



# Detailed geophysical and geologic study in the Lampedusa Island: SIMIT Project

G. Lombardo<sup>1</sup>, **F. Panzera**<sup>1</sup>, V.V. Salamanca<sup>1</sup>, S. Sicali<sup>1</sup>, N. Baldassini<sup>1</sup>, G. Barreca<sup>1</sup>,  
A. Di Stefano<sup>1</sup>, C. Monaco<sup>1</sup>, S. D'Amico<sup>2</sup>.

<sup>1</sup> *Dipartimento di Scienze Biologiche, Geologiche e Ambientali - Università di Catania, Italy*

<sup>2</sup> *Physics Department - University of Malta, Msida, Malta*

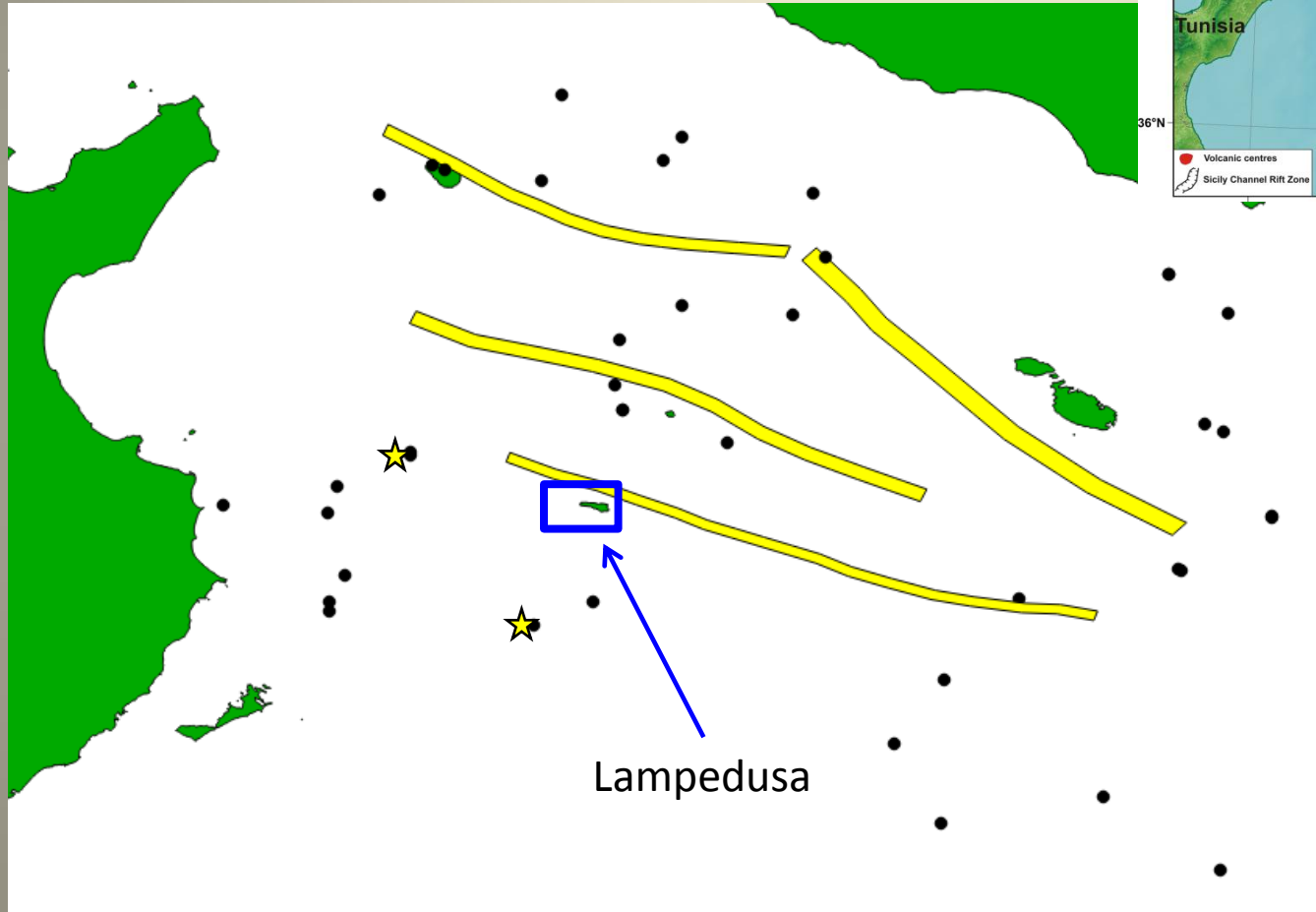


GRUPPO NAZIONALE  
DI GEOFISICA DELLA TERRA SOLIDA

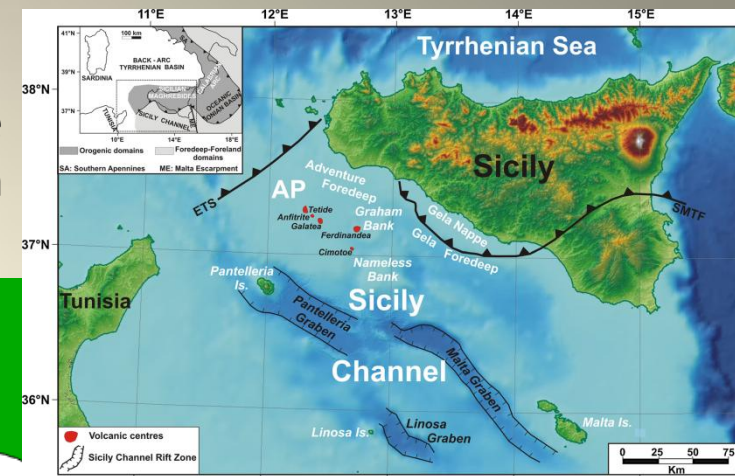


# Tectonic setting

The study area is located in the Sicily Channel and represents a submerged segment of the Cenozoic suture between Africa and Europe connecting the African Maghrebide units with the Sicilian belt



