

Title:

Geothermal conditions of the Mesozoic formations of the Miechów Trough

Abstract:

The aim of the research presented in the doctoral dissertation was to recognize the geothermal conditions of the Mesozoic formations of the Miechów Trough understood as a structure within the Permian-Mesozoic units of the Polish Lowland delving into the Miocene of the Carpathian Foredeep and the flysch of the Outer Carpathians.

The topic was analysed based on archival materials (PIG, PGNiG, health resorts: Busko-Zdrój, Solec-Zdrój and Hydrogeotechnika Sp. z o. o.), works carried out as part of projects conducted at the Department of Fossil Fuels, Faculty of Geology, Geophysics and Environmental Protection AGH, literature studies, as well as author's own research and observations focusing in particular on hydrogeochemical characteristics of waters.

The dissertation consists of 8 chapters, out of which chapters 1 to 4 introduce into the geological, lithostratigraphic and hydrogeological characteristics of the Mesozoic formations of the studied area. For further analysis focused on thermal and hydrogeochemical characteristics described in chapters 5 and 6, the following sediments were specified: the Upper Cretaceous (above Cenomanian), the Upper Cretaceous - Cenomanian, the Lower Cretaceous, the Upper Jurassic, the Middle Jurassic, the Lower Jurassic, the Upper Triassic, the Middle Triassic (Muschelkalk) together with the Upper Variegated Sandstone and the Lower Triassic (Lower and Middle Variegated Sandstone). Chapter 7 depicts the summary of analyses and selection of perspective regions in the studied area for the anticipated use of groundwater (including geothermal) for heating, recreational, therapeutic and industrial purposes. Chapter 8 is a summary of all the research presented in this dissertation and the indication of the main conclusions.

Thermal characteristics of the research area were made by adopting the distribution of a geothermal gradient calculated by another author as part of the work carried out at the Department of Energy Resources. The geothermal gradient allowed the author to calculate the depth temperature distribution at the depth of the tops of the discussed Mesozoic formations and the depth of the 20° C, 60° C and 100° C isotherms. These distributions are shown on the maps attached.

A particularly important aspect discussed in this dissertation is the hydrogeochemical characterization of the waters of the Mesozoic formations based on the interpretation of results of chemical analysis of 646 samples of water from 373 wells located in the studied area.

Based on the methodology developed by the author, hydrogeochemical gradients for each of the discussed Mesozoic reservoirs were calculated. This calculation facilitated the

estimation of the distribution of TDS values shown on the maps attached, and allowed to depict the phenomenon of hydrogeochemical anomaly. The next stage in the hydrochemical characterization of the research area was the development of maps for the occurrence of various types of chemical waters (determined based on the Altowski-Szwiec classification). It was facilitated by the proposed by the author classification of waters where all types of water are divided into 13 groups into bicarbonate, sulphate, chloride and mixed (based on anion-cation division). Further – pointing out on the presence of elements in waters, considered as therapeutic (so-called specific) was aimed at drawing attention on therapeutic (iodide, silicon, ferruginous, hydrogen sulfide waters) or industrial (iodine, bromine, magnesium) water use. The results are presented on the maps attached.

The chemical composition of waters was also used to make an attempt to interpret water exchange conditions, which are one of the key factors affecting the water exploitation. The interpretation was based on the calculated values of hydrochemical indicators: waters' metamorphism waters, water sulfaticity and genetic – Vinogradov's, as well as the value of TDS. The indicators have been grouped into the characteristic ranges having prognostic significance and presented on the maps attached with an additional division into depth intervals. A discussion was conducted on the relationship between the occurrence of individual groups of chemical types of waters and the value of hydrochemical indicators with the occurrence and influence of Miocene evaporites - chlorides and sulphates and dispersed bitumens and their deposits on the waters of the Mesozoic formation. The interpretation also takes into account the distance from recognized or probable recharge areas, the depth of the tested aquifers and the possible impact of faults. The analysis and interpretation of hydrochemical indicators allowed to draw some conclusions confirming the conditions of good, difficult and very difficult water exchange for some regions.

The summary of the description of geothermal conditions are proposals for the use of geothermal water that can be implemented in different regions of the studied area. Author indicates perspective areas for the use of geothermal water for heating, recreational and curative purposes, also recovery of iodine, bromine and magnesium as well as salt production (from groundwater, not necessarily geothermal). The base for selecting prospective areas is simultaneous fulfillment of the set conditions regarding the temperature criterion, TDS, depth of reservoir top (based on the developed distribution of these parameters for the discussed Mesozoic formations and concentrations of valuable components for industry and descriptive – discharge of well criterion (based on published materials).