Hypothesis testing formation mechanisms of proposed eolian & periglacial features in Southern Colorado

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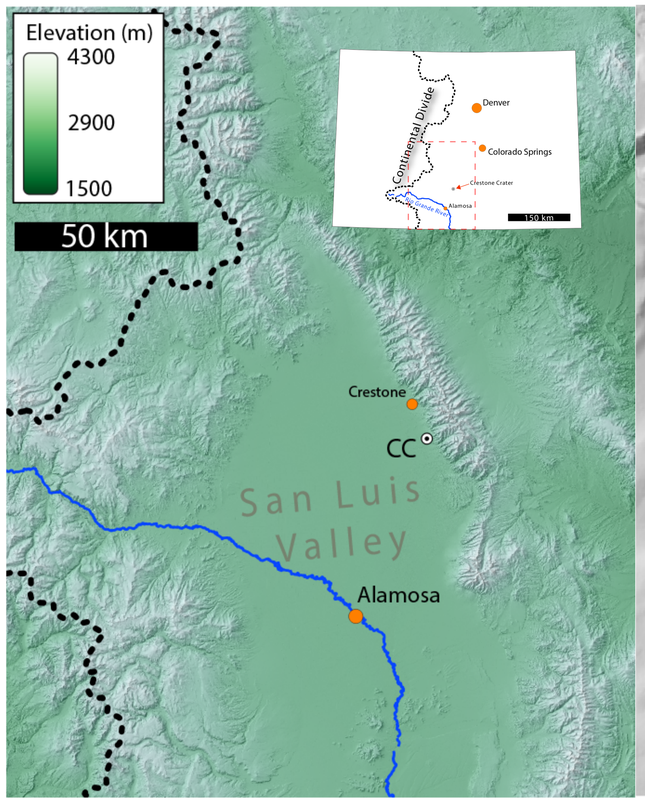
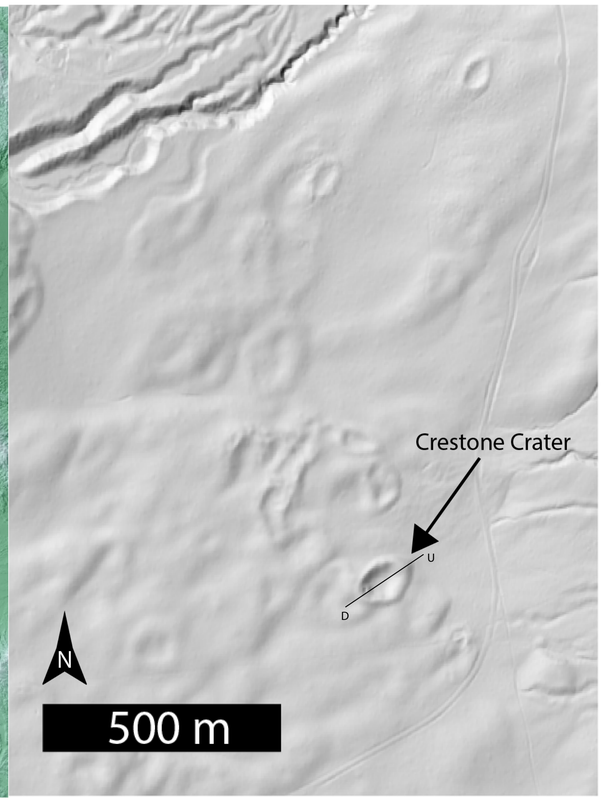
The Crestone Crater





Previous investigations have disagreed between small impact origin, eolian blowout, or a relict permafrost pingo.

How can we test these hypotheses through direct & indirect observation to conclusively characterize the formation mechanism(s)?

