



FROM IMAGERY TO DIGITAL REALITY: ERS & Photogrammetry

17th International Scientific and Technical Conference

Documenting with mm accuracy and transferring a neolithic monument

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Neolithic (Νέο + Λίθος) = New stone age from 17000 to 5000 years ago

This monument is from pottery period ~ 8500 years ago
Found at 3m below ground, neolithic layer, dimensions 5m x 6m

**Objective: Document the monument so that
it can be transferred at a new place.**



Phases of the work

- Mark the big stones with points
- Measure GCP points
- Flight plan
- Take aerial photographs
- Make a Photomod project
- Conduct aerotriangulation
- DTM, EDM, Orthophoto
- Transfer the object at a new place

Mark the stones

- Each stone was given a number and points were numbered



Measure Ground Control Points

- Ten of the previous points were measured with an accurate laser theodolite with precautions to keep accuracy near 1mm

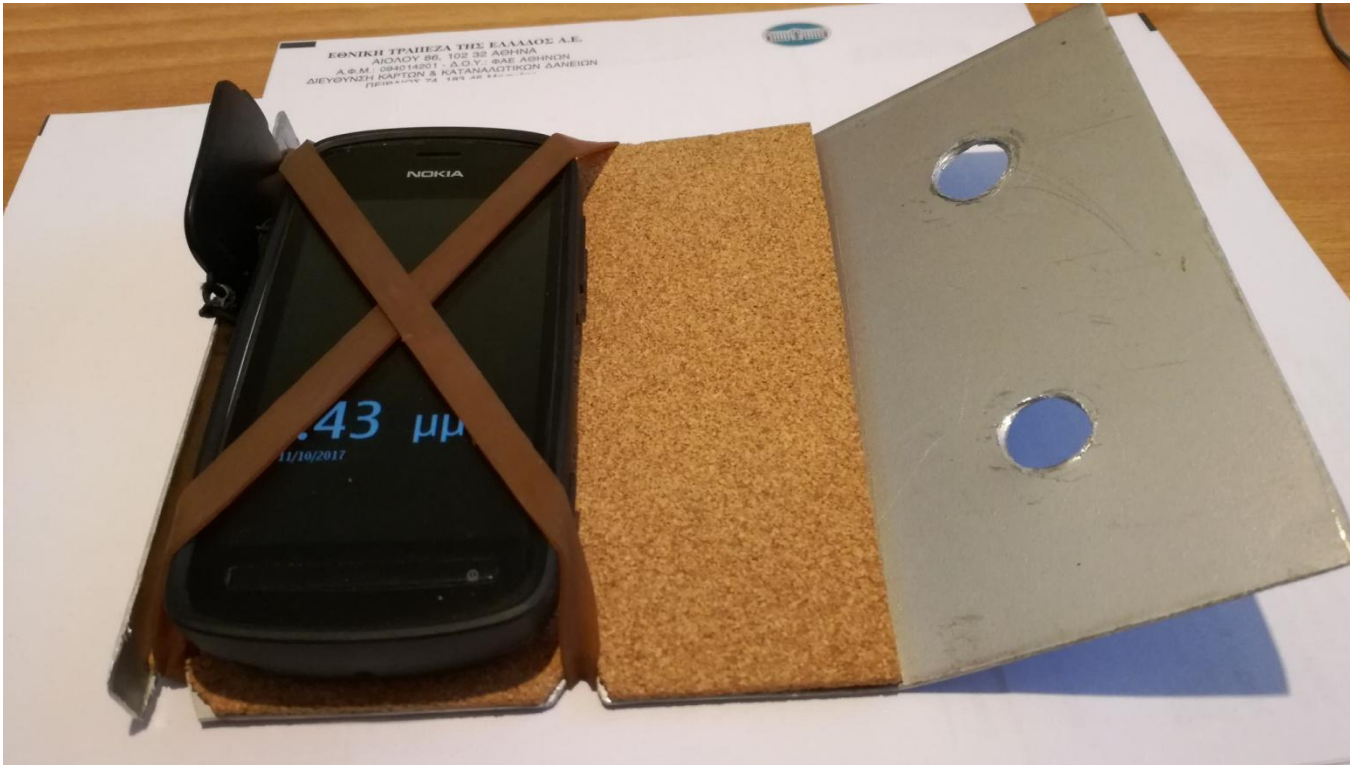


Take aerial photographs

- Nokia 808 camera with Carl Zeiss lens and 41Mp sensor and time lapse was used.
- The photographic platform was an aluminium foil mounted on a 5m topographic pole
- Base and flight lines distance was calculated beforehand with an excel sheet