*Modified from Civile et al. (2014)*

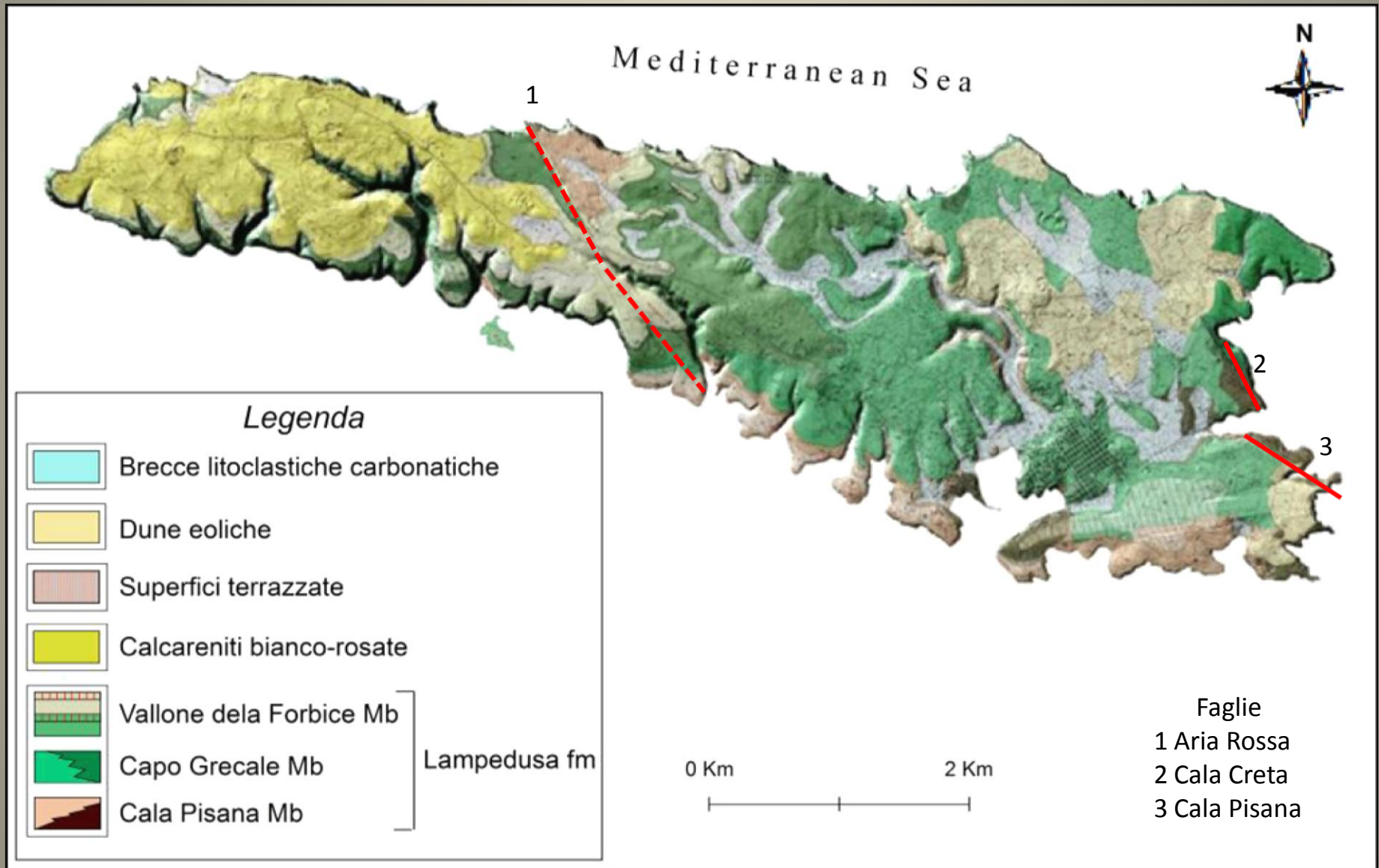


★  $M \geq 5.0$   
●  $4.0 \leq M < 5.0$

$M \approx 6.0-6.5 ?$

from Giardini et al. (2013) Seismic Hazard Harmonization in Europe (SHARE);  
from ISIDE: <http://iside.rm.ingv.it/iside/standard/index.jsp>

