Fluvial reservoirs in dryland endorheic basins: the Lake Eyre basin as a world class modern analogue

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ASP

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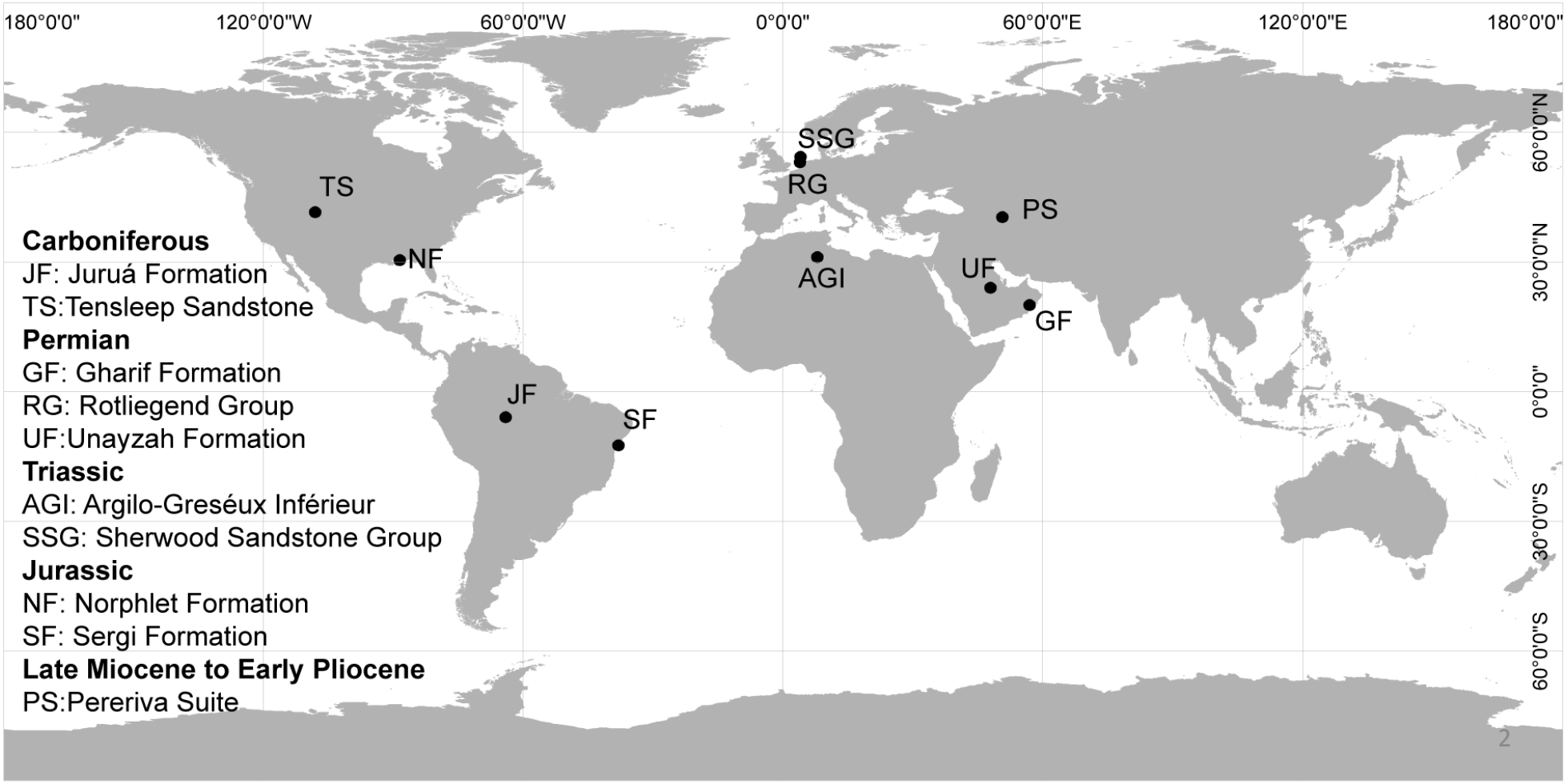
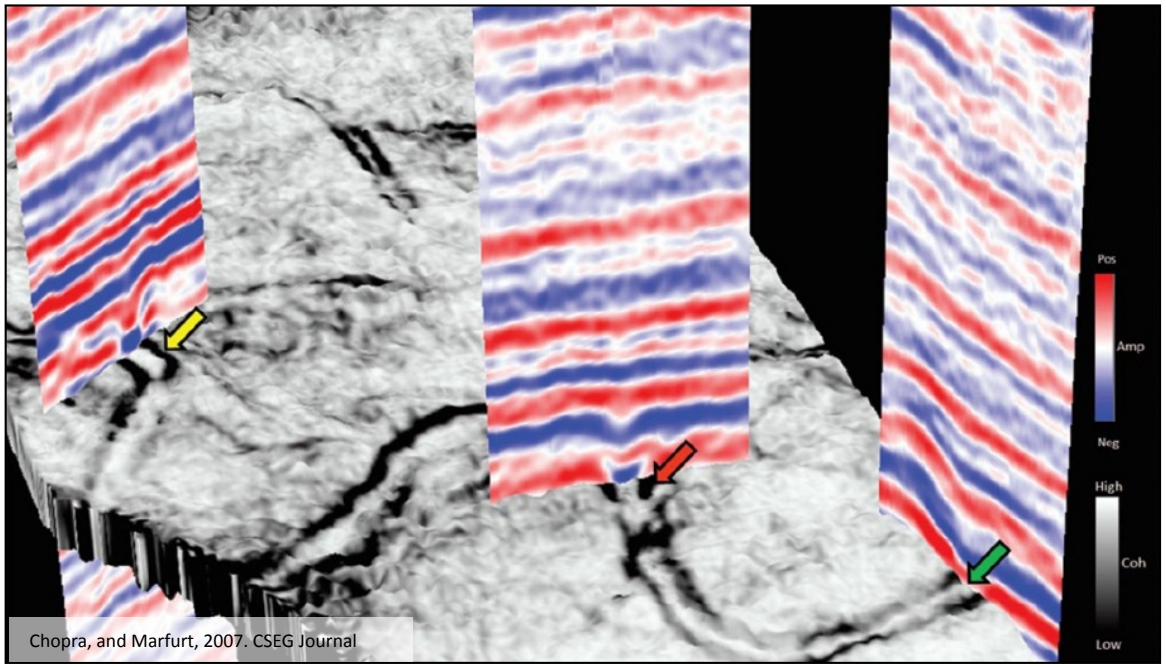
Lake Eyre Basin Analogues Research Group

Global reservoirs containing dryland fluvial sequences



Why modern analogues?

- Hard data is limited, obtaining quality three-dimensional interpretation of subsurface data is challenging, channels may be below seismic resolution.



Chopra, and Marfurt, 2007. CSEG Journal

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- Quantitative estimates of grain size distribution and channel geometries needed to determine reservoir volume and producibility.

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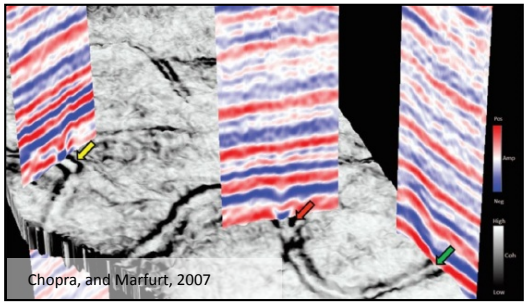
- **Modern analogues: an opportunity to observe lateral changes in deposit geometry and grain size along the same temporal surface.**



Project Aim and Objectives

Aim: Add to the analogue database for hydrocarbon reservoirs in dryland fluvial settings through investigation of a previously unstudied river.

