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Using "Selfie drones" for 3D mapping of volcano-tectonic features in Santorini, Greece

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Study area
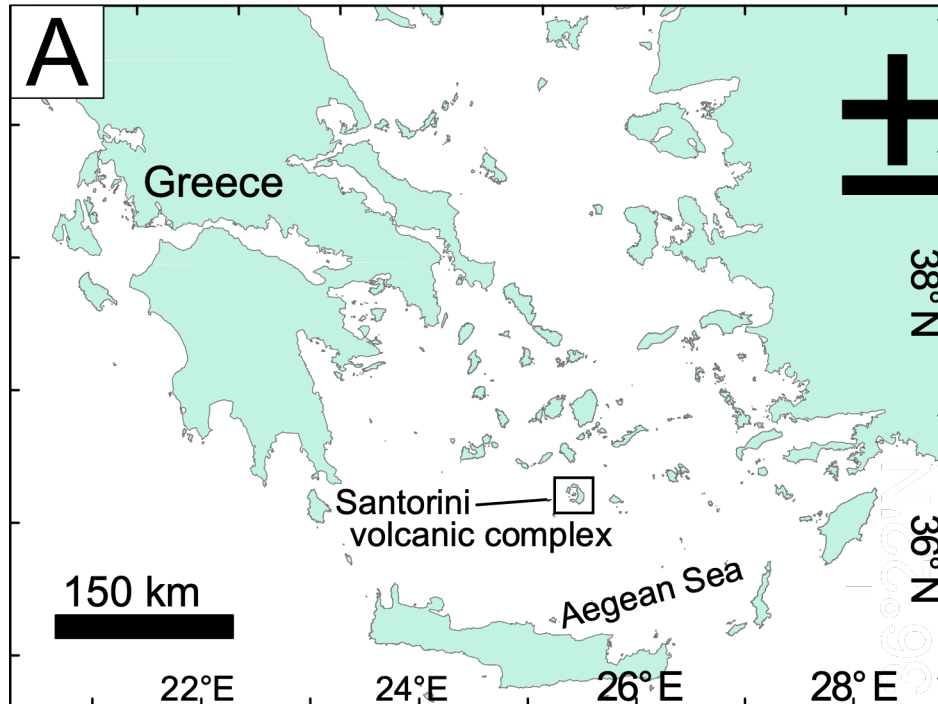
(A) Location of Santorini Volcanic Complex in the Aegean Sea
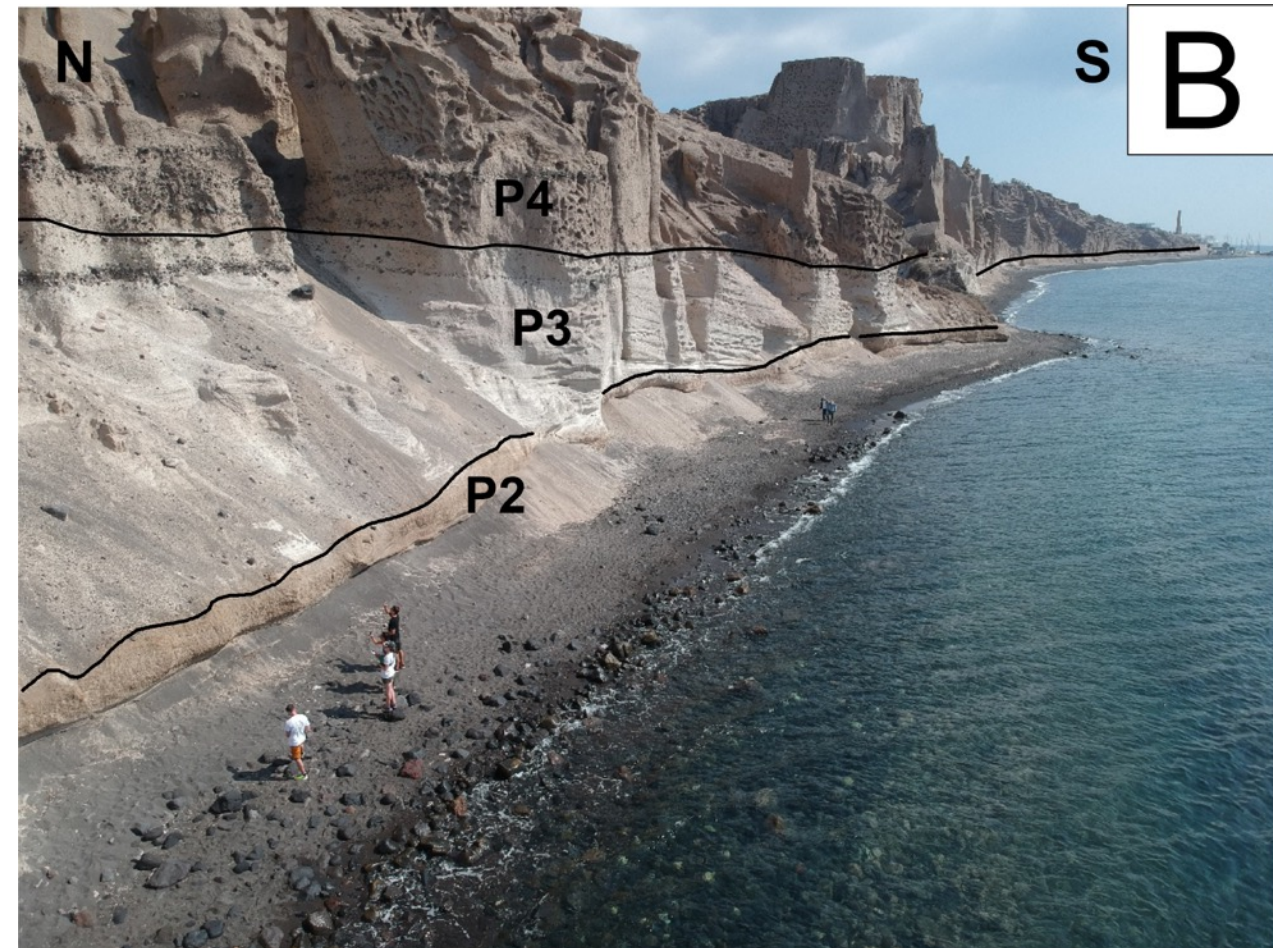
(B) Zoomed area where selected sites are mentioned

