

Thrust systems in the eastern Amadeus Basin: megathrusts and duplexes vs imbricate fans



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¹Project Geologist, NTGS

Who We Are: Basin Geoscience Team (Alice Springs)



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Project Geologist



Charles Verdel
Senior Geologist



Nick White
Project Geologist

Amadeus Basin

- Remanent of the Neoproterozoic to Palaeozoic Centralian Superbasin
- Deformed by two major tectonic events
- Deformation style is largely controlled by two laterally extensive salt layers



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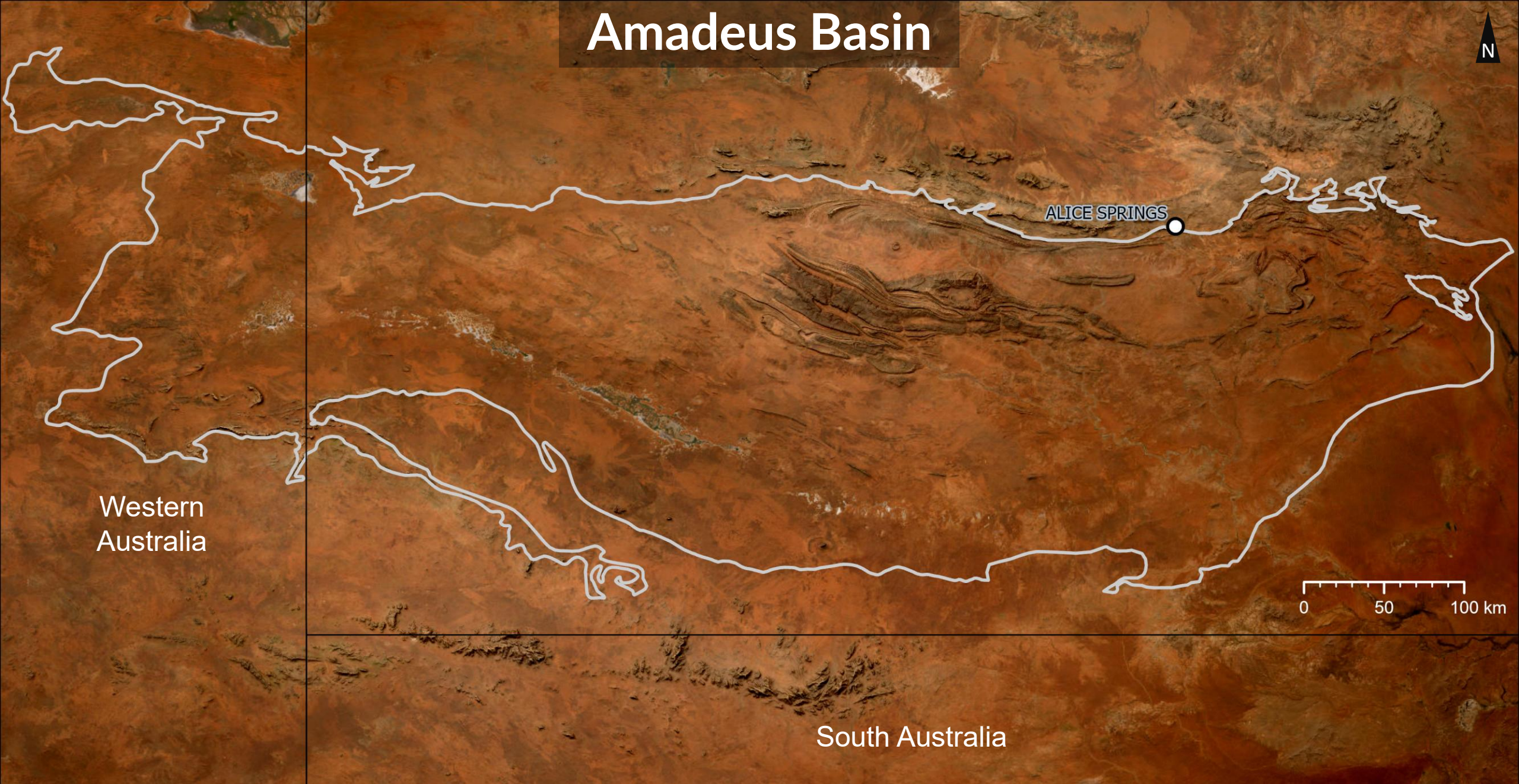


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Amadeus Basin



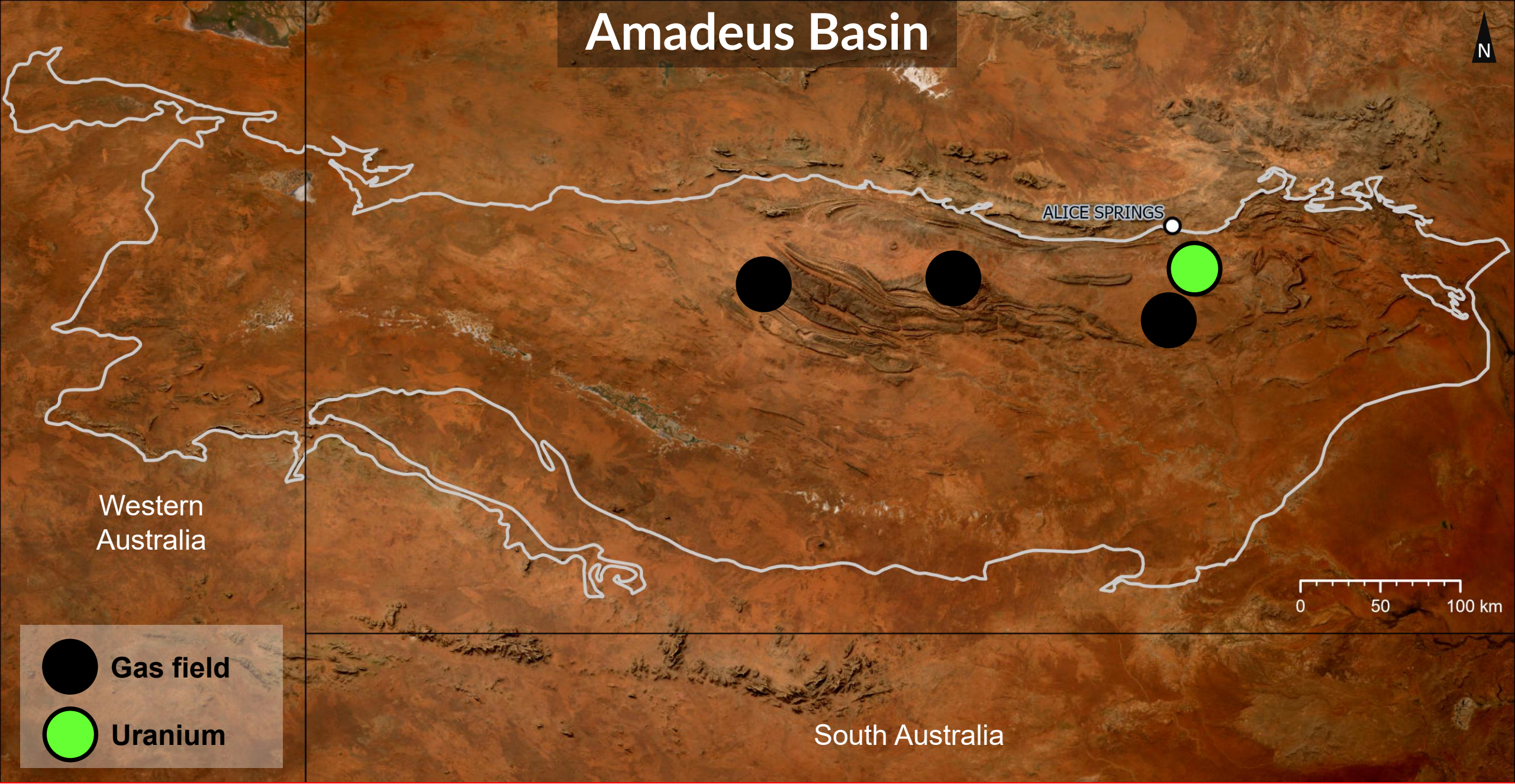
Western
Australia

ALICE SPRINGS

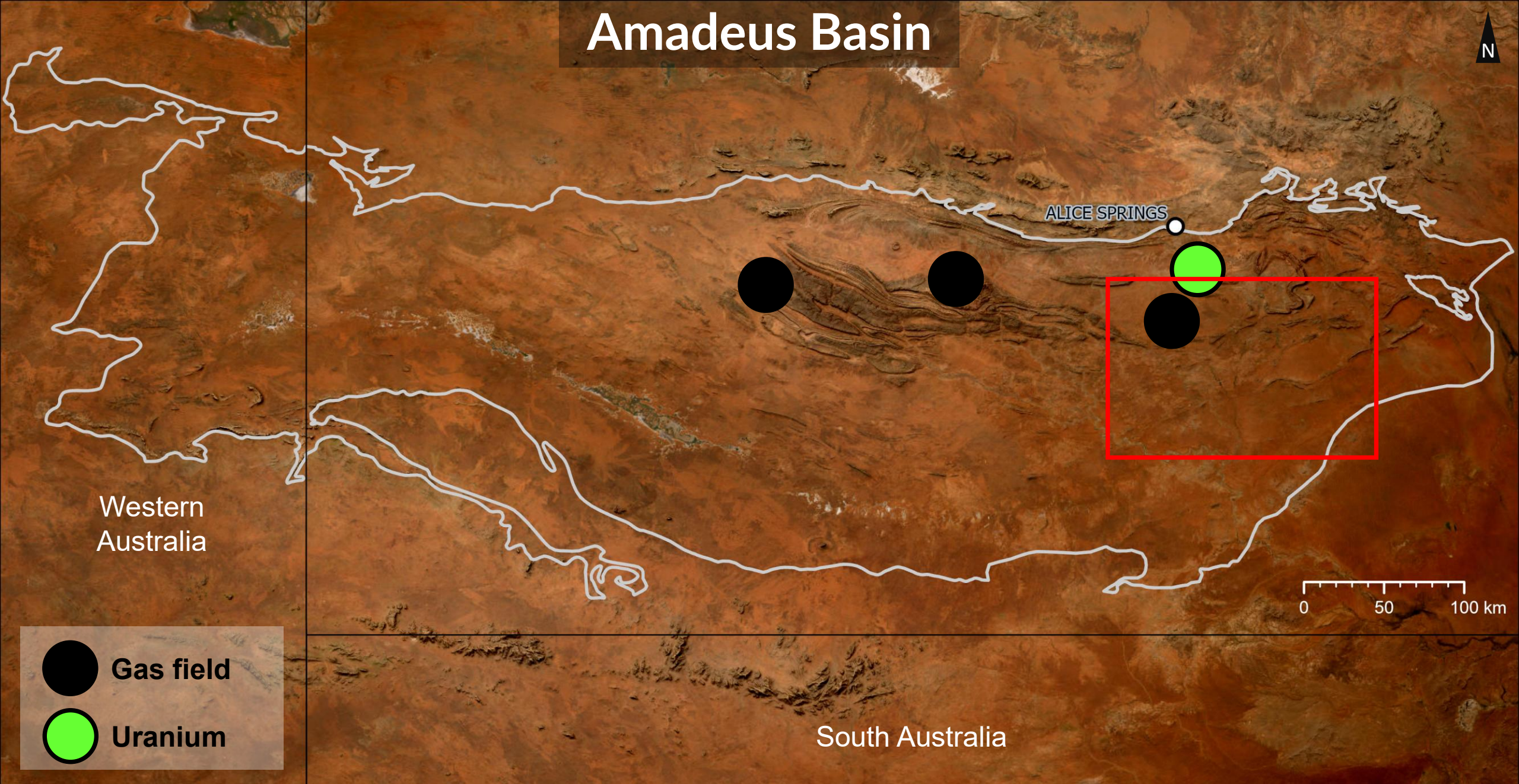
0 50 100 km

South Australia

Amadeus Basin



Amadeus Basin



Western
Australia

ALICE SPRINGS

0 50 100 km

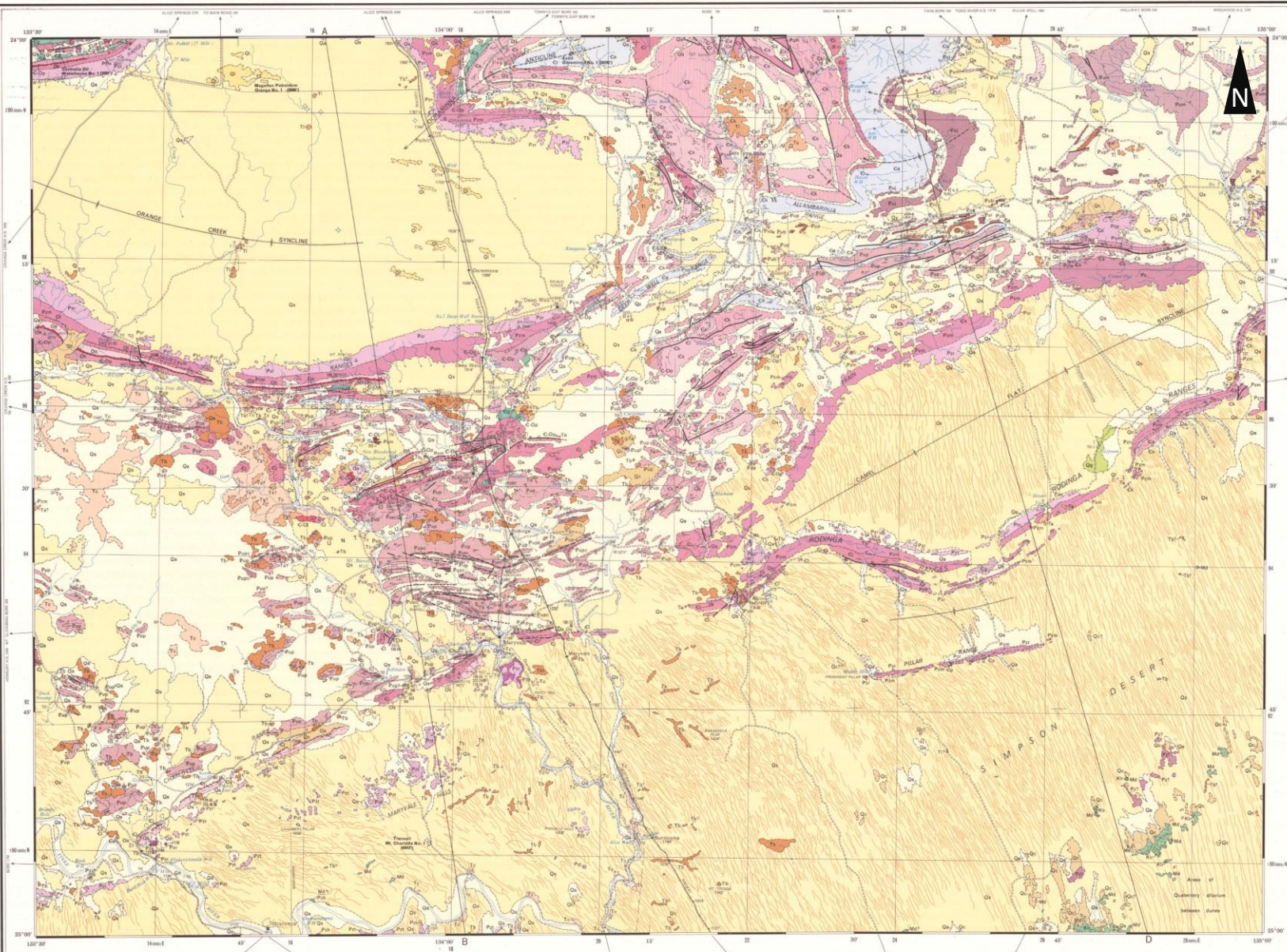
- Gas field
- Uranium

South Australia

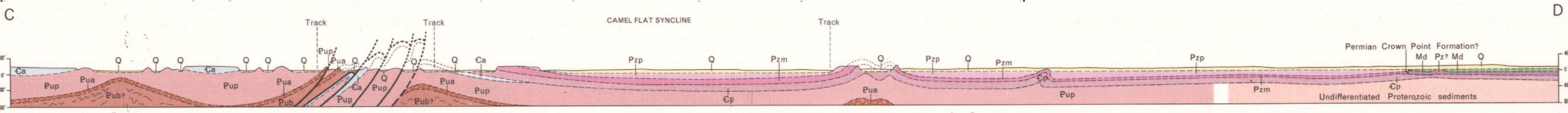
What is this talk about?

- Focus on the northeast Amadeus Basin
- Previous Bureau of Mineral Resources mappers interpret megathrust (~60 km displacement).
- NTGS fieldwork carried out during 2023–2025 find no support, propose imbricate thrust system (~10 km displacement).

RODINGA 1:250 000 (first edition)



Ranford LC and Cook PJ, 1968. *Rodinga (First Edition)* 1:250 000 geological map series, SG 53-02. Bureau of Mineral Resources, Australia, Canberra.

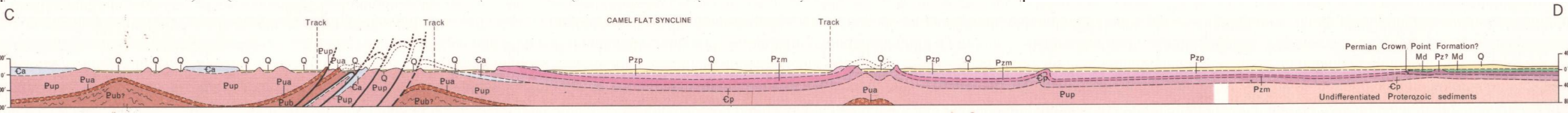
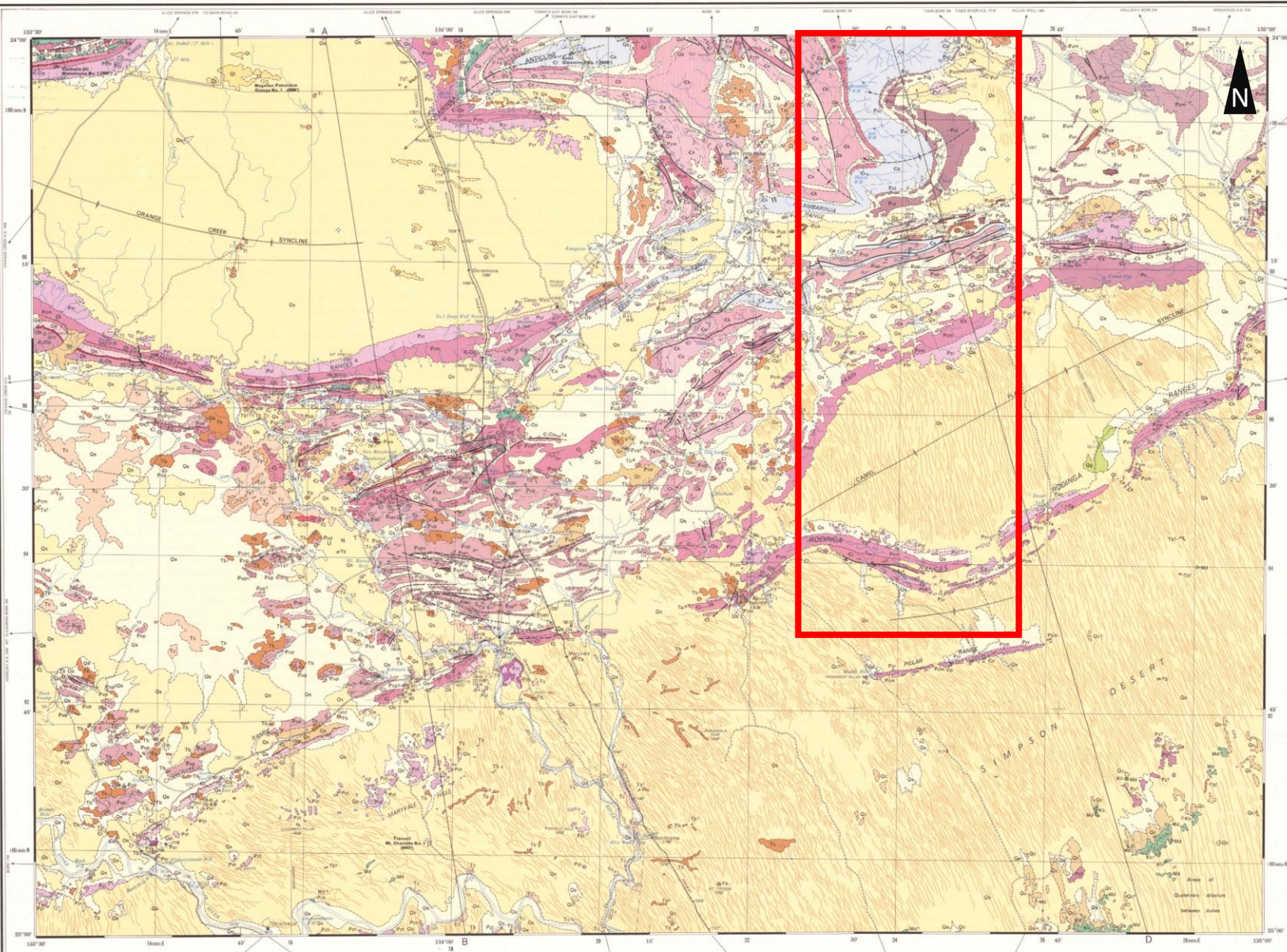


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N-S transect stratigraphy is Neoproterozoic to Cambrian

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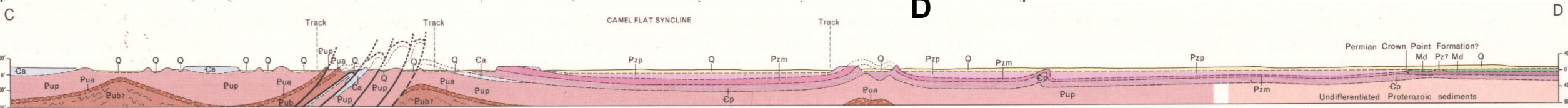
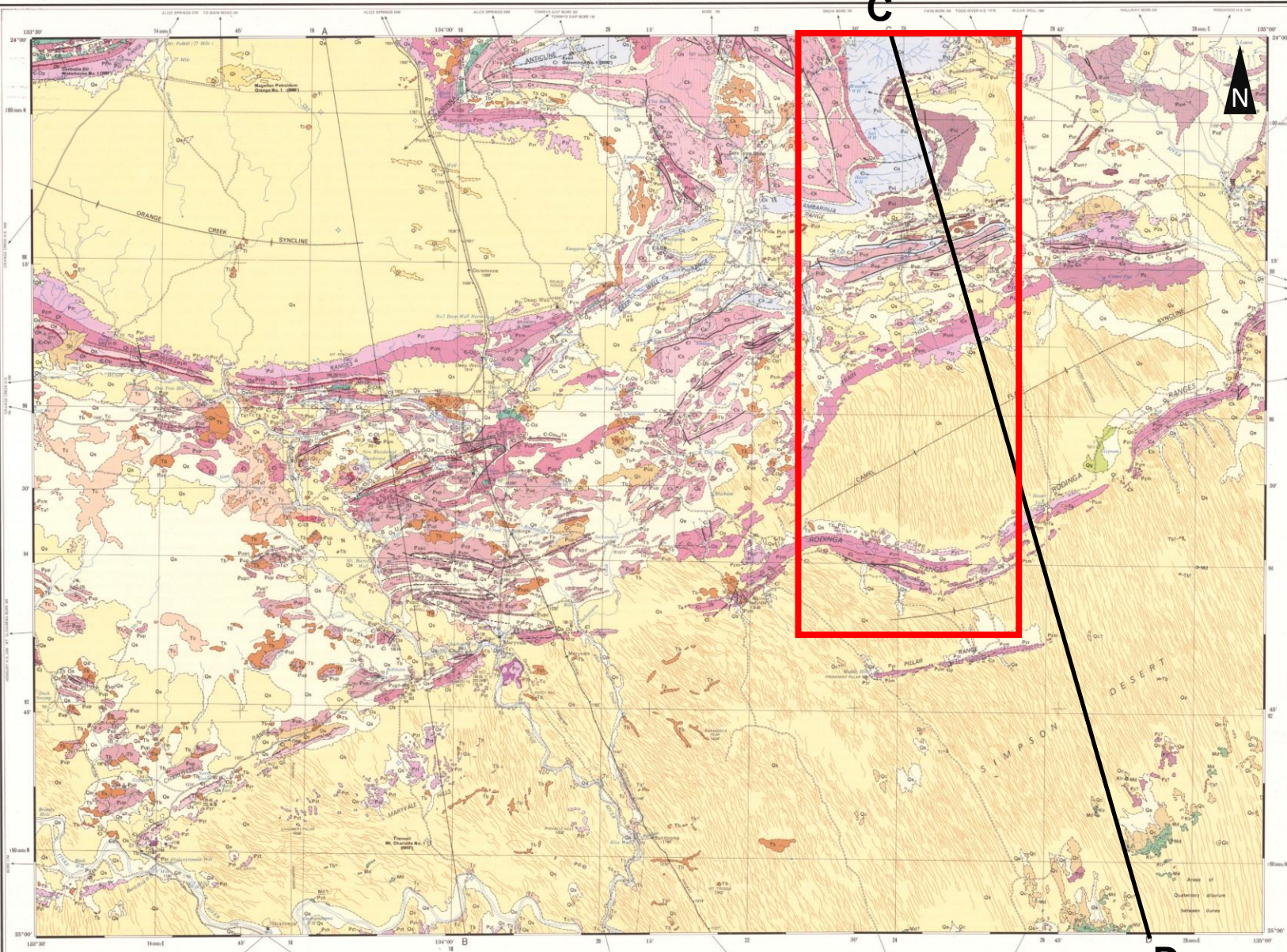