Objectives:

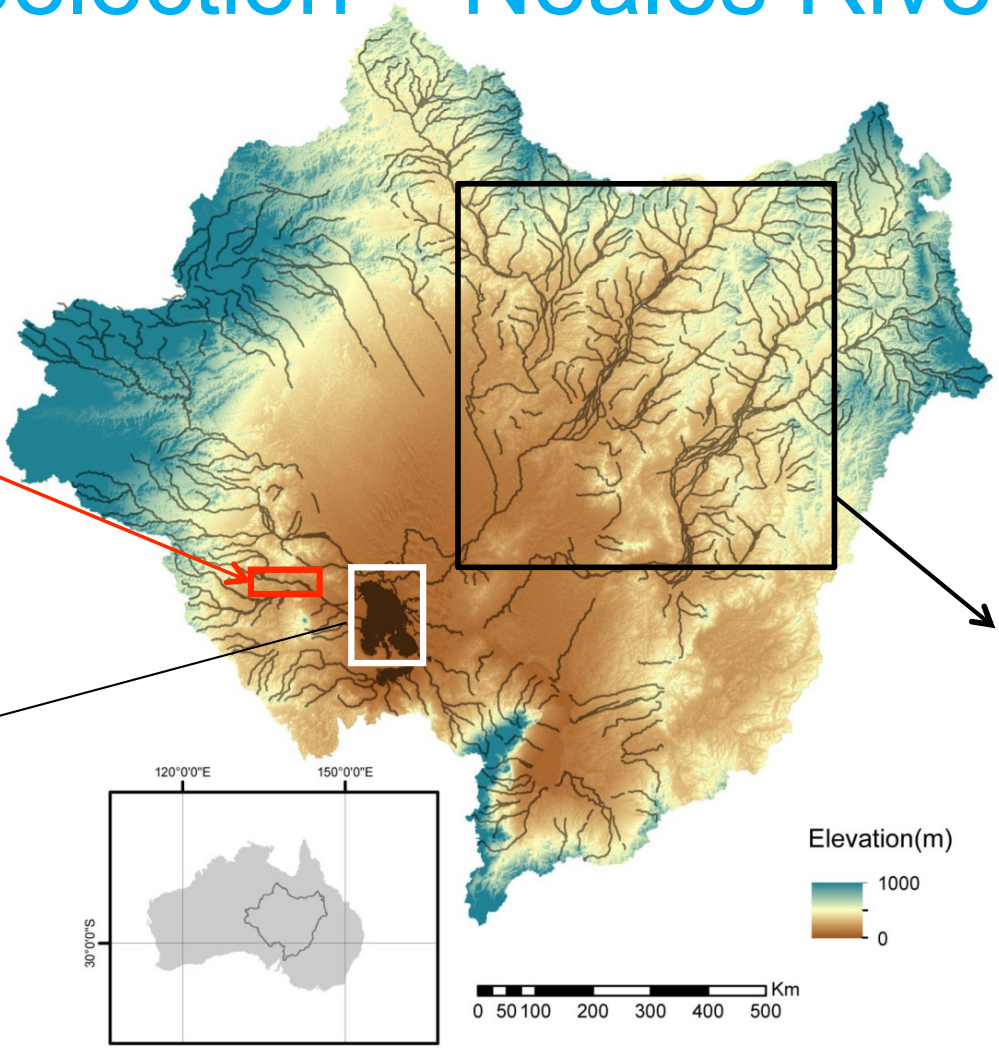
1. Provide an improved global channel geometry dataset from:

- Published datasets from modern drylands
- Published ancient counterparts
- Data collected under this study

2. Determine a process-based model for the study site, based upon topographic and sedimentology survey data.

Site Selection – Neales River

This study



