



Radiological situation in the Ojców National Park

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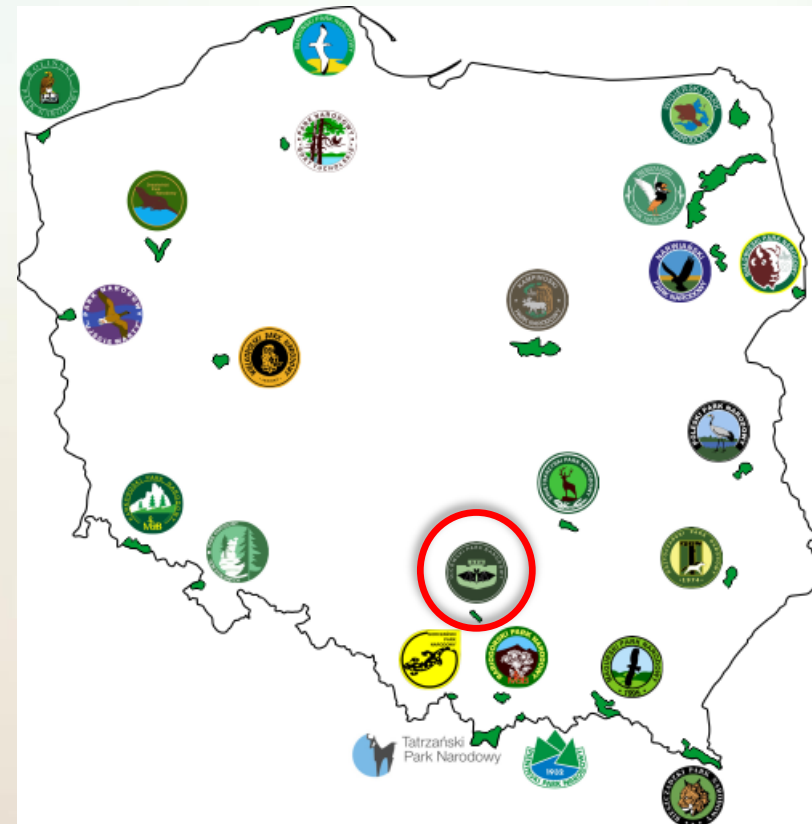
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14th International Workshop on the Geological Aspects of Radon Risk
MappingGARRM, Prague, September 2018

ONP location and area



- Ojców National Park (ONP) was founded in 1956
- located in the **Lesser Poland Voivodeship**
- located in the southern part of the **Kraków-Częstochowa Upland** (50° 12' N, 19° 46' E)
- park area covers the central part of the **Prądnik Valley** and lower and middle part of the **Sąpowska Valley**
- ONP area is 2145.62 ha ($\approx 21 \text{ km}^2$)
- it's the smallest national park in Poland



ONP location and area



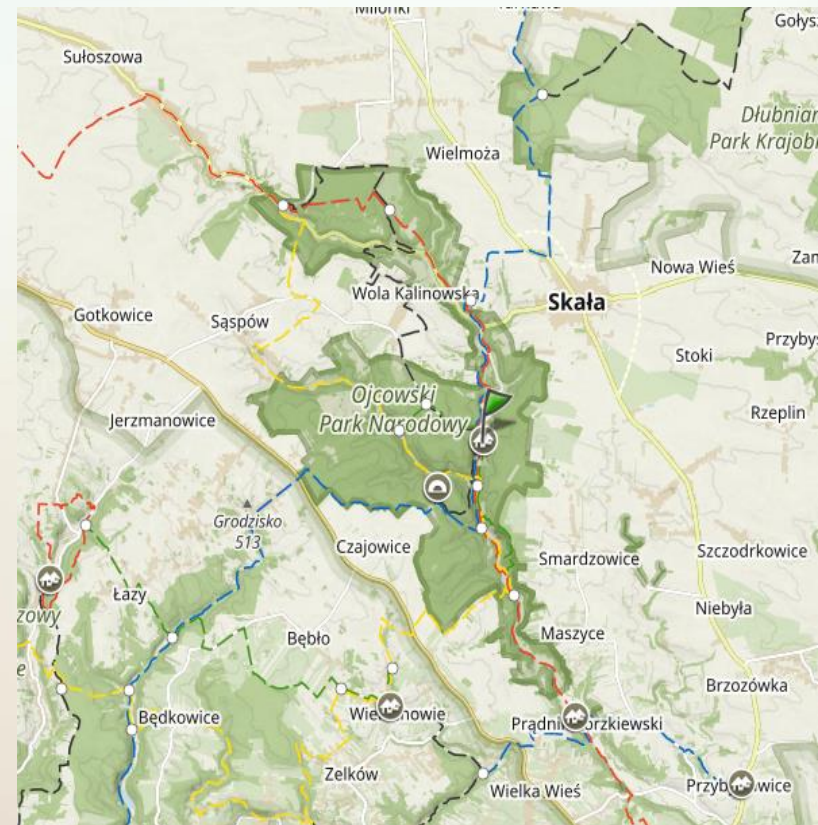
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ONP geological structures



