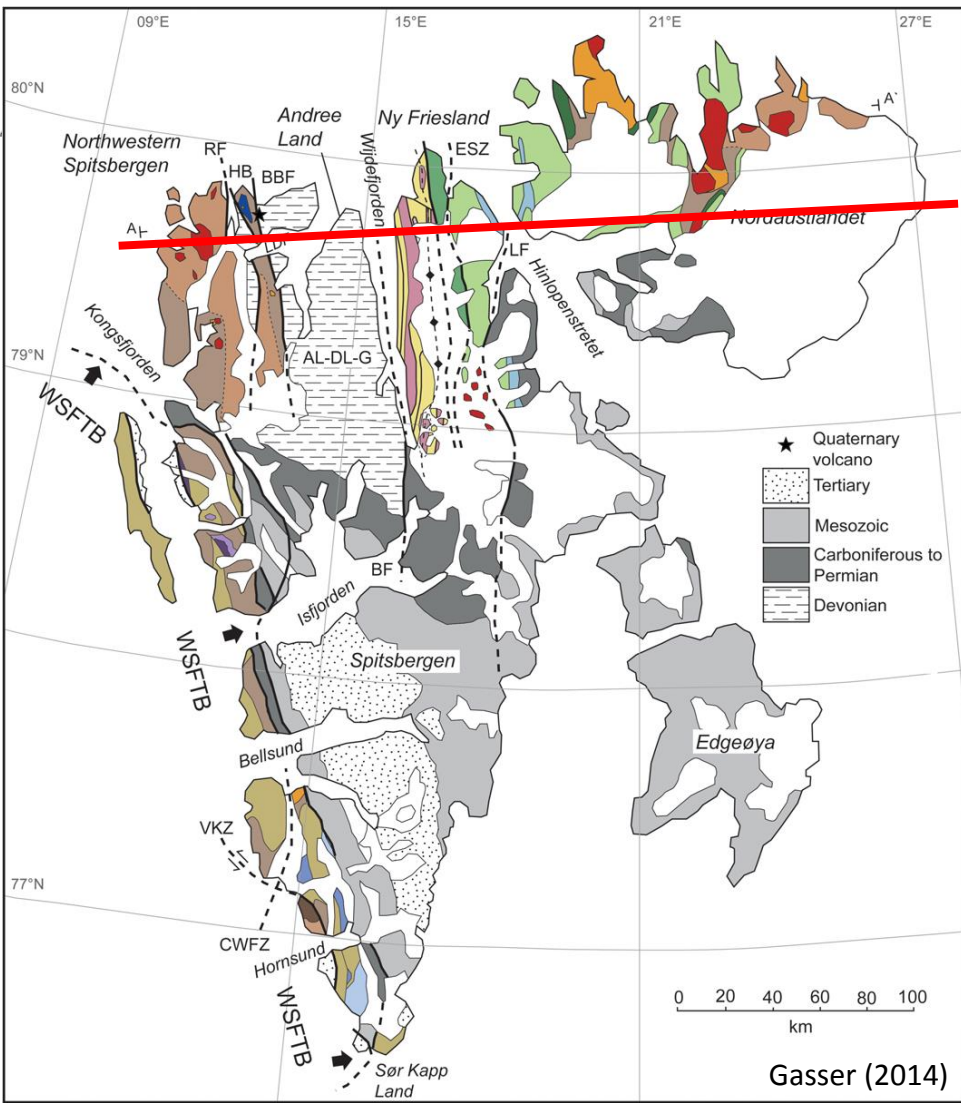
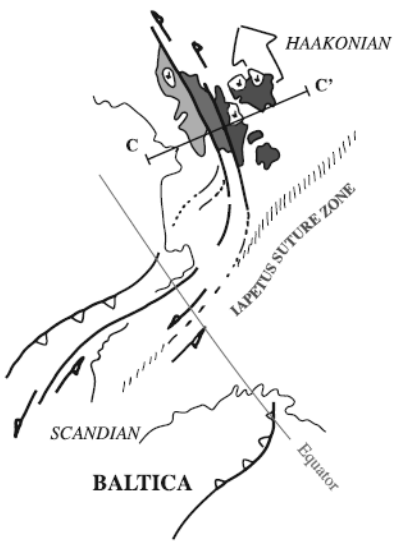
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Labrousse et al. (2008)

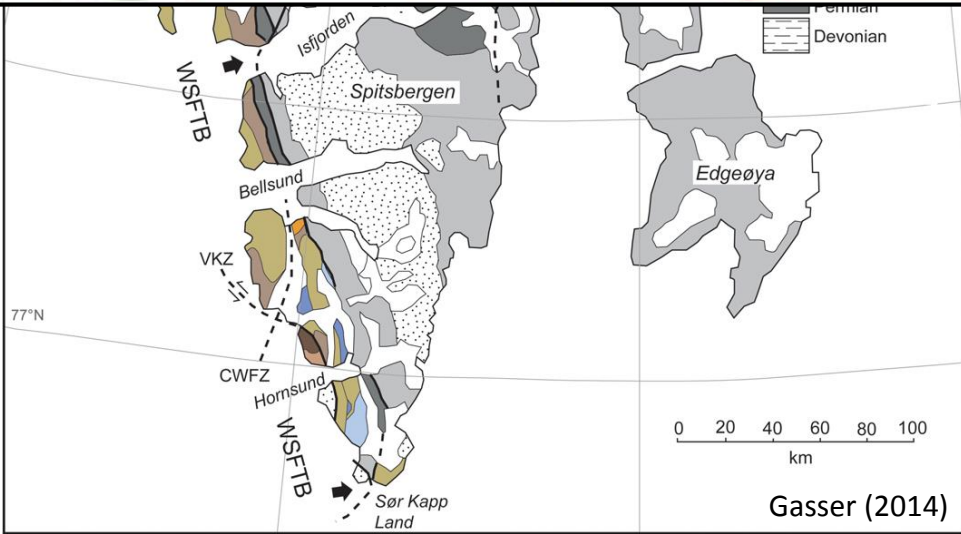
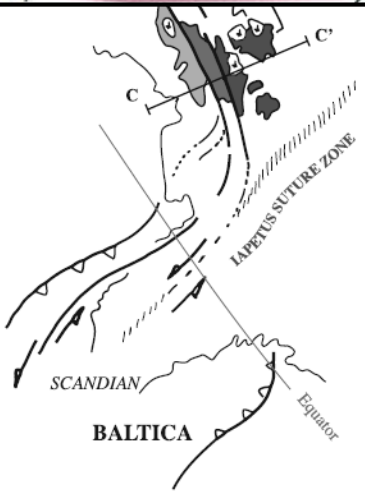
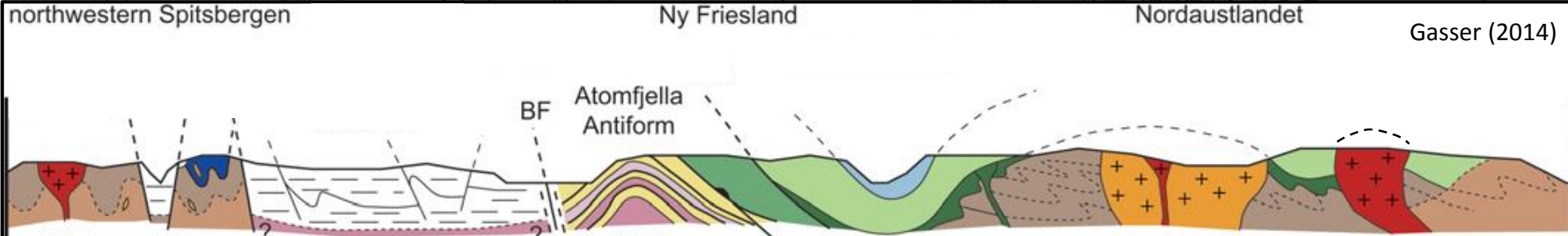
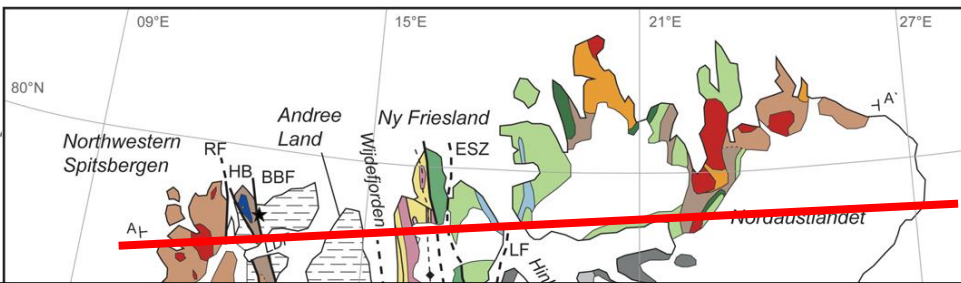
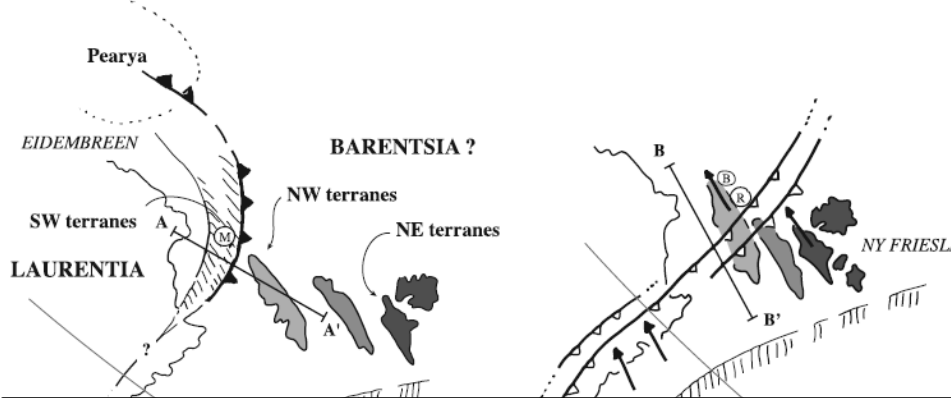
Gasser (2014)

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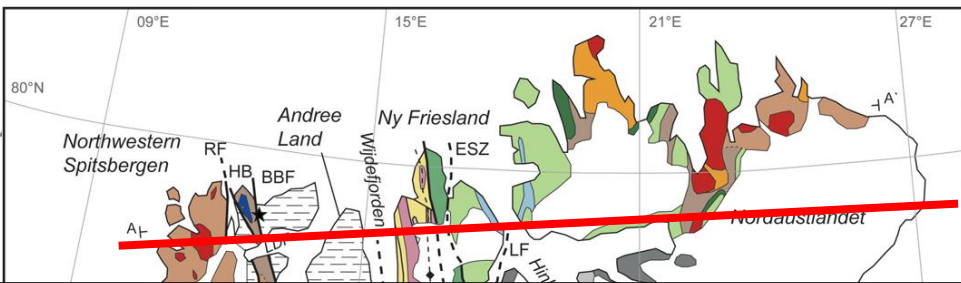
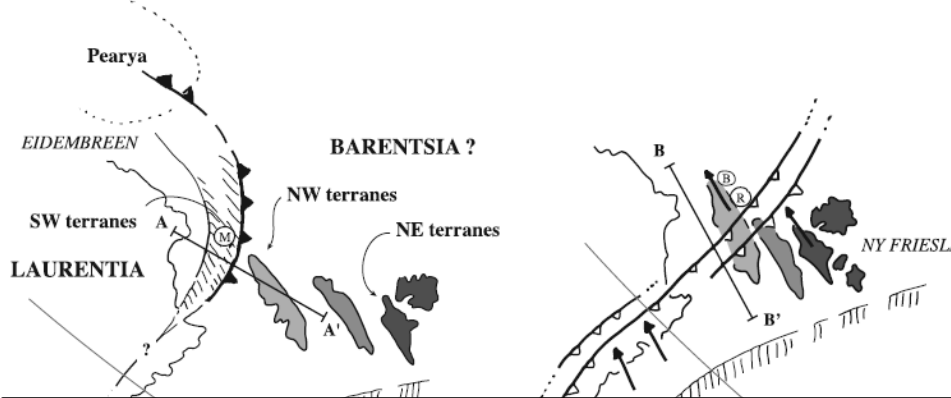
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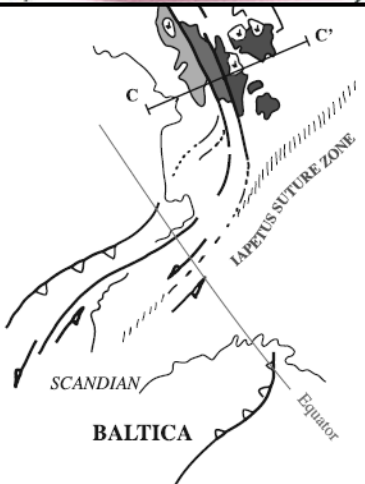
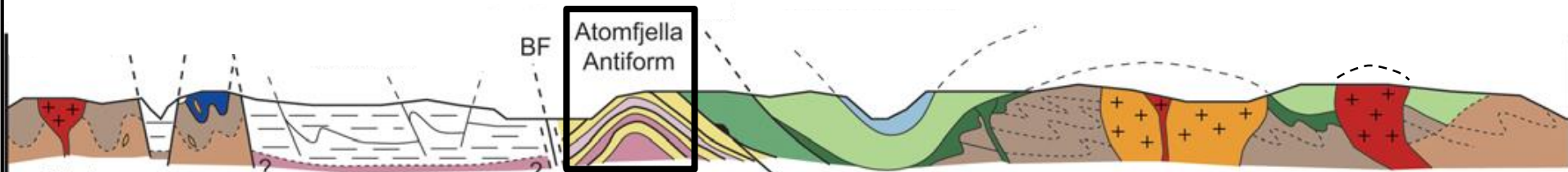


northwestern Spitsbergen

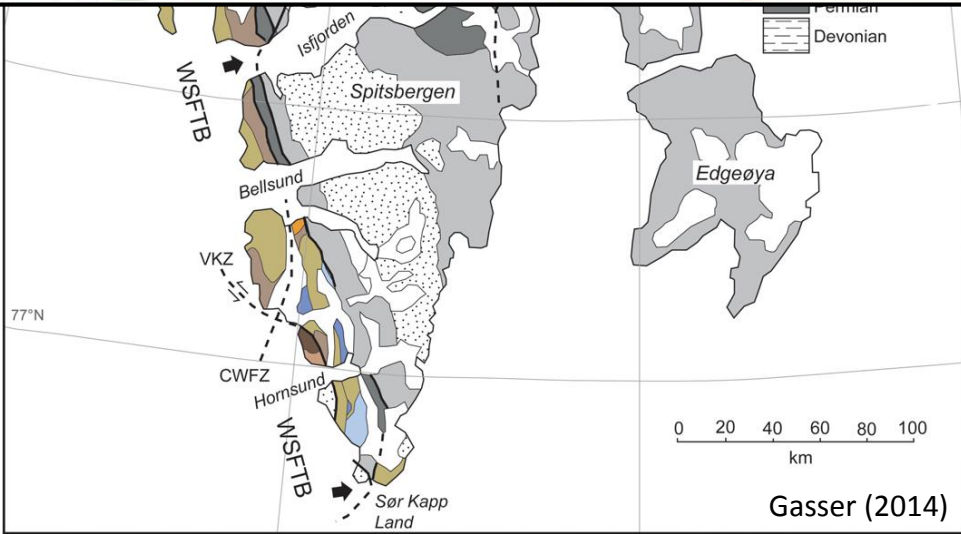
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Gasser (2014)



Labrousse et al. (2008)



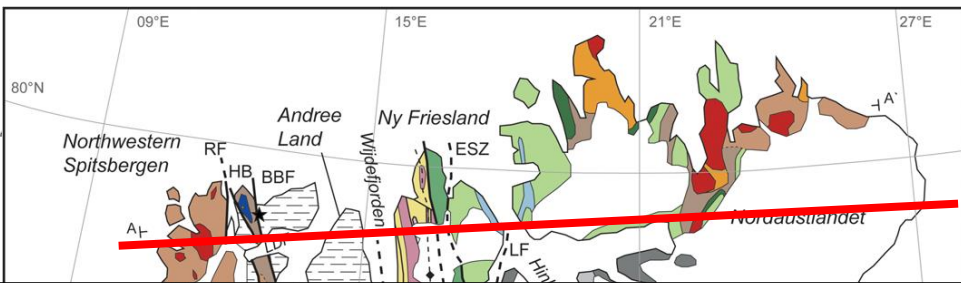
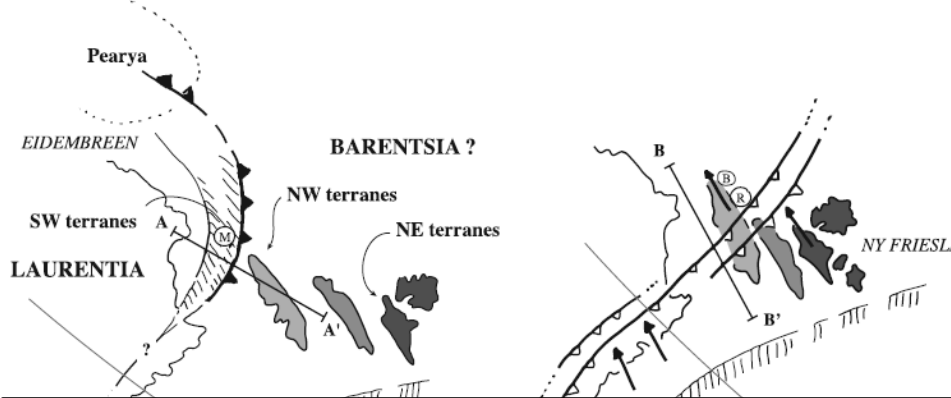
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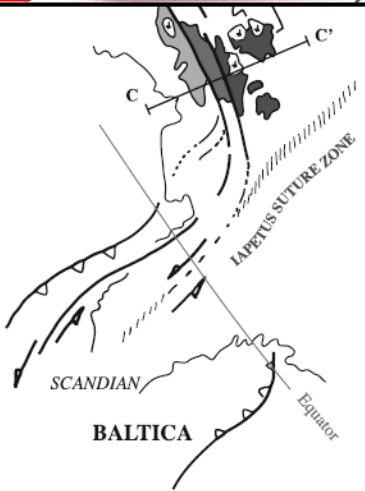
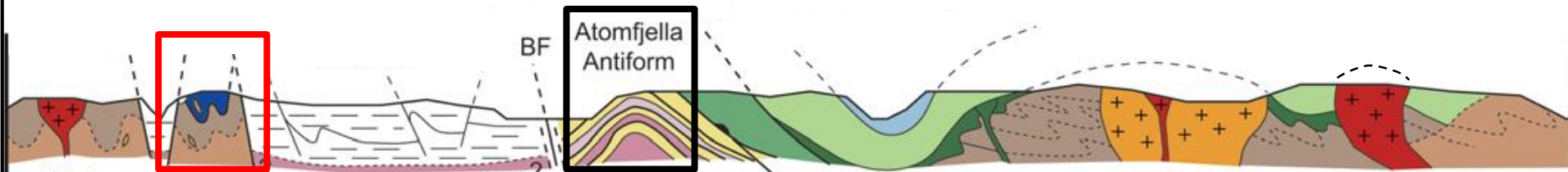


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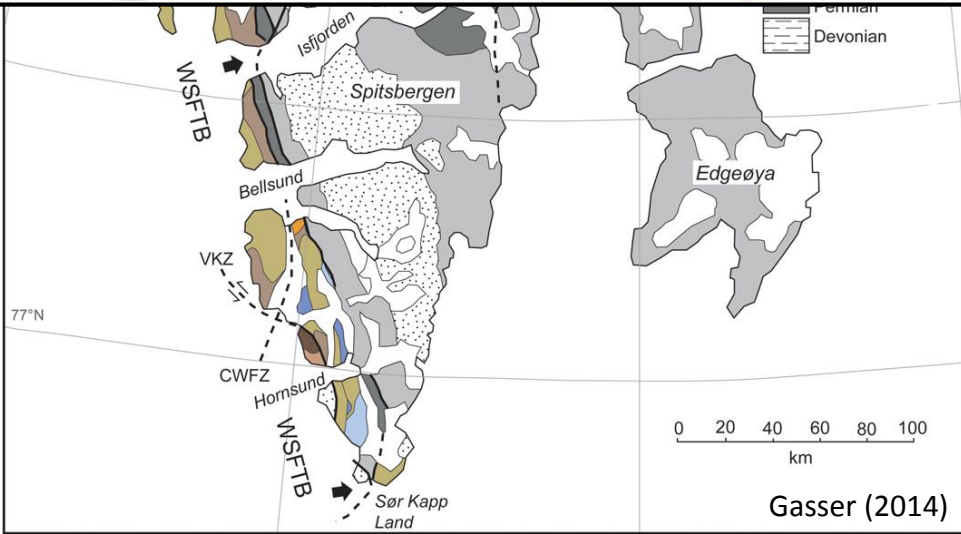
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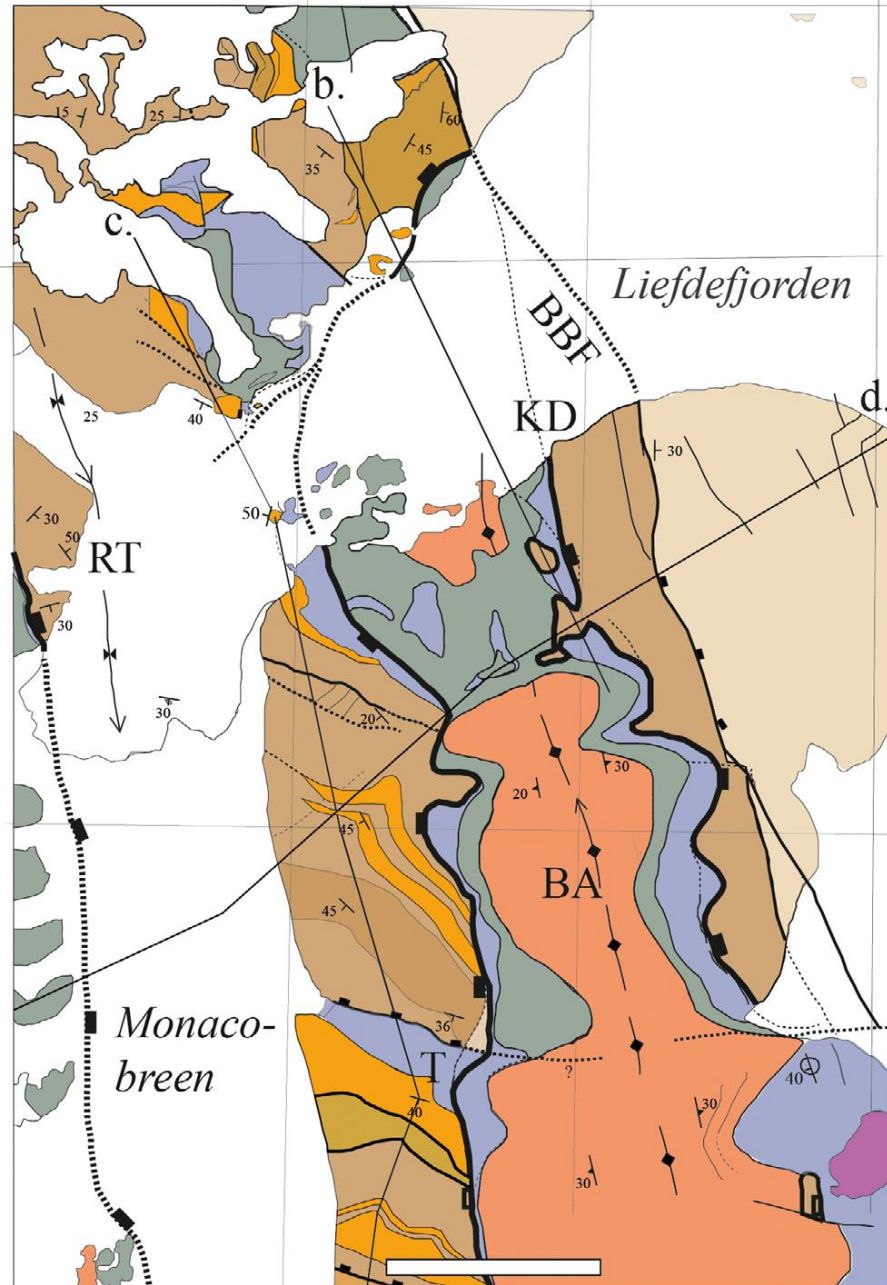
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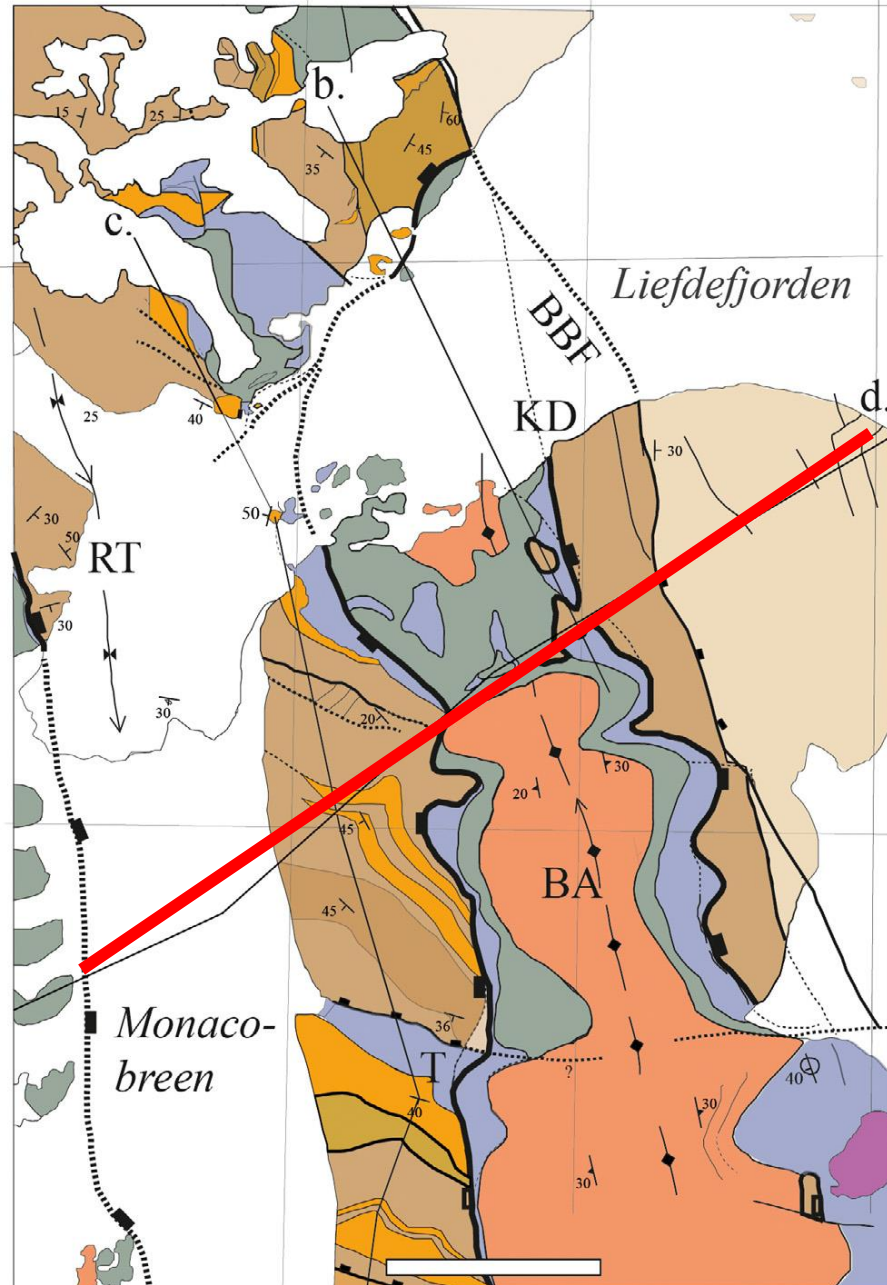
0 Core complexes exhumed in the late Silurian–Devonian due to normal top-north, top-west and top-east movements along bowed shear zones.

Braathen et al. (2018)

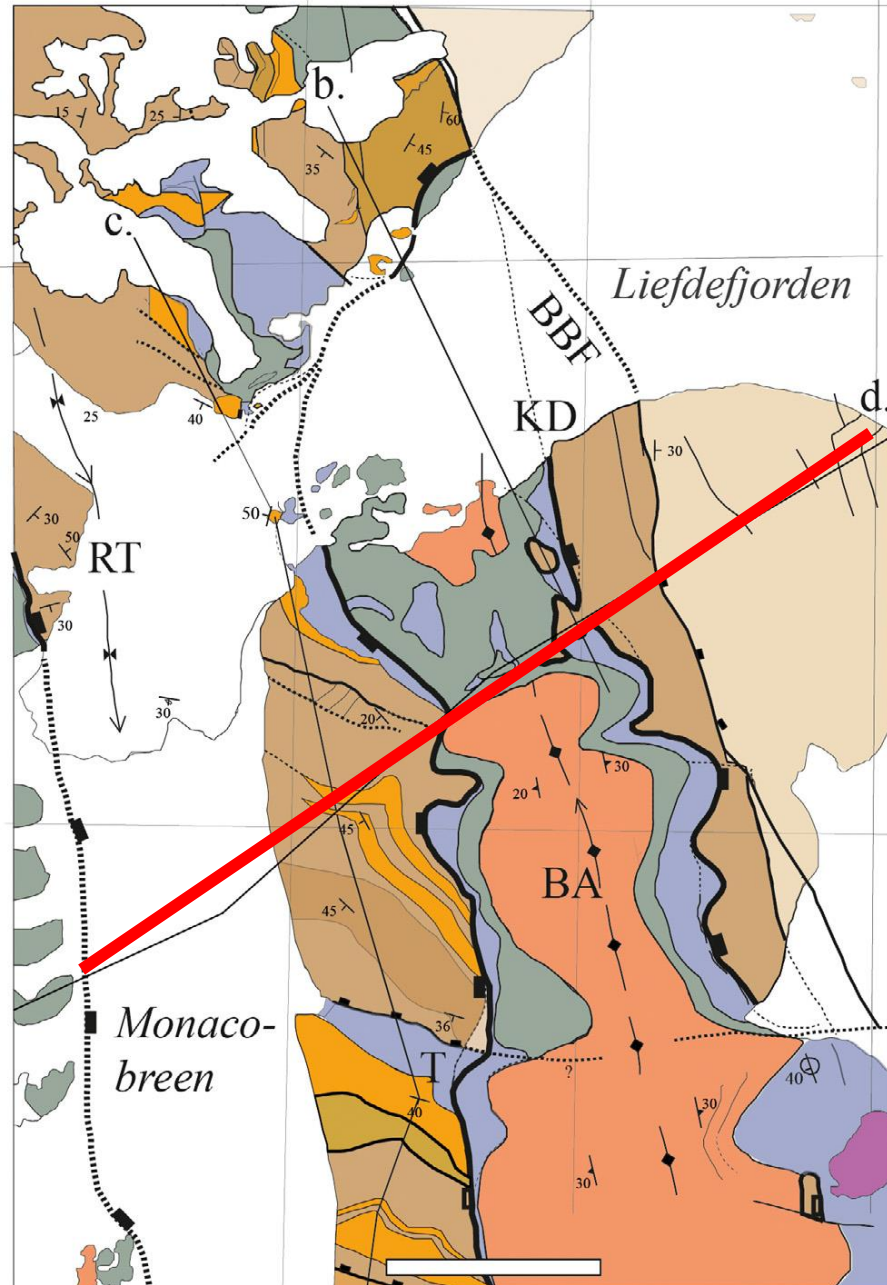


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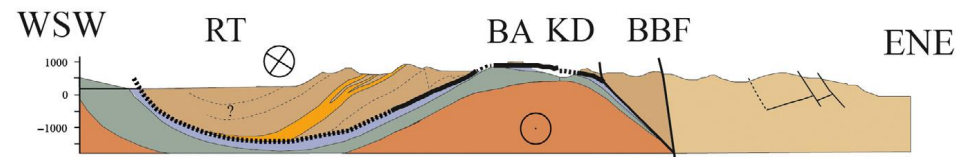
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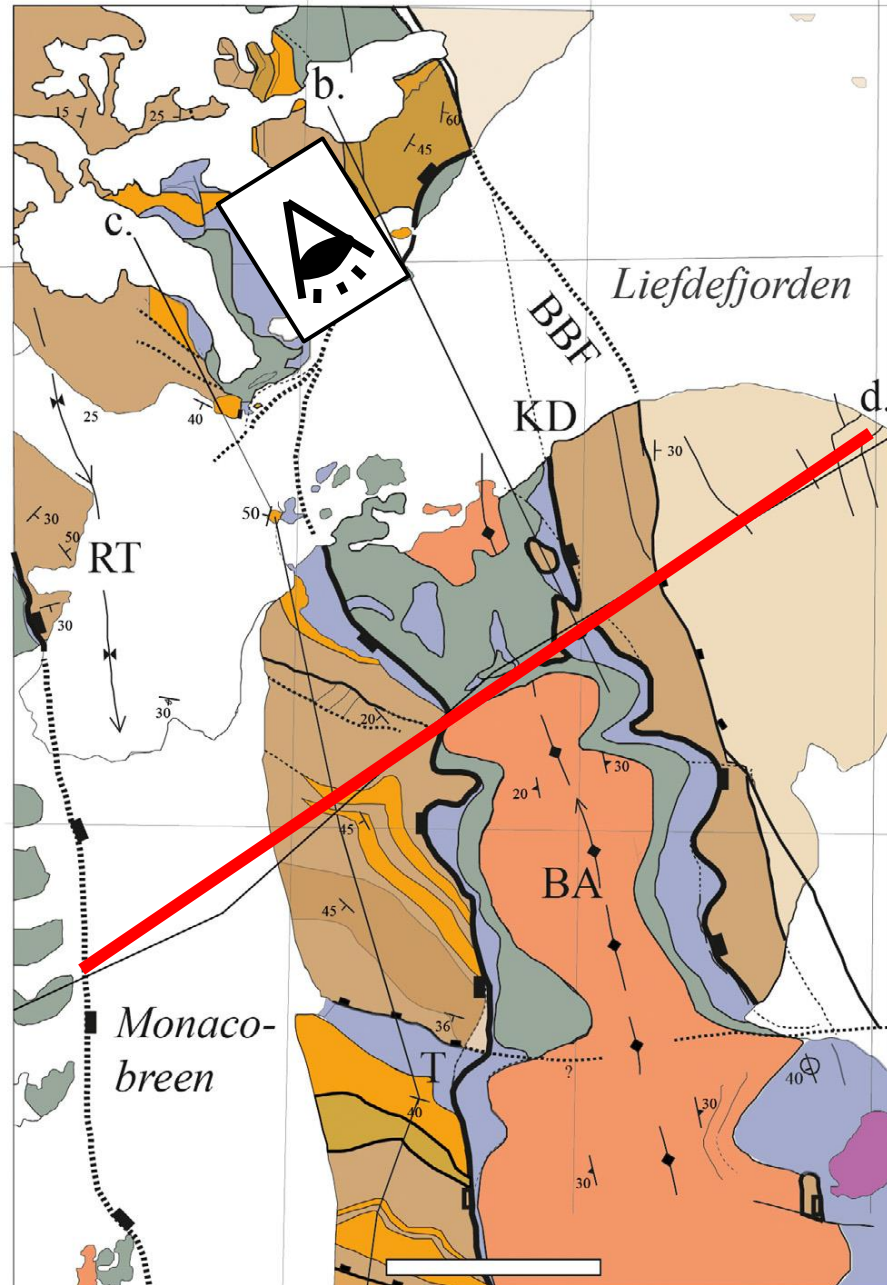
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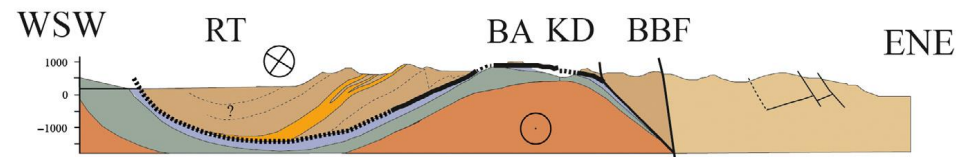
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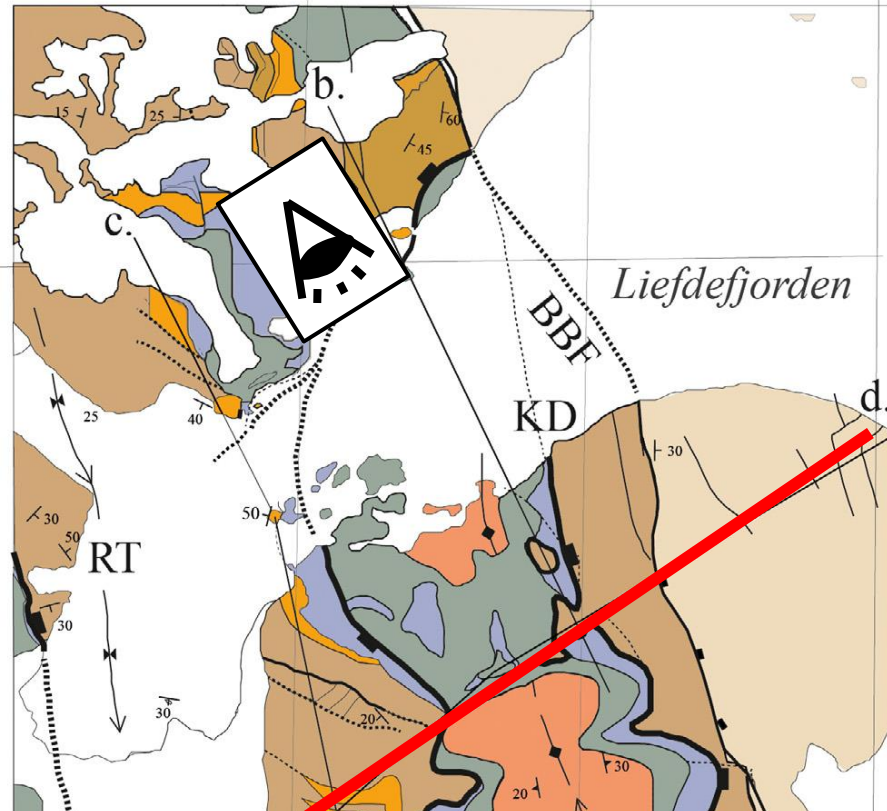
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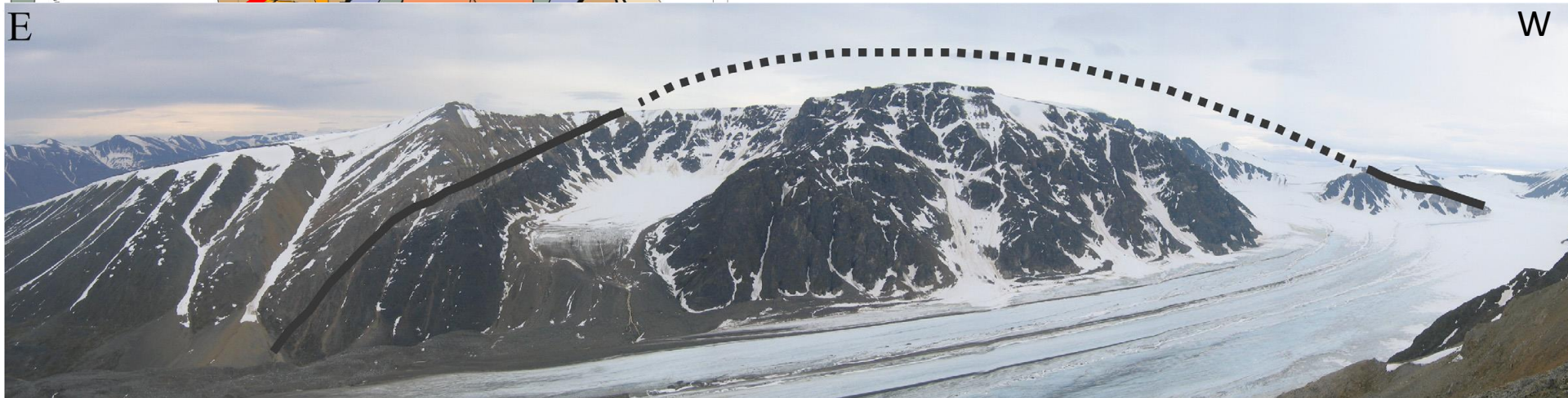
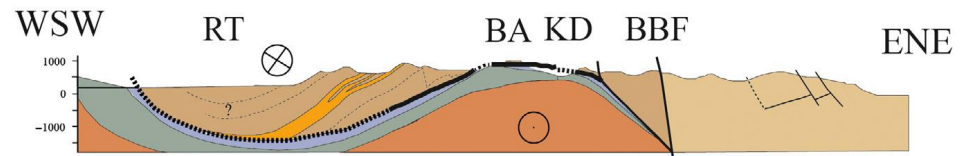
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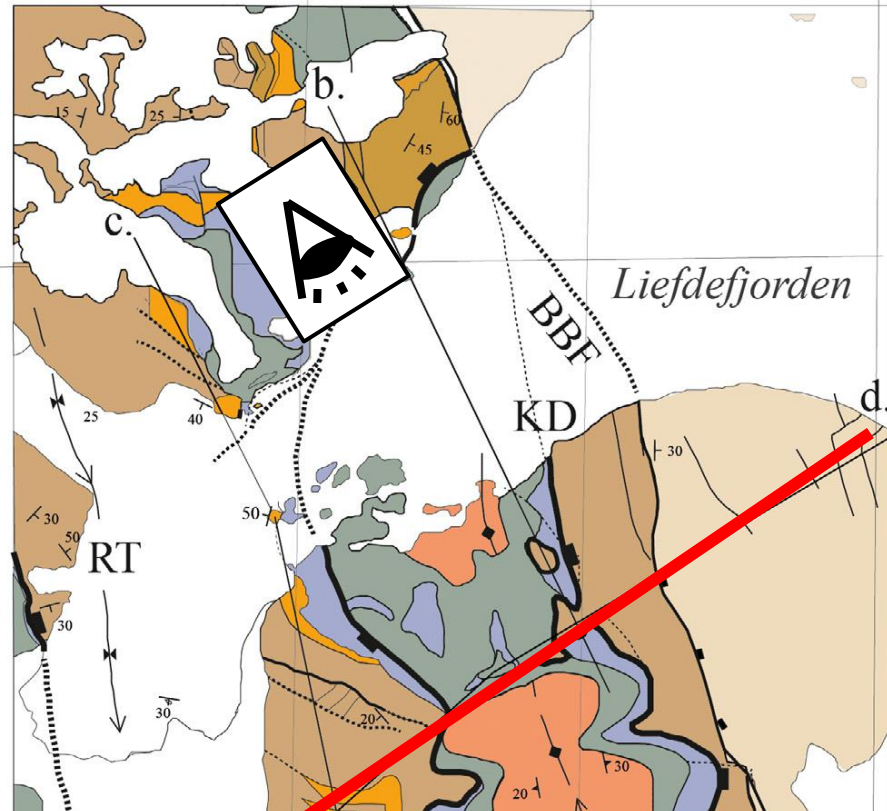
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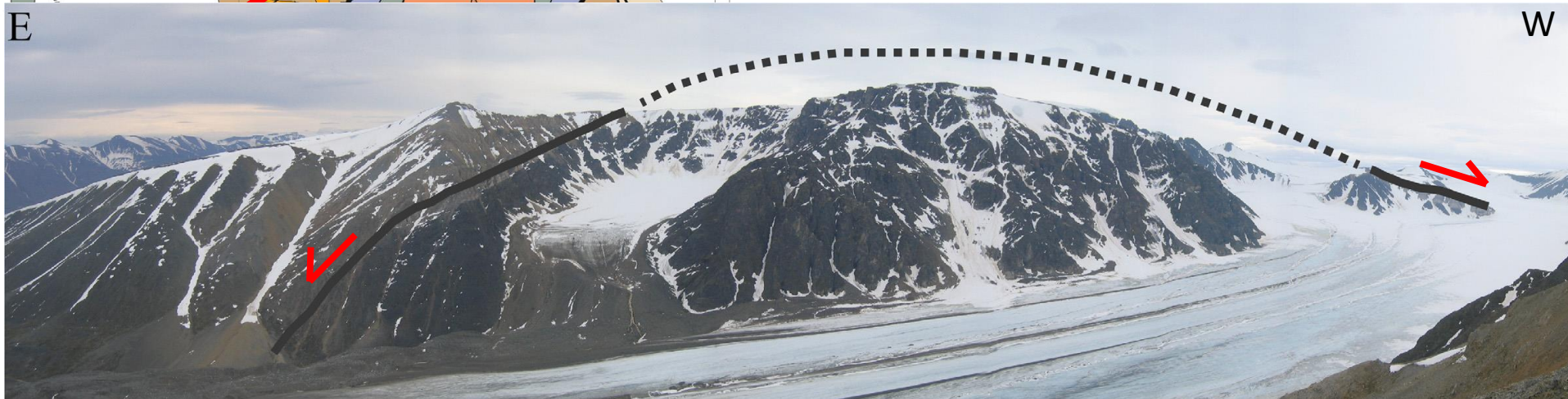
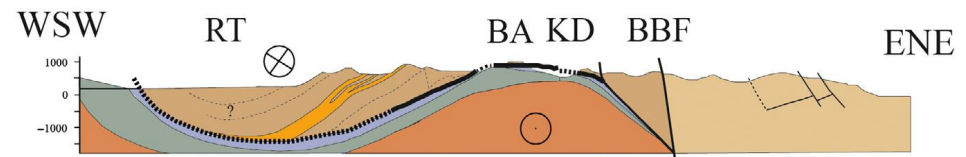
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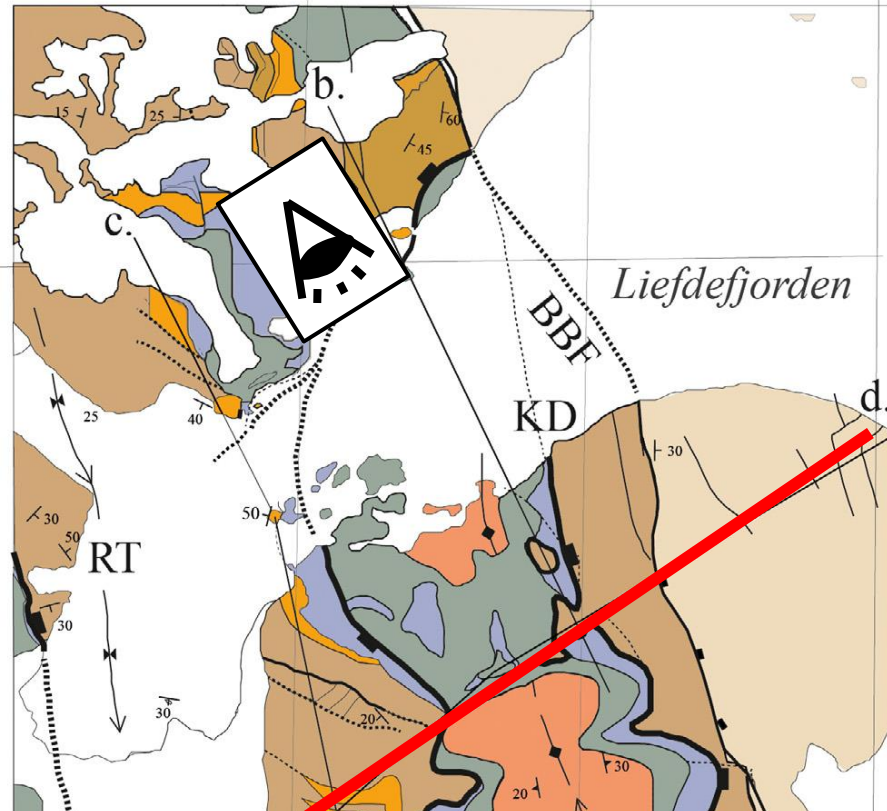
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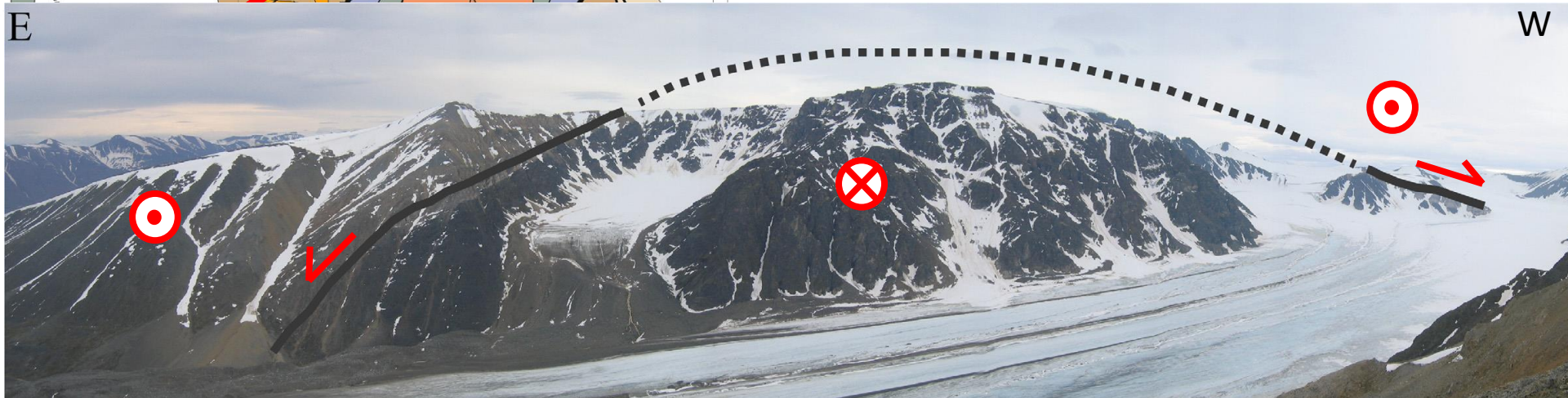
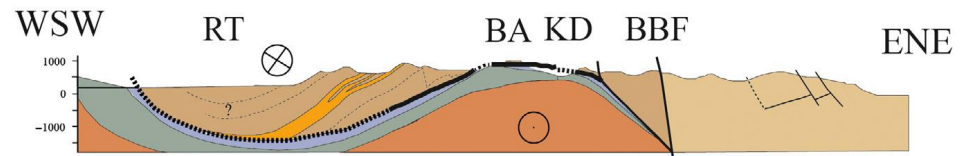
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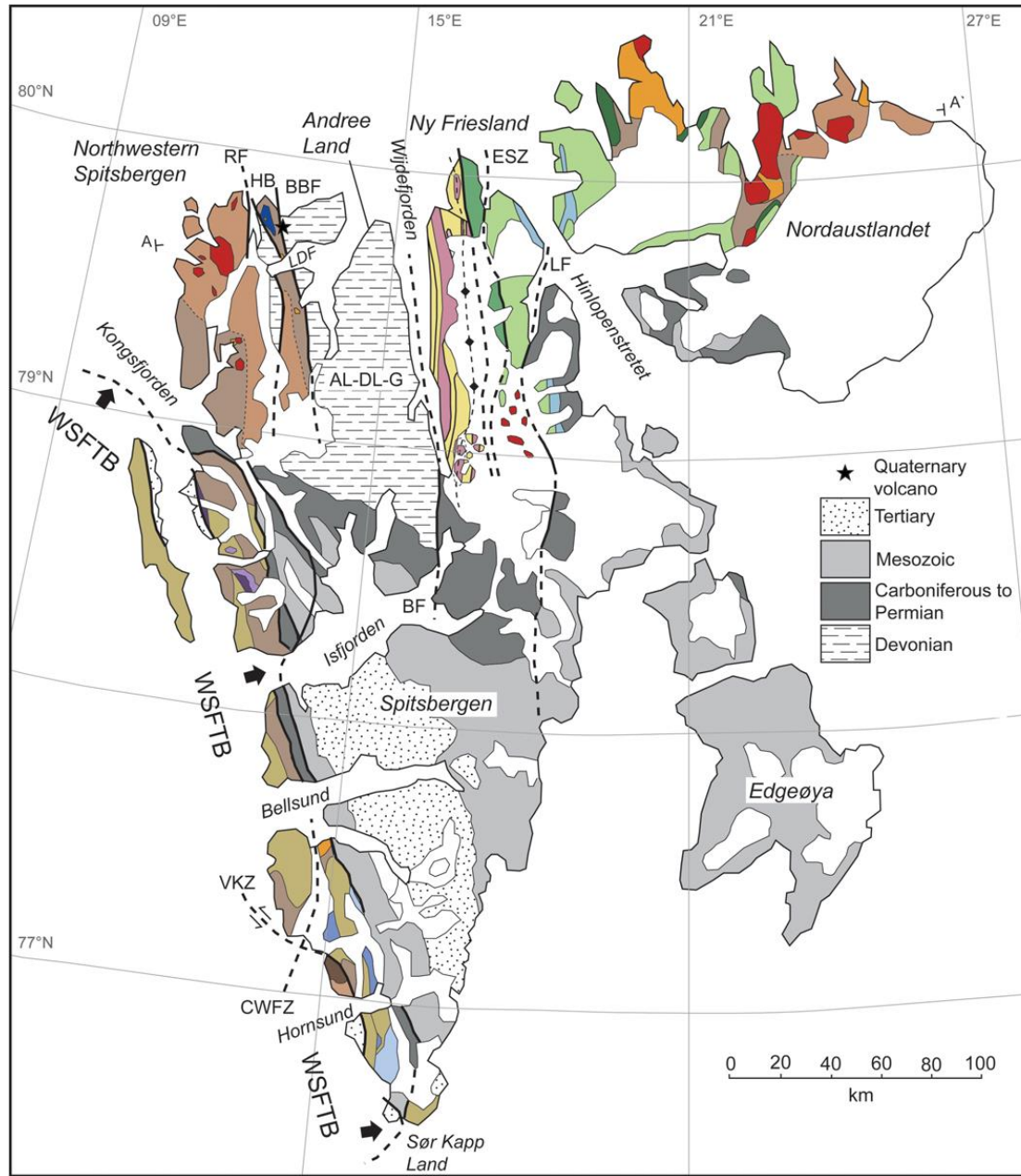
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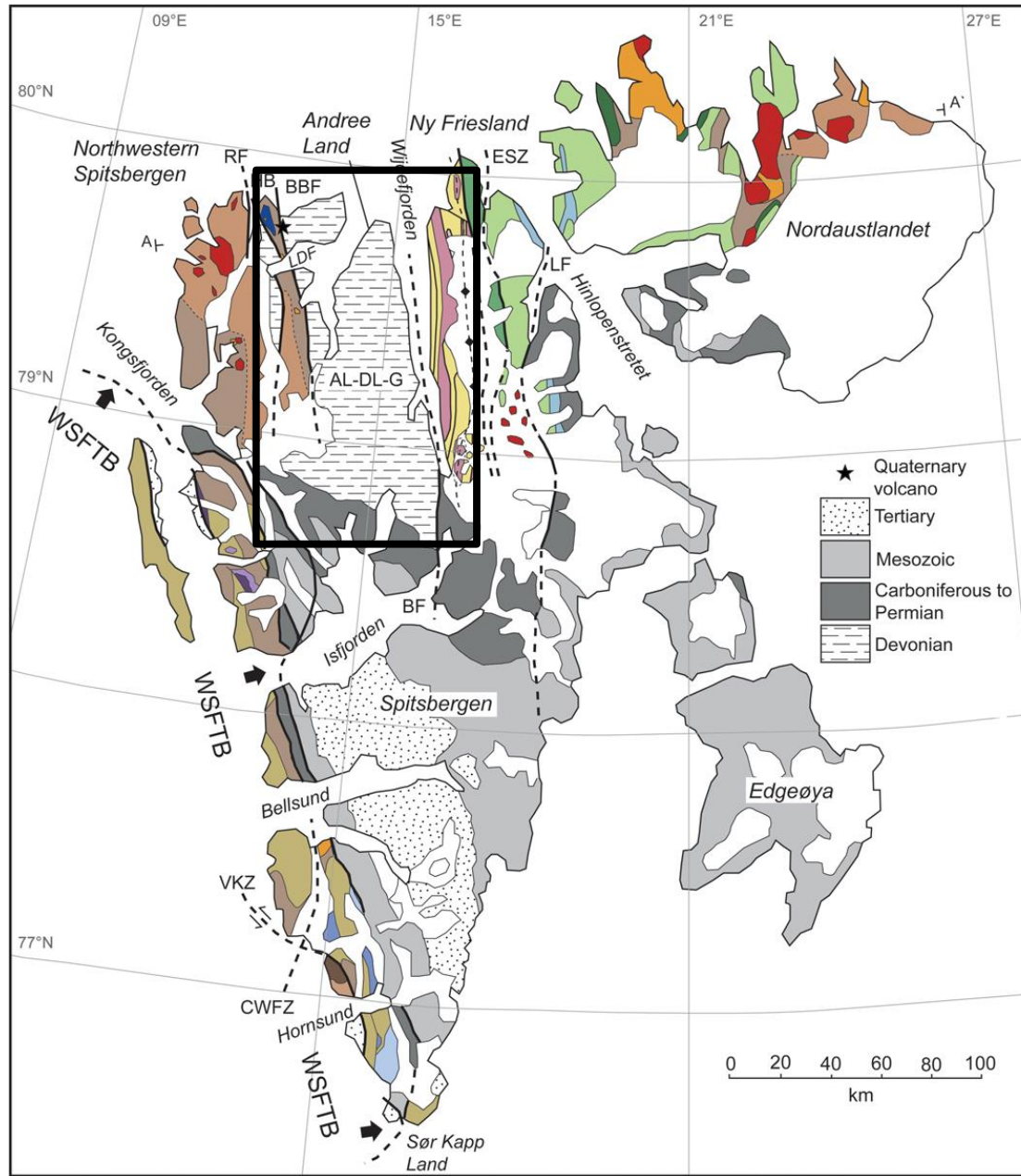


0 Devonian collapse basins in Spitsbergen formed during late–post-Caledonian sinistral transtension and were deformed during Late Devonian Ellesmerian contraction.



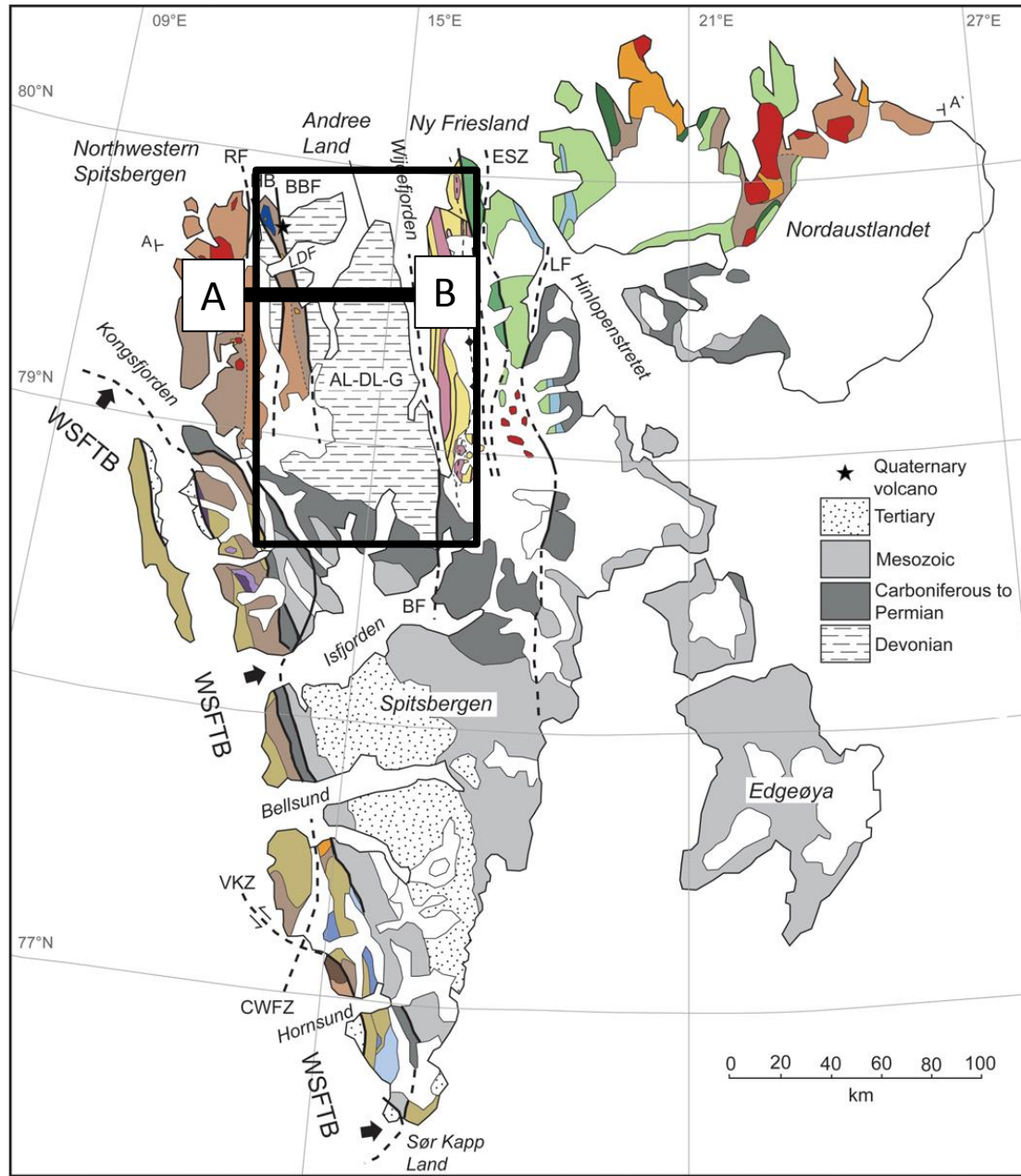
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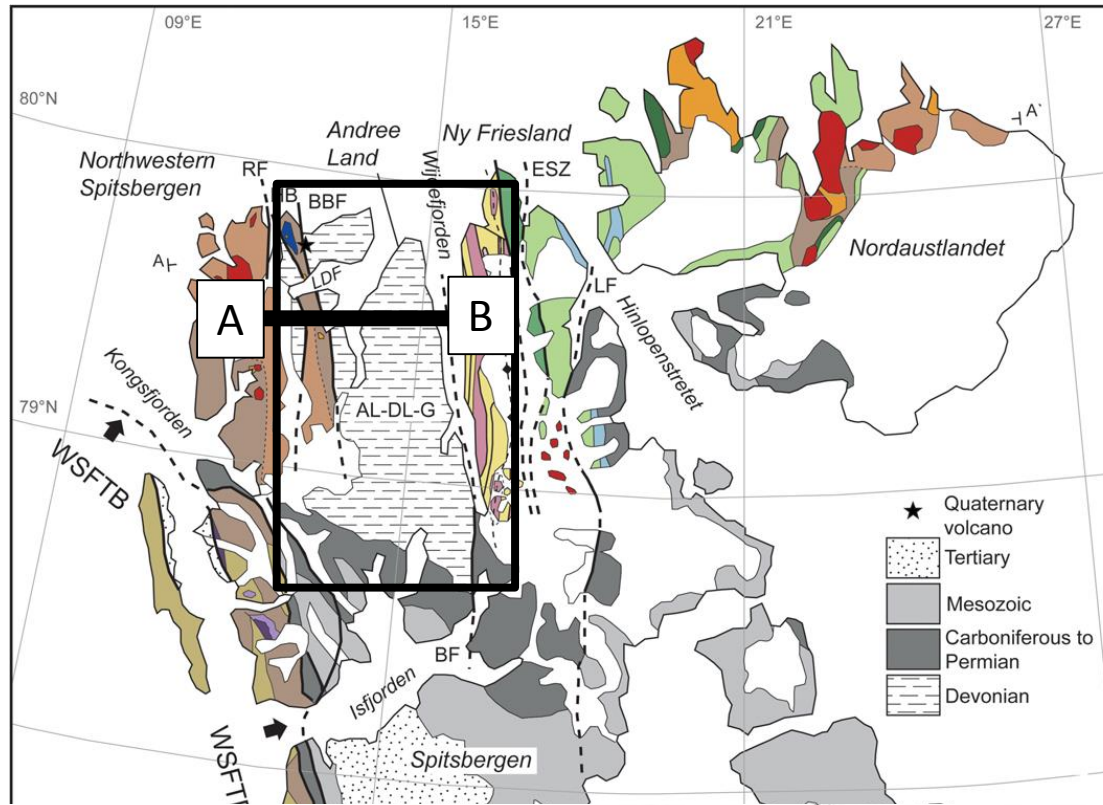
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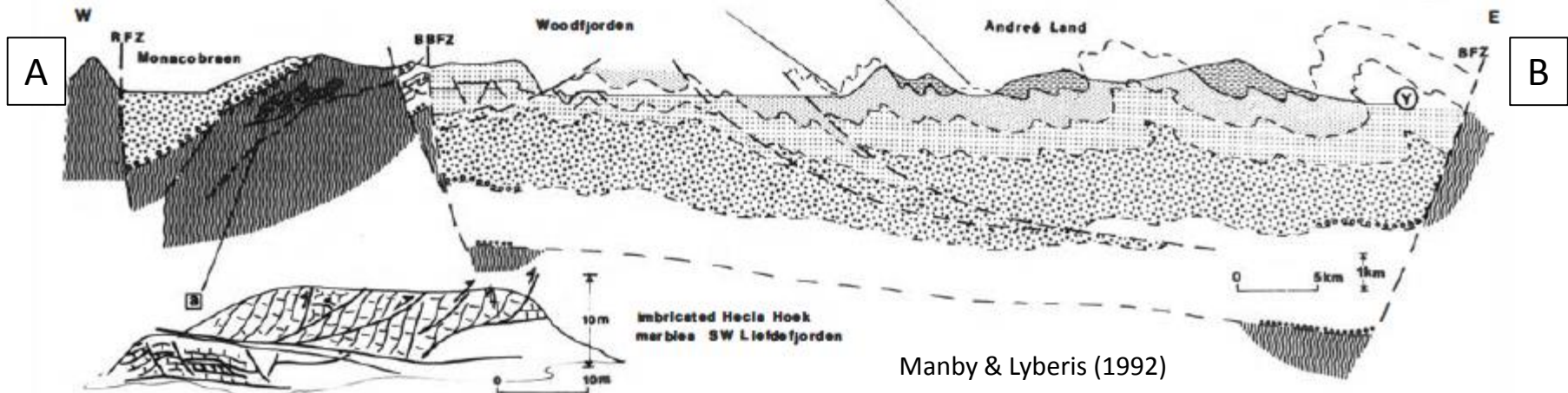


Gasser(2014)

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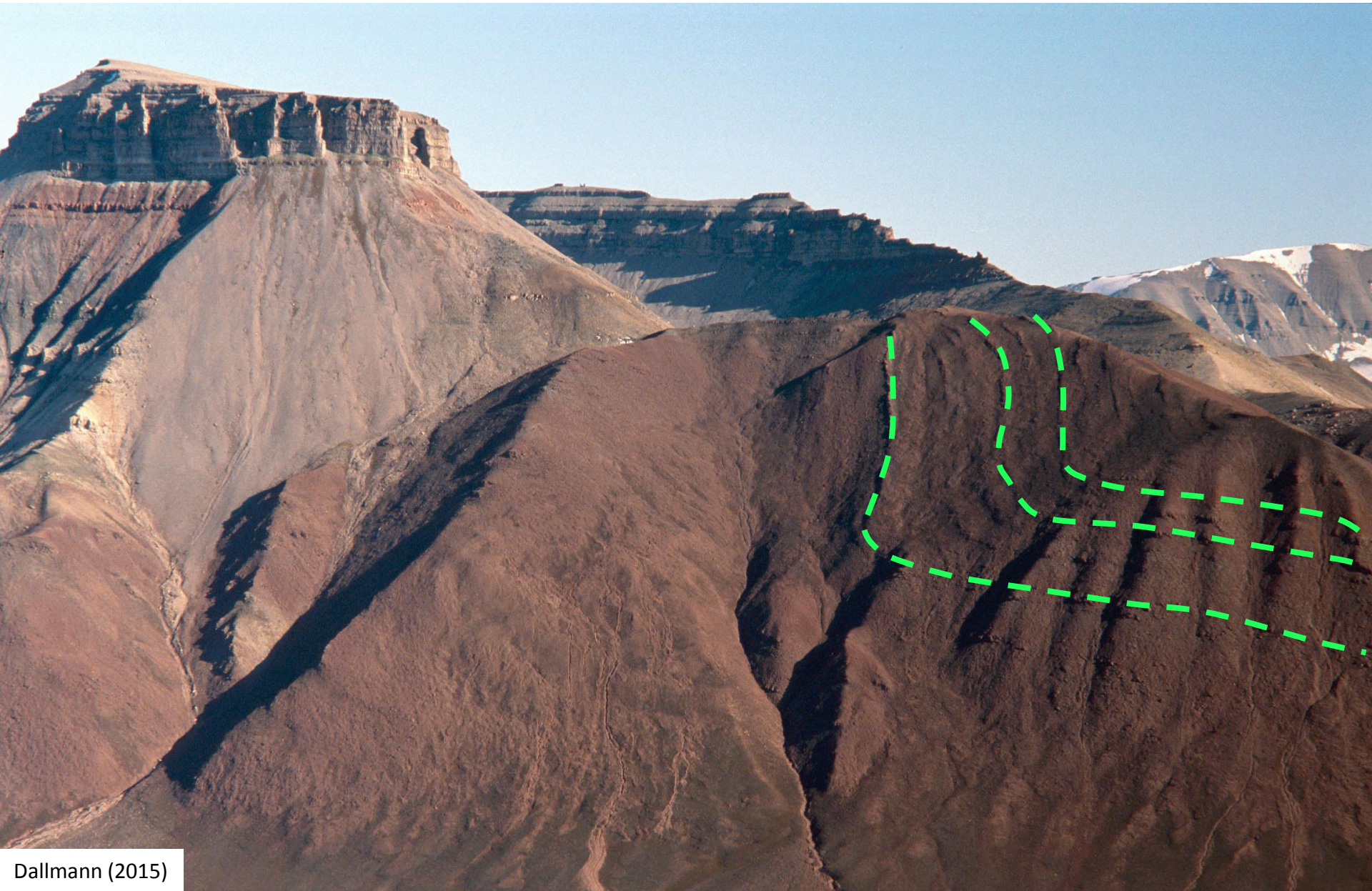


Manby & Lyberis (1992)

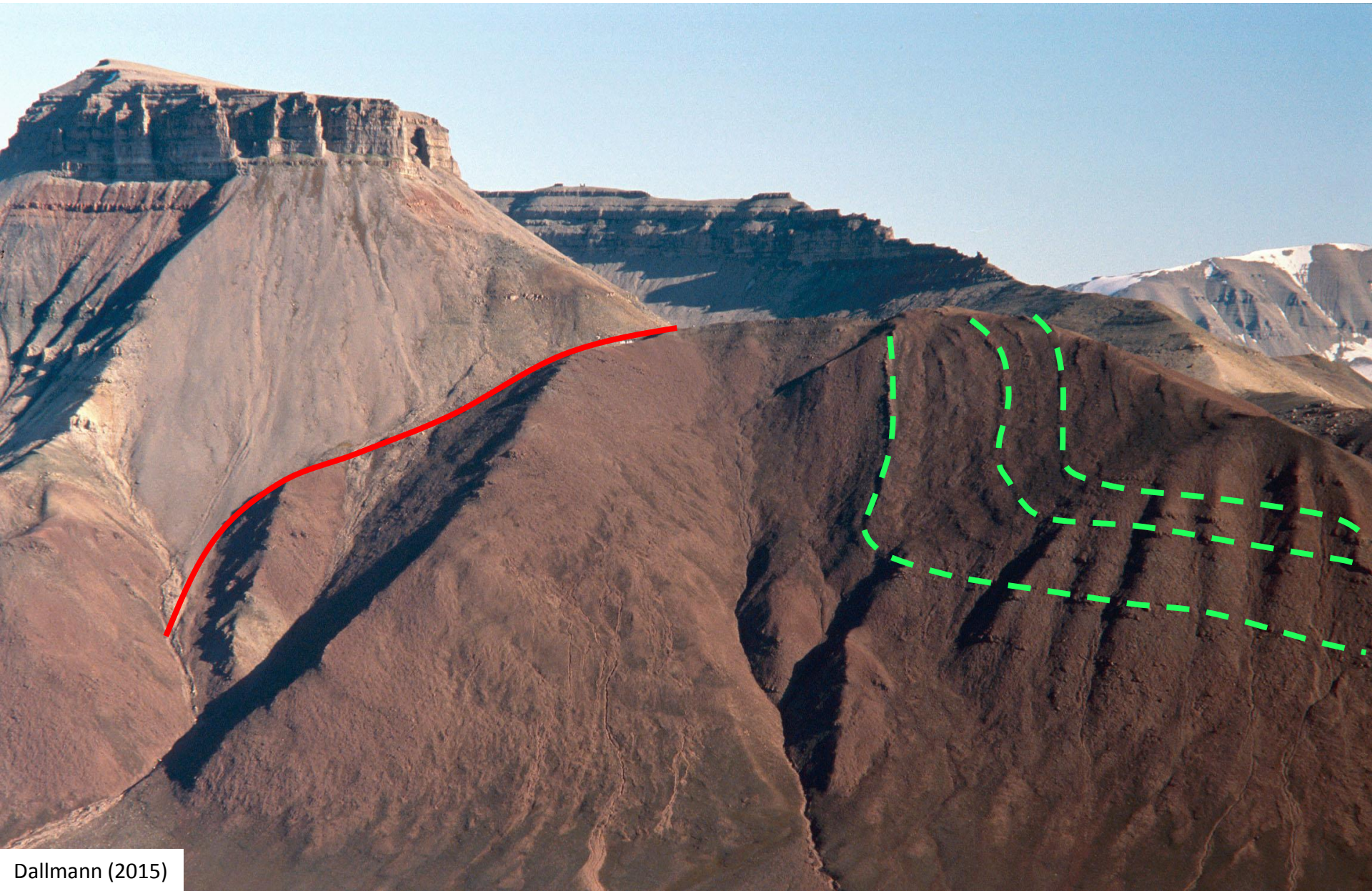
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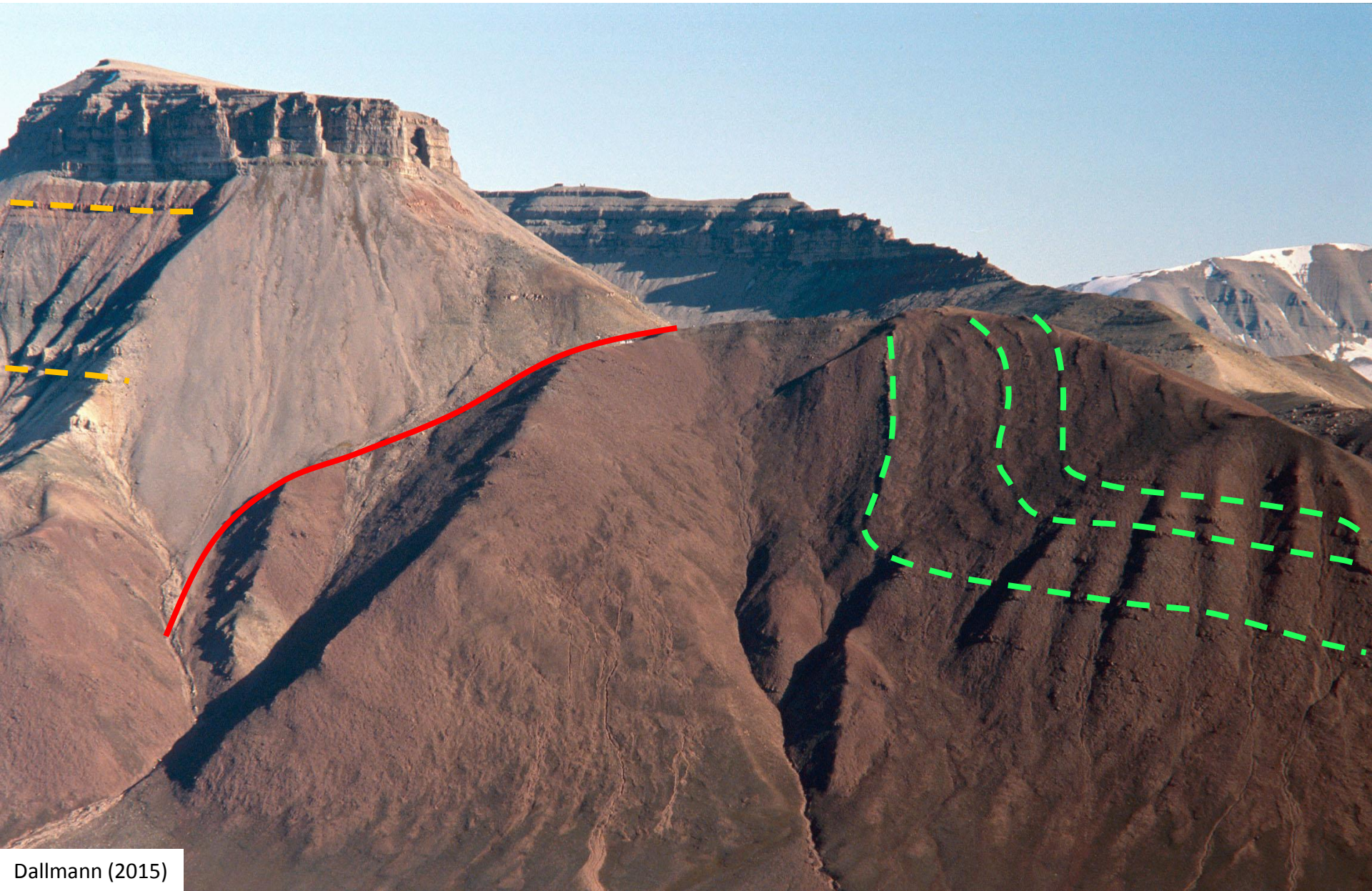
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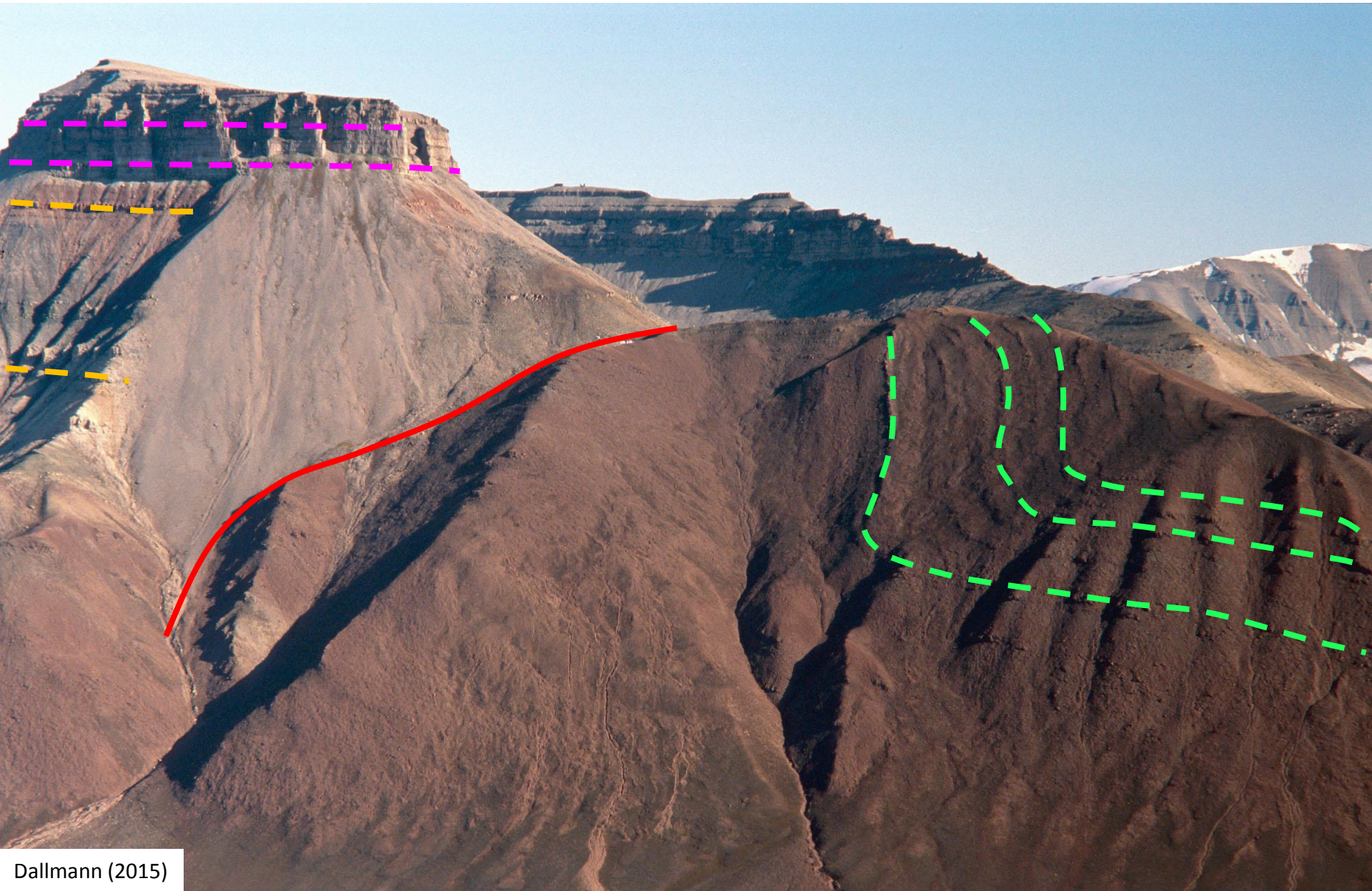
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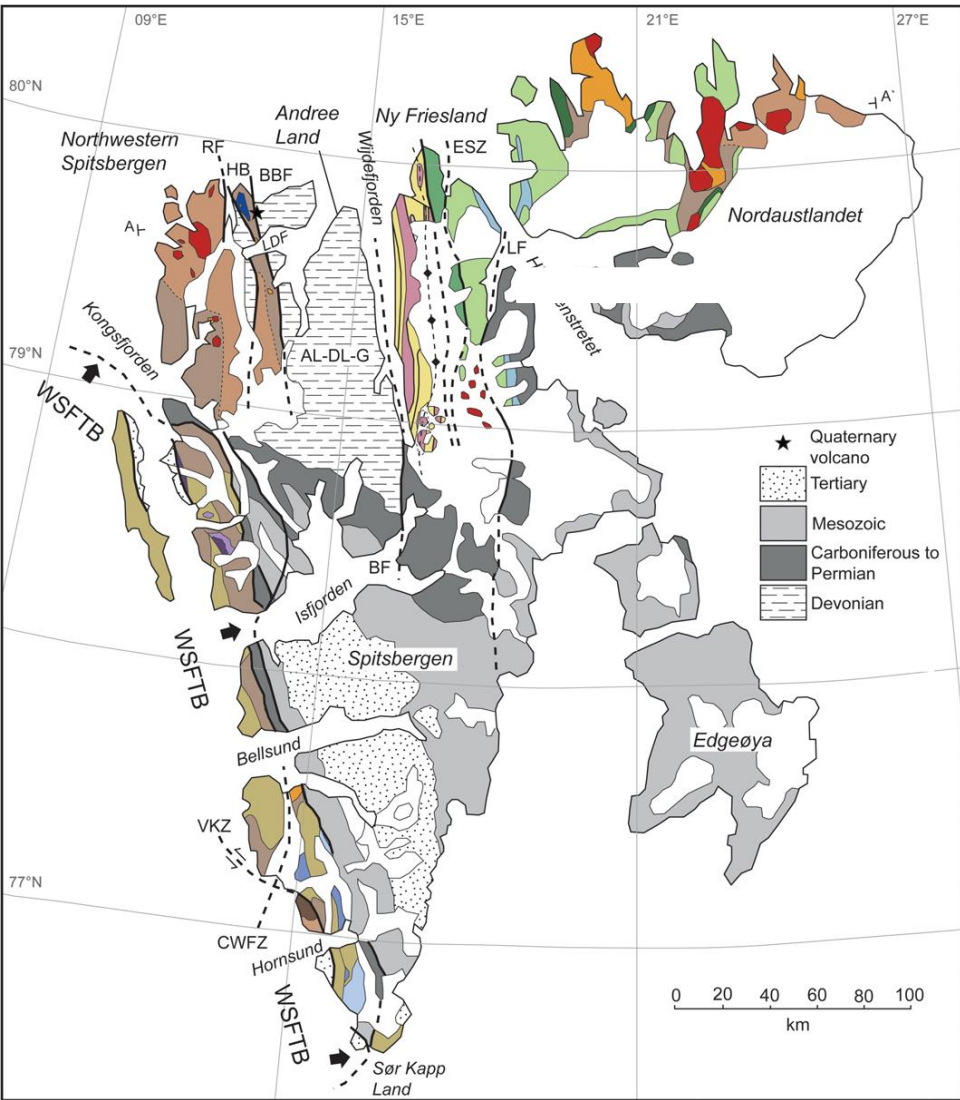
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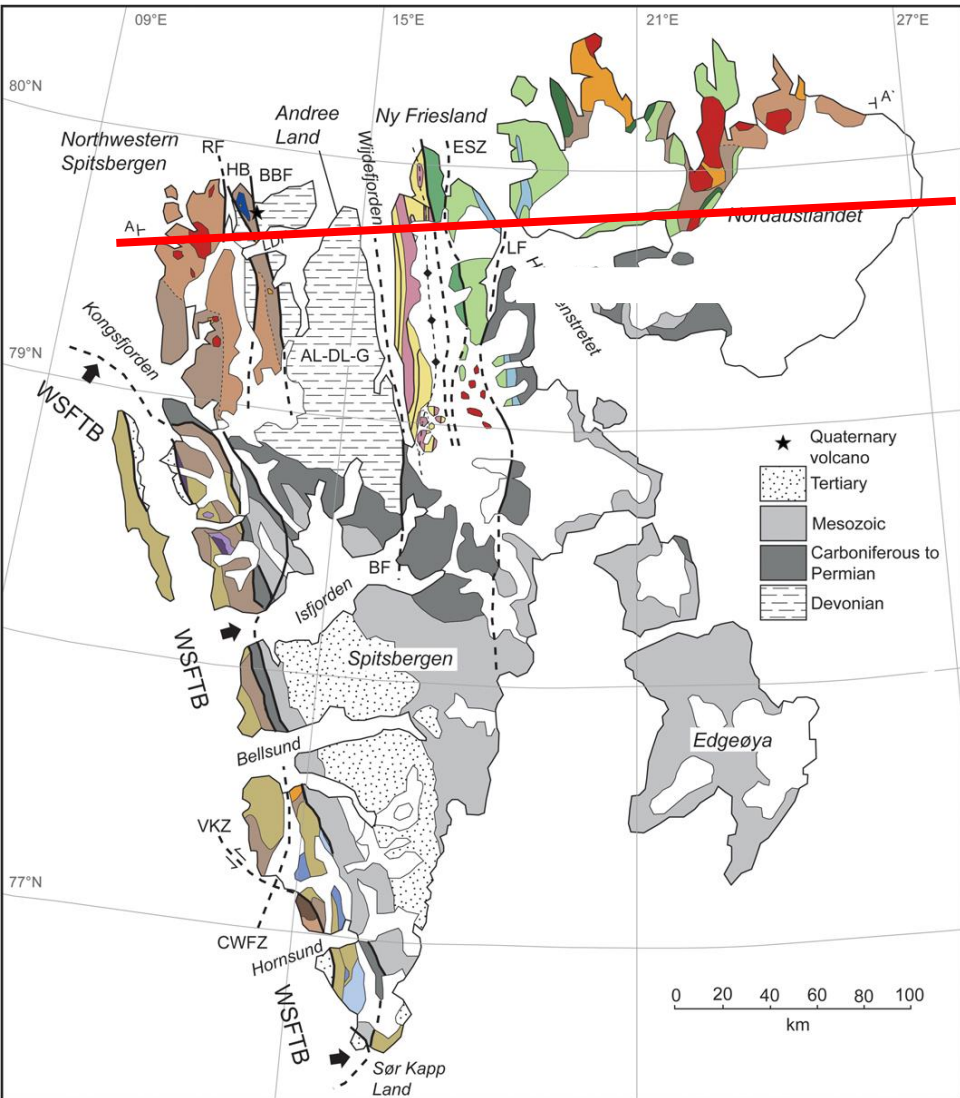


0 In Svalbard, Pennsylvanian rifting led to the formation of thick N–S-trending sedimentary basins like the Billefjorden Trough, which parallel dominant Caledonian fabrics.