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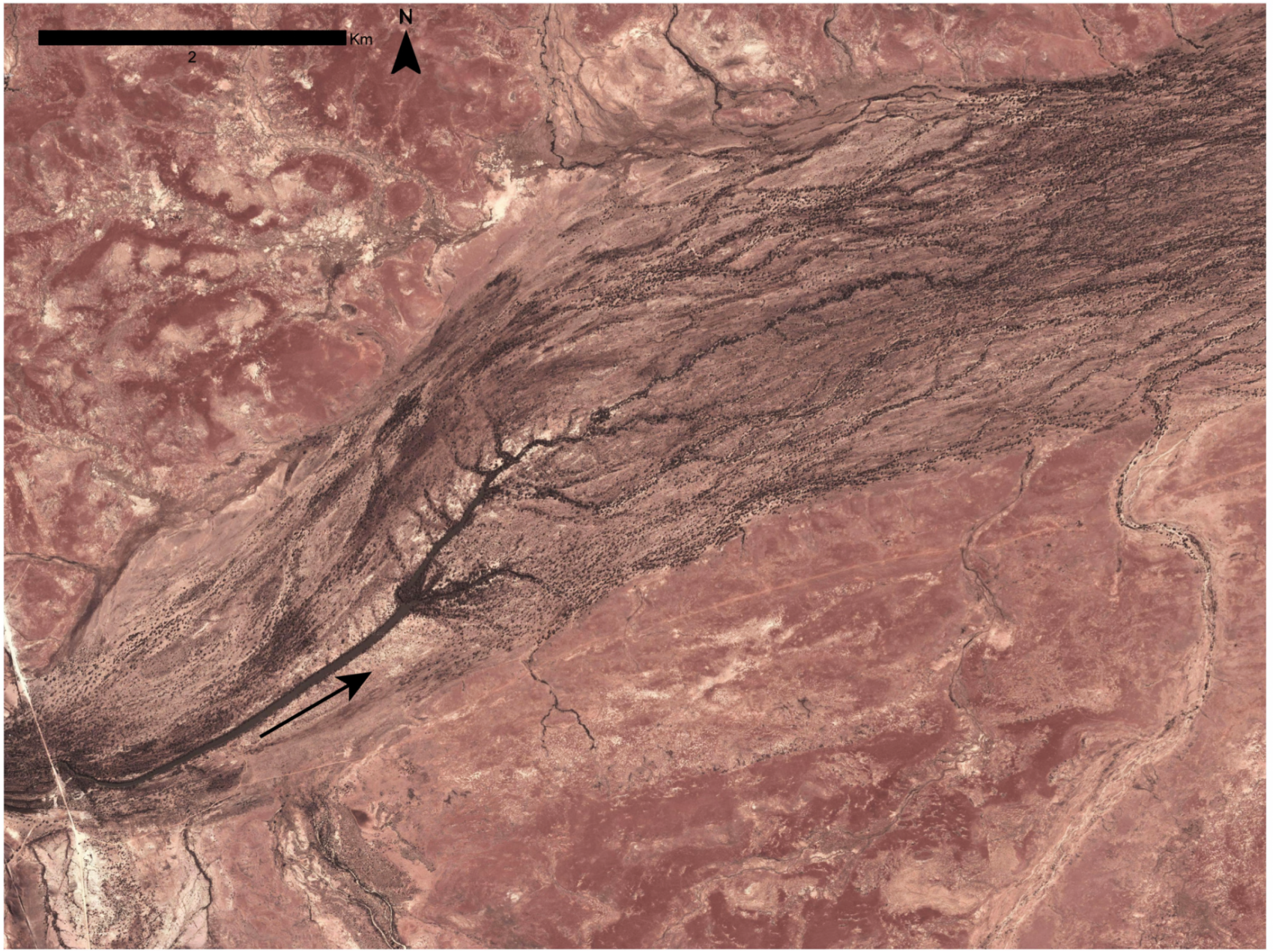
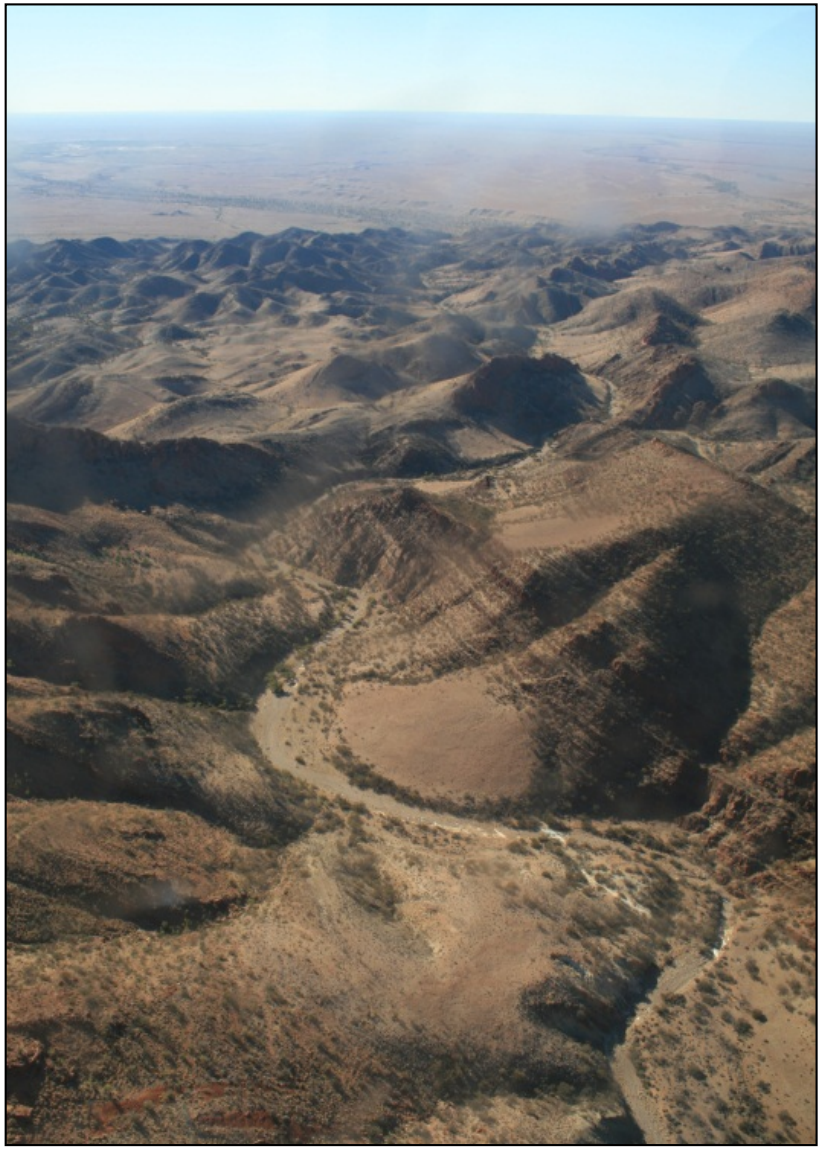
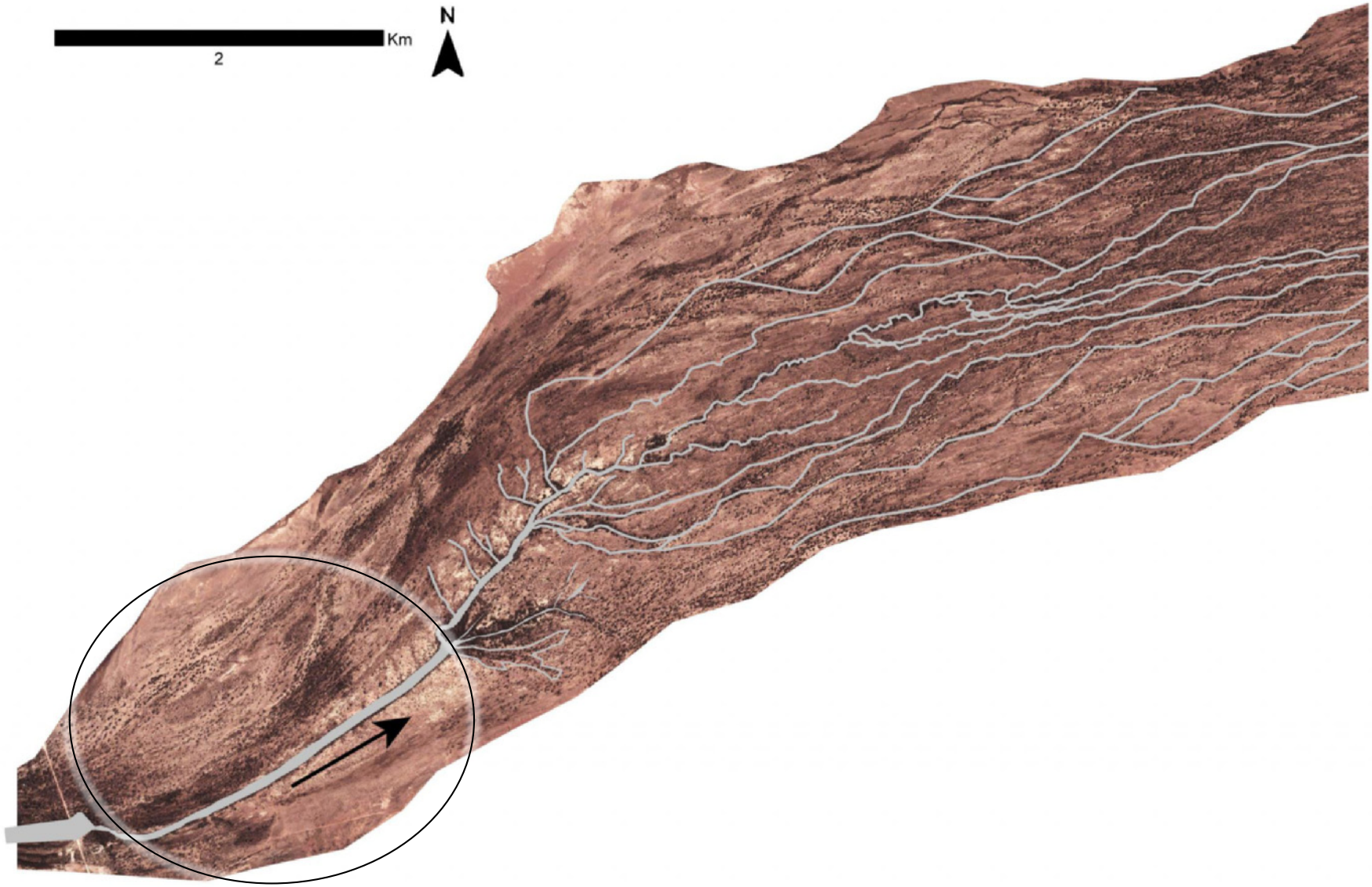
- Fluvial sedimentology to west of Lake Eyre relatively unstudied
- Upstream of previously studied TSCs
- Eastern rivers (Channel Country) have similar geomorphologies but different controls (geology, climate, slope)


