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Testing carbonate shelf geometry as a control on highstand delivery of siliciclastics to basin settings
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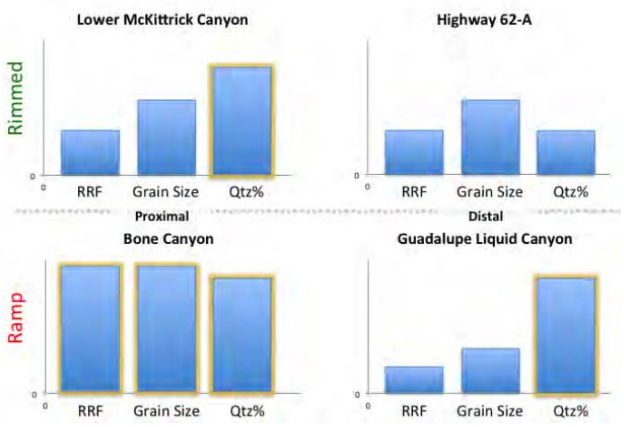
The research goal of this project was to test the role that shelf geometry may play in the delivery of siliciclastic sediments to basinal settings during highstands dominated by carbonate sedimentation. The Guadalupe Mountains provides an excellent natural laboratory to test if a rimmed shelf will limit the amount of siliciclastic delivery relative to a ramp geometry. Currently, the project is about 75% completed.

Data produced from the project includes three measured sections in the Guadalupe Mountains National Park and one just outside of the park boundary. Thin sections, grain-size analysis of the silicate fraction, Scanning Electron Microscopy (SEM), and X-ray diffraction (XRD) analyses have been completed on the samples collected from the measured sections. Conodonts have been recovered and identified from the samples. Those conodont specimens will be stored with the Guadalupe Mountains National Park collection at the Natural History Museum of New Mexico with Spencer Lucas as the curator.

Grain-size analysis and coupled XRD data indicate that the proximal and distal sections measured on the slope of the Guadalupian-aged rimmed platform exhibit minimal quartz detrital sediment. The average detrital fraction decreases downslope from 3.69% to 1.92%. Conversely, the Leonardian-aged ramp demonstrate a marked increase of the average detrital quartz updip, from 15.02% in the proximal section to 2.45% in the distal section. These results corroborate the research hypothesis that more siliciclastic sediment is delivered to basinal settings of ramps than basinal settings of rimmed platforms during highstands. However, the results also indicate that the siliciclastic sediment of either platform geometry did not transport very far into the basin. Tentatively, the delivery mechanisms of the siliciclastic sediment on the ramp geometry is thought to be from sediment gravity flows rather than eolian due to the rapid reduction of detrital quartz and associated sedimentary facies. Using similar logic, the rimmed platform probably received the siliciclastic sediment from eolian suspension, especially since the grain size of the detrital quartz was predominantly silt in both of the measured sections on the slope of the rimmed platform.

Interestingly, the volume of clay minerals was higher than expected and the XRD data indicate that some of that fraction was likely detrital, but most of the clay minerals were either produced *in situ* during diagenesis or diagenetically altered detrital clay. More work is needed to determine the relative importance of those two processes. However, this project has provided seed data that my colleague and I are using to pursue other funding to study the diagenetic story of the clay minerals recovered during this study.

To date, the project has partially funded RA positions for two MS graduate students. One who completed his thesis using the grain-size and XRD data described above. That student is now employed with an environmental firm in Houston, Texas. The other graduate student worked directly to help recover the conodont specimens from the rock and identify them with the help of Jim Barrick at Texas Tech University. However, his actual thesis work is not related to the project, but rather looking at fusulinid distributions on the Northwest Shelf of the Delaware Basin. He will graduate in the Fall of 2018.



Graphical abstract demonstrating a summary of the combined grain-size analysis and XRD data to determine the percentage of quartz. Figure shows the average data from each of the four measured sections. The remaining residual fraction (RRF) is the component left after the carbonate was dissolved. In this diagram, the y-axis shown relatively. For detailed, values see text above.