



Digital fossils: Photogrammetry applications for documentation, identification, and dissemination of paleontological resources data from national parks

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4 – National Park Service/ Oregon Caves National Park and Preserve



Late Miocene Felid and Camelid tracks in Death Valley NP

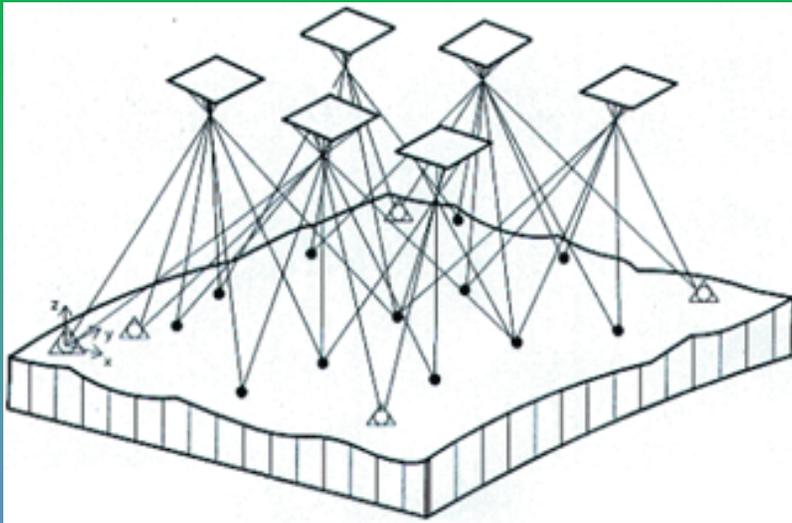


Image - <http://www.siddhi-its.in/services.html>

Photogrammetry:

What is it?

What's it good for?

- Non-contact method
- 3D feature extraction
- DEM or DTM extraction
- Digital mosaicked ortho-images
- 3D printing
- “uses of...” - Google search yields 2.2 million results



Barnyard in Copper Canyon, Death Valley NP

Can you work in a cave?



Image - Russ Graham

- Working in a cave isn't new...
- Did I mention "non-contact"



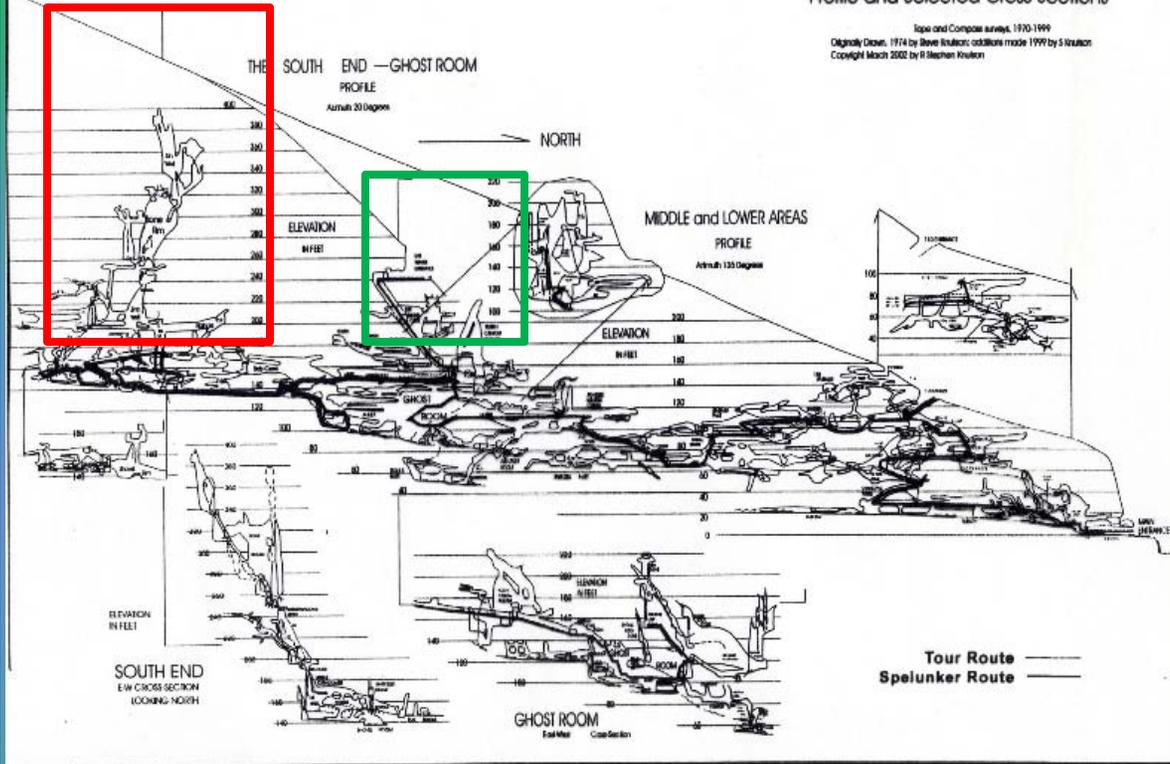
Image - <https://culturalheritageimaging.wordpress.com/2009/10/15/chi-team-images-magdalenian-material-in-the-foothills-of-the-pyrenees-mountains/>

