



# Lawn Hill Impact Structure North Eastern Queensland: An Analogue for Martian Muddy Splat?

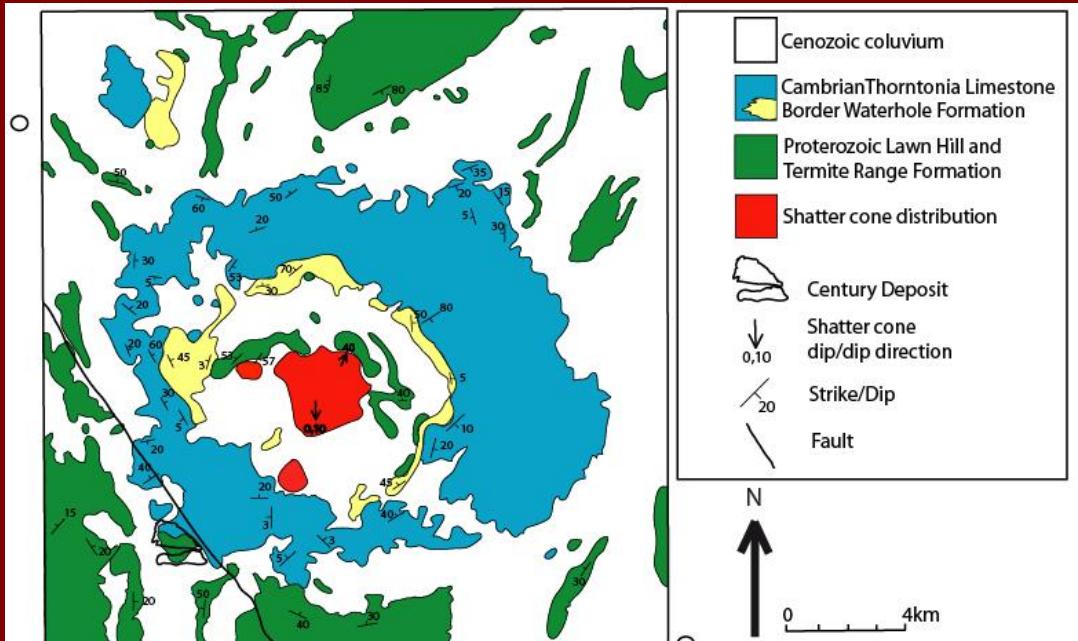
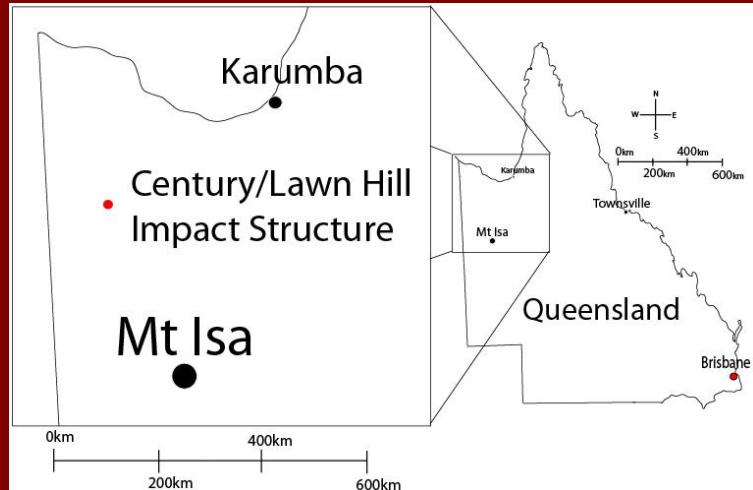
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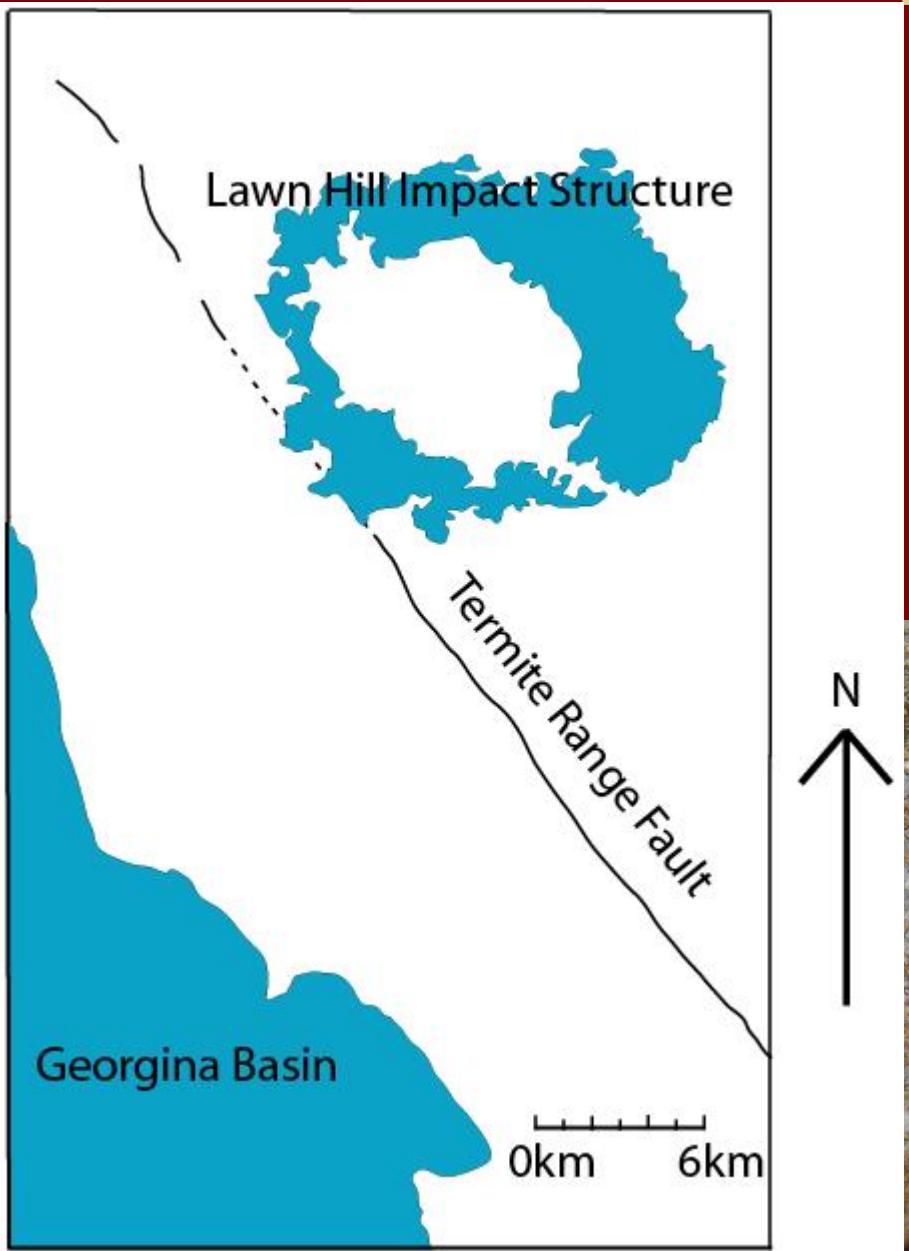


