Fluid transport in the Sherwood Sandstone: influences of diagenesis and lithofacies

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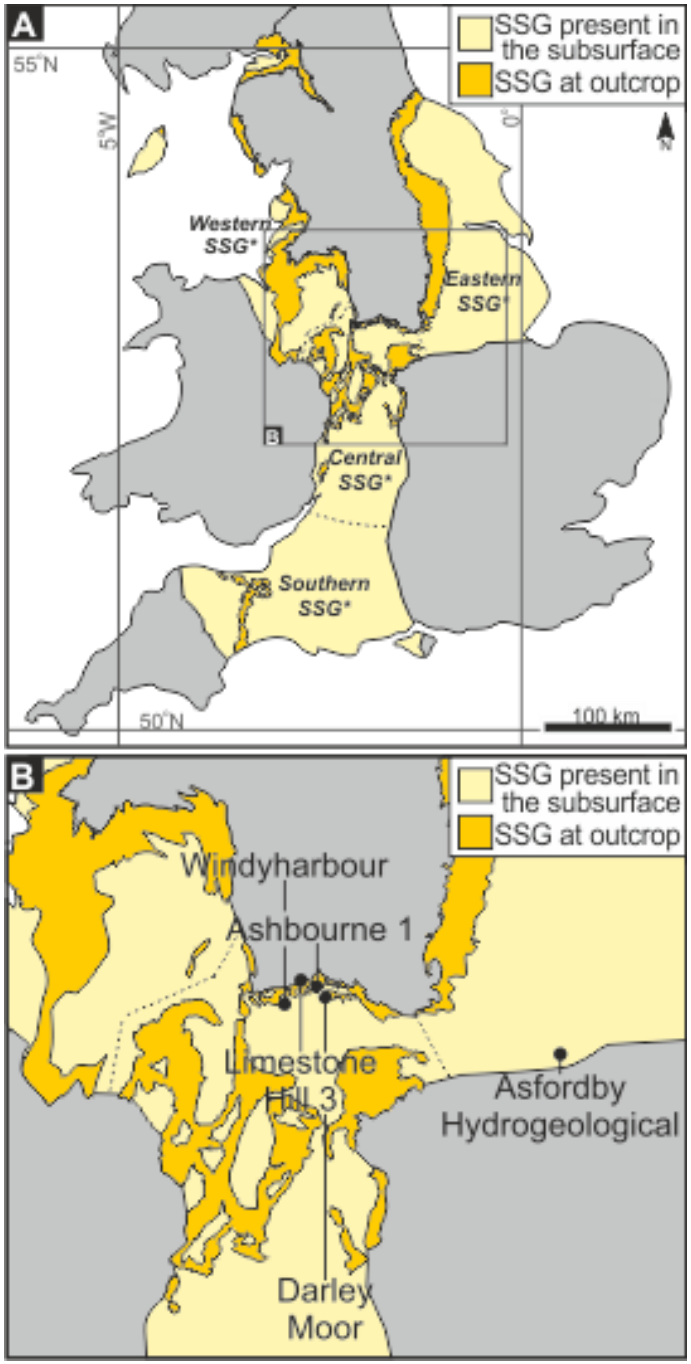
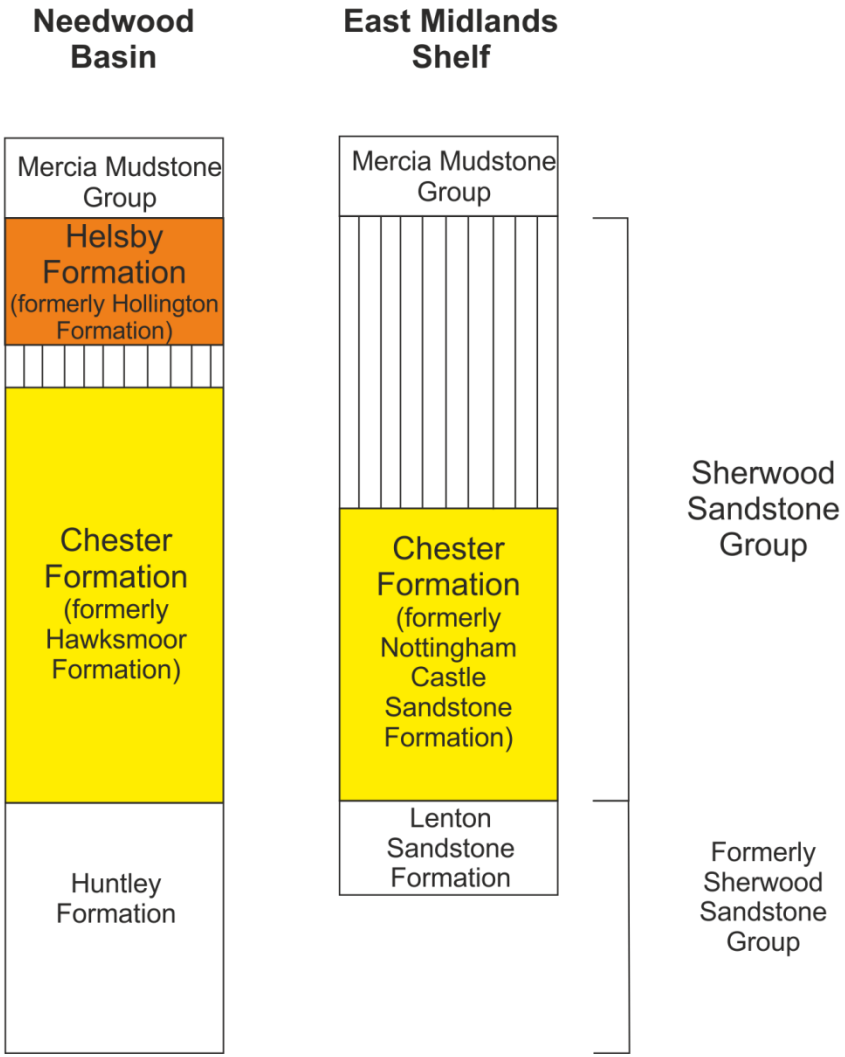


