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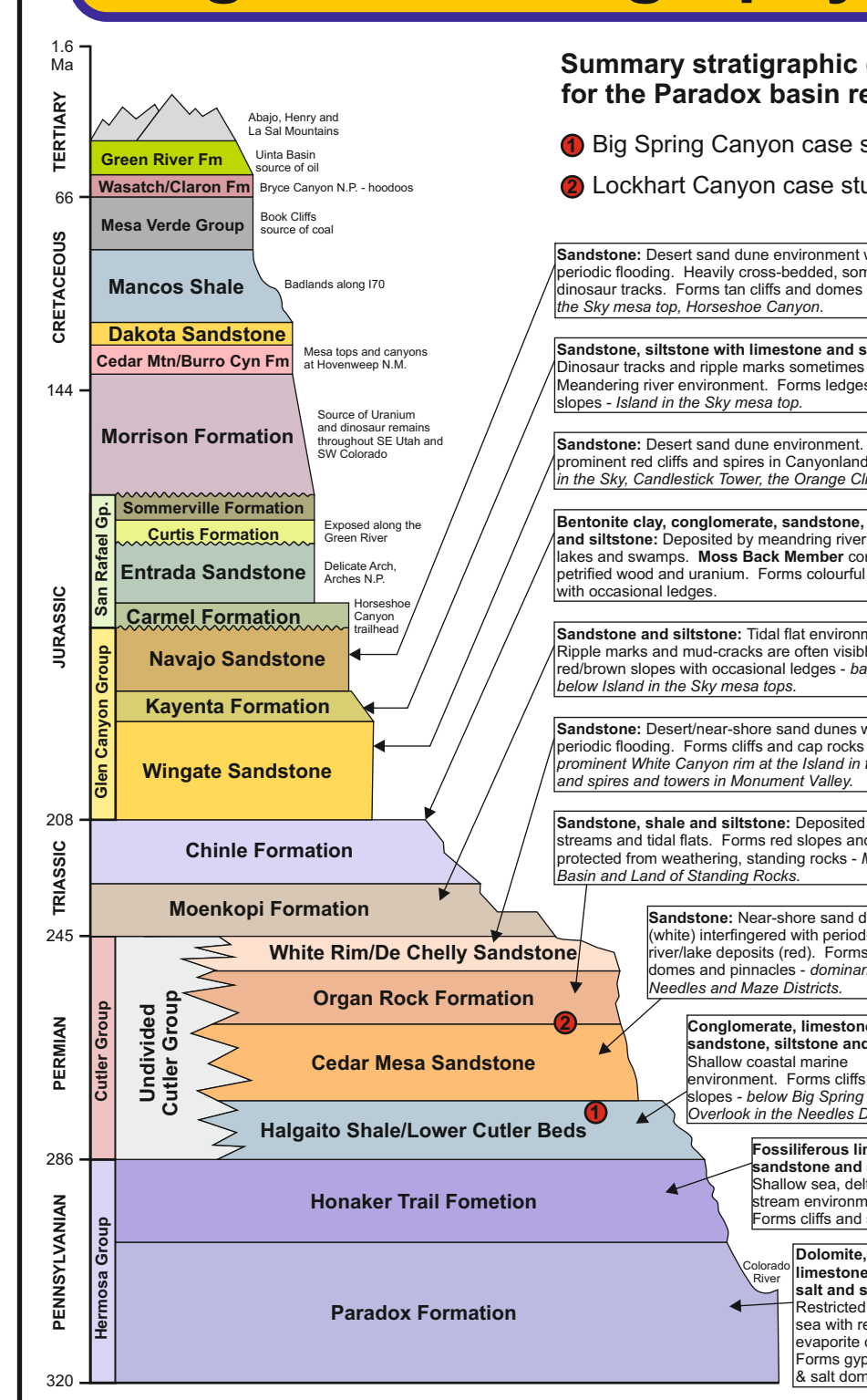
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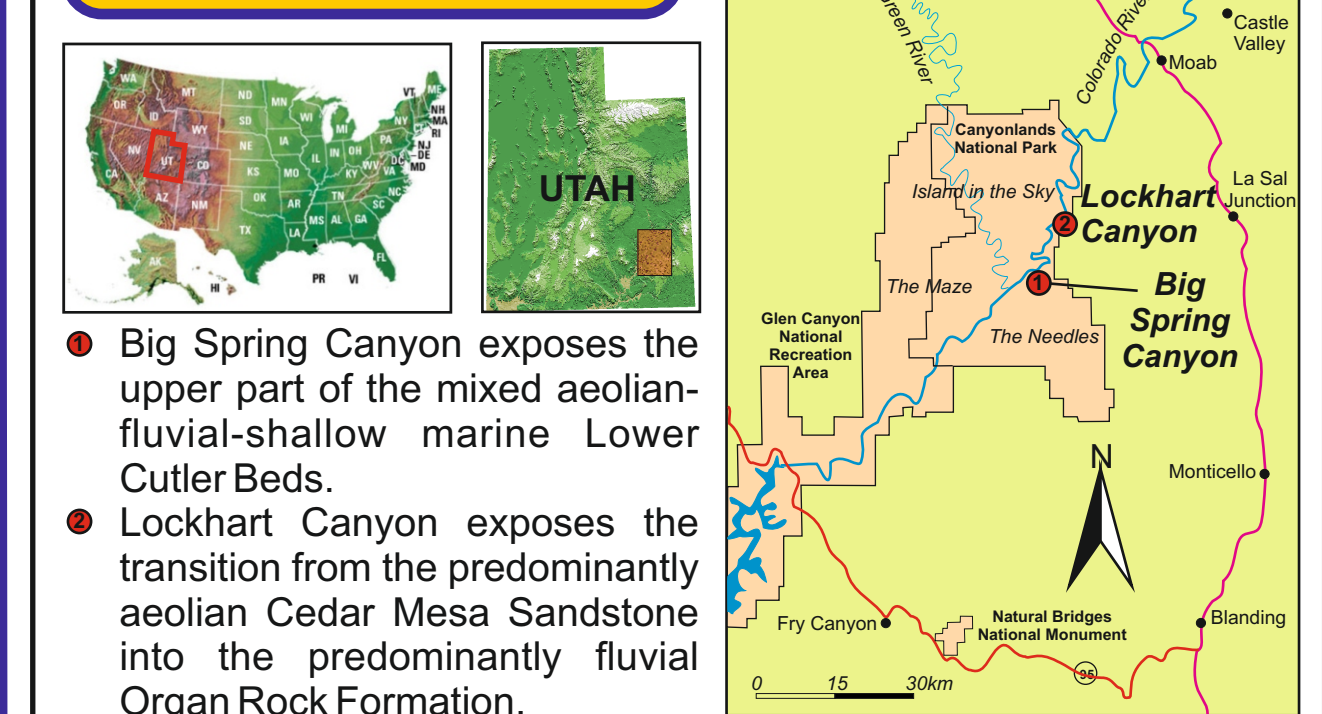
## Introduction and Geologic Setting

The Permian-Pennsylvanian Cutler Group of the Paradox foreland basin of southeast Utah is characterised by a variety of styles of interaction between coeval aeolian, fluvial and marine environments that have resulted in the generation and preservation of a complex suite of stratigraphic architectures. Detailed 3D architectural element analysis has enabled the nature of these interactions to be interpreted in order to constrain both the spatial and temporal scale over which competing processes operated. Of four formations that comprise the Cutler Group, detailed examples of aeolian-fluvial-marine interaction from two localities are presented here: firstly from the upper part of the Lower Cutler Beds and secondly from the upper part of the Cedar Mesa Sandstone and its transition with the overlying Organ Rock Formation.

