

RADON CHANGES IN COAL BEDS PRONE TO OUTBURSTS OF CH₄ AND CO₂ – PRELIMINARY RESULTS

M. Wysocka, M. Zmarzly
CENTRAL MINING INSTITUTE, Katowice

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Outburst – the description

- Definition (accordingly to Hargraves):
 - Outburst is a sudden release of coal and gas (CO_2 or CH_4) from freshly exposed face during driving of gallery's heads in coal seams,
 - The main reason of this phenomenon is the disturbance of the dynamic equilibrium in the strata
 - The size of released coal particles is small, usually it is a coal dust.

The characteristics

- Very rapid and fast process;
- The pressure of the gas is sometimes so high that parts of the mechanical support or mining equipment can be thrown away for a long distance in the galleries,
- In case of methane occurrence in the gas mixture the release may lead to its inflammation and explosion.

The scale of the outburst

- Nowa Ruda Colliery, 1958
 - A result of the outburst was a release of:
 - 750 000m³ CO₂
 - 5 000 tonns of coal
 - 5 miners were killed

Scientific problem

- Is it possible to apply investigations of radon level in the strata for the support of the prediction of geodynamic phenomena, like outbursts of tremors?

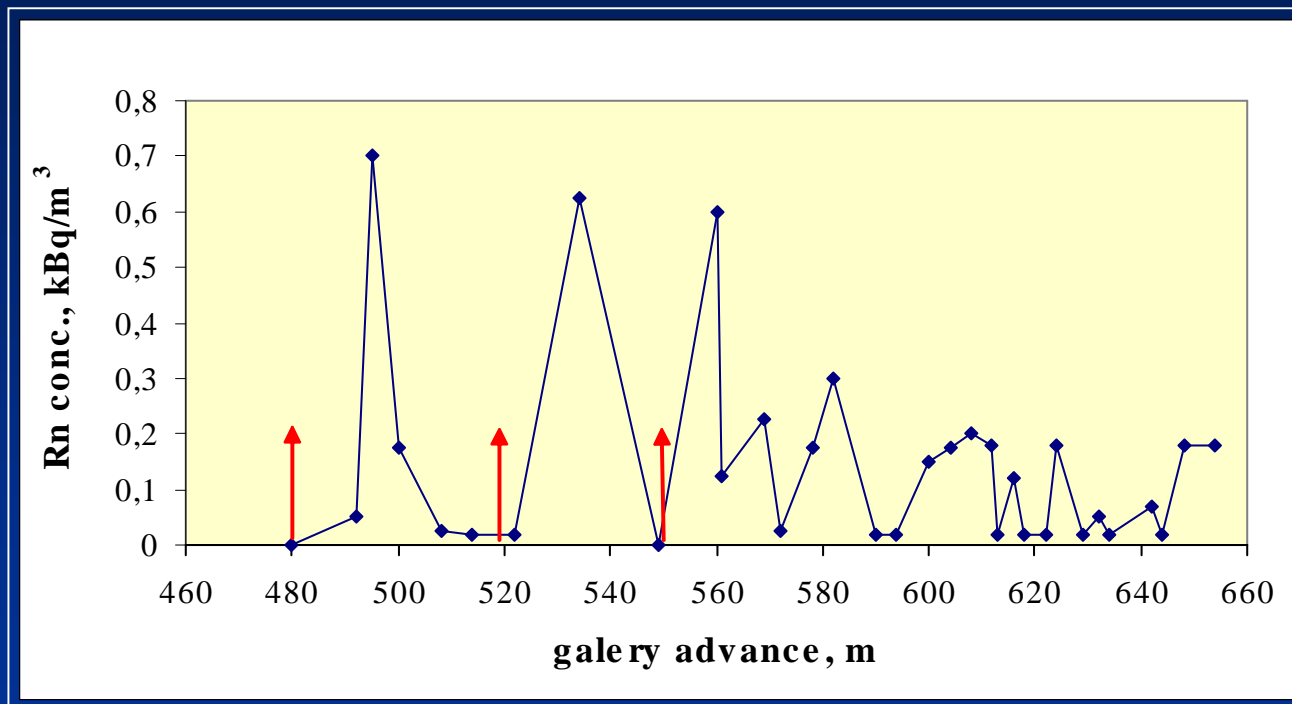
The most important features of radon

- Very low adsorption potential, therefore radon gas is only in small portion adsorbed by coal,
- Emission of radiation, therefore it is relatively easy to measure very low concentrations