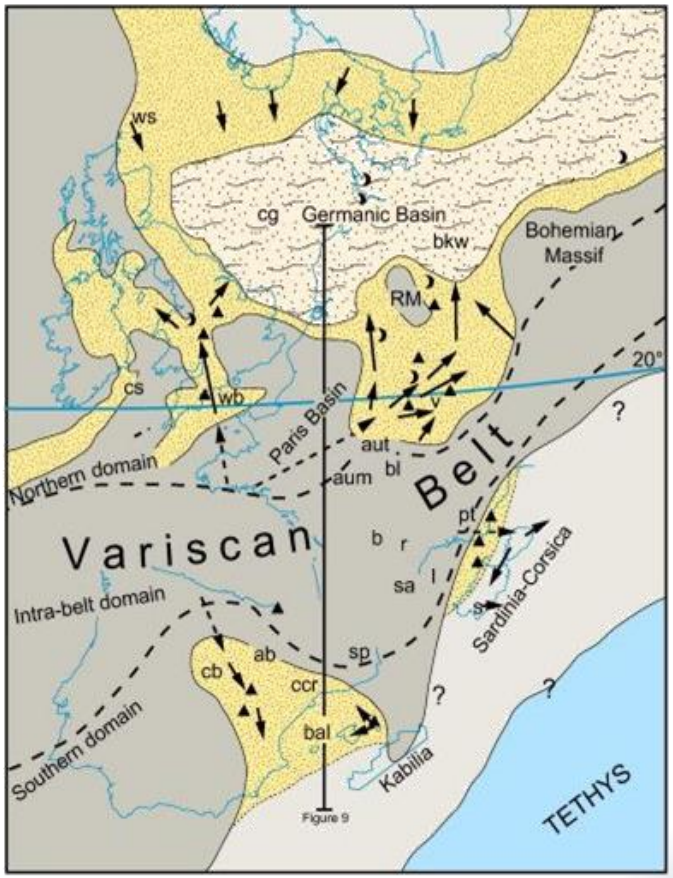
Introduction

- Lateral equivalent of hydrocarbon producing units
- Major aquifer
- CCS

- Needwood Basin
- Thin sections
- Diagenetic history



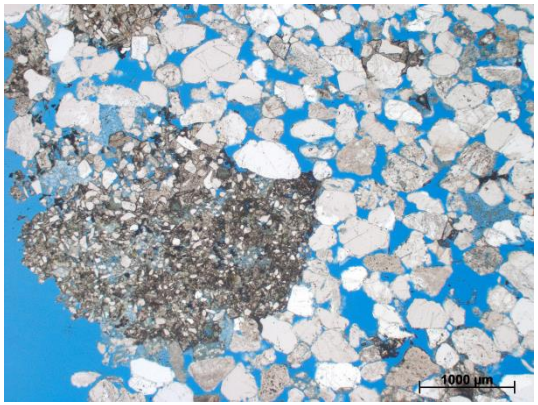
Adapted from Ambrose et al (2014)



(Bourquin et al., 2011)

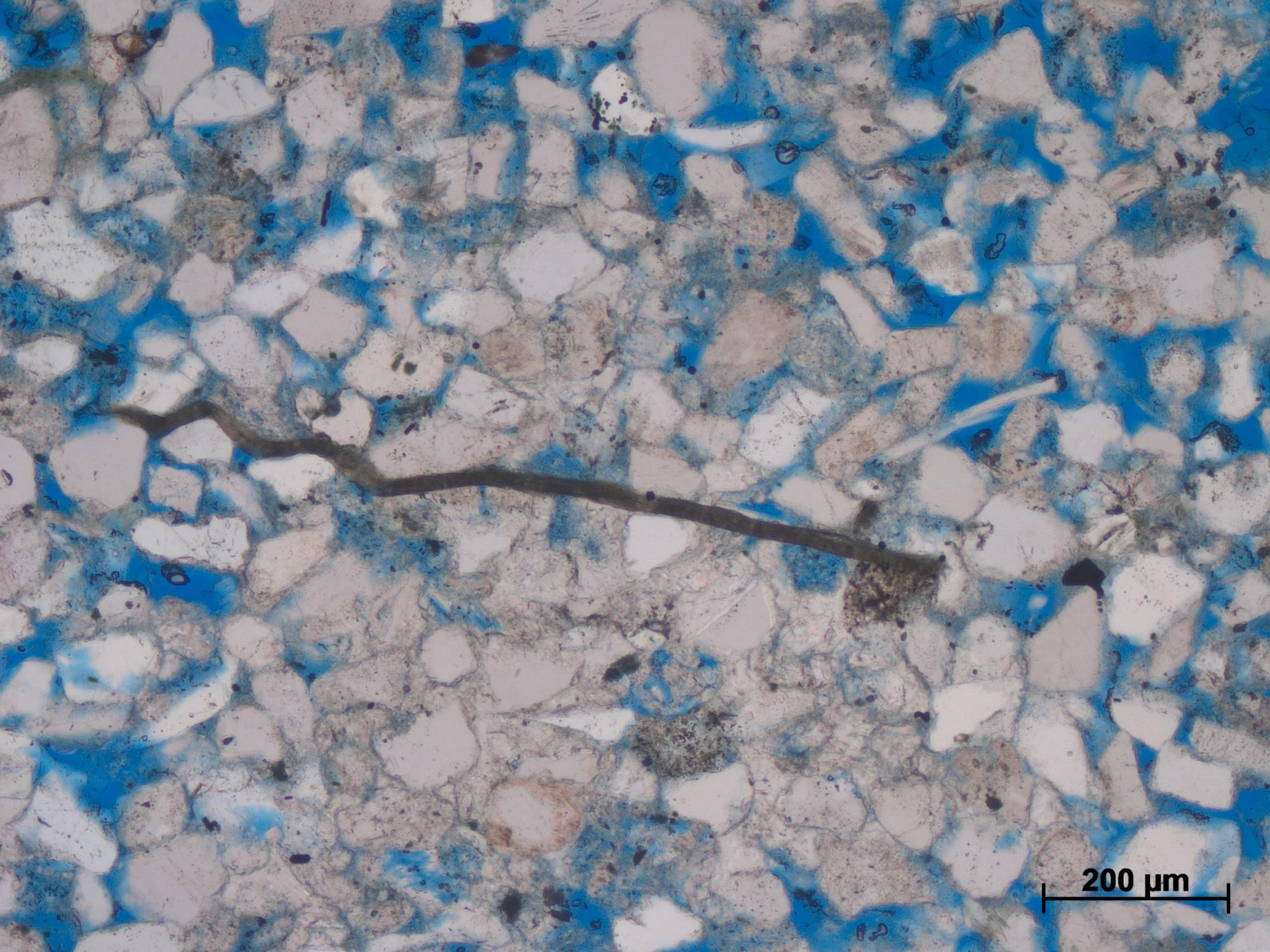
Data collection and Methods

- 5 borehole cores, 30 polished thin sections
- Optical Microscopy
- SEM
- jPOR (Grove and Jerram 2011)



