Stratigraphic architecture of back-filled incised-valley systems: Pennsylvanian-Permian lower Cutler beds, Utah, USA

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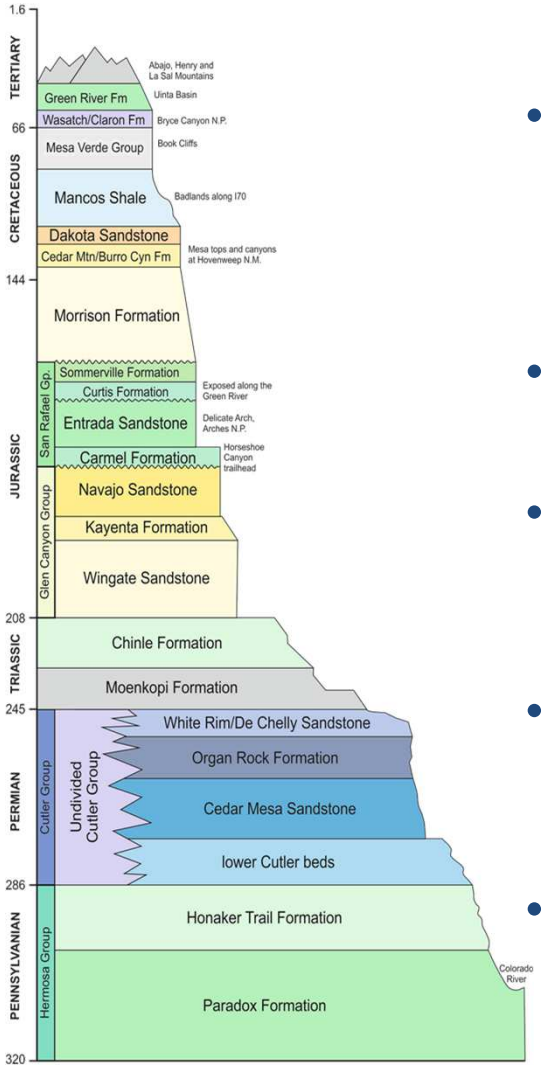
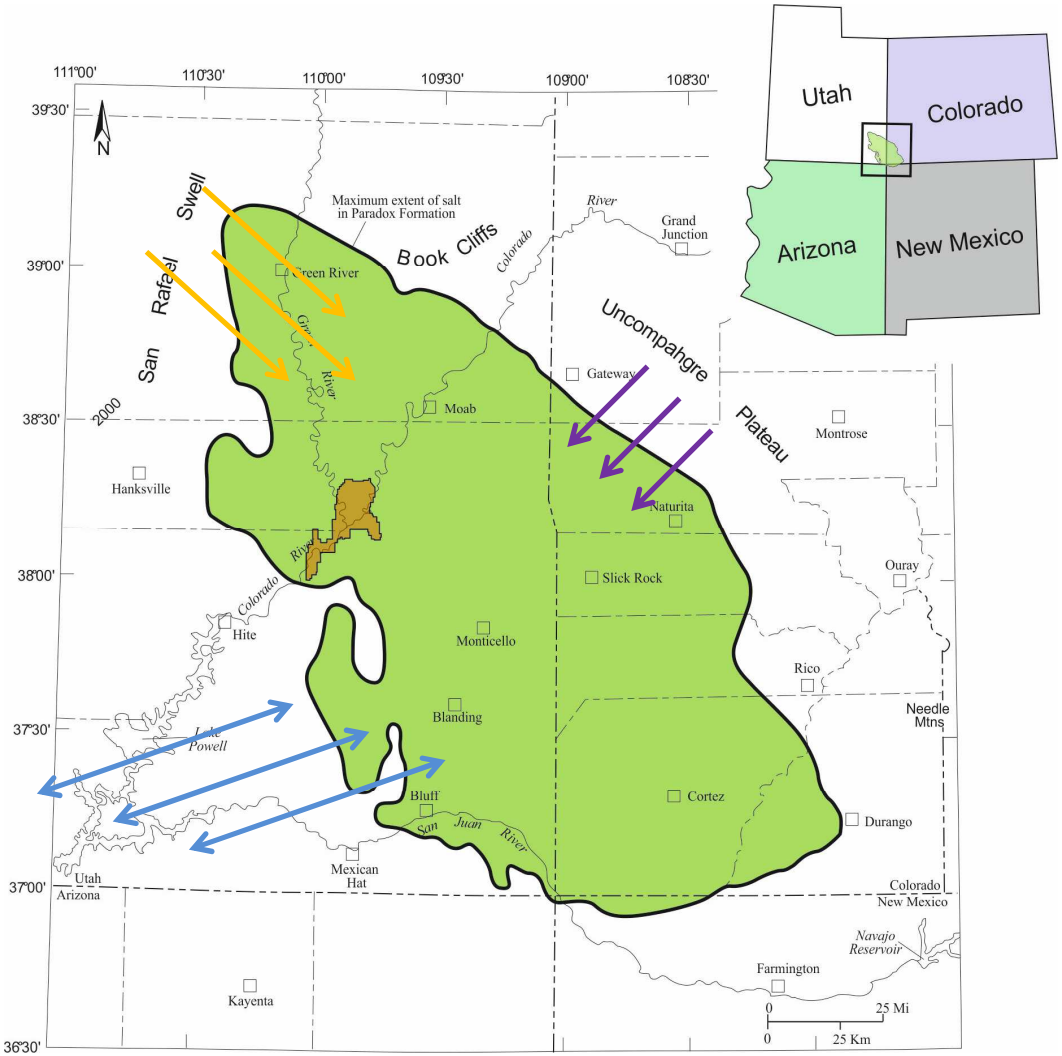
Introduction