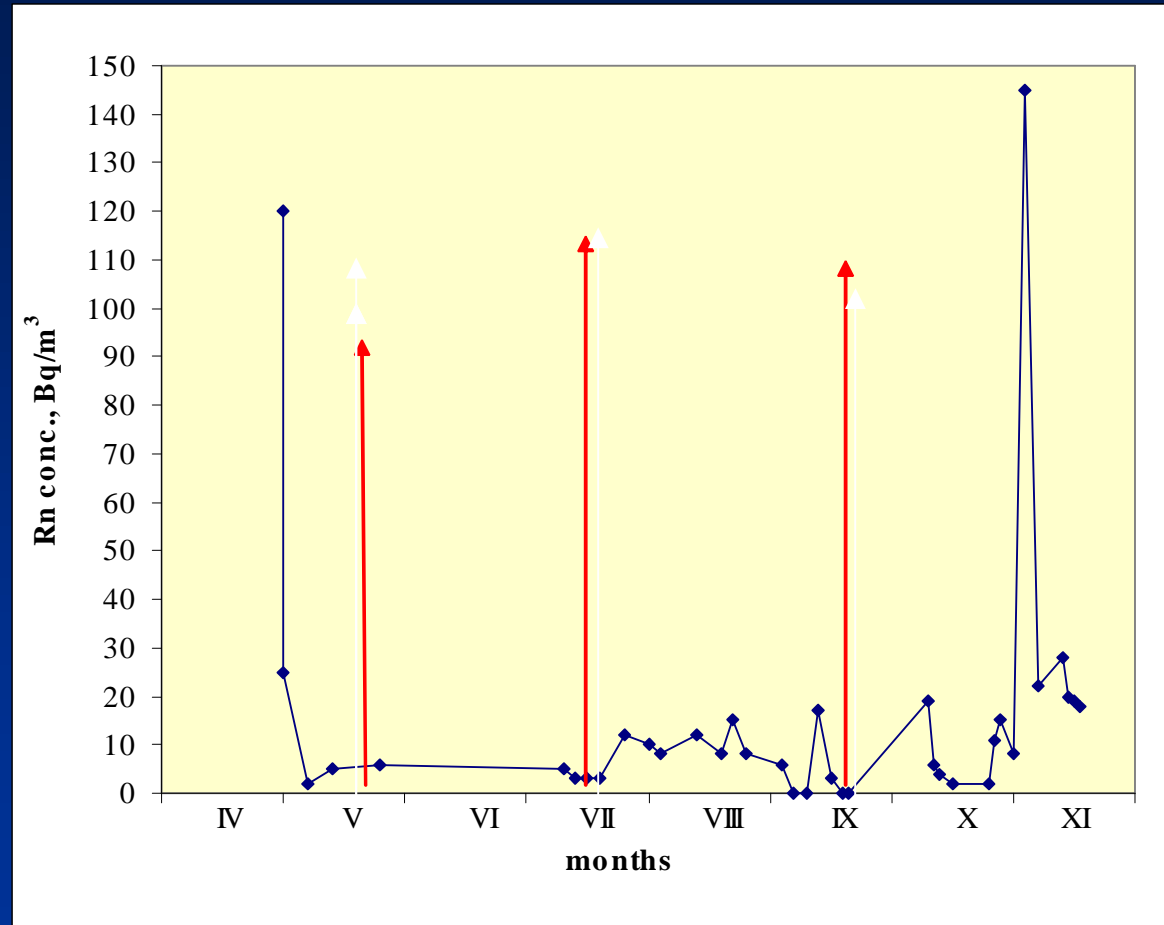
Investigations in the past years

- In 80's of the last century, investigations of radon level in coal seams prone to outbursts, have been done by Jolanta Lebecka and co-workers in collieries of Lower Silesian Coal Basin.
- In 90's investigations of relationship between radon level and tremors have been done in coal and copper ore mines in Poland

Results of investigations Thorez Colliery



Nowa Ruda Colliery



Outbursts in Upper Silesian Coal Basin

- In the past outbursts were not observed in coal mines in Upper Silesia
- For some years in three of Upper Silesian mines outbursts occur.
- In the Zofiówka coal mine in 2005 very serious event of methane and rocks release had happened:
 - 3 miners were killed, 4 were wounded,
 - about 280 m³ of rocks were thrown out
 - within 2 hours after the outburst about 10 000 m³ of methane was released.