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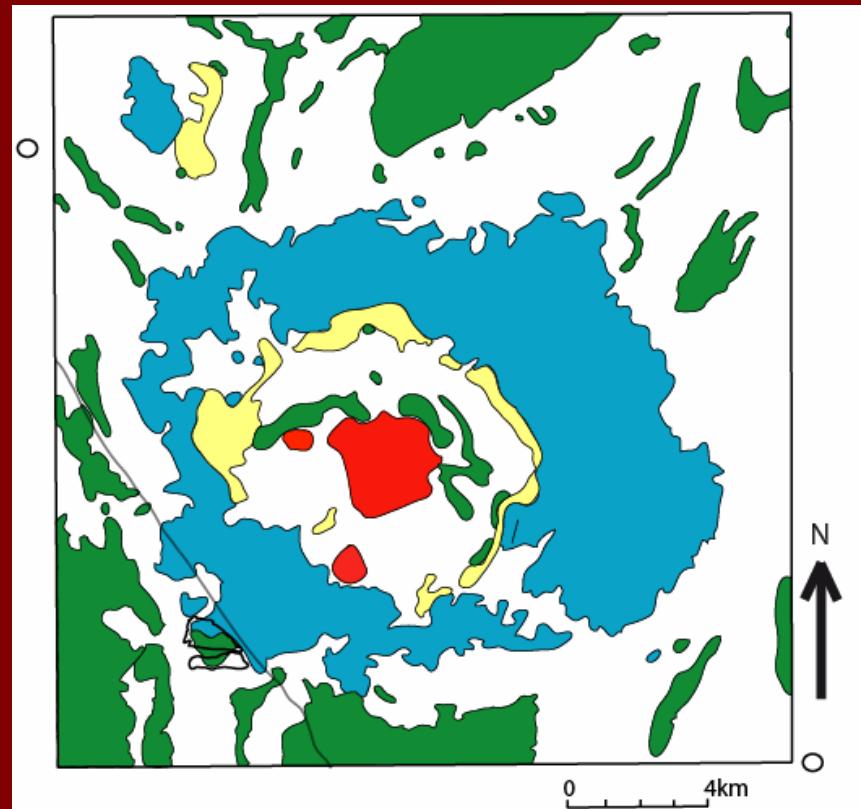
# Lawn Hill Impact Structure



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- Outlier of Georgina basin to SW



# Lawn Hill Impact Structure

- First recognized as an Impact by Stewart & Mitchell (1987)
  - Widespread shatter cones
  - Impact melt in outcrop
  - Planar deformation features in Qtz grains
  - Interpreted central uplift
- Indicated a Proterozoic age for impact
  - As did Shoemaker & Shoemaker (1996)

# Shifty Miners

- 1992 CRAE report indicating lawn hill was not of impact origin to prevent heritage listing near newly discovered Century deposit
- Poor scientific proof
- Little investigation since CRAE report and either ignored or discounted by ore geologists working at Century

# Century Pb-Zn

- 118mt ore
- Proterozoic Shale hosted
- $1451 \pm 44\text{Ma}$  Kaeys *et al* 2006
- Formed in sedimentary basins via hydrothermal exhalation

