Geology activities and Radon in Ischia island

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INTRODUCTION

The island's history is marked by intense volcanic and sismic activity. Its geological structure, consisting of a series of raised and inclined plates, is called: vulcanic-tectonic horst.

Mount Epomeo (789 m.) constitutes the highest part of the central plat. The lowest flat part (which includes Casamicciola, Barano and Ischia Ponte) is called Graben of Ischia.

Let's see the geological history of the island:

- **Phase 1**

  (150.000 years ago): Mount Vezzi was born, and the Scarrupata ~~of Barano with~~ the formation of various faults.

- **Phase 2**

  (150.000 - 75.000 years ago): formation of vulcanic domes (unexploded vulcanos) like Sant'Angelo, ~~and Castello Aragonese~~ in Ischia .

Afterward, a period of stasis.

Green tuff bought the typical green color for the long period that has been submerged.

- **Phase 3**

(55.000 - 33.000 years ago): an eruption beetween Sant'Angelo and Maronti beach favored the deposition of **green tuff** on a large part of the island;

- **Phase 4**

(28.500 - 18.000 years ago): lava flows, after all this a period of rest;

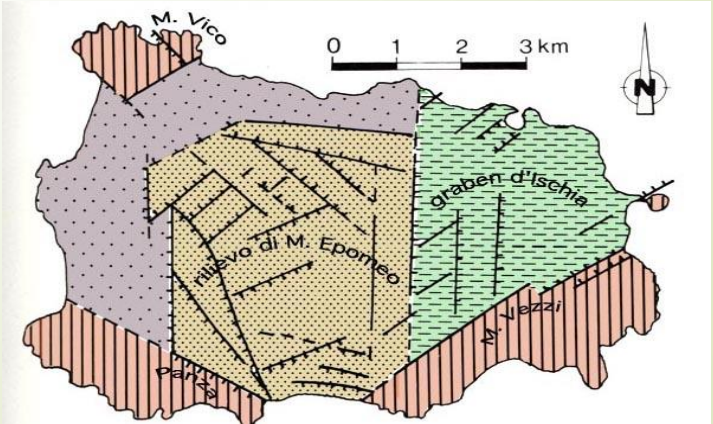
- **Phase 5**

(from 10.000 years ago to 1302): formation of the eruptive spots in the east part of the "Epomeo", with formations of various faults; the last volcanic phenomena happened in 1303 with the eruption of the Arso hill.

Geothermic activities

In the depths of the island is a magma reservoir that causes an intense hydrothermal activity with fumaroles, hot springs, mud.

<u>Epomeo Mount</u> is rounded by many faults and fractures (consequence of the lively geological activity) which favor the rising up of gas and hot water.