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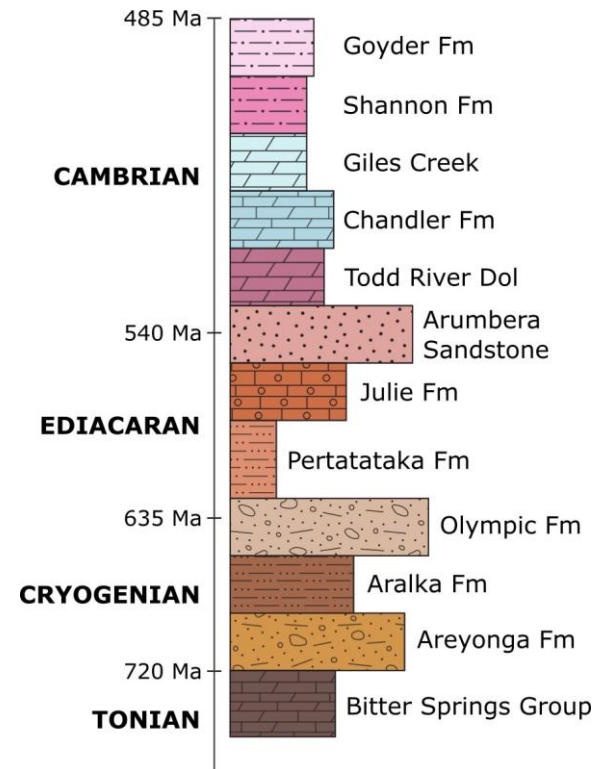
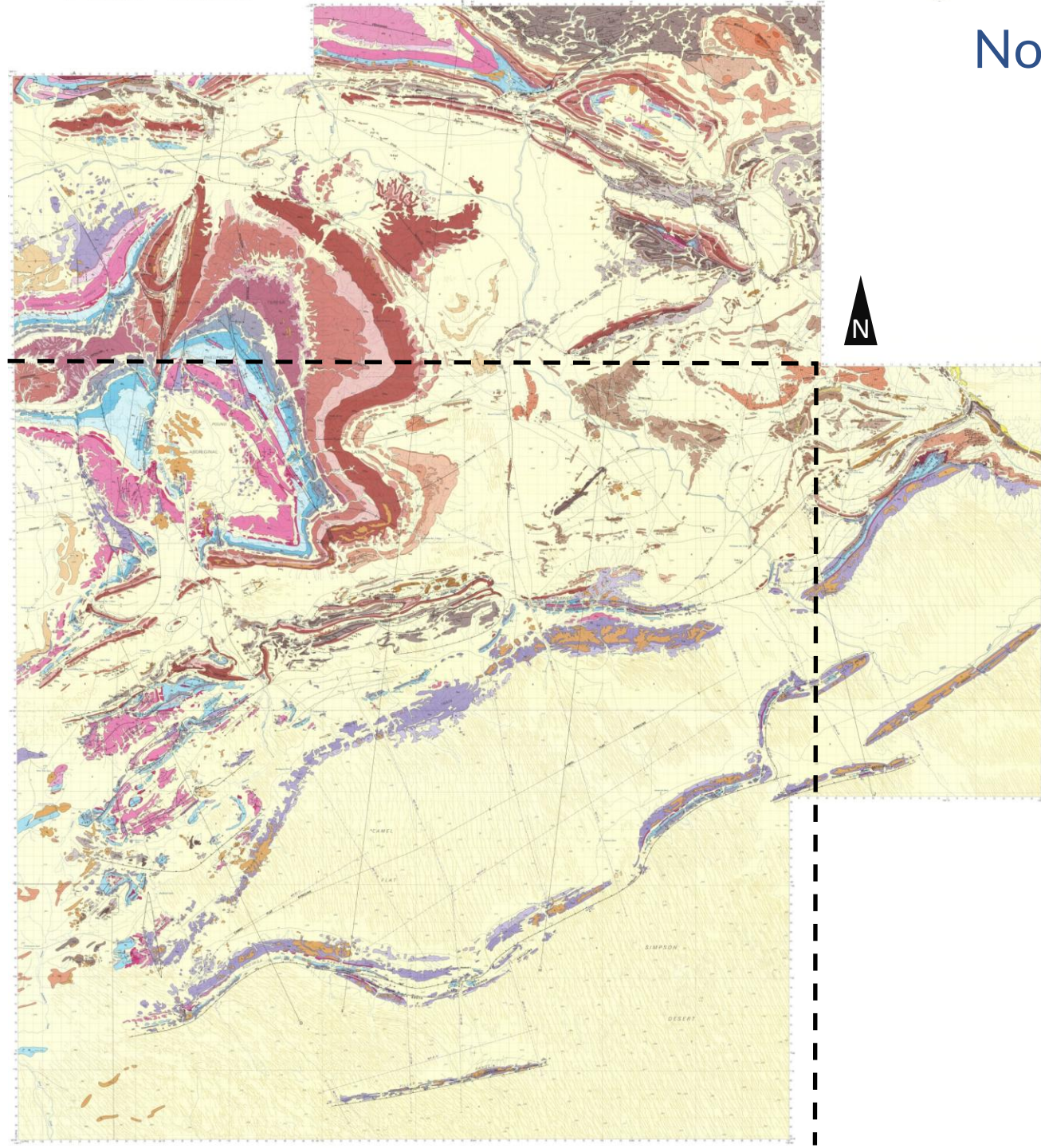


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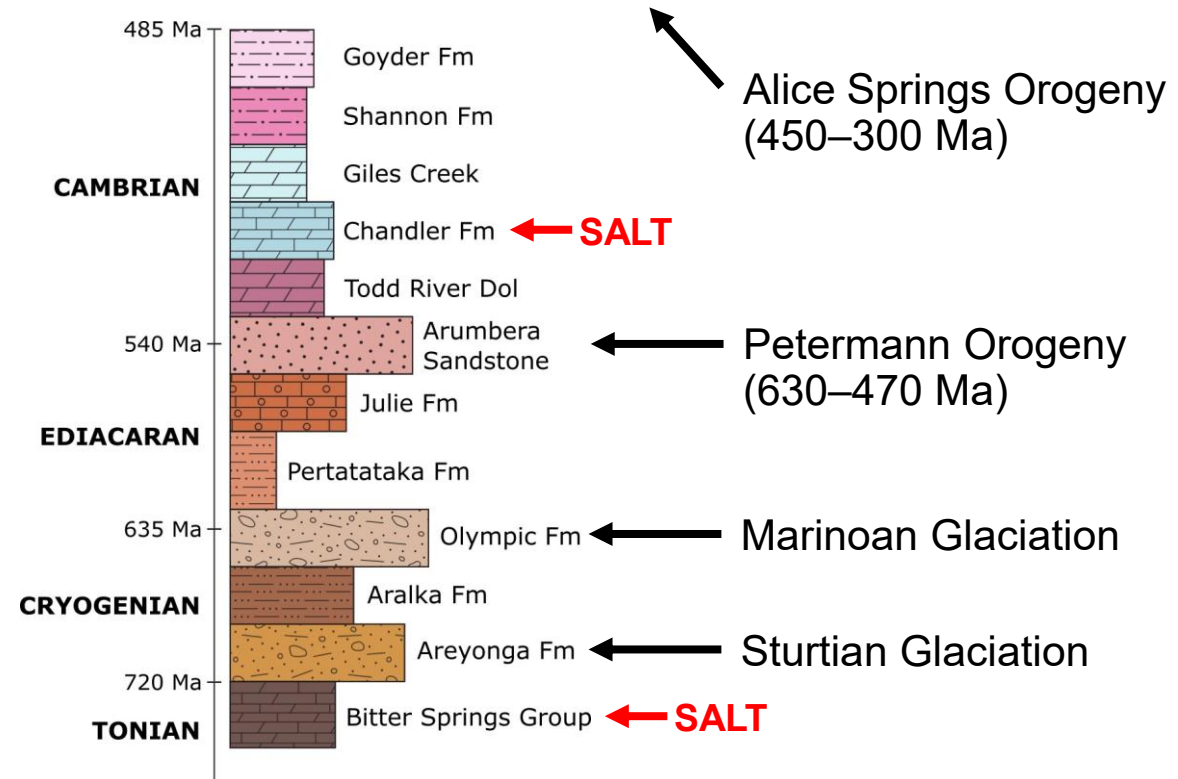
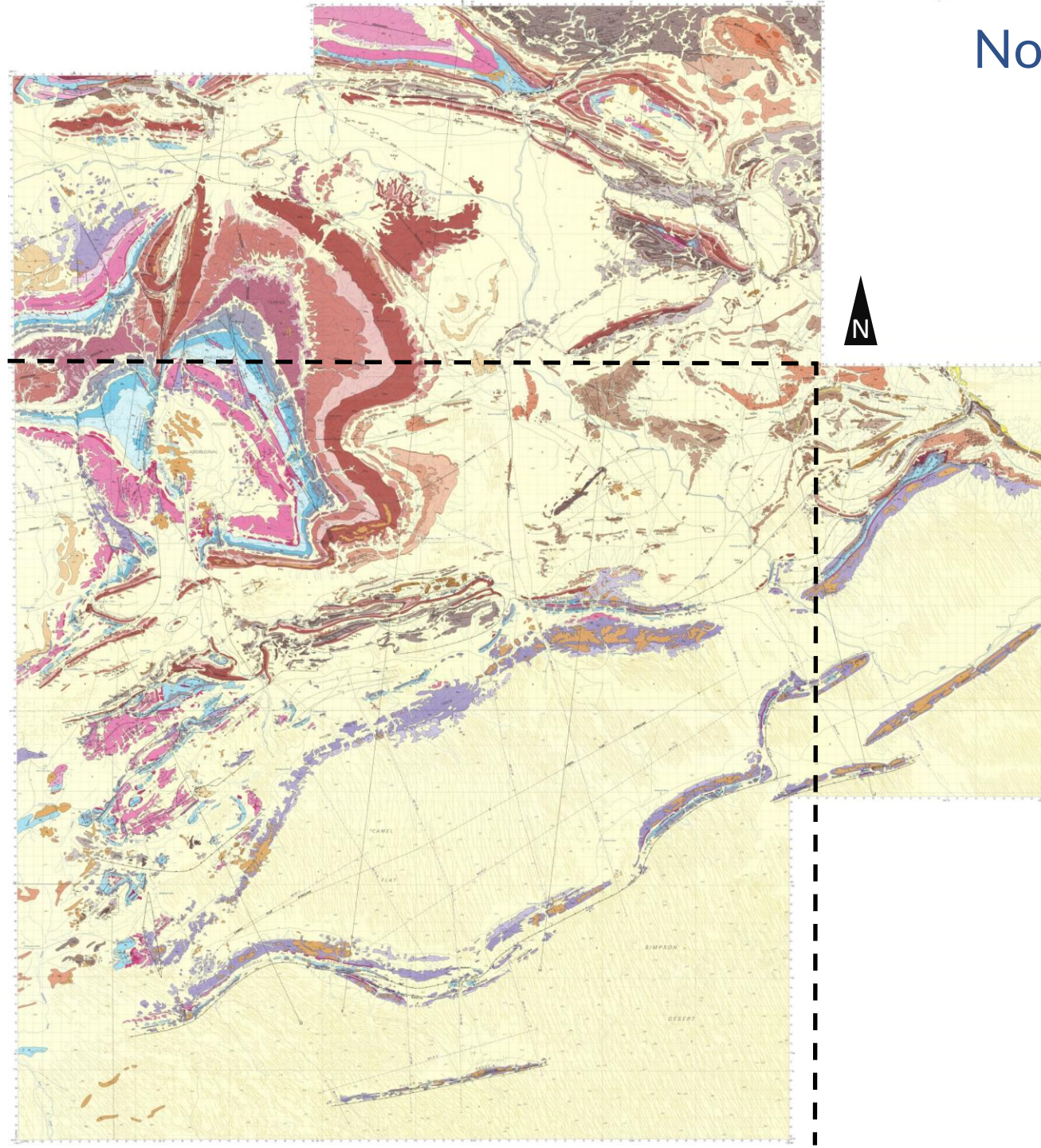


Northeastern Amadeus Basin 1:100 000 Megathrust & Duplex



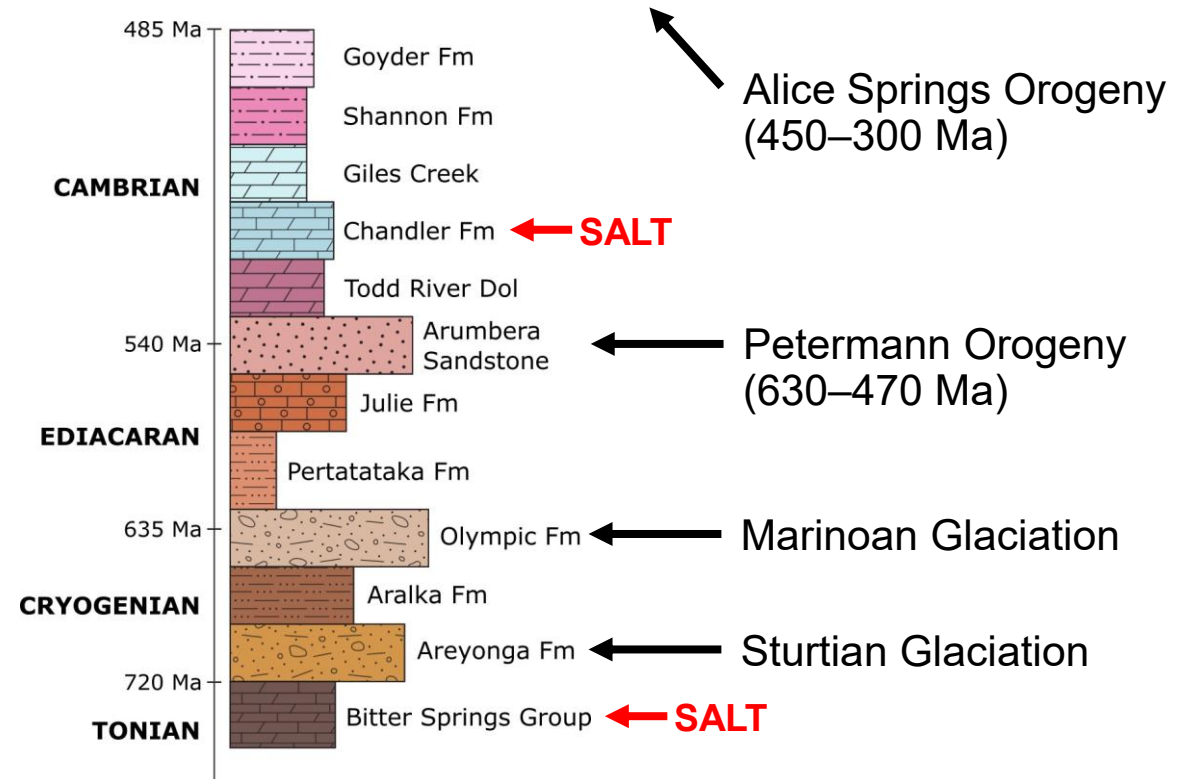
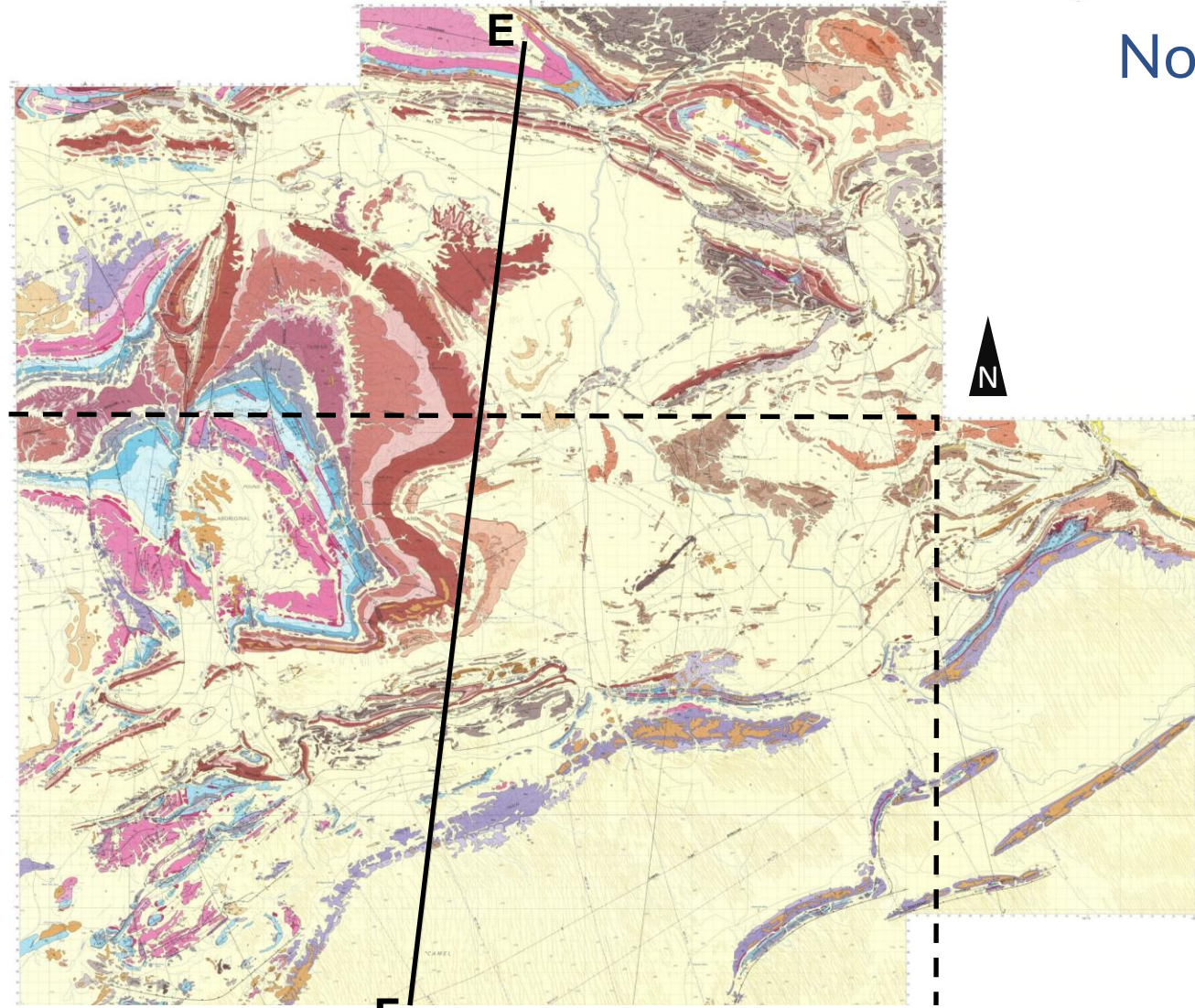
Oaks RQ Jr, Stewart AJ, Deckelman JA, Conrad KT, 1990–Geology of the Northeastern Amadeus Basin (1:100 000 scale map). *Bureau of Mineral Resources, Canberra*

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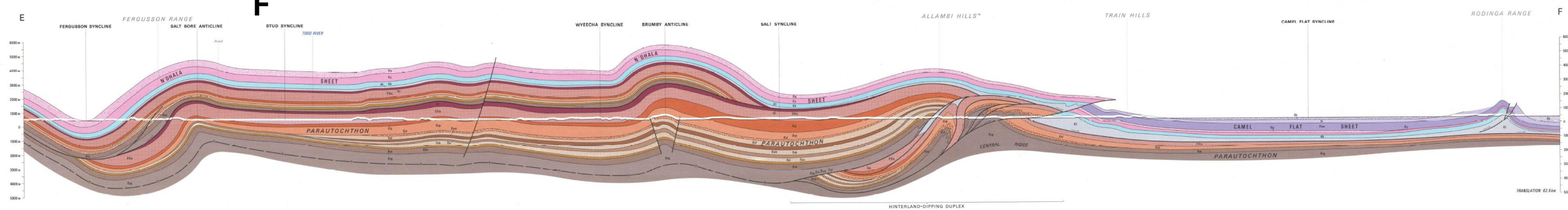