- But getting far into a system with this equipment?
- Considerations:
 - where you'll be working
 - what are your goals
 - what do you need for task

OREGON CAVES

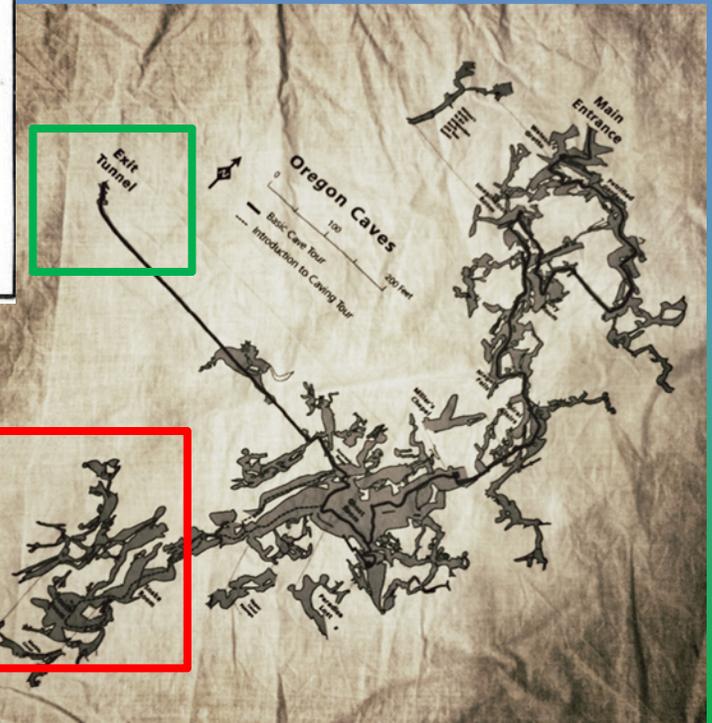
Oregon Caves National Monument
Profile and Selected Cross-Sections

Tape and Compass survey, 1970-1999
Originally Drawn, 1974 by Steve Neumann; additions made 1999 by S. Neuman
Copyright March 2002 by R. Neuman Neuman



Green = Access

Red = Bone Dome



What is needed at a minimum?

- Stuff that can survive cave trip
- Lights (LEDs – powerful & rechargeable)
- Camera (and a rugged case)
- Scales (ideally made of plastic)

Way into a cave...

Body remains in context



Trace fossils (track and claw marks) which cannot be collected.