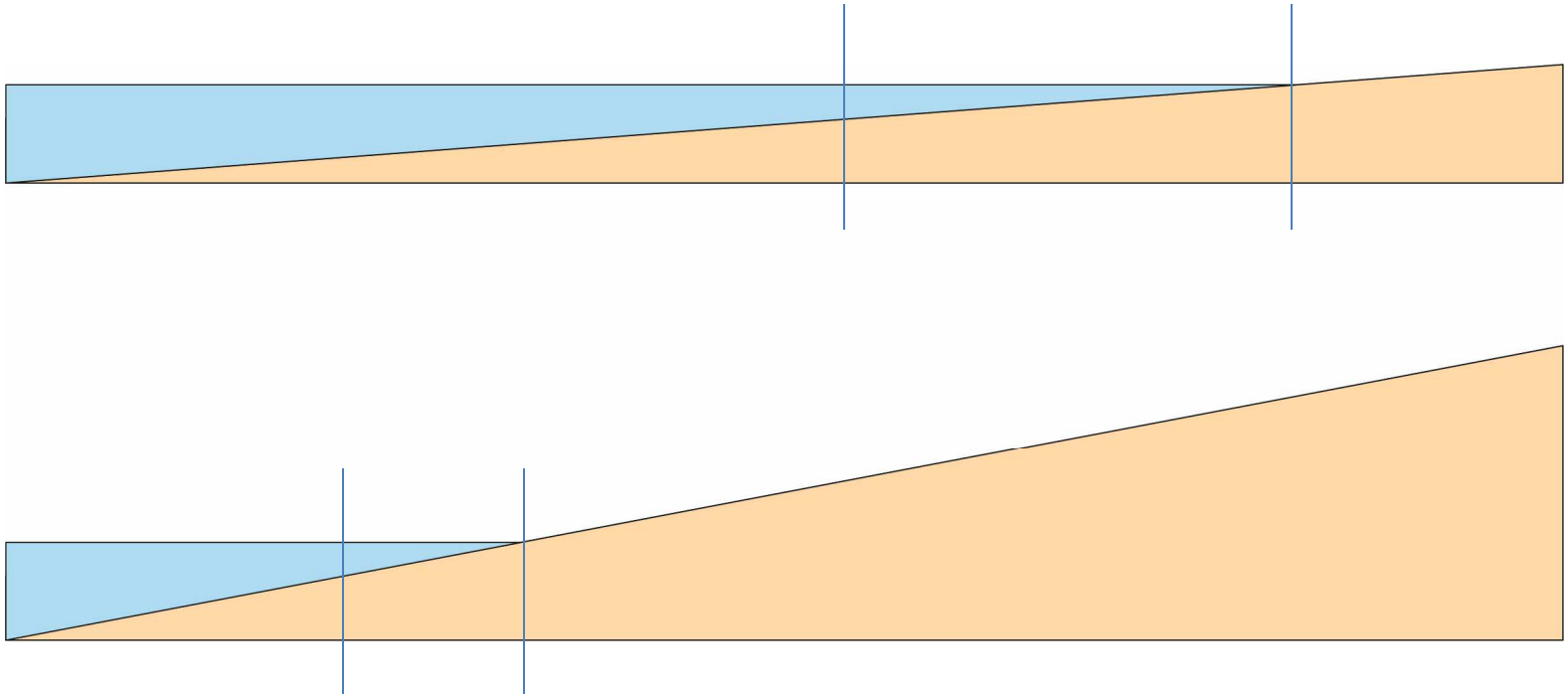


- Two hundred metre thick tripartite succession of aeolian, fluvial and shallow marine facies in almost equal proportions
- Exposed in the Paradox Basin, southeast Utah
- Deposited in a semi-arid littoral environment with a palaeolatitude ~20^{o} north of the equator
- Succession comprised of sandstones, mudstones, siltstones, limestones and gritstones
- High-frequency RSL changes identified (Jordan & Mountney, 2010; 2012)

Paradox Basin



Coastal Morphology



- Coastal plain characterised by a low-relief, low-angle morphology
  - Denoted by extensive unbroken thin (1-3 m) limestone elements of regional extent

Identification of IV's

- A lower bounding surface (erosive) of regional lateral extent
- Abrupt lateral transition from non-marine to marine element types
- Presence of incised-valley specific element types
- Thickness of preserved marine succession

Identification of IV's

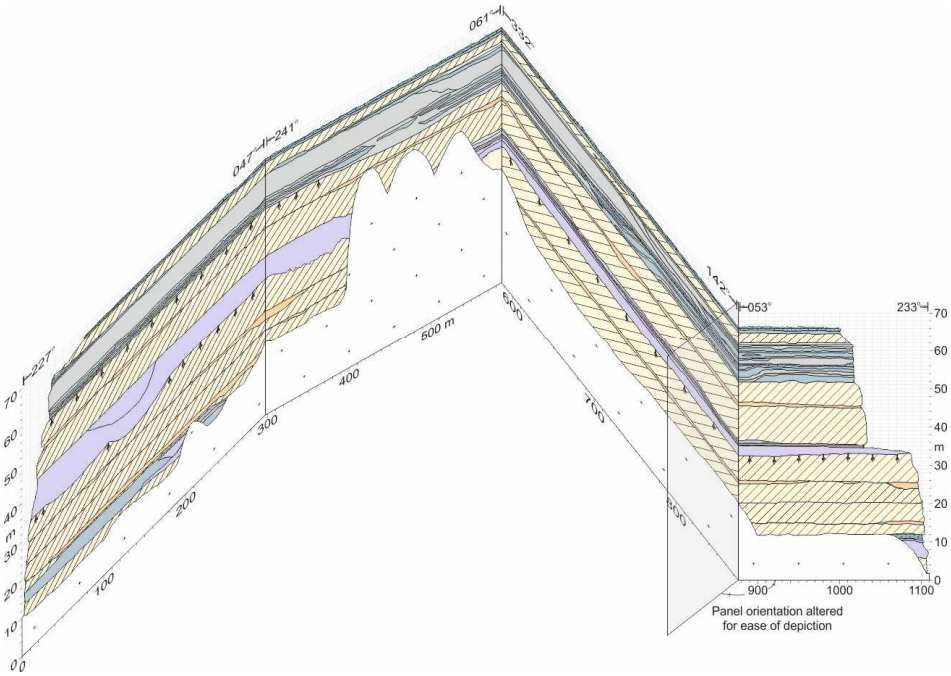
Interfluve

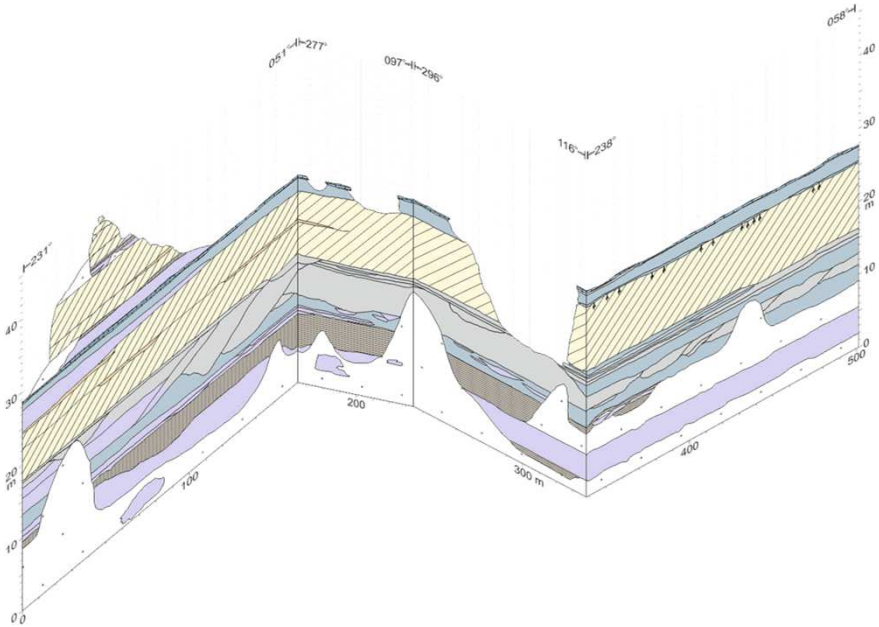
Incised-valley infill

- Marked changes in the thicknesses of marine facies types between interfluve and incised-valley locations
- Thickness variations exacerbated by an interpreted low-angle, low-relief coastal plane