The geological structures of ONP are mainly limestones from the upper Jurassic period:
valleys, canyons, gorges



Prądnik Valley (wikimedia.org)

ONP geological structures



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Prądnik Valley (gorskiewojaze.blogspot.com)

ONP geological structures



A lot of interesting rock formations



(www.polskieszlaki.pl)

ONP geological structures



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Hercules's Mace (www.gorskiewojaze.blogspot.com)

ONP geological structures



Over 700 caves



Łokietek's Cave (www.ojcowskiiparknarodowy.pl)

ONP geological structures



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Łokietek's Cave (www.ojcowskiParkNarodowy.pl)

ONP geological structures



Over 700 caves



foto: Albin Marciniak

Łokietek's Cave (klubpodroznikow.com)

ONP geological structures



Over 700 caves



Ciemna (Dark) Cave (ojcow.eu)

ONP geological structures



Over 700 caves



Ciemna (Dark) Cave (www.gorskiewojaze.blogspot.com)

Types of measurements



Scientific project carried out with student research group from the Jagiellonian University:

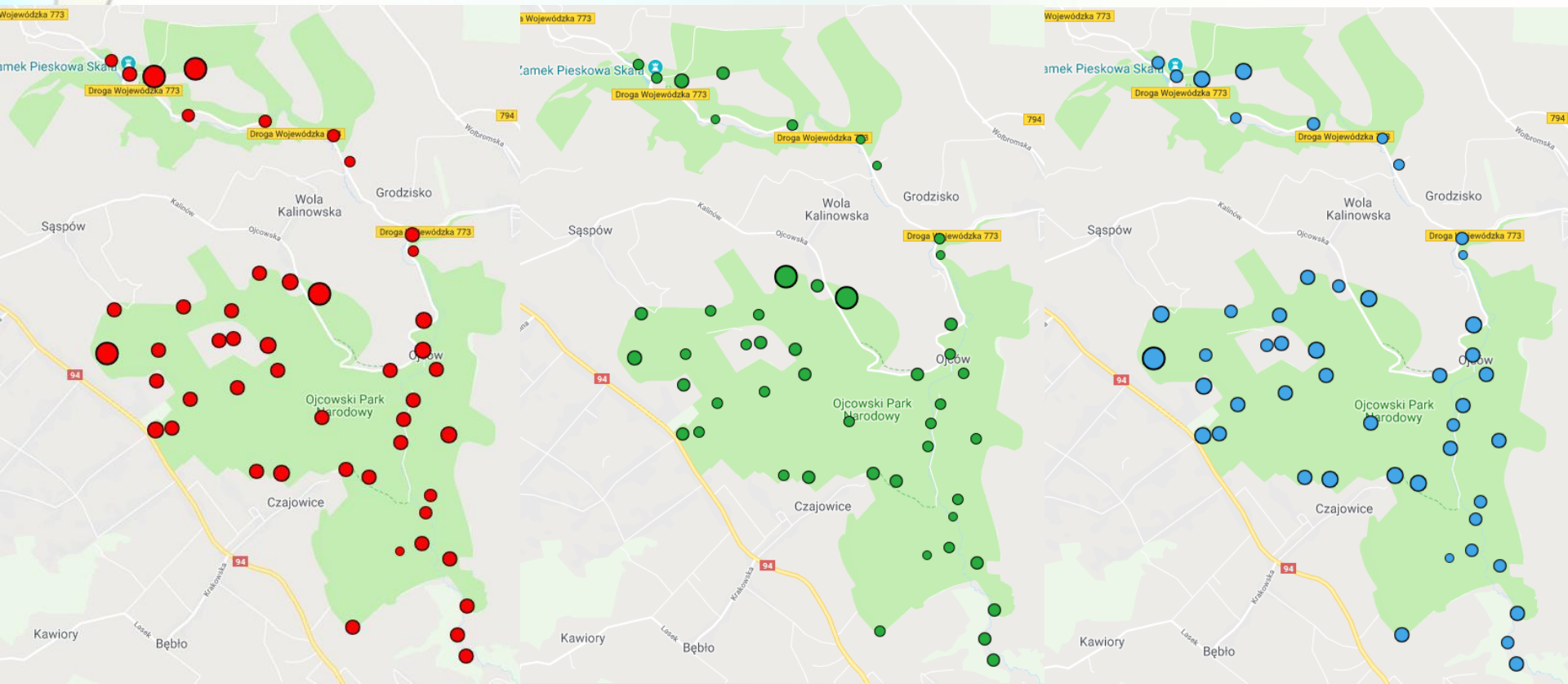
- concentration of natural radioisotopes in the soil (**K-40, Ra-226, Th-232**)
- gamma dose rate in the air (ambient dose rate equivalent **H*(10)**)
- **Rn-222** concentration
 - in soil gas
 - in water
 - inside the buildings (still in progress)
 - in caves (other project)



