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D20. Recent Advances in Stratigraphy

STRATIGRAPHIC HISTORY AND PROVENANCE OF THE UPPER CRETACEOUS (CONIACIAN-SANTONIAN) CREVASSE CANYON FORMATION IN WEST-CENTRAL NEW MEXICO

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INTRODUCTION

The Crevasse Canyon Formation in west-central New Mexico near Datil is well situated for field-based analyses and sample collection to further understand its depositional history. Although the Crevasse Canyon has received a considerable amount of study throughout parts of northwestern New Mexico and the Southwestern U.S., very little is known about the depositional history and provenance of these strata in west-central New Mexico.

The current interpretation throughout much of New Mexico for the Crevasse Canyon Formation has been documented to represent nonmarine, fluvial sedimentation and delineates the stratigraphic transition from marine sedimentation to nonmarine sedimentation in the Cordilleran foreland basin that developed from the Sevier Orogeny. However, in west-central New Mexico where much of the Crevasse Canyon is exposed, the stratigraphy represents marginal marine to offshore sedimentation which may be explained in part by subsidence in and around the Seboyeta embayment.

The proposed project will combine classic field based analytical techniques (detailed measured stratigraphic sections, facies analyses) with U-Pb geochronology of detrital zircon with the aim of providing both new stratigraphic constraint as well as provenance and sediment dispersal trends. The proposed project will contribute new measured sections as well as N=7 new U-Pb detrital zircon ages from the Crevasse Canyon Formation. There are currently no geochronological ages from this section of the Crevasse Canyon.

(1) STUDY AREA - WEST CENTRAL NEW MEXICO

(A) Western Cordillera Tectonic Setting

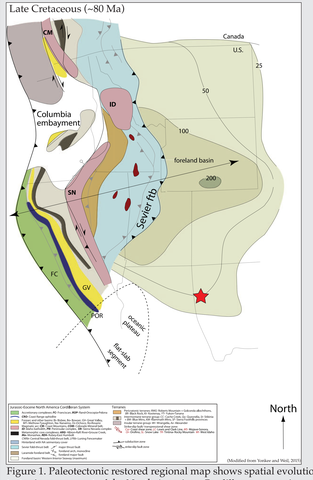
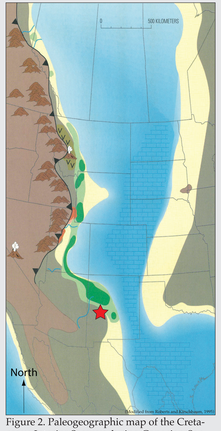


Figure 1. Paleotectonic restored regional map shows spatial evolution of tectonic component of the North American Cordilleran orogenic system for the Late Cretaceous. Red star = Reynolds Field Station study area.

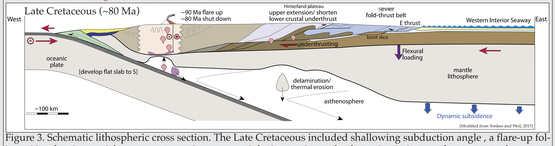
(B) Western Interior Seaway



(Modified from Roberts and Kirschbaum, 1995)

Figure 2. Paleogeographic map of the Cretaceous Interior Seaway during Conacian-Santonian time. Red star = Reynolds Field Station study area.

(A) Tectonic Setting Cross Section View



(Modified from Yonkee and Weil, 2015)

Figure 3. Schematic lithospheric cross section. The Late Cretaceous included shallowing subduction angle , a flare-up followed by shutdown of the magmatic arc, lower crustal thickening beneath a hinterland plateau, shortening in the eastern Sevier belt, and broad dynamic subsidence of the Western Interior Seaway.