*For more information about our group's research into icy and windy surface processes on Earth and Mars, visit us online!
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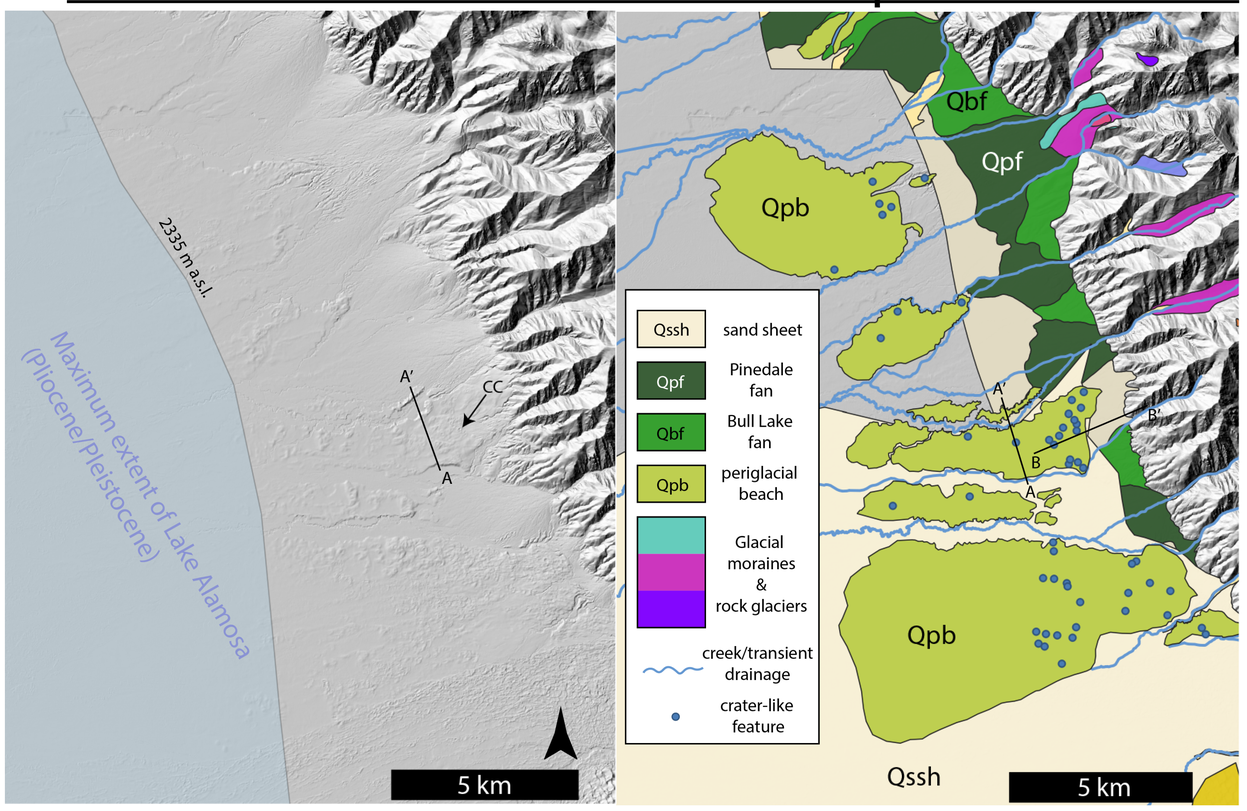
Airborne LiDAR reveals previously unmapped unit of more crater-like features near paleoshoreline



Figures: Left: Context map of the location of the Crestone Crater within the San Luis Valley and Colorado. GIS data obtained from Colorado Geological Survey, elevation data obtained from National Elevation Dataset. Middle Left: Hillshaded 1/9" DEM of Crestone Crater & nearby crater-like features. Data from National Elevation Dataset. Middle Right: Hillshaded map showing contour of paleo shoreline and location of topographic profiles. Right: Same extent as middle left showing Quaternary units (National Park Service - Great Sand Dunes) and mapped crater-like features.

