

# XXXVIII IAH Congress

Groundwater Quality Sustainability  
Krakow, 12–17 September 2010

## Extended Abstracts

**Editors:**  
Andrzej Zuber  
Jarosław Kania  
Ewa Kmieciak



University  
of Silesia  
Press 2010



abstract id: **463**

topic: **0**  
**Keynote lectures**

title: **Occurrence and use of thermal and medicinal waters in Poland**

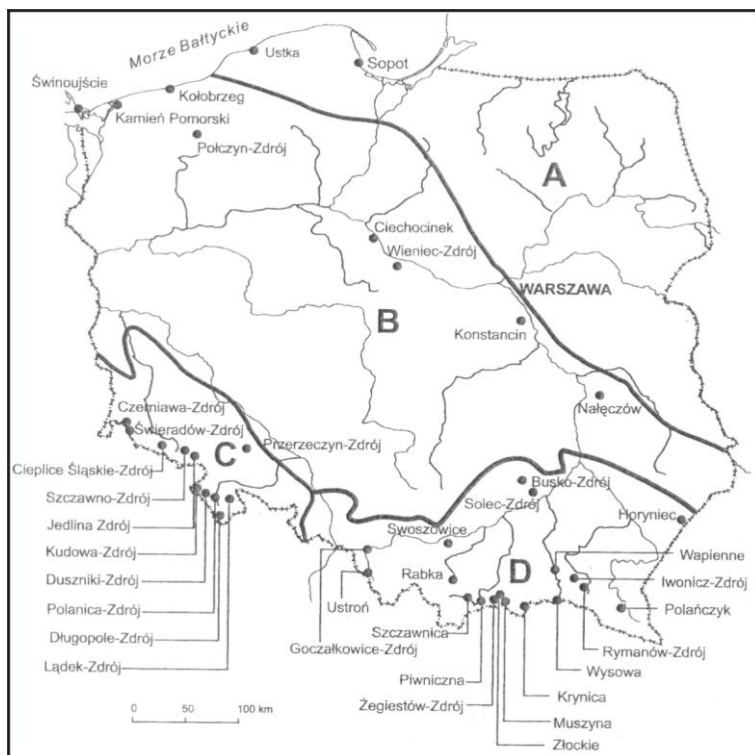
author(s): **Jan Dowgiałło**  
Institute of Geological Sciences, Polish Academy of Sciences, Poland,  
dowgian@twarda.pan.pl

keywords: thermal waters, medicinal waters, Carpathian province, Sudetic province, Polish Lowlands

According to the Polish legislation thermal groundwater is a mineral product and comes under the Geological and Mining Law, voted 1994. Its temperature is by definition 20°C at the outflow from a well or spring. Another type of groundwaters included among mineral products are medicinal (curative) waters. To obtain this qualification a water has to contain at least 1000 mg/dm<sup>3</sup> TDS (mineral water) and/or one or more components of specific biologic impact on the human body (Fe<sup>2+</sup>, J<sup>-</sup>, F<sup>-</sup>, CO<sub>2</sub>, H<sub>2</sub>S, Rn, H<sub>2</sub>SiO<sub>3</sub>) in defined minimum amounts.

It must also be approved by the Council of Ministers. Also a simple thermal water without any specific component may be recognized as medicinal, A business exploiting thermal or medicinal groundwater is reckoned as a mine and, consequently, the extraction and protection of such water must be done under the supervision of mining offices.

Geologically Poland may be divided into 3 provinces: Carpathian (including the Carpathian Mts, and the fore-Carpathian basin, (D on Fig. 1), Sudetic (including the Sudetes Mts and the fore-Sudetic block (C) and the Polish Lowlands province (B, A).



**Figure 1.** Polish health resorts in which mineral and thermal wayers are recognized as medicinal and applied for therapeutic treatments. A — Polish Lowlands, Precambrian platform; B — Polish Lowlands, Palaeozoic platform; C — Sudetes Mts and the fore-Sudetic block; D — Carpathians Mts and the Carpathian foredeep.