after Varvara et al., 2019; Bonali et al., 2020
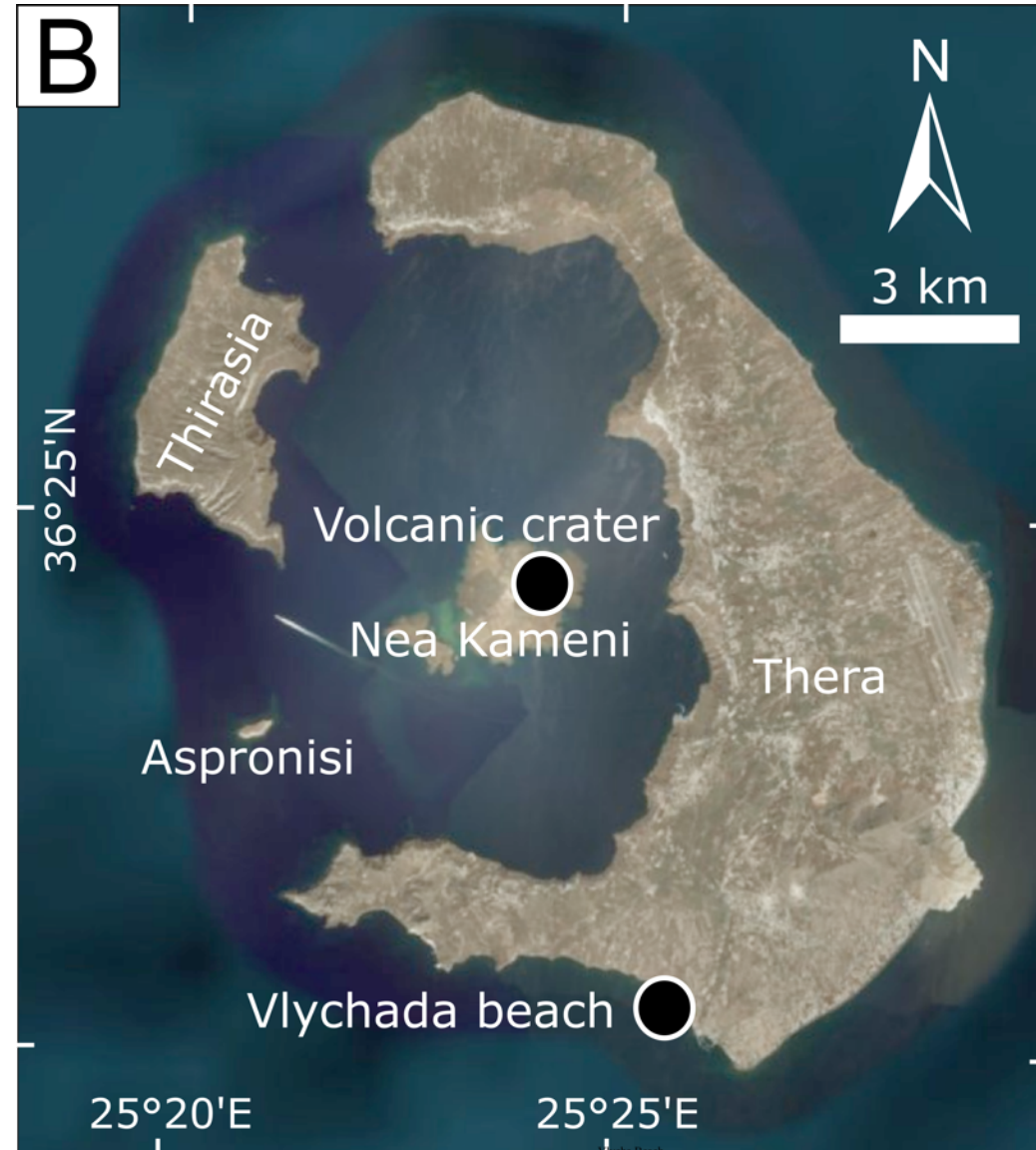
(A) Panoramic view of Nea Kameni island, where the location of 1570-1573 crater is indicated

