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Vertical Evolution of MTC

The vertical succession of MTE bodies in the Williams Ranch Member underwent an evolution over time. This evolution, from oldest to youngest, is as follows:

· Large, semi-rigid slump bodies with a high degree of internal mesoscopic deformation (Units 7 and 8).

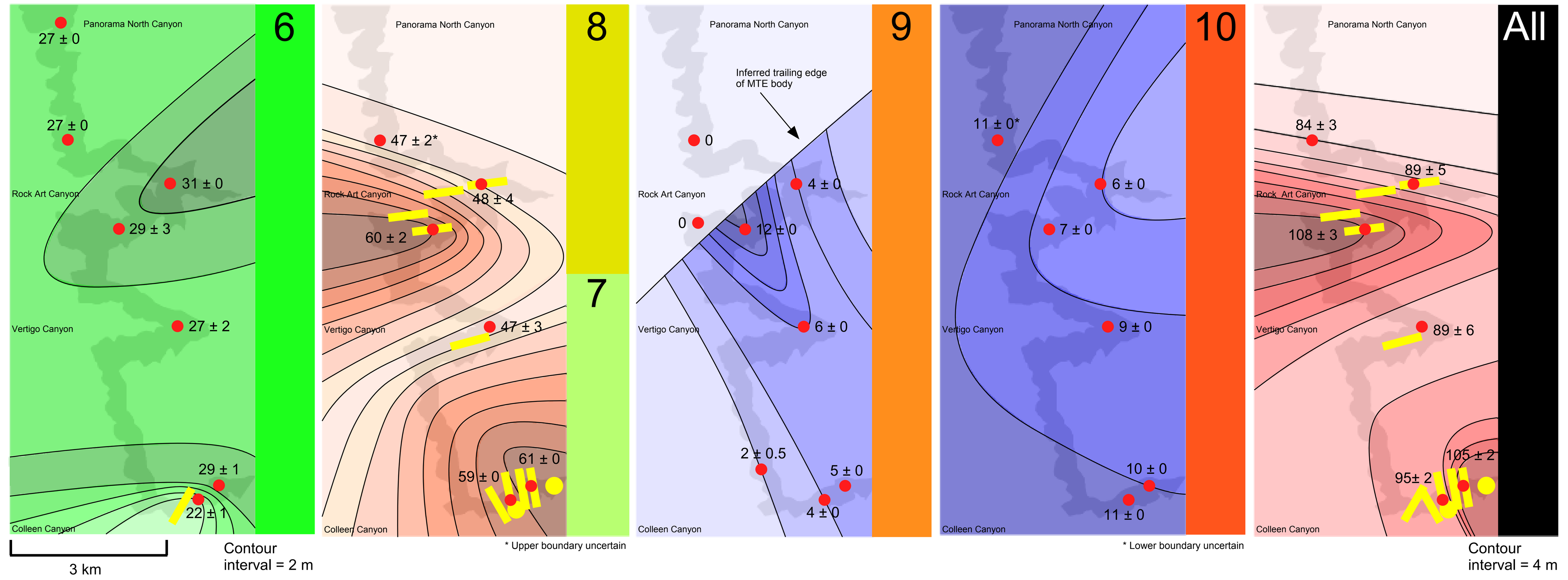
· Small, semi-rigid slump bodies with a higher degree of mesoscopic deformation (top of Unit 8, Unit 9).

·A return to sediment gravity flows as the primary form of deposition with localized slumping on local topography (Unit 10).

This pattern of waning size and/or deformation of MTE bodies occurs as the basin lowers its gradient through time (unit 6 is not considered as its nature in the Delaware Mountains is unclear).

Isopach Maps of Correlation Units, Williams Ranch Member, Delaware Mountains Study Area

Note: Units 7 and 8 have been mapped as a combined unit due to uncertain unit boundaries in Rock Art and Vertigo Canyons



Thickness Relationships

Isopach maps of the five correlation units suggest that:

· Unit 6 may be a drape or a rigid slide body.

· Units 7 and 8 had the largest amount of mesoscale deformation and had the greatest effect on overall thickness.

· Unit 9 is a local (less far-traveled) MTE body that may have slumped from a locally steep gradient immediately to the north.