Take aerial photographs

- The camera and the platform



Take aerial photographs in the field



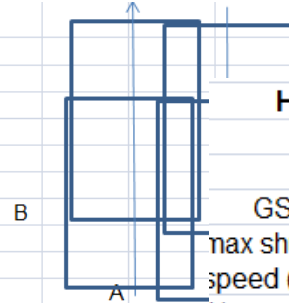
Flight plan

UAV- Flight plan

Basic Data

Camera	Nokia 808 (3:4)
focal_length (mm)	8.02
focal_length (pixels)	5728.6
CCD dimation a (mm)	7.5152
CCD dimation b (mm)	10.013
CCD dimation a (pixels)	5368
CCD dimation b (pixels)	7152
Pixel size (mm)	0.0014
Ground Velocity (V) m/sec	1
minimum lapse interval (sec)	5

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	H (m)= 2	3	4	5	5.5	6	7	8	9	
A (m)	1.874	2.811	3.748	4.685	5.154	5.622	6.559	7.496	8.434	
B (m)	2.497	3.745	4.994	6.242	6.867	7.491	8.739	9.988	11.236	
GSD (m)	0.0003	0.0005	0.0007	0.0009	0.0010	0.0010	0.0012	0.0014	0.0016	
max shutter speed (sec)	0.0002	0.0003	0.0003	0.0004	0.0005	0.0005	0.0006	0.0007	0.0008	
1/x x=	5729	3819	2864	2291	2083	1910	1637	1432	1273	
										base (m)
overlap										lapse time (sec)
50%	1.25	1.87	2.50	3.12	3.43	3.75	4.37	4.99	5.62	
55%	1.12	1.69	2.25	2.81	3.09	3.37	3.93	4.49	5.06	
60%	1.12	1.69	2.25	2.81	3.09	3.37	3.93	4.49	5.06	
65%	1.00	1.50	2.00	2.50	2.75	3.00	3.50	4.00	4.49	
	1.00	1.50	2.00	2.50	2.75	3.00	3.50	4.00	4.49	
	0.87	1.31	1.75	2.18	2.40	2.62	3.06	3.50	3.93	
										side lap
										distance between flights
0%	1.87	2.81	3.75	4.69	5.15	5.62				
10%	1.69	2.53	3.37	4.22	4.64	5.06				
20%	1.50	2.25	3.00	3.75	4.12	4.50				
30%	1.31	1.97	2.62	3.28	3.61	3.94				
40%	1.12	1.69	2.25	2.81	3.09	3.37				
50%	0.94	1.41	1.87	2.34	2.58	2.81				
60%	0.75	1.12	1.50	1.87	2.06	2.25				
70%	0.56	0.84	1.12	1.41	1.55	1.69				
80%	0.37	0.56	0.75	0.94	1.03	1.12				

