- A version of these slides can also be found on ResearchGate https://www.researchgate.net

- This presentation will be published in a paper as part of Petroleum Geology Conference Series (PGCE VIII Conference Volume)

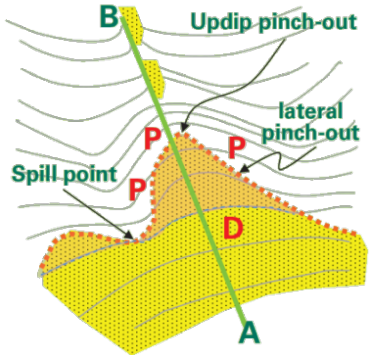
StratTrapsProject

The edges of the wedges:

a systematic approach to trap definition and risking for stratigraphic, combination and sub-unconformity traps

Edith M.G. Fugelli[1], Eleanor J. Stirling[2], Mark Thompson [3], Eva Maria Traa [4]

[1]Ex-BP, [2]BP Russia,, [3]Ex-BP, now LOCL, [4]BP Norway,

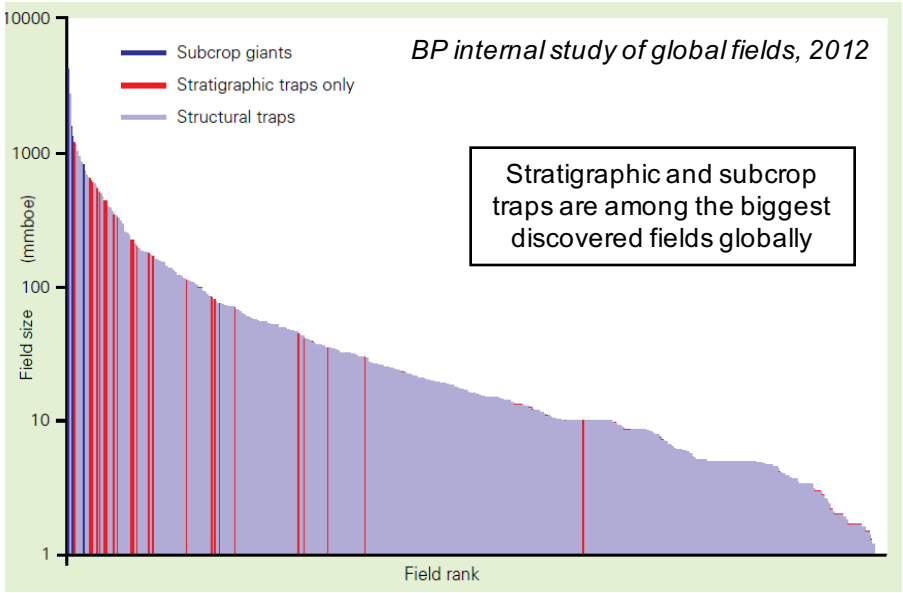


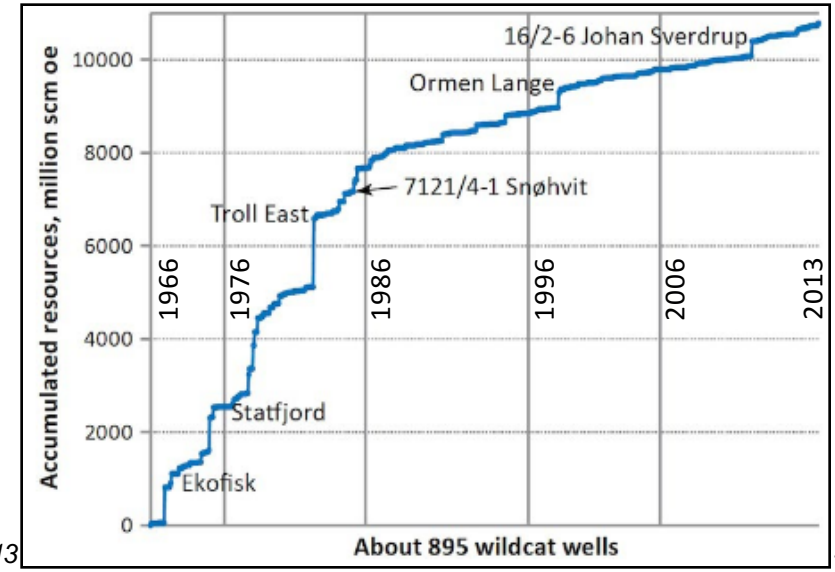
Talk outline

- Definitions and systematic edge description
- Types of edges, and what controls them
- Where to find edges – shallow marine / paralic example
- Using concepts in frontier exploration (foreland basin 2D example)
- Using concepts in mature basins (passive margin 3D example and Snadd Discovery)
- Risking – bottom-up meets top-down, no double dipping please!
- Summary and conclusions

