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# 3D Geovisualization of petrified tree trunks: The case of Lesvos Geopark

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*«Activity 1.1 - [3D GeoHeritage Map] - “North Aegean Digital Transformation in Culture and Tourism”»*

Πράξη: «Διαπεριφερειακός Ψηφιακός Μετασχηματισμός Αιγαίου Αρχιπελάγους στον Πολιτισμό και Τουρισμό», Κωδικός MIS 5047046



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# Introduction

The aim of this research is to propose a methodology for the 3D geovisualization of petrified tree trunks. The acquisition of high-resolution aerial and terrestrial images and the collection of accurate Ground Control Points (GCPs) are the main work of the method that is being used to produce high-quality 3D models of fossilized trees.

- Geological sites should be preserved for cultural, scientific, historical and educational reasons. (UNESCO. Executive Board, 1999).
- Image-based modelling techniques are widely used for geometric surfaces and these methods use 2D images to reconstruct 3D geometrical objects (Remondino and El-Hakim, 2006).
- Aerial and terrestrial photogrammetry are used for visualizing geosites (Bauwens et al., 2017).

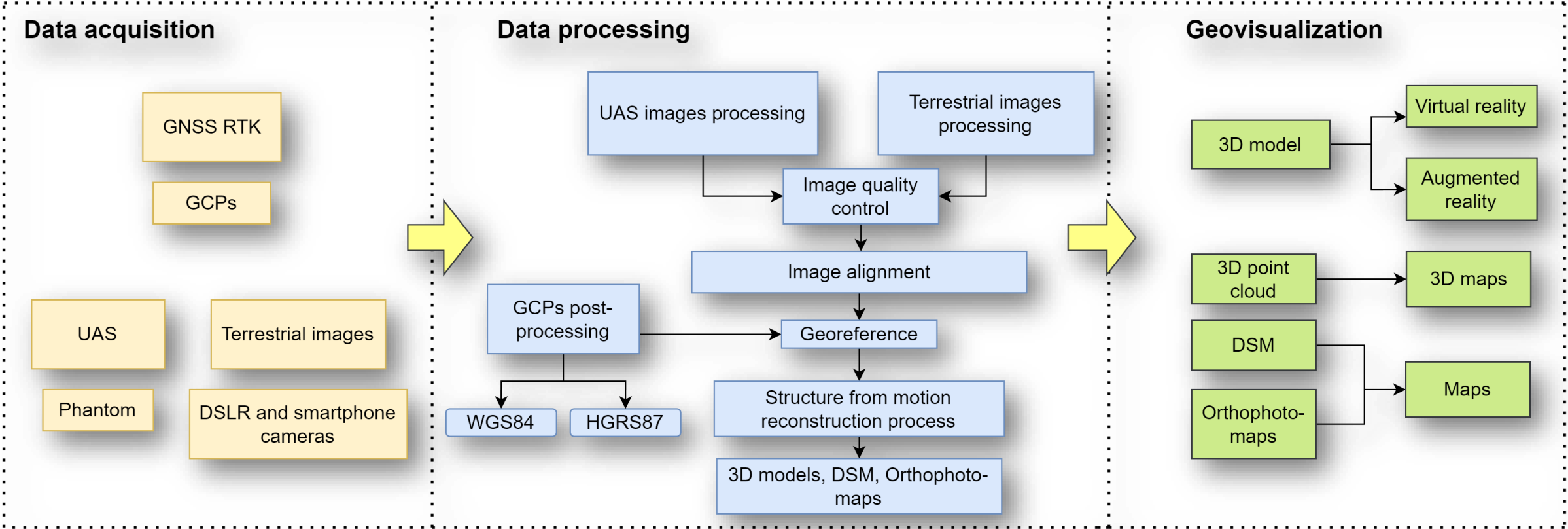


# Study area

- The Petrified Forest of Lesvos is one of the most significant natural heritage sites in the world and is situated on the island of Lesvos, Greece.
- The UNESCO Global Geopark of Lesvos Island has been a founding member of the Geoparks Network.
- Sigi Park of the Natural History Museum was selected as a case study and 18 petrified tree trunks were modelled and geovisualized.