N
2
Km

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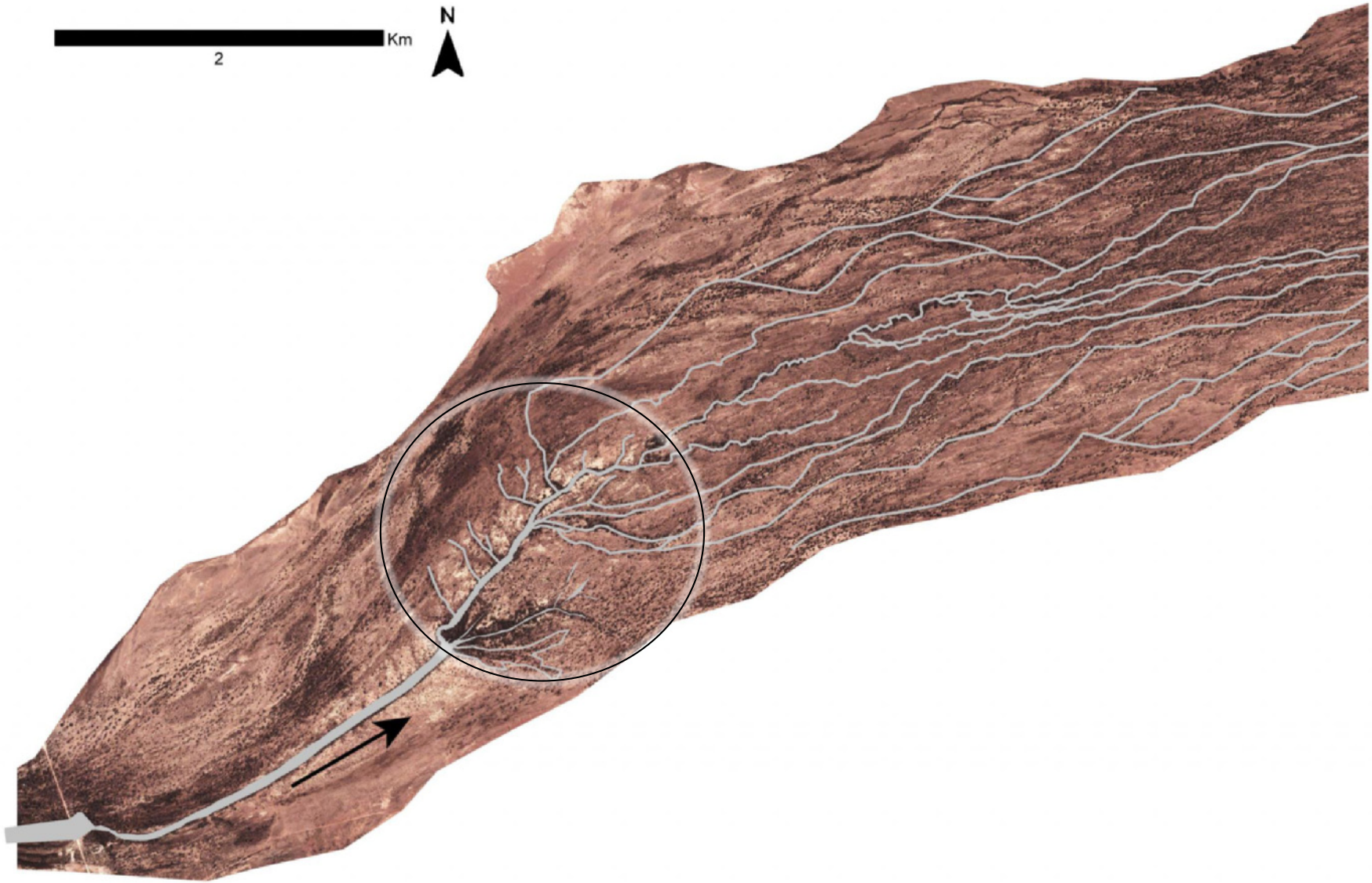
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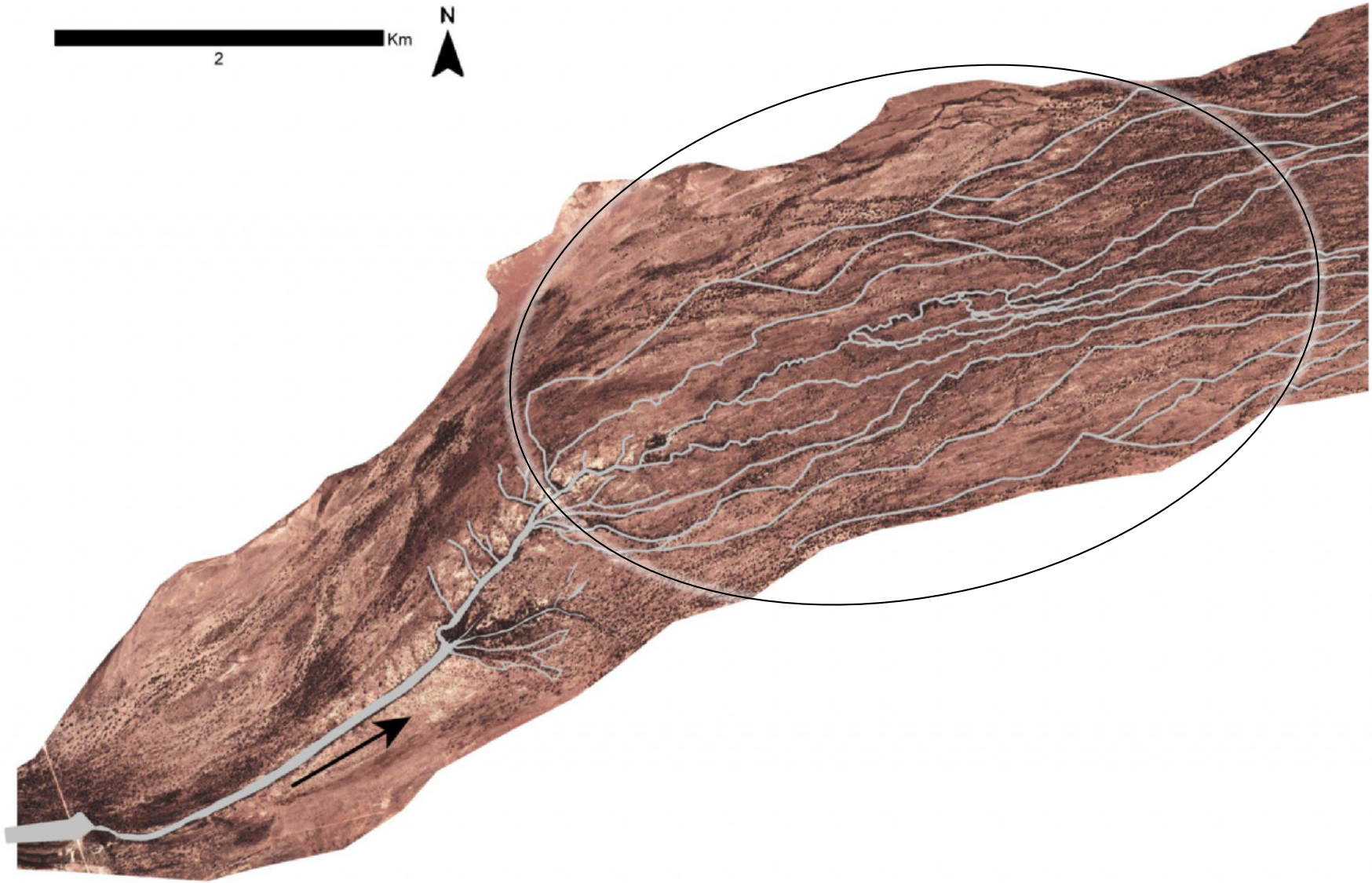