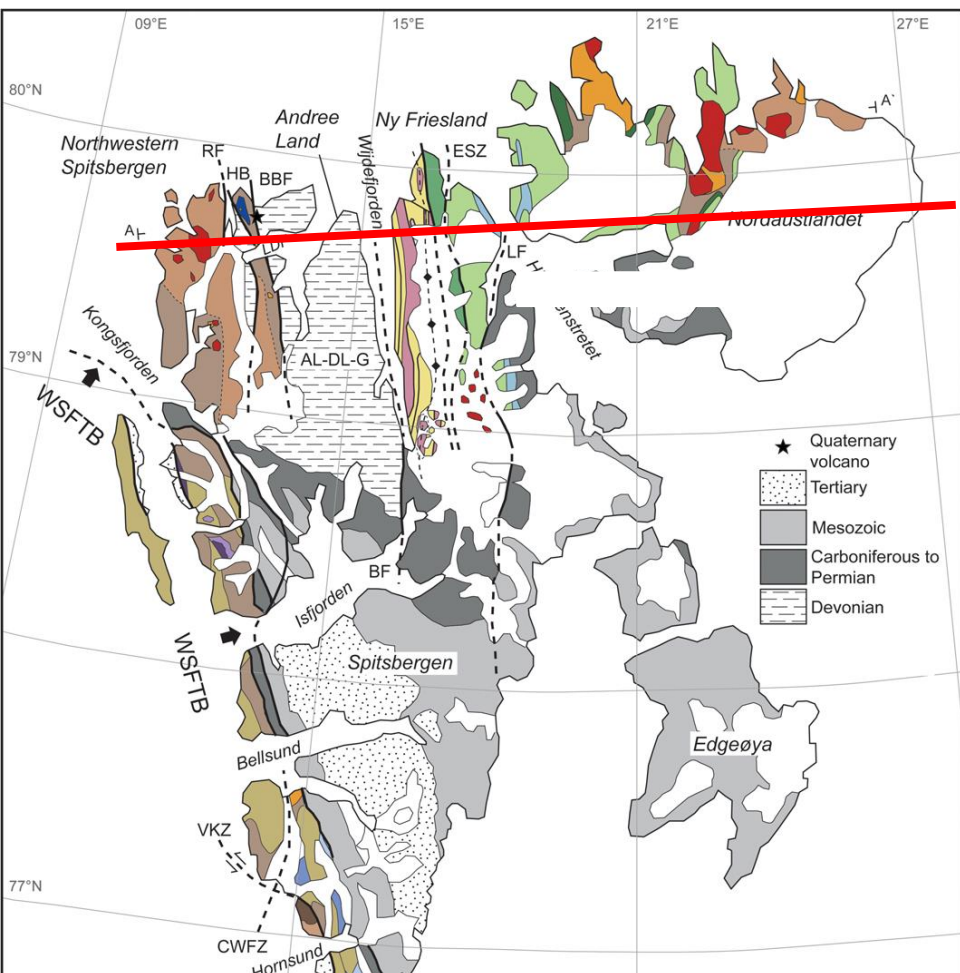
Gasser (2014)

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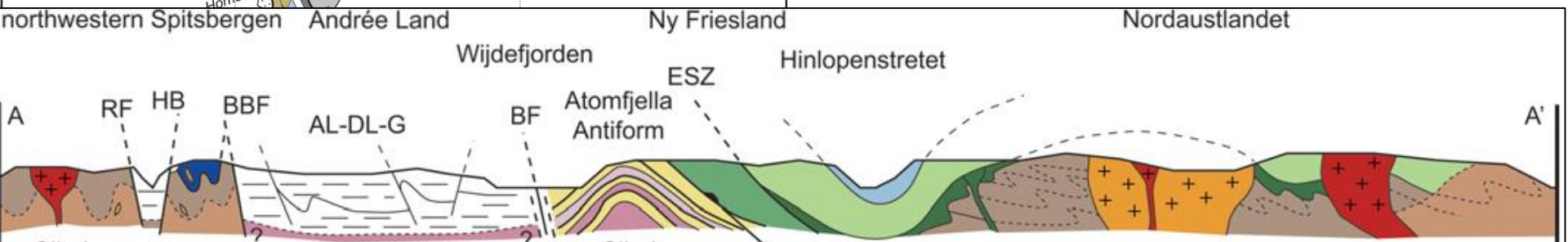


Gasser (2014)

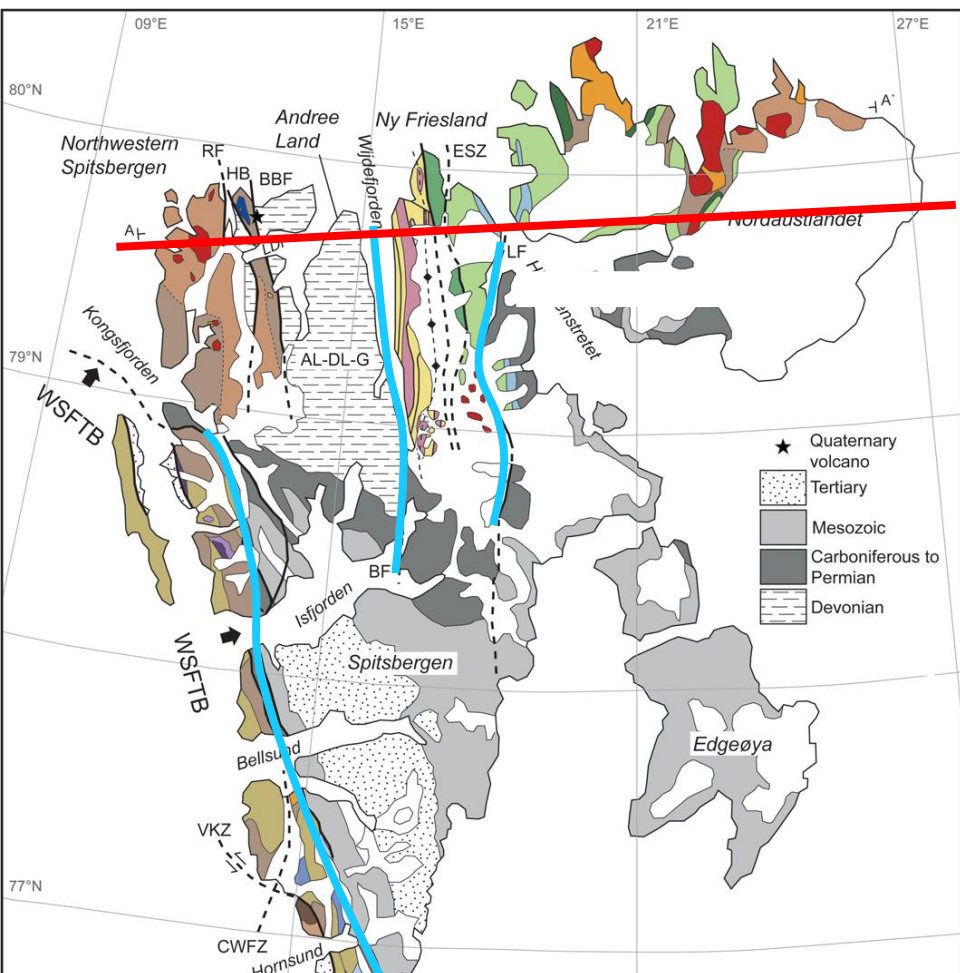
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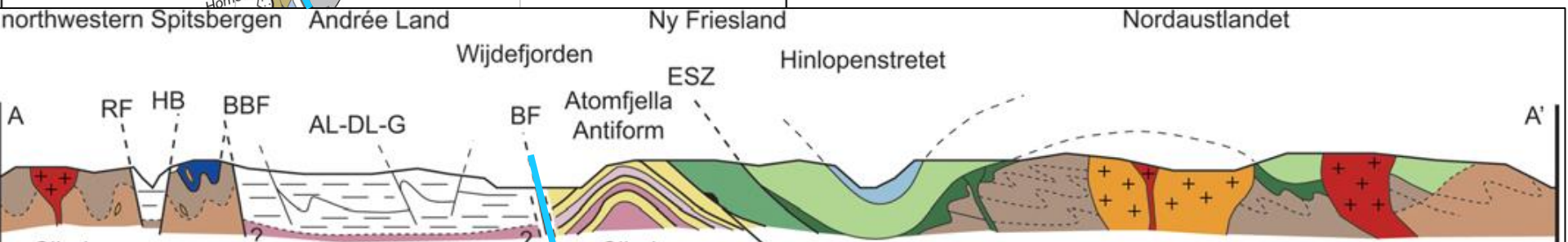
Gasser (2014)



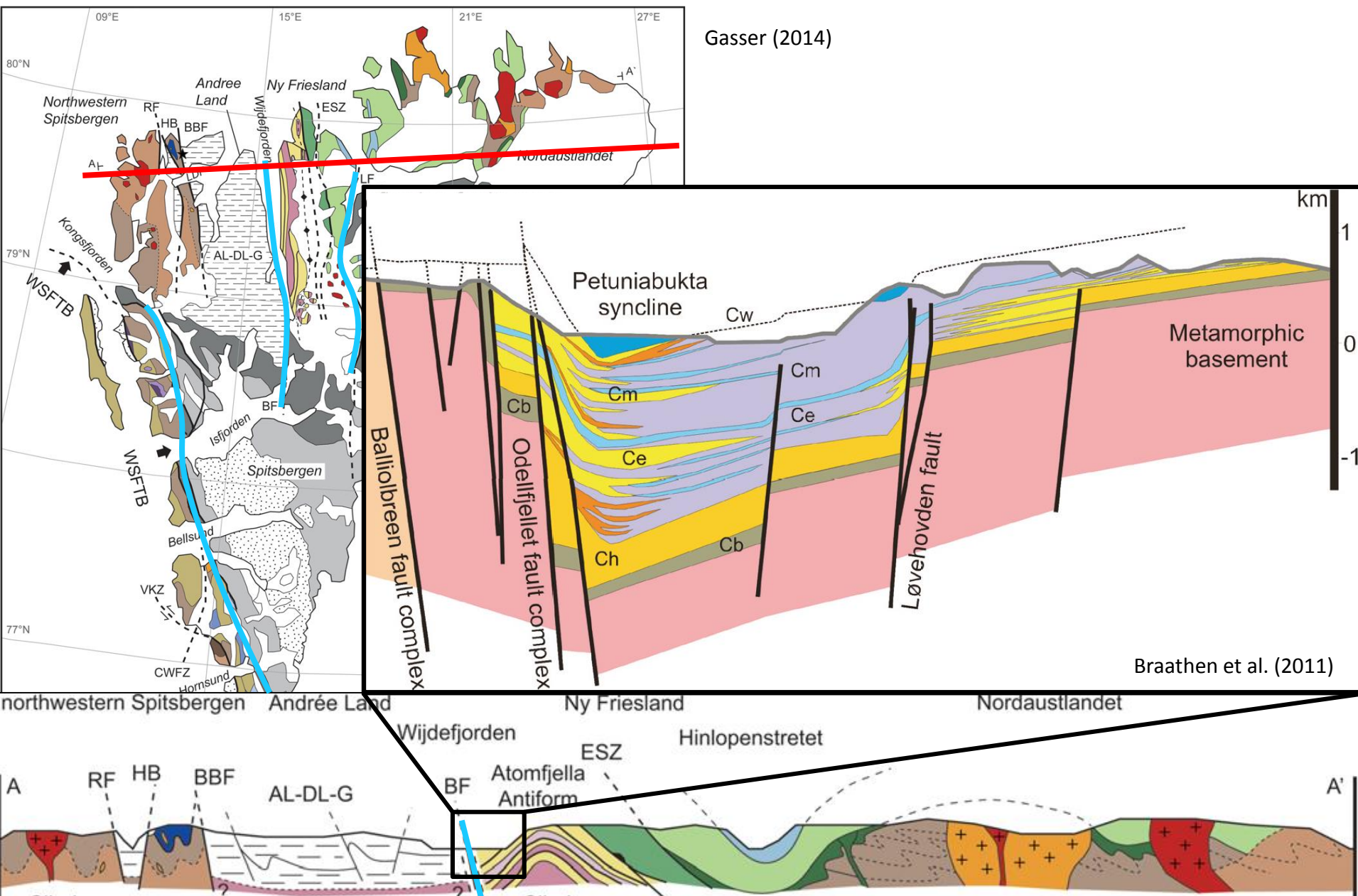
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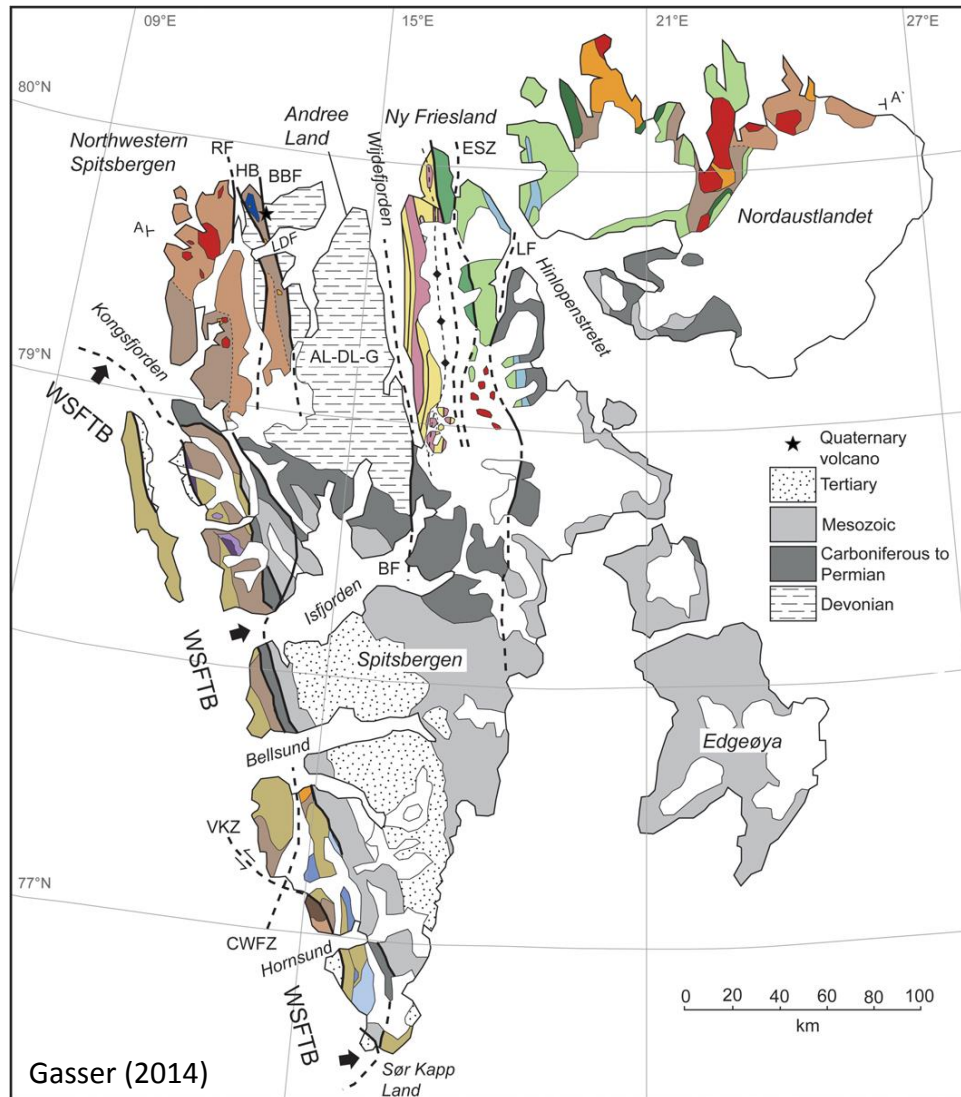
Gasser (2014)



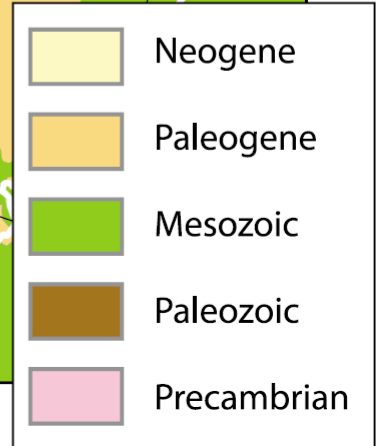
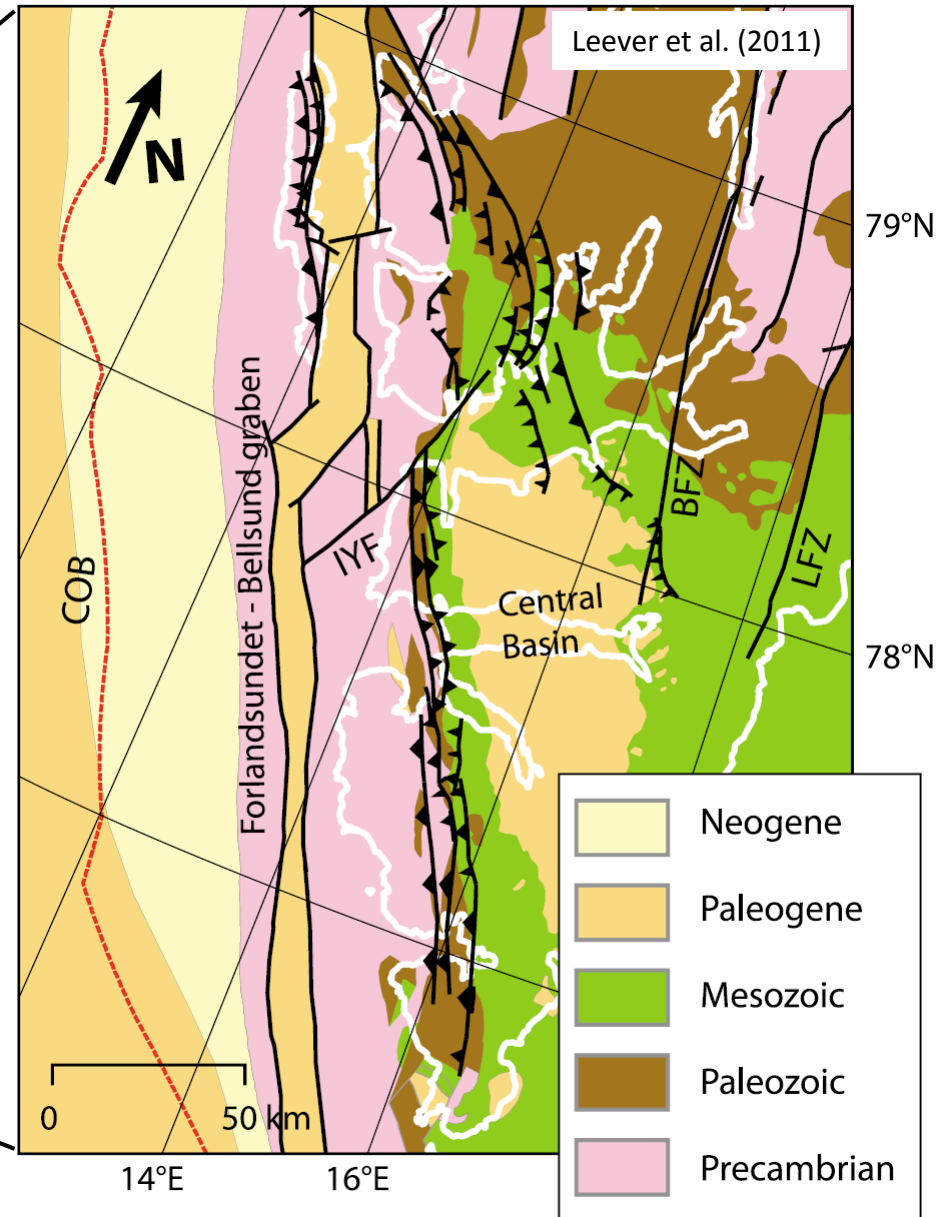
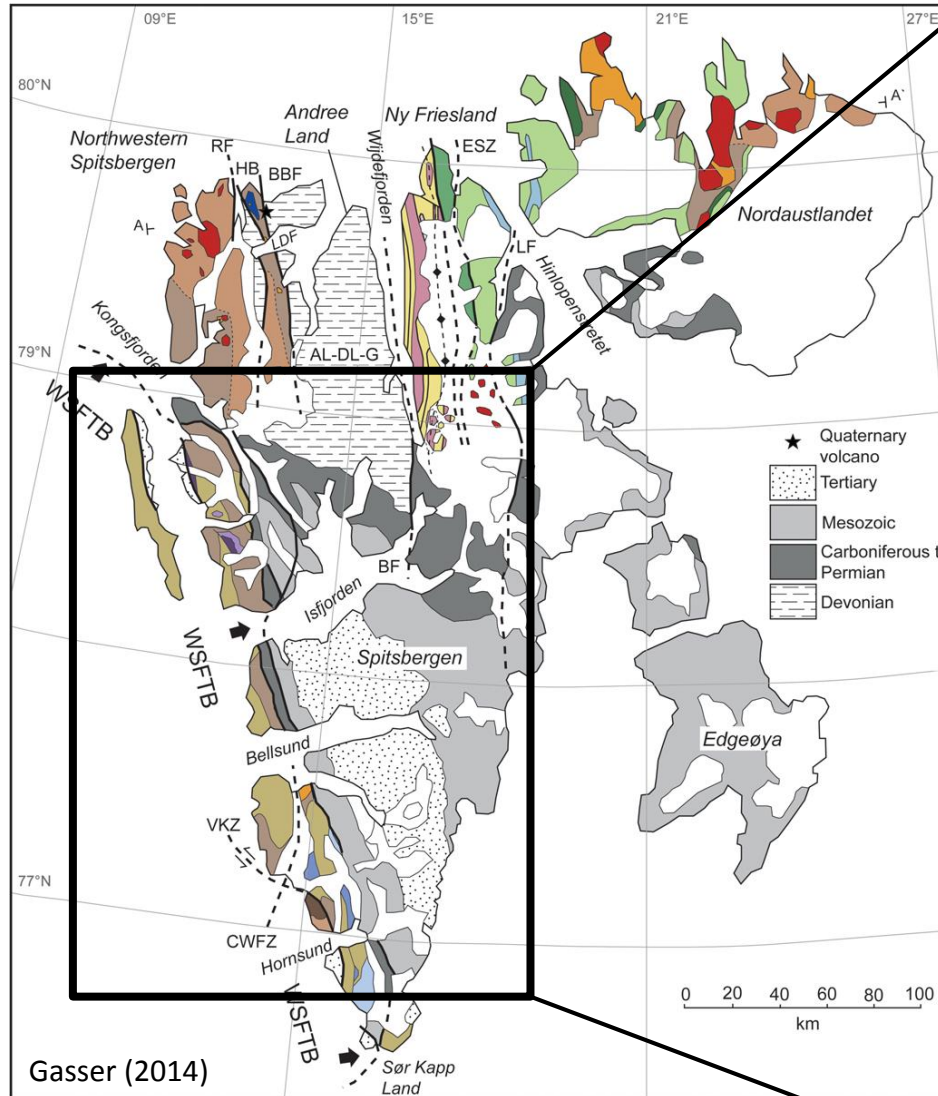
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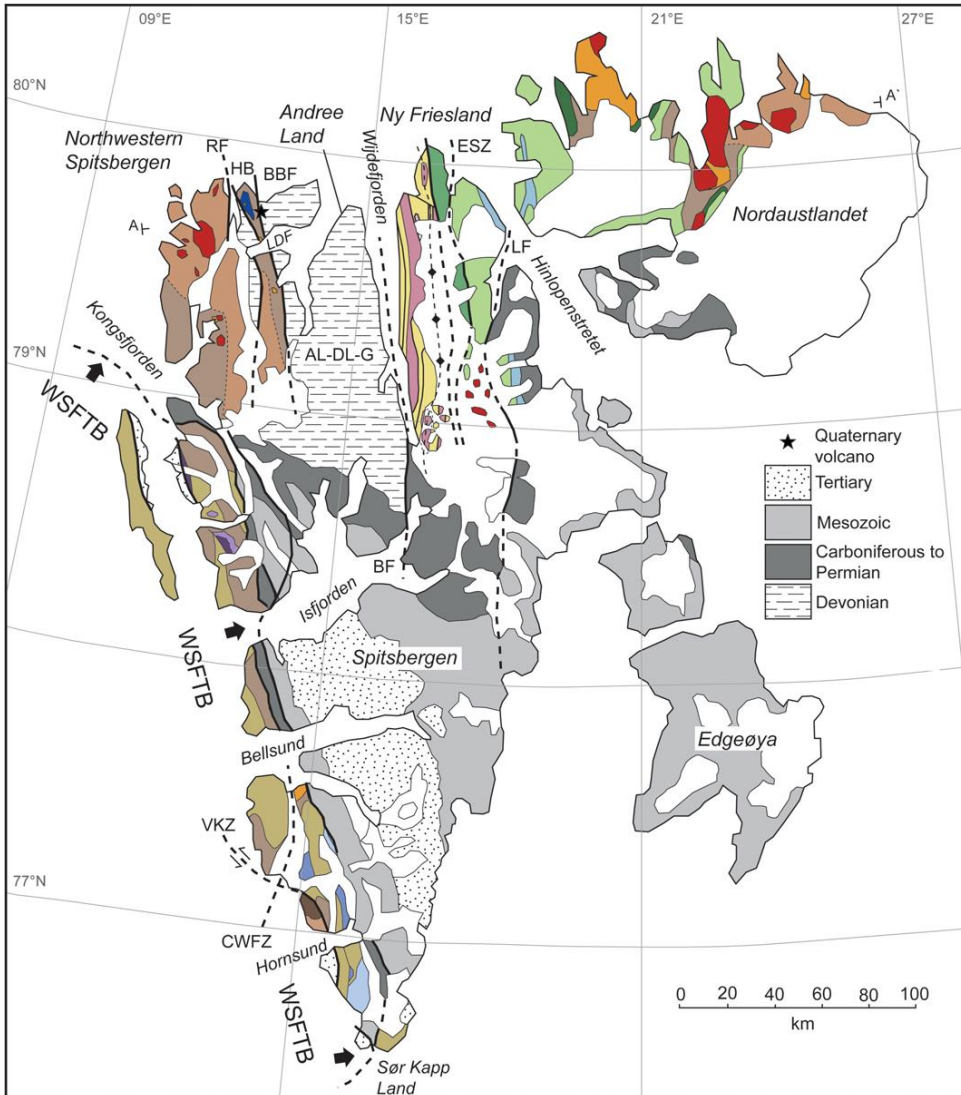
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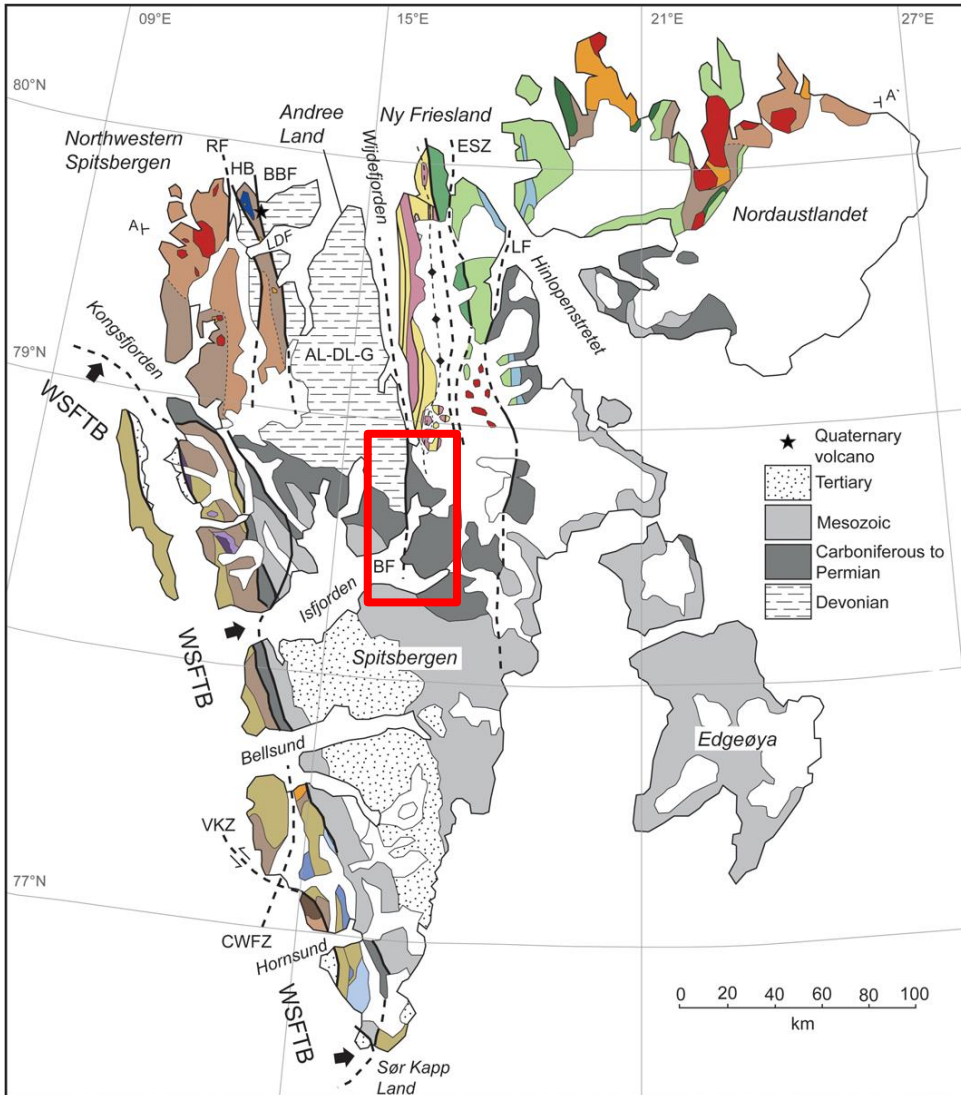




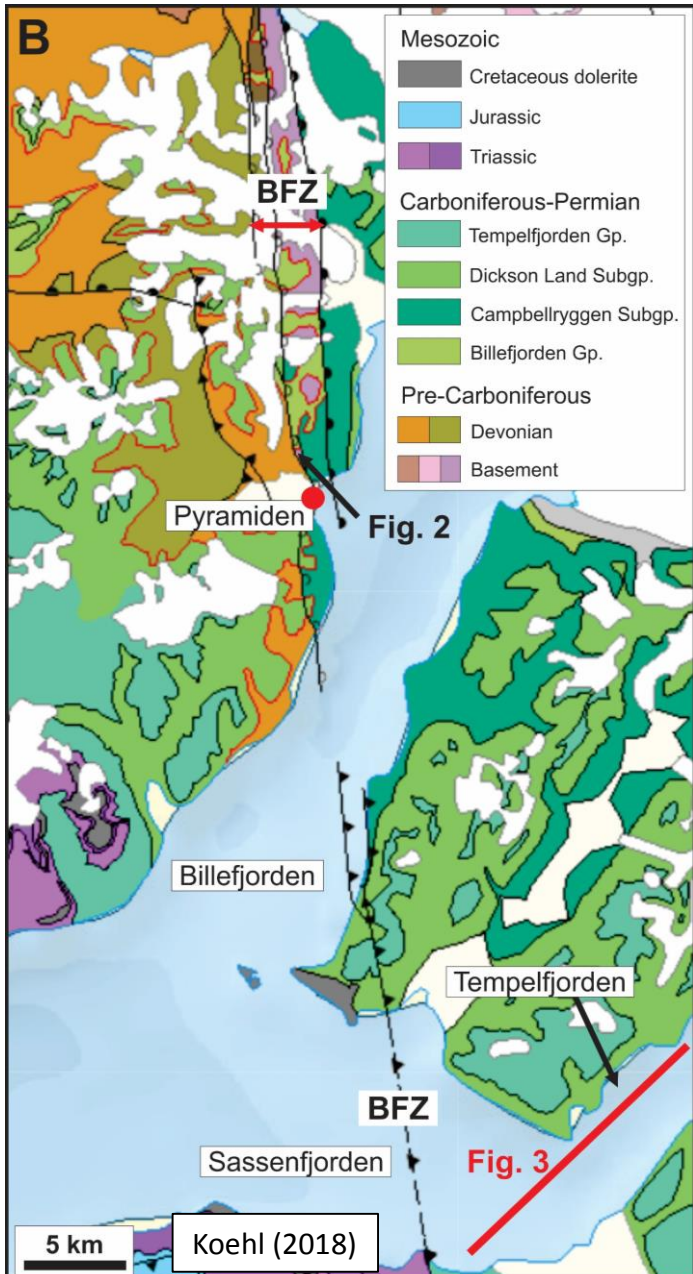
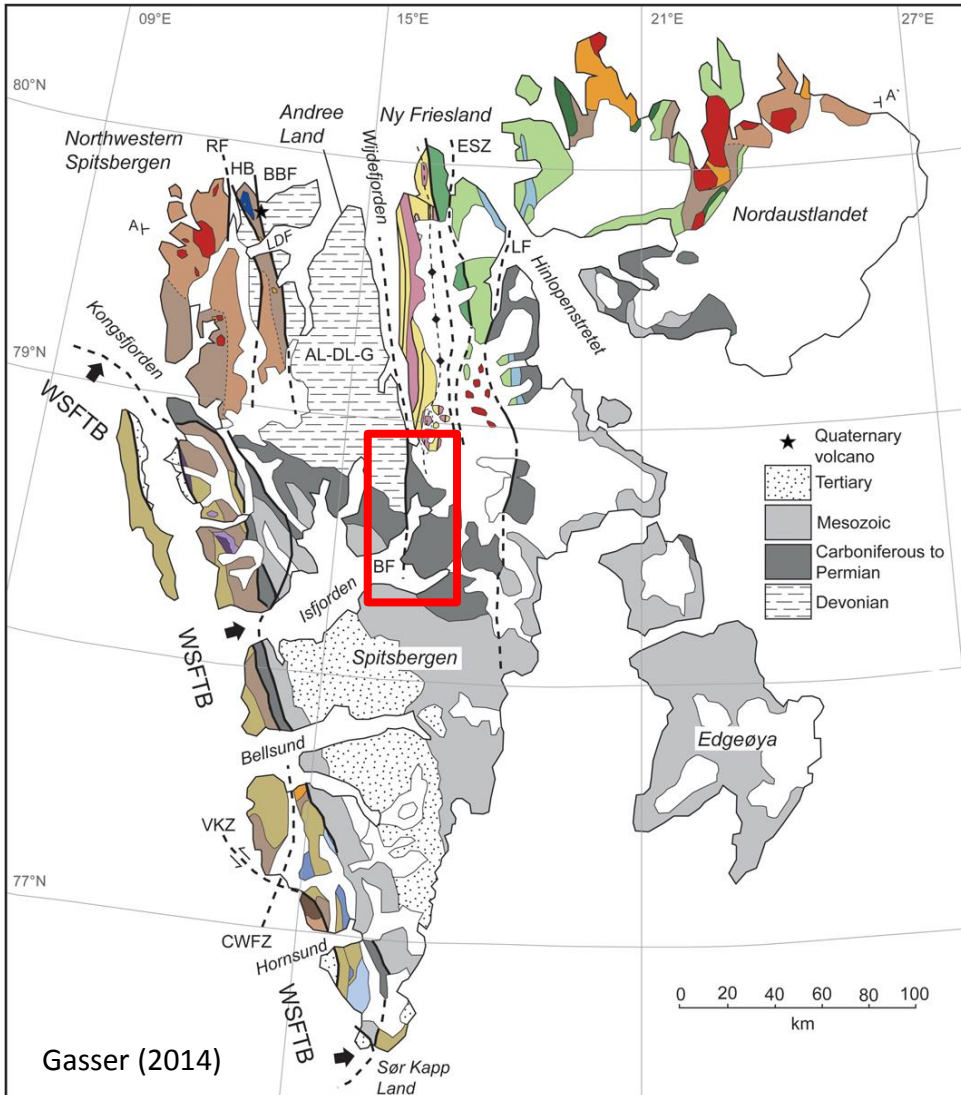
1 In Pyramiden, folded Devonian metasedimentary rocks are juxtaposed against sheared, coal-rich, Mississippian strata.



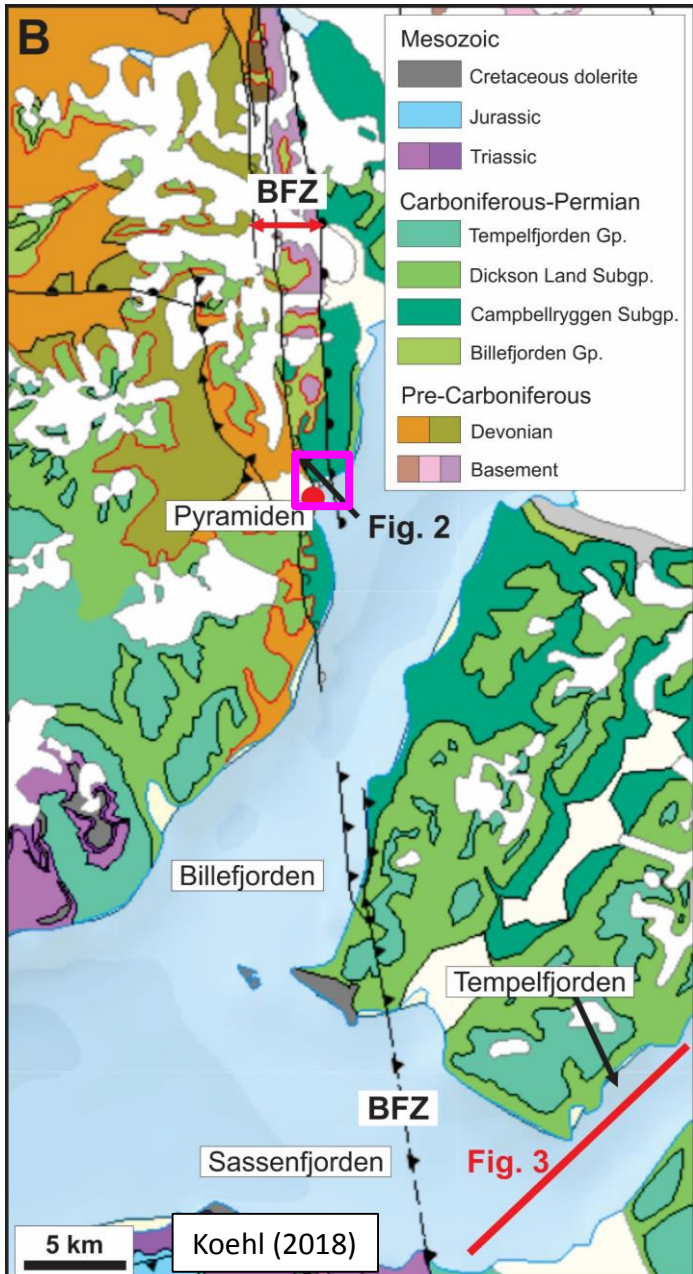
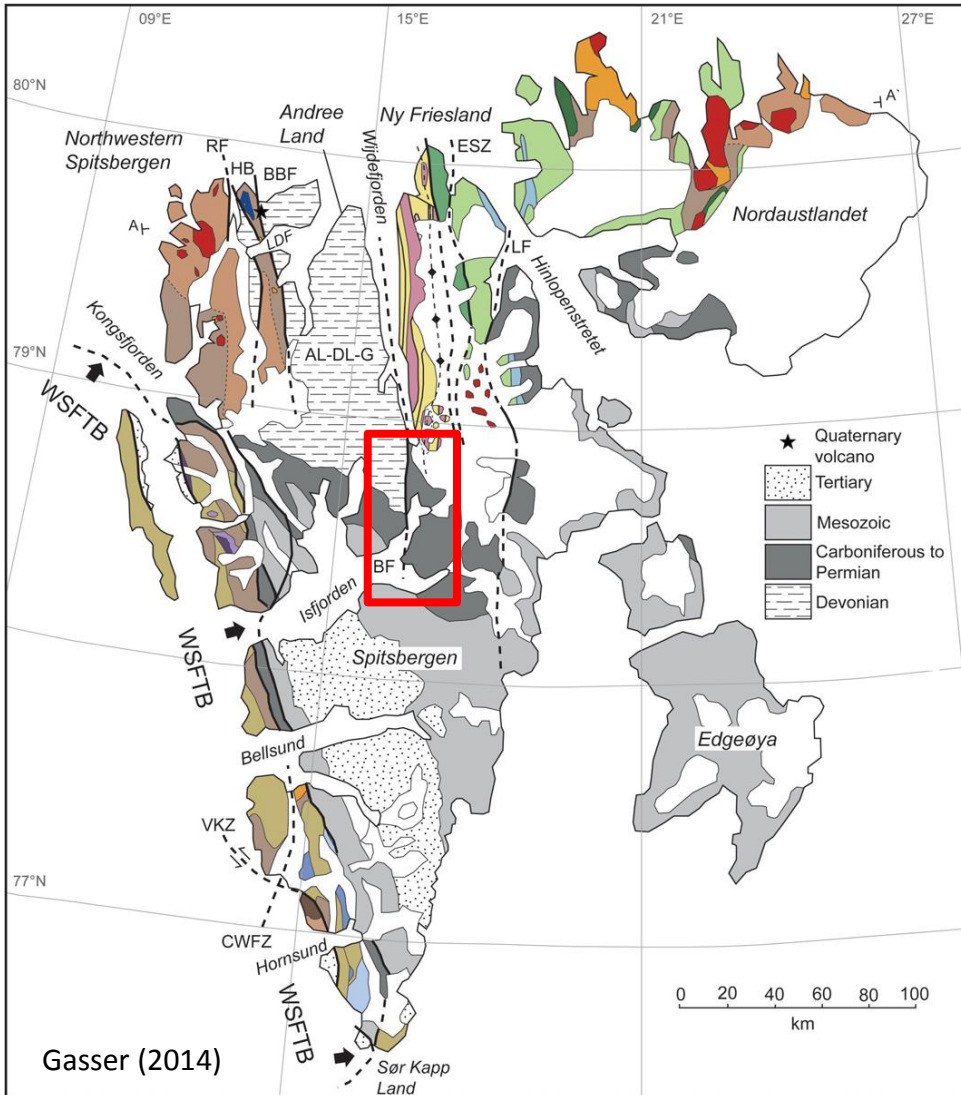
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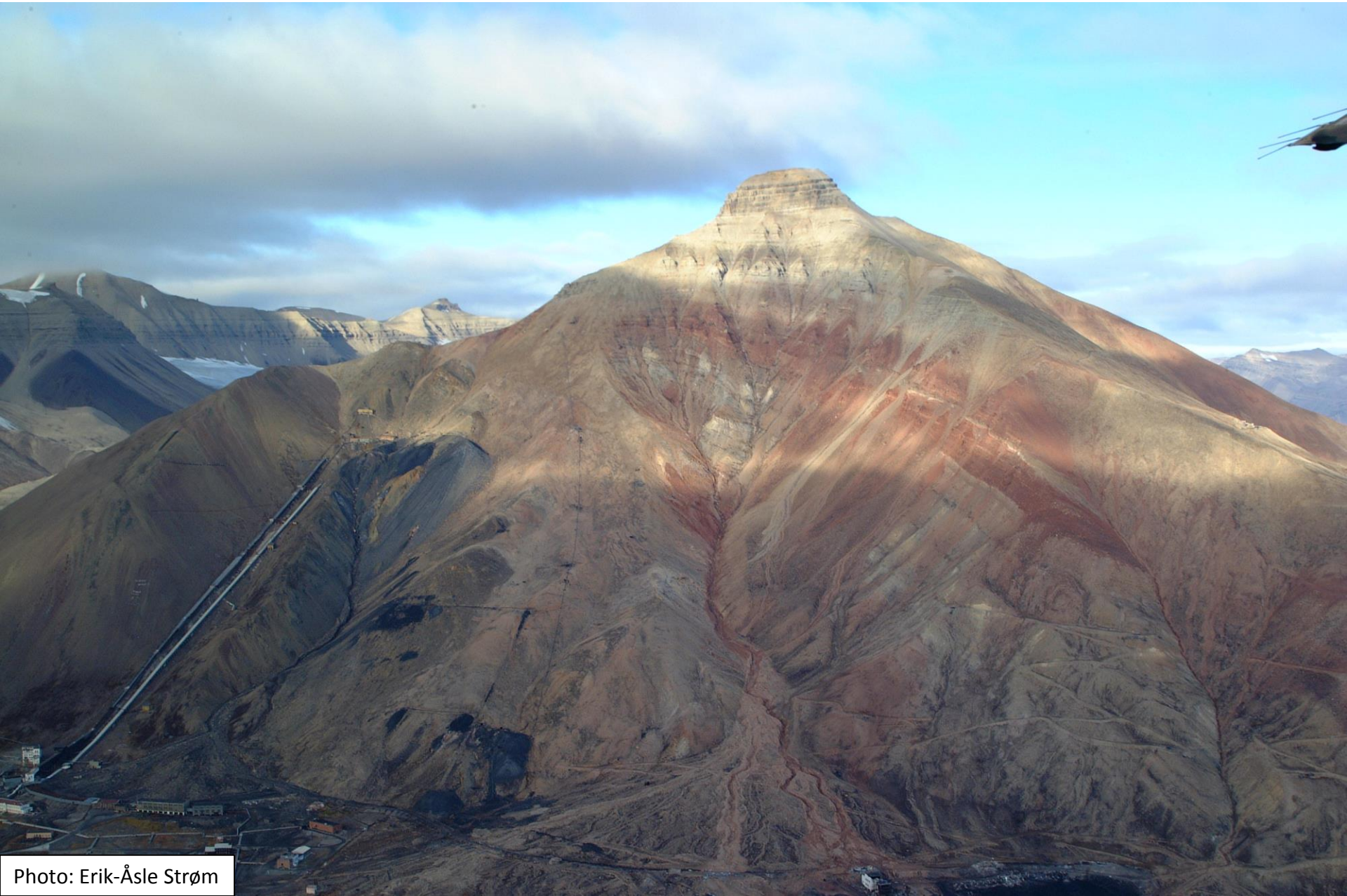


Photo: Erik-Åsle Strøm

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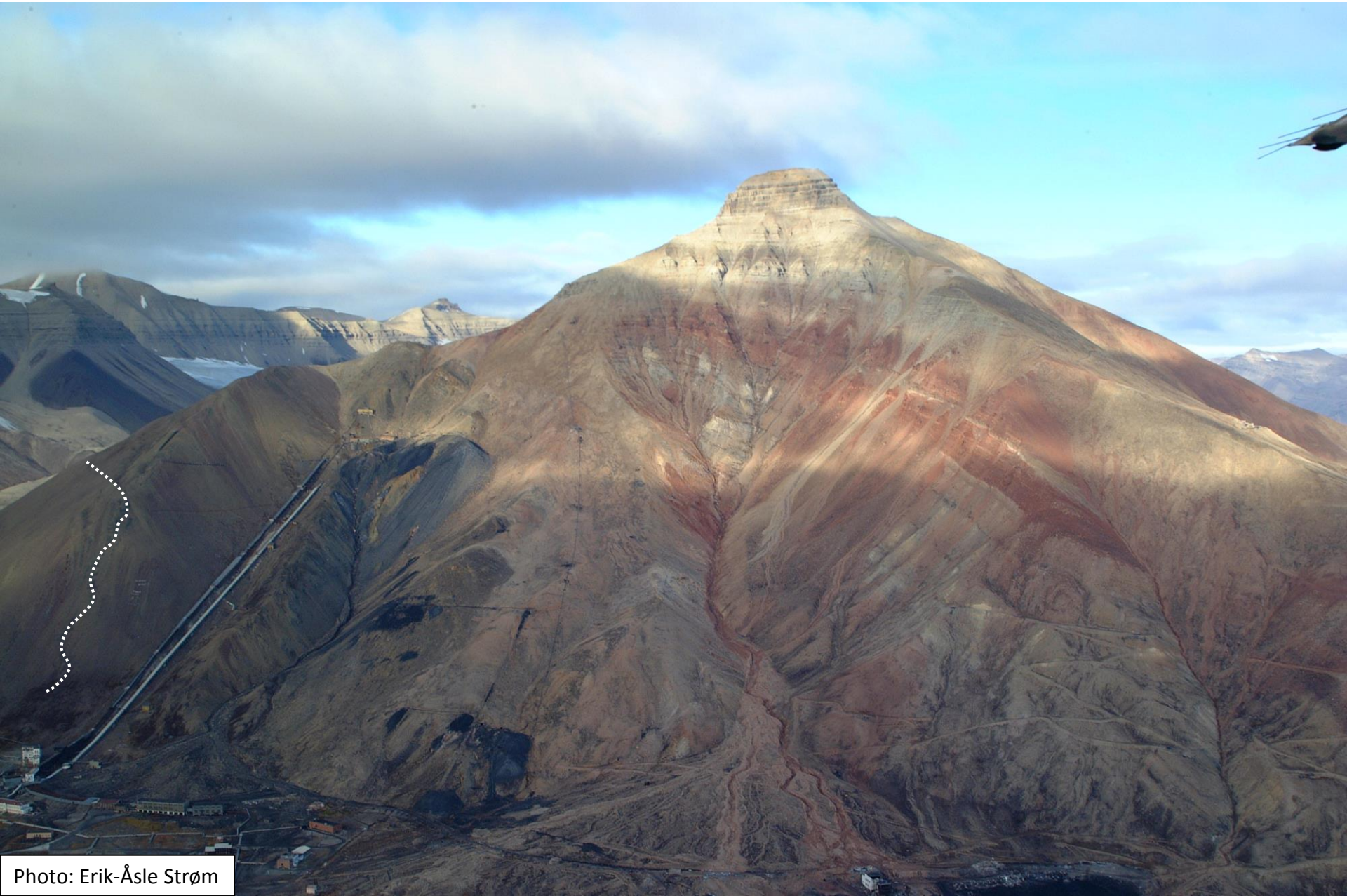


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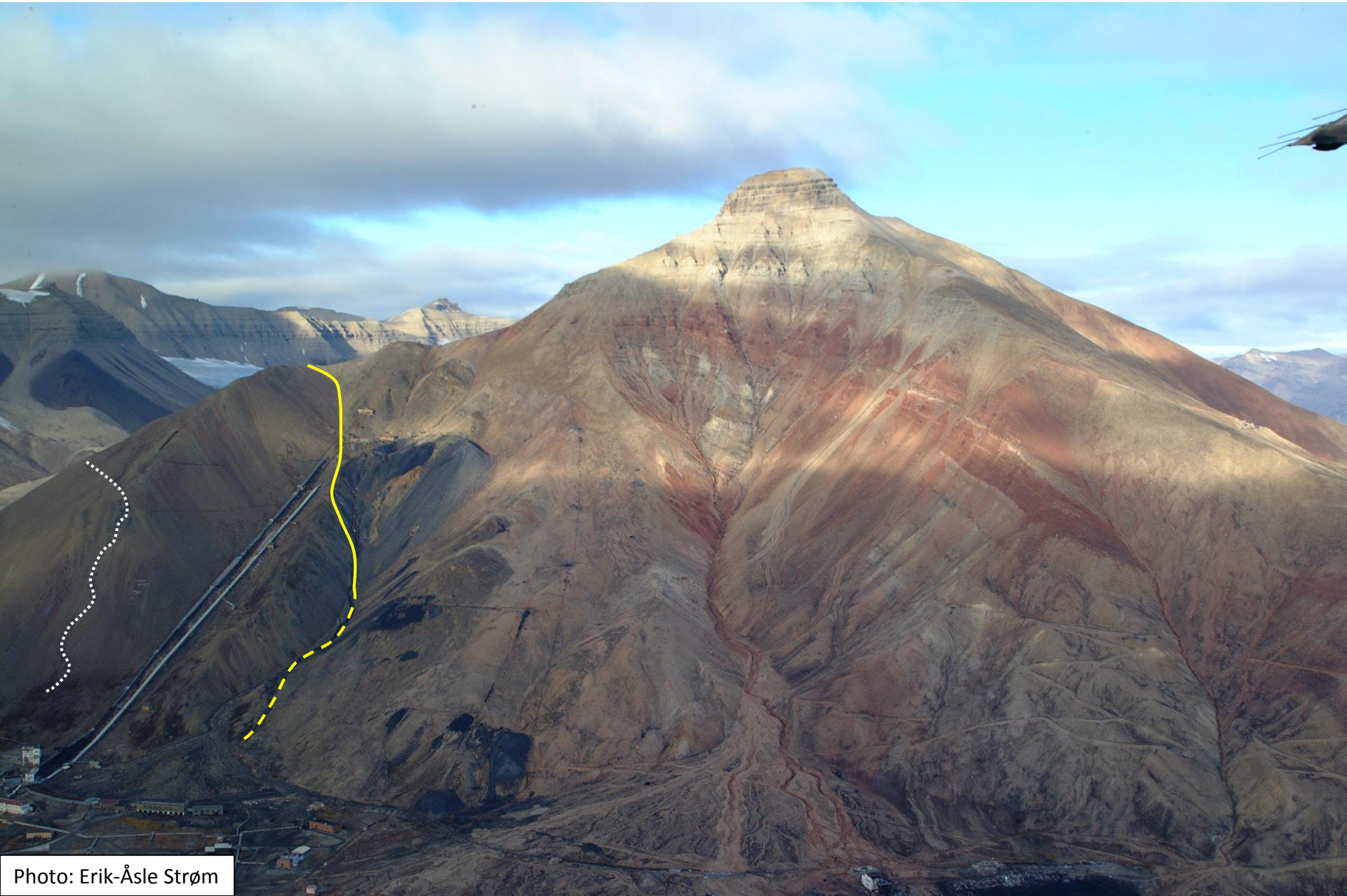


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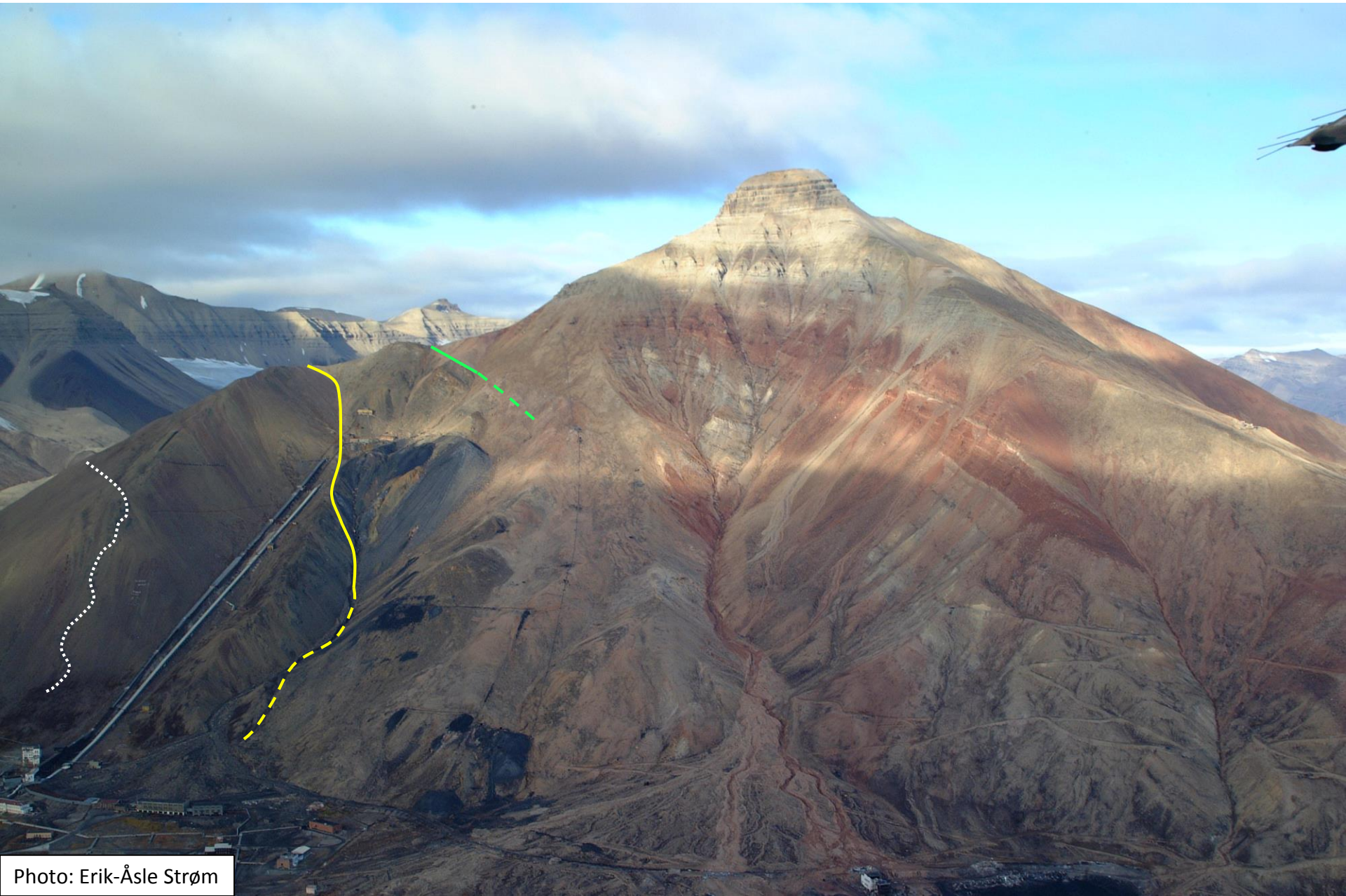


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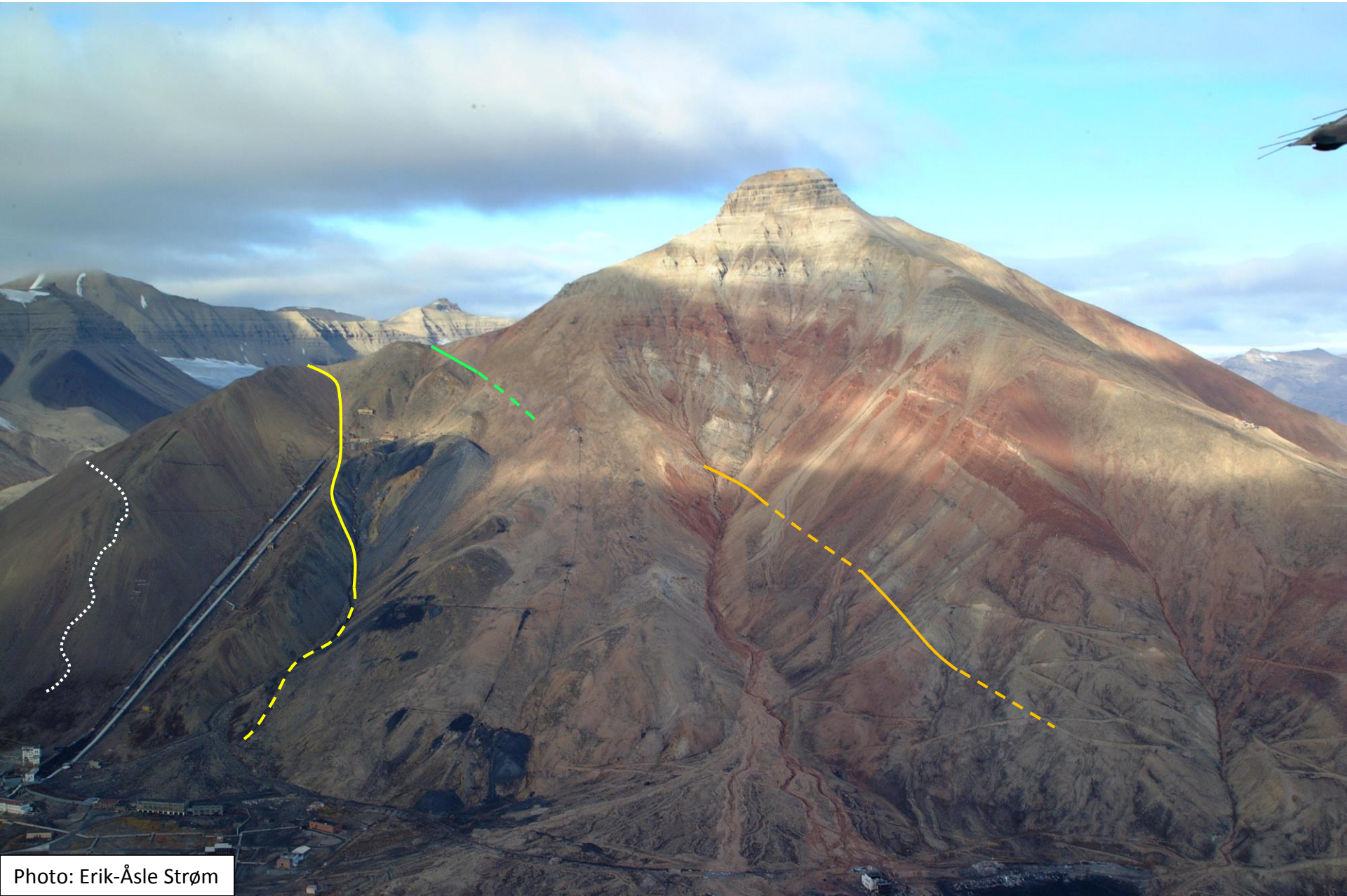


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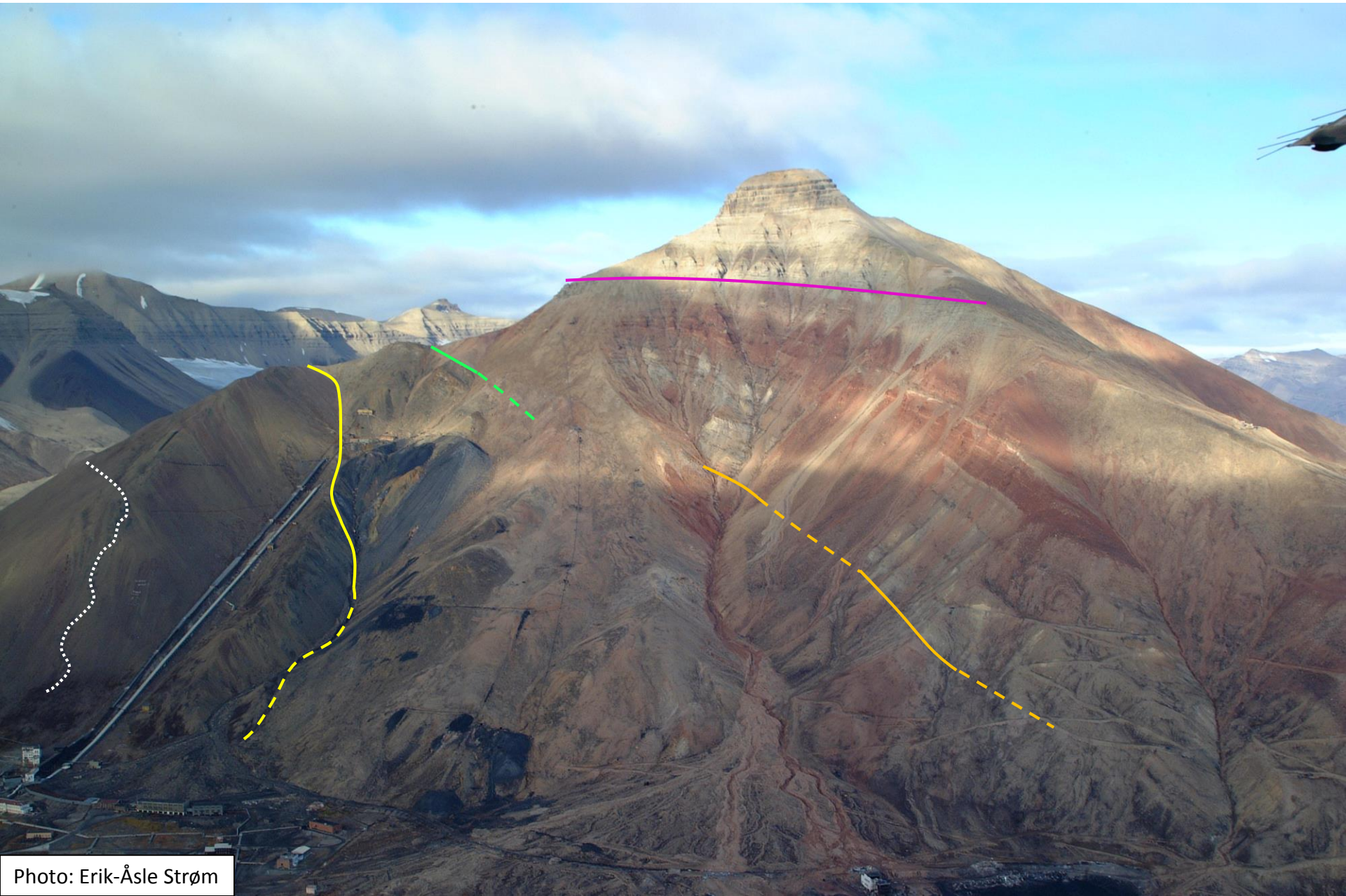


Photo: Erik-Åsle Strøm

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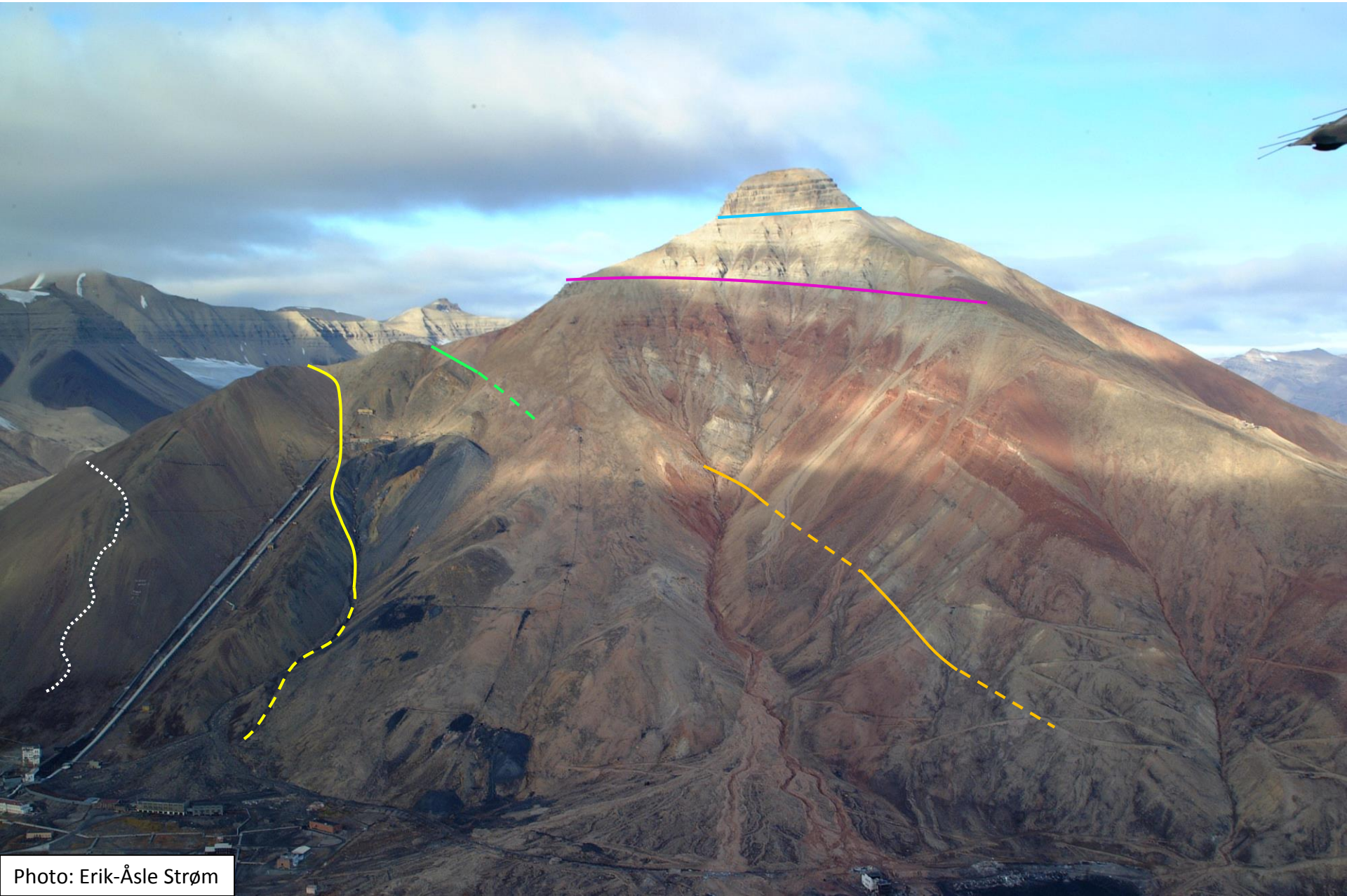


Photo: Erik-Åsle Strøm

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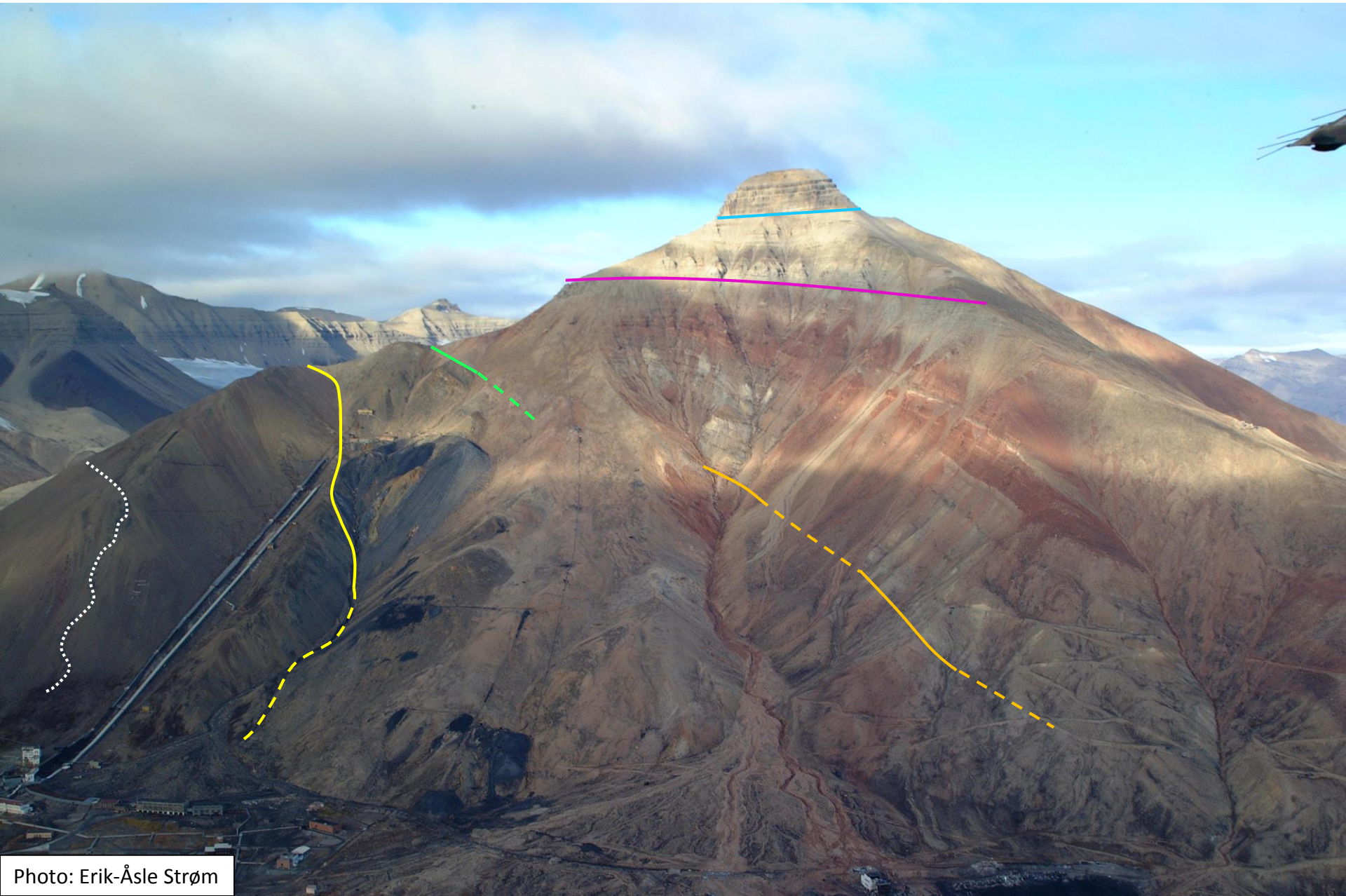


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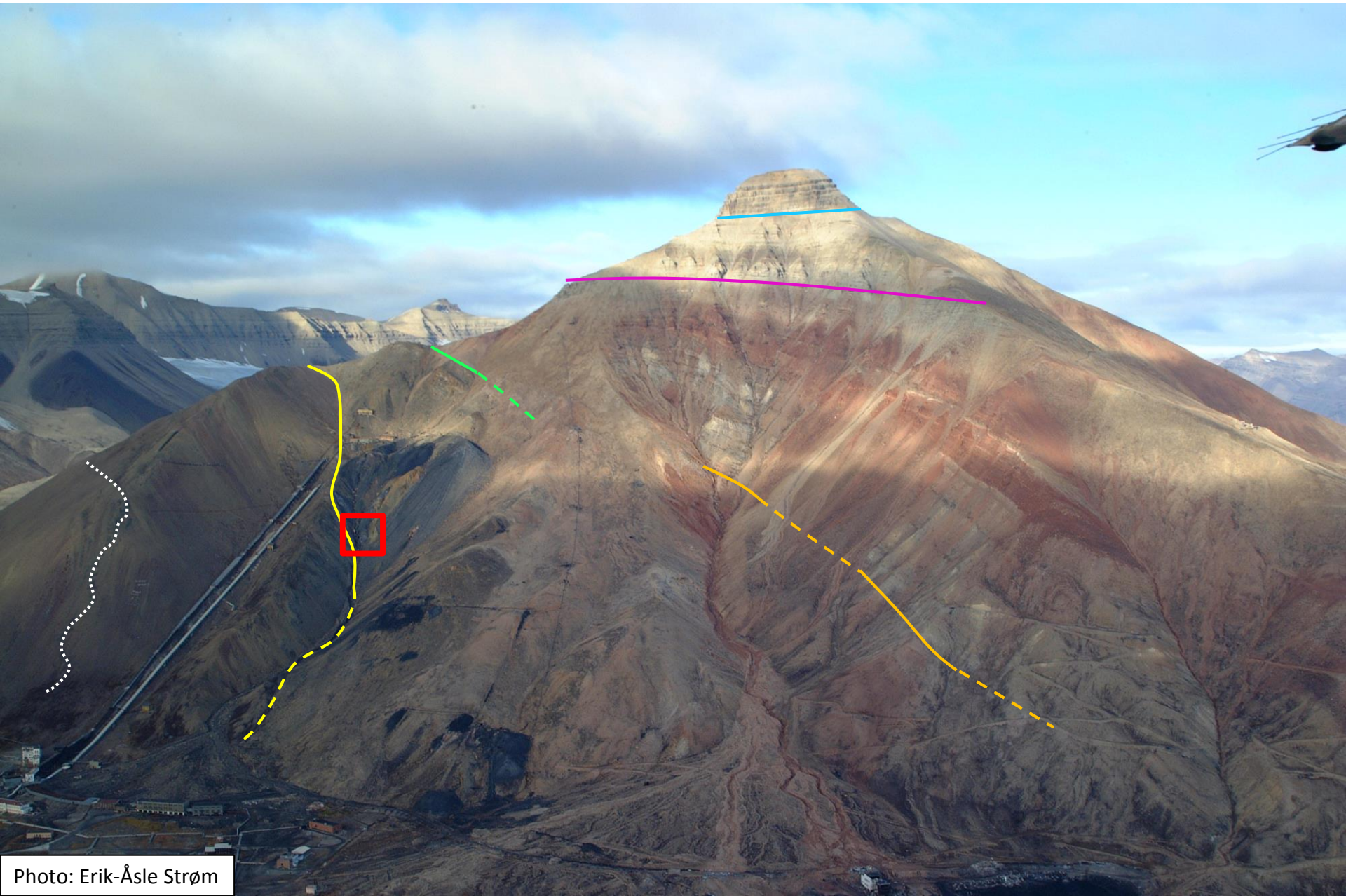


Photo: Erik-Åsle Strøm

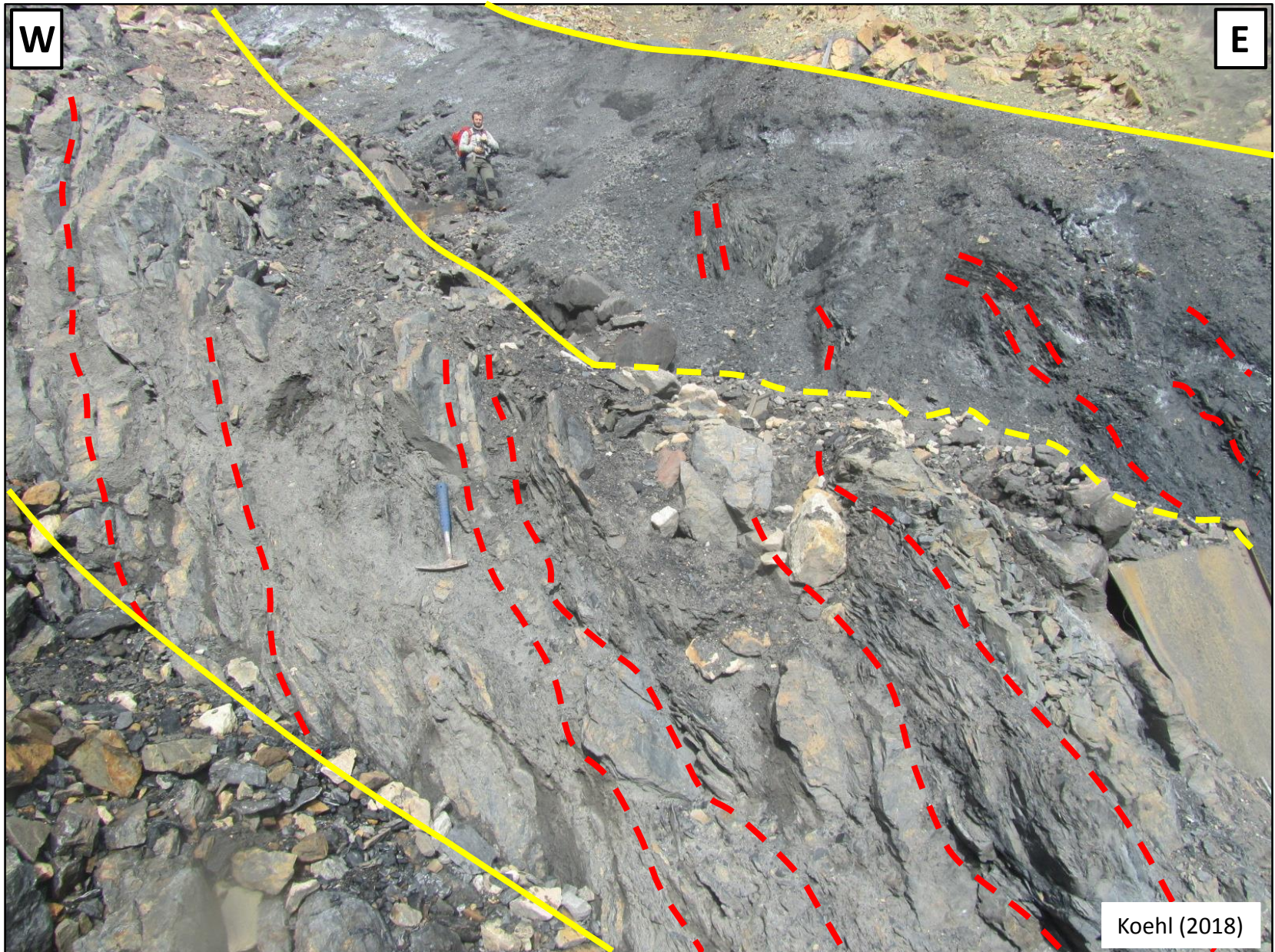
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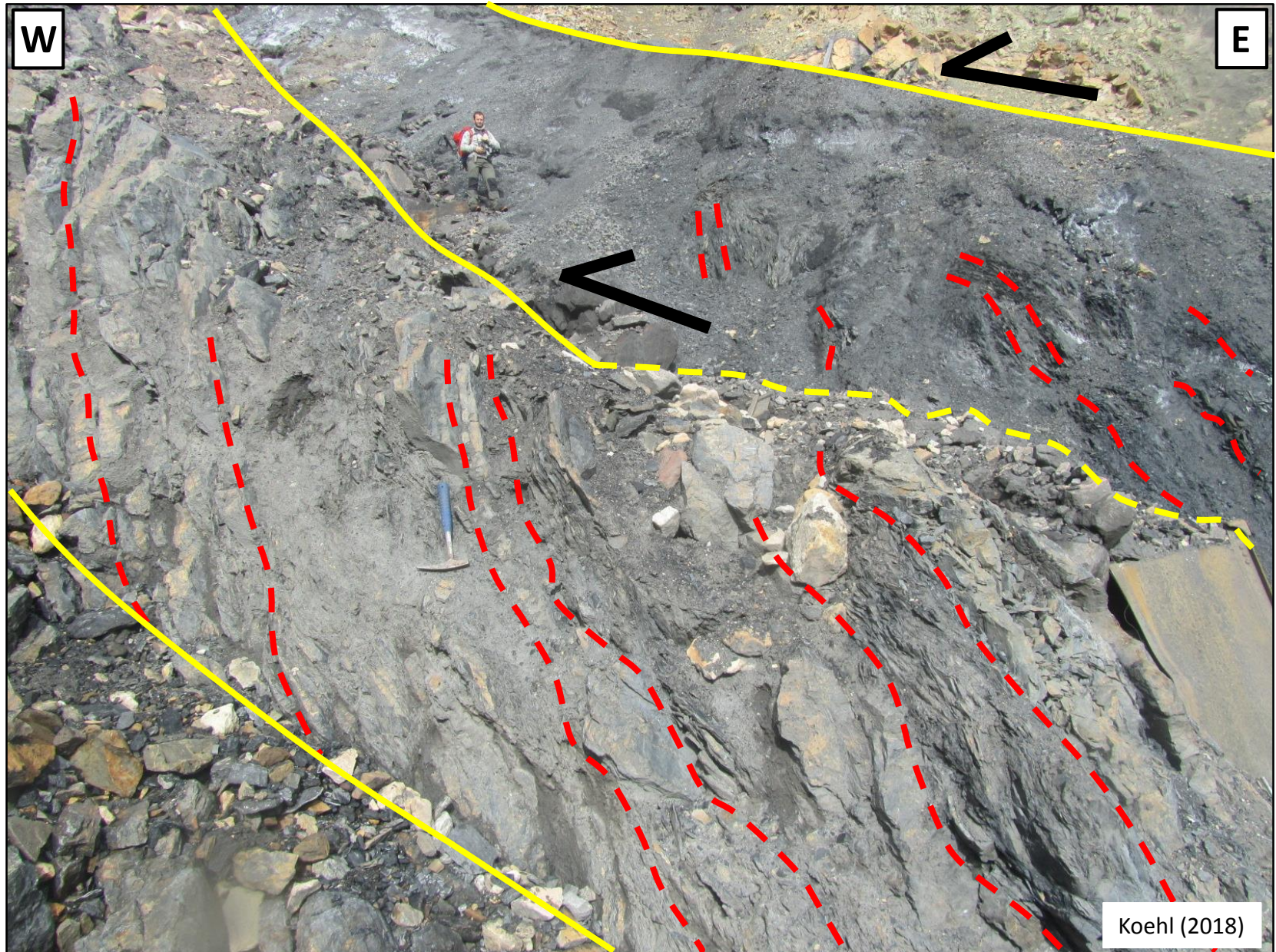
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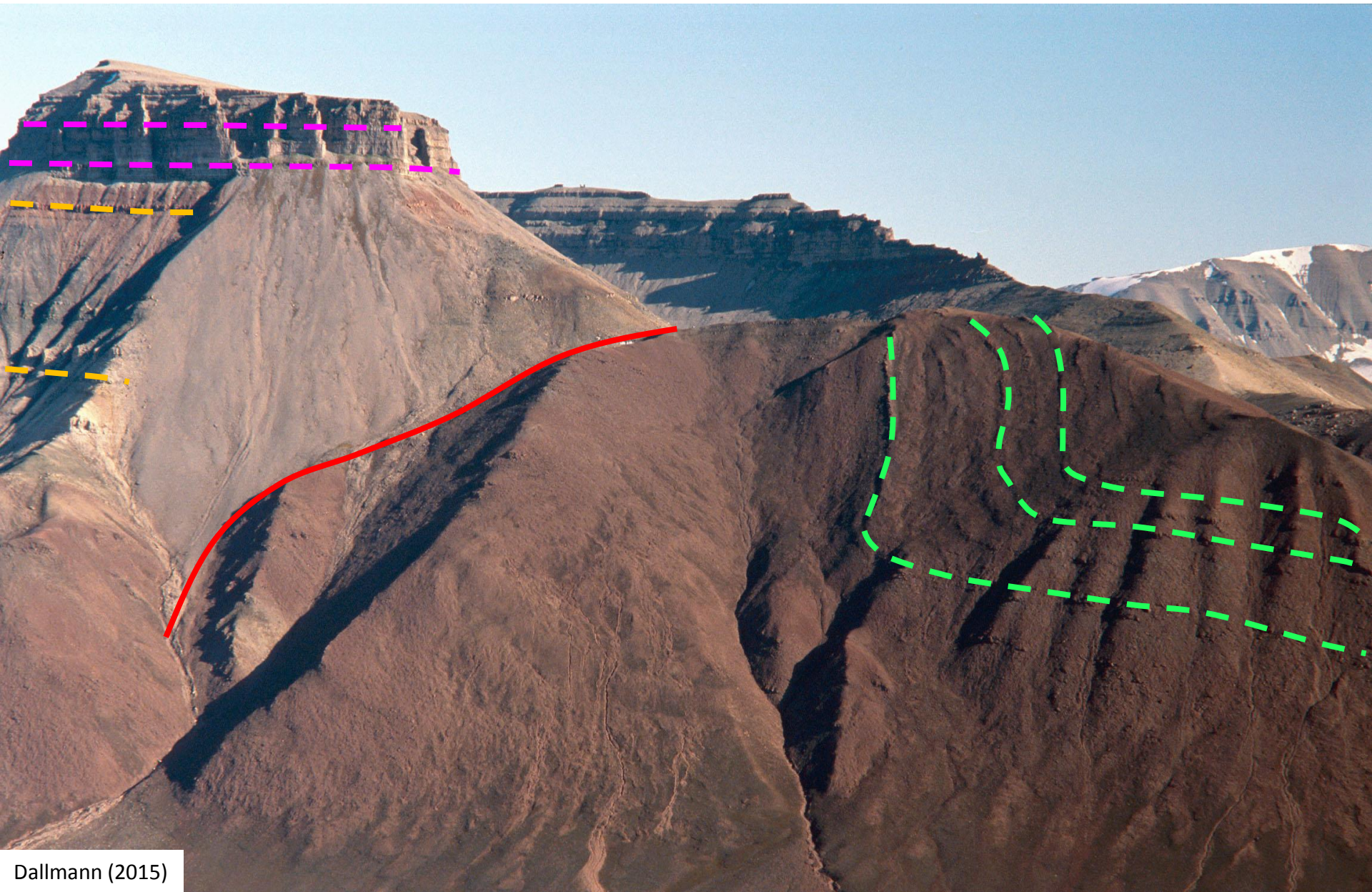
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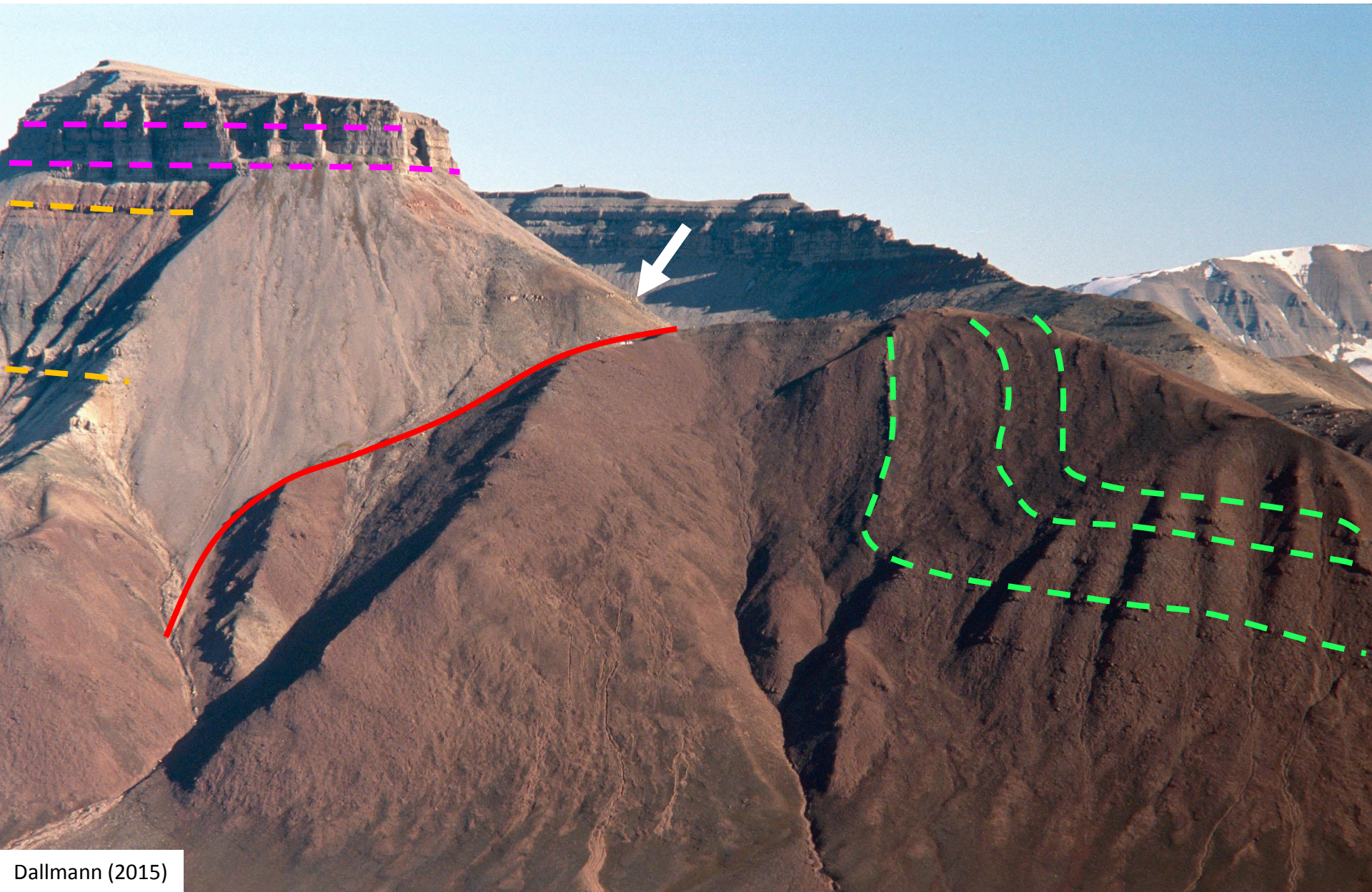
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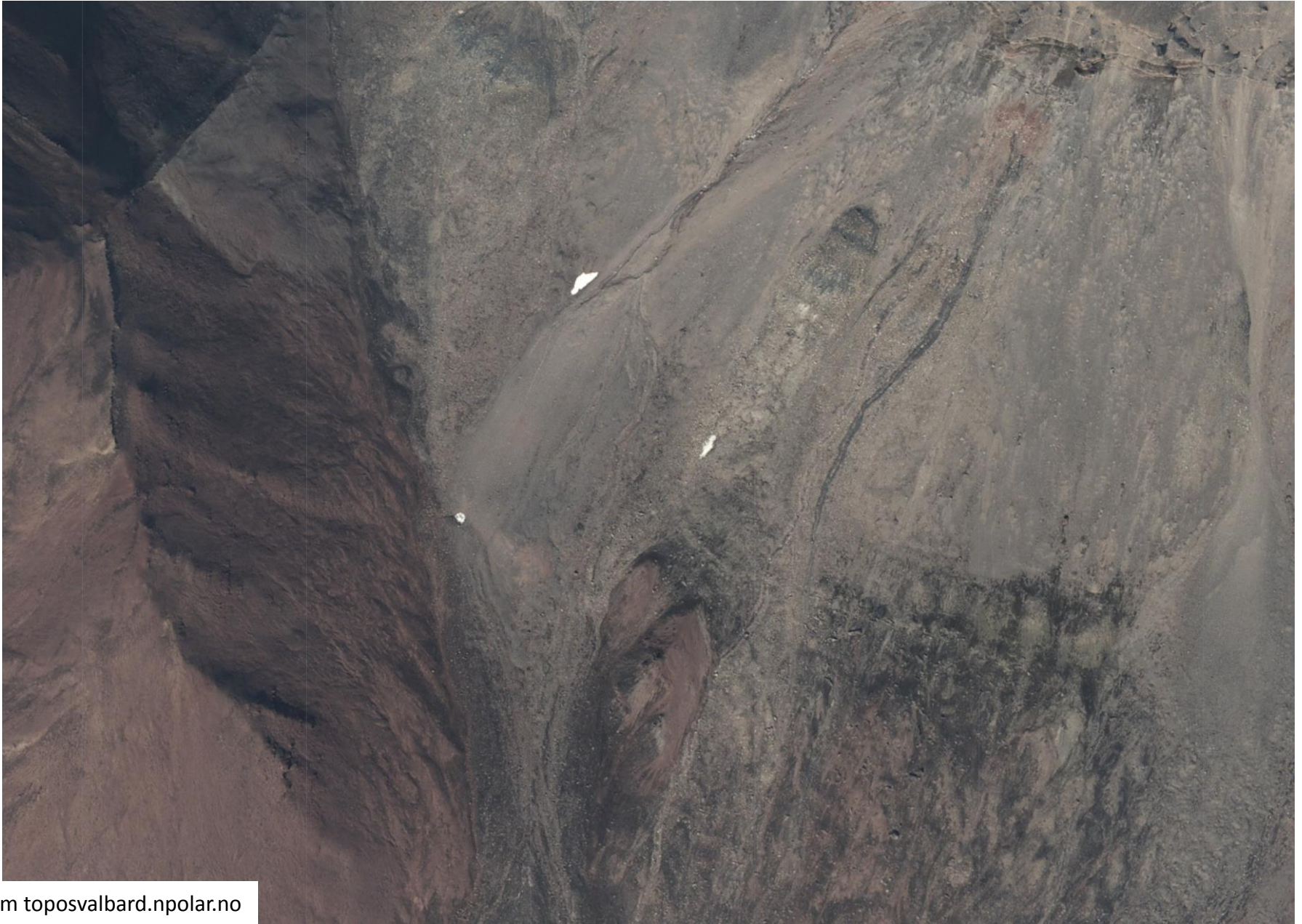
1 In central Spitsbergen, undeformed Mississippian rocks overlie folded Devonian strata.



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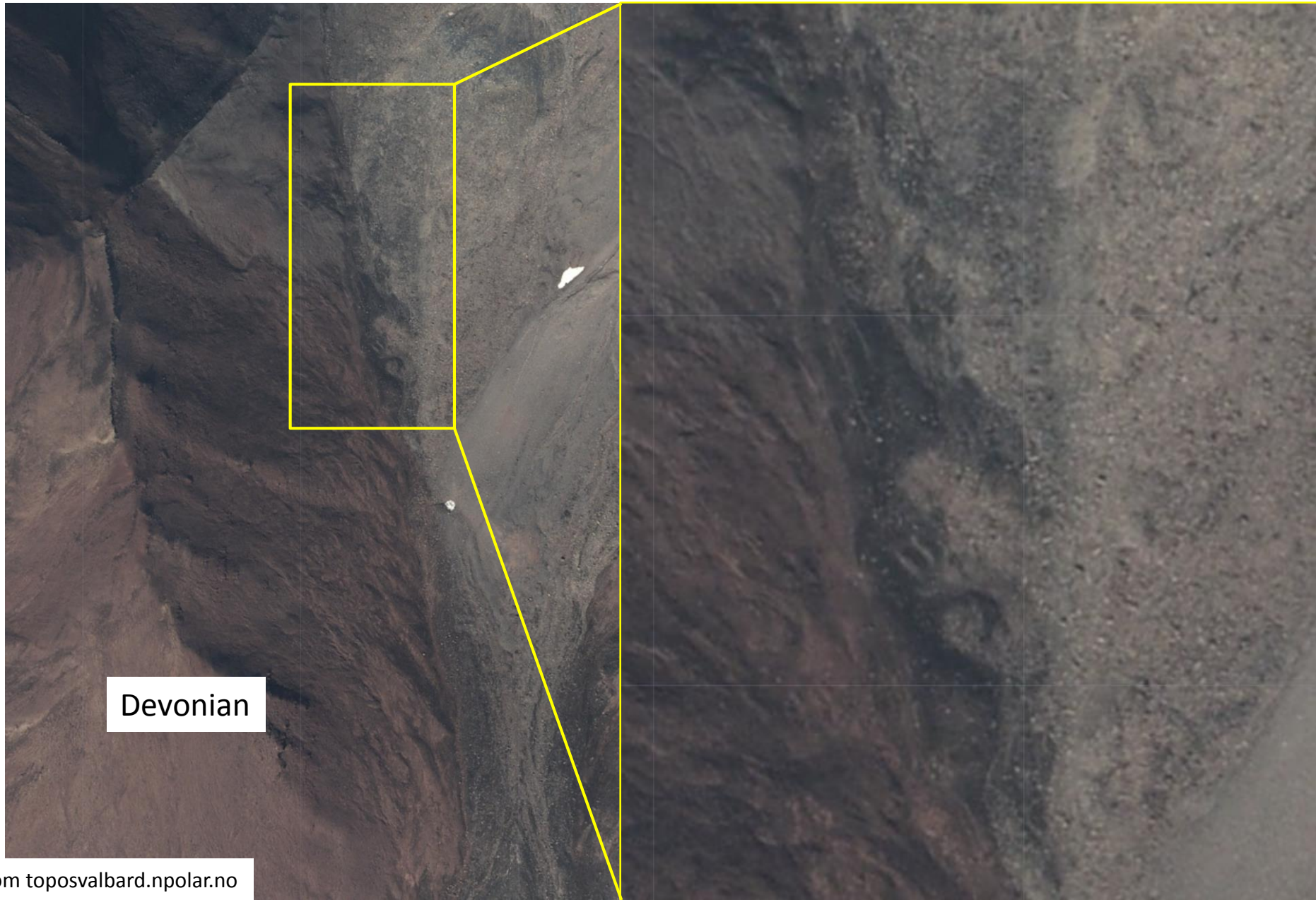
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Devonian

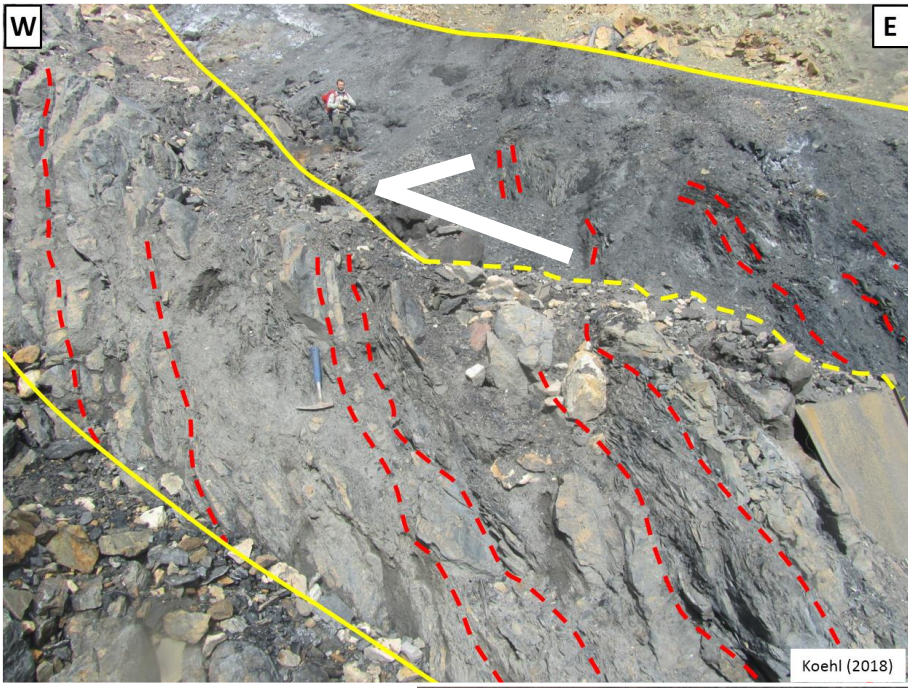
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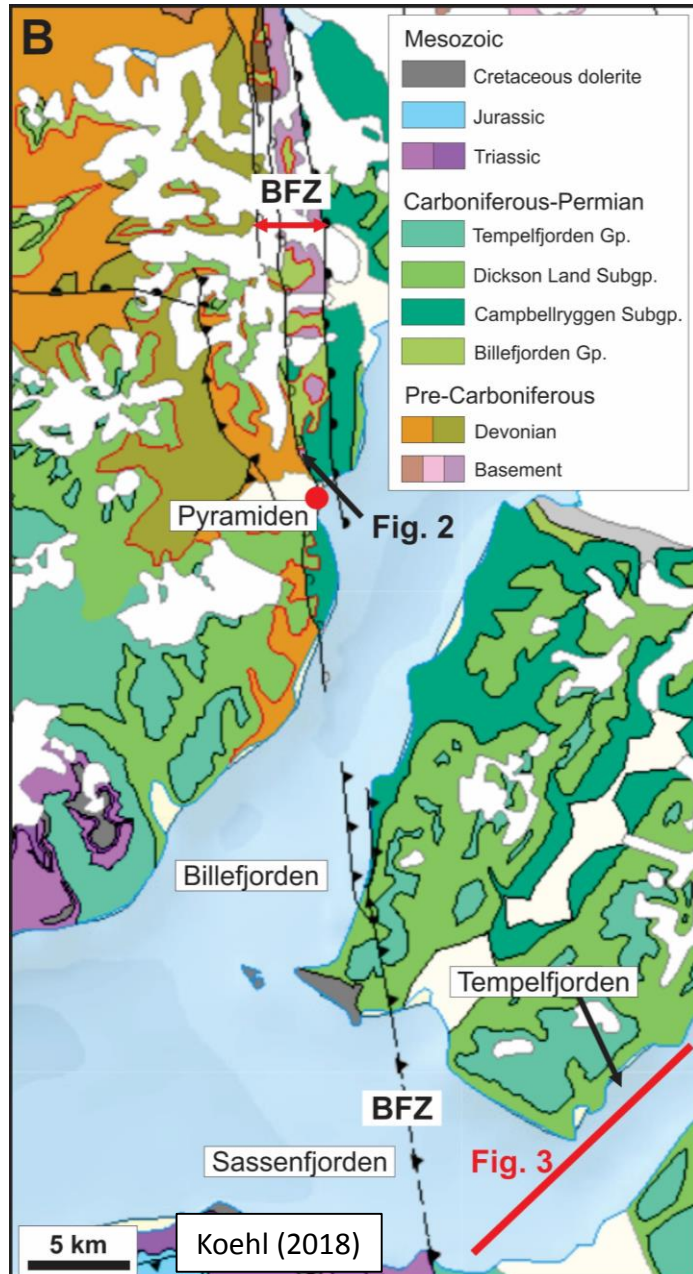
Devonian

Coal?