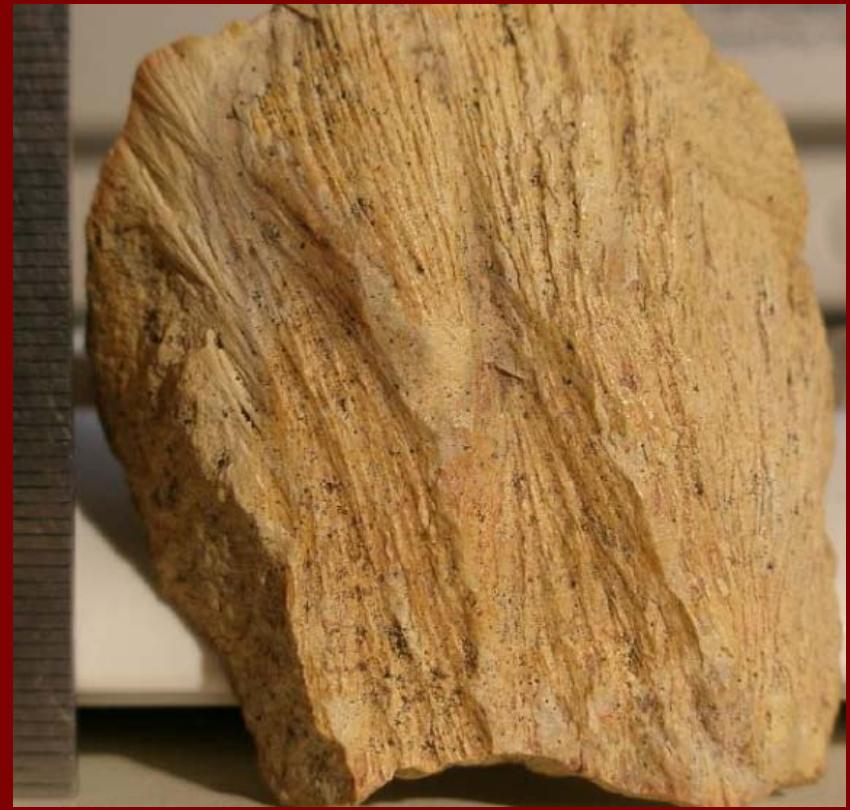


# Unanswered Questions

- When did the impact occur?
- Was the limestone whacked?
- Was the limestone semi-consolidated when it was whacked?

# Evidence for Impact

# Shatter cones

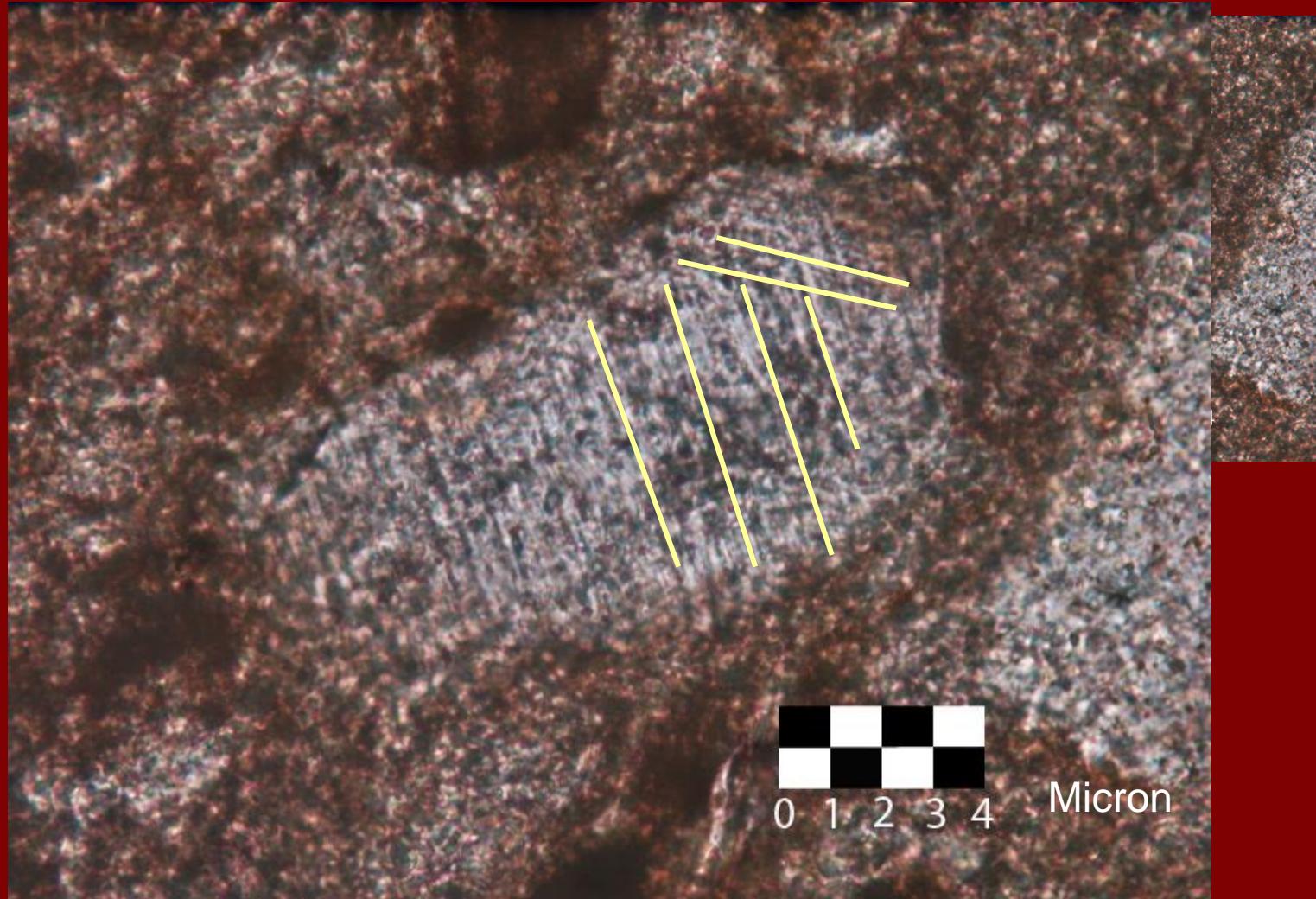


# Impact melt

- Contorted melt textures in outcrop and core
- Impact related spherules with rapid cooling features
- Breccia textures in core melt horizon



