

PHOTOGRAMMETRY FOR QUICK AND EASY DOCUMENTATION OF CONFLICT DAMAGE

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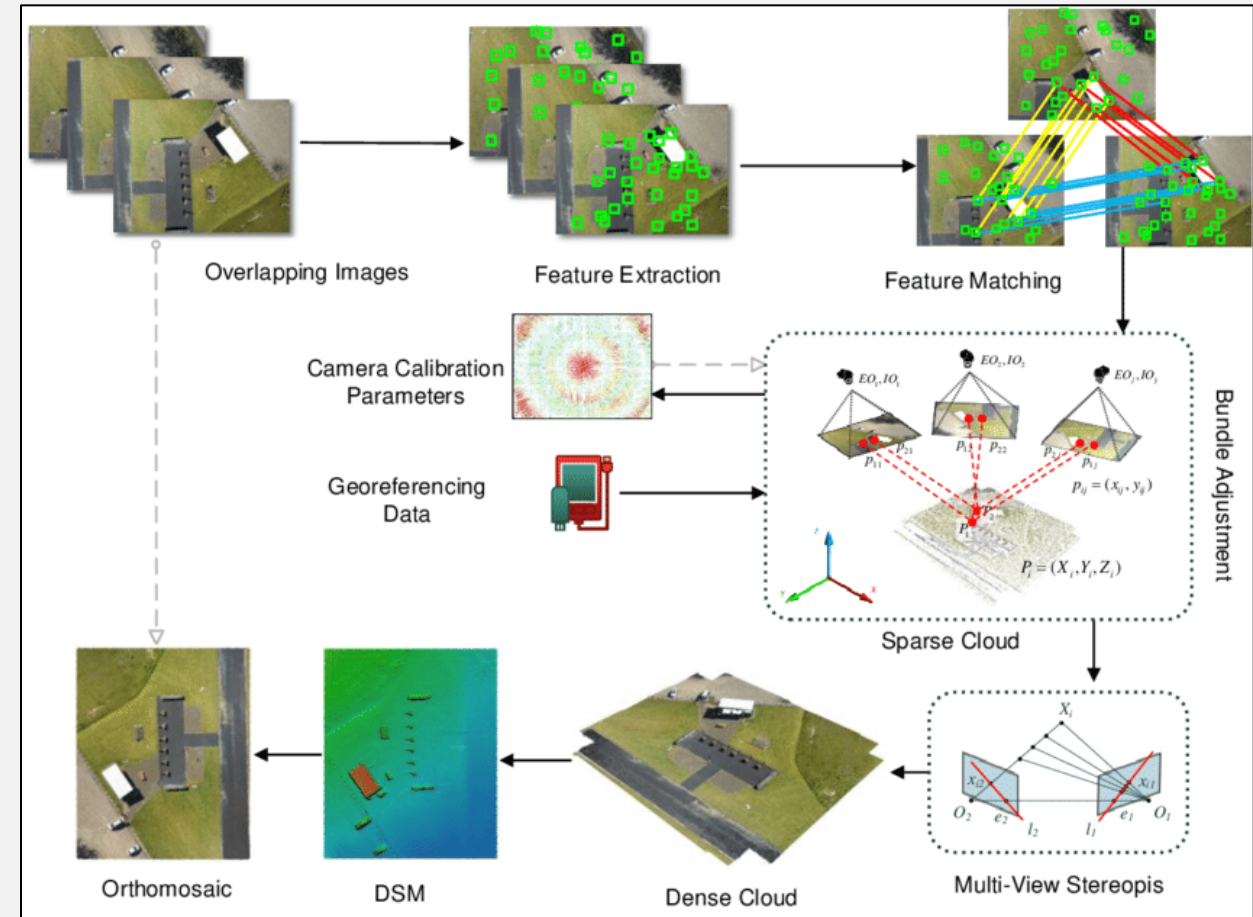
&

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WHAT IS PHOTOGRAMMETRY?