N
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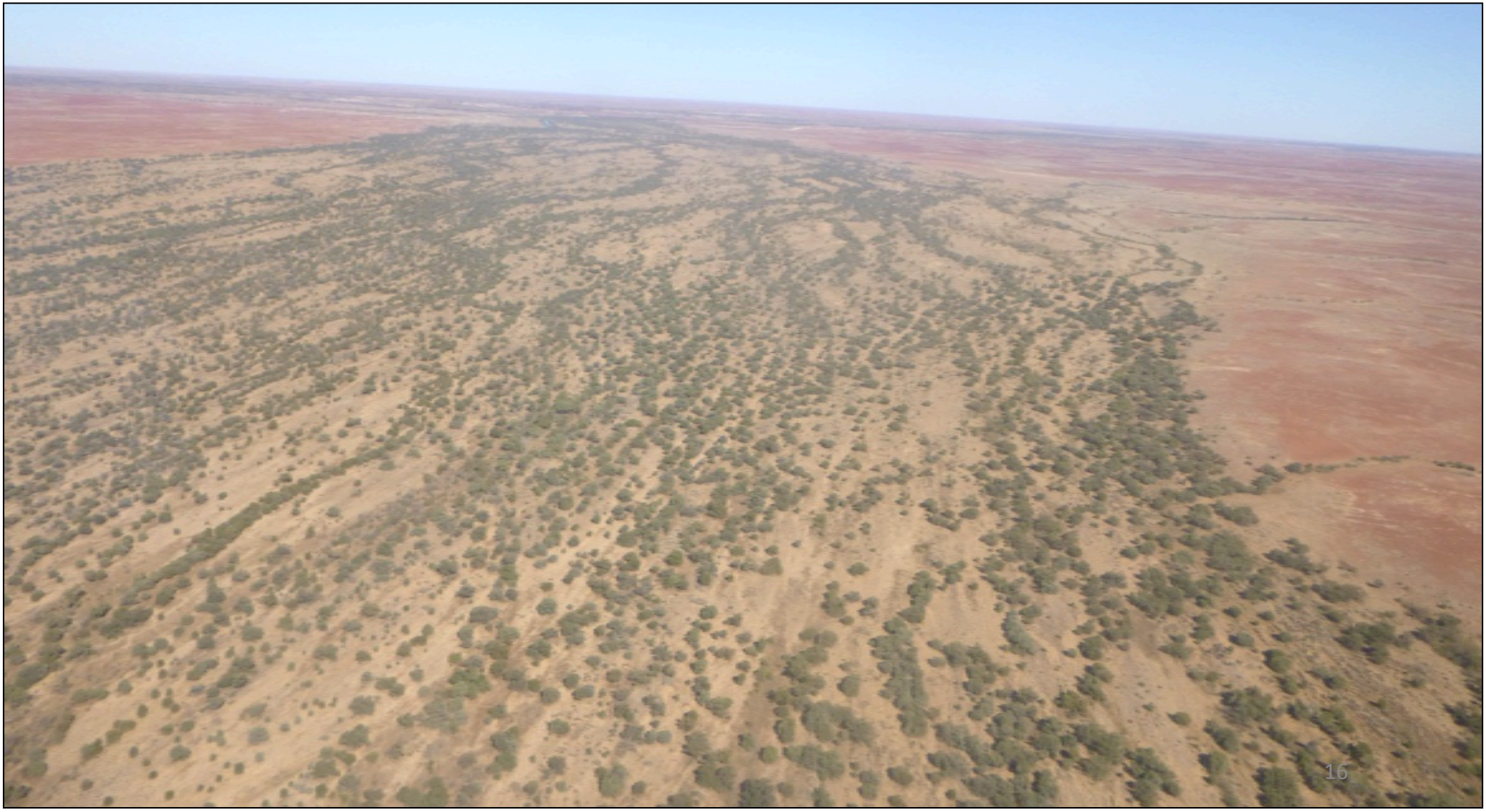
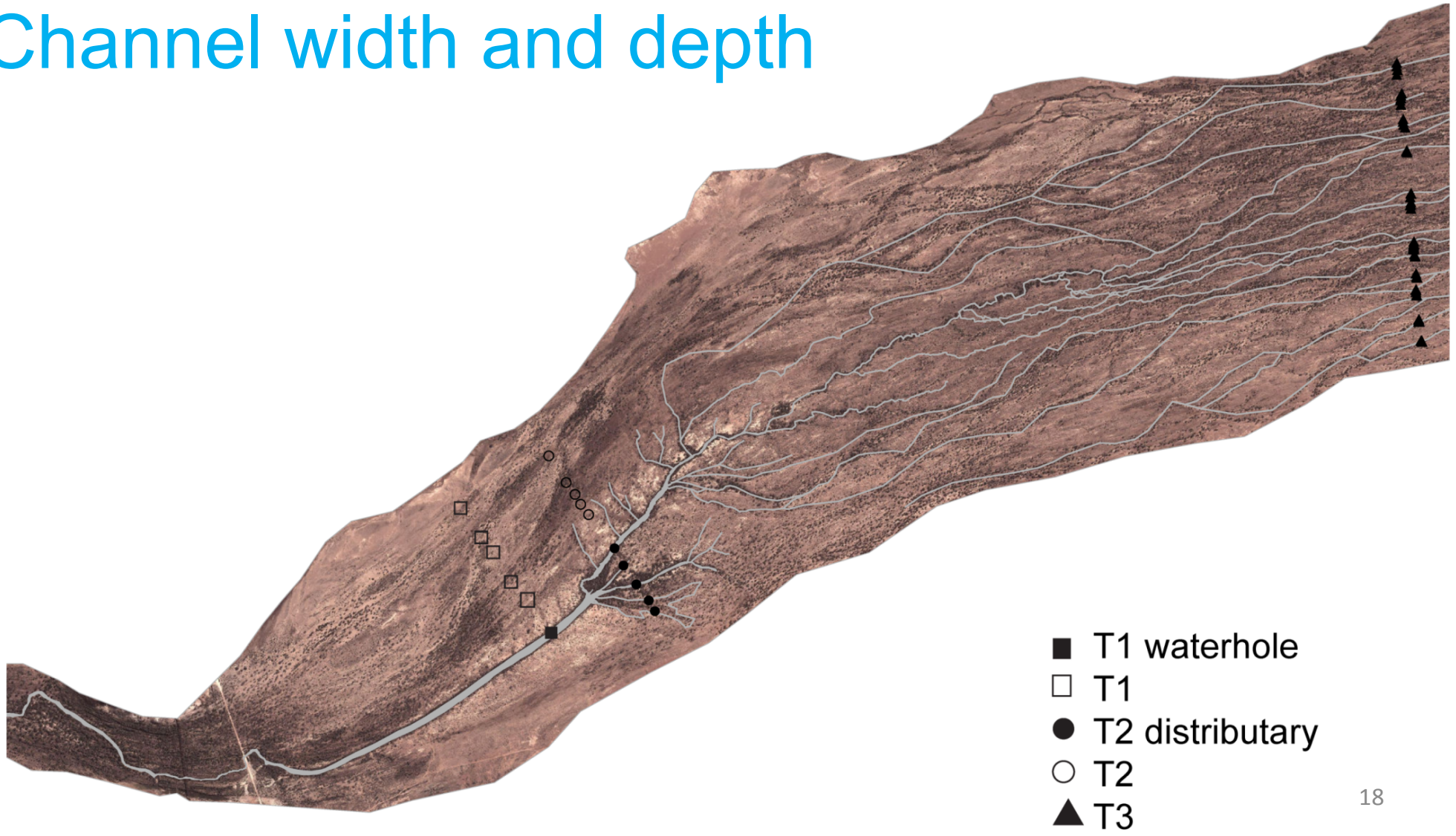
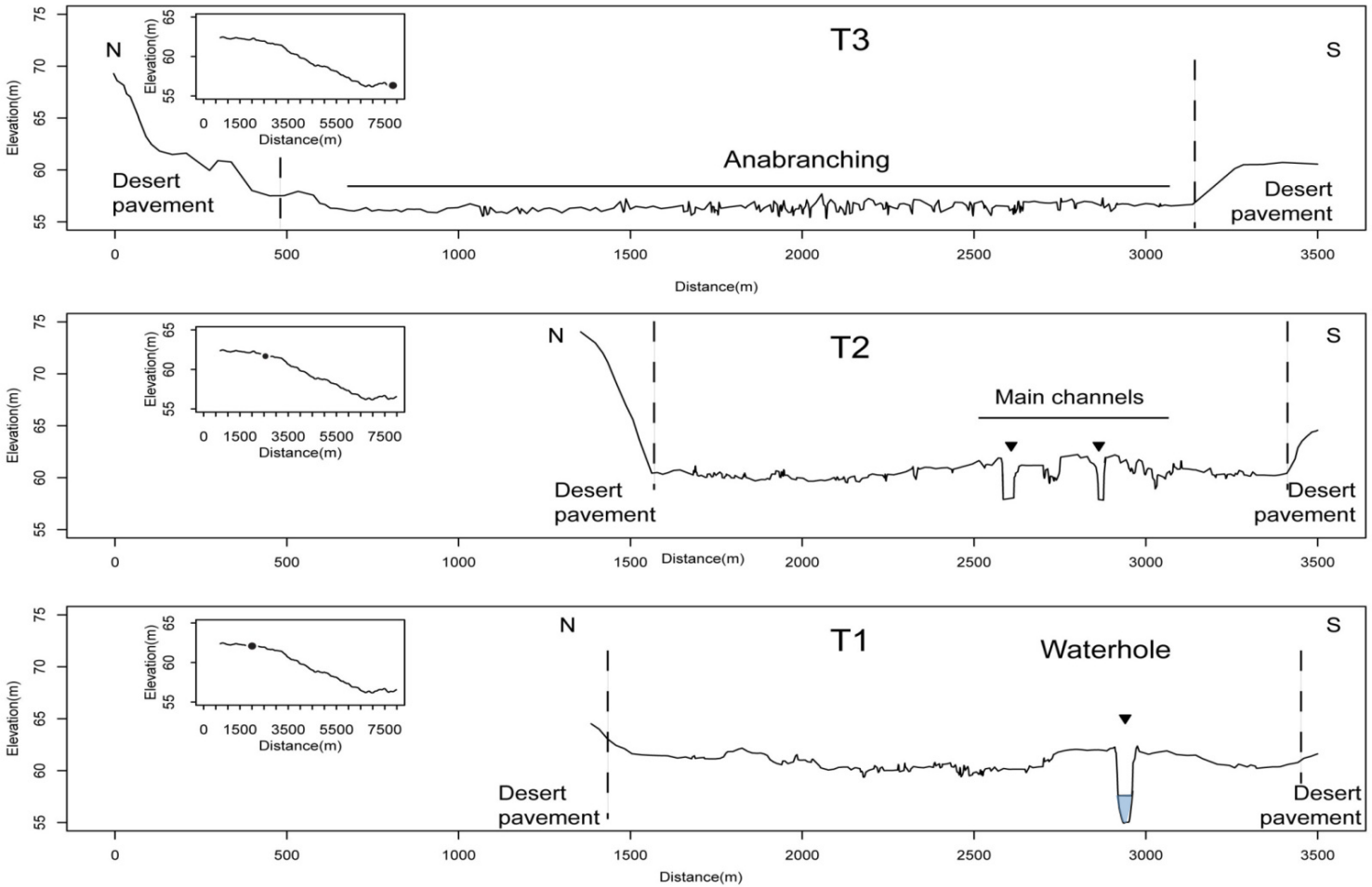
2