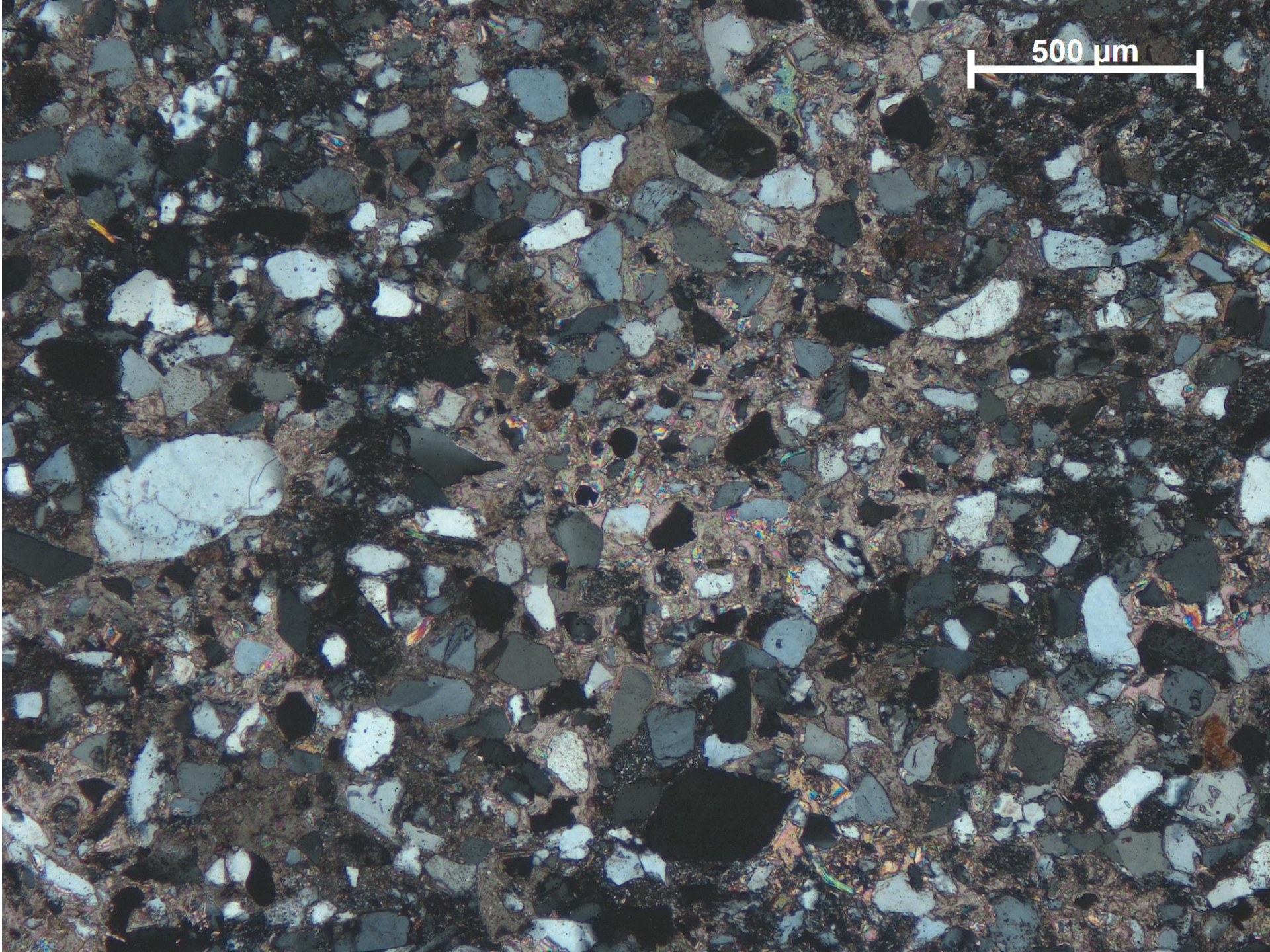
Diagenetic textures

- Compaction


200 µm

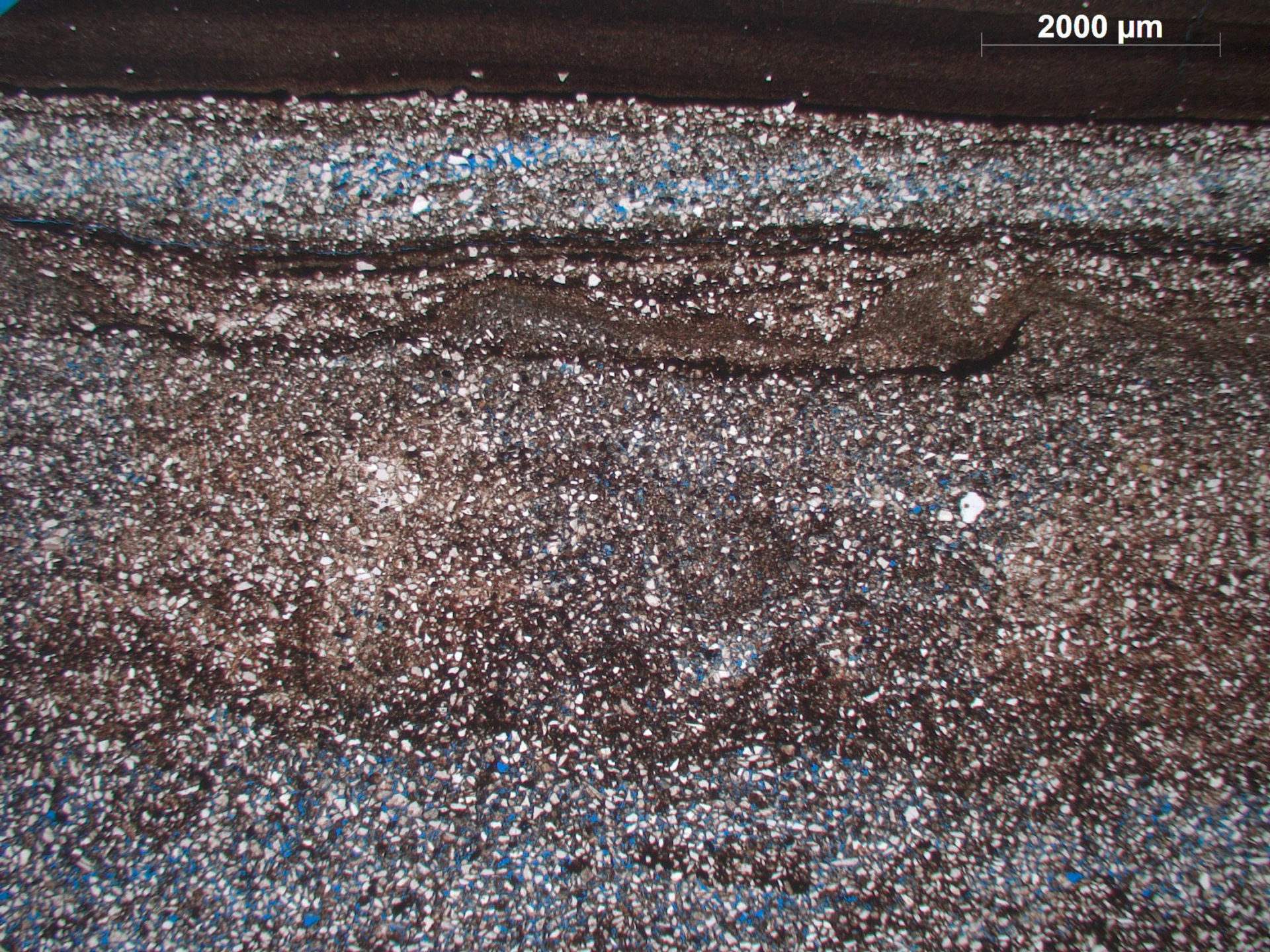
Diagenetic textures

- Compaction
- Cements, exploded grain texture


500 µm

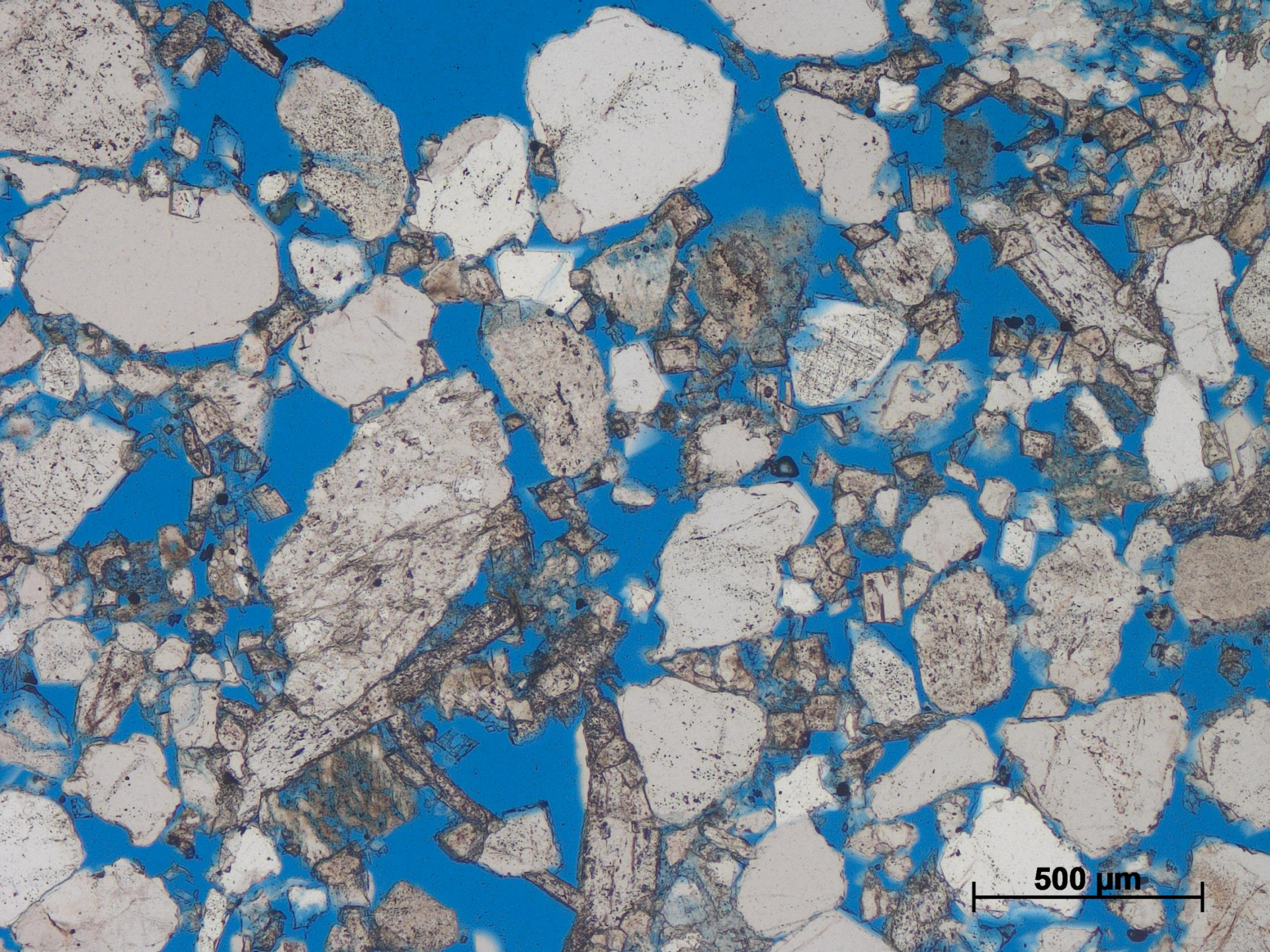
Diagenetic textures

- Compaction
- Cements, exploded grain texture