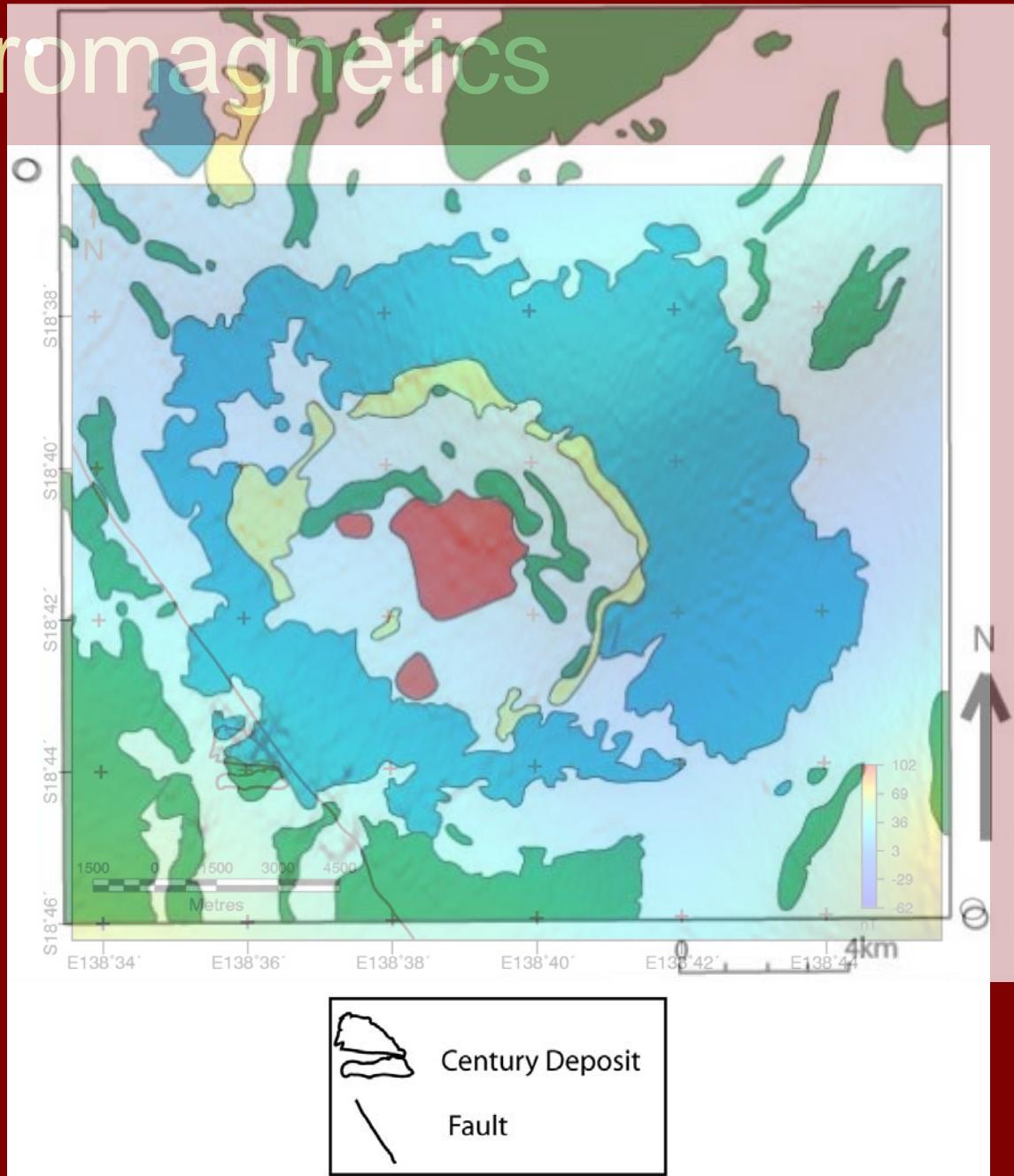
# Planar Deformation Features (PDFs)



# Was the Limestone Impacted?

# Aeromagnetics

- Magnetic anomaly corresponds to Border waterhole breccia
- Magnetic anomaly corresponds to central uplift

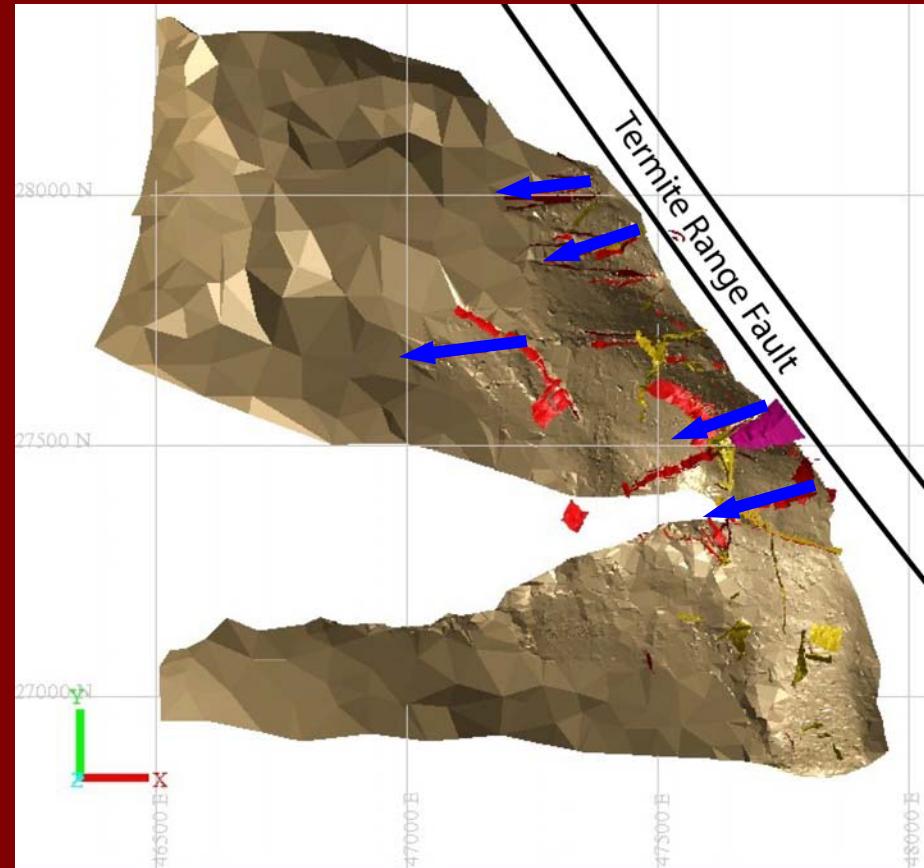
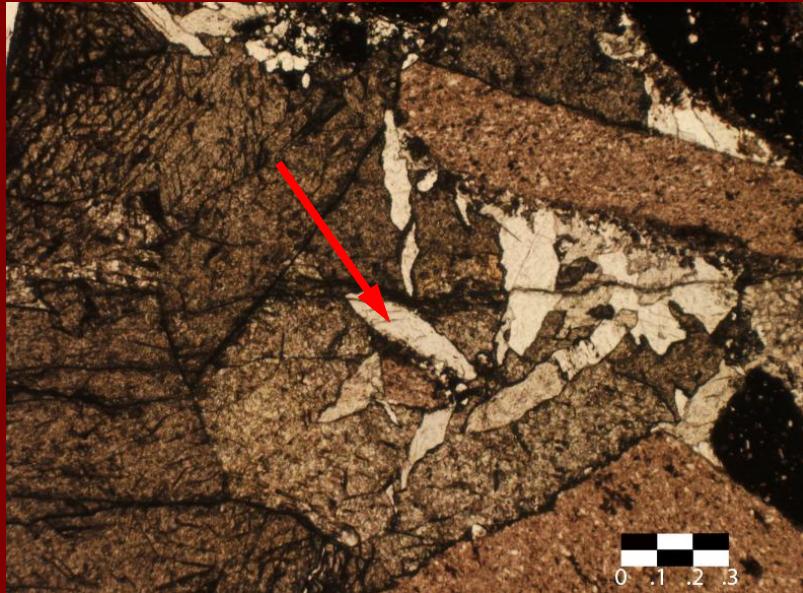