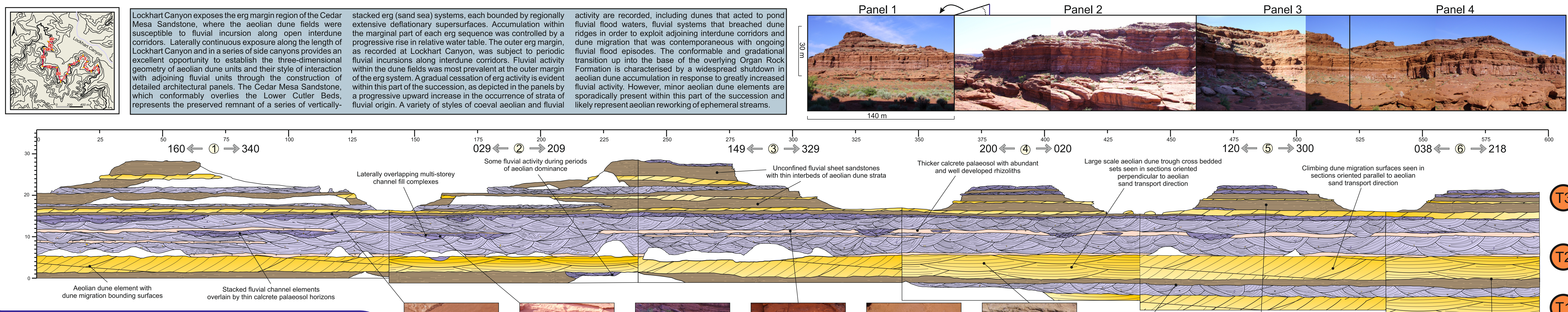
### Regional Stratigraphy



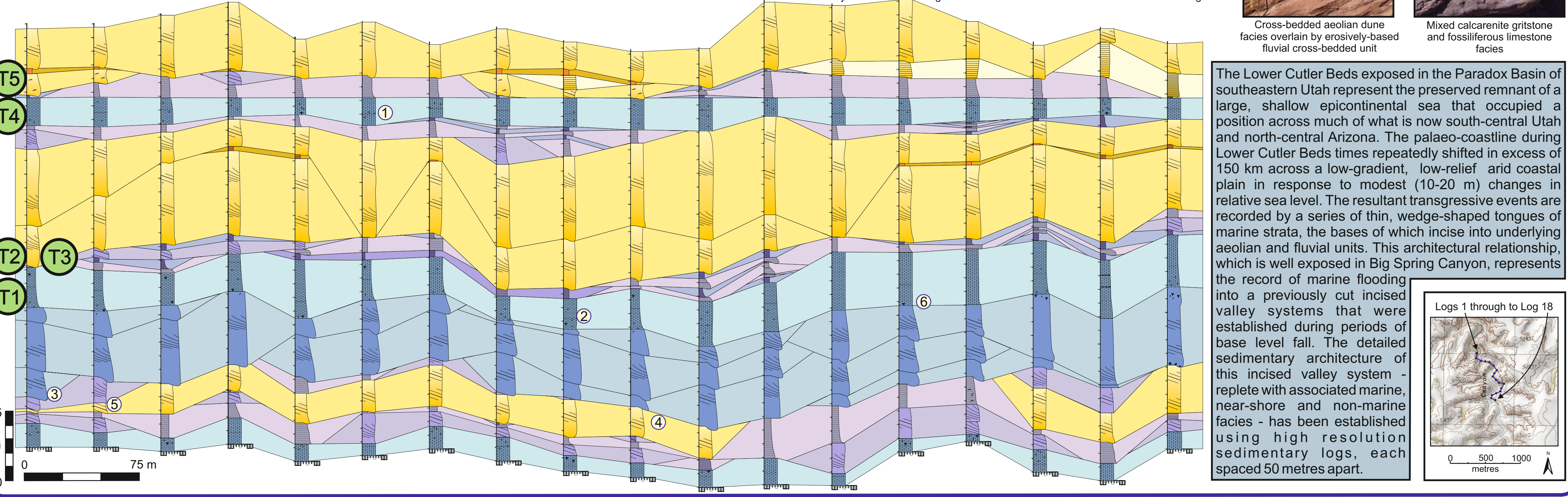
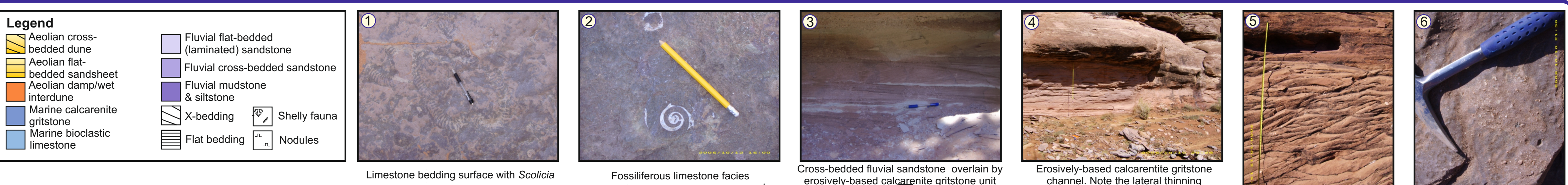
### Study Location



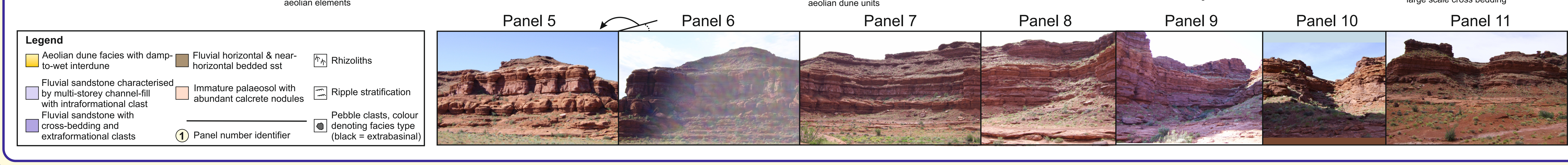
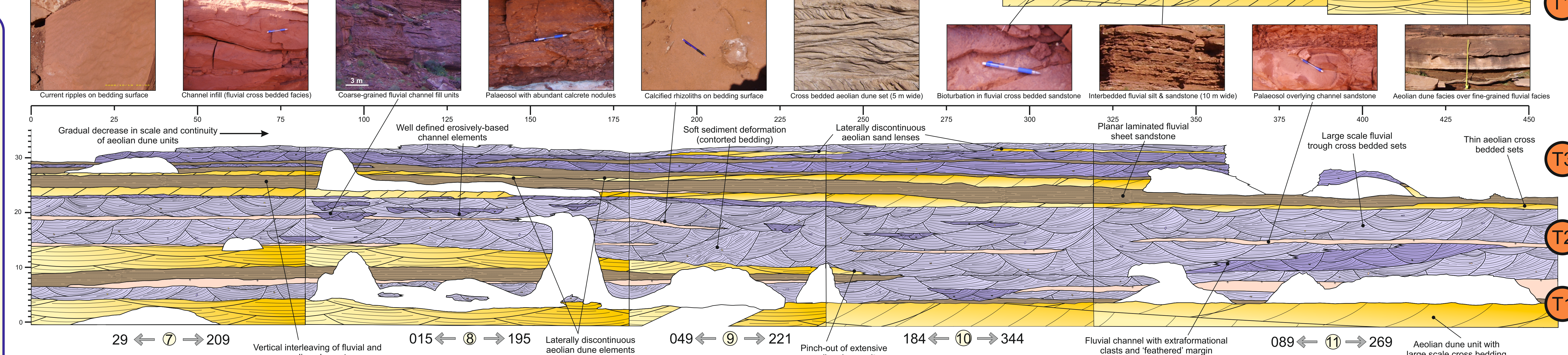
## Case Study 2: Lockhart Canyon



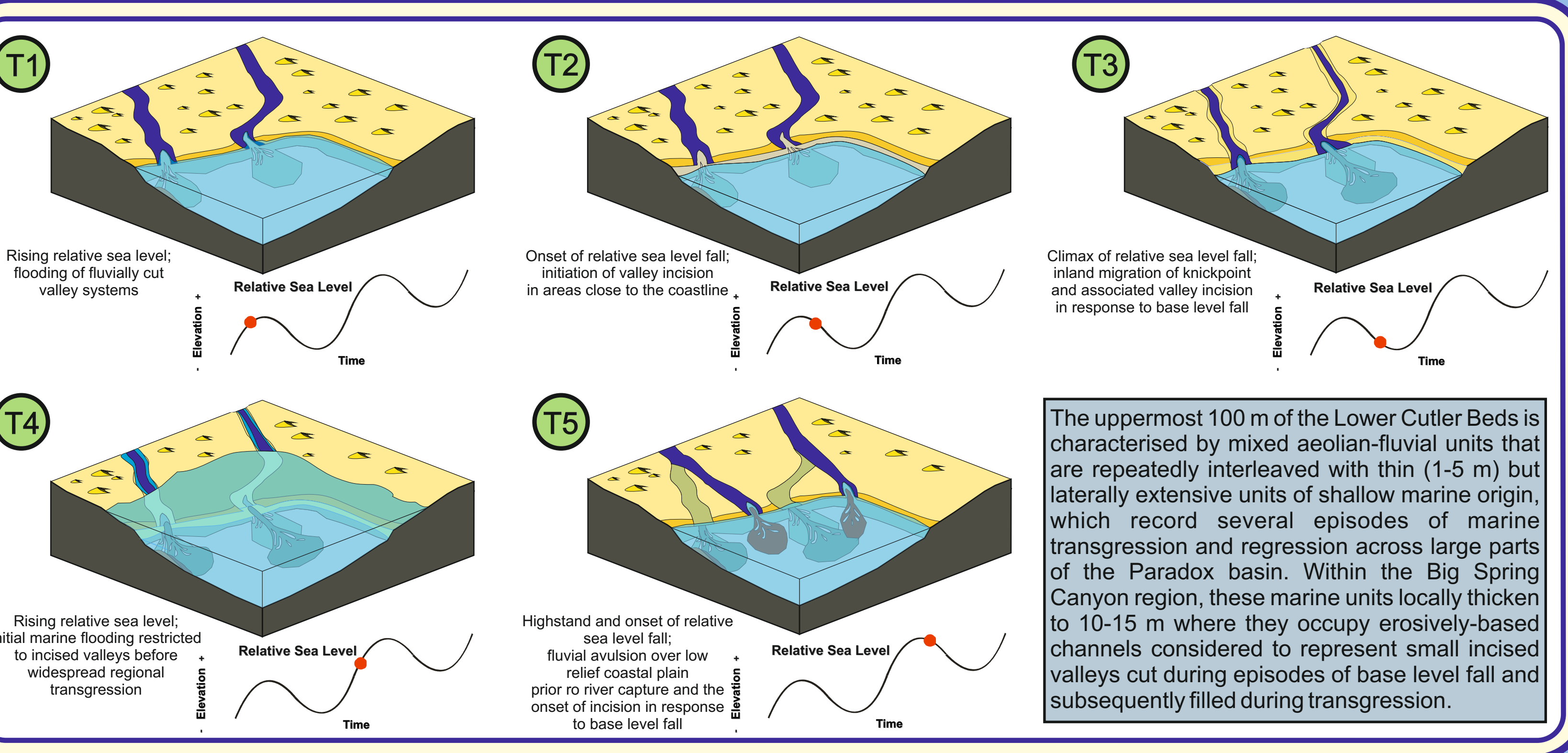
## Case Study 1: Lower Cutler Beds



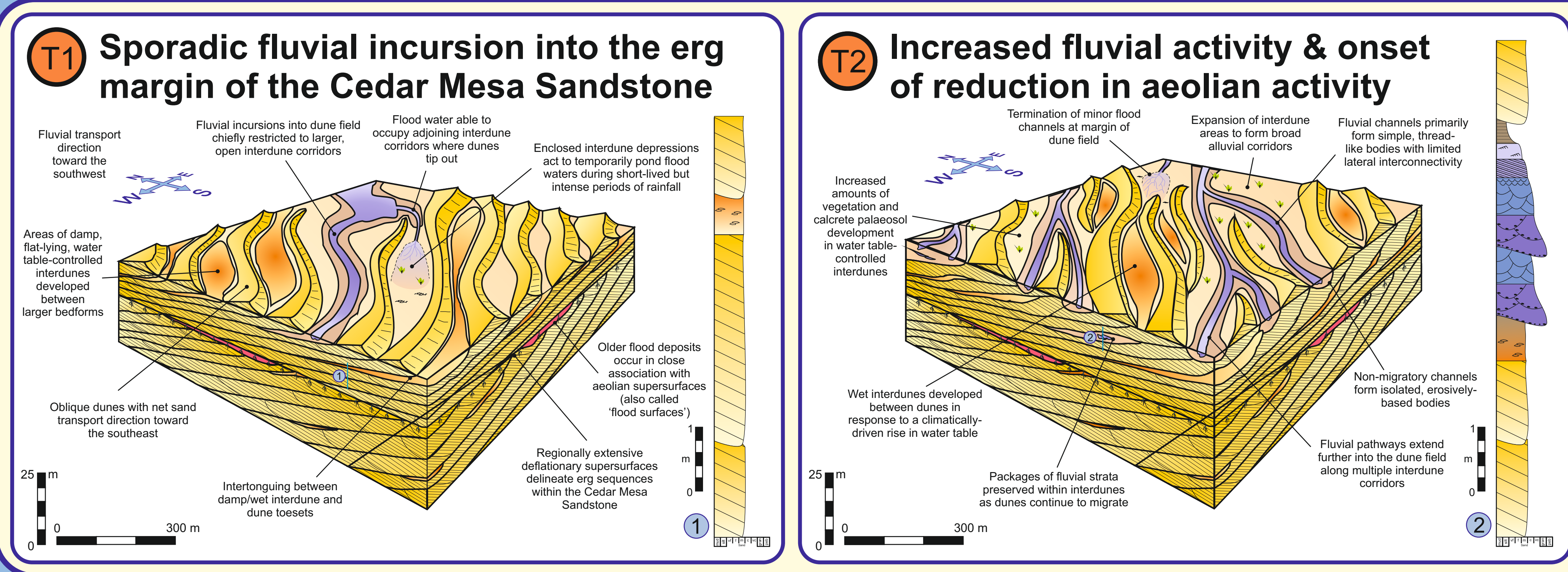
The Lower Cutler Beds exposed in the Paradox Basin of southeastern Utah represent the preserved remnant of a large, shallow epicontinental sea that occupied a position across much of what is now south-central Utah and north-central Arizona. The palaeo-coastline during Lower Cutler Beds times repeatedly shifted in excess of 100 km across a low-gradient, low-relief and coastal plain in response