- Sedimentary structures


2000 µm

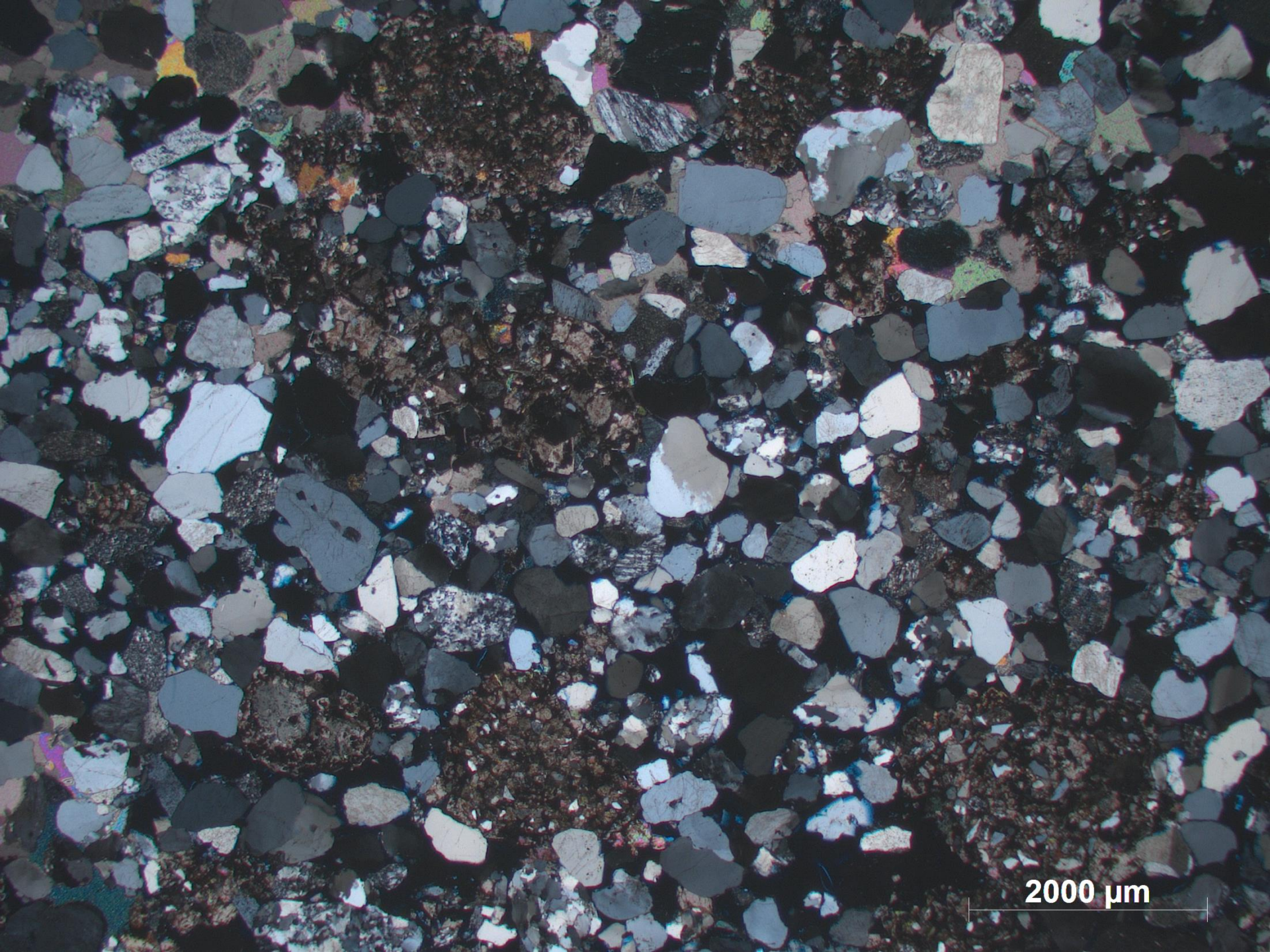
Diagenetic textures

- Compaction
- Cements, exploded grain texture
- Sedimentary structures
- Framework grain dissolution


500 µm

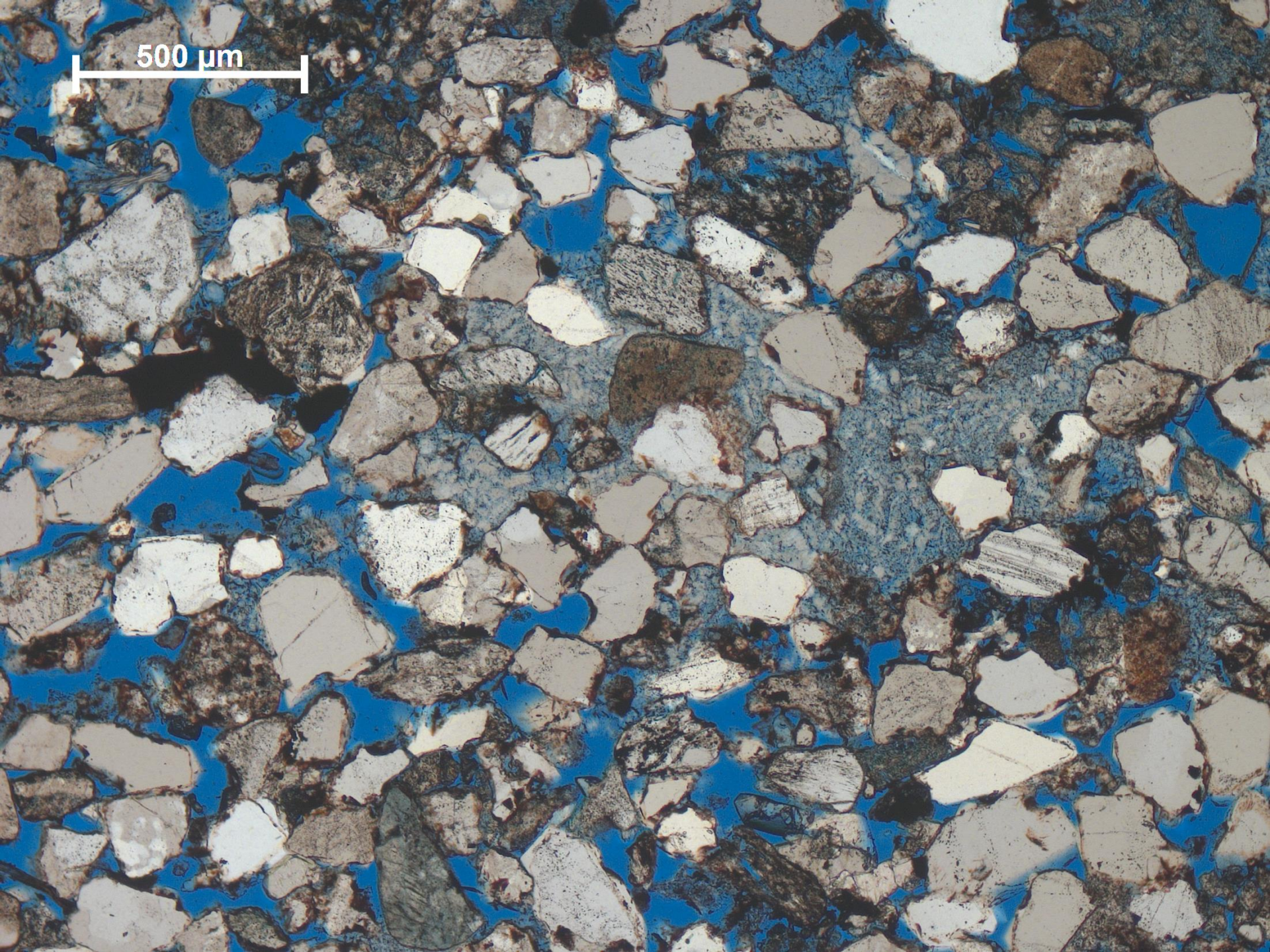
Diagenetic textures

- Compaction
- Cements, exploded grain texture
- Sedimentary structures
- Framework grain dissolution
- Calcrete and dolocrete


2000 µm

Diagenetic textures

- Compaction
- Cements, exploded grain texture
- Sedimentary structures
- Framework grain dissolution
- Calcrete and dolocrete
- Replacement minerals