Data Set

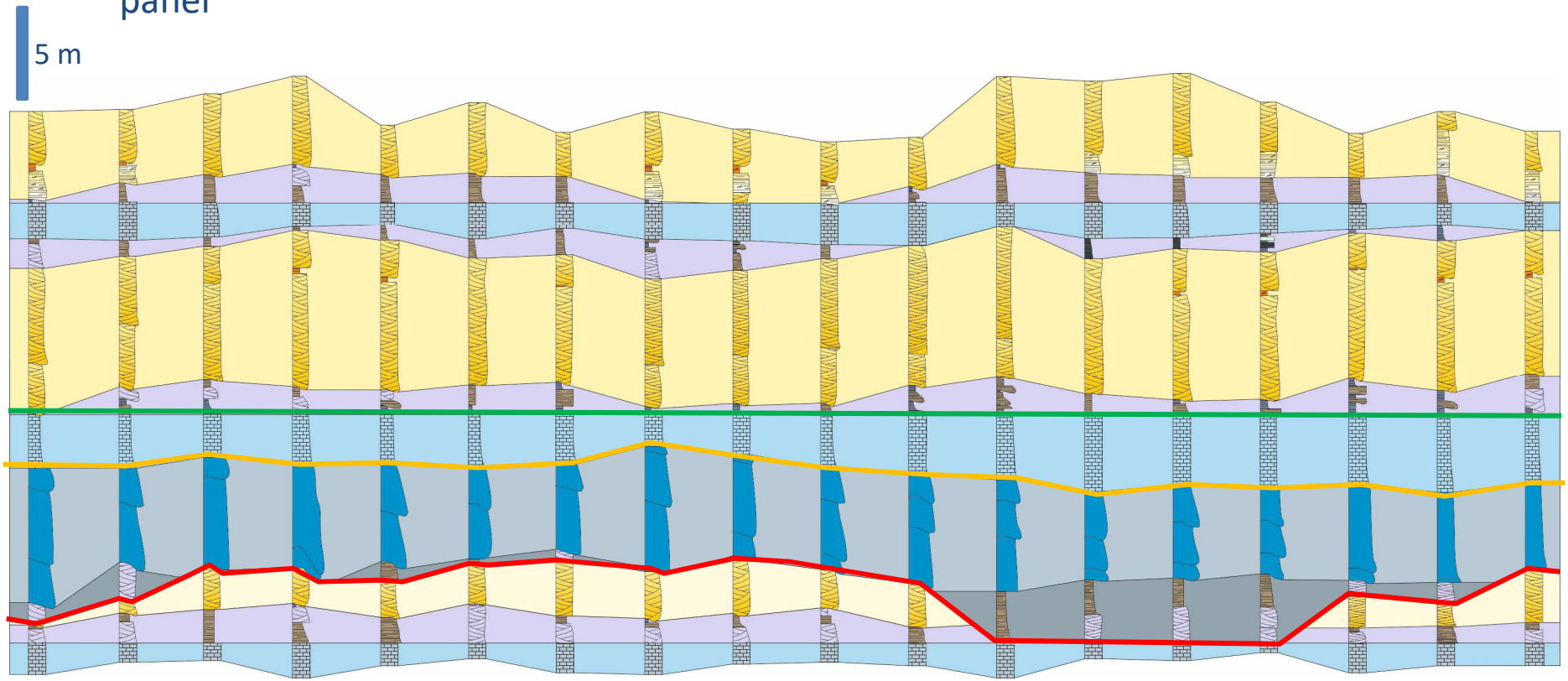
- A series of pseudo-three-dimensional architectural panels that include proximal, medial and distal locations within a series of incised-valley systems