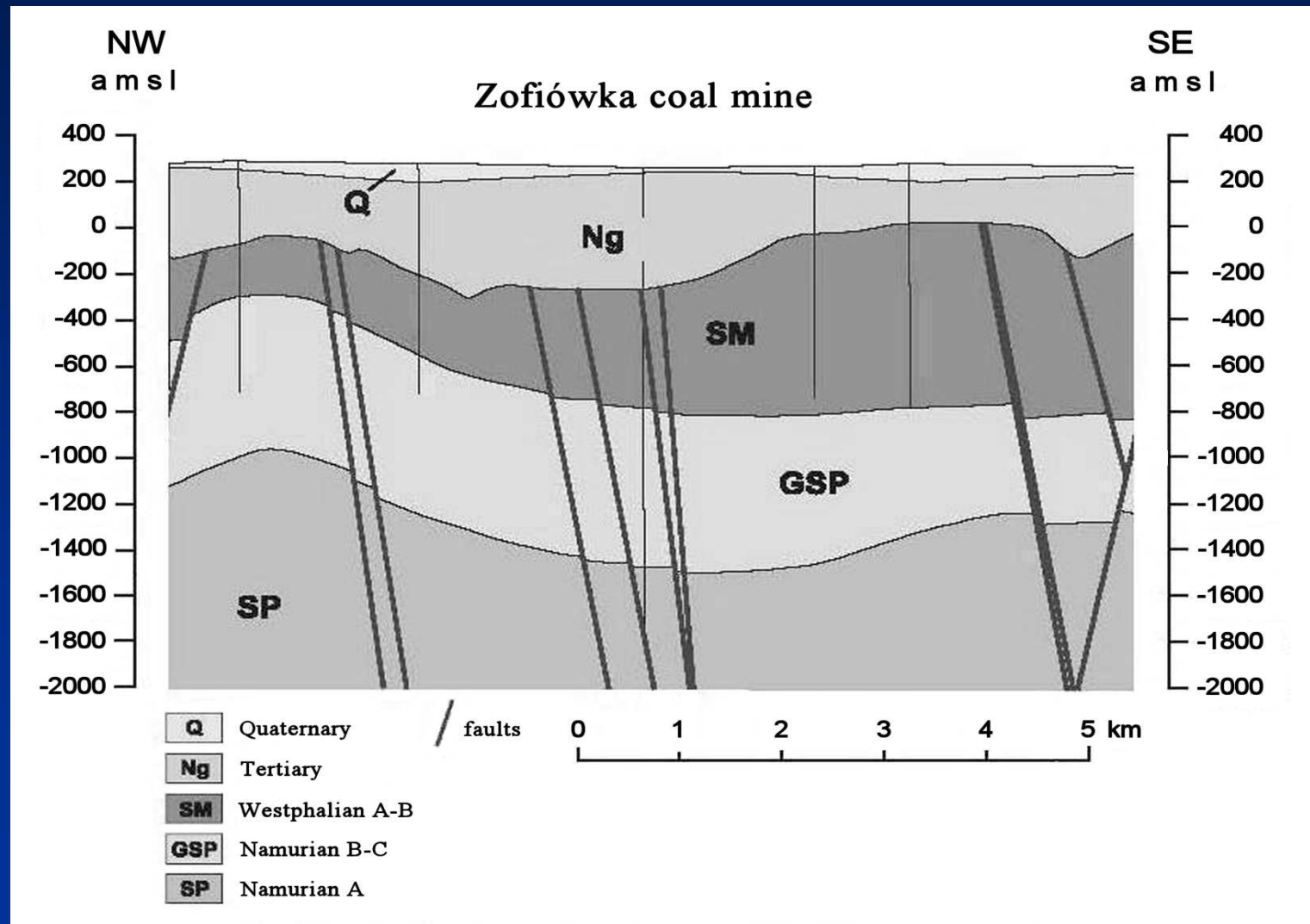
The goal of the investigations in Zofiówka mine

- To find if any correlations between changes of radon in rocks and another indexes are observed
- To support control of the geodynamic phenomena