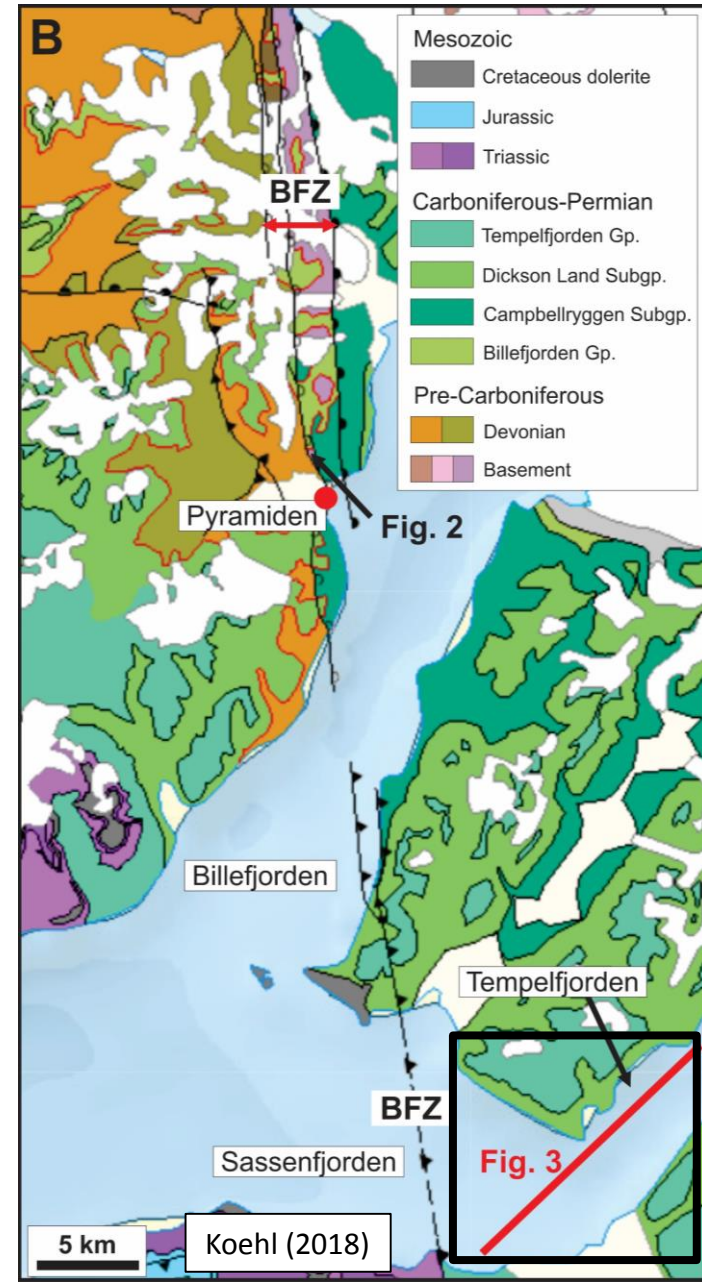
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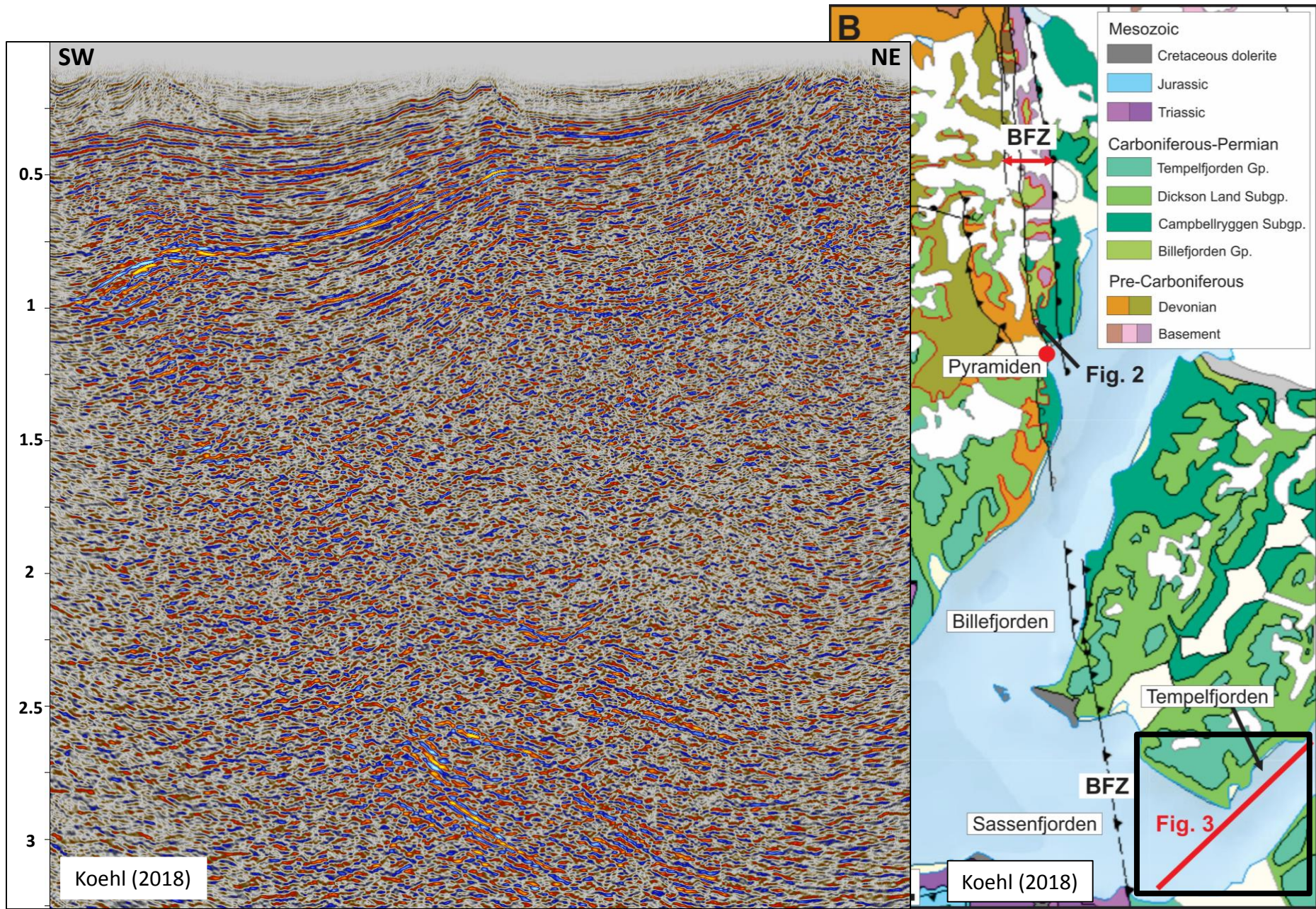
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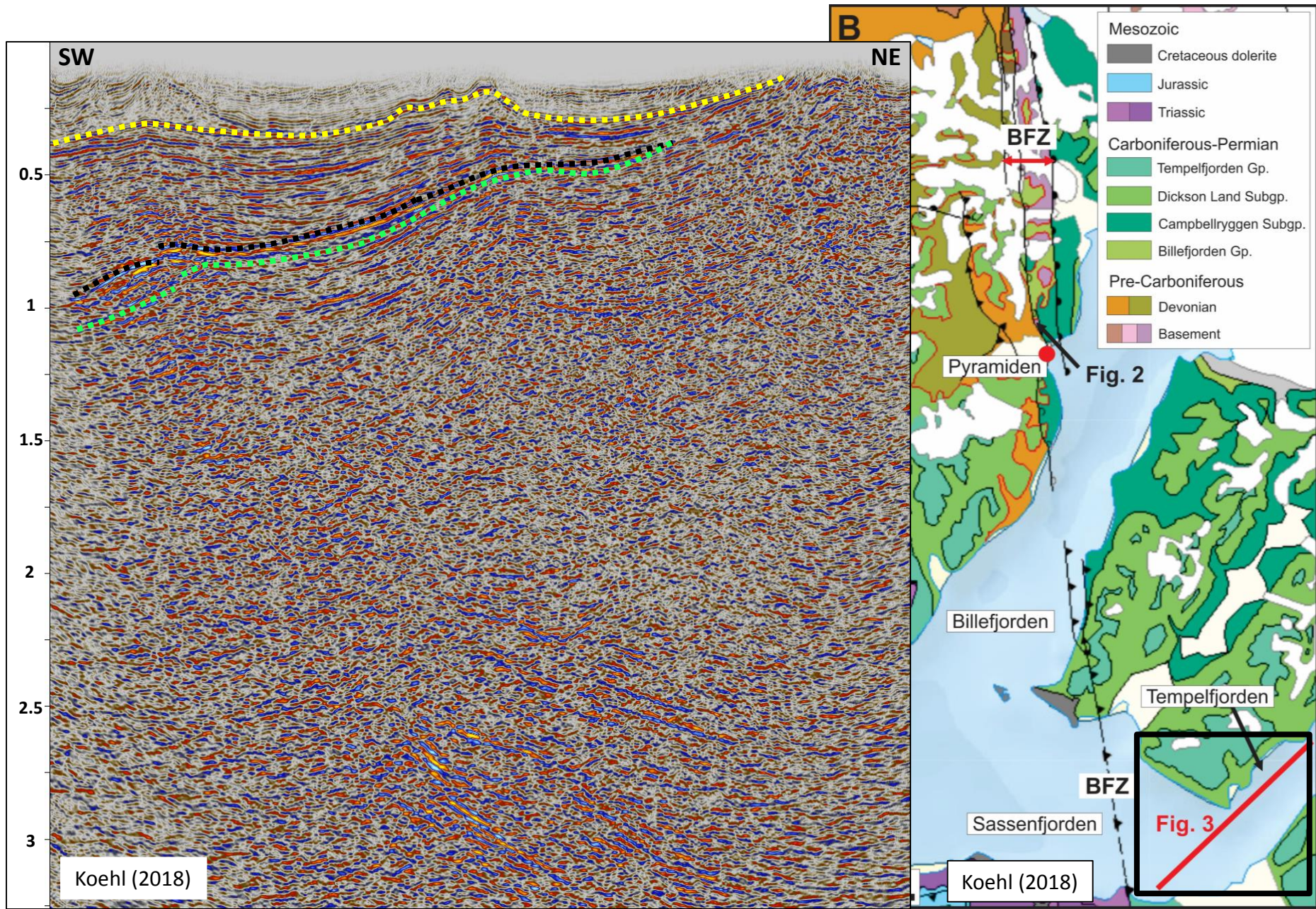
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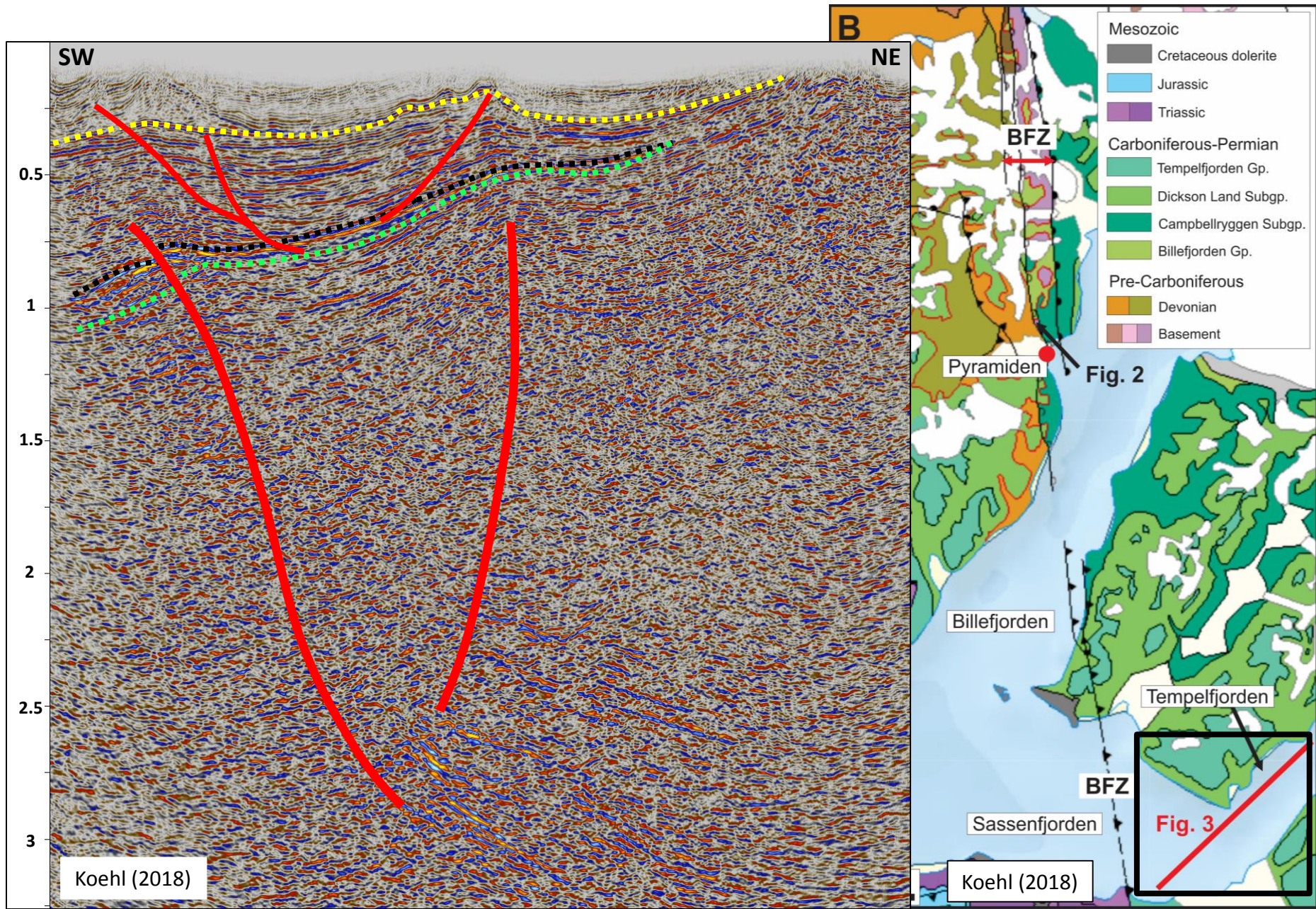
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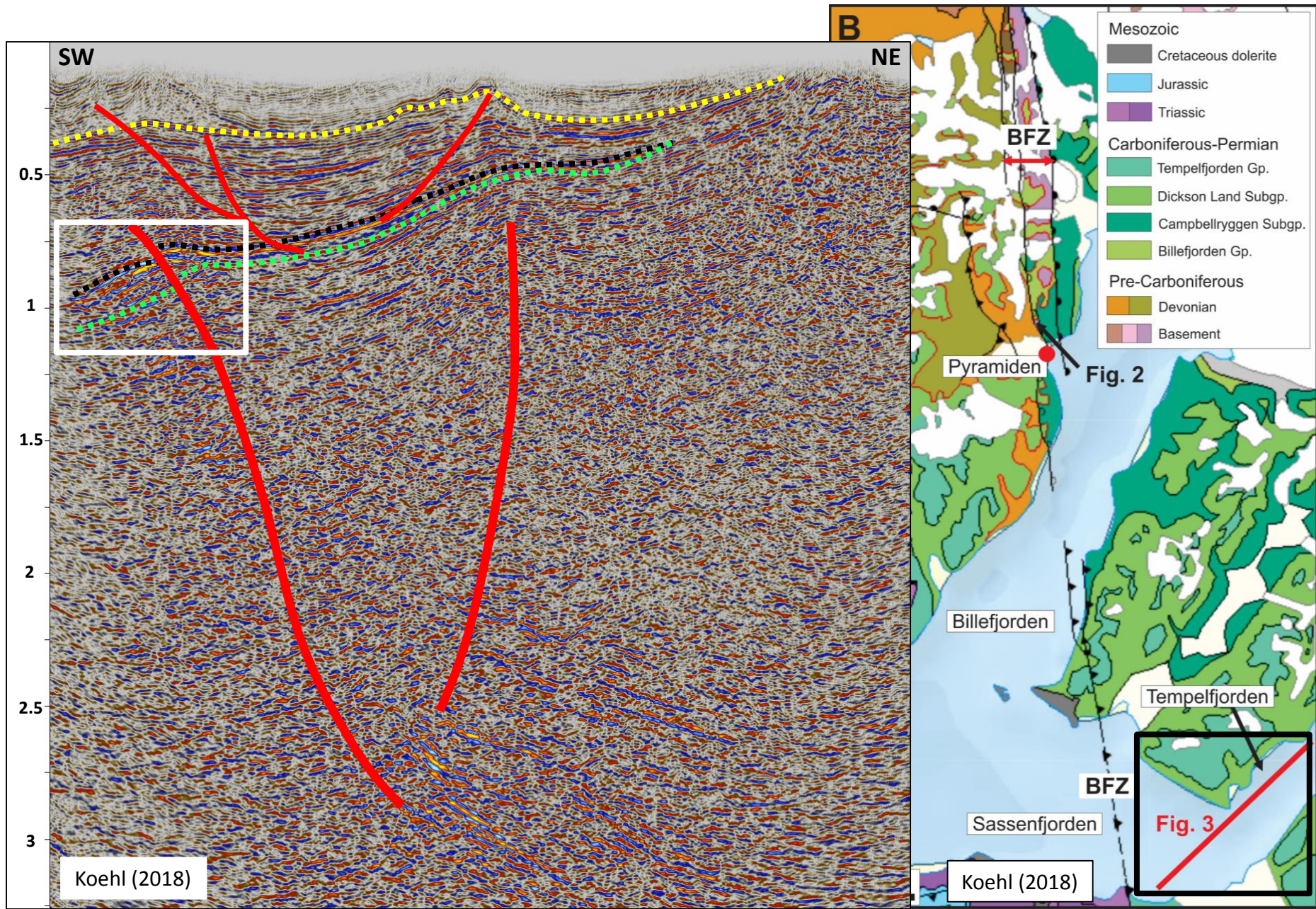
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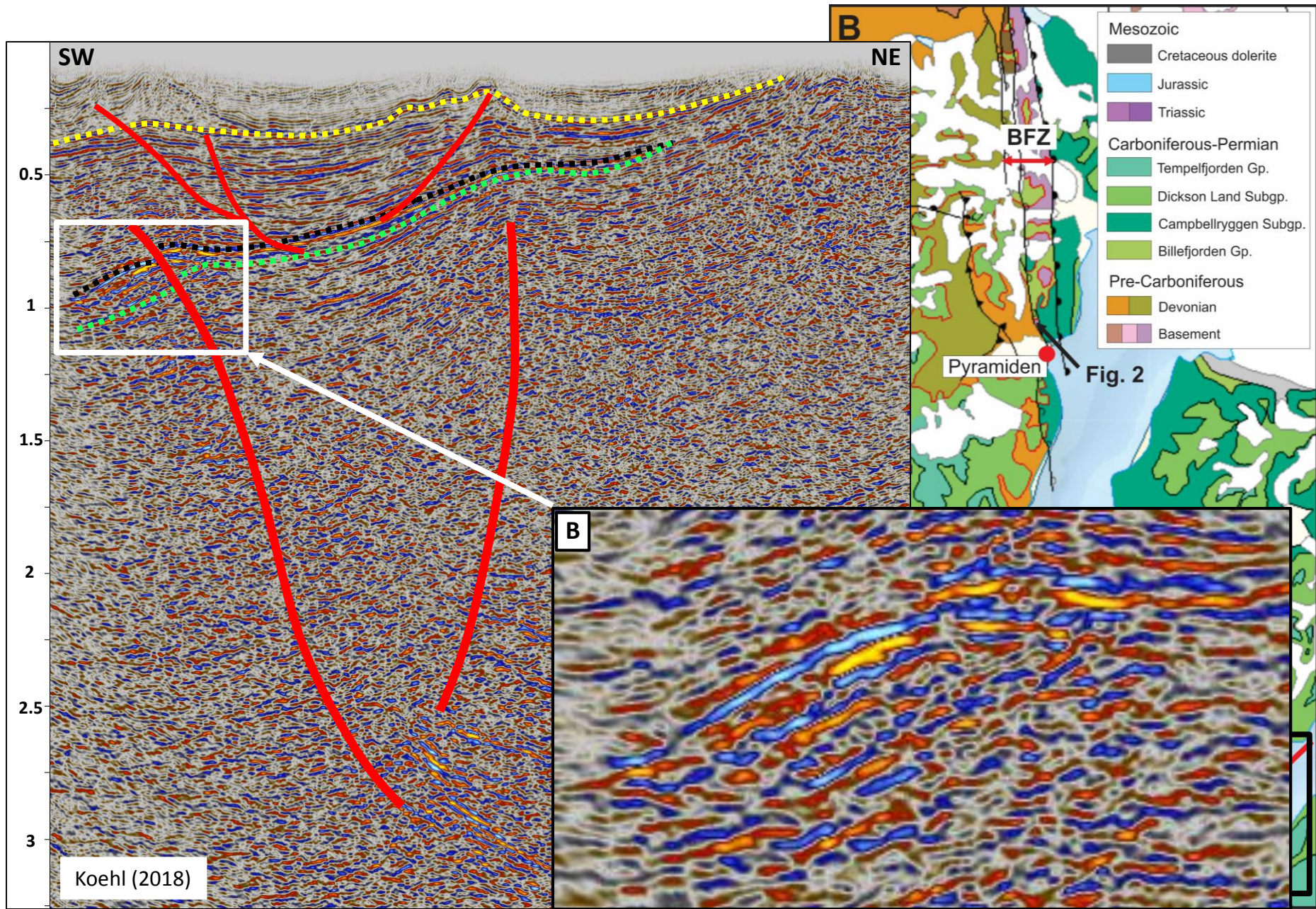
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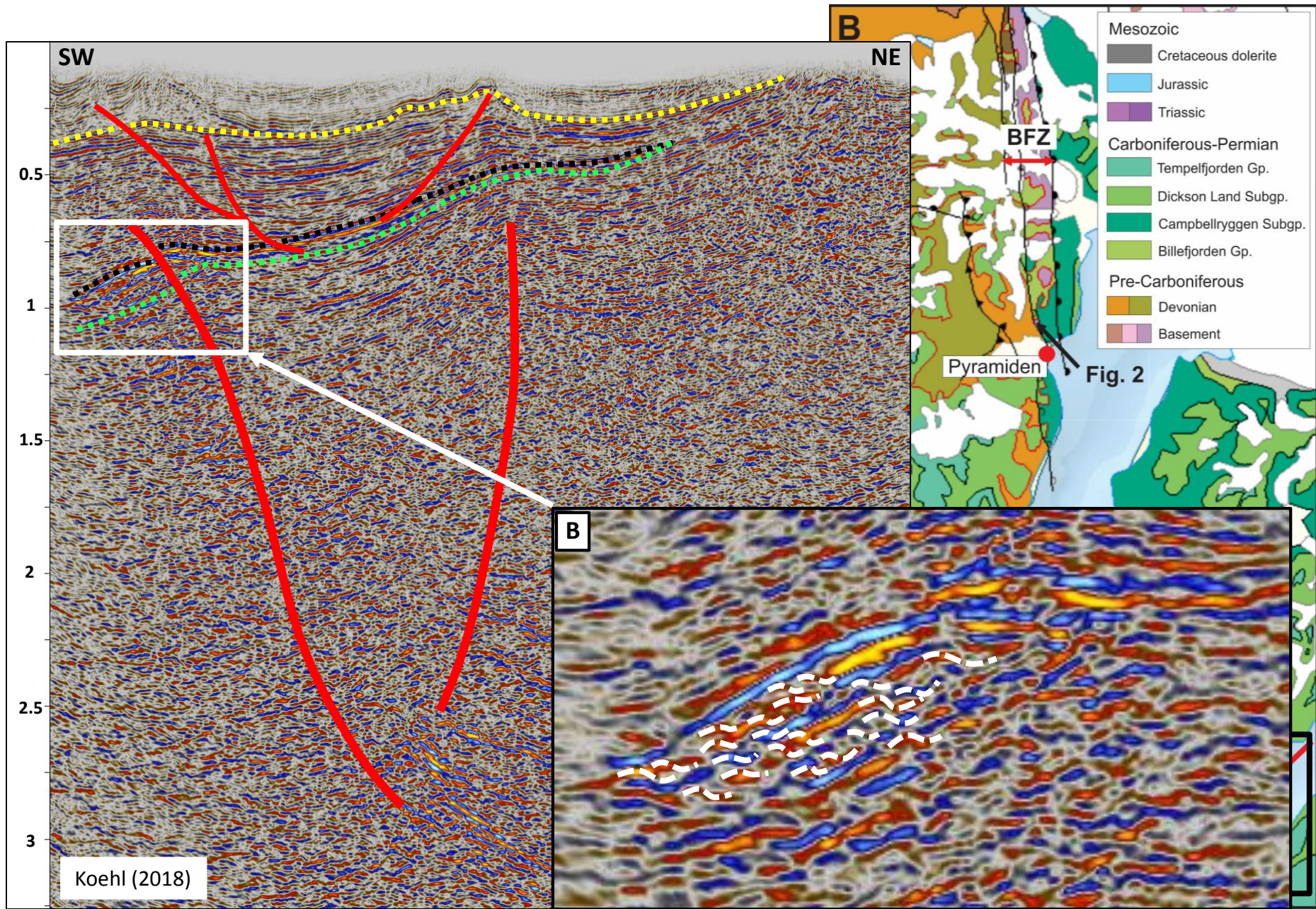
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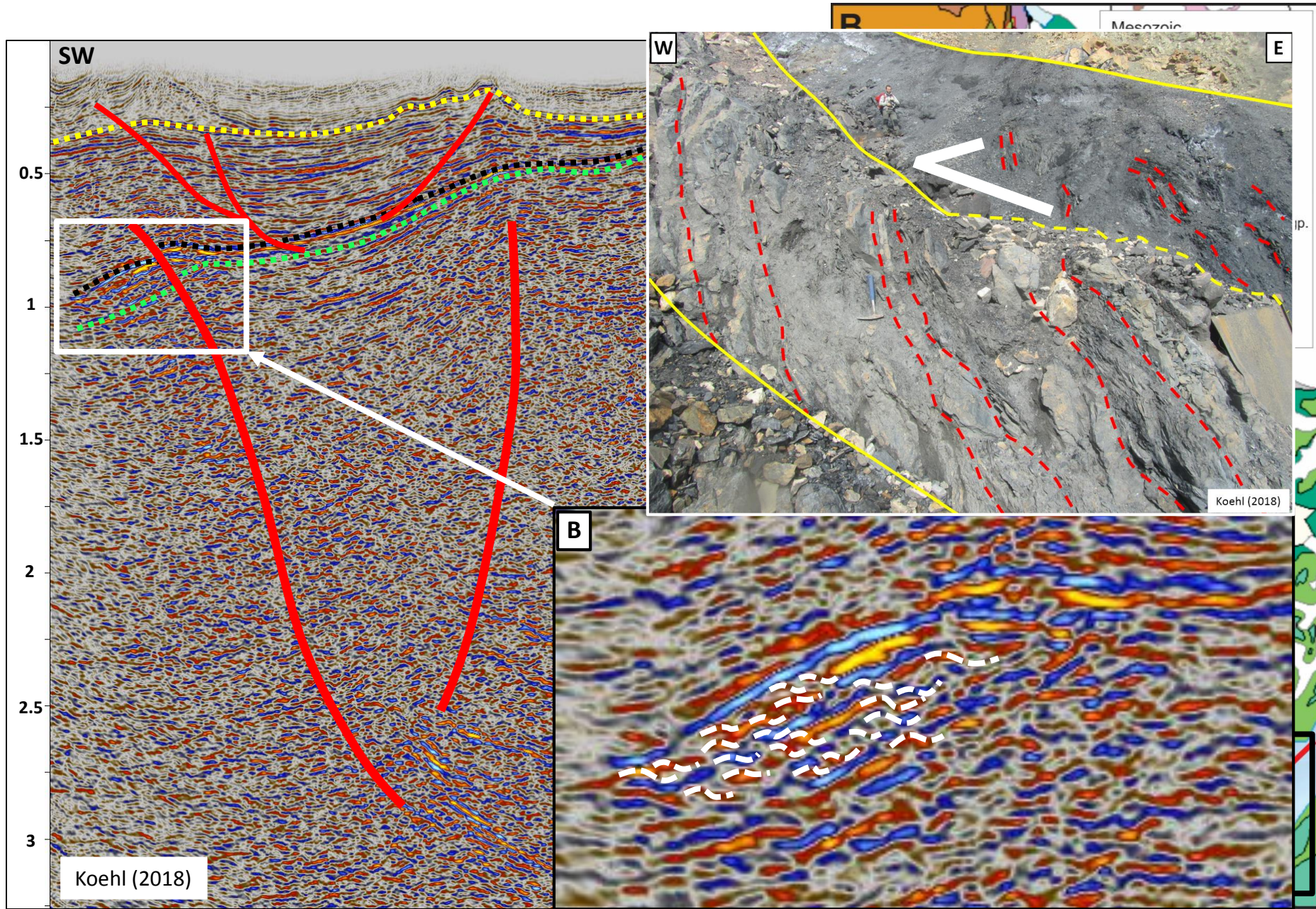
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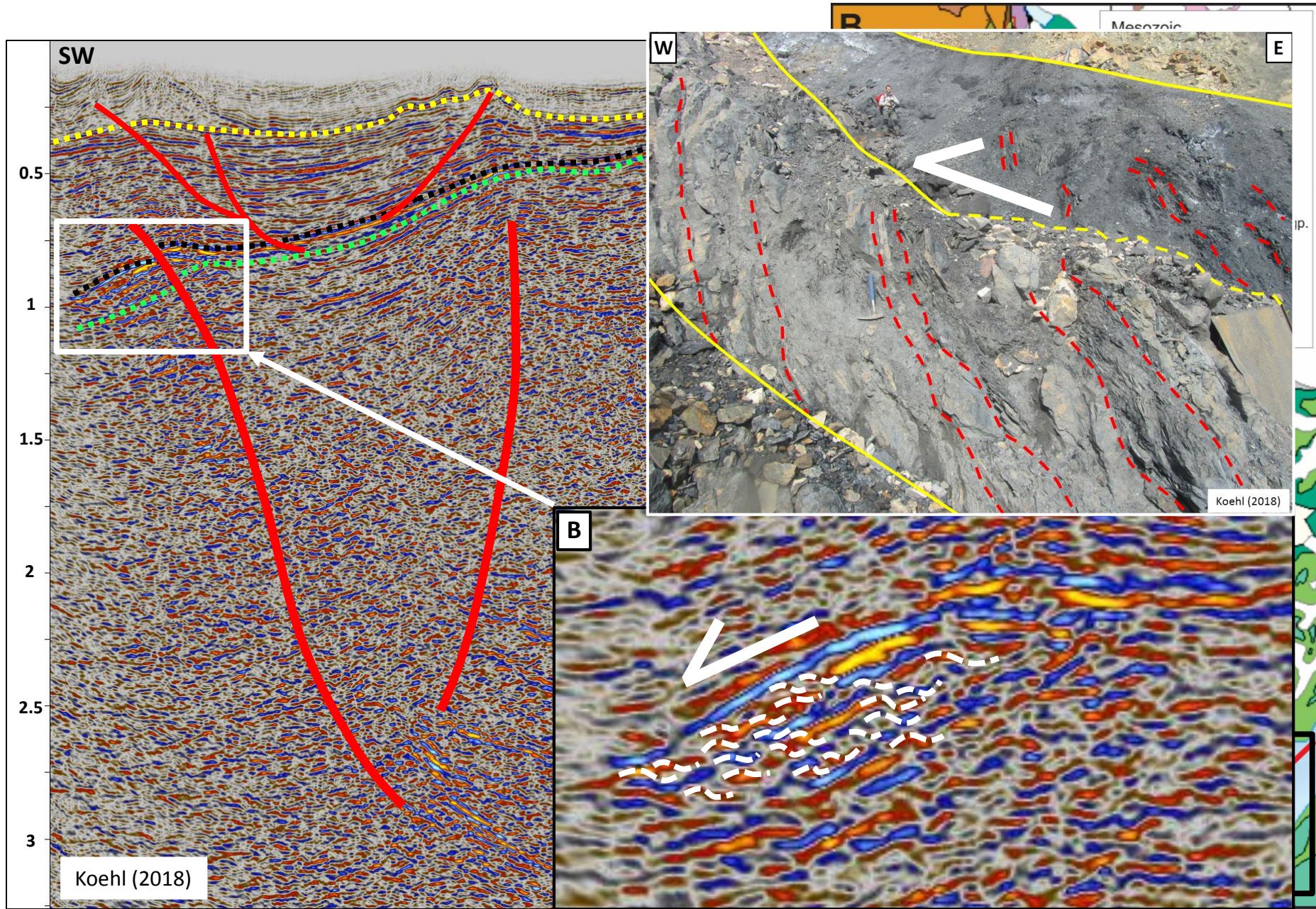
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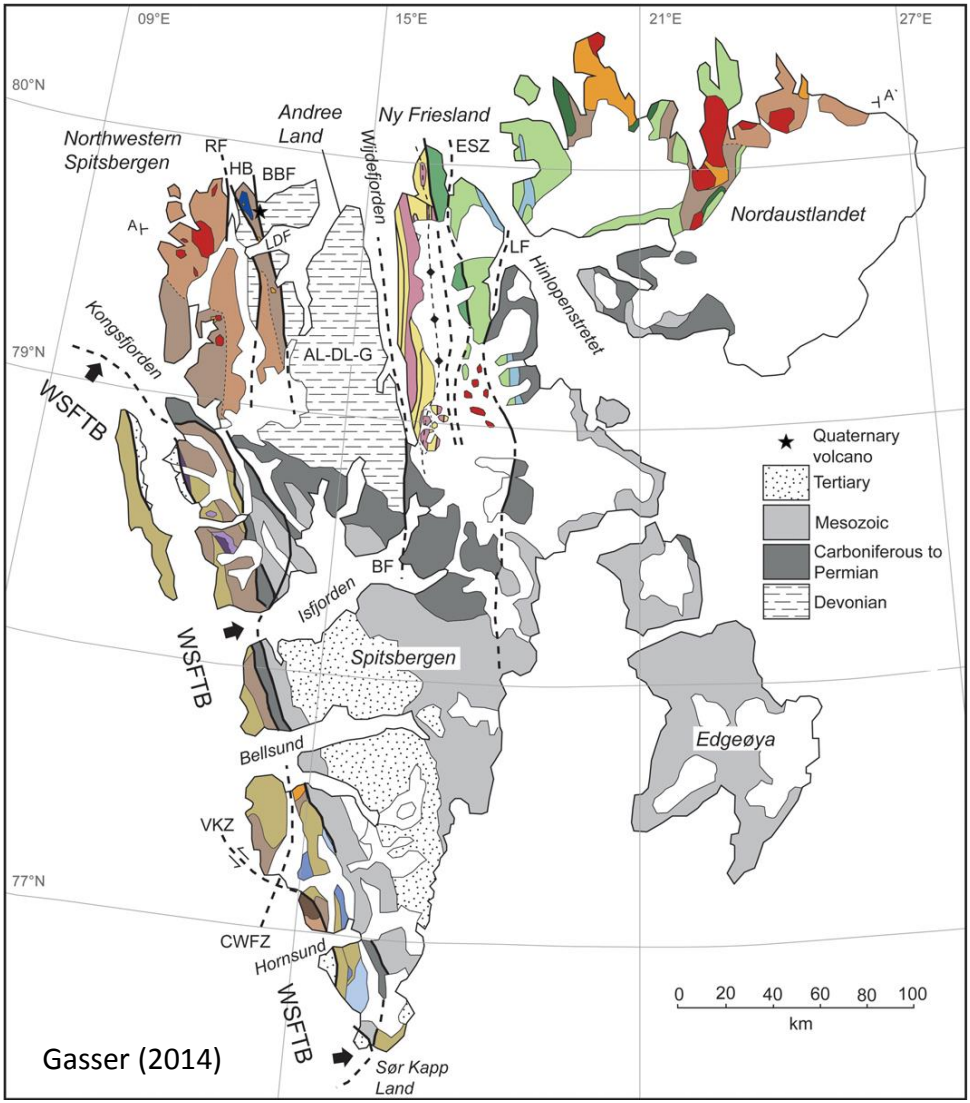
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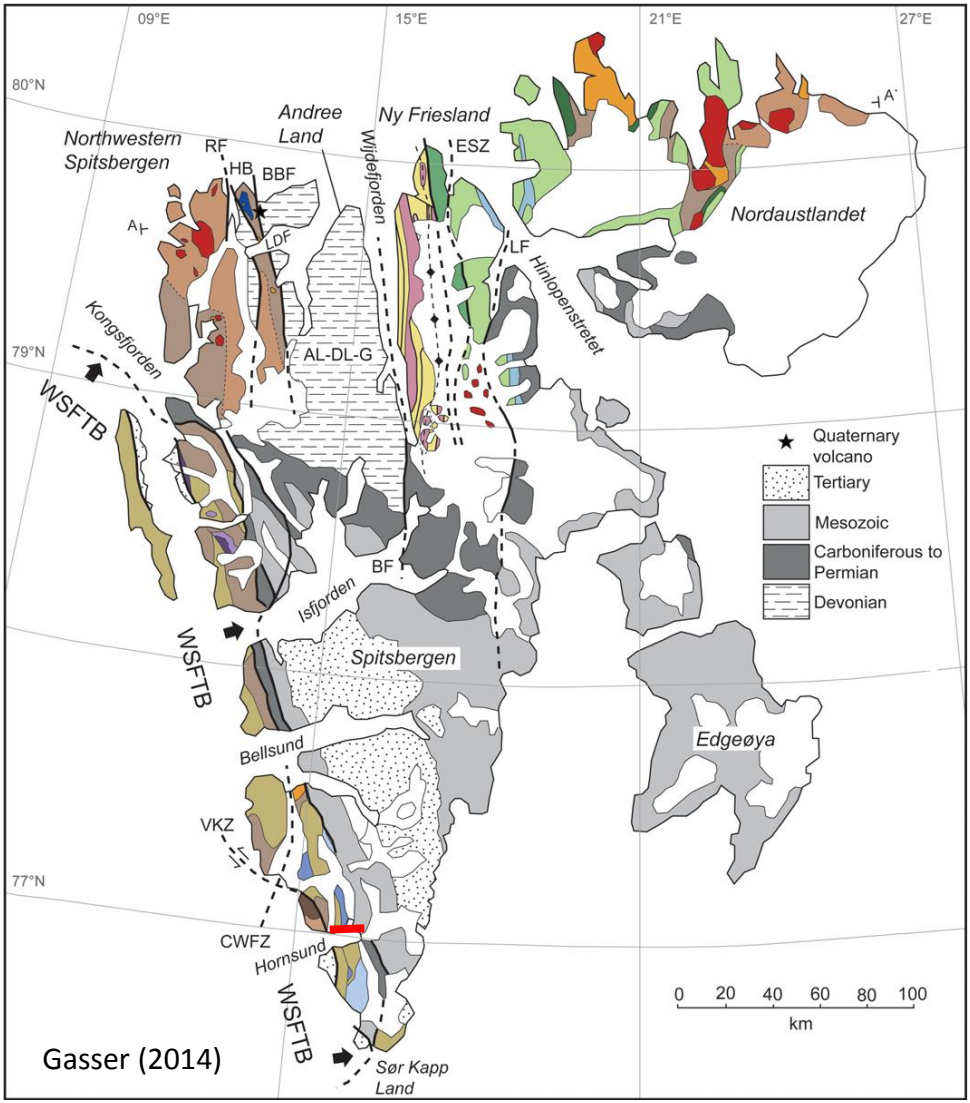
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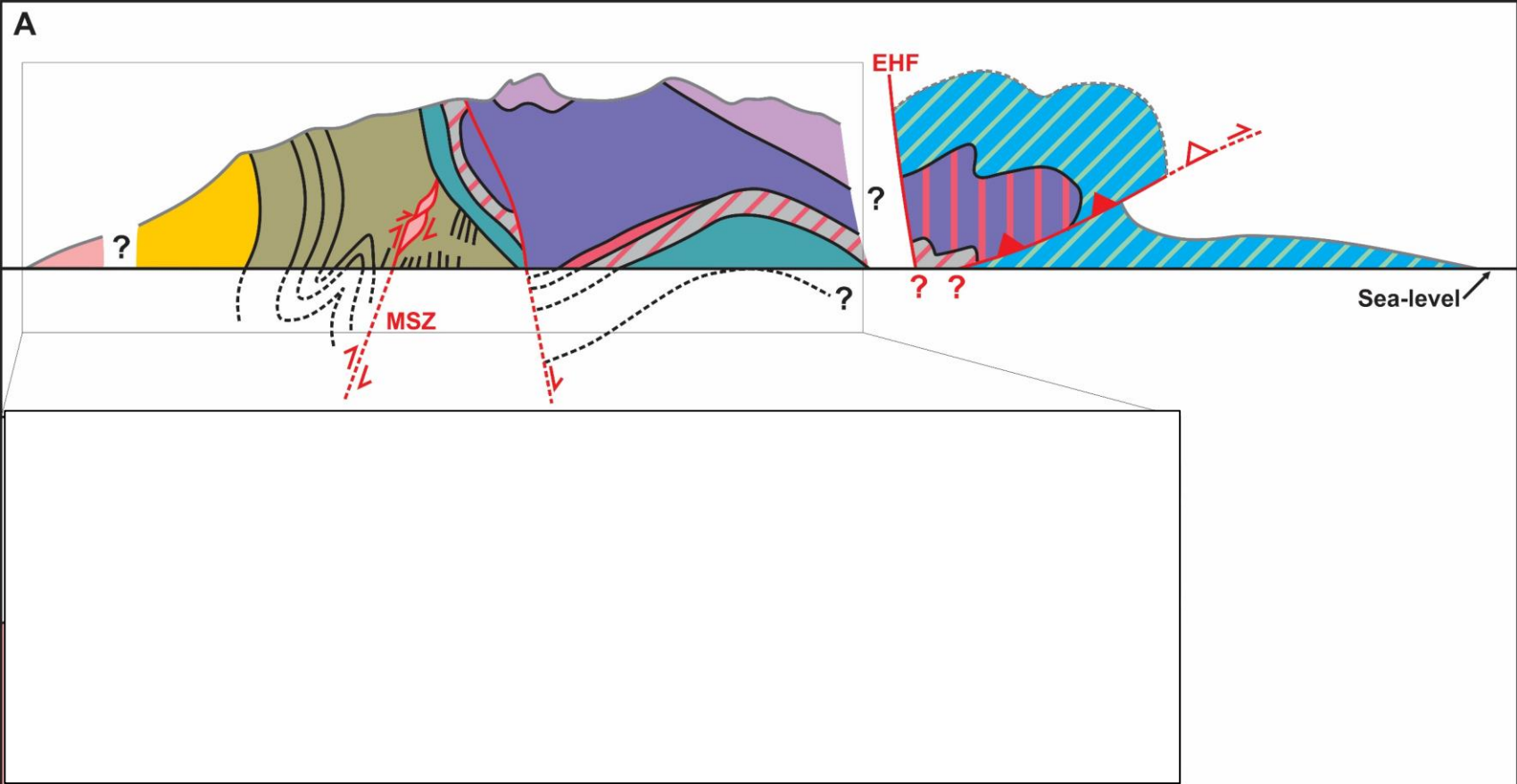
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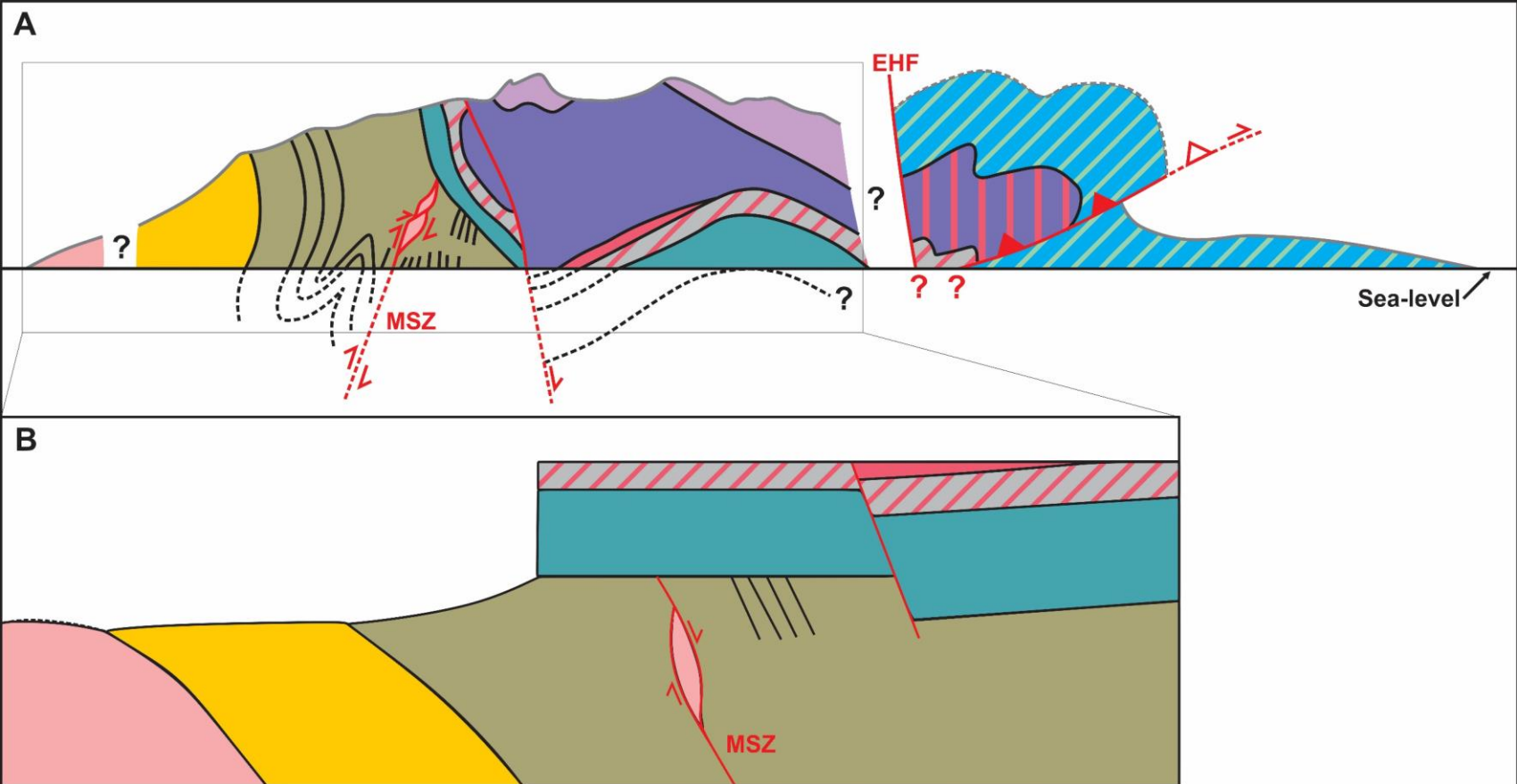
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Legend

- Jurassic–Cretaceous
- Triassic undifferentiated
- Triassic (Vardebukta, Tvillingodden, & Kistefjellet Fm.)
- Permian–Triassic
- Permian (Kapp Starostin Fm.)
- Basement
- Pennsylvanian–Permian (Treskelodden Fm.)
- Pennsylvanian (Hyrnefjellet Fm.)
- Upper Devonian–Mississippian (Adriabukta Fm.)
- Devonian (Marietoppen Fm.)

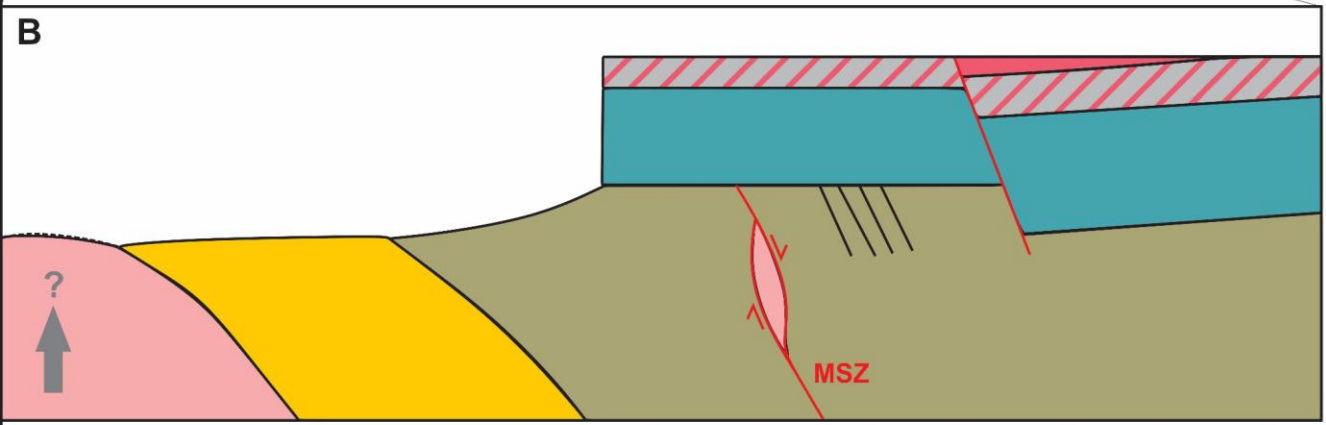
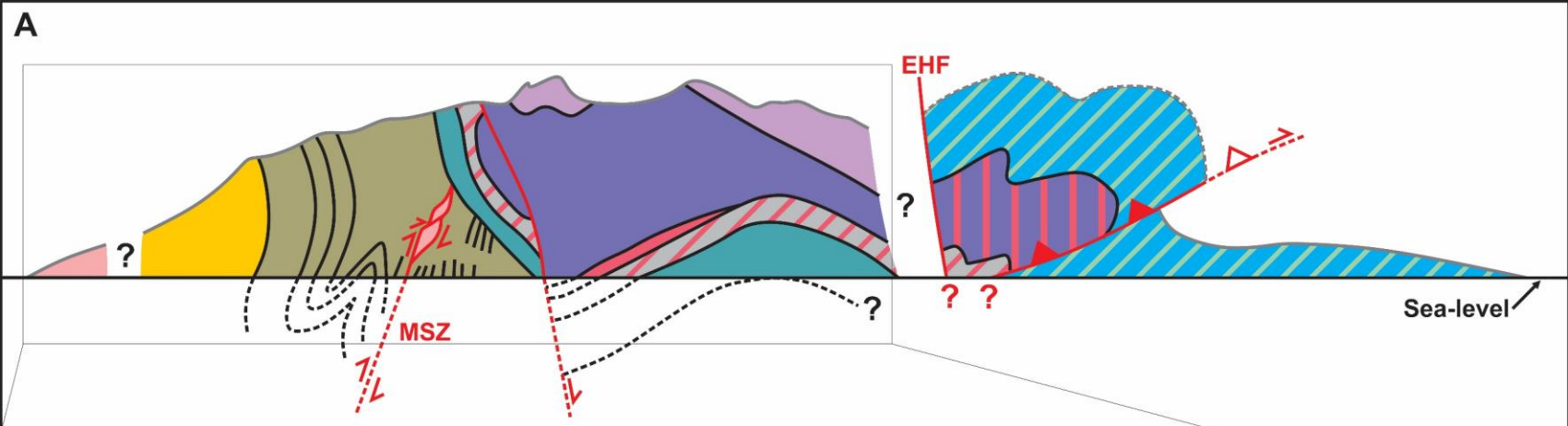
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Legend

- | | |
|--|--|
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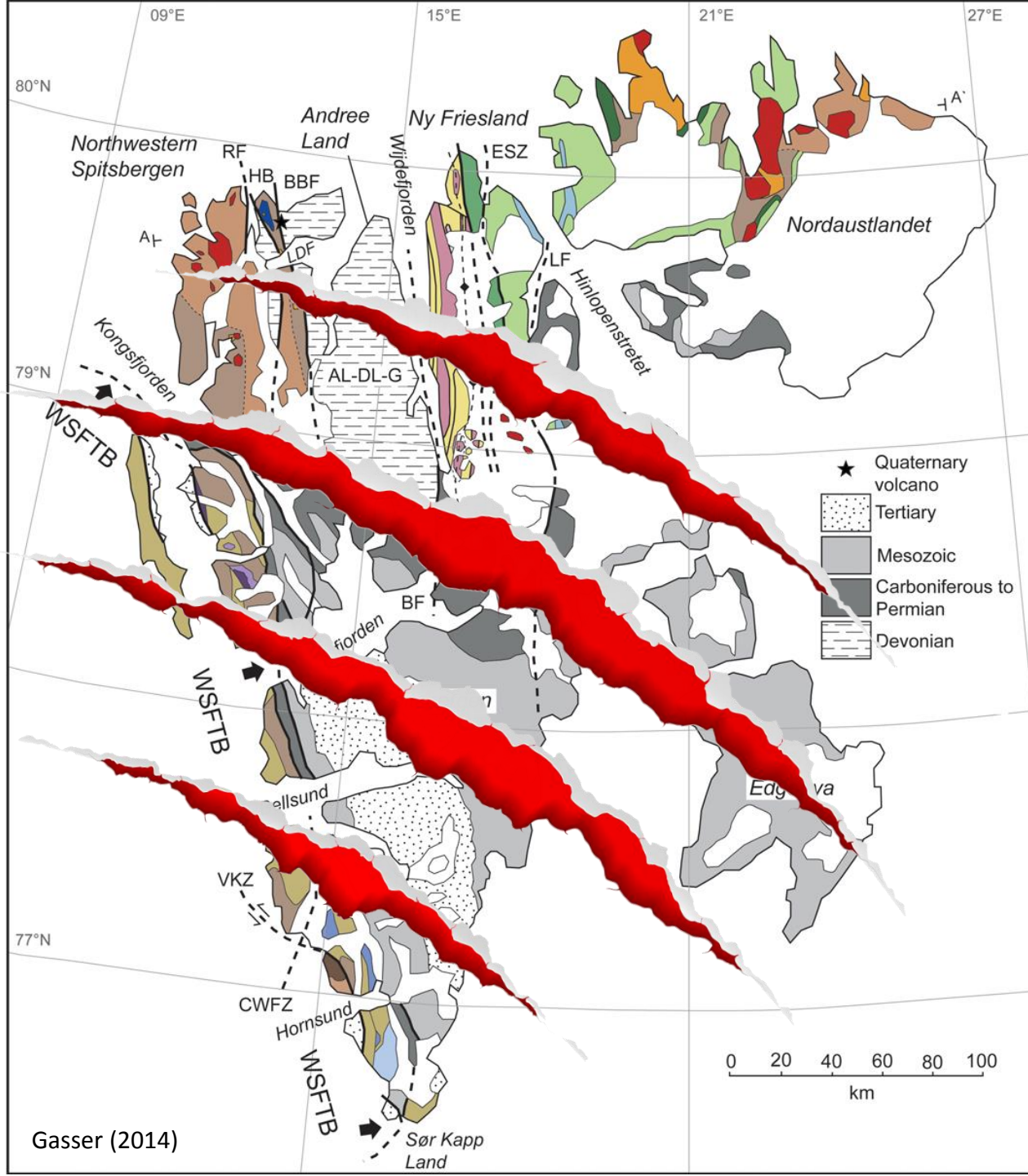
2

This geological map of the Svalbard archipelago illustrates various geological units and tectonic features. The map includes a coordinate grid with latitude lines at 77°N, 79°N, and 80°N, and longitude lines at 09°E, 15°E, 21°E, and 27°E. Key geographical features and tectonic zones are labeled, including Northwestern Spitsbergen, Andree Land, Ny Friesland, Nordaustlandet, Spitsbergen, Edgeøya, and Sør Kapp Land. Specific tectonic zones are marked with dashed lines and arrows: WSFTB (Western Spitsbergen Fault Tectonic Belt) near Kongsfjorden, MSETB (Mid-Spitsbergen Extensional Tectonic Belt) near Isfjorden and Homsund, and another MSETB near Sør Kapp Land. Other labeled features include RF, HB, BBF, LDF, AL-DL-G, ESZ, LF, Hinlopenstrøket, BF, and VKZ. A legend in the lower right corner defines the symbols and colors used for geological units: a star for Quaternary volcano, a dotted pattern for Tertiary, a light gray box for Mesozoic, a dark gray box for Carboniferous to Permian, and a hatched pattern for Devonian. A scale bar at the bottom right indicates distances from 0 to 100 km. The source 'Gasser (2014)' is noted in the bottom left corner.

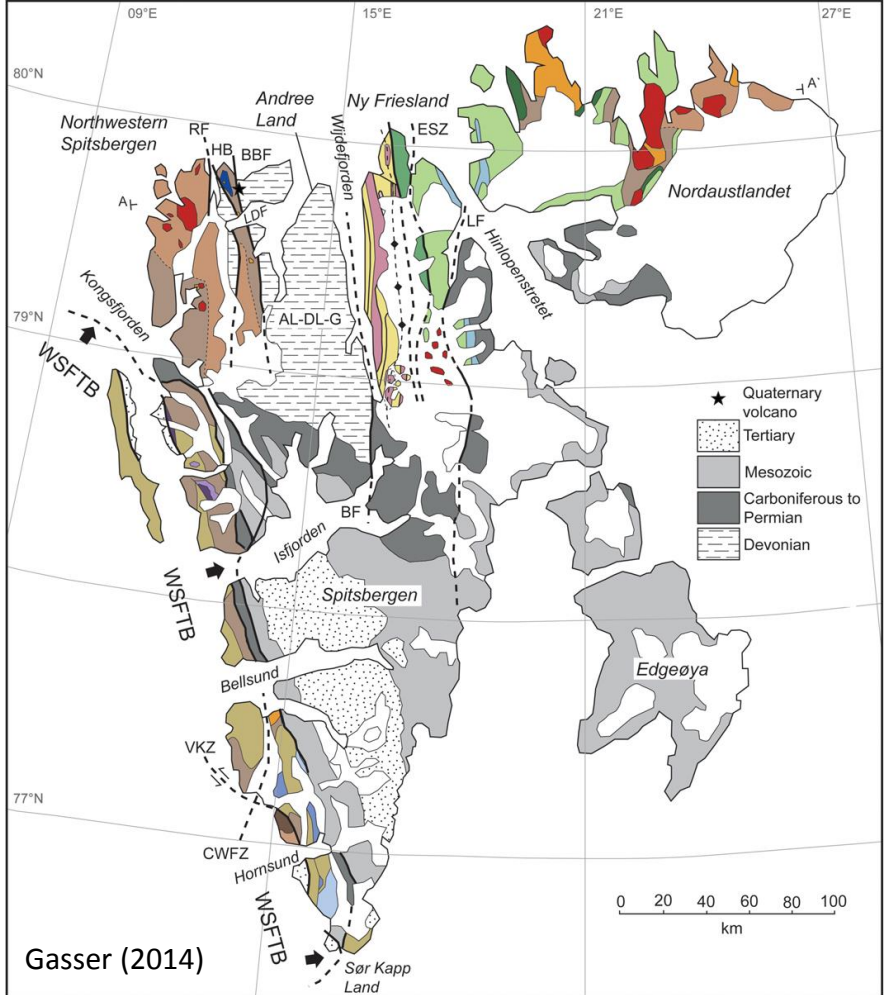
★ Quaternary volcano
 Tertiary
 Mesozoic
 Carboniferous to Permian
 Devonian

0 20 40 60 80 100
 km

Gasser (2014)

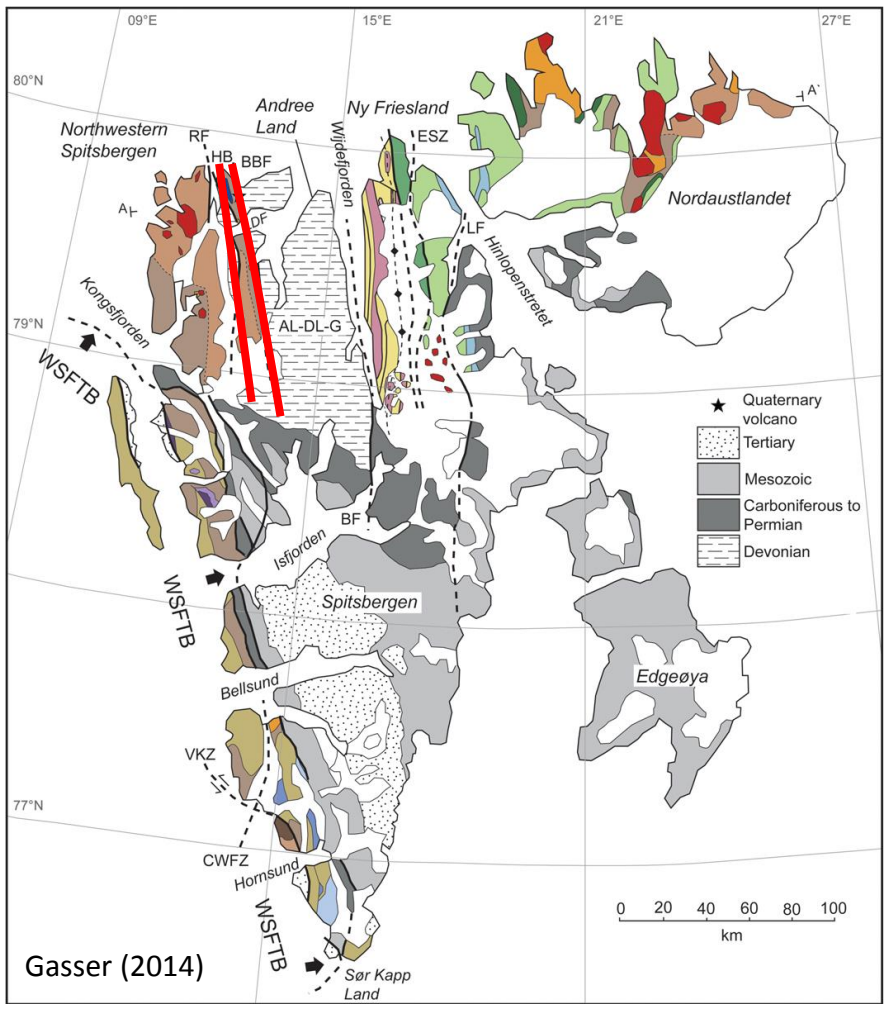


2 A major N–S-trending basement ridge in Isfjorden may represent the southwards continuation of the Bockfjorden Anticline core complex.



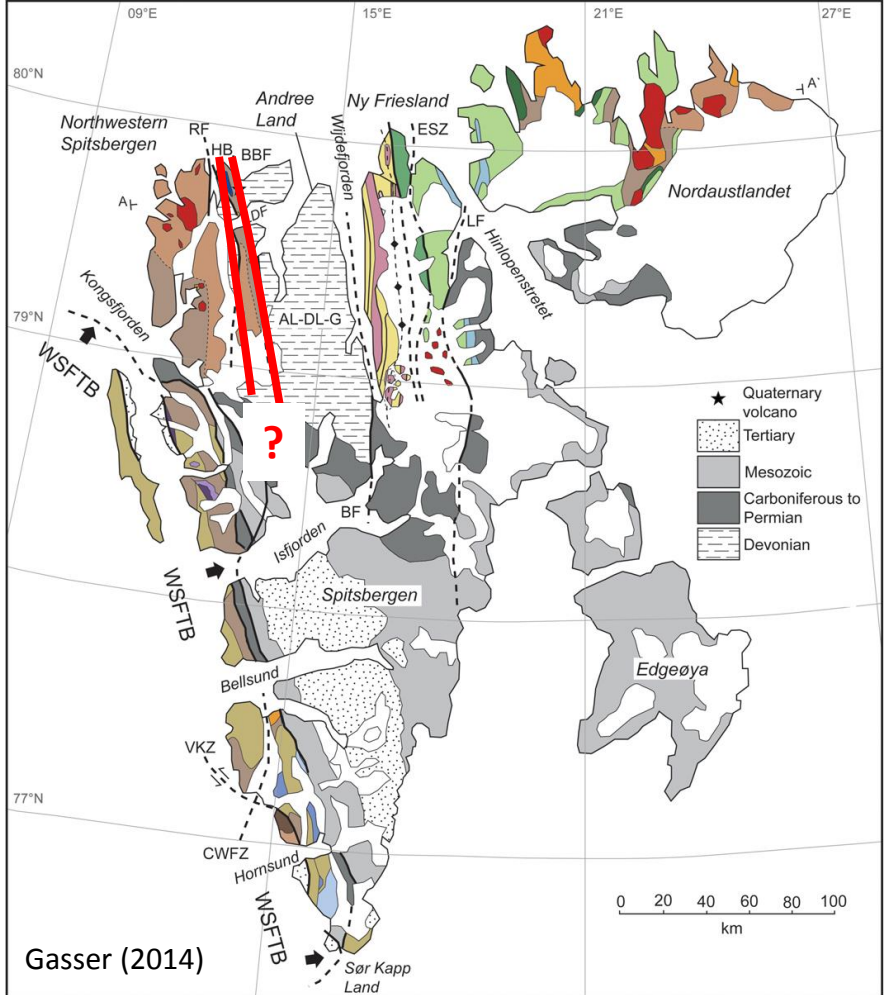
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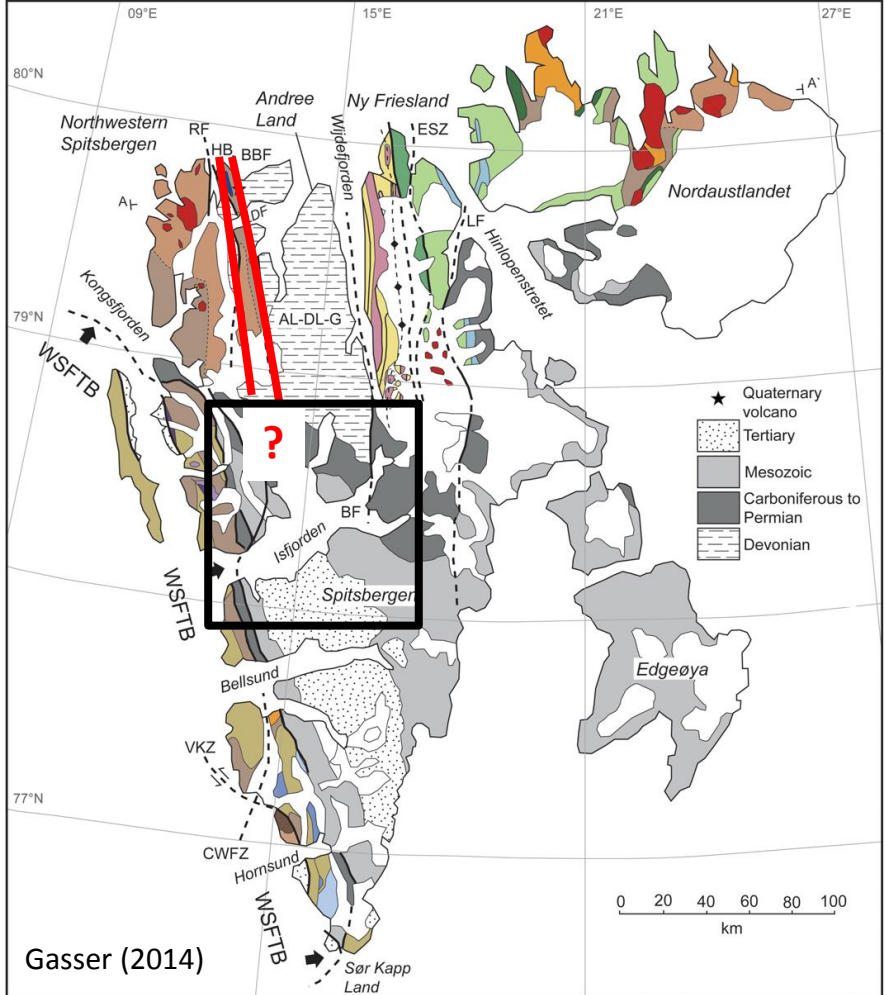


2

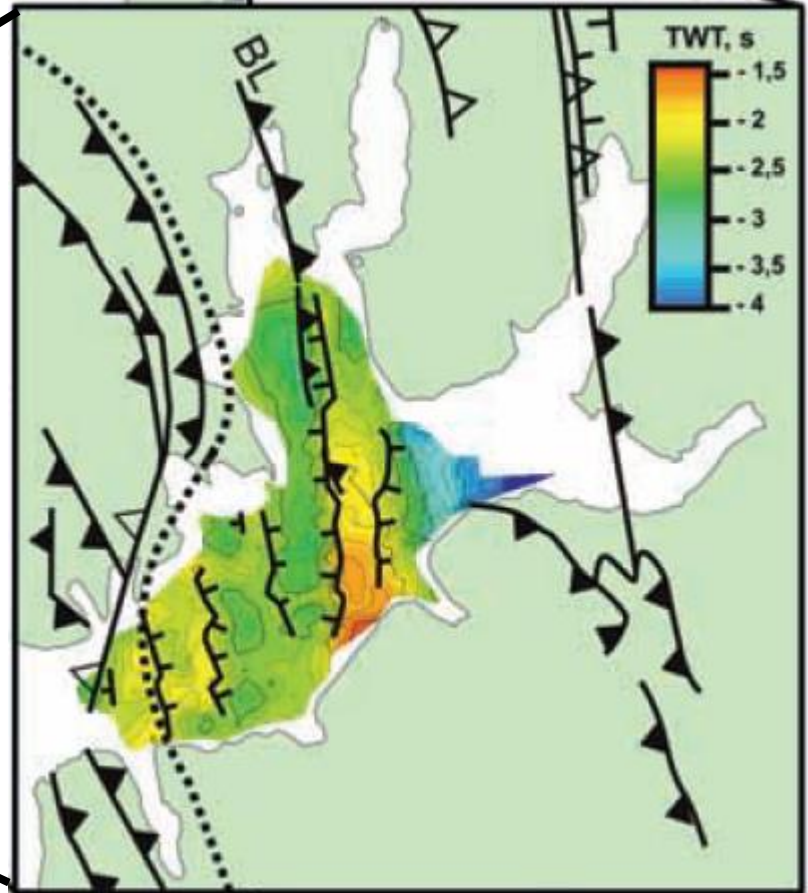
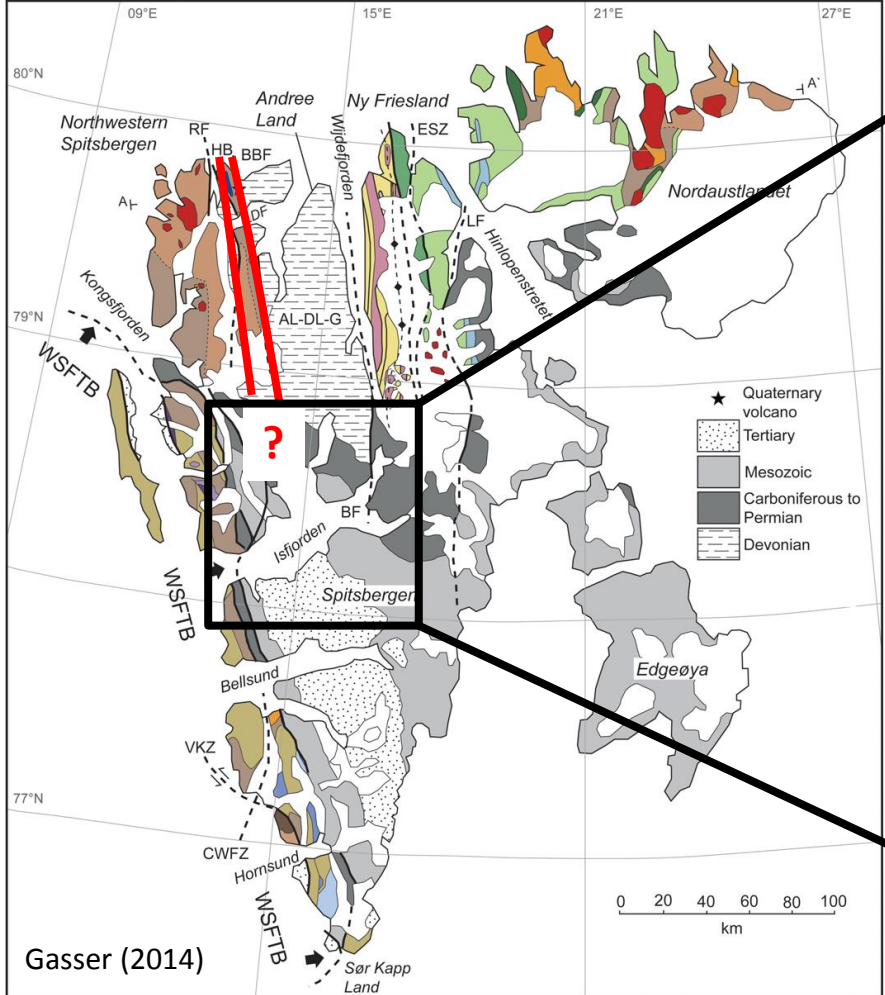
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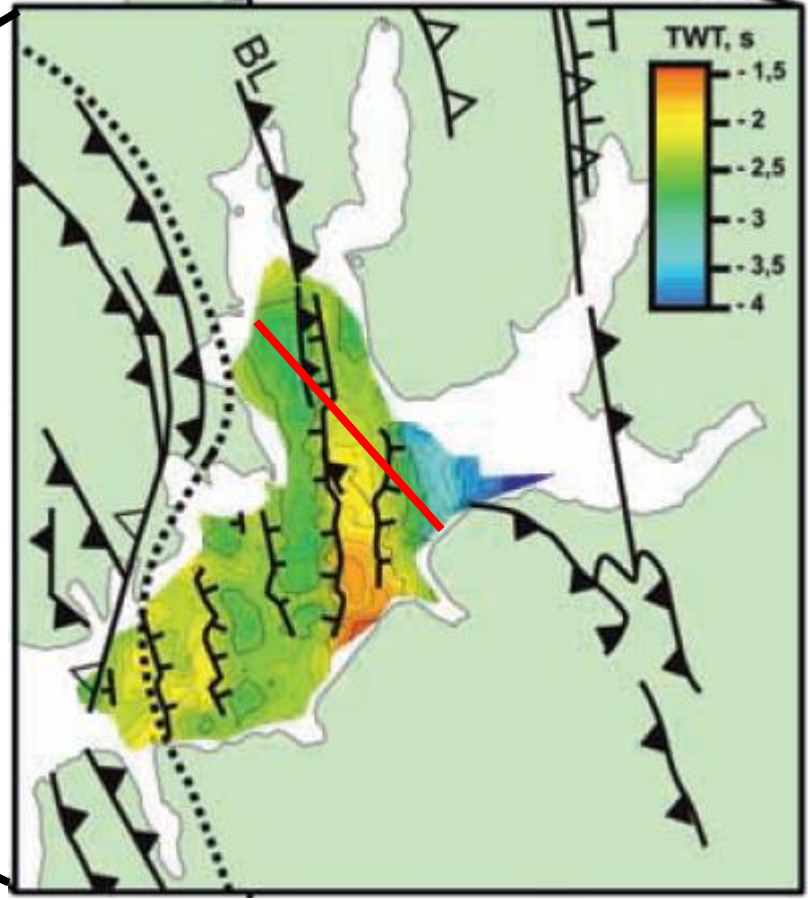
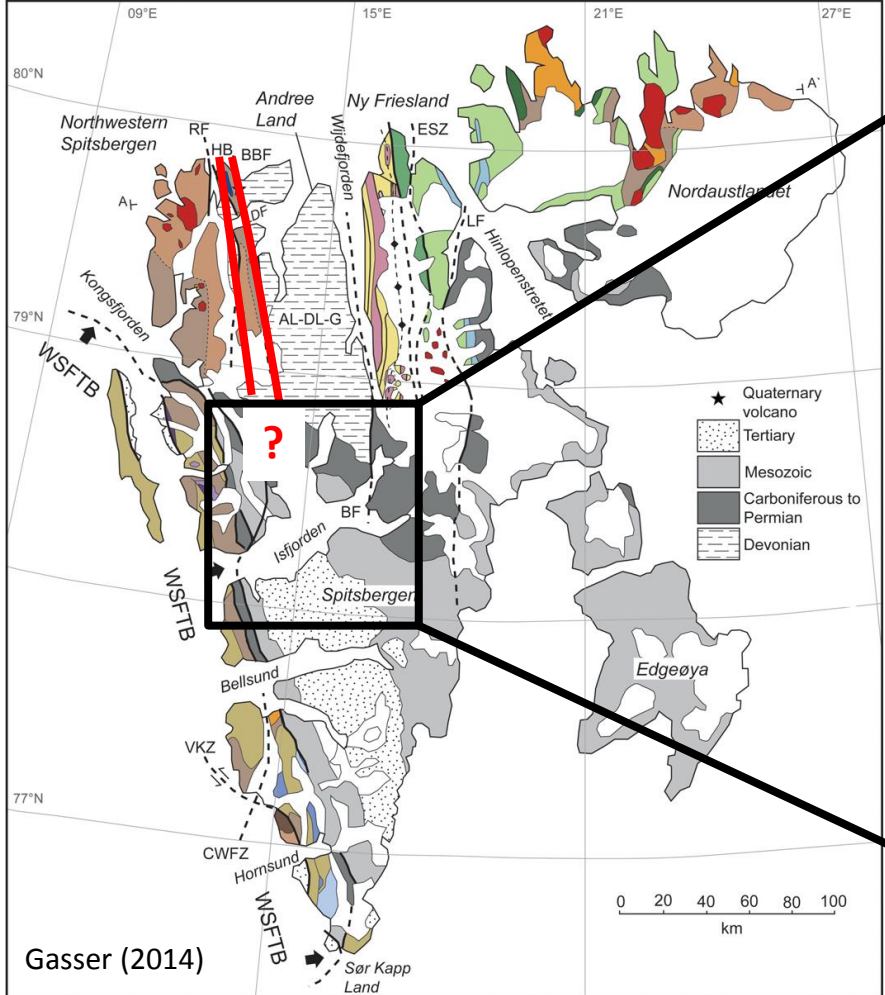


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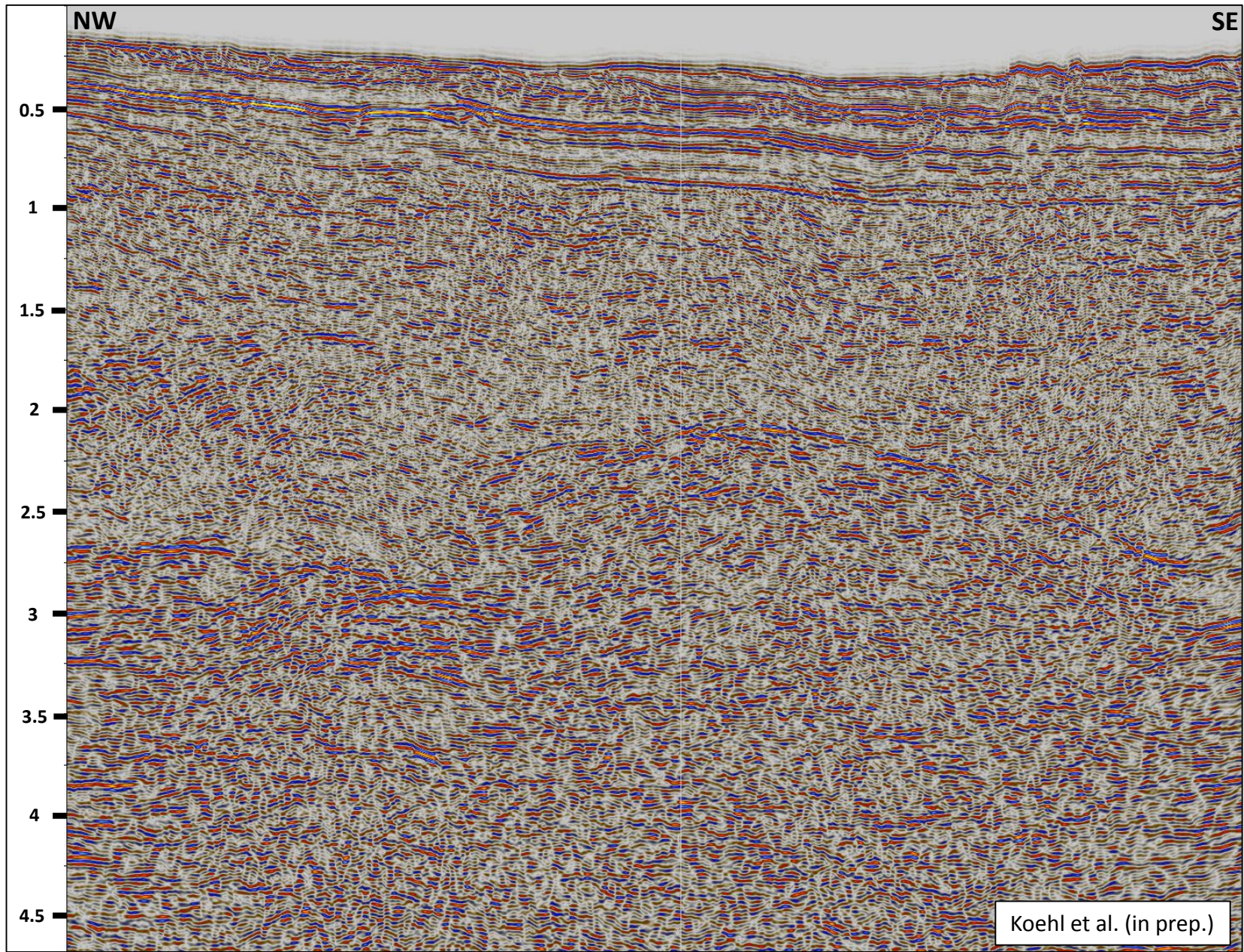
Blinova et al. (2013)

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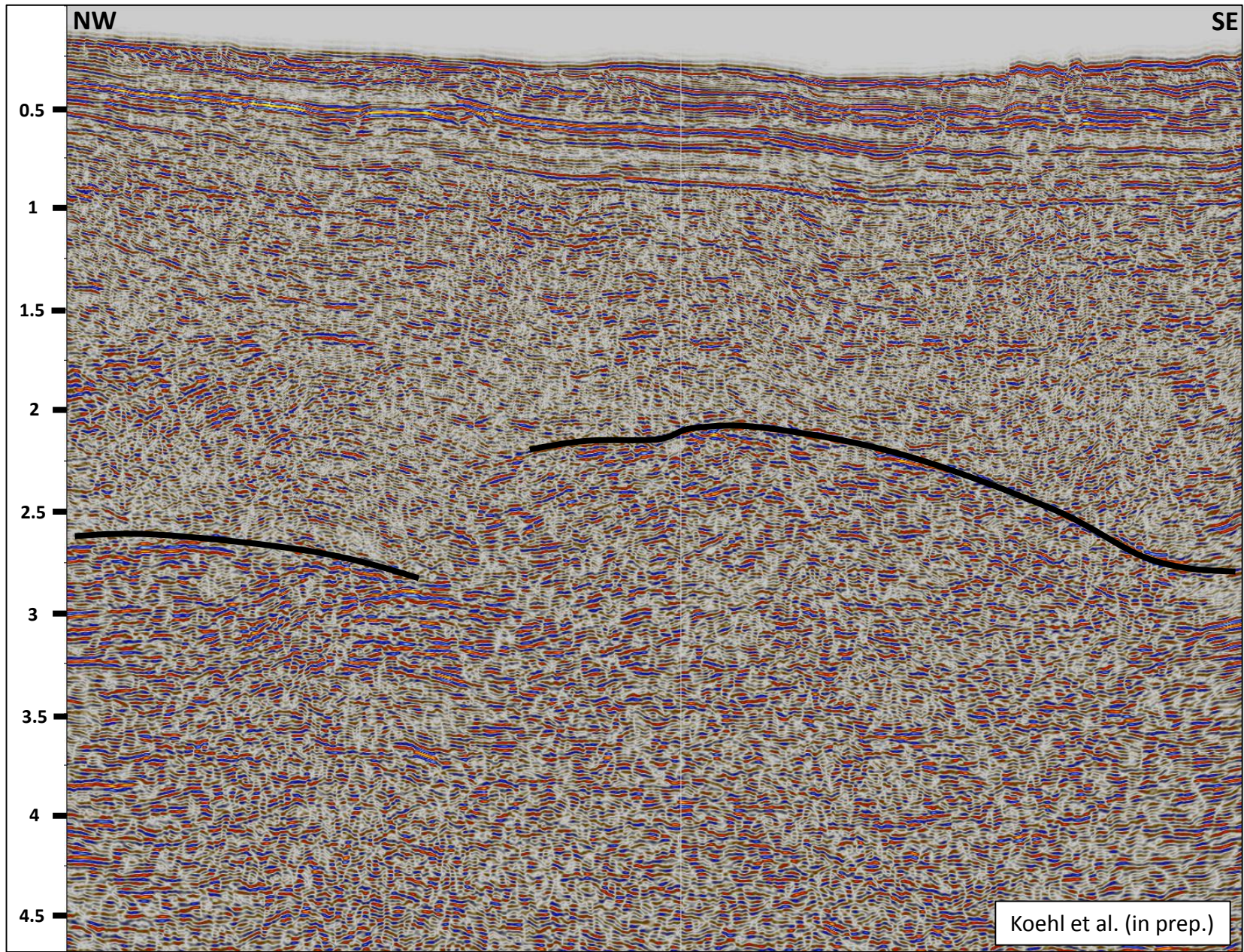


Blinova et al. (2013)