# Calcite in Impact melt

- Nodules of rounded calcite
- Up to 5cm in diameter
- Some limestone may have been melted during impact

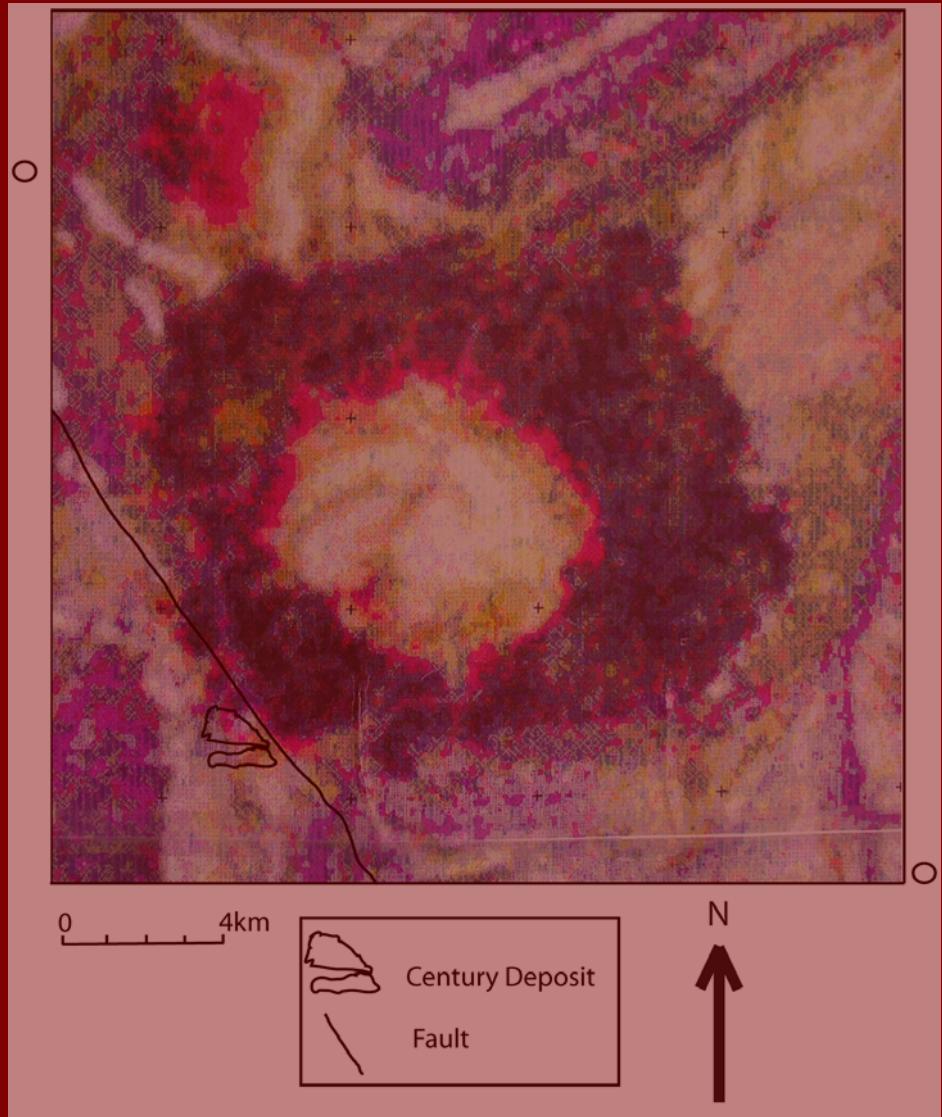


# Limestone Breccia “dykes”



# Radiometrics

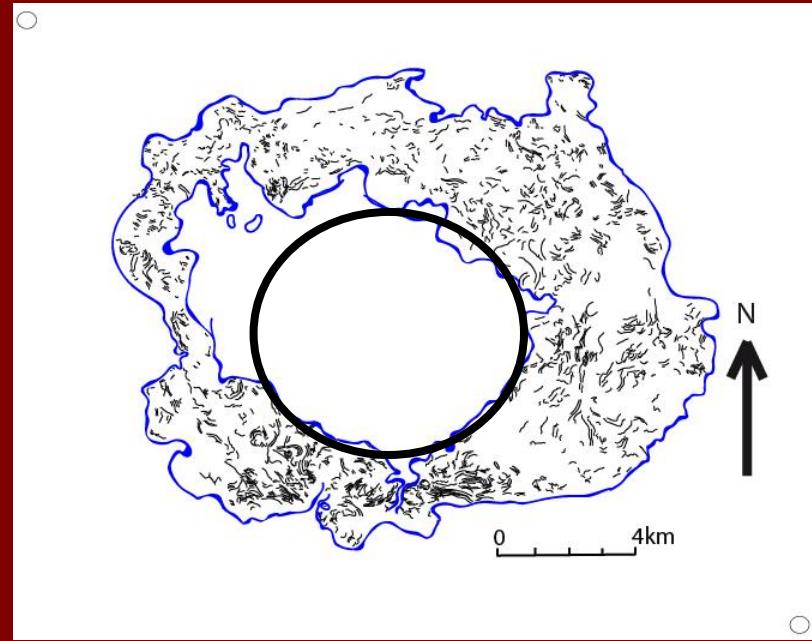
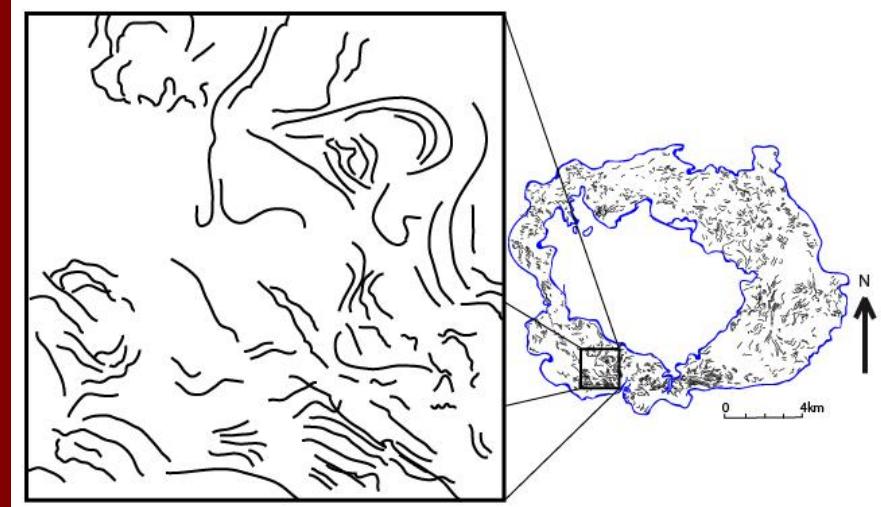
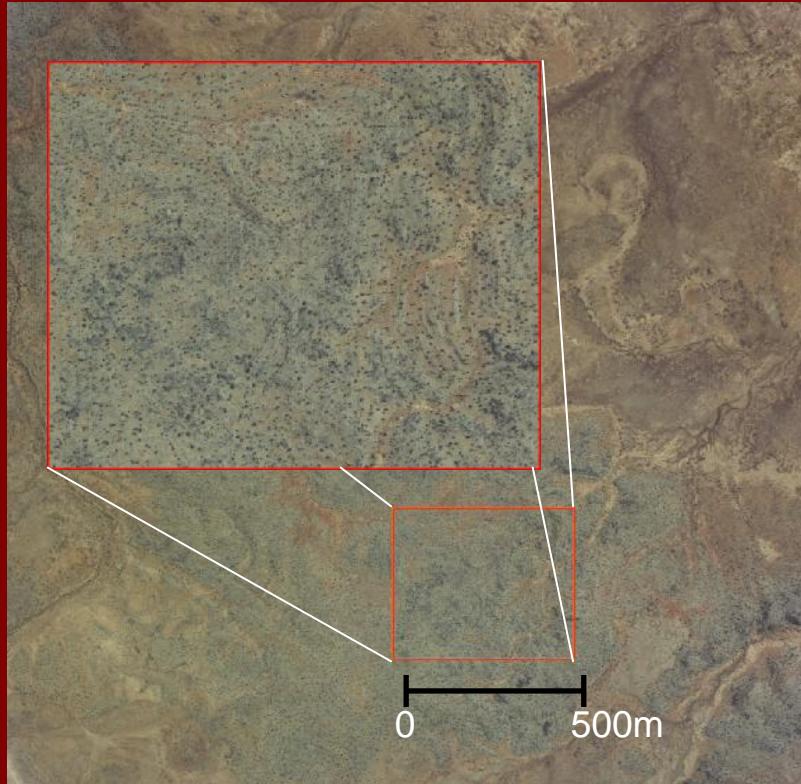
- High K zone corresponds with border waterhole formation
- Interpreted as fallback breccia
- Possible mixing of high K Proterozoic shale with chert breccia from Thorntonia Limestone during fallback after impact



# Evidence for Semi-consolidated limestone impact

# Thorntonia Limestone bedding

- Aerial photograph indicates contorted bedding
- General bedding trend around an ideal crater rim