GSD 1mm

Base 2.75m

Dist between lines 2.06m

Project in Photomod

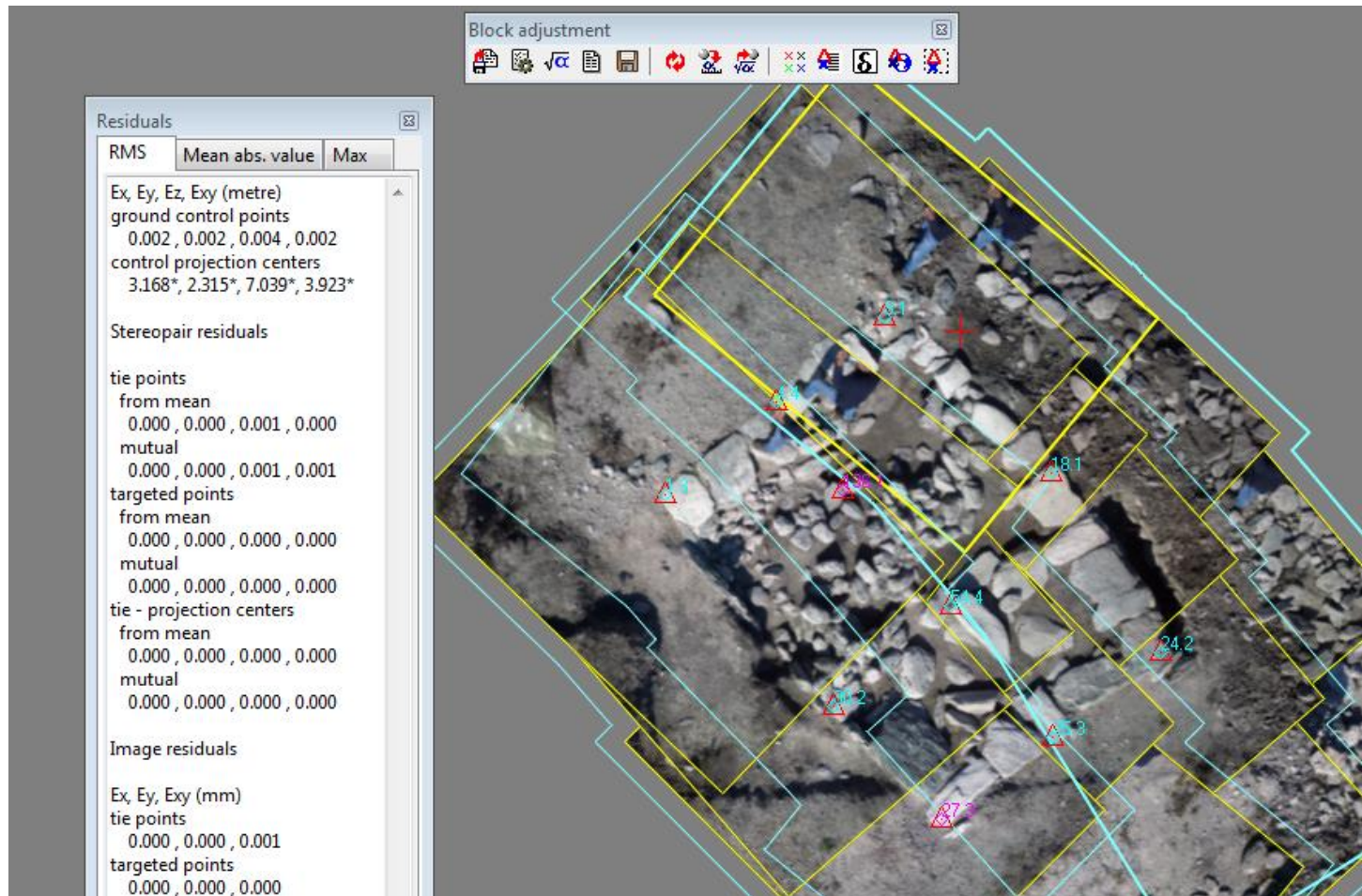


Don't underestimate such a project

6.5m x 5m with 1mm GSD
is equivalent to a project of

3250m x 2500m with 50cm GSD
i.e. 8 km²

Aerial triangulation



Aerial triangulation

- Report in Greek (set language to Greek)
- All marked points were measured as tie points