# Methodology



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# Data acquisition

- GNSS RTK technique is used to collect the ground control points (GCPs) around the fossils, that is required to georeference the high-resolution images.
- The marking of GCPs, is done at the fossil sites using numbered targets which must be visible in the images.
- For the accurate georeferencing, 4-5 control points are distributed around the petrified tree and on it.
- This process is achieved by using the Topcon Hiper SR GNSS



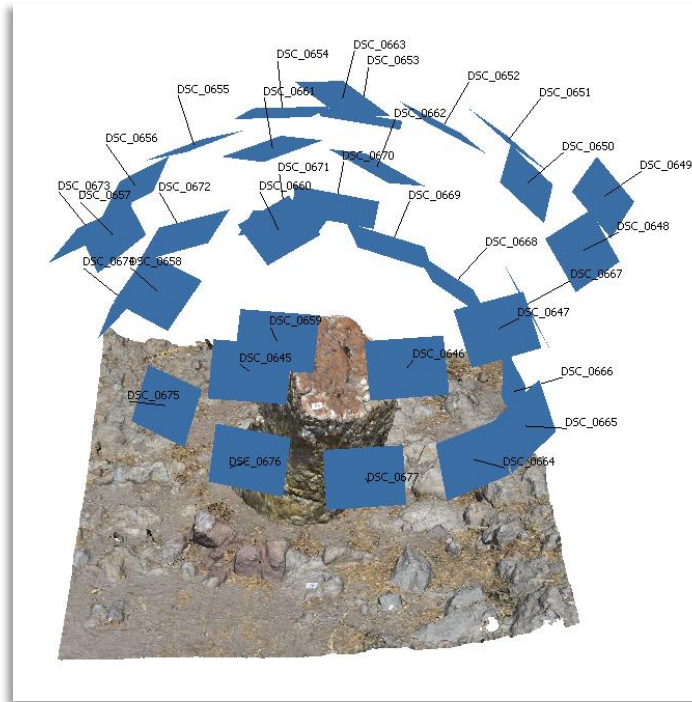
# Data acquisition

- The high-resolution images of the fossils were collected with the Nikon D3400 camera and the Redmi Note 9 Pro smartphone camera.
- Manual low flights of 3-5 meters were carried out to collect images of the petrified trees that were standing and tall with the Phantom 4 Pro.
- Fusion of terrestrial and aerial images for tall standing or large fossils.
- Approximately, 40-50 images for every site have been captured.



# Data acquisition

- Capable of overlapping between images
- Fixed focal length
- Each point of the fossil appears in at least three images