Introduction

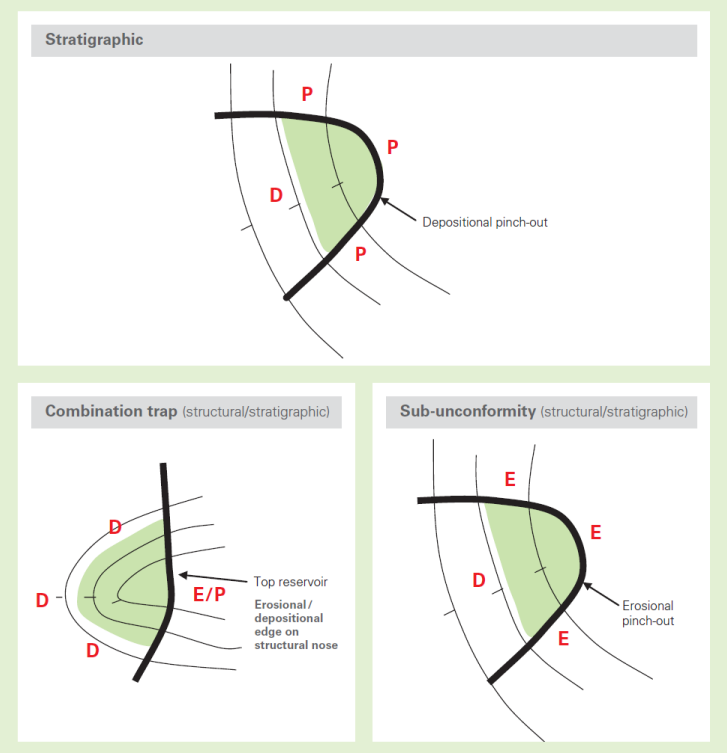
- The context
  - Historically viewed as high risk
  - Few data on successes – even fewer on failures!
  - Recent discoveries show potential overlooked
- The opportunity
  - If 10% of remaining fields are stratigraphic traps, YTF is ~200 Bboe
  - Can rejuvenate exploration in mature basins
  - Allows new basin entry where structural traps are unlikely to yield sufficient volumes
- The challenge
  - Can we **predict** where they are likely to occur?
  - How can we **reduce risk** to acceptable levels?
  - Can we **shift our thinking** to overcome the usual "it's a strat trap, so it's too risky" attitude?