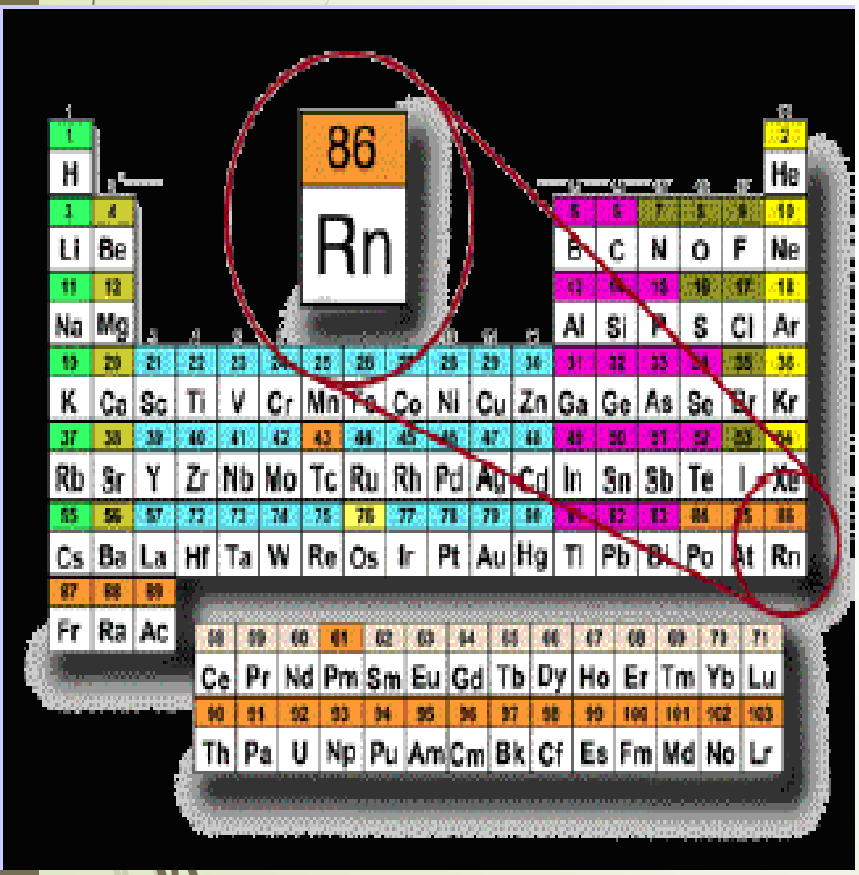


Ischia's green tuff

The island has had phases with sinkings, and successive phases of emersion from the sea (about 55,000 years ago)

- **The characteristic tuff's green colour, present on the island, exists because of the particular coloration from the rocks of the long sinking period under sea level until about 28,000 years ago.**
- **Rn concentration in cell of tuff rockes is quite high: 67 (Bq kg-1)**

What is Radon?



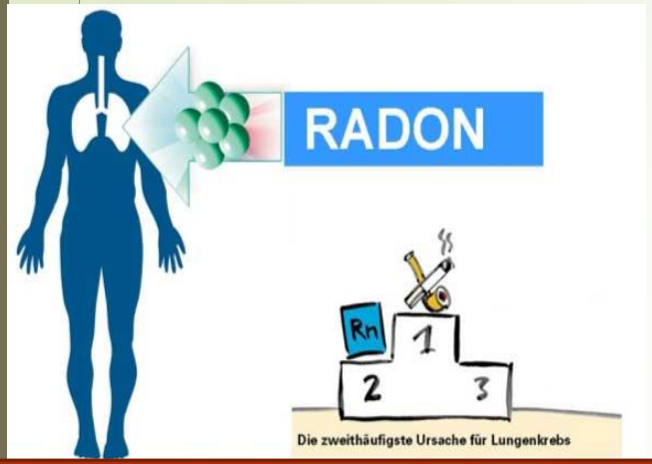
- Radon is a natural radioactive noble gas, produced by the decay of Radium, which comes from the decay of Uranium.
- Radon is colorless and odorless.
- The radon decay is a typical alpha radioactive decay with emission of alpha particles

