11th INTERNATIONAL WORKSHOP on the GEOLOGICAL ASPECTS OF RADON RISK MAPPING
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Indoor radon concentration and its exhalation rates from building materials used in Sicily (Italy)

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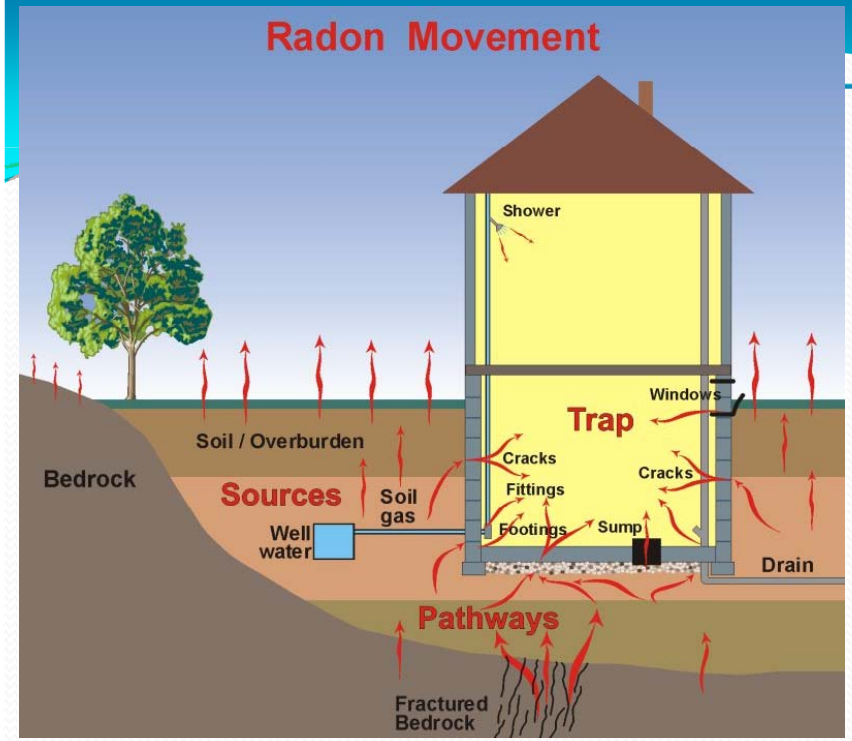
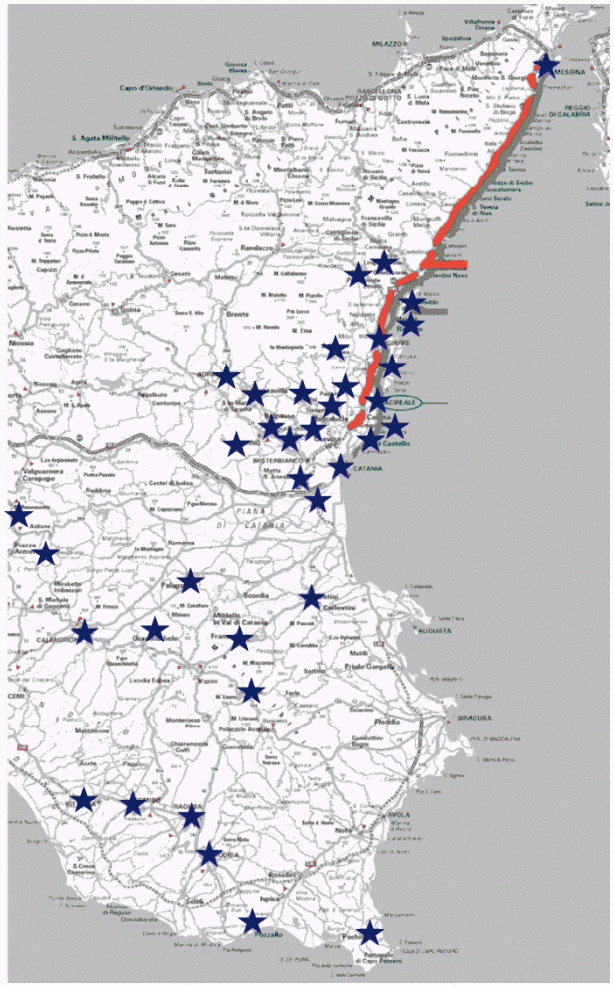