1. The Carpathian Mts (D) consist of Inner (Tatra Mts. and Podhale basin) and Outer Carpathians. The Podhale synclinorium is a typical artesian structure supplying considerable amounts of thermal, slightly mineralized water for space heating and recreation, from Eocene and Trias-

sic deposits. Typical of the Outer Carpathians are waters: a) carbonated, b) Cl-Na, c) mixtures of a) and b) types. The origin of c) type waters is an object of discussion as some scientists consider them to have been released from clayey sediments during the process of their diagenesis, while other ones tend to attribute their saline component to relic sea waters. The a) type waters are grouped mainly in the Poprad R. catchment, recognized as medicinal and used in numerous health resorts like Krynica or Muszyna. Waters of b) type occur within the flysch formation, sometimes appearing as springs which were the ground for founding health resorts like Rabka or Iwonicz, but generally at depths of several hundred m. They are often connected with oil and gas deposits. Springs of c. type water also appeared formerly as springs and allowed to start the therapeutic activity (e.g. Wysowa, Szczawnica, Rymanów). At several places drilling aimed at increasing the medicinal water amount was successful. However the flysch is generally typical of low permeability and yields are scarce from boreholes except those situated in fault zones. This is the reason why the use of thermal waters for heating purposes (to be certainly found in deep boreholes) did not develop here so far. The Carpathian fore-deep provides saline waters from thick Miocene sediments. These waters occur often in connection with gas deposits. Waters connected with evaporite (gypsum) deposits of Badenian age contain often considerable amounts of H<sub>2</sub>S, a product of sulfate bacterial reduction, and are used for therapeutics in health resorts like Busko, Solec or Horyniec.

2. The Sudetes Mts. (C) are an area, where in a number of renowned health resorts mineral and thermal waters are recognized as medicinal and used for healing treatments. The most common type of these waters are carbonated ones, appearing in springs and shallow wells situated in areas where faults cut crystalline Precambrian and Palaeozoic formations (Świeradów, Duszniki) Sometimes they occur also in sedimentary formations of Carboniferous (Szczawno) or Cretaceous (Polanica, Kudowa) age. Slightly mineralized thermal waters appear in springs at Łądek (gneiss) and at Cieplice (Carboniferous granite). Spring water temperature at Łądek does not exceed 29°C while 700 m. deep drilling provided water of a temperature over 45°C. Natural springs at Cieplice supplied water of maximum temperature 43°C. A 2000m deep borehole resulted in an spontaneous water outflow (40 m<sup>3</sup>/h) with temperature exceeding 86°C. The Sudetic thermal waters are of meteoric origin and owe their temperatures to deep circulation enabled by considerable altitude differences and a dense network of dislocations rather than to the tetrrestrial heat flow, which in most parts of the massif does not exceed 60 mW/m<sup>2</sup>.

3. The Polish Lowlands province is typical of a thick Cenozoic series covering in its NW part (B) the formations belonging to the Caledonian platform and in the SE part – to the Precambrian platform. Thick Palaeozoic and Mesozoic series occur in the western part of the province while to the East they are thinning or even do not exist. (A). Zechstein evaporites form in the western part numerous salt structures penetrating into the Mesozoic and being there the source of groundwater salinization. Another source of salts dissolved in these waters are possibly connate marine waters present in Triassic and Jurassic sediments. In several sites saline waters appear at the ground's surface as for instance at Kołobrzeg, where they have been used for salt production already in the Middle Ages and at present are applied as medicinal mineral waters in the local health resort. Other sites where saline groundwaters are used for curative purposes are: Świnoujście, Międzyzdroje, Ciechocinek etc. At Ciechocinek thermal saline water was reached in Lower Jurassic sediments by drilling to around 1300 m. Recently another drilling was carried out in Toruń and over 60°C thermal water was reached in the Lower Jurassic at

depth exceeding 2000 m. Thermal waters from Jurassic and Cretaceous sediments are used for space heating and recreation in other sites of the western part of Polish Lowlands at Pырzyce, Mszczonów, Uniejów etc. This is possible due to high heat flow density which at places exceeds 90 mW/m<sup>2</sup> as well as to good reservoir parameters of a considerable part of the Mesozoic series. The possibilities of medicinal and thermal waters use in the eastern part of the Polish Lowlands is considerably limited because of low heat flow density and thinning or even absence of Permian and Mesozoic formations.

#### **REFERENCES**

The number of relevant references amounts to several hundred and they cannot be listed here.



**International Association of Hydrogeologists**



**AGH University of Science and Technology**

**2-vol. set + CD**  
**ISSN 0208-6336**  
**ISBN 978-83-226-1979-0**