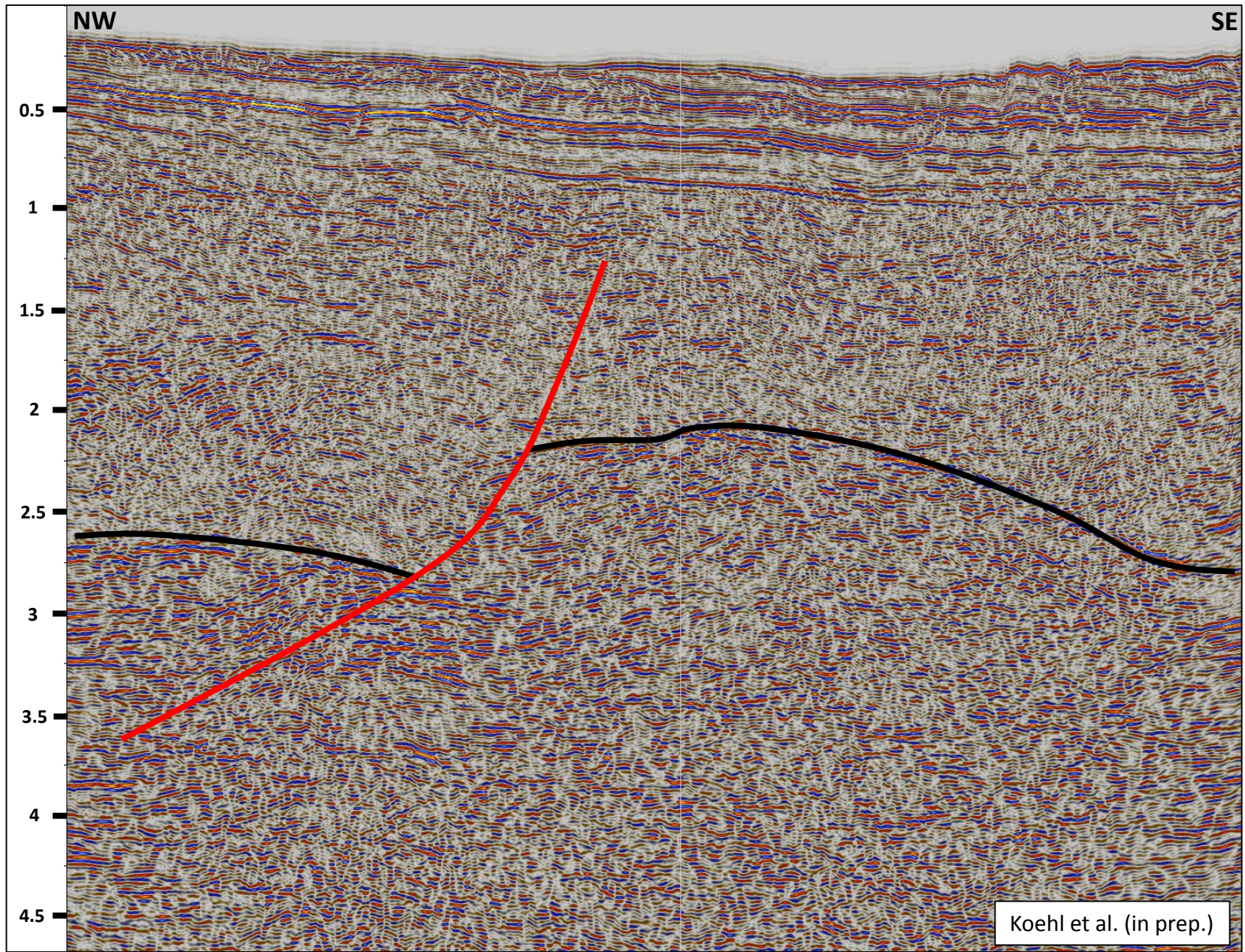
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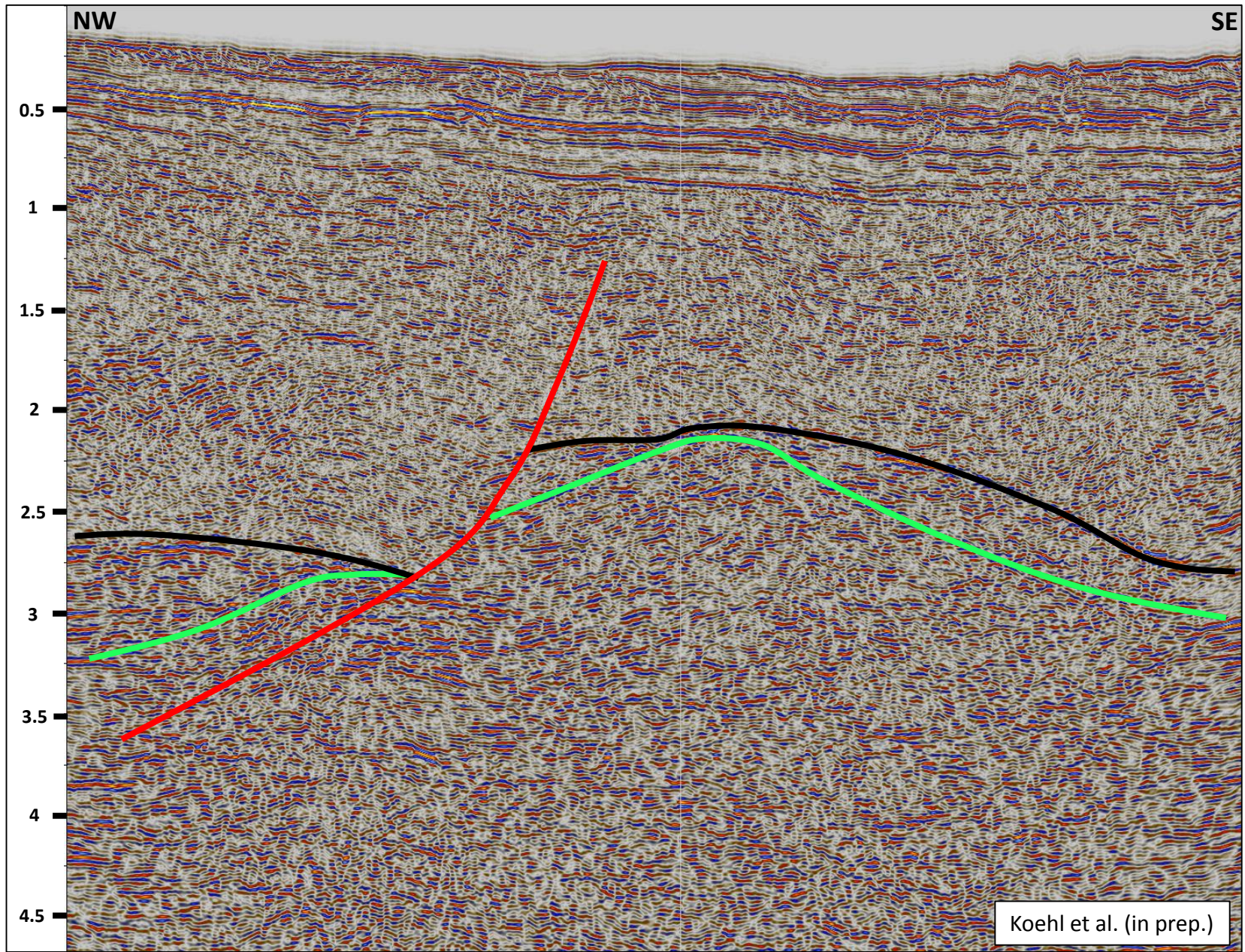
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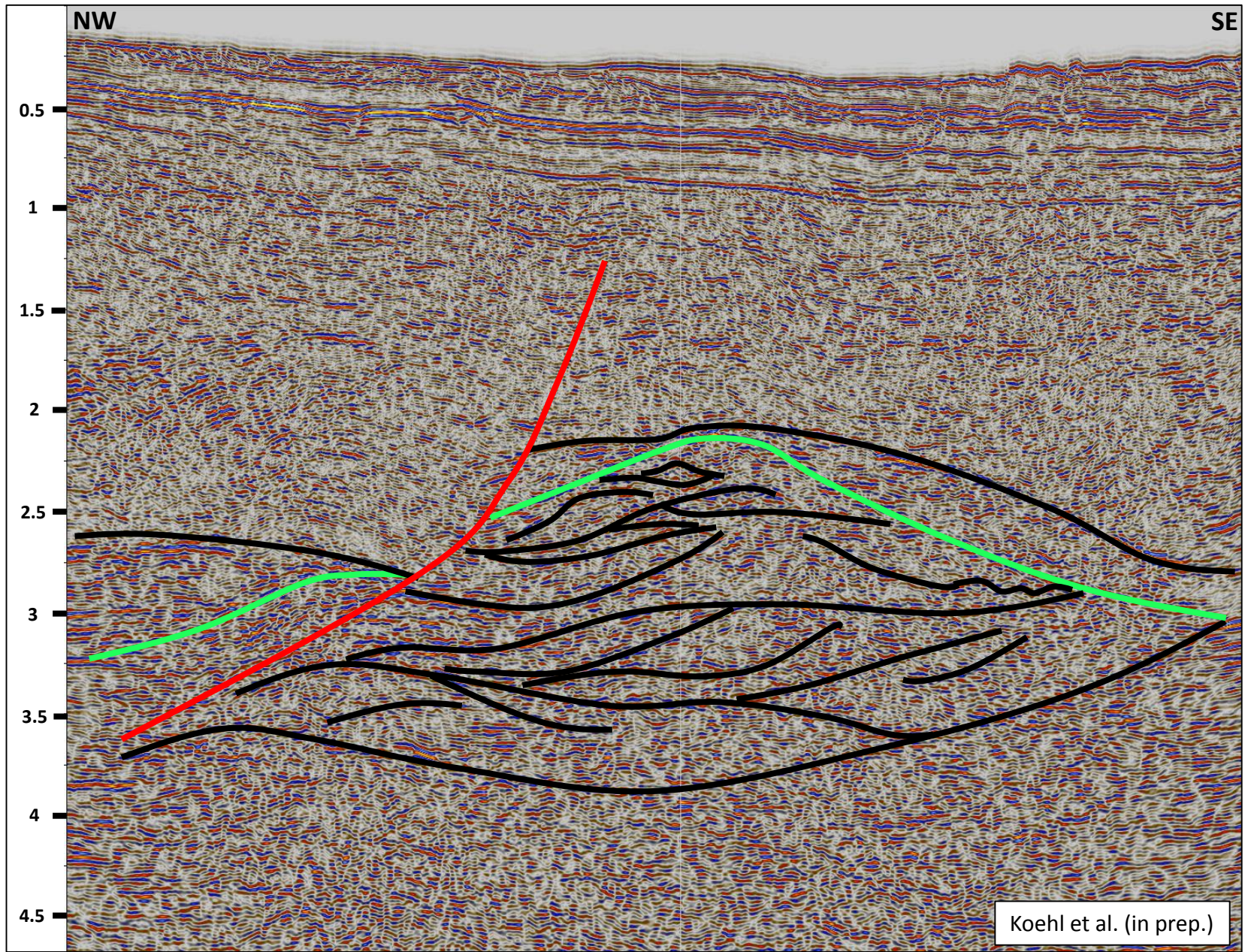
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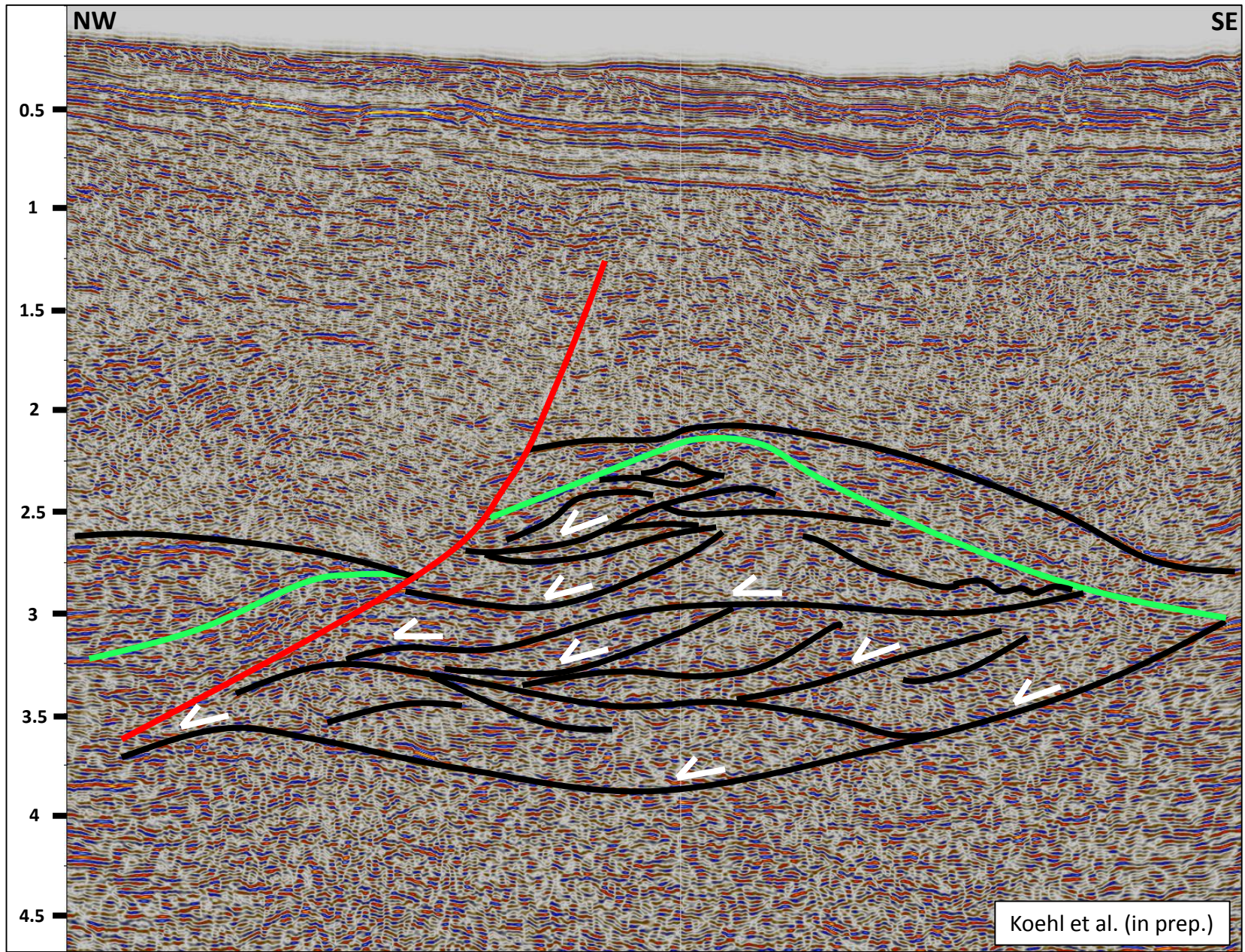
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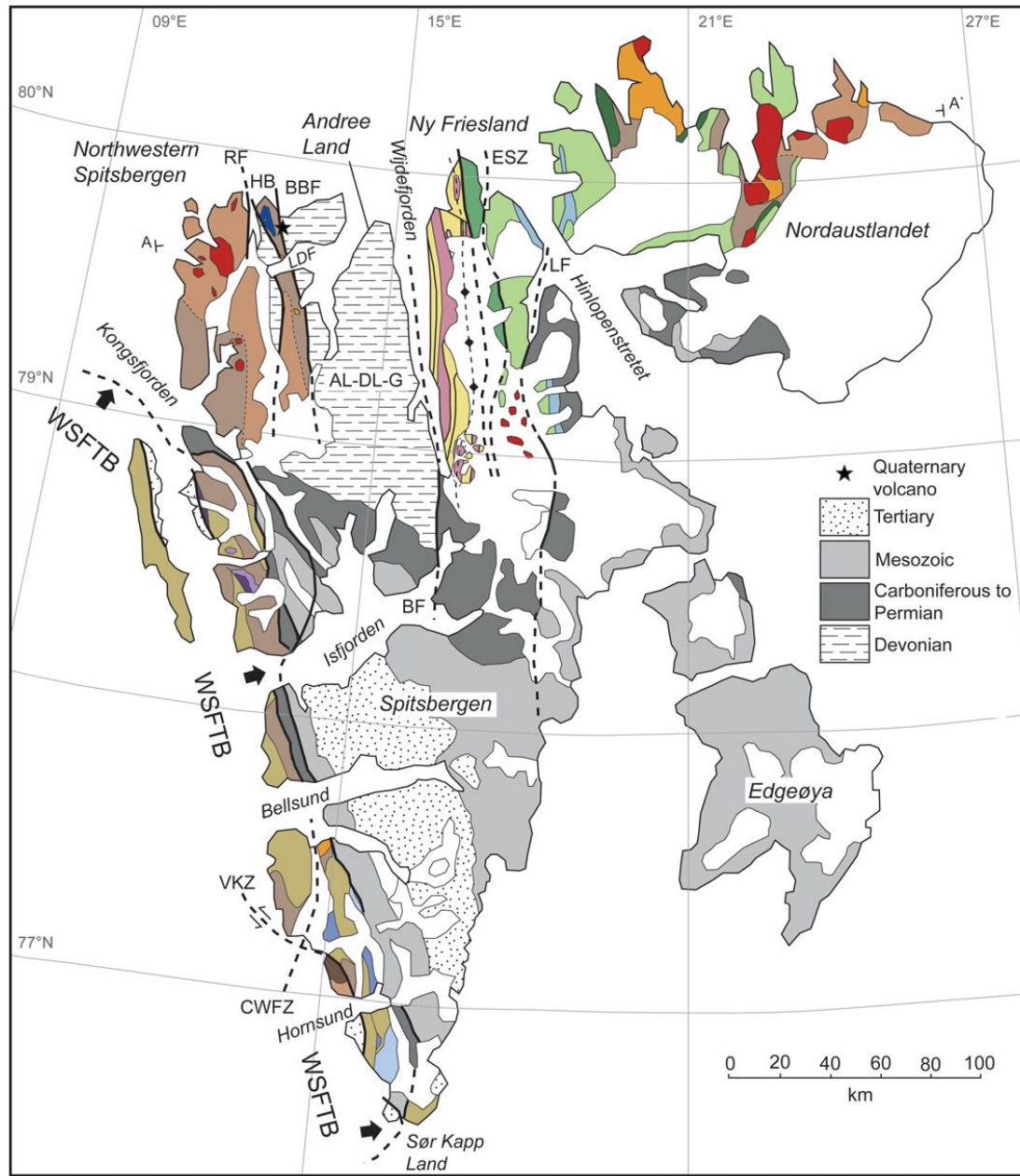
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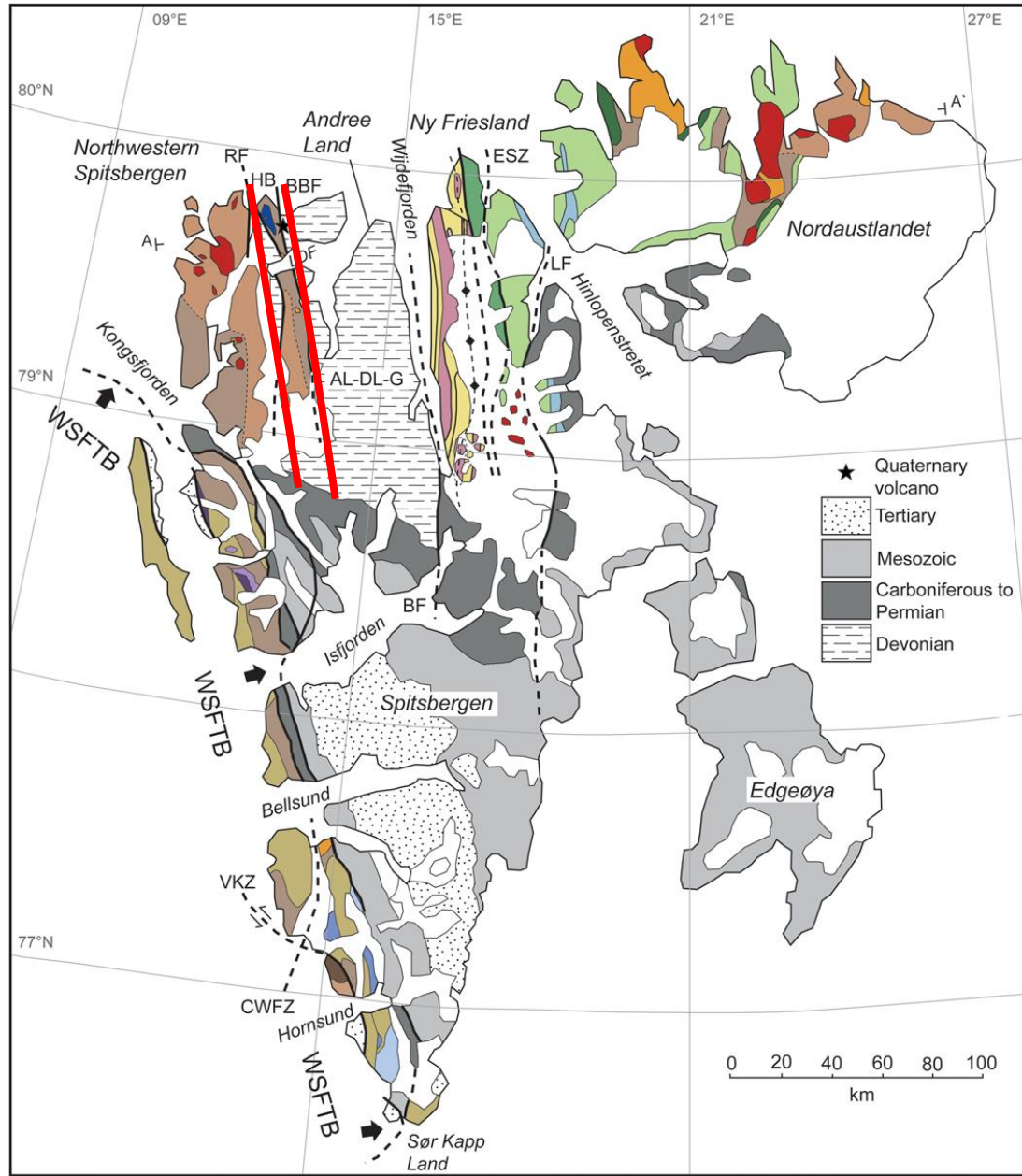
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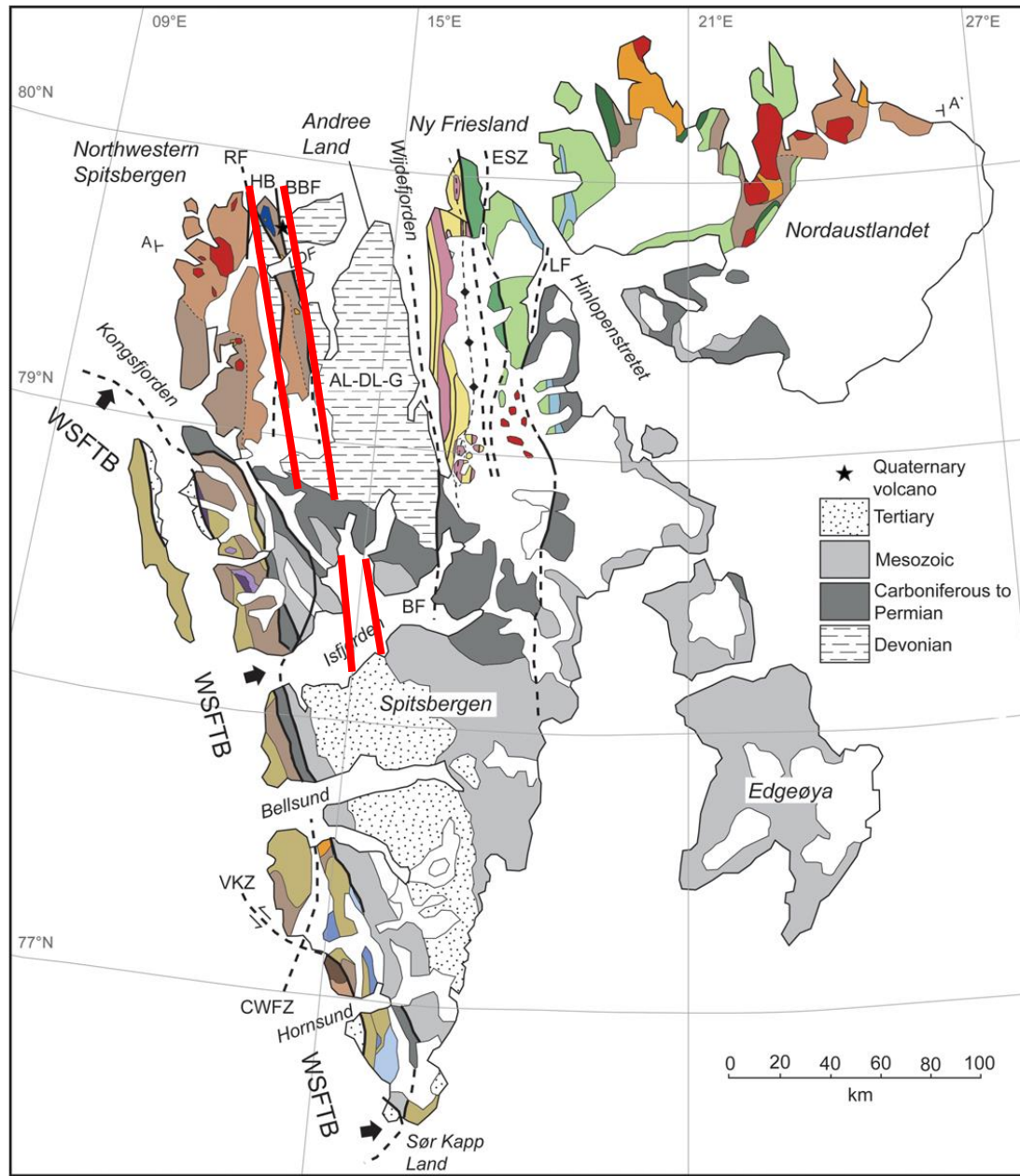
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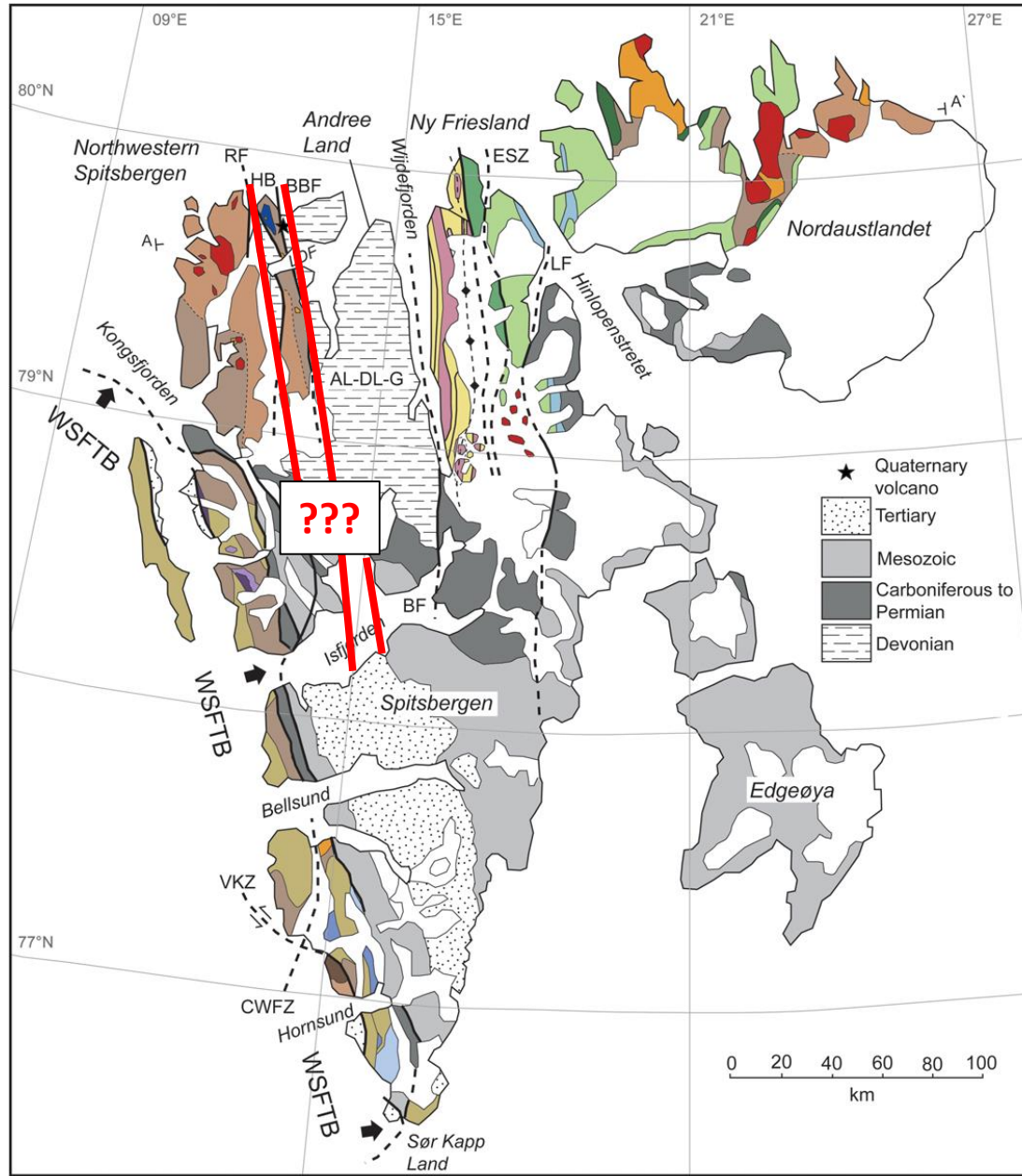
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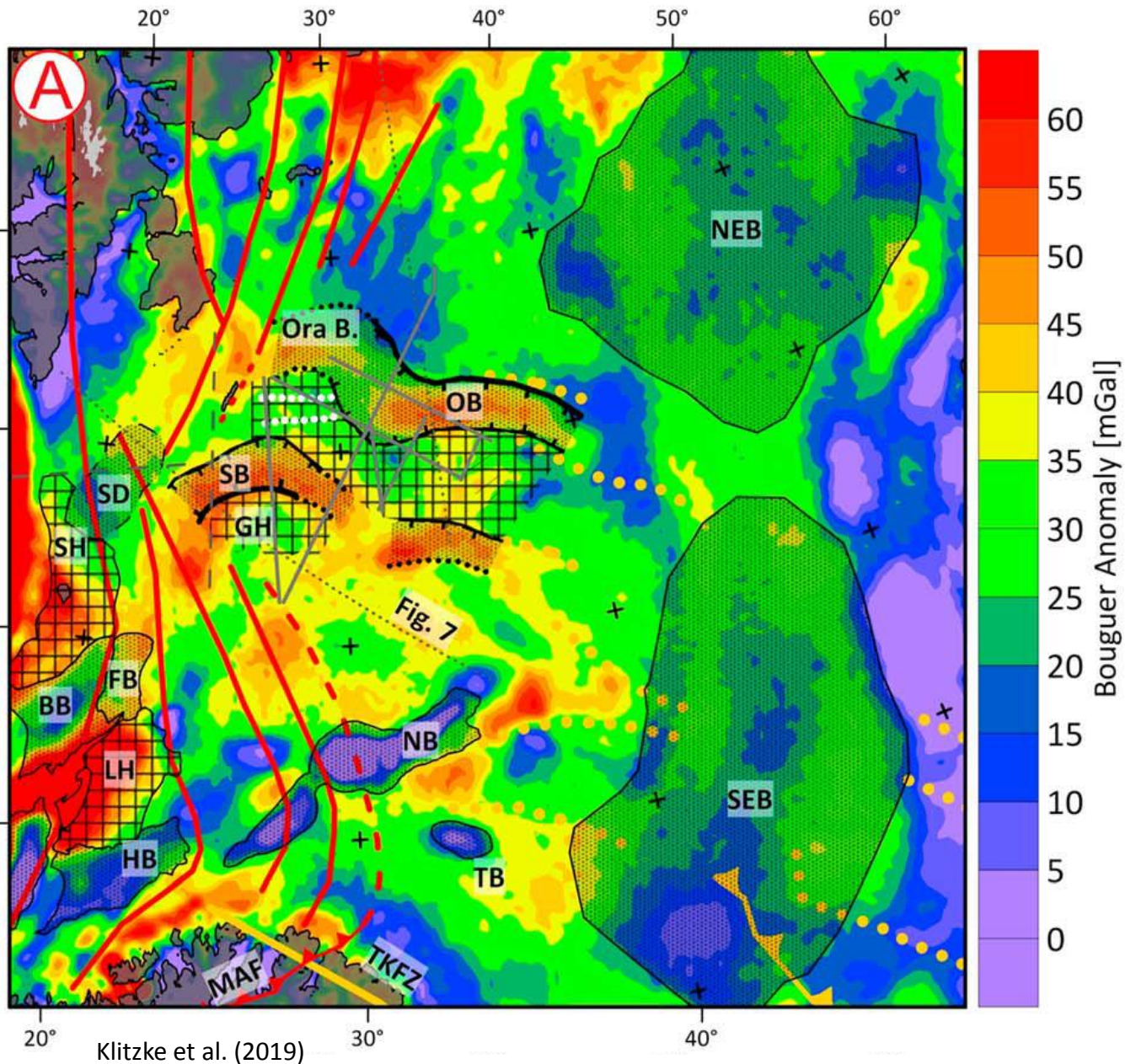
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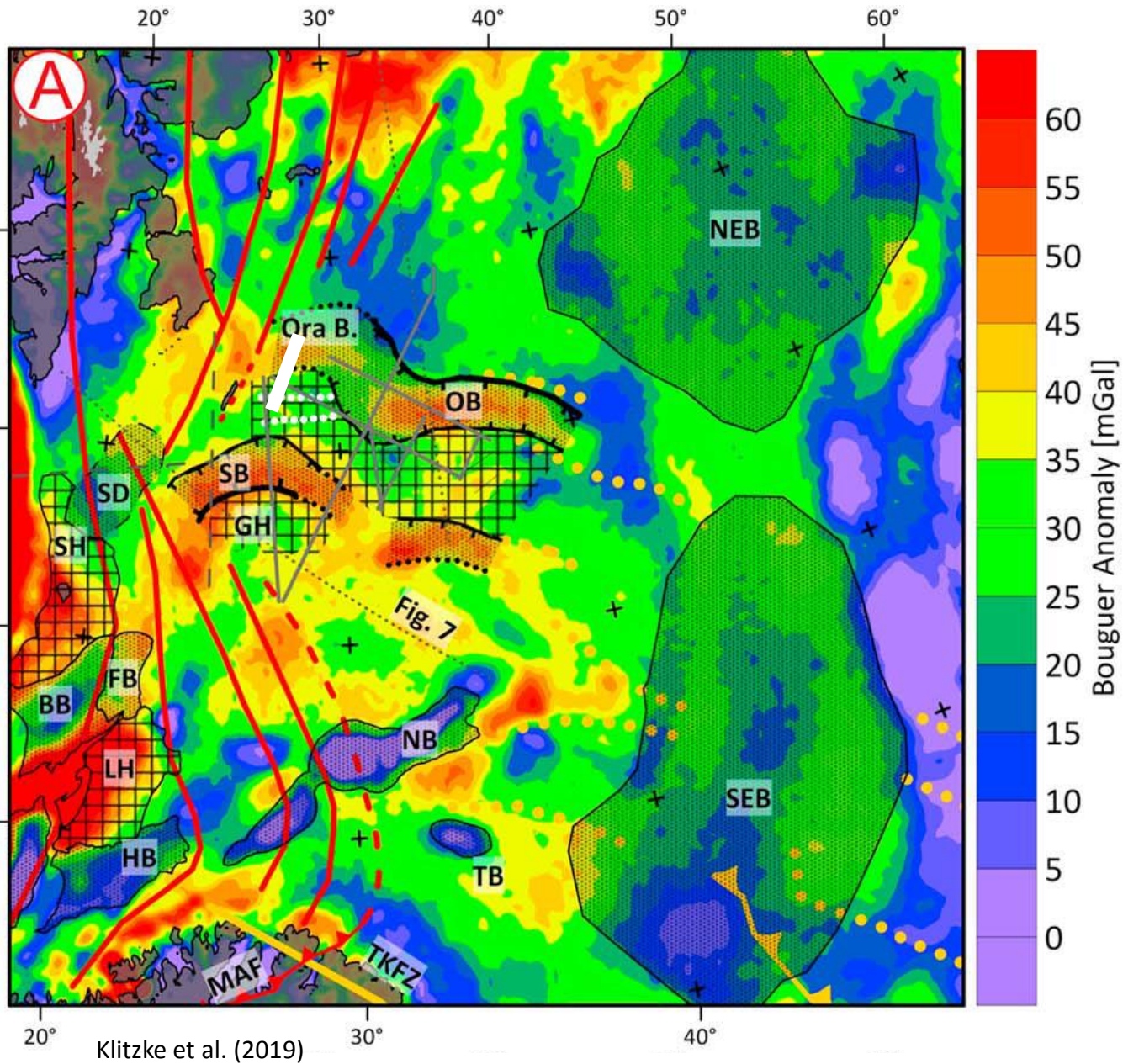
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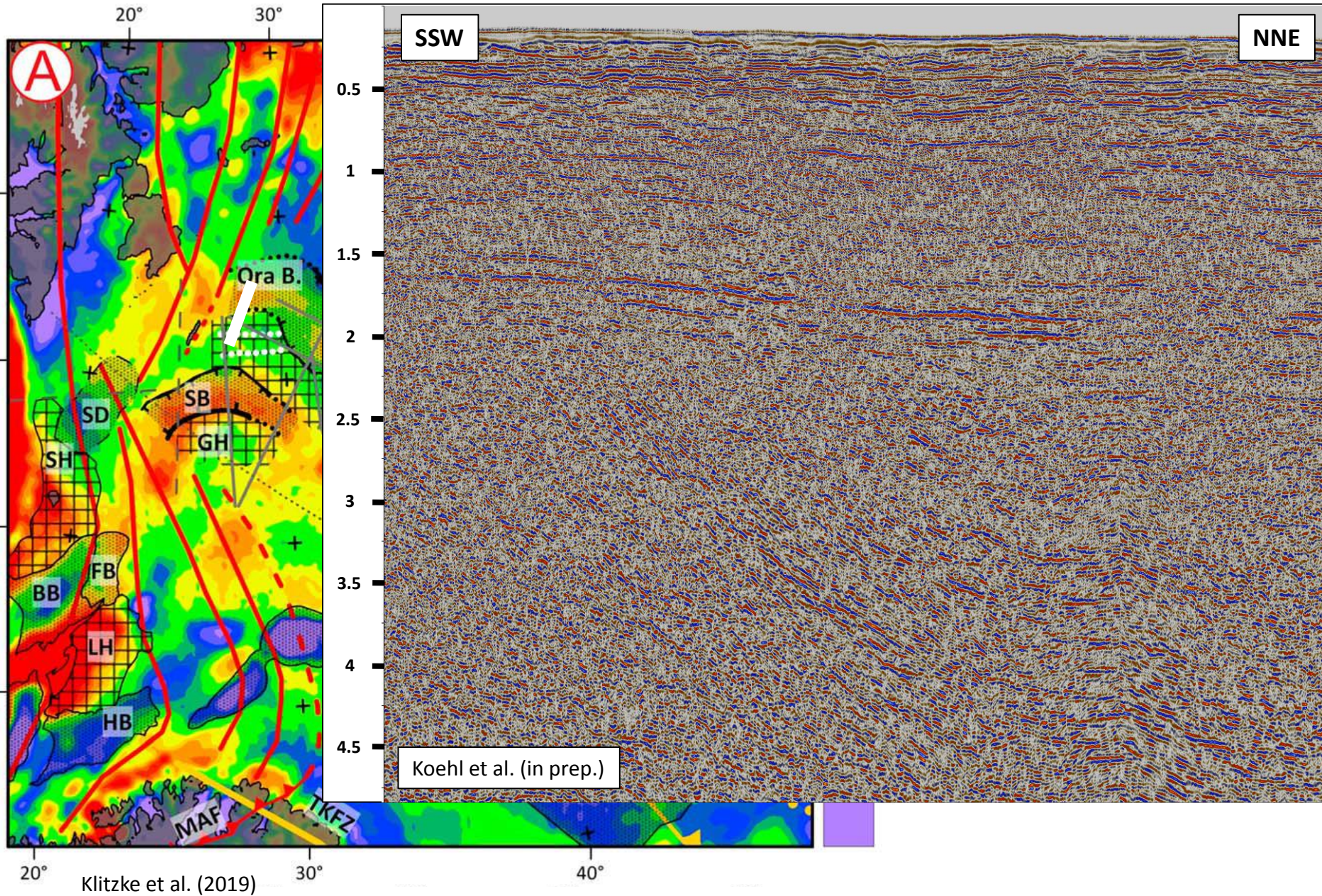
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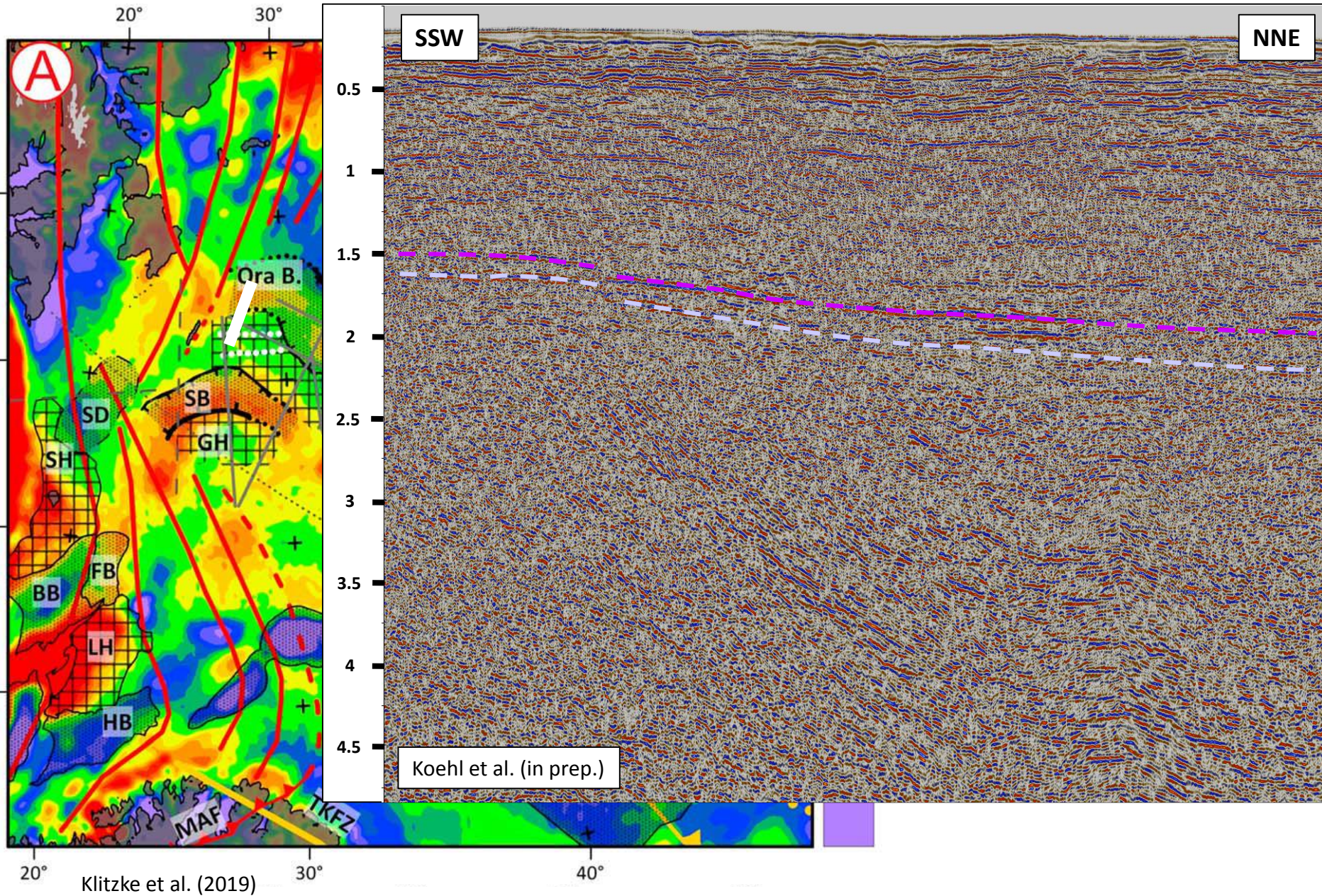
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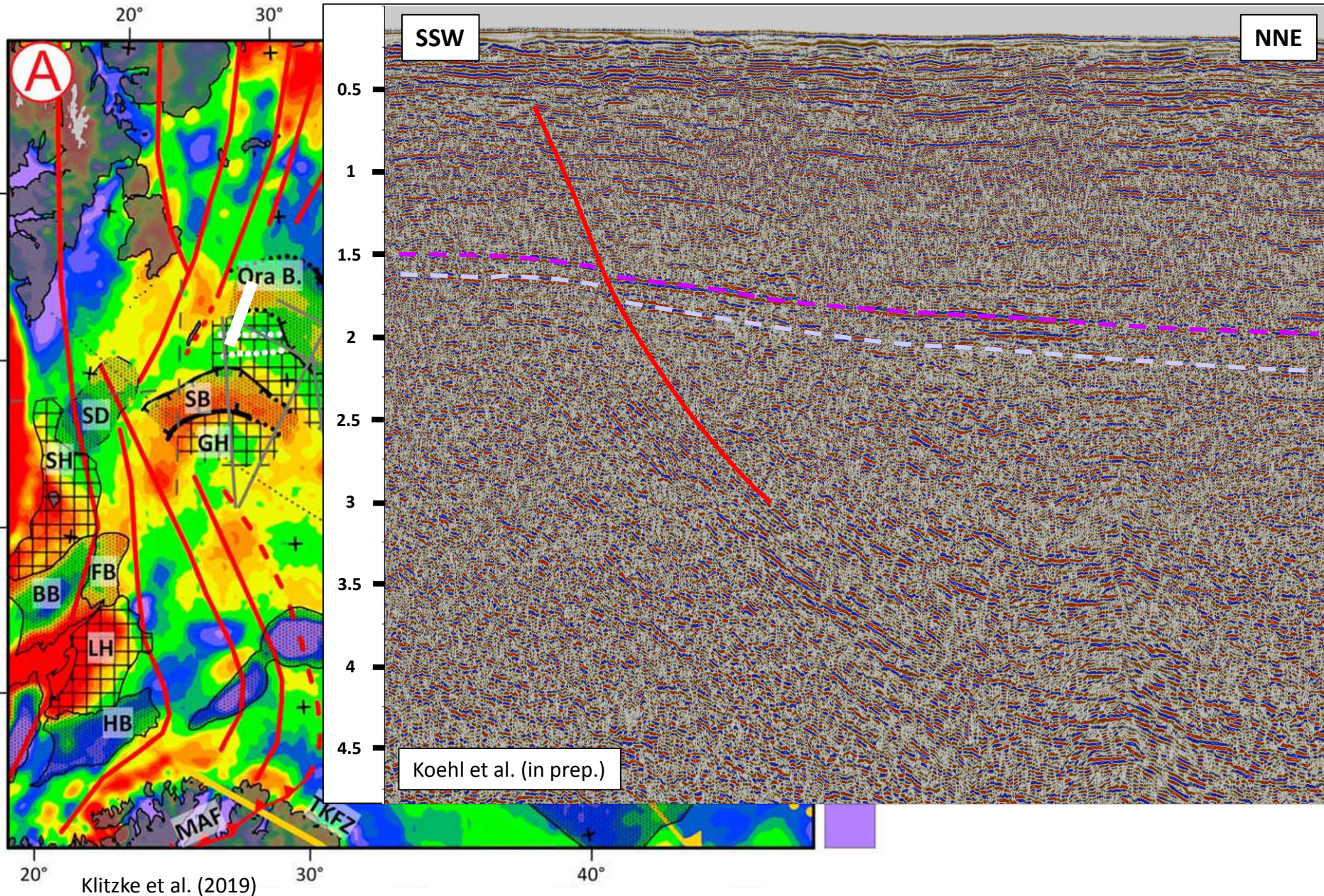
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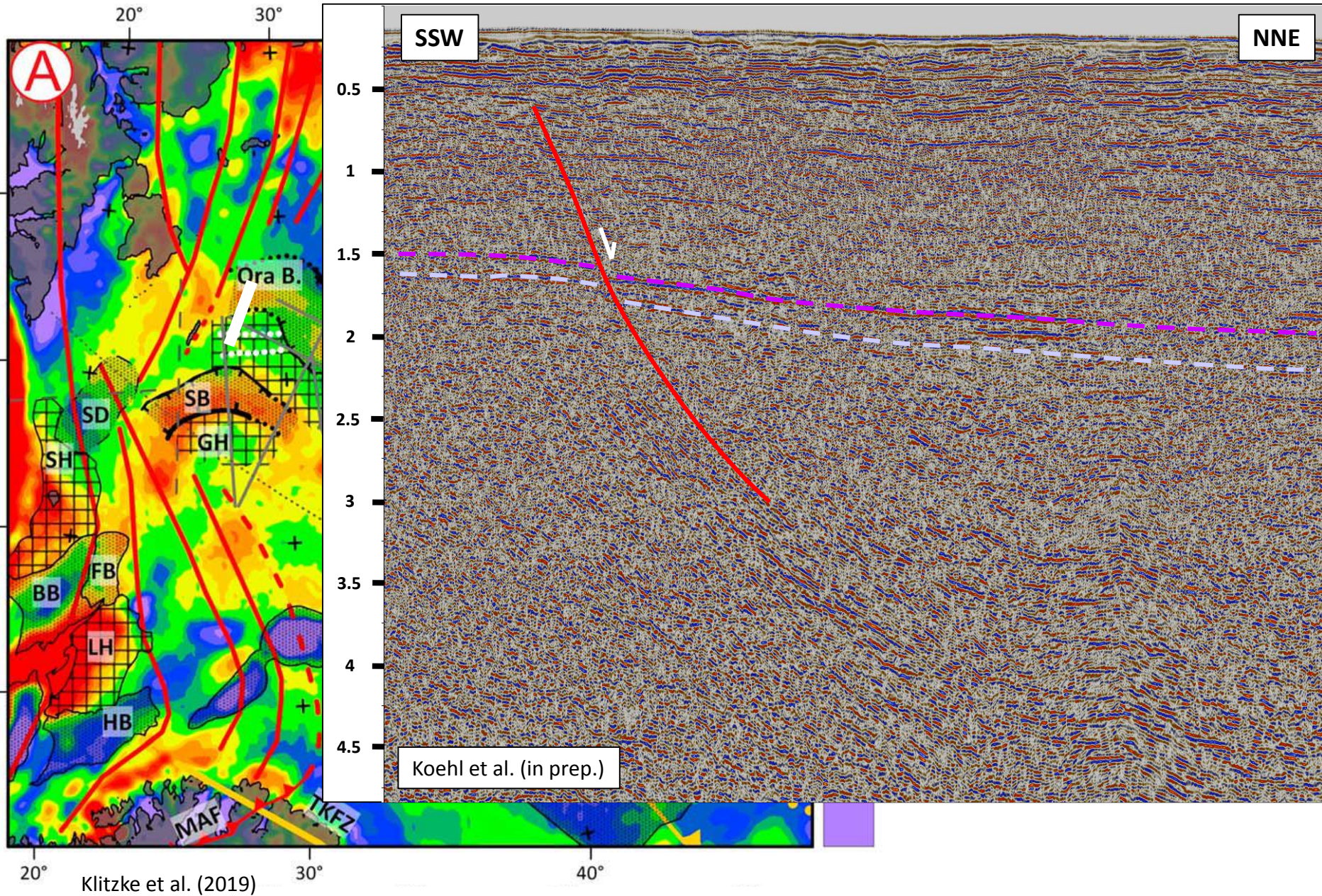
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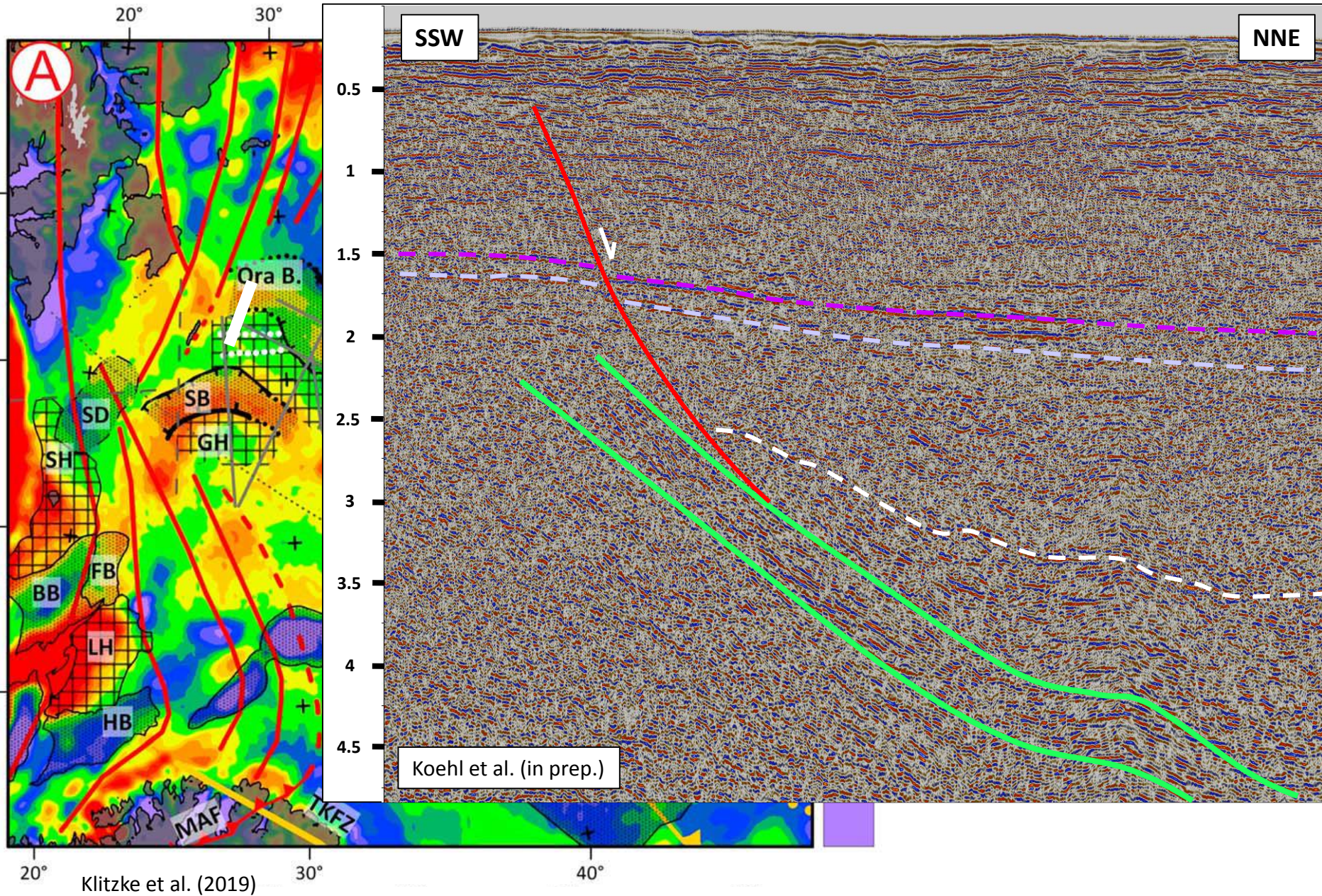
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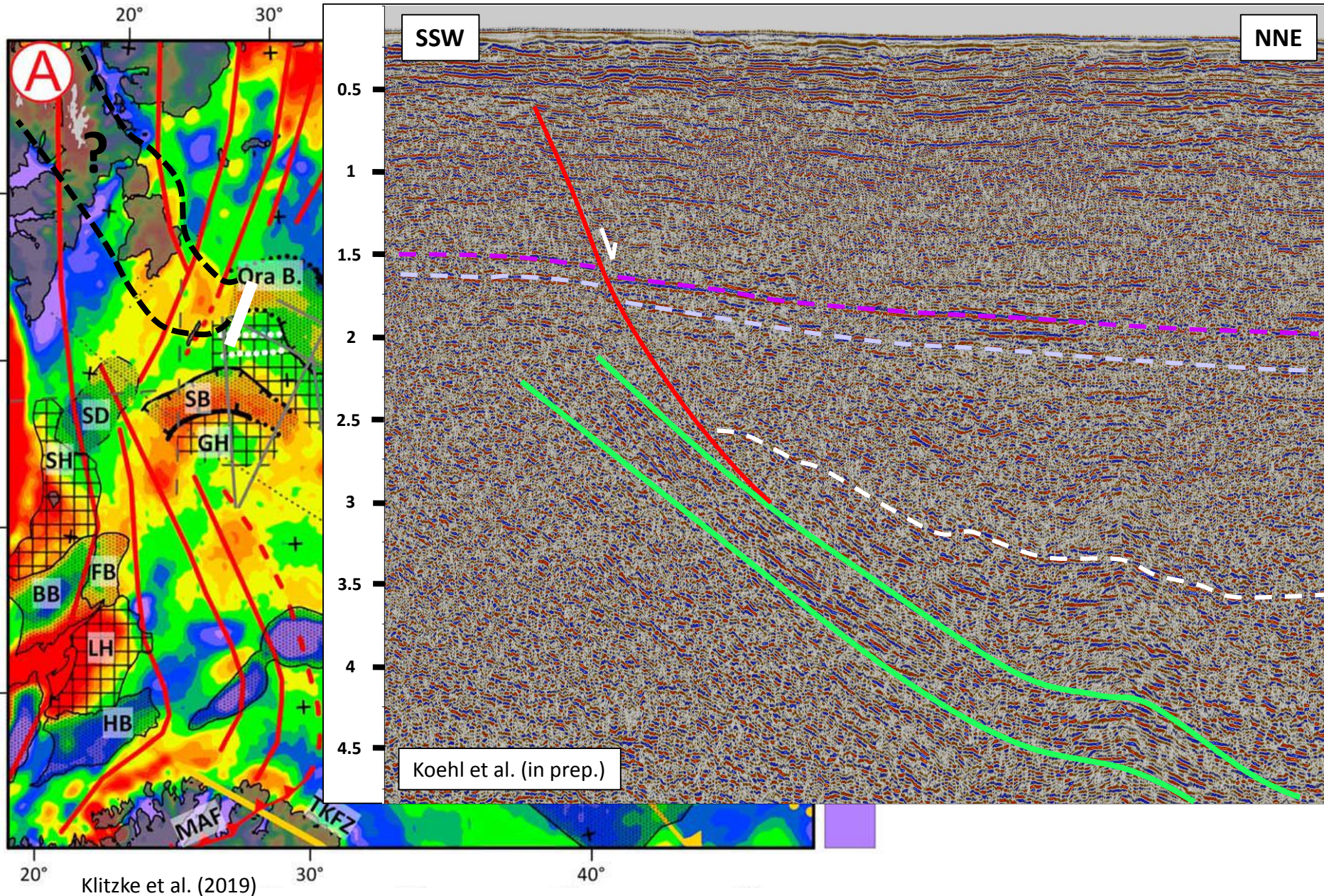
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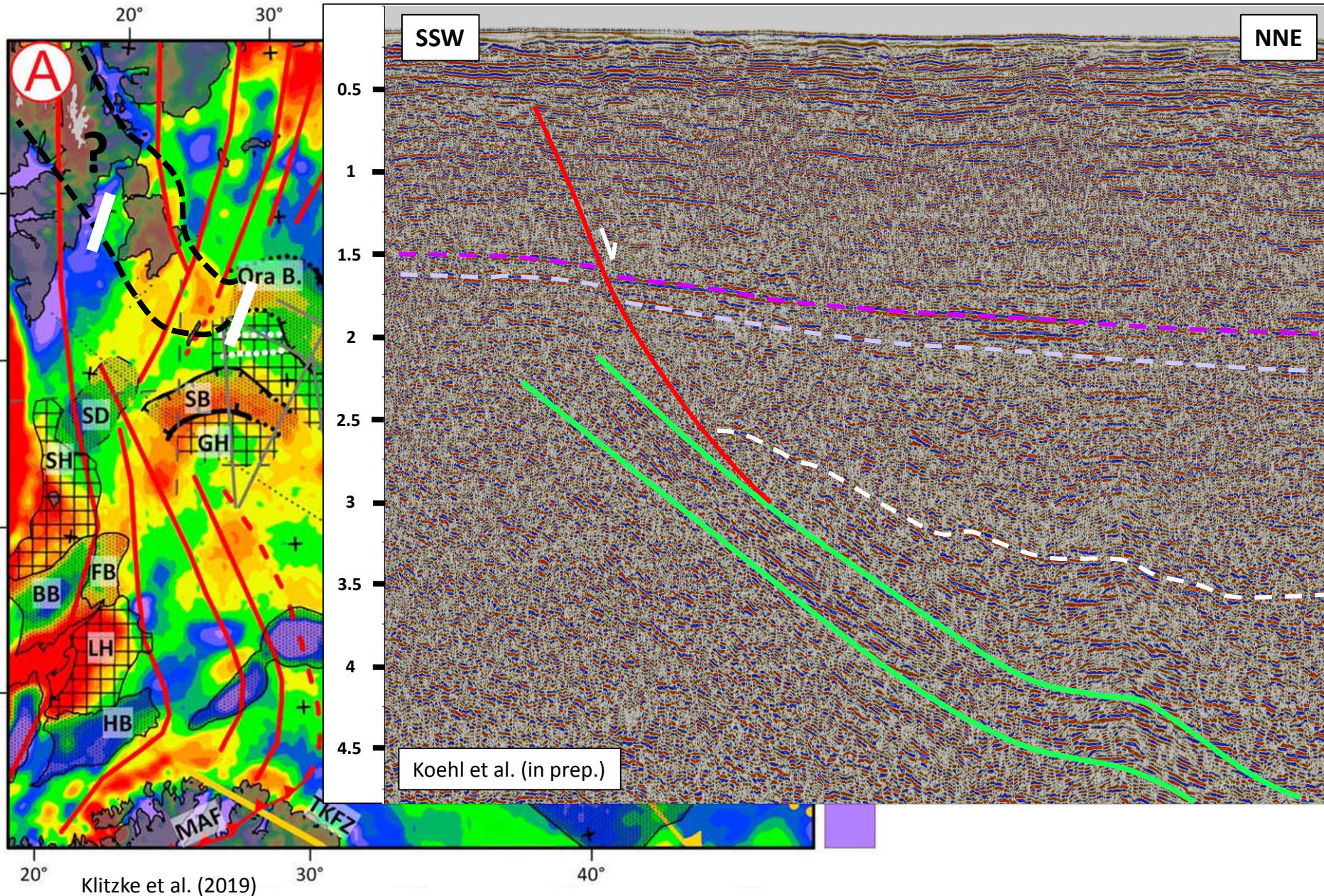
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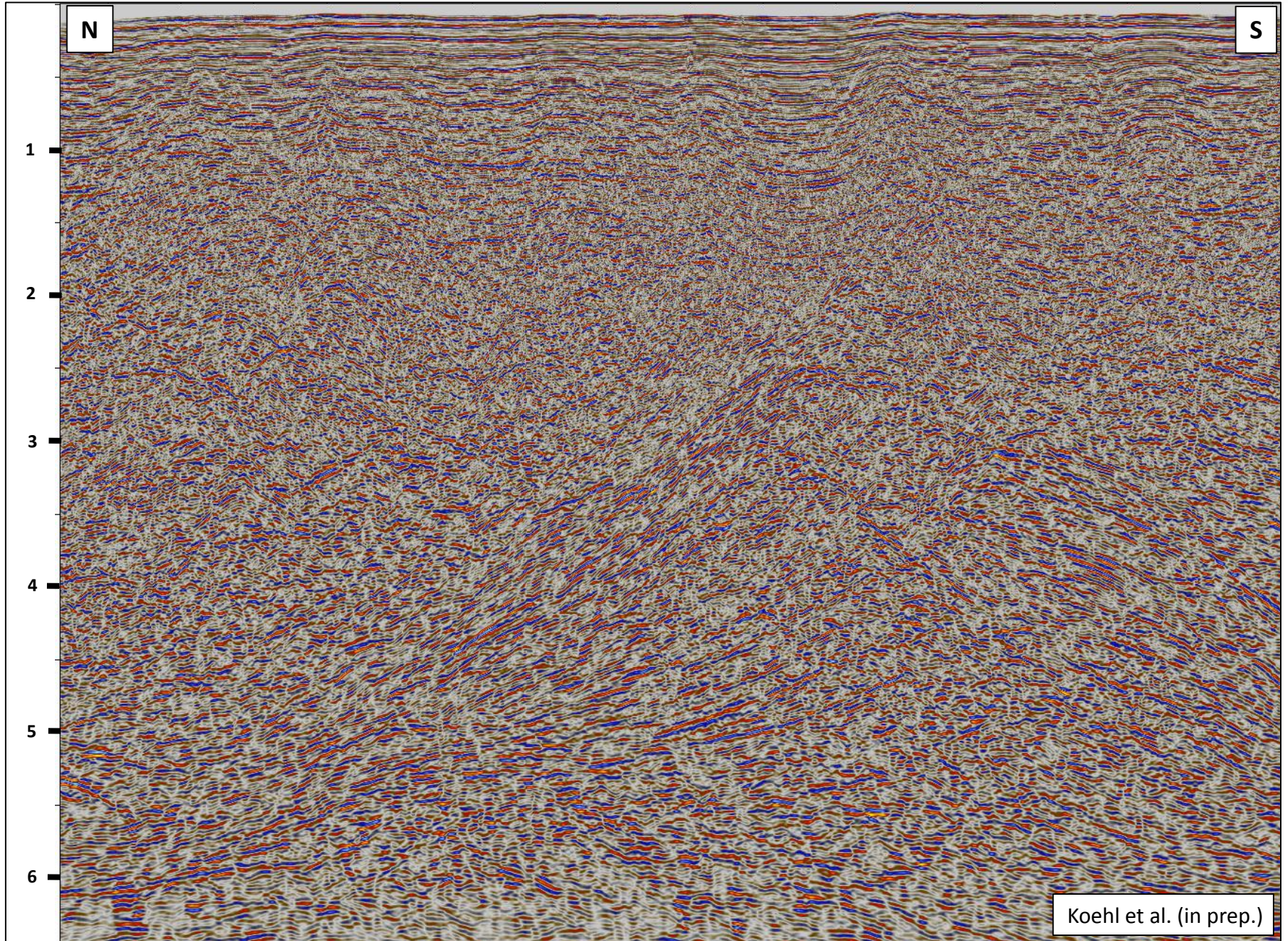
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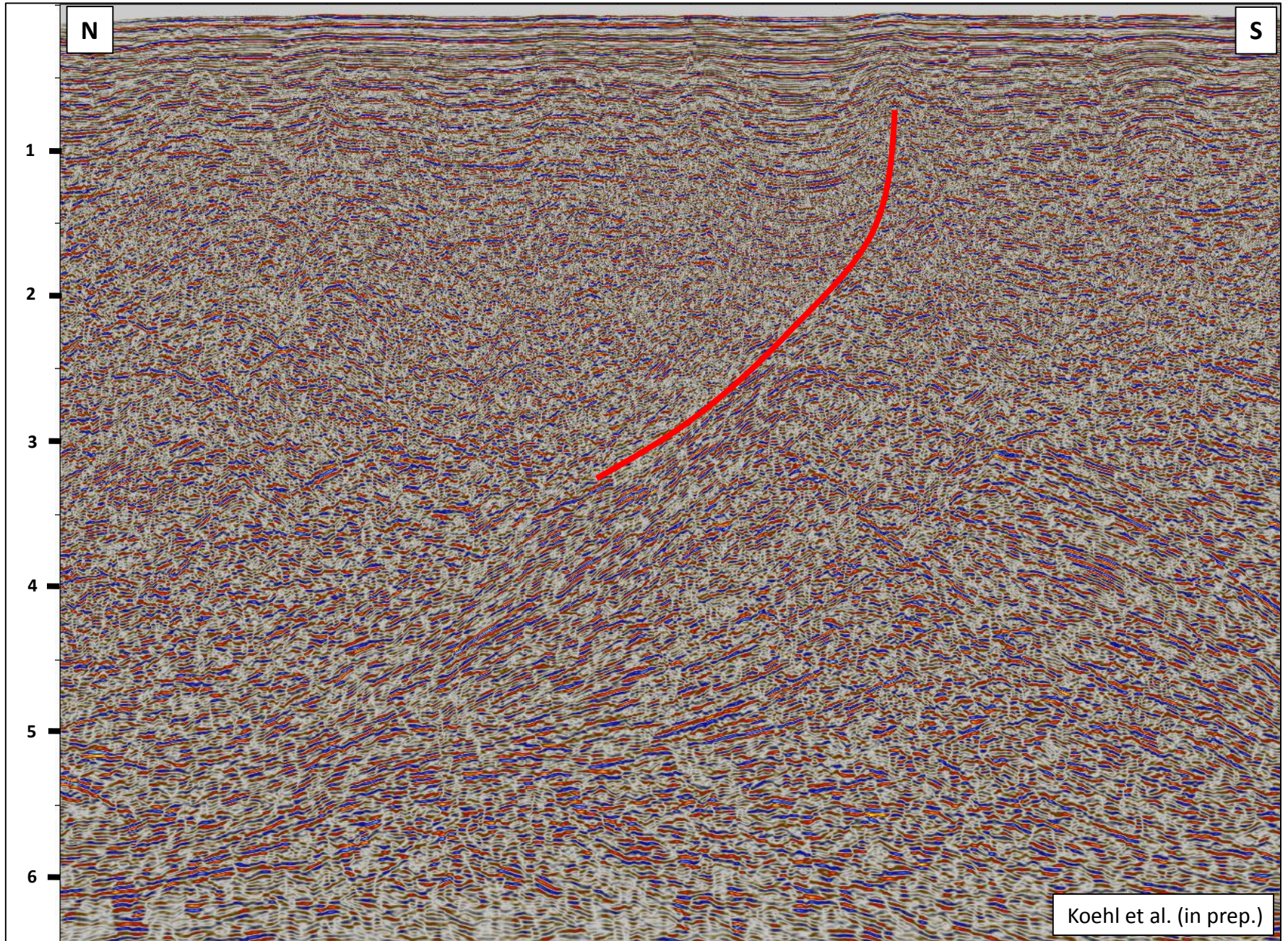
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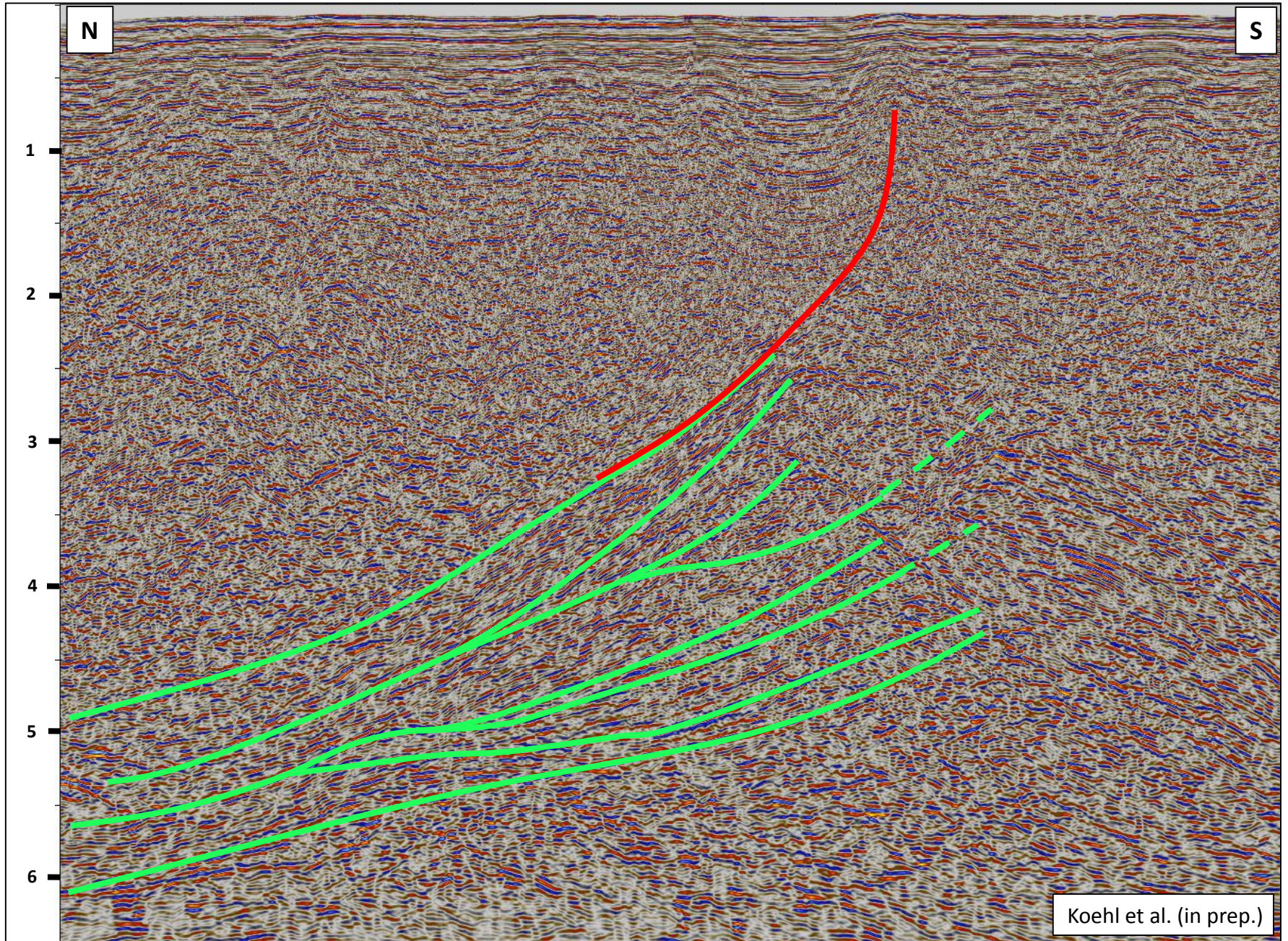
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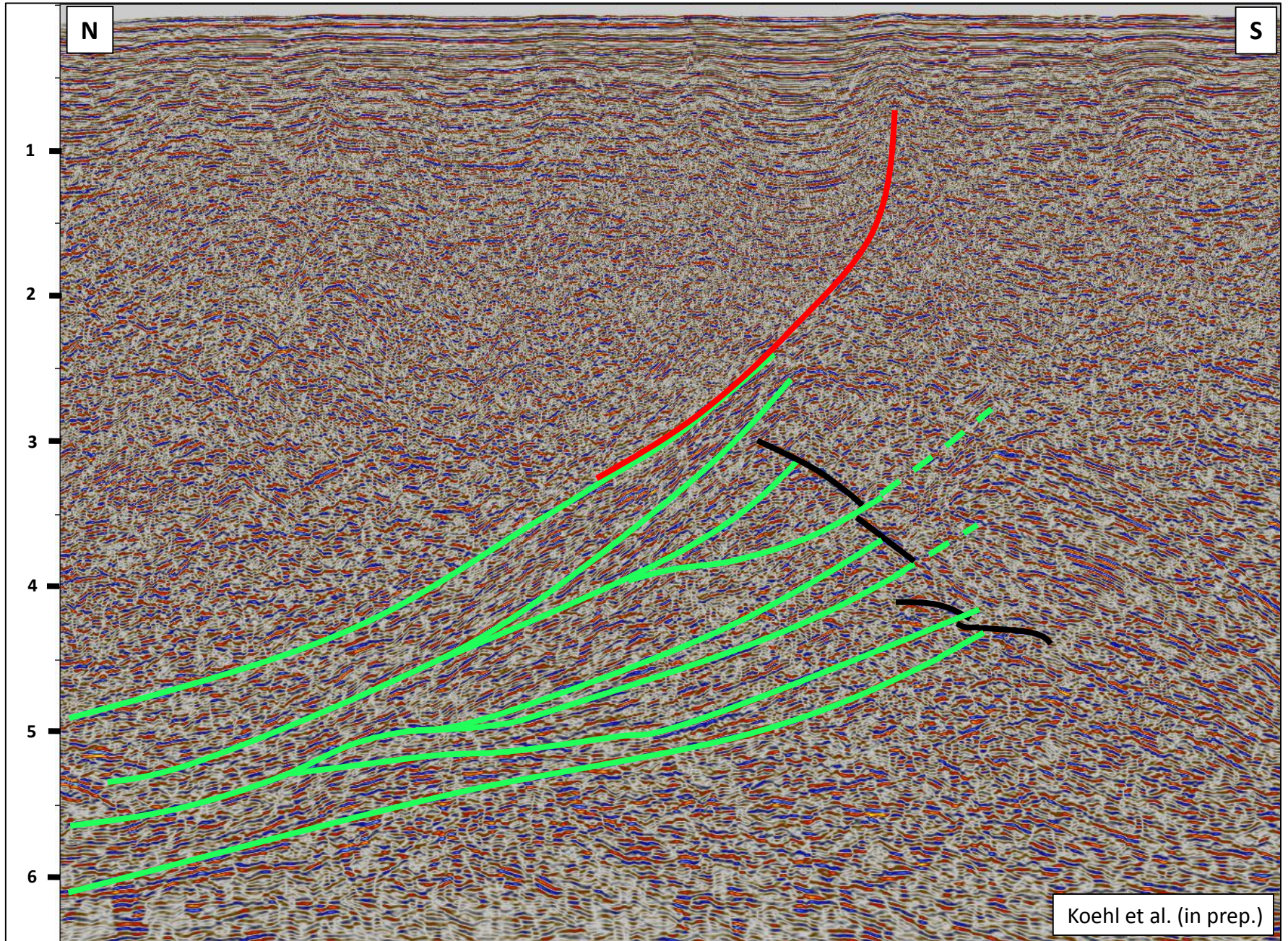
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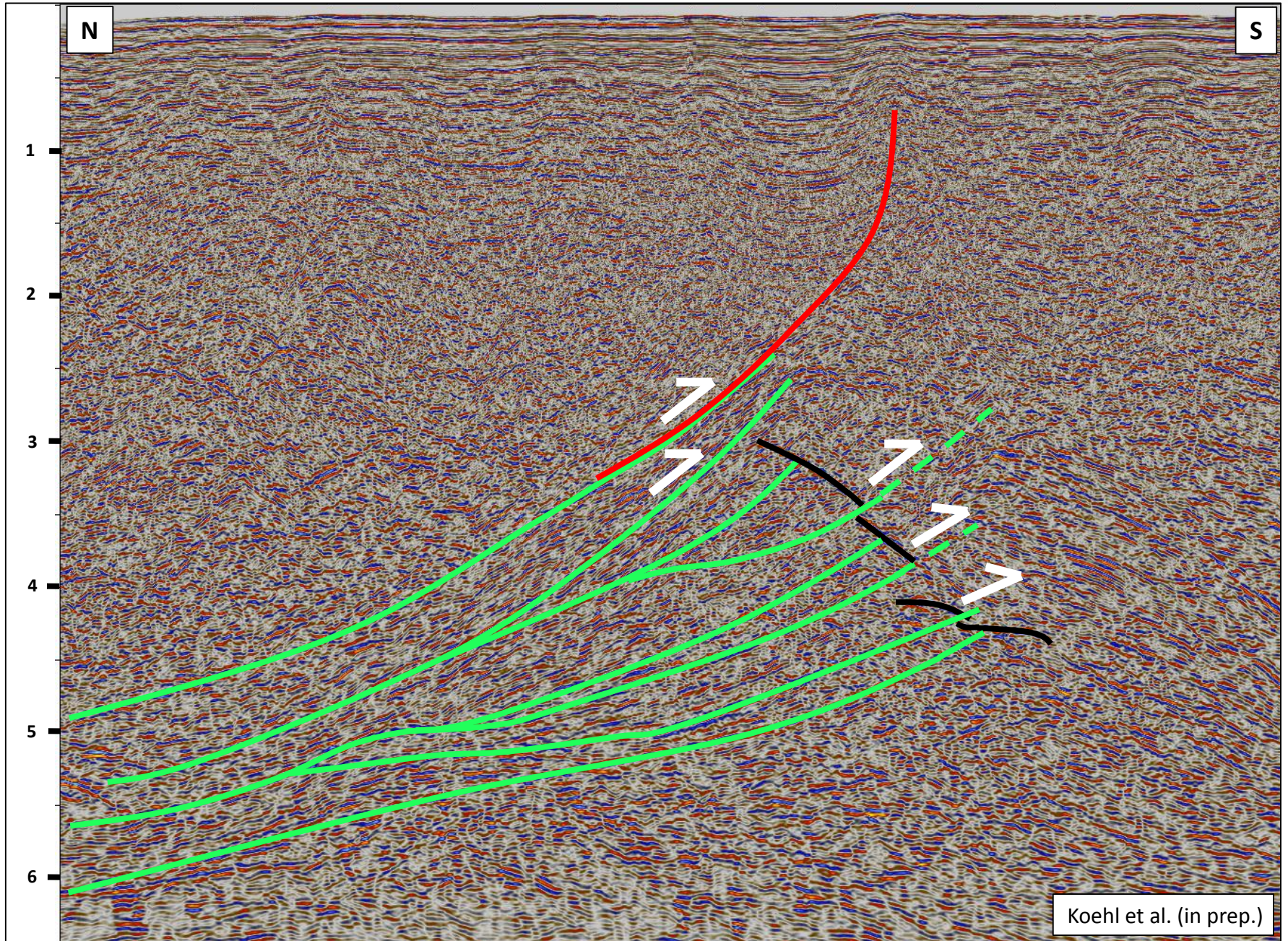
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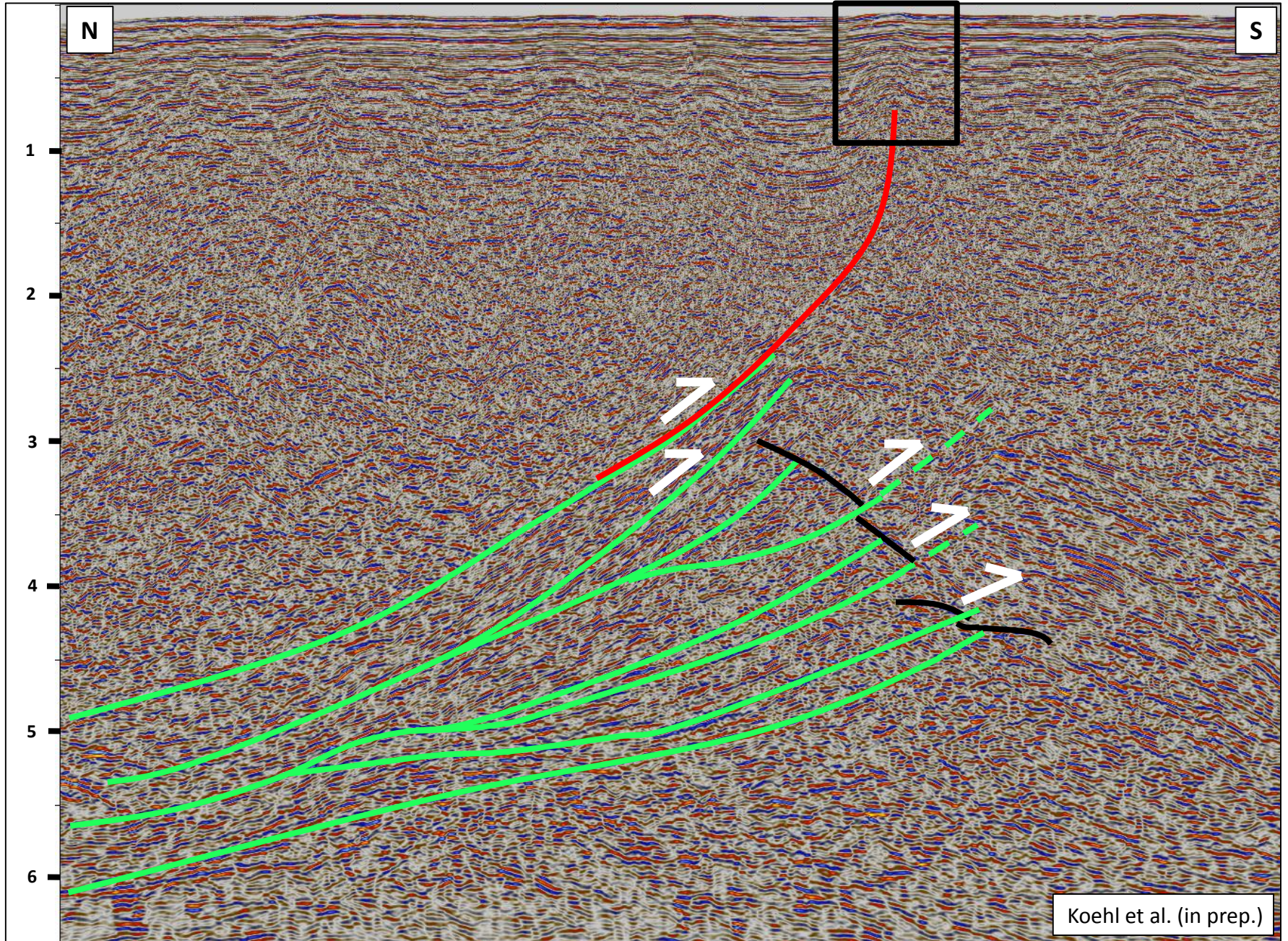
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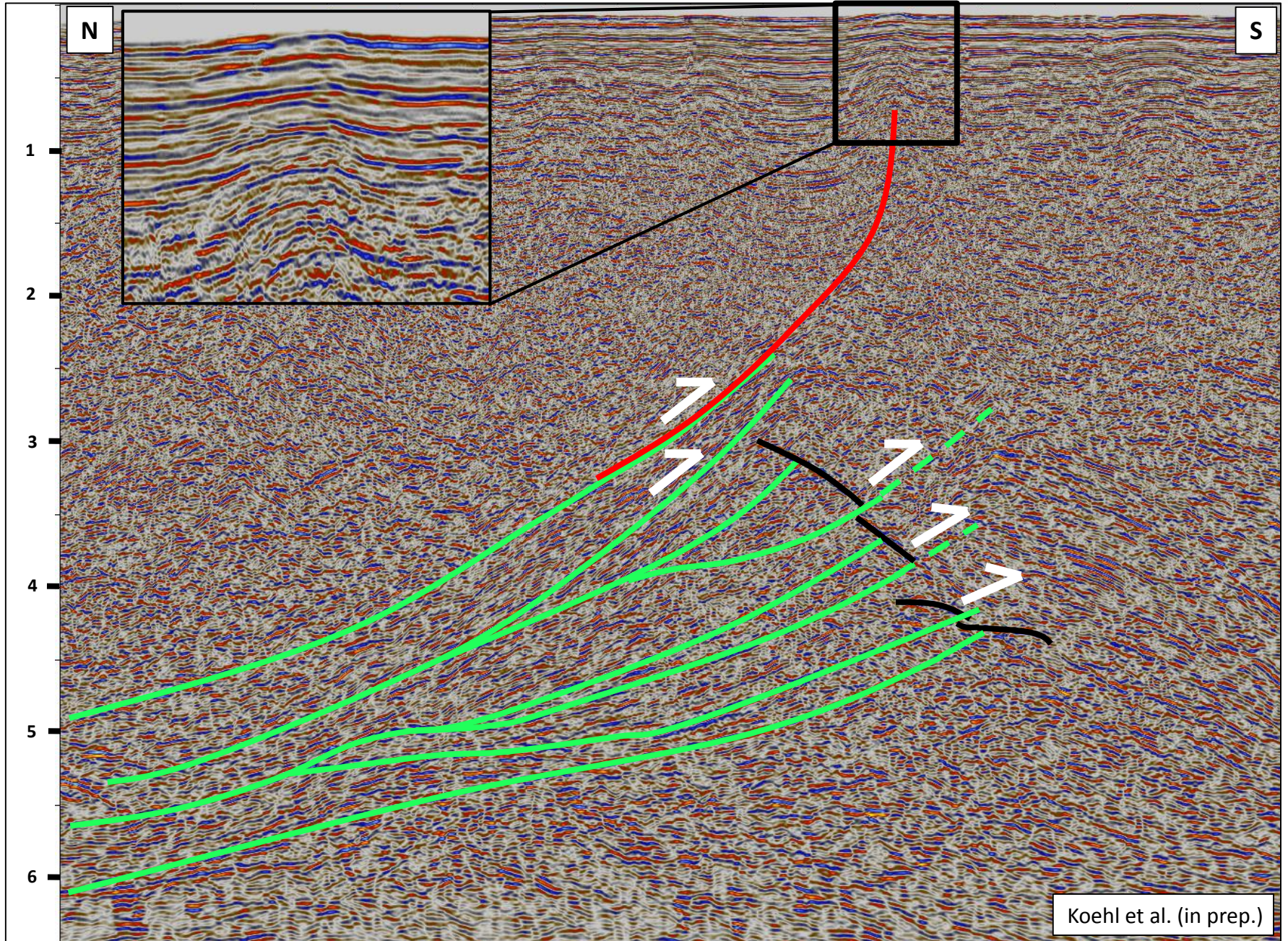
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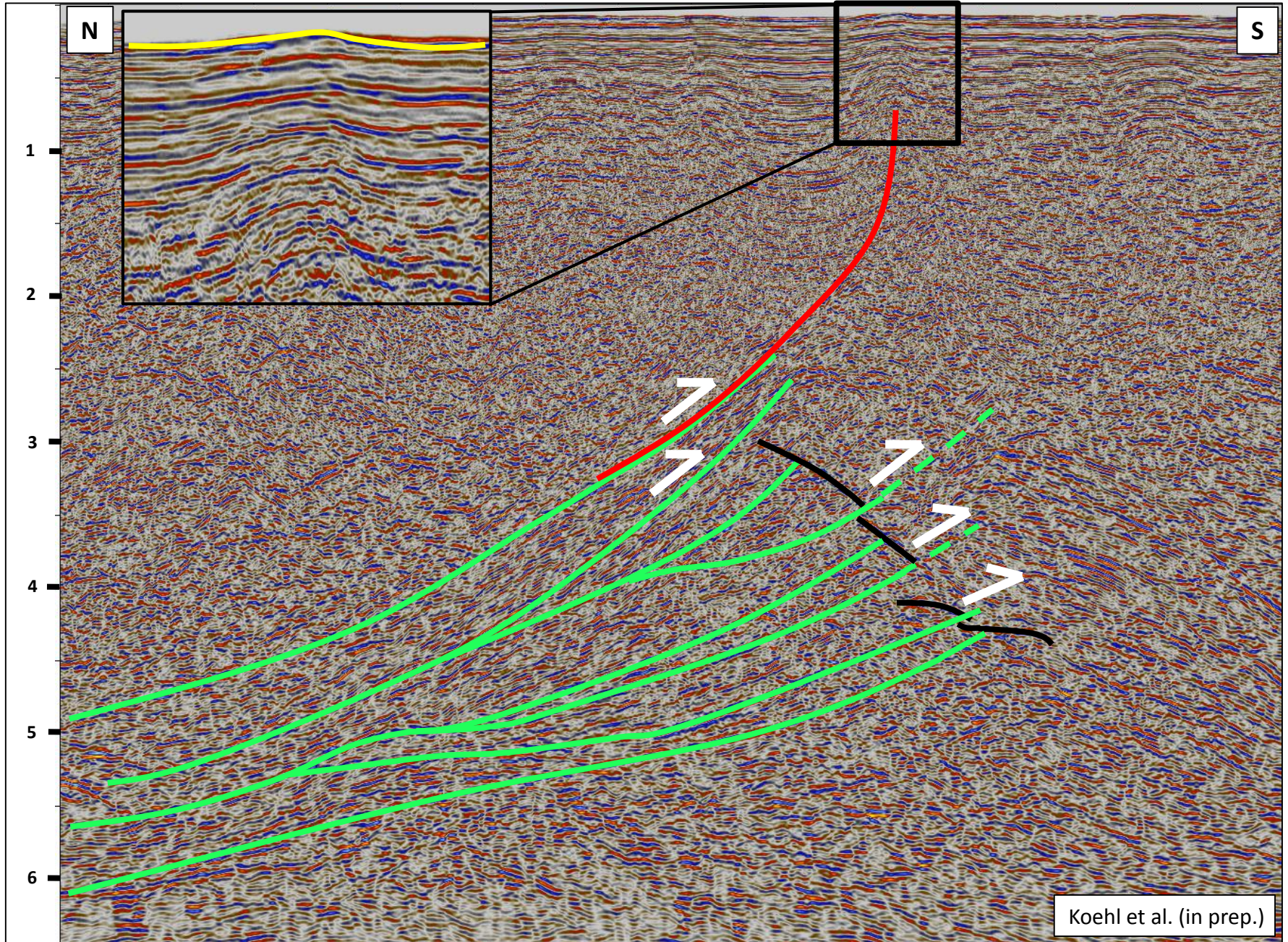
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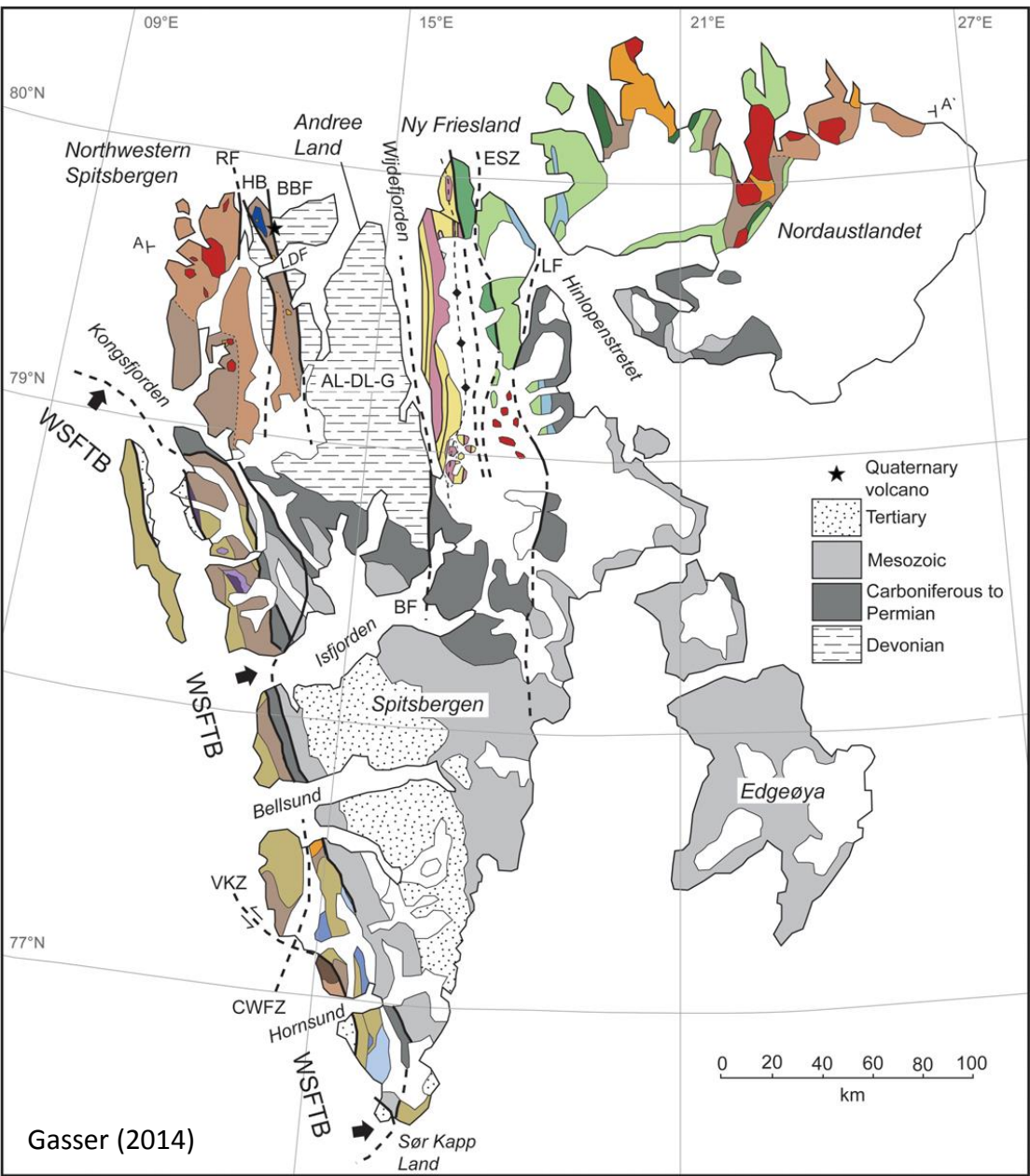
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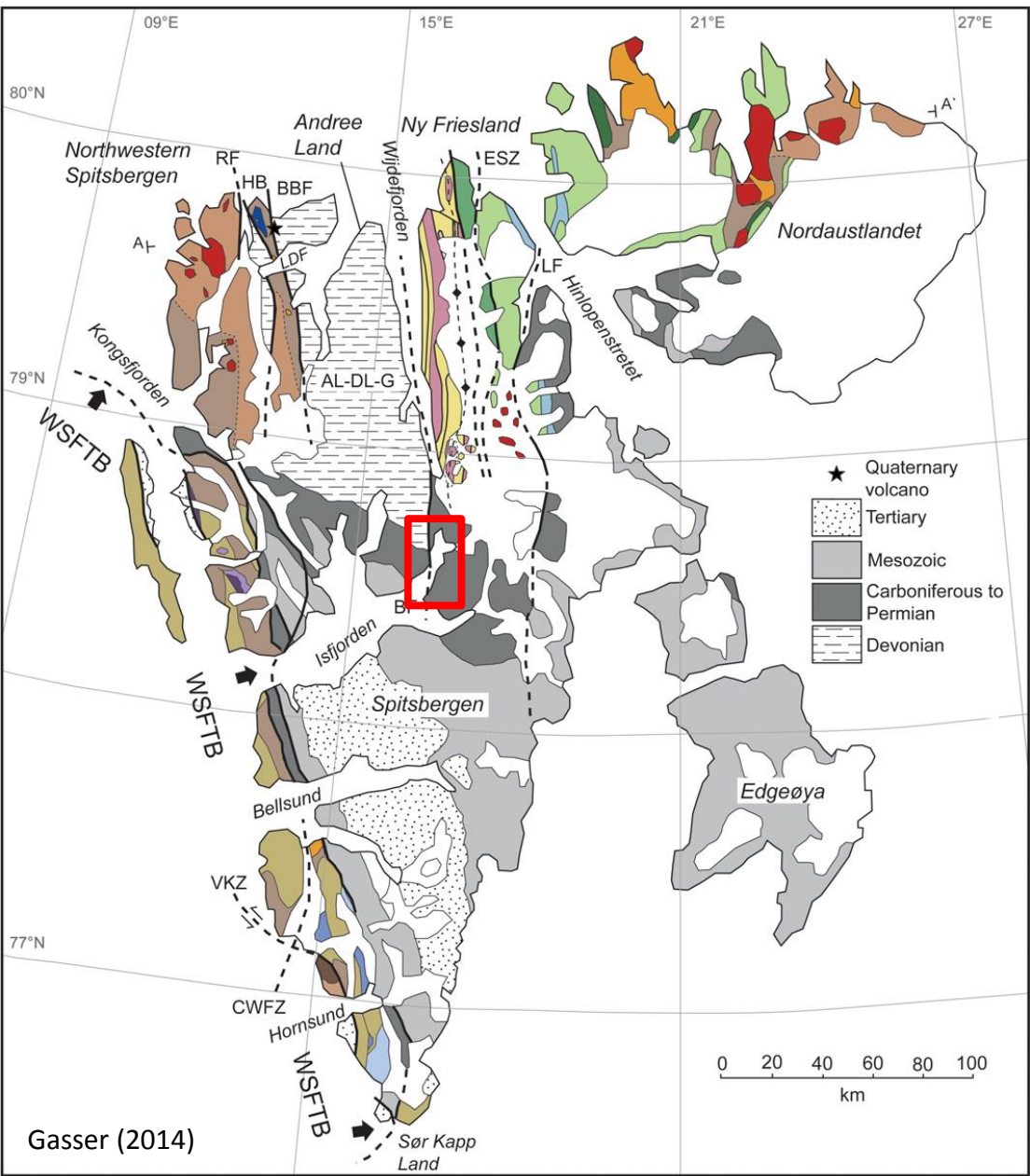
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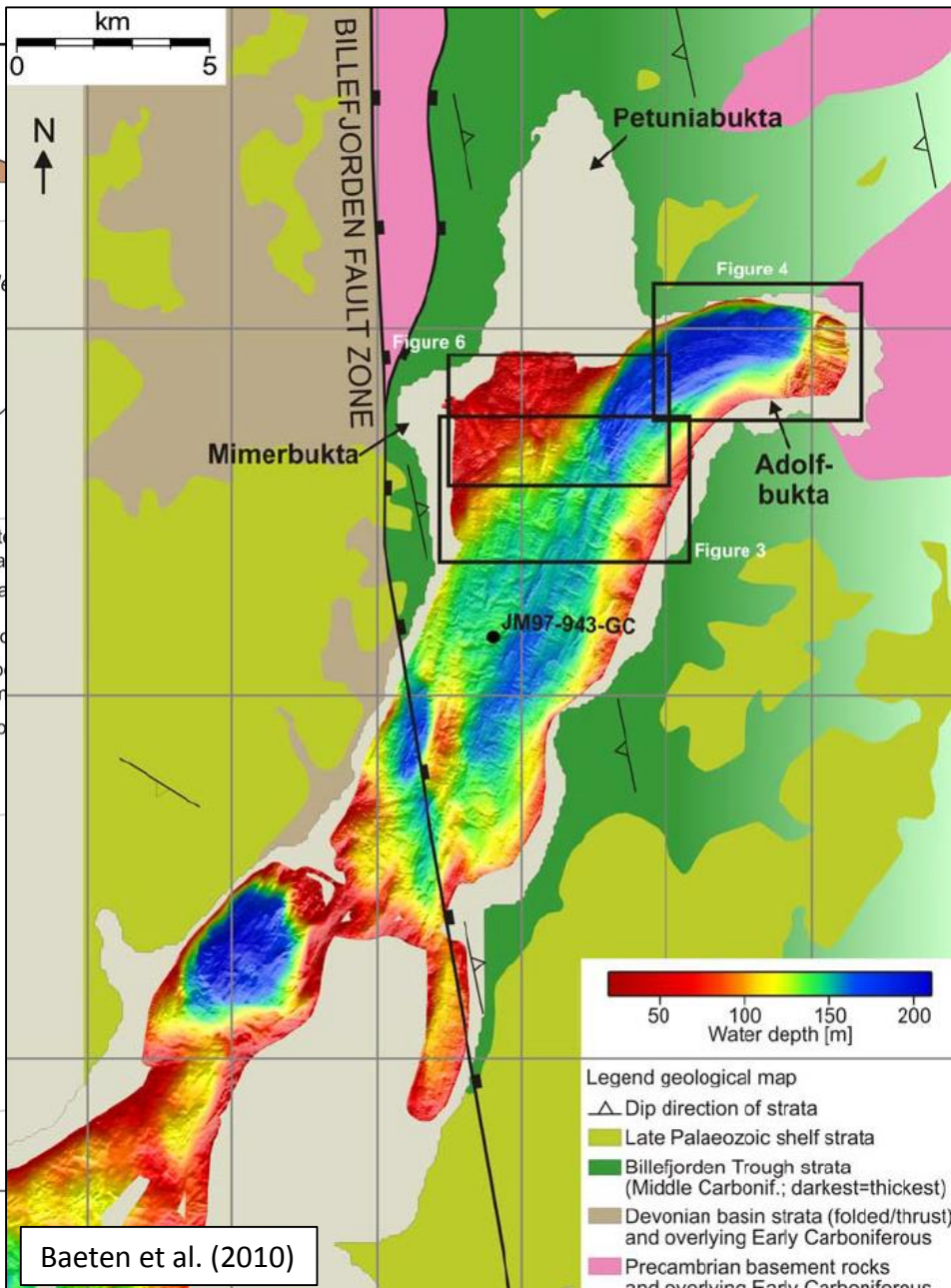
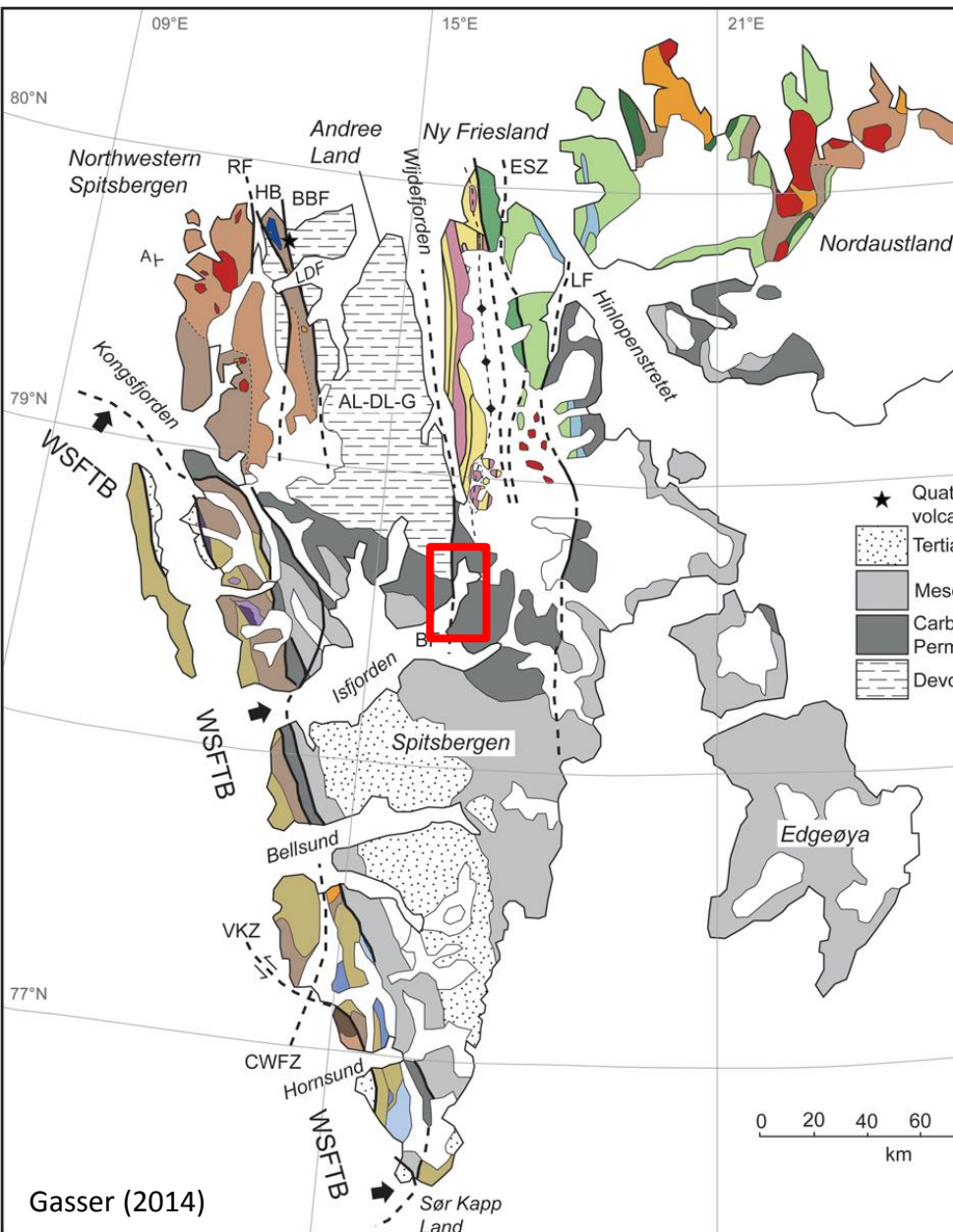
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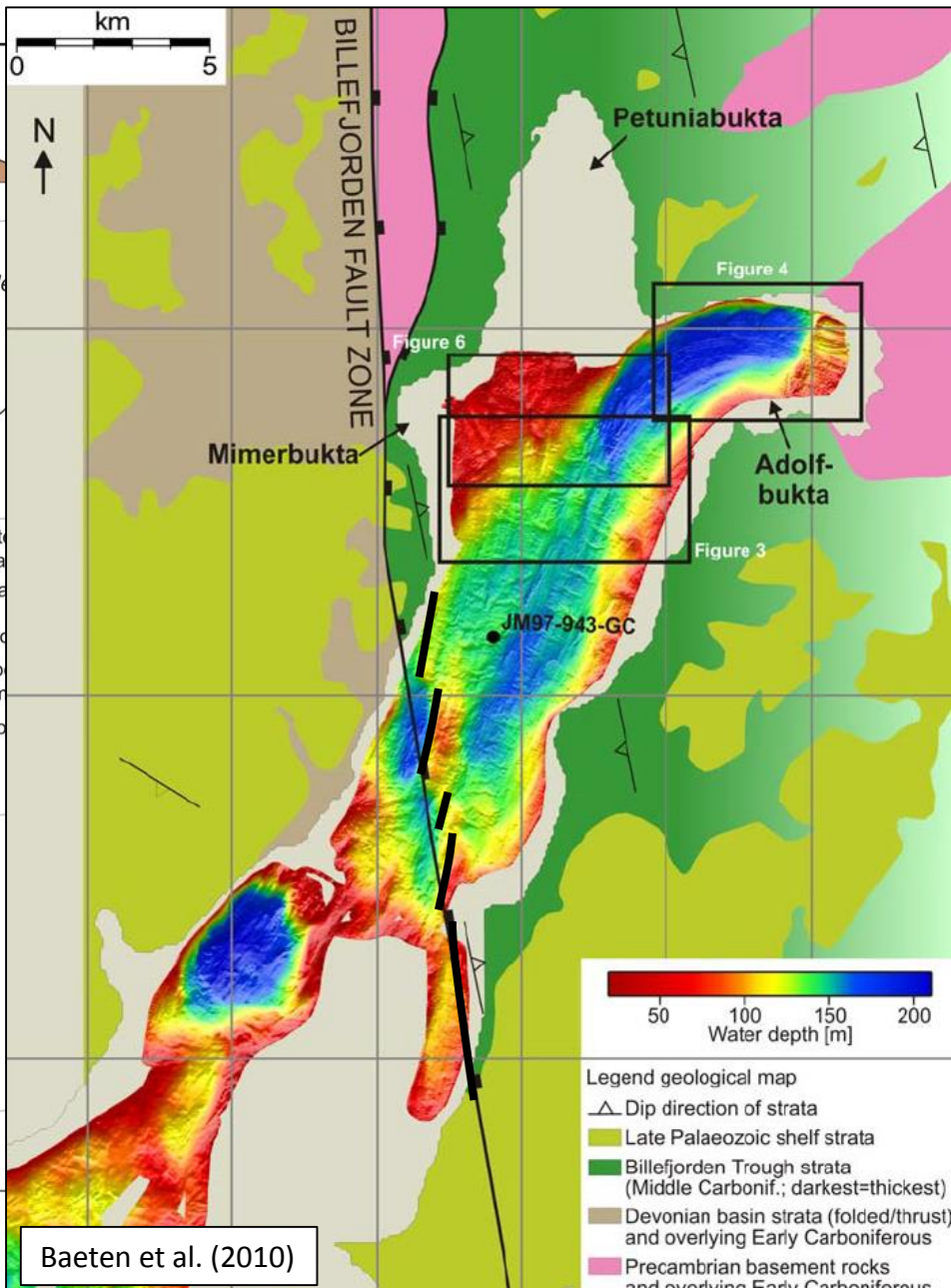
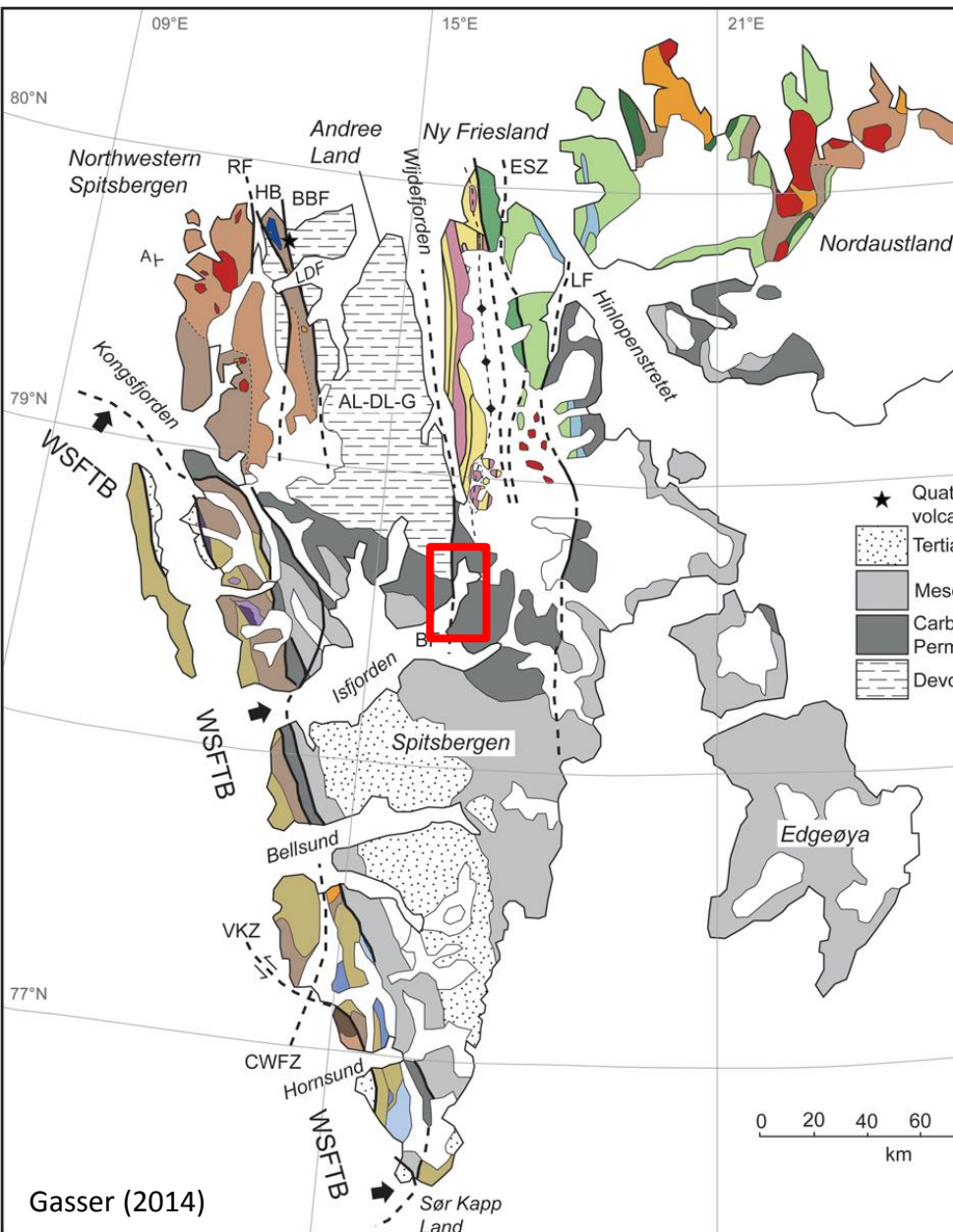
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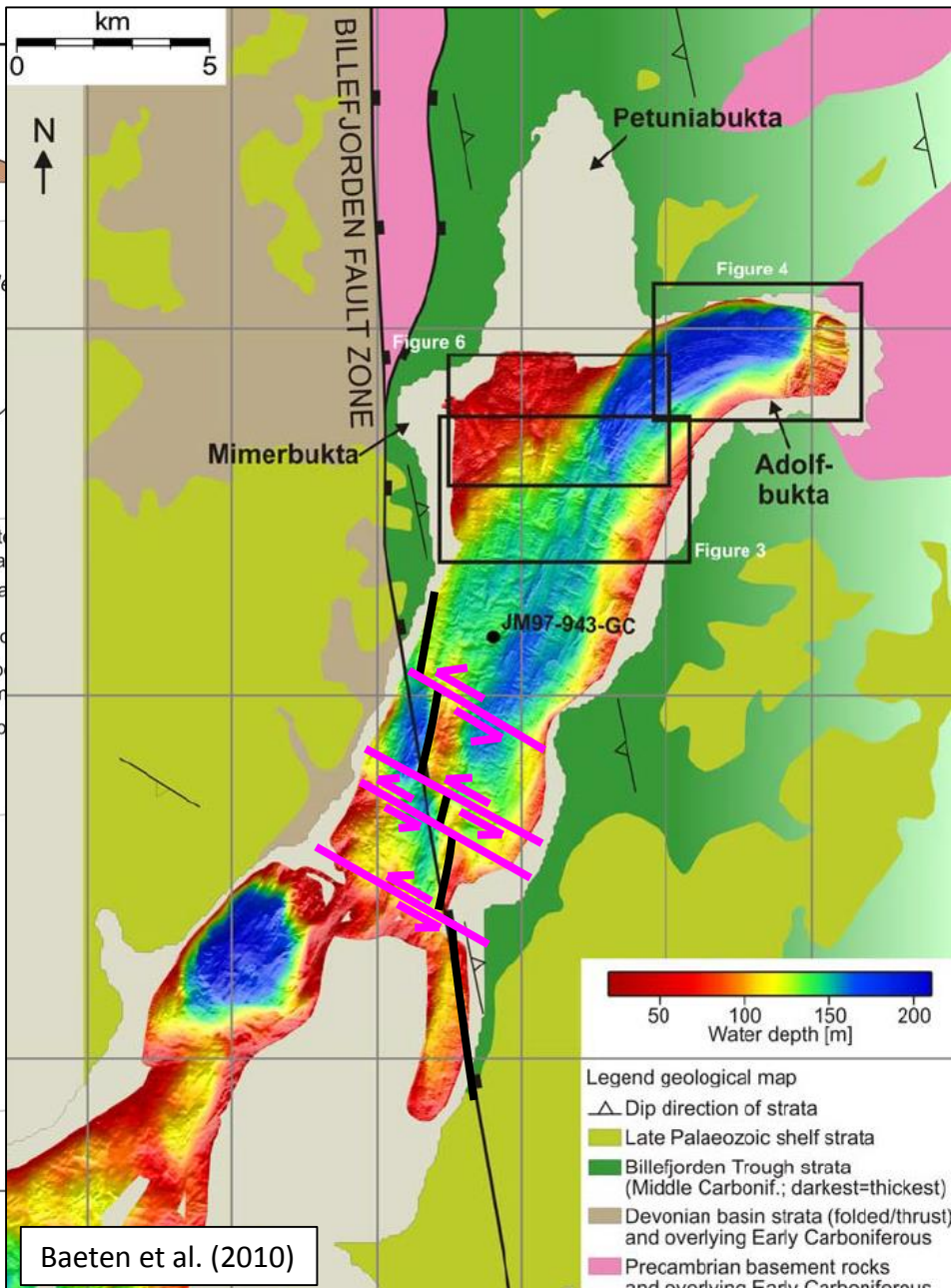
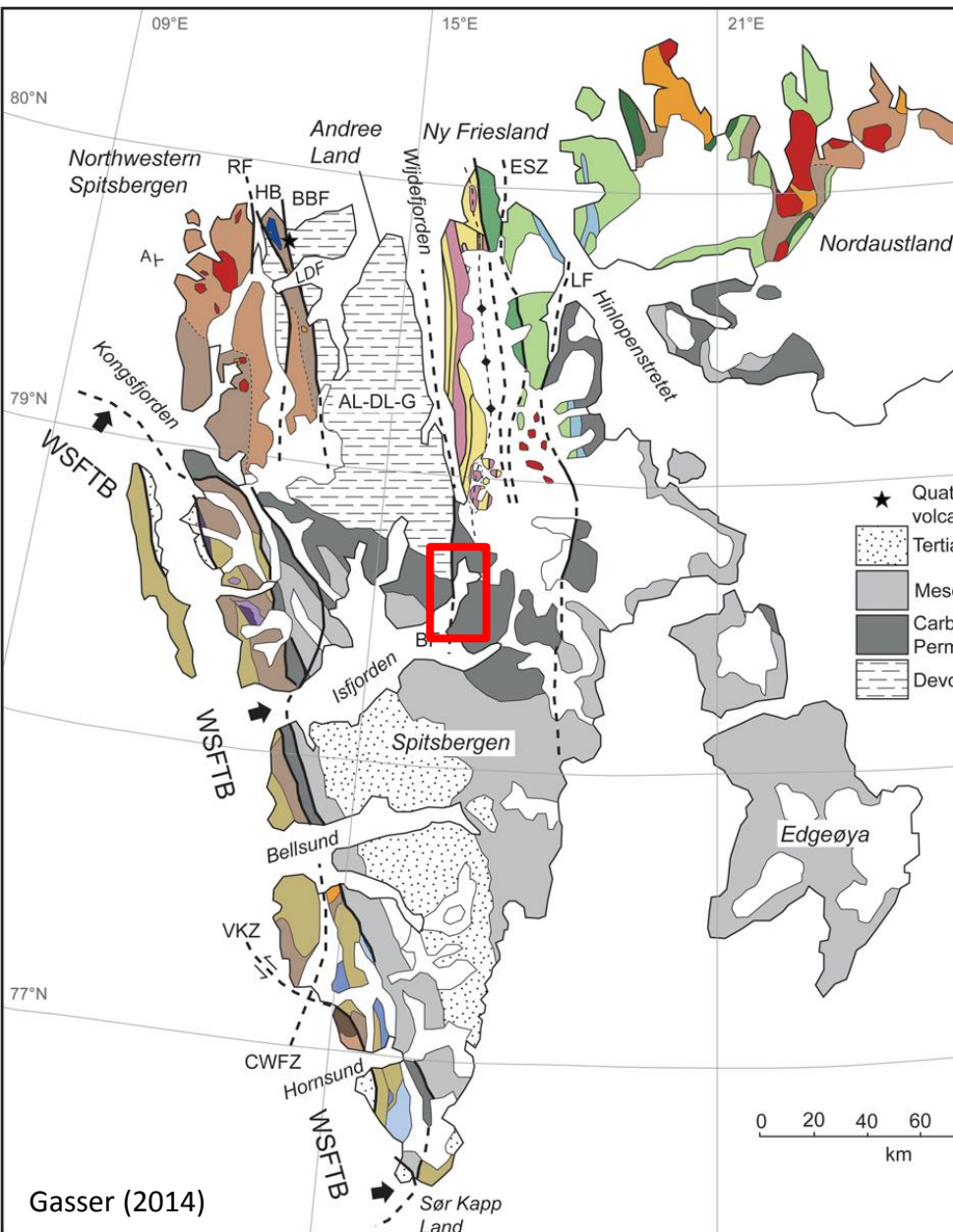
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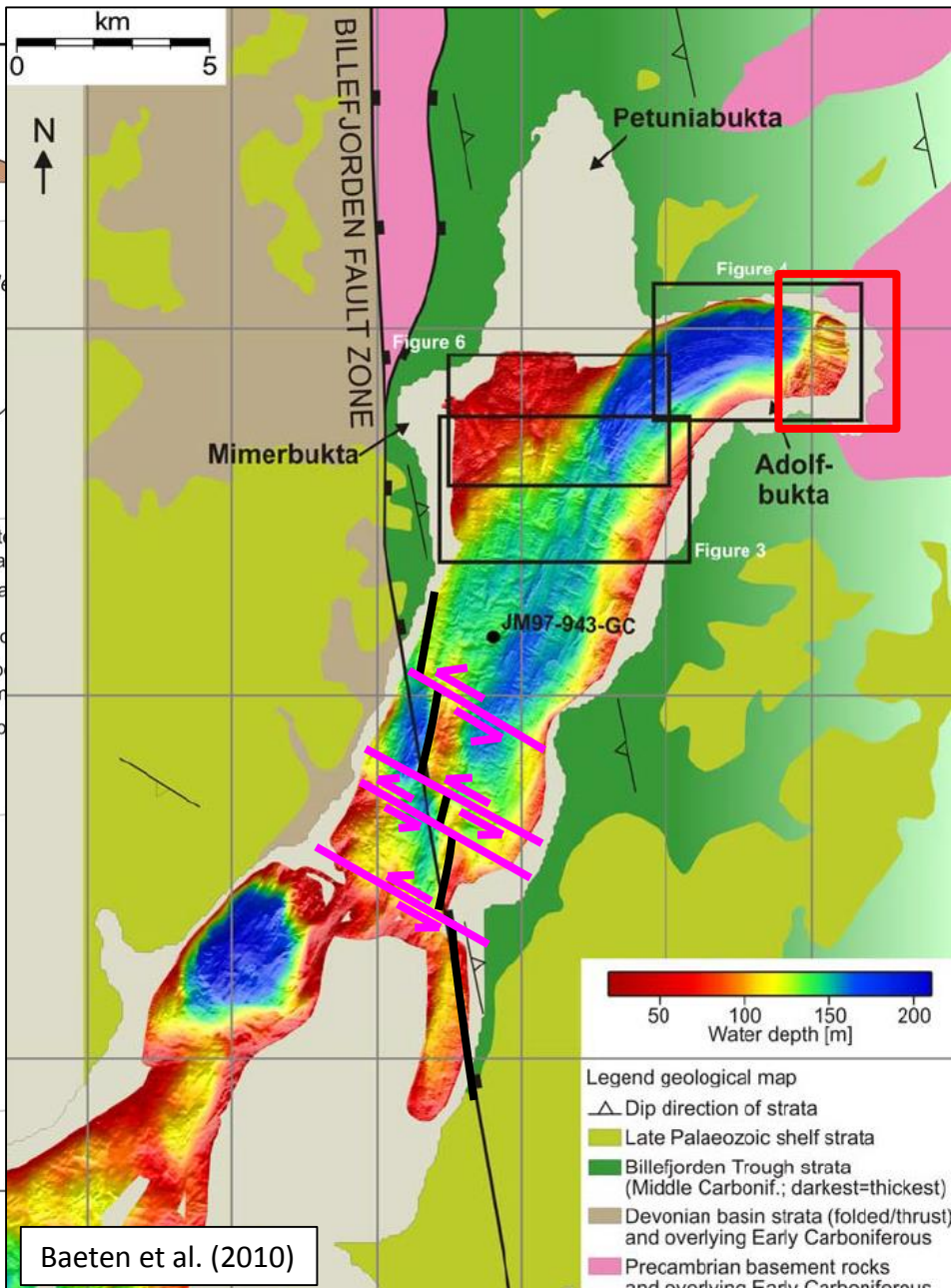
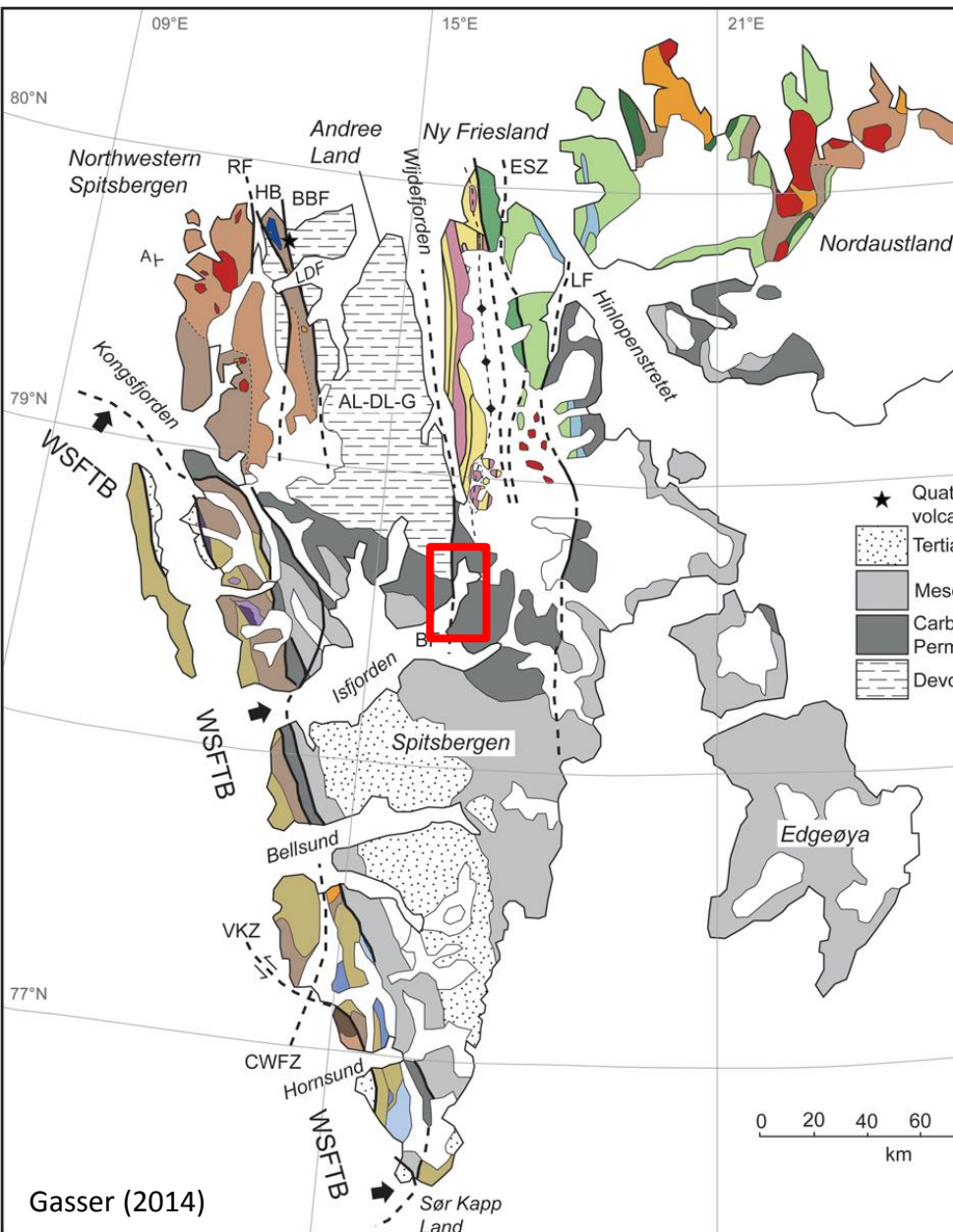
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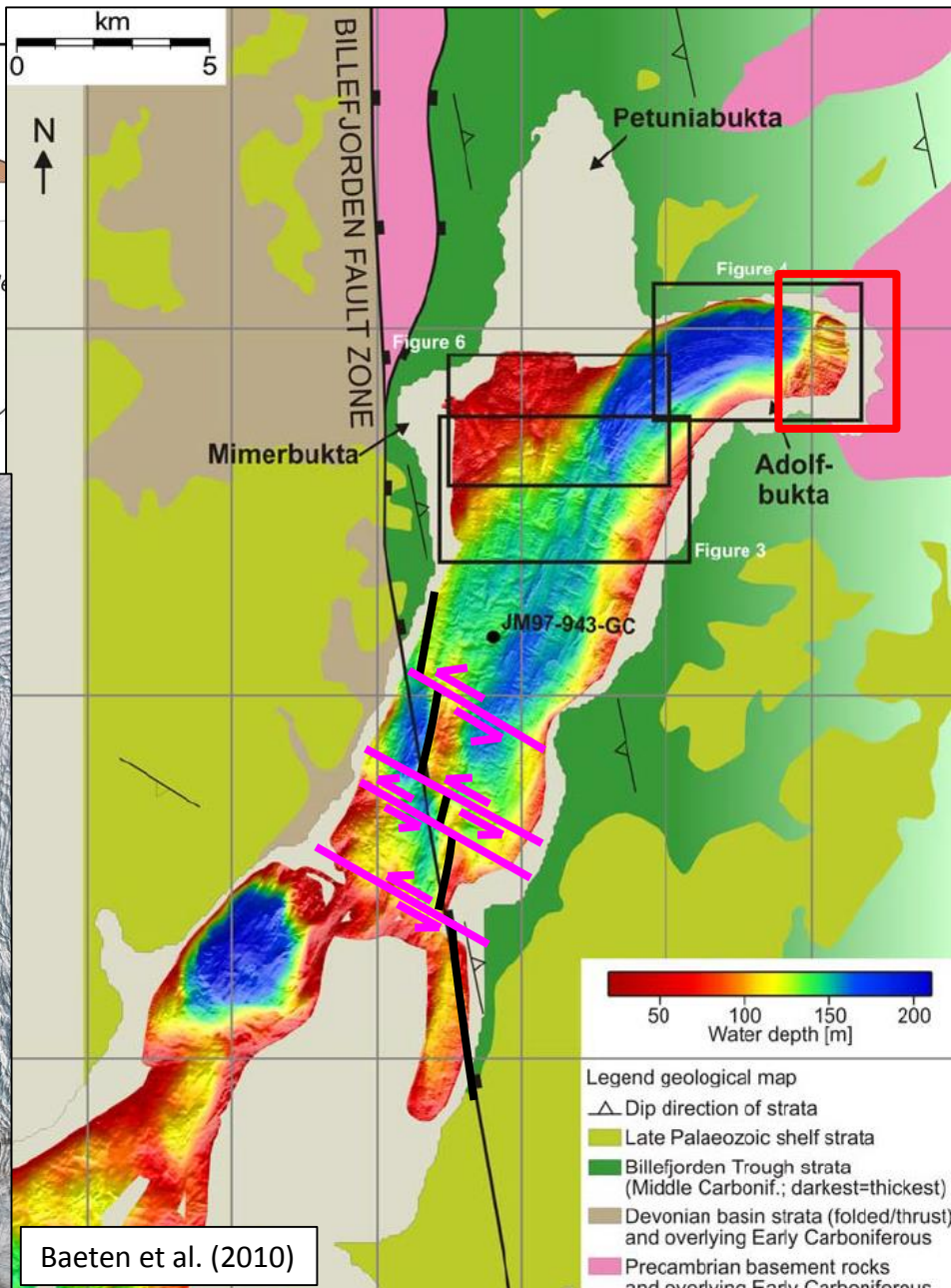
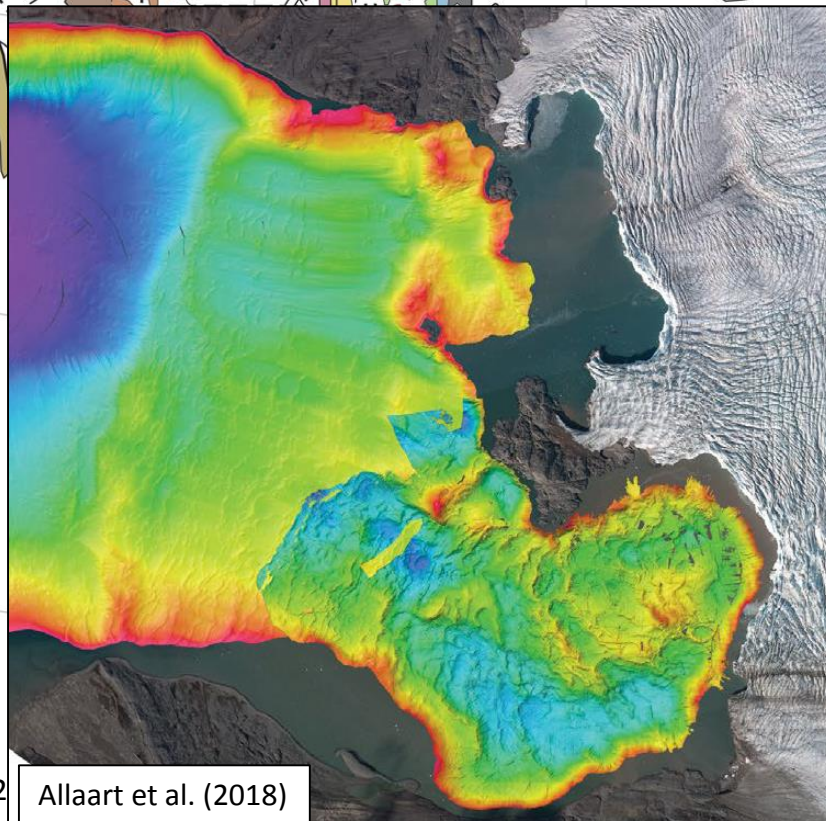
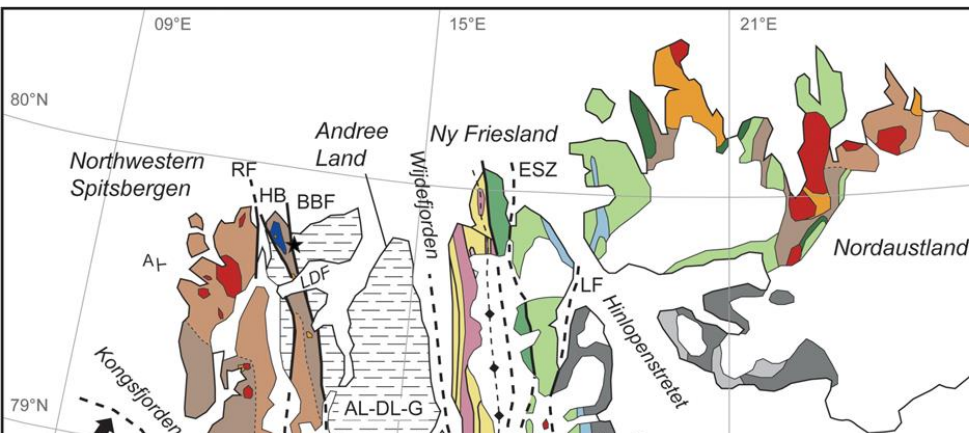
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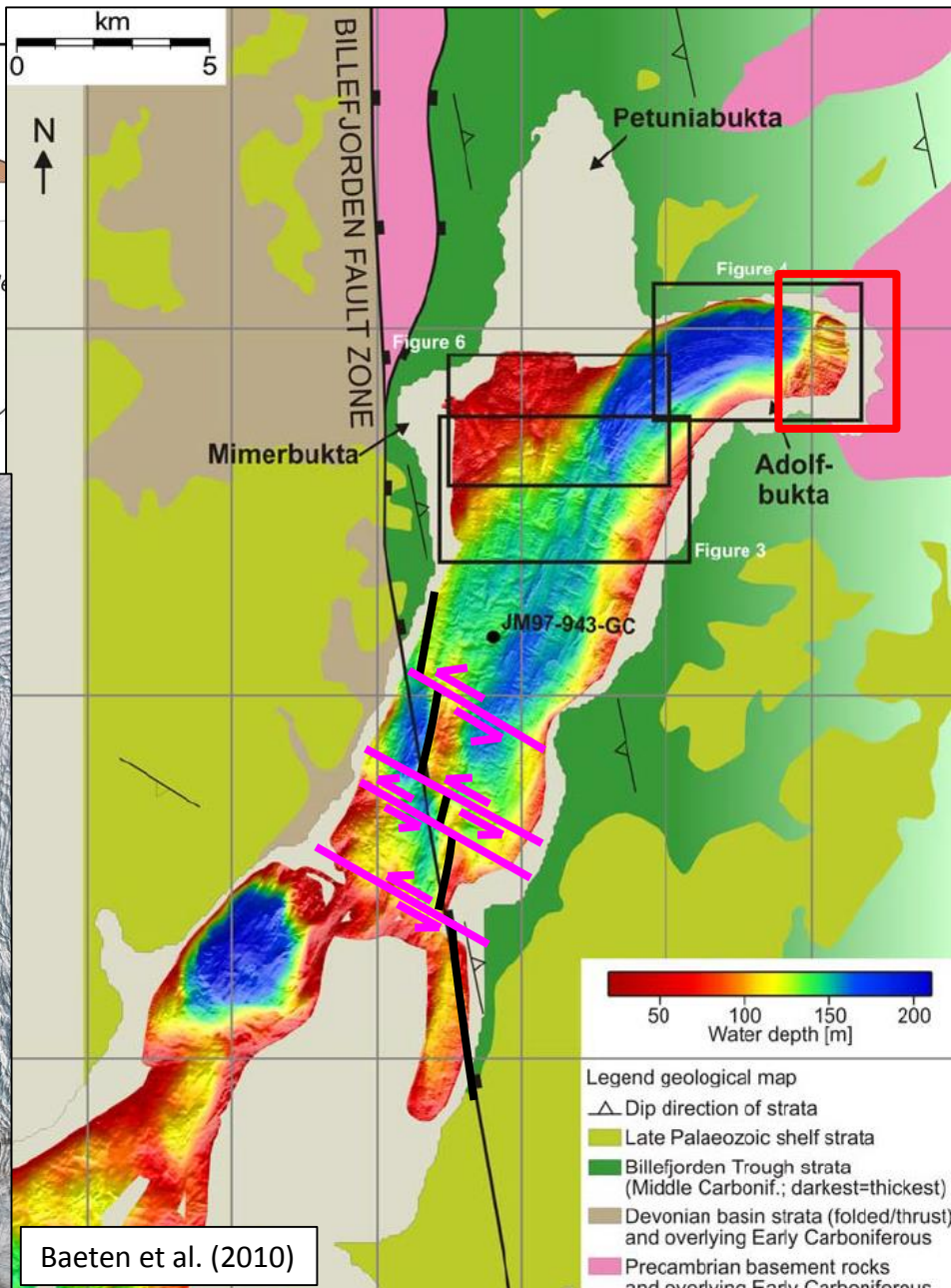
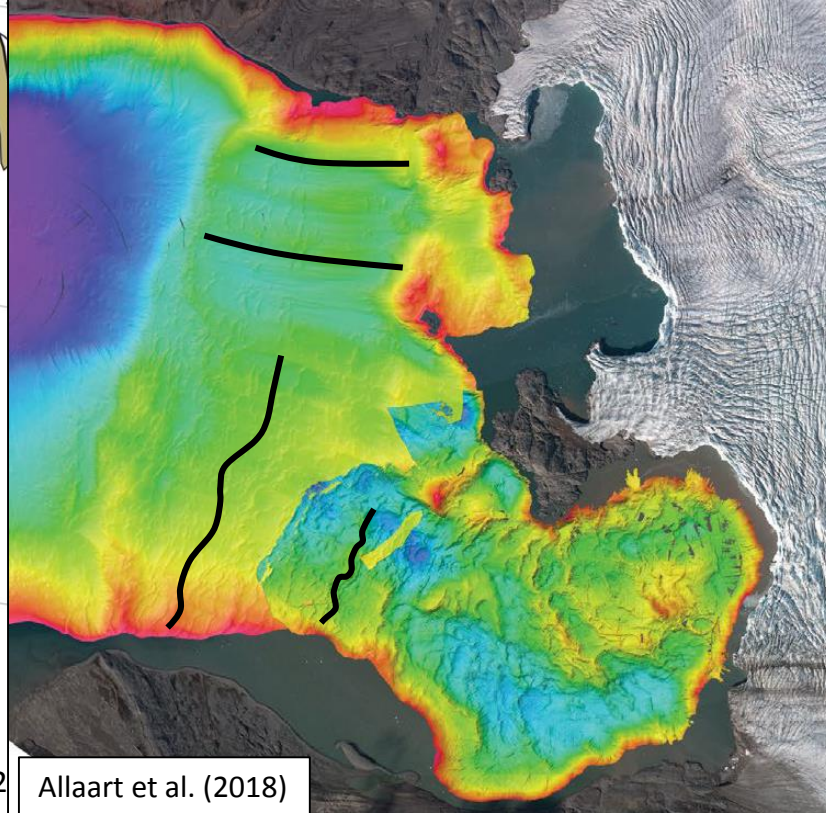
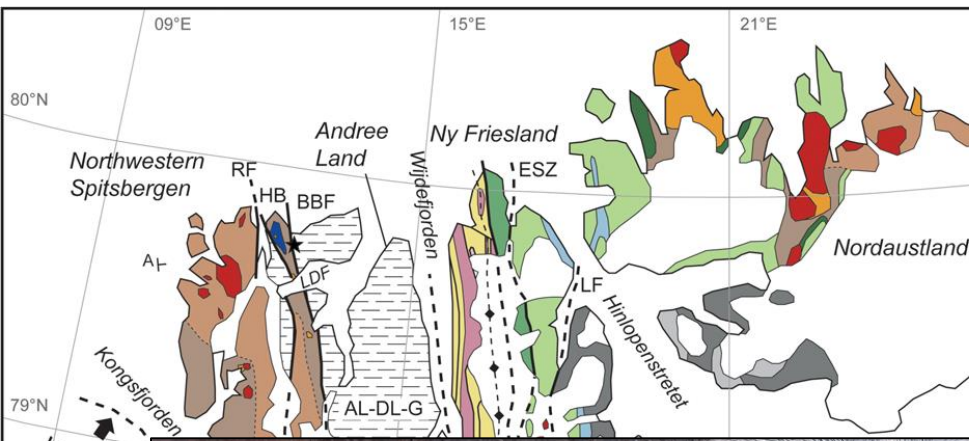
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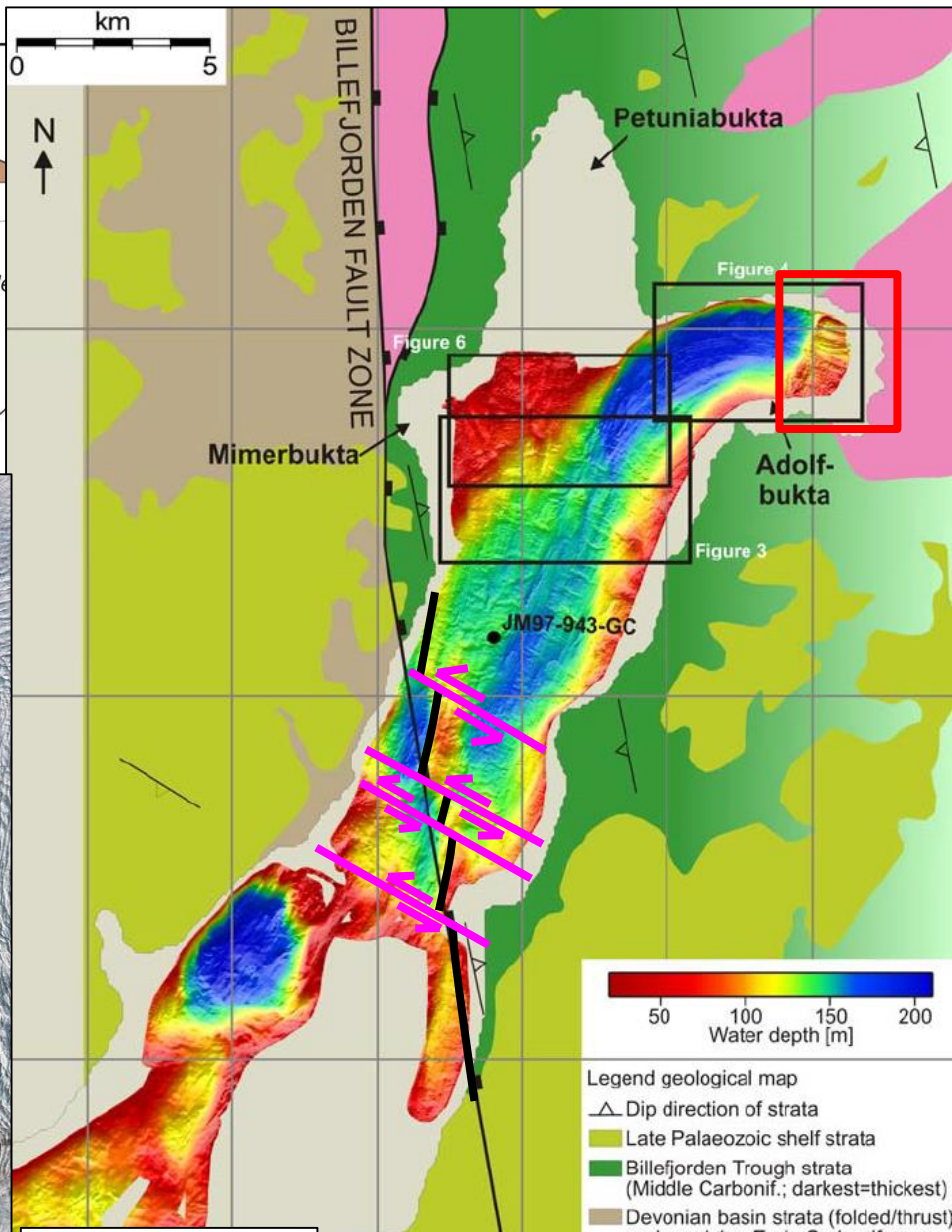
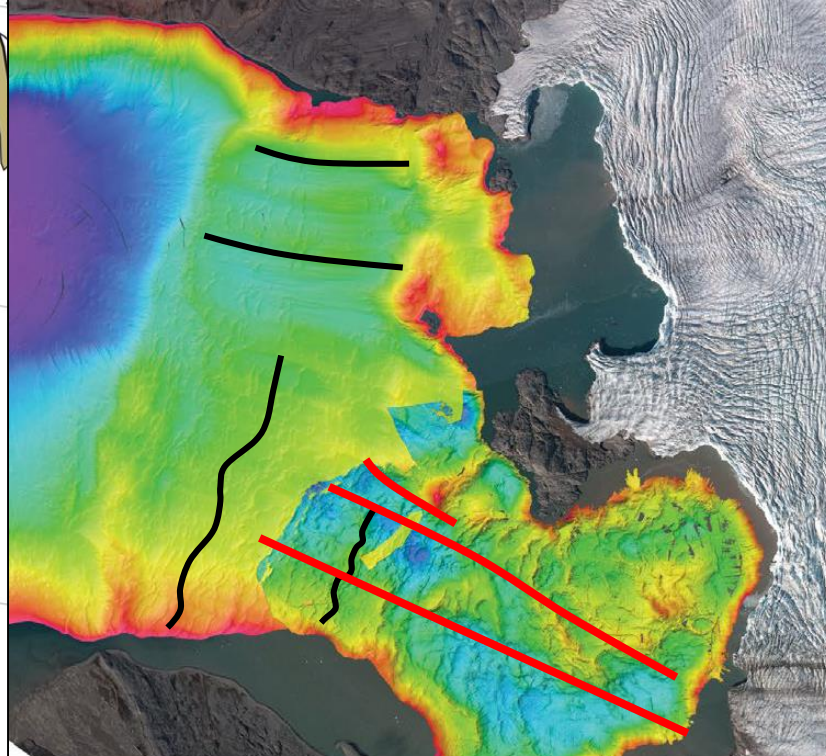
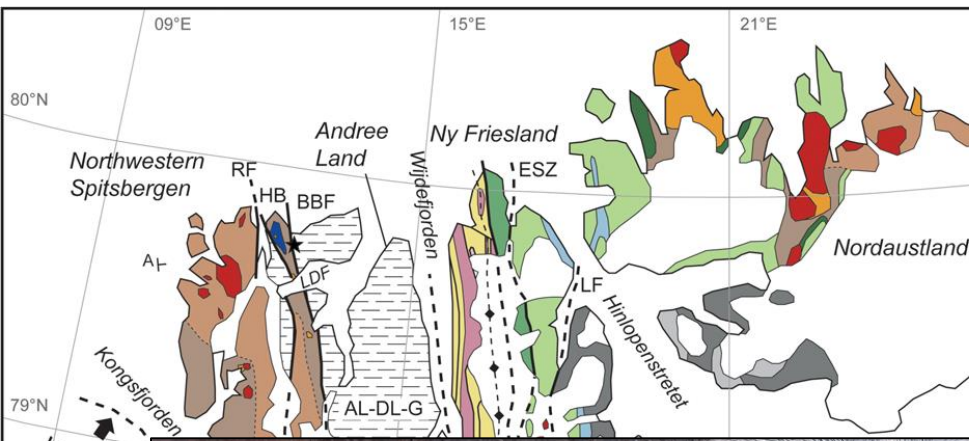
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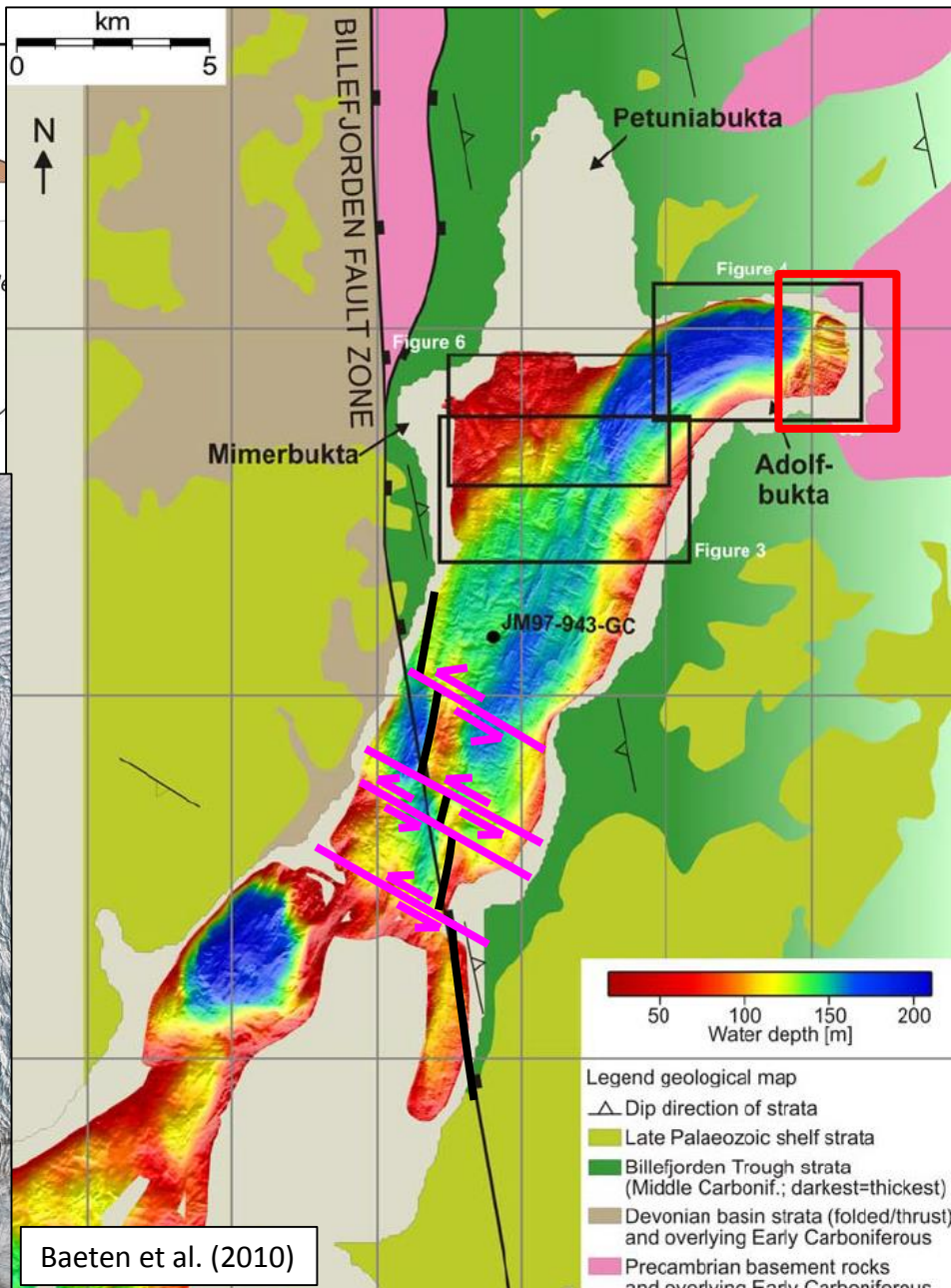
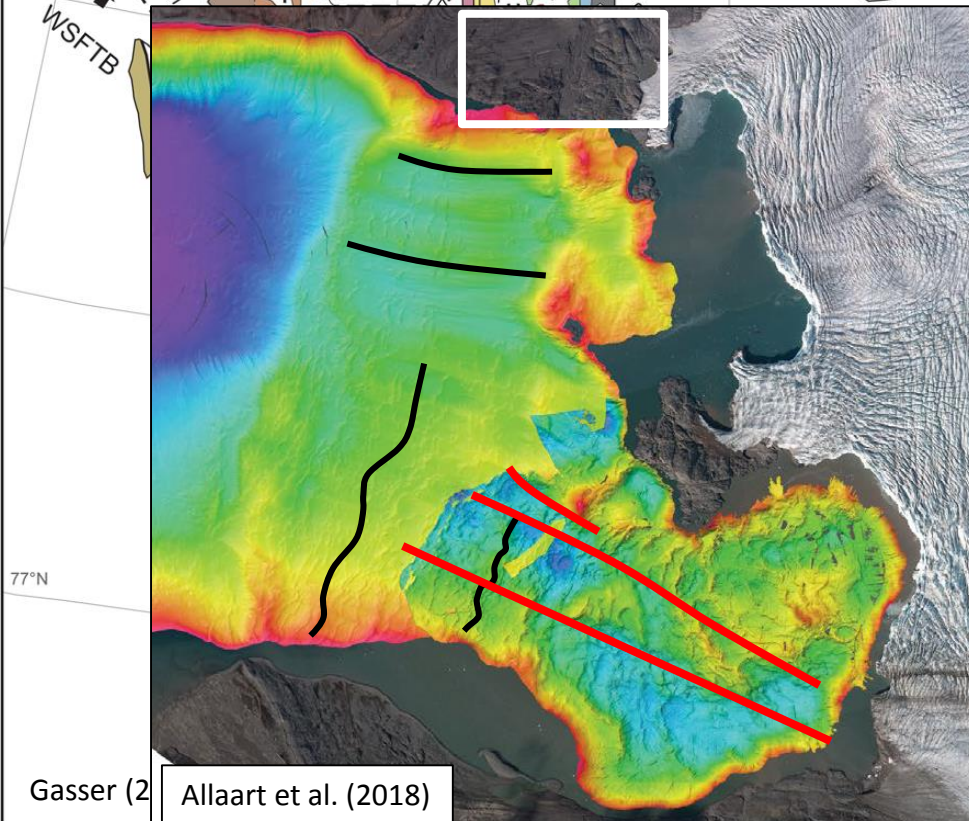
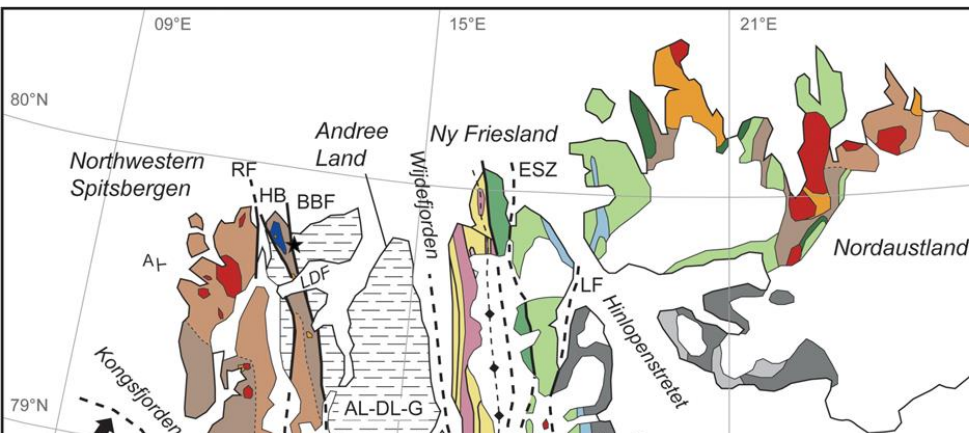
Gasser (2) Allaart et al. (2018)