Radon in Ischia

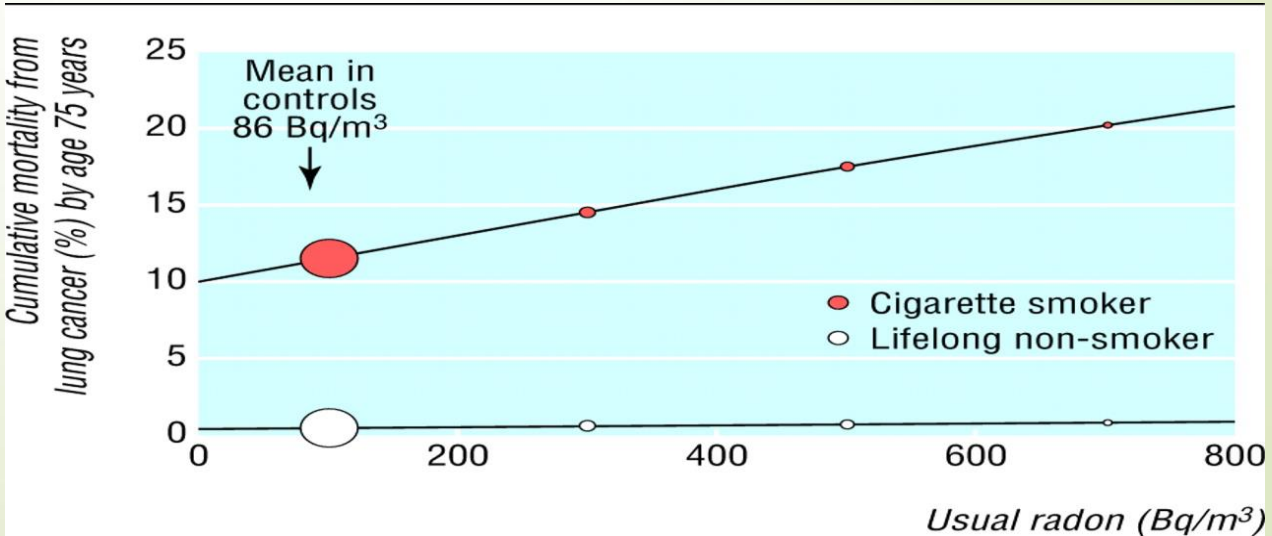
Now we will talk about natural radioactivity of the island. Ischia has a rich thermal basin (about 100 sources) with different natural radioactive radon gas concentration.

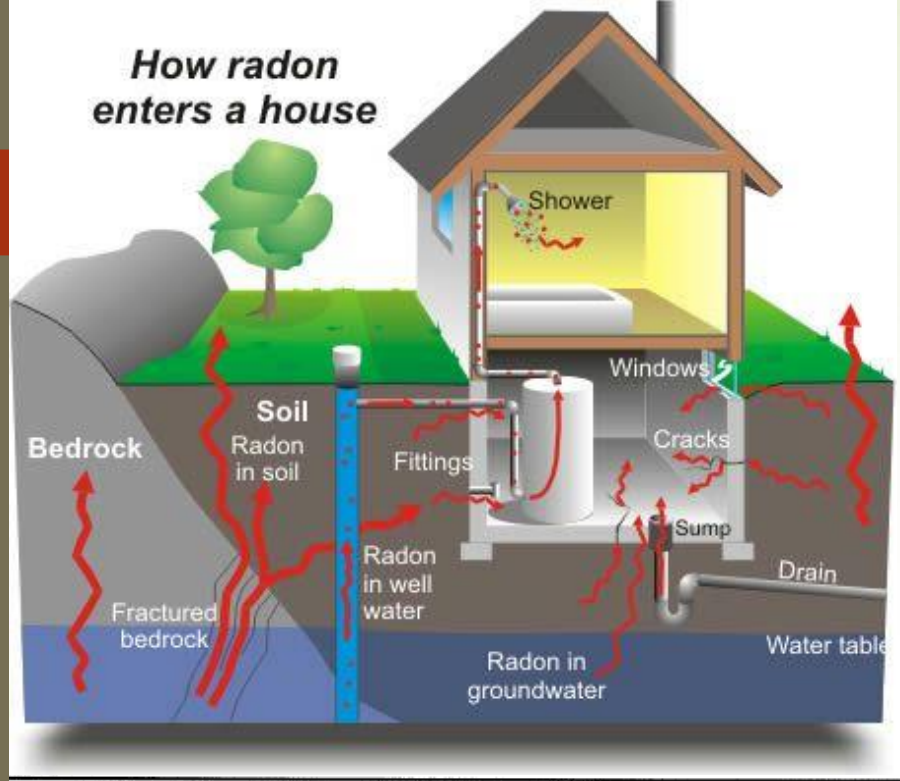
But the tuff (widely used in building constructions) contains much radon and this can cause a high concentration of radon in the less ventilated rooms.