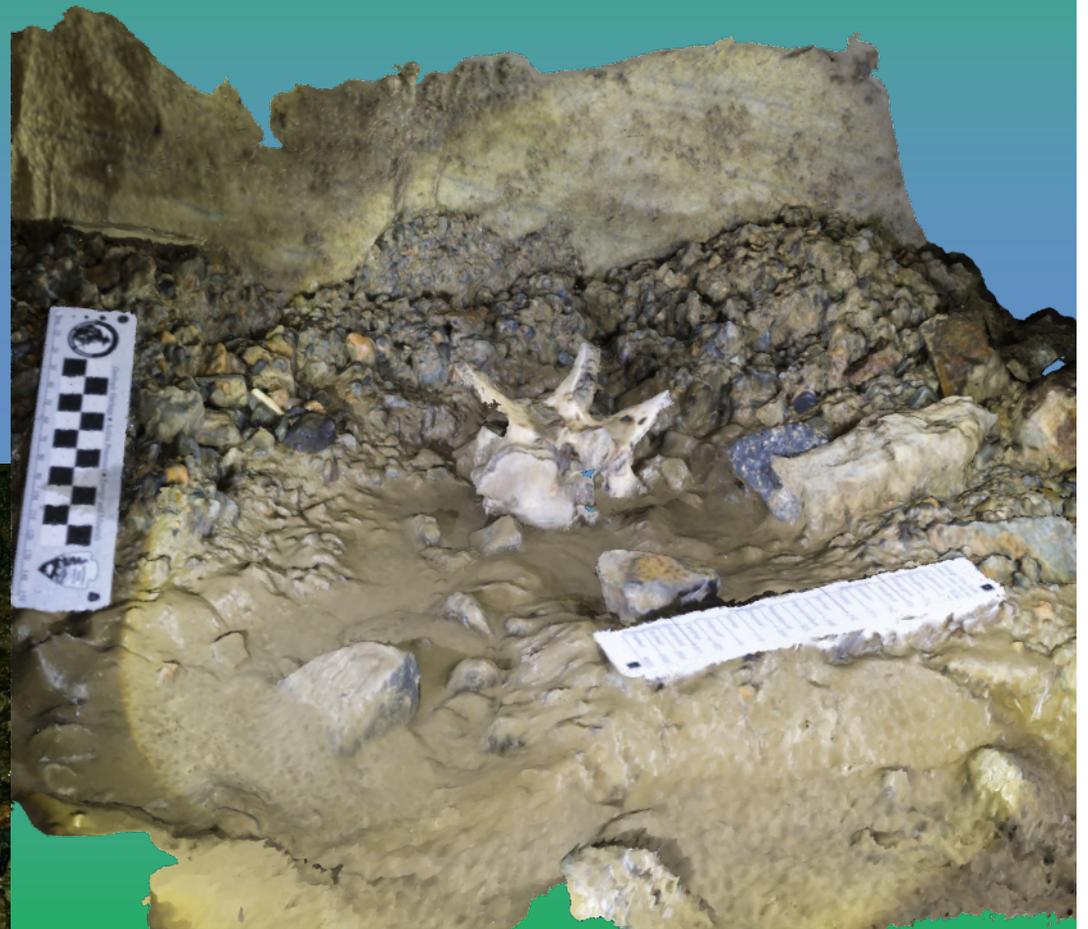
Most important item: Patient help*

*possibly the hardest item...



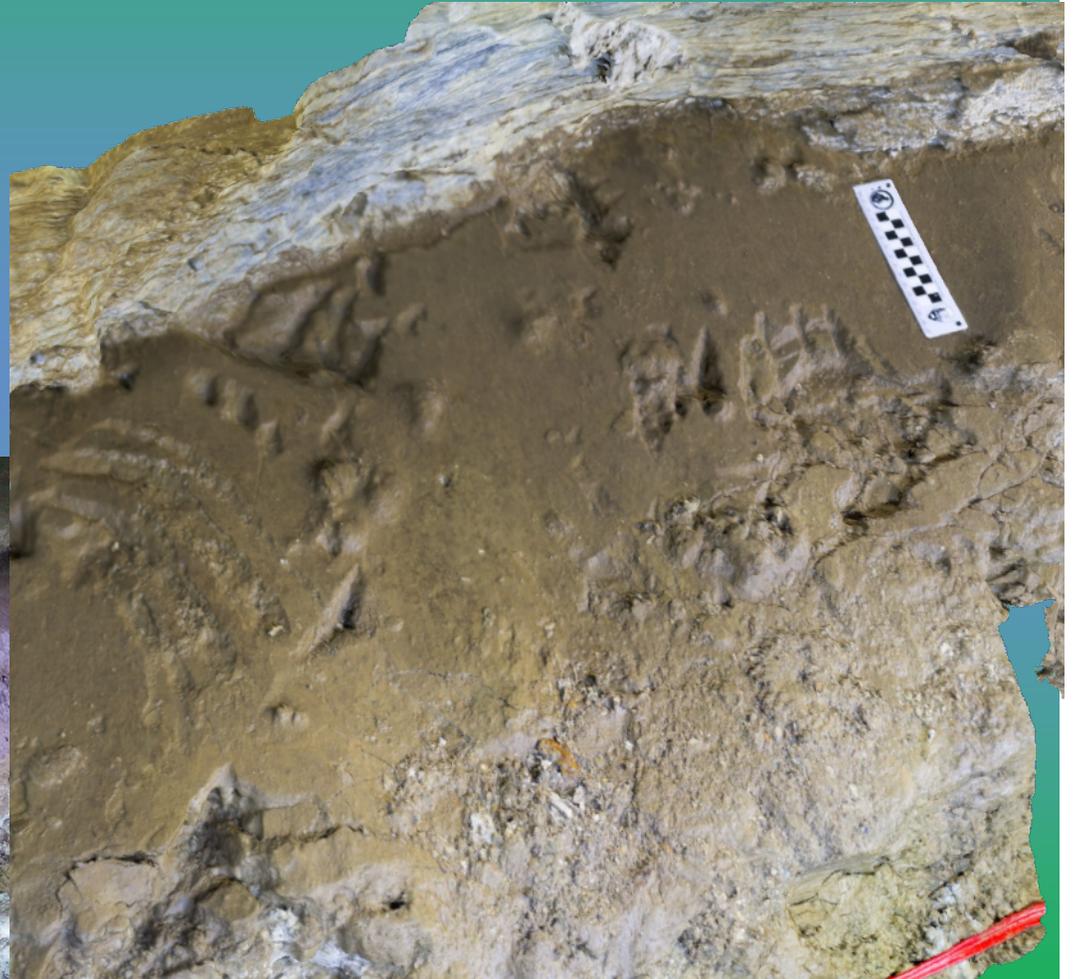
Photogrammetric model...