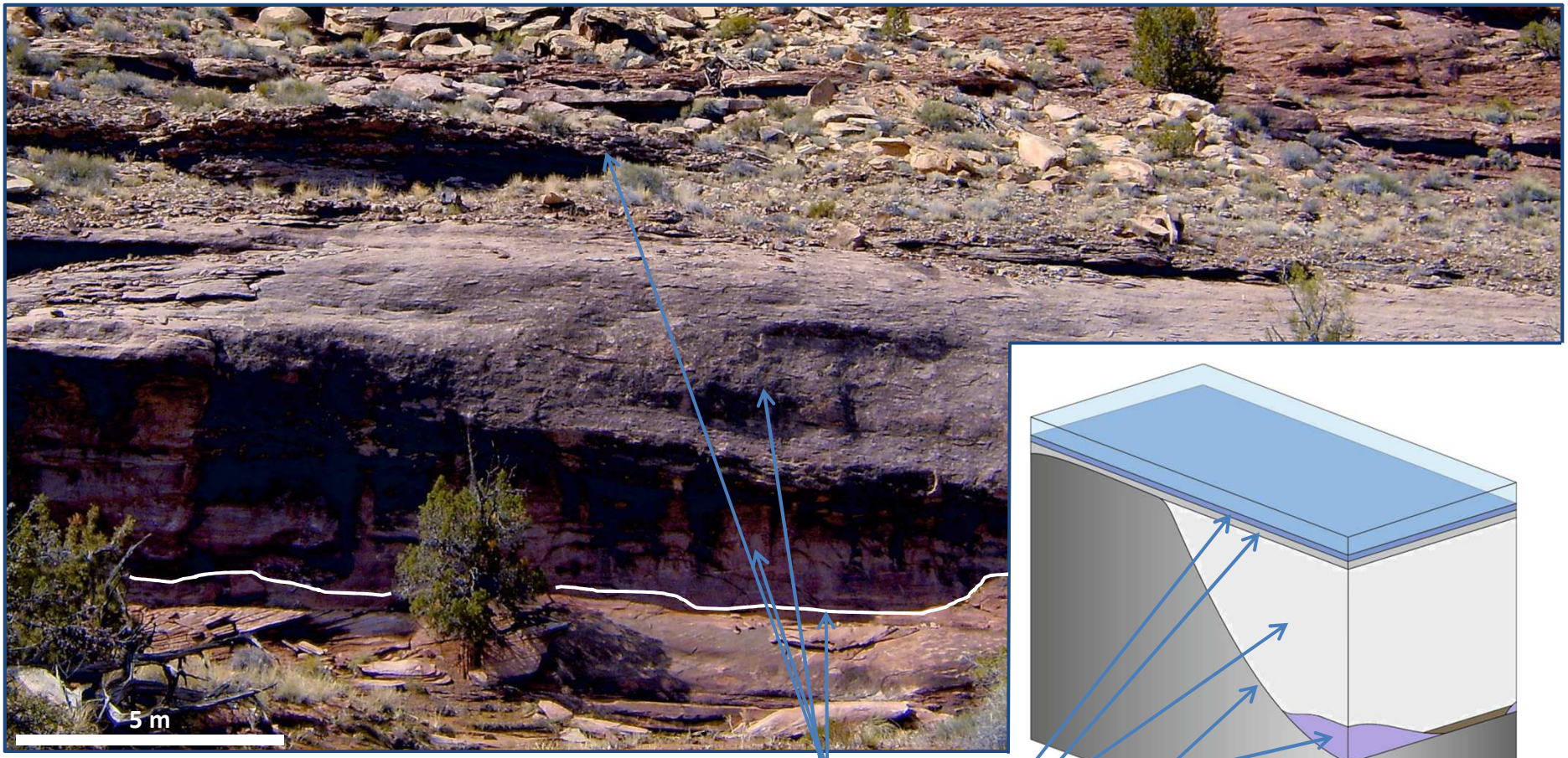


Data Set cont'd

- Eighteen high-resolution sedimentary logs spaced ~25 m apart to create a fence panel



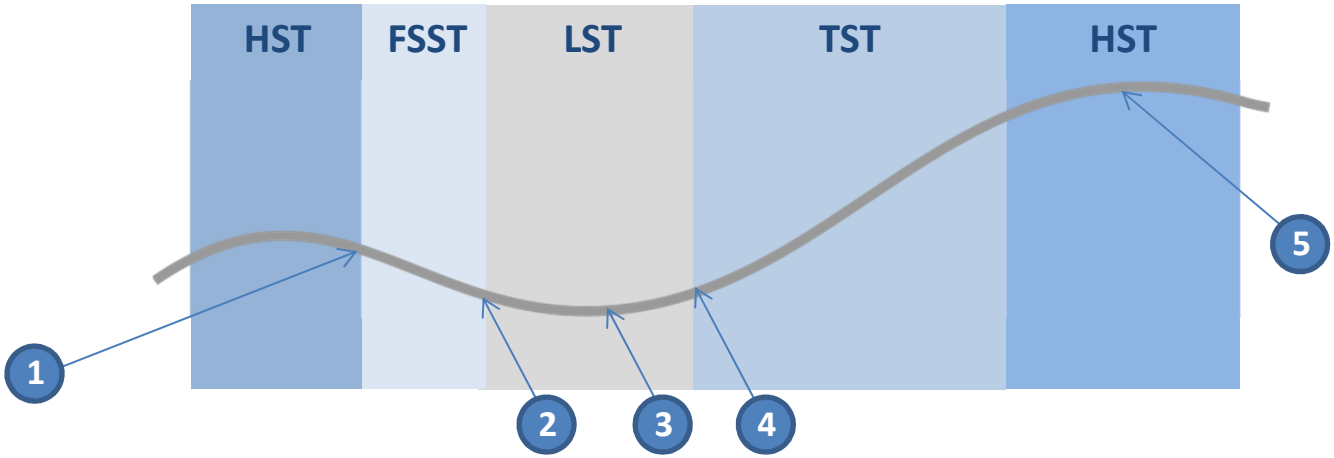
Incised-Valley Infill



Incised-Valley Architecture

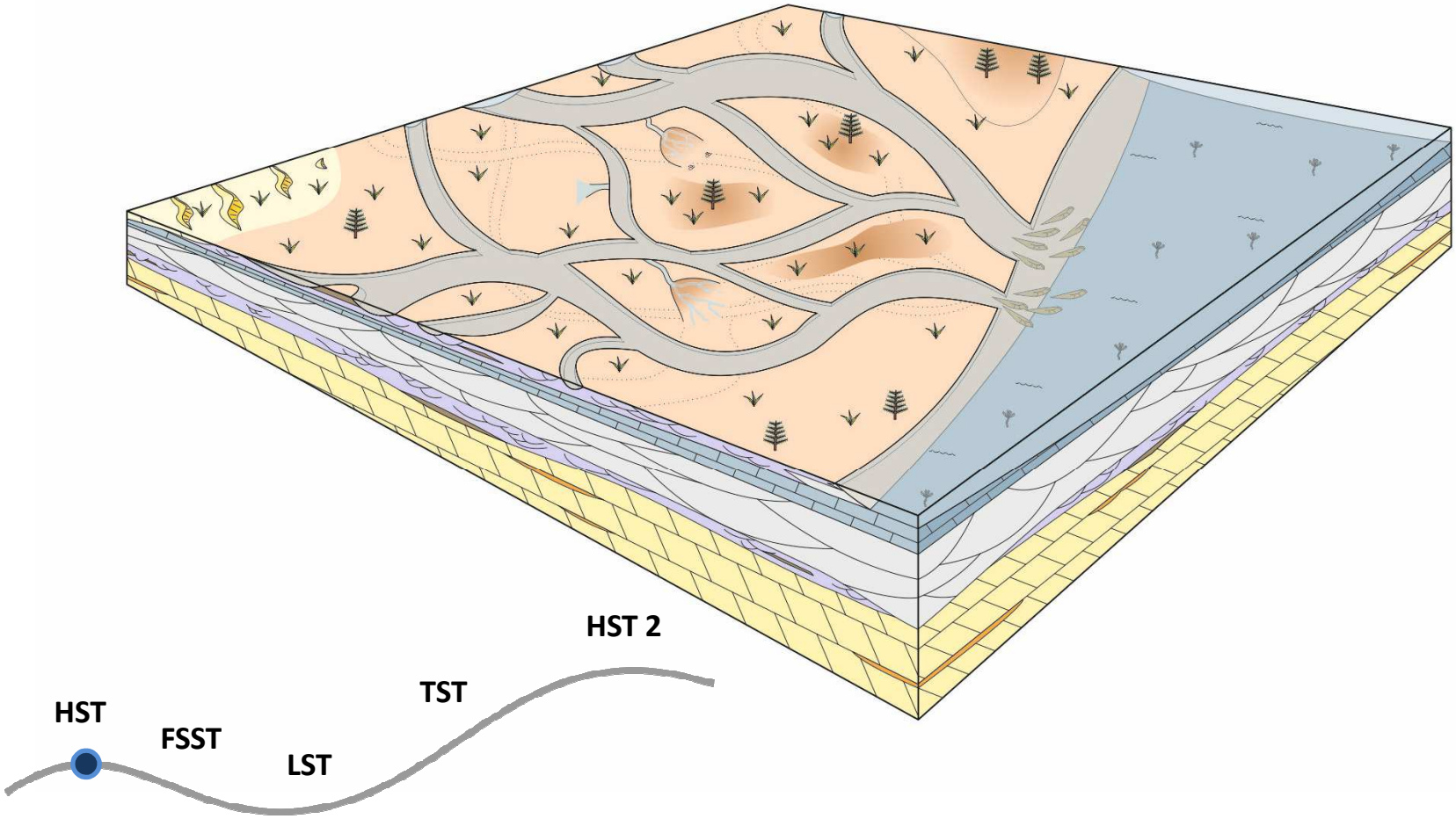
- Thicknesses up to 20 m
- Width >1 km
- Length >40 km
- Three time independent incised-valley systems recognised in the upper 70 m of the lower Cutler beds