Baeten et al. (2010)

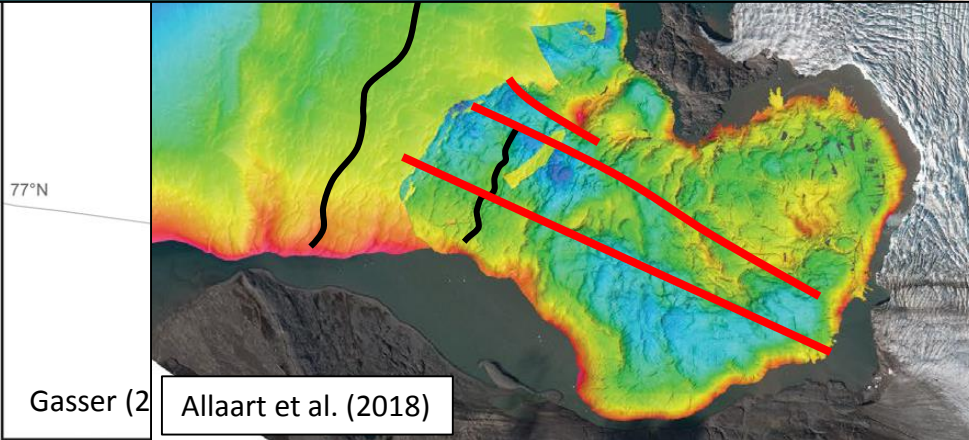
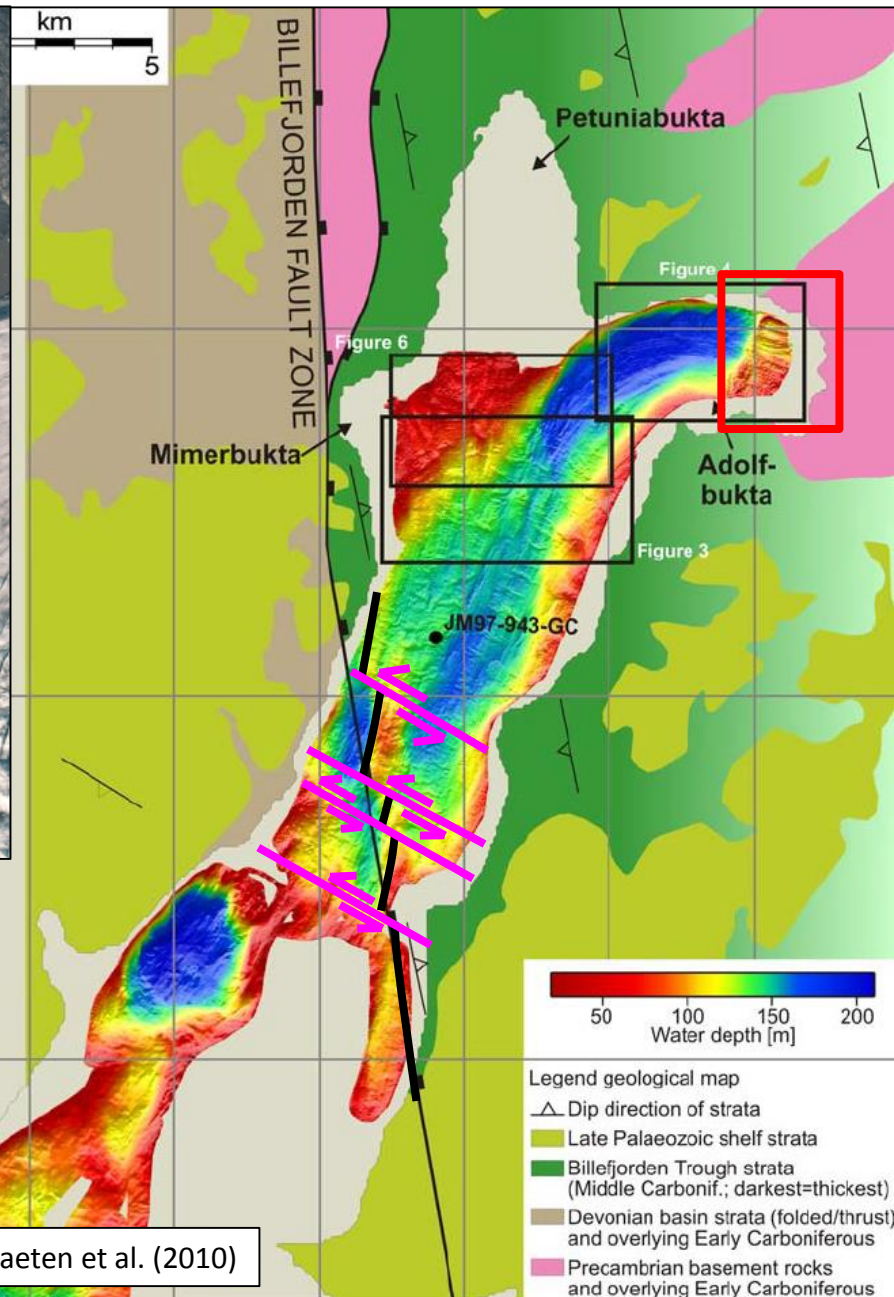
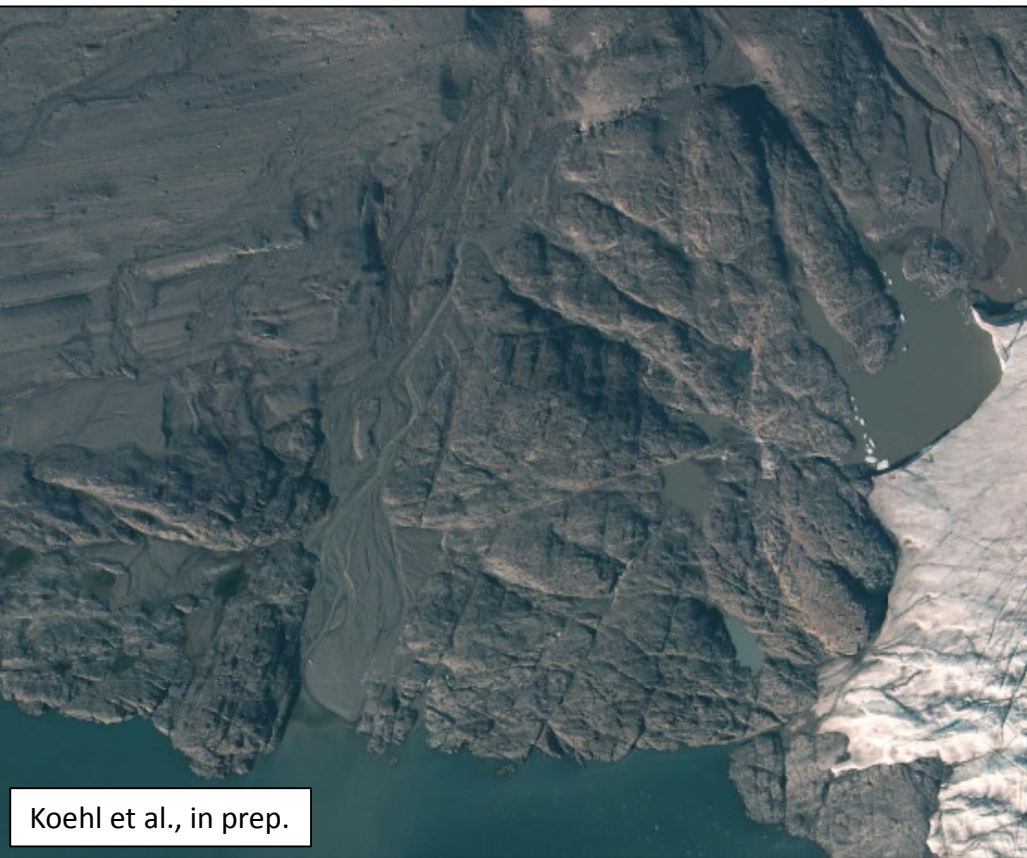
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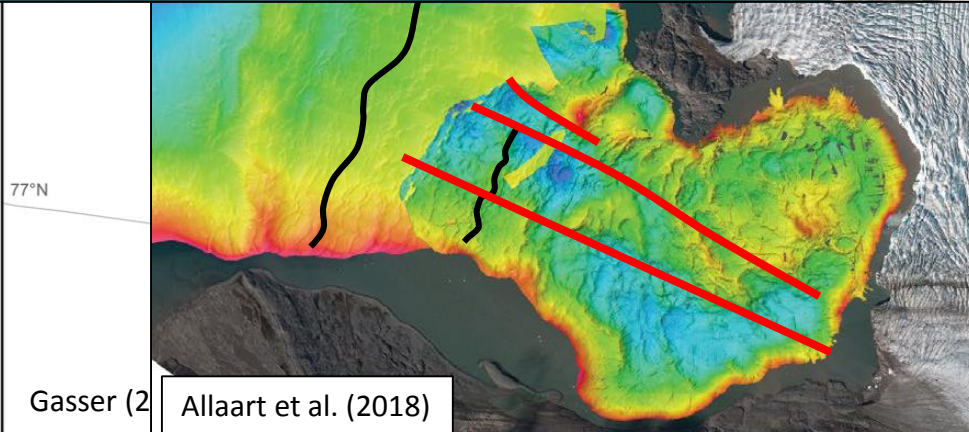
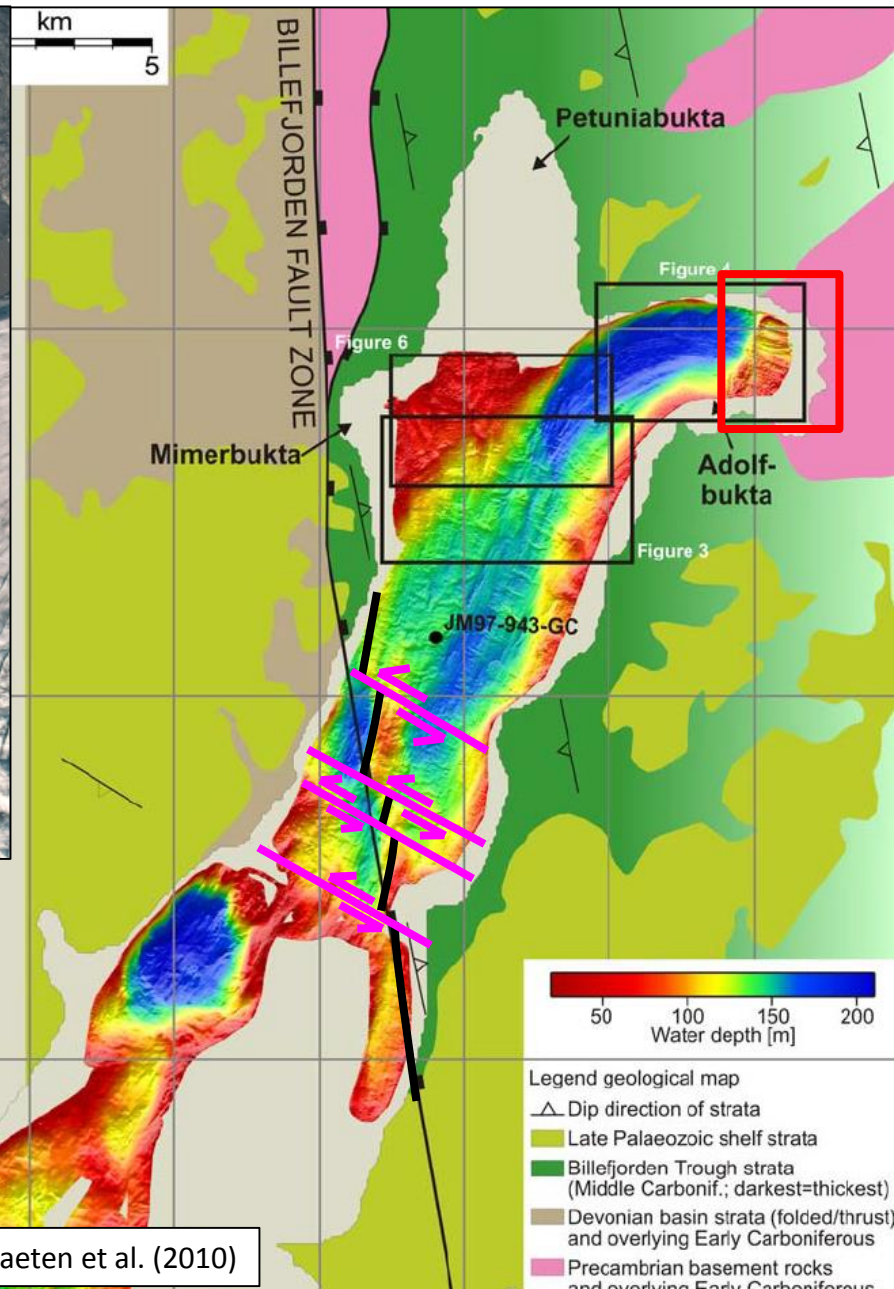
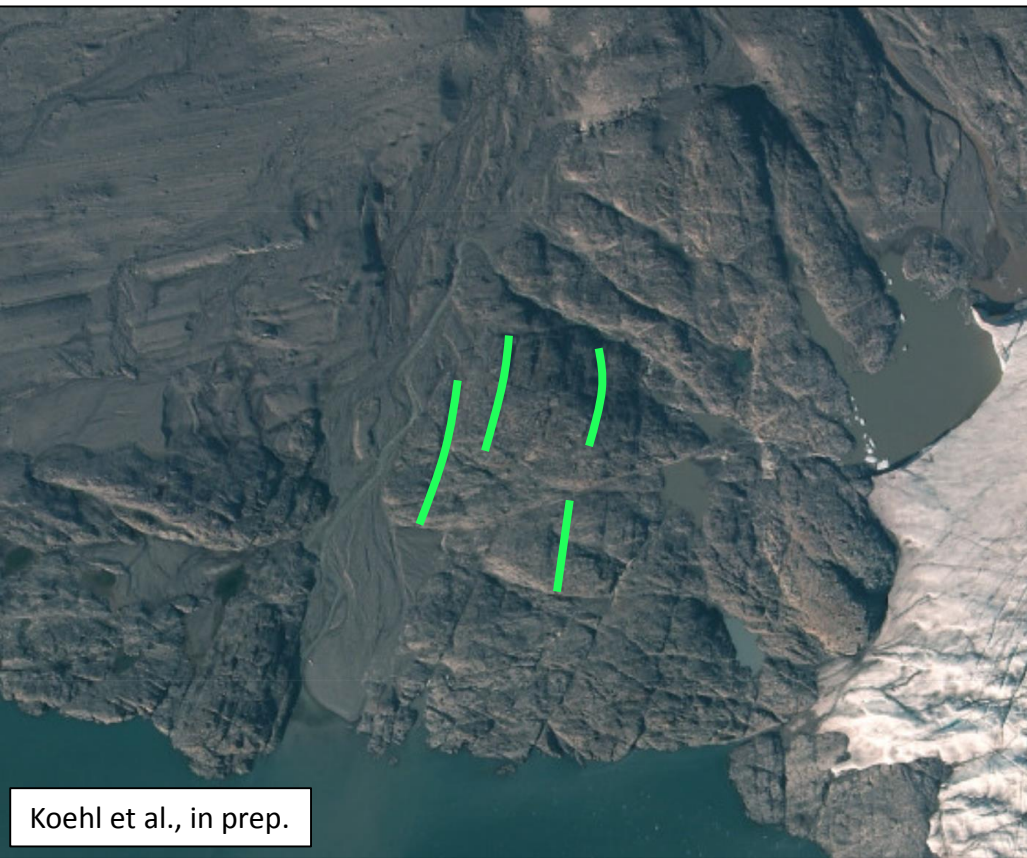


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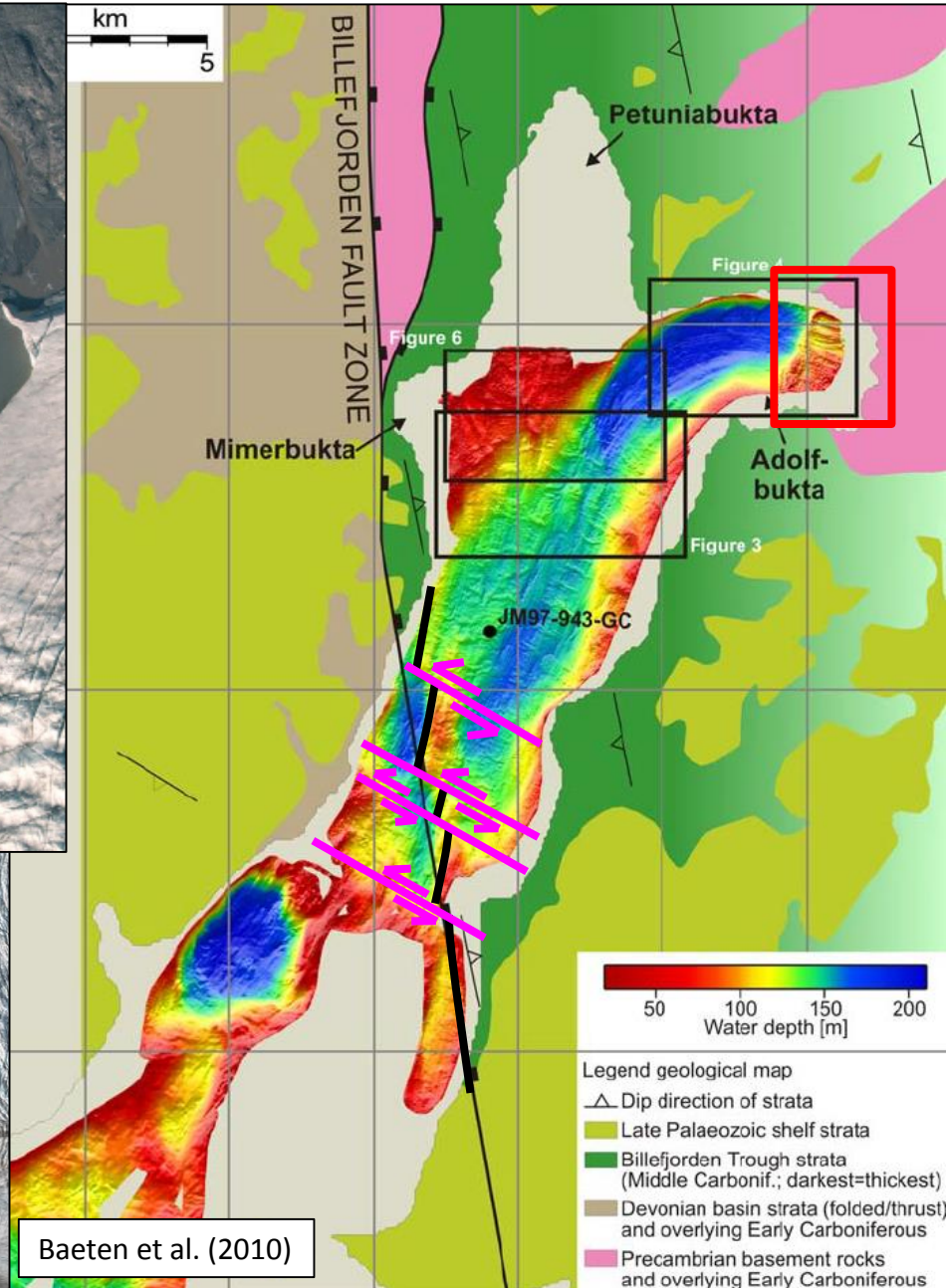
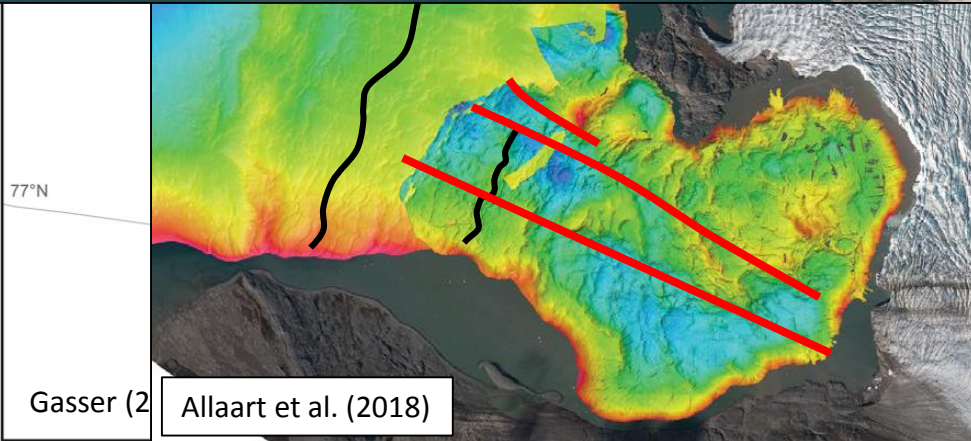
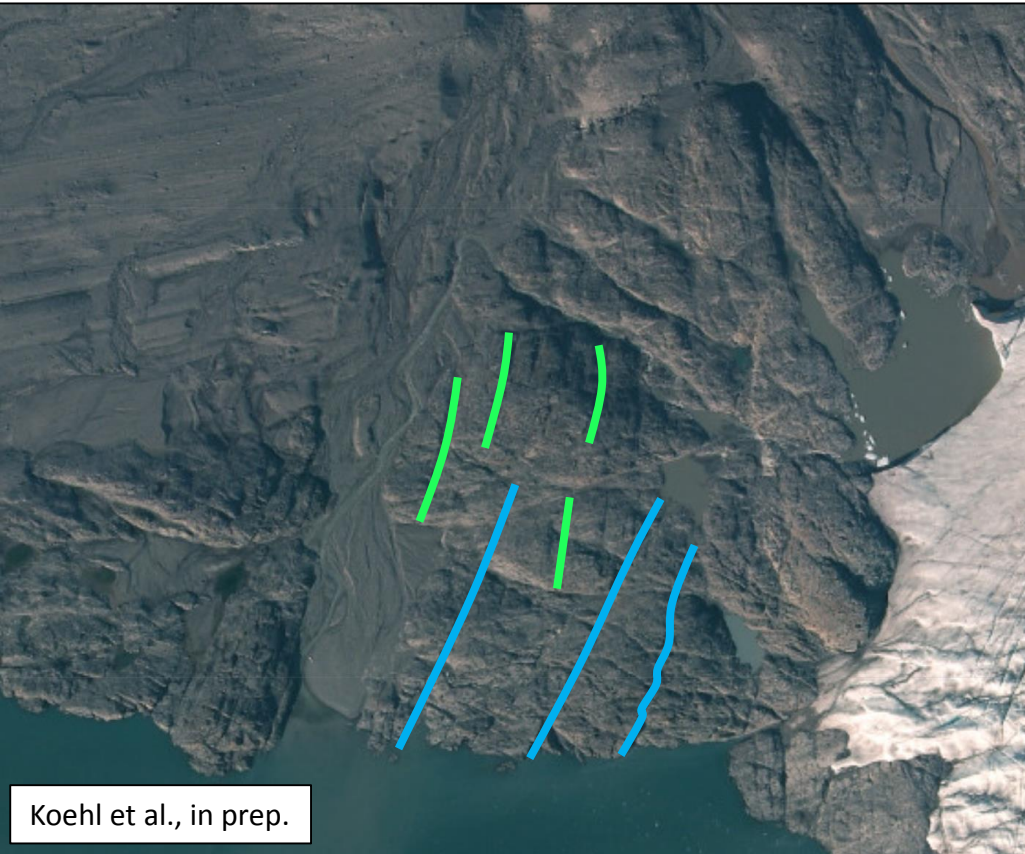


Baeten et al. (2010)

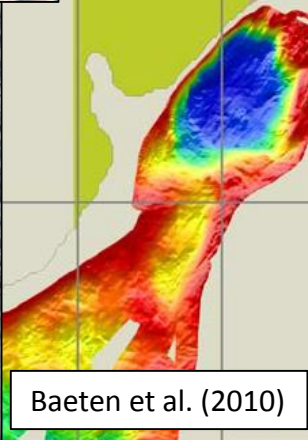
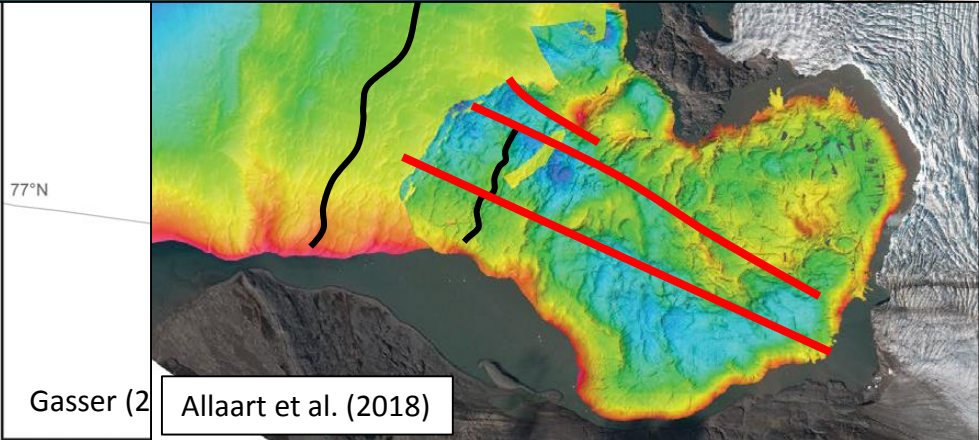
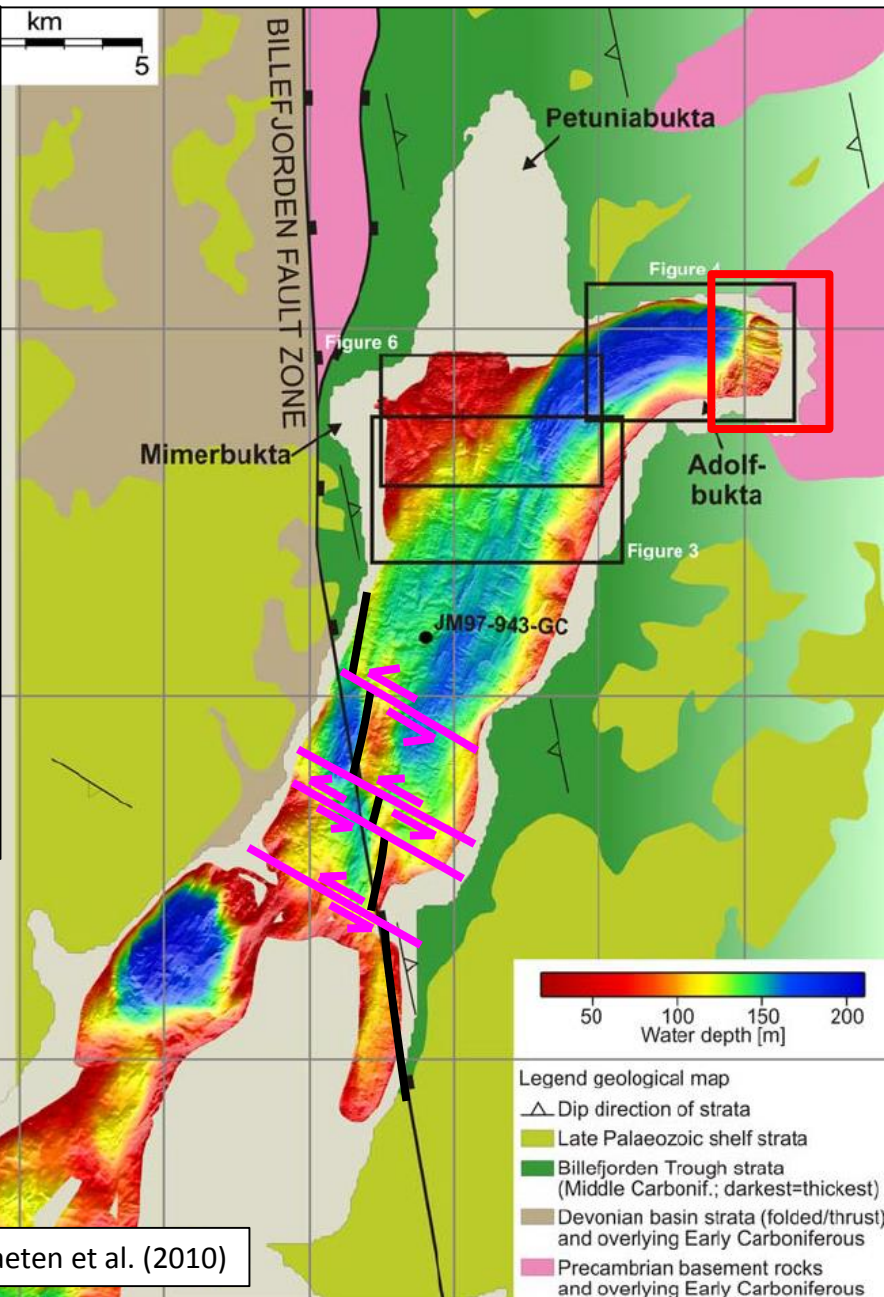
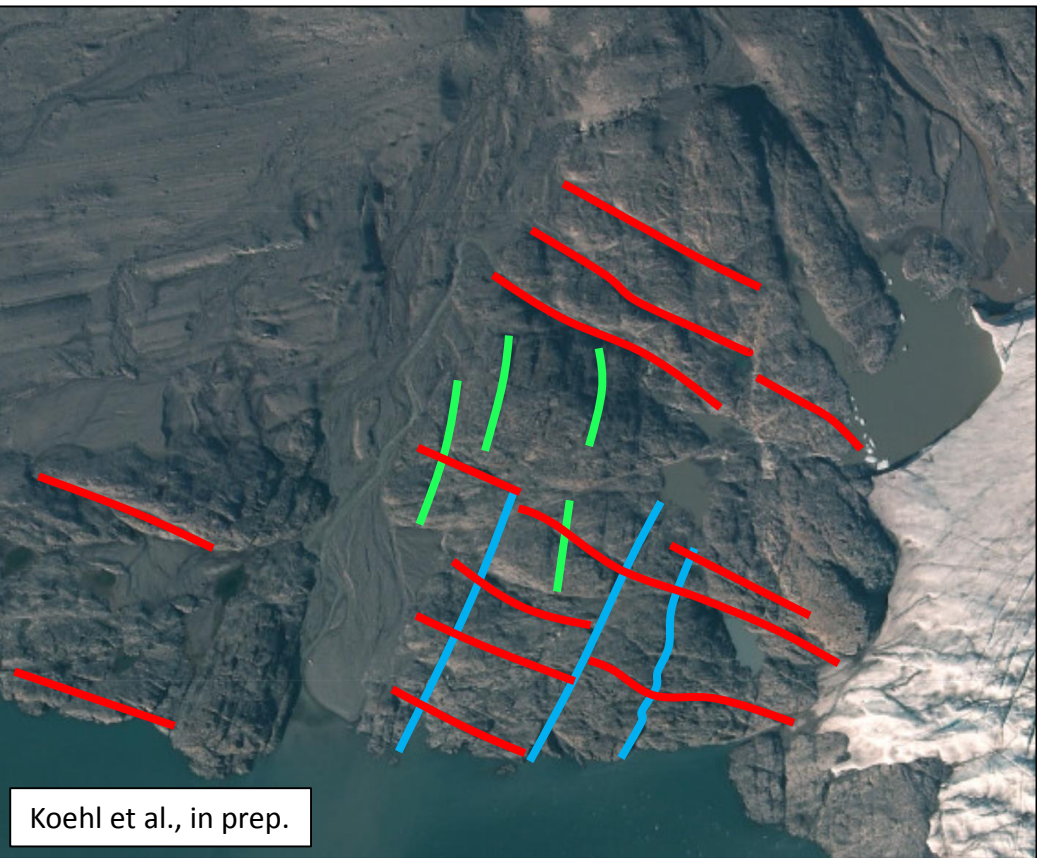
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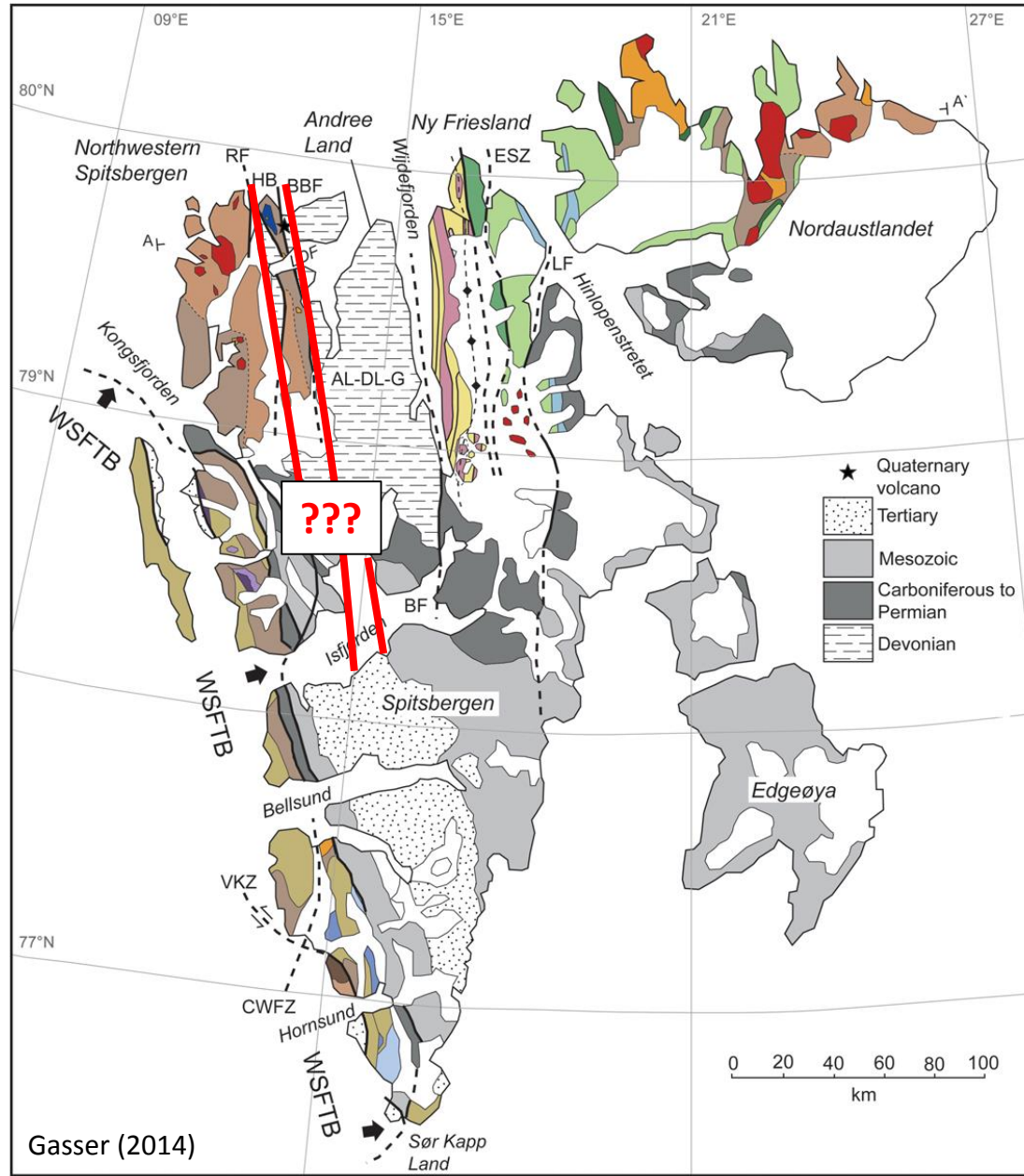
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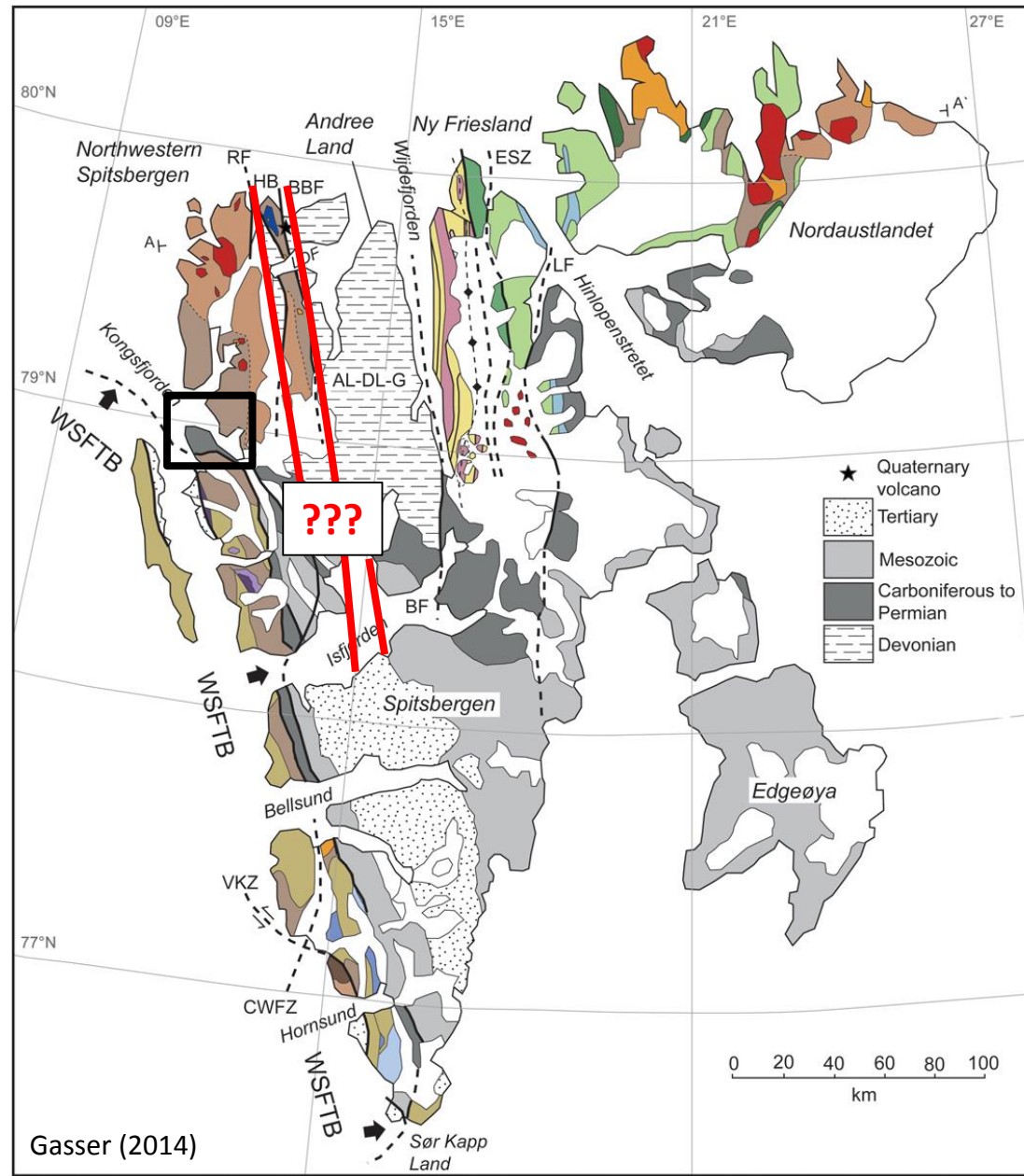
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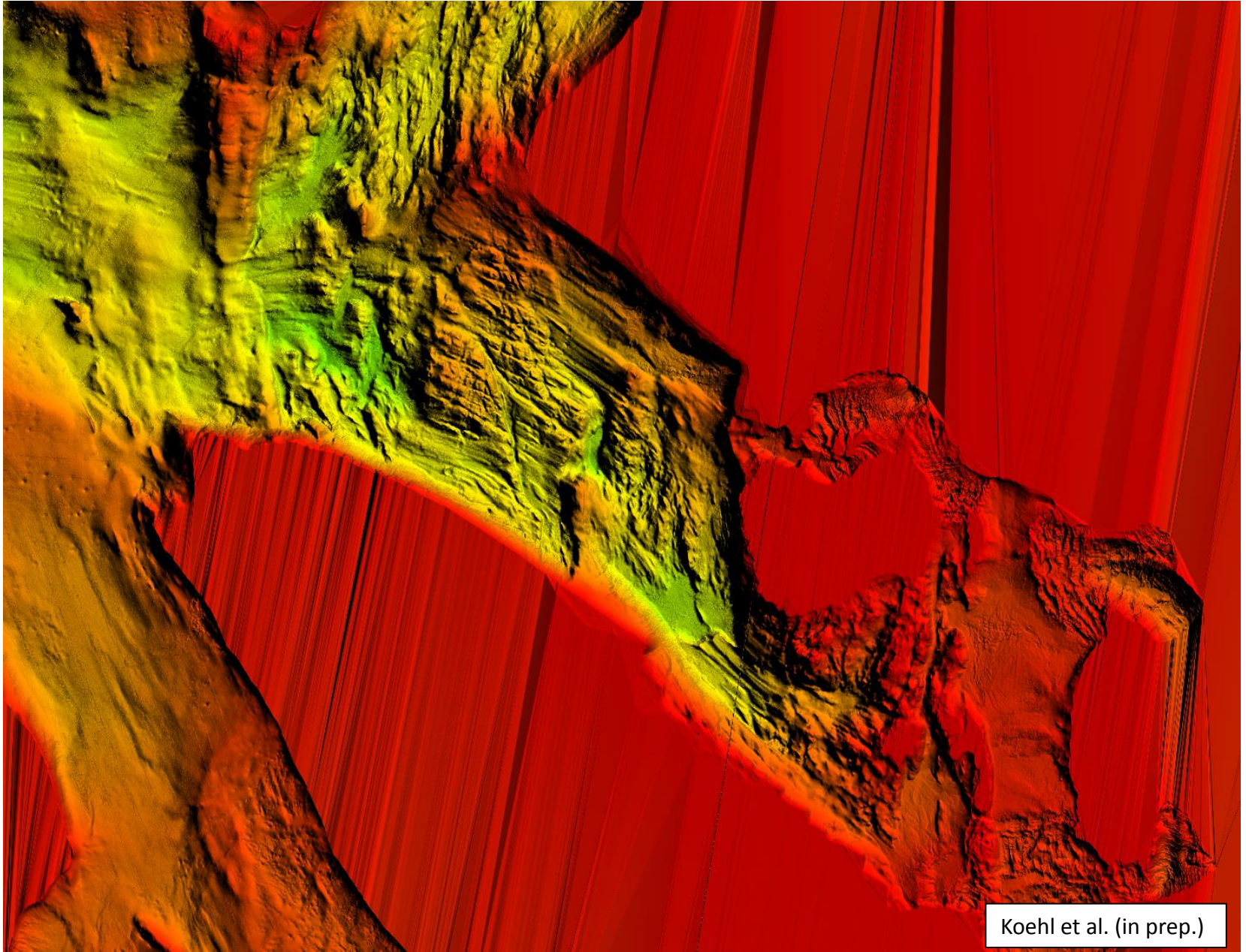
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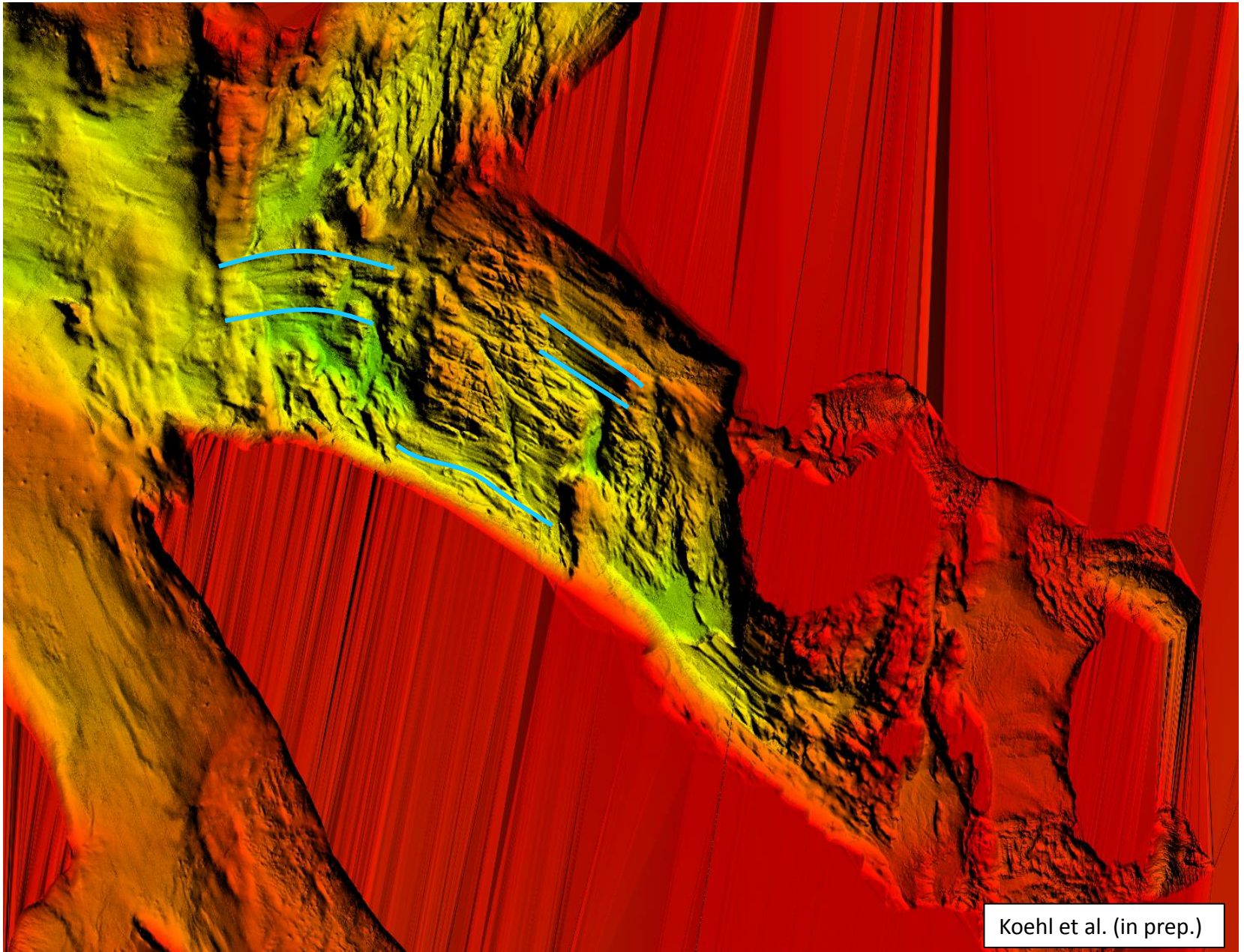
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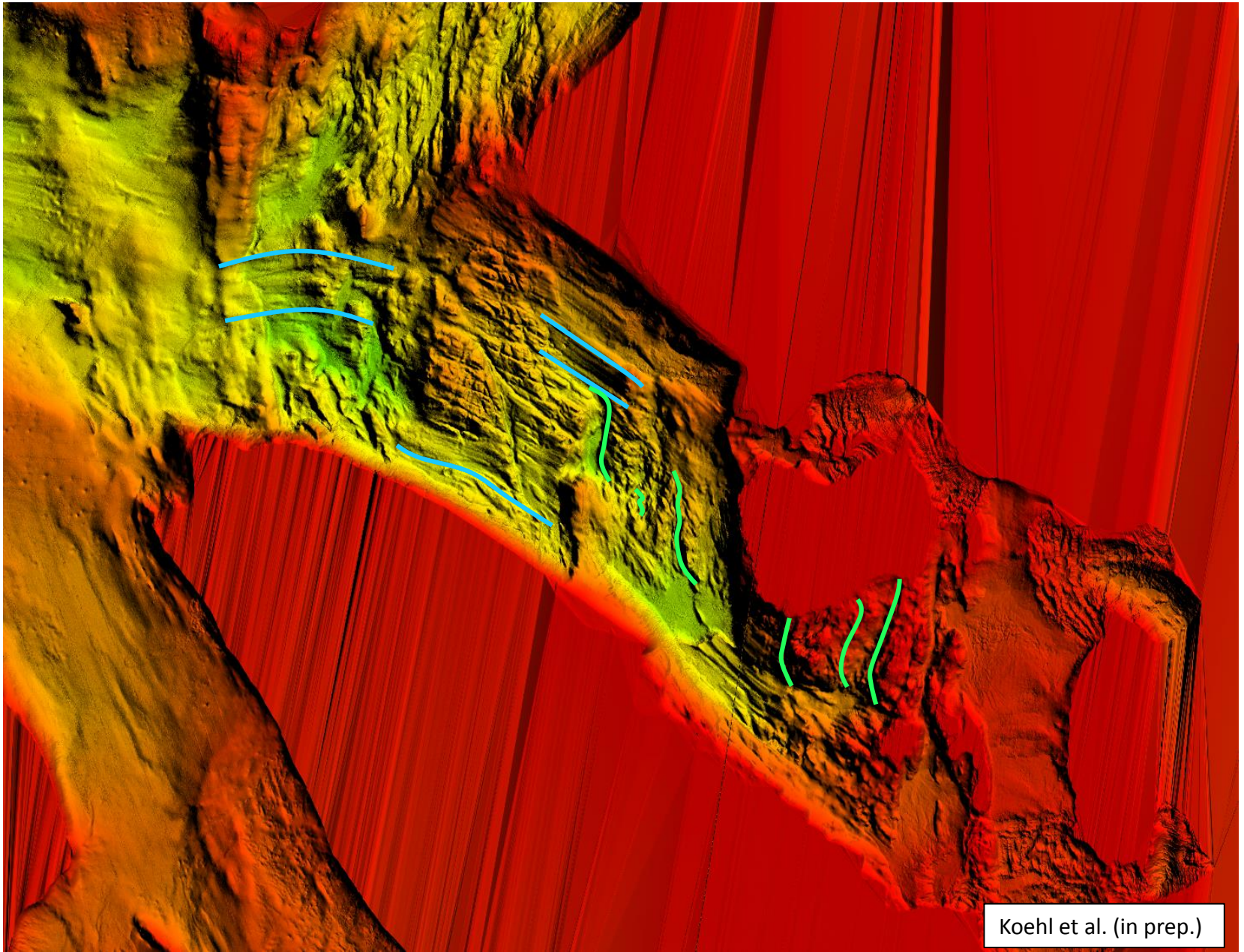
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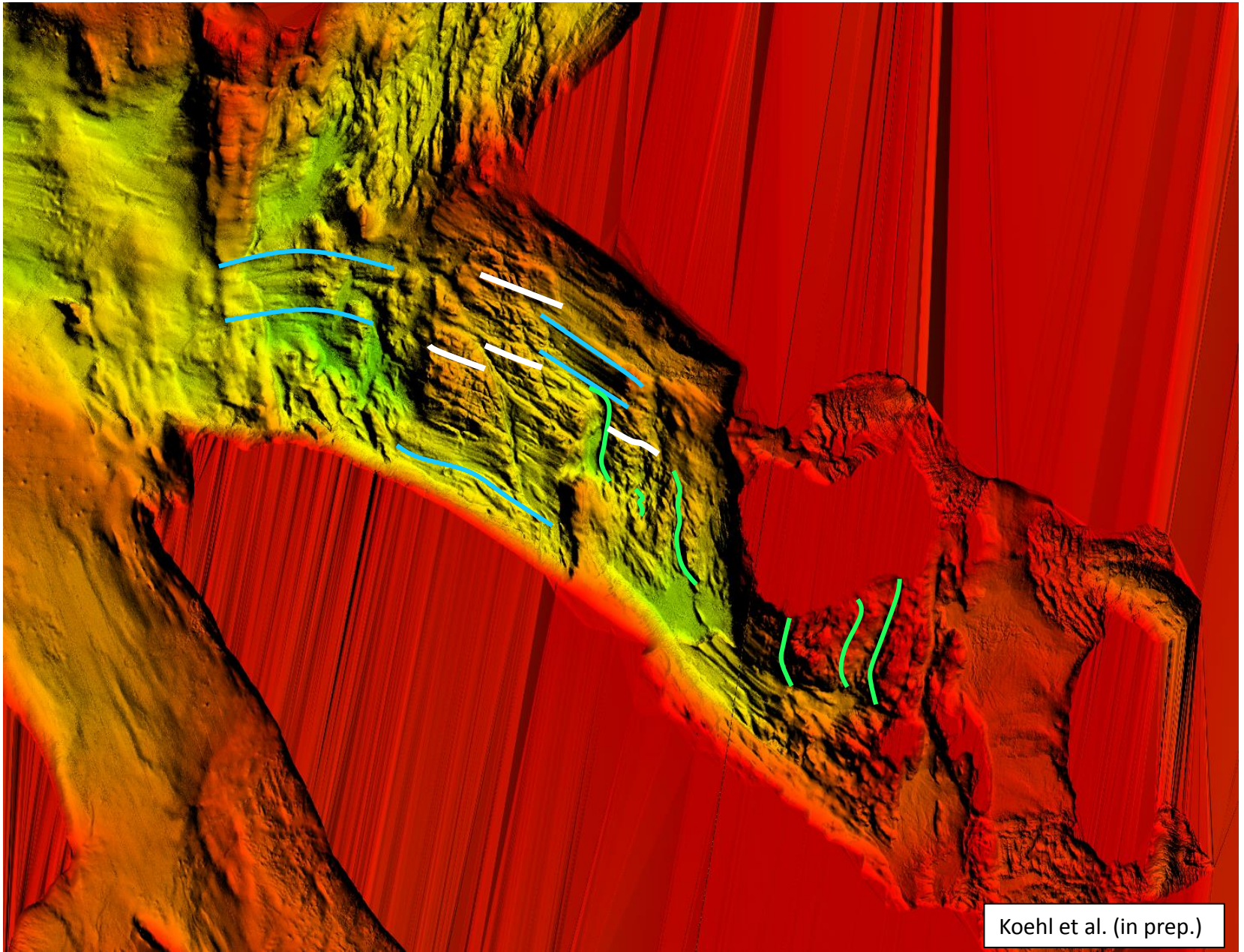
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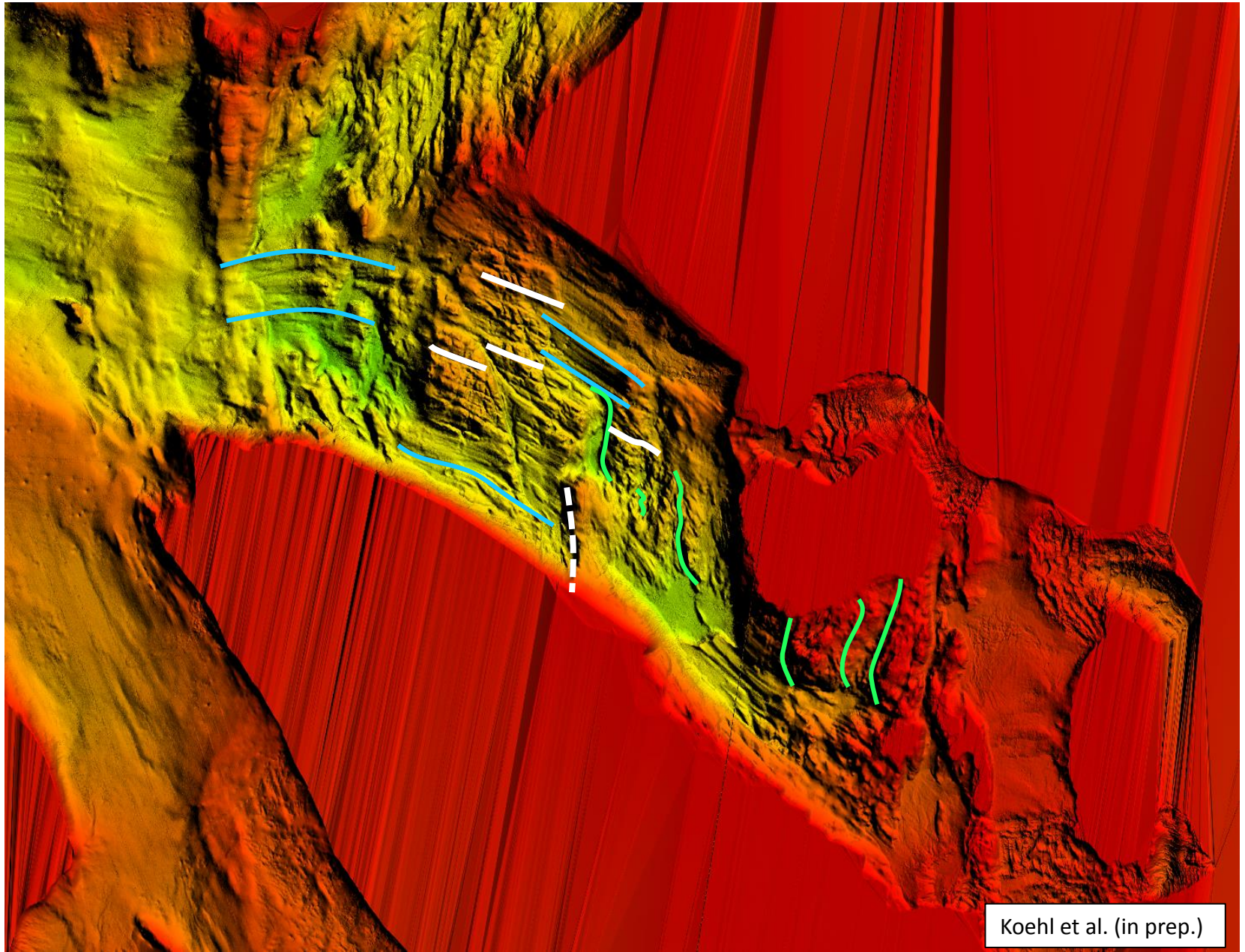
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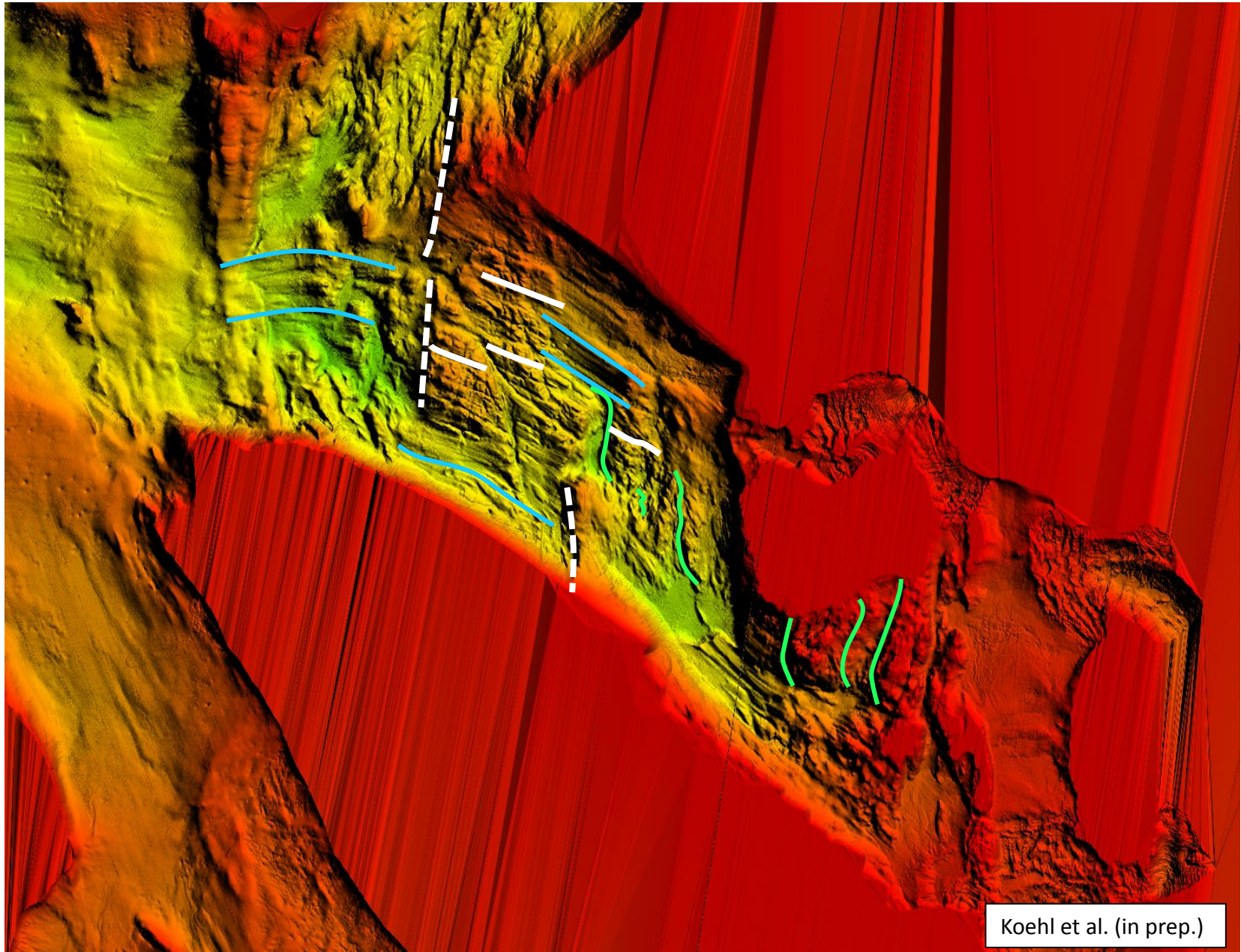
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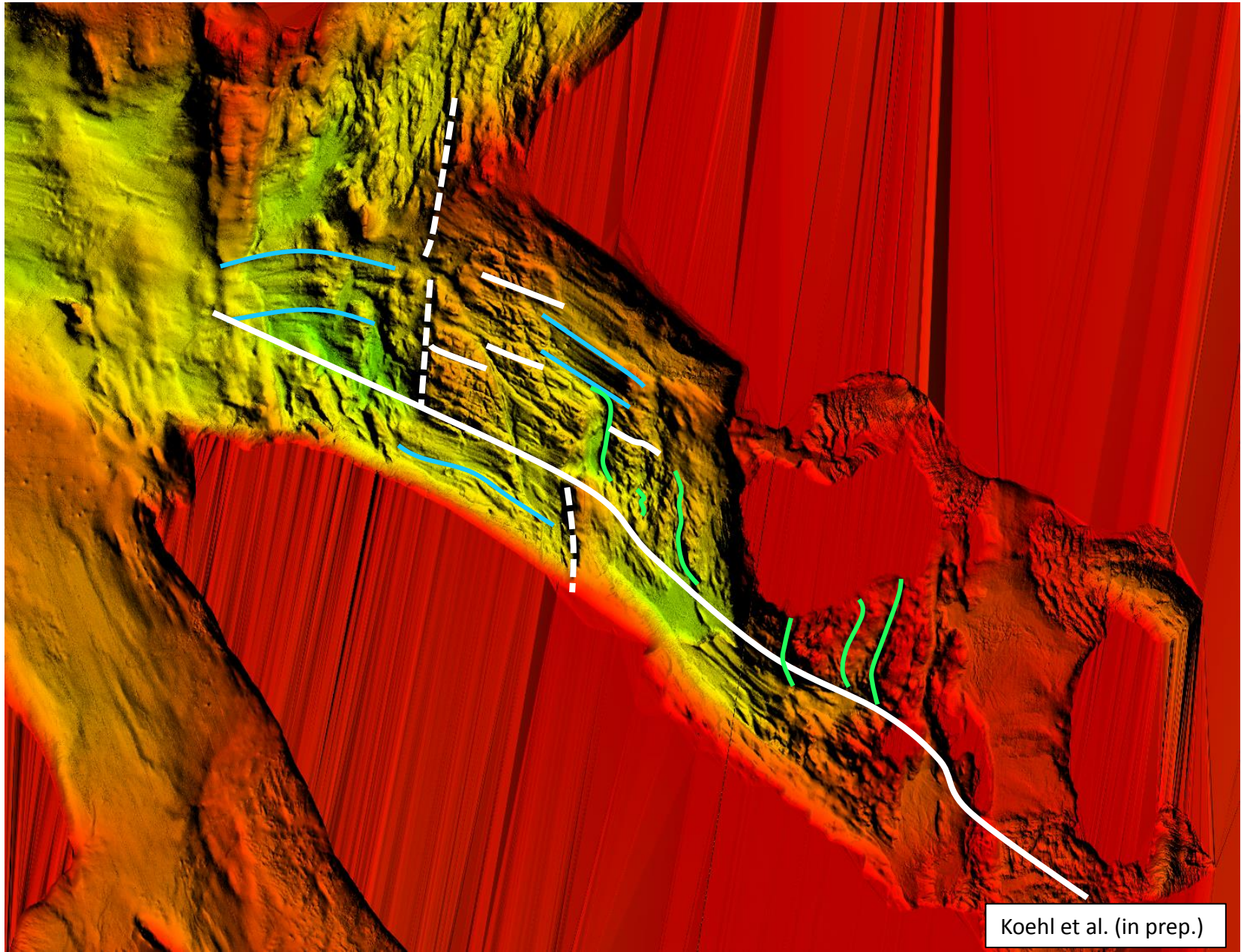
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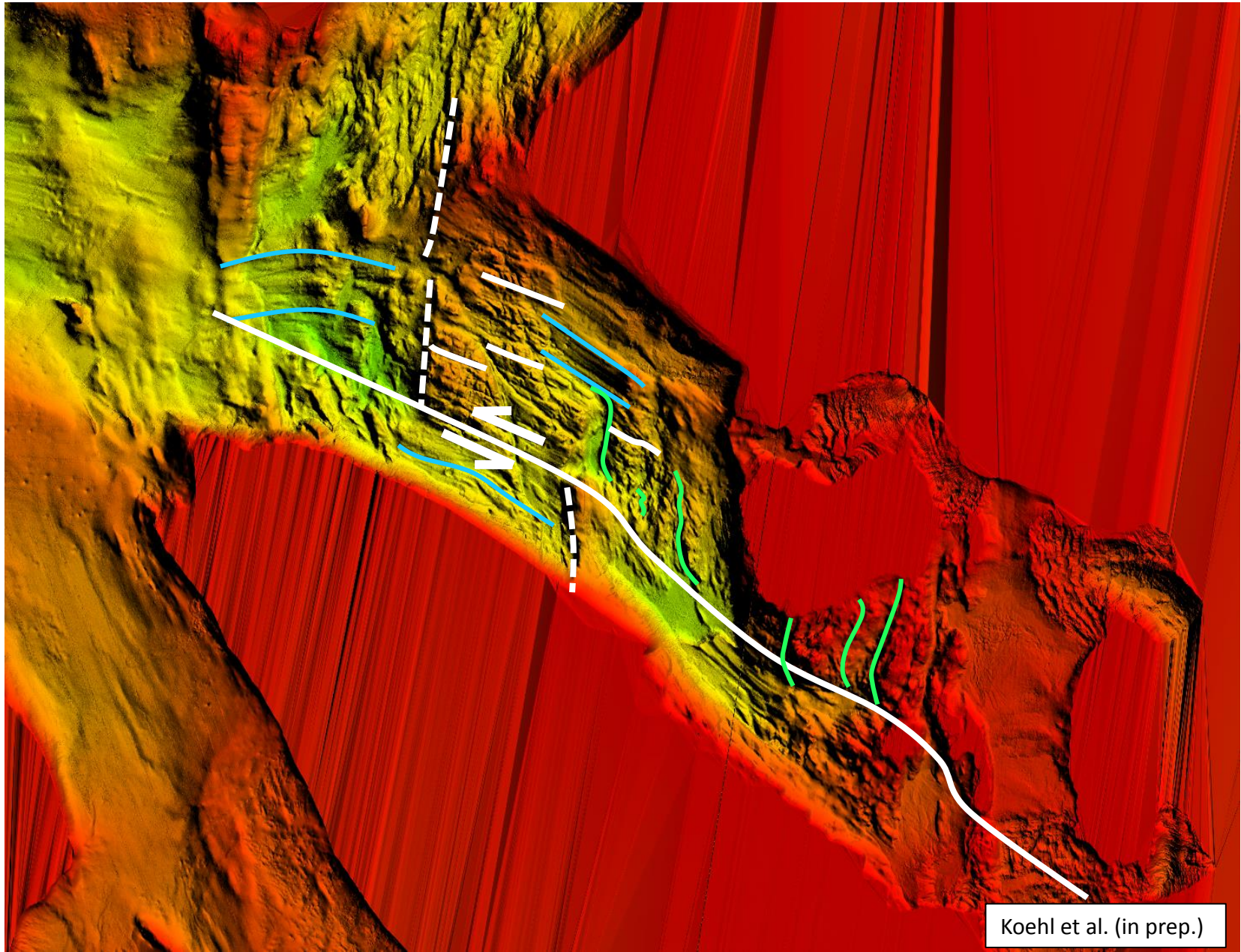
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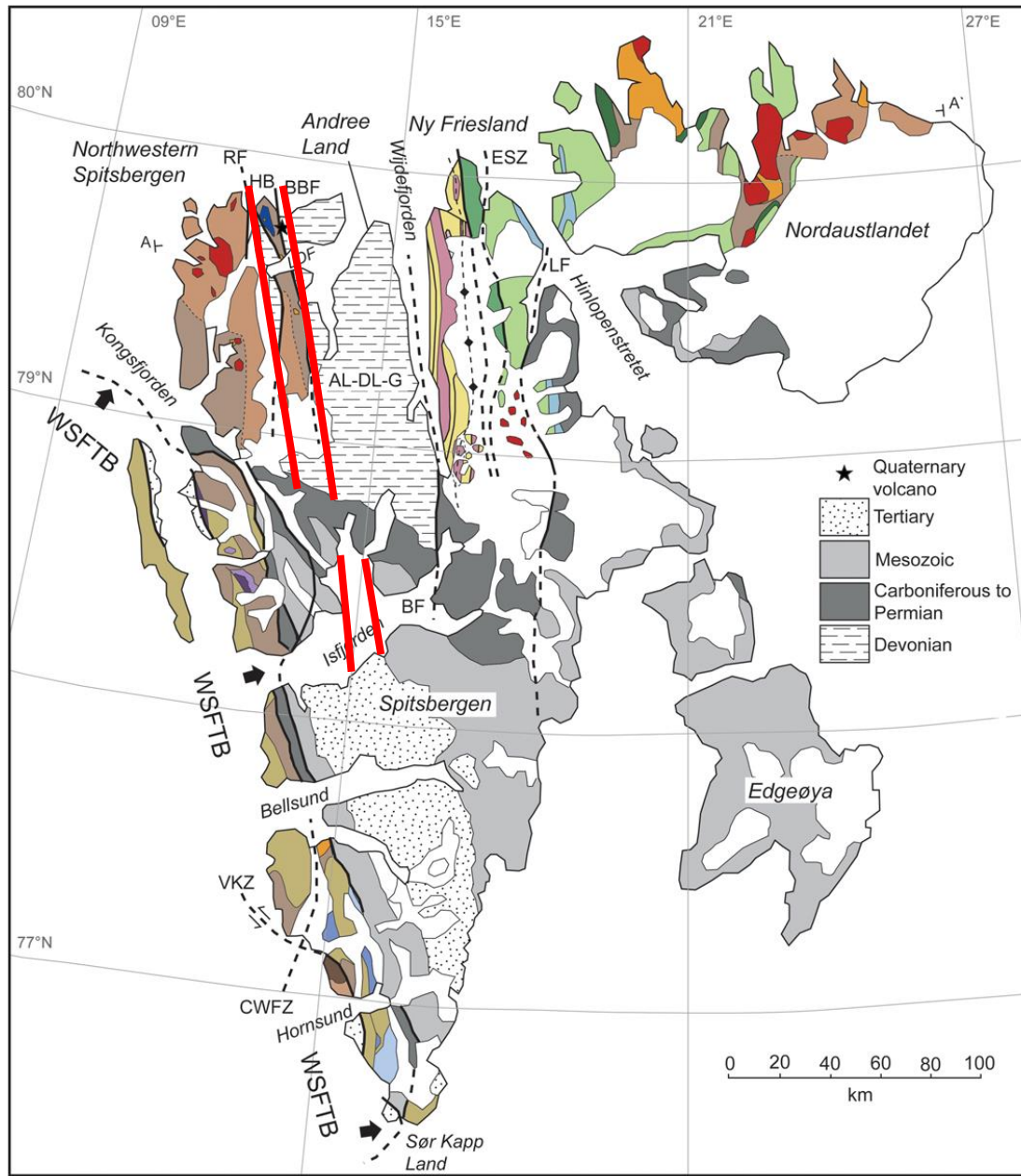
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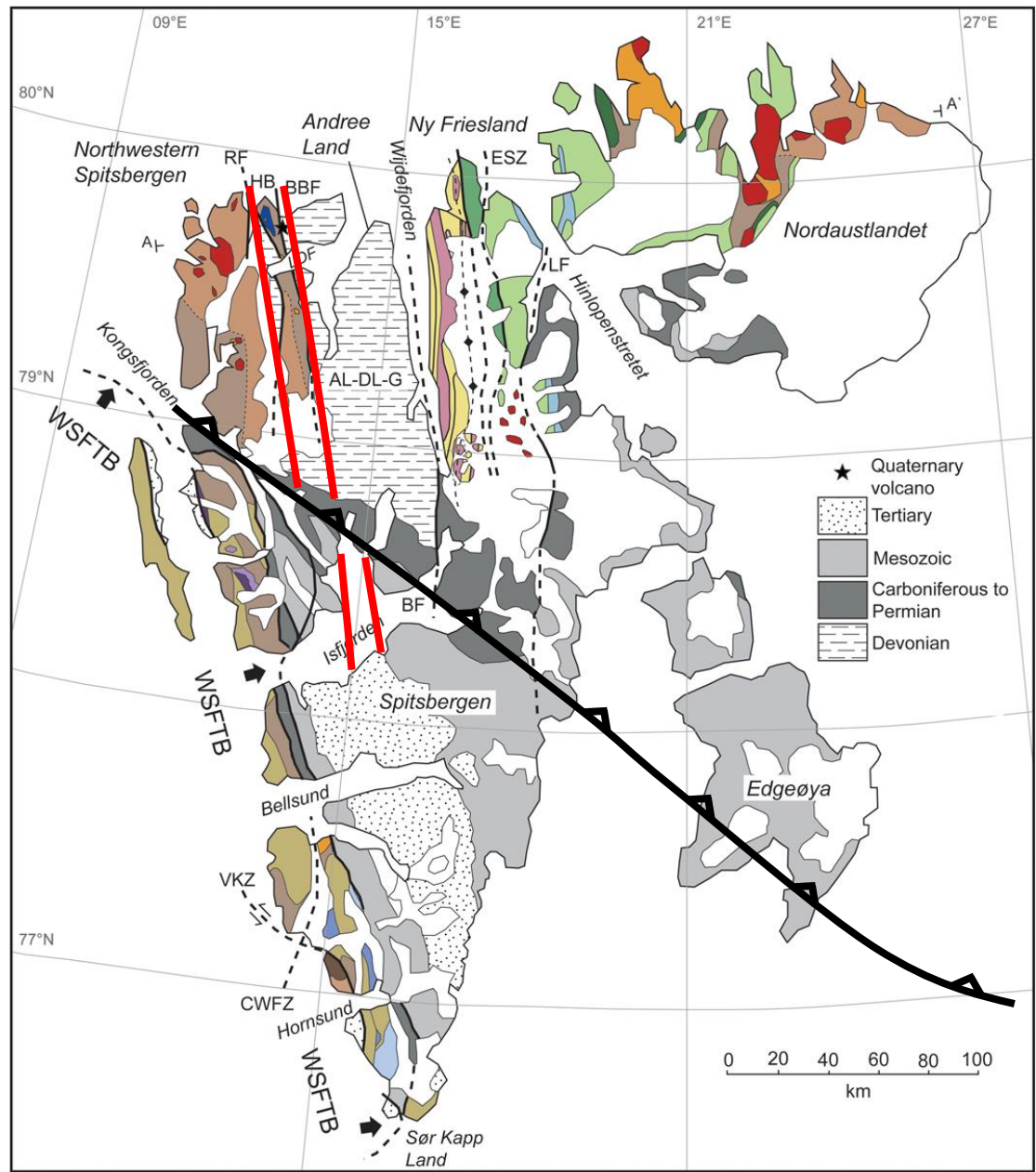
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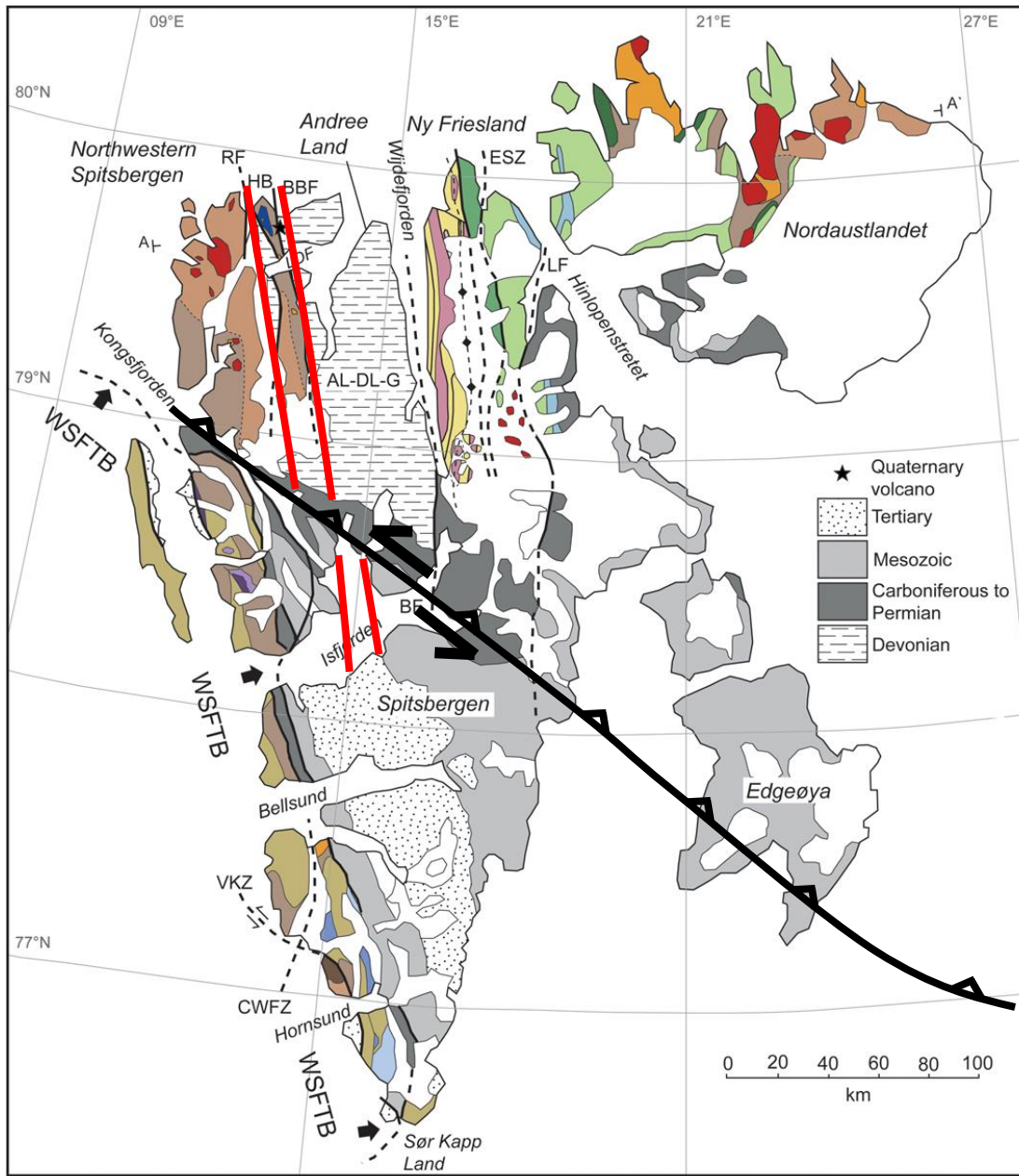
2 On the 29th of March 2016, an earthquake coinciding with the location of the WNW–ESE-striking Timanian thrust struck near the southwestern coast of Edgeøya.