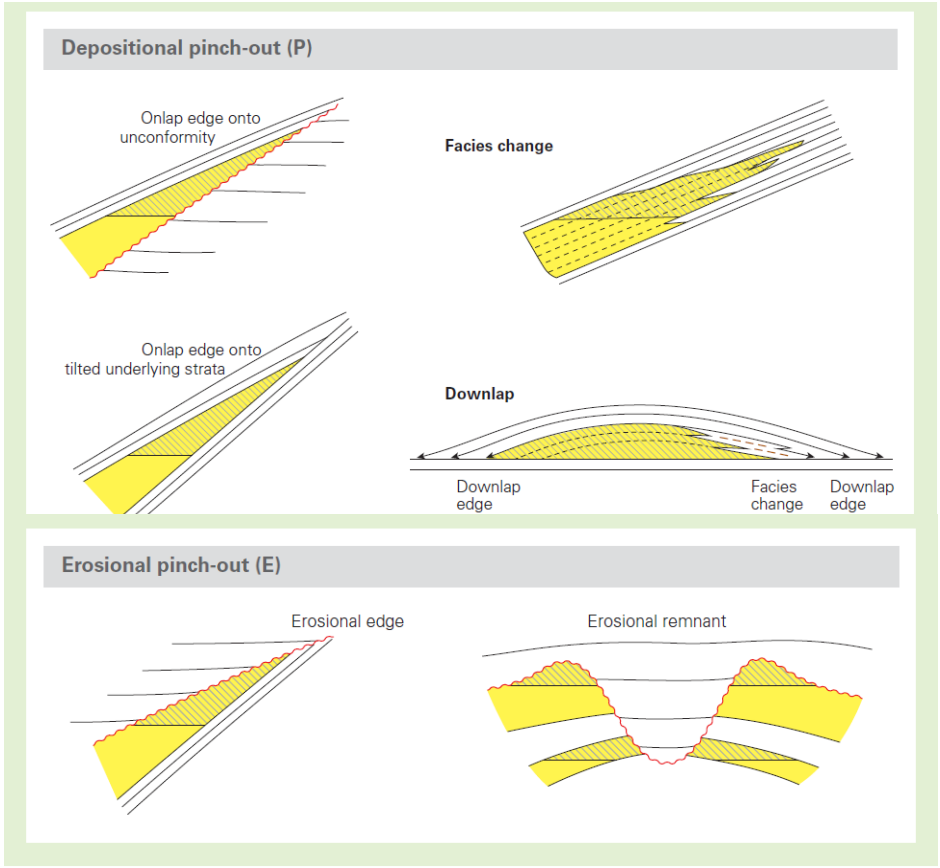




Norwegian Petroleum Directorate, 2013

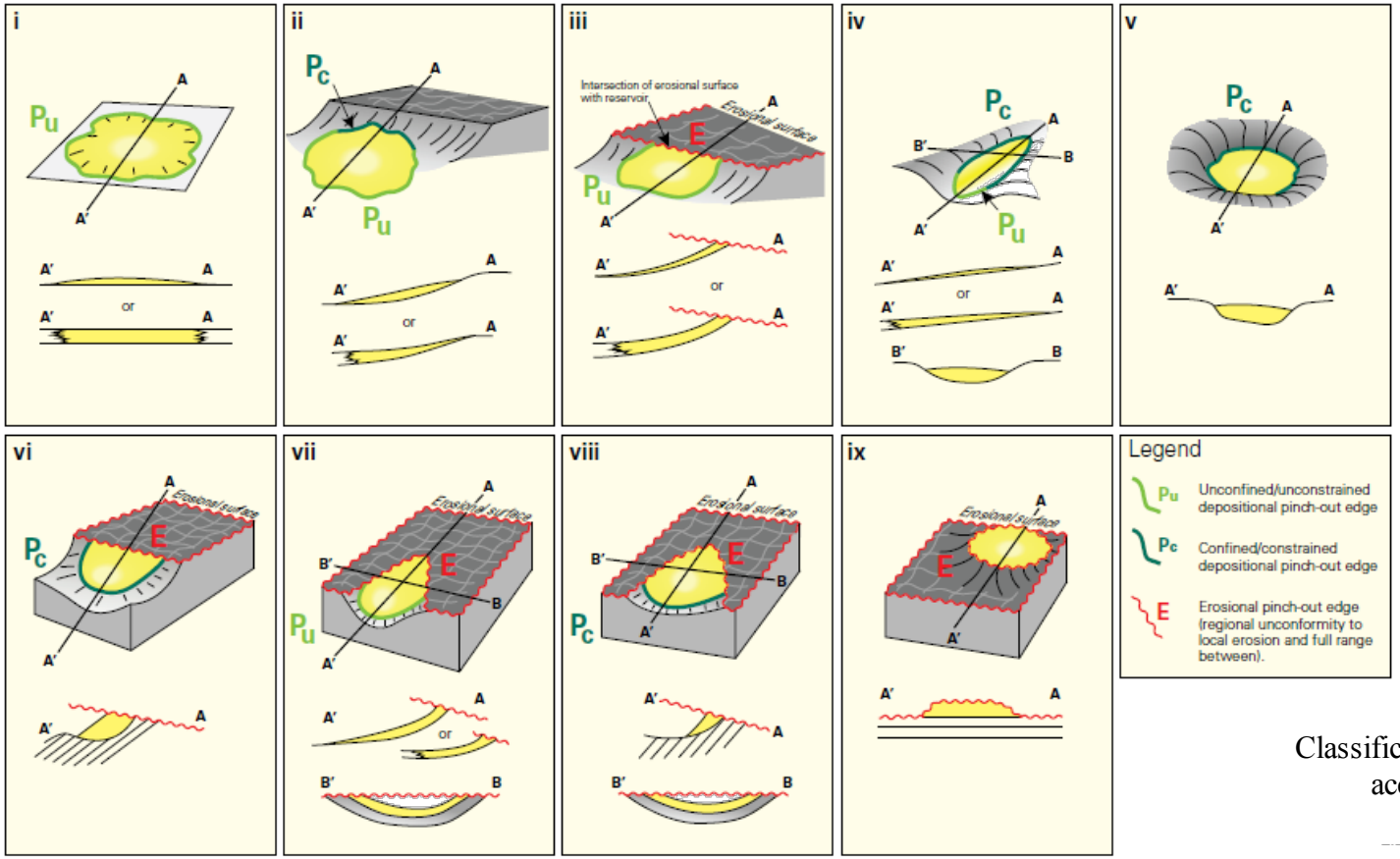
What is a stratigraphic trap?





- Depositional pinch-out
  - Onlap, facies change, downlap
- Erosional pinch-out
  - Beneath regional u/c or local incision
- Defining every edge of a potential trap allows correct risk assessment

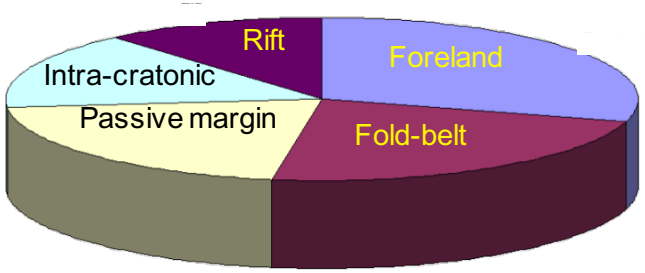
Factors favouring development of strat traps



- What favours development of wedges and edges?
- It doesn't depend on basin type…

- Pre-existing topography and structural elements
- Depositional stacking patterns