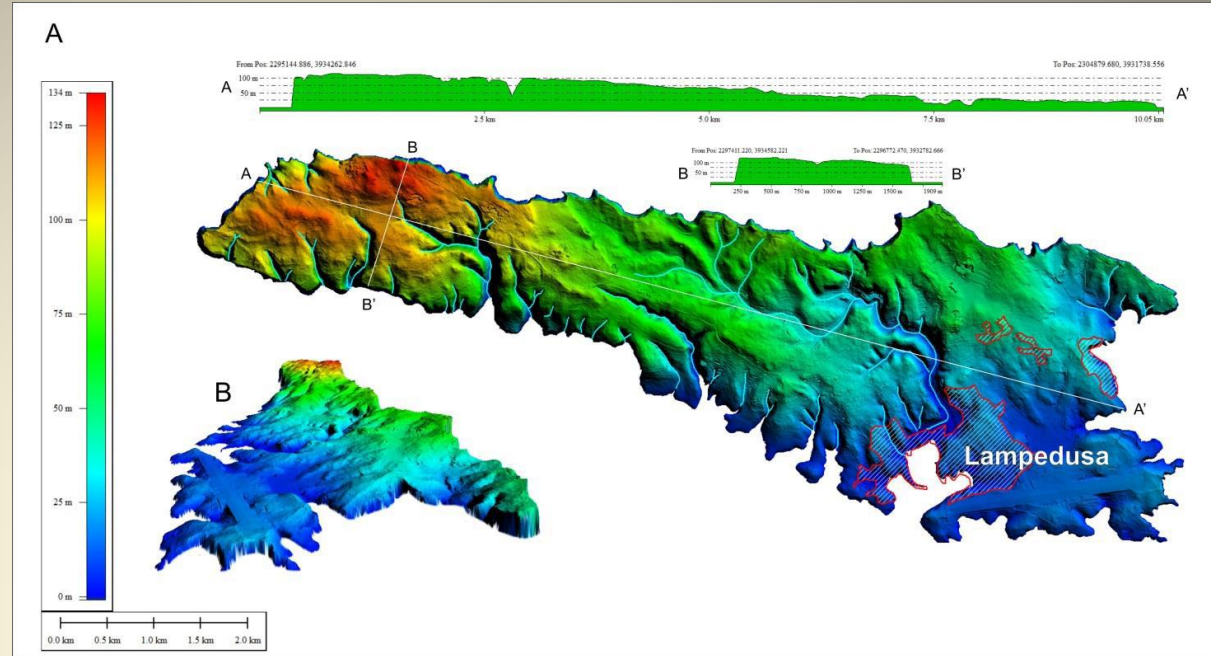
# Geologic setting



*Modified from Grasso and Pedley (1988)*

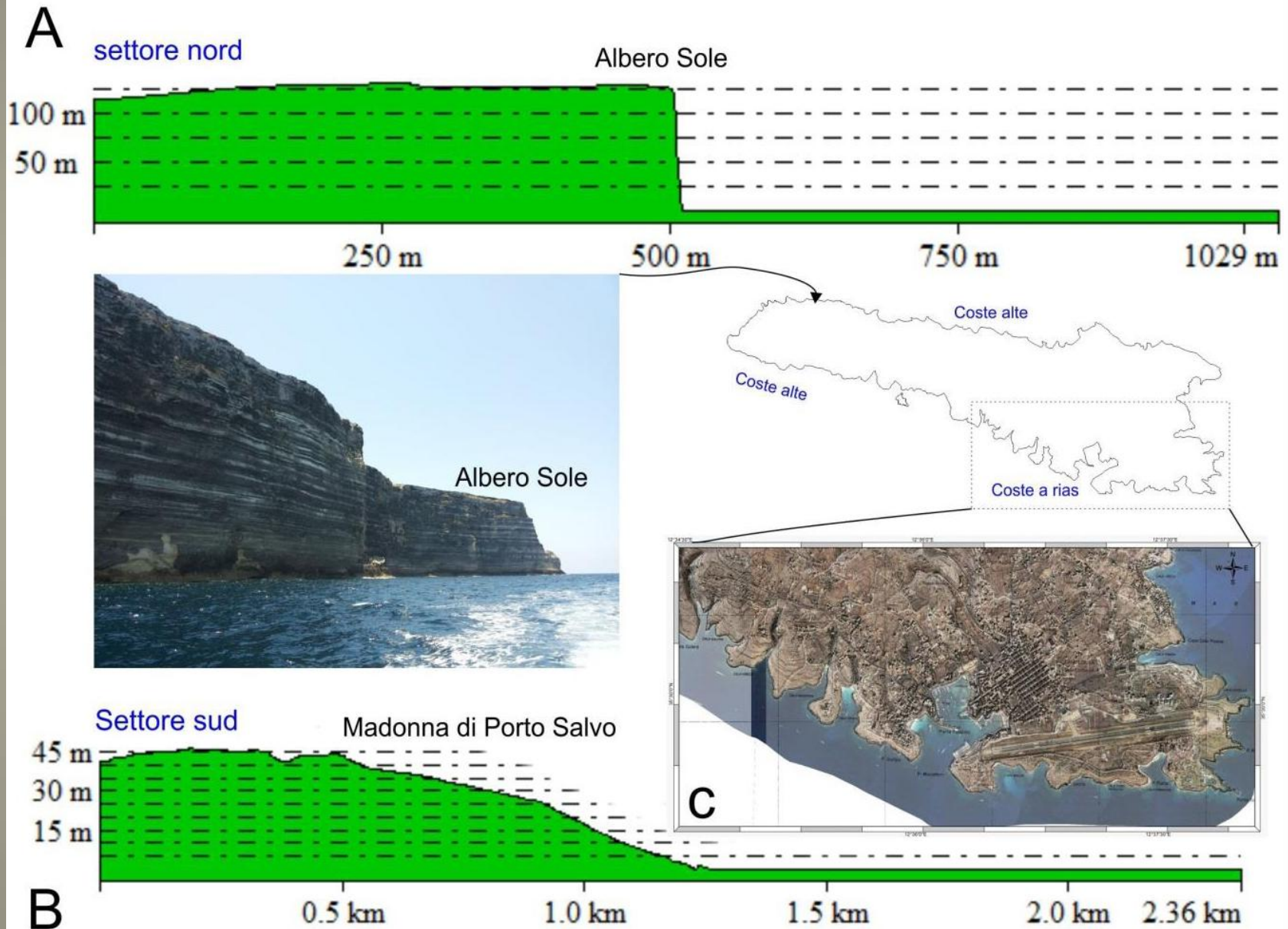
# Geomorphologic setting

The lithological homogeneity of the island and the sub-horizontal setting of the outcropping rocks gave rise to the development of a typical Plateau landscape with almost flat morphology incised by deep valleys.



The different response to the rocks erosion, gave rise also to the development of different coastal landforms, characterized by high coasts in the north and north-west and low in the south east.

# Geomorphologic setting



# Noise measurements

94 measurement sites were selected in Lampedusa spacing them homogeneously along a grid having size of about 600 m and taking into account the outcropping lithology.