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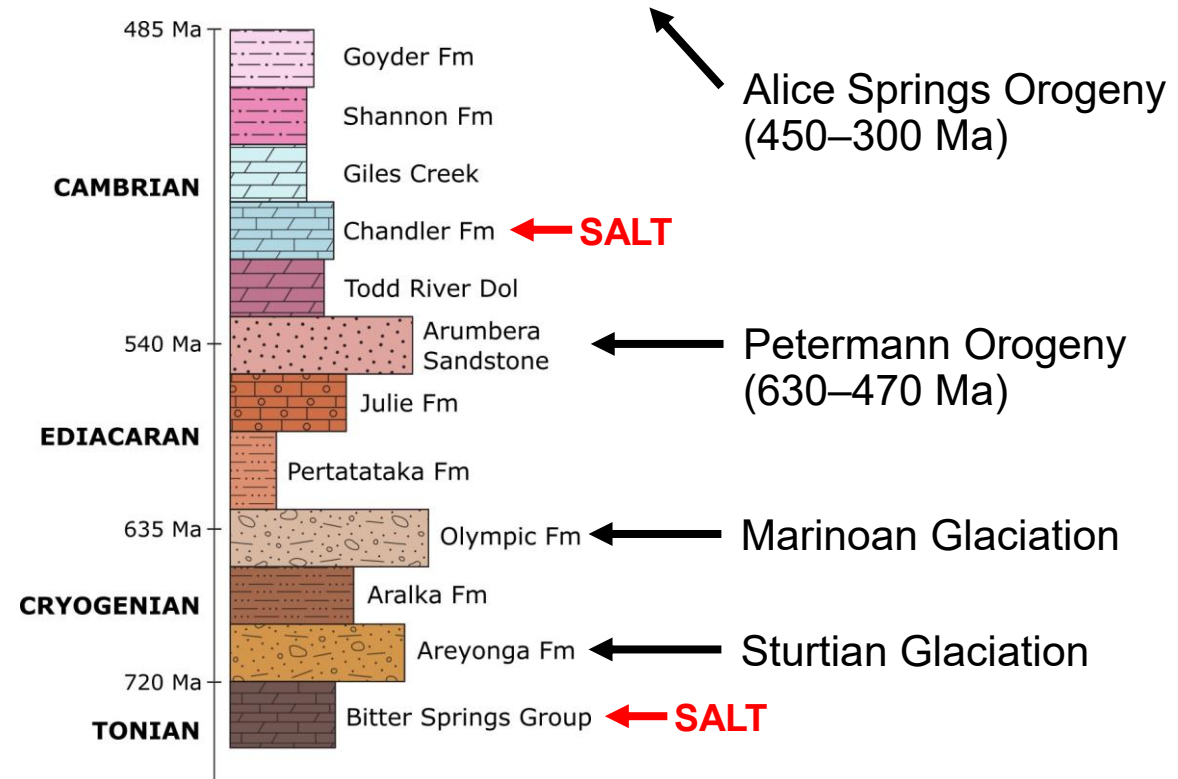
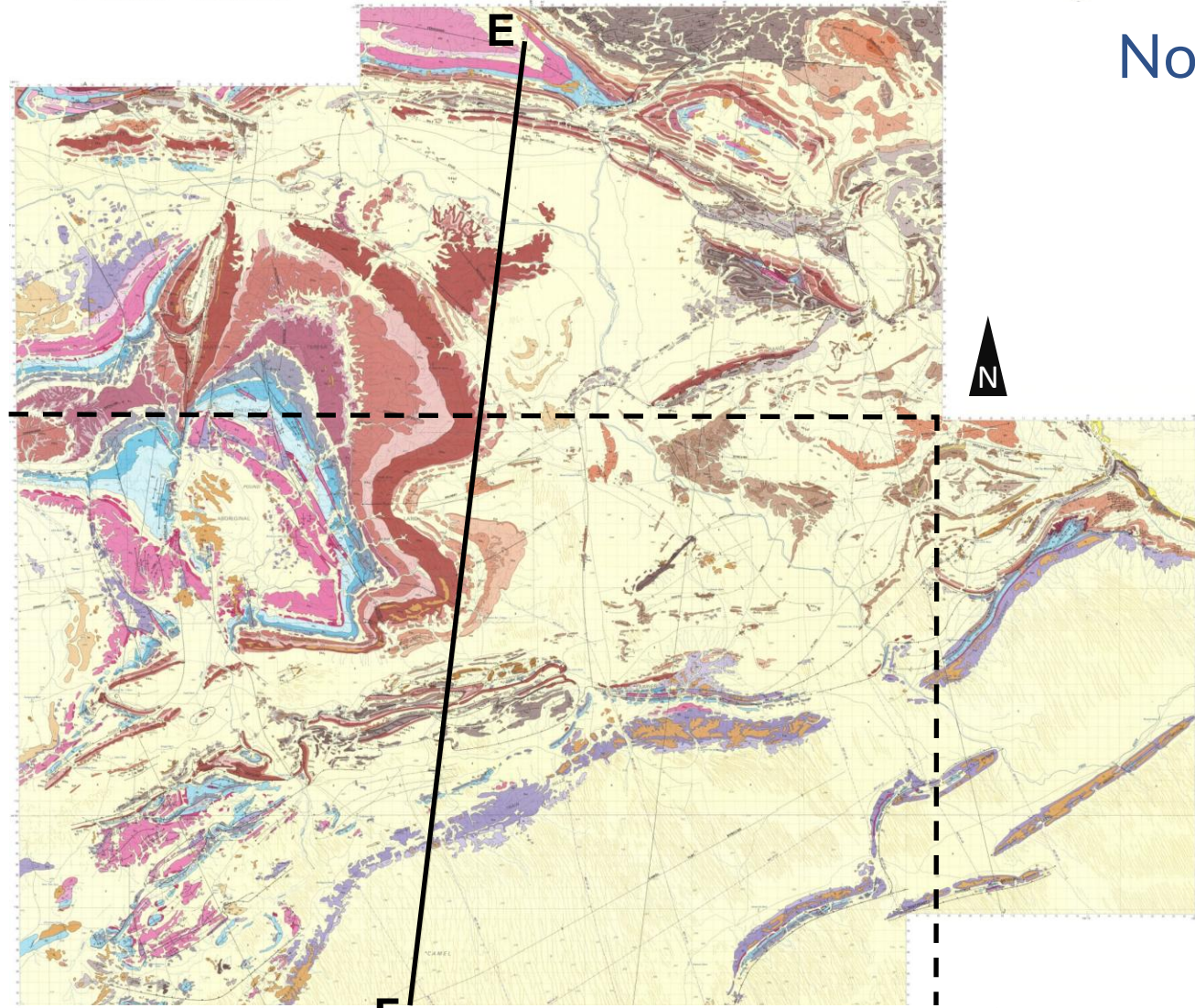
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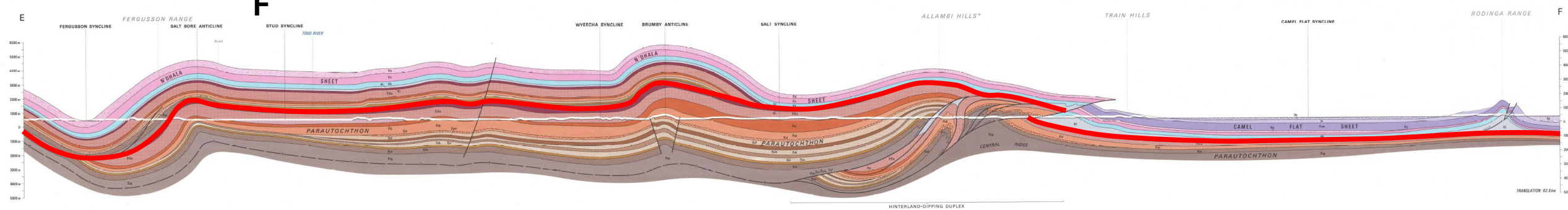
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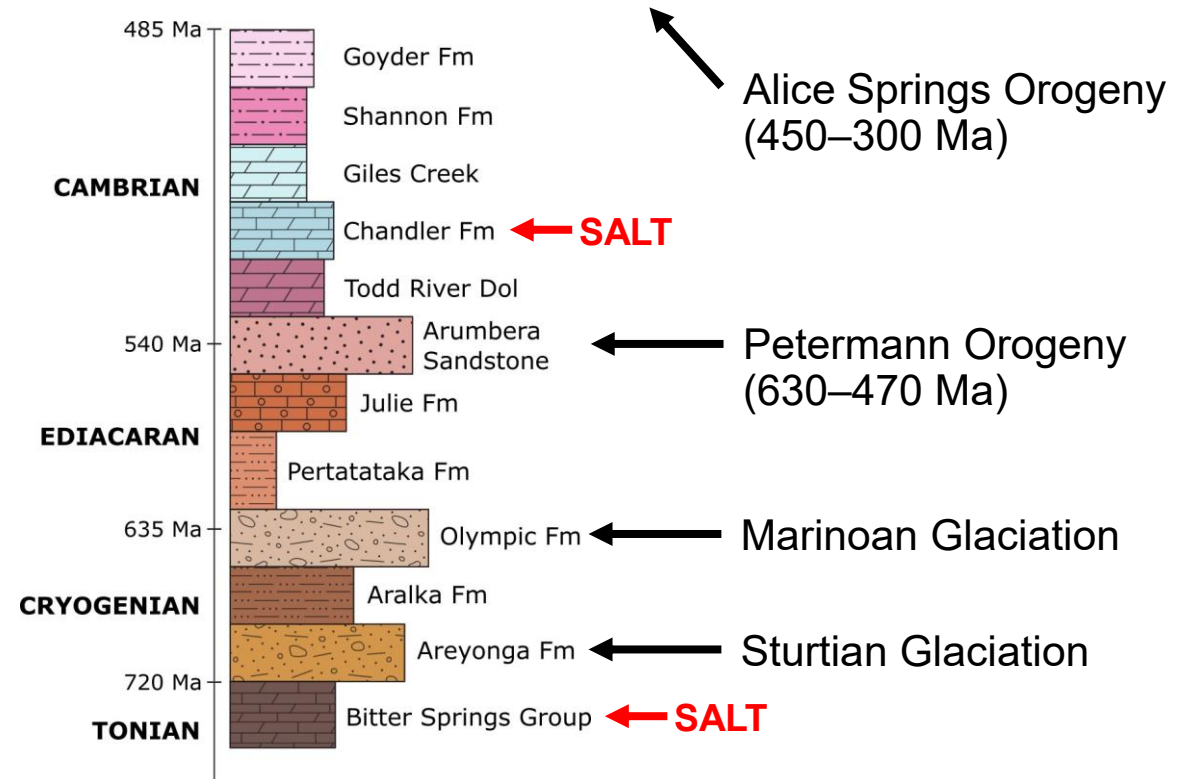
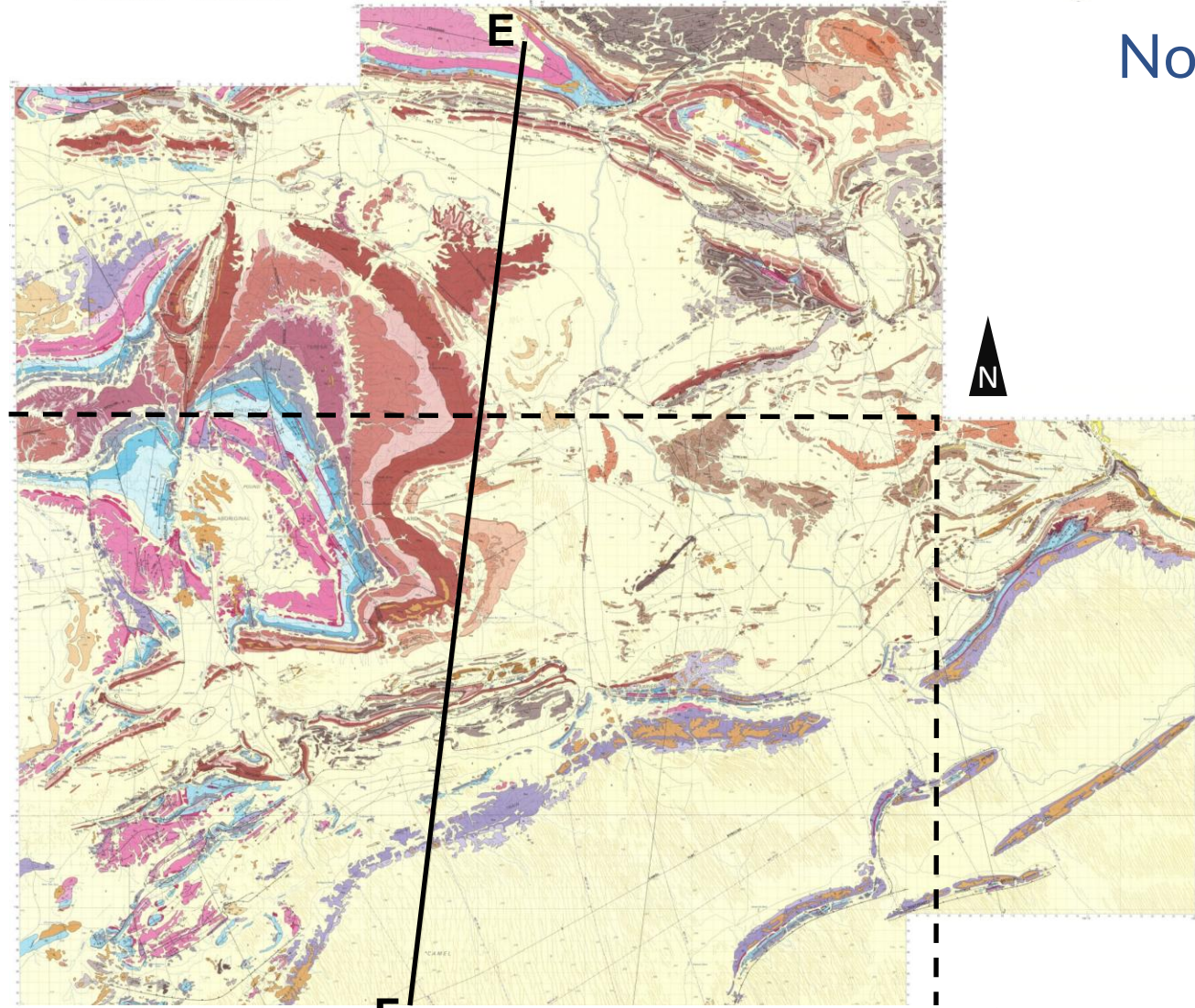
Northeastern Amadeus Basin 1:100 000 Megathrust & Duplex



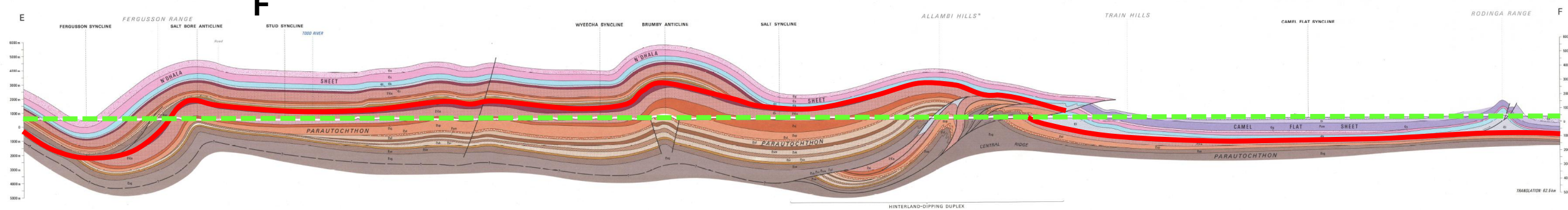
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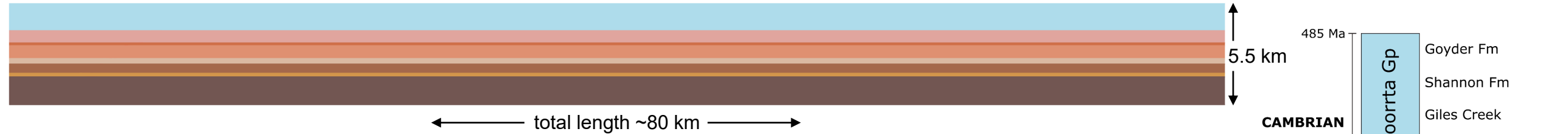
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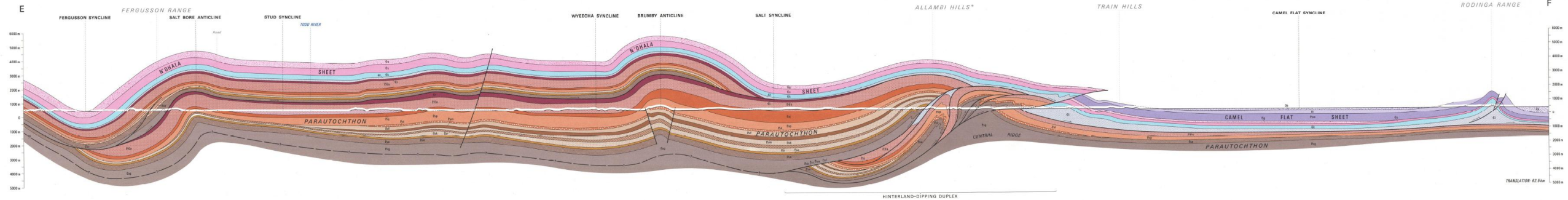
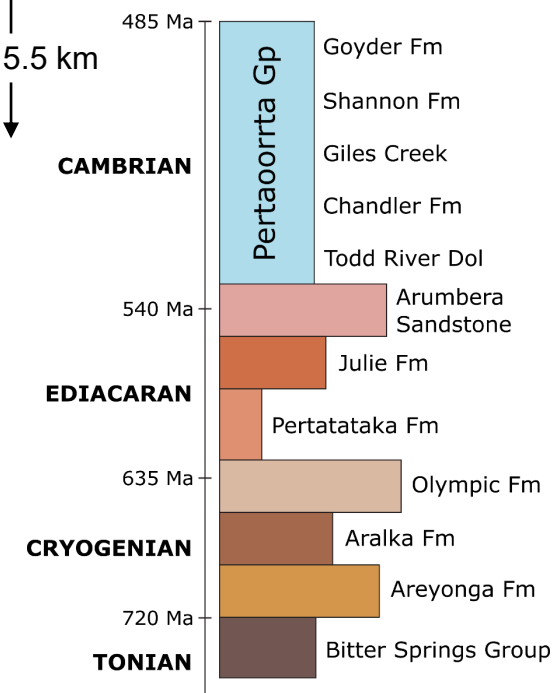
Megathrust & Duplex Forward Model

North

South



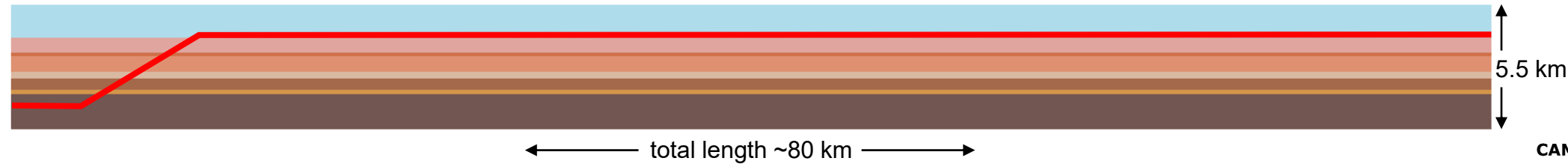
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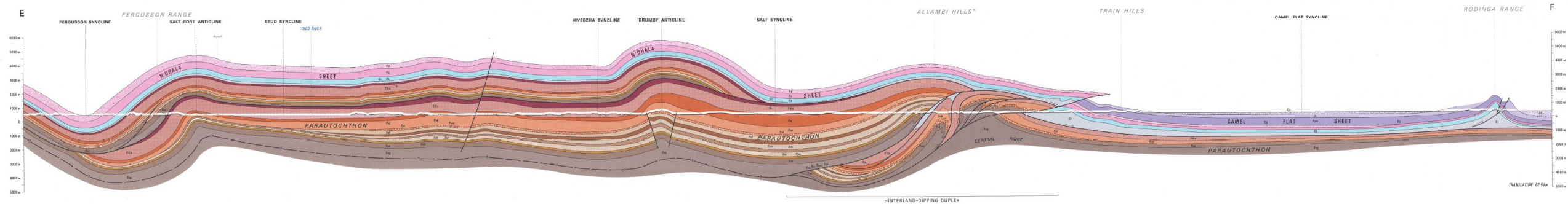
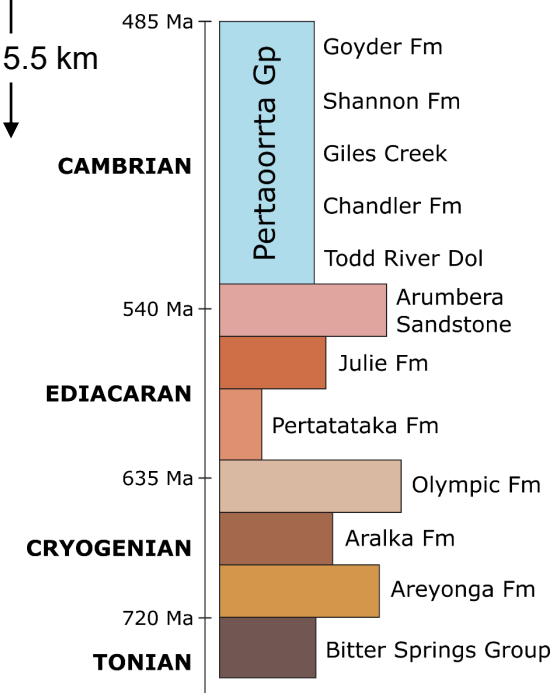
Megathrust & Duplex Forward Model

North

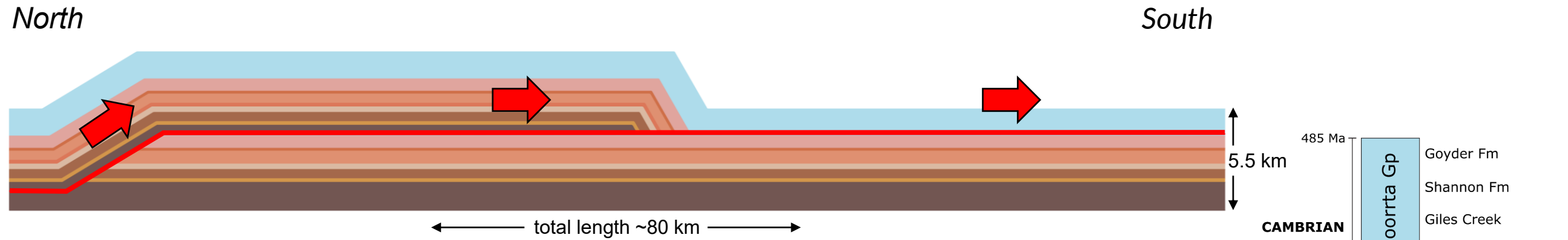
South



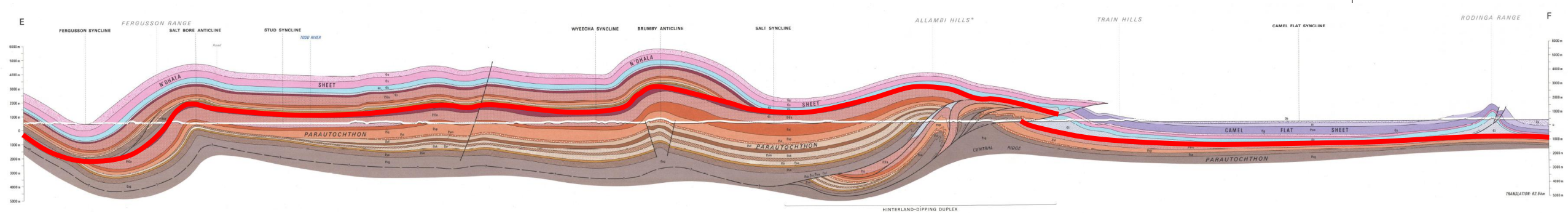
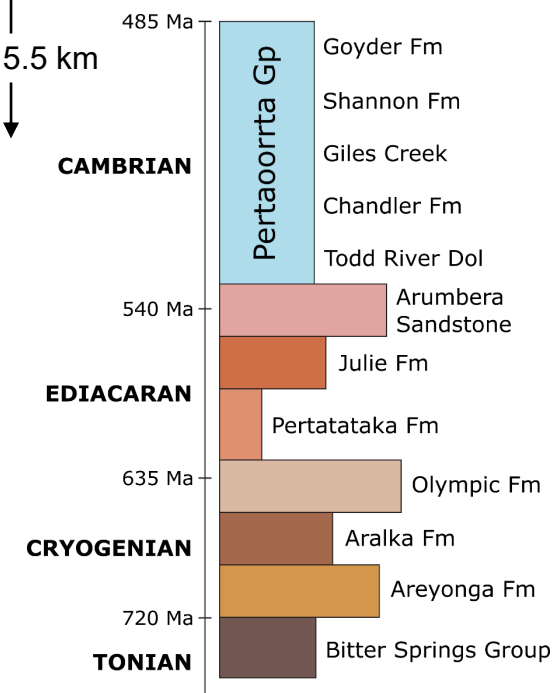
Alice Springs Orogeny: Megathrust (fault-bend fold)



Megathrust & Duplex Forward Model



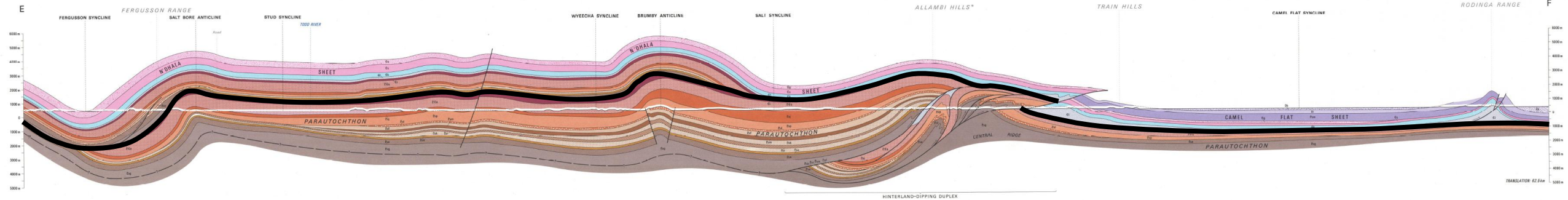
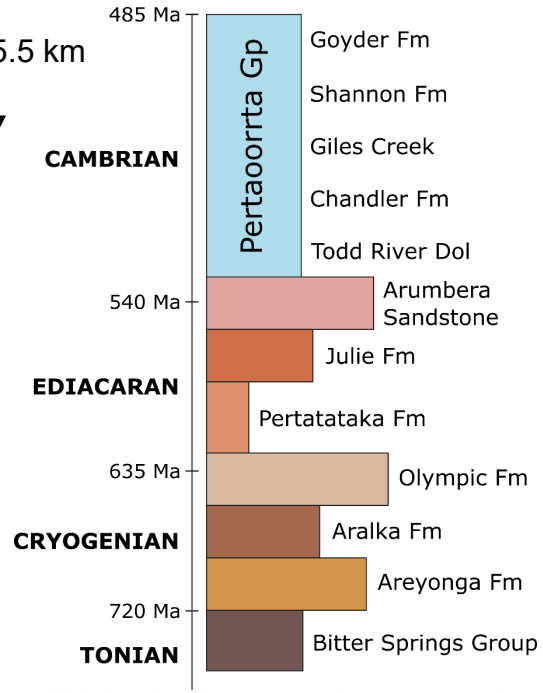
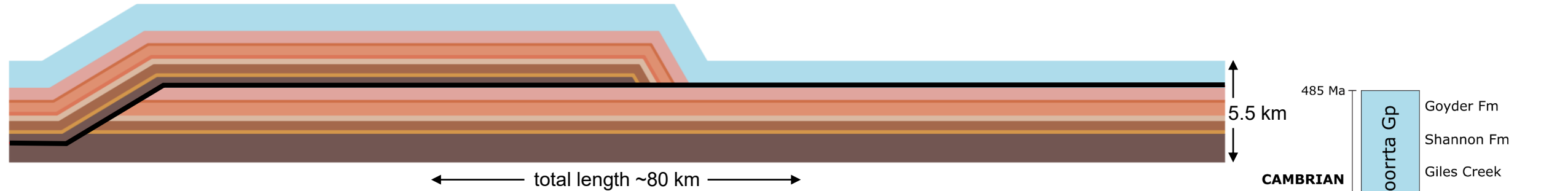
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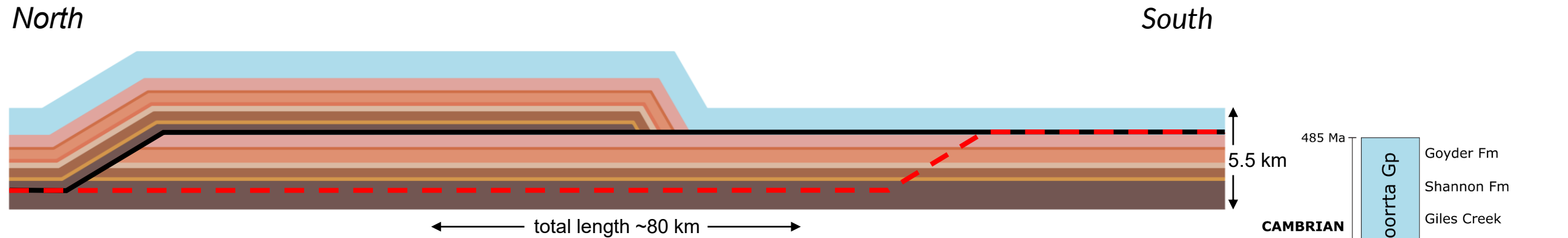
Megathrust & Duplex Forward Model

North

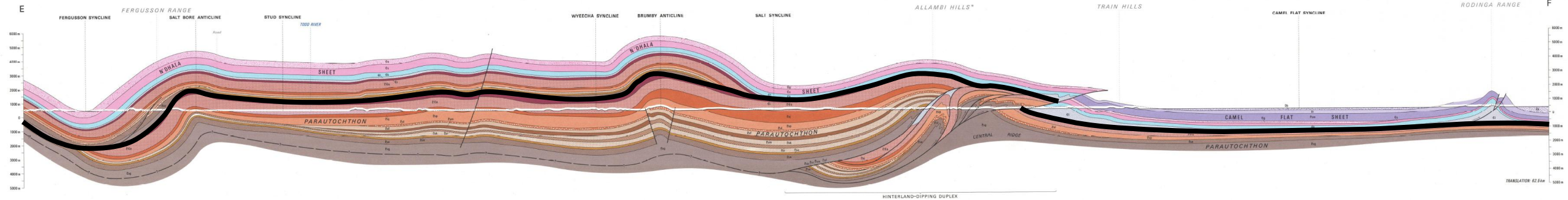
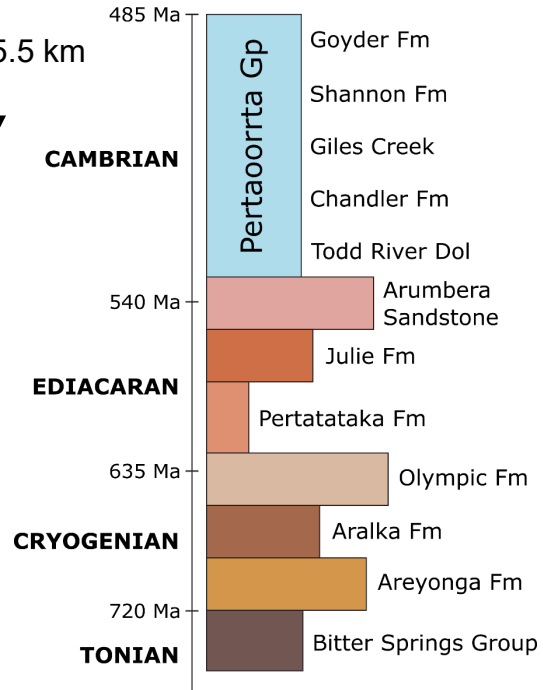
South