Stratigraphic Timing



1. Incised-valley incision occurs at the end of highstand and the start of the falling stage as base-level falls
2. Valley incision ends when base-level stops falling = lowstand
3. ‘Back-flooding’ occurs during base-level rise within the lowstand
4. Complete infill ends at the beginning of transgression where interfluve areas become inundated by marine waters
5. Capping marine elements accumulate/deposit

Conceptual Models



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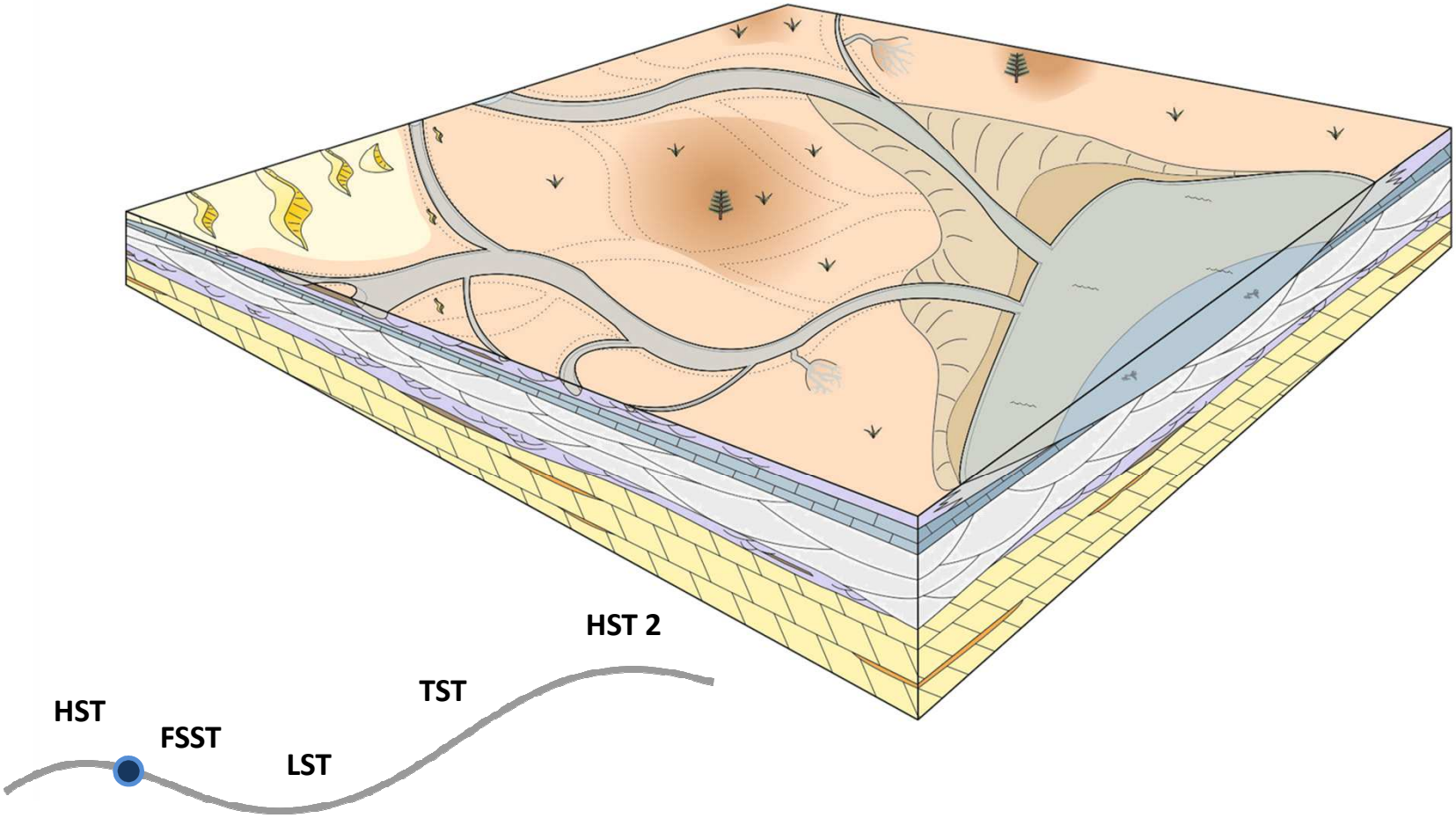