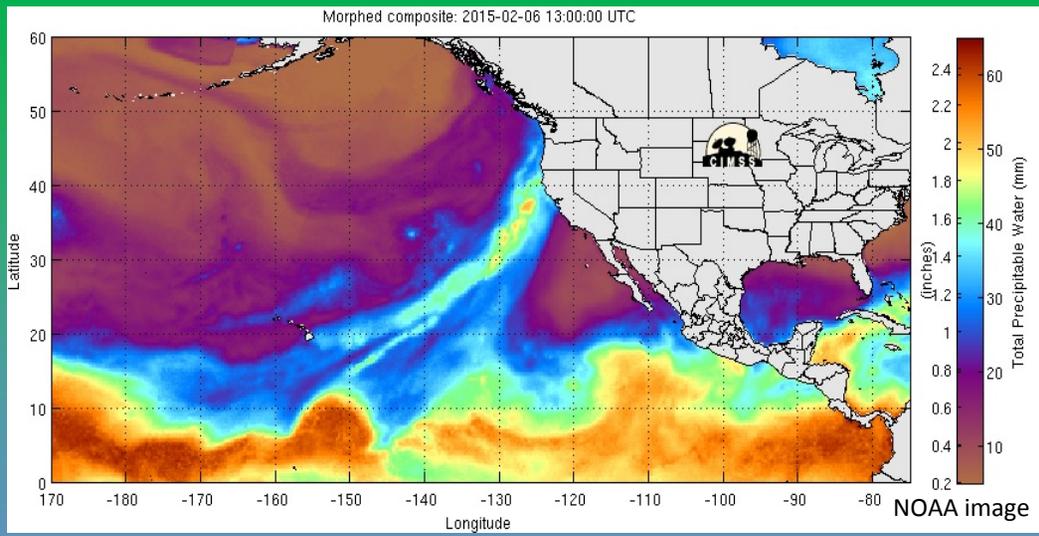
Ursid vertebrae



Photogrammetric model...

Ursid and felid tracks/claw marks





Weather is a factor in photogrammetry.
Even underground...
February Pineapple express rain event for 3 days (worst flooding in 20 yrs)



So...Retreat to a dry room:



Fossil Archive from Alaska's Lake Clark NP&P

- Rains a lot here too, so we work in the collections...