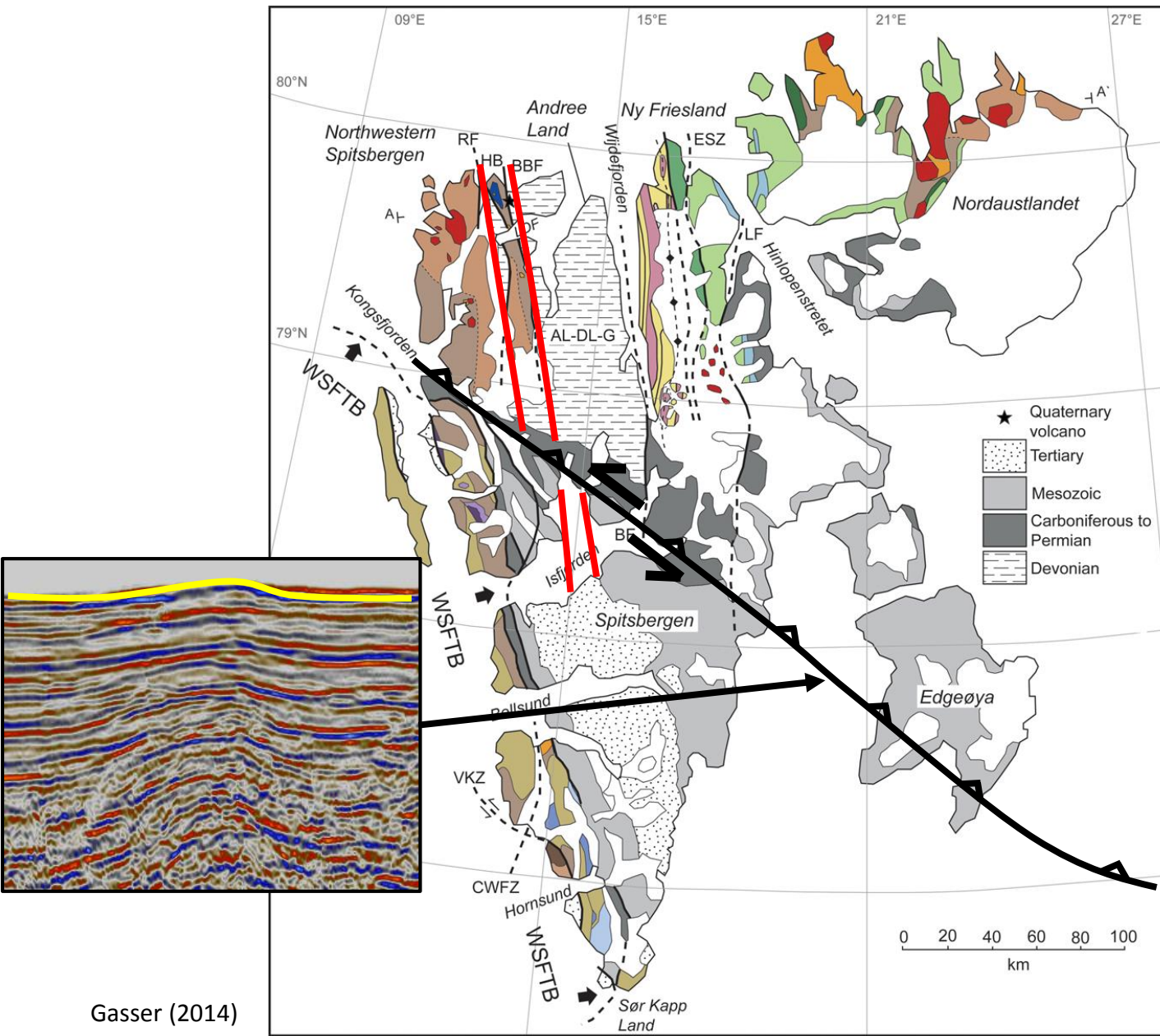
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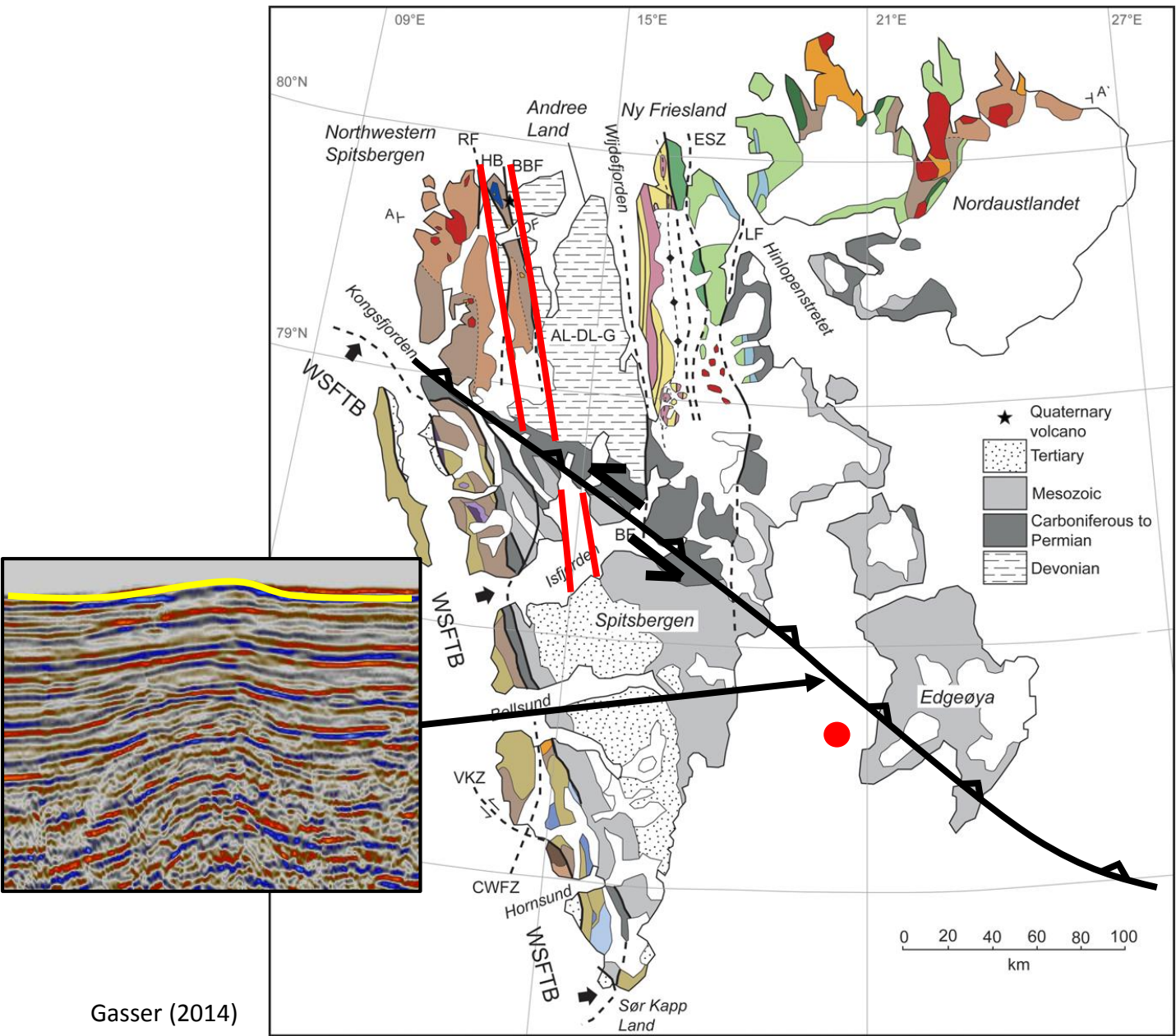
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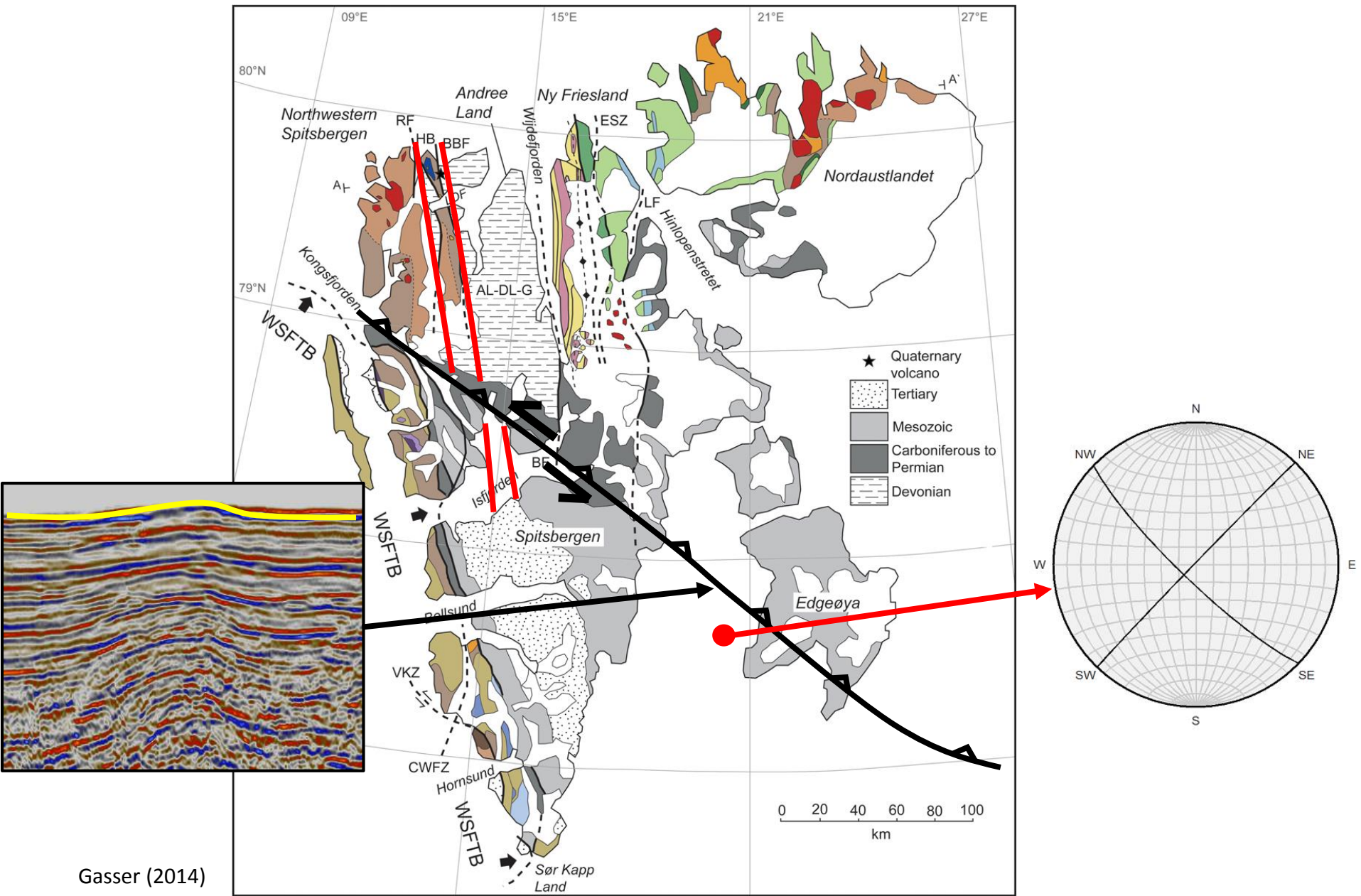
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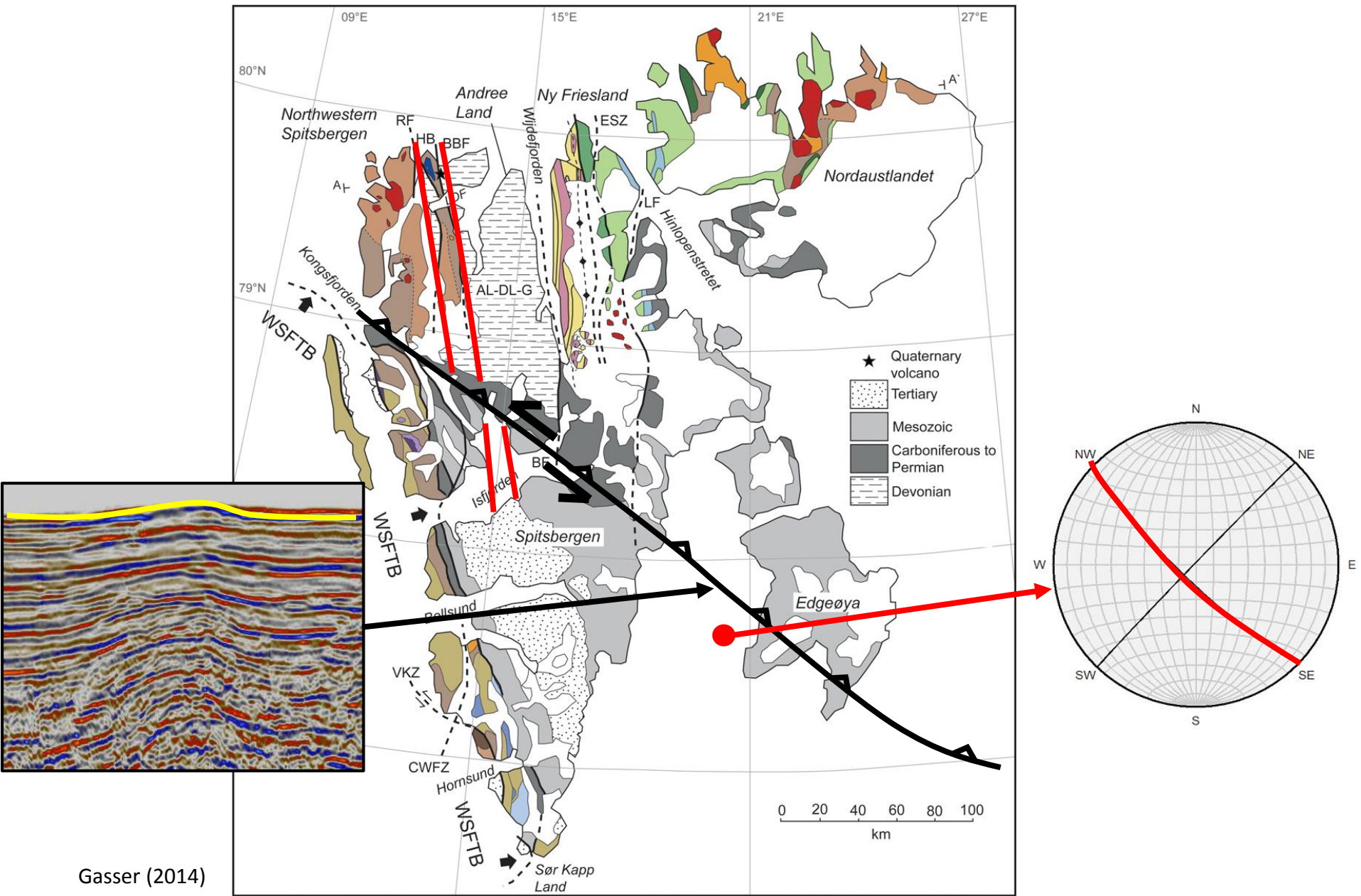
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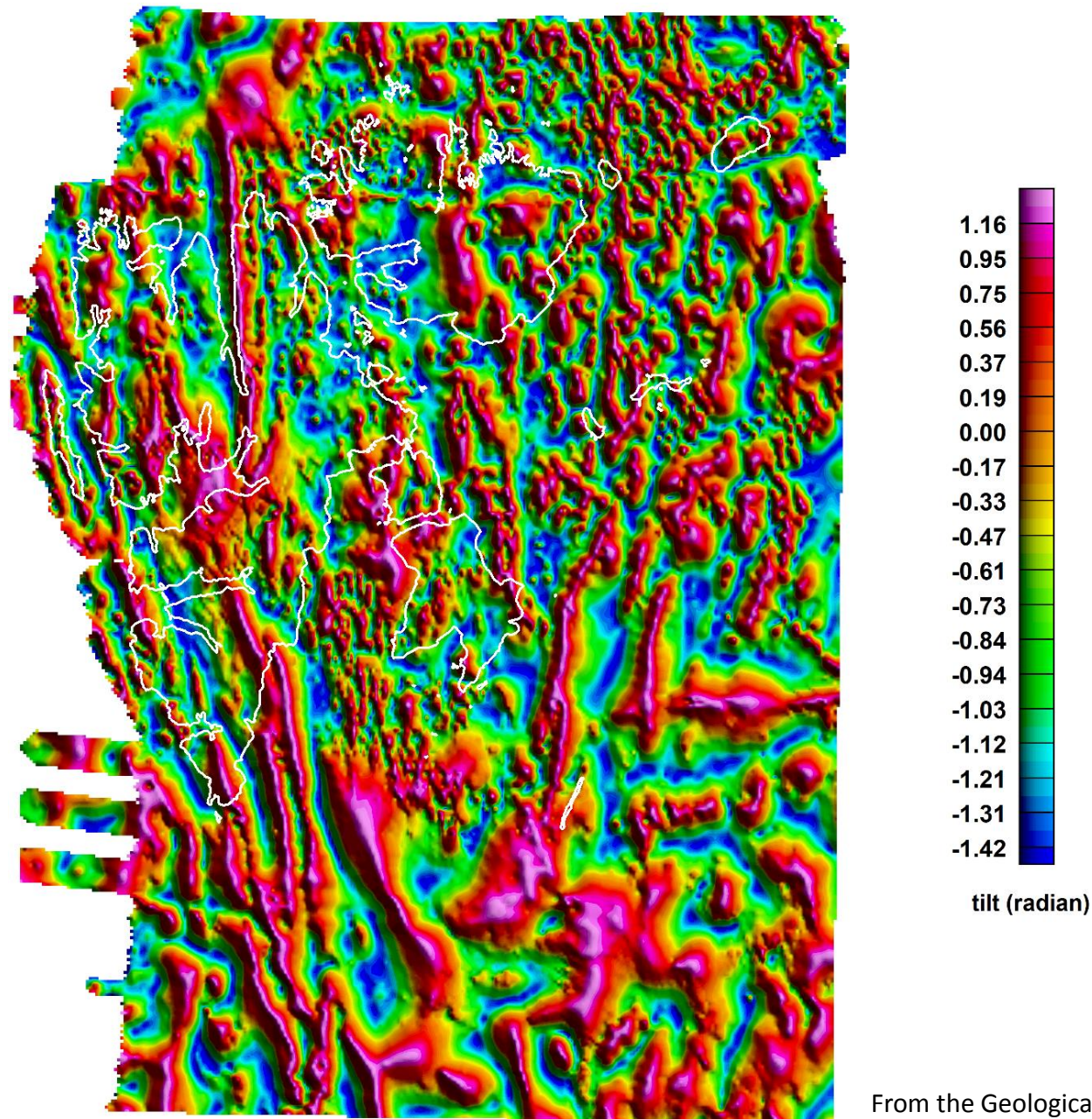
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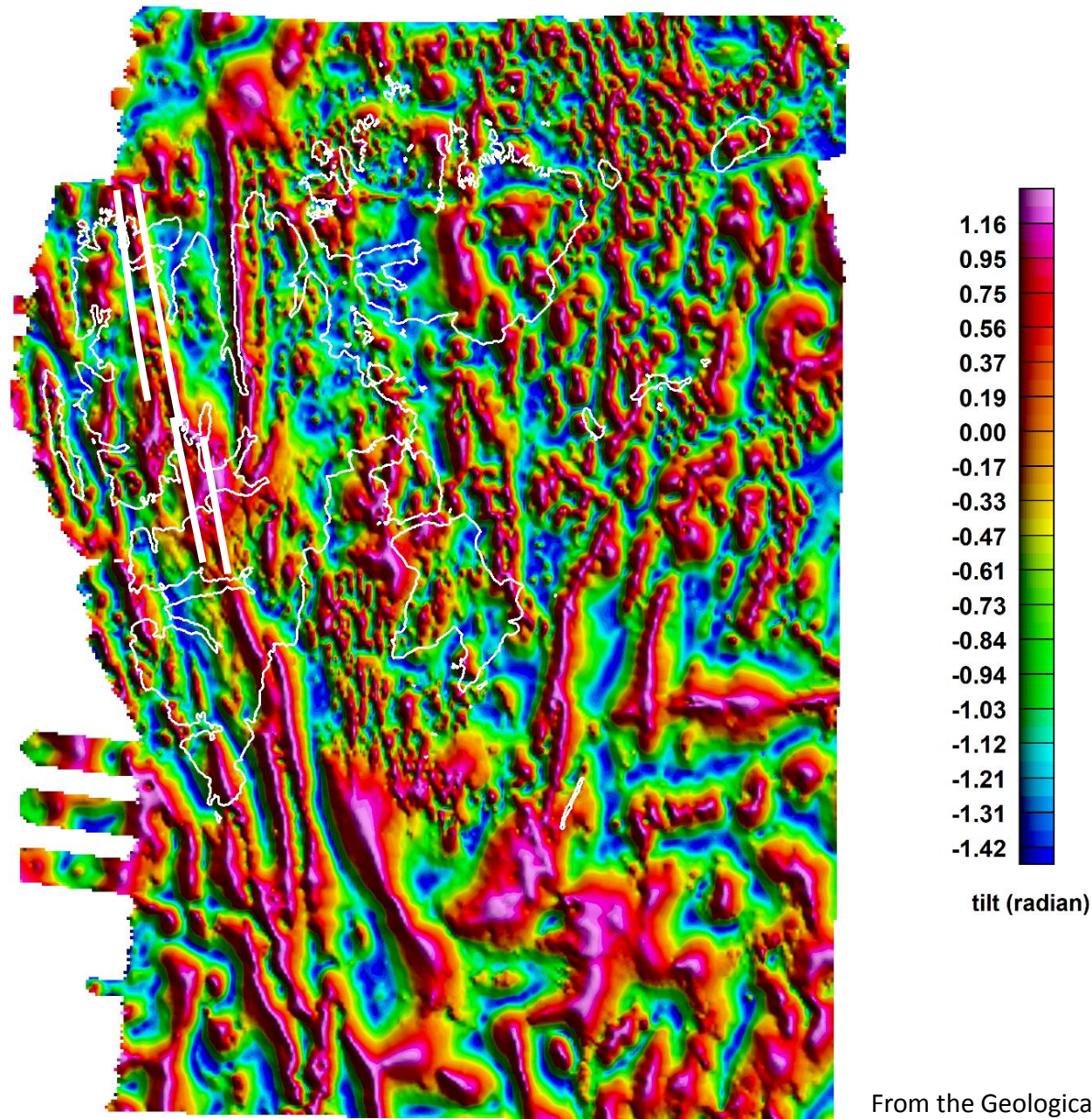


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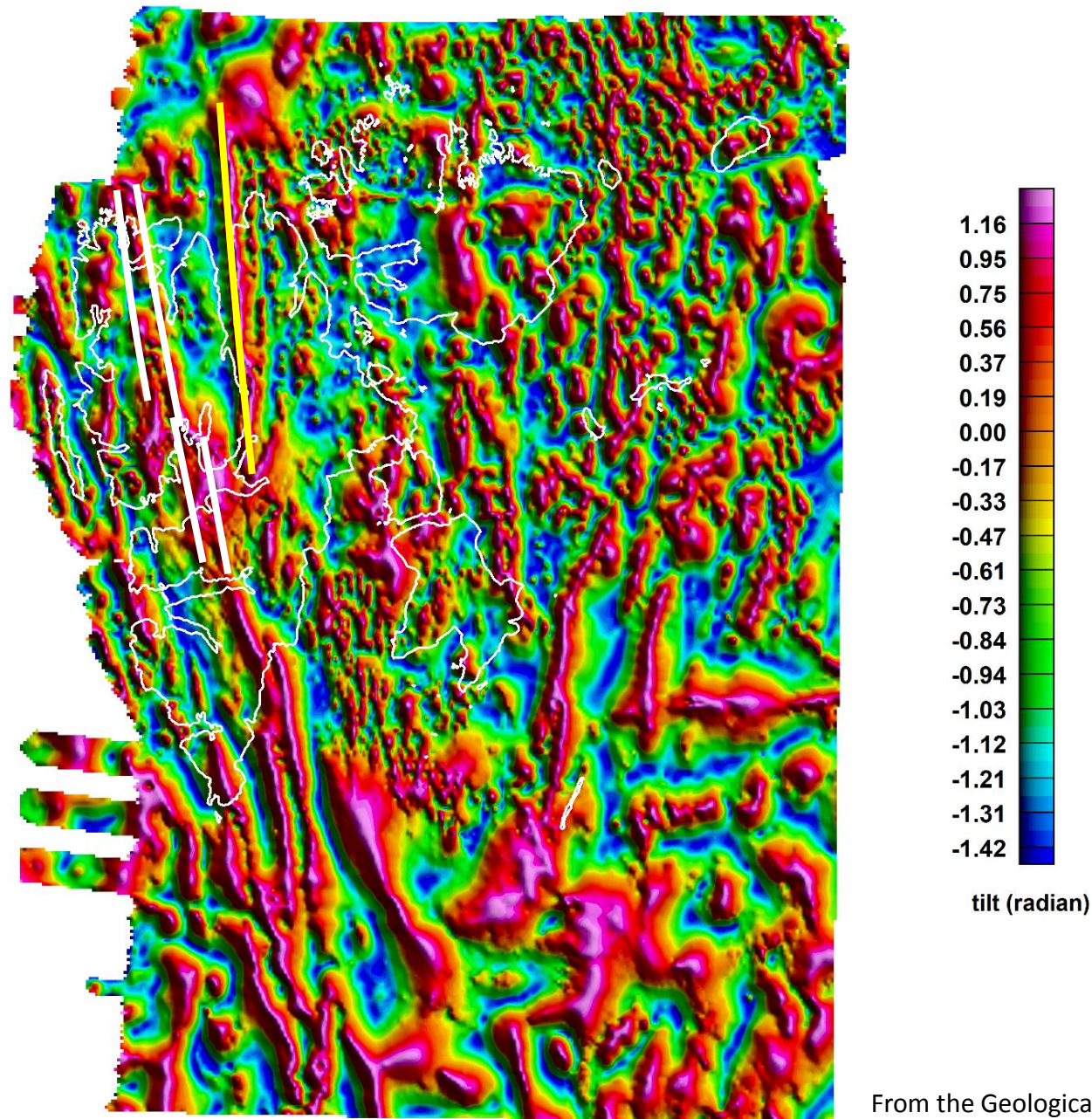


From the Geological Survey of Norway

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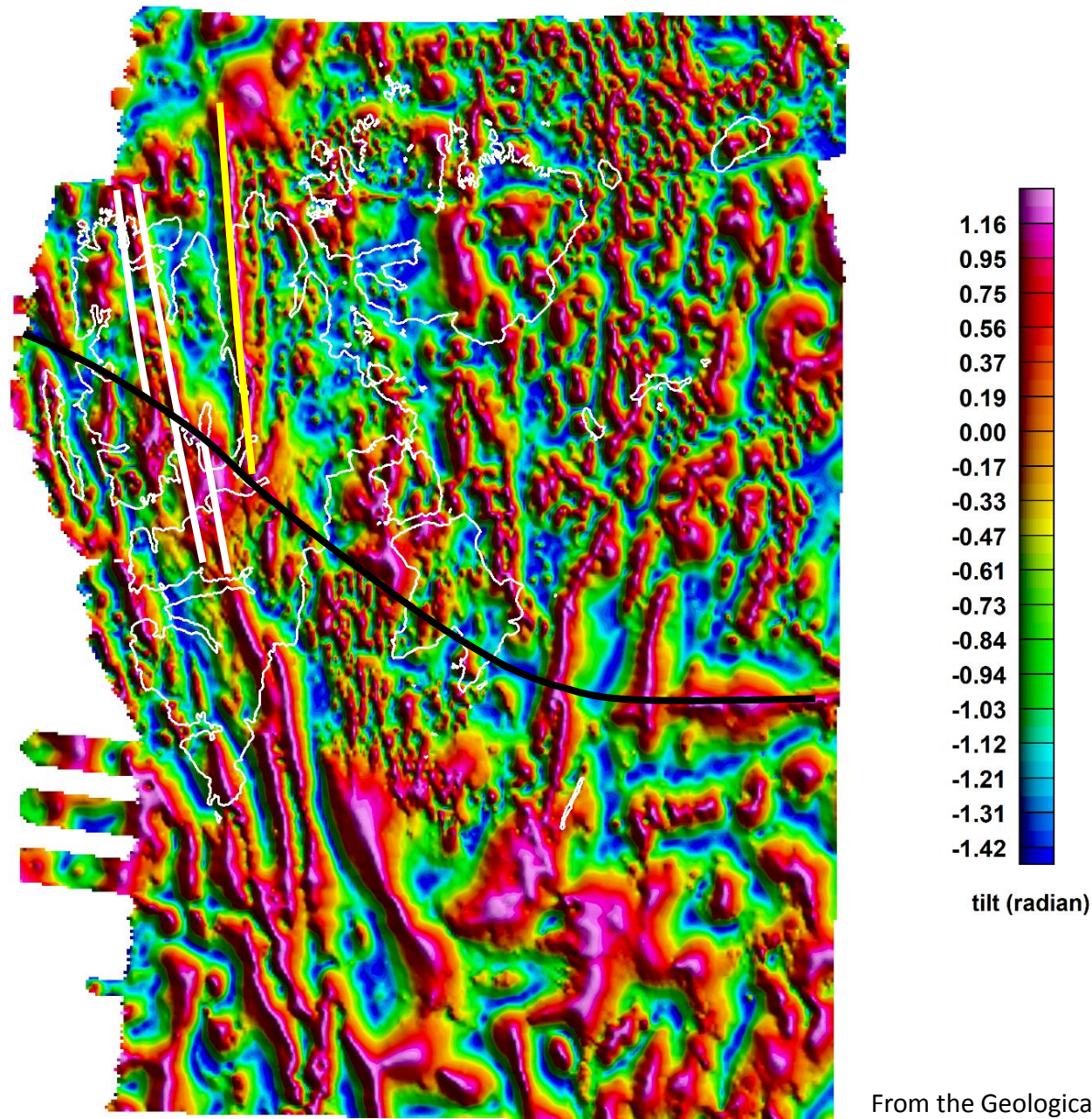


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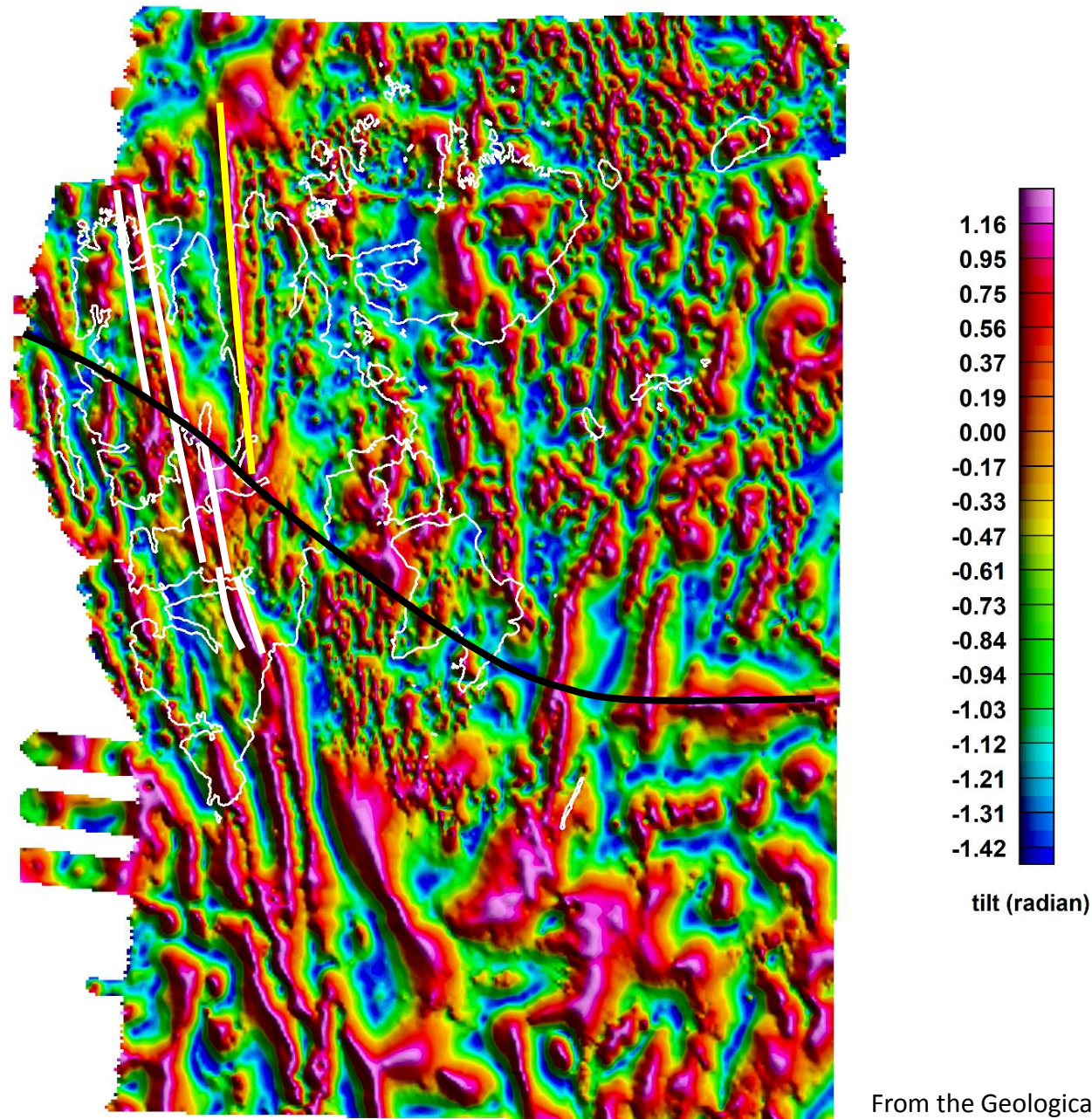
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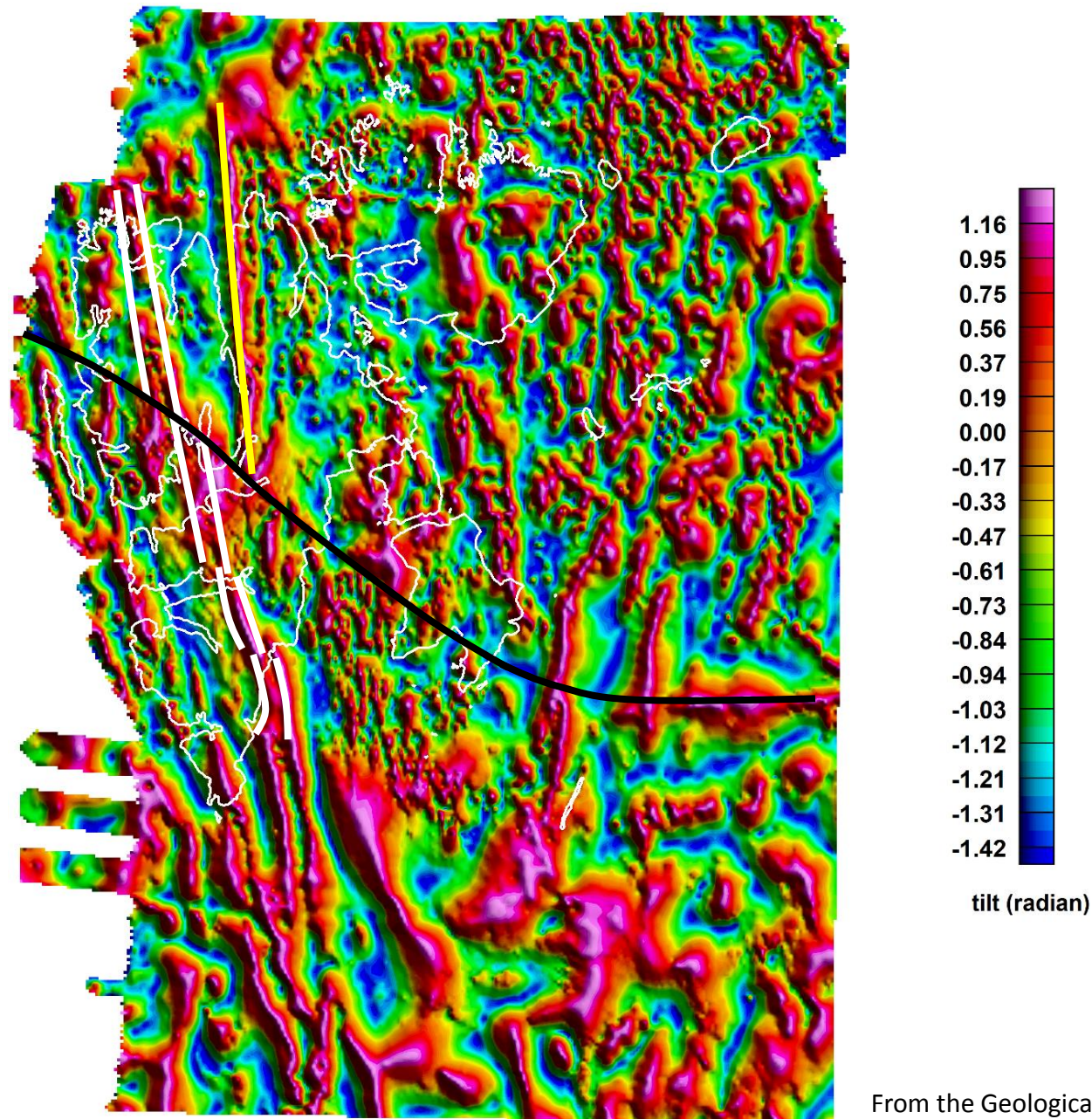


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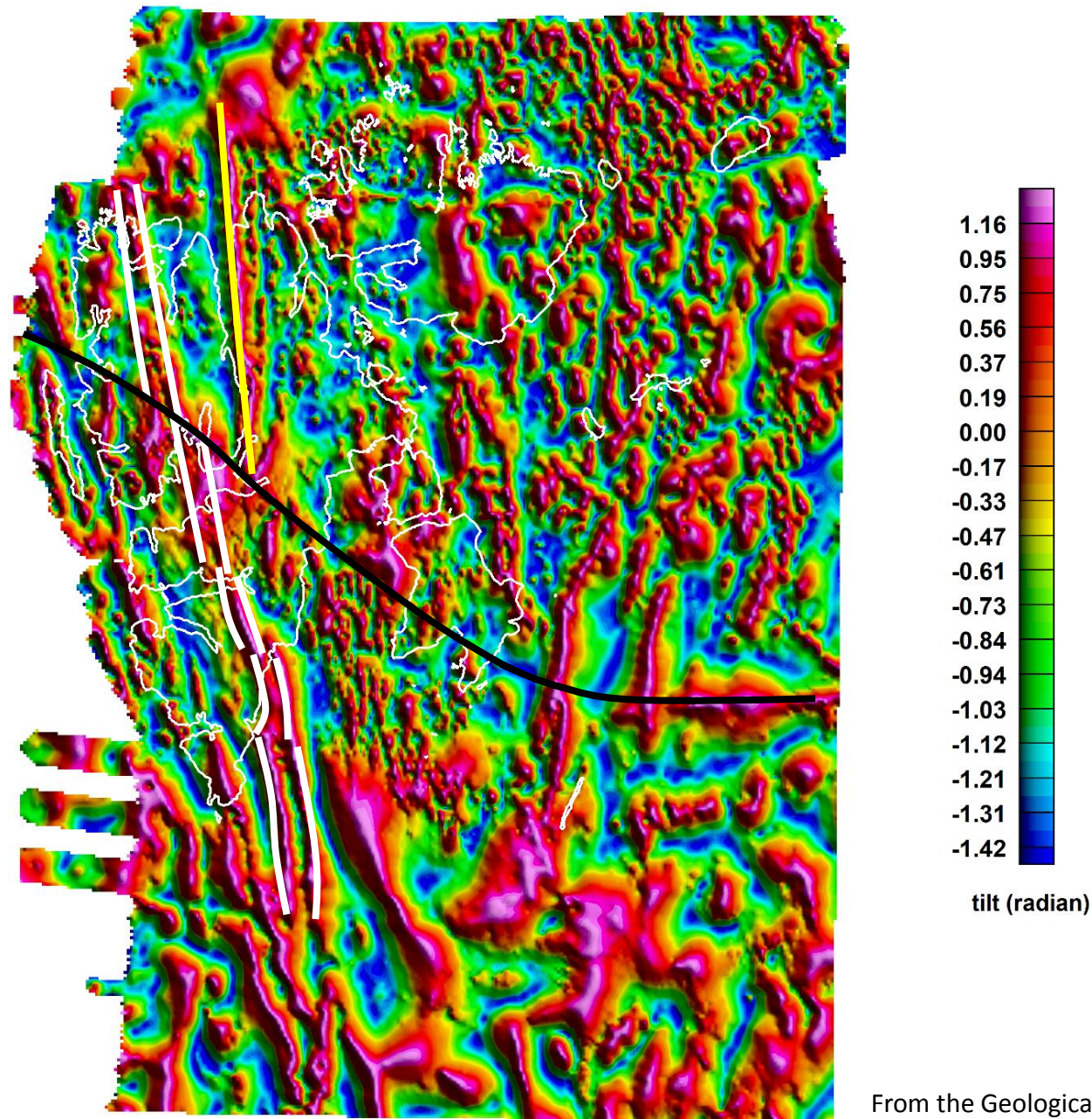
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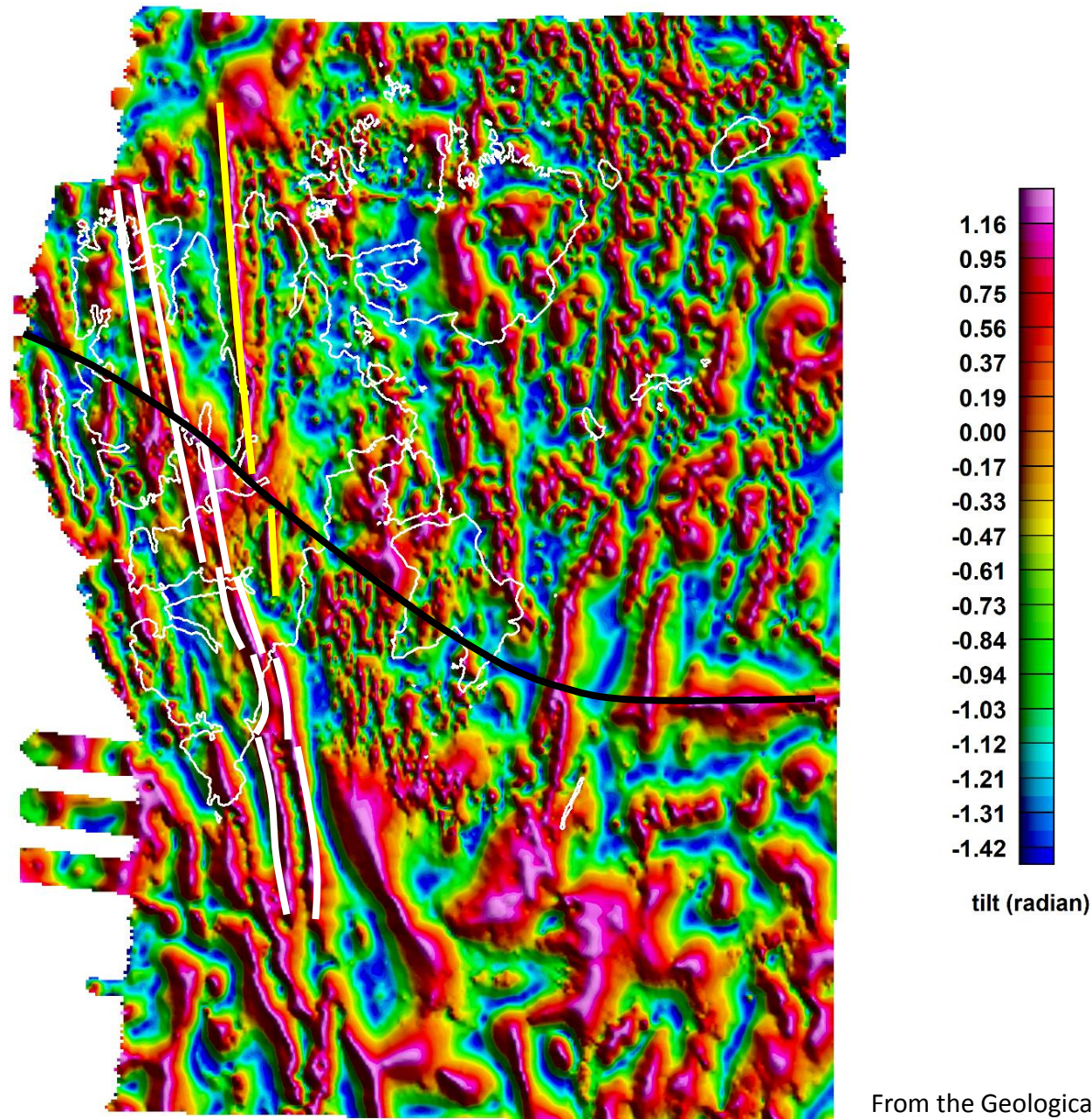
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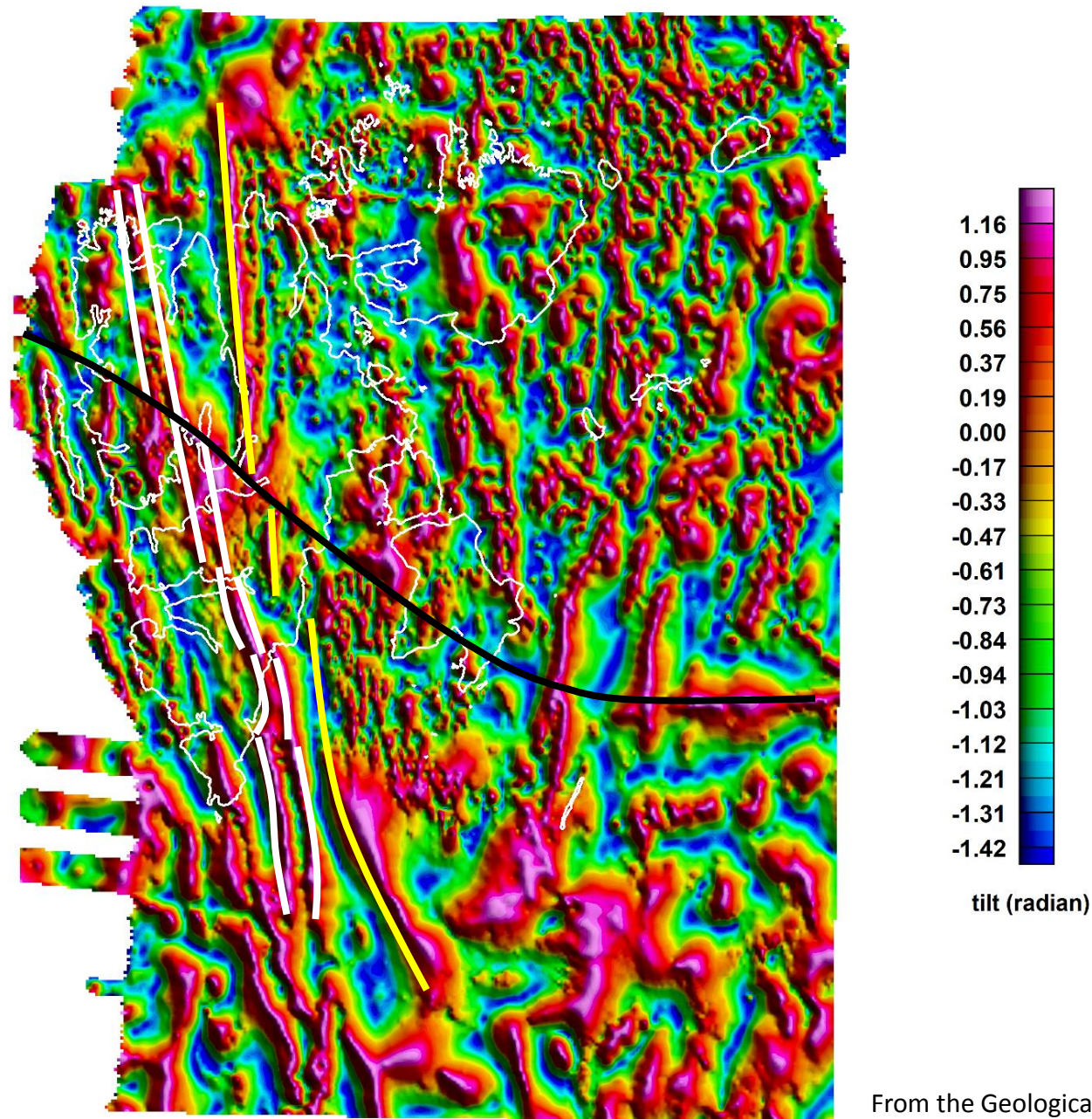


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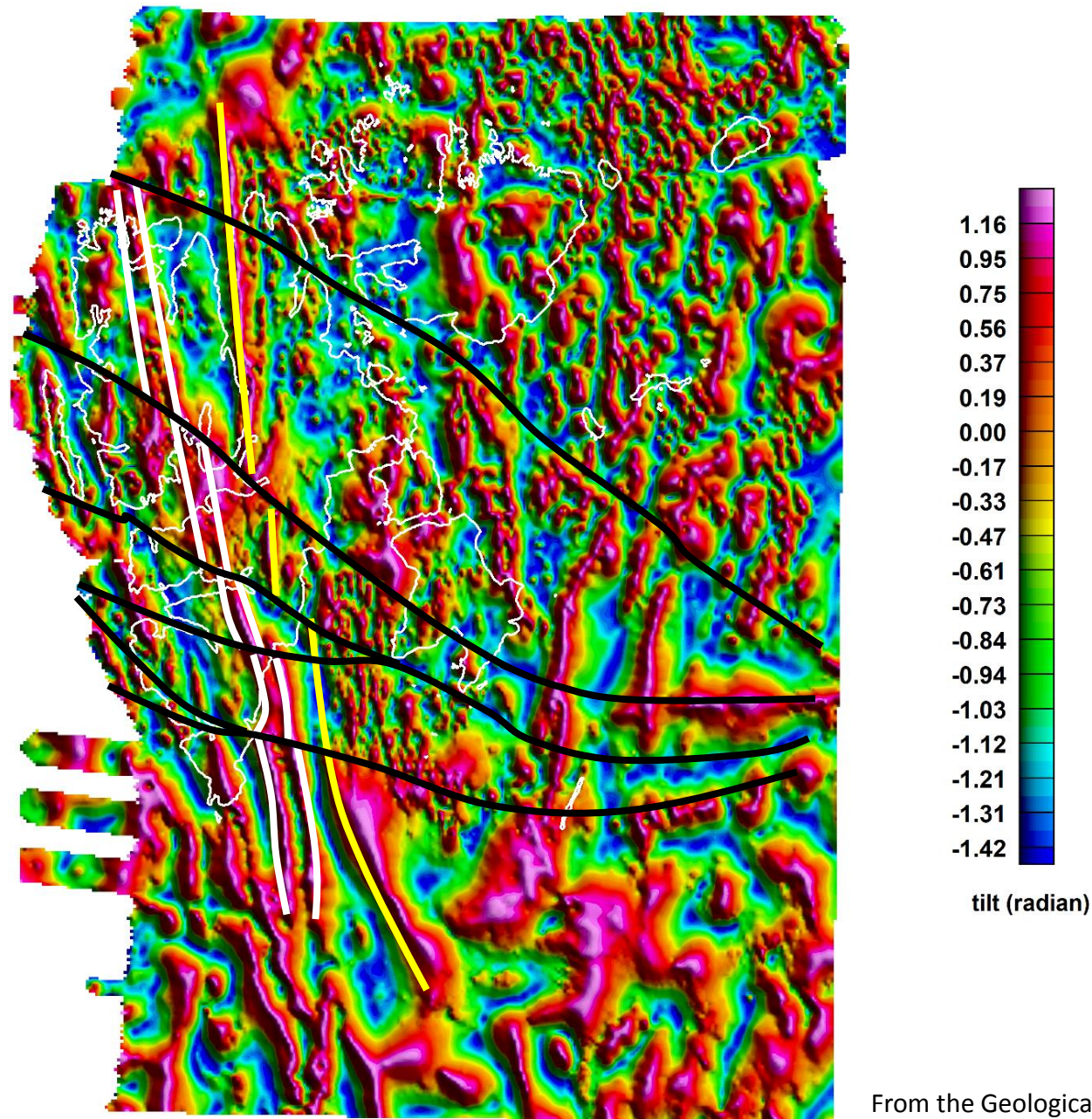


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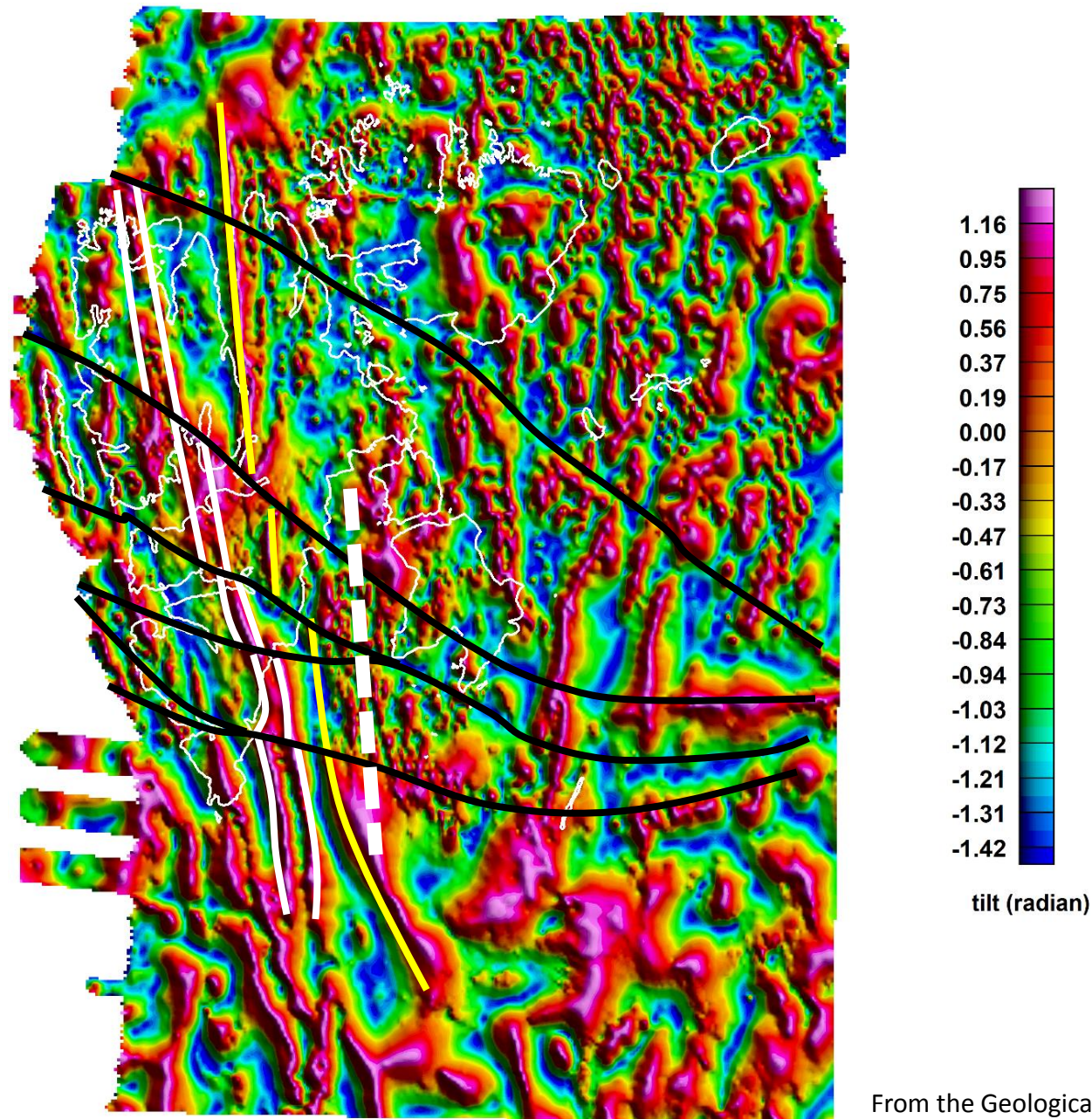


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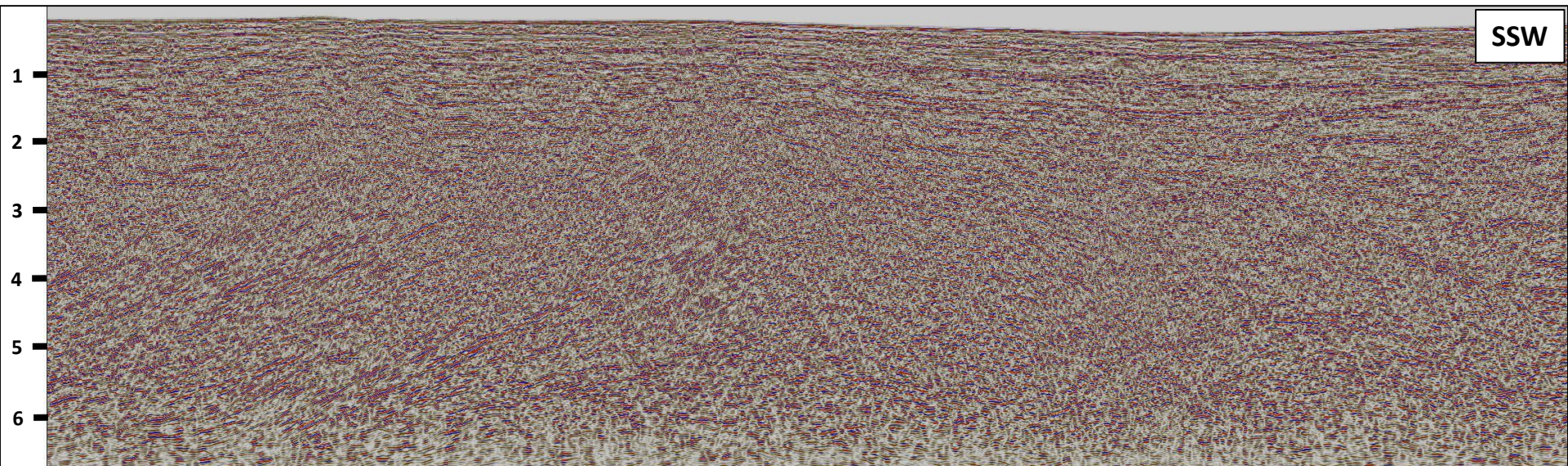
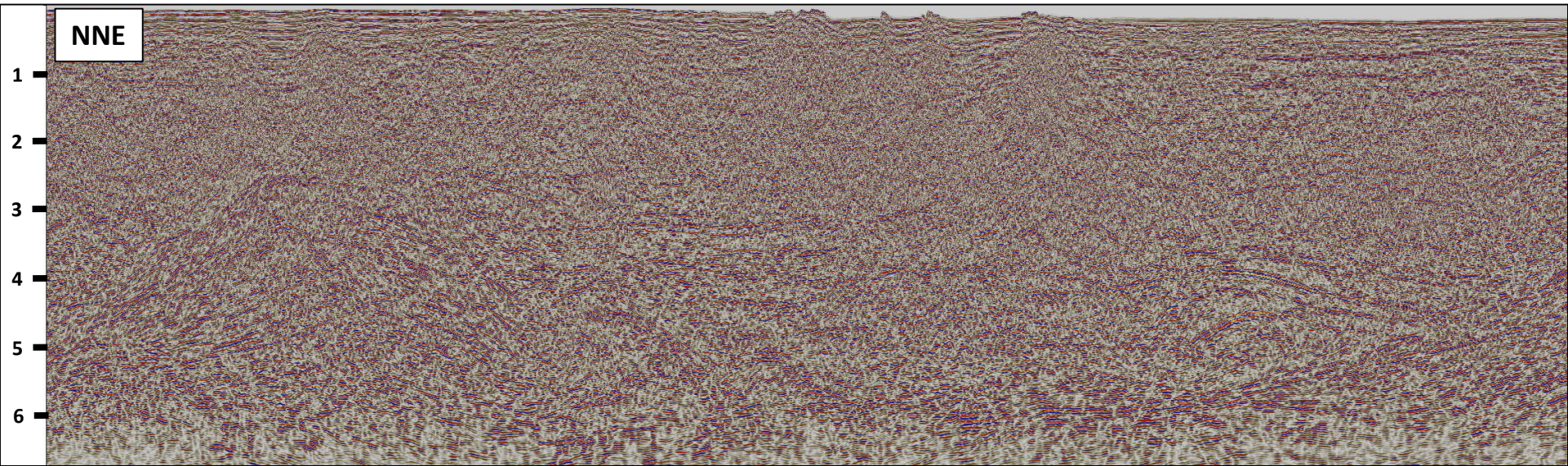
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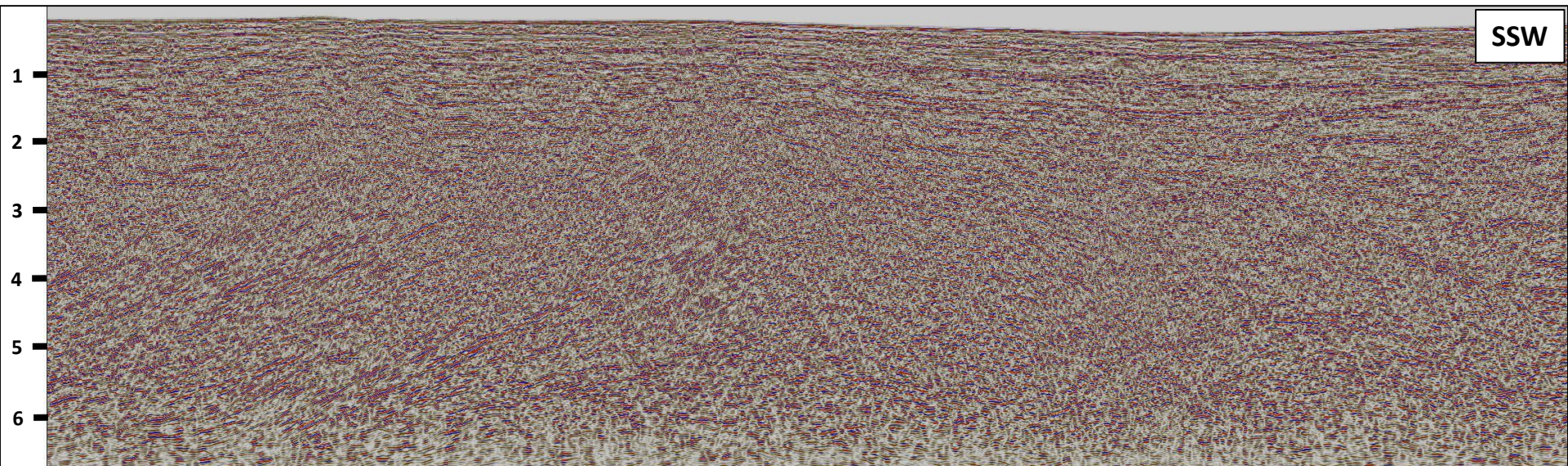
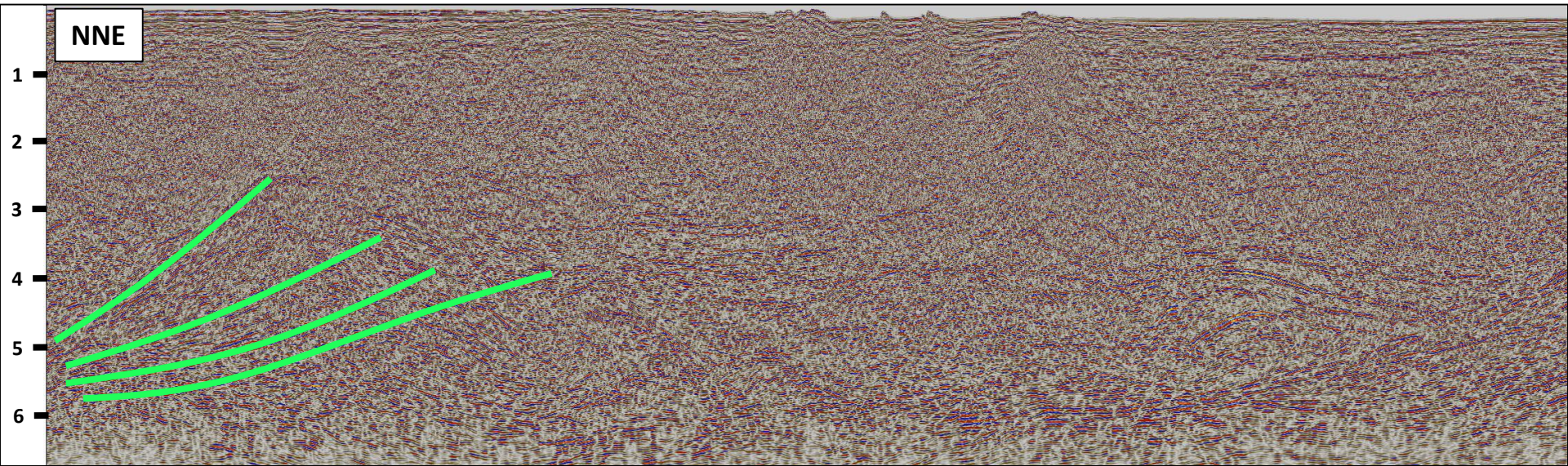