Results – soil radioactivity



49 soil samples for gamma spectrometry analysis



K-40

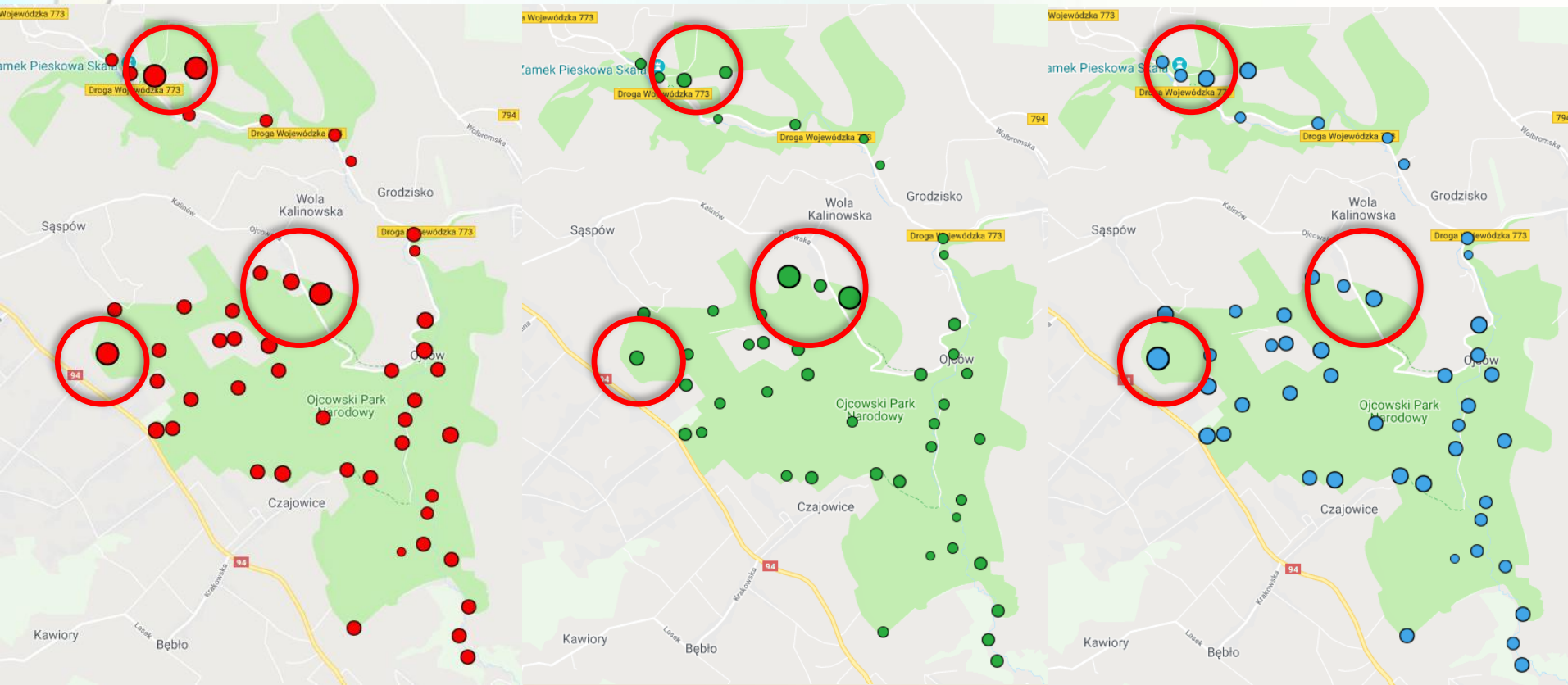
Ra-226

Th-232

Results – soil radioactivity



