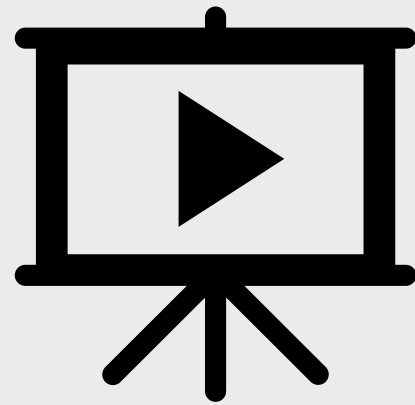


Boulder deposits on the southeastern coast of Cyprus and their relation with palaeotsunami events of the Eastern Mediterranean

*Evelpidou N., Zerefos Ch.,
Synolakis C., Repapis Ch.,
Karkani A., Polidorou M.,
Saitis I.*

To view the video
presentation, please
follow the link below

<https://www.youtube.com/watch?v=fUTciq9cSeU&feature>





Ogerius Panis and Marchisius Scriba (ca 1294 AD), wrote about a tsunami event in **Lemesos** and **Pafos** which is believed to have occurred in **May 1222 AD**:

"... at Cyprus, the sea was lifted up by the shock and rushed inland; the sea in places opened up in huge masses of water big as mountains and surged inland, razing buildings to the ground and filling villages with fish ... Baffa (Pafos), they say, suffered most ... the harbor dried up and then the town was submerged by the sea ... the town and its castle were completely ruined and its inhabitants wiped out ..."