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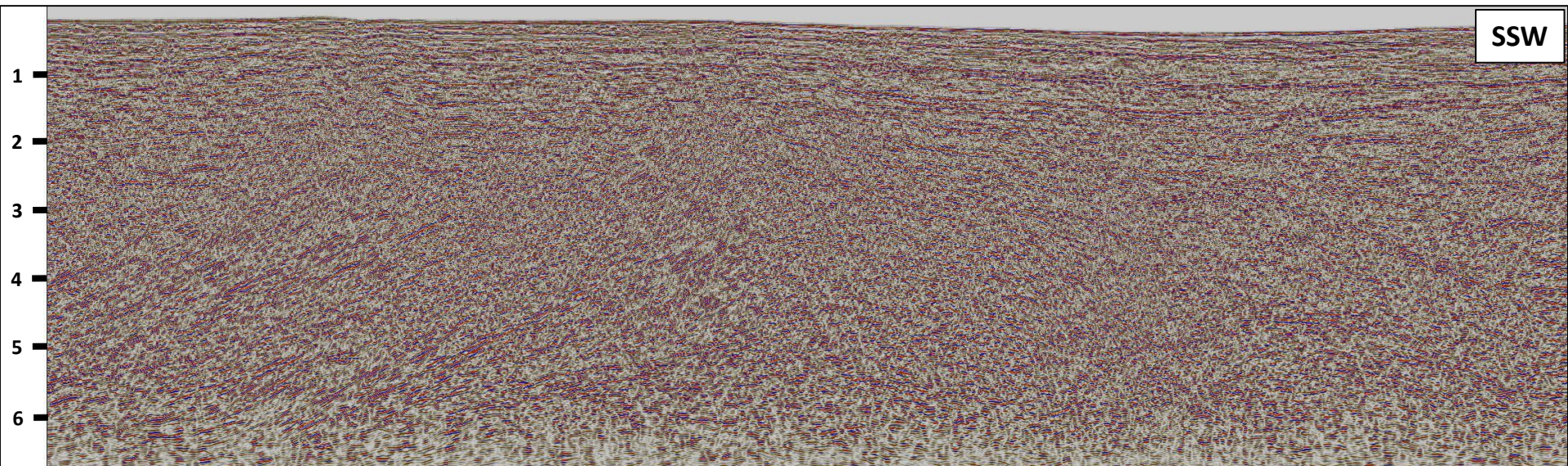
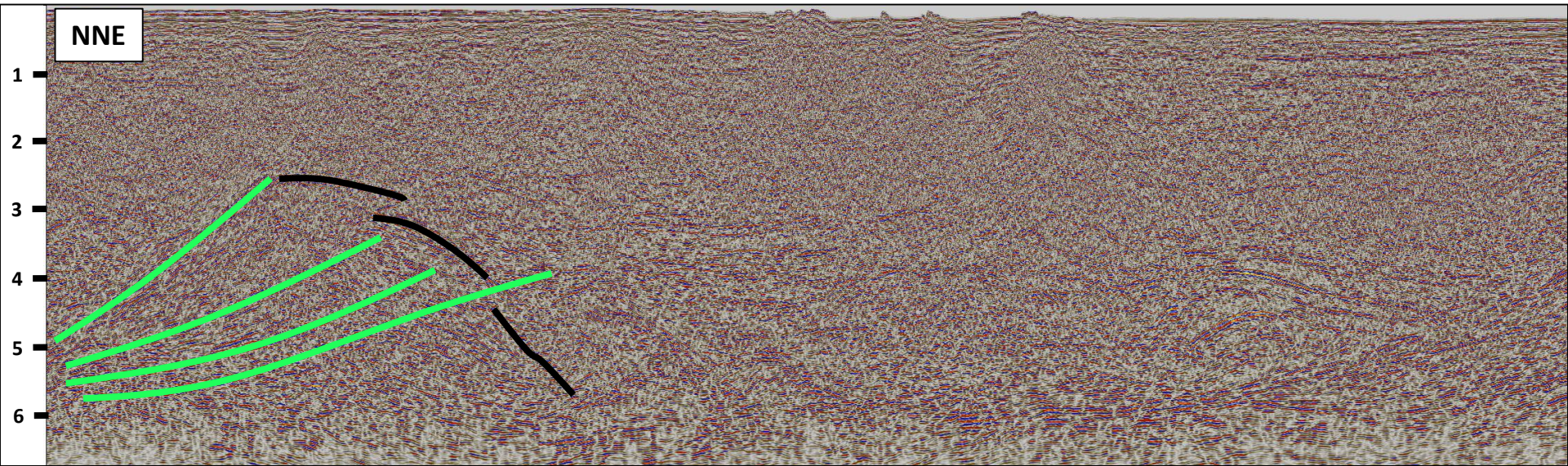
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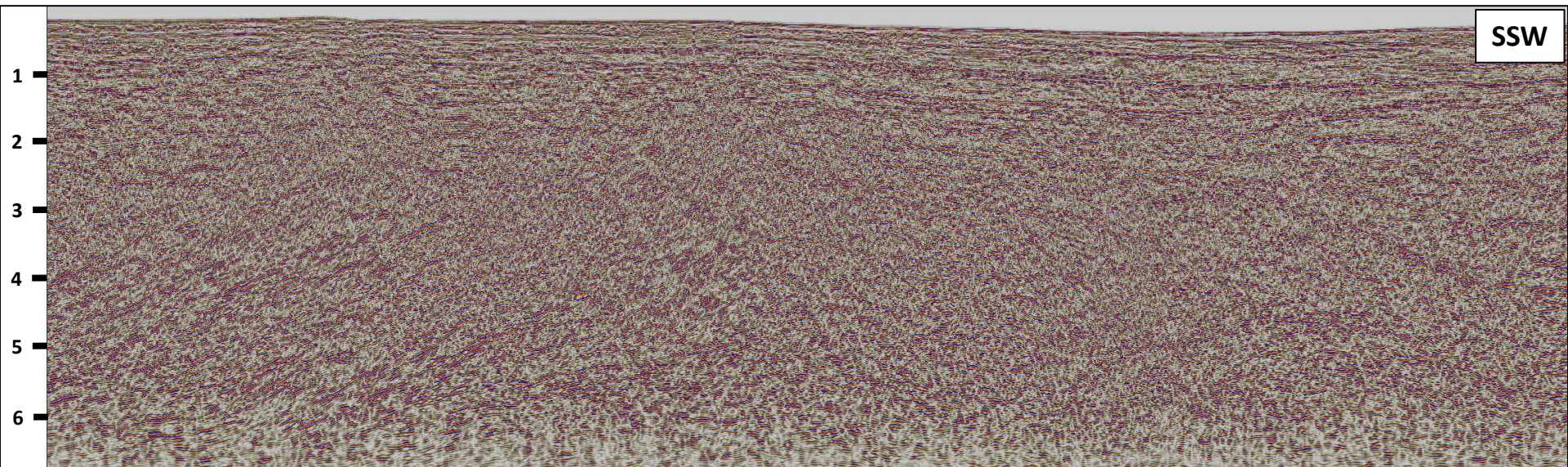
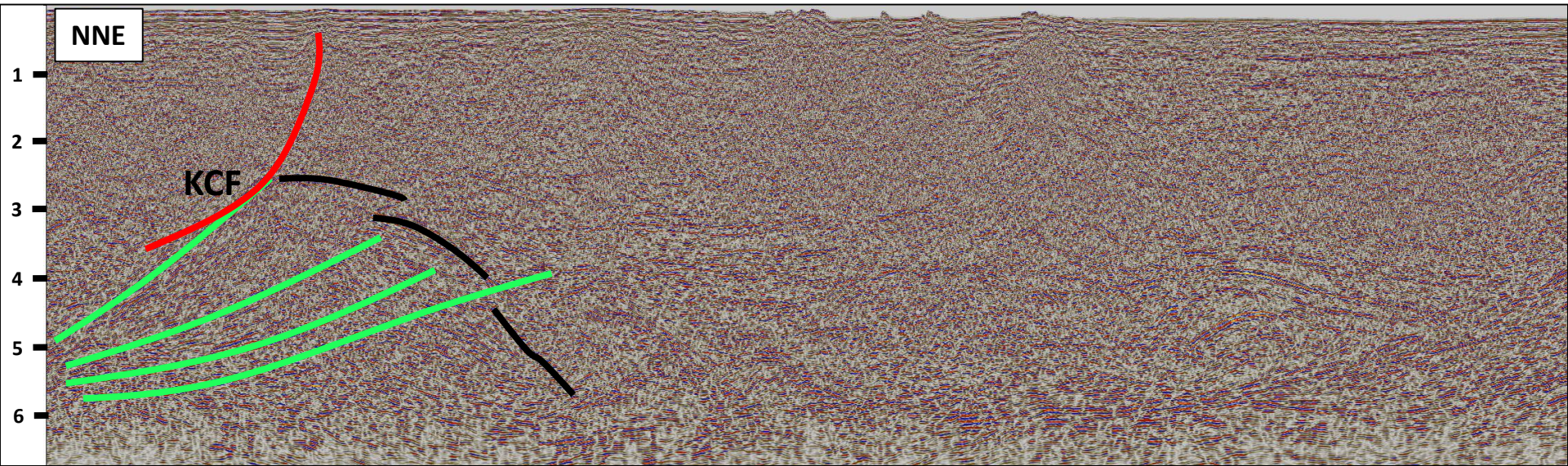
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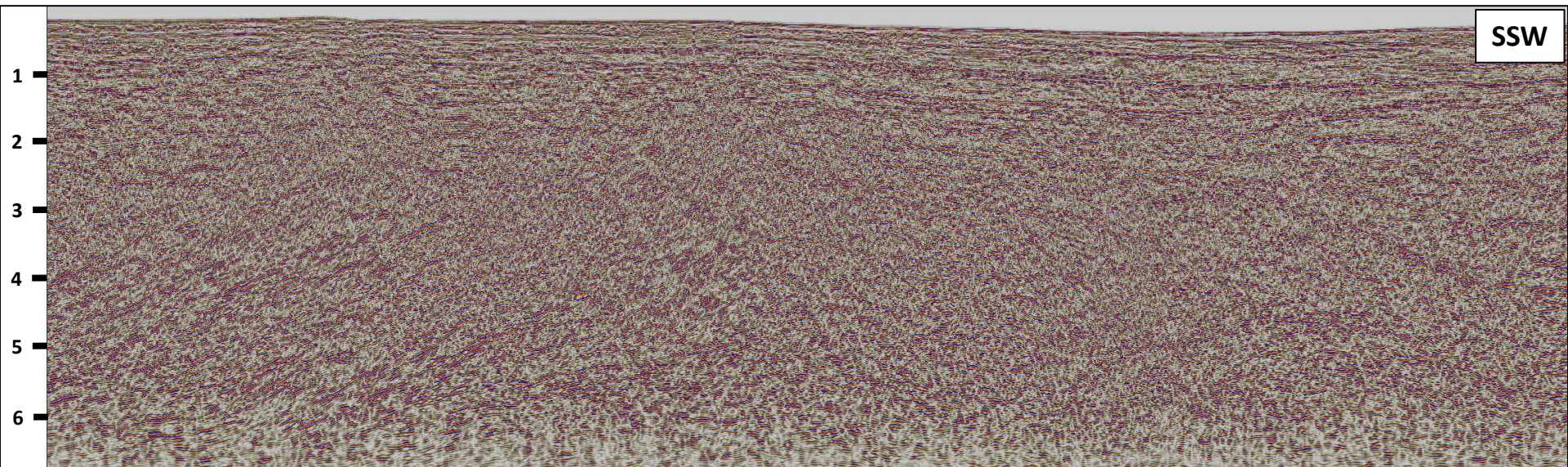
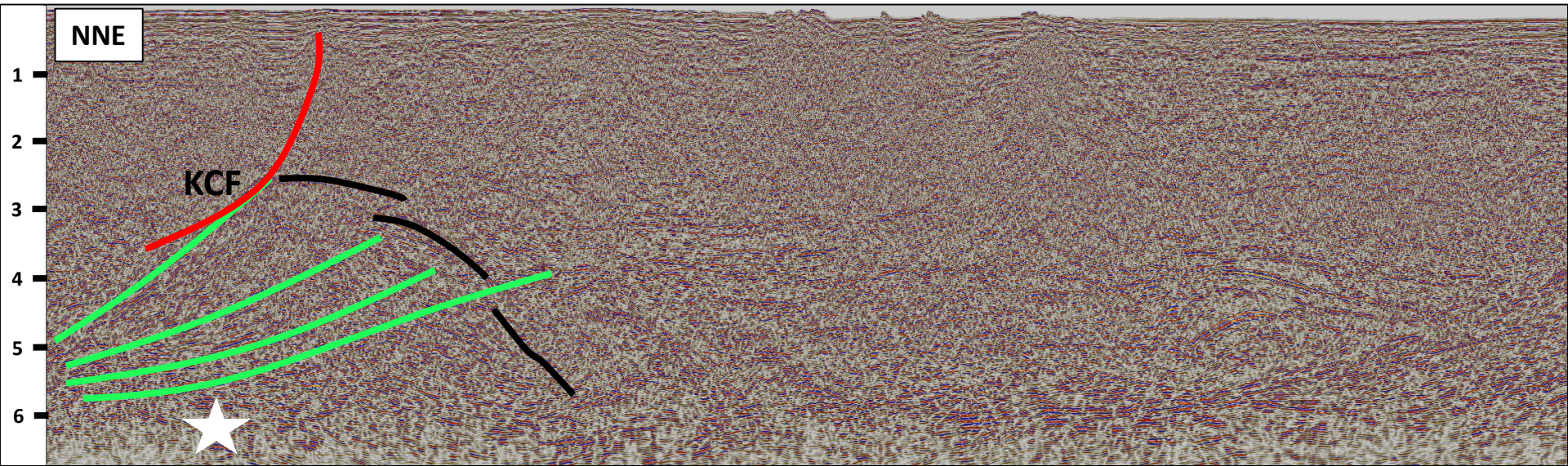
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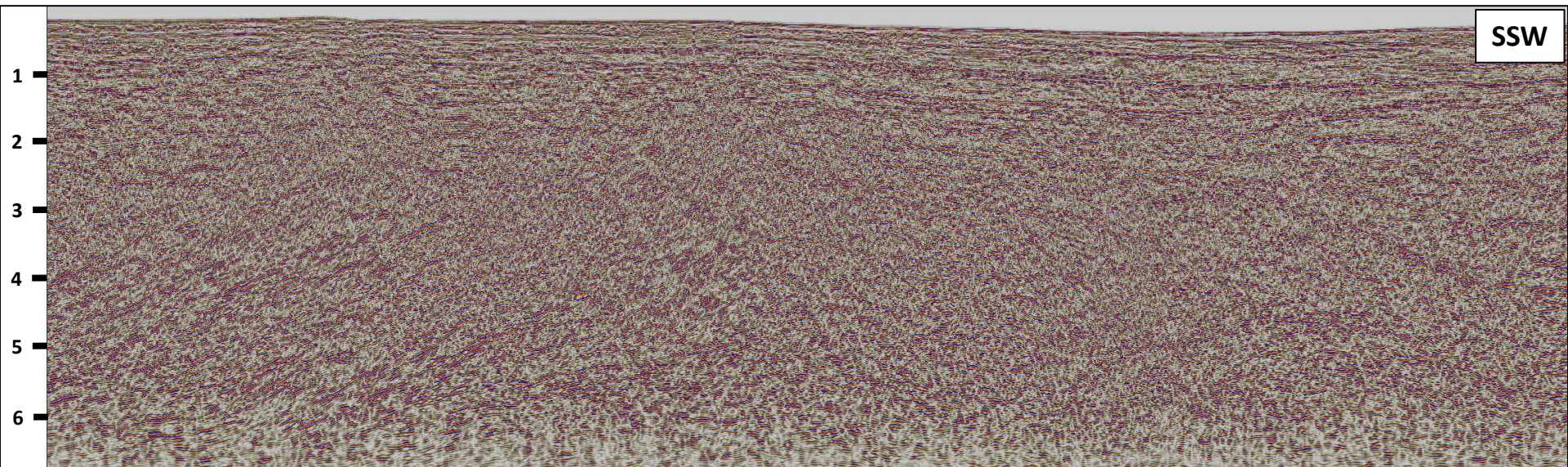
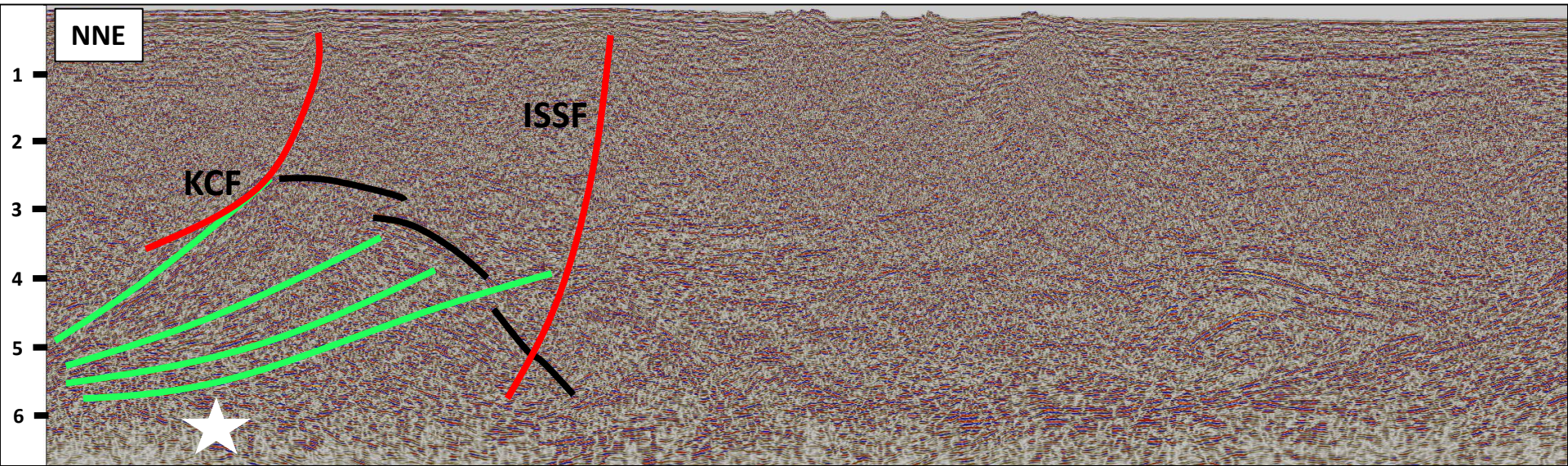
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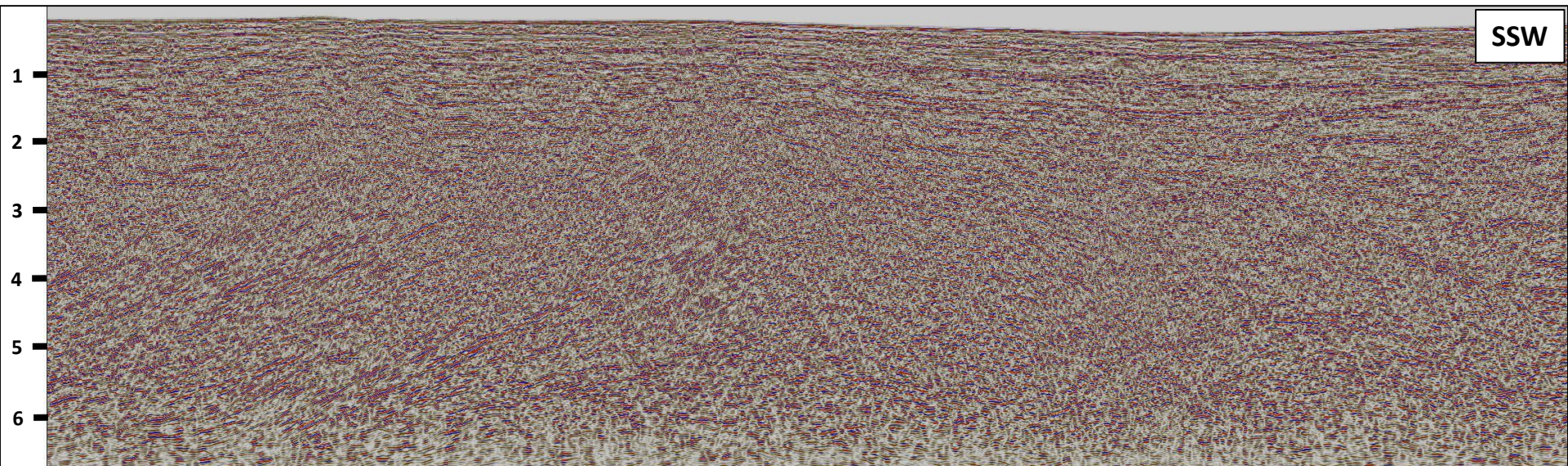
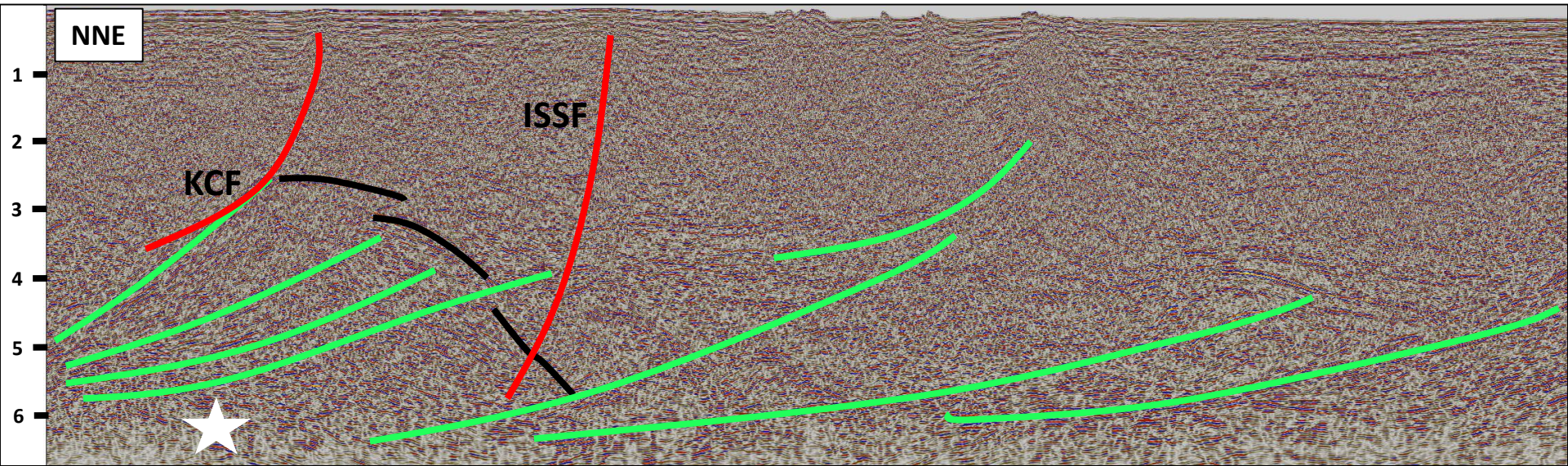
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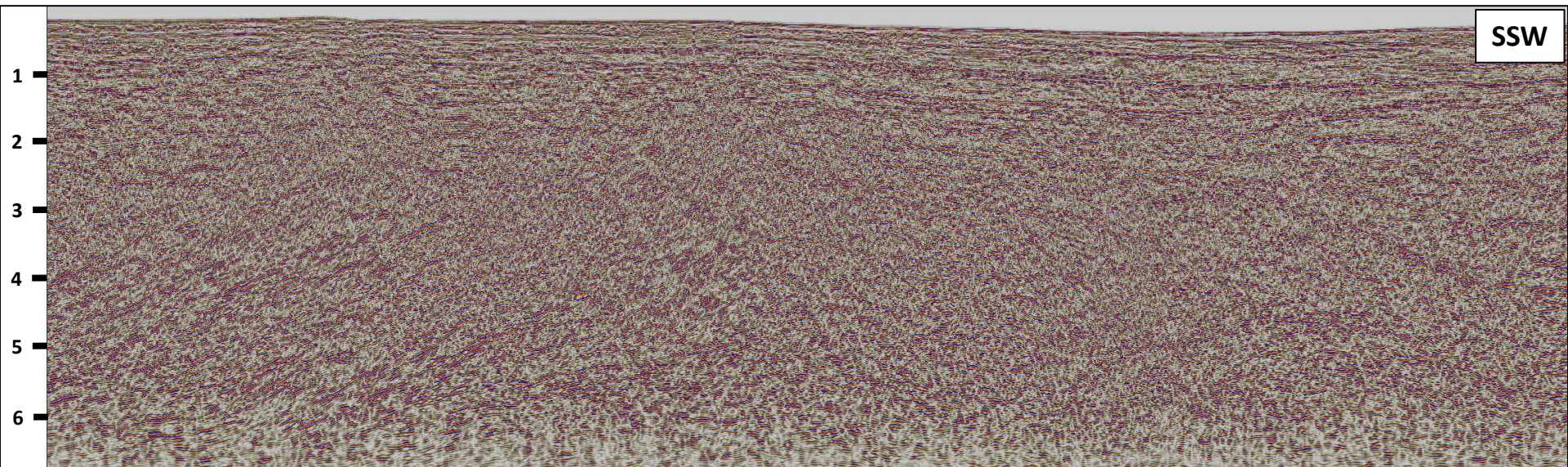
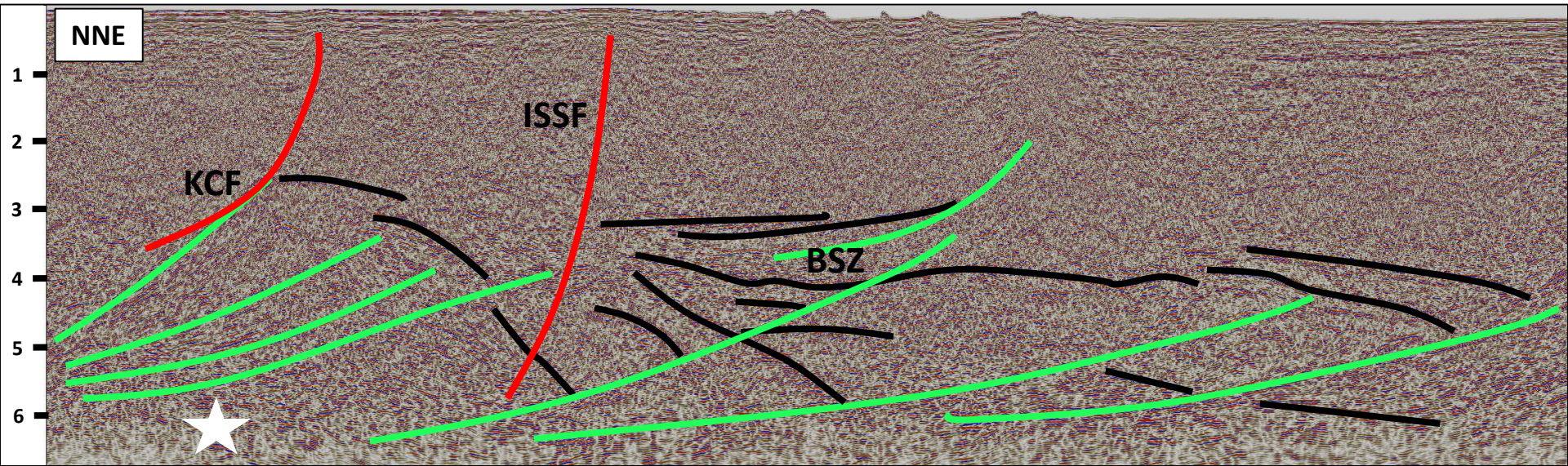
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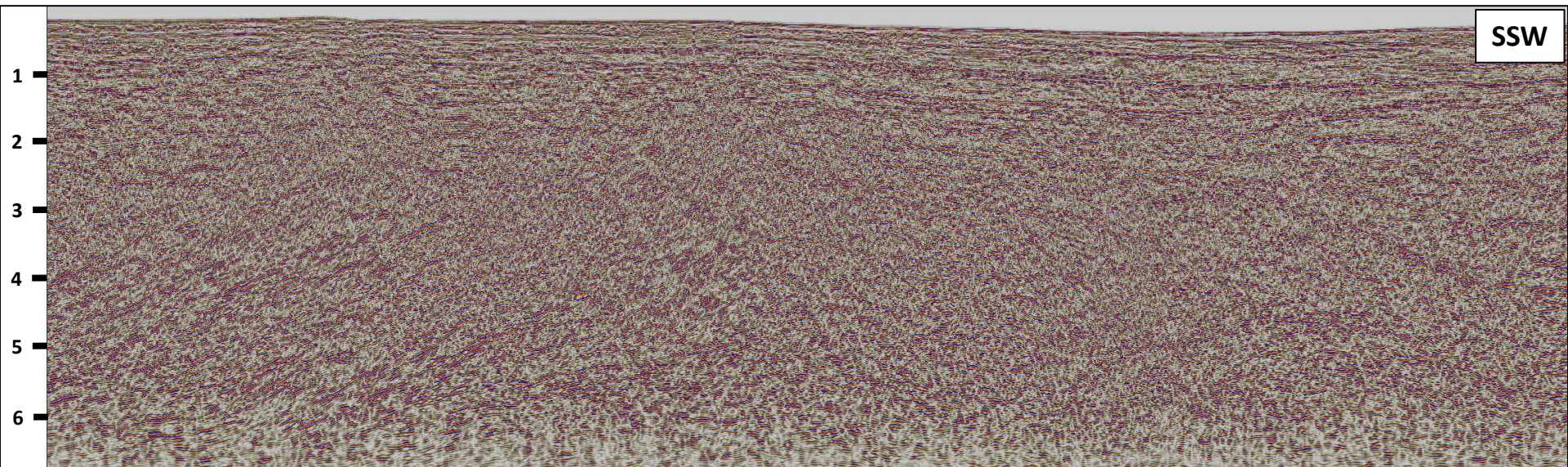
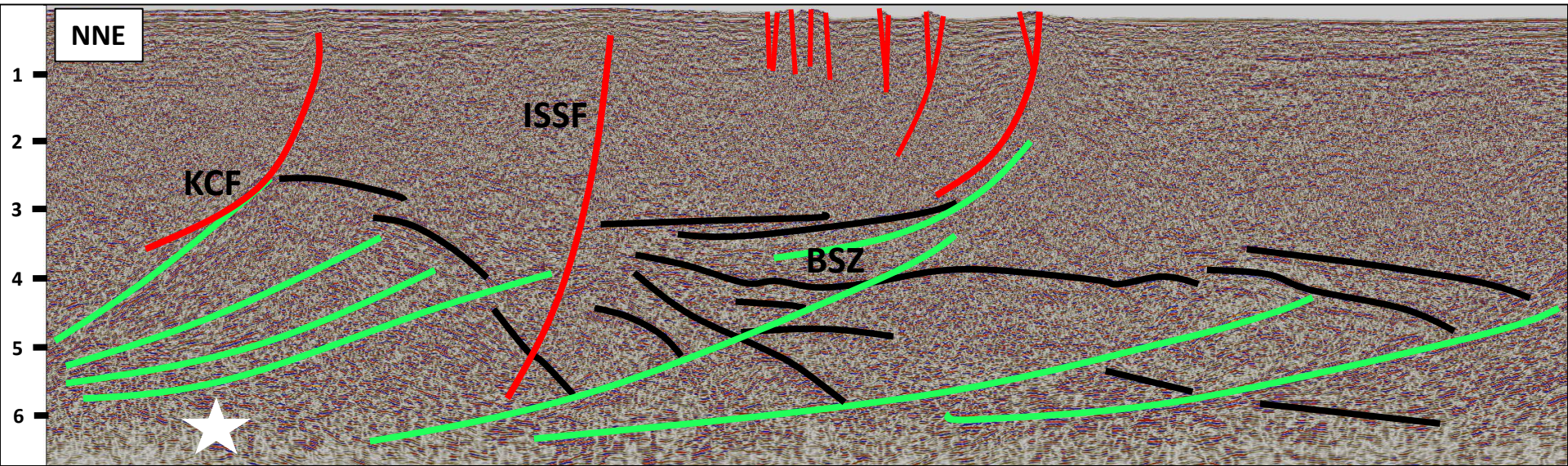
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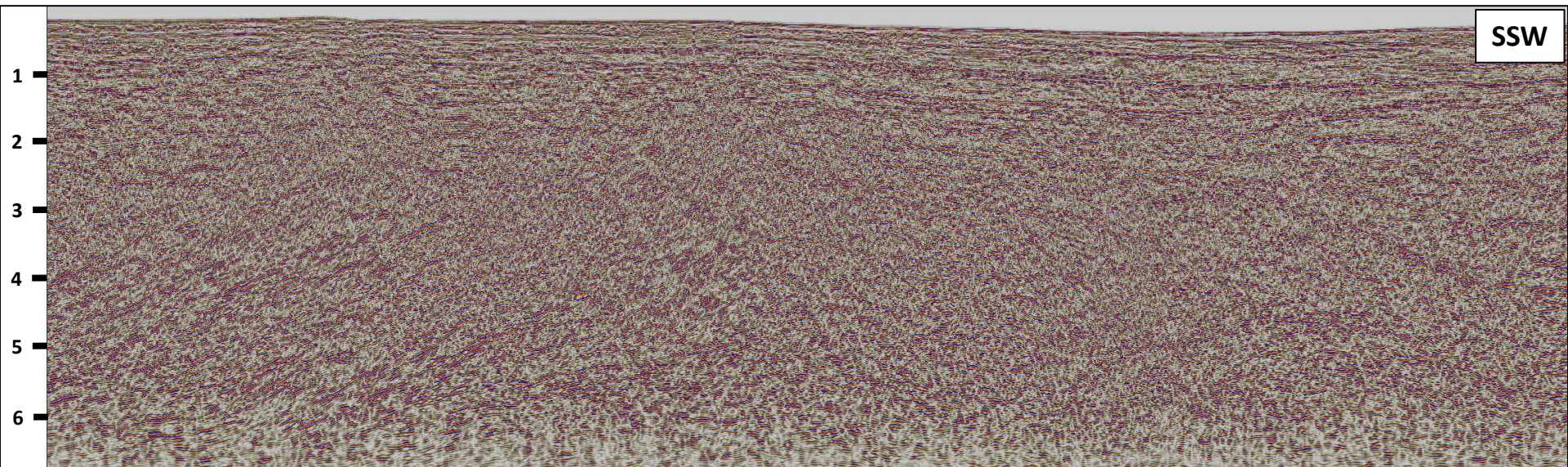
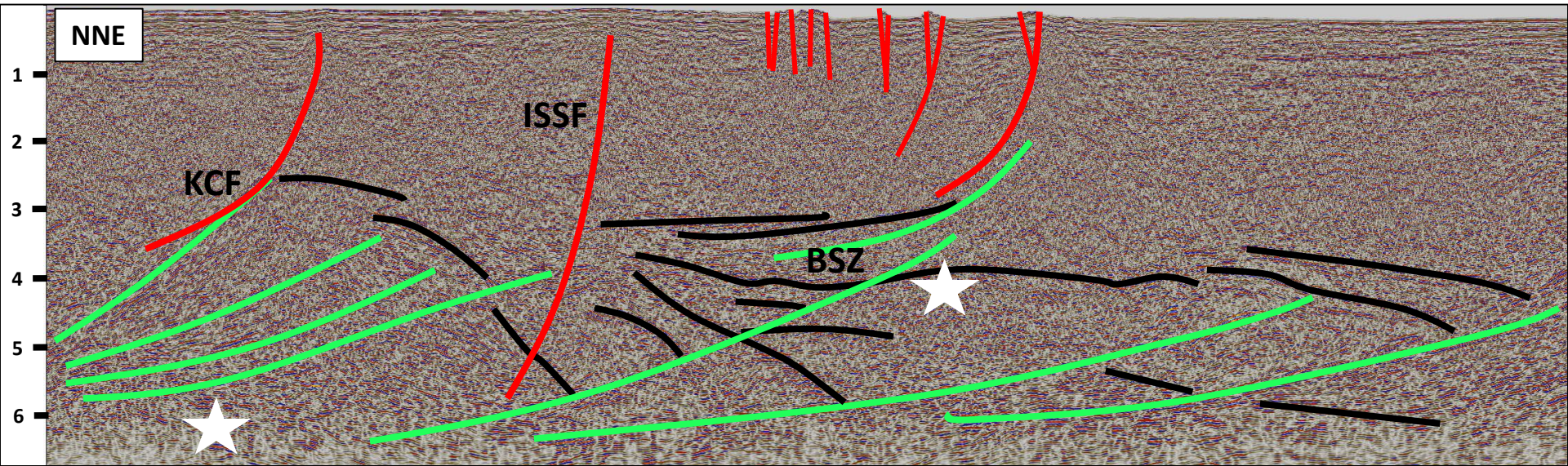
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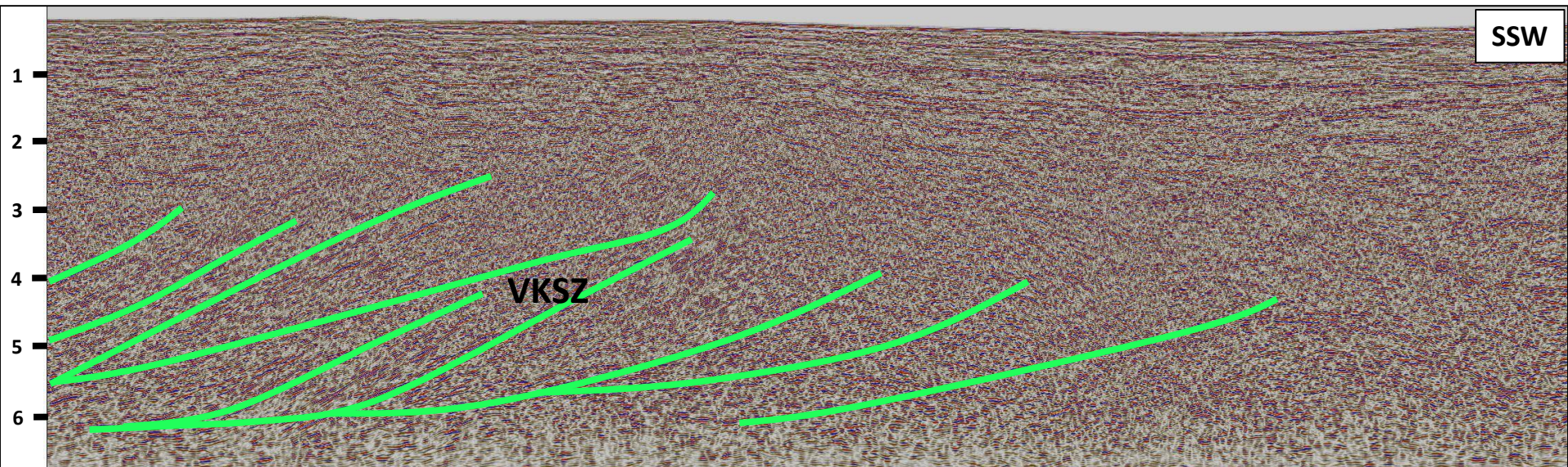
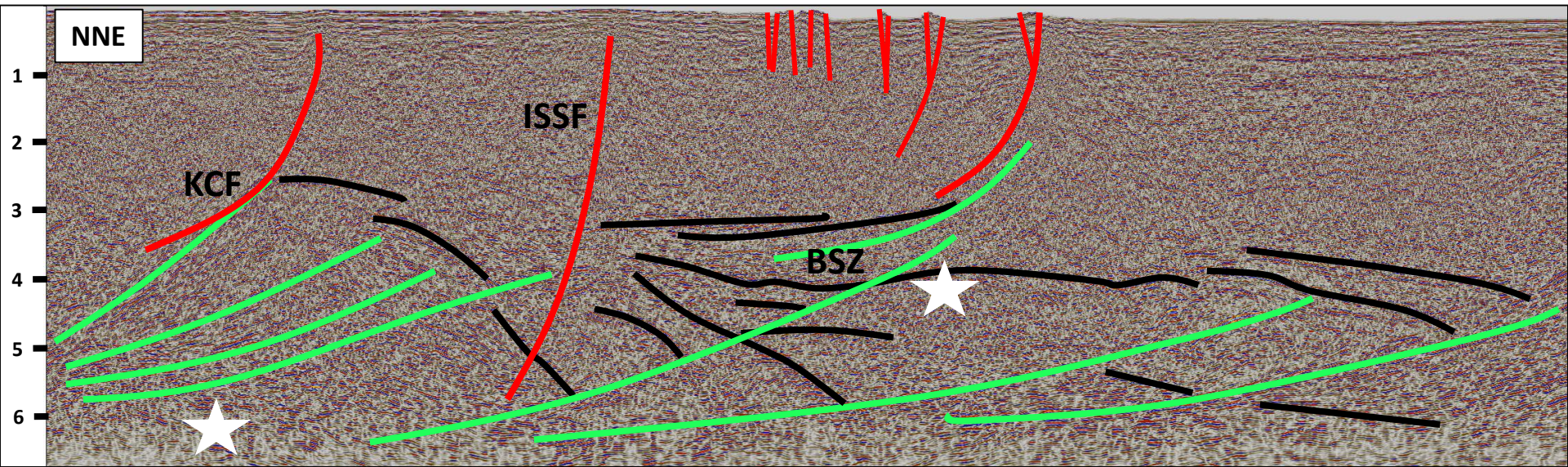
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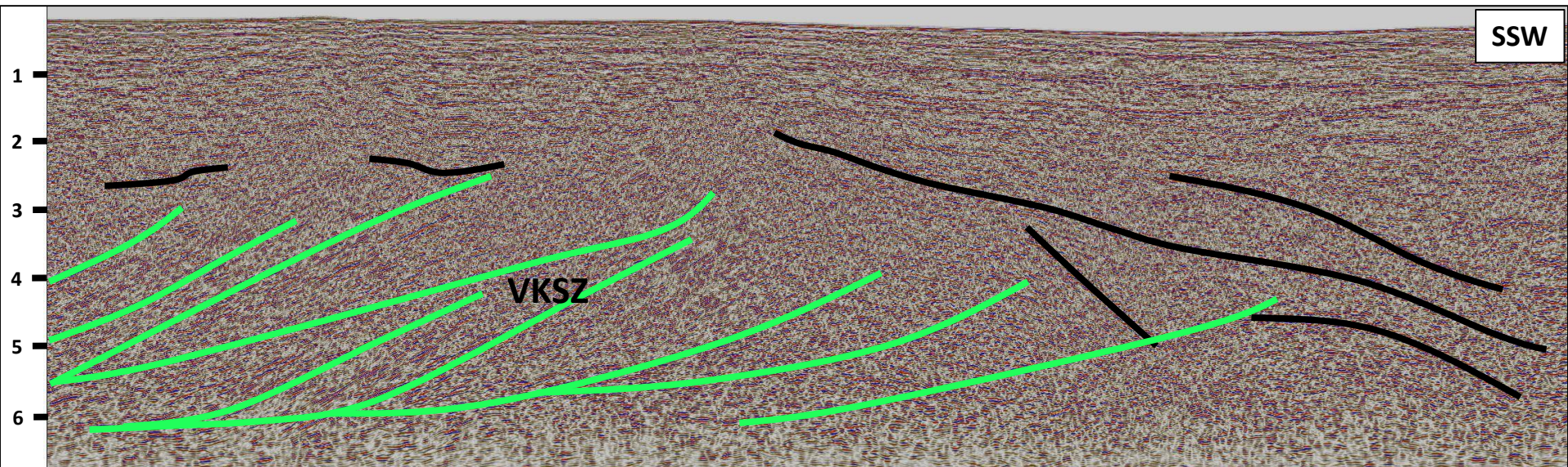
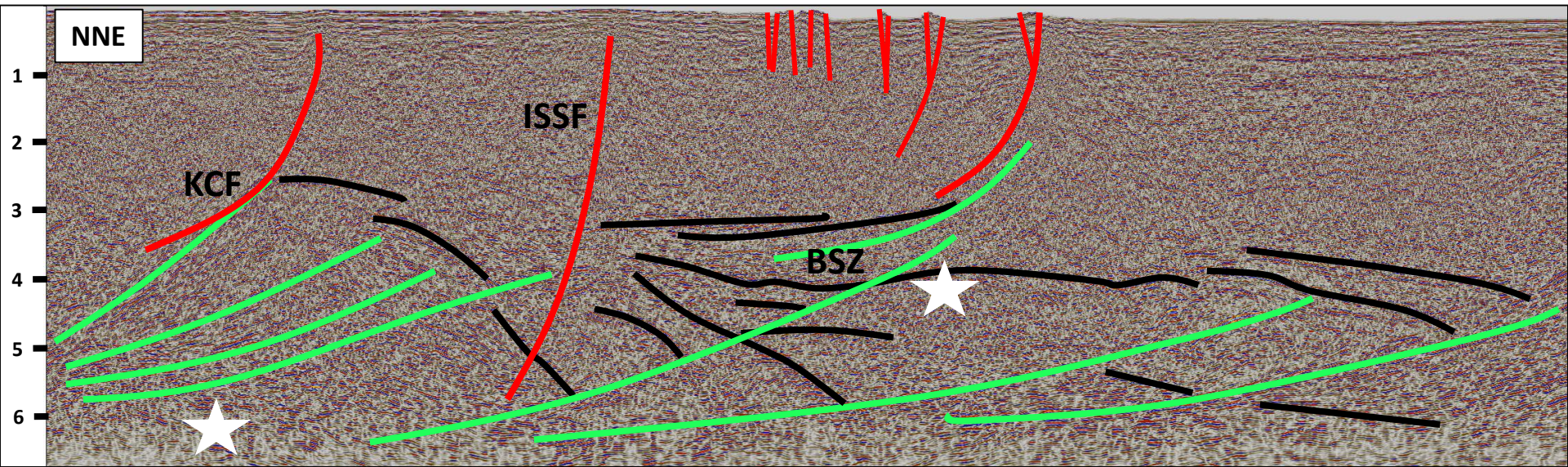
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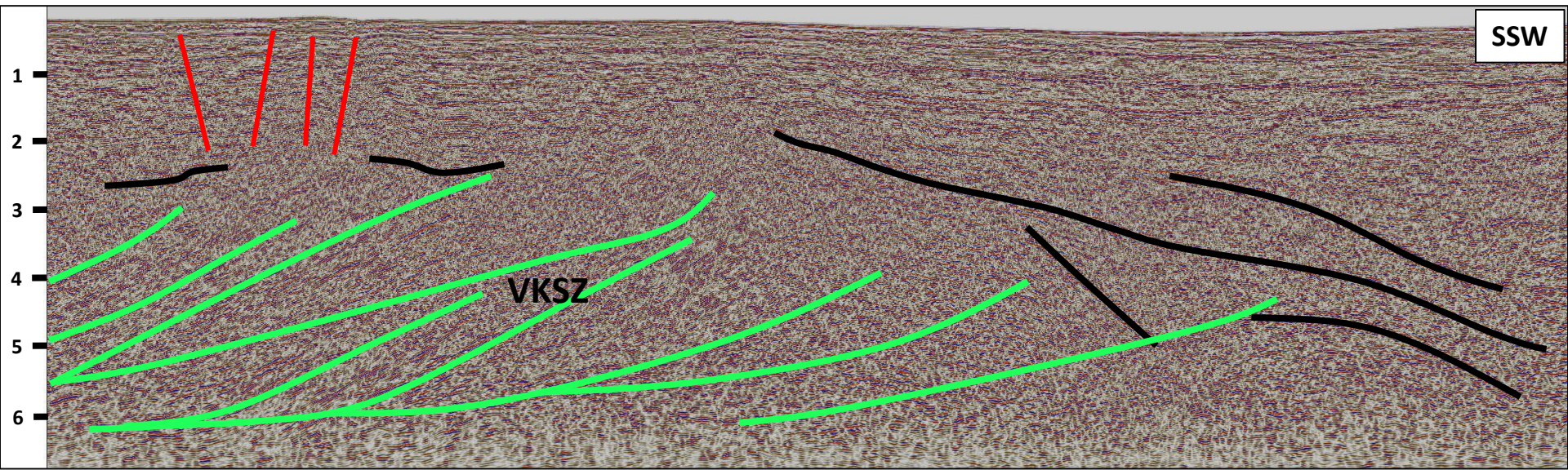
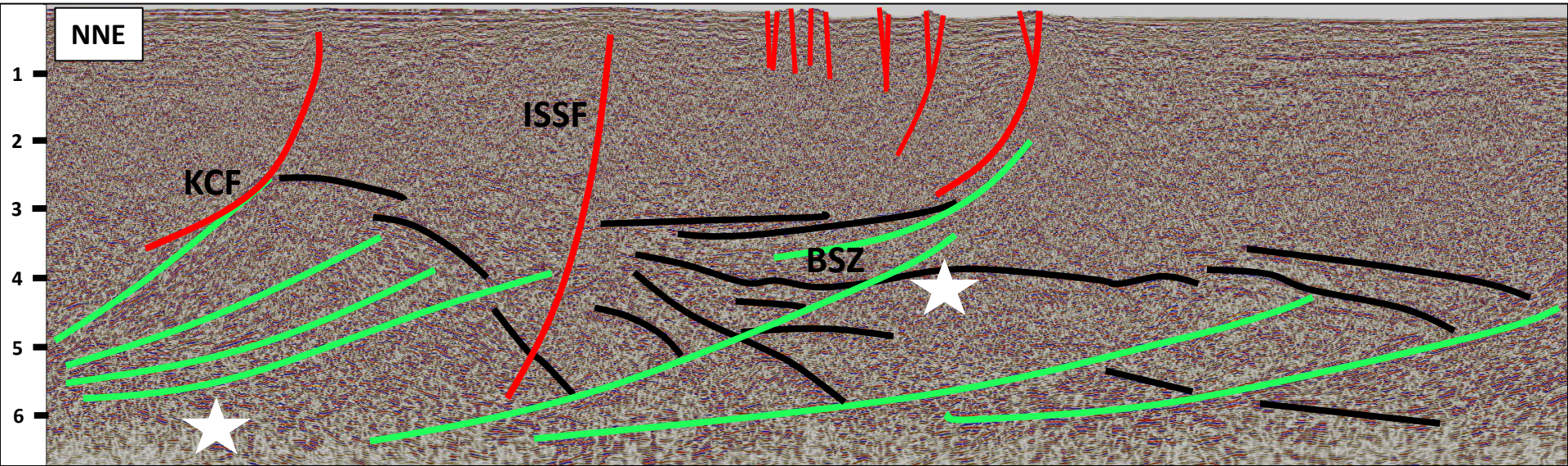


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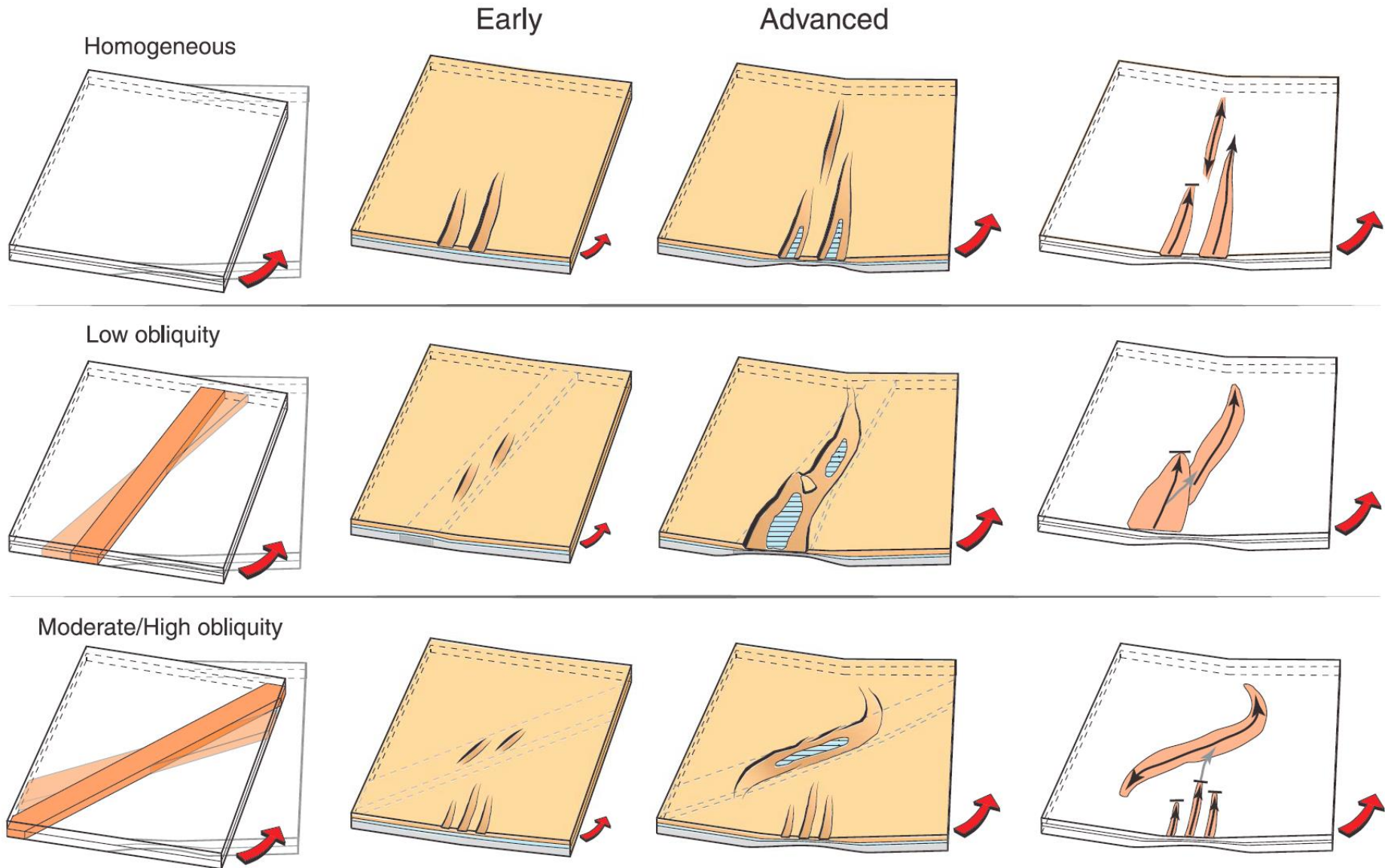


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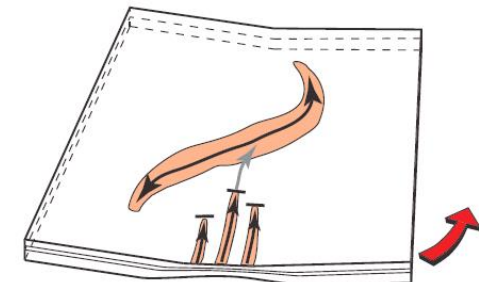
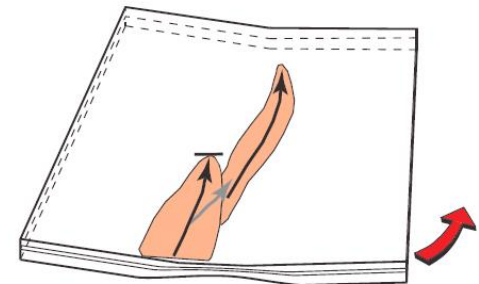
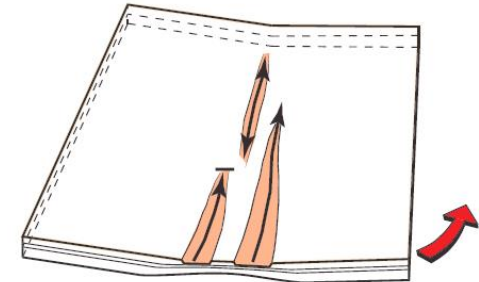
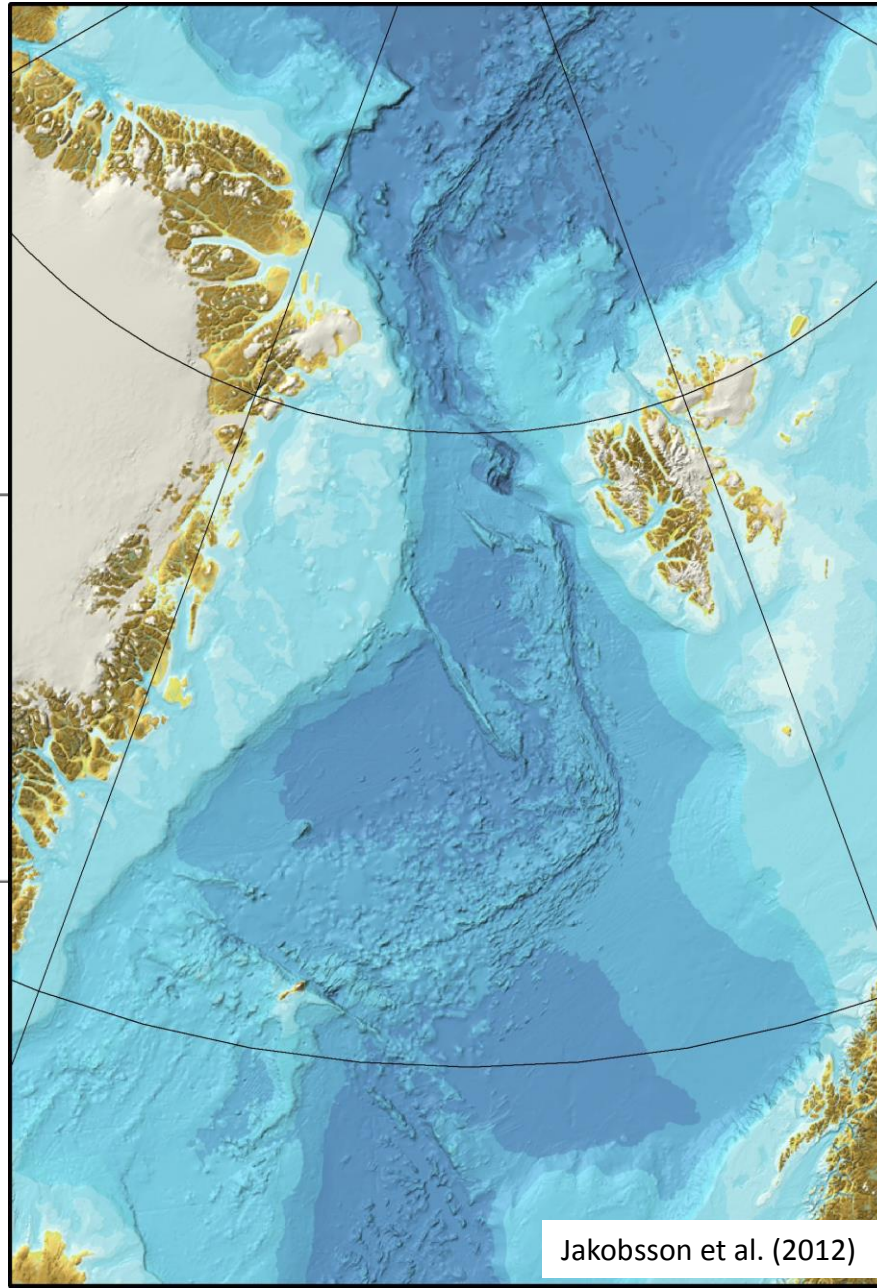
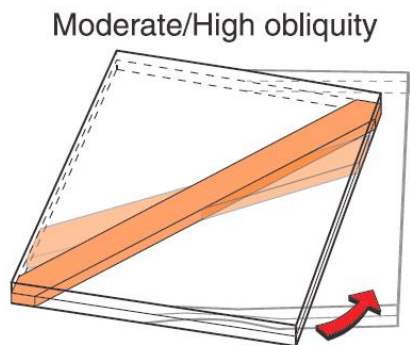
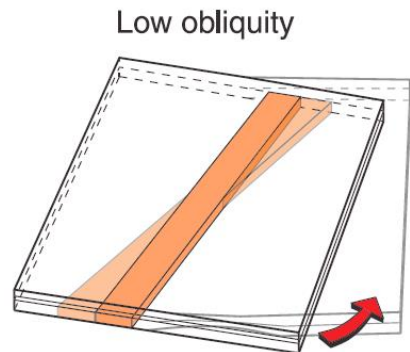
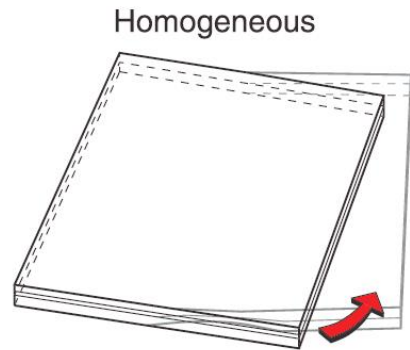
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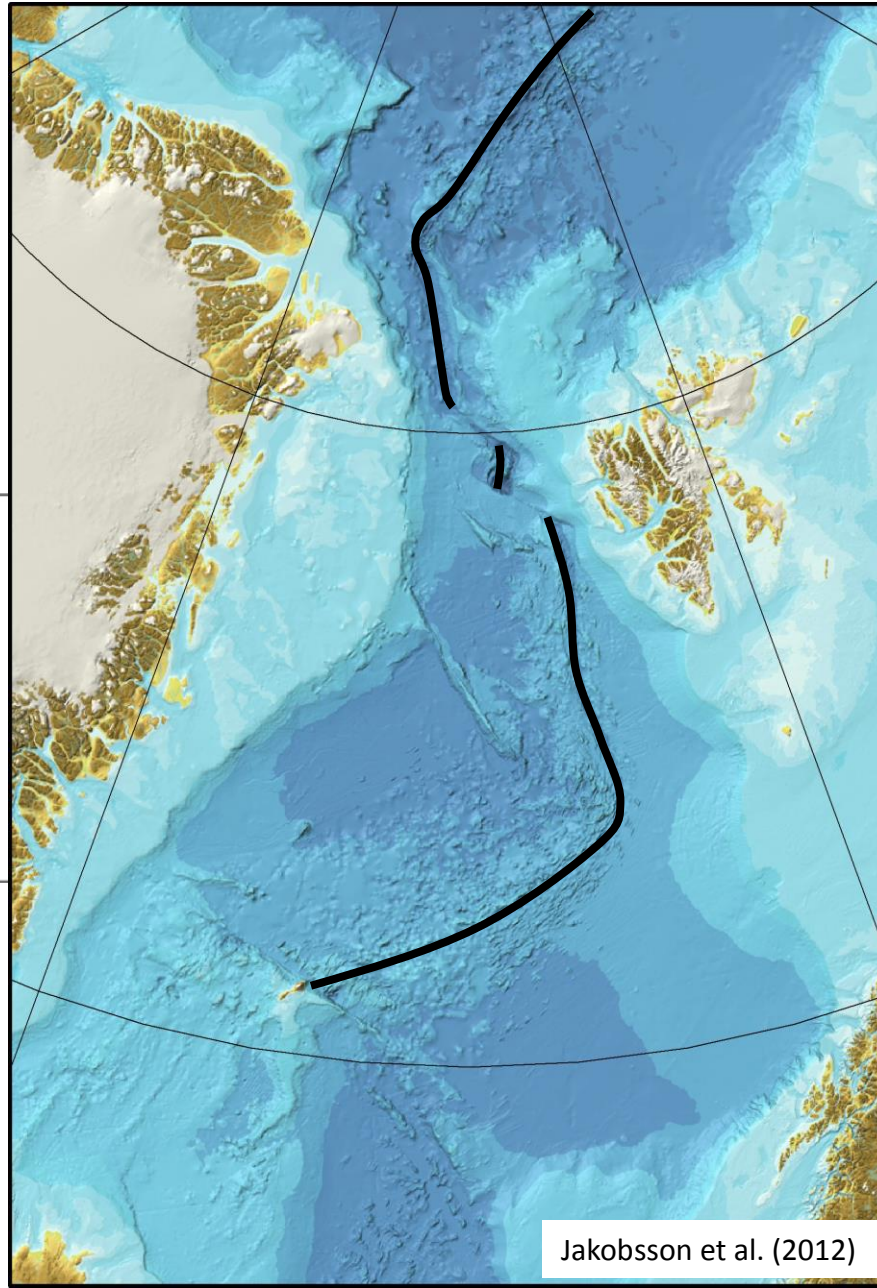
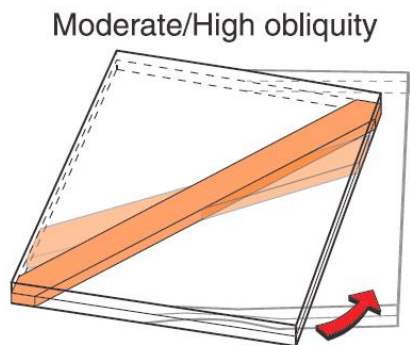
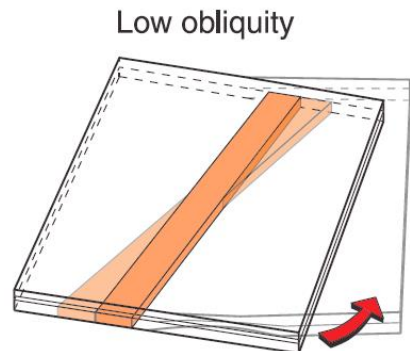
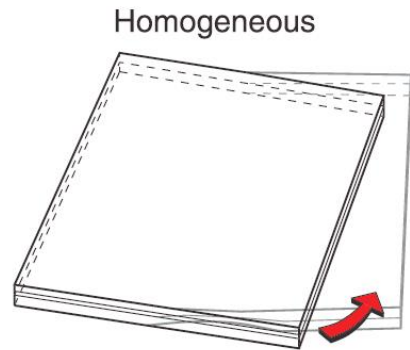
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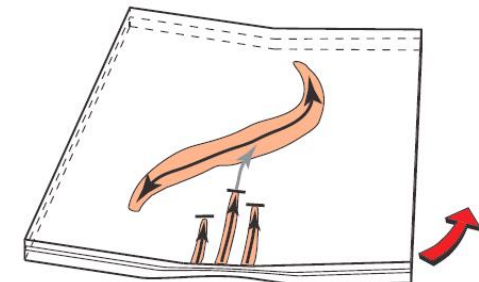
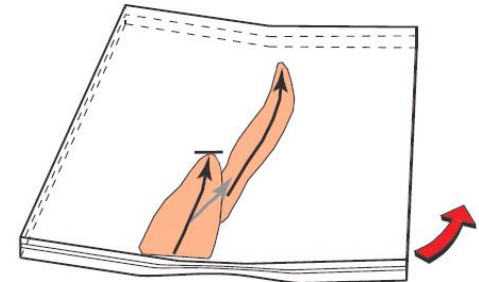
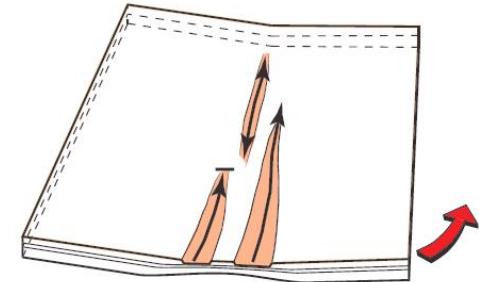
Jakobsson et al. (2012)

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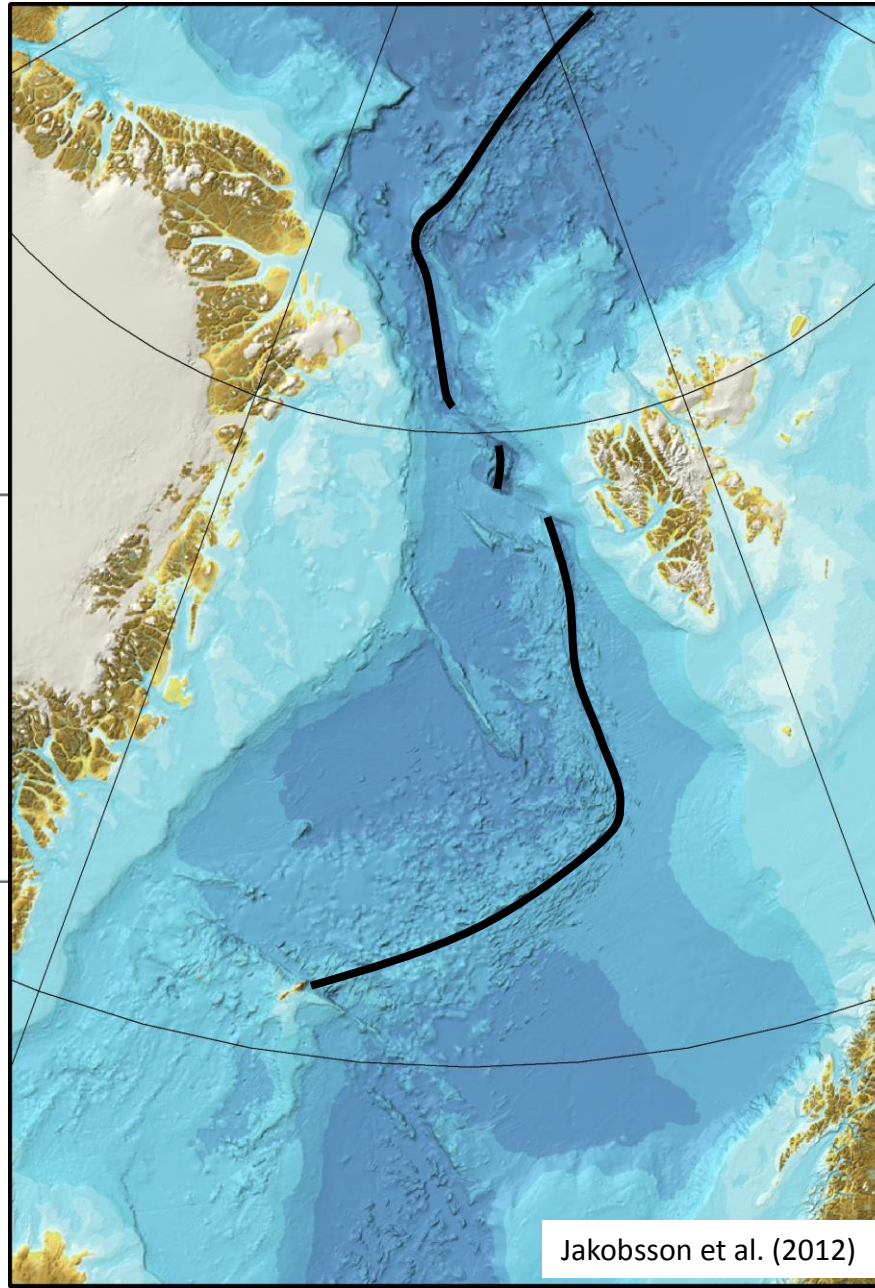
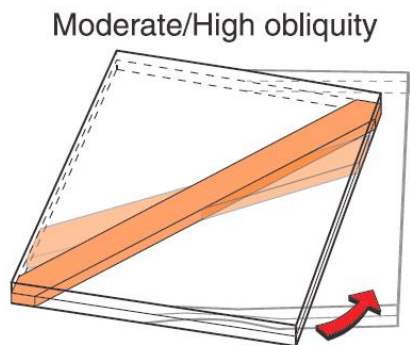
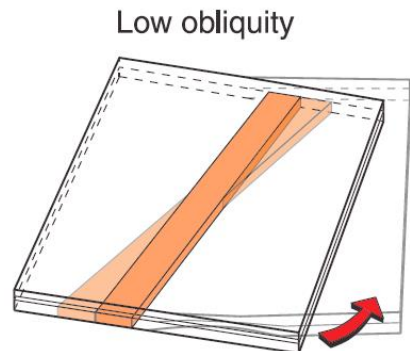
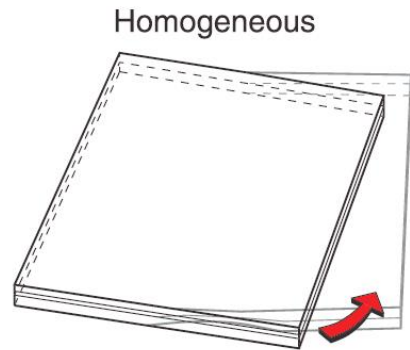


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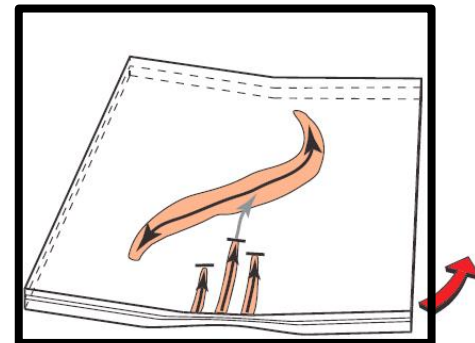
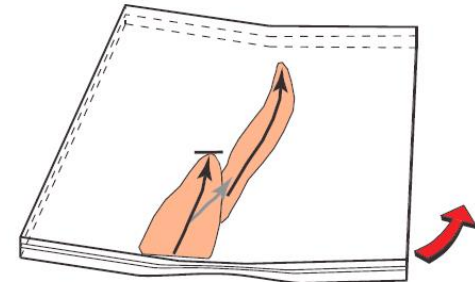
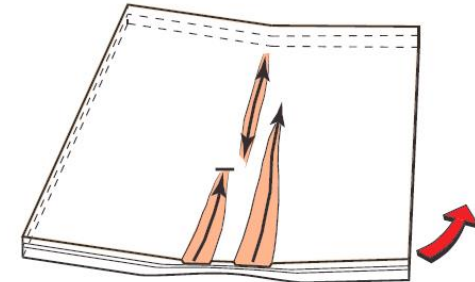


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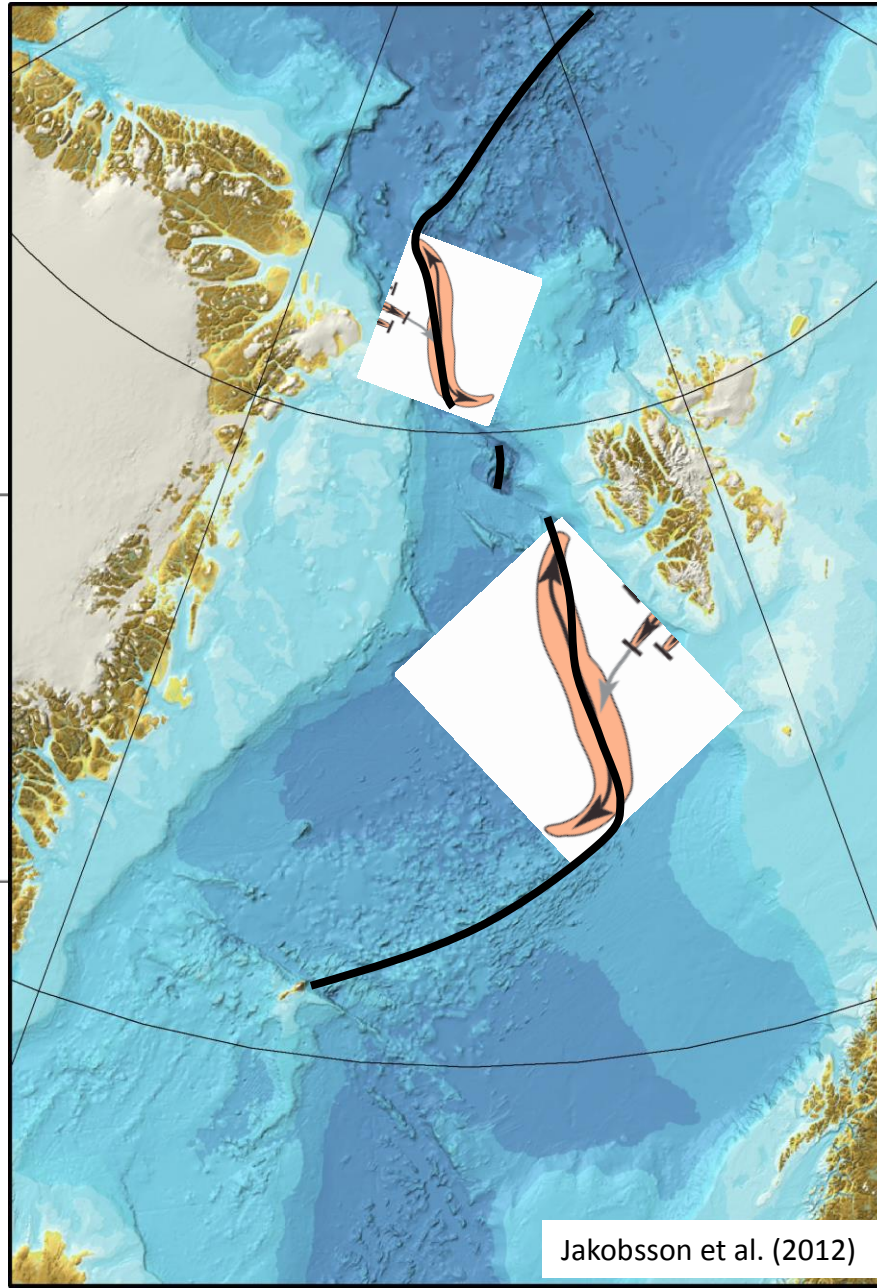
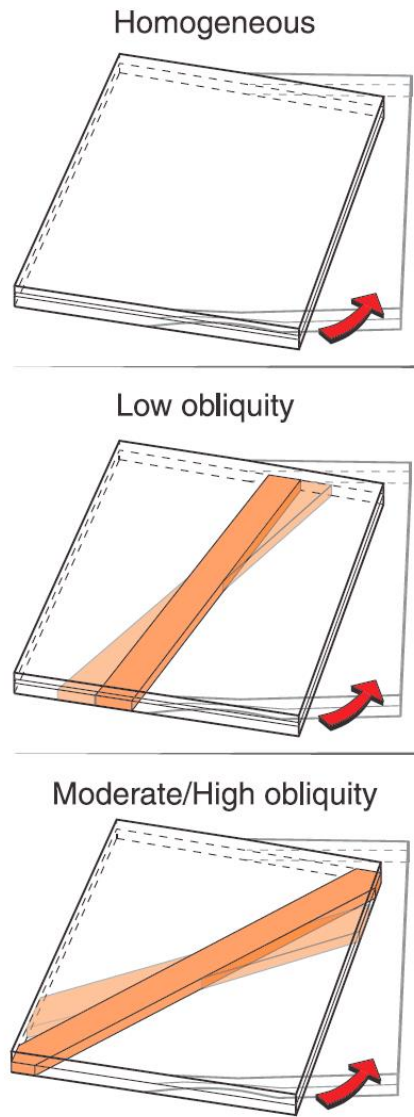


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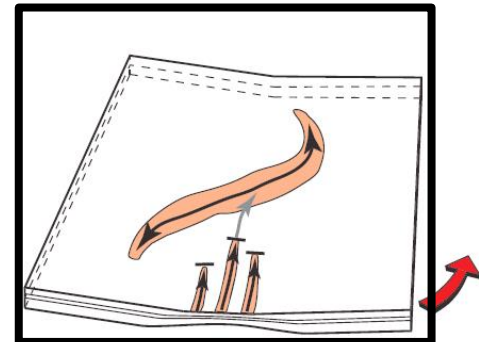
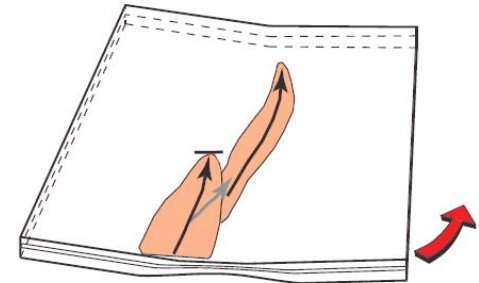
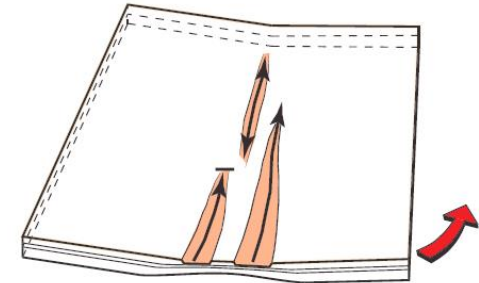


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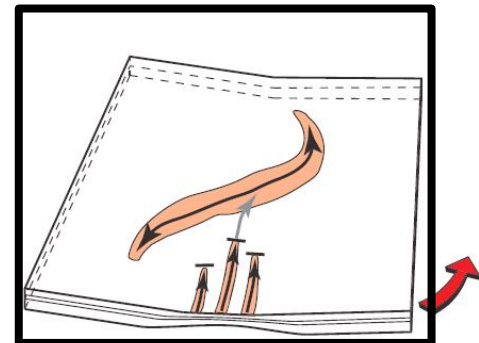
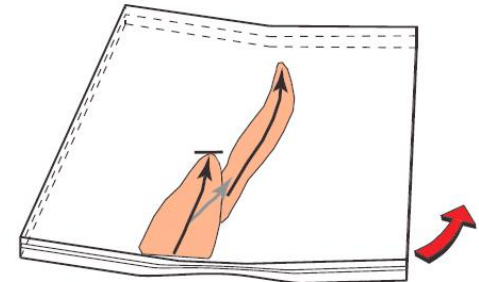
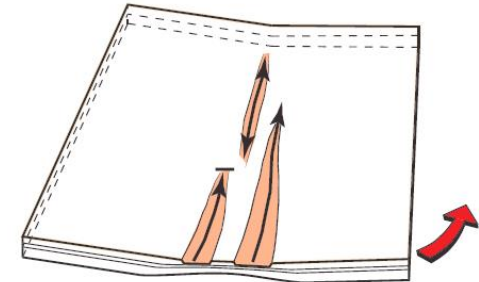
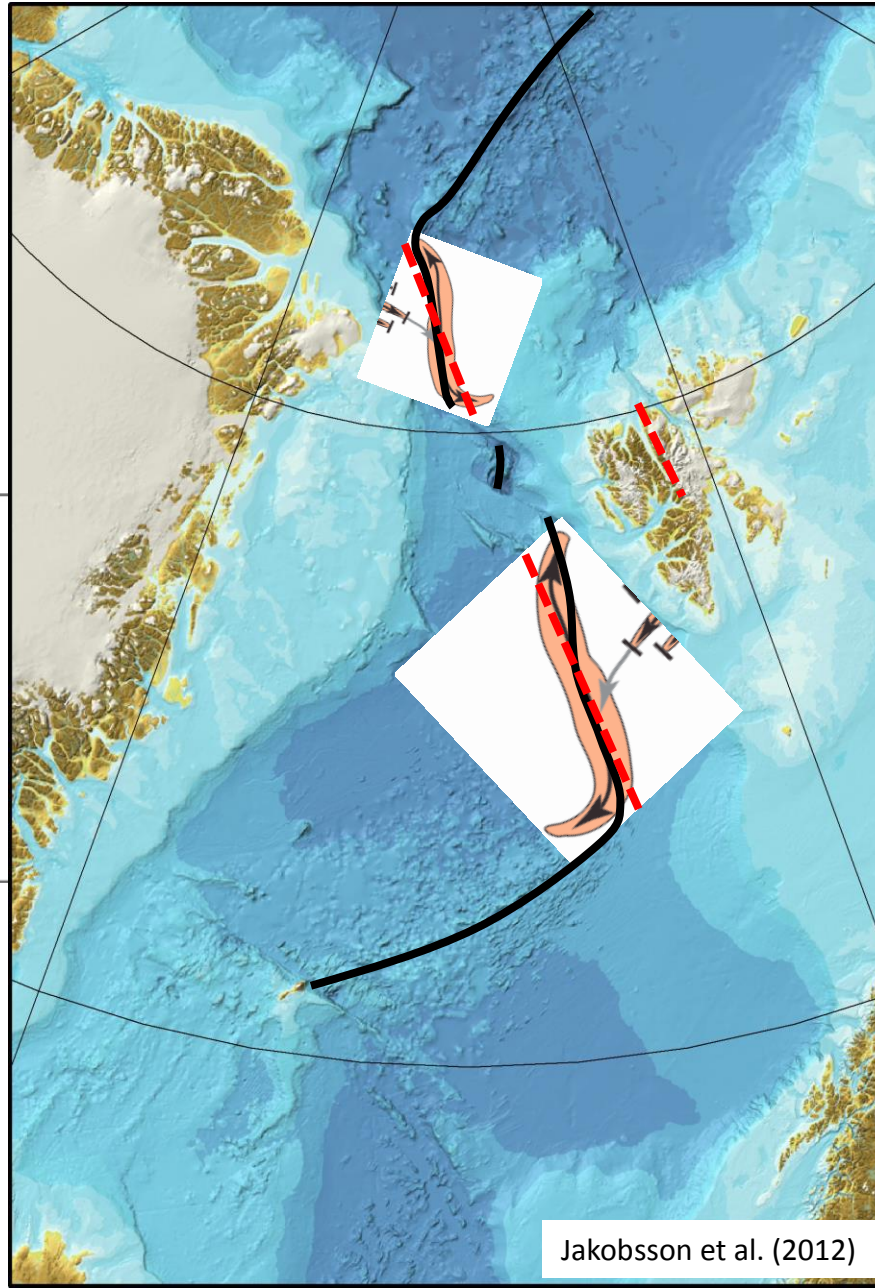
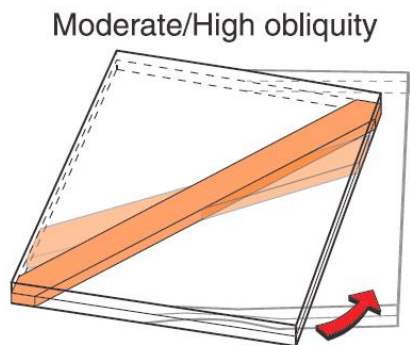
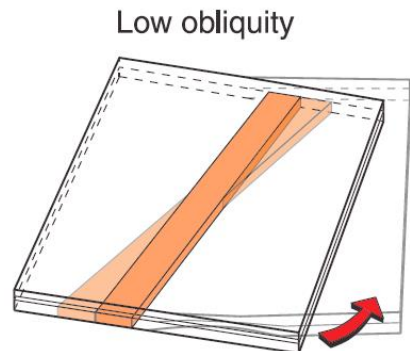
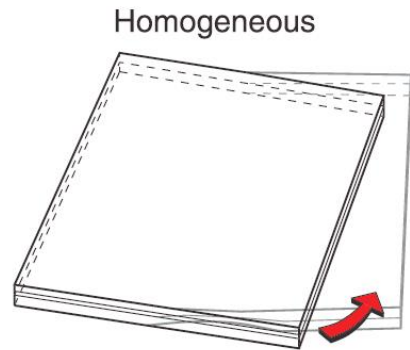


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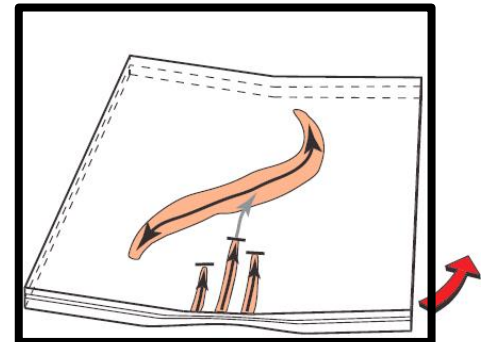
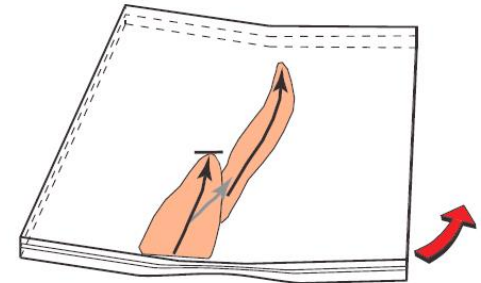
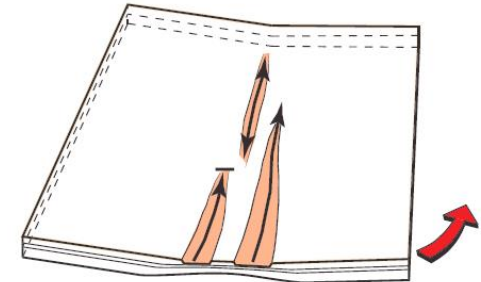
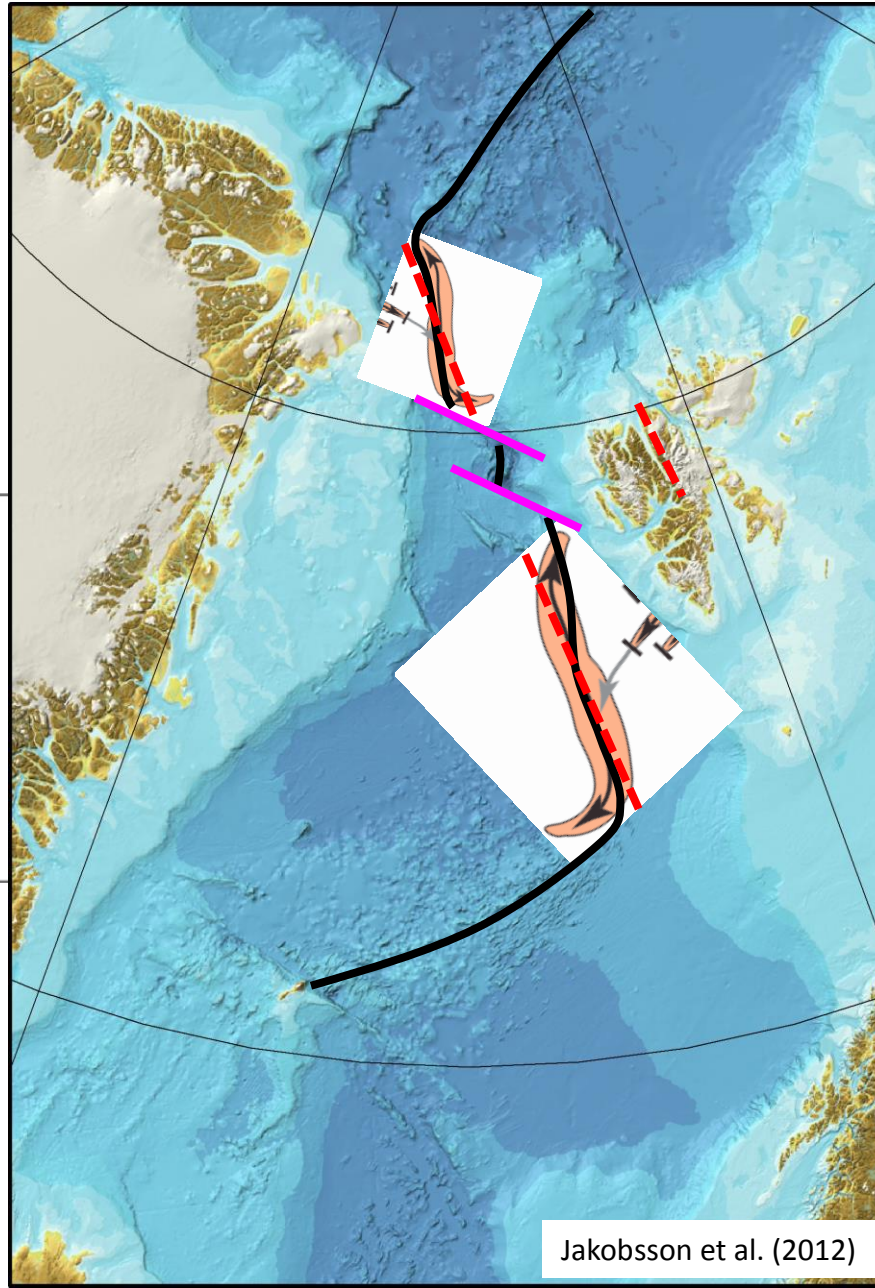
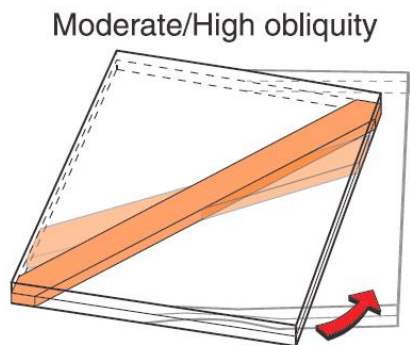
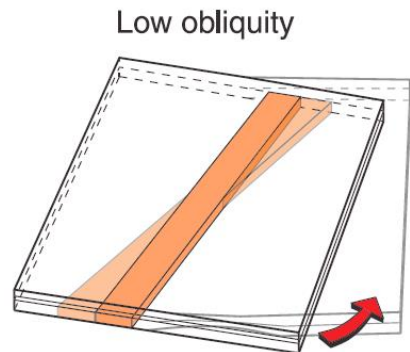
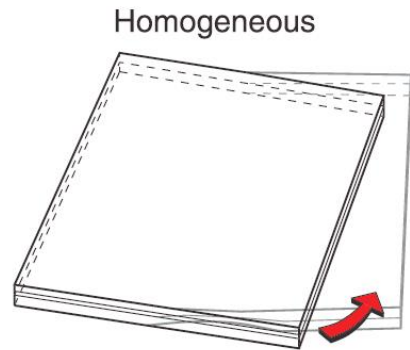
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Jakobsson et al. (2012)

Molnar et al. (2017)

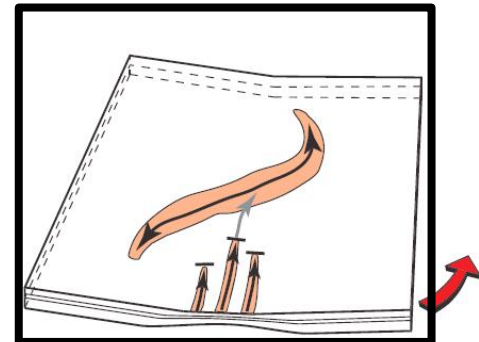
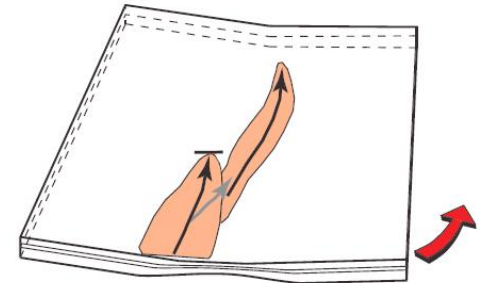
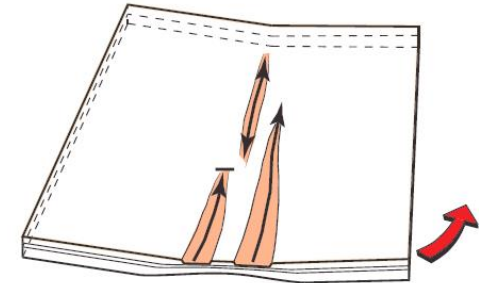
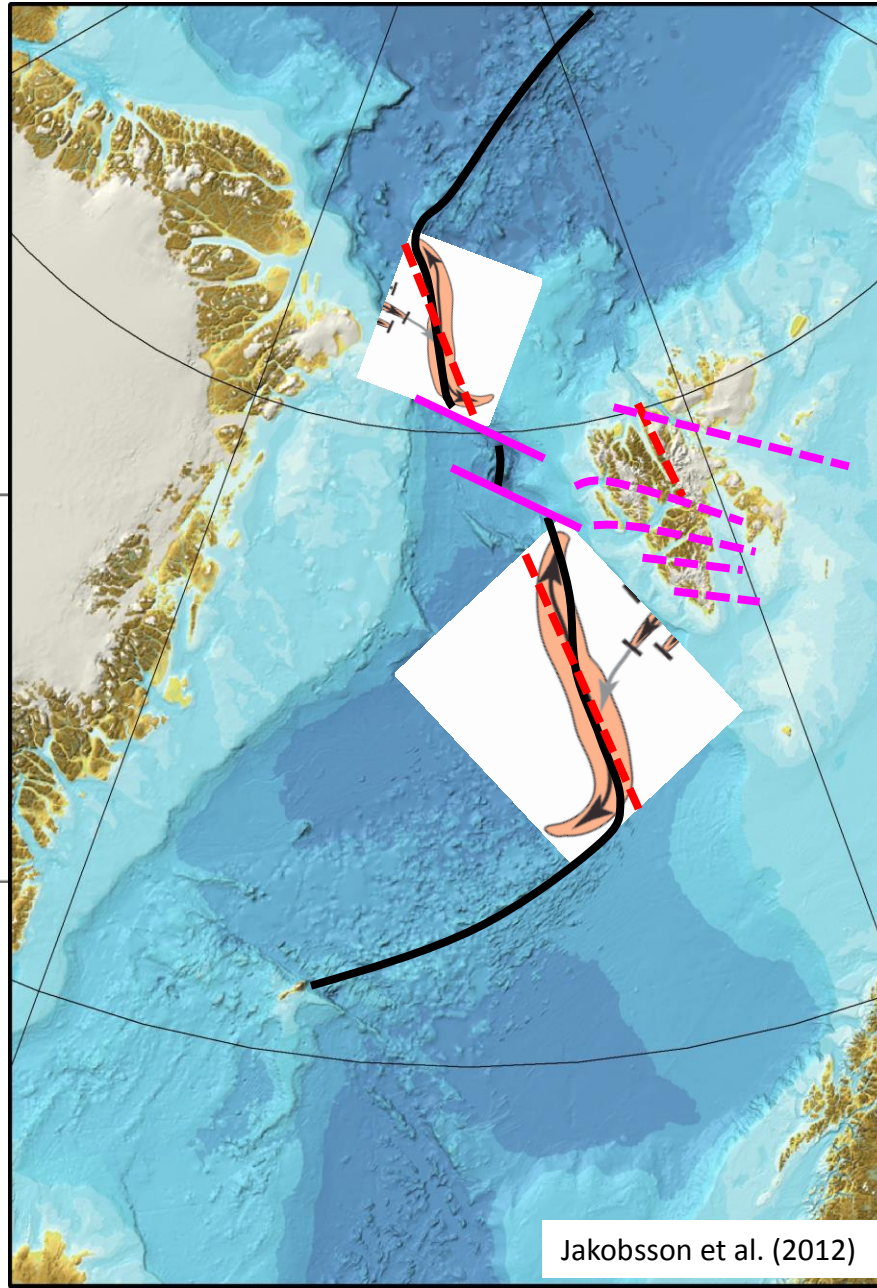
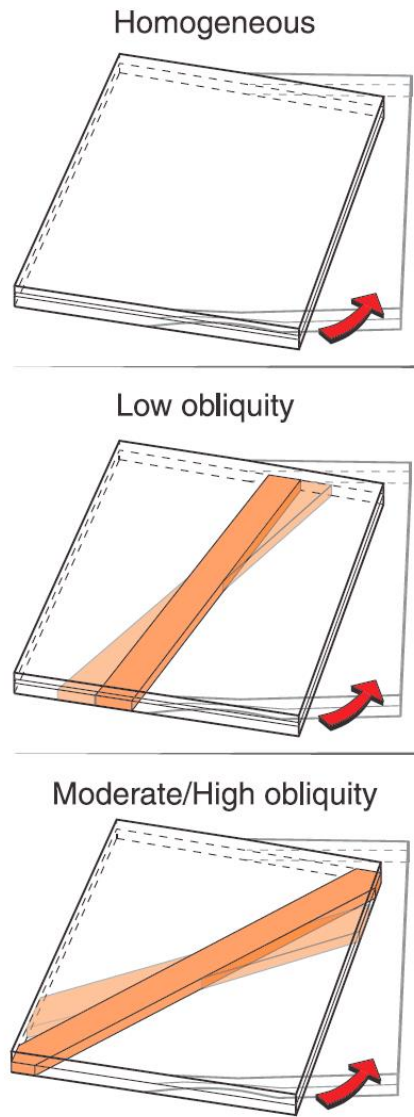
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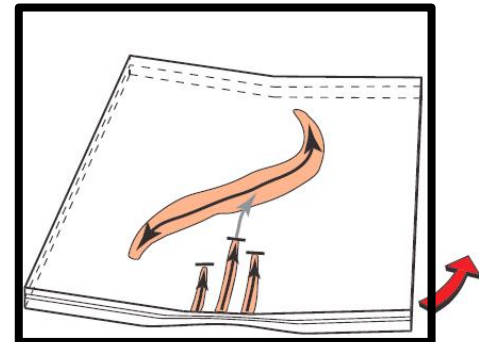
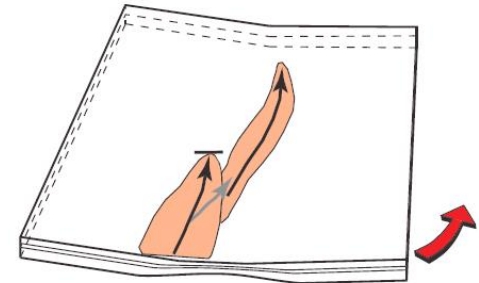
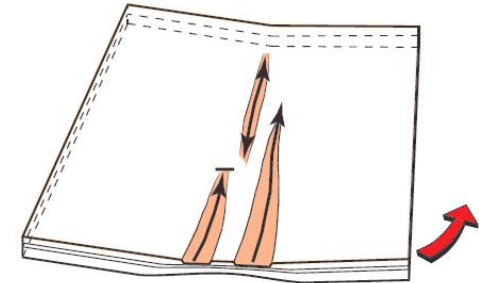
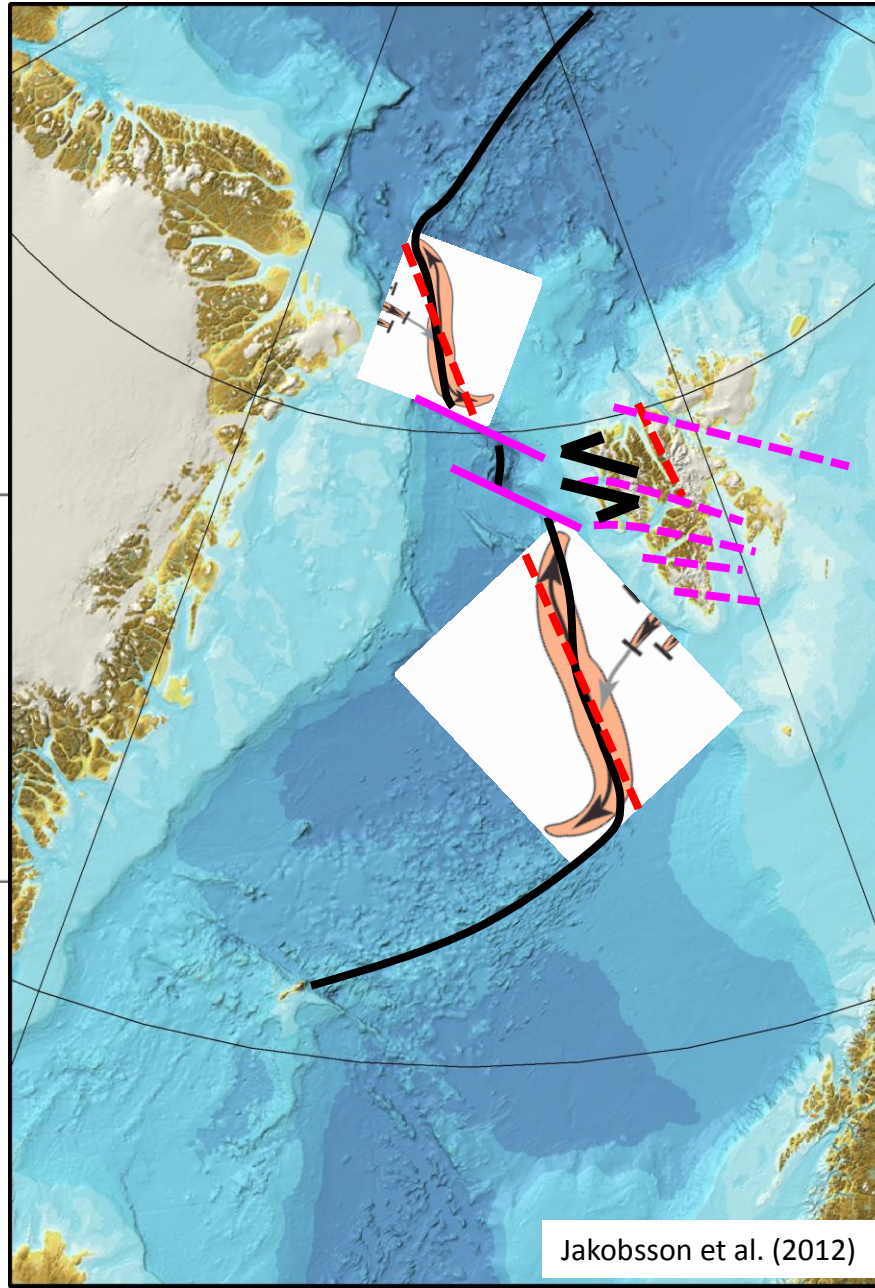
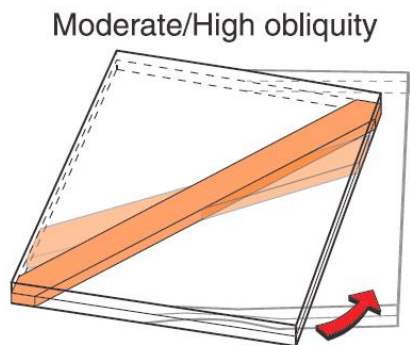
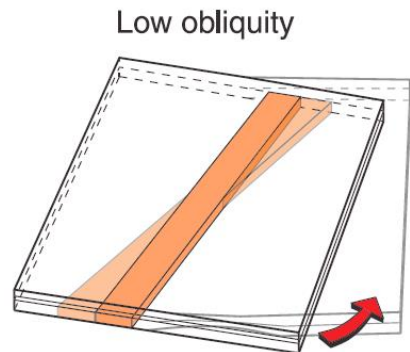
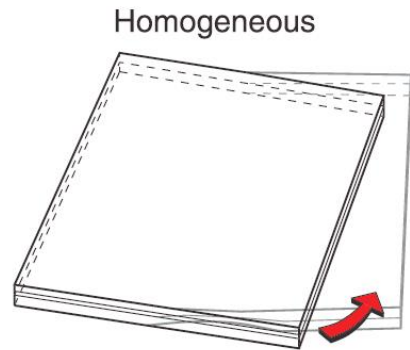
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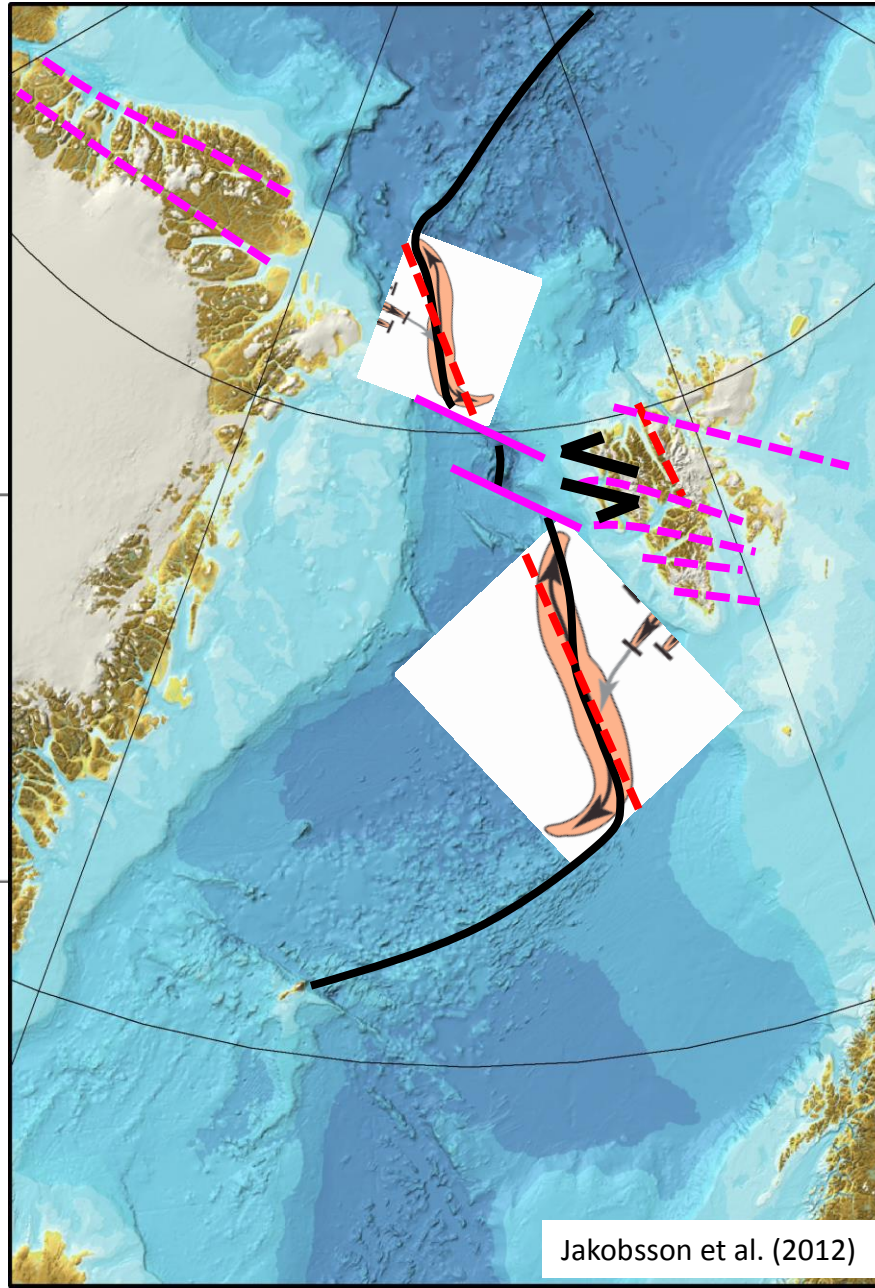
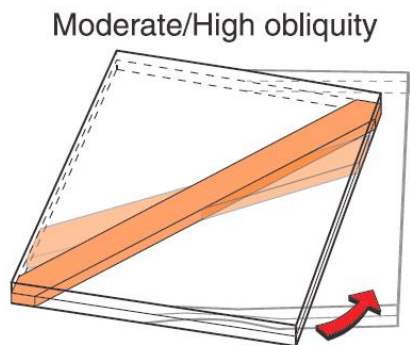
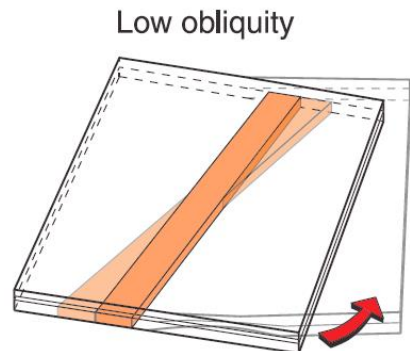
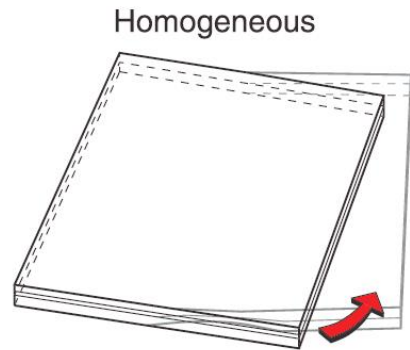
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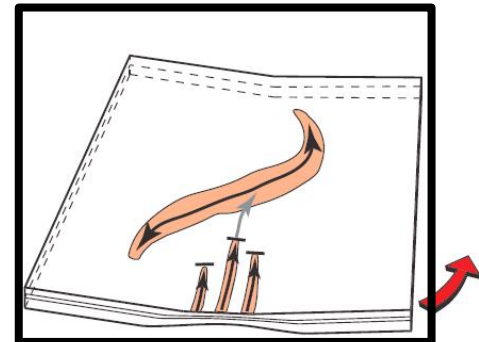
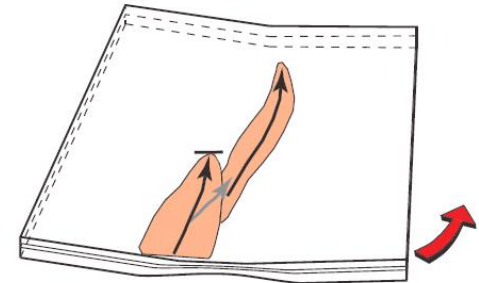
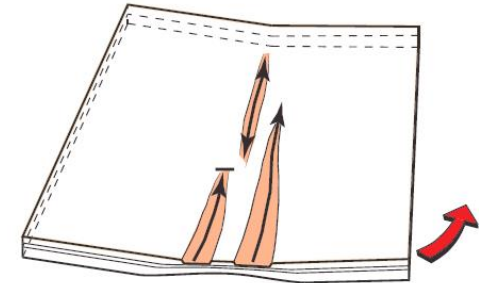
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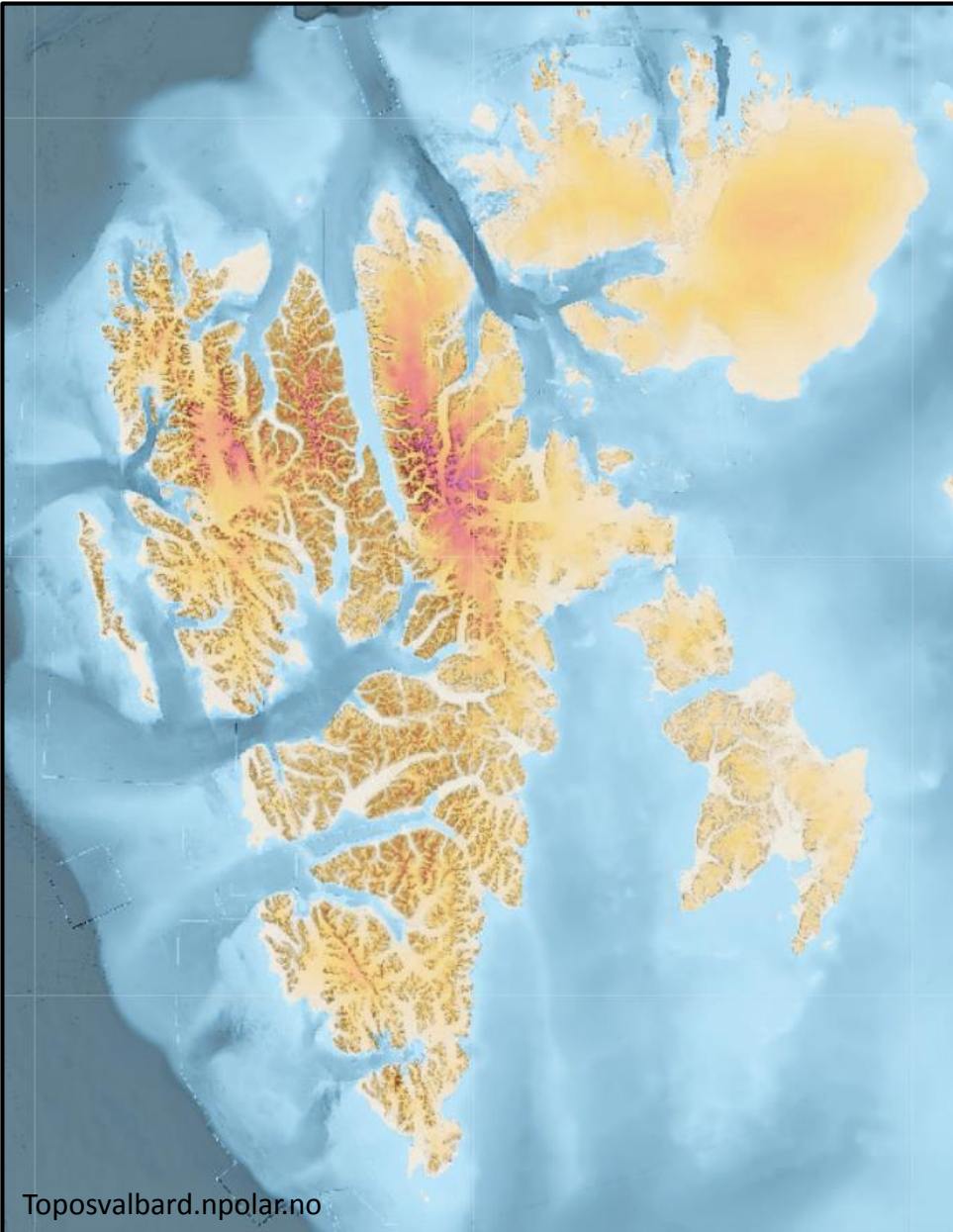


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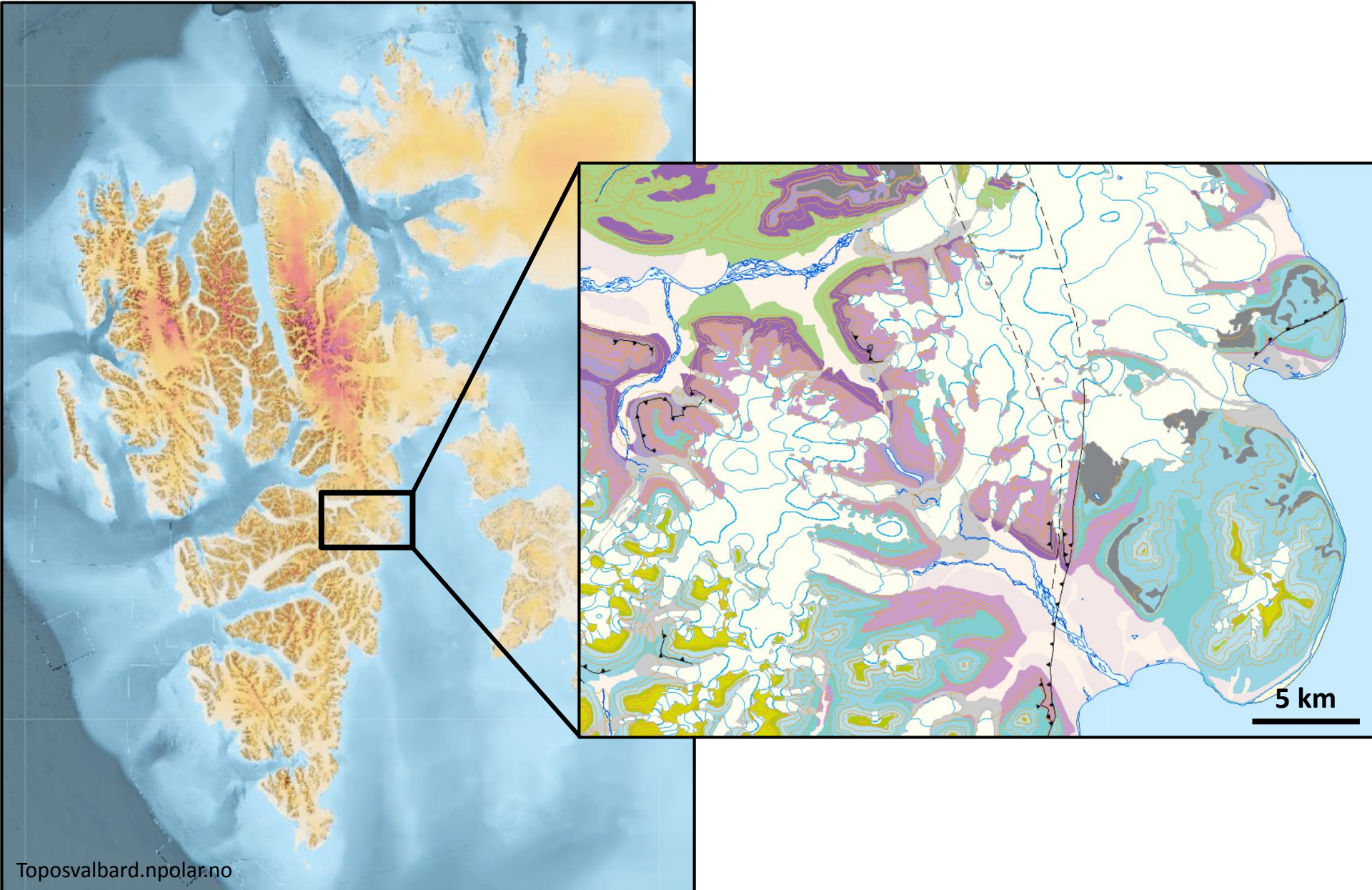




3 High-amplitude seismic reflections in Agardhfjellet in eastern Spitsbergen are truncated by the Top Mississippian reflection.