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K-40

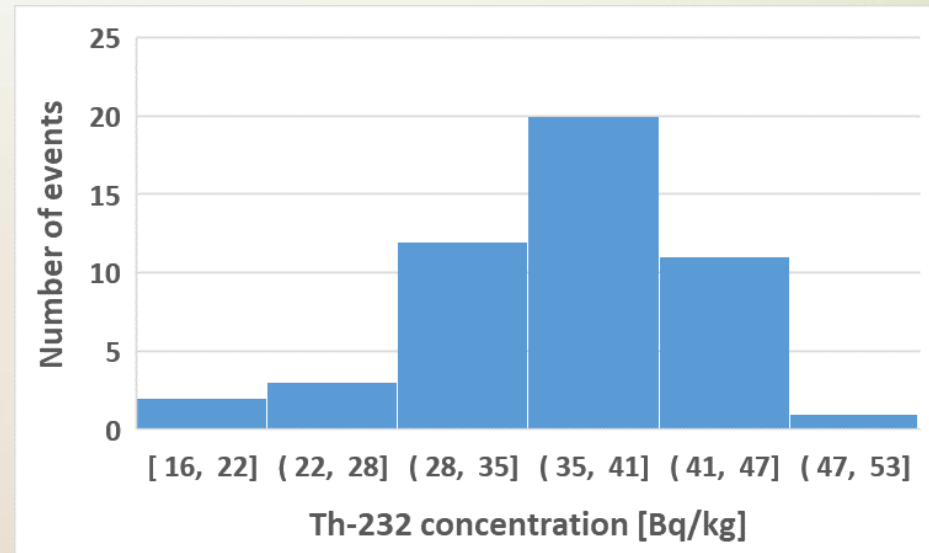
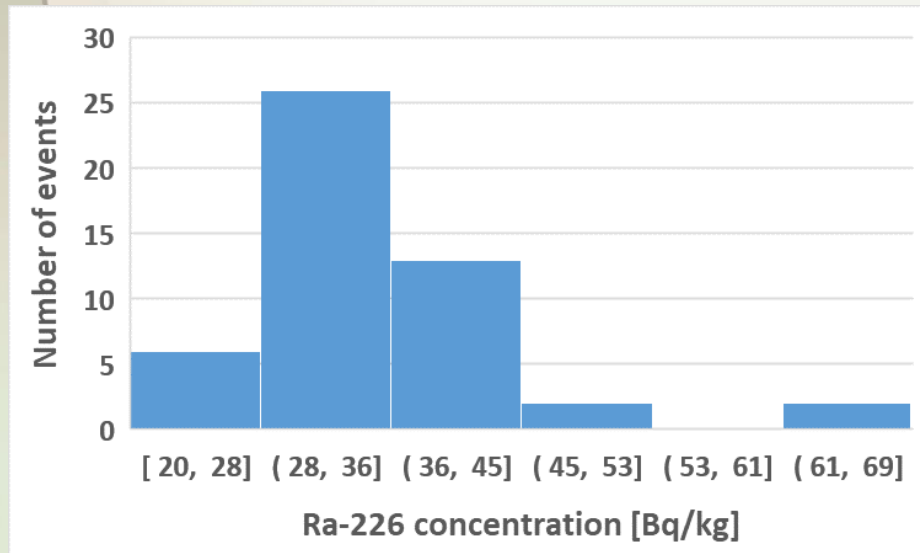
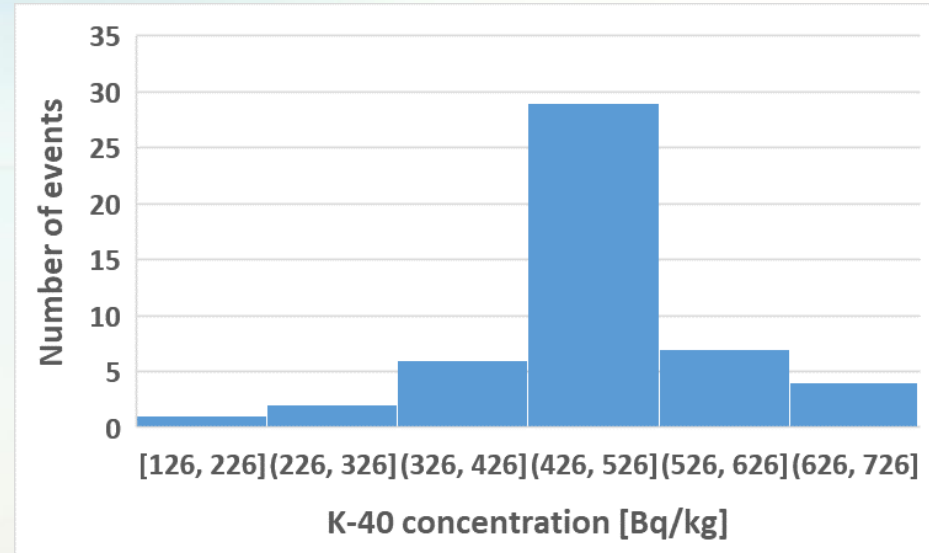
Ra-226