Investigations in Zofiówka coal mine

- Investigation site: E-3 galery, driven in coal seams 412/upper layer and 413/2 in the area prone to outbursts
- Radon samples are taken from the boreholes drilled in the side-walls and in the roof of the heading of the gallery.
- In the same time obligatory measurements of outbursts' indexes are done
- The comparative level of radon concentration in the gas from the coal seam is measured in the borehole drilled in some distance from the heading

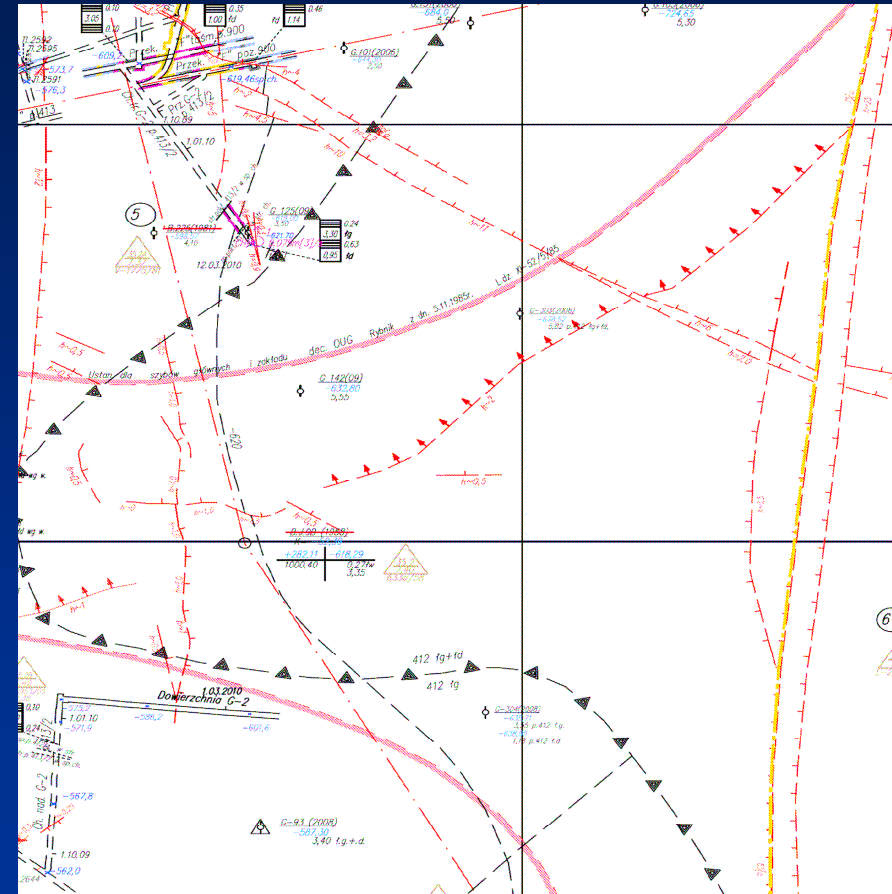
The cross-section of Zofiówka coal mine



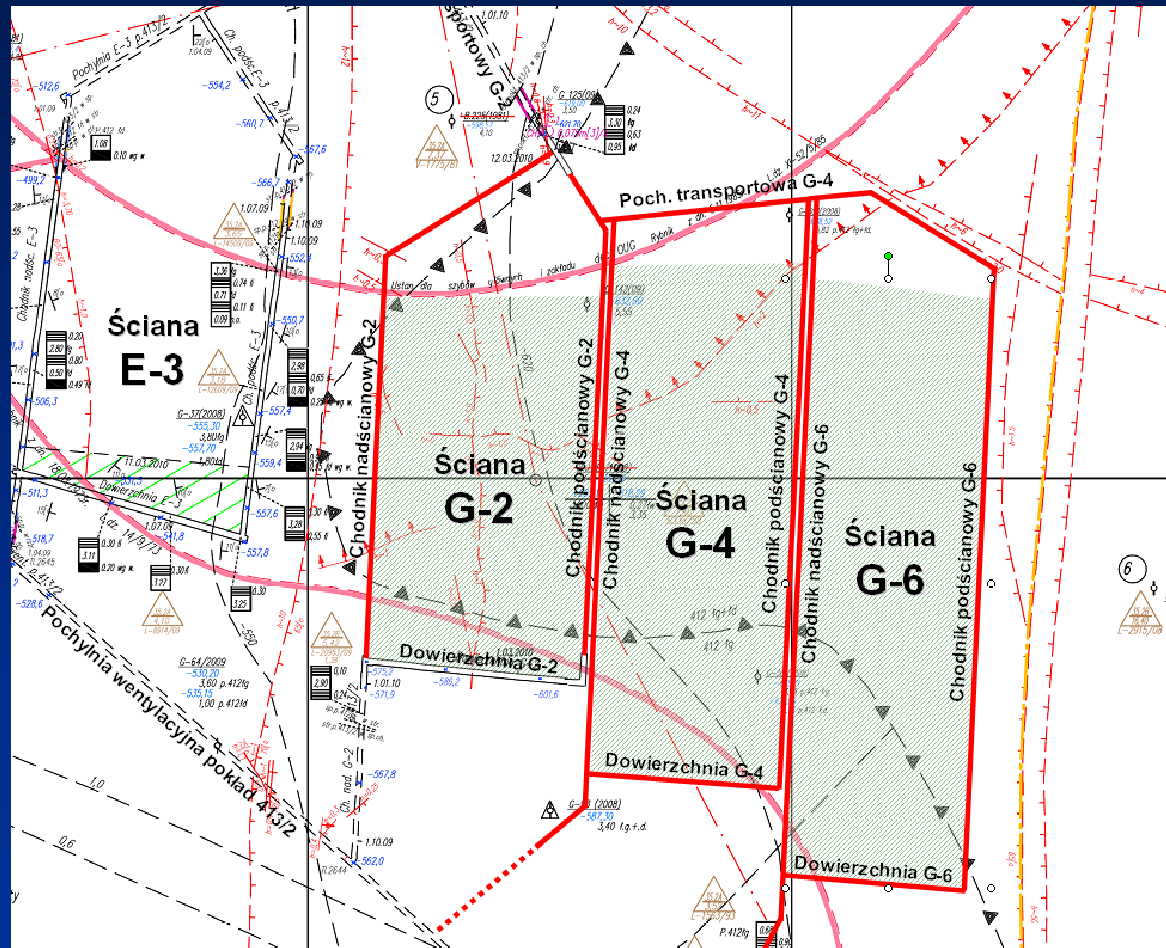
Location of the test site

The depth of -550 m below sea level, at the mining level 900 m. The gallery under observation is driven into the coal bed number 413/2 in so called the Mudstone Series in of the Westphalian A.

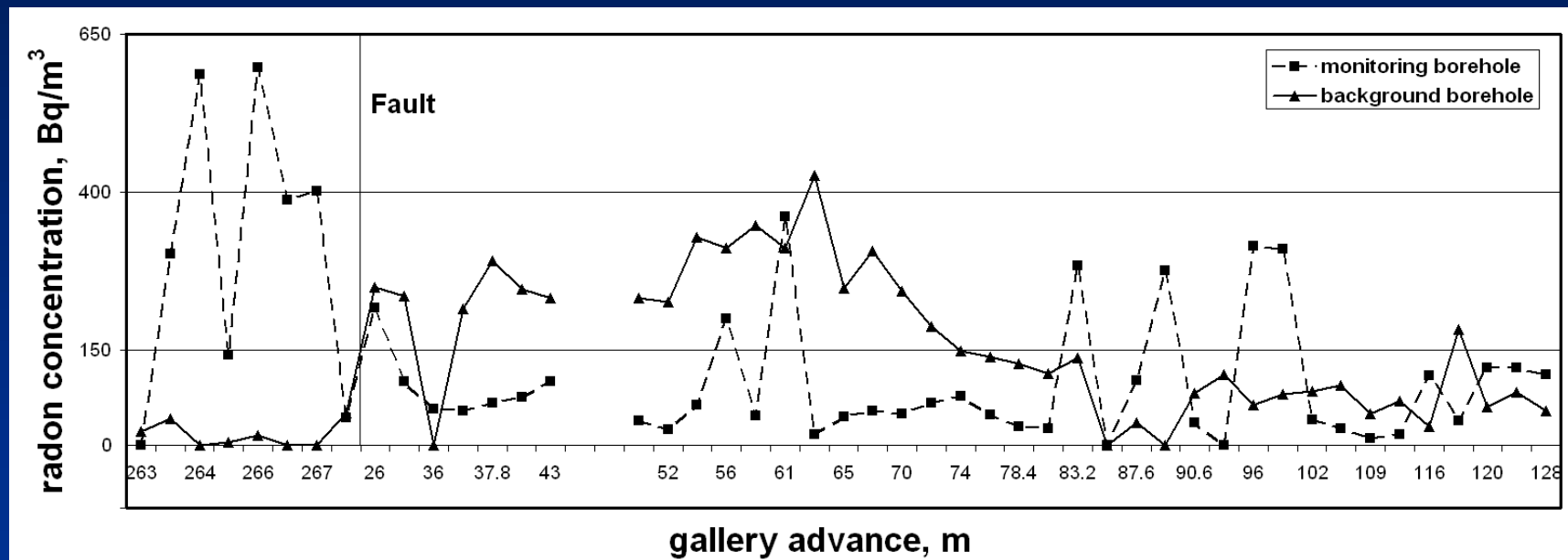
in the head of the gallery numerous faults may occur in the strata.