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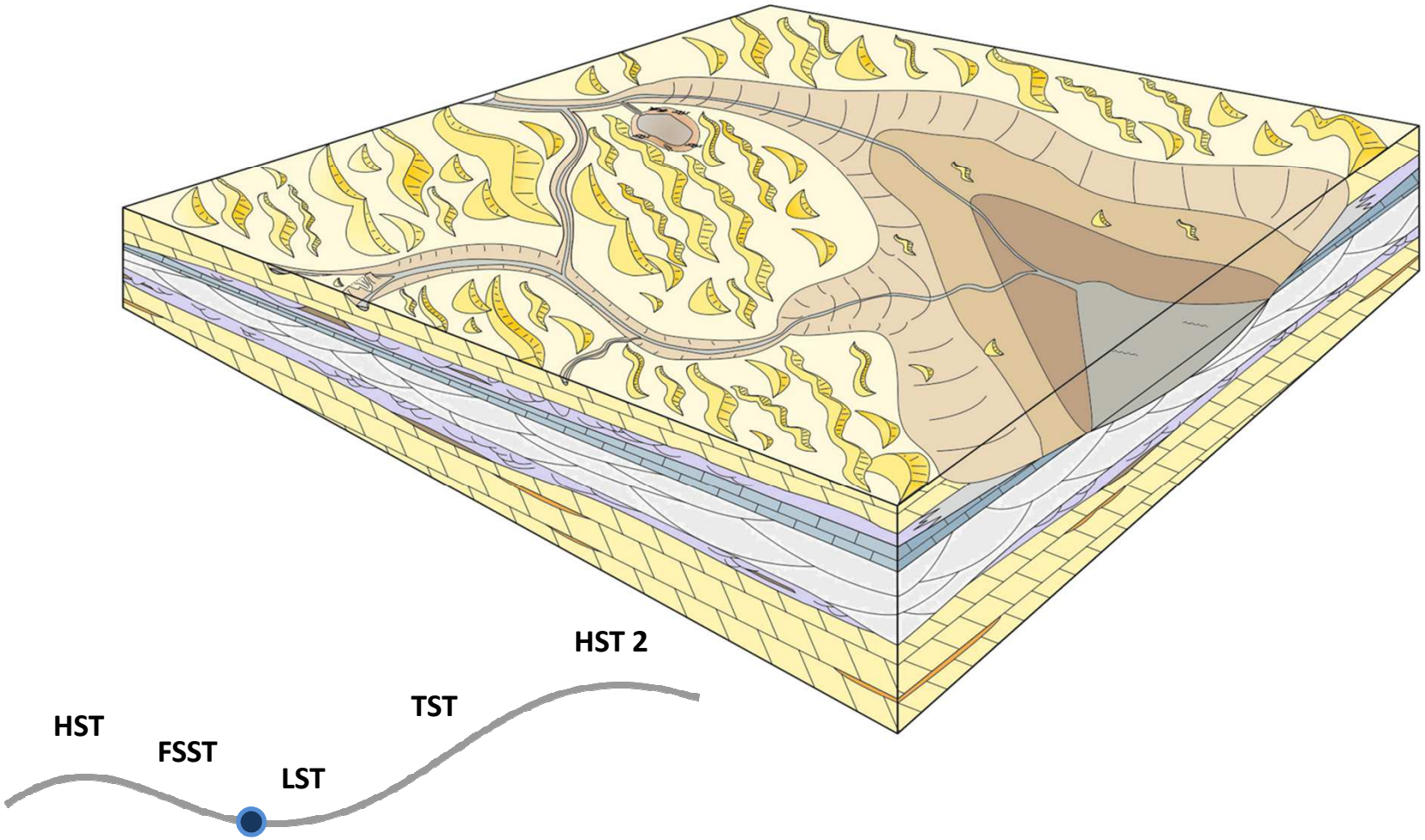

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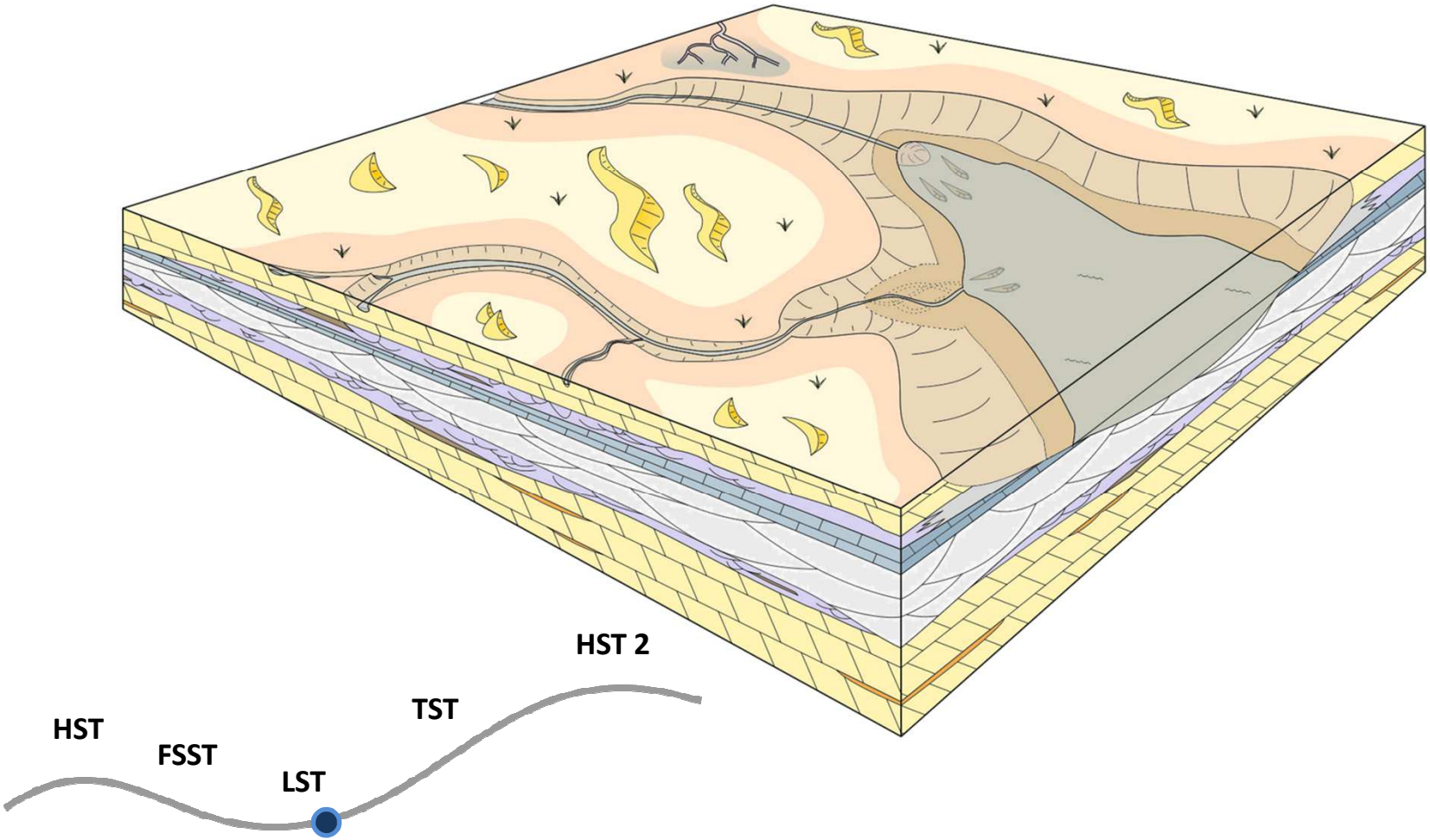