Formation Hypotheses & Tests

Small Impact

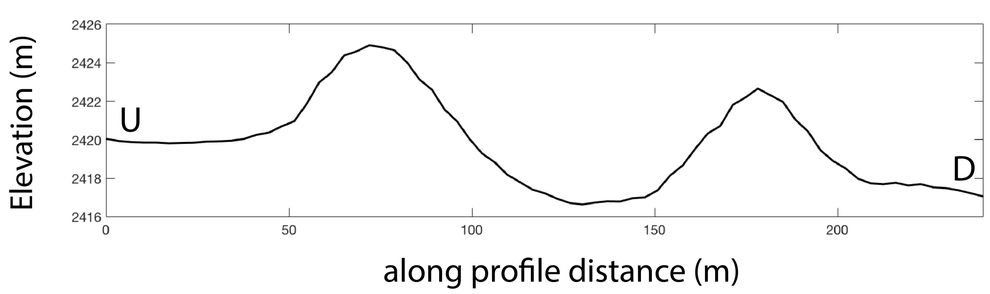
- Depth:diameter ratio ✗
- Breccia/shocked minerals ✗
- Crater density & production functions ✗

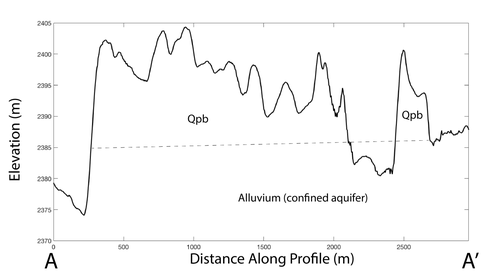
Eolian Blowout

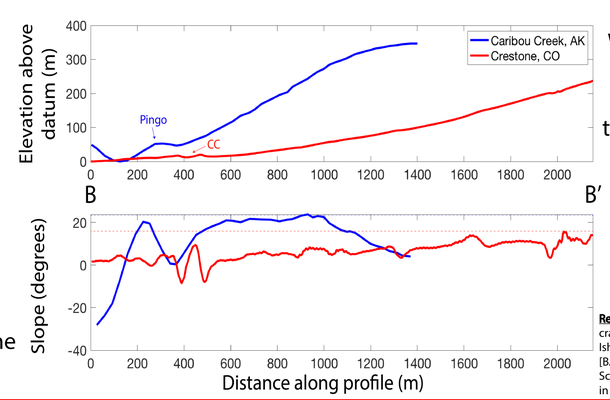
- Known regional eolian processes (Great Sand Dunes National Park) ★
- Trends with prevailing wind direction ★
- Full perimeter rim, continuous vegetation ?

Relict Open-System Pingo

- ★ Variably permeable substrate & proximity to paleolake shoreline
- ★ Topography permits significant hydraulic head
- ★ Mean annual temperature at Last Glacial Maximum ~ 0° C







Profiles Left: Along semi-major axis of the Crestone Crater, trending NE-SW. Note the shallow depth relative to the diameter. Middle: A profile across the newly mapped Qpb 'periglacial beach' unit shows that is approximately 10 m thick. Right: Comparison of topography between the slope above the Crestone Crater & Caribou Creek Pingo in Alaska, showing the Crestone Crater would have had sufficient hydraulic head to grow an open-system pingo.

Summary

We conclude with high confidence that the Crestone Crater is not an impact feature, but it does pass tests for both eolian and periglacial origin. What are some other tests (geological or geophysical) that could distinguish between the processes involved? I appreciate your feedback and ideas, please feel free to email me!

References: Marvin, U.B., and Marvin, T.C., 1966, A re-examination of the crater near Crestone, Colorado: Meteoritics, v. 3, n. 1. 10 p; Cox, C., Isherwood, R., Reitz, A., 2011, Analysis of the origin of the Crestone Crater [B.Sc. Thesis]: Colorado School of Mines ; Meng, T. M., Prudhomme, K., Schwans, E., 2015, On the origin of the Crestone Crater: Relics of the ice age in a modern high desert [B.Sc. Thesis]: Colorado School of Mines.