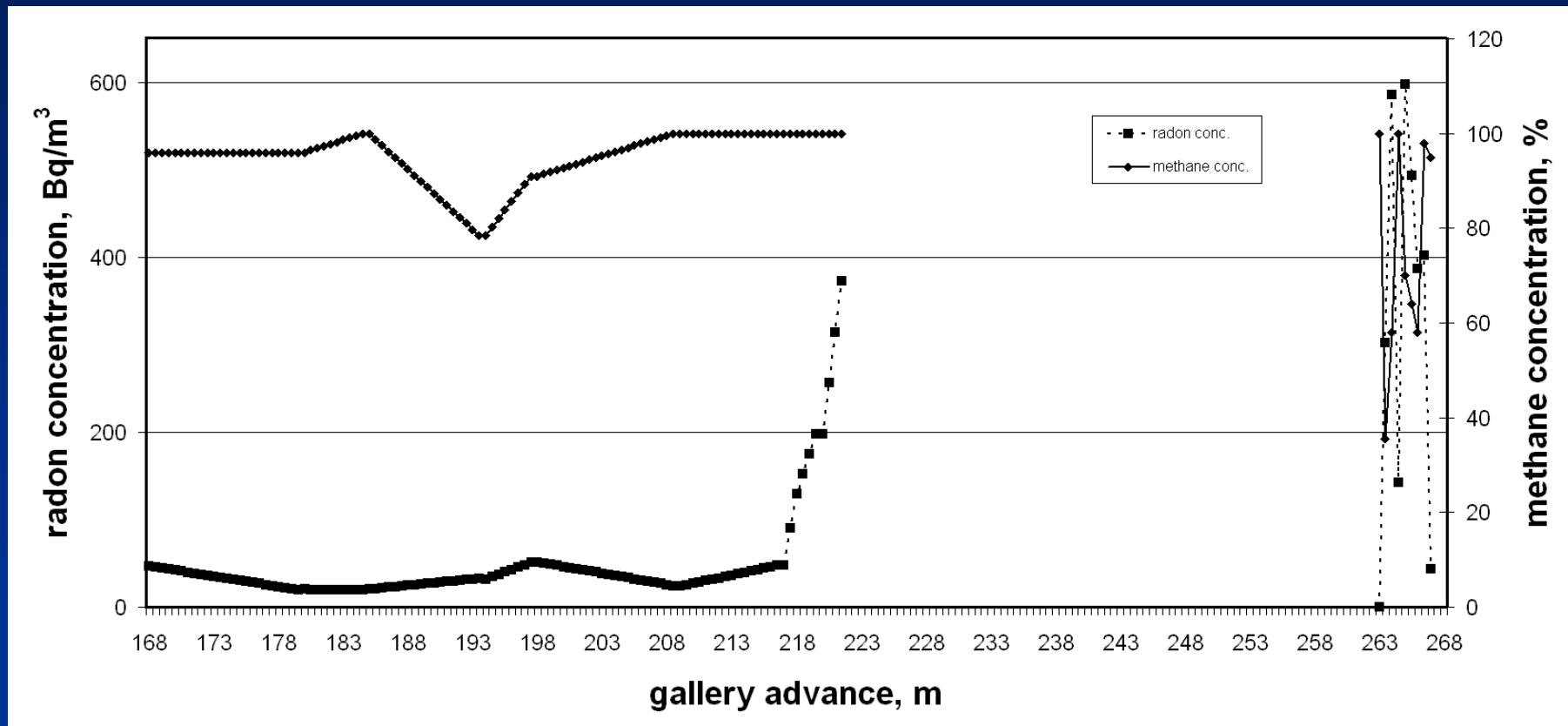
The coal faces advance



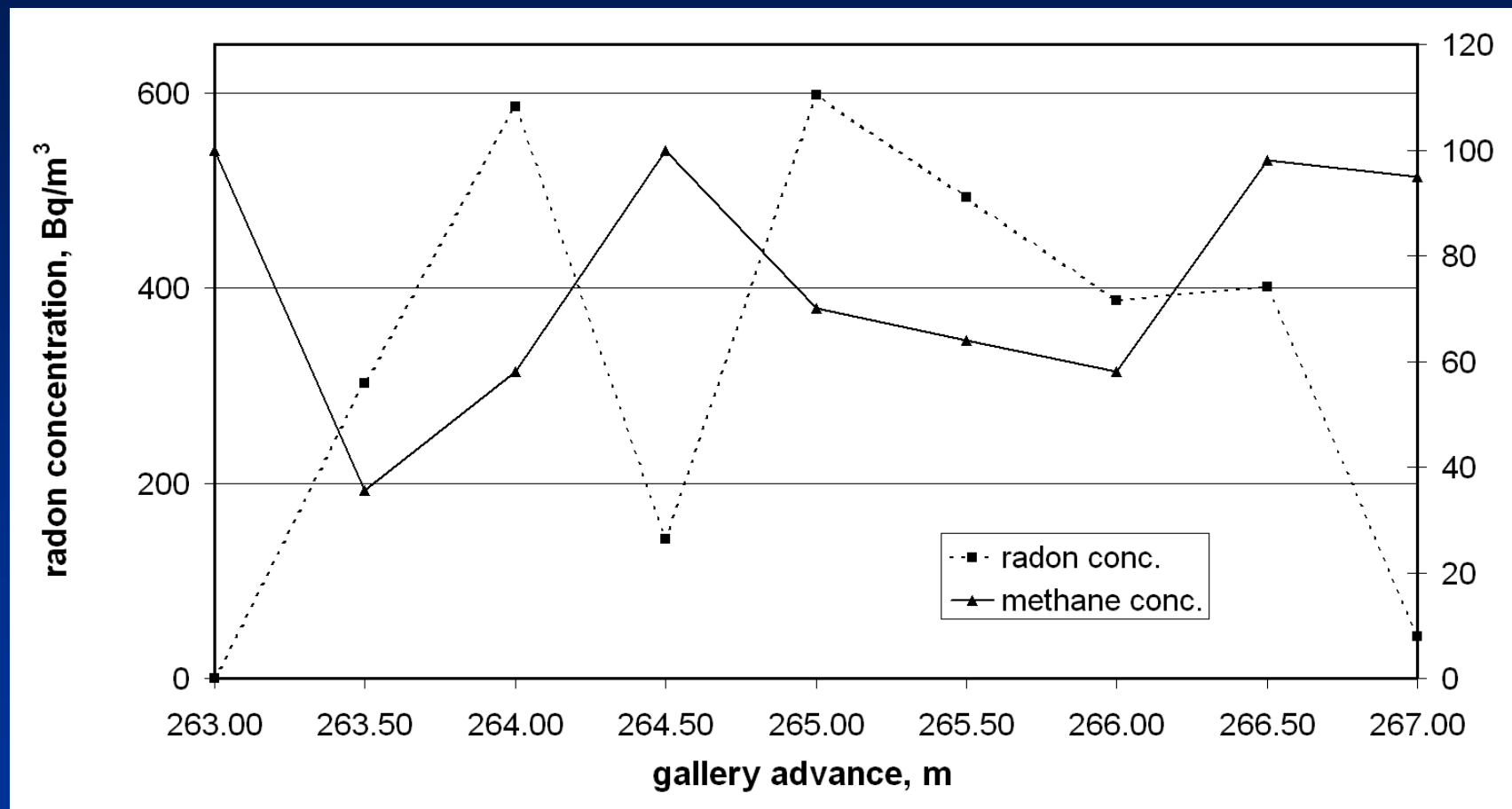
Radon concentration in the background borehole and monitoring ones