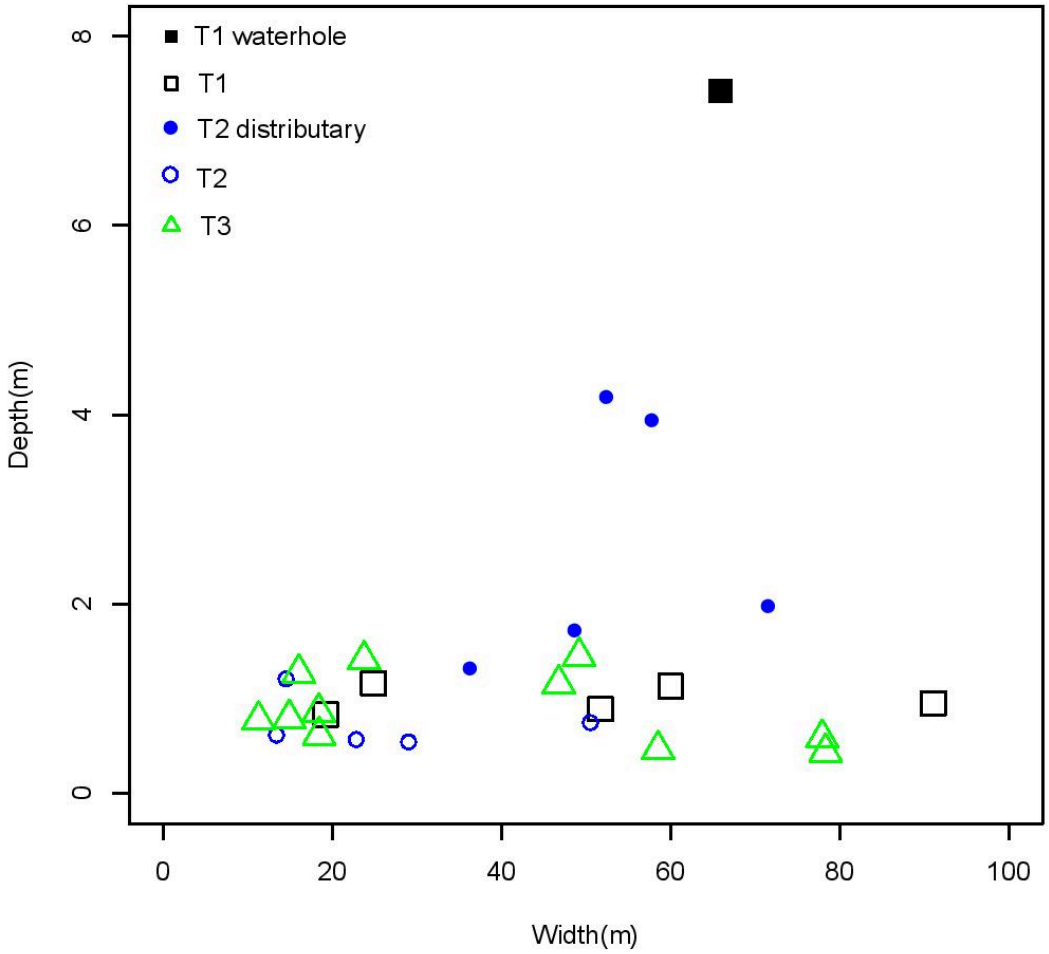
Channel width and depth



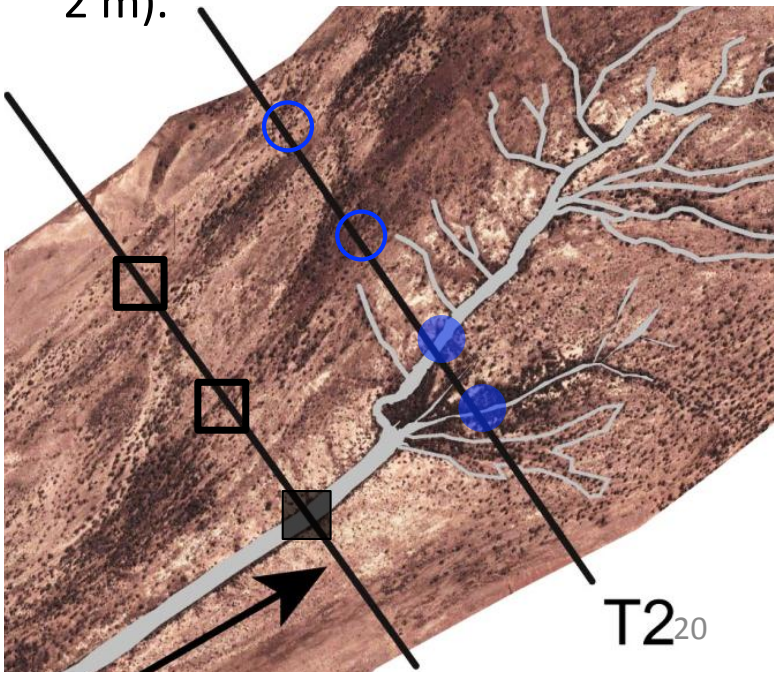
Channel width and depth- transects



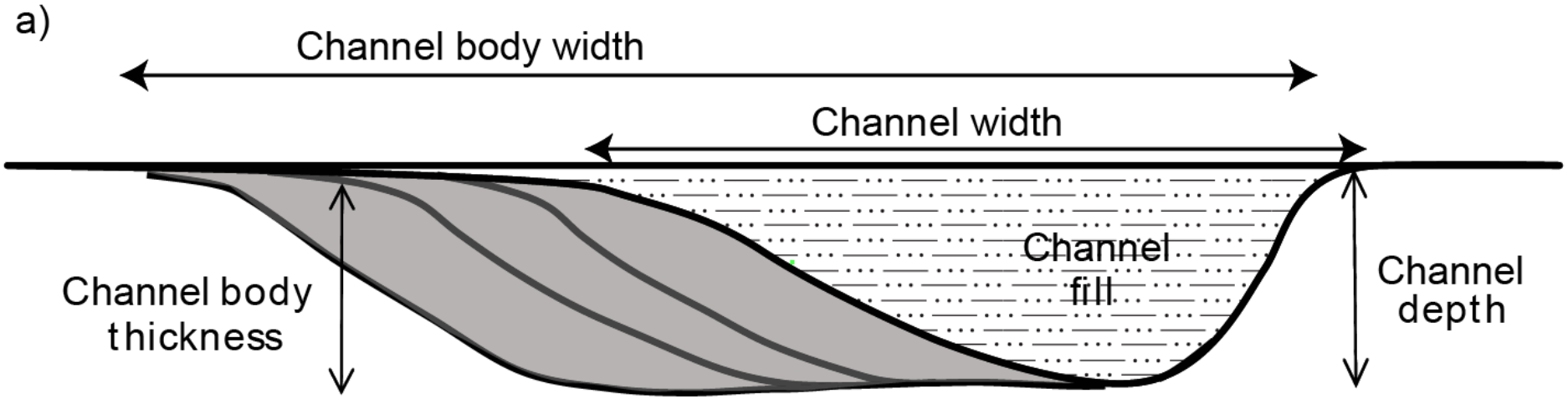
Channel width and depth



- Waterhole (T1) deepest, ~ 8 m.
- T2 two channels
  > 4 m deep.
- Similar depth in low-elevation floodplain T1 and T2 and T3 (up to 2 m).

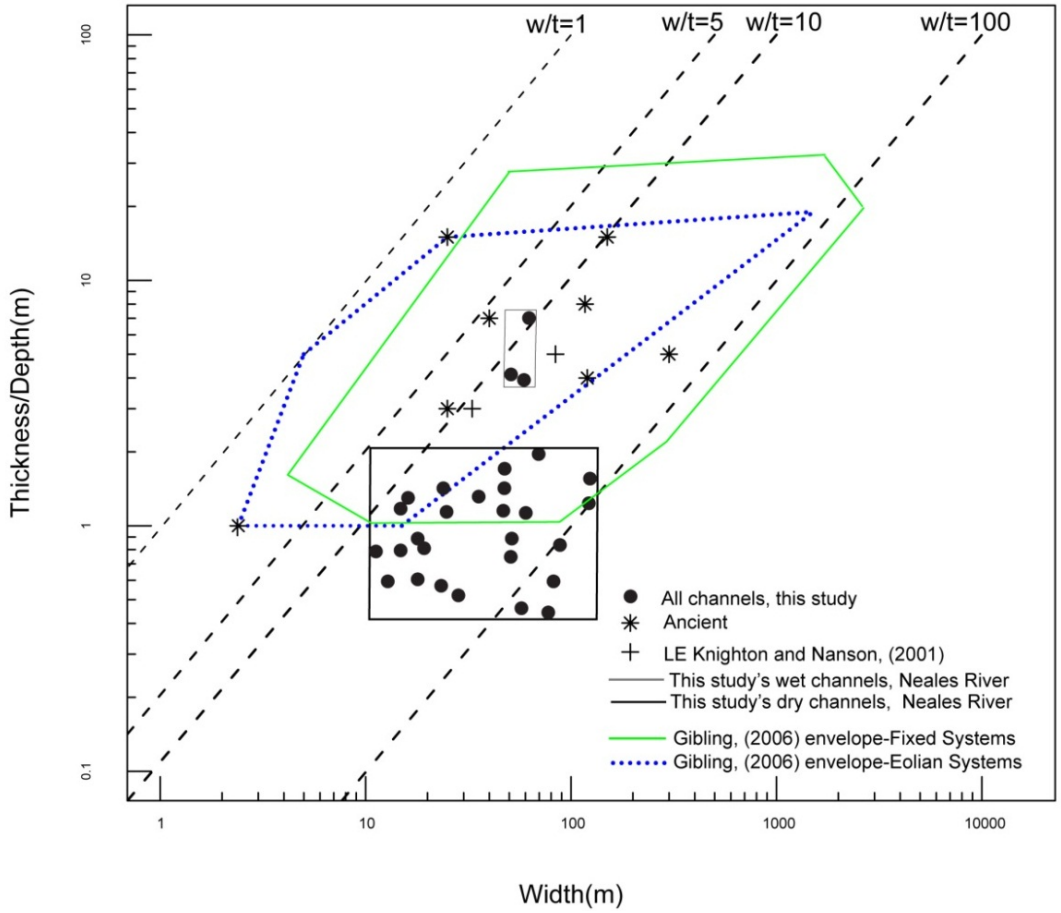


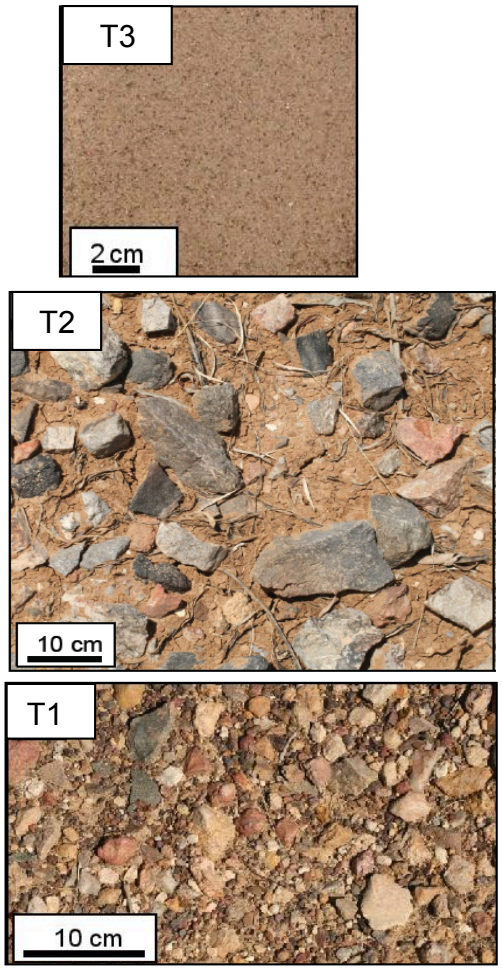
Channel W/D: comparison with published systems