to modest (10-20 m) changes in relative sea level. The resultant transgressive events are recorded by a series of thin, wedge-shaped tongues of marine strata, the bases of which incise into underlying aeolian and fluvial units. This architectural relationship, which is well exposed in Big Spring Canyon, represents the record of marine flooding into a previously cut incised valley systems that were established during periods of base level fall. The detailed sedimentary architecture of this incised valley system - replete with associated marine, near-shore and non-marine facies - has been established using high resolution sedimentary logs, each spaced 50 metres apart.



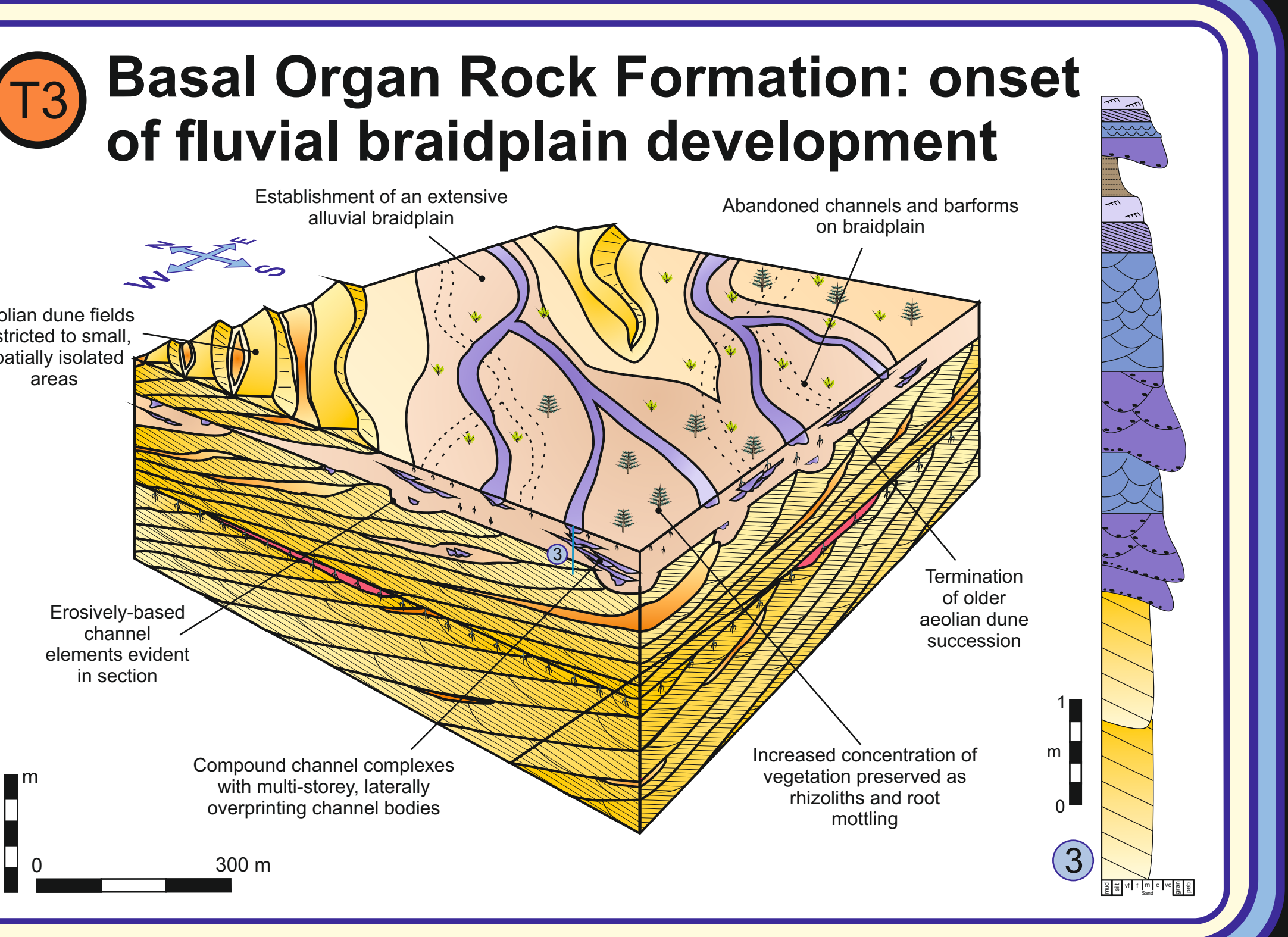