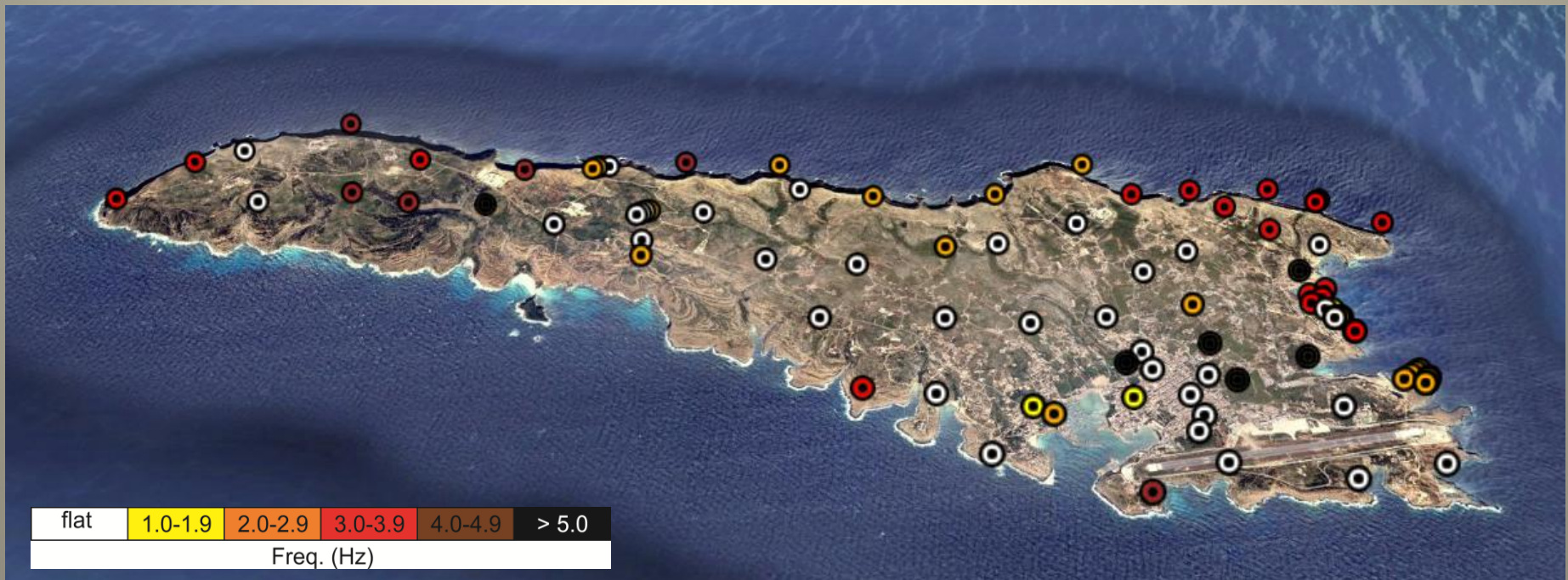
Time series of 30 minutes length were recorded using a sampling rate of 128 Hz and processed through the Horizontal to Vertical Noise spectral Ratio technique (HVNR).

Spectral ratio peaks having amplitude greater than two units, in the frequency range 0.5-30 Hz, were considered significant (SESAME 2004).



## HVNR results

- The results obtained by processing the ambient noise measurements set into evidence that major spectral ratio peaks are detected in the frequency range 2.0 – 5.0 Hz.
- Comparison with the Lampedusa lithology points out that flat HVNR are observed on stiff rock (limestone) extensively outcropping in the plateau located in the central part of the island.
- More pronounced spectral ratio peaks are detected in the measurement sites located close to the outcrops of more recent and soft deposits and along the Coast area.



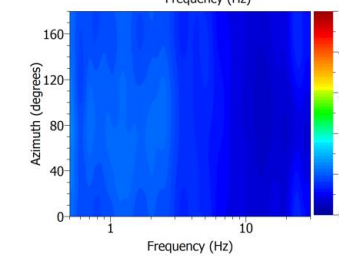
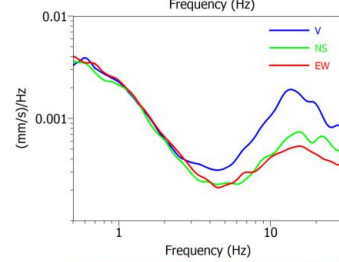
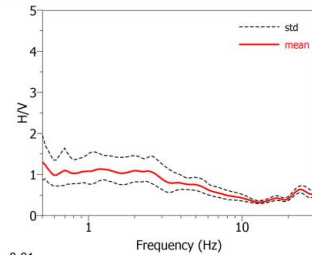
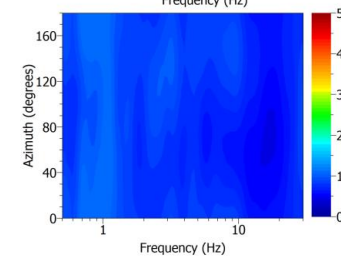
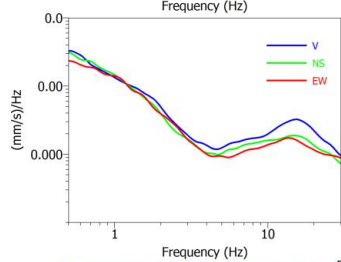
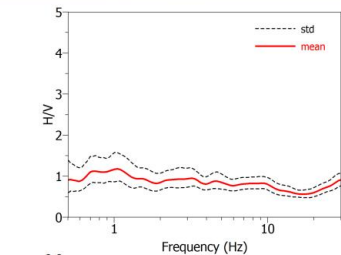
# HVNR results: stratigraphic effects