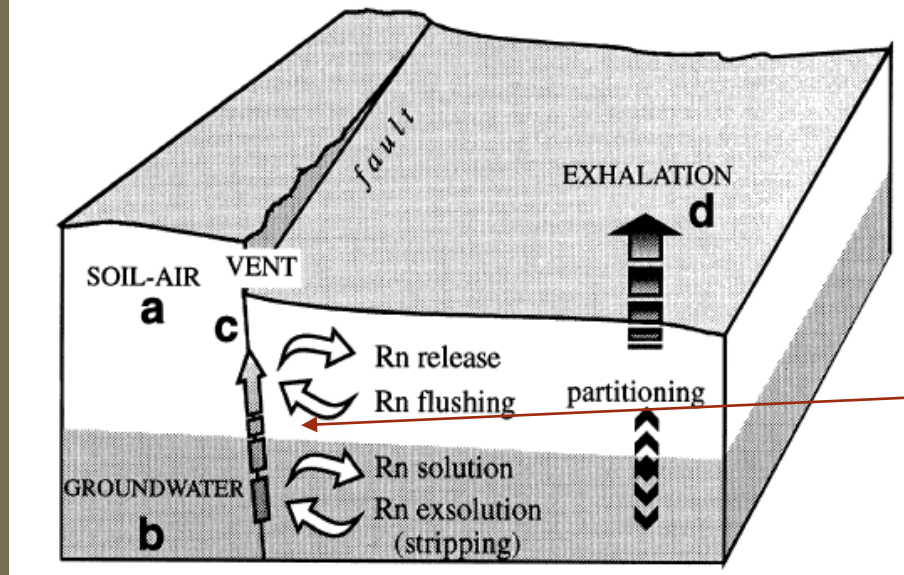
Health implications of Radon



- **Alpha rays are not dangerous when they hit the outer human body, so the only risk is when we breathe radon gas.**
- **The alpha particles by radon cause one of the most important risk factors of cancer in the respiratory system.**
- **Lung cancer risk increases proportionally with indoor radon concentration**
- **This risk becomes higher in smokers: the total risk factor for smokers is 10-100 times higher than that for non- smokers.**







Where is Radon?

- Radon can be found in small amounts in every type of ground and rocks.

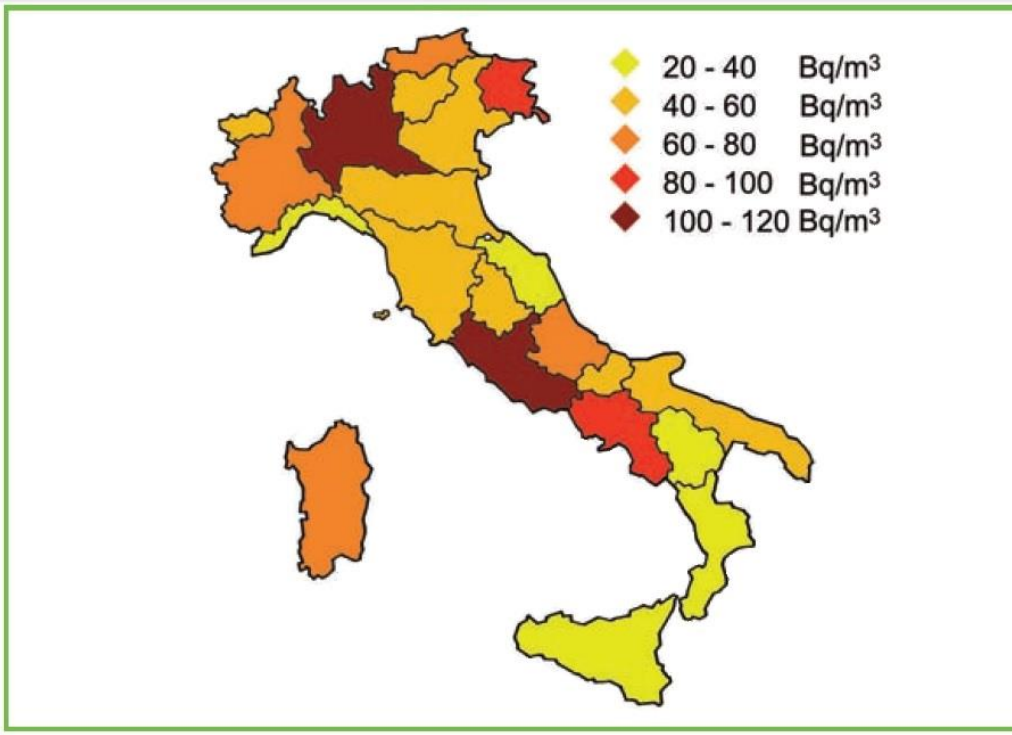
•It comes out from the soil, it can be stored in closed spaces, like in houses and workplaces (indoor exposure).