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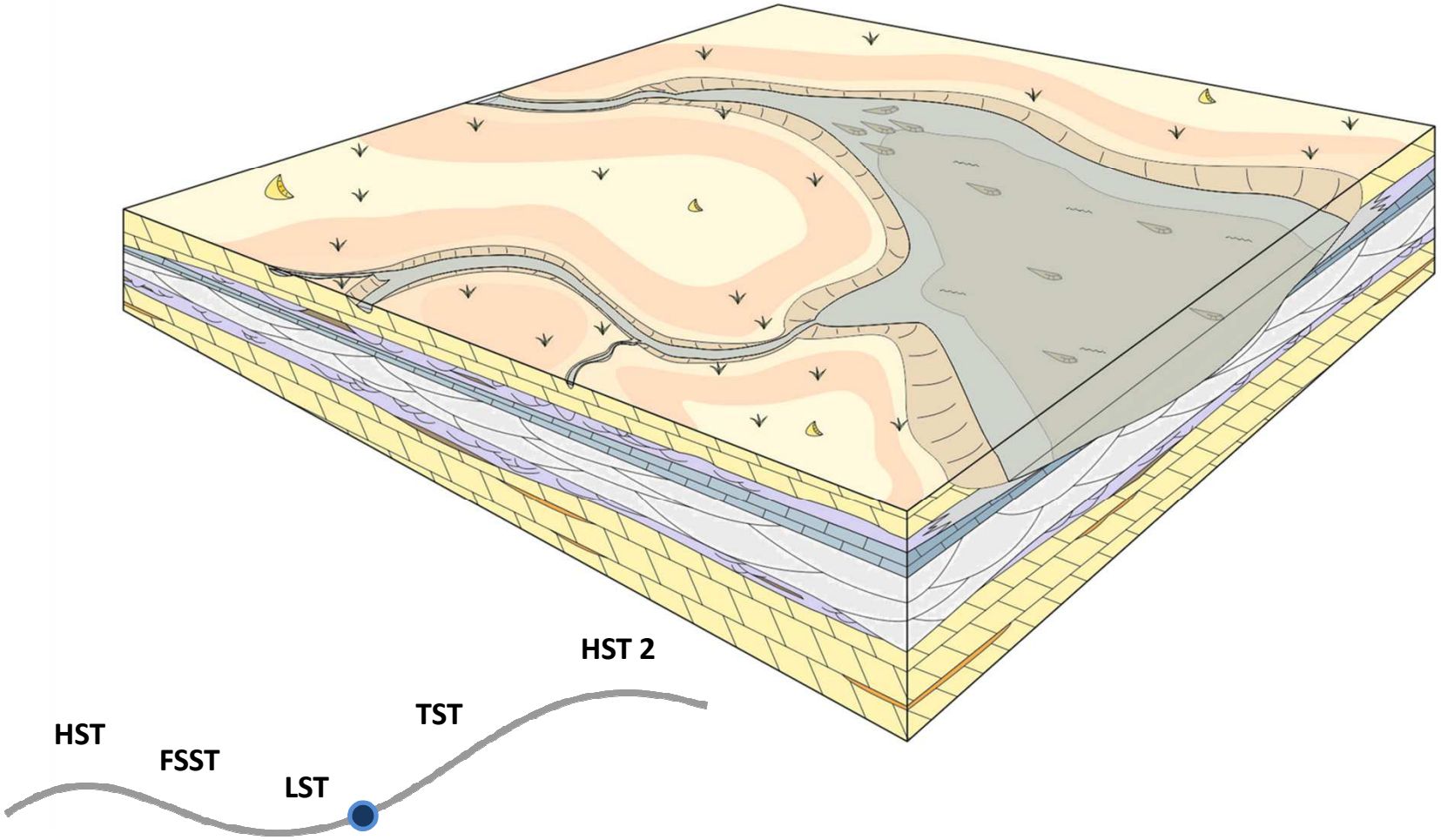

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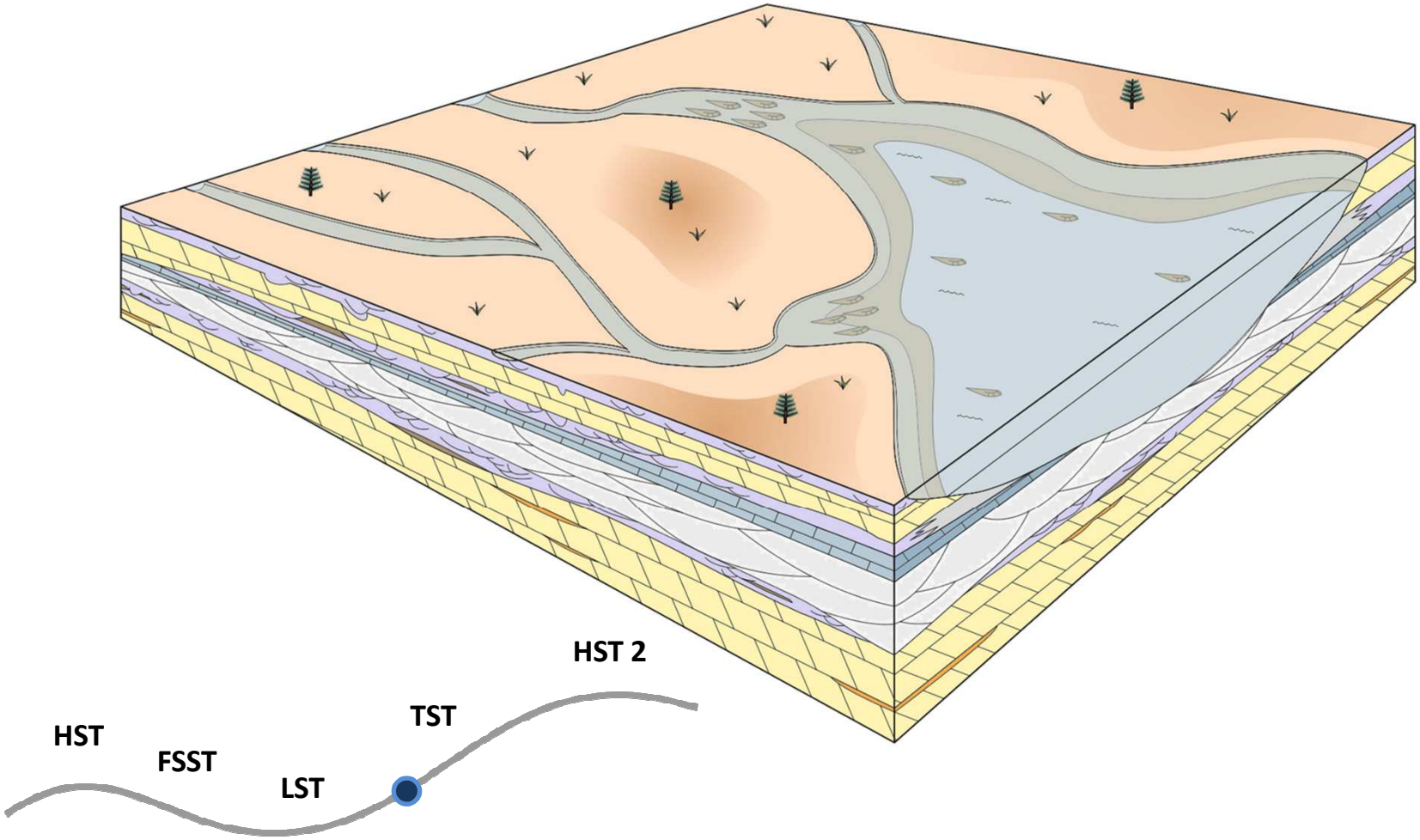