## Stiff soil

LAMP 27



LAMP 49

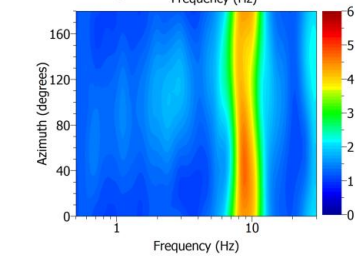
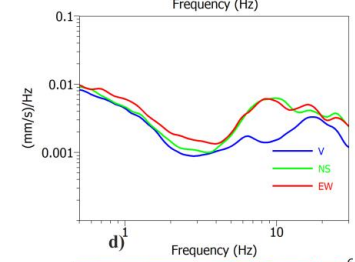
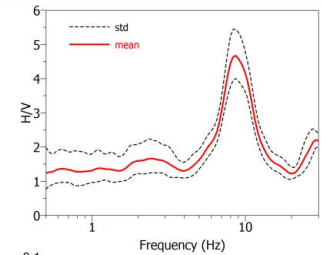
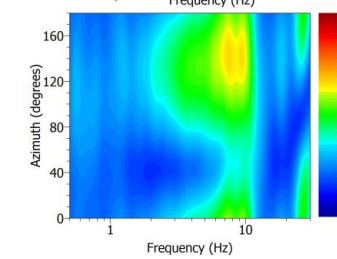
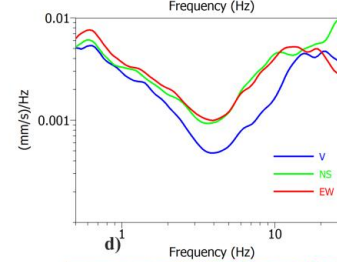
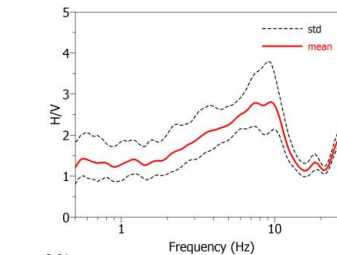


## Soft soil

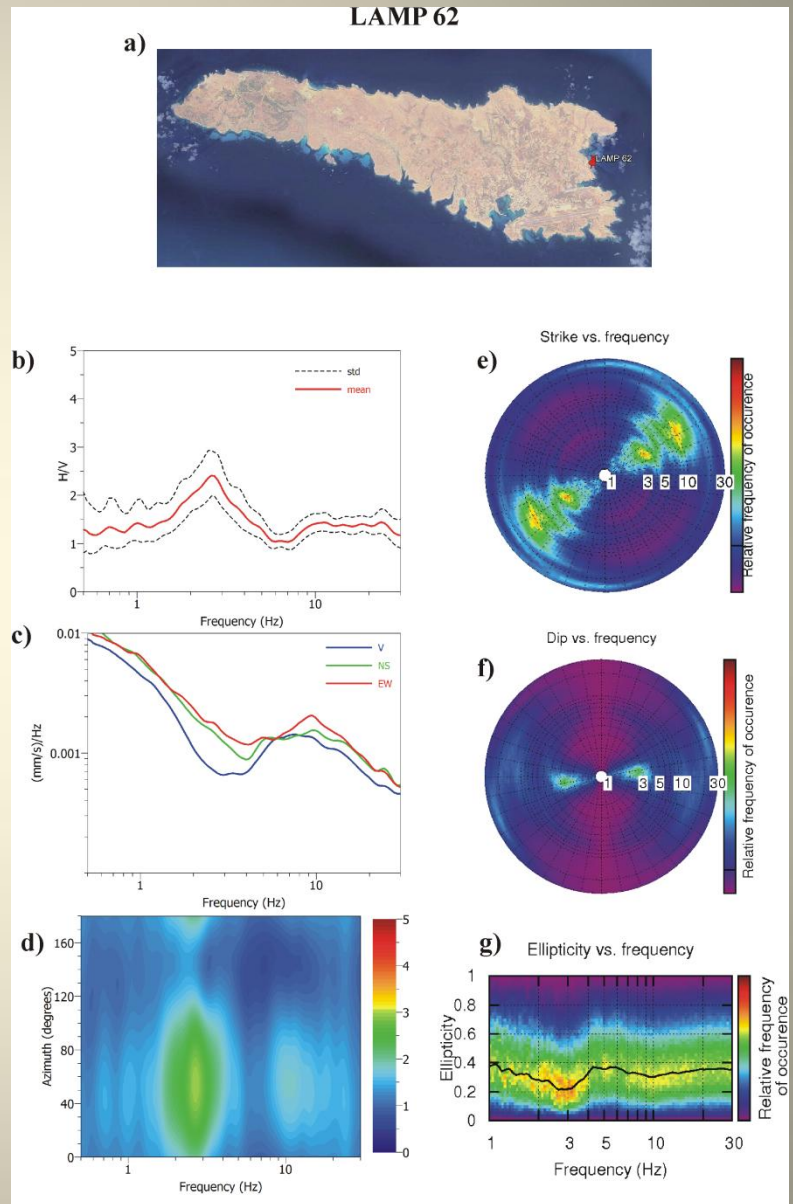
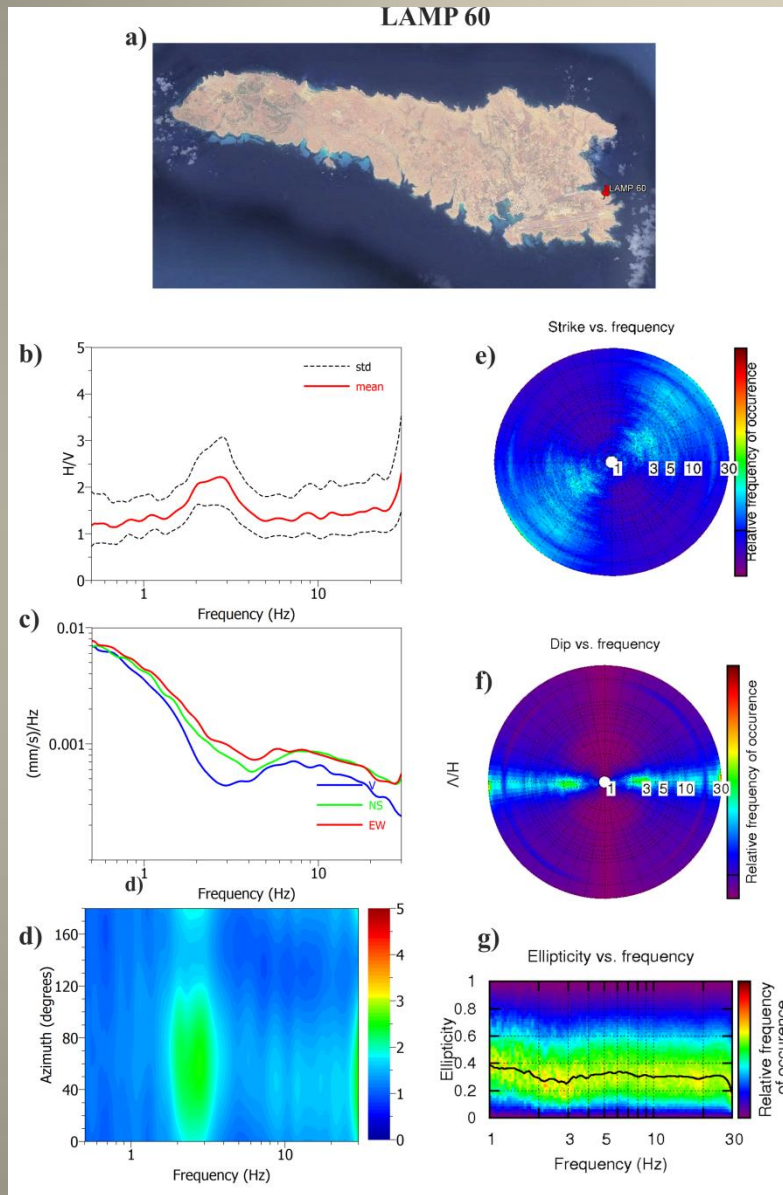
LAMP 12