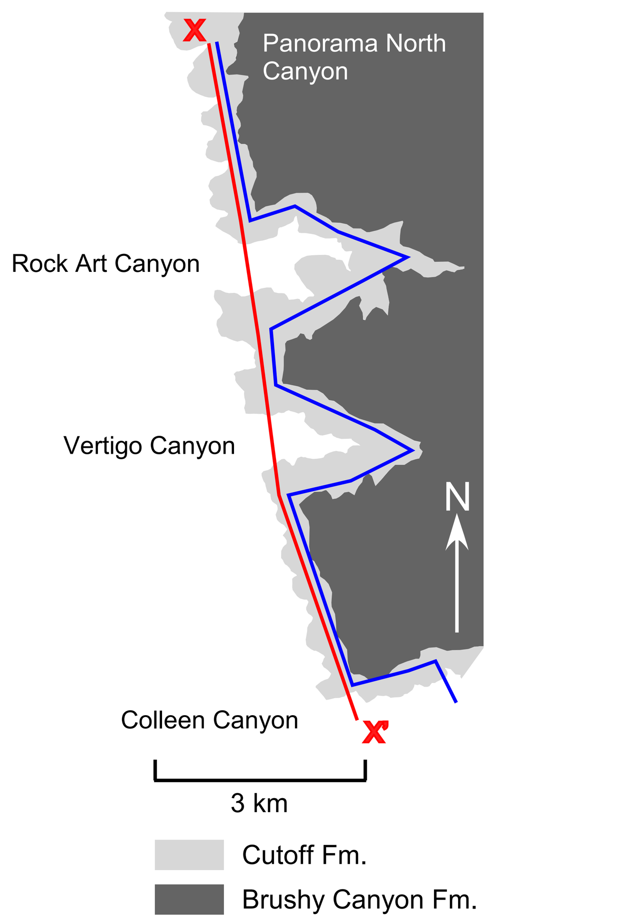
· Unit 10 is a drape (with local slumping at its top).

· CDZs are concentrated in thicks.

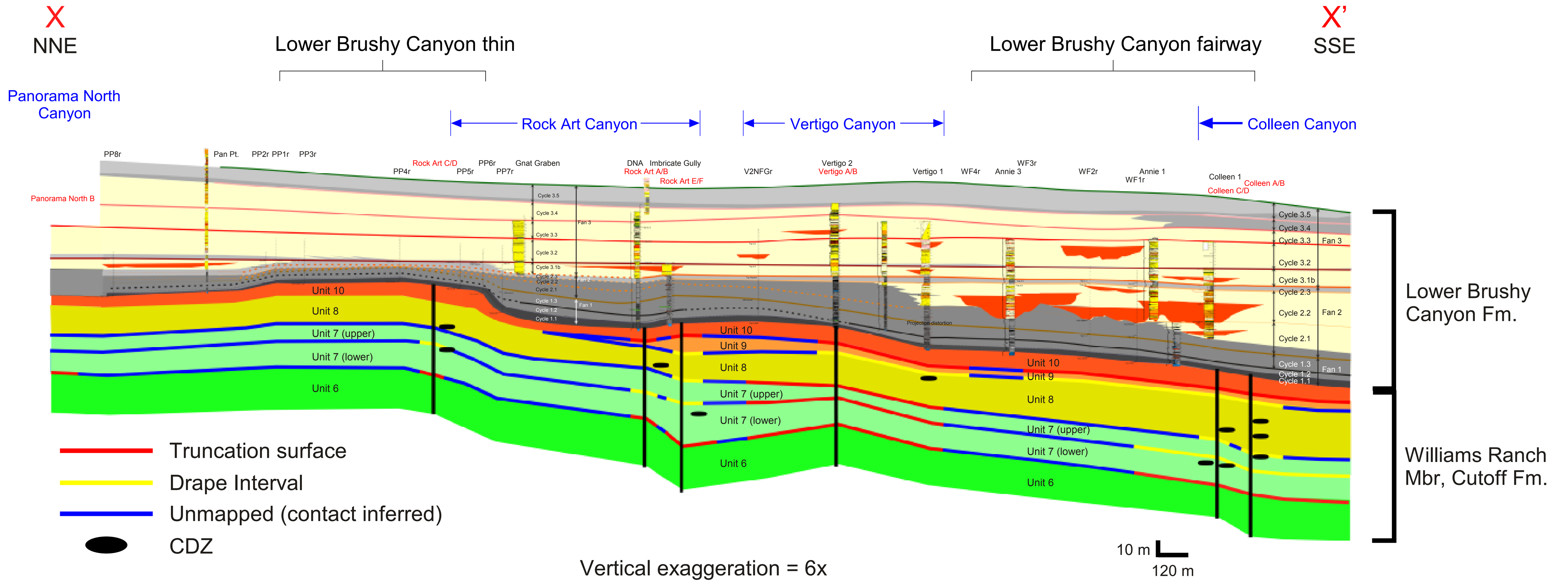
. Cutoff topography affects Brushy Canyon geometry, but units underlying the Williams Ranch Member must also be a control. Basement control remains a possibility.