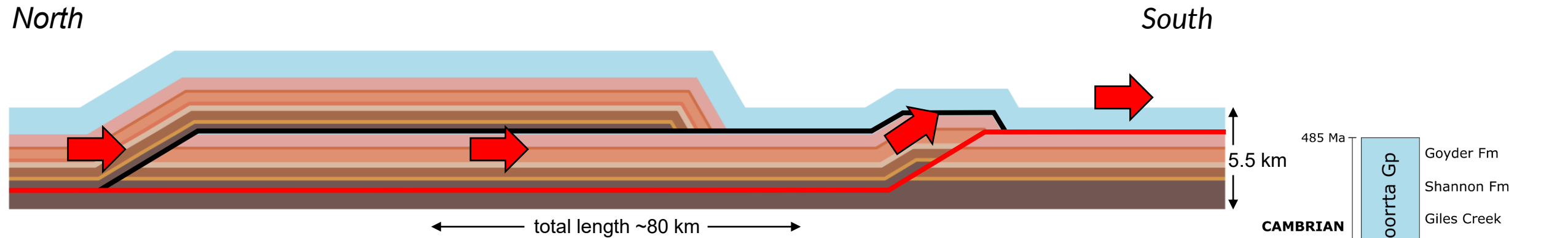
Megathrust & Duplex Forward Model



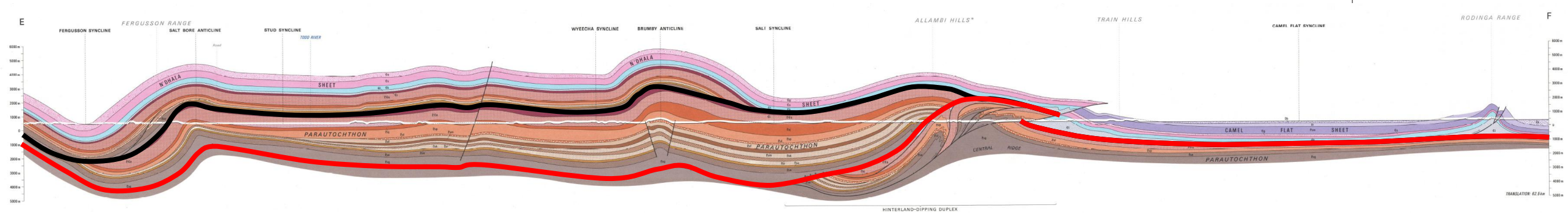
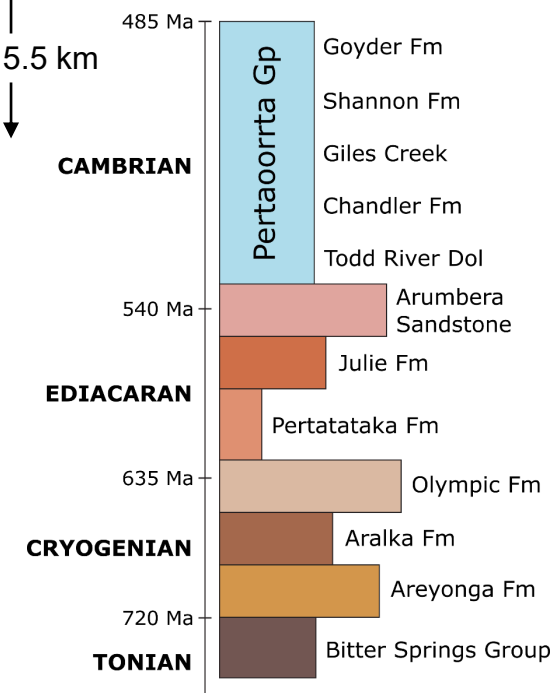
Megathrust propagation



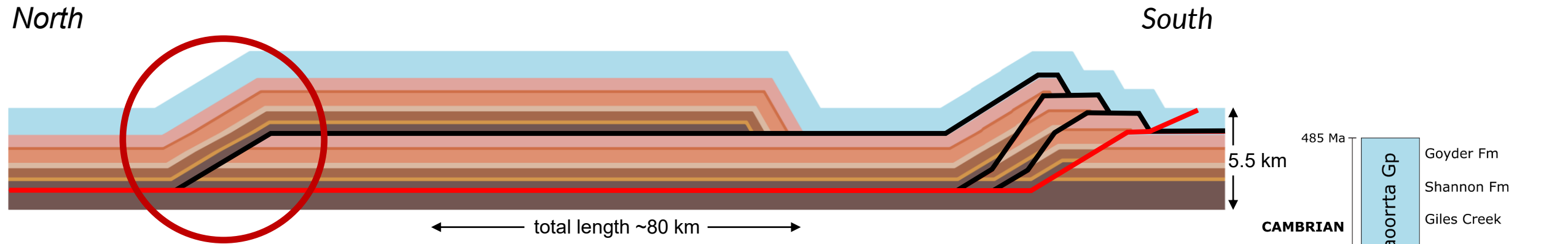
Megathrust & Duplex Forward Model



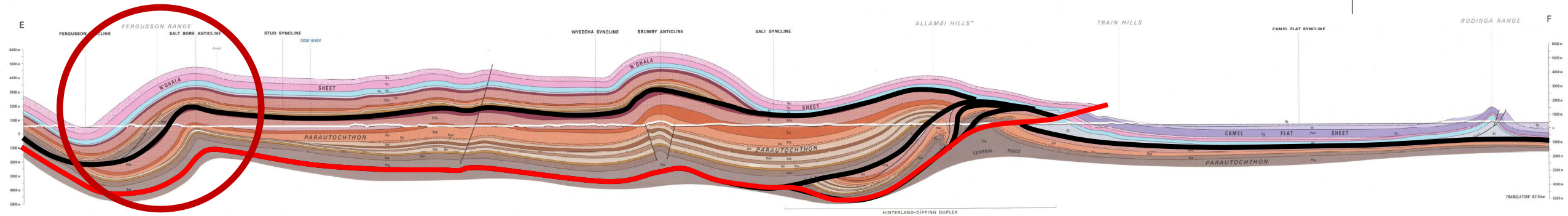
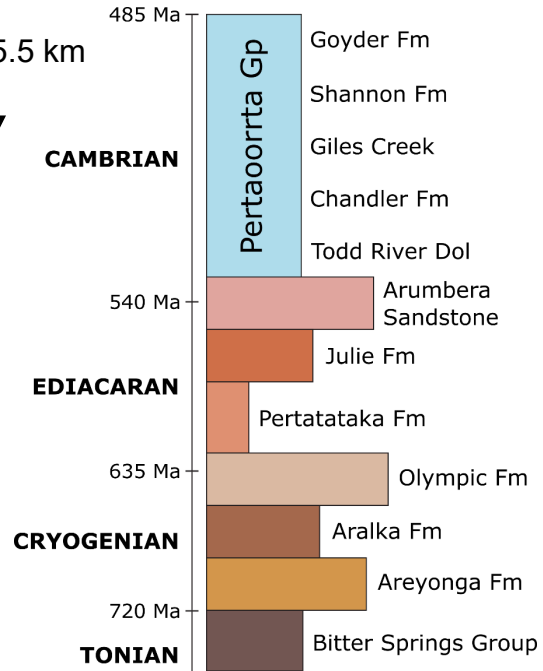
Megathrust propagation (fault-bend fold)



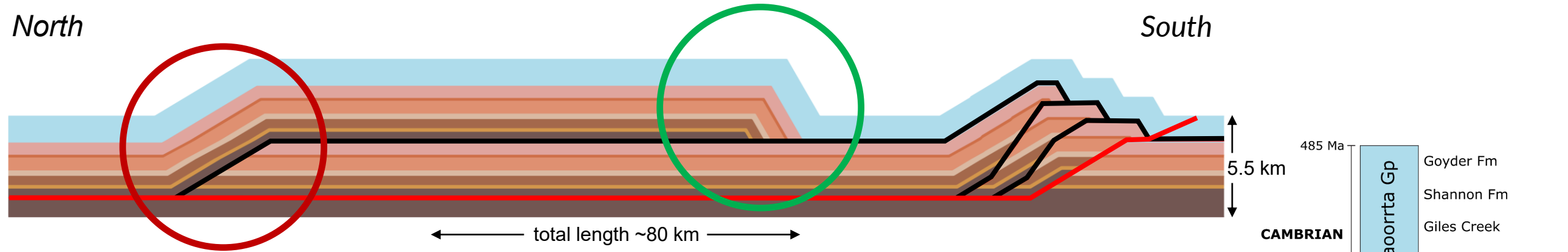
Megathrust & Duplex Forward Model



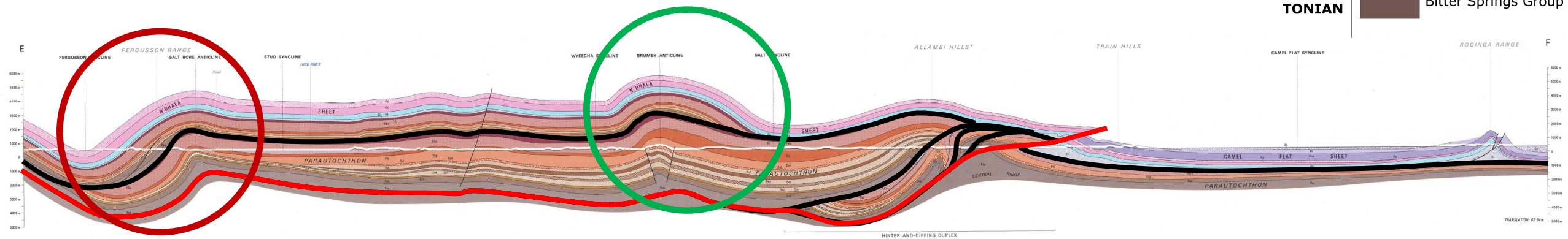
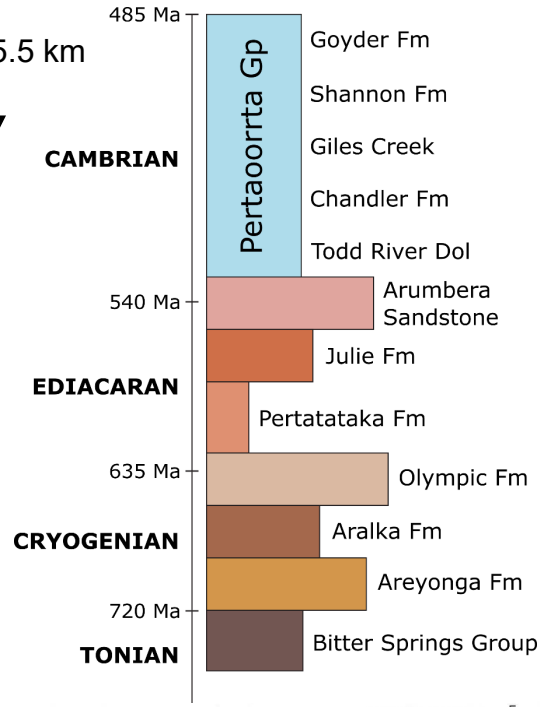
Duplex development



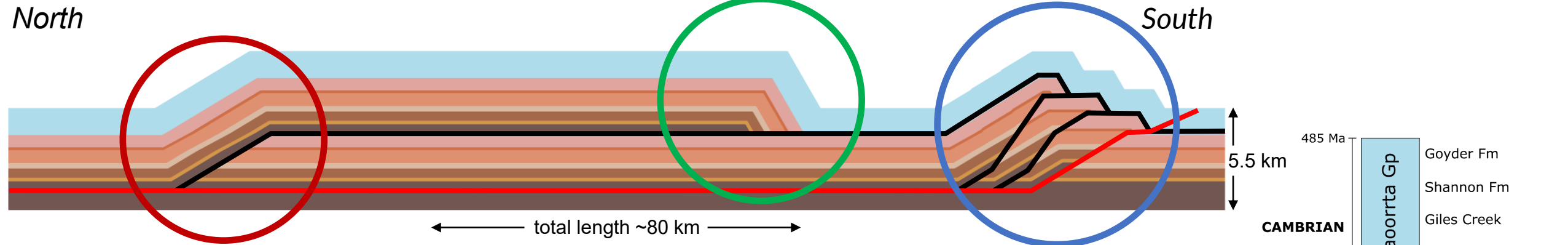
Megathrust & Duplex Forward Model



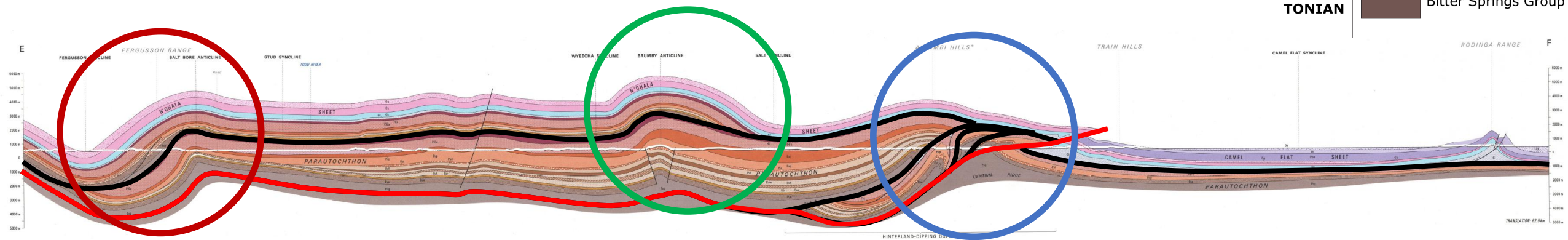
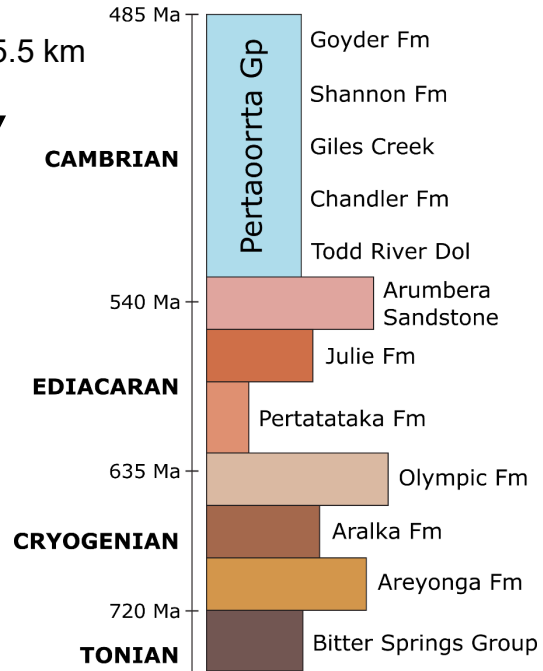
Duplex development



Megathrust & Duplex Forward Model

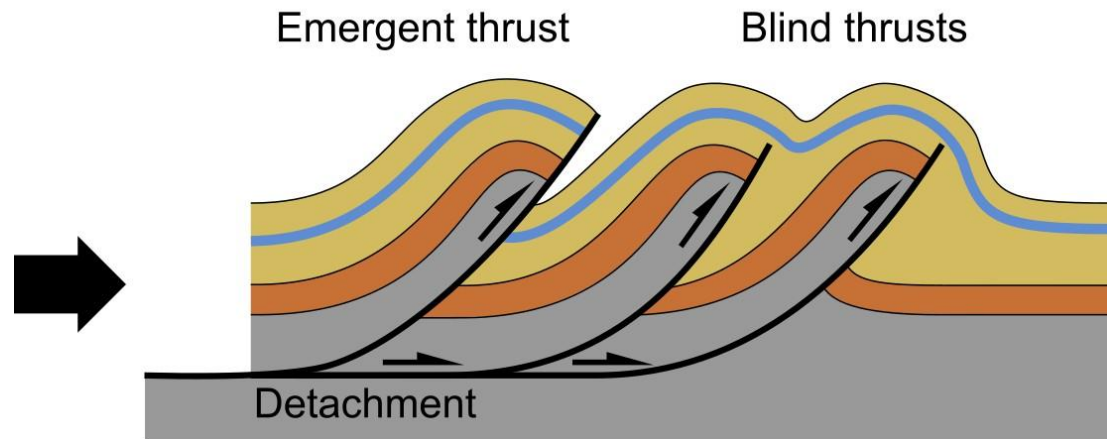


Duplex development

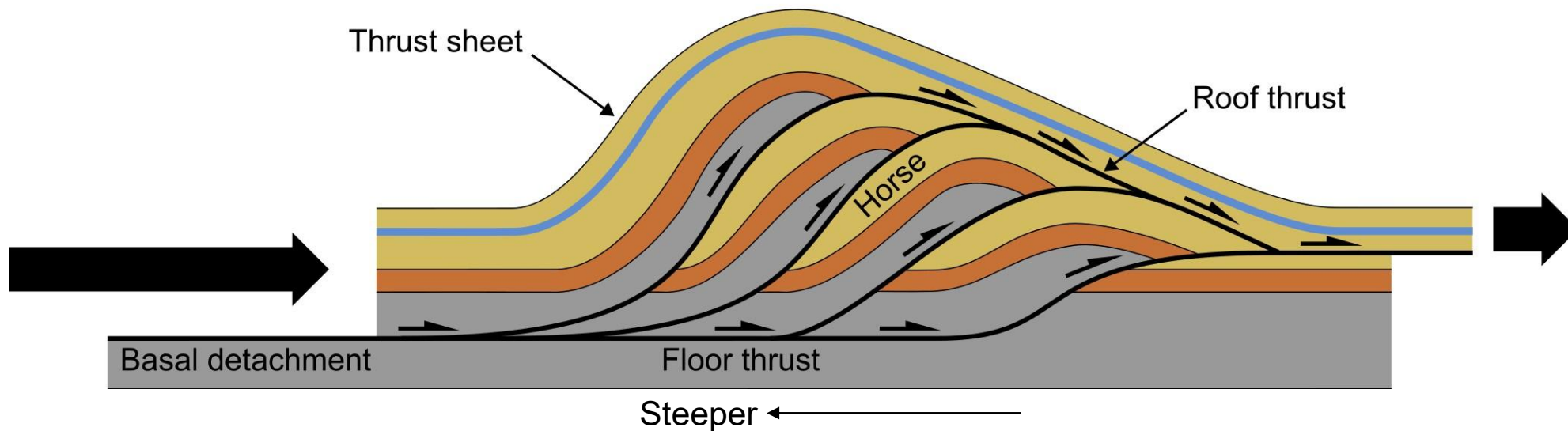


Thrust Systems

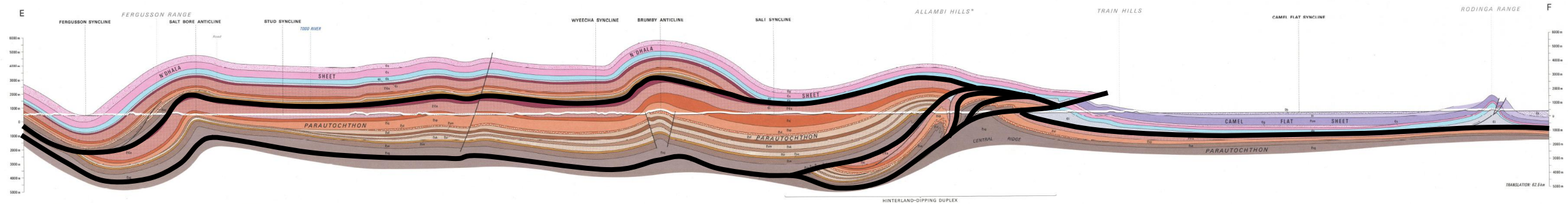
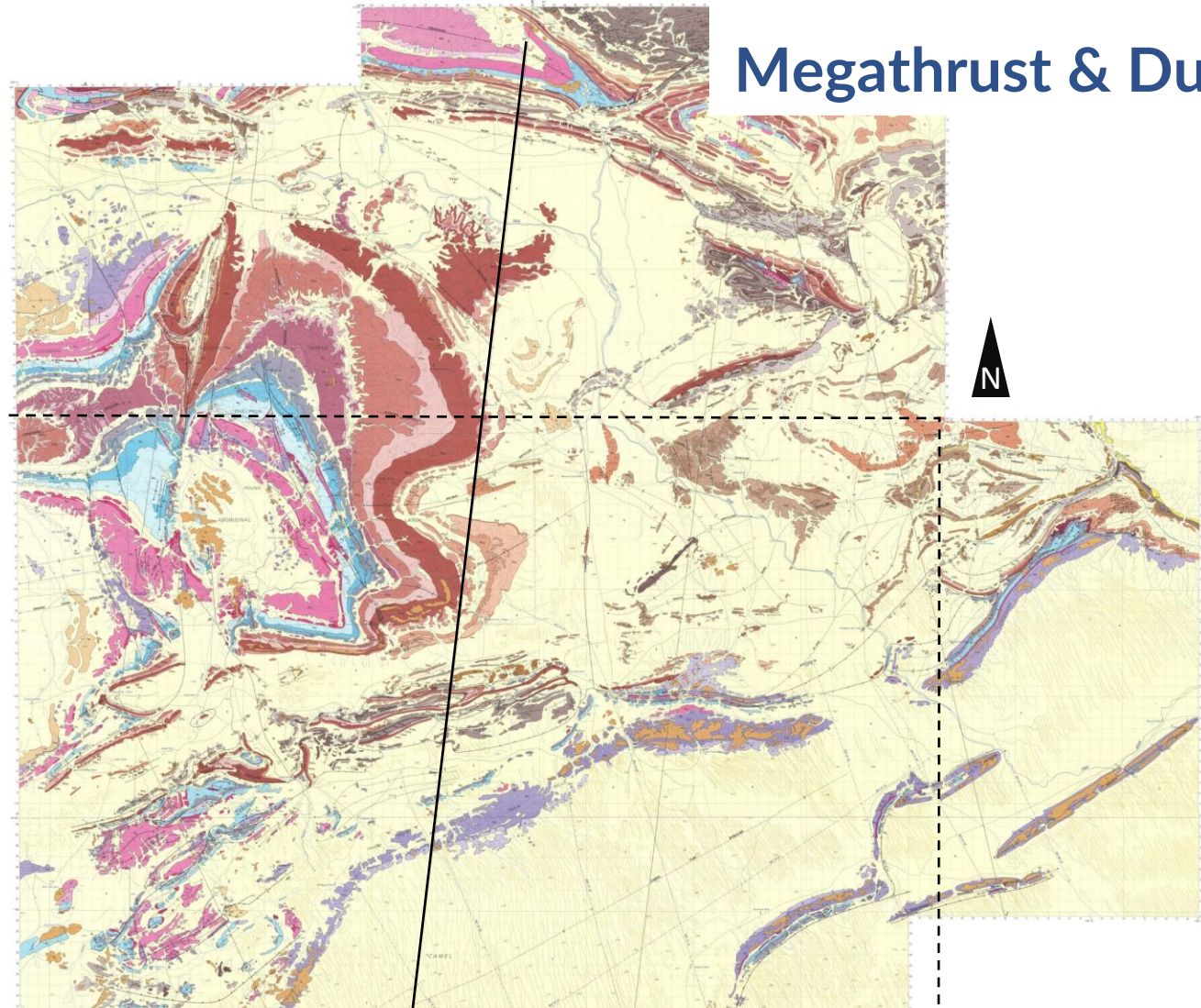
Imbricate Fan



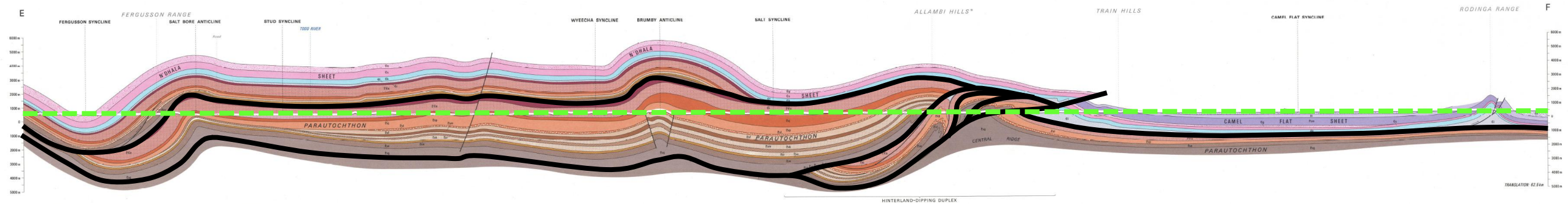
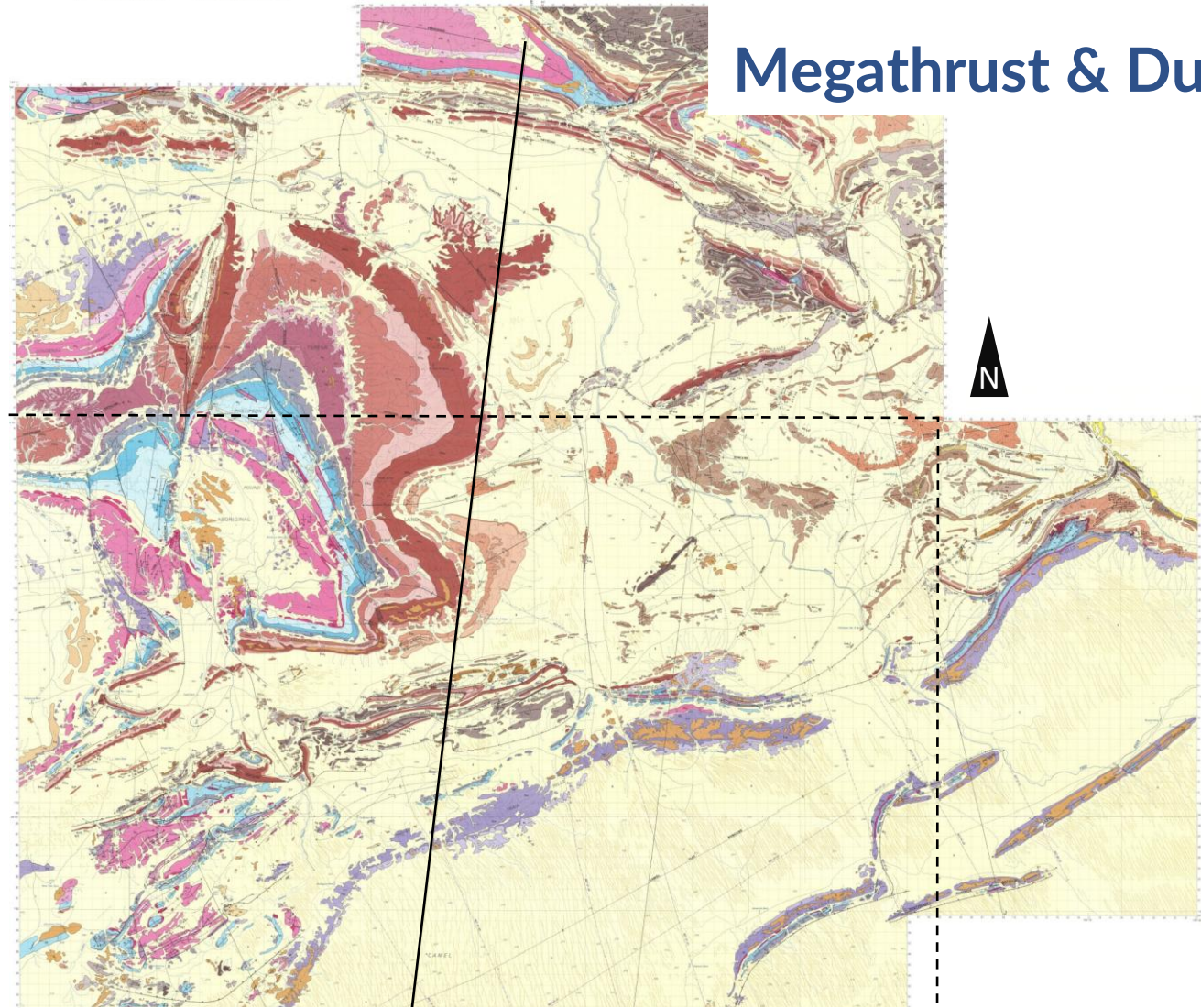
Duplex (antiformal stack)