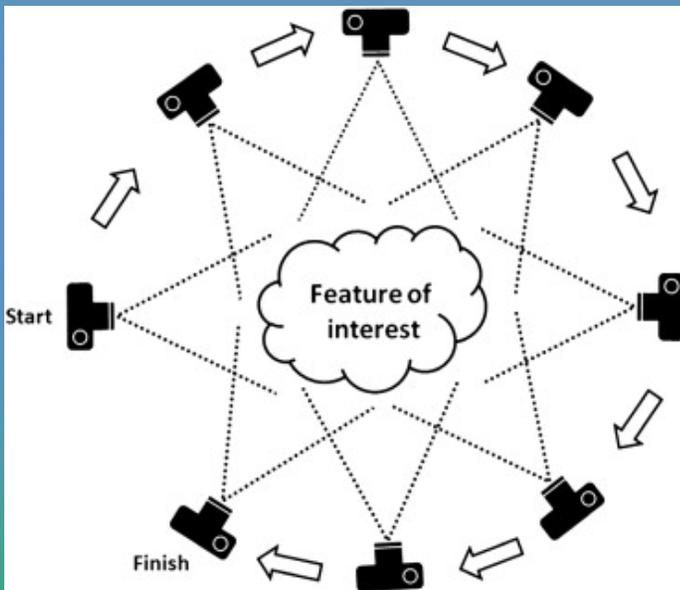
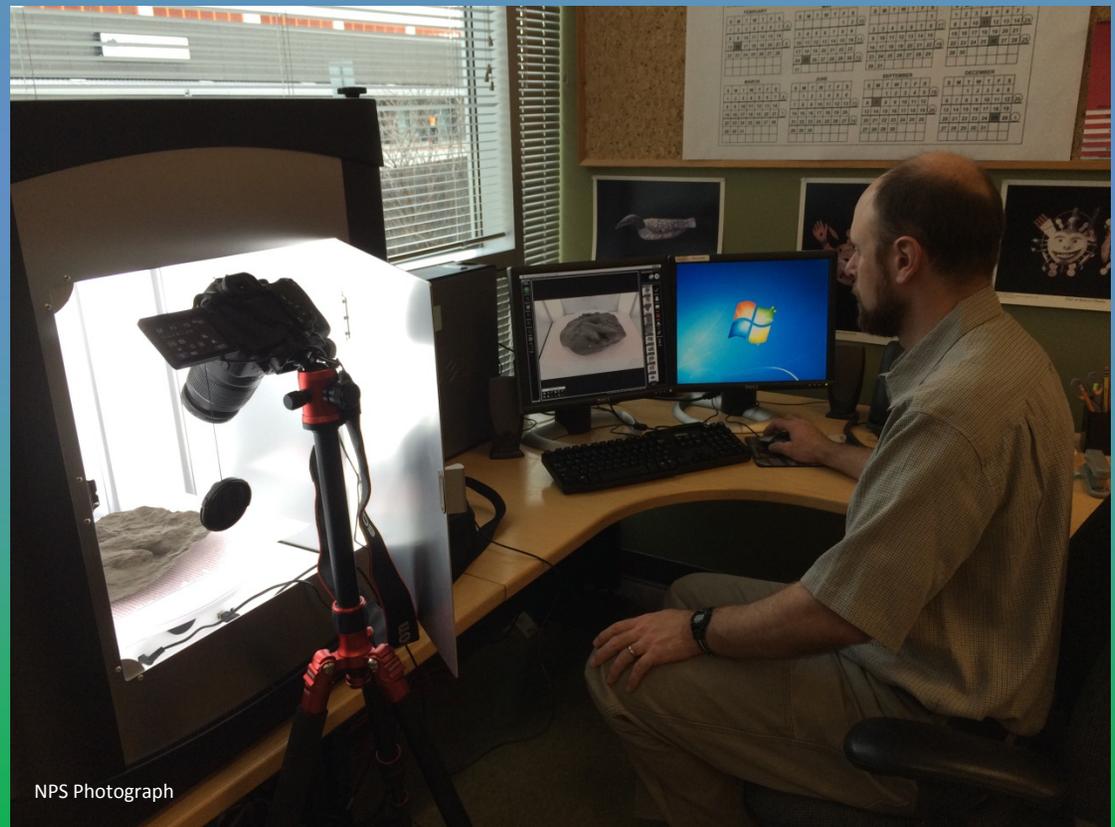


Image - <http://archphotogrammetry.com/tag/camera/>



NPS Photograph

Data for remote study & analysis

Photogrammetric model...

Retroceramus porrectus
(Echwald, 1871)