# Soft sediment in Siliceous breccia

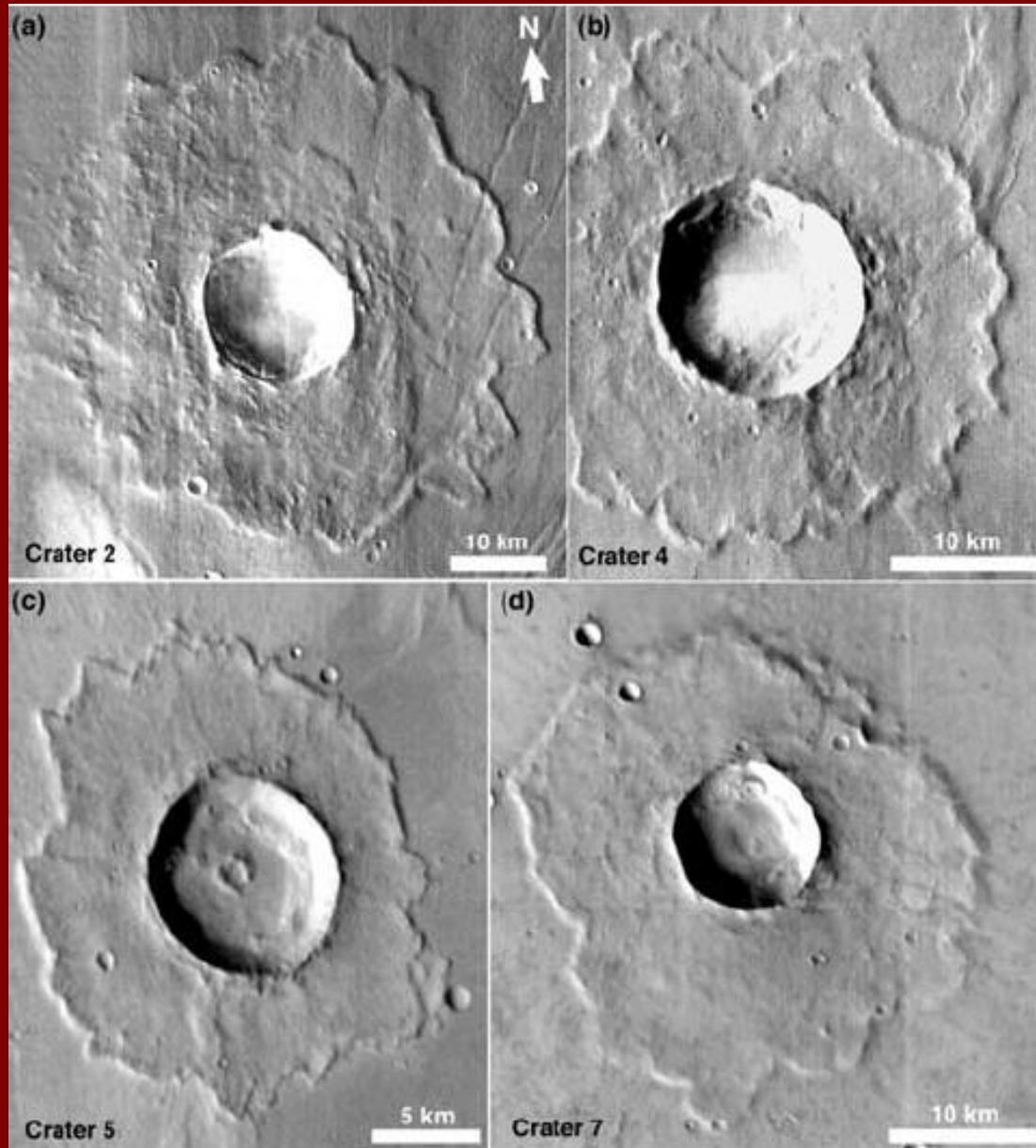
- Soft mud or silt incorporated into Border Waterhole Formation



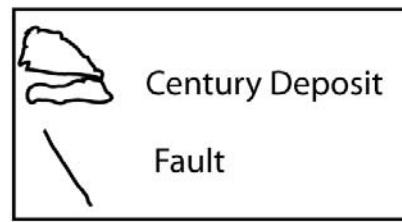
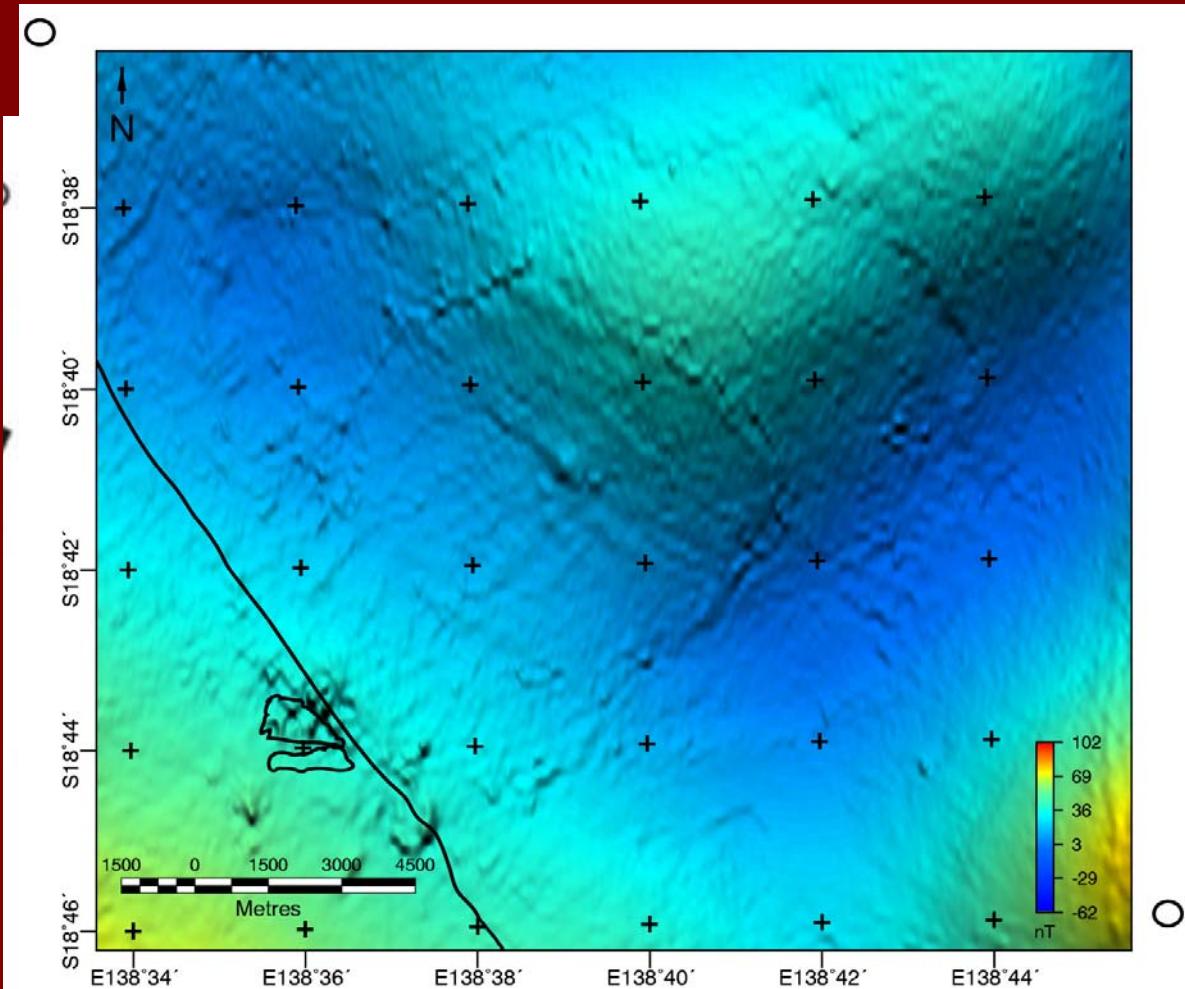
- Incorporated into fallback breccia during impact