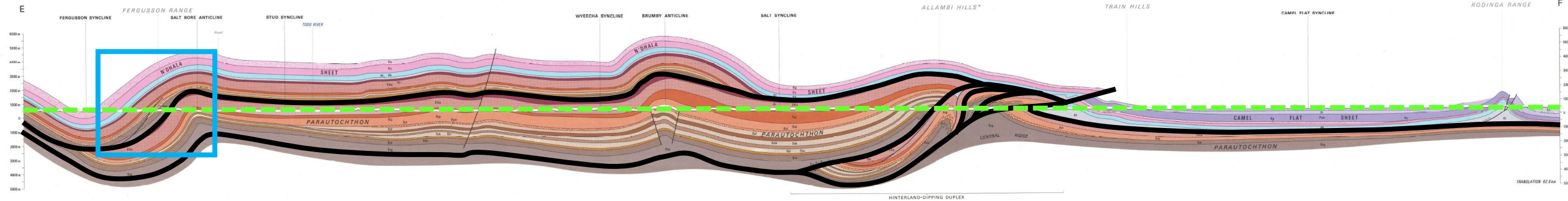
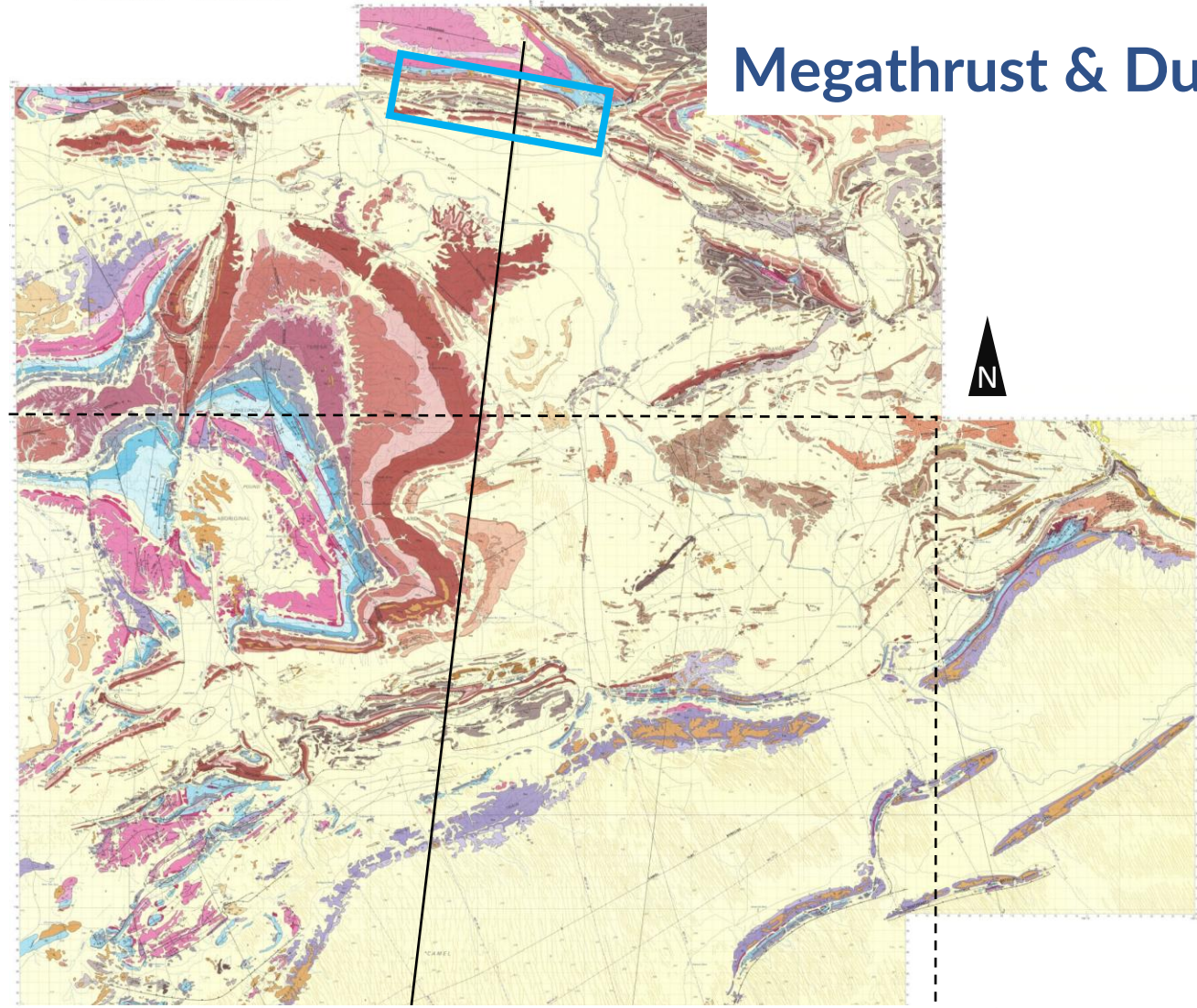
Megathrust & Duplex Validation



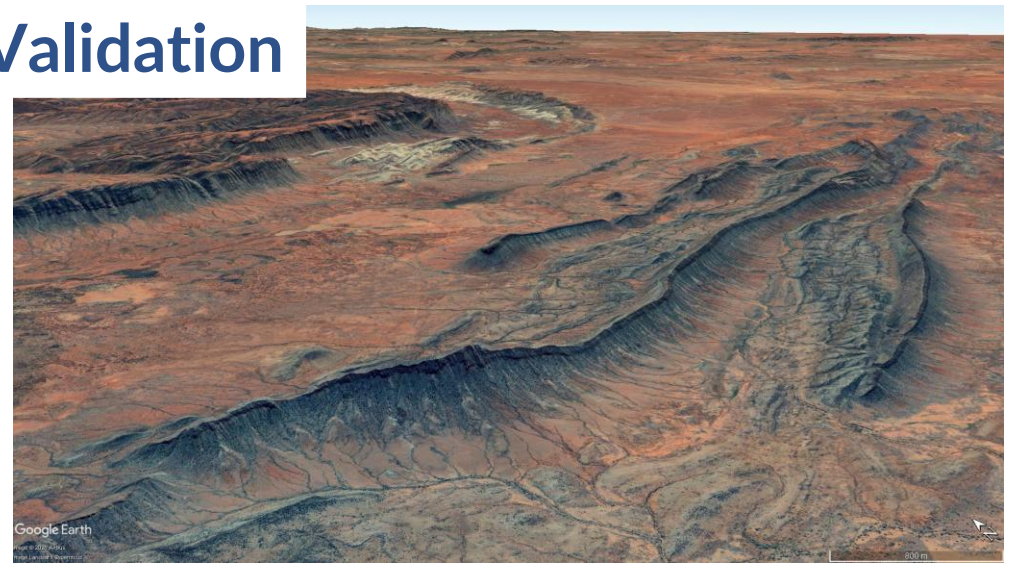
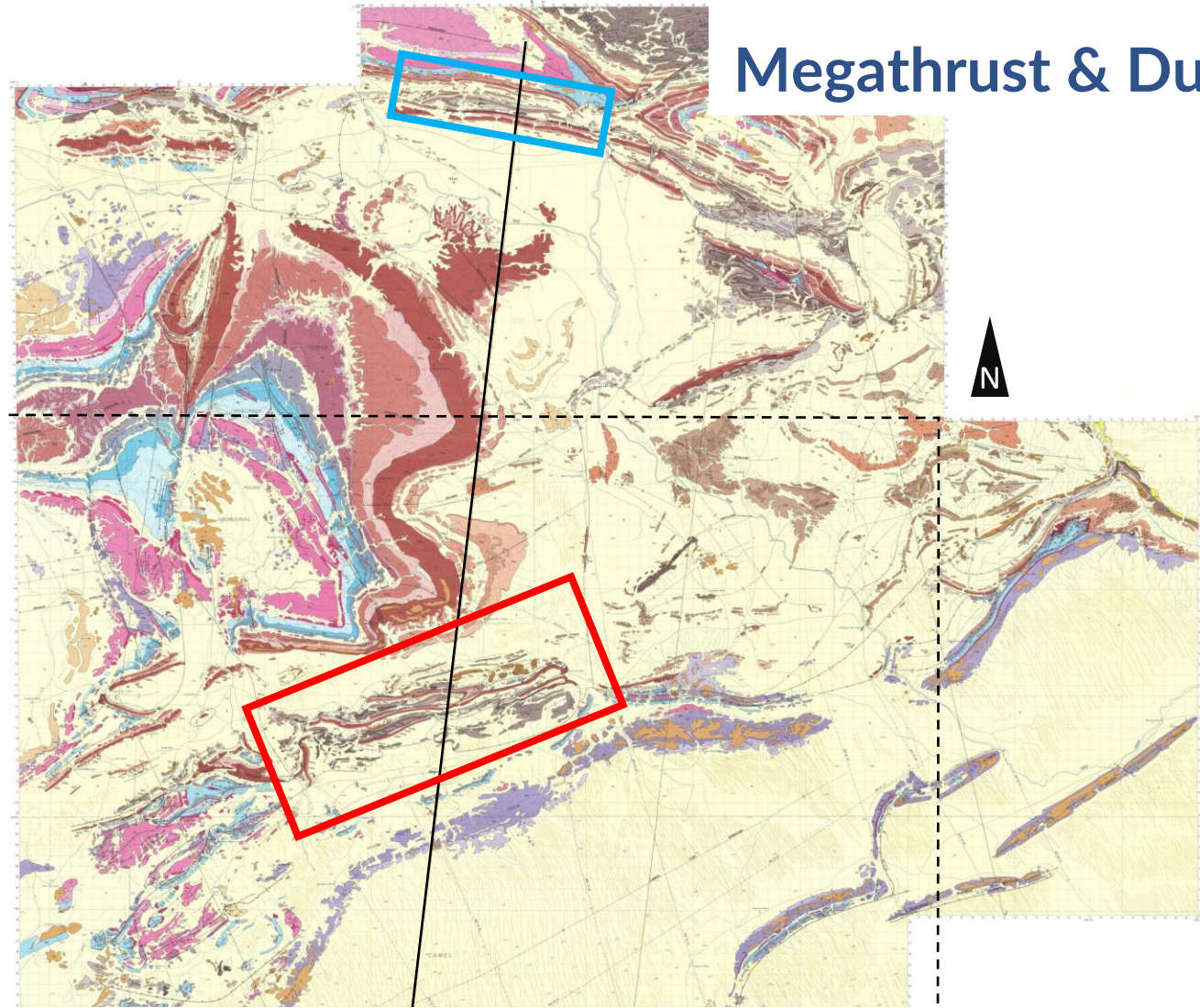
Megathrust & Duplex Validation



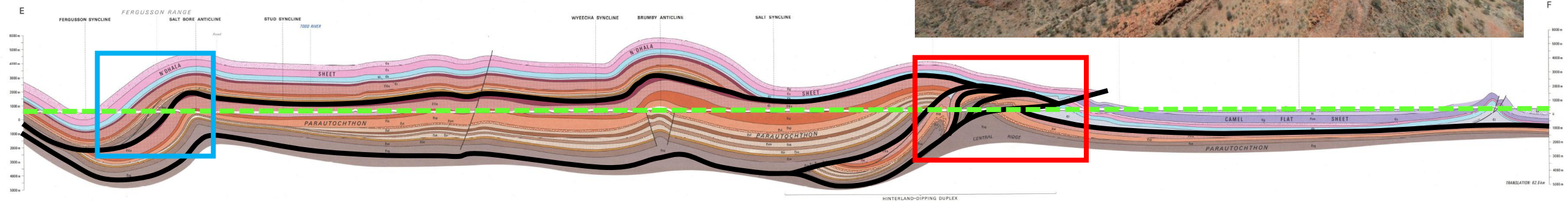
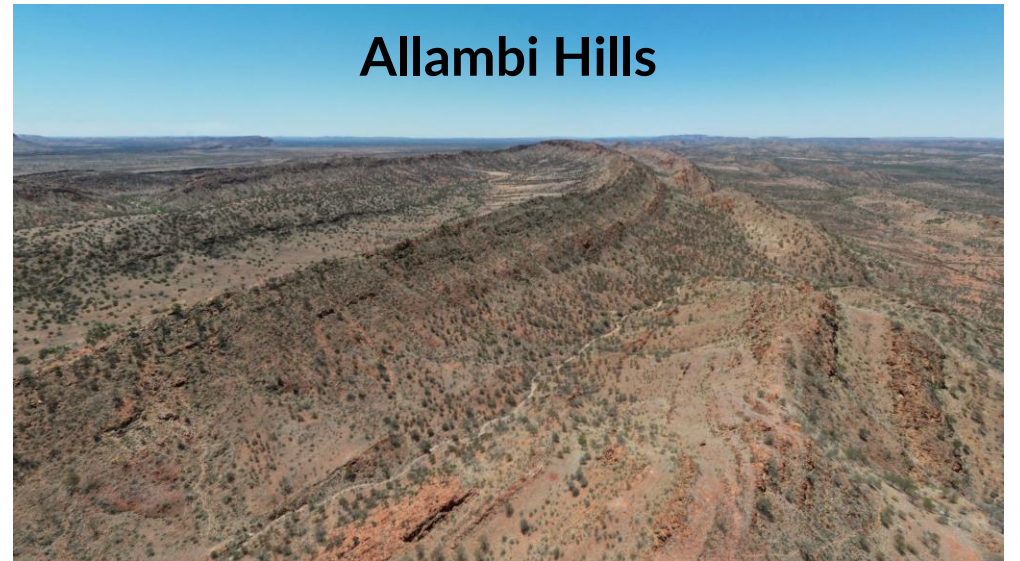
Megathrust & Duplex Validation



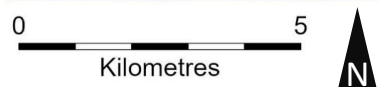
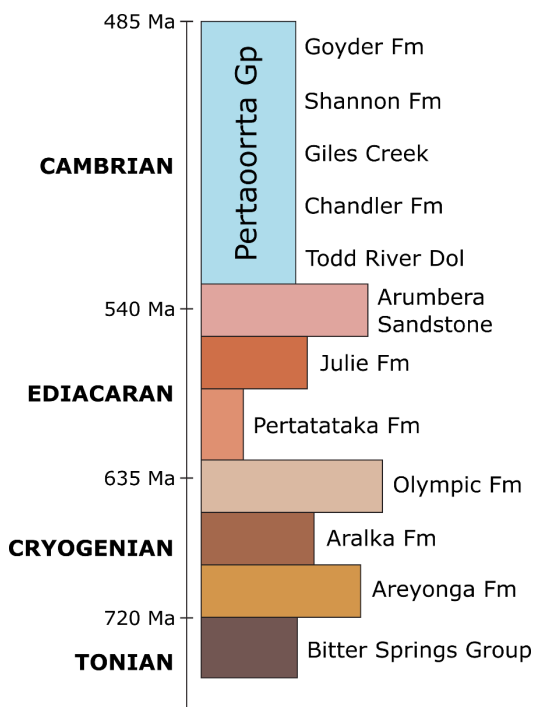
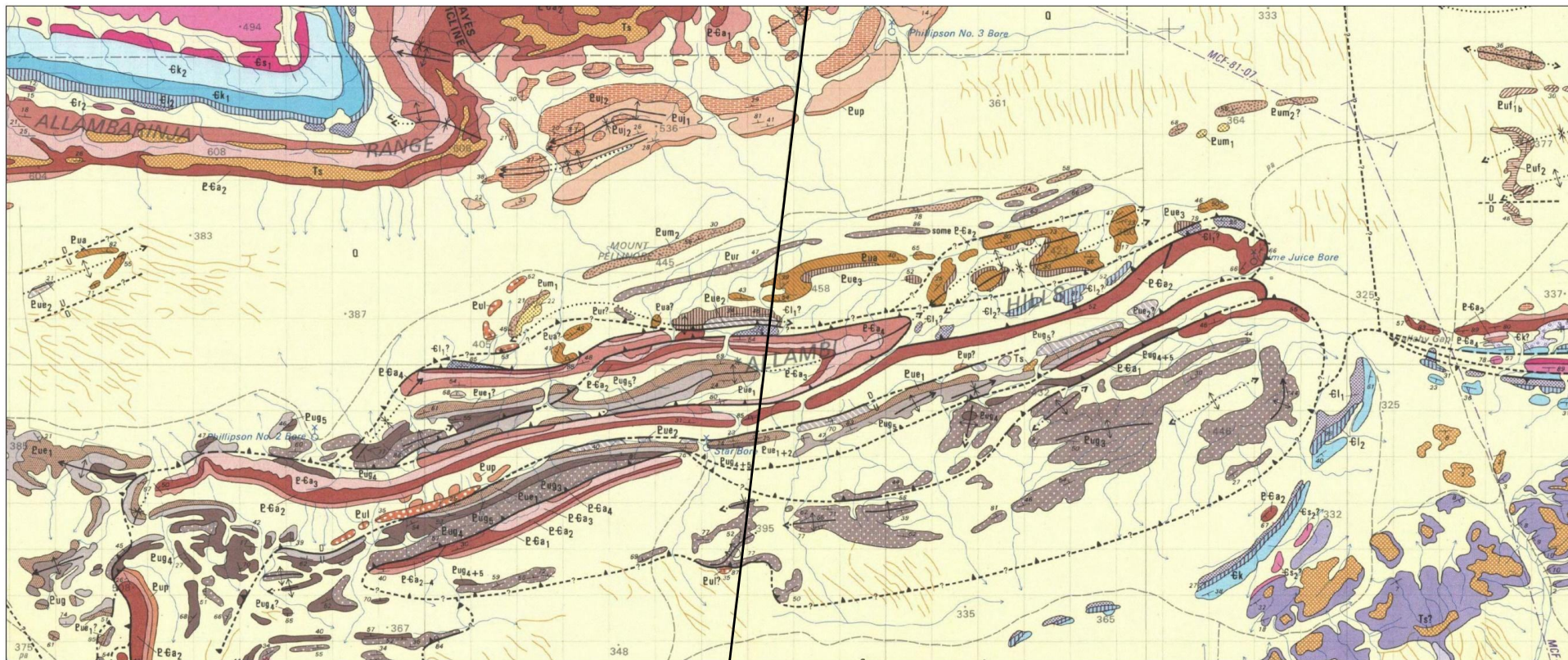
Megathrust & Duplex Validation



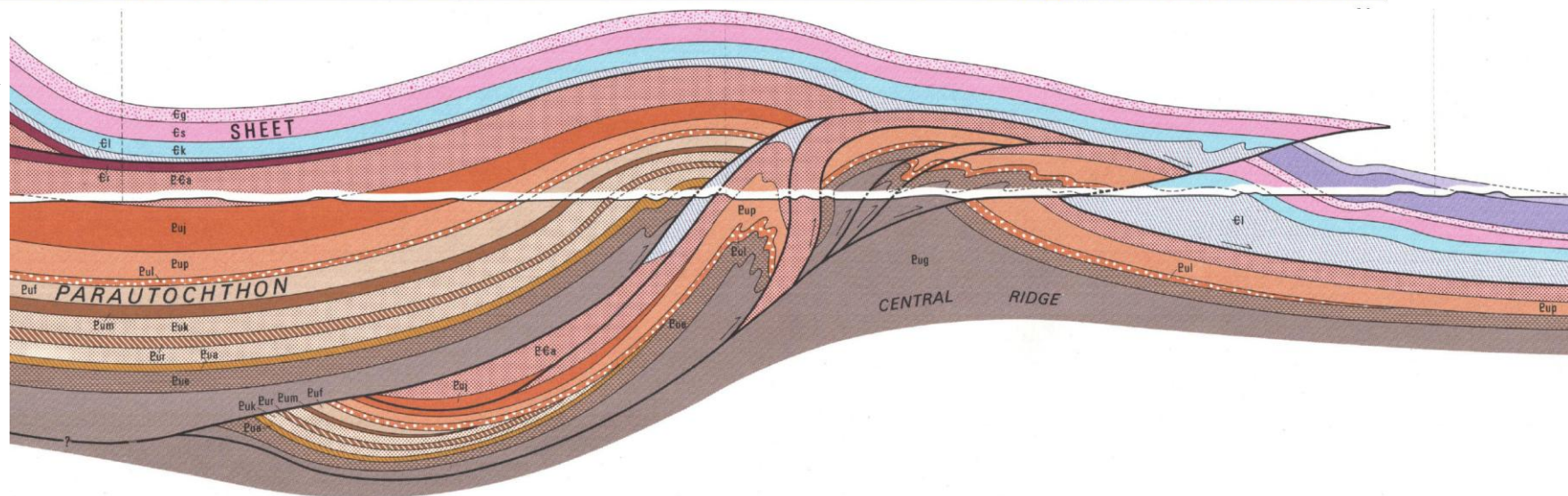
Allambi Hills



Northeastern Amadeus Basin 1:100 000

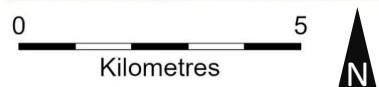
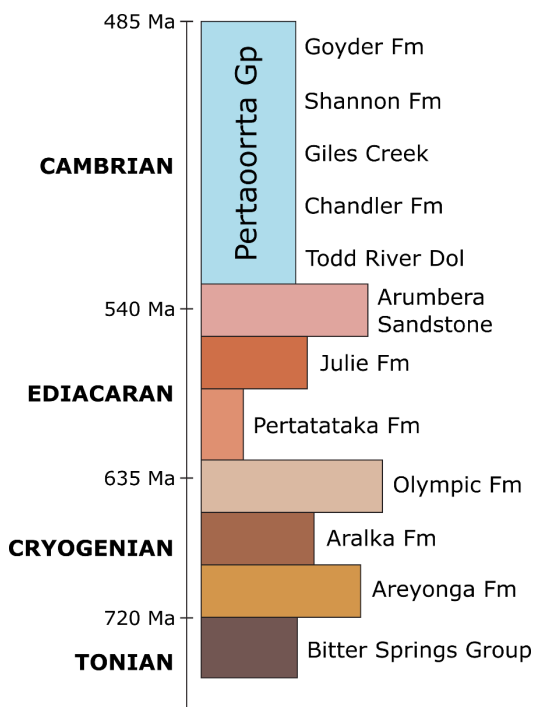
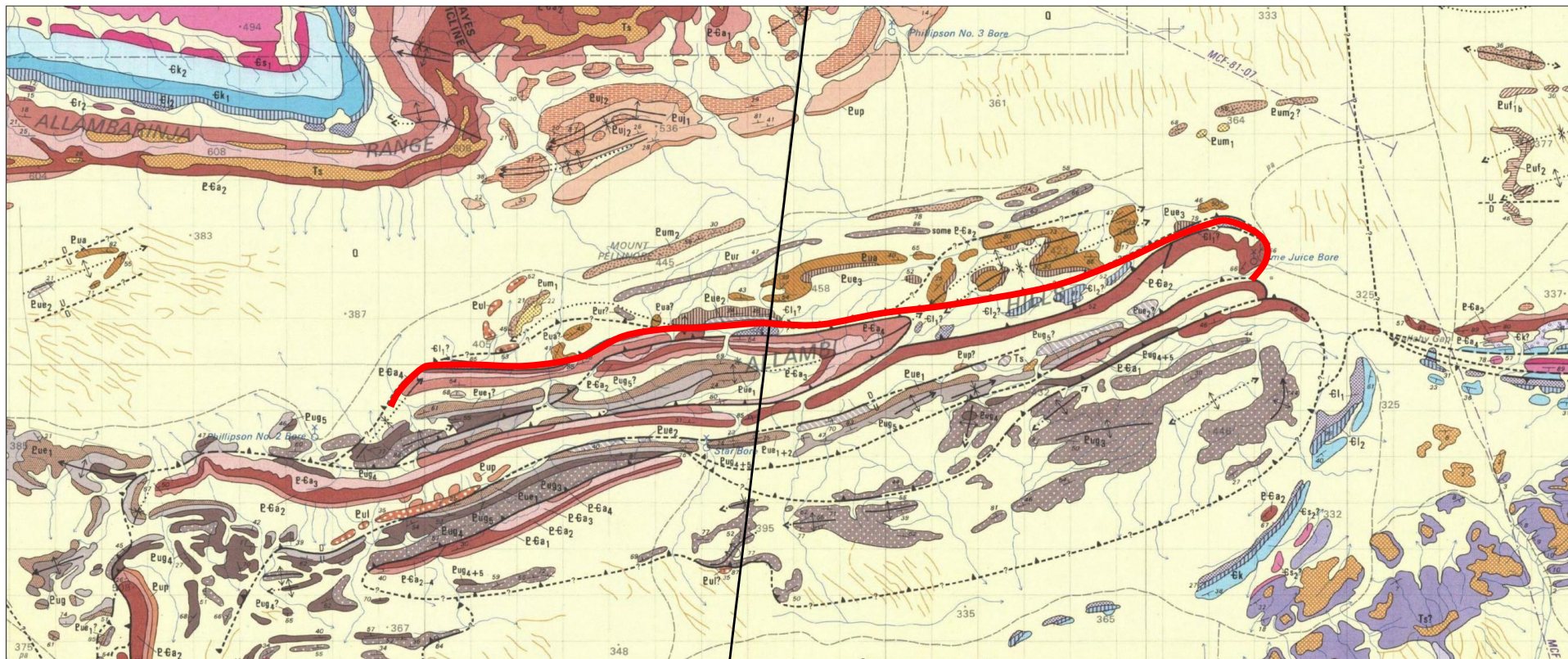