(2) GEOLOGIC & STRATIGRAPHIC OVERVIEW

(A) Geologic Map of Sandstone Bodies in Reynolds Field Station

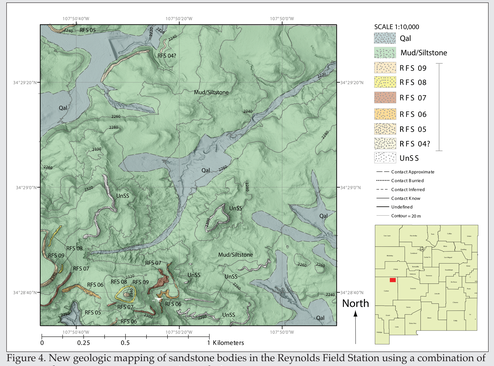
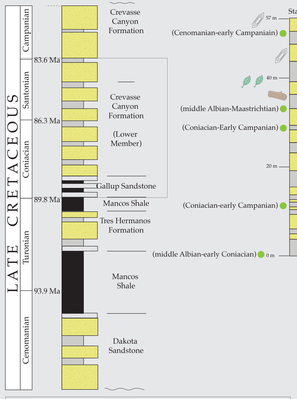
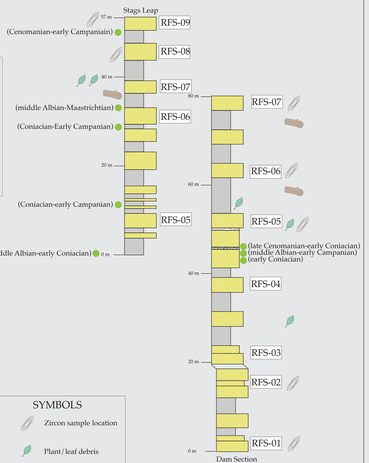


Figure 4. New geologic mapping of sandstone bodies in the Reynolds Field Station using a combination of boots-on-the-ground and drone mapping techniques.

(B) Late Cretaceous Regional Stratigraphy



(C) Generalized Measured Stratigraphic Column



LITHOLOGY
- Nonmarine (fluvial) sandstone
- Nonmarine (fluvial) siltstone
- Marine shale
- Marginal marine (deltaic) sandstone

SYMBOLS
- Zircon sample location
- Plant/ leaf debris
- Woody debris / stumps
- Palynology Sample

(3) SEDIMENTOLOGY & DEPOSITIONAL ENVIRONMENT

(A) Outcrop and Field Photos

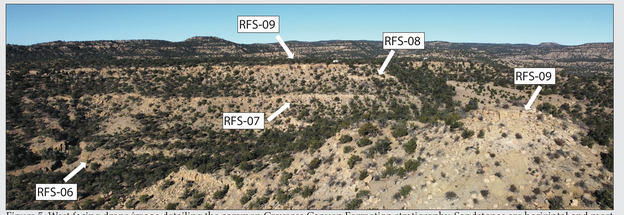


Figure 5. West facing drone image detailing the common Crevasse Canyon Formation stratigraphy. Sandstones are horizintal and most are laterally continous over 10s of meters. RFS samples 06-09 of the Stag Leap section are pictured. White camper van on the far cliff face for scale.

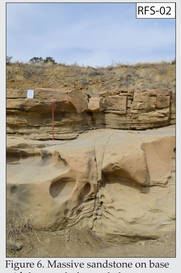


Figure 6. Massive sandstone on base with low angle forsets below top massive sandstone. Top surface contains ripple marks.

Figure 7. Top portion of RFS-06 containing clear abundant dune scale cross stratification.

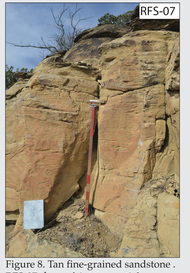


Figure 8. Tan fine-grained sandstone . RFS-07 shows faint tangential cross stratification.