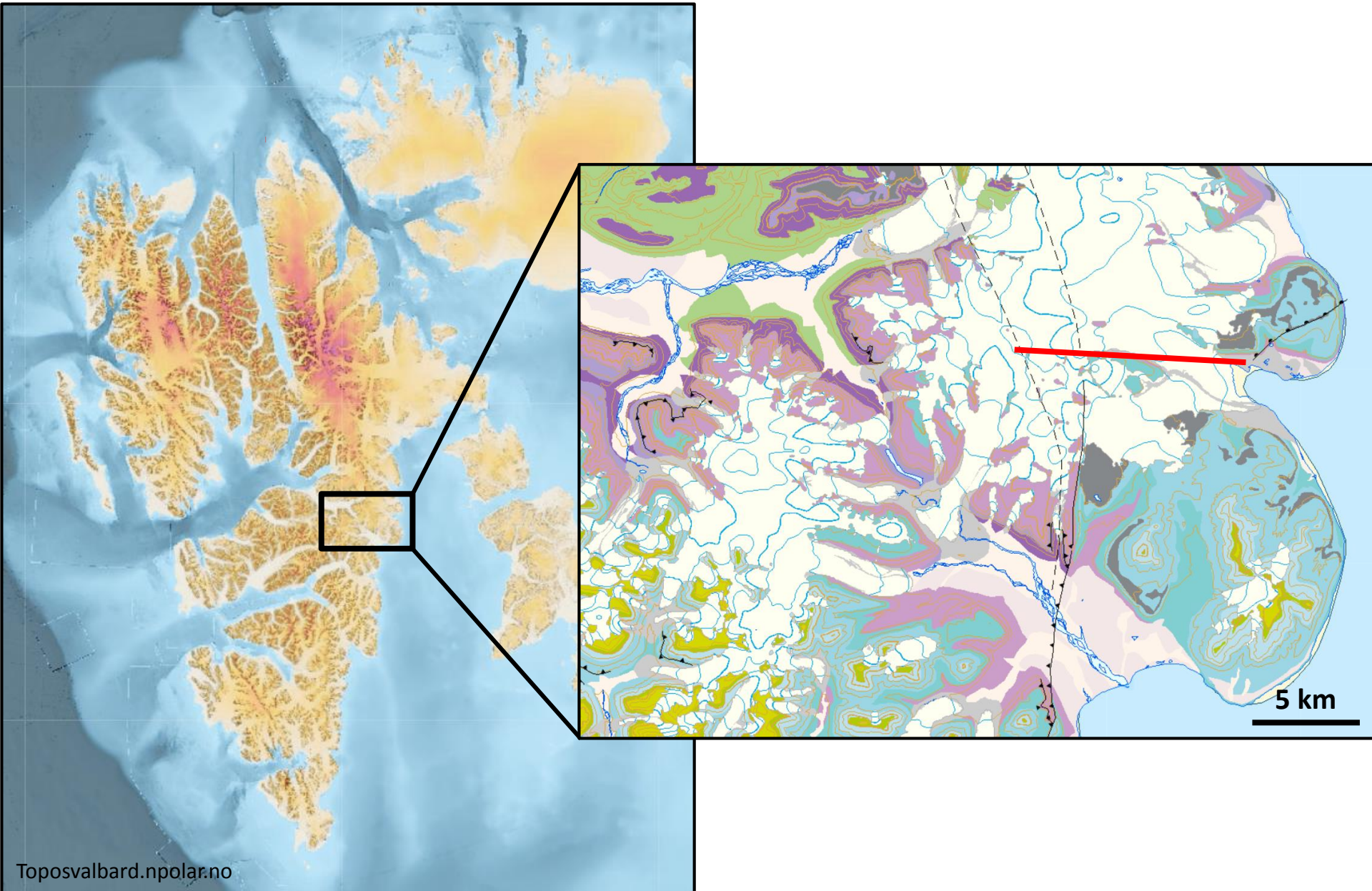


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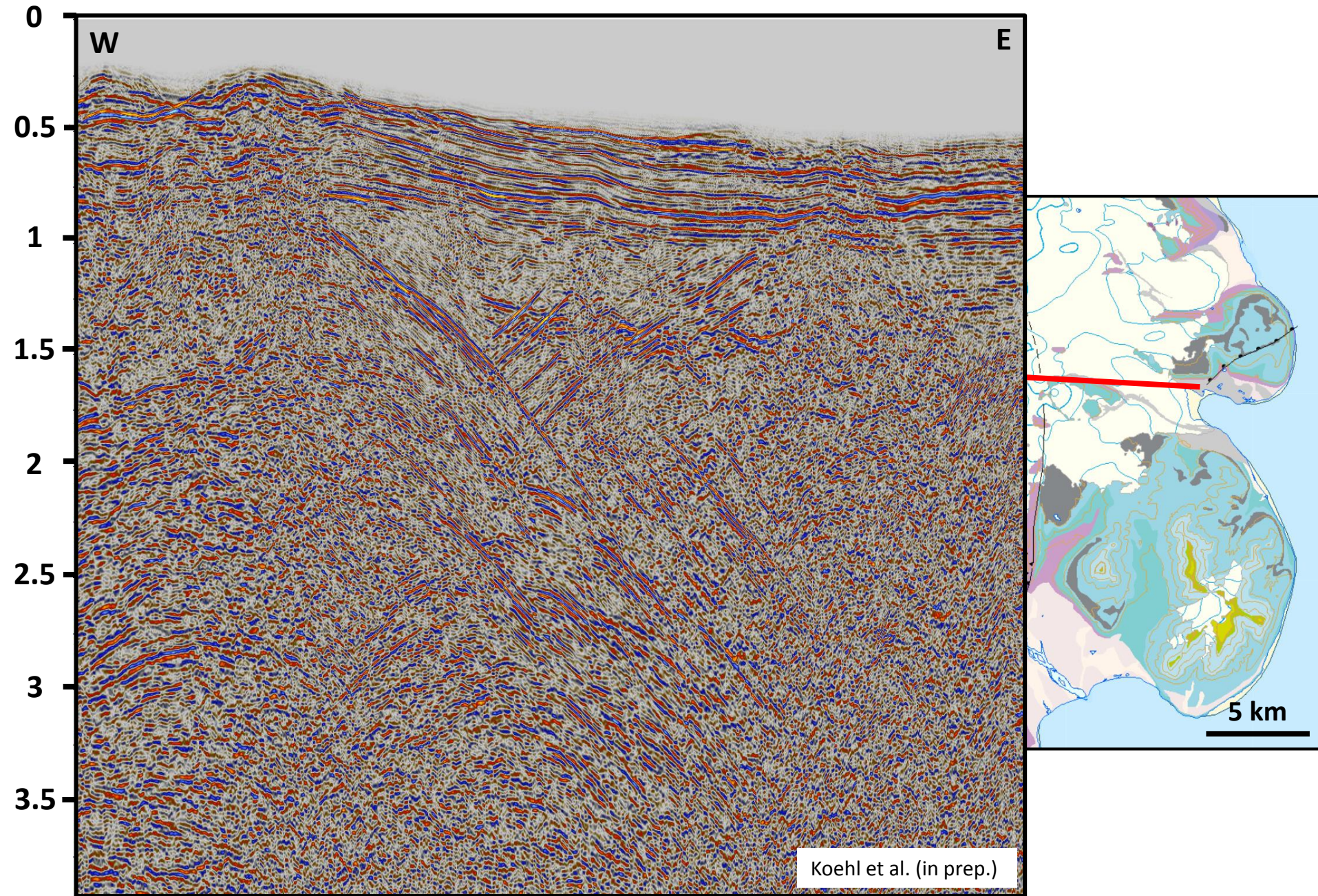


5 km

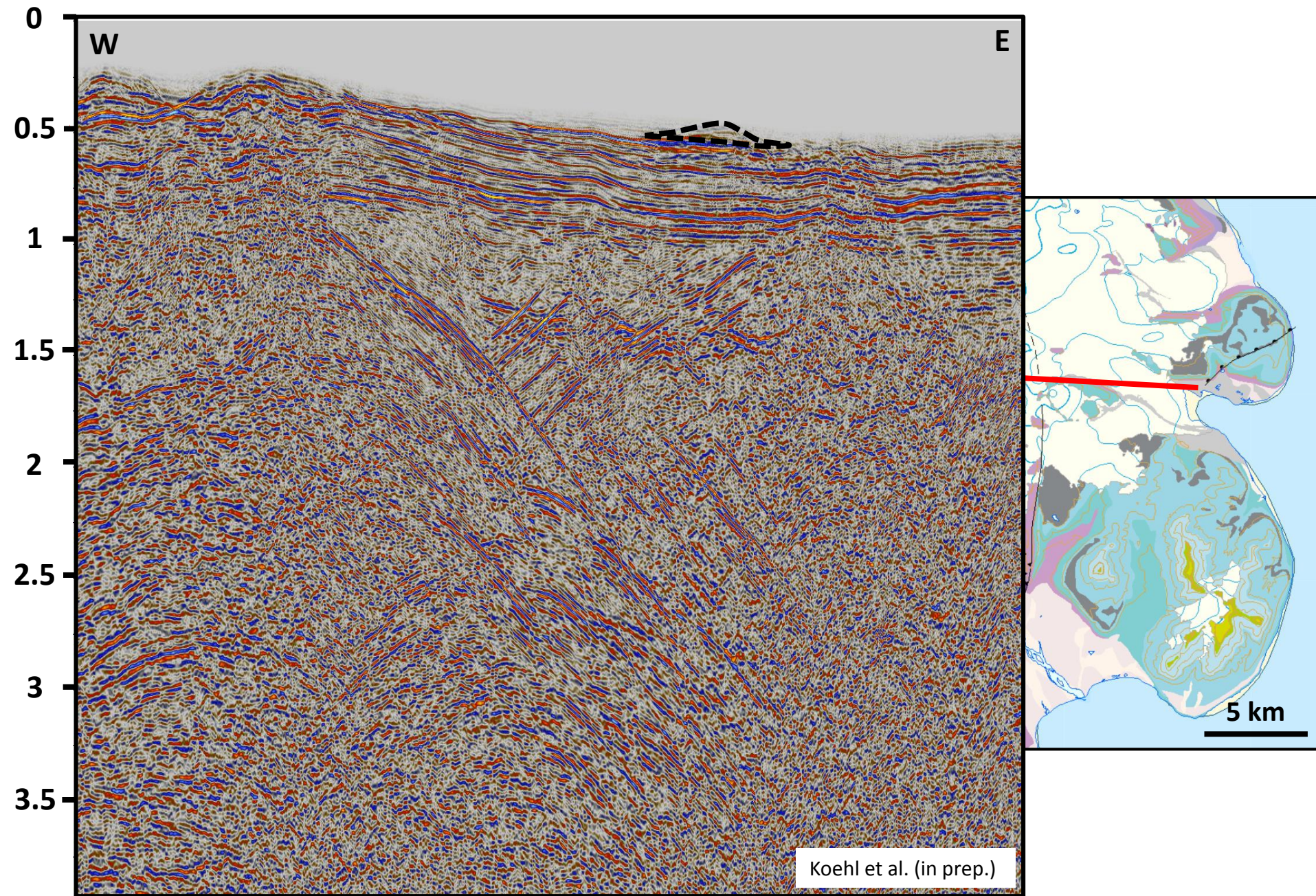
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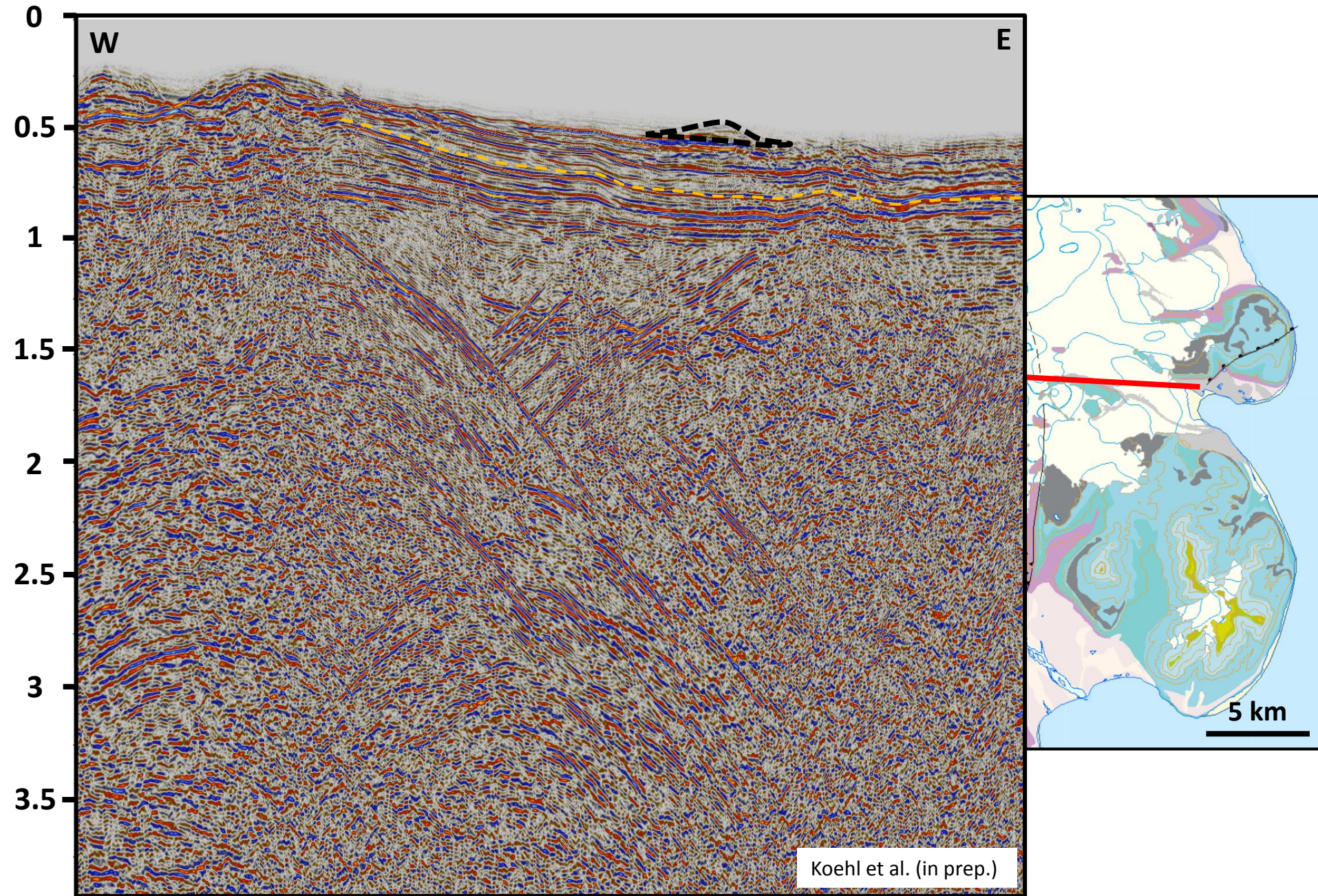
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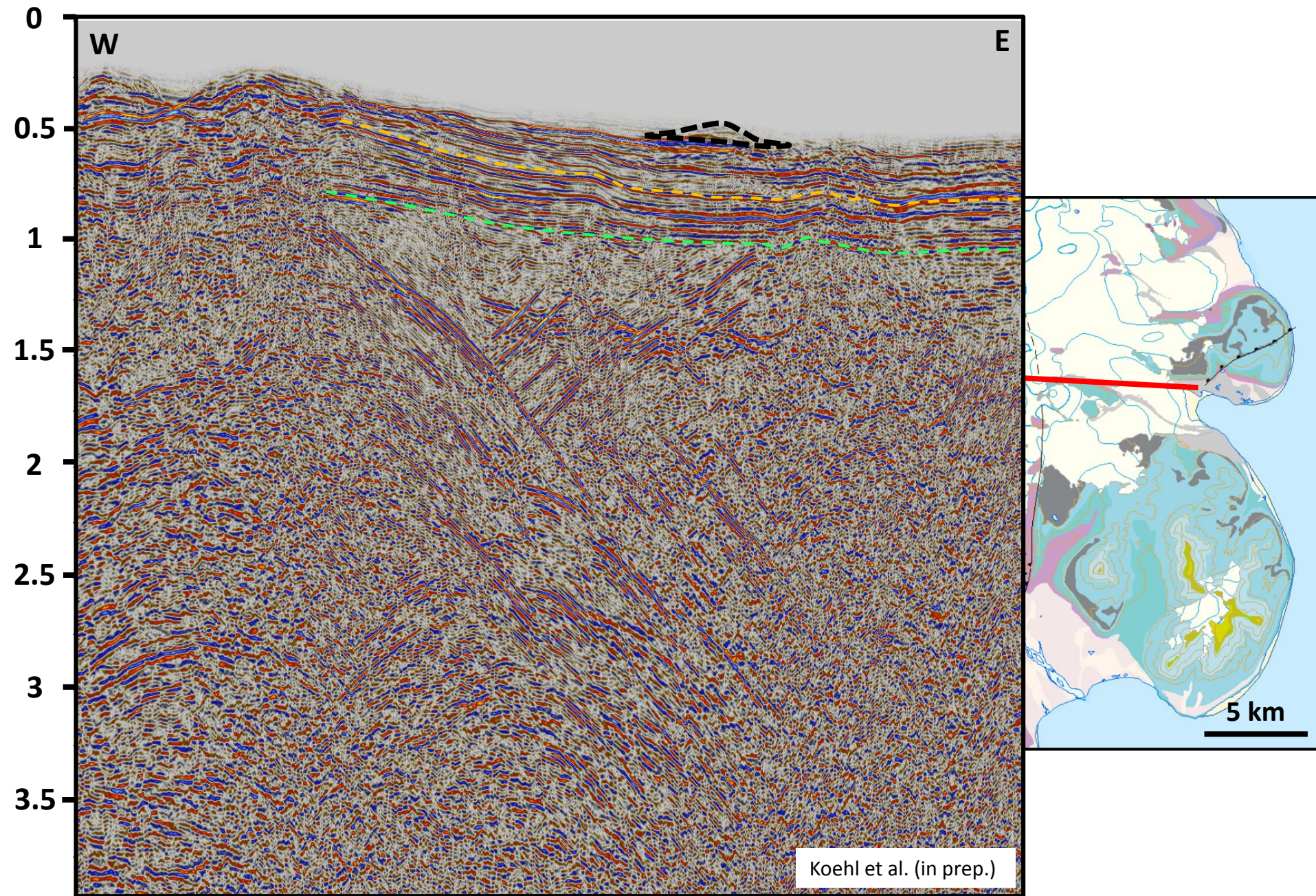
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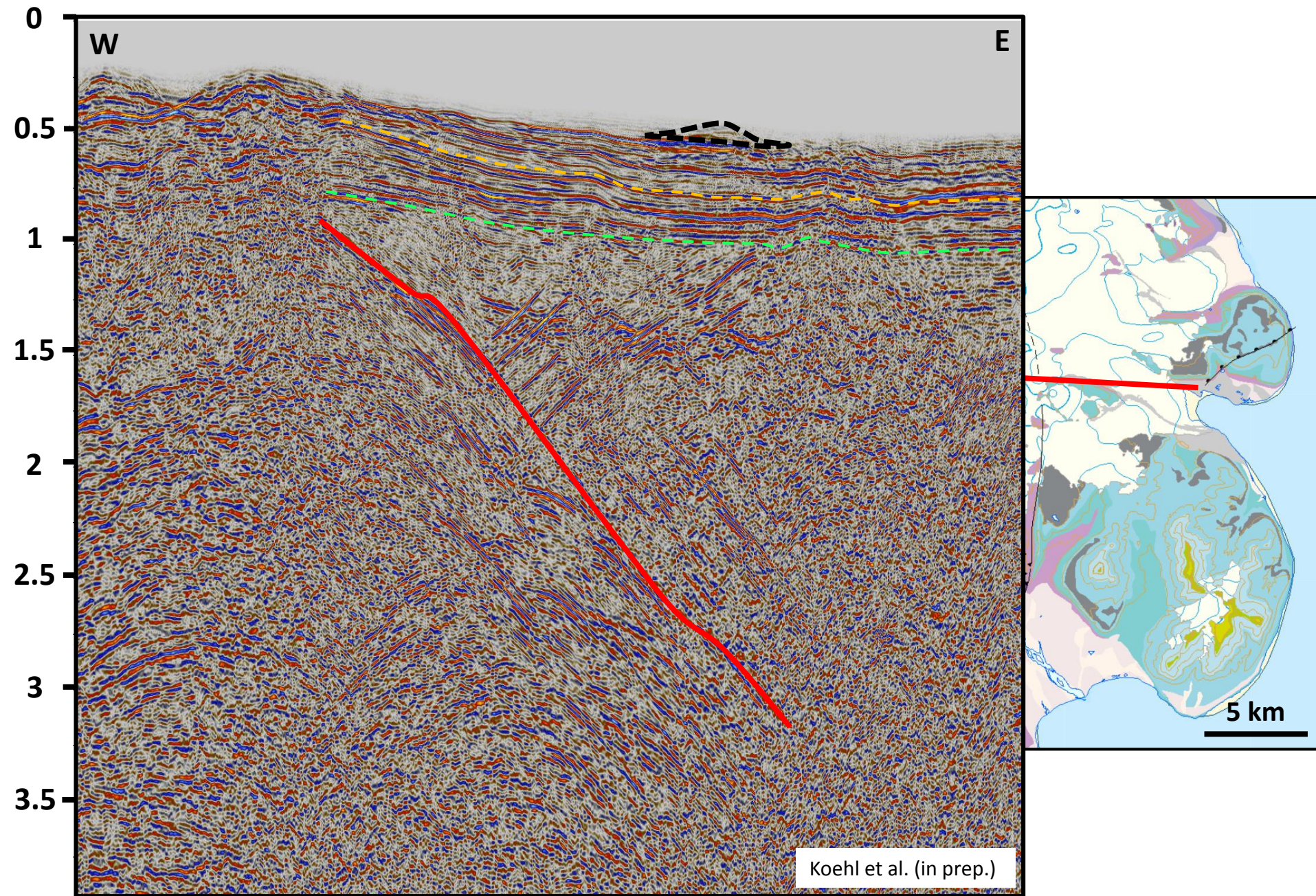
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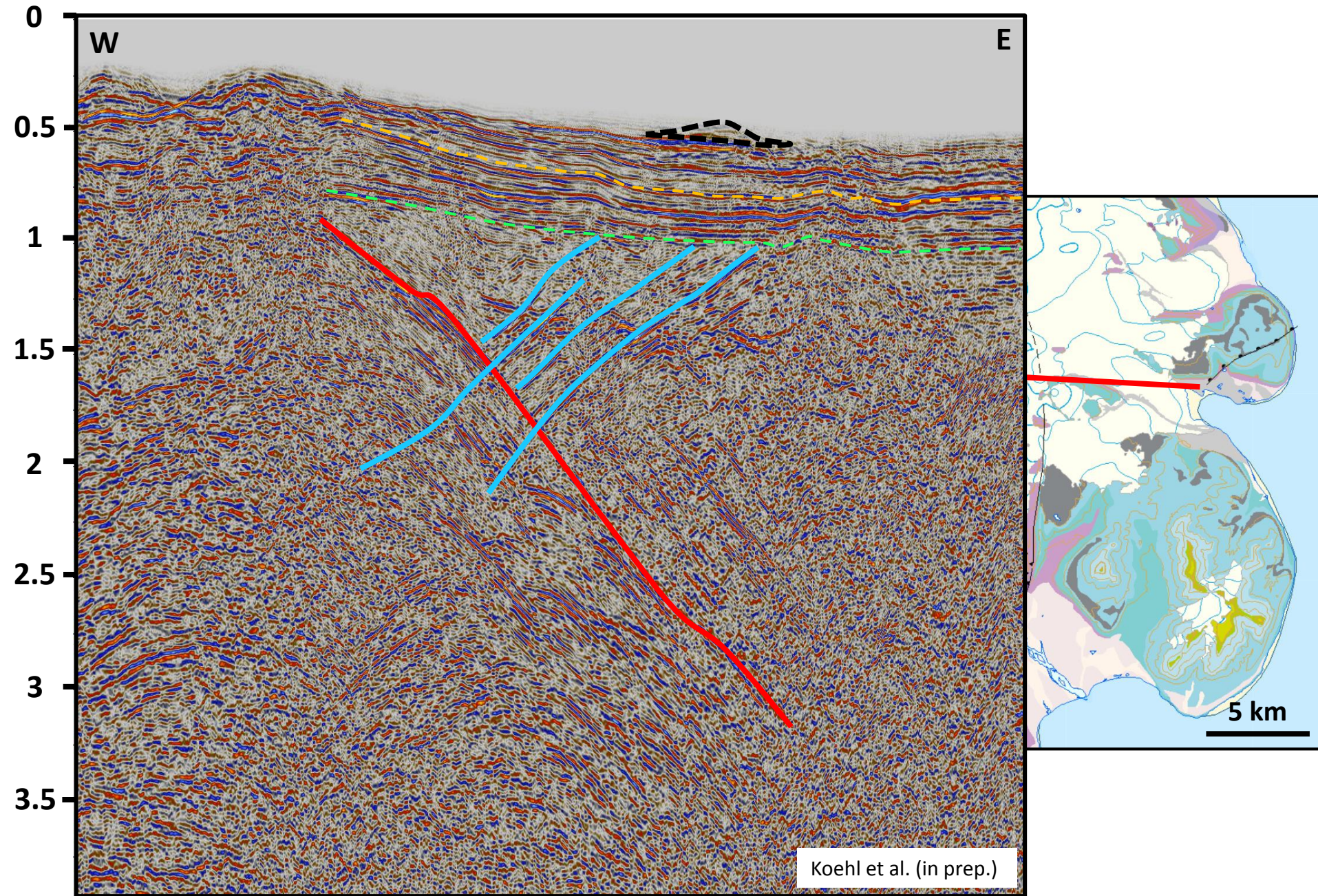
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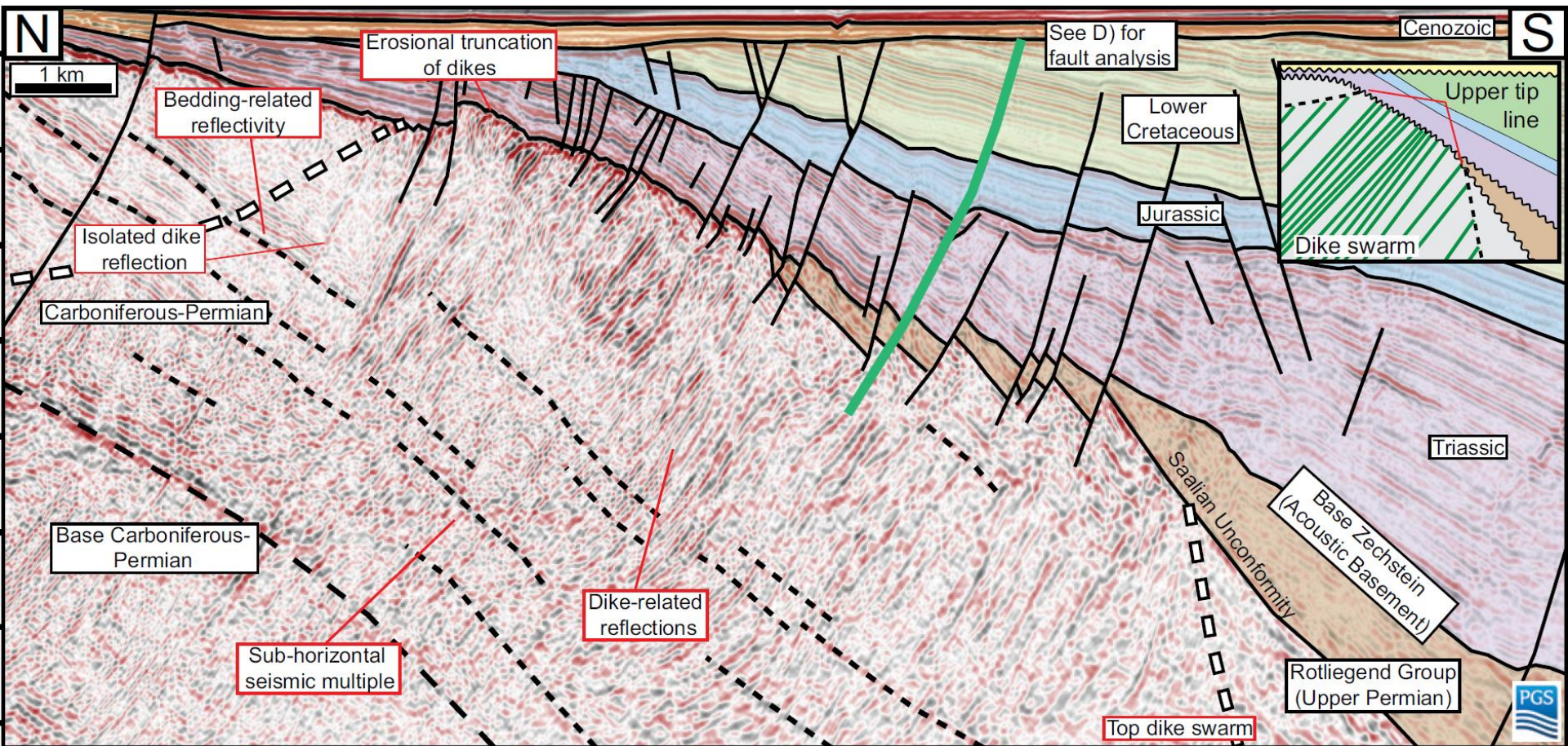
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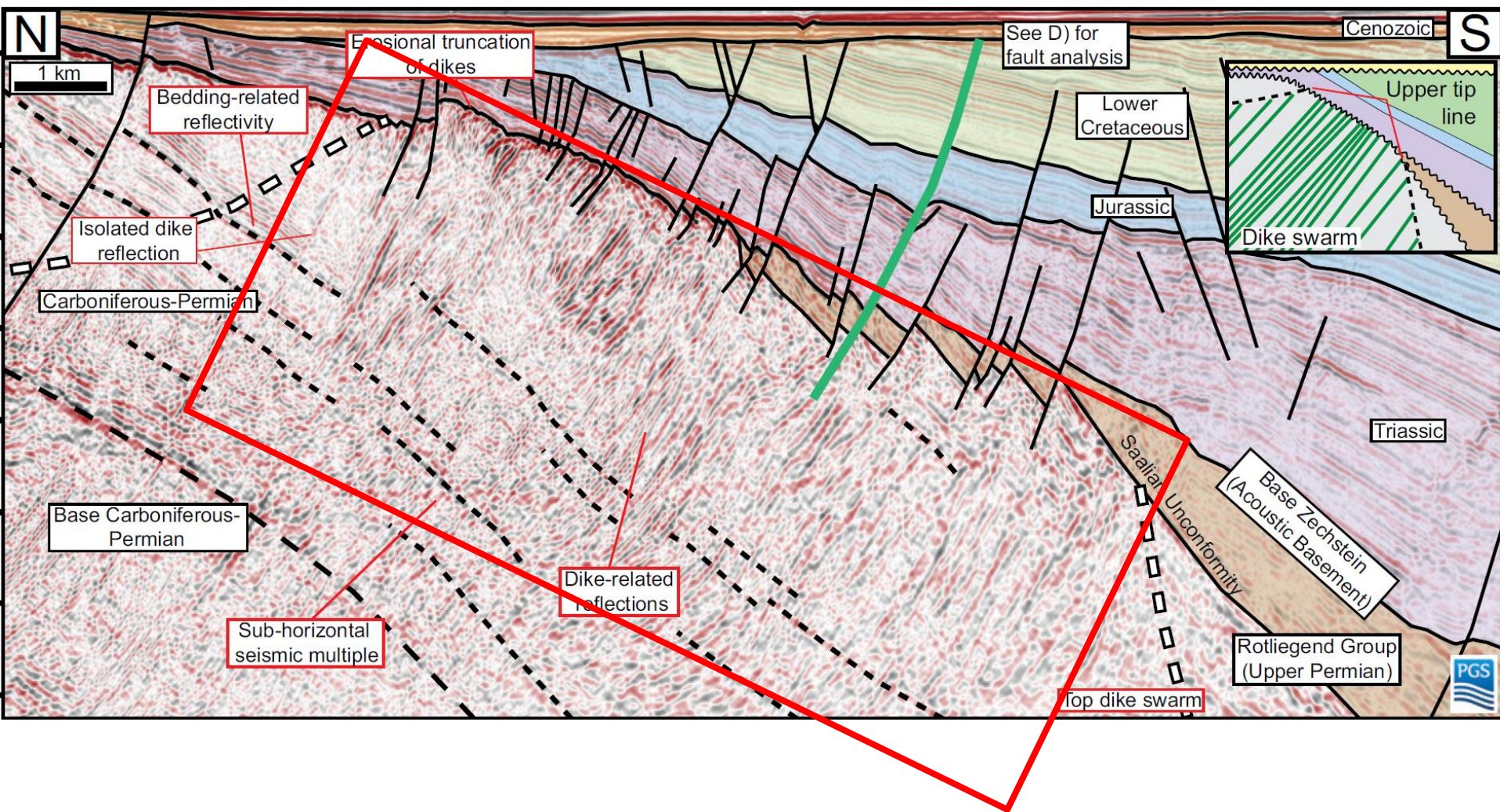
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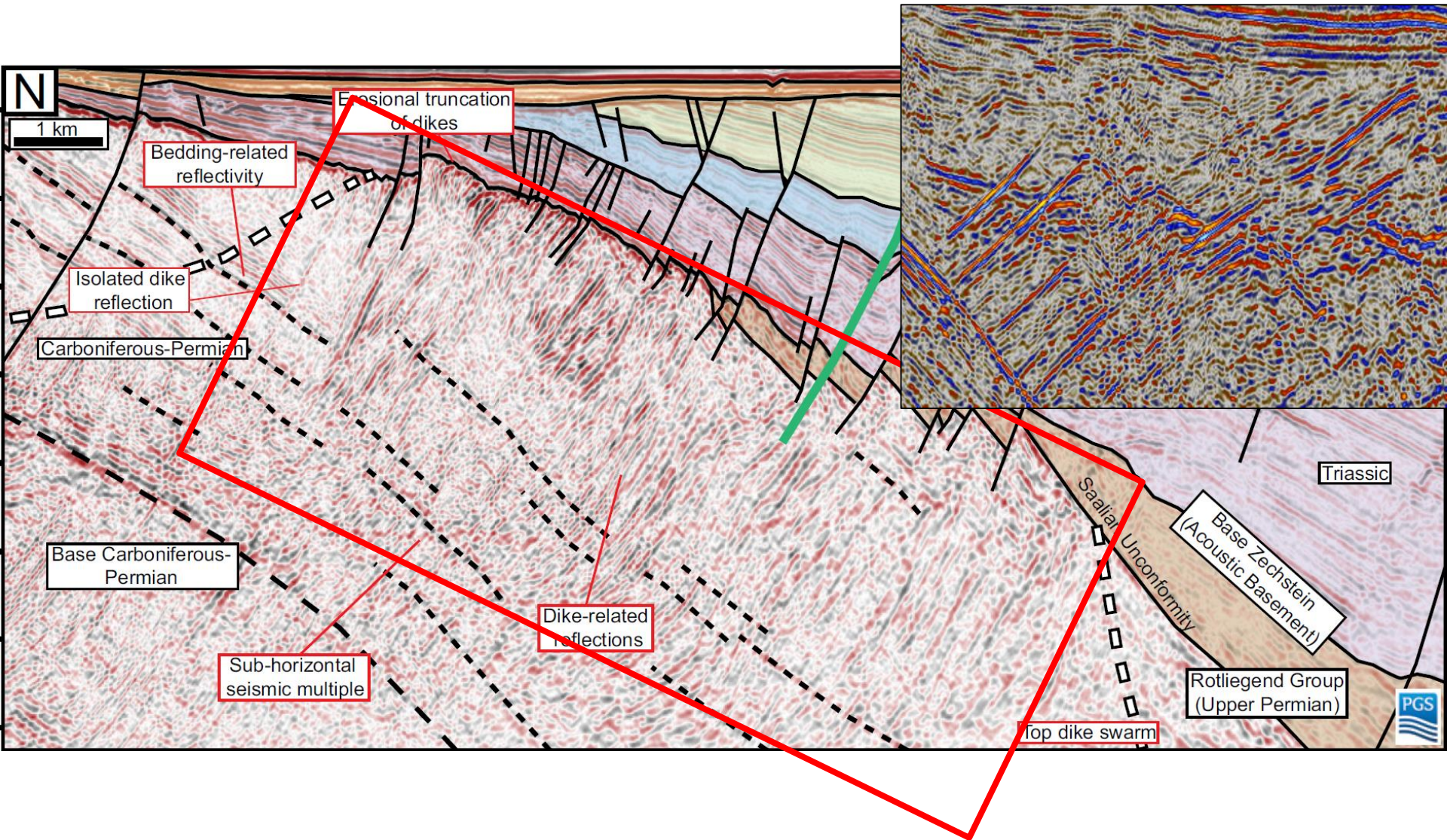
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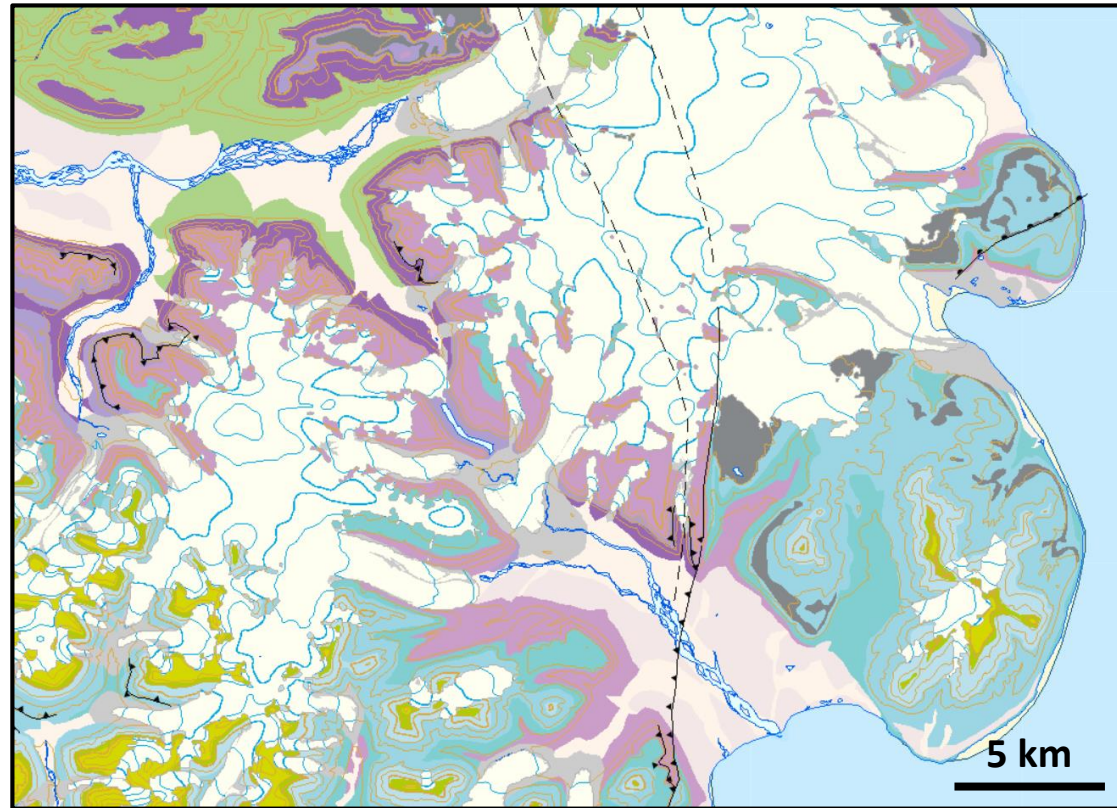
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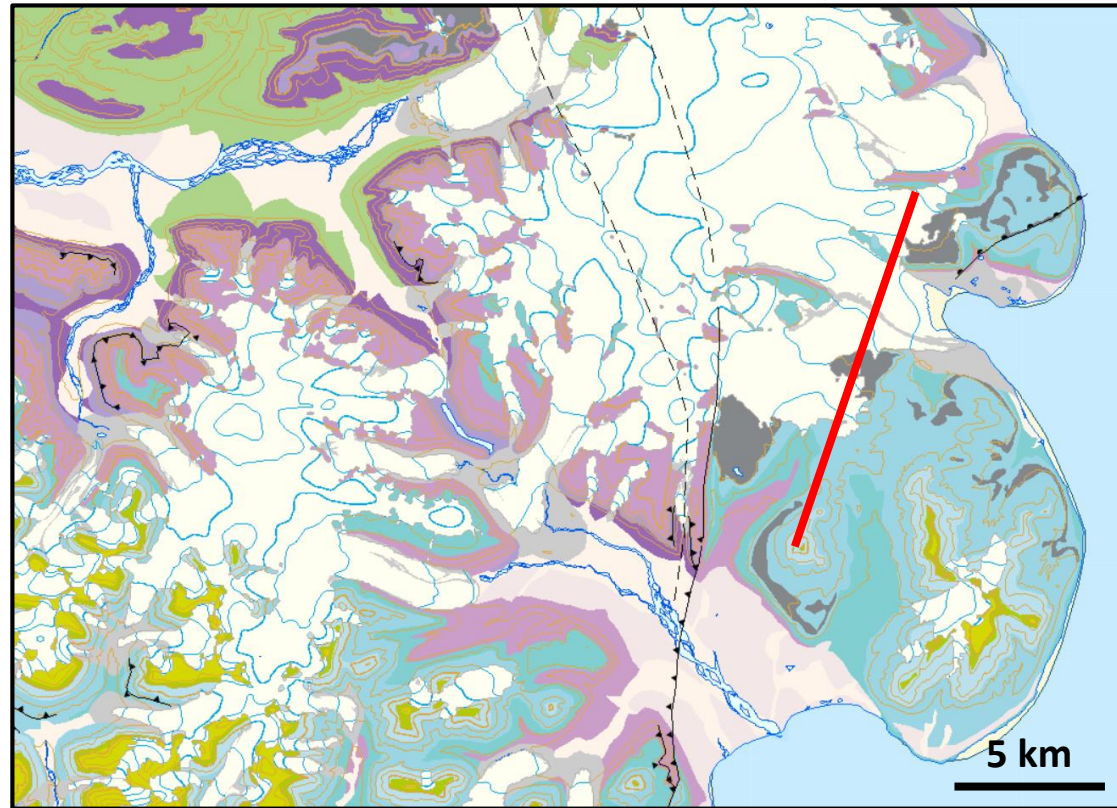
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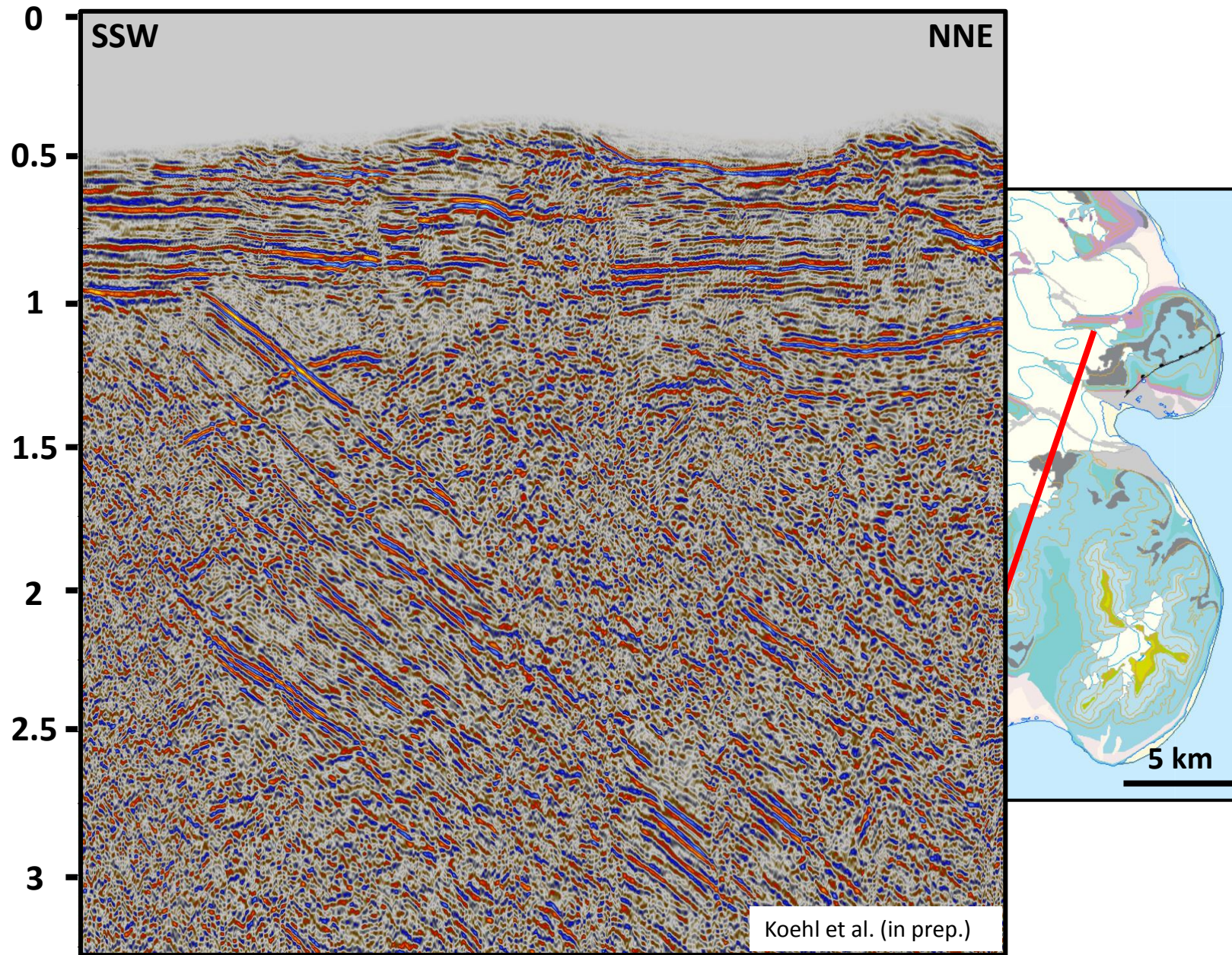
- 3** Cretaceous dykes penetrate all older rocks and crop out in eastern Spitsbergen as flat-lying sills.



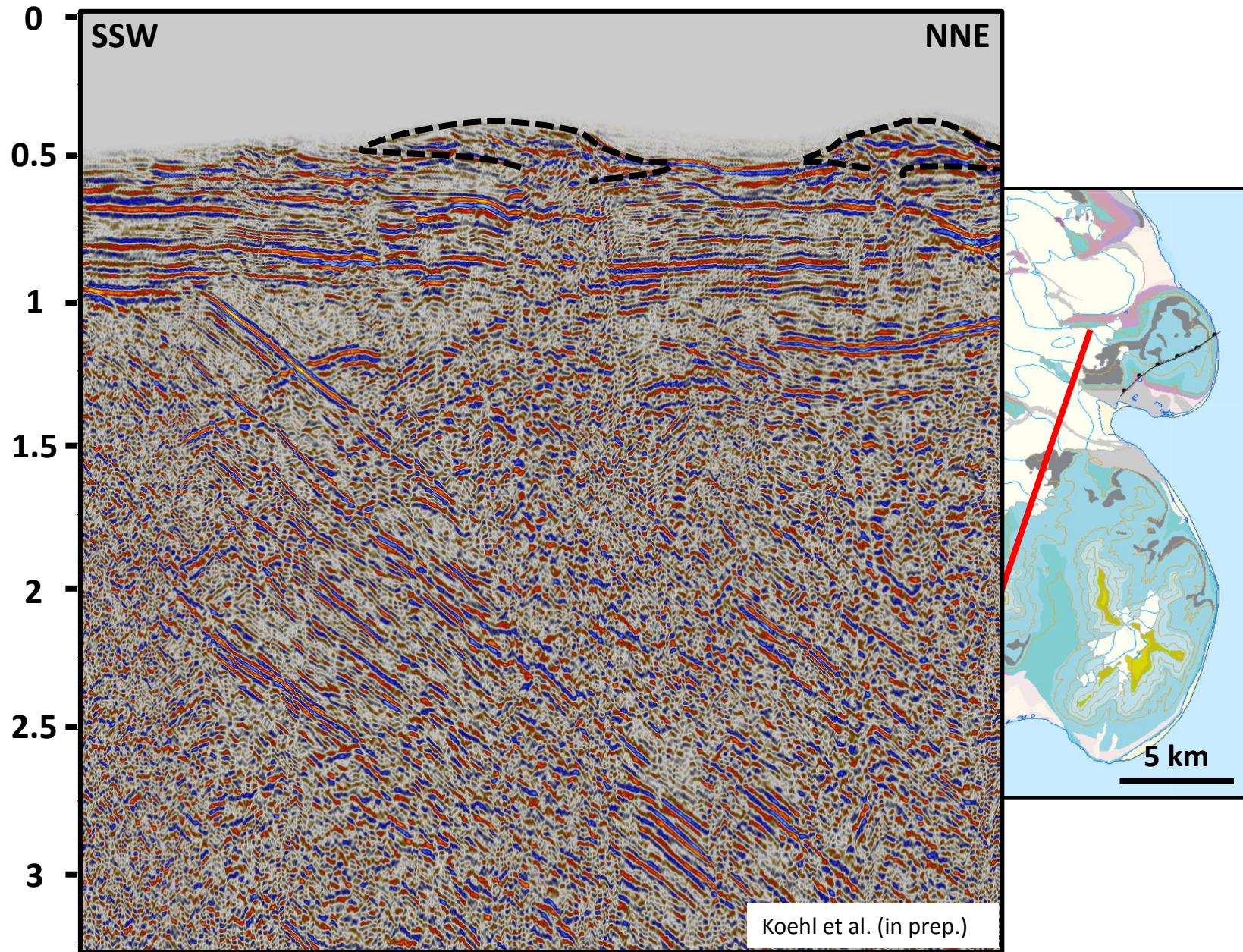
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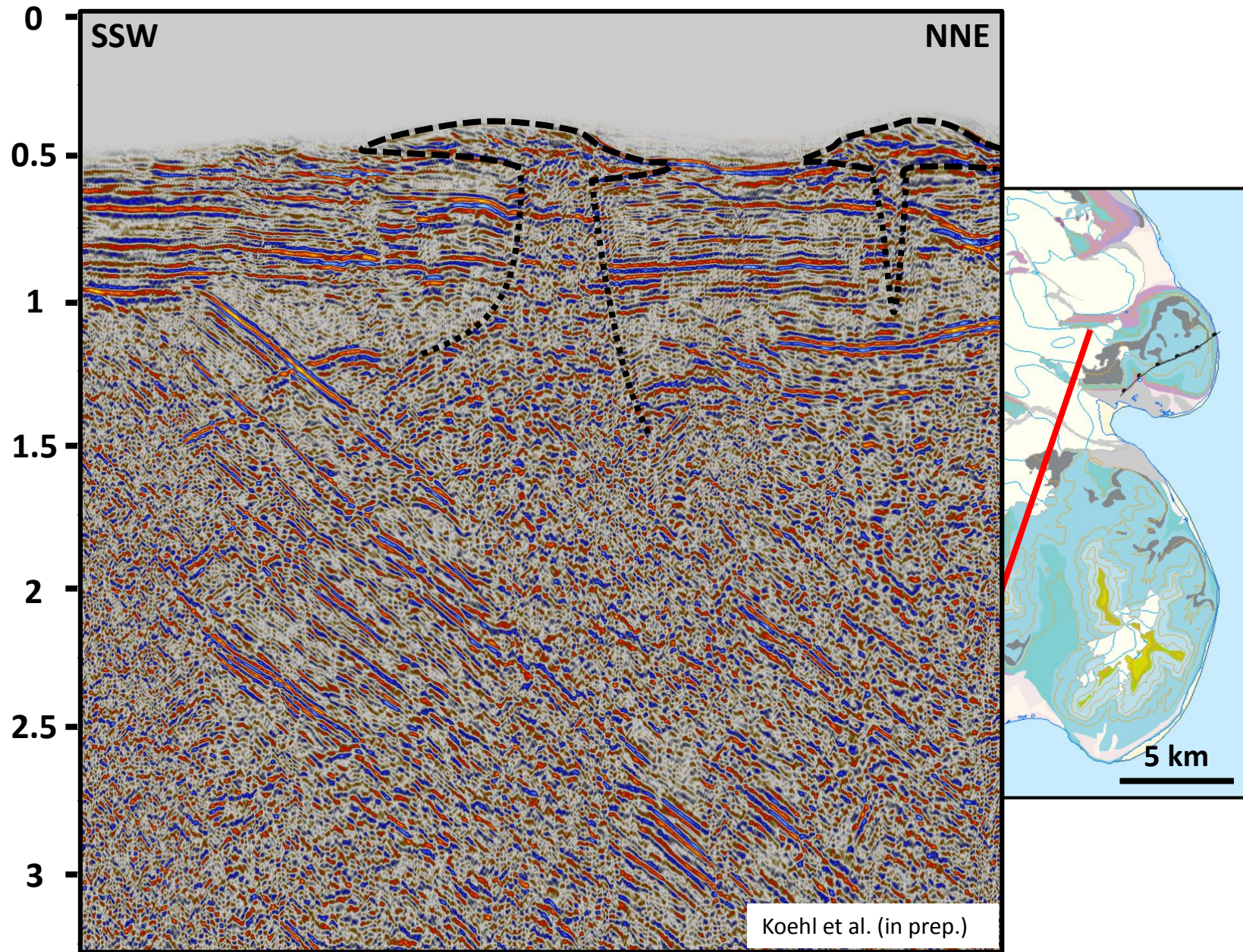
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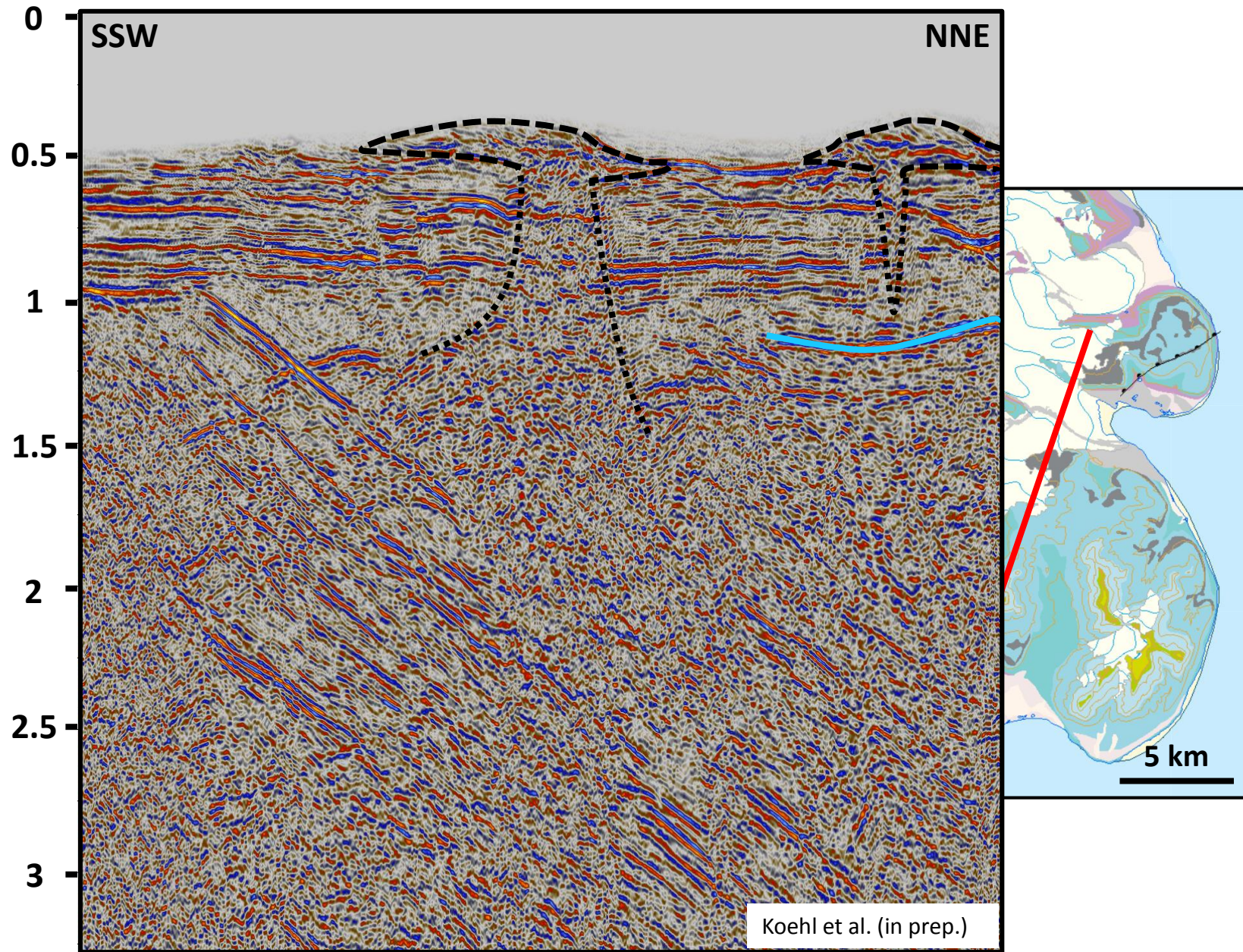
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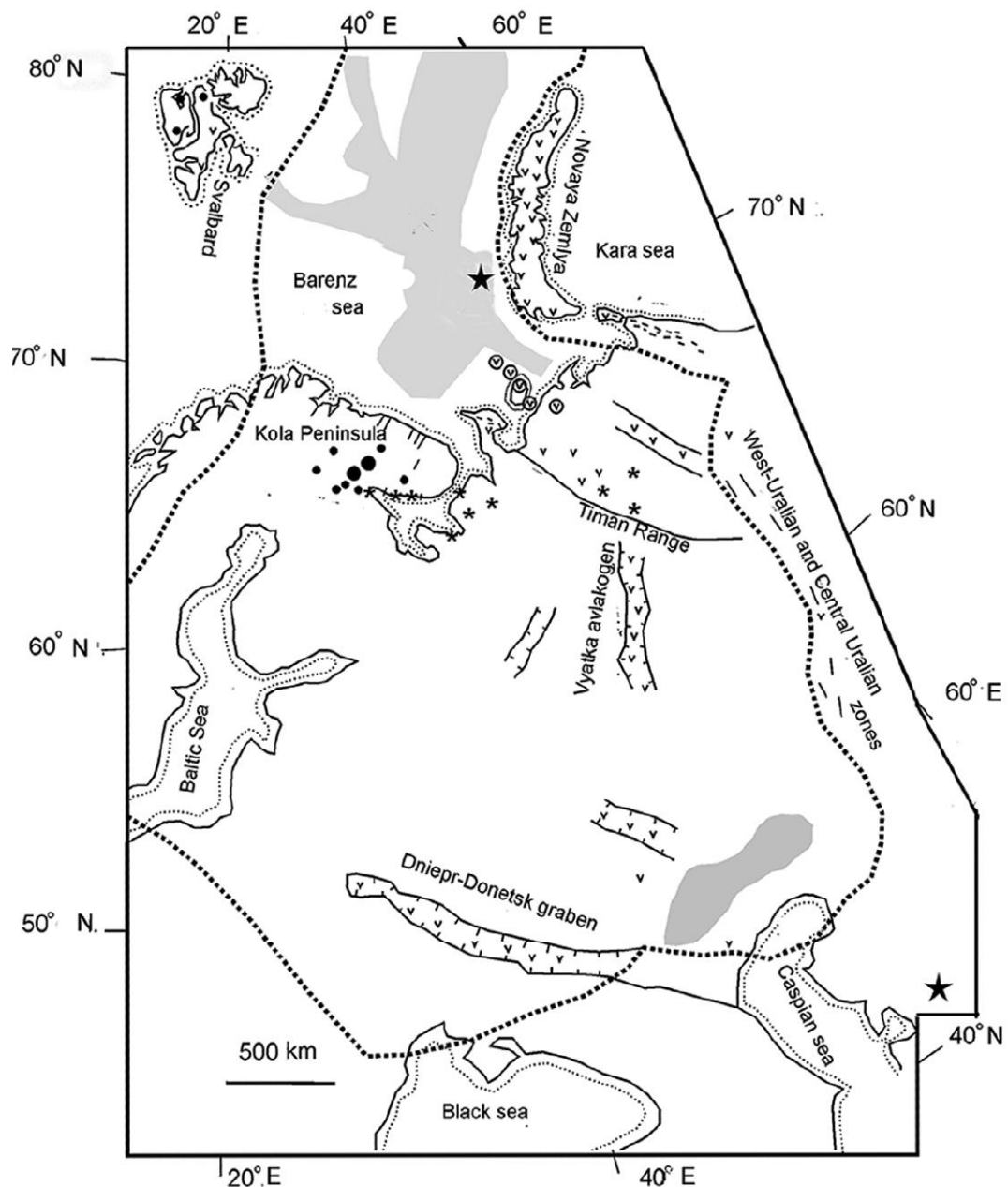


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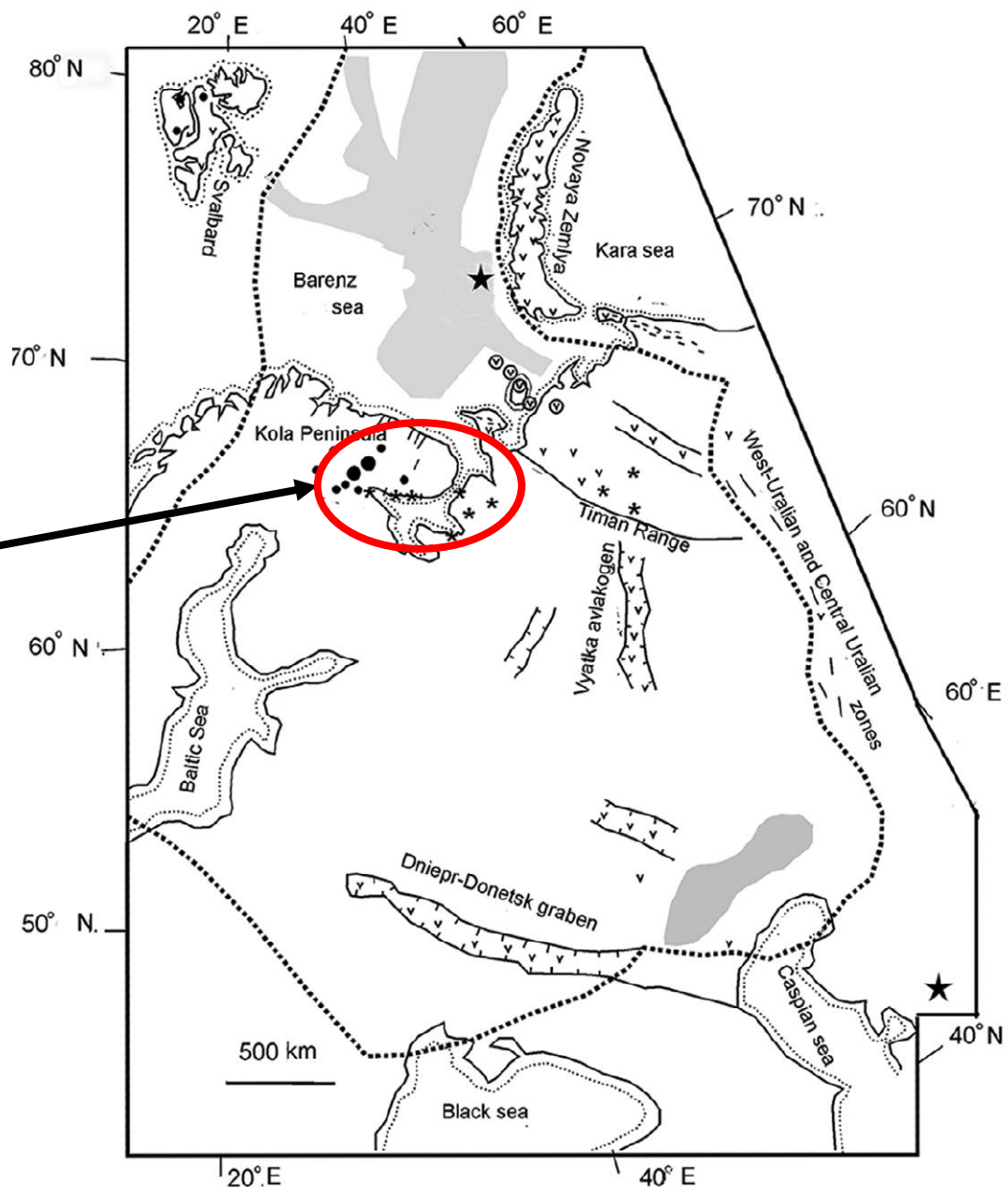
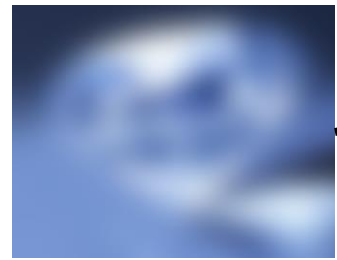
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Devonian–Mississippian dykes in eastern Spitsbergen may be part of a large magmatic system that affected areas from northwestern Russia to Svalbard.



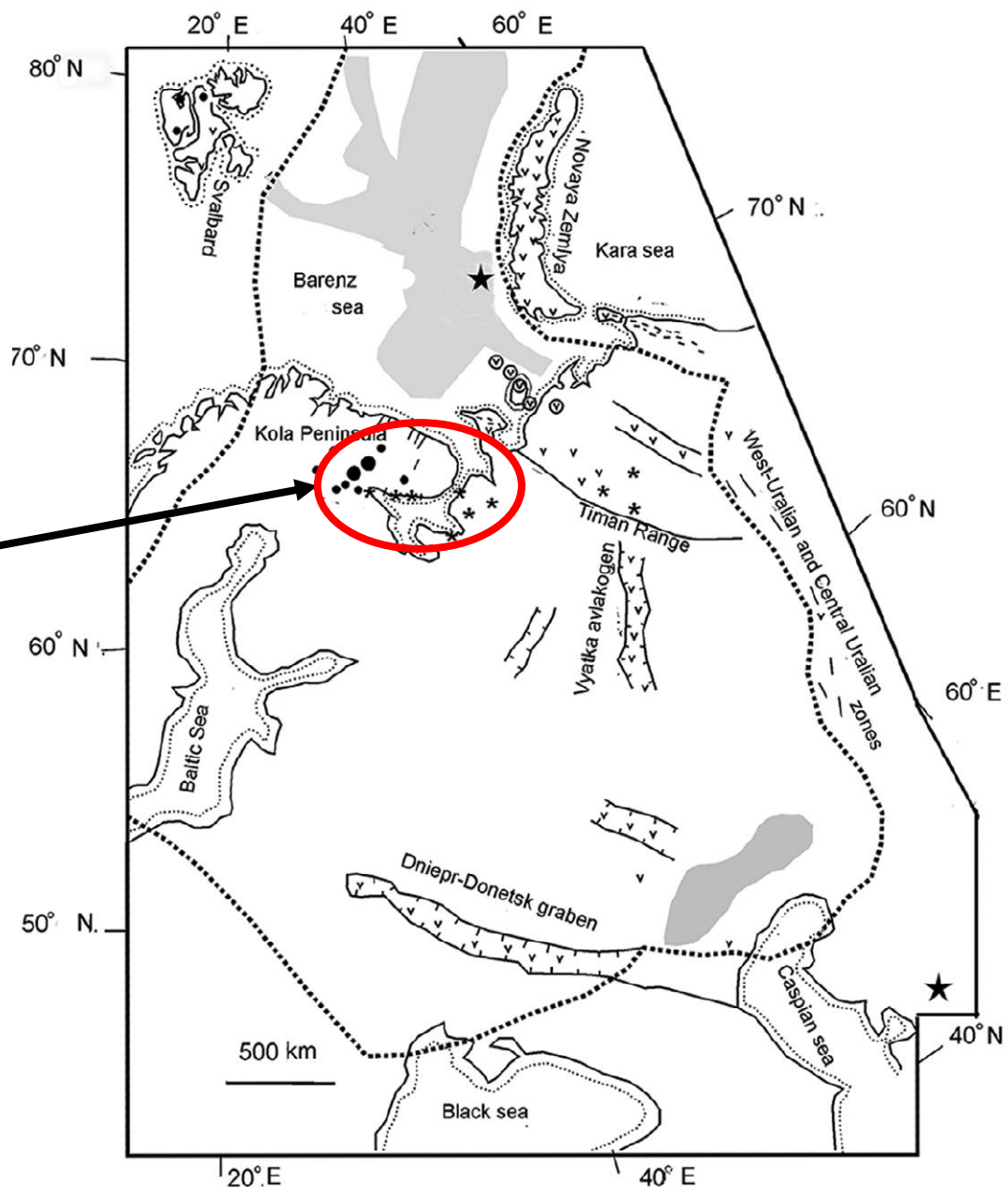
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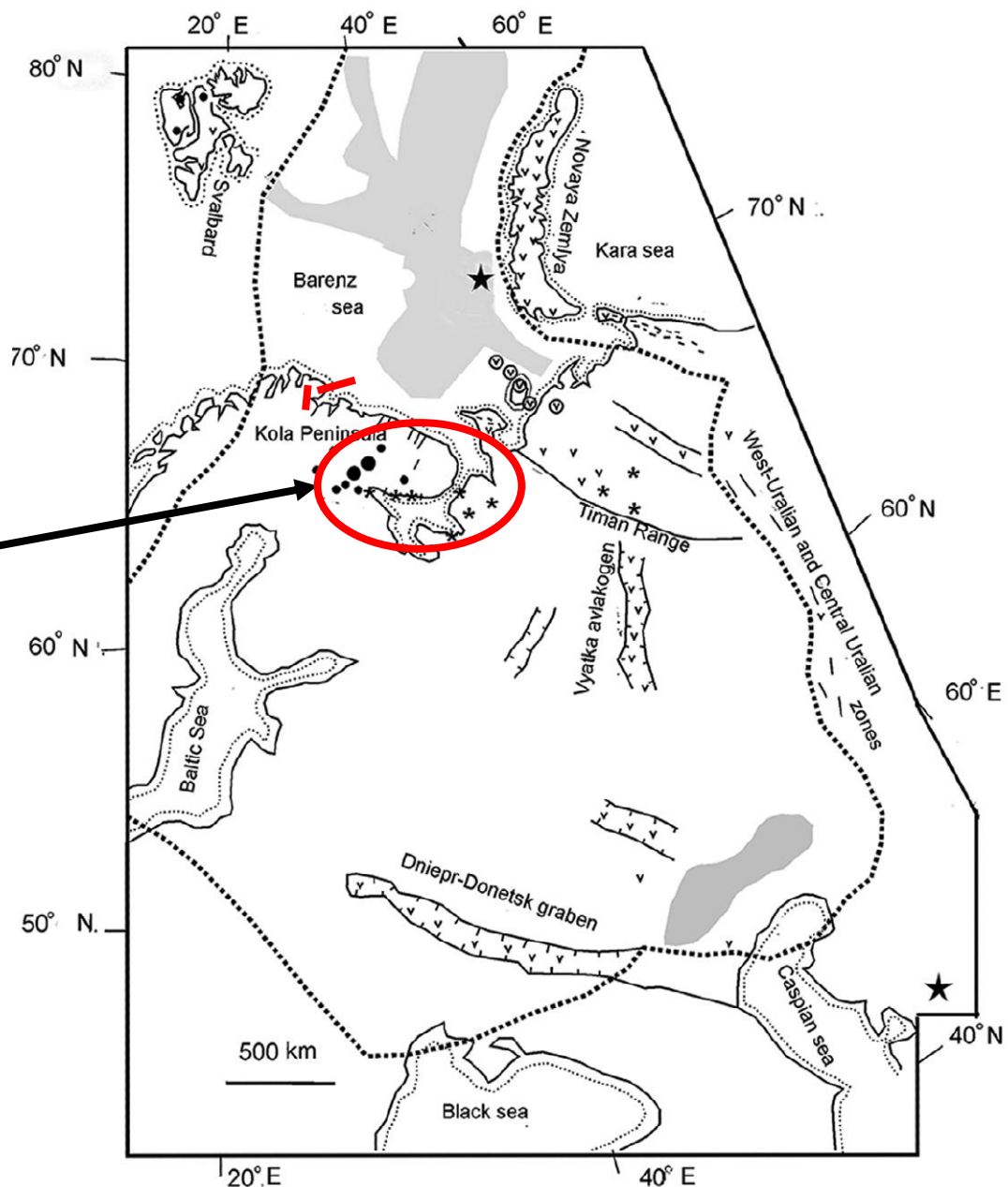


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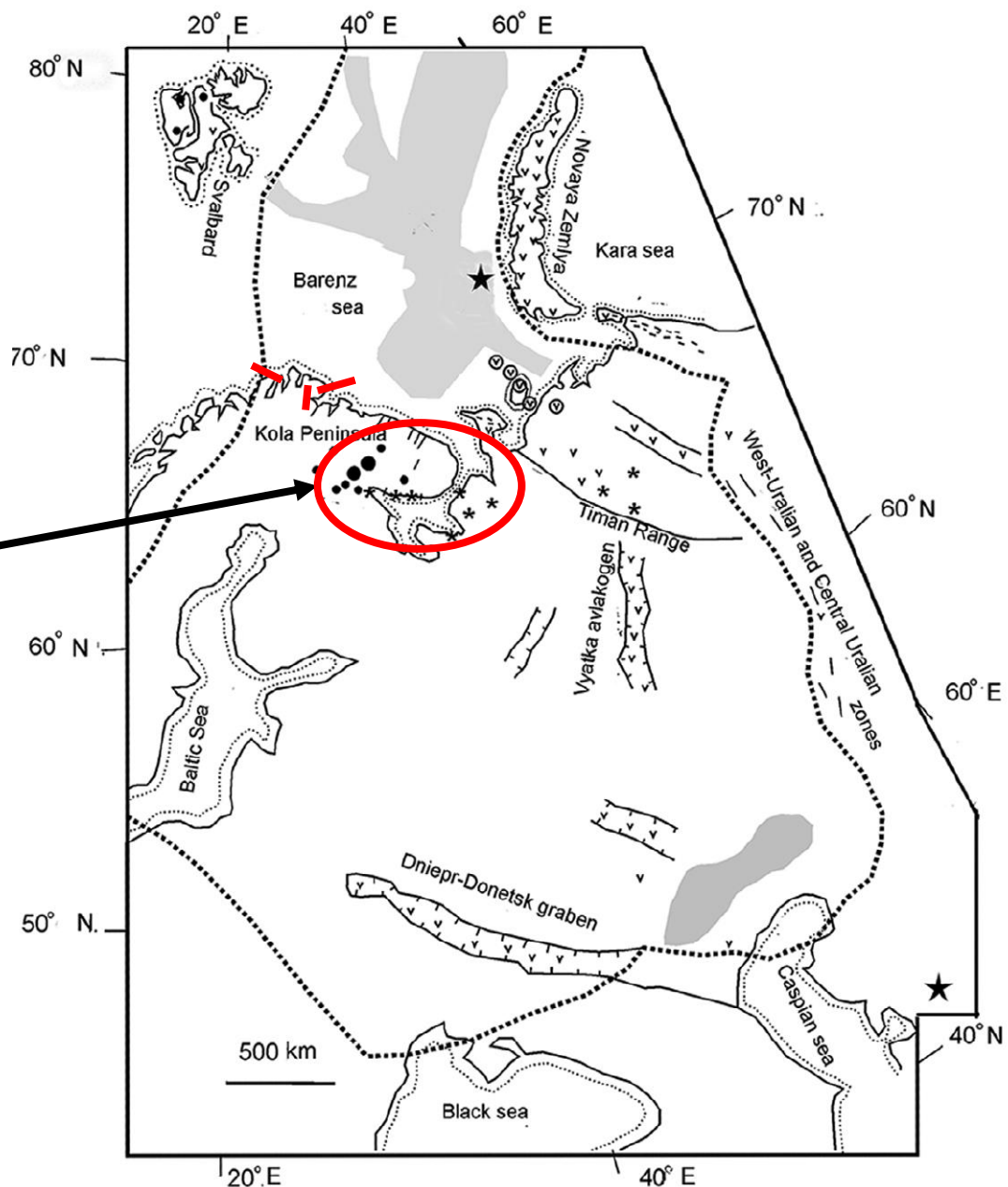


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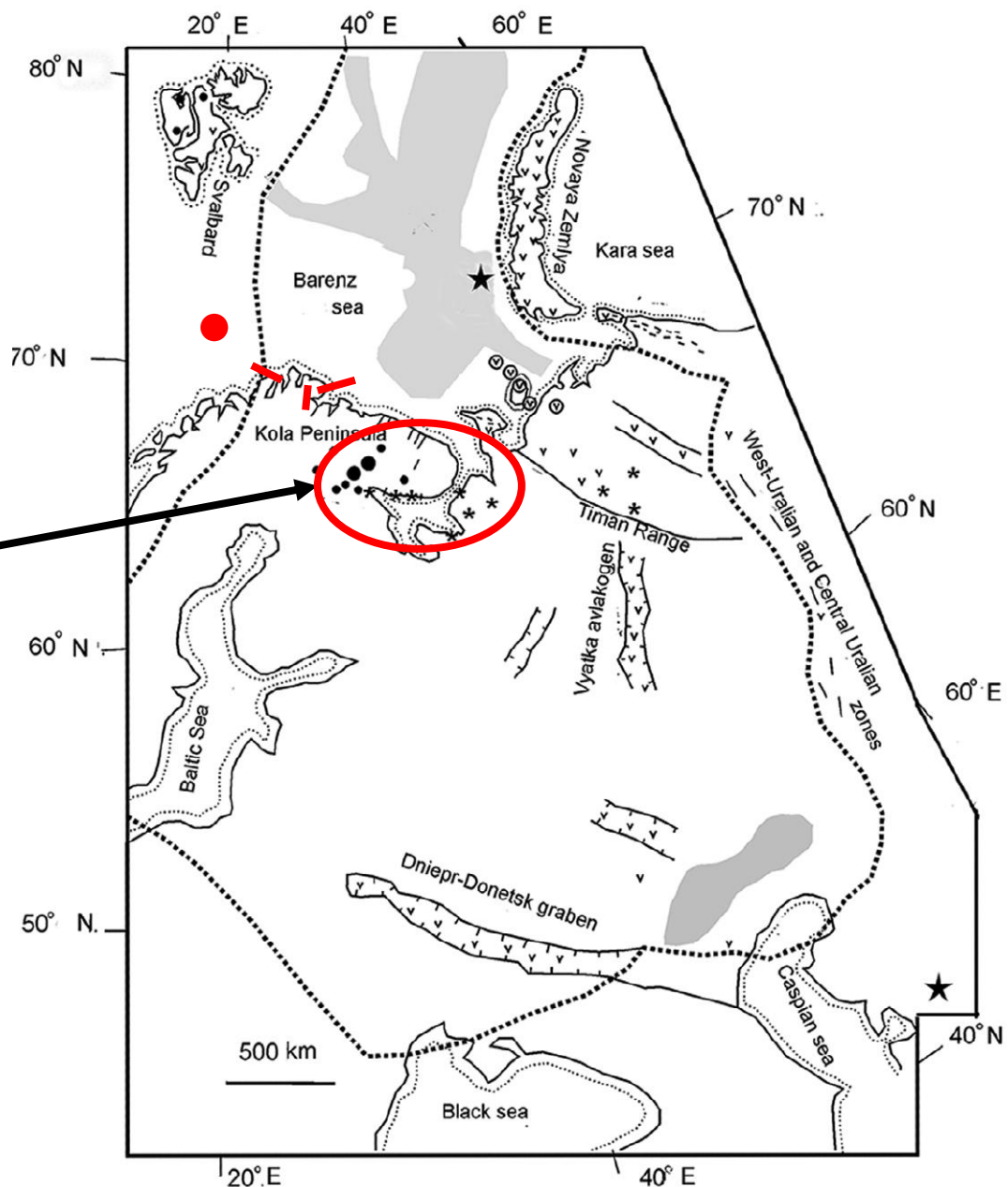
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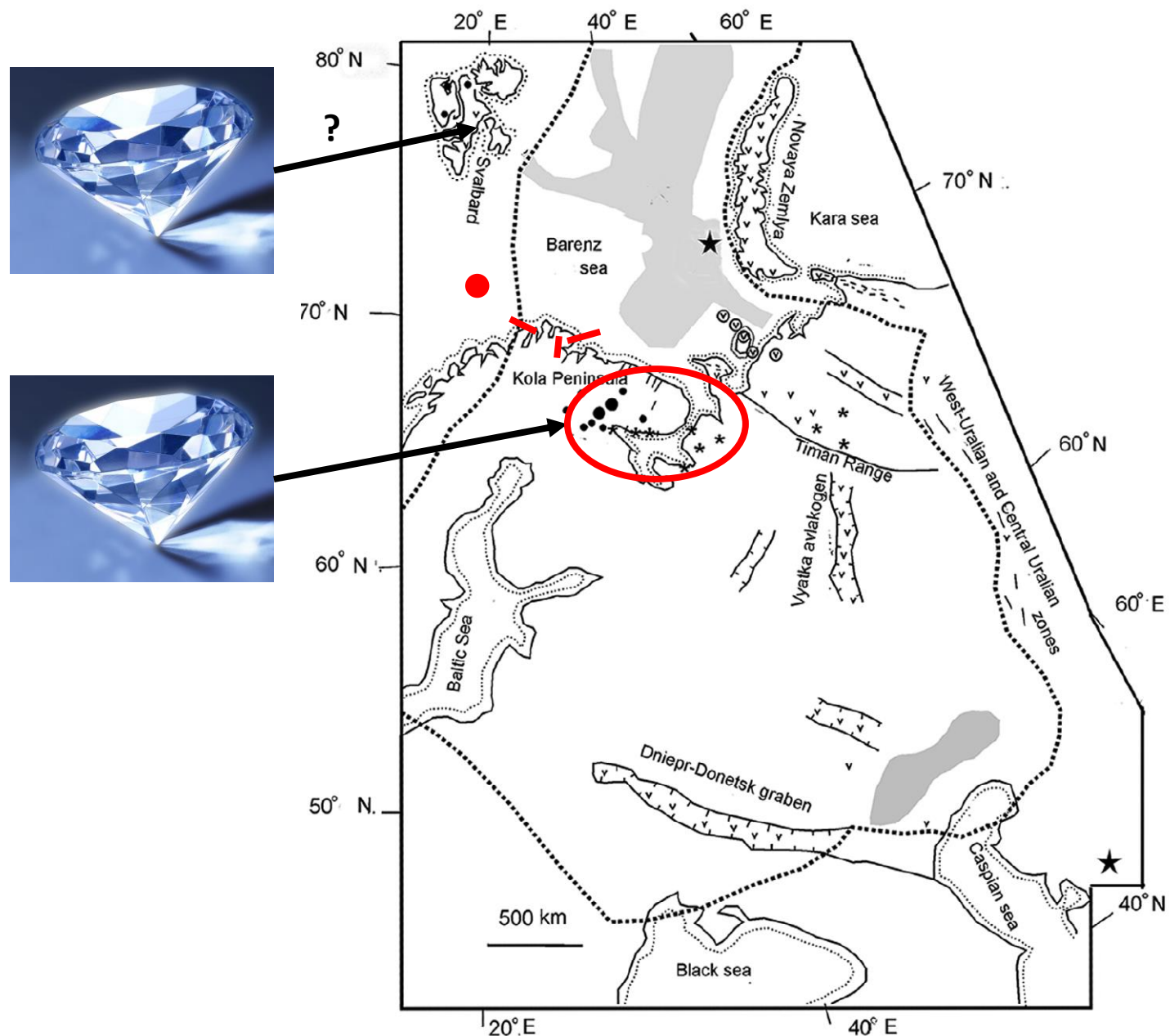


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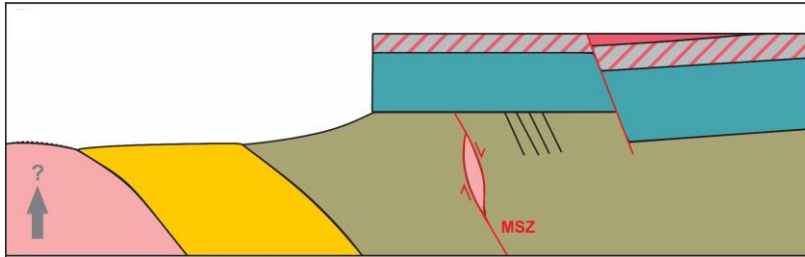
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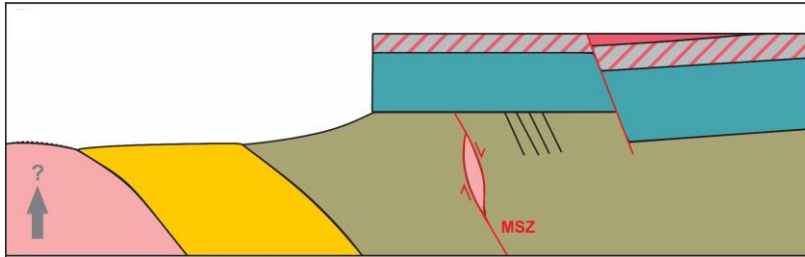
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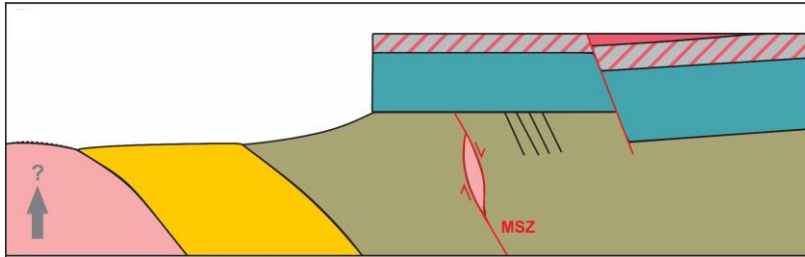
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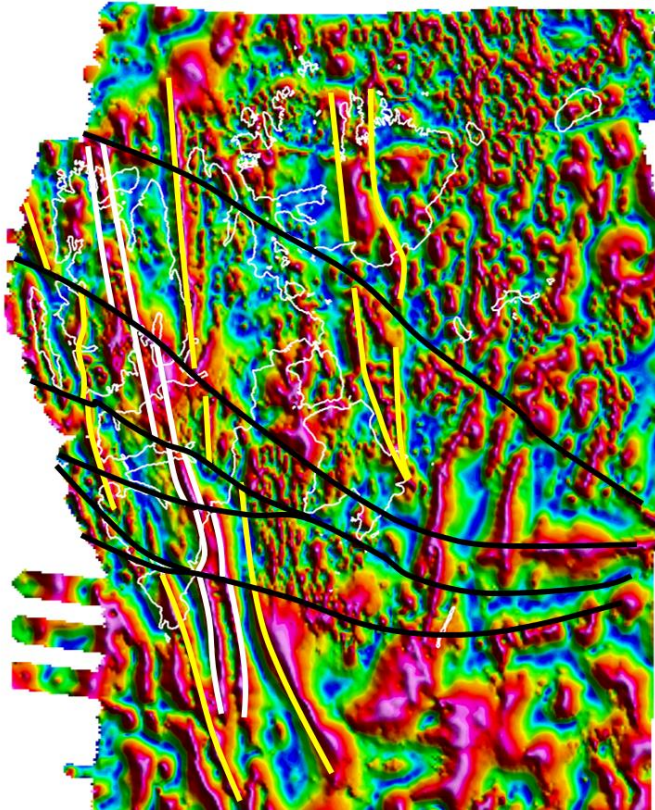
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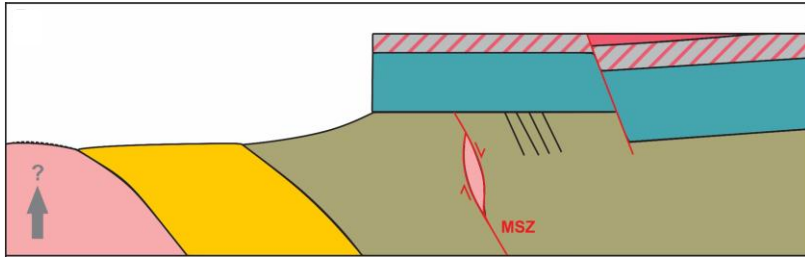
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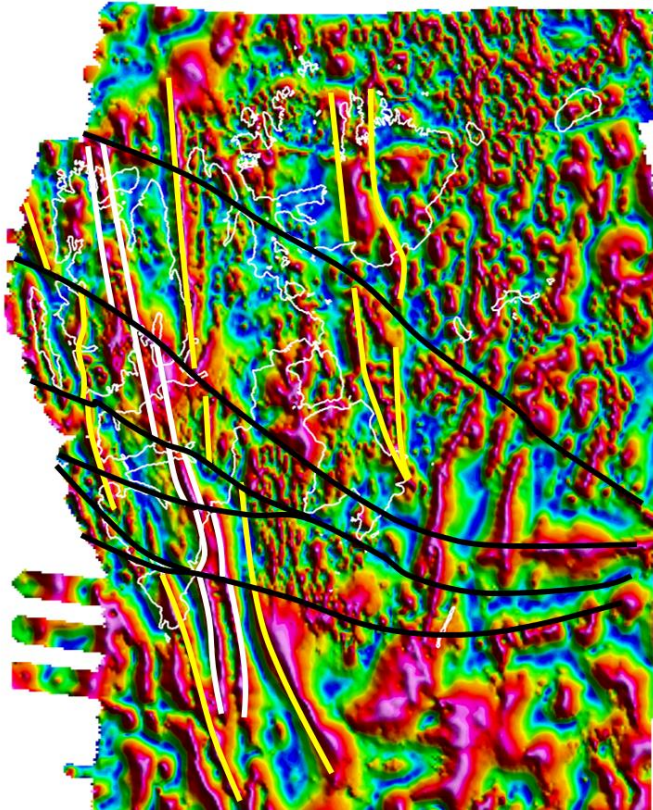
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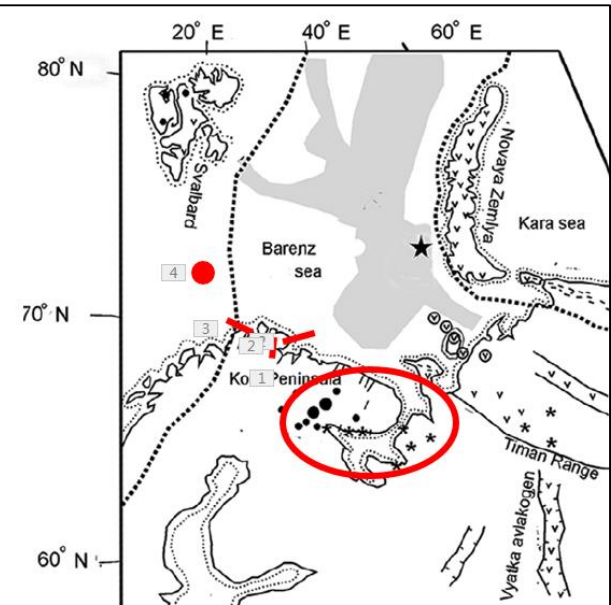
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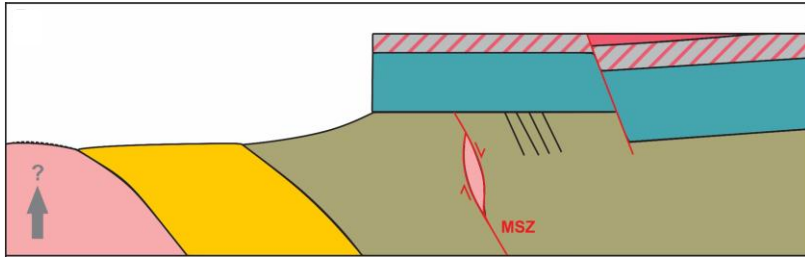
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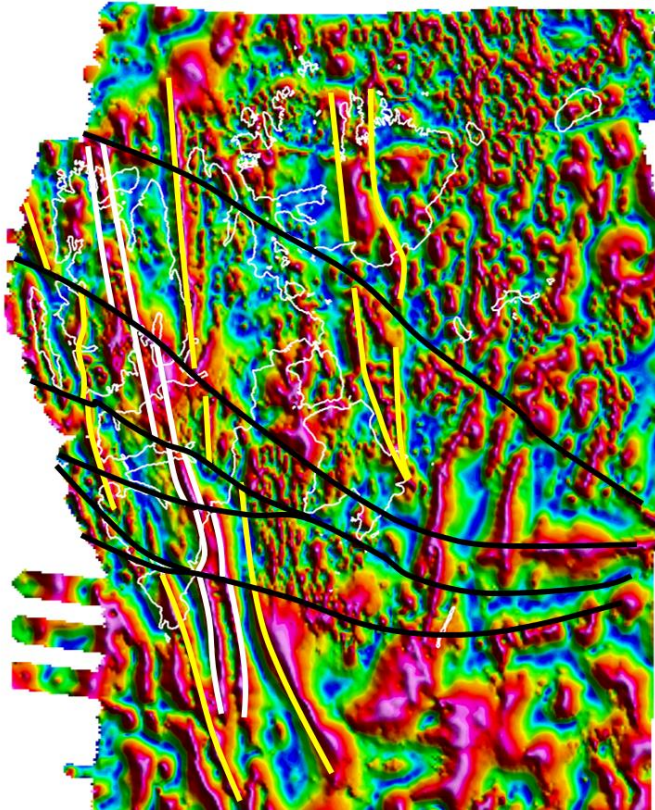
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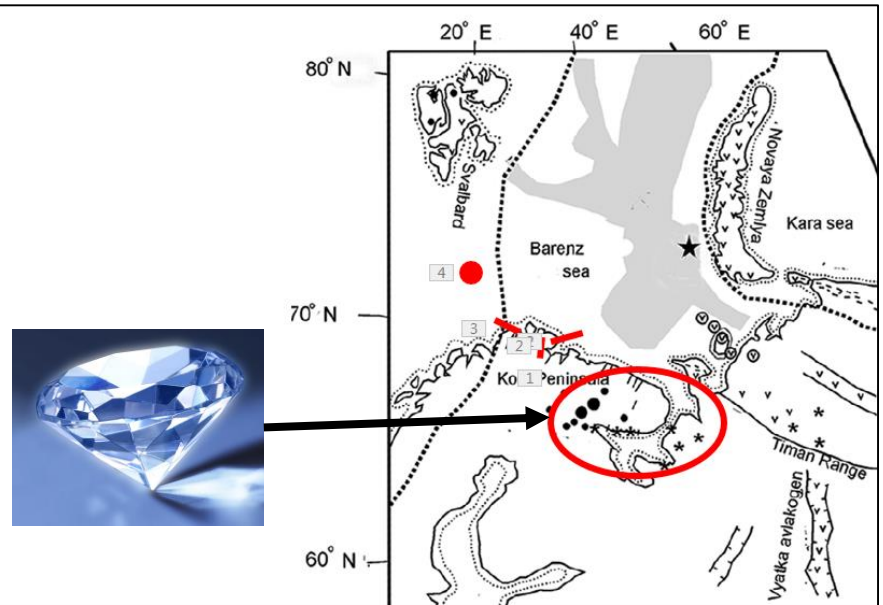
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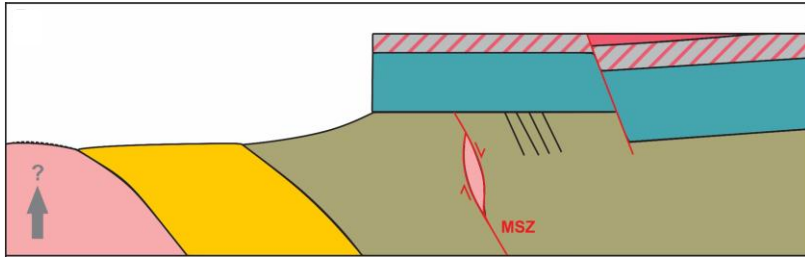
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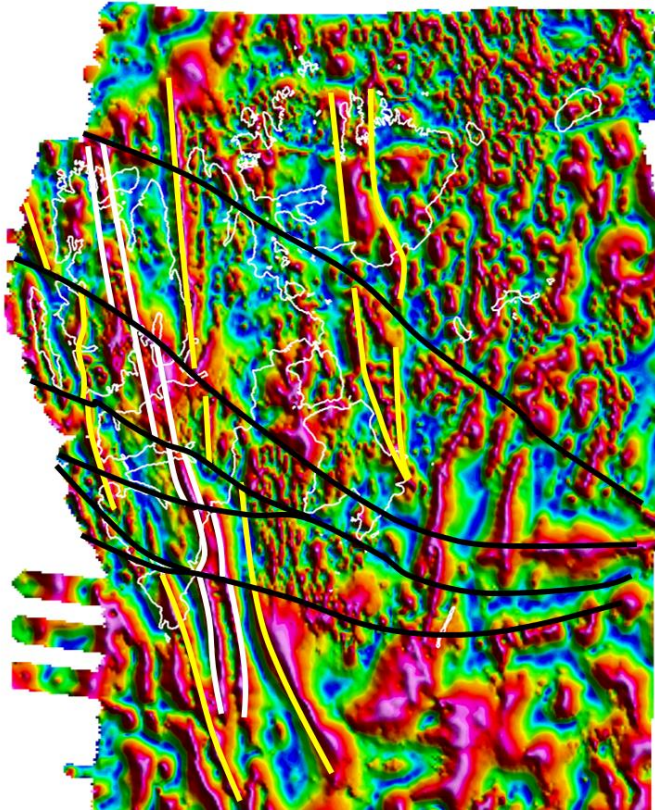
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