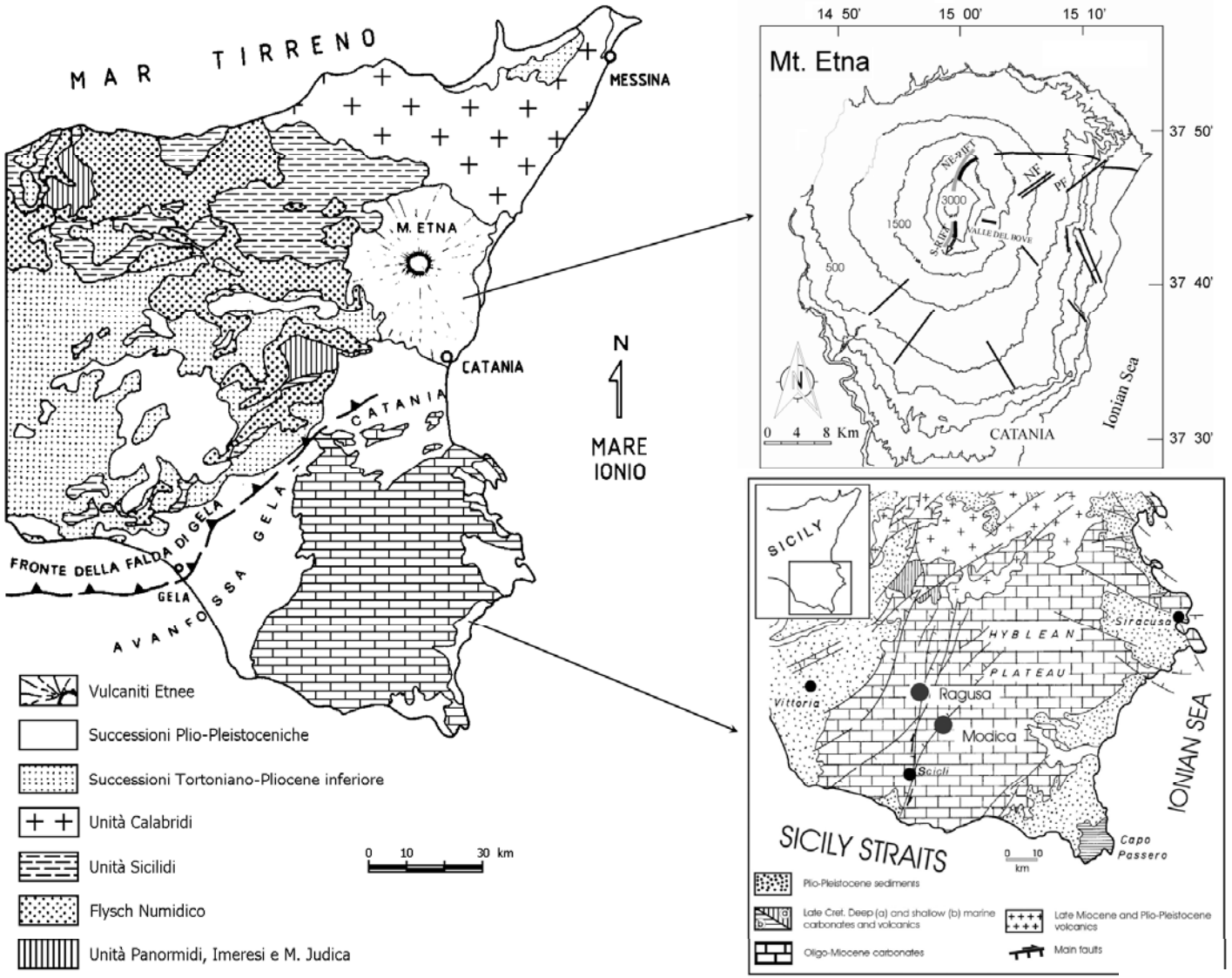
Indoor Radon Survey

2005-2012



Geological framework

- ✓Hyblean-Maltese escarpment
- ✓Mt. Etna Volcano
- ✓Pernicana Faults
- ✓Naca Faults
- ✓Hyblean Plateau