•The quantity of Radon in the soil depends on the local geology.

• Some types of soil permit free air circulation, more than others: this explains why the levels of radon are more elevated in some zones and smaller in others. For example: numerous faults in the subsoil of Ischia facilitate the rising of Radon gas in surface.

Radon in Campania

- In Campania (and in Ischia) radon average concentration in houses (indoor exposure) is on average 100 Bq per cubic meter of air.
- Italian areas with higher radon concentrations: Lazio, Lombardia, Campania, Friuli.
- The maximum concentration allowed by Italian law is 500 Bq/cm.



Radon Detectors

- Liceo Ischia adheres to radon projects proposed by INFN of Naples from 2006 today
- Radon measures have been made using:

1. Electret (E-perm)

2. LR-115 (nuclear tracks detector)

ENVIRAD PROJECT 2006-2011

Envirad

INFN

- In 2006, the students of Liceo Ischia measured radon concentration in a very particular suburb in Forio d'Ischia, named "Cierco".

- Here the houses have been built entirely with green tuff and the environment is full of tuff.
- Moreover, some of them are entirely engraved in tufaceous rock, while some others lie on big tufaceous blocks.

- MEASURED DATA FROM CIERCO FORIO SUBURB

HOUSES IN FORIO			
Room	Flat	Concentr. (Bq/m^3)	Error
Casa Co1 (in tuff)	Groundfloor	250	18
Casa Co2 (in tuff)	Firstfloor	296	19
Casa Co3 (in tuff)	Near to tuff rock groundfloor	479	27
Casa Mi1 (cement)	Groundfloor	349	22
Casa Ca1 (cement)	groundfloor	387	23
Casa Ca2 (cement)	Near to tuff rock firstfloor	511	29
Casa Ca3 (cement)	Near to tuff rock groundfloor	559	31

- **The radon average concentration measured in these houses is about 4 times higher than Ischia's. In some houses radon concentration can overcome the limit allowed (500 Bq/cm). This is because the tufaceous rock behaves like a sponge that on one side absorbs radon and on the other side loses radon in the environment.**

Rn Concentration in public building Ischia (2009-2011)

Scuola media "G. Scotti"			
Locale	Piano	Concentrazione	Errore sd
Segreteria	PT	395 Bq/m^3	50
Aula 6	PI	213	35
1 N Aula 5	PI	602	69
3 B Aula 1	PI	209	35
Aula 8 (vicino 3 I)	I	176	33
Aula 14 (2 E)	PT	200	34

Tribunale d'Ischia			
locale	piano	concentrazione	errore sd
aula udienza	PT	841	92
aula 3	PT	1203	127
archivio	PI	277	39
cancelleria penale	PT	710	79
g.o.t n. 15	PT	288	40
aula cancelliere	PT	300	41

Scuola elementare Cartaromana "O. Buonocore"			
Locale	Padiglione	Concentrazione	Errore sd
Aula 3	A (PT)	211 Bq/m^3	38
Aula 1	A (PT)	255	39
Aula 6	A (PT)	273	44
Aula 2	B (PT)	309	44
Aula 3	B (PT)	297	44
Presidenza	C (PT)	270	41
Segreteria	C (PT)	267	40
Aula 4	C (PT)	351	47
Aula 2	D (PT)	369	52
Palestra	Palestra	213	36