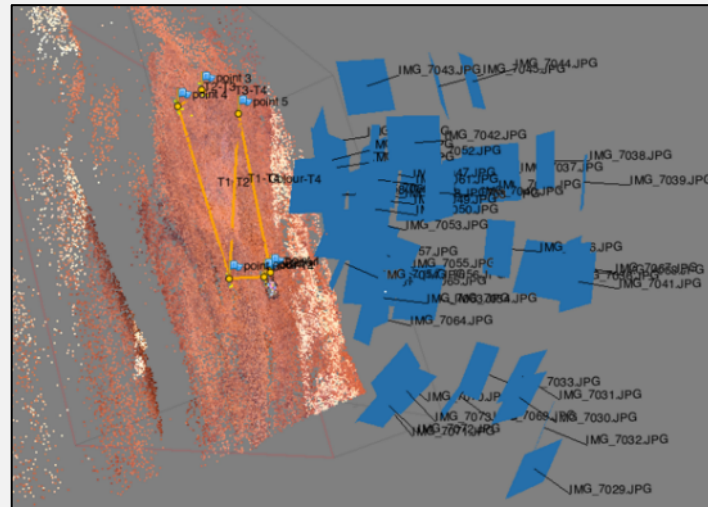
- 3D reconstruction of a surface using imagery
- Provides non-invasive method of data collection
- Permanent record of feature



Photogrammetry workflow (Source: Javadnejad, 2018)

SFM PHOTOGRAMMETRY

- Structure-from-Motion (SfM) photogrammetry = automatic features matching on corresponding images:
 - Must take images from multiple directions and angles / lots of overlap between images
 - Adding scale: ground control to georeference



SOFTWARE

- Commercial
 - RealityCapture - \$99/3 months
 - Agisoft Photoscan - \$59/standard, \$529/pro for educational licence
 - Autodesk ReCap Photo - \$40/month, \$350/yr (free for education)
- Free
 - VisualSFM
 - COLMAP
 - 3DFZephyr
 - AliceVision Meshroom

HARDWARE

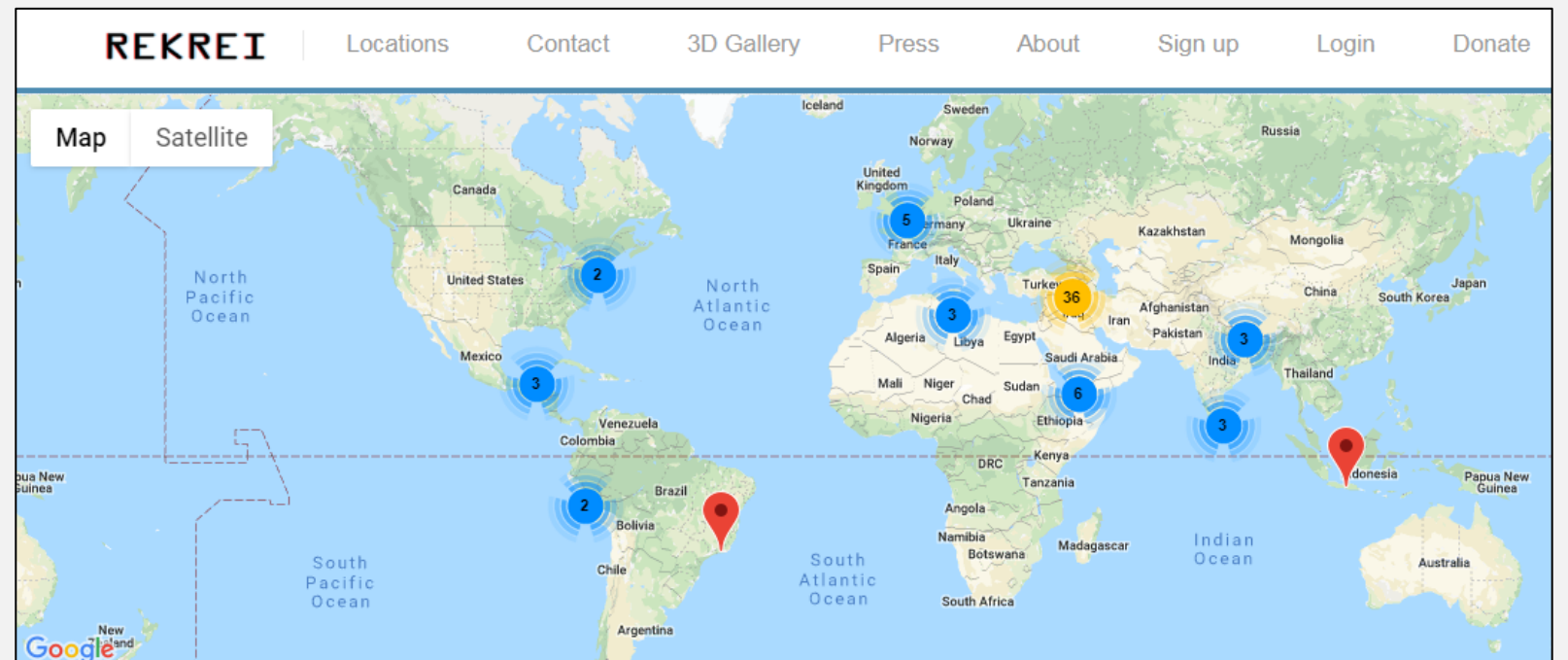
- **Camera**
 - DSLR (plus macro lens) or video camera
 - Camera phone
 - Drone/UAV
- **Computer**
 - Scales to the number of photos and level of detail required
 - Can solve on an iPhone or tablet
 - For 400 photo model, 4hrs @ 384GB RAM desktop PC
 - Can solve on cloud if local computer resources are limited
- **Other**
 - Tripod
 - Turntable
 - Lighting tent
 - dGPS / total station