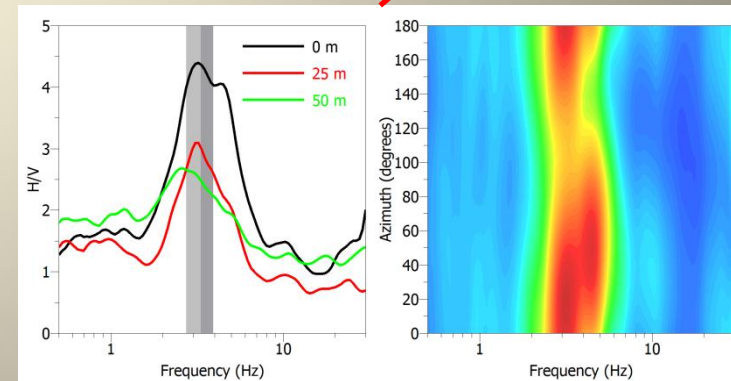
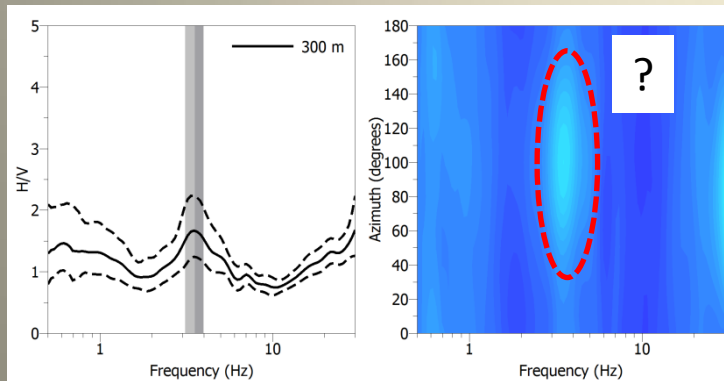
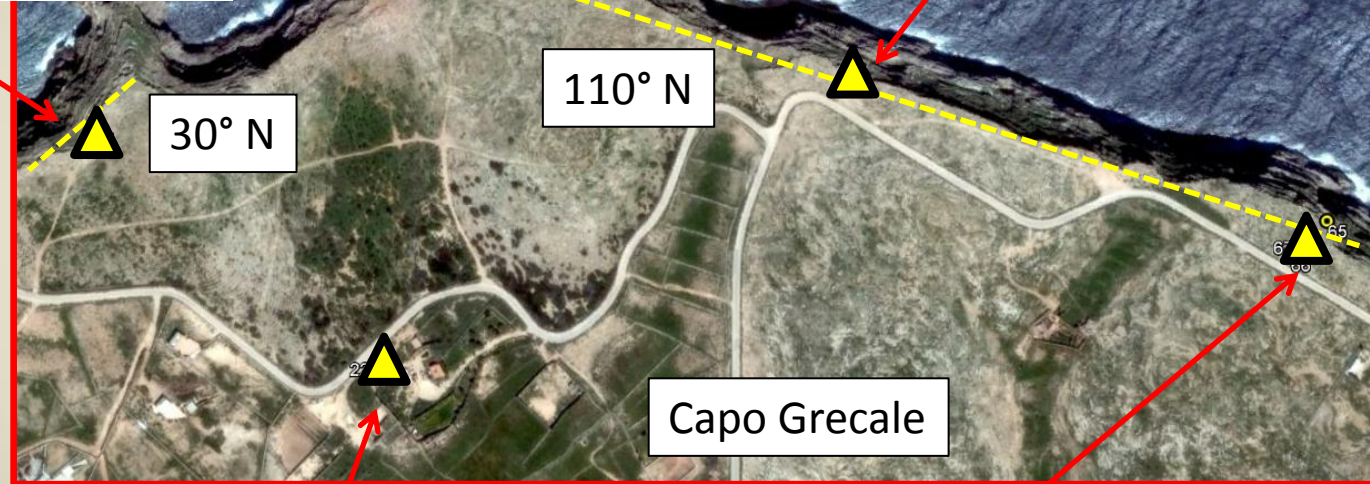
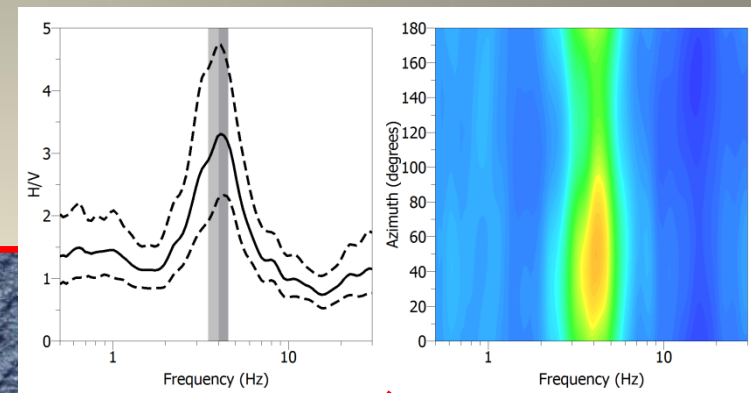
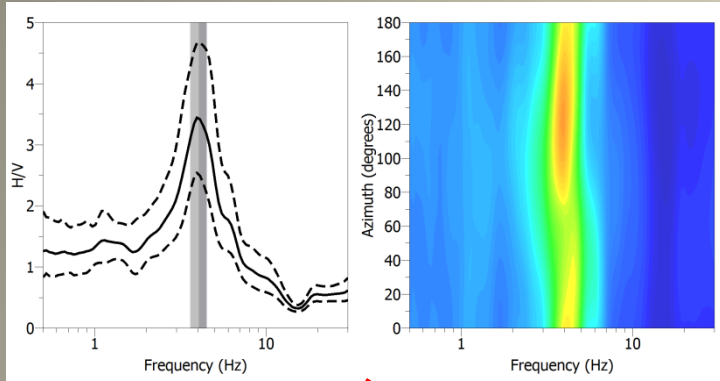
LAMP 55