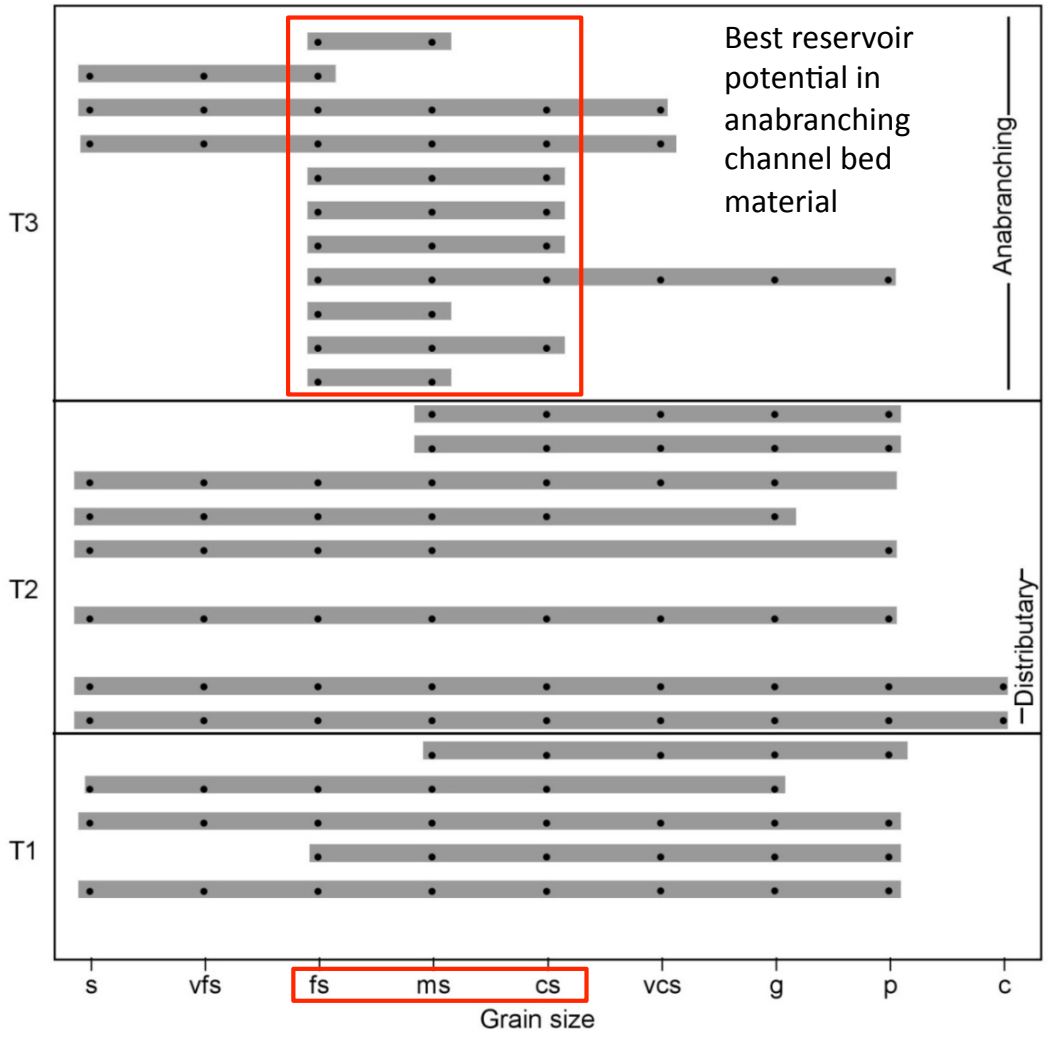


- This study: no evidence of lateral migration.
- Sand body deposit likely to have similar w/d to channels.
- Next slide: Comparison between our channel w/d and published channel body w/t.

Channel W/D: comparison with published systems



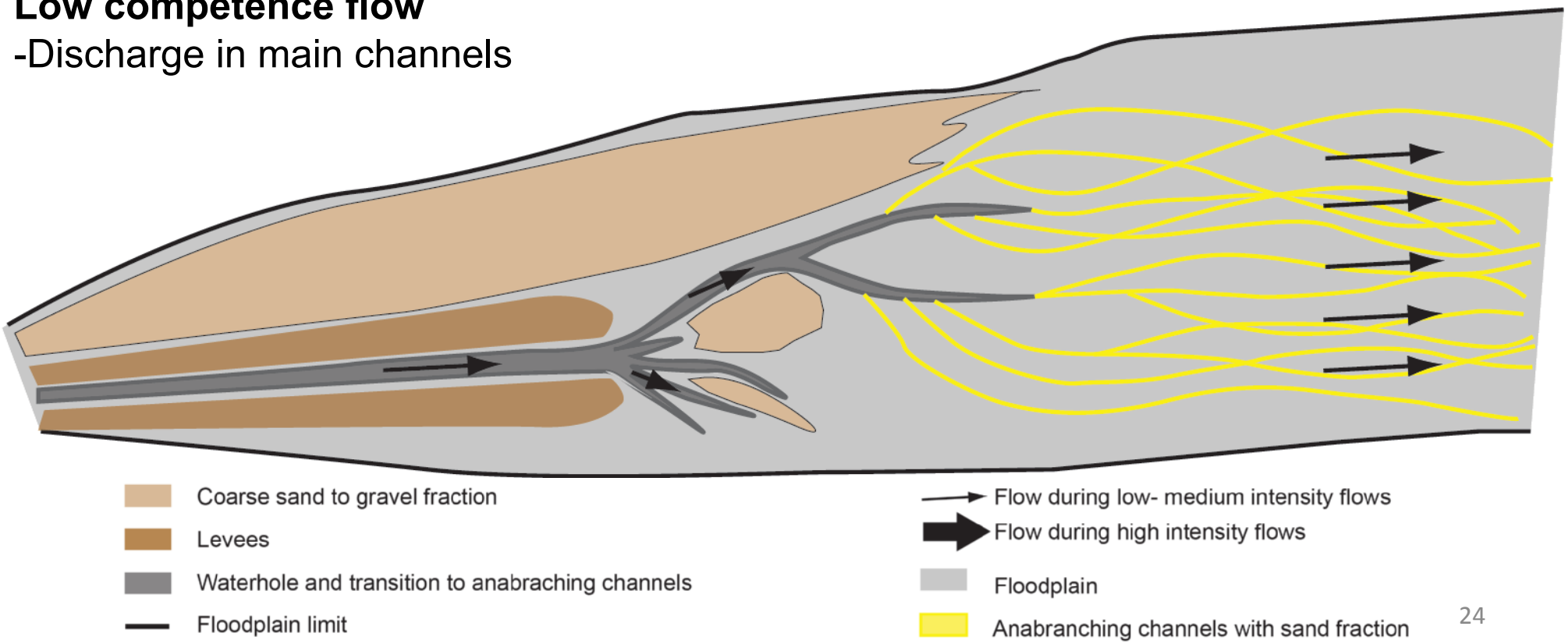

T3
2 cm
T2
10 cm
T1
10 cm


Best reservoir potential in anabranching channel bed material
T3
T2
T1
Anabranching
Distributary
s
vfs
fs
ms
cs
vcs
g
p
c
Grain size