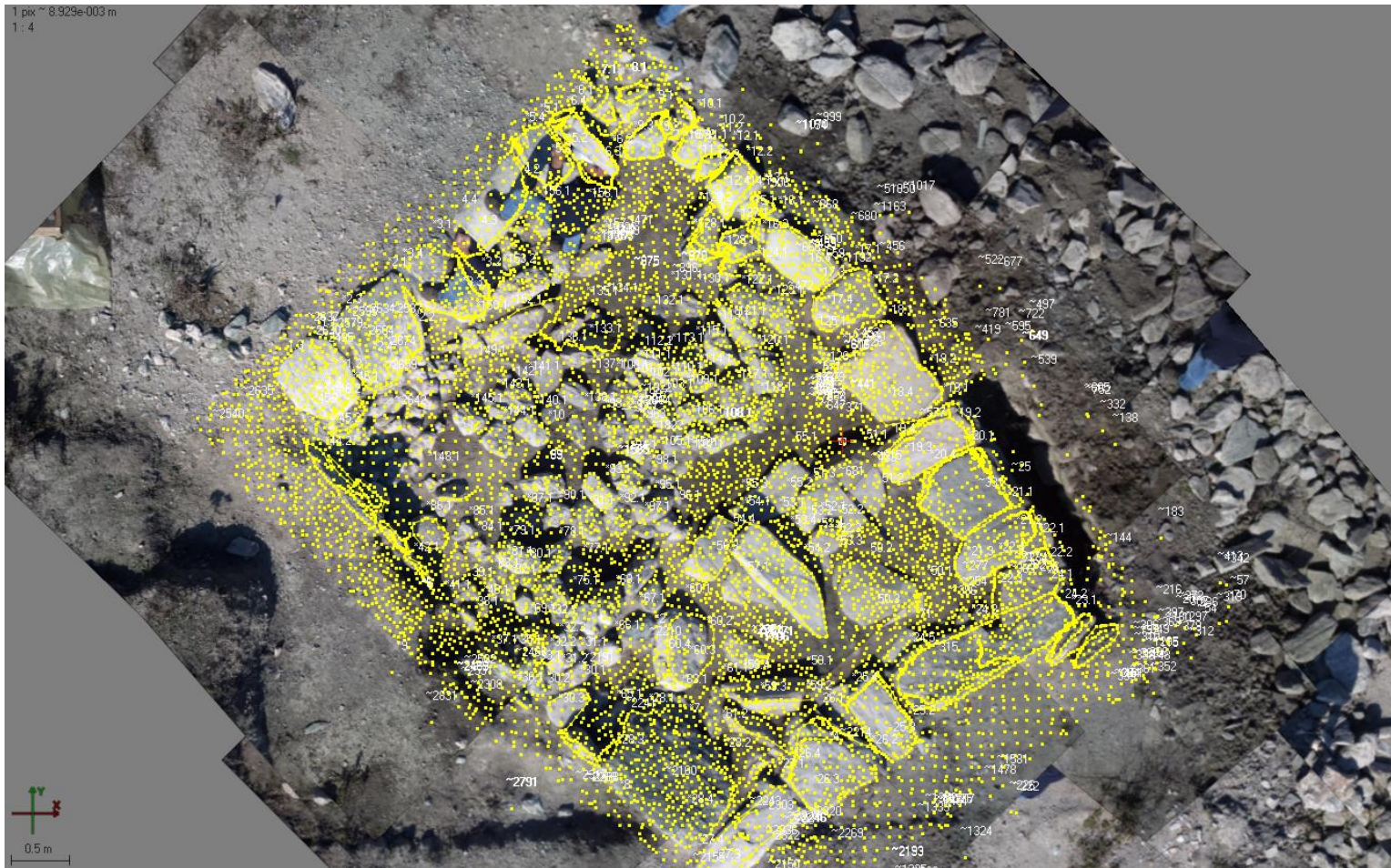
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== Πέμπτη, 12 Οκτωβρίου 2017 == 7:16:14 μμ ==  
Αναφορά συνόρθωσης μπλοκ
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Μπλοκ: Αμυγδαλή2_Πετρες copy [2]  
Αριθμός λωρίδων: 4  
Αριθμός στερεοζευγών: 12  
  