Classification of stratigraphic traps according to basin type



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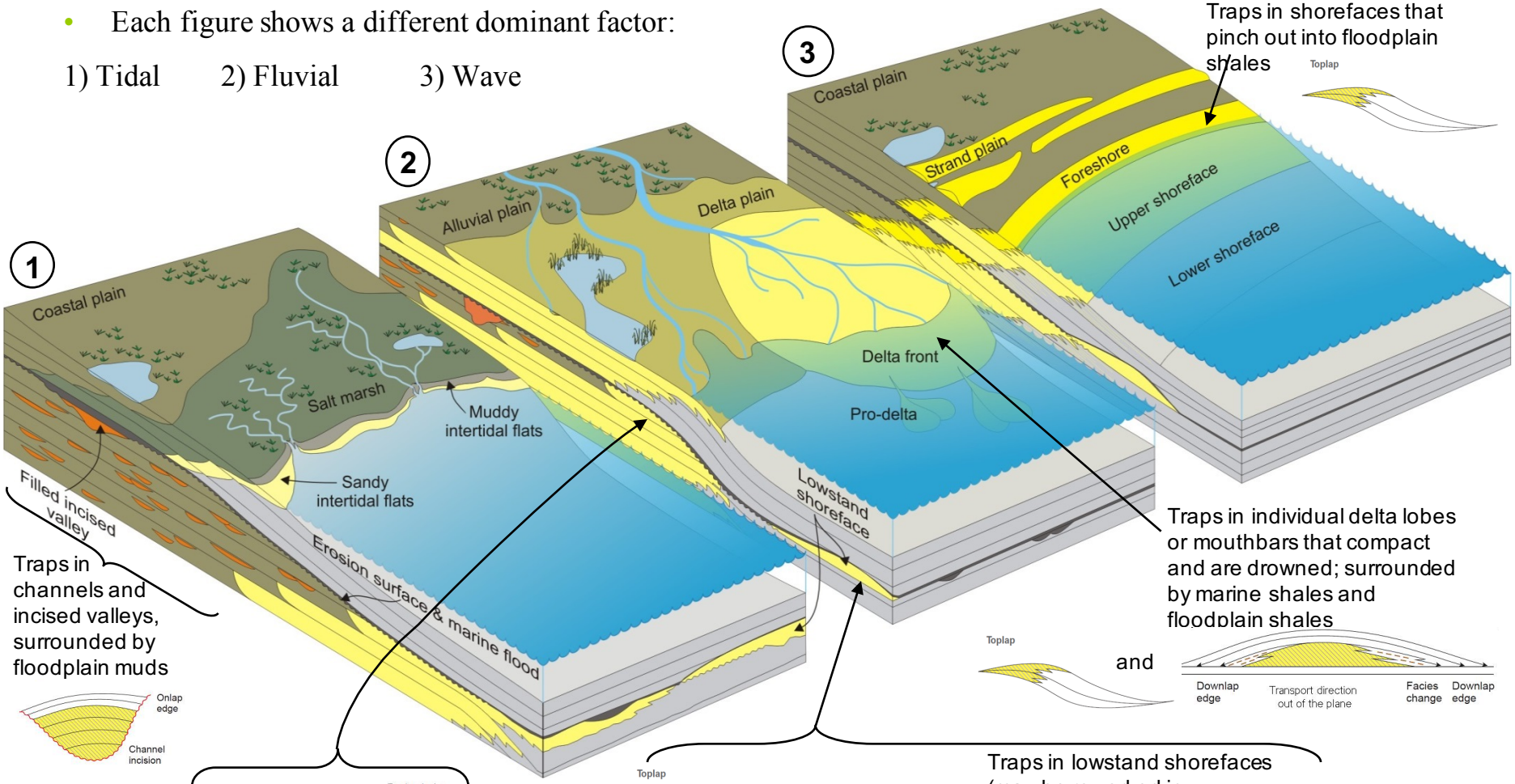
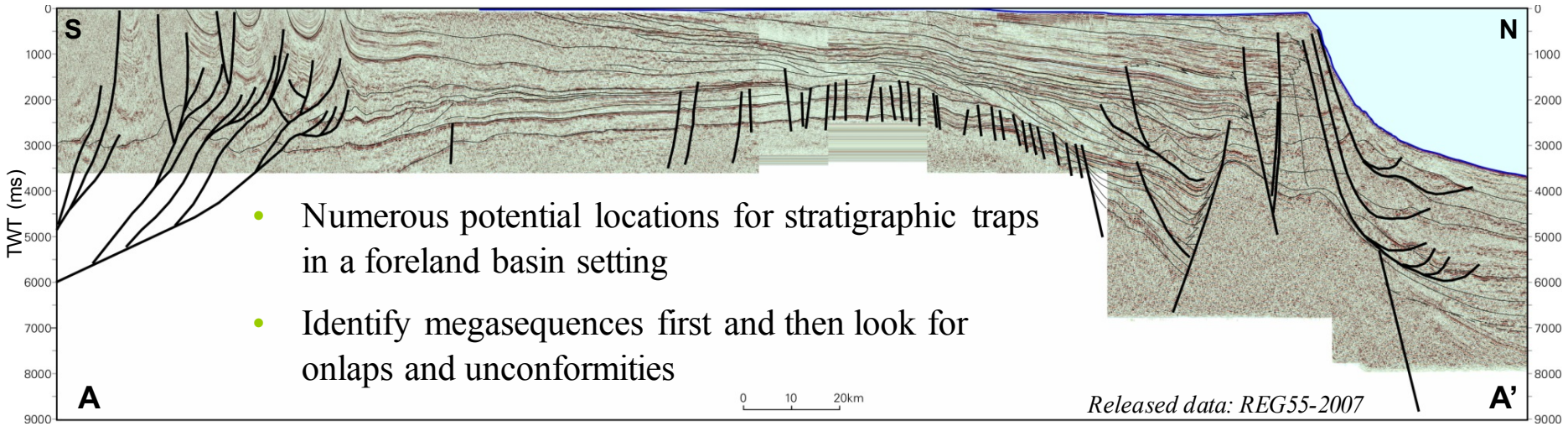
Summary of paralic stratigraphic trap types

- Each figure shows a different dominant factor:

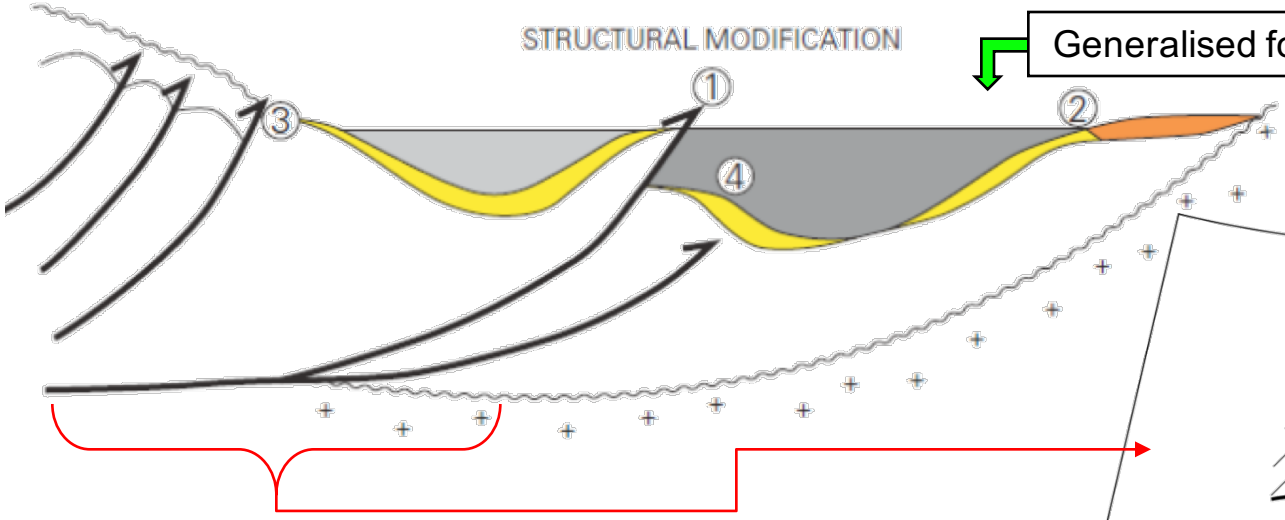
1) Tidal 2) Fluvial 3) Wave



2D foreland basin, Arctic region

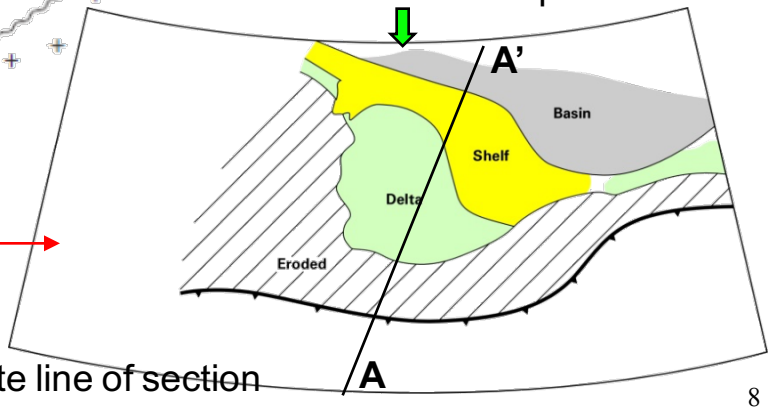


- Numerous potential locations for stratigraphic traps in a foreland basin setting
- Identify megasequences first and then look for onlaps and unconformities