PROJECT MOSUL

[Project Mosul](#) uses crowd-sourced imagery to digitally reconstruct heritage that has been destroyed (launched 2015)

- May 2019: 6231 images uploaded

Location of images crowd-sourced for Project Mosel May 2019 (Source: [projectmosul.org](#))



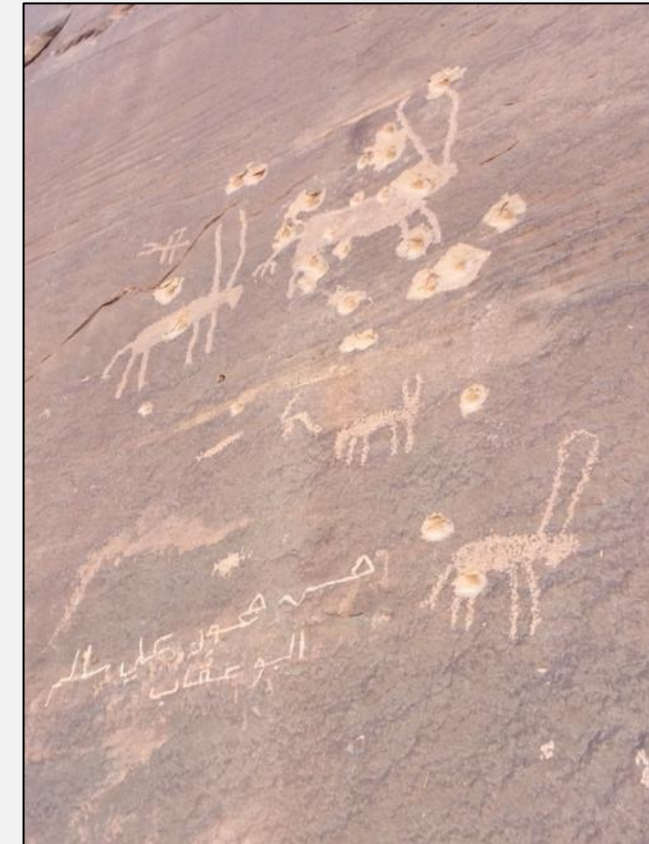
HERITAGE IN THE CROSSFIRE



Wadi Rum, Jordan:

- To quantify material deterioration associated with bullet impacts on rock surface in Wadi Rum
- To determine the effect of bullet holes on petroglyph stability
- To extract information from petroglyphs