Th-232

Results – soil radioactivity



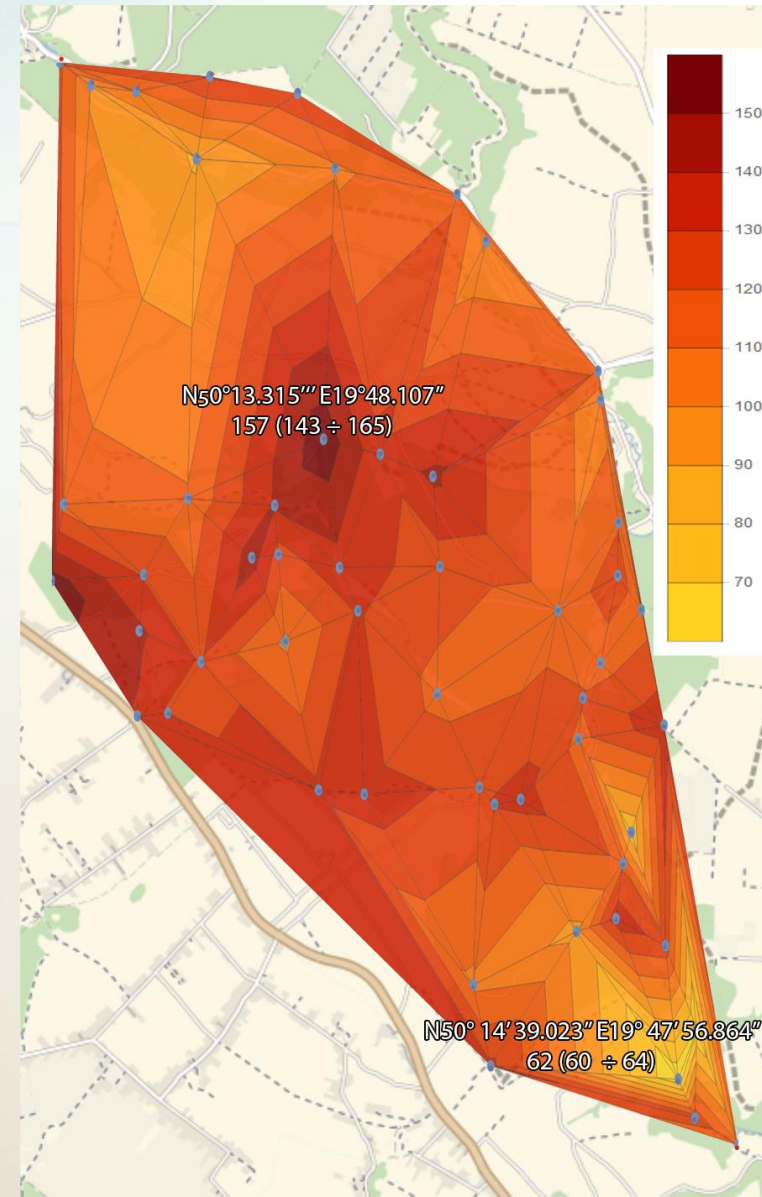
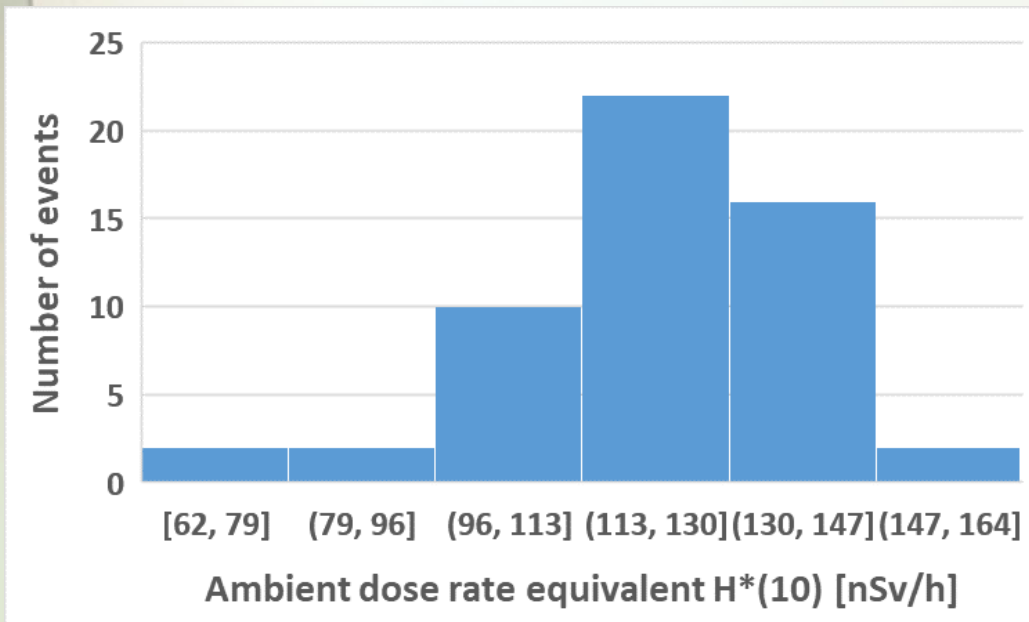
	K-40	Ra-226	Th-228
	Bq/kg		
Mean	479	36	36
Median	486	34	37
St. dev.	103	8	6
Minimum	126	20	16
Maximum	697	69	53