Generalised foreland basin schematic section

Simplified depositional environment map



Approximate line of section

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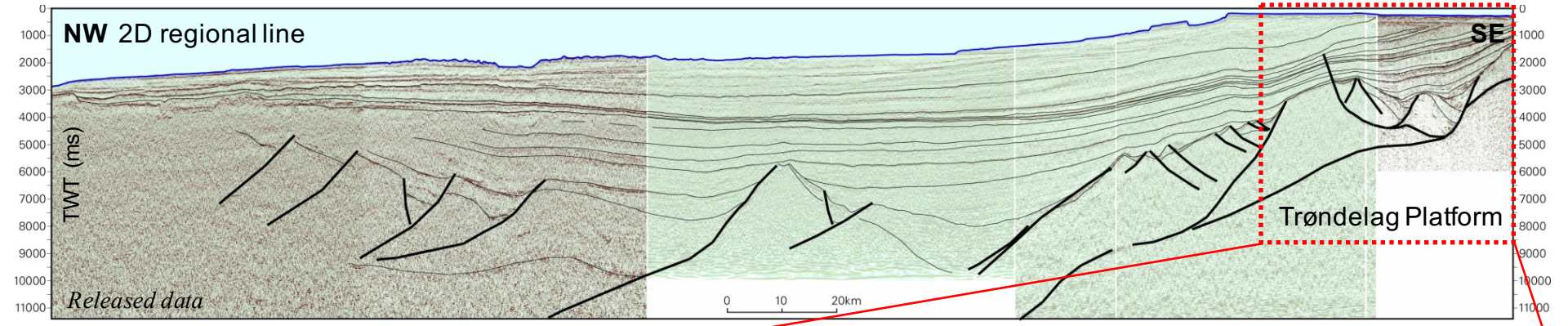
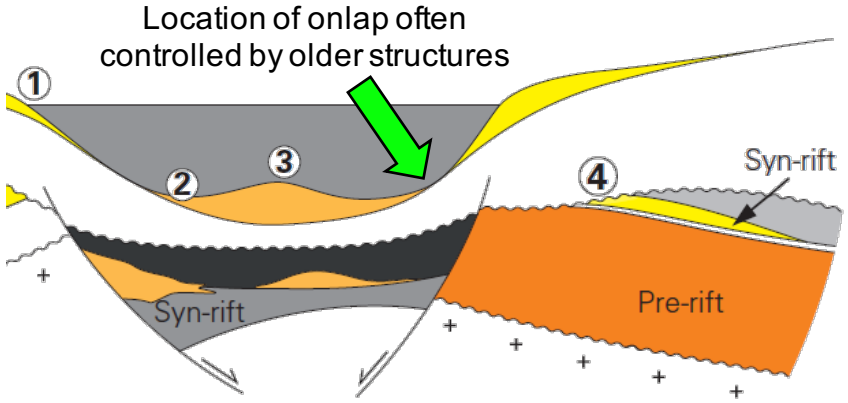
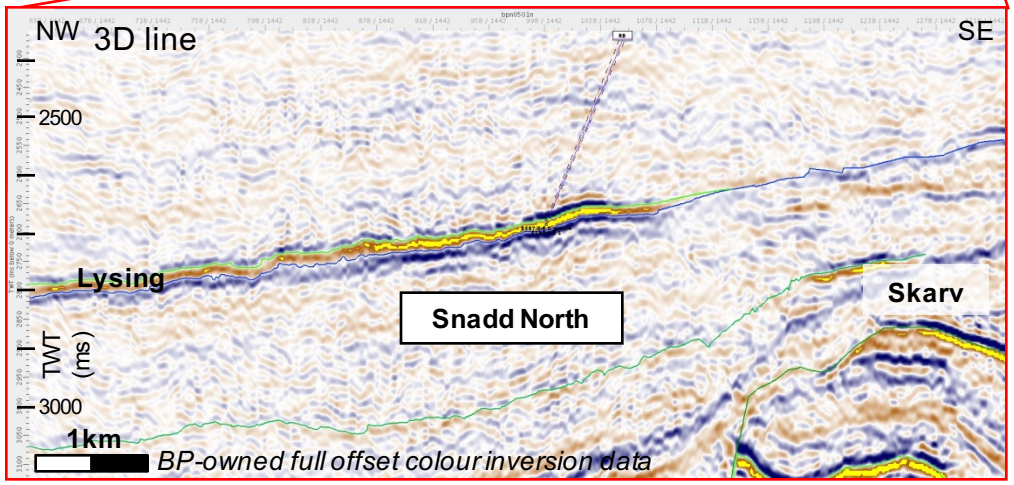
2D to 3D – Norwegian Sea