(B) UAV-captured picture showing a part of the LBA deposit outcropping along the Vlychada beach, where the recognizable phases are indicated

Our approach

Our UAV-based SfM-UAV workflow

Data collection
- Area selection
  ↓
- Flight planning
  ↓
- GCPs placement
  ↓
- Drone flight

SfM-MVS processing
- Photo alignment
  ↓
- Sparse point cloud
  ↓
- Dense point cloud
  ↓
- 3D DOM
  DSM
  Orthomosaic

(A) UAV-collected pictures already aligned with the sparse cloud also processed - The selfie drone (Dji Spark) we used, is also shown

(B) Dense cloud generated by the SfM software presenting the 1570-1573 Volcanic Crater
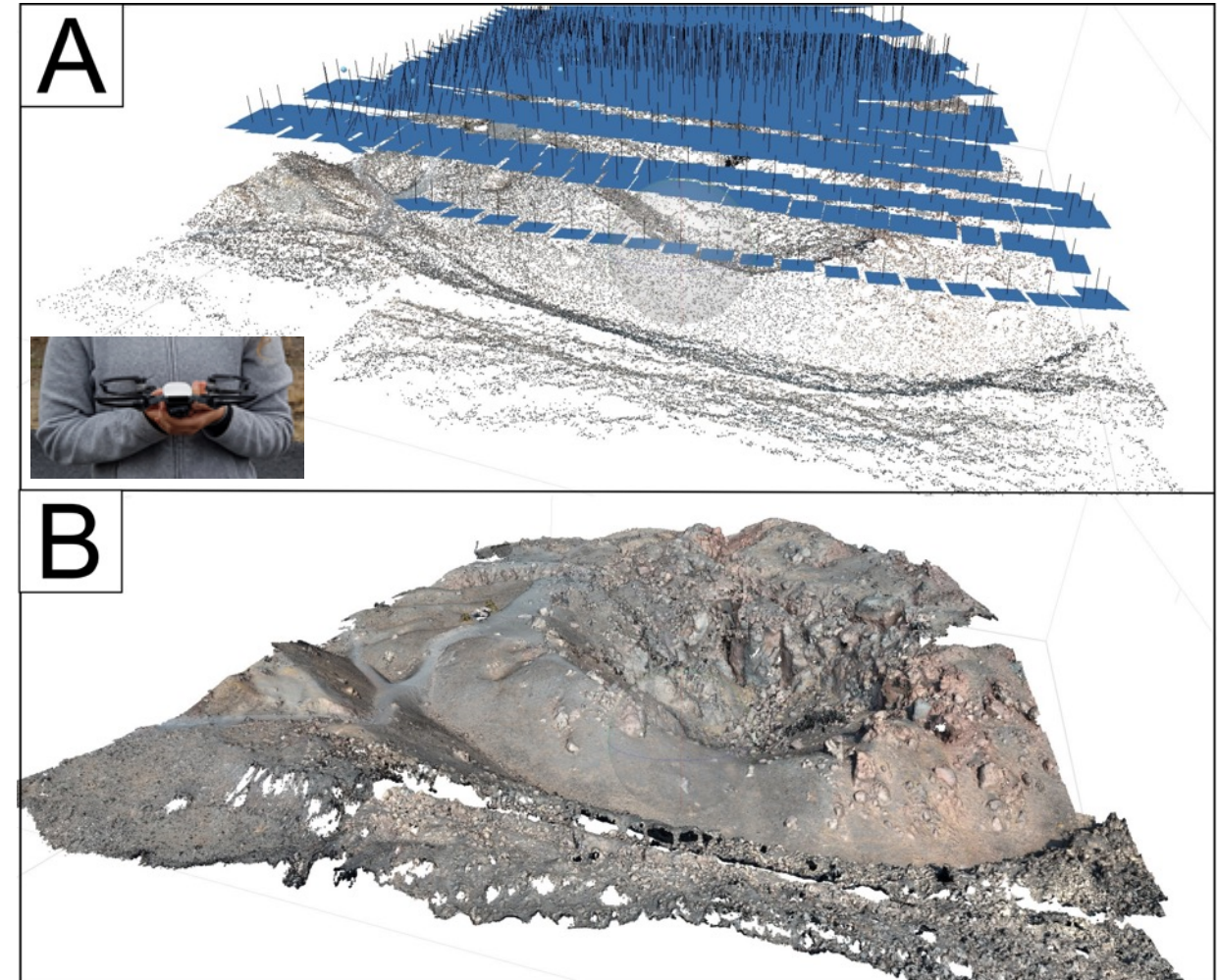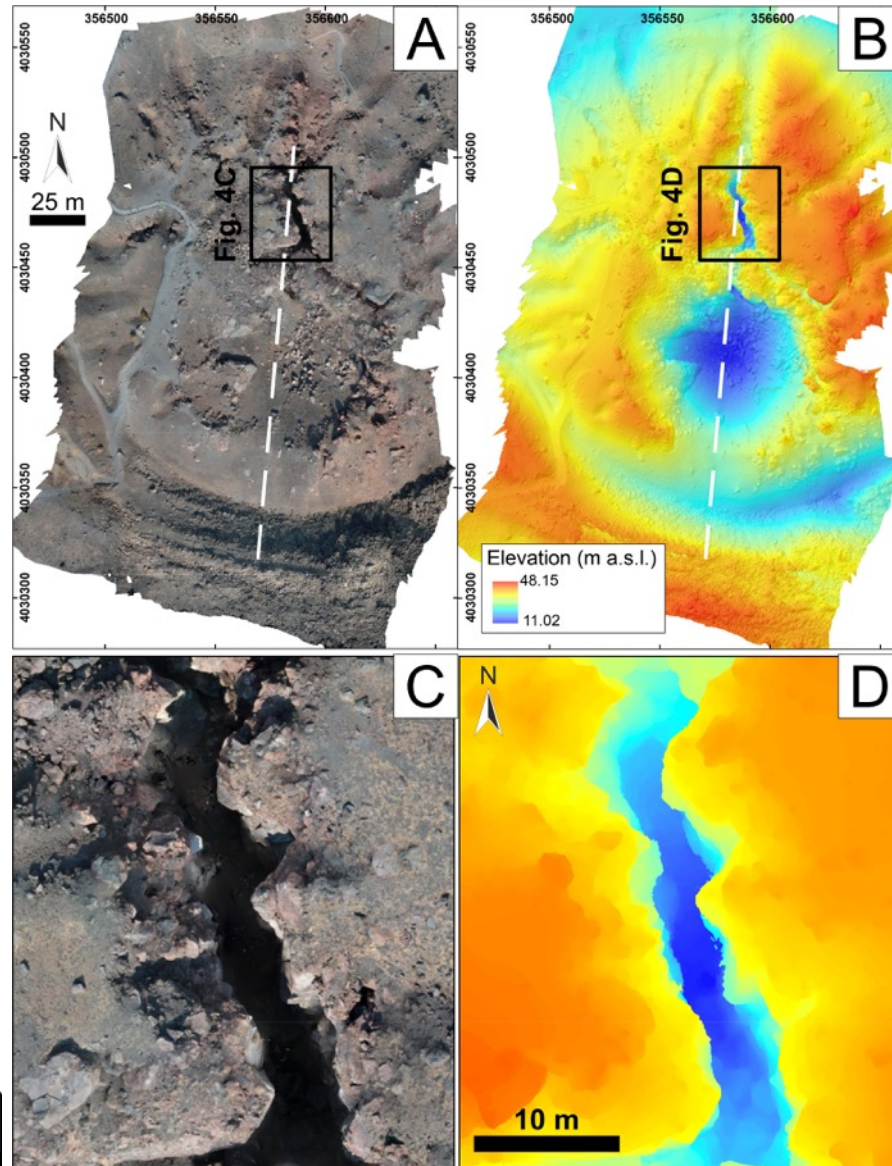
(A) Orthomosaic (9.47 mm/pix) and DSM (3.79 cm/pix) (B) of the 1570-1573 volcanic crater. (C-D) Detailed view of the northernmost fracture. (E) 3D Virtual Outcrop of the volcanic crater available online as virtual outcrop (https://skfb.ly/6PUNt).
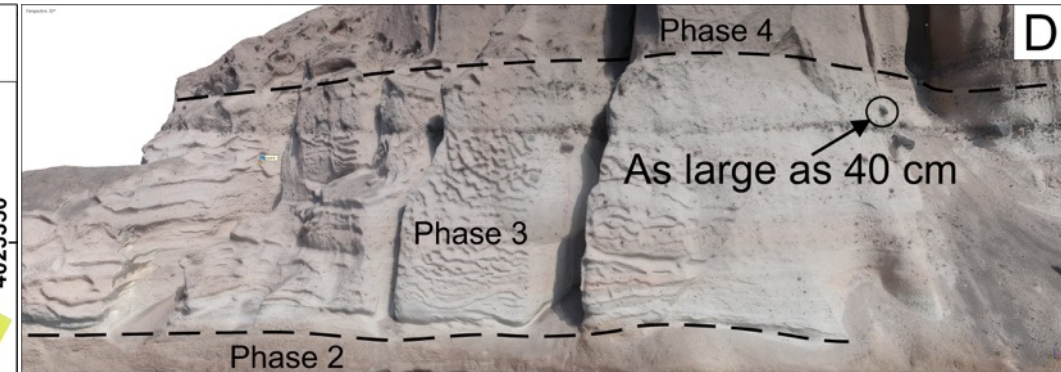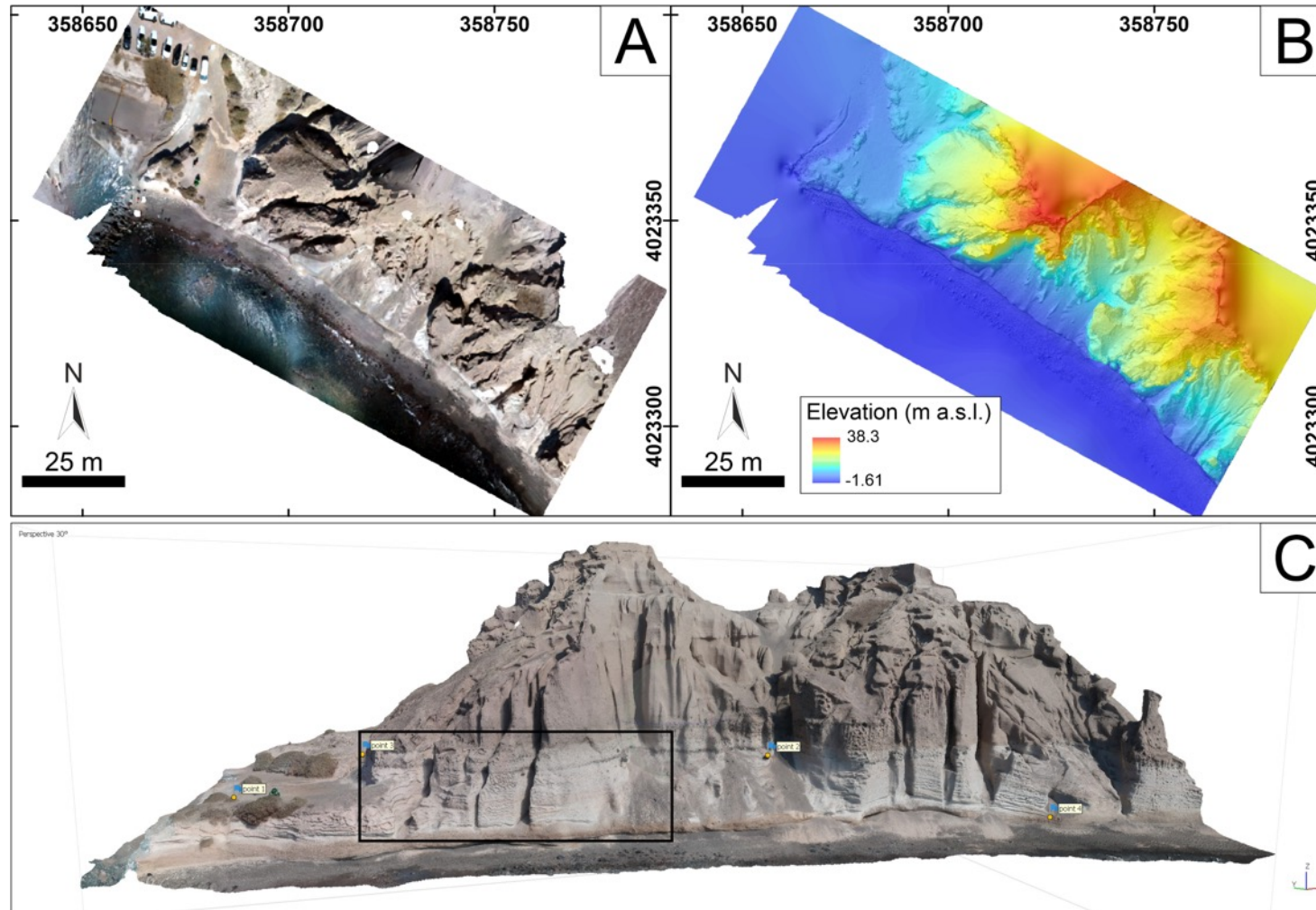
(A) Orthomosaic (1.67 cm/pix) and DSM (8.37 cm/pix) (B) of the outcrop related to LBA deposits along the Vlychada beach.
(C) 3D Virtual Outcrop of the volcanic outcrop available online (https://skfb.ly/6PZPO), where it is possible to recognize the different phases with very high detail (D).

Final remarks

By applying the Structure from Motion to pictures collected using the selfie drone, we were capable of:
- reconstructing the two sites with centimetric to sub-centimetric resolution;
- recognize geological features on very high-resolution DSM and Orthomosaics;
- mapping vertical volcanic deposits on 3D DOM;
- collect new quantitative data for the two sites. At the same time as showcasing the selected geosites, we have discussed and compared the advantages provided by the different types of image-taking techniques, from traditional ones such as field photographs, to more advanced ones such as UAV-based photographs and 3-D models.

References
- Bonali et al., (2020). Selfie drones for 3D modelling, geological mapping and data collection: key examples from Santorini volcanic complex, Greece. GISTAM 2020, SCITEPRESS.
- Varvara, A., Paraskevi, N., Pavlina, B., Pantelia, S., Luca, B. F., Lemonia, R., & Andreas, M. (2019). The Story Map for Metaxa Mine (Santorini, Greece): A Unique Site Where History and Volcanology Meet Each Other. GISTAM 2019, SCITEPRESS.

See you soon in Santorini!