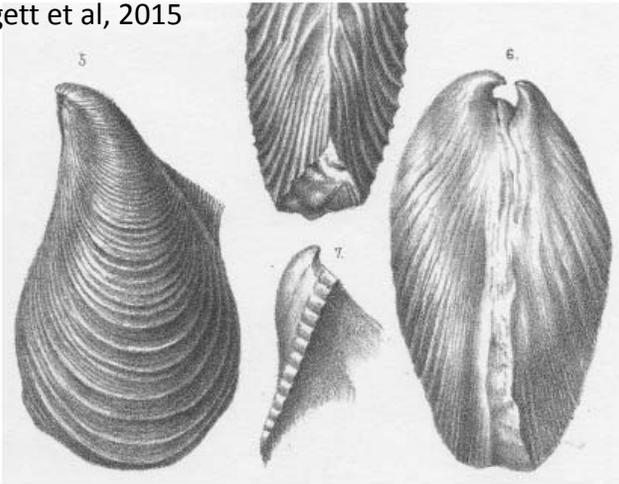
NPS Photograph



On line too -

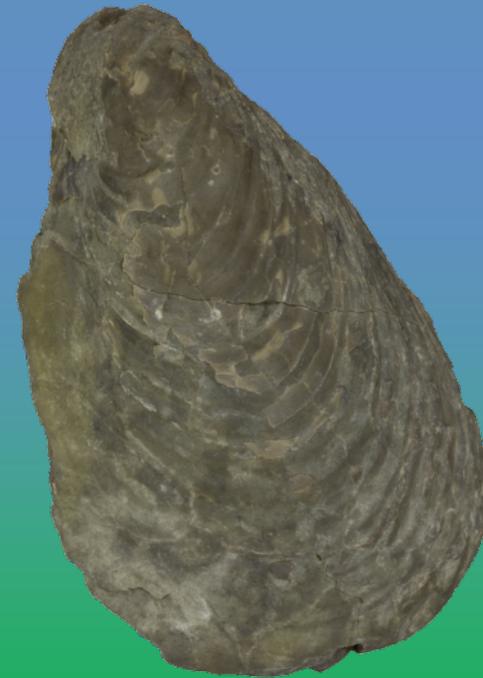
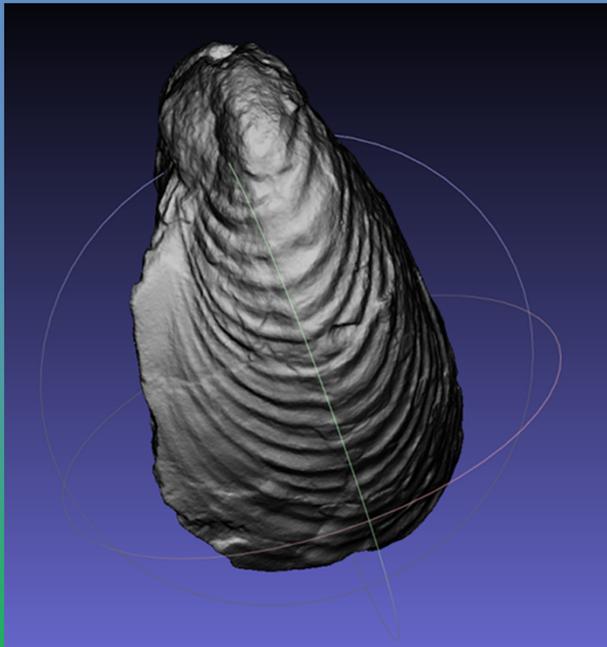
<https://sketchfab.com/models/0564b218186d4bb59b413578018401fb>

Blodgett et al, 2015



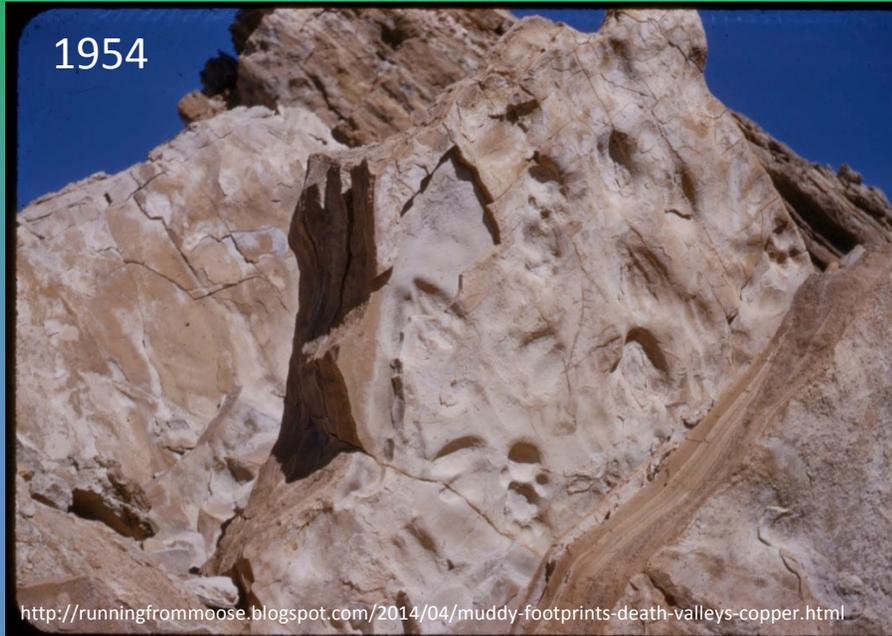
Retroceramus lucifer (Eichwald, 1871). Eichwald, 1871, p. 194-195, Pl. XVIII, figs. 5-7. Originally named *Inoceramus lucifer* by Eichwald as a new species. Ralph Imlay (USGS paleontologist, expert on Jurassic fossils) considered this to be the only species of inoceramid found in the Red Glacier Formation.

Photogrammetric model...