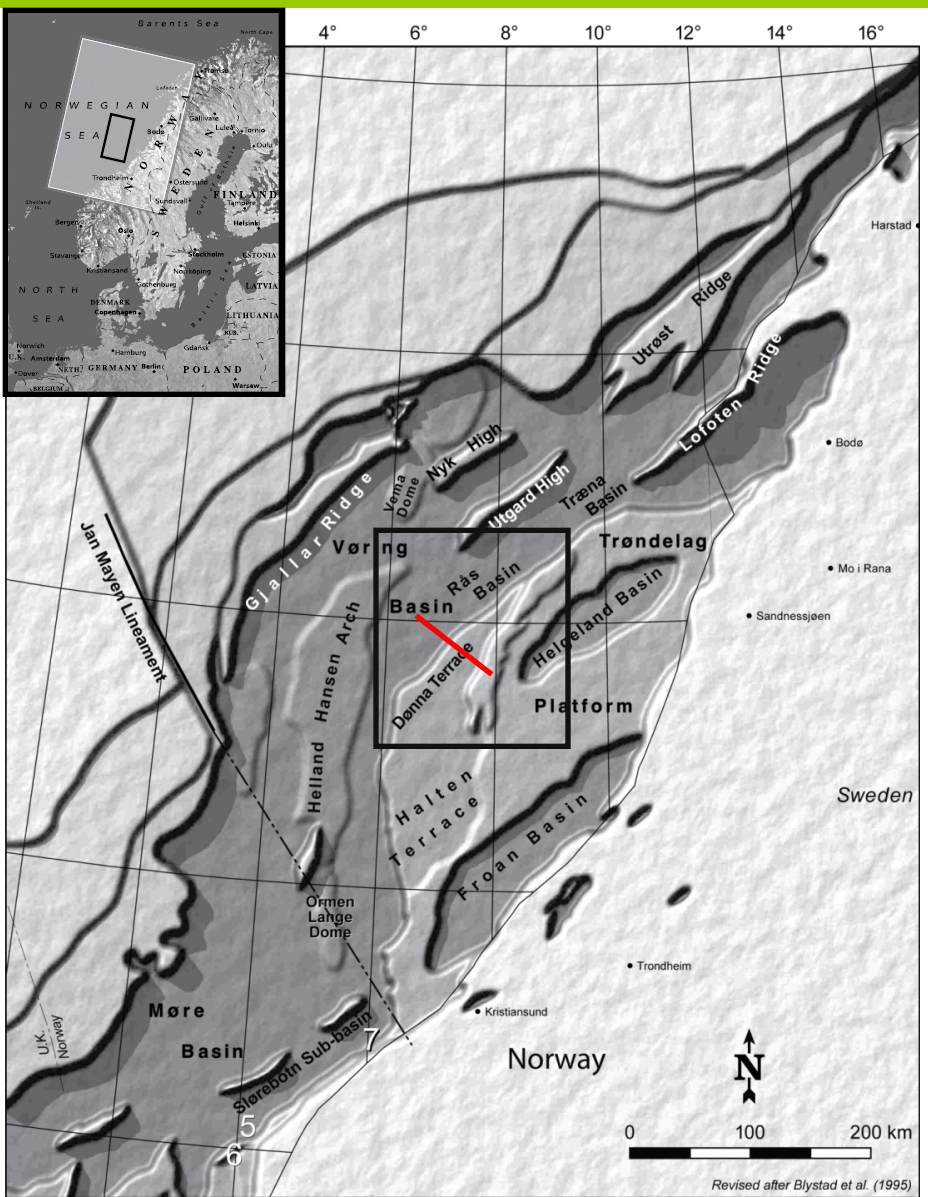


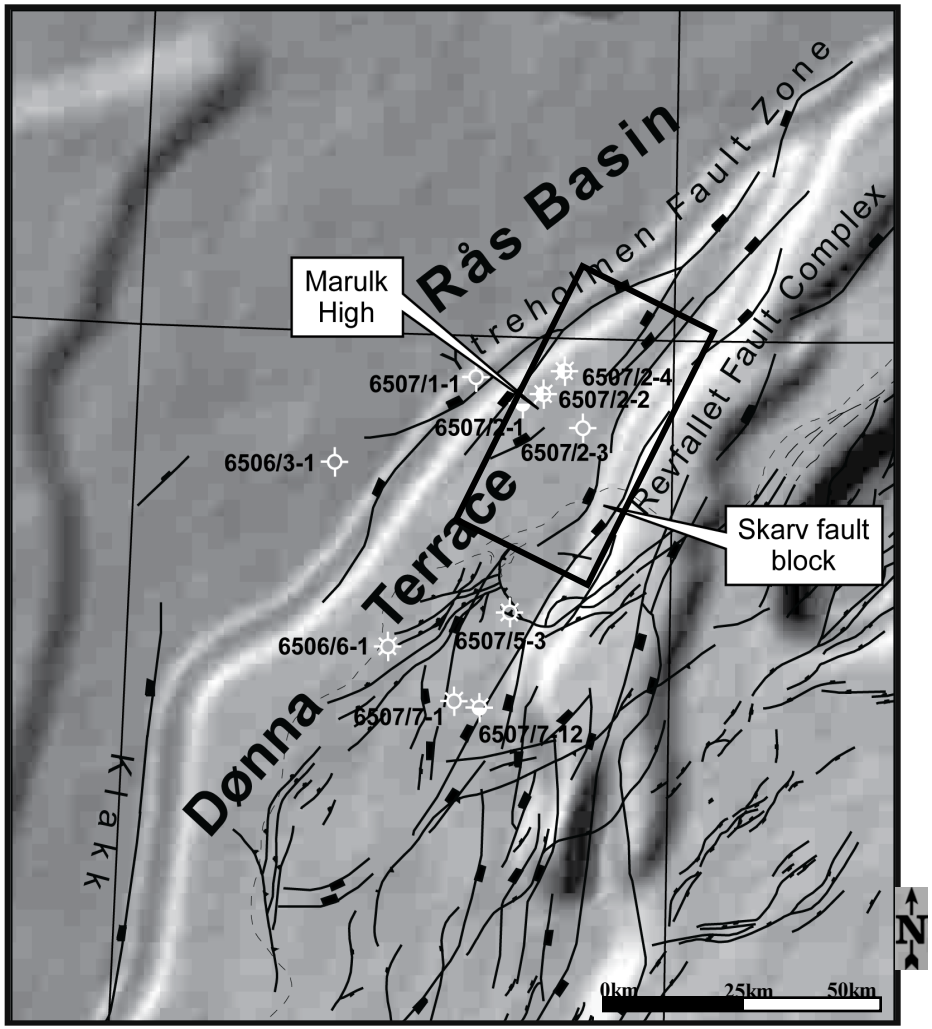
Generalised rift to post-rift basin schematic section