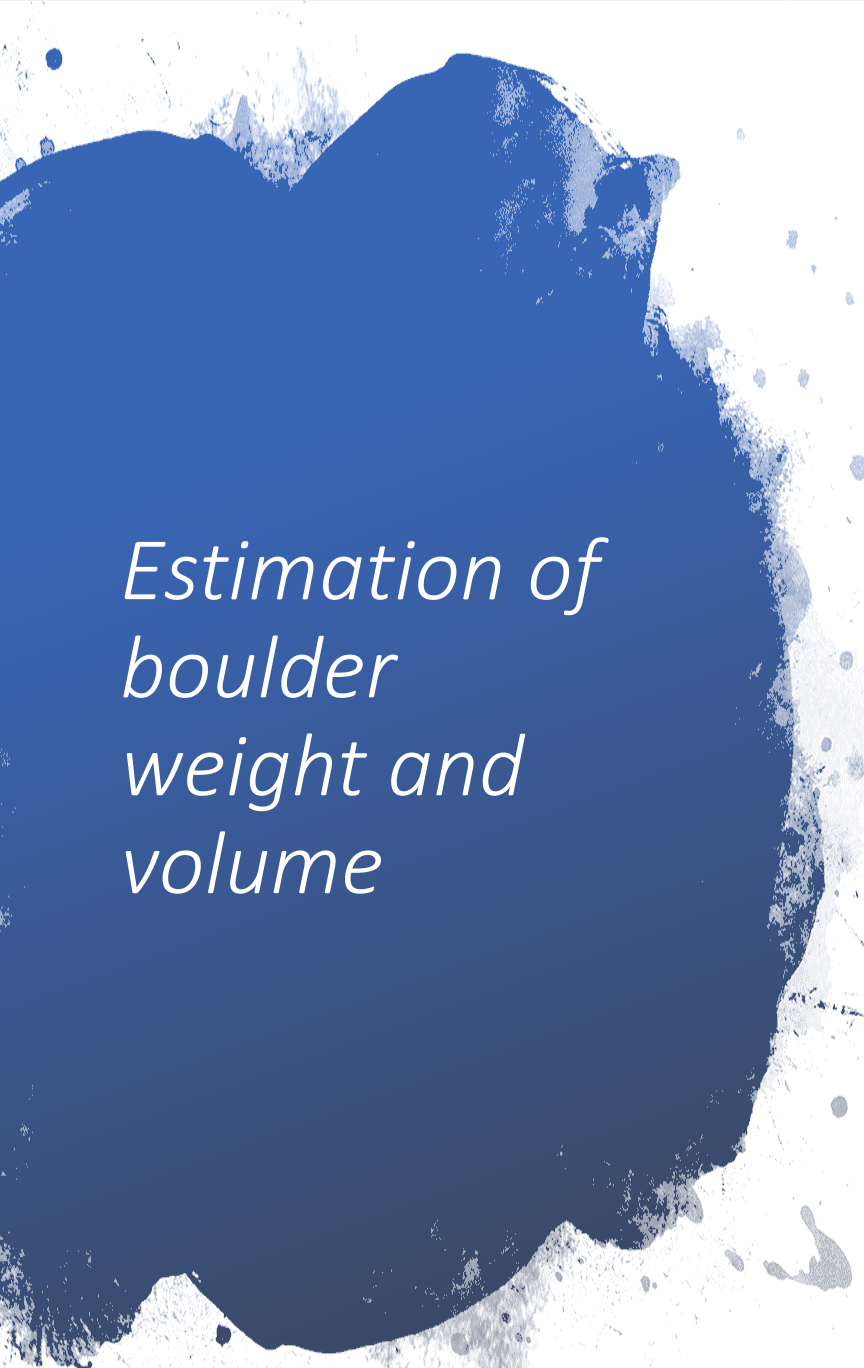




Methods

- Geomorphological survey
- Detailed boulder mapping with hand-held GPS and DGPS-GNSS
- Topographic profiles
- Boulder dimensions (a, b, c-axis)
- Elevation and distance from sea level
- Aerial photography using DJI mavic pro drone





Estimation of boulder weight and volume

- Water displacement method, to calculate the volume
- Reduction of calculated volume by 25% to account for potential overestimation (Shah-Hosseini *et al.*, 2016)

Hydrodynamic equations

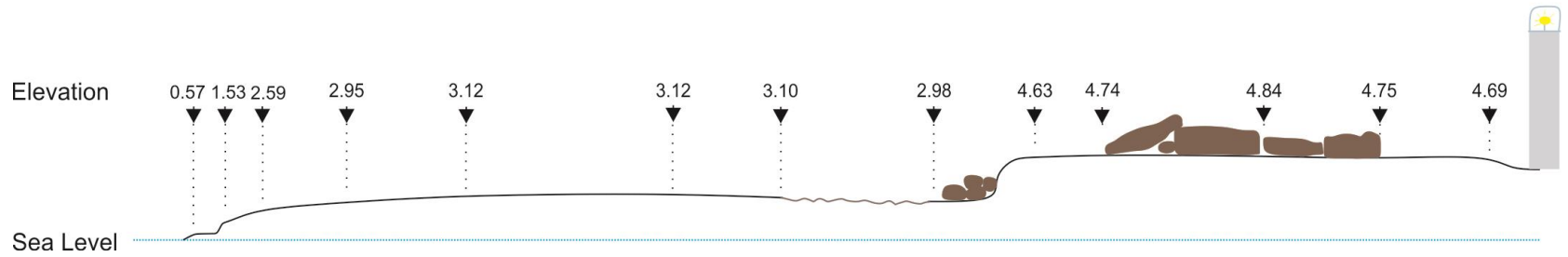
- Pignatelli *et al.* (2009)
- Nandasena *et al.* (2011)
- Barbano *et al.* (2010)
- Benner *et al.* (2010)
- Engel and May (2012)

Volume (m³)