500 µm

Diagenetic textures

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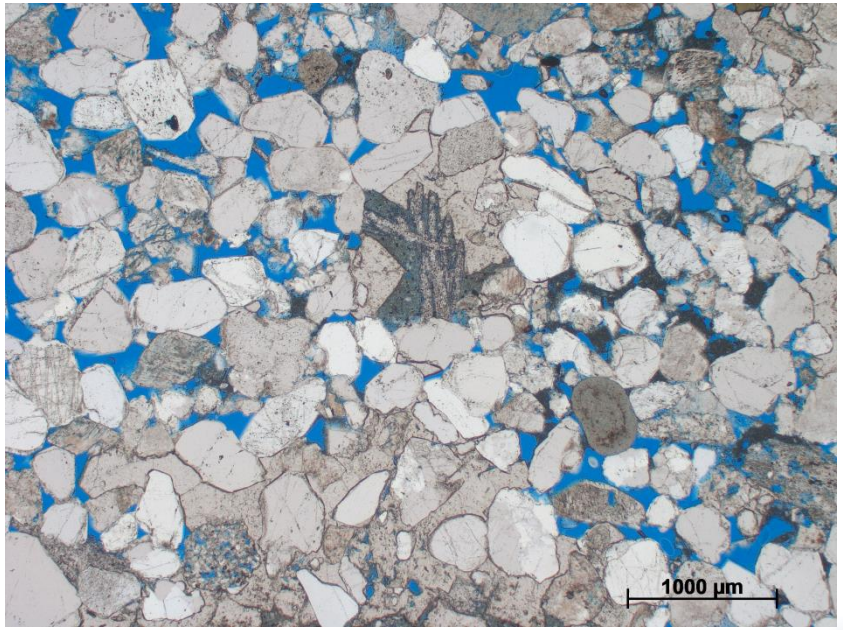
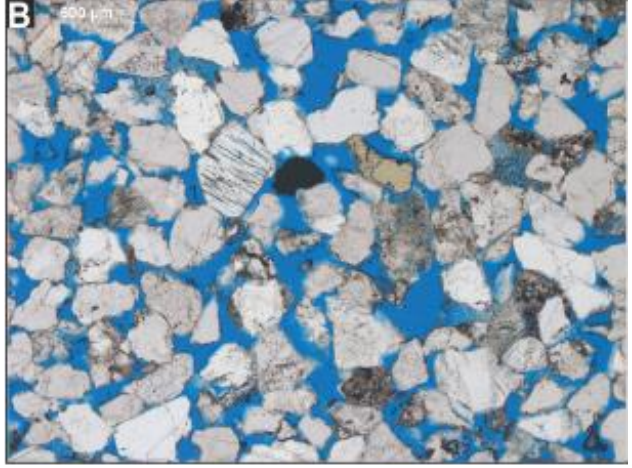
- Replacement minerals

Baryte mineralisation

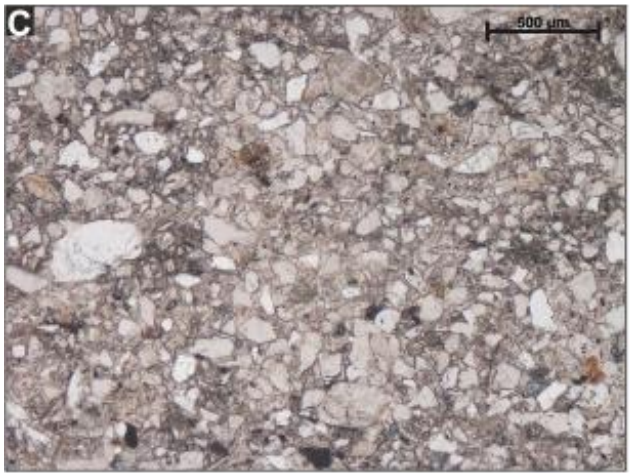


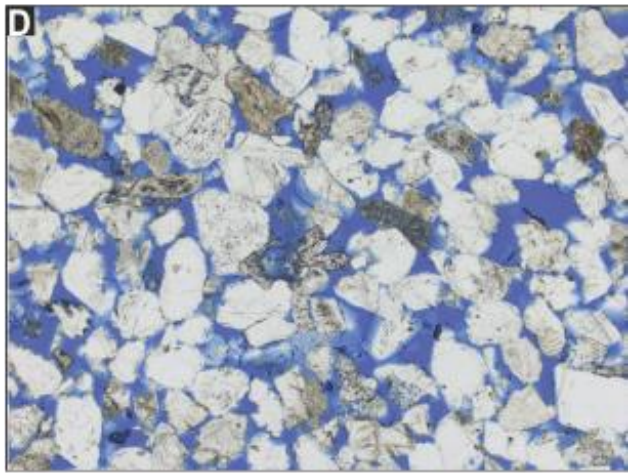
Cross bedded sandstone



Low-angle cross bedded sandstone

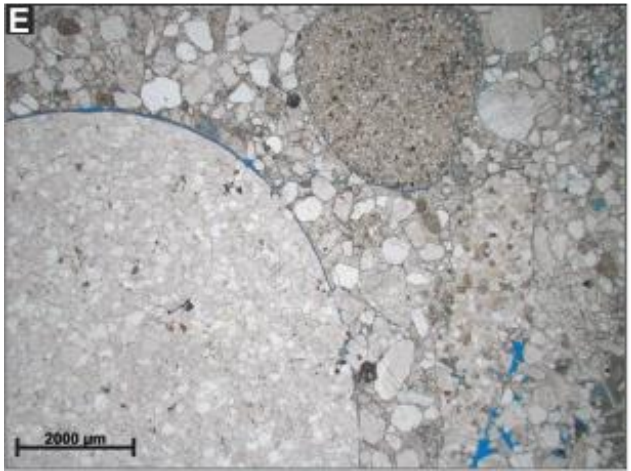
Horizontal/ near-horizontal bedded sandstone

