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

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The Crestone Crater

Airborne LiDAR reveals previously unmapped unit of more crater-like features near paleoshoreline

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)?

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 ~ 0º C

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:


*For more information about our group's research into icy and windy surface processes on Earth and Mars, visit us online! tapir.lpl.arizona.edu

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.