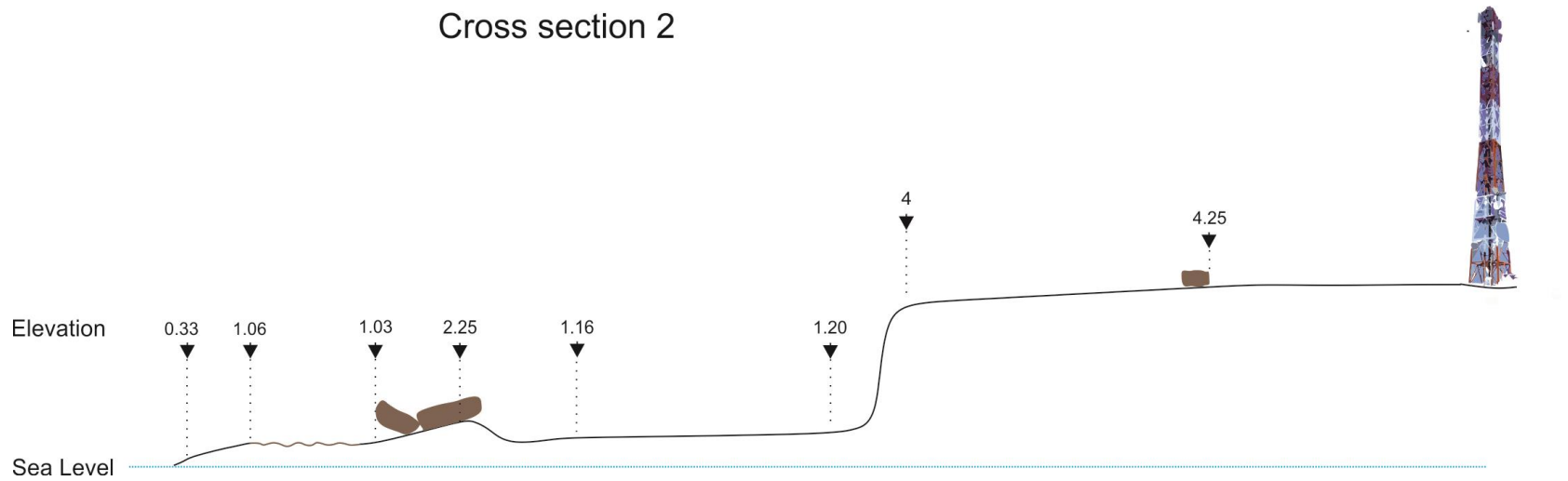
- 0.04 - 2.69
- 2.70 - 7.32
- 7.33 - 14.87
- 14.88 - 32.95
- 32.96 - 55.57