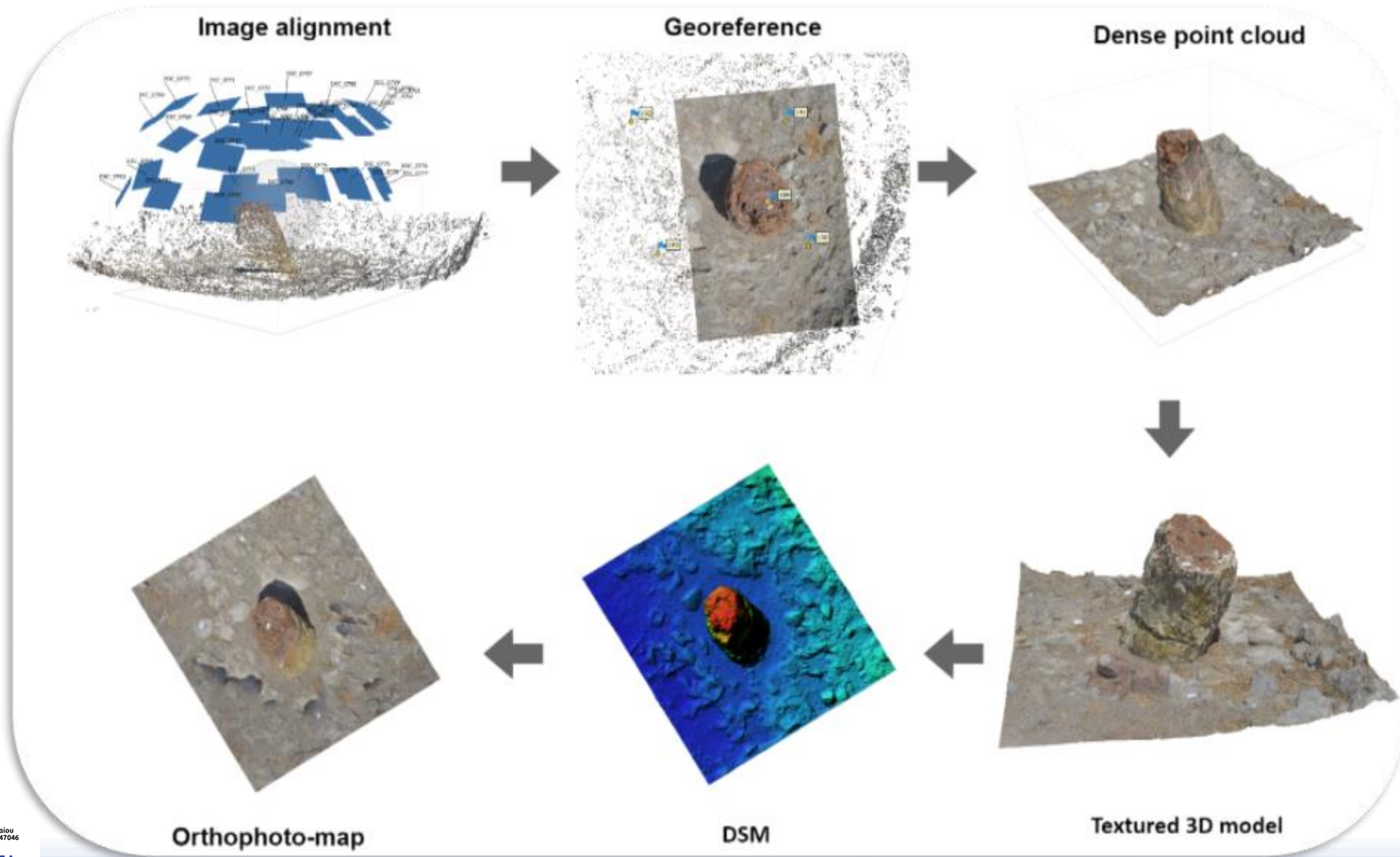


Terrestrial images



Aerial images

# Data processing



# Results

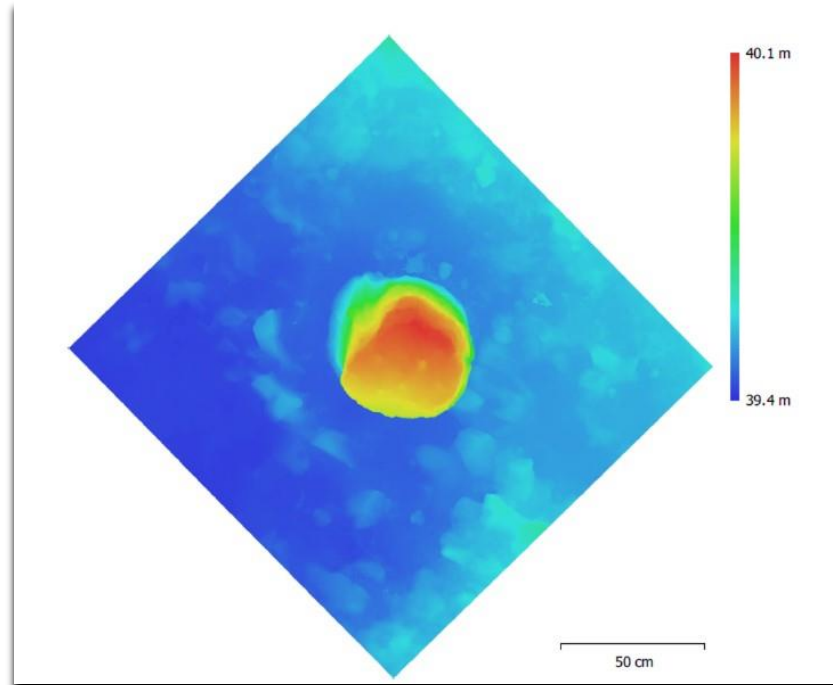
Fossil	3D point cloud	DSM	Orthophoto-map
3	5.991.283 points	0.97 mm/pix	0.244 mm/pix
4a	4.851.020 points	1.97 mm/pix	0.492 mm/pix
5	10.939.368 points	1.35 mm/pix	0.338 mm/pix
6	5.634.027 points	2.48 mm/pix	0.619 mm/pix
8	4.879.346 points	1.60 mm/pix	0.401 mm/pix
9	4.341.085 points	1.06 mm/pix	0.265 mm/pix
10	4.452.287 points	0.95 mm/pix	0.239 mm/pix
11	4.916.263 points	1.25 mm/pix	0.312 mm/pix
12	3.695.644 points	1.08 mm/pix	0.269 mm/pix
13	2.297.231 points	1.10 mm/pix	0.276 mm/pix
14	2.581.249 points	1.14 mm/pix	0.286 mm/pix
15	3.175.113 points	1.12 mm/pix	0.281 mm/pix
X1	1.926.858 points	1.13 mm/pix	0.282 mm/pix
X2	4.391.451 points	1.51 mm/pix	0.378 mm/pix
X3	5.750.254 points	1.16 mm/pix	0.291 mm/pix
X4	4.253.882 points	1.21 mm/pix	0.302 mm/pix
X5	4.188.860 points	1.11 mm/pix	0.276 mm/pix
X6	2.806.918 points	0.92 mm/pix	0.232 mm/pix