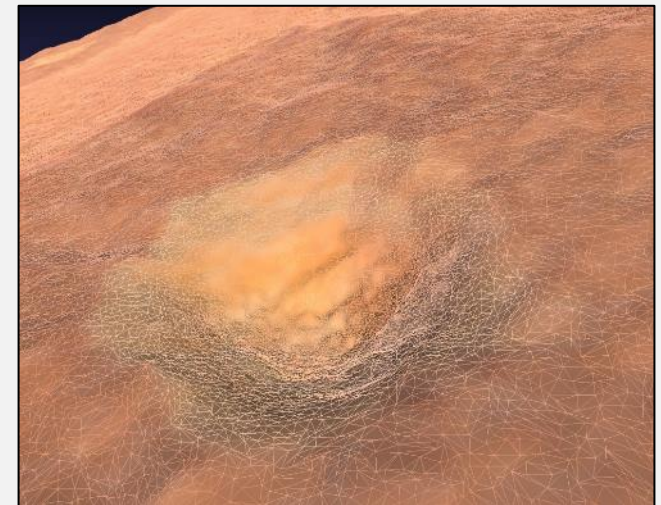
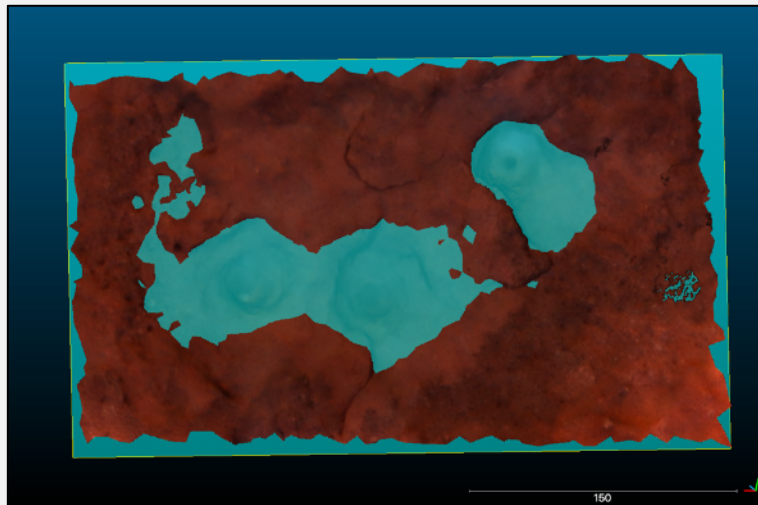
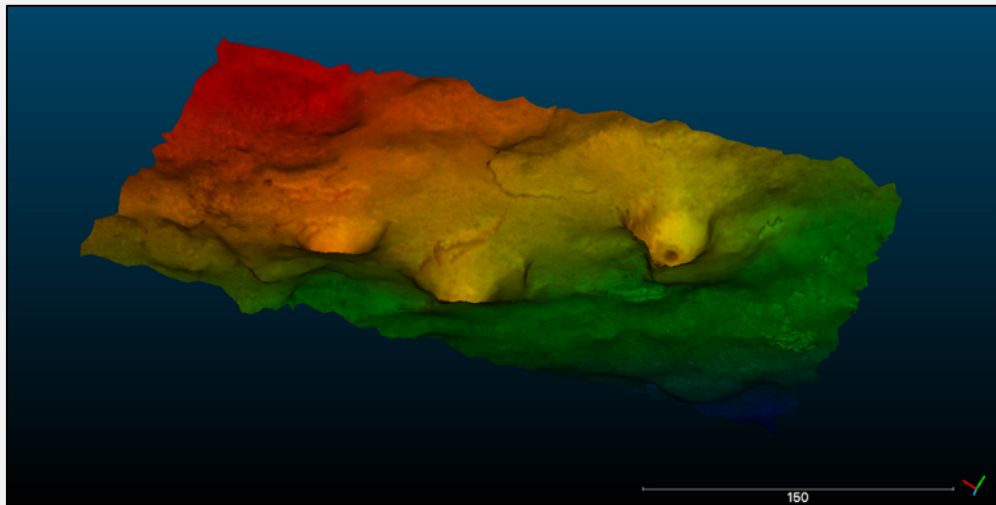
SfM photogrammetry using AgiSoft PhotoScan software