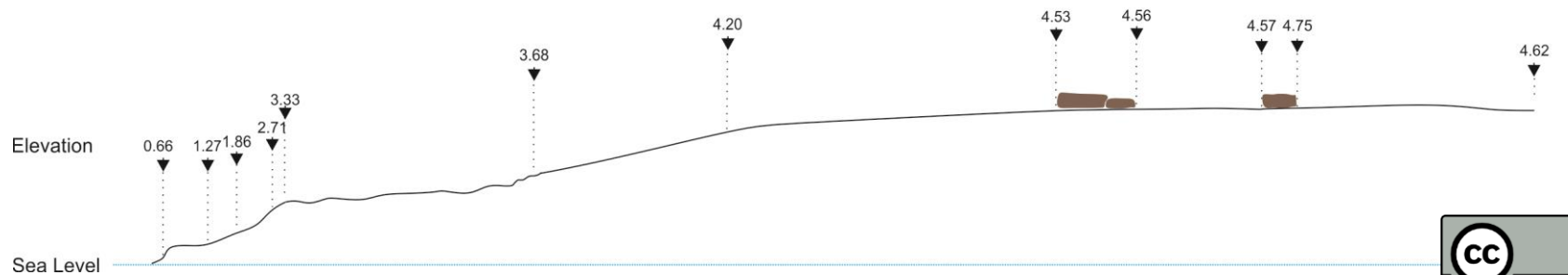
Cross section 1

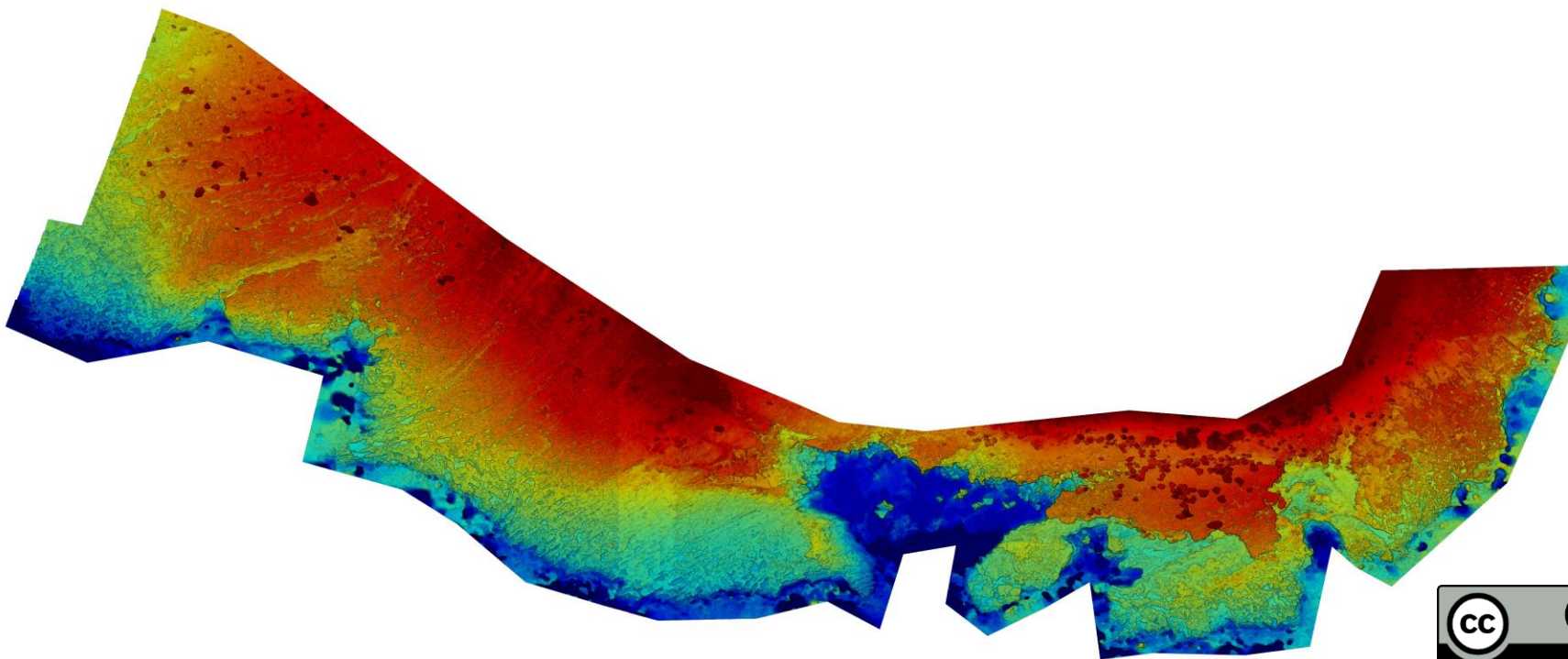


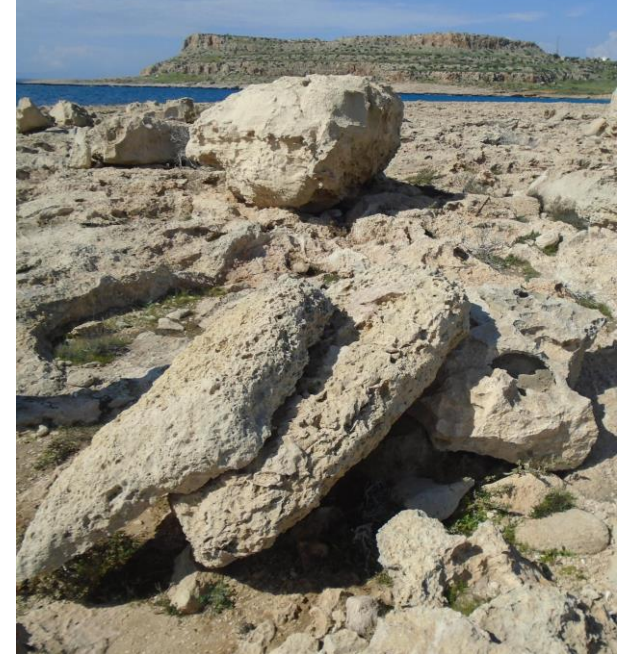
Cross section 2

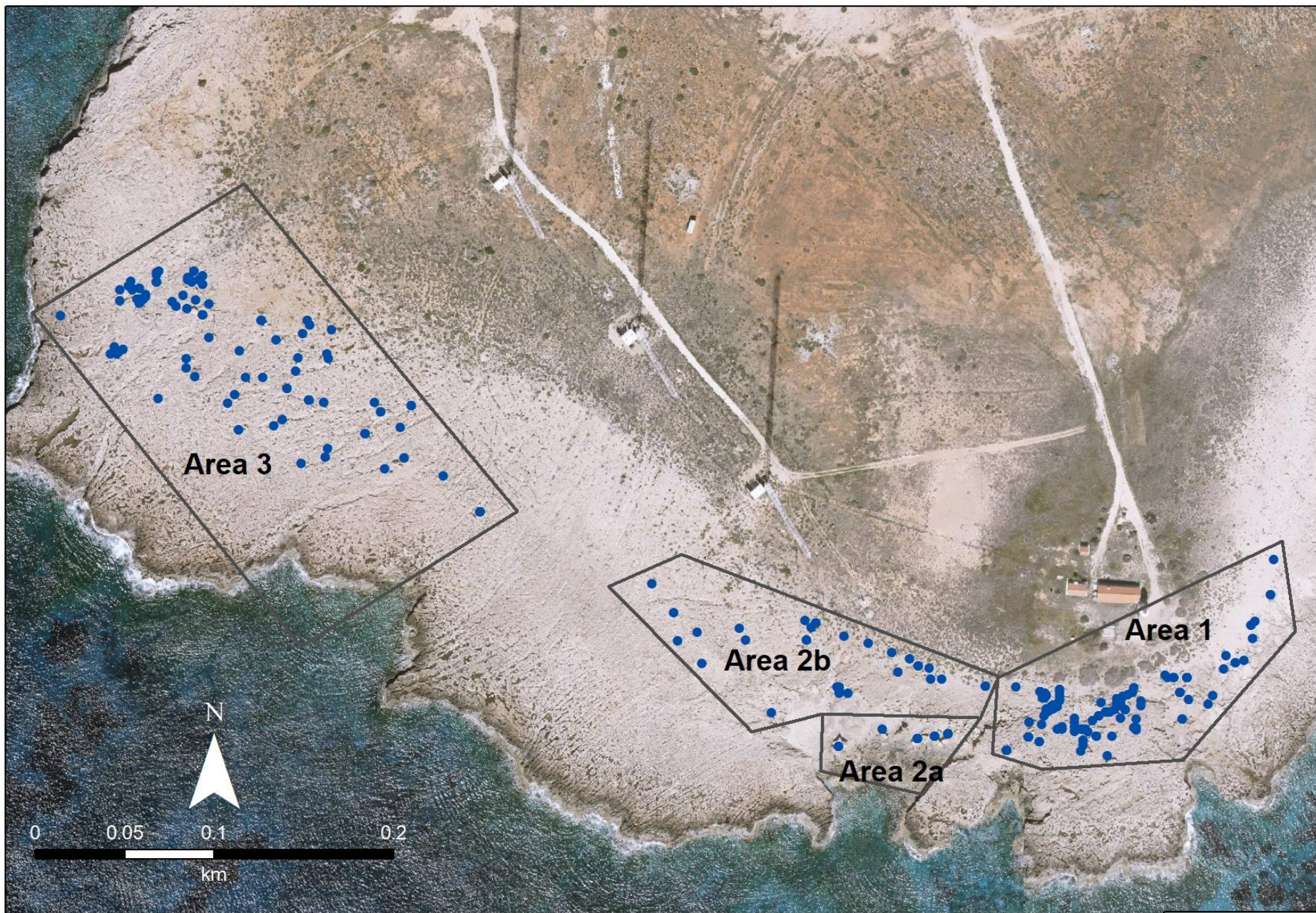


Cross section 3







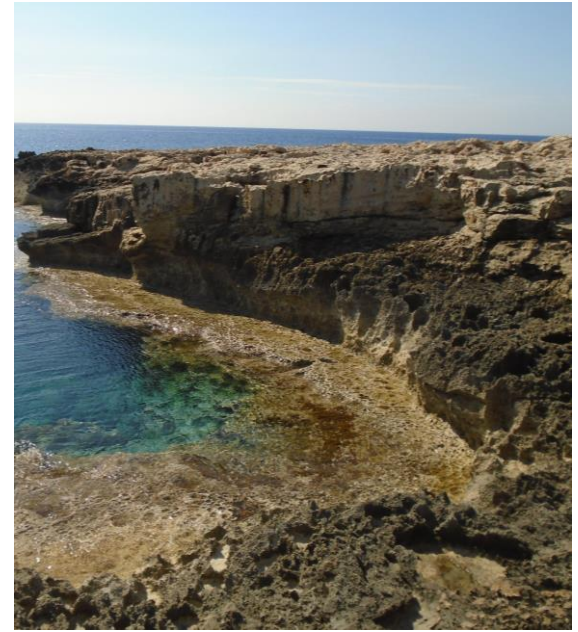


5 LARGEST VALUES OF STORM WAVE HEIGHT FOR JBB SCENARIO

Boulder no	Axes (m)			Volume (m ³)	Pignatelli <i>et al.</i> (2009)		Nandasena <i>et al.</i> (2011)	