North

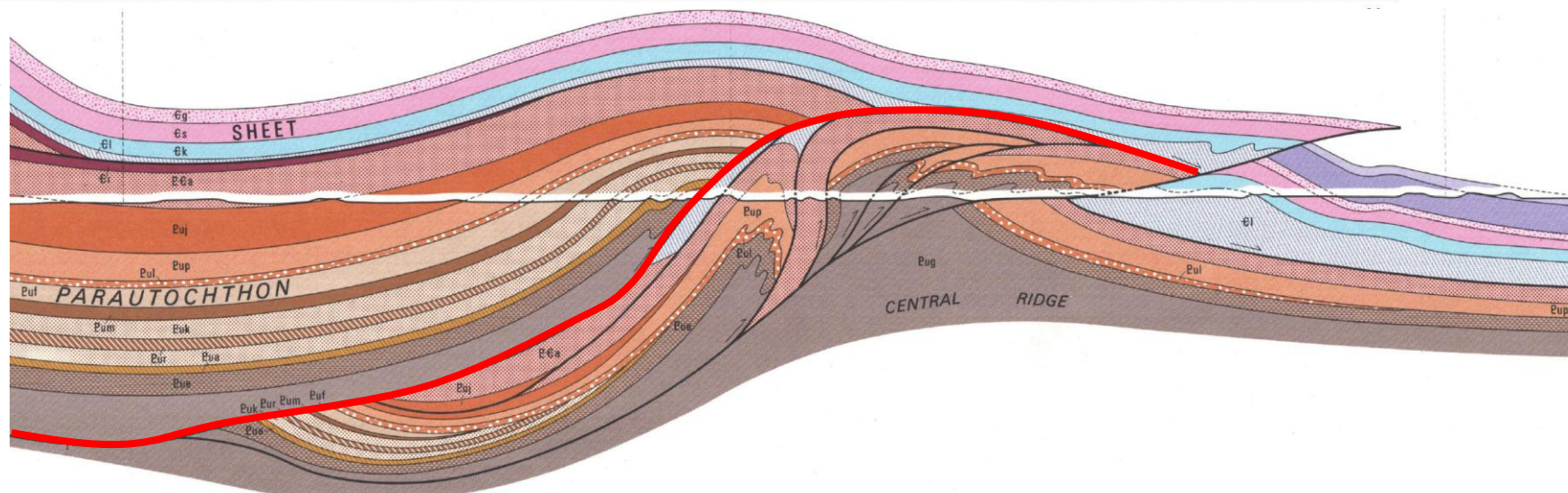


South

Northeastern Amadeus Basin 1:100 000

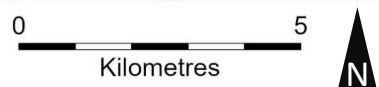
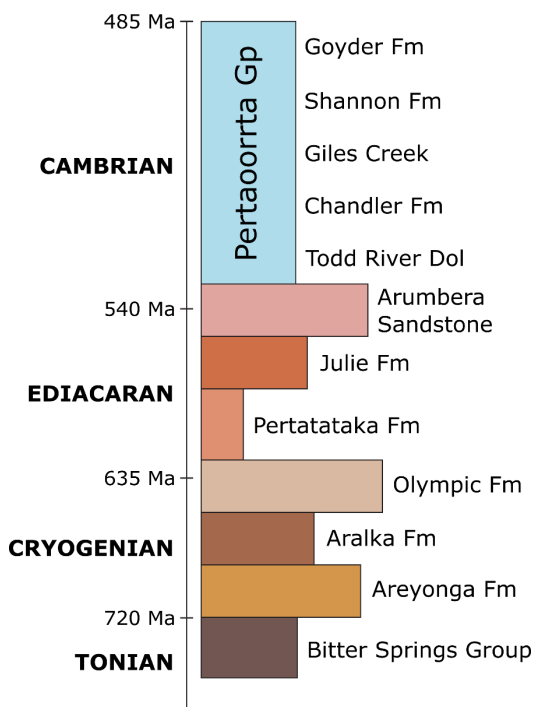
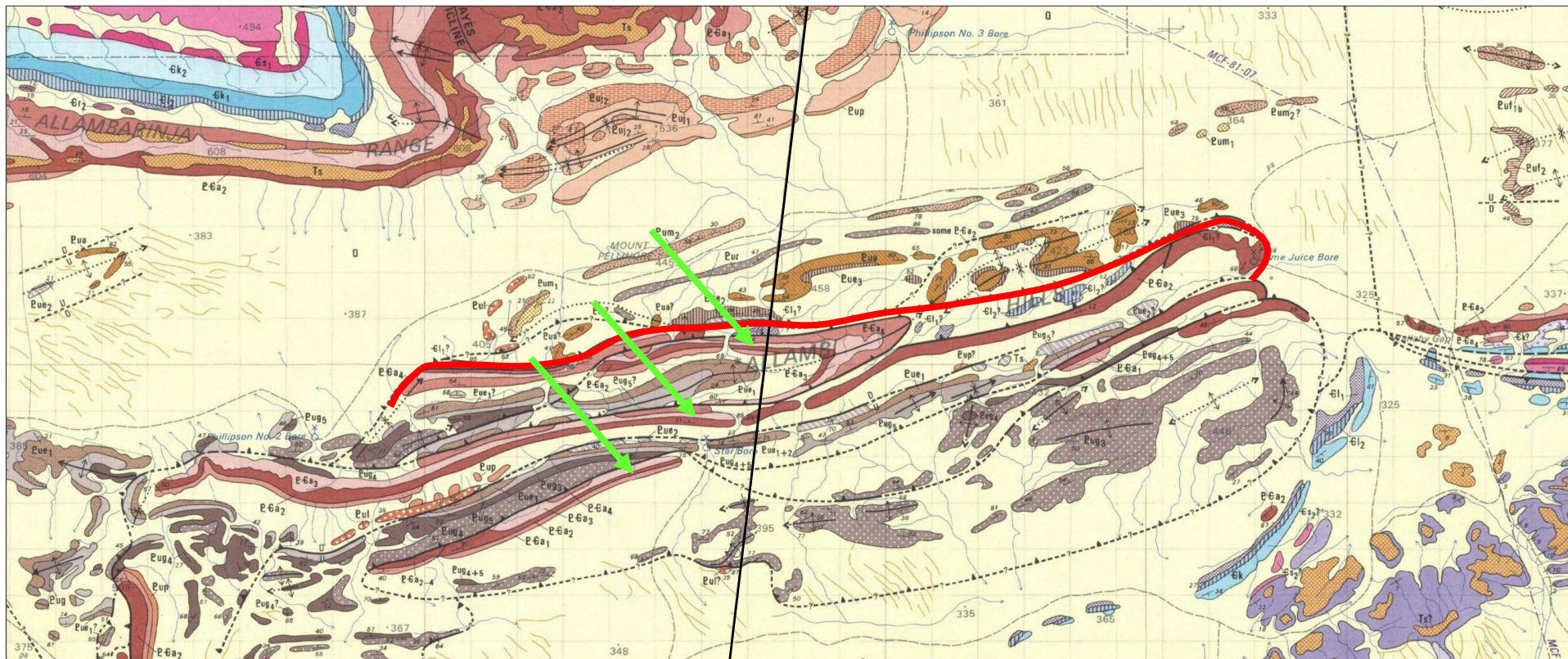


North



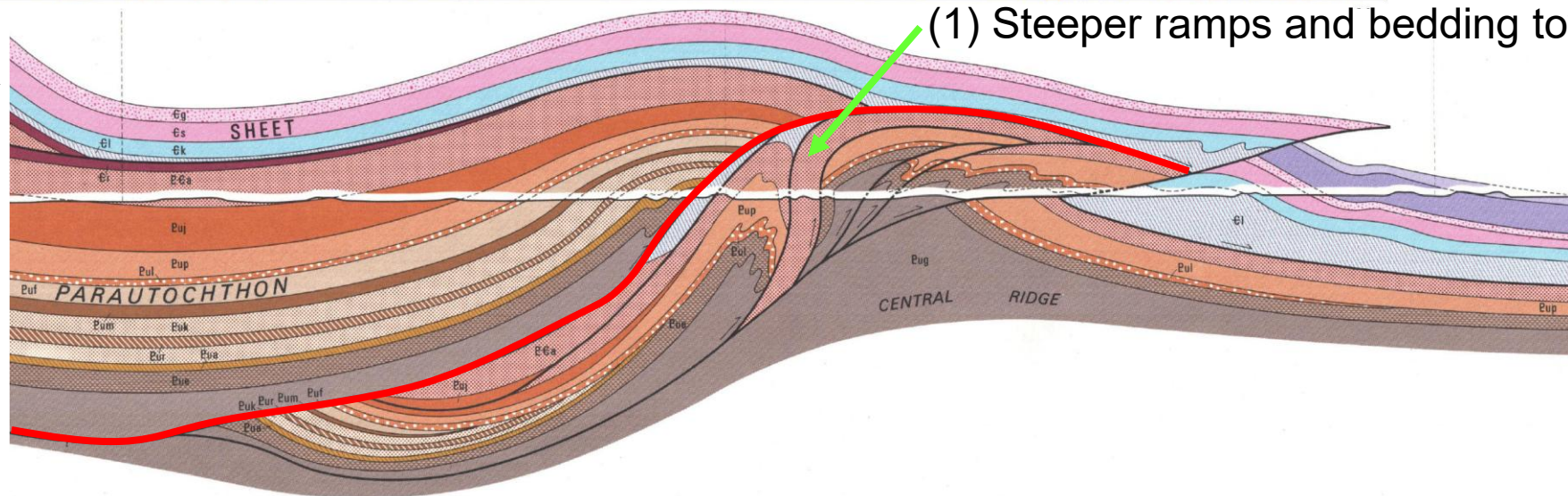
South

Northeastern Amadeus Basin 1:100 000



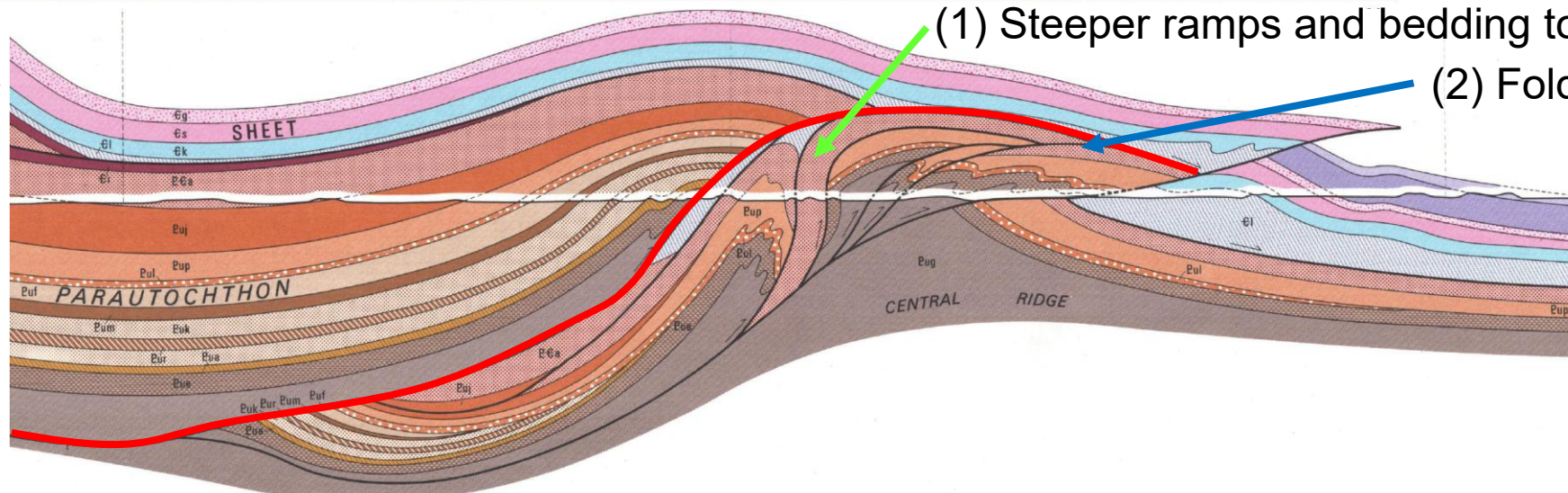
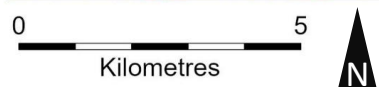
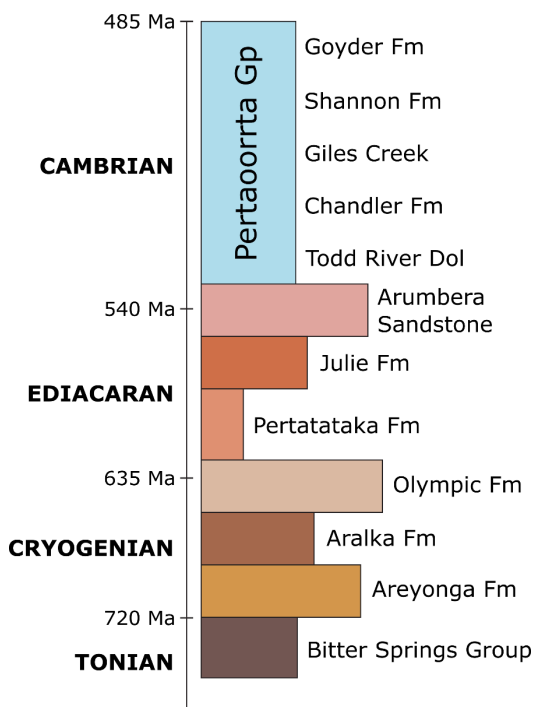
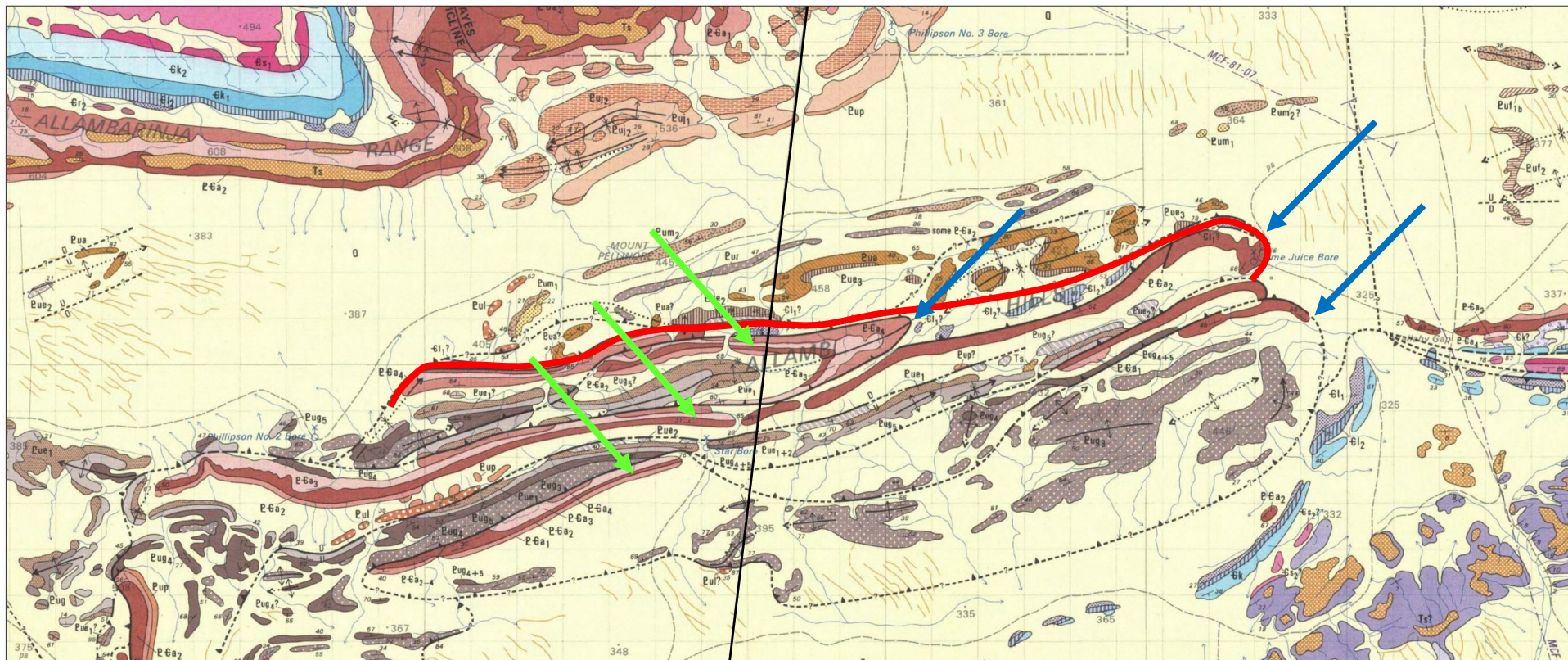
(1) Steeper ramps and bedding towards hinterland?

North



South

Northeastern Amadeus Basin 1:100 000



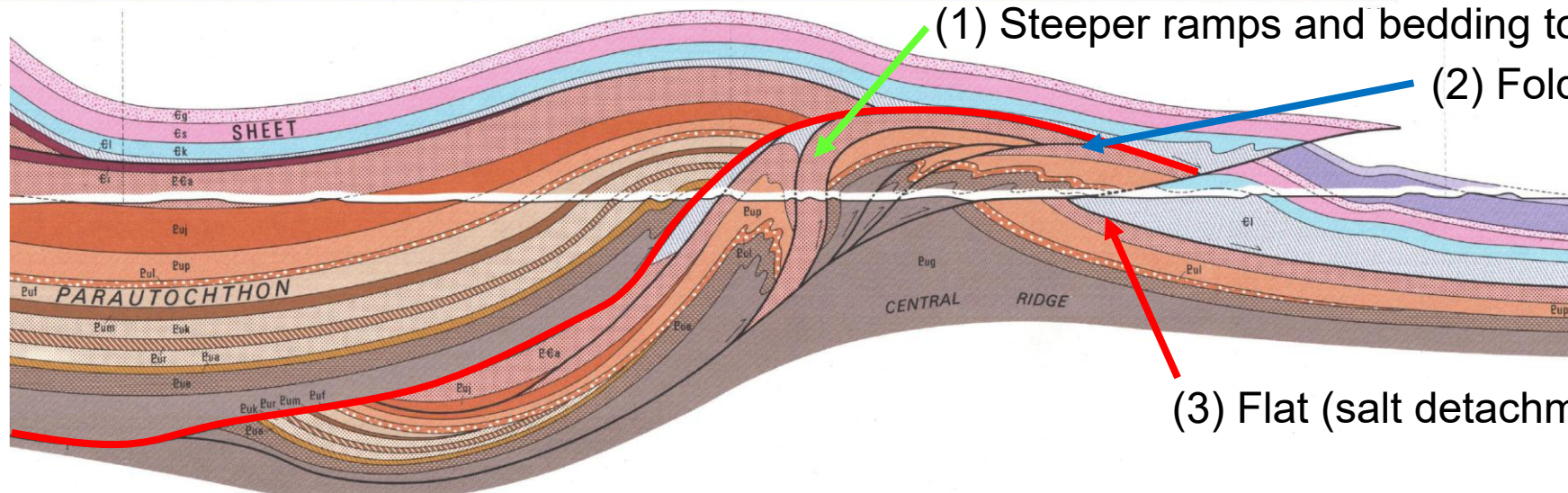
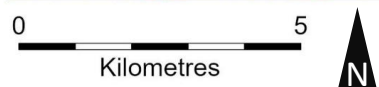
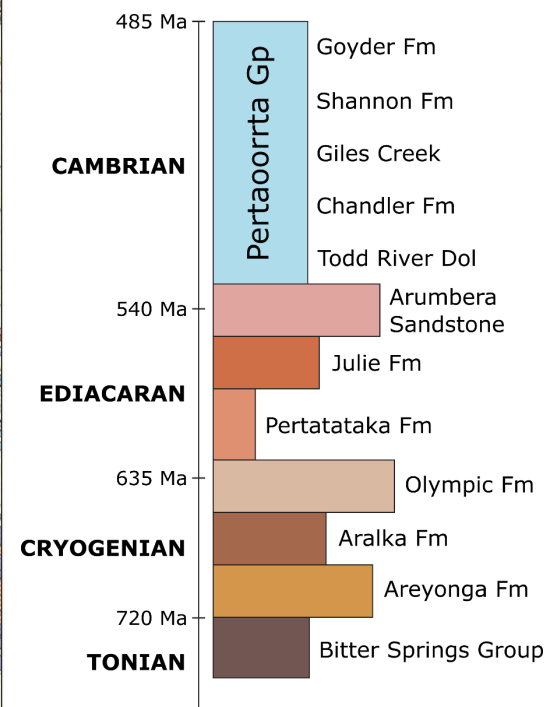
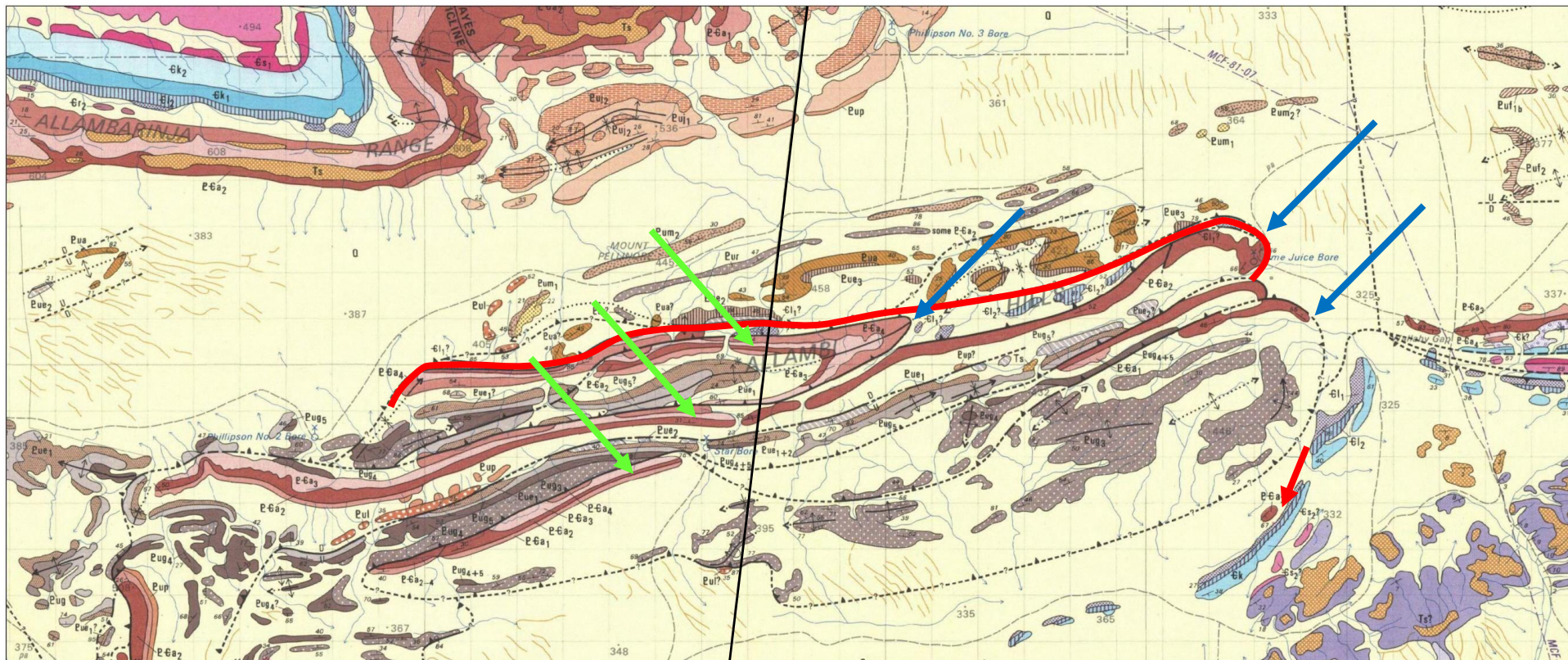
(1) Steeper ramps and bedding towards hinterland?

(2) Folded horse thrusts?

North

South

Northeastern Amadeus Basin 1:100 000

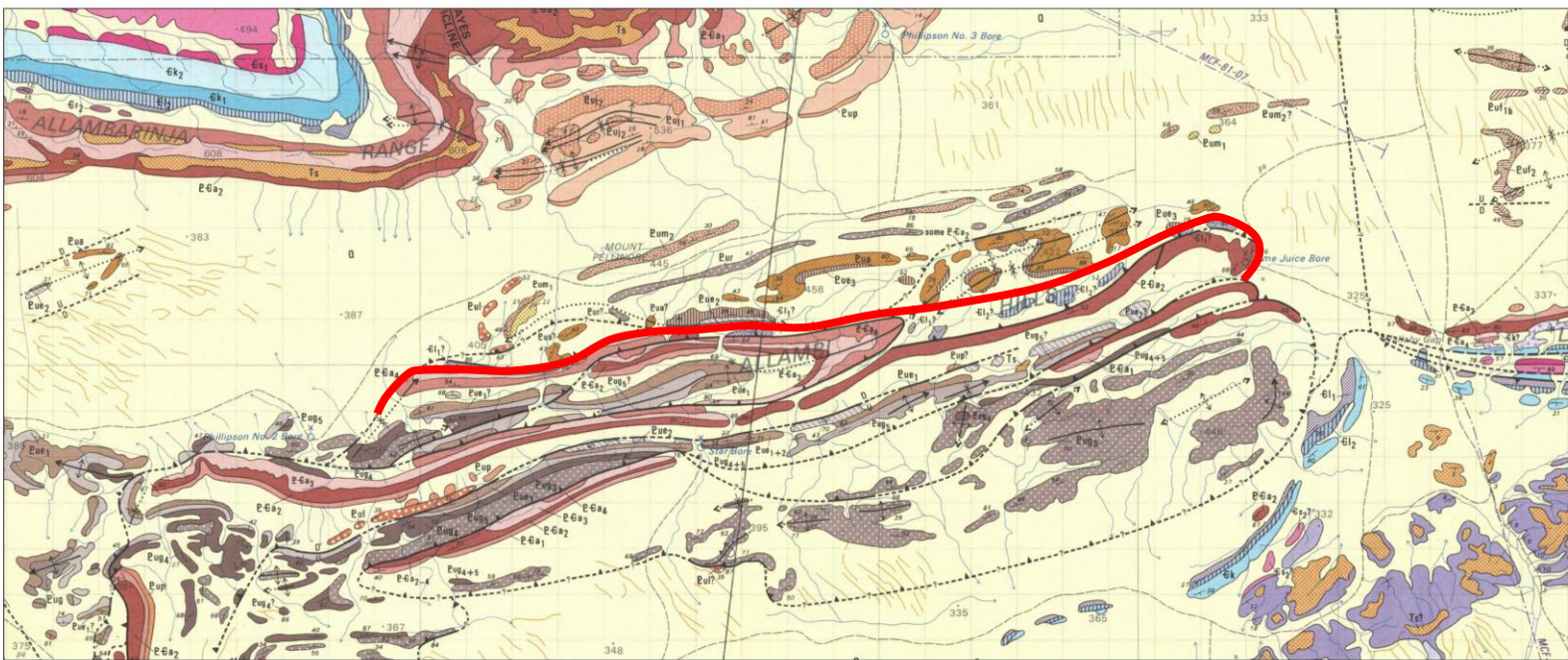


(1) Steeper ramps and bedding towards hinterland?