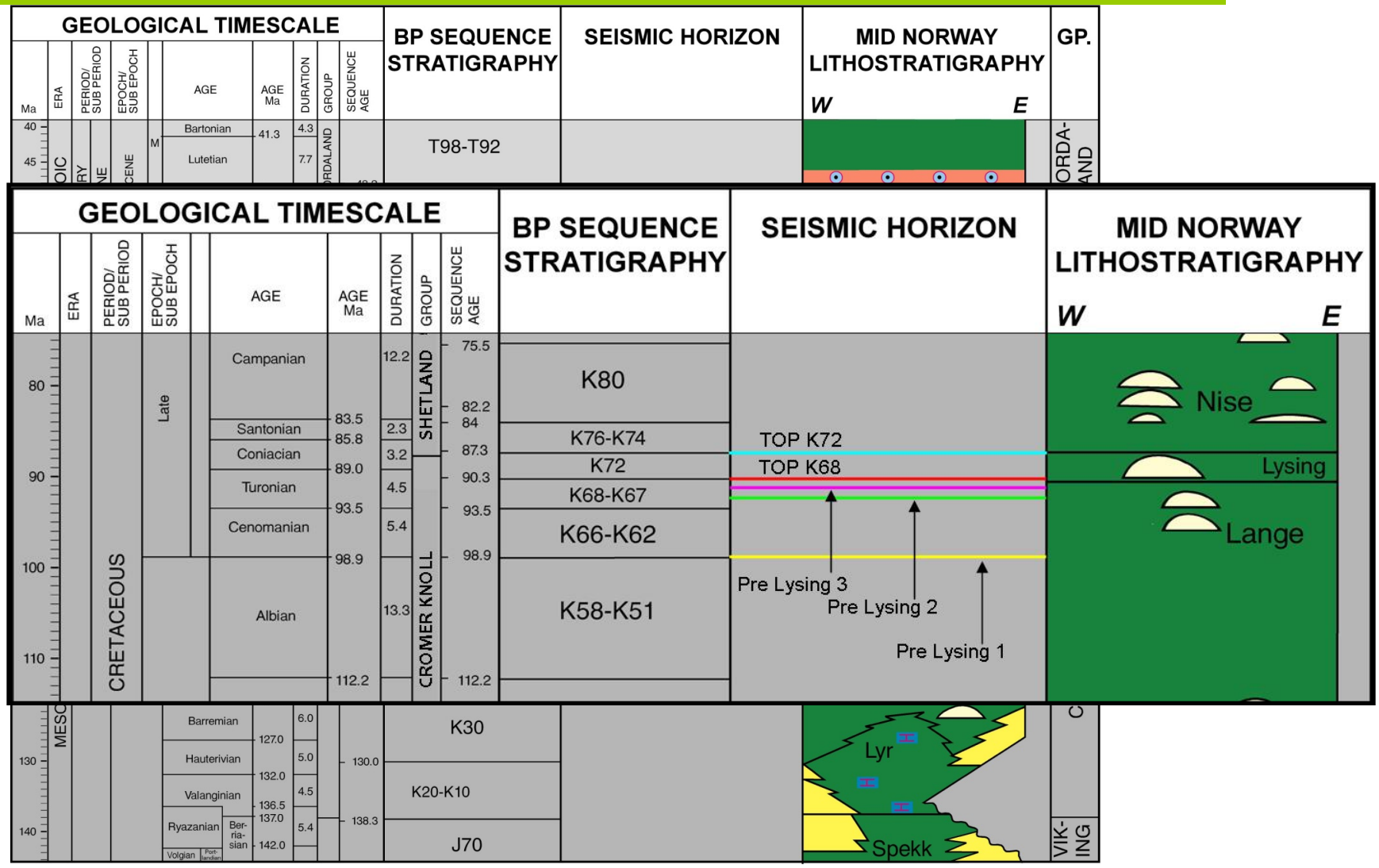
- Zone of structural weakness at basin-forming fault controls location of post-rift fan onlaps
- 2D shows where to focus; 3D, designed to image pinch-outs, needed to de-risk trap

Location map, Dønna Terrace





Stratigraphic framework, Norwegian Sea



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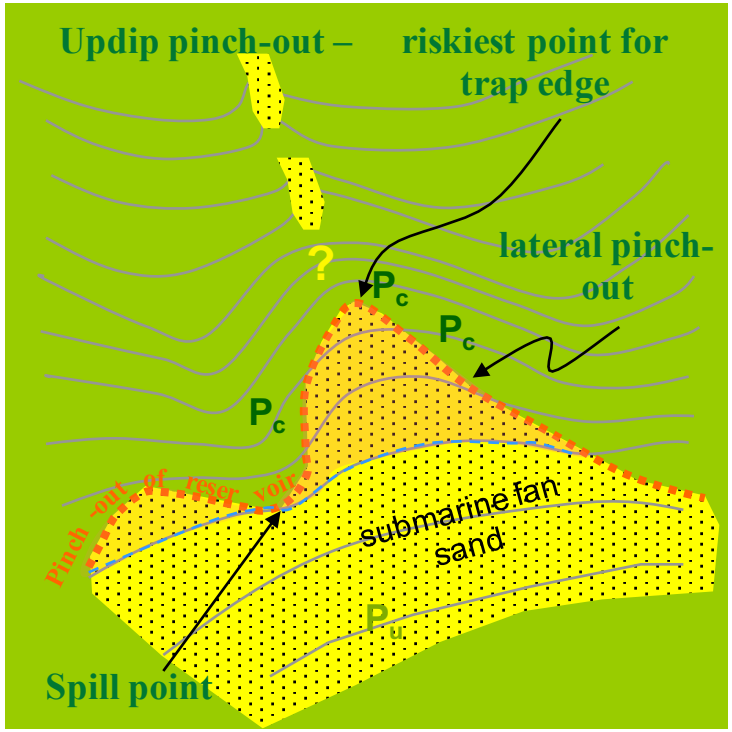
Risking a stratigraphic trap

- What are your edges?
  - Unconfined depositional pinch-out – hard to predict where edges are
  - Confined and/or eroded – easier to see, less risky
  - Structural influence/control increases chances of edges
- Don't double-dip!
  - Don't make a seal high-risk if it works in structural traps elsewhere…. it's not the seal quality that is high risk
  - It's generally the trap edge that is uncertain/risky, not the seal quality
  - Bottom seals however do require more thorough work



Summary

- Stratigraphic traps are under-explored and have the potential to contain significant YTF both in new plays and mature basins
- Systematic definition of each trap edge aids accurate risking; defining edges of depositional elements is critical to locate traps
- Pre-existing and syn-depositional tectonic and structural elements have a major influence on the location of stratigraphic and sub-unconformity traps; including key structural elements on a depositional map allows locations of potential traps to be identified
- Rift and foreland basin examples show that 2D can help locate favourable parts of a margin, while 3D is needed to locate trap edge
- If risked properly, stratigraphic, combination and sub-unconformity traps can compete with structural traps on a fair footing

Acknowledgements

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