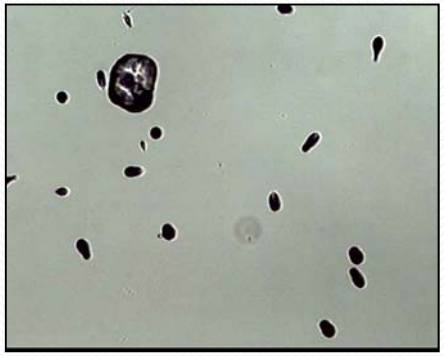
Measuremet Methodology

Nuclear Solid Track Detector CR-39

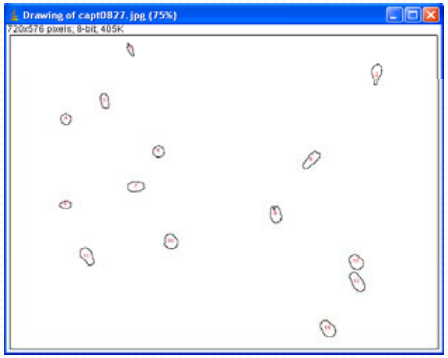
Detector

etching: NaOH 6M 98°C 1h

Reading system



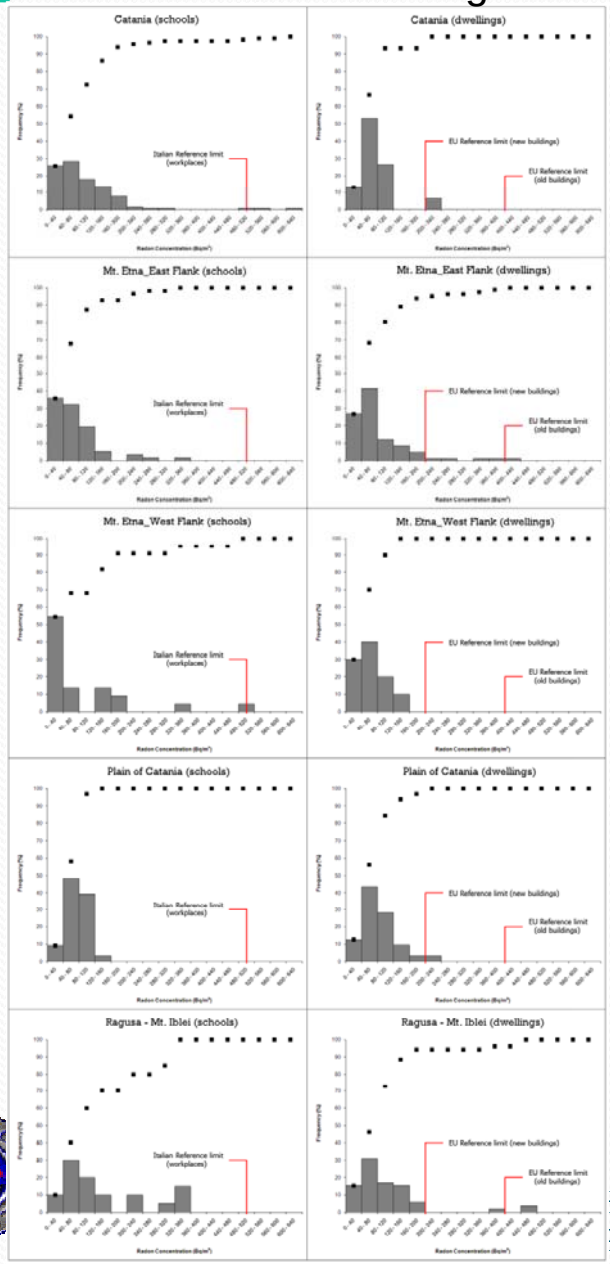
Calibration



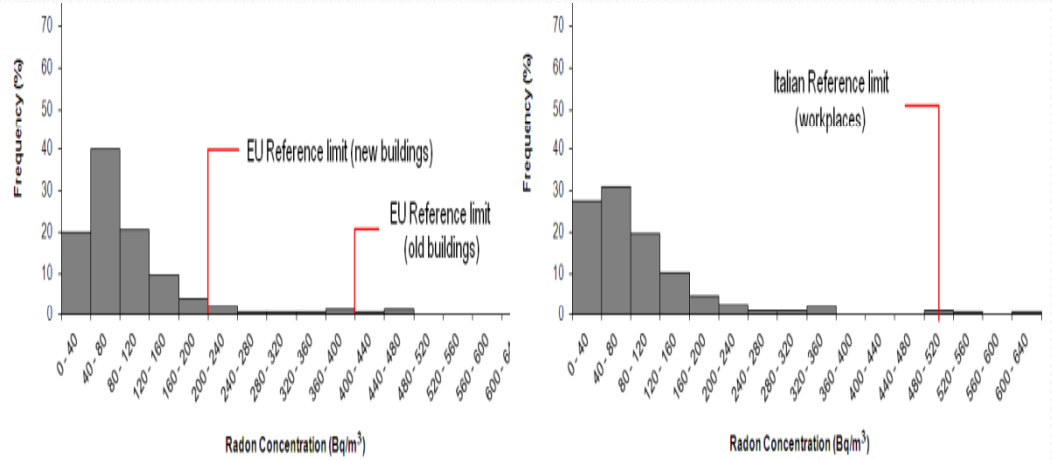
Radon and Natural Radioactivity Research Laboratory (University College of Dublin)

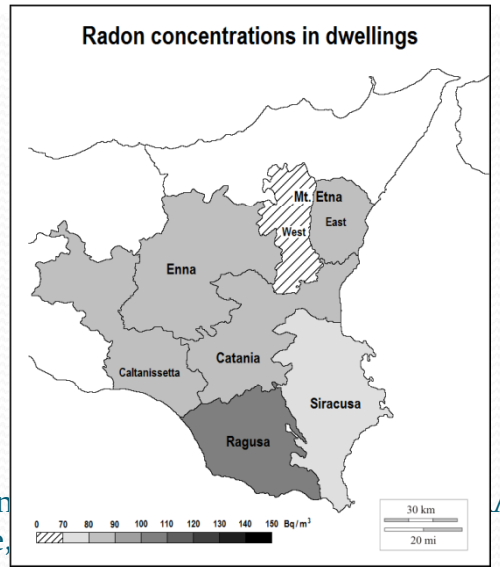
Results

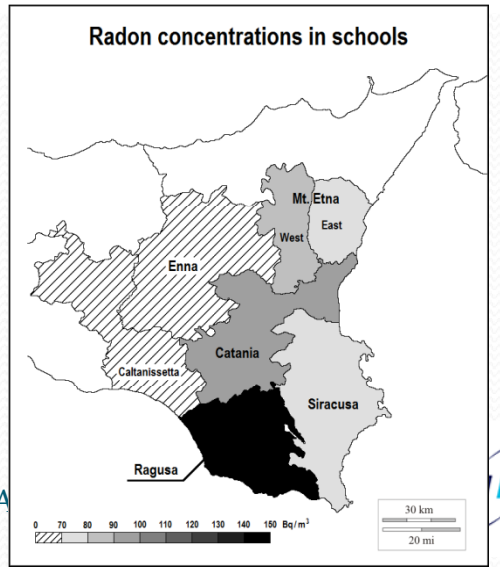
Schools: 249 Dwellings: 200



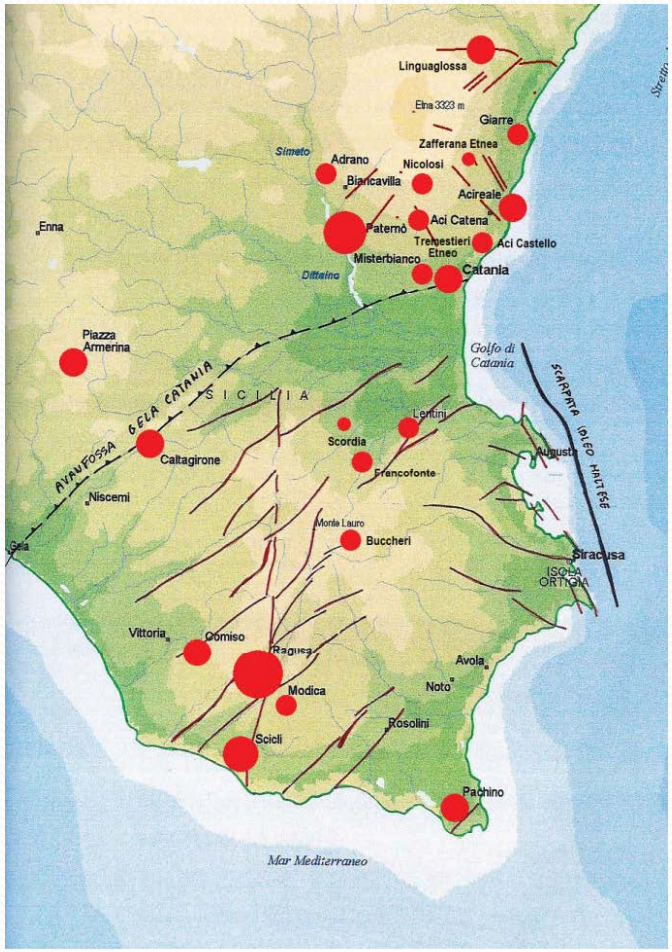
	Detectors	Radon concentration (Bq m^{-3})				
	N	Min	Max	Med	Av	SErr
Schools	249	7	634	68	95.2	14.4
Dwellings	200	7	468	67	83.6	10.6