Screen-grab from MeshLab (Share-ware)

Photo-monitoring in Death Valley NP



Images of felid and camelid tracks



Copper Canyon area

Young fossils ~3 mya

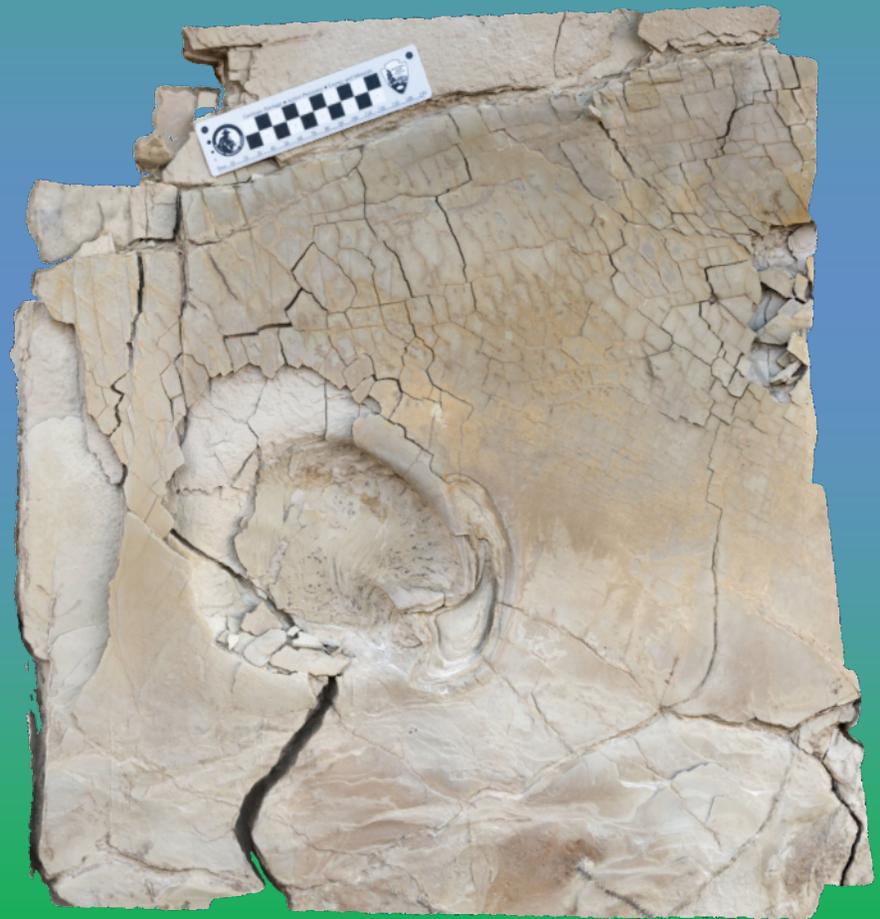
Restricted access

Fragile and difficult to collect

...where it rained.

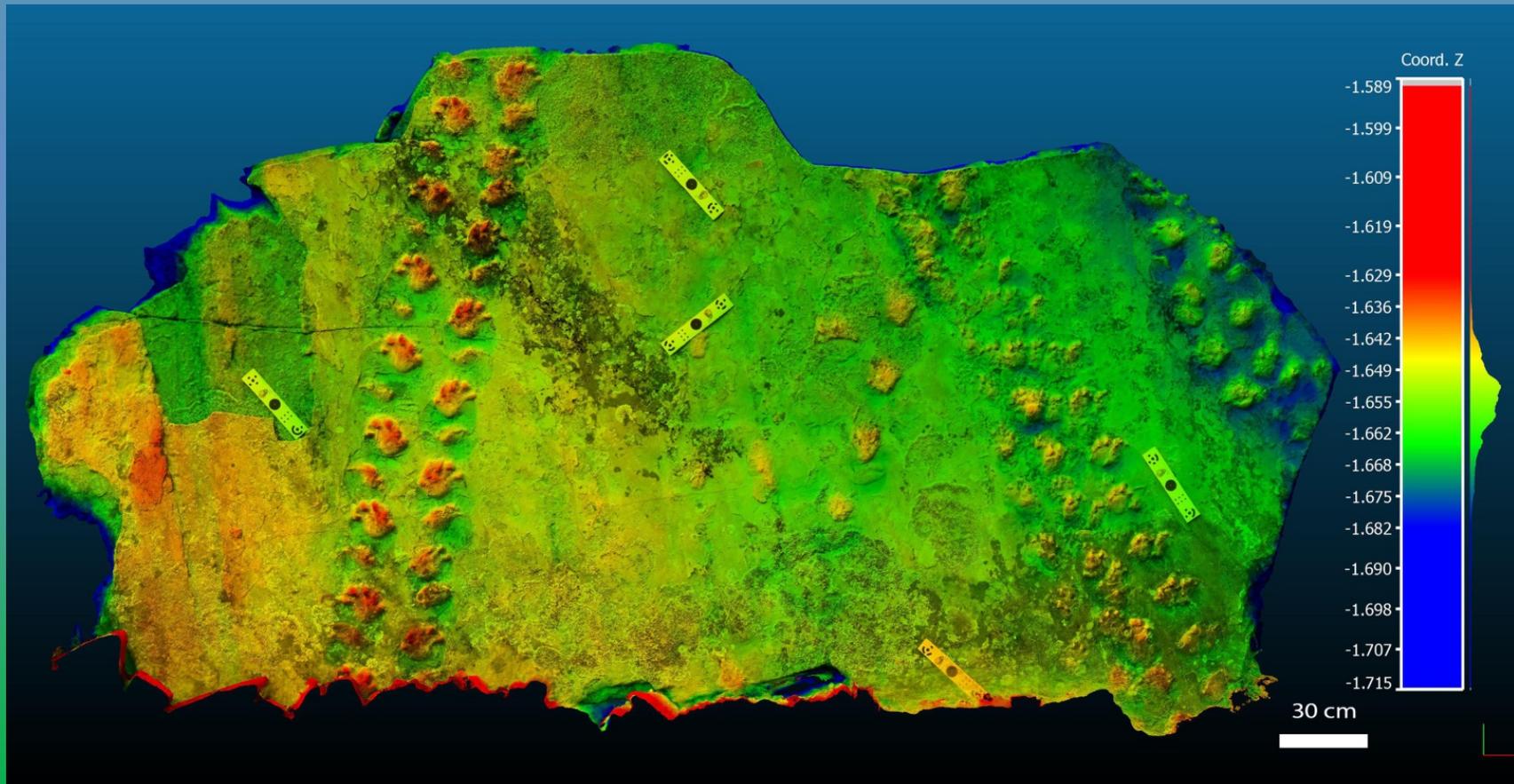
Photogrammetric model...