Παράμετροι συνόρθωσης:  
  εξωτερική συνόρθωση  
  Σύστημα συντεταγμένων: GGRS87  
  Μονάδες μέτρησεις: metre
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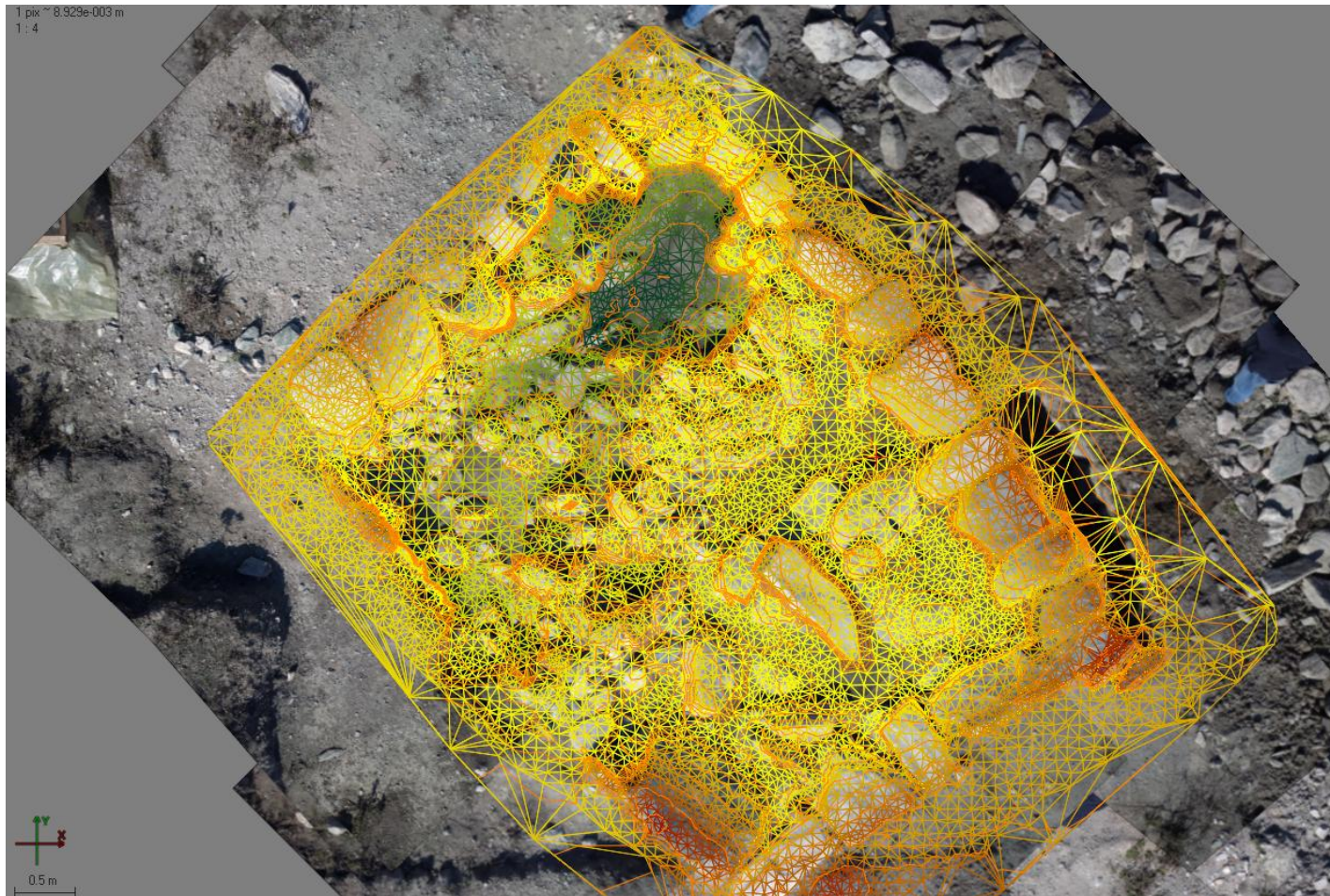
σημεία σύνδεσης