Results

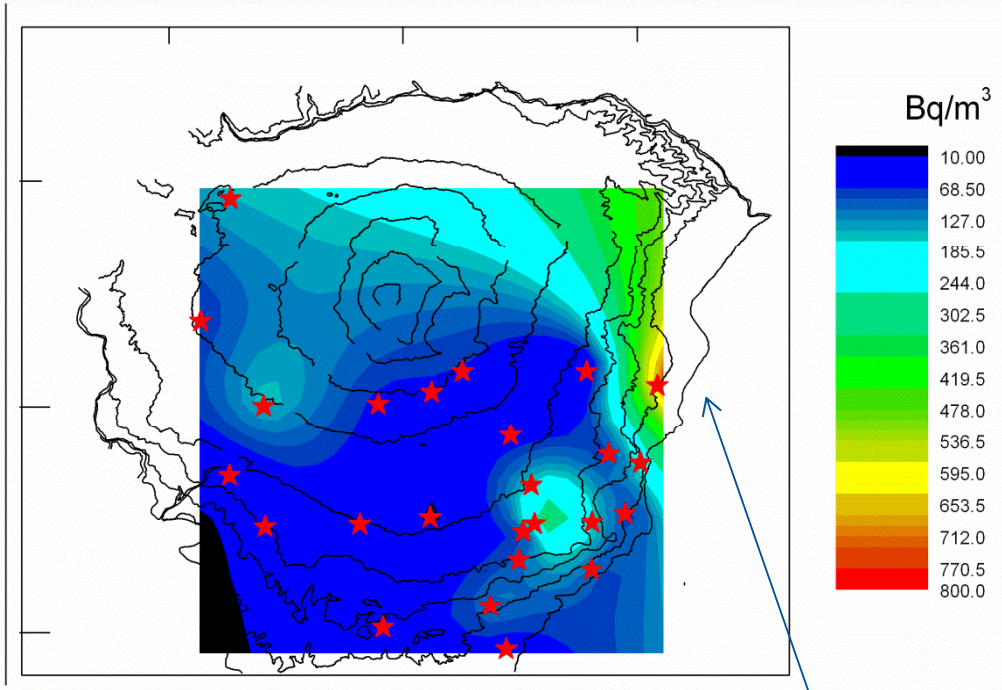


LEGENDA:

● <40 ● 40-80 ● 80-120 ● 120-160 ● 160-200 ● >200

Radon concentrations in Bq/m³

Etnean area

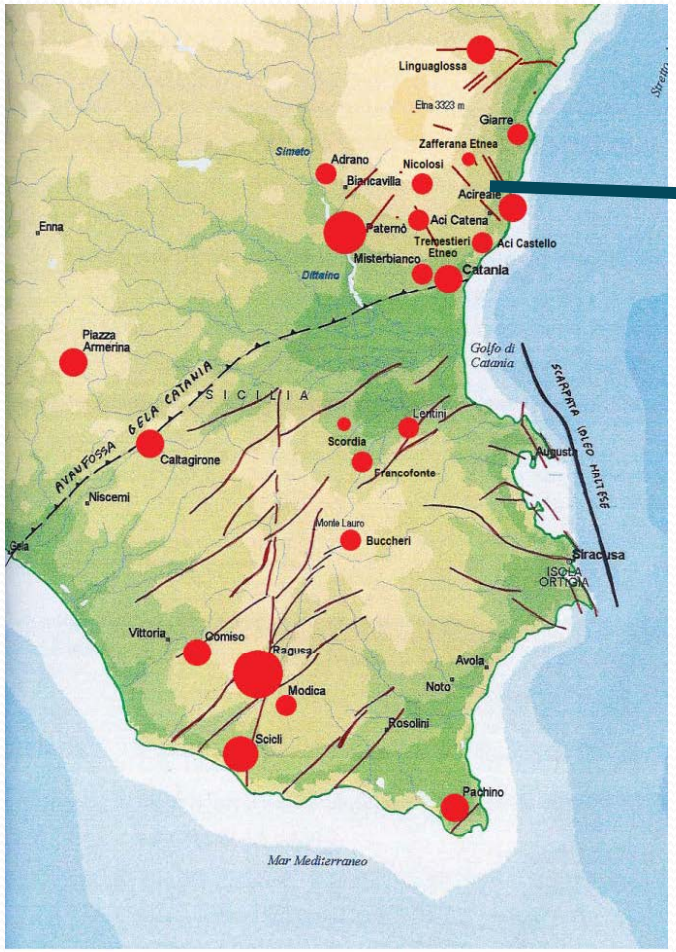


Timpe Fault System

Higher in-door Radon concentration near fault systems

Results

S. Venerina Village



LEGENDA:

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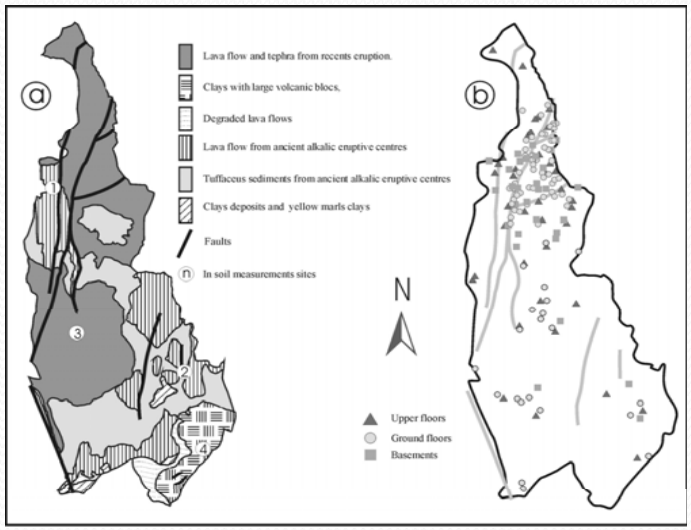
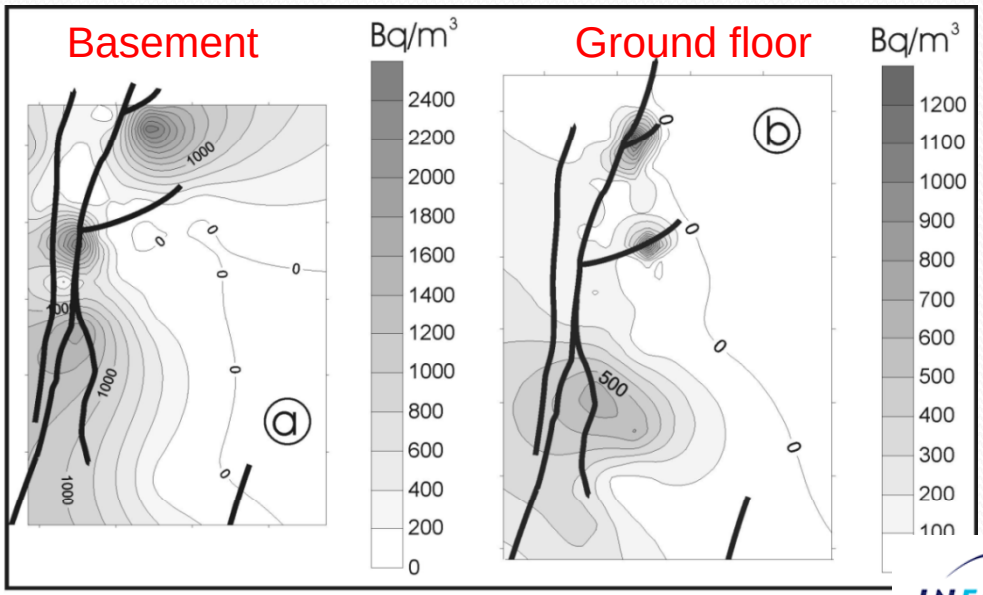
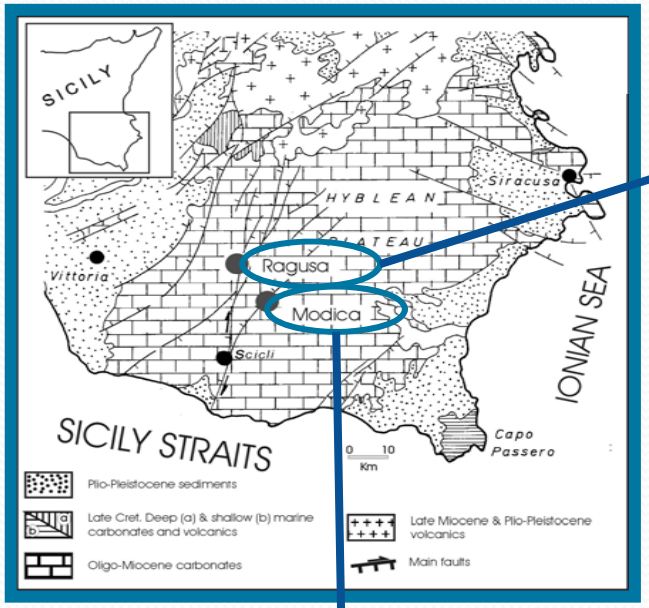
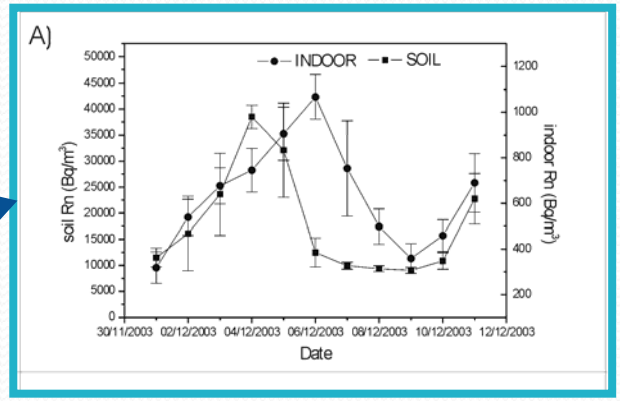
Radon concentrations in Bq/m³