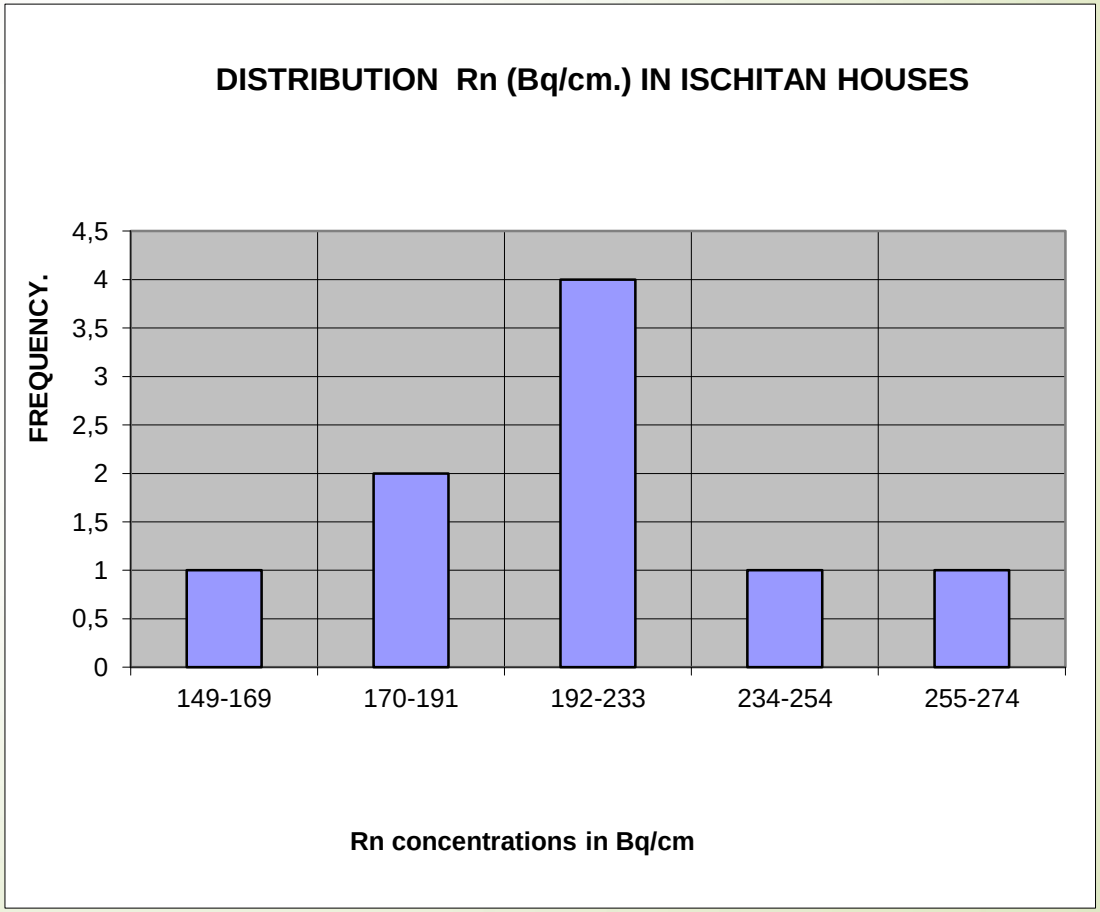
Scuola elementare "Marconi"			
Locale	Piano	Concentrazione	Errore sd
Segreteria 39	I	474 Bq/m^3	57
Aula asilo 1	PT	406	51
4B 25	I	453	55
Aula magna	PT	394	51
5C 11	I	497	59
Informatica 19	I	439	56
5B	II	587	68
Segreteria 40	II	271	41
1D	PT	257	42

RADIOLAB

Rn Concentration in ischitan houses (2011-2018)

• Average radon concentration in ischiatan houses in ground or underground floor: **370 Bq/cm**

•Average radon concentration in ischiatan houses in firsth or upper floor : **194 Bq/cm**



•Thank you for your kind attention !

•Enjoy your stay in Ischia…

Agostino Mazzella and Liceo Ischia

9.23.18