*1	389112.943	4382738.449	48.419
*1.1	389111.641	4382743.374	48.342
*1.2	389111.855	4382743.012	48.299
*1.4	389111.686	4382742.857	48.259
*10	389113.613	4382742.568	47.924
*10.1	389114.920	4382745.242	48.154
*10.2	389115.109	4382745.107	48.147
*10.3	389114.813	4382744.976	47.993
*100.1	389114.259	4382742.999	48.016
*101.1	389114.384	4382742.971	48.026
*102.1	389114.521	4382742.940	48.035
*103.1	389114.650	4382742.835	48.122
*105.1	389114.633	4382742.345	48.052
*106.1	389114.912	4382742.602	48.163
*107.1	389114.903	4382742.320	48.045
*109.1	389114.863	4382742.872	48.171
*11	389114.721	4382746.381	48.297
*11.1	389114.970	4382744.970	48.093
*11.2	389115.097	4382745.032	48.160
*11.3	389114.936	4382744.850	47.964
*110.1	389114.727	4382742.978	48.066

DTM + Brake lines

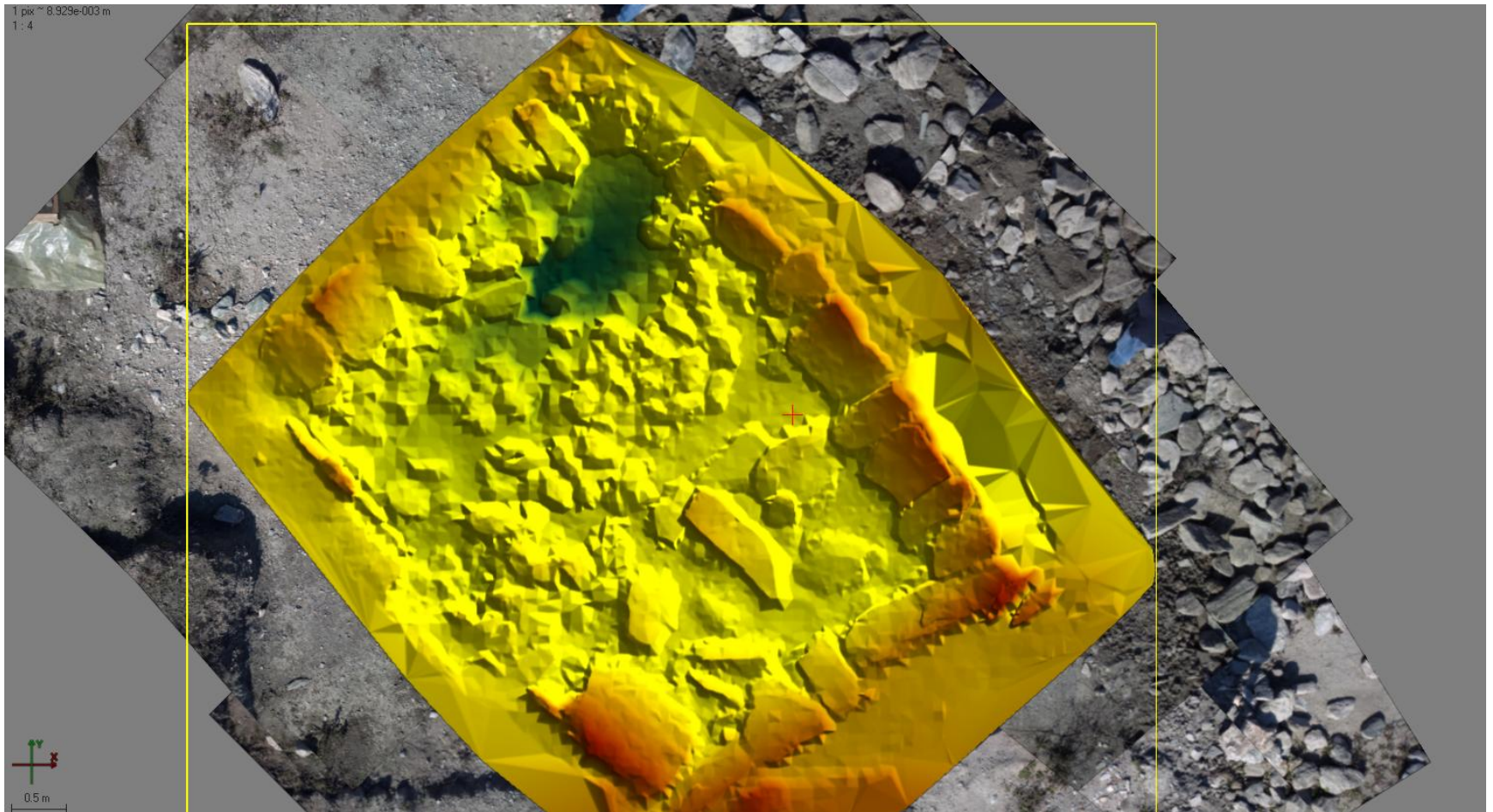


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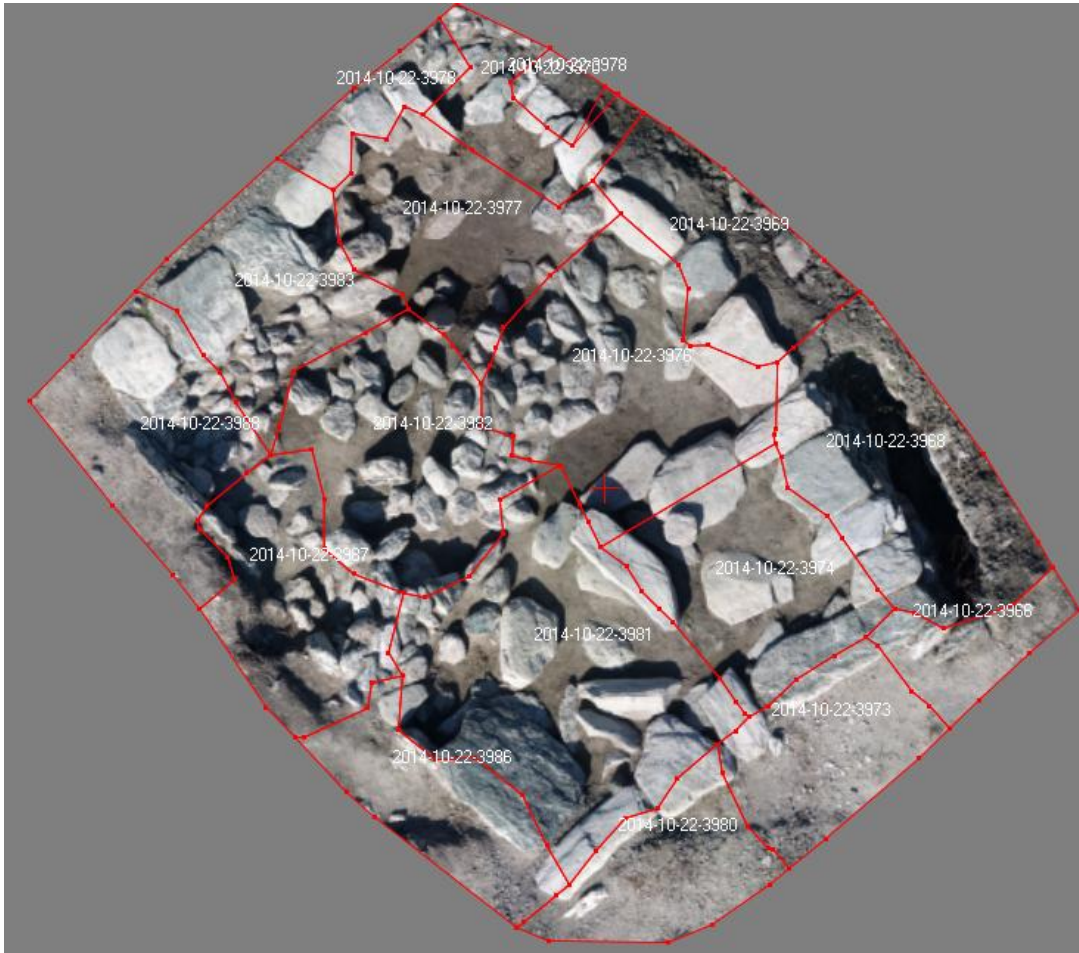