MATERIAL DETERIORATION ASSOCIATED WITH BULLET IMPACTS

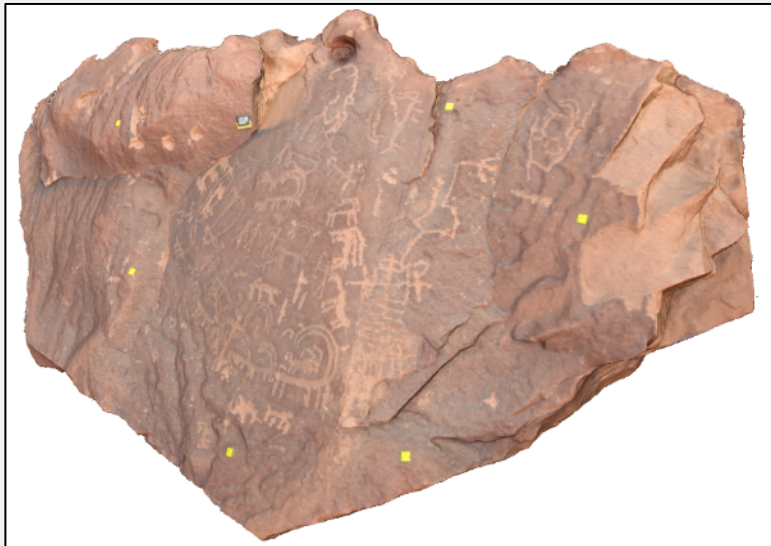
- Depth of impact
- Volume loss of material
- Surface area of disturbance