## Facies Models: Lower Cutler Beds (Incised Valley Fill Units)



## Facies Models: Cedar Mesa - Organ Rock Transition Zone



## Facies Models: Basal Organ Rock Formation: onset of fluvial braidplain development



## Conclusions

The Permian Cutler Group, situated in the Paradox Basin of southeast Utah, records a variety of styles of interaction between aeolian dune deposits, fluvial channel and sheet deposits, and shallow marine transgressive shoreline and shelf deposits. These interactions reflect a range of both sudden and gradual transitions between competing environments and occur on a variety of spatial scales in three separate formations of the Pennsylvanian-Permian Cutler Group. The Lower Cutler Beds represents an arid coastal succession that experienced episodic marine transgressions, which led to the generation of a tripartite series of interactions between marine, aeolian and fluvial components of the depositional system. Shallow marine architectural elements are characterised by both calcarenite gristone facies, arranged into erosively-based cosets, and by micritic limestone facies, with abundant marine macro-fossils. The coarse-grained calcarenite gristone facies occur most commonly as complex cosets of strata, which form the fill of deeply incised channelised elements that cut down into underlying aeolian and fluvial units and which are interpreted as incised valley fill complexes. The overlying Cedar Mesa Sandstone records a basin-wide transition to a predominantly aeolian dune system, accumulation and preservation of which was controlled by a progressive but gradual rise in water table in marginal areas to form a wet aeolian system, and by an excess of sediment supply coupled with ongoing basin subsidence in more central parts of the basin to form a dry aeolian system. Evidence for fluvial incursion is widespread at the outer margin of the aeolian dune system but progressively diminishes with increasing distance into central parts of the palaeo-dune field. The overlying Organ Rock Formation comprises a bipartite succession of aeolian and fluvial strata which is interpreted to represent the preserved remnant of a fluvial terminal fluvial system. Within this system, most examples of fluvial and aeolian interaction demonstrate the contemporaneous nature of the two competing systems and the fluvial channels are interpreted to penetrate into a distal dune field that occupied the southern part of the basin.

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