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DSM



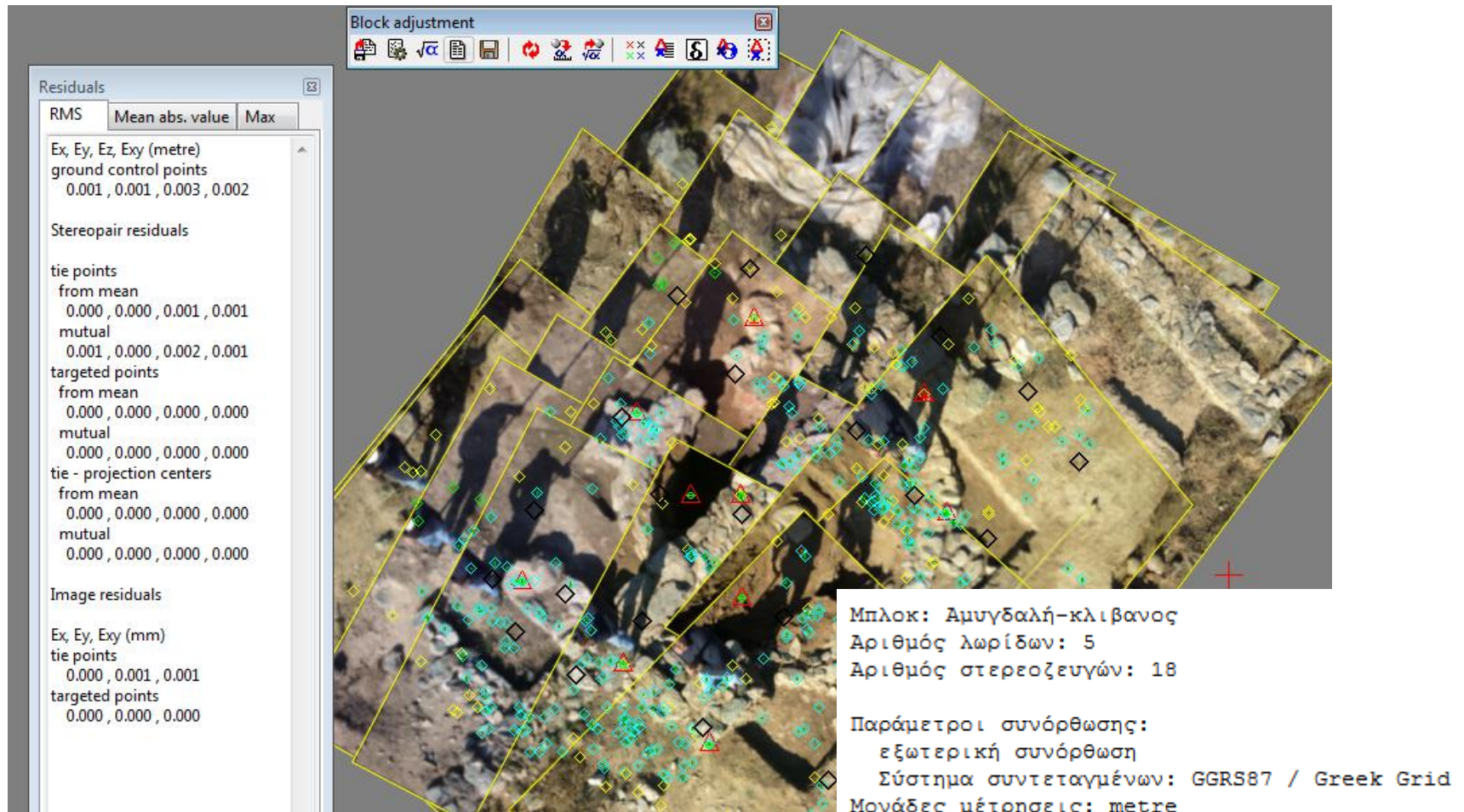
Orthomosaic with geomosaic program



move the monument to a new place



Similar works of the same accuracy Neolithic pottery oven



Similar works of the same accuracy Hellenistic house 2100 years ago

