

Nested crater morphology, ring-structures and temperature anomalies detected by close-range photogrammetry and thermal remote sensing at Láscar volcano, Chile



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GFZ

Helmholtz-Zentrum
POTSDAM

photo: Global Volcanism Program

HELMHOLTZ

- **satellite observation**

Sentinel-2, Landsat 7 ETM+ & Landsat 8 OLI

- **repeat drone (UAS) surveys** Nov 2017, Feb 2020

Optical camera

FLIR Tau 2 Thermal Imaging Camera

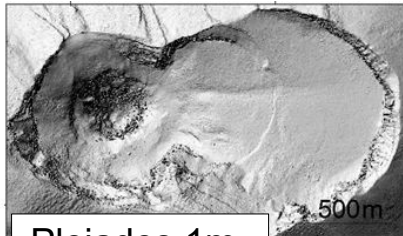
- **Structure-from-Motion (SfM) processing**

Agisoft Metashape: optical image

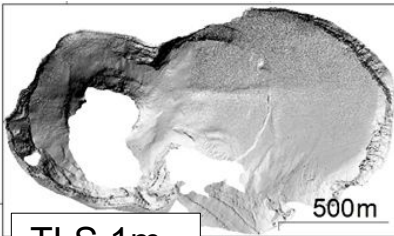
Pix4Dmapper: thermal image

- **DEM of Difference analysis**

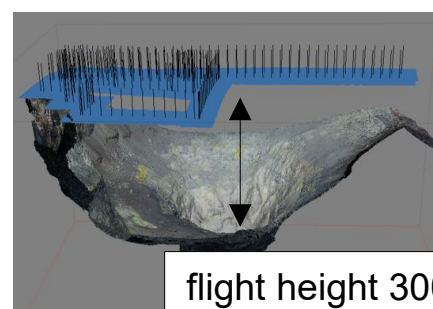
neither satellite nor ground-based survey can realize the investigation of deep active crater