# HVNR results: morphologic effects



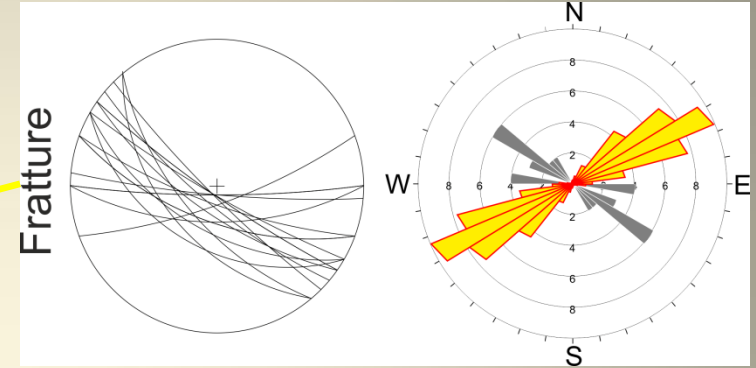
# HVNR results: morphologic effects



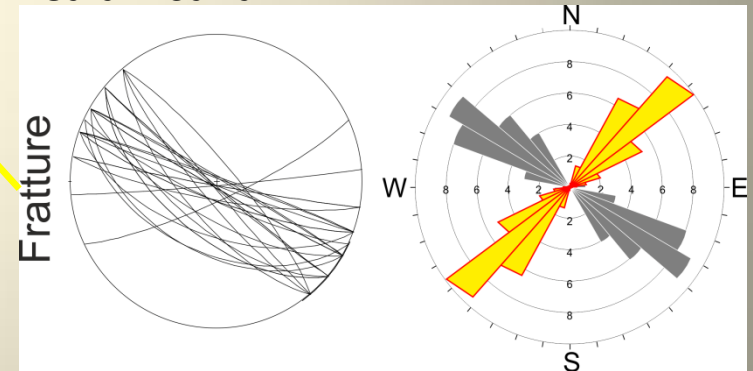
# HVNR results: relationship with structural analysis