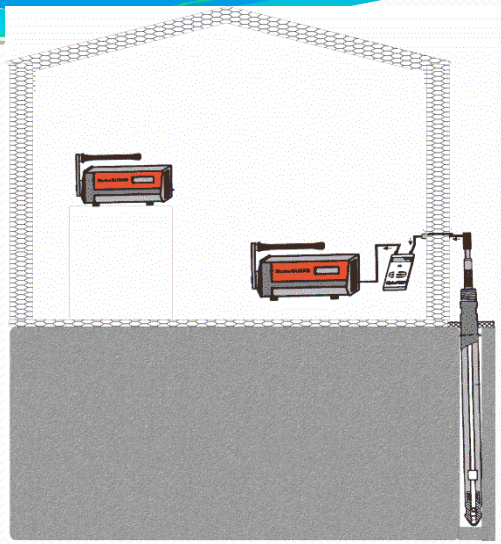




Results from Ibleian foreland

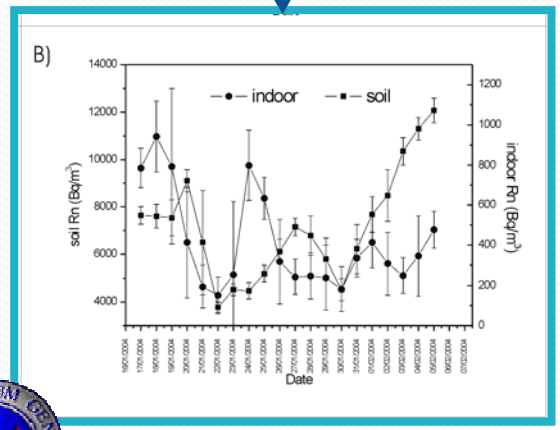




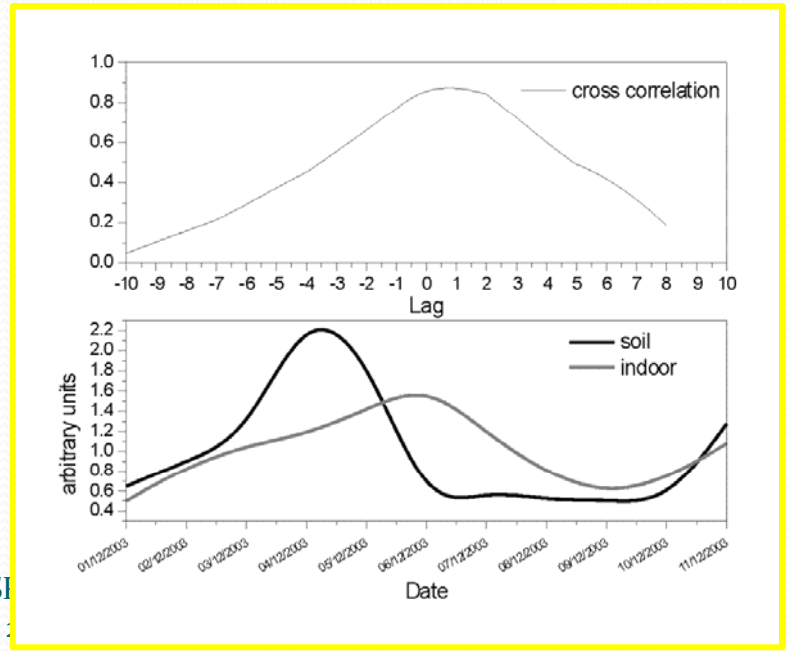


Continuously measurements of soil and indoor Rn Concentration

Ragusa



Good correlation between soil and indoor radon trend, with a delay of 1 day



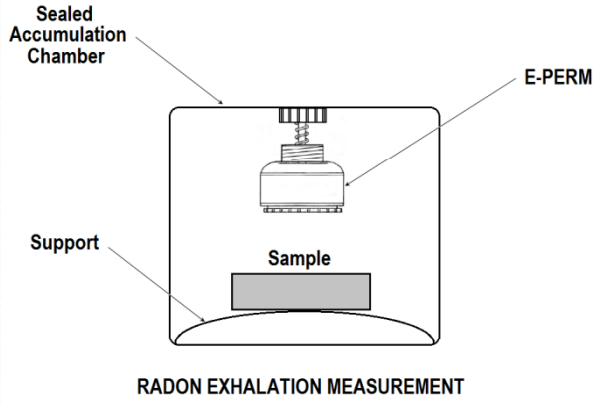
Laboratory Analysis

➢ ***Radionuclide measurements via γ spectrometry***

HpGe detector

- ❖ Oven at 80°C for 4 hours
- ❖ Crushed and homogenized (250 μm).
- ❖ Oven at 80°C for 24 hours.
- ❖ Weighted and placed in a Marinelli beaker of 100 ml
- ❖ Sealed for 4 weeks.

➢ ***Radon exhalation rate – Can technique***



RADON EXHALATION MEASUREMENT

Surface exhalation rate

$$E_A = \frac{Ch\lambda t}{\left[t + 1/\lambda\left(e^{-\lambda t} - 1\right)\right]} \qquad \left[Bqm^{-2}h^{-1}\right]$$