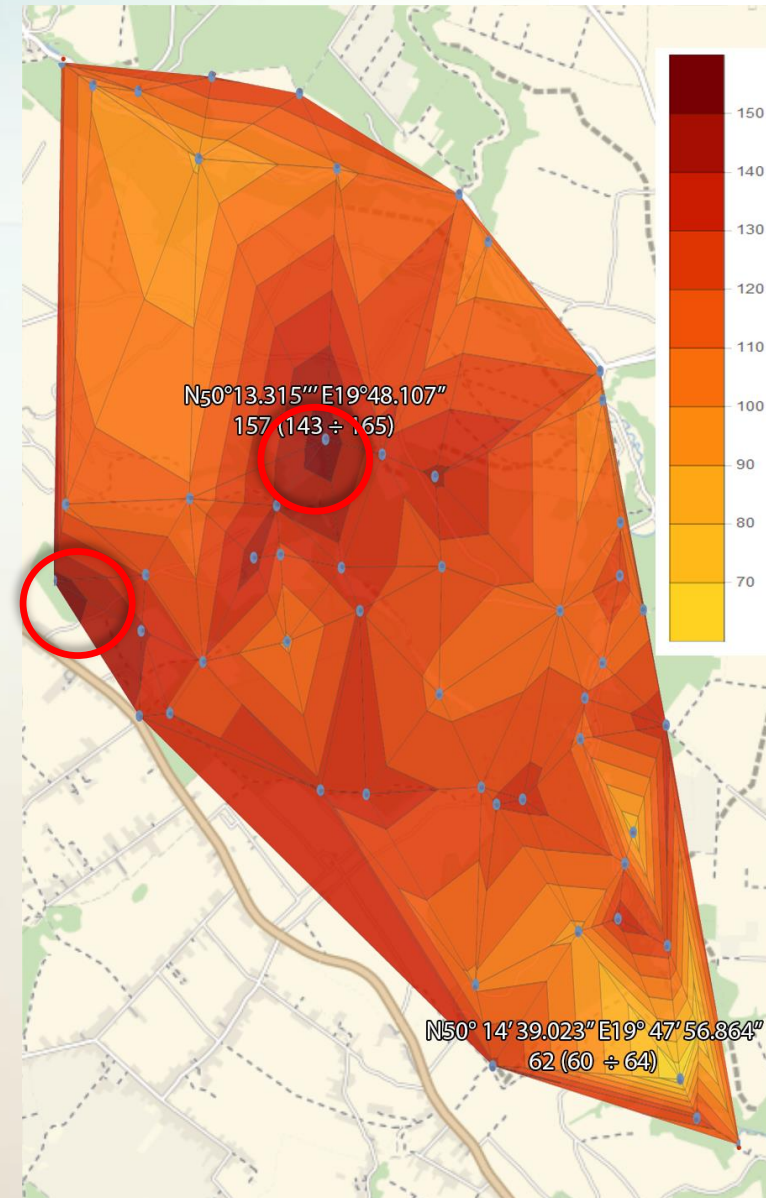
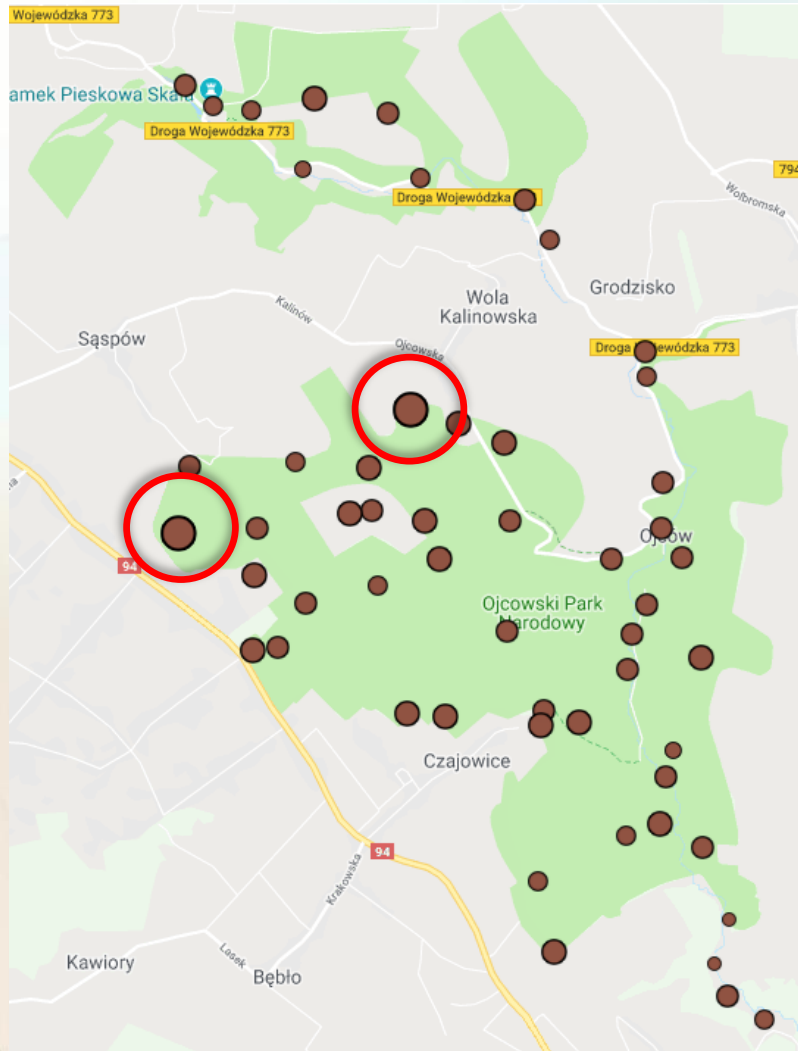
Results – gamma dose rate