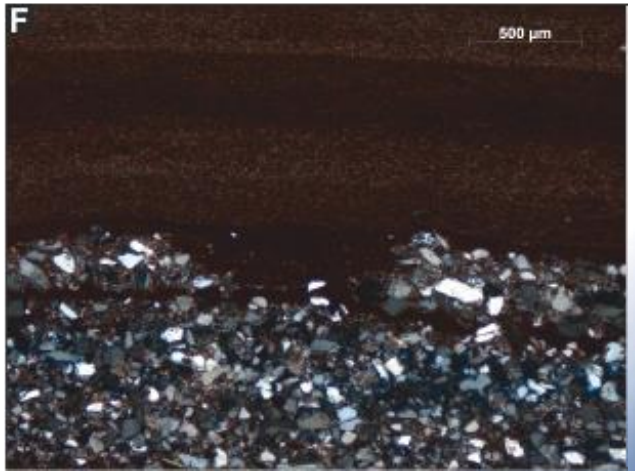




Massive sandstone

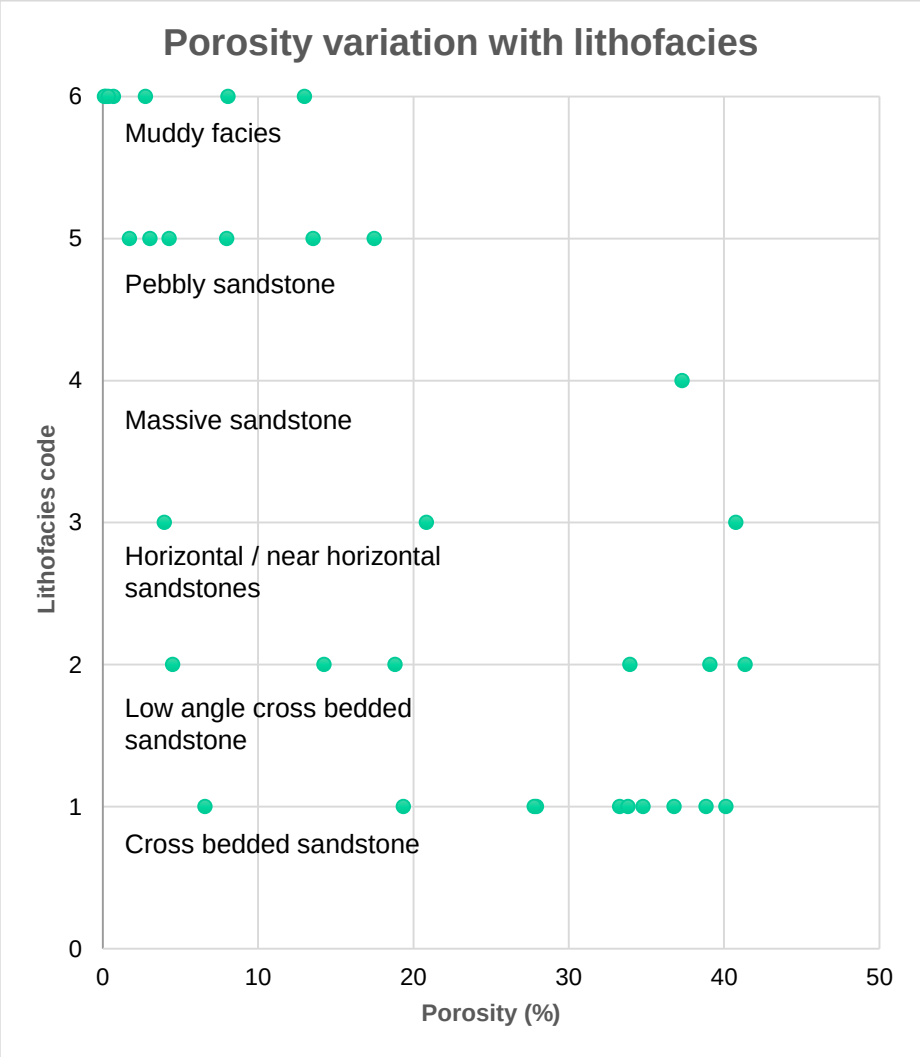
Pebbly sandstone



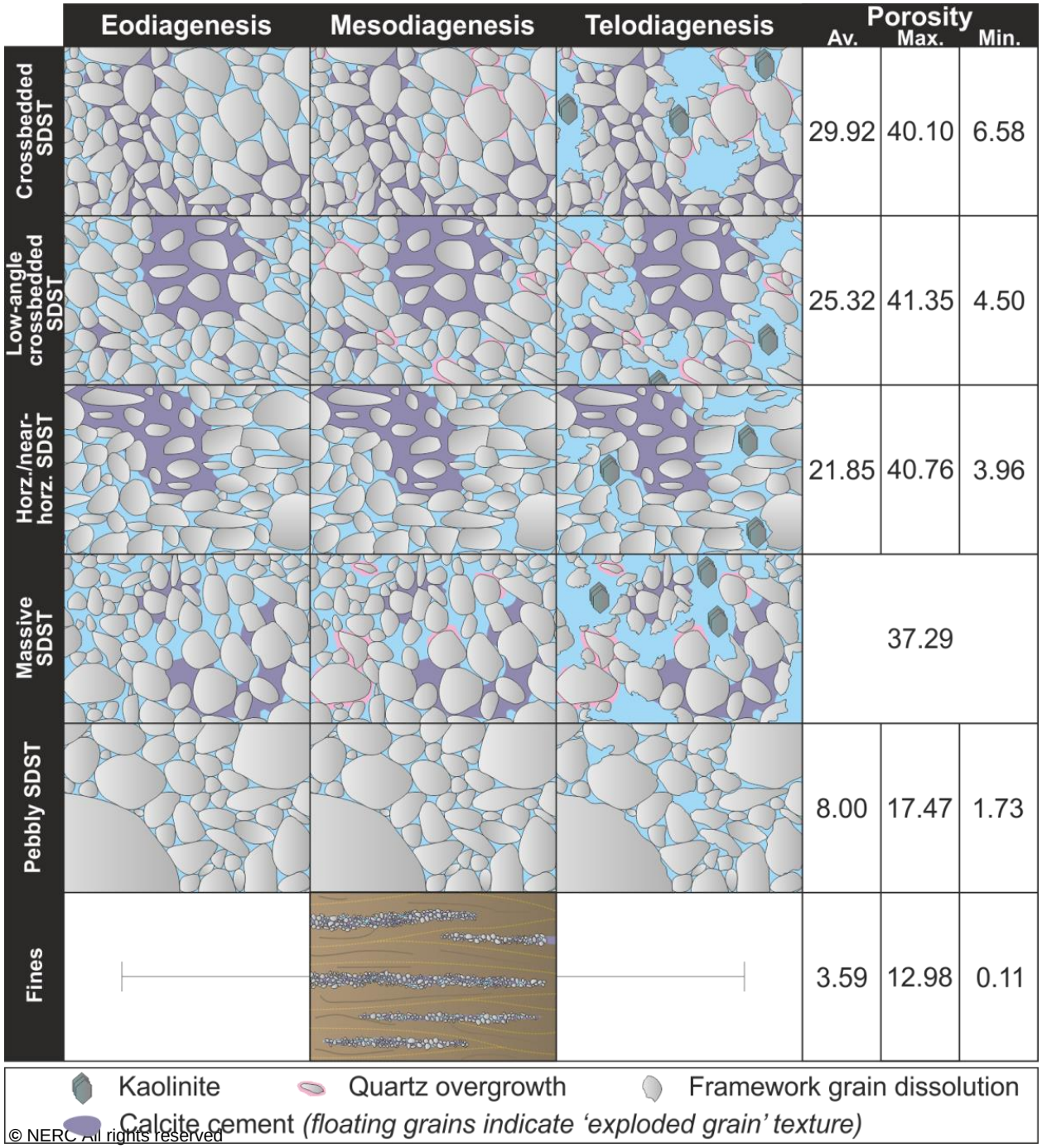


Muddy facies

Porosity



- Calcrete/dolocrete 17% less pore volume
- Iron oxide cement 8% less
- Baryte 23% less
- Calcite cement, no difference to porosity