(C) Reynolds Field Station Paleobotany

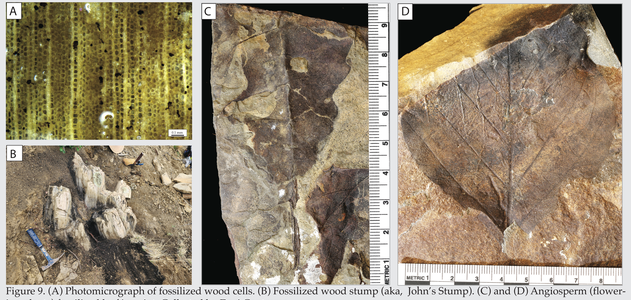
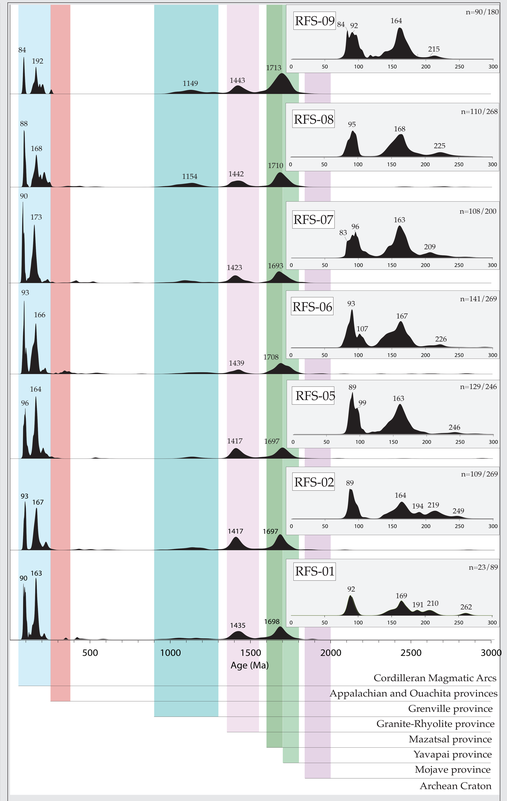


Figure 9. (A) Photomicrograph of fossilized wood cells. (B) Fossilized wood stump (aka, John's Stump). (C) and (D) Angiosperm (flowering plants) fossilized leaf imprint. Collected by Dori Contreras.

(4) DETRITAL ZIRCON GEOCHRONOLOGY



Averaged Peak Ages:
- 90 Ma, 170 Ma, 1151 Ma, 1430 Ma and 1702 Ma.

Figure 10. U-Pb probability density plots for 7 samples collected from the Reynolds Field Station. Colors indicate the primary source for peak ages. Light blue = Cordilleran mafmatic Arc, red = Appalchian and Ouichita provinces, teal = Grenville, light purple = Granite-Rhyolite province, dark green = Mazatsal province, light green = Yavapai, and dark purple = Mojave. Archean zircons are minimal. Relative ages were derived from LA-ICP-MS analyses.

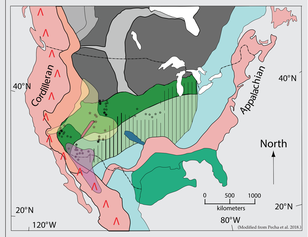
(5) PRELIMINARY RESULTS

Based on new detrital zircon data and preliminary interpretations, the lower part of the Crevasse Canyon Formation is of Coniacian-Santonian age but could be as young as early Campanian.

Based on preliminary sedimentary and palynology data, this section of the Crevvase Canyon Formation appears to represent a non-marine fluvial system.

Young Cretaceous aged zircons are likely sourced from the Cordilleran Magmatic Arc while older Precambrian zircons are likley from recycled Mesozoic Eolionites and recycled Paleo and Mesoproterozoic basement.

Provincance interpretations tell us that headwaters must have originated directly form the Cordilleran arc to the west in order to deposit zircons of the same age as the formation.



(Modified from Pecha et al. 2018.)

Figure 11. North American crustal province map. Age domains are color coded to match the age-probability diagrams. Adapted from Laskowski et al. (2013) and Gehrels et al. (2011), which were originally based on Hoffman (1988). Distribution of Mesozoic eolianites from Leier and Gehrels (2011).

ACKNOWLEDGEMENTS

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