	H*(10) nSv/h
Mean	121
Median	125
St. Dev.	18
Minimum	62
Maximum	157



Results – gamma dose rate

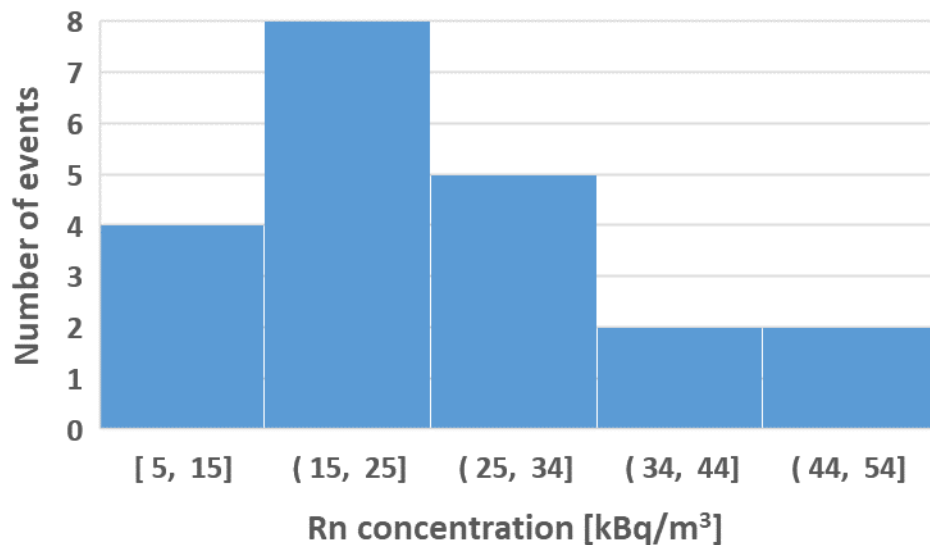




Results – radon in soil and water

21 measuring points of radon Rn-222 in soil gas concentration

	Rn-222 kBq/m ³
Mean	24,4
Median	24,0
St. Dev.	11,9
Minimum	5,2
Maximum	53,8



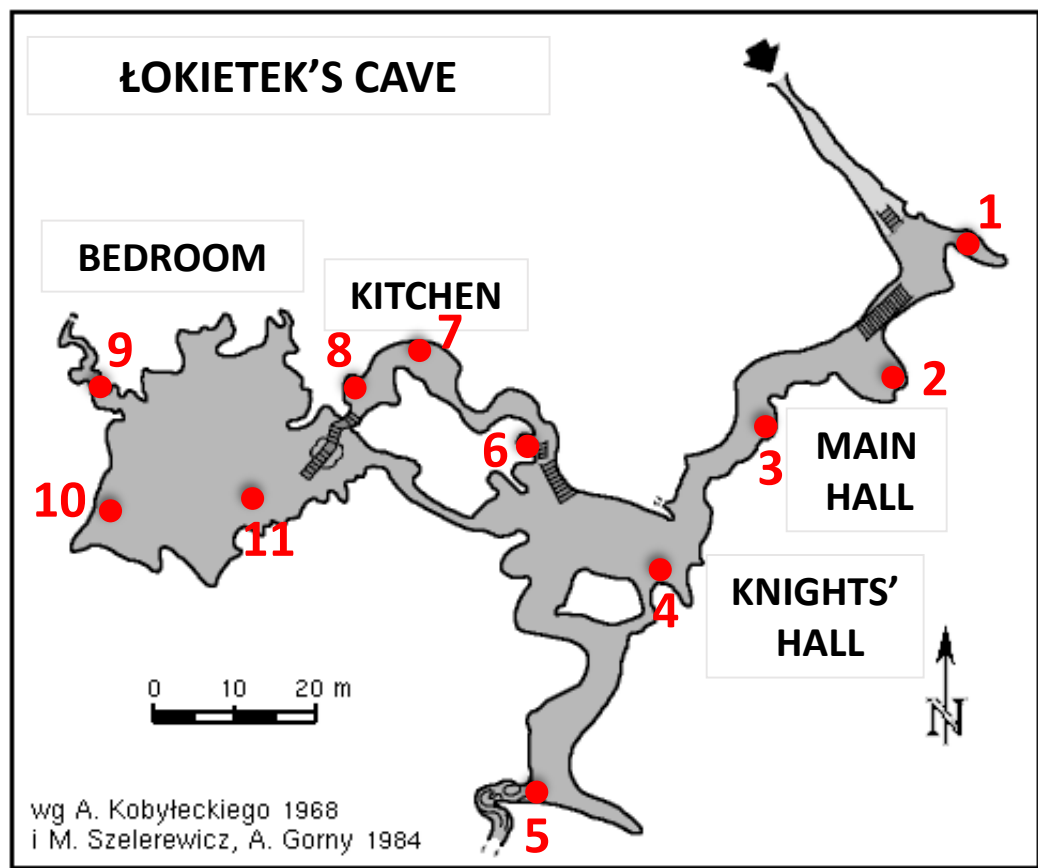
only 4 active spring with water

Spring	Method	Rn-222 [Bq/dm ³]
Młynnik (Mill)	LSC	19 ± 2
Harcerz (Scout)		3 ± 1
Prądnik		3 ± 1
Miłości (Love)		4 ± 1
Młynnik (Mill)	AquaKIT AlphaGUARD	19 ± 8
Prądnik		2 ± 2