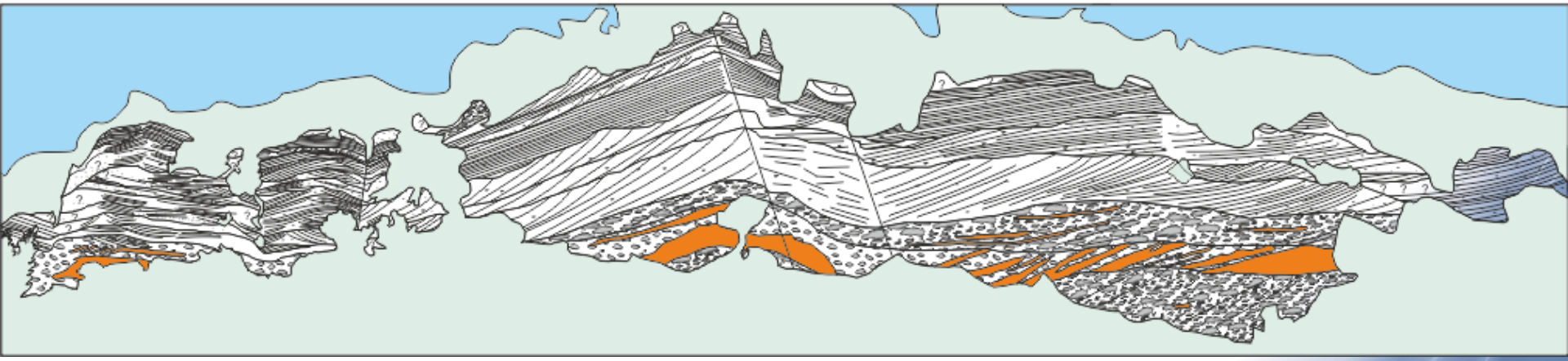


Facies control on diagenesis

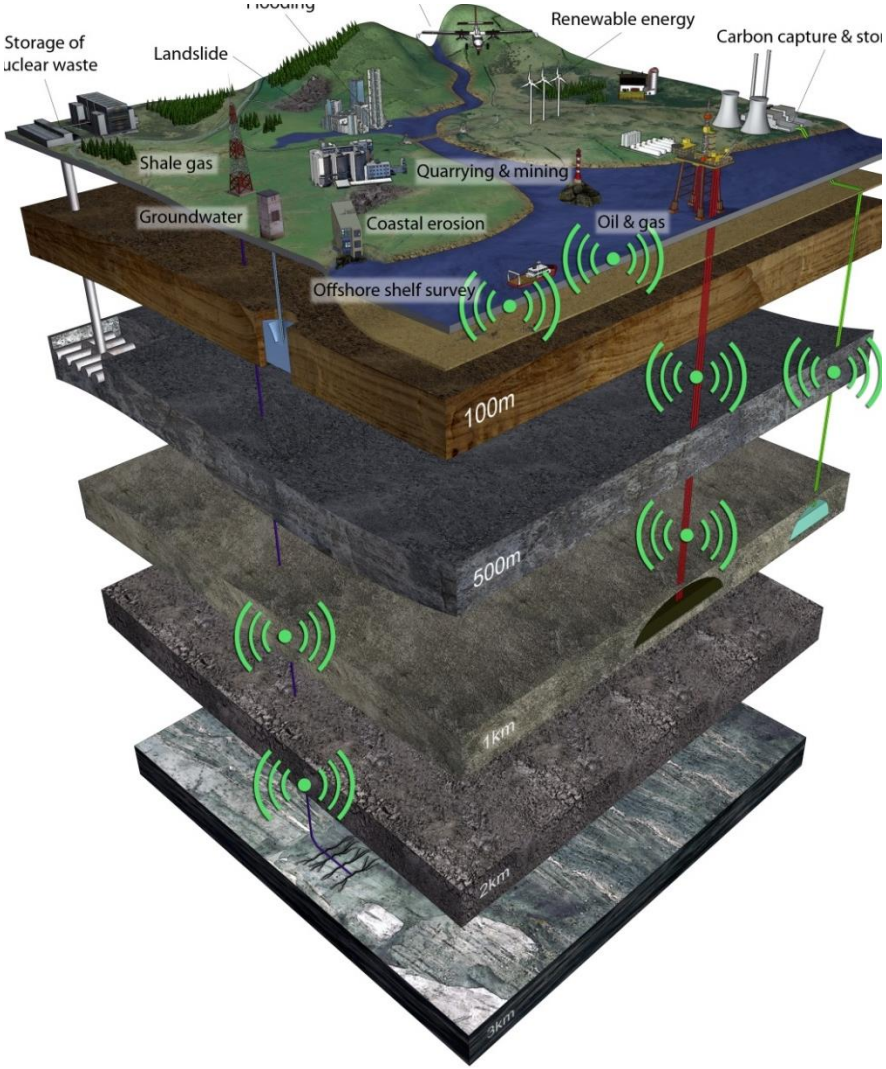
- Quartz overgrowths
- Framework grain dissolution
- Compaction
- Exploded grains/calcite cement
- Dolomite cement

Implications for fluid flow

- Small part of a bigger picture
- Fluid flow modelling
- Improve efficiency of extraction
- Reduce associated risk
- Aquifer management - pathways



Further work



- Energy Security and Innovation Observing System (ESIOS)
- Statistics
- Permeability

Thank you and any questions?

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References

Bourquin, S., Bercovici, A., Lopez-Gomez, J., Diez, J. B., Broutin, J., Ronchi, A., Durand, M., Arche, A., Linol, B. AND Amour, F. (2011). The Permian–Triassic transition and the onset of Mesozoic sedimentation at the northwestern peri-Tethyan domain scale: palaeogeographic maps and geodynamic implications. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 299(1), 265-280.

Grove, C. and Jerram, D. A. (2011) 'jPOR: An ImageJ macro to quantify total optical porosity from blue-stained thin sections', *Computers & Geosciences*, vol. 37, no. 11, pp. 1850–1859

Ambrose, K., Hough, E., Smith, N. J. P. and Warrington, G. (2014) 'Lithostratigraphy of the Sherwood Sandstone Group of England, Wales and south-west Scotland', *British Geological Survey Research Report, RR/14/01.*