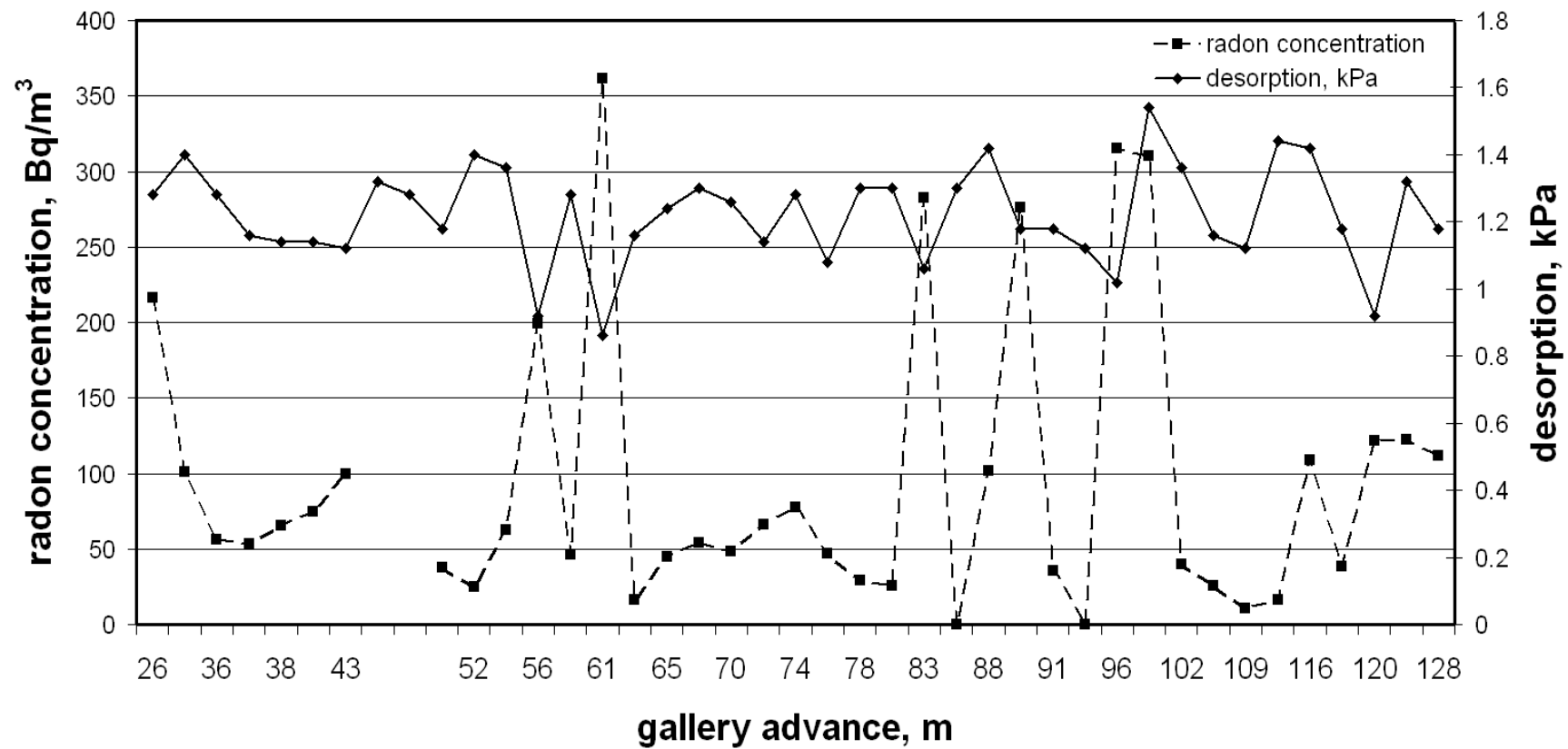
Changes of methane and radon concentration as the function of the gallery advance



Changes of methane and radon concentration as the function of the gallery advance — certain gallery section



Changes of radon concentration vs desorption index



Conclusions

- **Until now, results of preliminary investigations, started in 2009 in the Zofiówka coal mine, were not satisfactory.**
- **During this time no events of gas outburst were observed, despite the frequent occurrence of warning values of other routinely used hazard indicators such as the intensity of gas desorption from coal and methane concentration in seam gas.**
- **However, some interesting correlations have appeared which may suggest a possible relationship between the changes in radon concentrations and particular hazard indicators.**