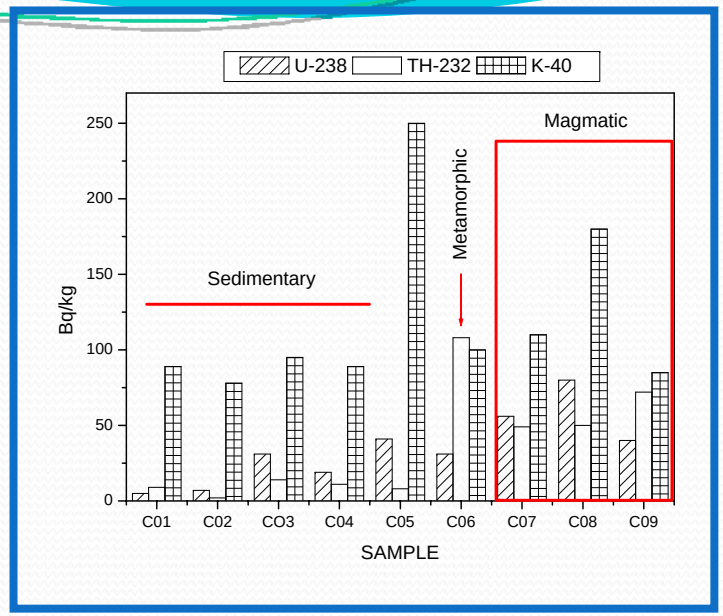
Mass exhalation rate

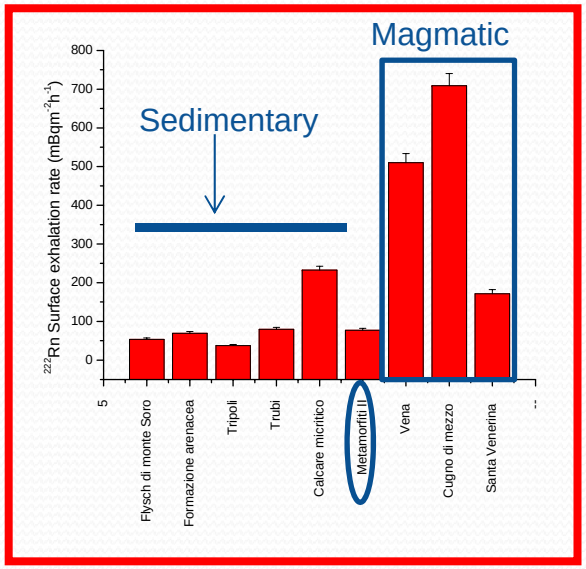
$$E_M = \frac{CV\lambda t}{M\left[t + 1/\lambda\left(e^{-\lambda t} - 1\right)\right]} \qquad \left[Bqkg^{-1}h^{-1}\right]$$

Laboratory Analysis

➢ *1st step rock analysis*

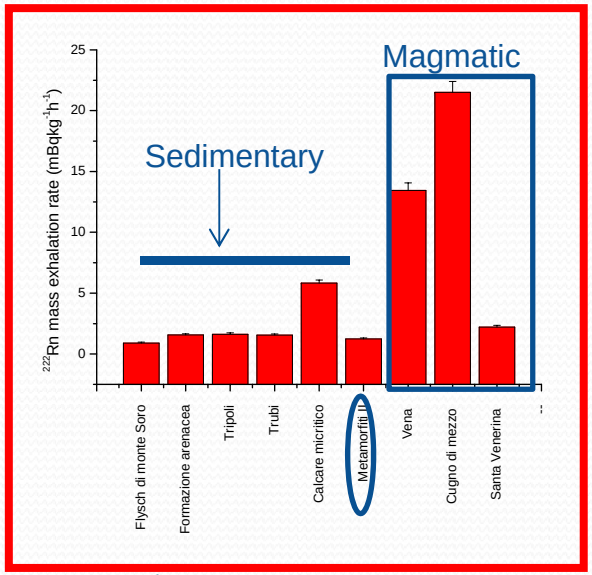






Surface exhalation rate

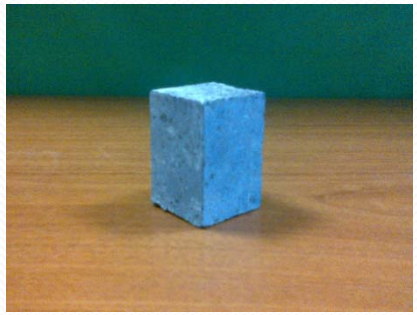
Mass exhalation rate

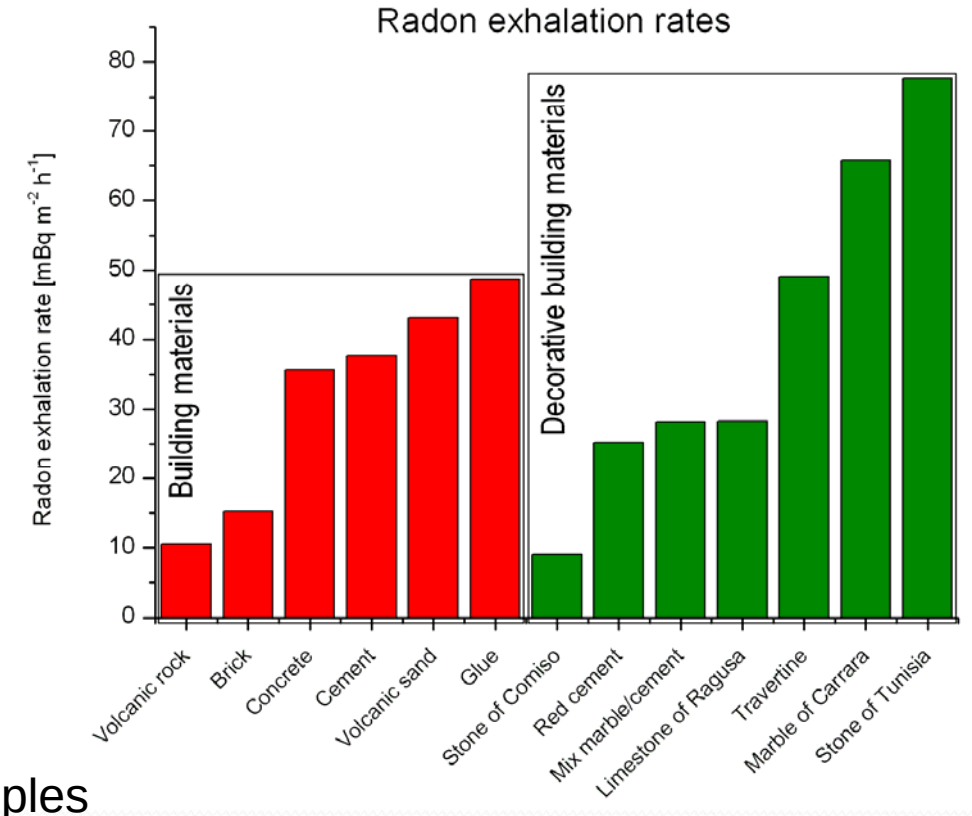


Higher radon exhalation values in volcanic rocks, according to major Uranium amount.