Pleiades 1m



TLS 1m

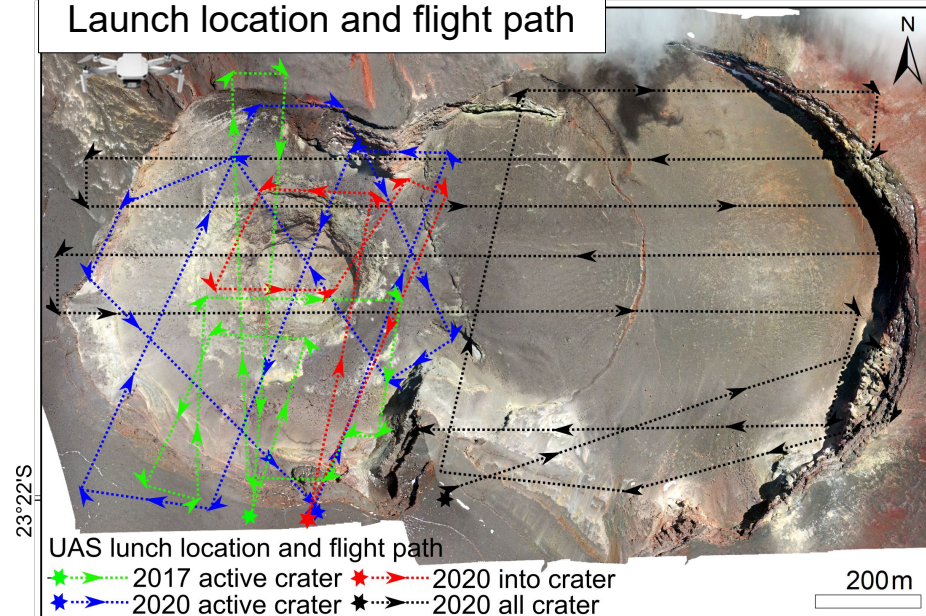


flight height 300m

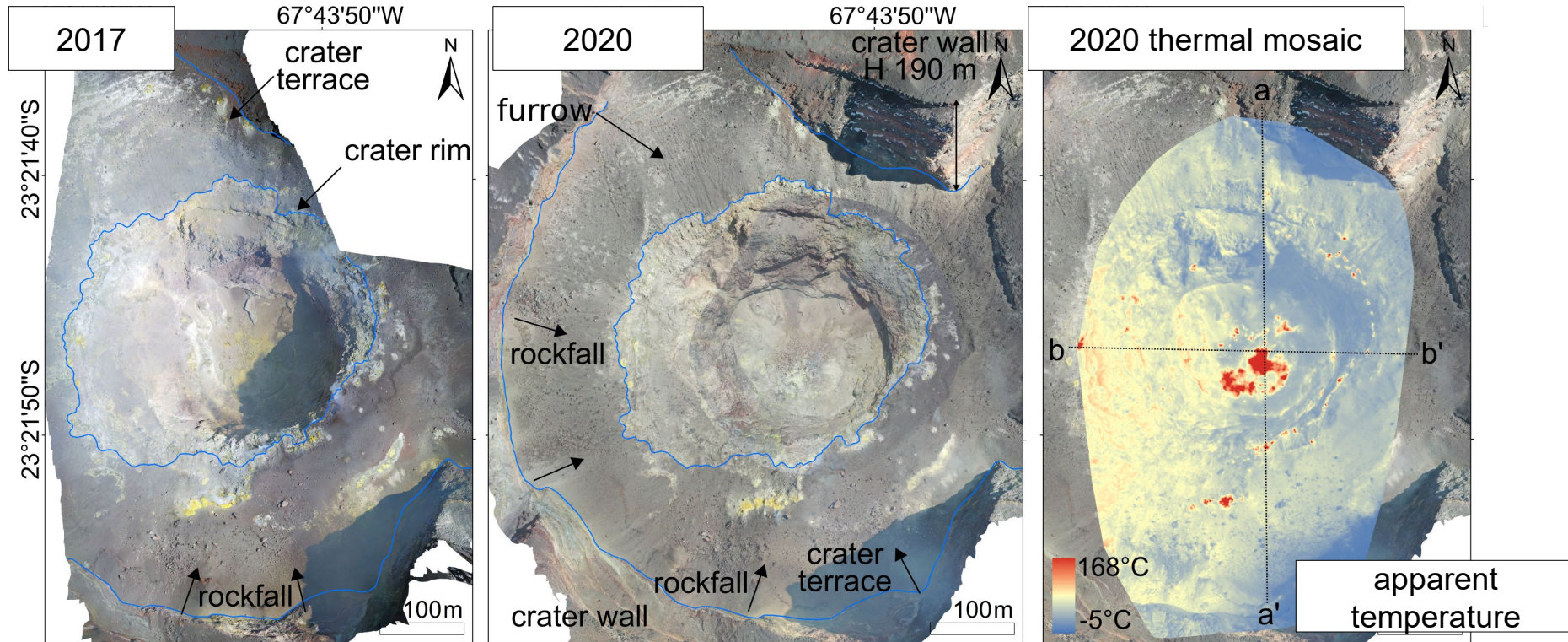
DJI Phantom 4 Pro
DJI Mavic Pro Platinum



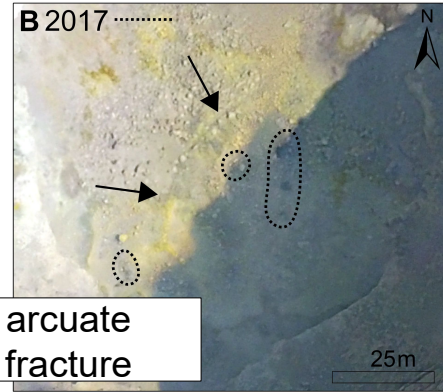
Launch location and flight path



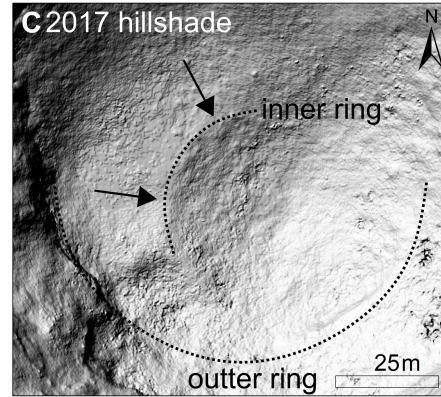
- orthomosaic 2017: 7.7 cm/pixel, orthomosaic 2020: 7 cm/pixel and 5.3 cm/pixel
- thermal orthomosaic 2020: spatial resolution 45 cm/pixel, radiometric resolution 0.04 degree/pixel