Cala Creta

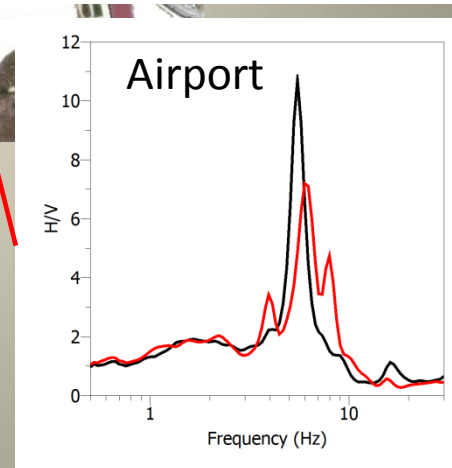
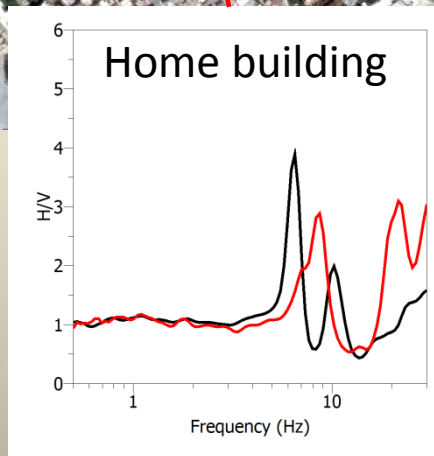
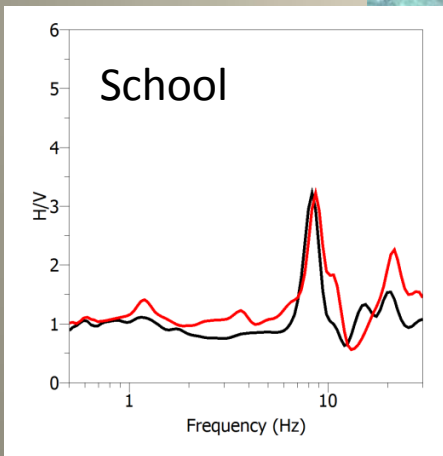
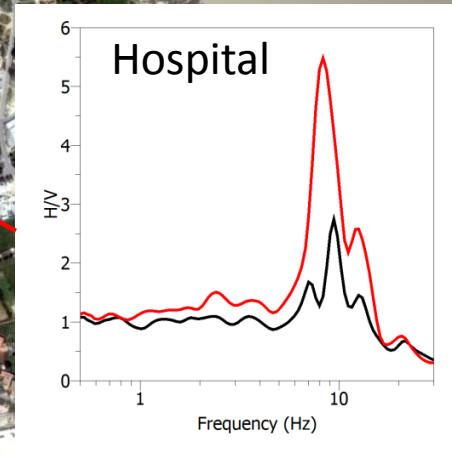
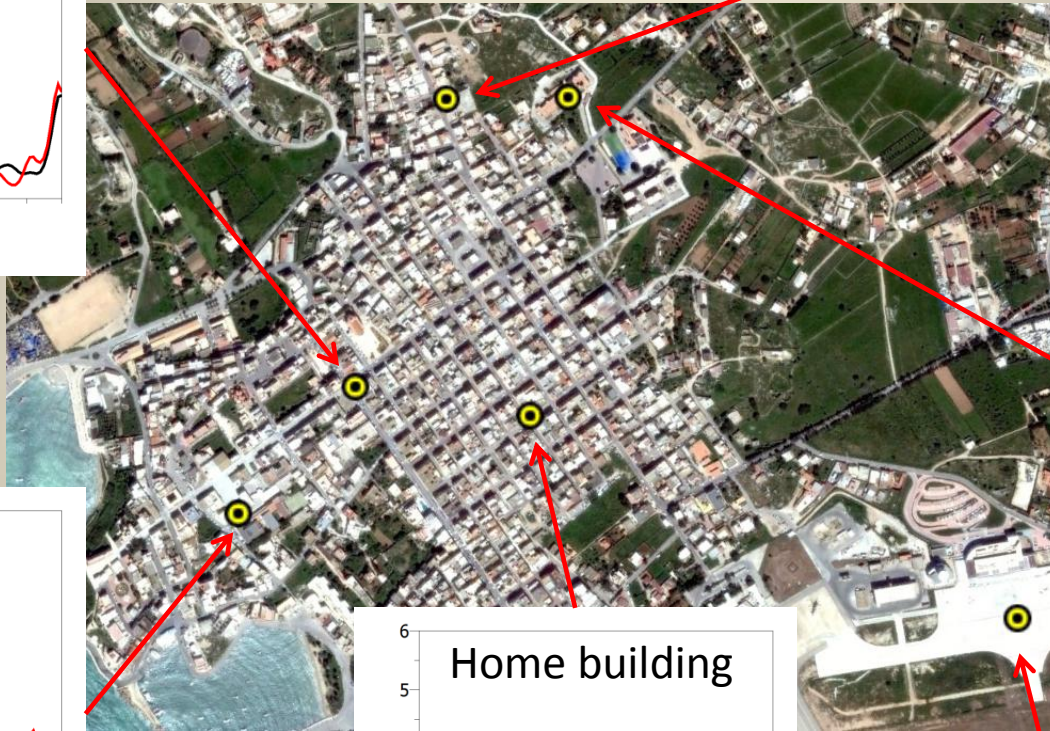
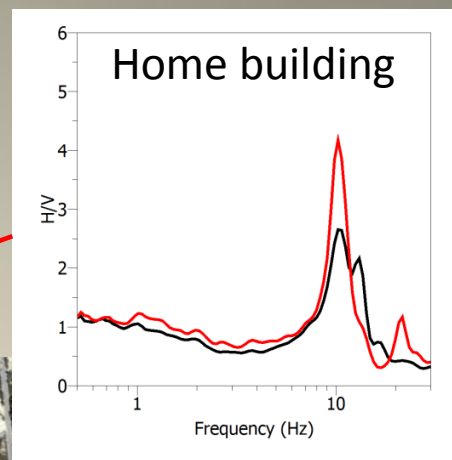
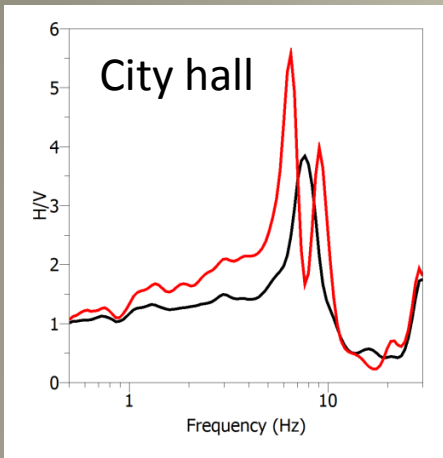


Cala Pisana



Orthogonal relationship between polarization and fractures azimuth

# HVNR on buildings





## Concluding remarks

- Flat HVNR are observed on stiff rock (limestone). High frequency peaks are observed on detritus and soft soil.
- Significant directional site effects are observed on cliff area, with maxima transversal to the structures strike.
- Buildings have fundamental frequency in the range 5.0-10.0 Hz
- Particular attention should be paid if urban area develops to NE, where soft soil outcrop

## Forthcoming investigations

- Shear wave velocity investigations (Geophysic group)
- Scenario earthquakes (Geophysic group)
- Buildings vulnerability assessment (Engineering group)
- Cross-border civil protection plans (Italy and Malta Civil Protection)