Laboratory Analysis

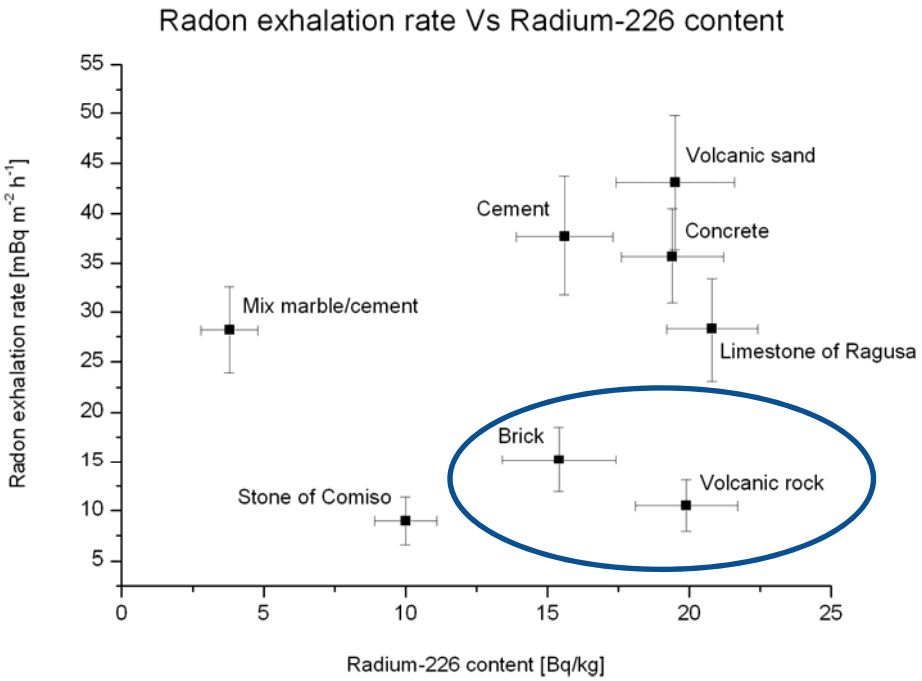
- ***2nd step building material analysis***



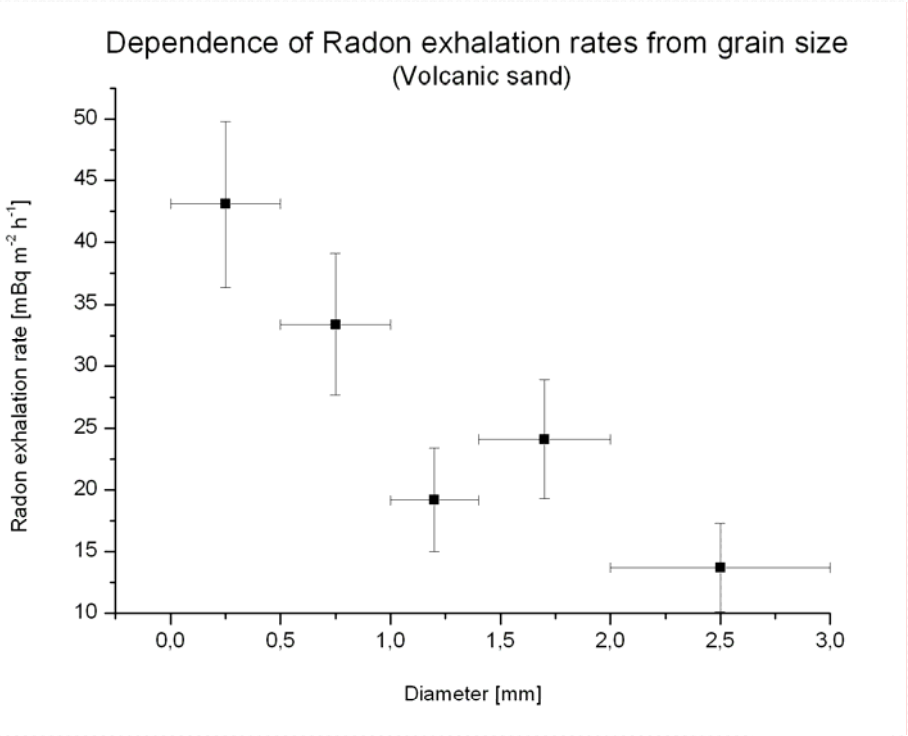


Higher values in marble samples

Results



No evident correlation between Rn exhalation and Radium content in building materials



Correlation between Radon exhalation and grain size

Conclusion

✓ Measurements of indoor radon concentration in buildings of the east Sicily

✓ ***Correlation between indoor radon concentration and geological structures***

✓Radionuclide amounts in soil samples and building materials by gamma spectrometry

✓ ***Higher radionuclide amount on volcanic samples***

✓Radon exhalation rate by laboratory measurements both in soil and building material samples

✓***Not evident correlation between radon exhalation and radionuclides amount on building material sample***

✓***Correlation between radon exhalation and grain size***

✓***Lower exhalation rates in compact materials (bricks, volcanic blocks)***

THANKS