Results – radon in caves

Measurements in Łokietek's Cave – **CR-39** track detectors

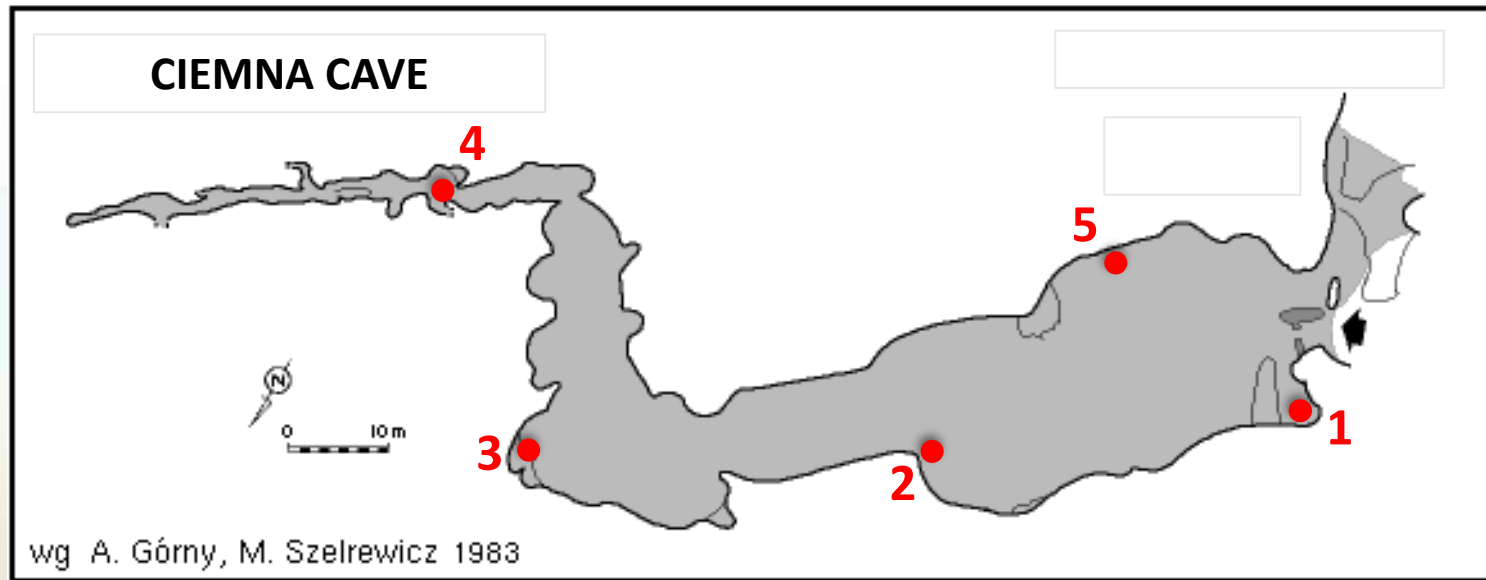


Detectors' location	Rn-222 Bq/m ³
1	647 ± 35
2	402 ± 26
3	lost
4	lost
5	lost
6	543 ± 31
7	490 ± 29
8	508 ± 30
9	lost
10	476 ± 29
11	548 ± 31



Results – radon in caves

Measurements in Ciemna (Dark) Cave – **CR-39** track detectors



Detectors' location	Rn-222 Bq/m ³
1	396 ± 26
2	277 ± 21
3	290 ± 22
4	2 861 ± 107
5	852 ± 42



Summary

- Concentrations of natural radioisotopes in soil [Bq/kg]:

	Poland	ONP
K-40	425 (60 ÷ 1011)	479 ± 103
Ra-226	27.5 (4.3 ÷ 112.0)	36 ± 8
Th-228	23.5 (3.5 ÷ 115.0)	36 ± 6

- Gamma dose rate [nSv/h]:

Poland	Kraków	ONP
92	119 (108 ÷ 128)	121

- Radon concentration in caves:



~3 000 Bq/m³



We would like to thank
director (**Józef Partyka**)
and employees of ONP for enabling
park area for our measurement survey.

We also would like to thank
student research group from the
Jagiellonian University:
M. Dąbrowska, M. Styczeń,
K. Piotrowska, M. Szulik, D. Sikora
for their commitment and field work
during the project.
Their help was highly appreciated.



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