Geologic Map, Delaware Mountains Study Area

Blue line: Location of study area cross section
Red line: Location of cross section projection



Cross Section X-X' from Panorama North Canyon to Colleen Canyon



Cross section assumptions:

· Thickness change is constant within all correlation units between measured sections
· Underlying structure is a control on MTE body geometries with possible basement influence
· Topography at the surface of the Cutoff Formation is a control on Brushy Canyon Formation deposition
· Thickness changes within the five correlation units may be a result of folding or of thrust sheet stacking within those units

Brushy Canyon Formation section after Slope and Basin Consortium (2004)

Ongoing Research

Immediate research goals include:

· Completion of mapping and measured sections in southernmost Guadalupe Mountains.

· Correlation with six fourth-order stratigraphic cycles of Kerans and Fitchen (1995).

· Creation of synthetic dipmeter log from data collected along five measured sections in the Delaware Mountains study area to determine if the identified outcrop relationships can be predicted from subsurface data.

· Field research of mass transport deposits (Eocene Hecho Group, Spain; Cretaceous Gosau Group, Austria) in other contractional basins with comparison to Cutoff Formation.

Land access issues have prevented continuing work in the Delaware Mountains, but planned future research there includes completion of mapping and measured sections of additional structural and thickness data, as well as extension of the study to include outcrops to the north and south and the Cutoff units below the Williams Ranch Member.

Conclusions

1) Deformed basinward Cutoff units were correlated with previously published undeformed shelfward units. Five basinward-stepping units were identified atop correlation unit 5 as part of the Williams Ranch Member (WRM).

2) A tentative second- and third-order sequence stratigraphic framework was established for the Cutoff that correlates to previous work on shelfal equivalents.

3) In the Delaware Mountains, at least 8 MTEs are represented in the WRM, not including earlier phases of multi-phase events. In the Guadalupe Mountains, MTEs were likely numerous, but their number is less well constrained.

4) Transport direction was primarily NNW to SSE with a secondary NE to SW component.

5) The three uppermost MTE bodies appear to be locally derived; the remainder may have been margin- or- slope-sourced, based on calculations using a power law relating runout and volume developed by Legros (2002).

6) MTE bodies within the WRM exhibit a pattern of waning volume and degree of deformation through time.

7) The dominant structural style is contractional, except north of Italy Canyon in the Guadalupe Mountains, where extensional evacuation scars coexist with scattered contractional features north of Italy Canyon.

8) CDZs and drape intervals are concentrated in areas of increased MTC thickness. ZAMs appear to result from local extension with later contractional overprinting. Some ZAMs appear to have been subjected to more than one phase of transport.

9) The WRM generally thickens basinward across the study areas through progradation and mass transport, with local variance resulting from preexisting topography and contractional “pile-ups.”

10) The WRM influenced development of paleo-bathymetry below the Brushy Canyon Formation (BCF) by filling preexisting larger-scale lows and creating smaller highs above them. Progradation and small-scale mass transport of the Cutoff shifted the toe of slope basinward from the inherited Victorio Peak toe of slope. The pinchout of the lower BCF coincides with the basinward limit of significant WRM mass transport deposits.

11) Internal Cutoff structure could potentially be used to predict paleo-bathymetry below the BCF. The highest percentage of CDZs and drape intervals is found within WRM thicks, filling preexisting lows and creating smaller local highs. The lowest percentage of these features occurs in WRM thins, above preexisting highs, which remain as larger regional pre-BCF highs.

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