# Results

Orthophoto-map of petrified trunk 12



DSM of petrified trunk 12



3D model of petrified trunk 12



# Geovisualization

Animated map of petrified tree trunks of the Sigrí Park



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# Geovisualization



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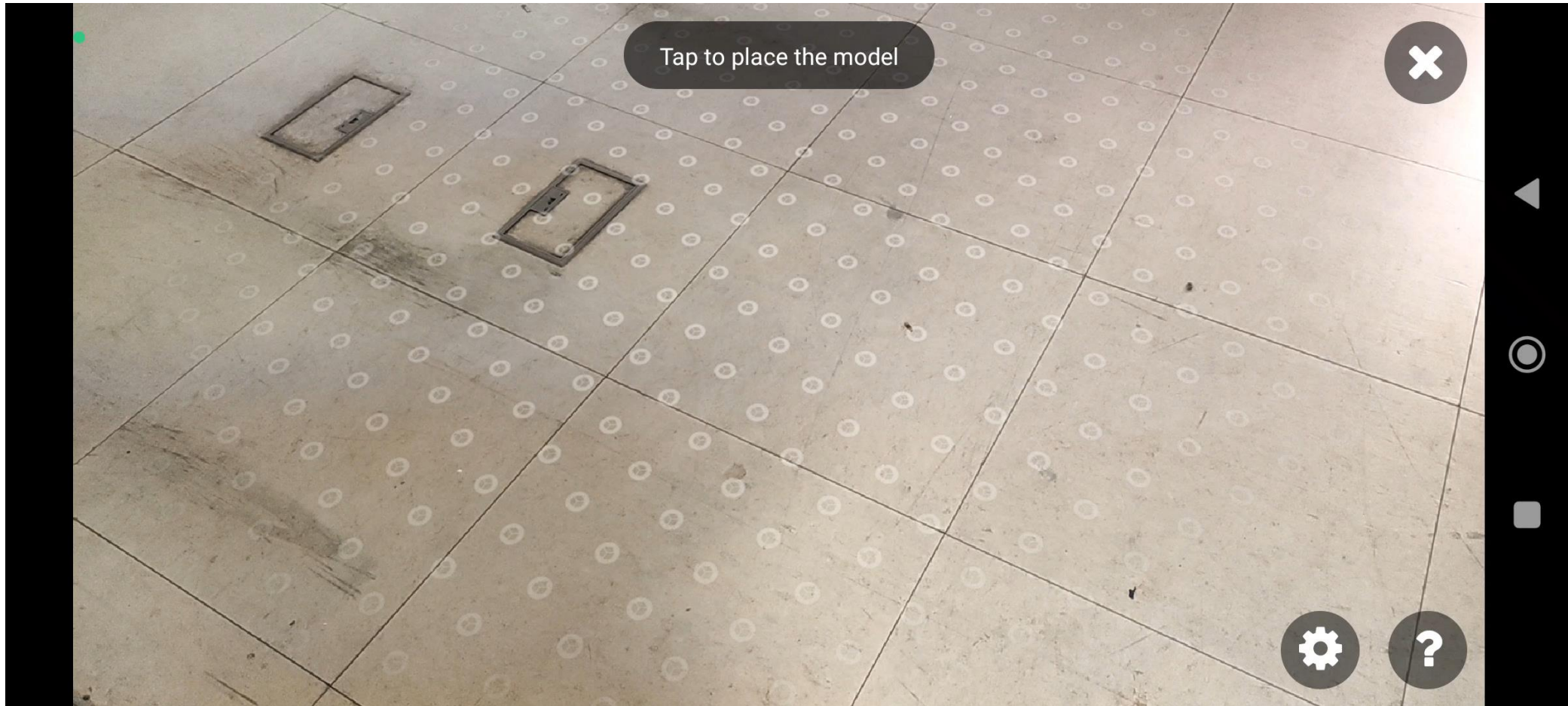
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# Conclusions

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- This research is conducted, due to the importance of the utilization and highlighting of the geosites of Lesvos Geopark.
- A methodology based on terrestrial close-range photogrammetry was developed for the purpose of recording of the sites and the individual fossils that appear in them.
- Fusion of terrestrial and aerial photogrammetry is an efficient technique to collect images of tall standing petrified tree trunks or larger sites.
- High-resolution orthophoto-maps and DSMs are produced.
- The contribution of this methodology is the production of high-quality 3D models and their geovisualization, which aims to environmental, touristic, educational, and cultural promotion of Geoparks.

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