# Muddy splat Martian analogue?

- Rampart craters at Mars's Northern latitudes
- Caused by melted ice and sediment flow during impact
- Possible thickening of surrounding sediment

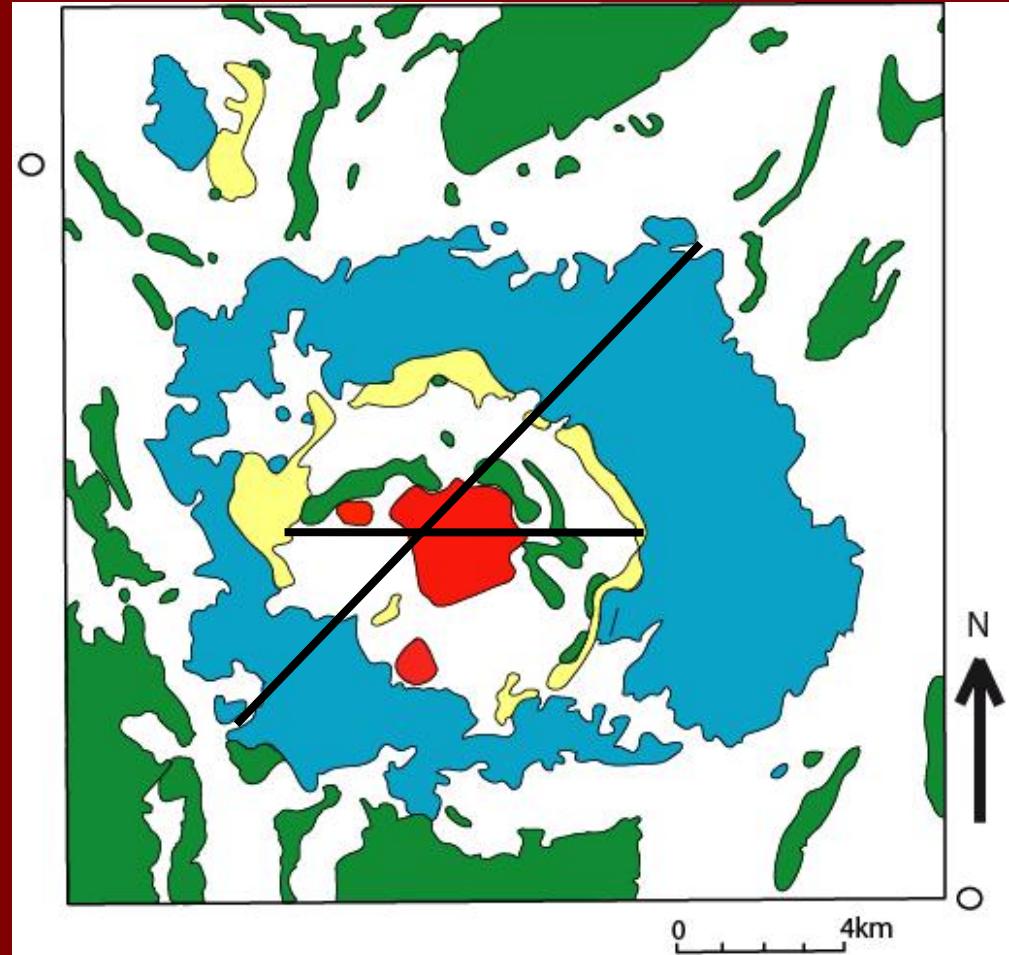


# Possible remnant rampart



# Conclusions

- Pre-limestone timing indicates around an 18km crater rim
- Solid limestone = mid Cambrian or younger impact (pretty likley)
- Muddy splat = Ordian age of 520-510ma (less likley)
- revised rim diameter would be more like 7km



# Acknowledgements



- Dr Bruce Schaefer
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  - Rod Anderson
  - Allen Neil
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