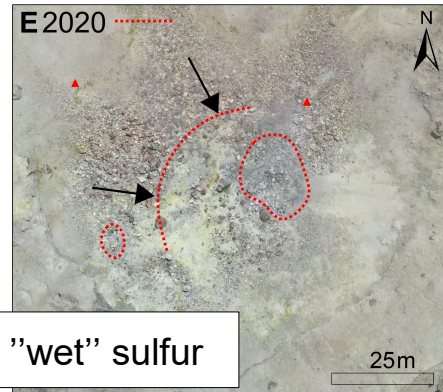
- 67°43'50"W



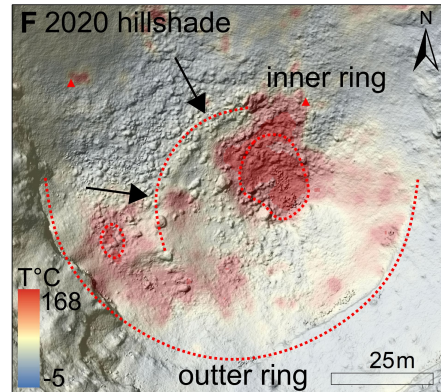
arcuate
fracture



may present
geometry of
conduit top



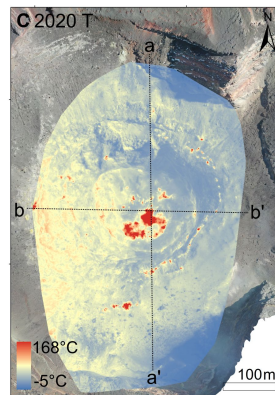
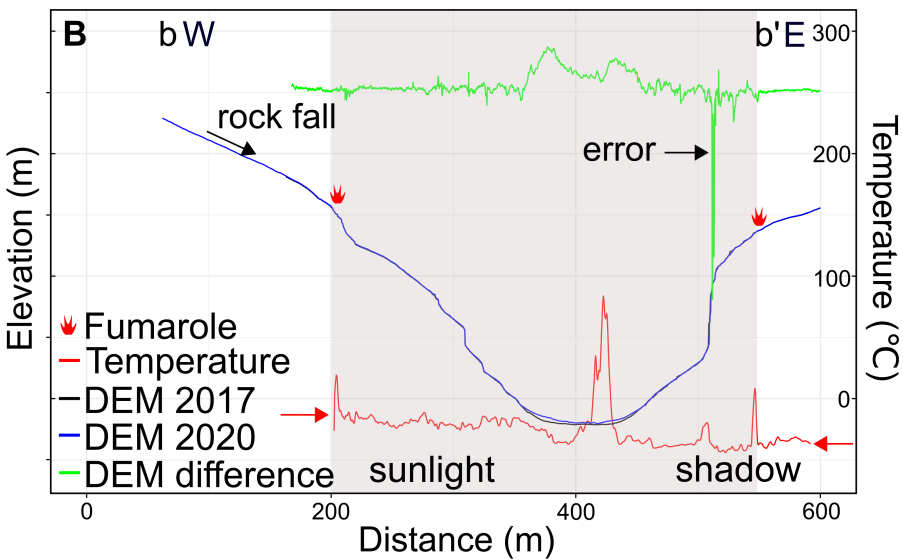
''wet'' sulfur



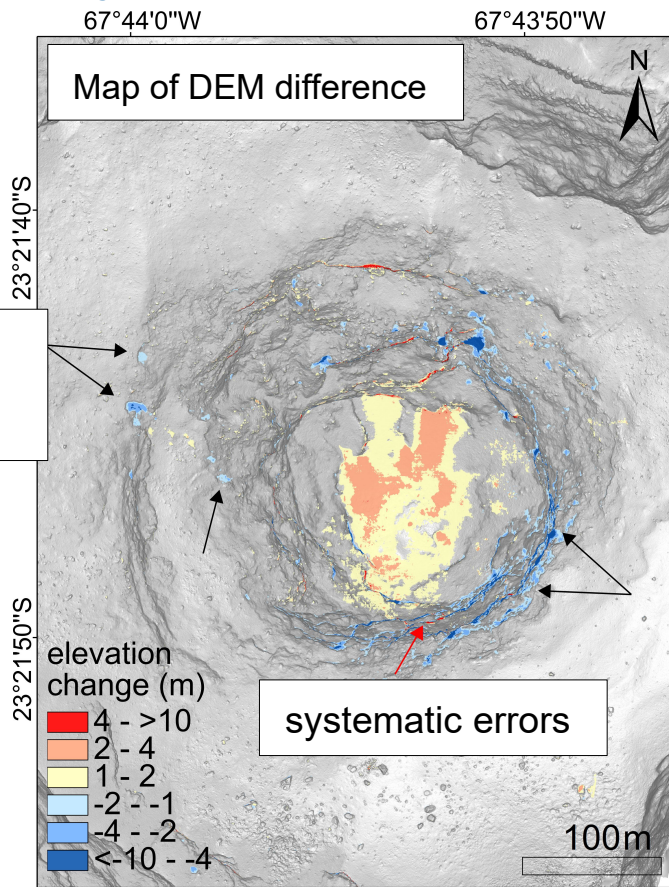
inner ring 60m

outer ring 90m

- **DEM profile:** DEM 2020 overlays DEM 2017 on the area of crater floor
- **DEM difference:**
maximum positive DEM difference 5.5 m (WE)
total volume gain on the crater floor is $1.65 \times 10^4 \text{ m}^3$
- **Thermal profile:** shadow effect, approx. 20°C temperature difference



localized
crater wall
collapse



Discussion: crater morphology relate to thermal activity

- **Stage I:** sealing, pressurization, $1.65 \times 10^4 \text{ m}^3$ volume of material accumulation on crater floor
- **Stage II:** minor explosion, thermal anomaly rapid enhance to peak value immediately follow explosion
- **Stage III:** continuous rock fall, collapse recovering the crater floor, thermal anomaly gradually decrease