	a-axis	b-axis	c-axis		H _s (m)	H _t (m)	H _s (m)	H _t (m)
57	1.77	1.09	1.87	2.71	19.57	4.9	15.2	3.8
41	5.13	3.10	1.62	19.32	16.95	4.2	13.2	3.3
86	4.80	4.29	1.60	24.71	16.74	4.2	13	3.3
94	4.31	1.98	1.58	10.11	16.53	4.1	12.9	3.2
98	3.50	1.52	1.52	6.07	15.91	4	12.4	3.1

5 LARGEST VALUES OF STORM WAVE HEIGHT FOR SBMS SCENARIO

Boulder no	Axes (m)			Volume (m ³)	Nandasena <i>et al.</i> (2011)		Barbano <i>et al.</i> (2010)	
	a-axis	b-axis	c-axis		H _s (m)	H _t (m)	H _s (m)	H _t (m)
86	4.80	4.29	1.60	24.71	7.40	1.85	8.64	2.16
53	5.49	4.41	1.12	20.34	7.27	1.82	8.17	2.04
87	2.62	4.46	1.10	9.638	7.28	1.82	8.16	2.04
3	4.10	3.70	0.98	11.15	6.17	1.54	6.96	1.74
72	5.18	3.32	1.23	15.86	5.73	1.43	6.69	1.67