(2) Folded horse thrusts?

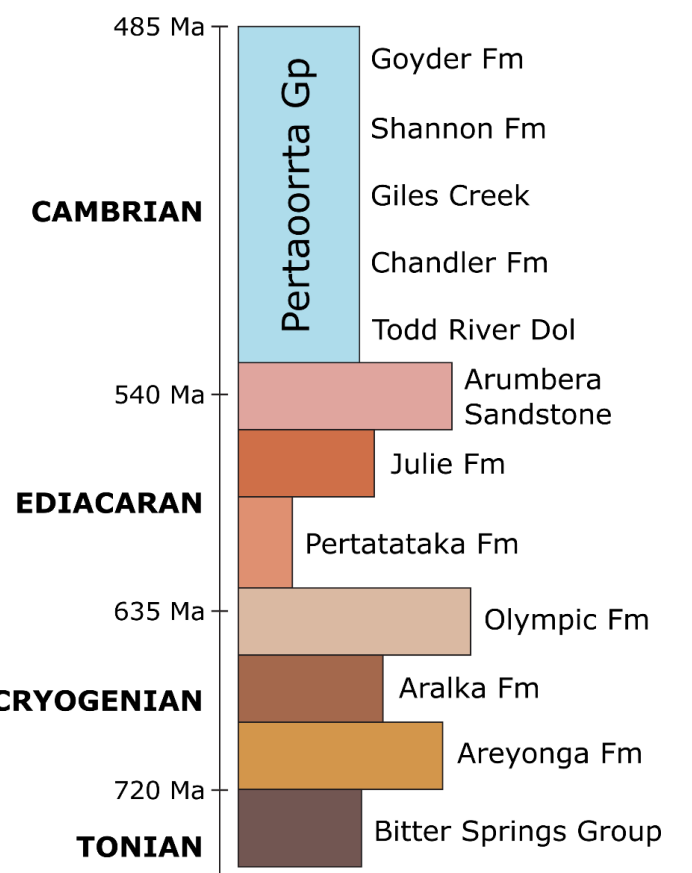
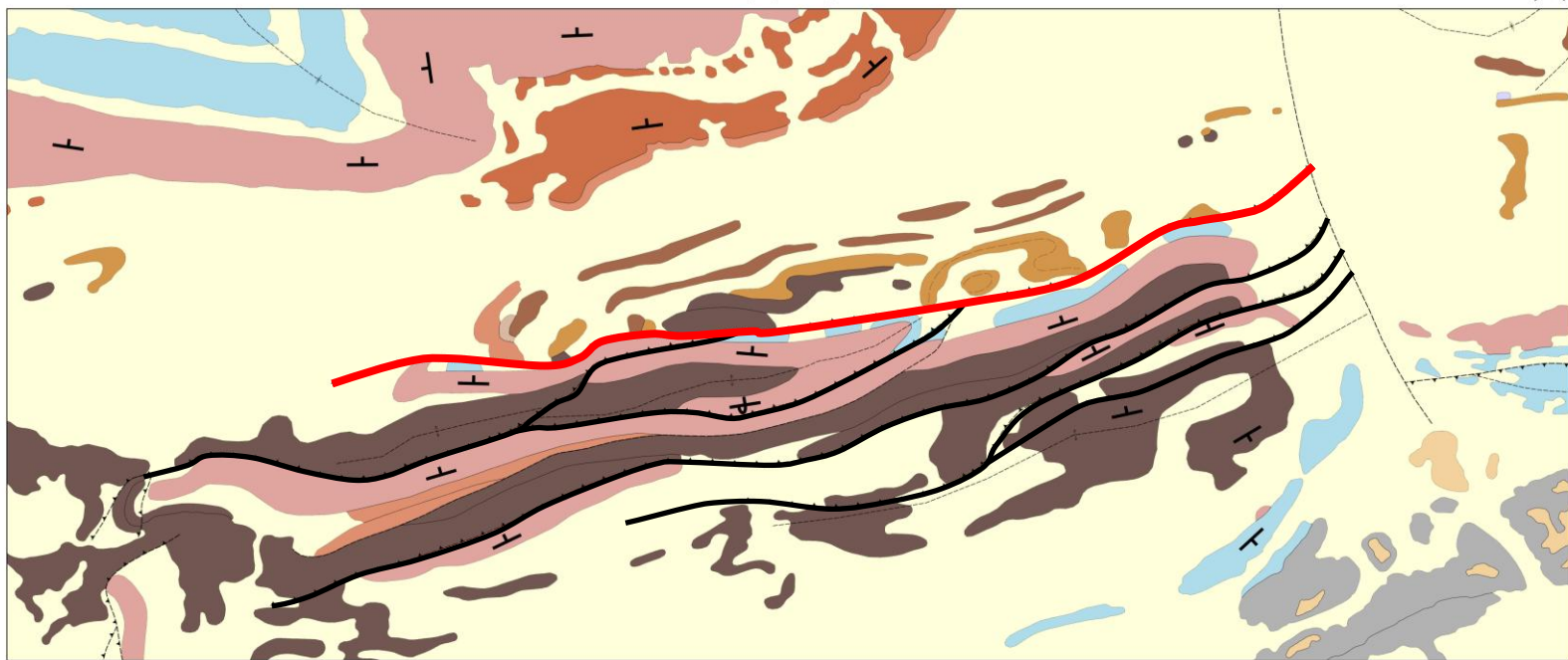
(3) Flat (salt detachment)?

Northeastern Amadeus Basin 1:100 000



0 5
Kilometres

NTGS Mapping 1:250 000



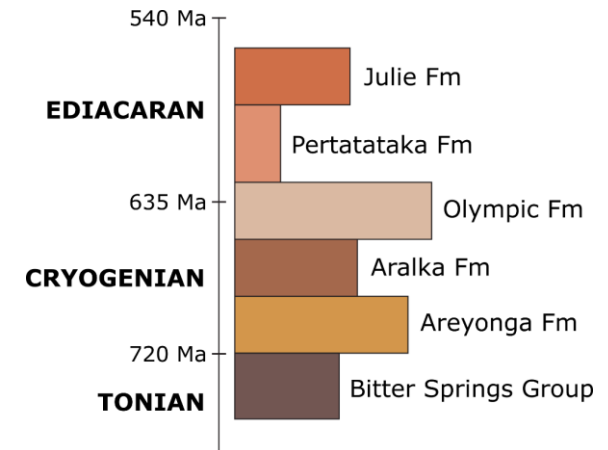
Imbricate Fan Model

North

South

← total length ~70 km →
(height 5.5 km)

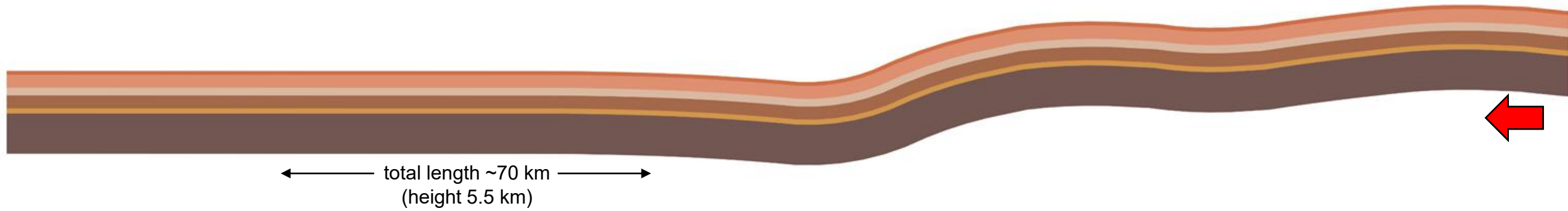
Layer Cake Deposition



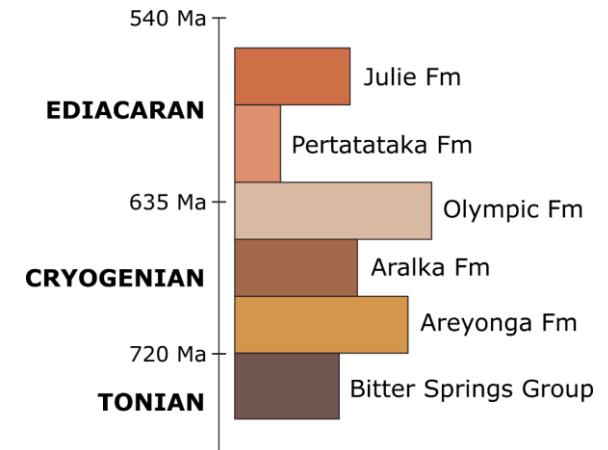
Imbricate Fan Model

North

South



Petermann Orogeny: Uplift



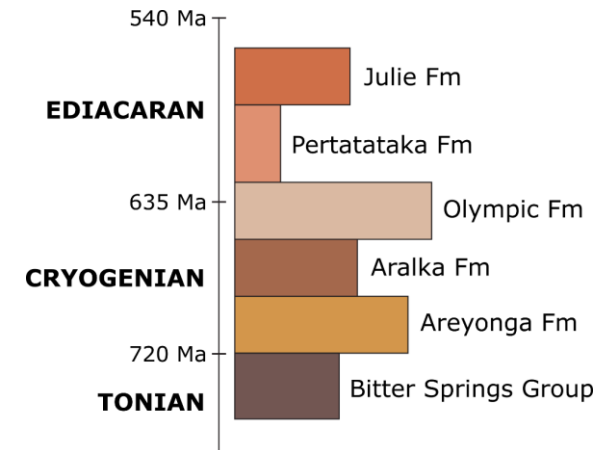
Imbricate Fan Model

North

South

← total length ~70 km →
(height 5.5 km)

Petermann Orogeny: Erosion



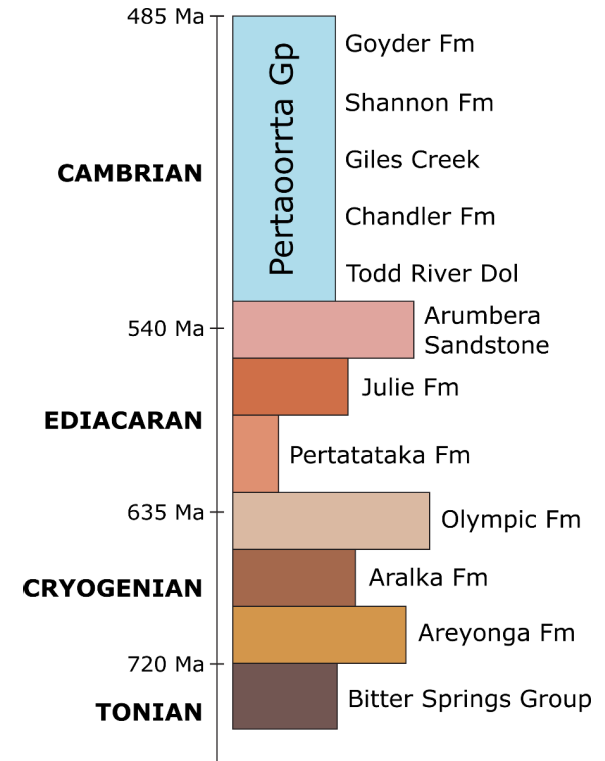
Imbricate Fan Model

North

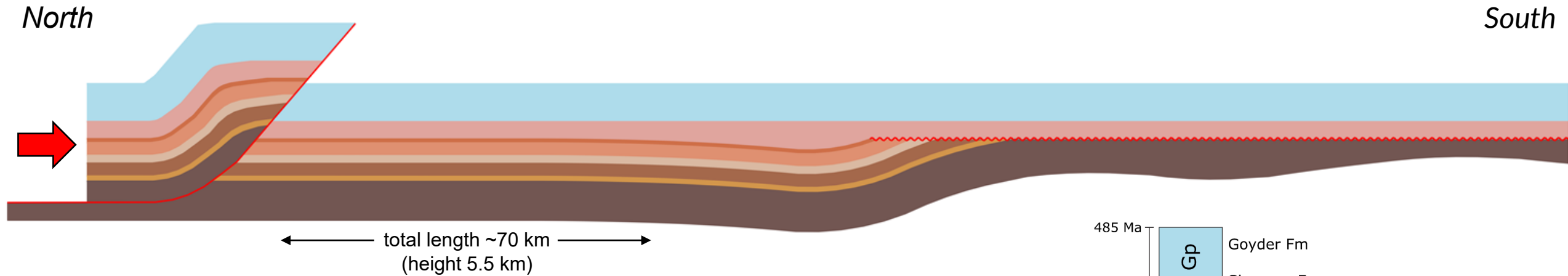
South

total length ~70 km
(height 5.5 km)

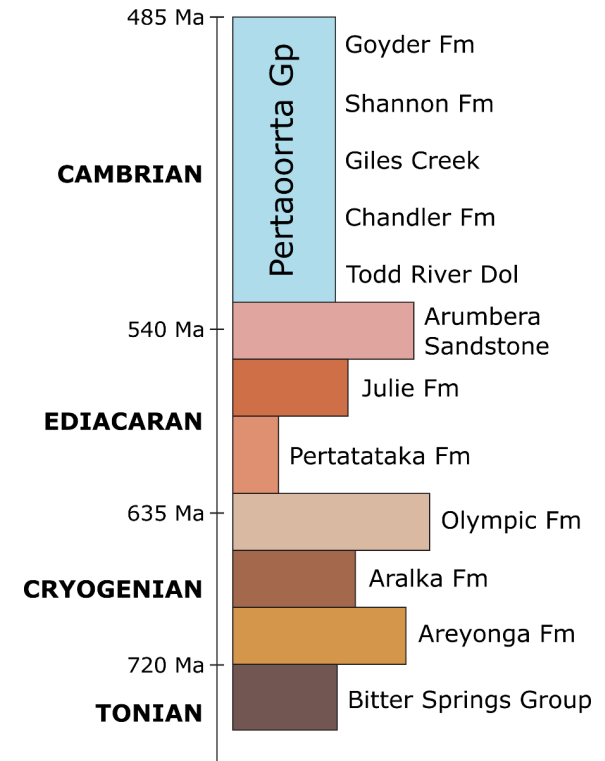
Deposition



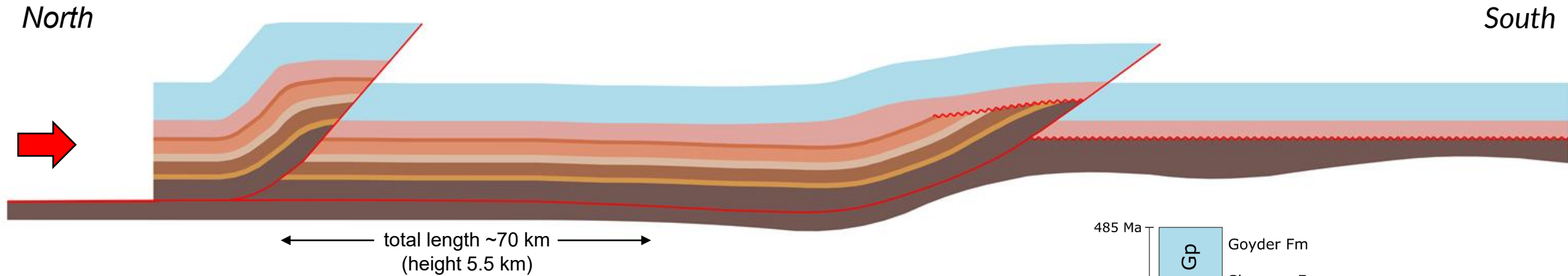
Imbricate Fan Model



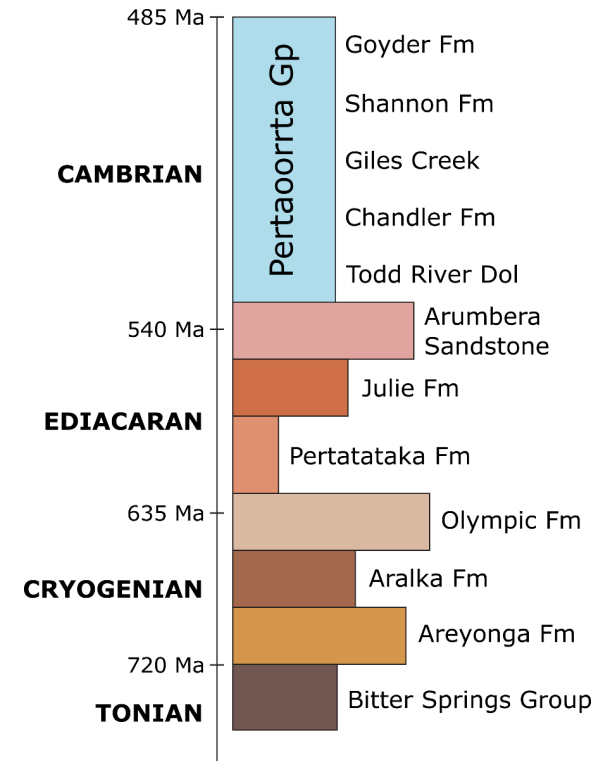
Alice Springs Orogeny: Thrust 1



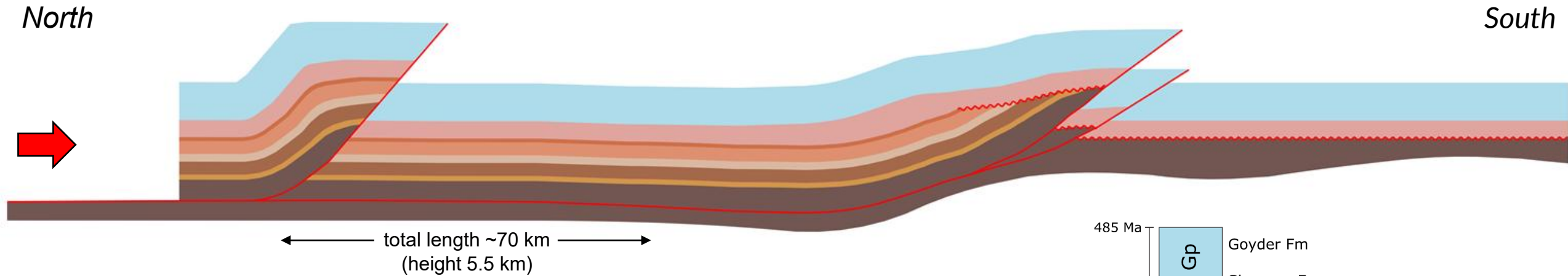
Imbricate Fan Model



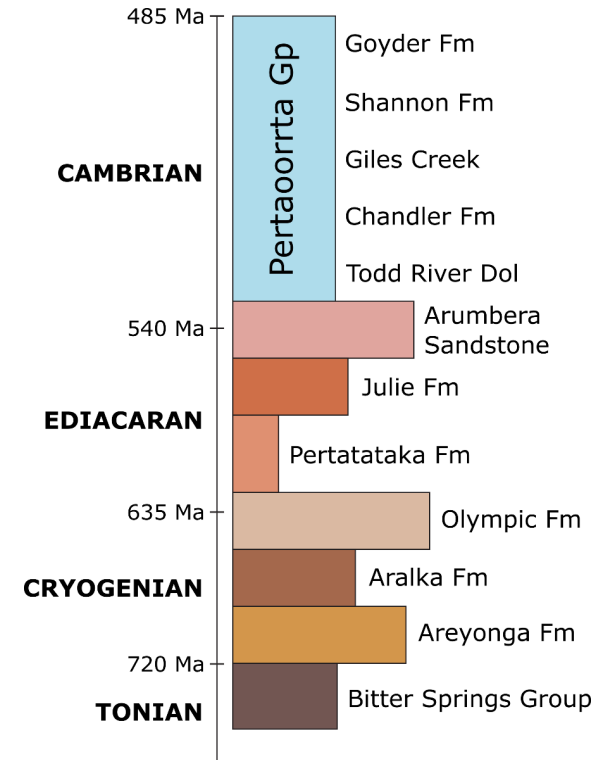
Alice Springs Orogeny: Thrust 2



Imbricate Fan Model



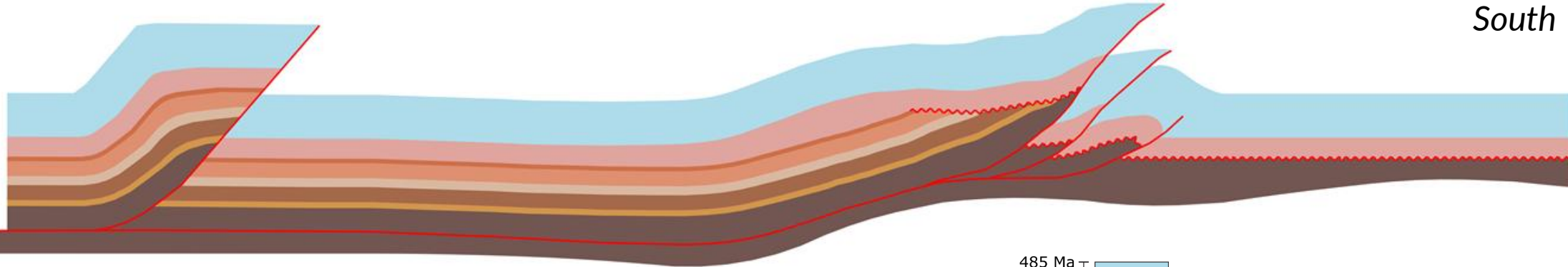
**Alice Springs Orogeny: Thrust 3
(imbricate fan)**



Imbricate Fan Model

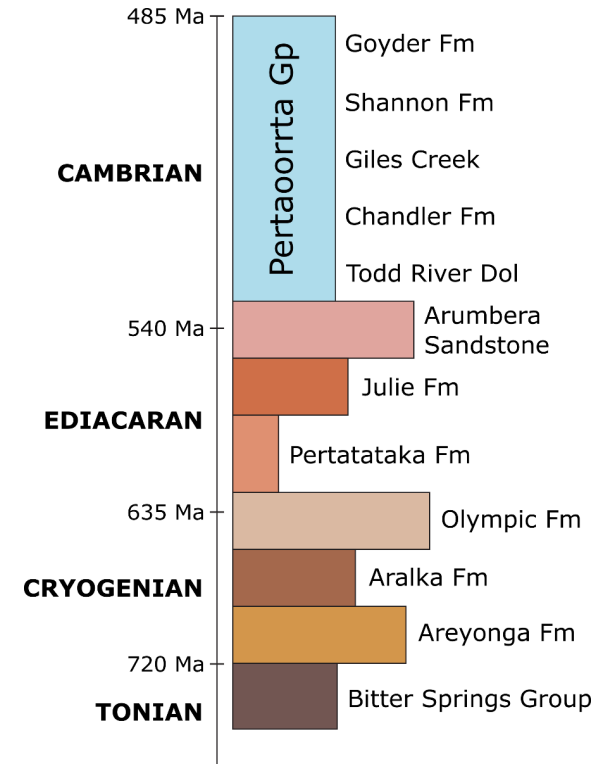
North

South



total length ~70 km
(height 5.5 km)

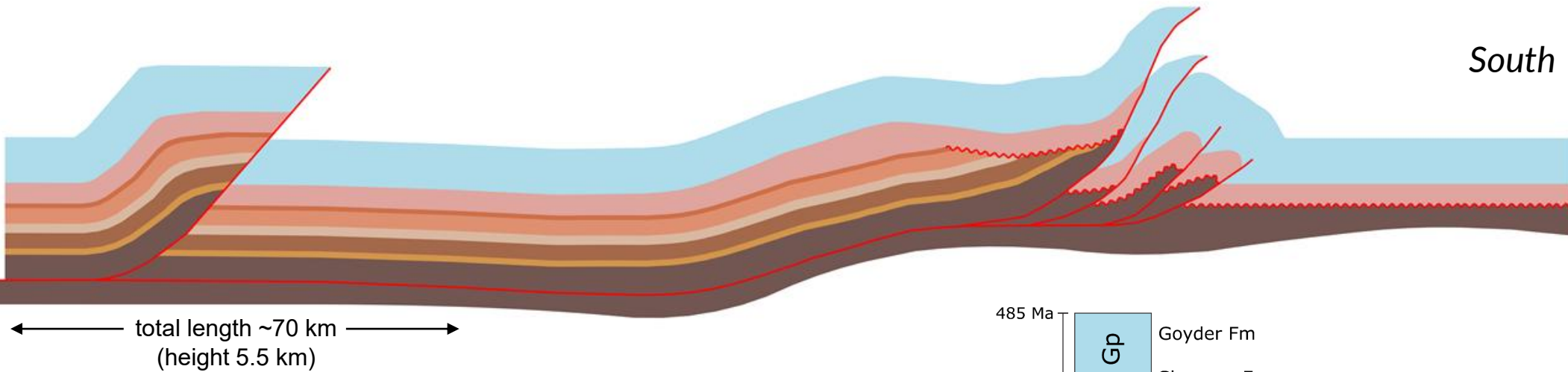
**Alice Springs Orogeny: Thrust 4
(imbricate fan)**



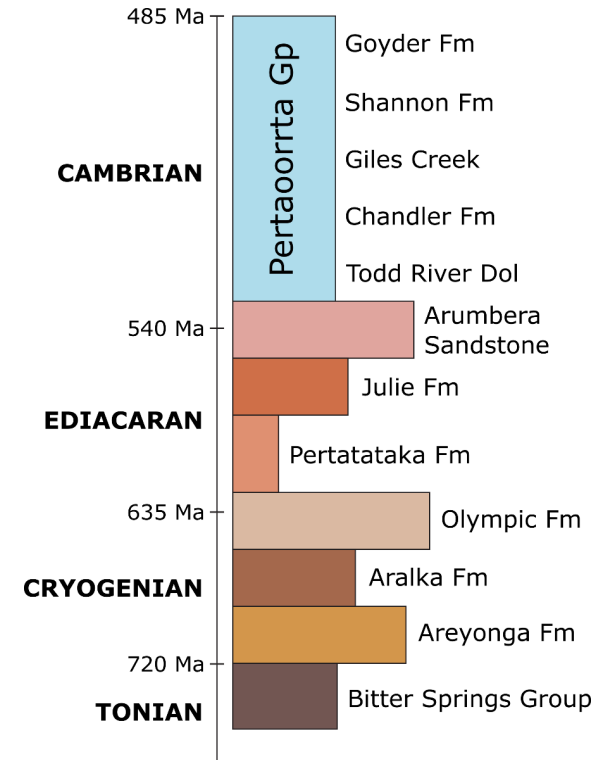
Imbricate Fan Model

North

South



Alice Springs Orogeny: Thrust 5
(imbricate fan)