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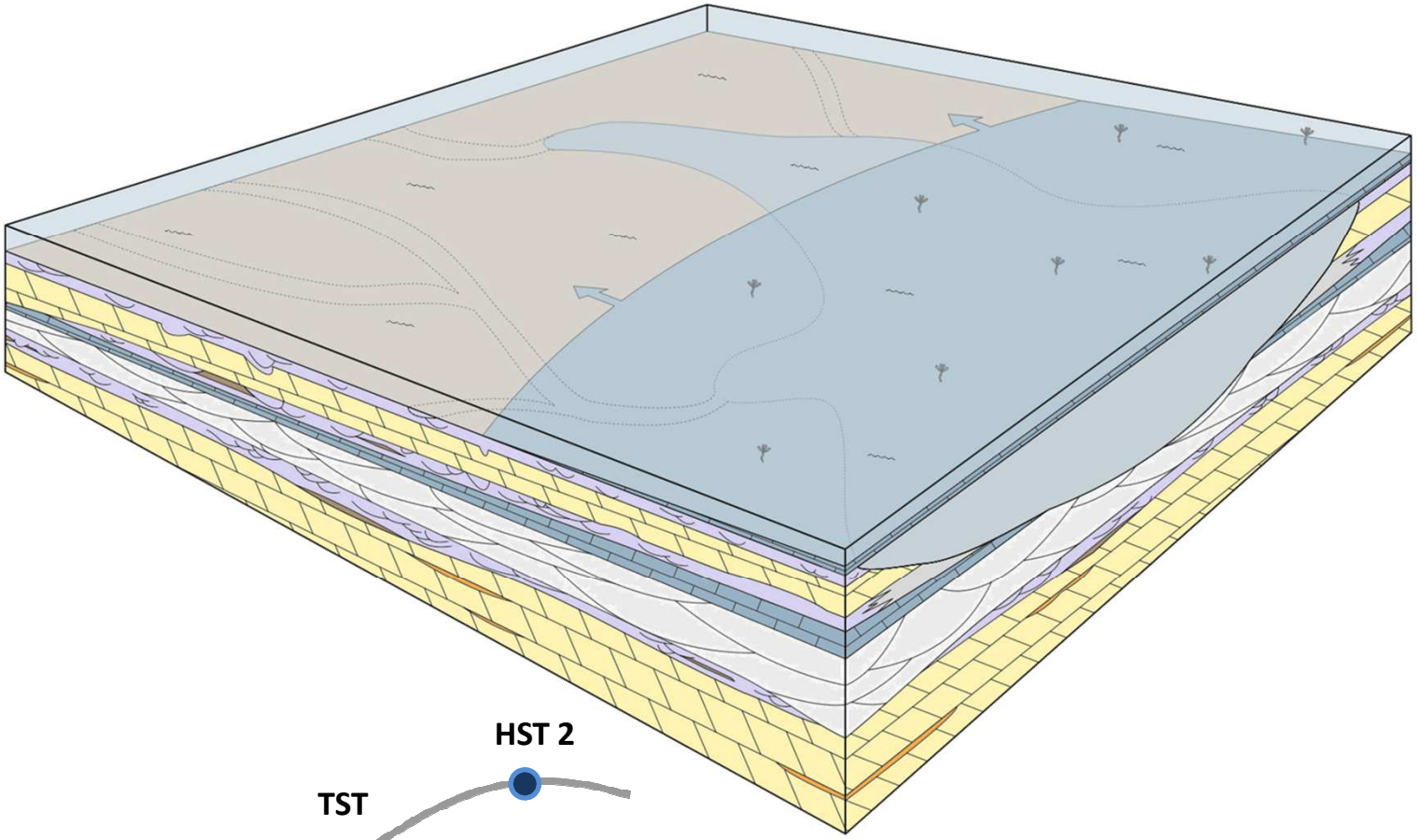

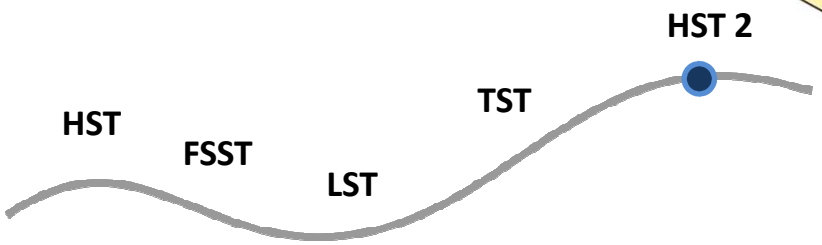

Conclusions

- Incised-valley formation resulted from changes in base-level, related to relative sea-level cycles
- Incision events associated with separate sequences resulted in the generation of multiple time independent incised-valley systems
- Each incised-valley system records an episode of cut-and-fill during a single cycle of base-level fall and rise; individual valley fills do not preserve evidence of multiple cut-and-fill events

References

- Jordan, O.D., Mountney, N.P. 2010 Styles of interaction between aeolian, fluvial and shallow marine environments in the Pennsylvanian to Permian lower Cutler beds, south-east Utah, USA, Sedimentology, 57, 1357-1385
- Jordan, O.D., Mountney, N.P. 2012 Sequence Stratigraphic Evolution and Cyclicity of An Ancient Coastal Desert System: The Pennsylvanian–Permian Lower Cutler Beds, Paradox Basin, Utah, U.S.A, Journal of Sedimentary Research, 82, 755-780