Camelid track



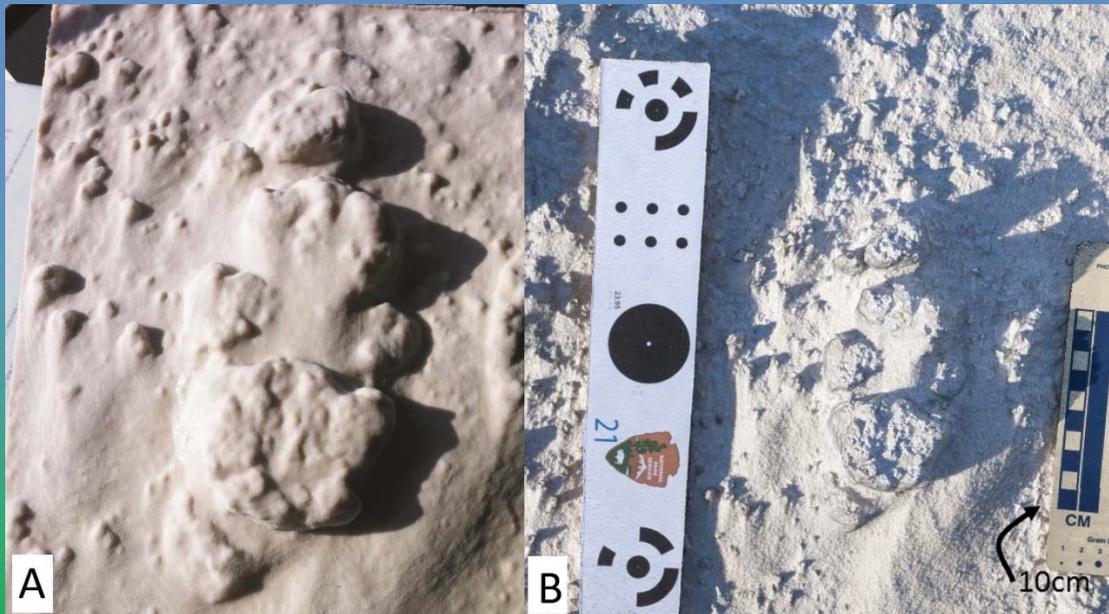
Surface models

- MicroDEM
 - Color ramp based on distance from parallel plane
 - Visualize subtle surface variation



3D prints

- Allows for public engagement, outreach and education
- A record for curation and study
- Download and print from home or office...
 - Instant* science and art!
- Printers now offer full-color renderings
 - Scales down to $\sim 200\mu\text{m}$



*Depends on print speed

Wood and Santucci, 2014

We all need support!

- Geological Society of America – GeoCorps America program
- Environmental Stewards Program (AmeriCorps)
- Dr. Torrey Nyborg - Loma Linda University
- Staff at DEVA, ORCA, LACL and NPS Alaska Region
- Ryan Hodges – NPS Mojave Desert I&M Network
- Field help - Justin Tweet, Ivan Bates, Jill Dyer, Emily Ring





Questions?

Pictographs – Sago Canyon, UT