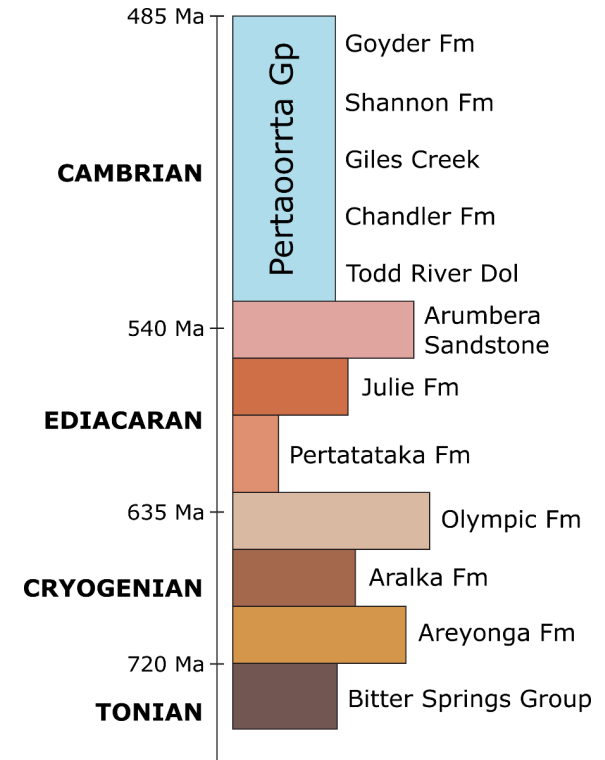
Imbricate Fan Model

North

South

total length ~70 km
(height 5.5 km)

**Alice Springs Orogeny: Thrust 6
(imbricate fan)**



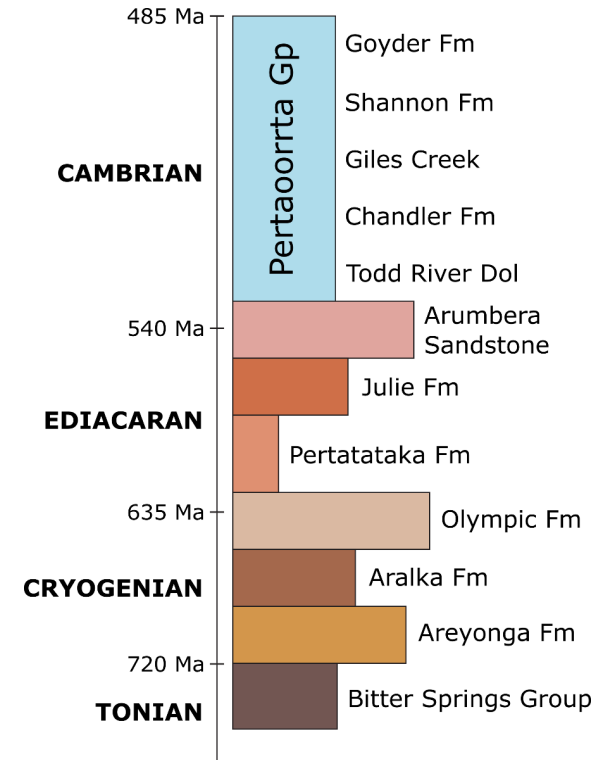
Imbricate Fan Model

North

South

total length ~70 km
(height 5.5 km)

Alice Springs Orogeny: Fold

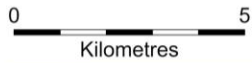


Imbricate Fan Model

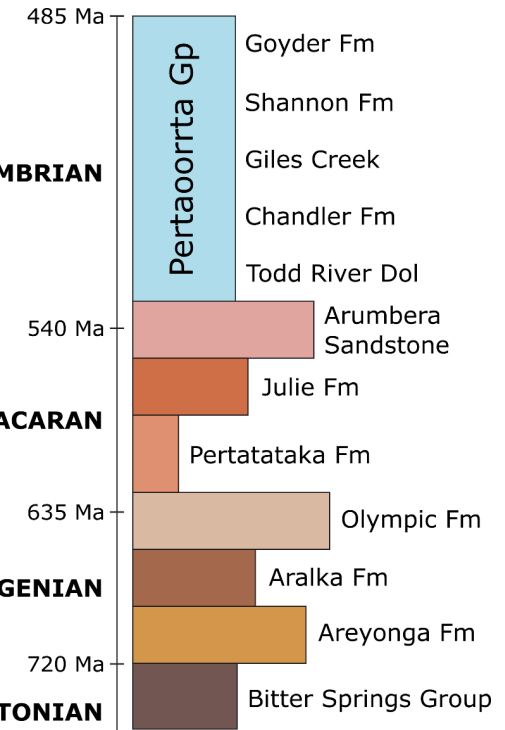
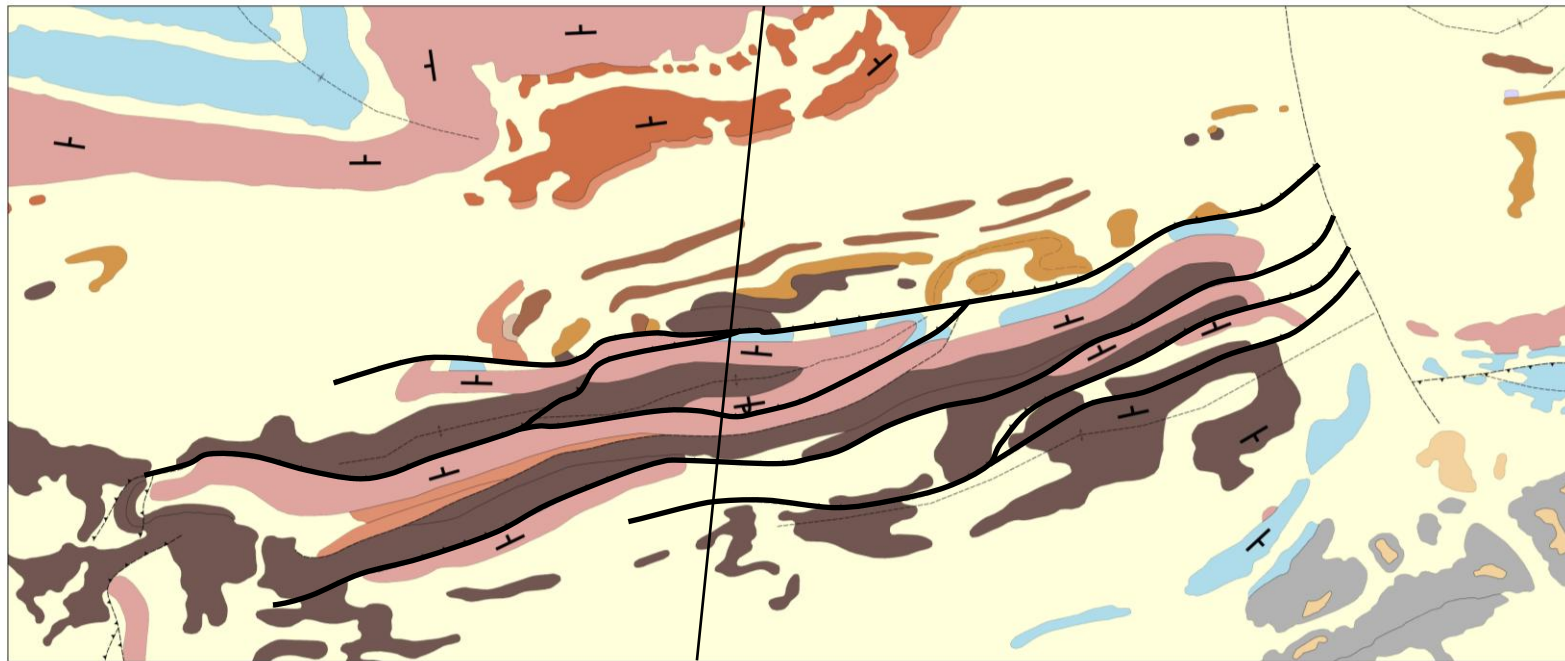
North

South

Topography



NTGS Mapping 1:250 000



Imbricate Fan Model

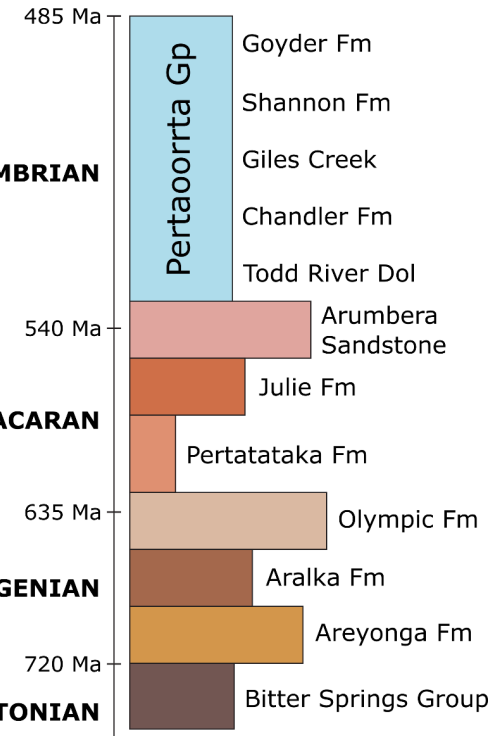
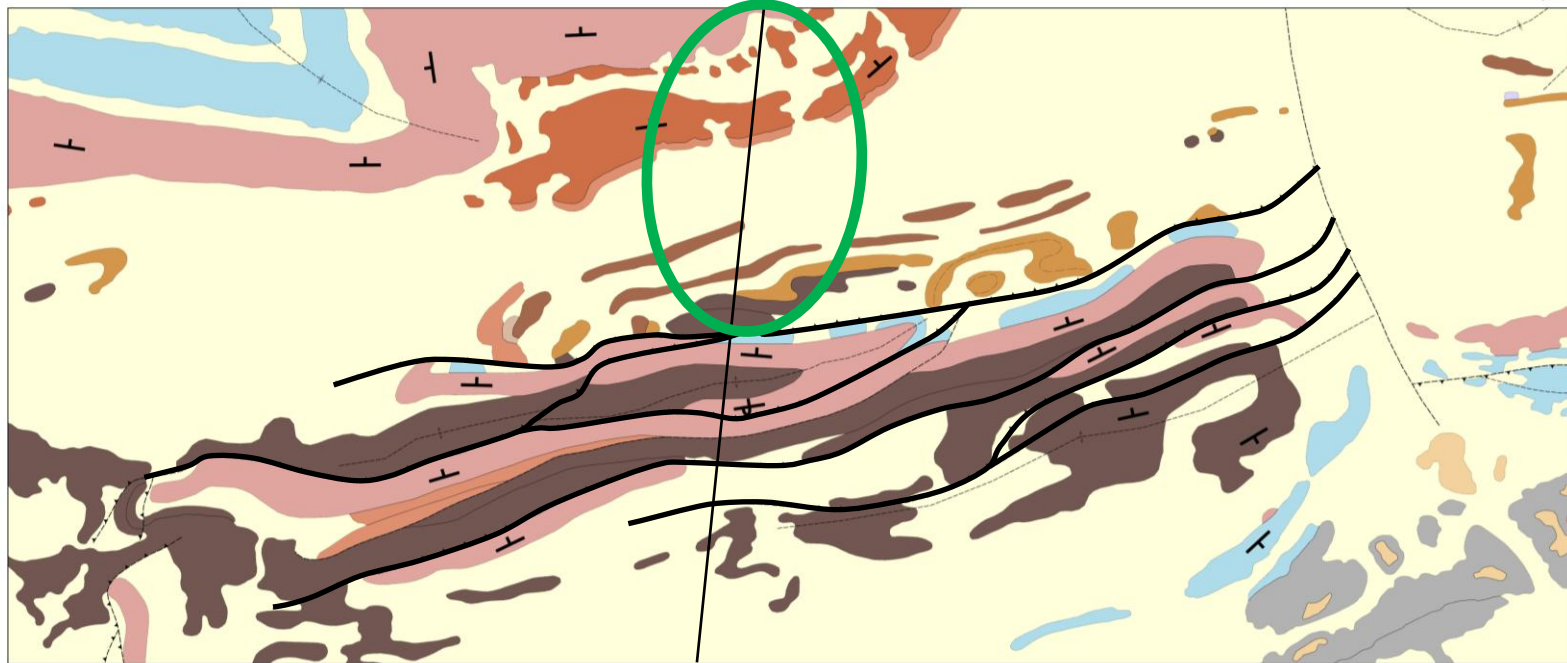
North

South

Topography

0 5
Kilometres

NTGS Mapping 1:250 000

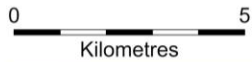


Imbricate Fan Model

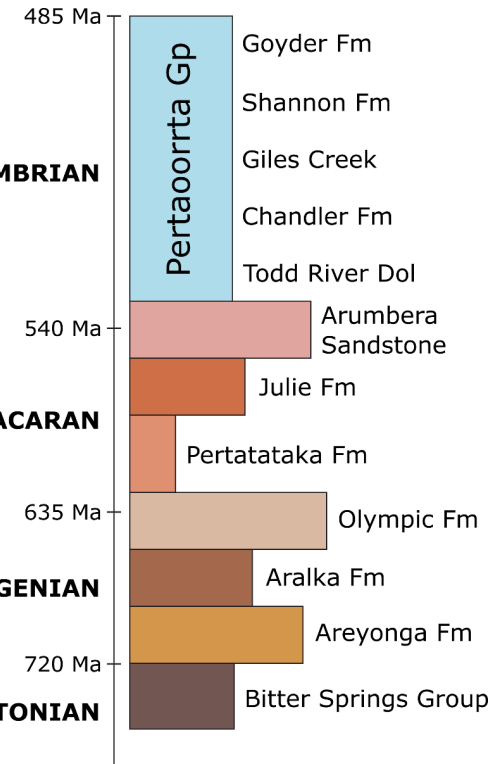
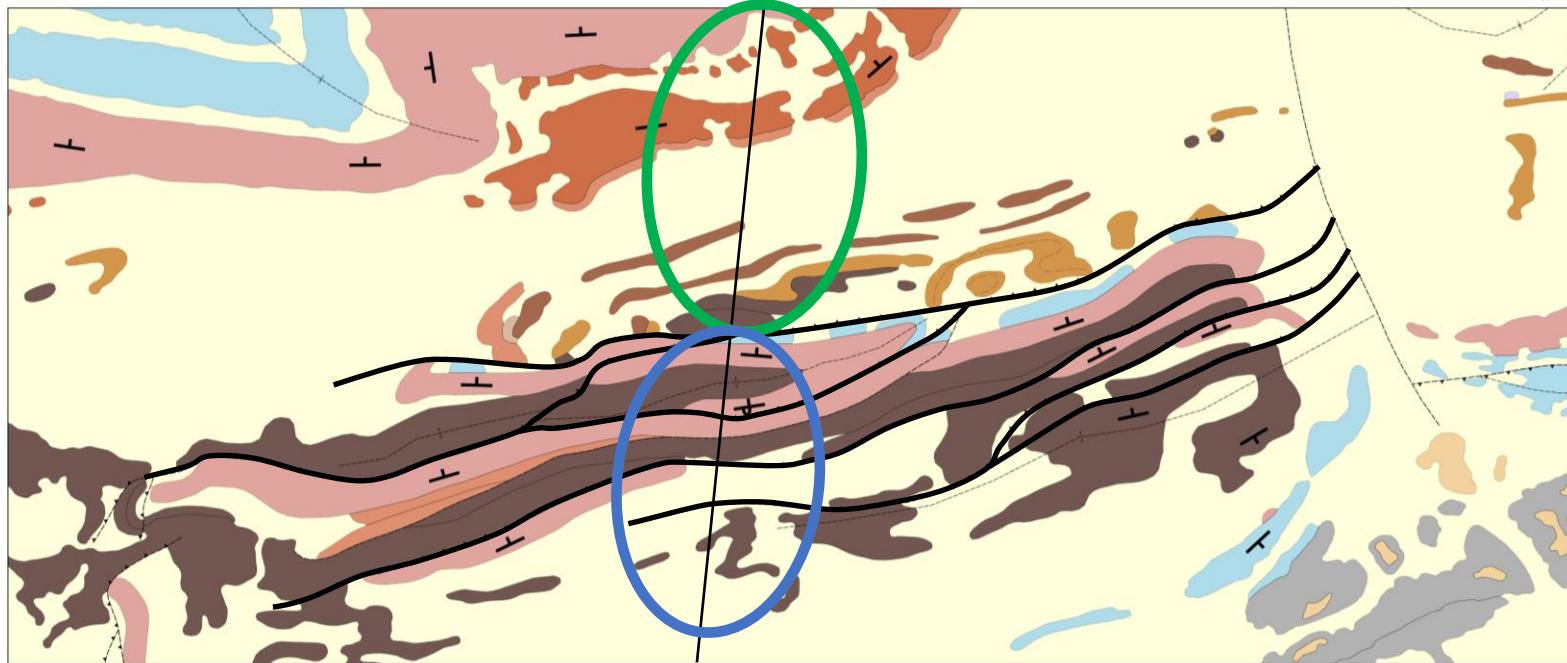
North

South

Topography



NTGS Mapping 1:250 000



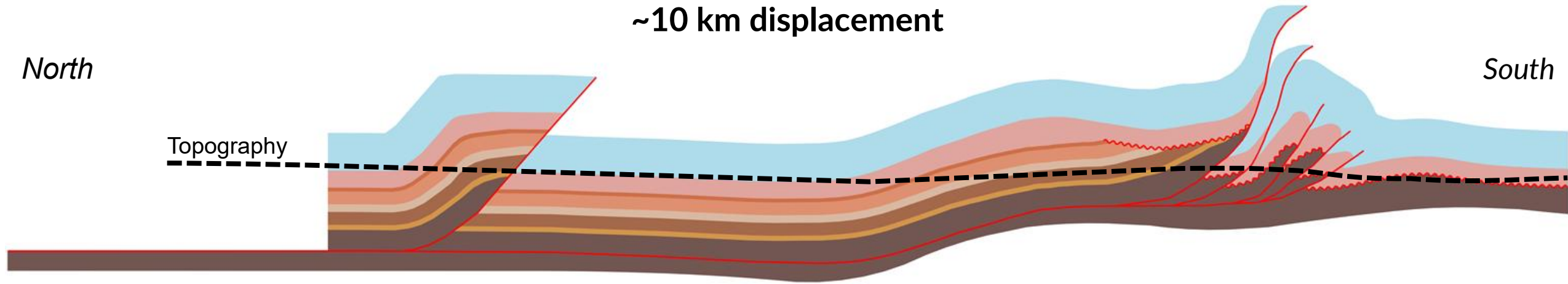
Imbricate Fan Model

~10 km displacement

North

South

Topography

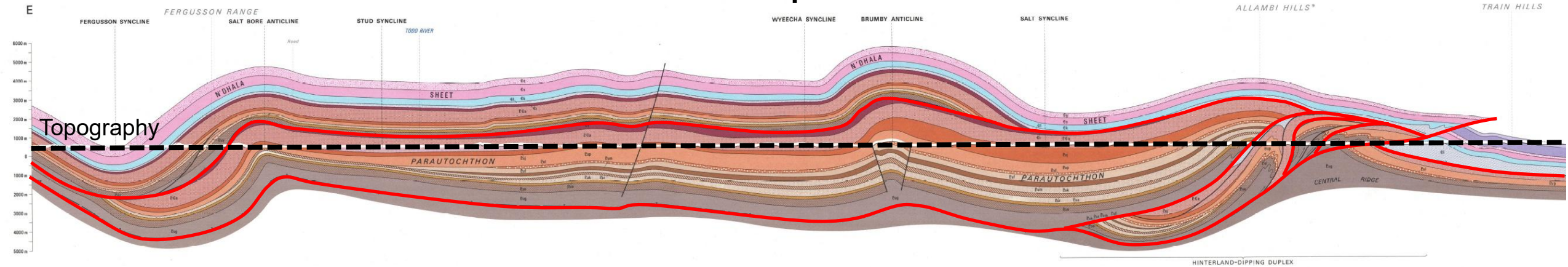


Megathrust & Duplex Model

~60 km displacement

E

Topography



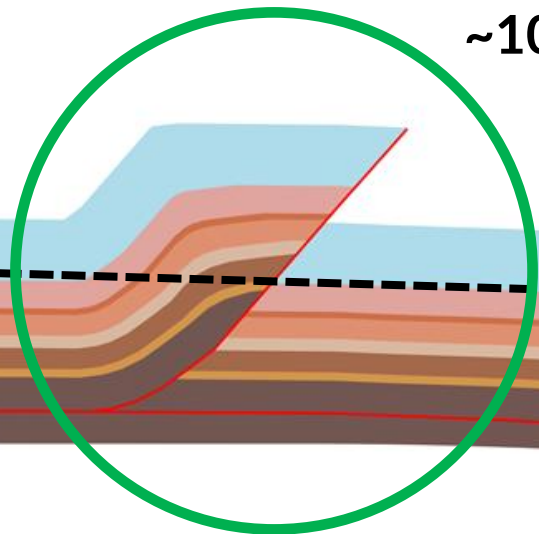
Imbricate Fan Model

~10 km displacement

North

South

Topography

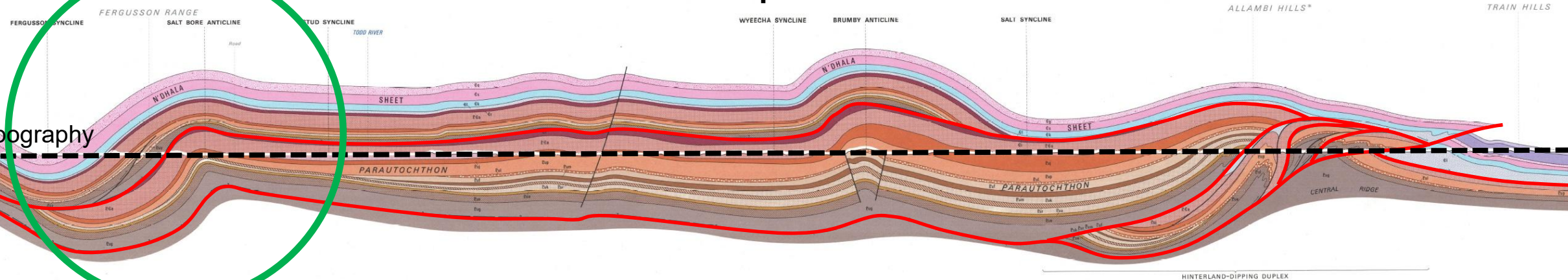


Megathrust & Duplex Model

~60 km displacement

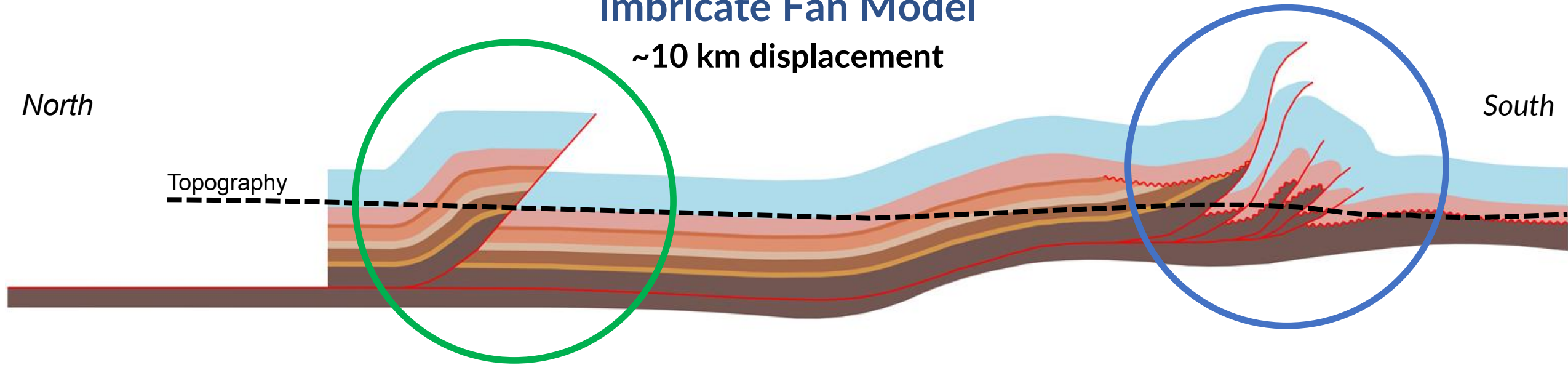
E

Topography



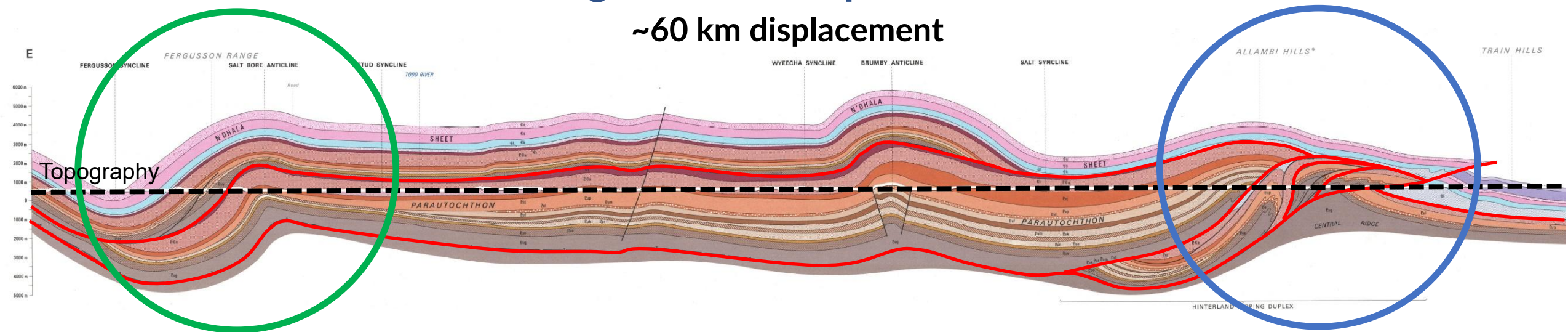
Imbricate Fan Model

~10 km displacement



Megathrust & Duplex Model

~60 km displacement



- **NTGS fieldwork carried out in 2023–2025 find no support for megathrusts.**
- **Propose imbricate thrust system.**
- **Two models predict different structural architecture of the NE Amadeus Basin.**