*Geomorphological evidence
and boulders origin*





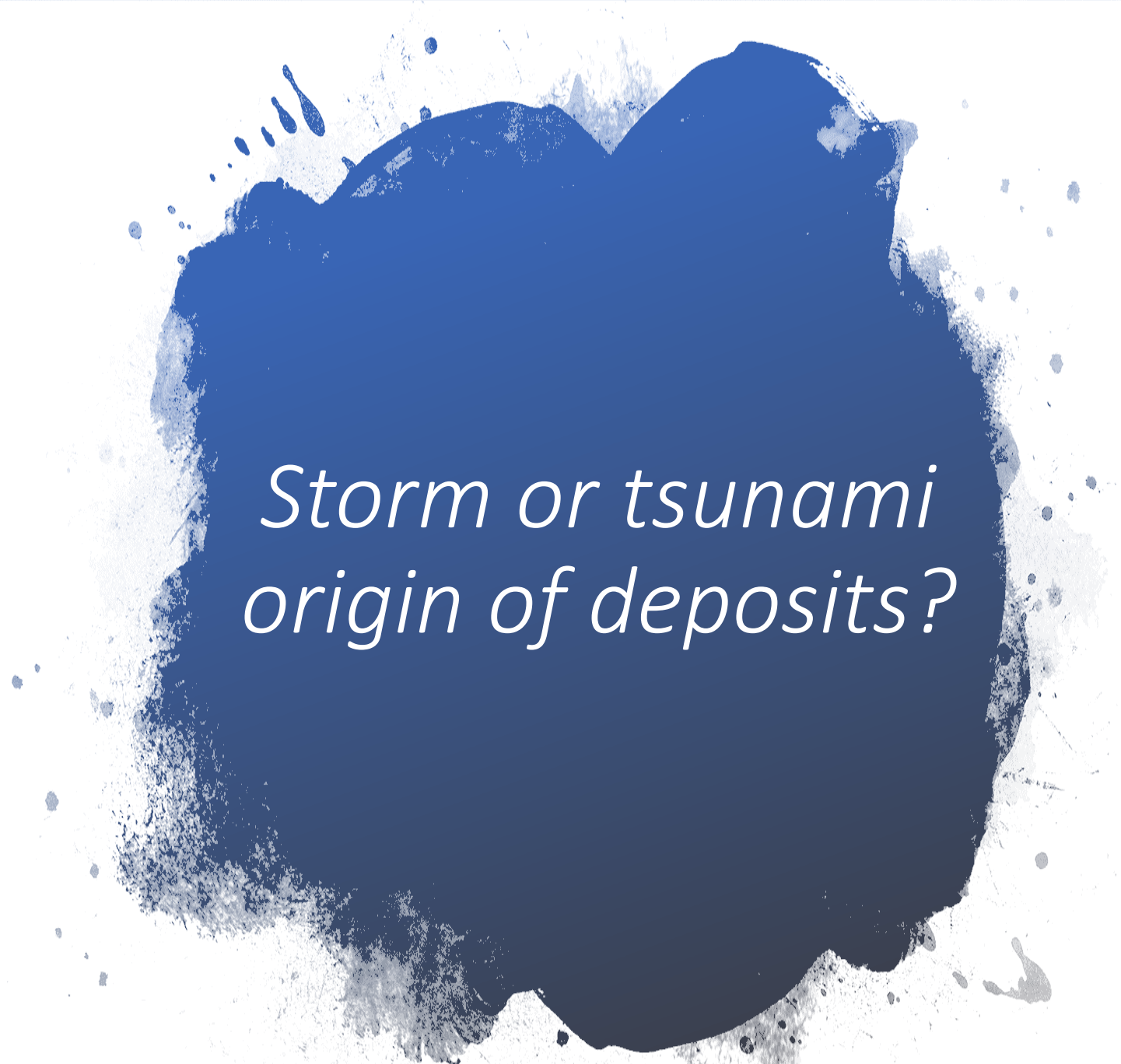




BY



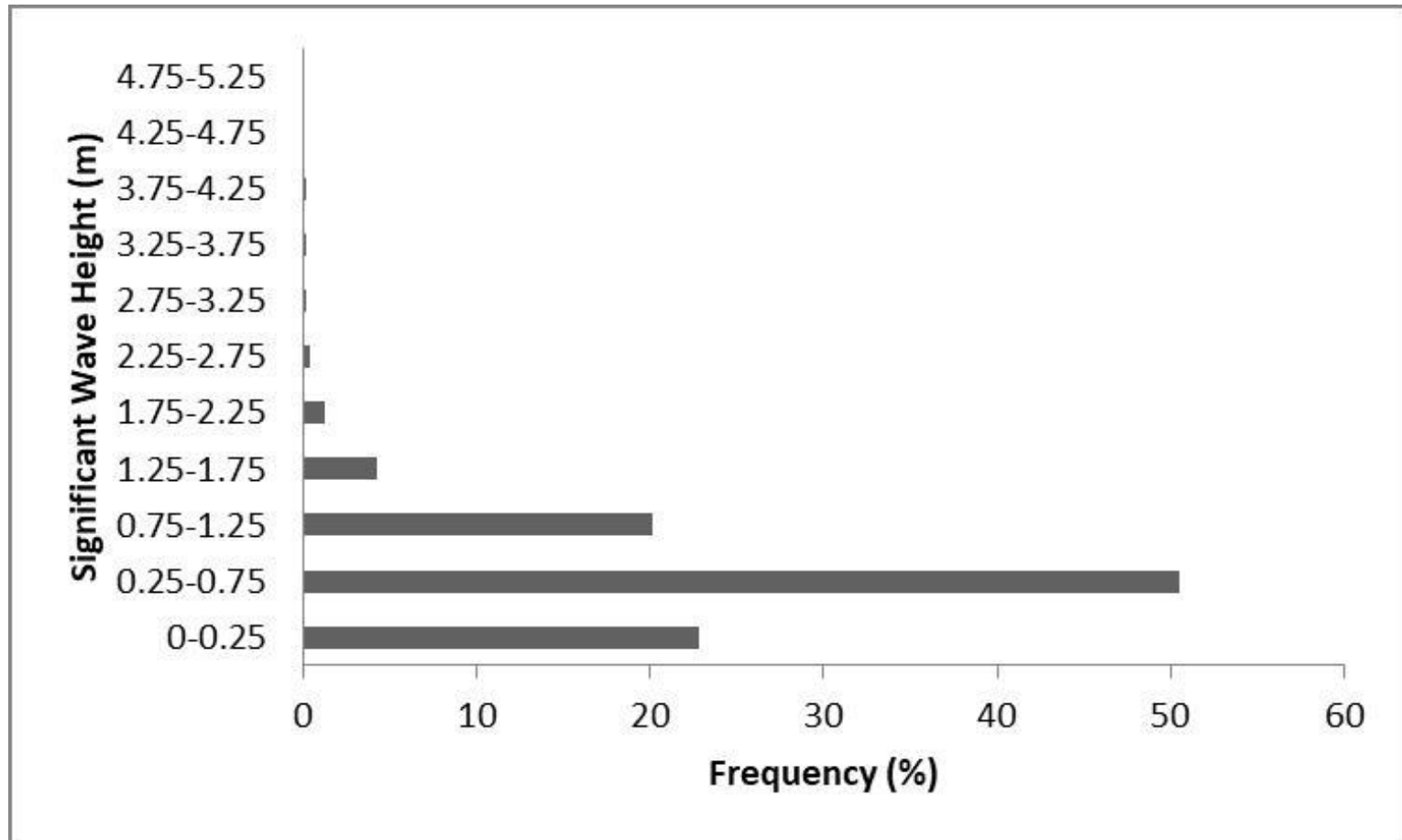




*Storm or tsunami
origin of deposits?*



Storm or tsunami origin of deposits?



Frequency of significant wave heights near the study area (1961-1980: Loizidou & Dekker, 1994; 06/2005-02/2008: Ministry of Commerce, Industry and Tourism of the Republic of Cyprus, 2008).

Correlation with known tsunami events

Date	Source	Area Affected
1202	Possibly landslide near the Levantine coast due to a strong earthquake	Levantine coast and Cyprus.
1222	Strong submarine earthquake south of Pafos	Cyprus
1303	Strong earthquake in Hellenic Arc between Crete and Rhodes	From Crete to Levantine coasts
1953	Strong double earthquake south-west of Cyprus	Cyprus

Correlation with known tsunami events

SAMPLE CODE	LAB CODE	ALTITUDE (M)	MATERIAL	¹⁴ C AGE (BP)	CALIBRATED AGE (BC/AD)
ANT001	LTL19209A		Vermetus sp.	696 ± 45 BP	AD 1512- 1824
ANT002	LTL19210A		Vermetus sp.	987 ± 45 BP	AD 1309- 1496
ANT003	LTL19211A		Vermetus sp.	>1950 AD	-



Conclusions

- We have analyzed 272 boulders located at Cape Greko, at the southeastern coast of Cyprus.
- Size, distribution and geomorphic characteristics suggests that at least some of the studied boulders are owed to a tsunami event.
- Application of hydrodynamic equations further supports that some of the boulders were transported by a tsunami event.
- At least two high energy events have impacted the study area, one associated with the 1303 AD earthquake and tsunami and the second unrelated to any well-known associated tsunami, based on historical sources.
- Overall, it is highly likely that boulders owe their dislocation to multiple events from various sources.