Process based model

Low competence flow

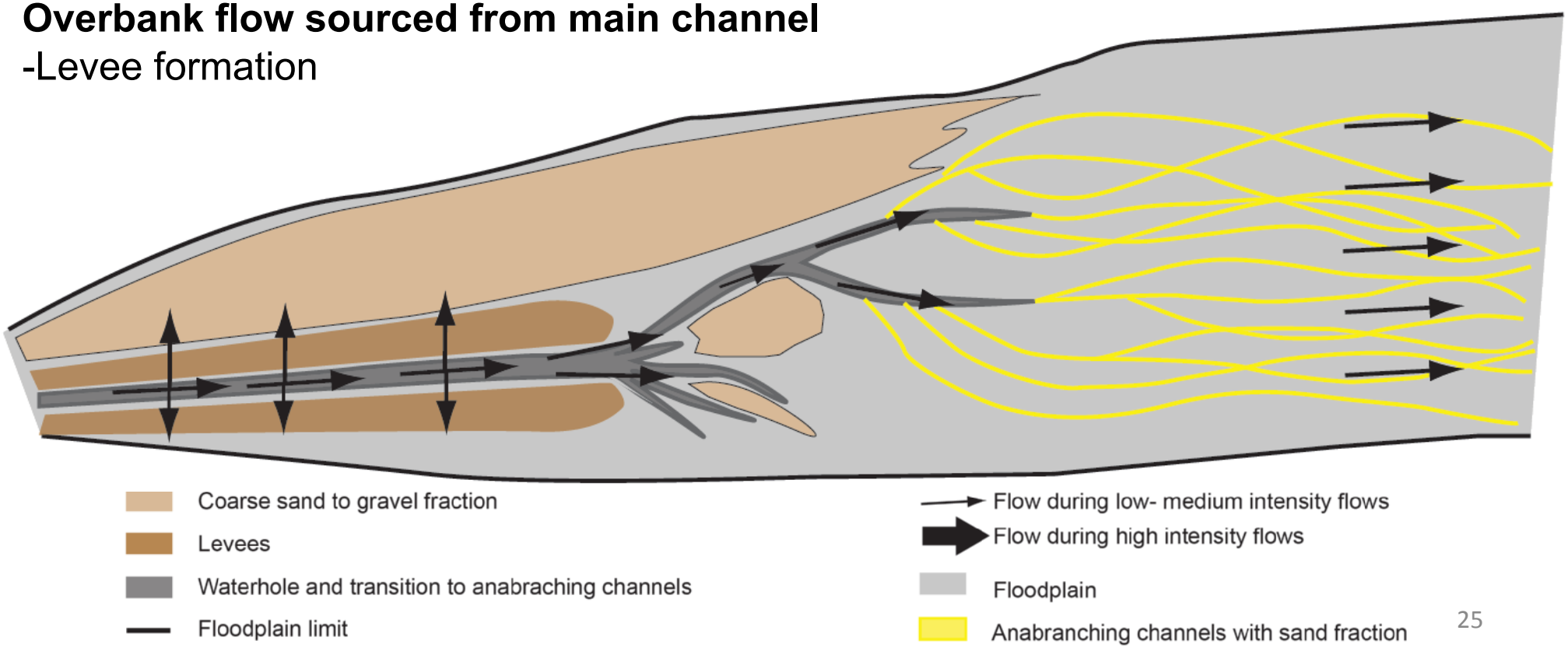
-Discharge in main channels



Process based model

Overbank flow sourced from main channel

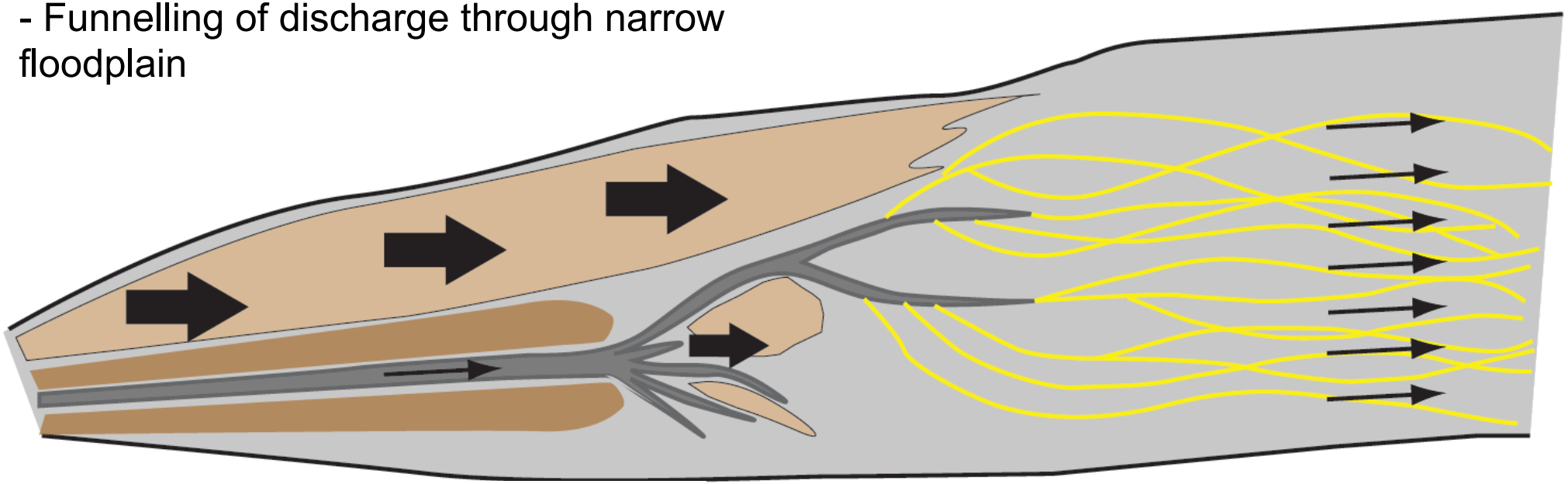
-Levee formation



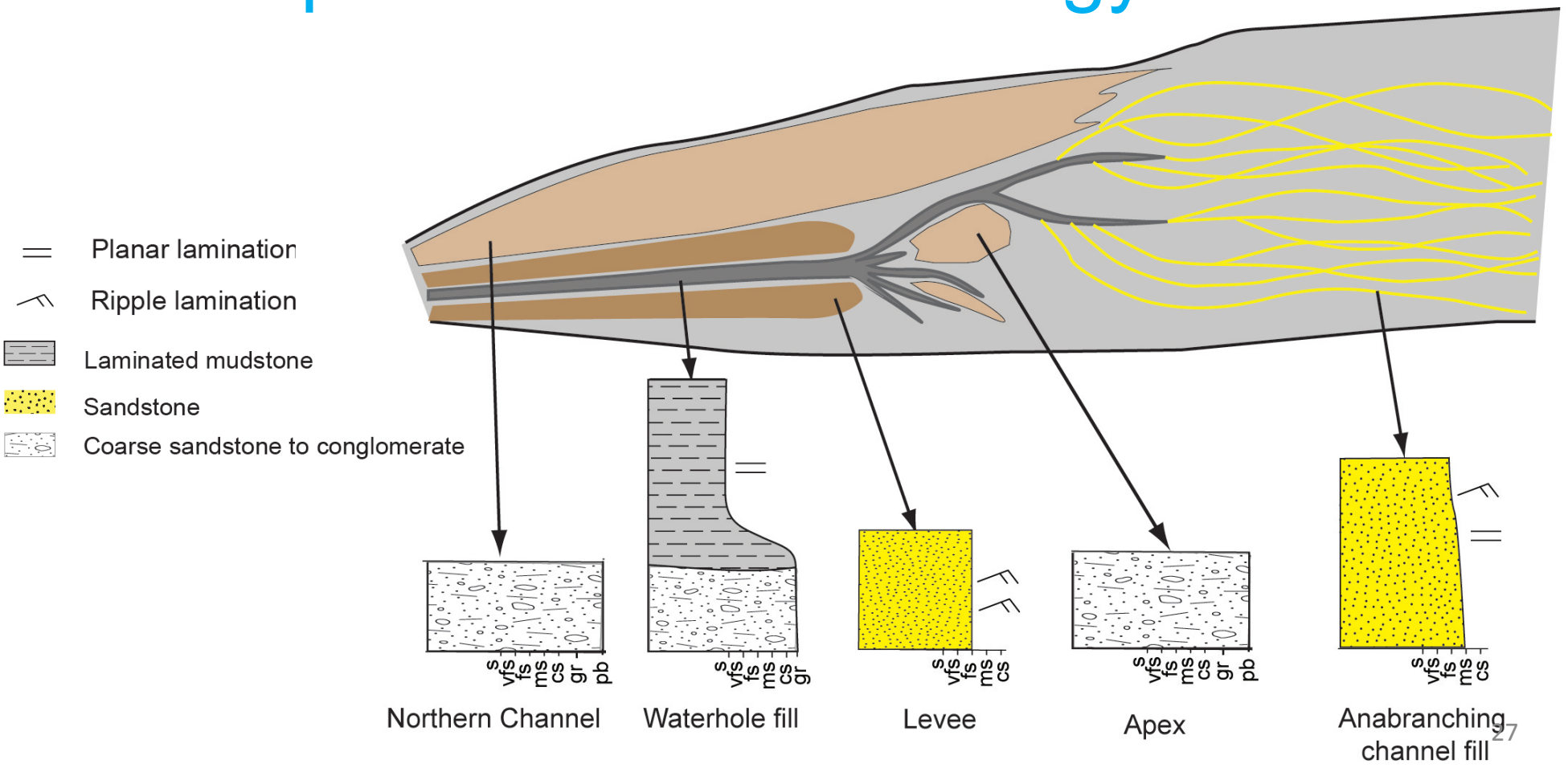
Process based model

High competence flow

- Funnelling of discharge through narrow floodplain



Expected vertical lithology trends



Conclusions

- New analogue dataset from the Lake Eyre basin for application to dryland fluvial successions.
  - Distribution of lithofacies not as expected.
  - Wide range in channel w/d, planform and grain size over short distance (2 - 3 km).
  - Process based model explains controls on sediment transport and deposition under different magnitude discharge events, likely link between location of different depositional elements.
  - Anabranching channels are likely to form the best reservoir; deepest channels likely to form reservoirs with baffles/barriers.
- Understanding variability is key; a greater number of modern dryland rivers studies needed in order to reduce uncertainty in subsurface interpretation.

Acknowledgements

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- Thank you to:
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- Kidman Pty Ltd.
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Thank You!