EXTRACTING PETROGLYPHS

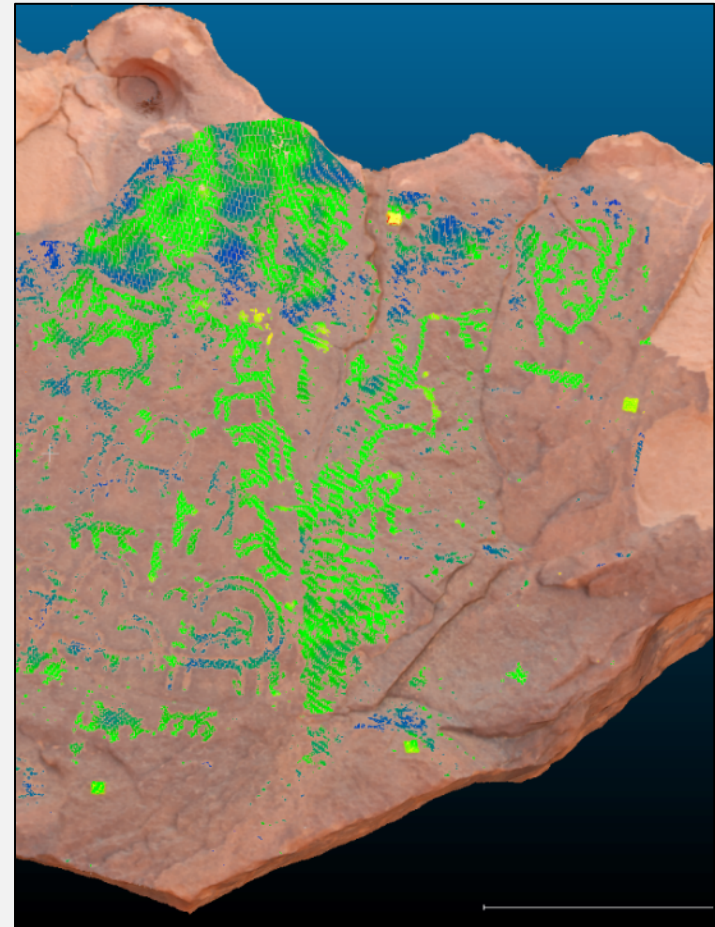
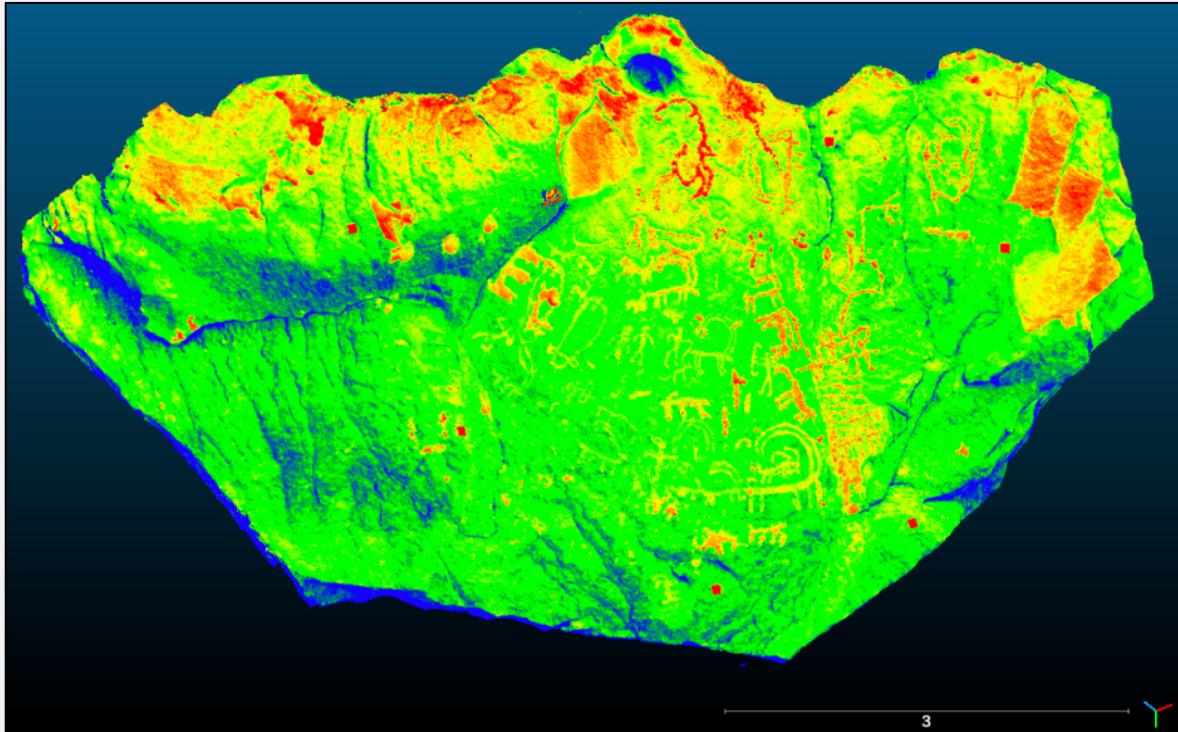
Problems associated with extracting information on petroglyphs

- Multiple layers of petroglyphs
- Graffiti damage



EXTRACTING PETROGLYPHS

Using both colour and depth from 3D models



ADVANTAGES FOR QUANTIFYING CONFLICT DAMAGE

- Low cost – limited investment needed
- Basic equipment – available to most users
- Straightforward – requires limited training
- Field-friendly – simple models can be made on-site
- Requires limited planning – make models *ad hoc*
- Easily shared – non-proprietary file formats and free software
- Can be crowd-sourced

SUMMARY

- SfM photogrammetry can provide a low-cost, portable, non-invasive method of reconstructing surfaces that preserves the integrity of the feature of interest
- Appropriate image capture is essential – to ensure accurate reconstruction multiple images need to be taken from a range of angles and viewpoints (**G**arbage **I**n **G**arbage **O**ut)

Things to consider:

- If want to accurately represent feature then need to add scale / ground control and be able to quantify the errors in the photogrammetric process
- Specialist software is required – industry standard is AgiSoft Photoscan, free software options available
- Computer requirements dependent on level of detail required