

Calculations of the elastic parameters (velocity of P-waves and S-waves) and bulk density for selected wells from the Western Carpathians

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The paper presents results of calculation of the following elastic parameters: compressional wave velocity (VPEQ), shear wave velocity (VSEQ), velocity ratio VPEQ/VSEQ, acoustic impedances for either wave (AIPEQ, AISEQ), and bulk density (RHEQ). Elastic parameters were calculated for different lithostratigraphic series from fourteen selected boreholes from the Western Carpathians for which results of the quantitative interpretation of well logs were available. The analyzed area is located in the Polish Carpathians between Bielsko-Biała and Nowy Targ.

Those series contain Precambrian, Cambrian, Devonian (Lower, Upper and Middle), Carboniferous (Lower and Upper), Triassic, Jurassic, Cretaceous, Miocene and Paleogene rocks. The calculations were made for very different lithology, which was characteristic for those stratigraphic series, with the use of the *Estymacja* computer program written by Maria Bala and Adam Cichy within the research project No 8 T12B 046 20.

The idea of the method of estimation of P-waves and S-waves elastic parameters was based on known theoretical models (e.g. given by Biot-Gassmann or Kuster-Toksöz) relations which describe multiphase media corresponding to rocks with granular structure (grains: solid phase) filled with pore saturating medium (liquid phase, gas phase, solid phase). Elastic parameters of rocks are a resultant of all phase components: rock matrix and medium, and depend on relationships between components of the rock medium and isotropy or anisotropy of the rock skeleton. The computer program *ESTYMACJA*, allows elastic parameters of the rocks to be determined from results of integrated analysis of well logging data i.e. lithology, porosity and water, gas and oil saturation in the flushed zone or virgin zone. In our calculation the theoretical Biot-Gassmann's model was used.

Those calculations were made for rocks in the A – 3 well, Ch -1 well, D – 6 well, J – 2k well, L-3a well, L - 7 well, R - 3 well, Ś – 1 well, W – 6 well, W – 1 well, W - 3 well W-4 well, Z – 1 well.

Averaged values of estimated velocities VPEQ and VSEQ, VPEQ/VSEQ ratio, acoustic impedances (AIPEQ, AISEQ), and bulk densities RHEQ for each stratigraphic units together with lithology description were used to create a generalized set of parameters for groups of nearest wells or boreholes situated at the same profile. However, due to great variability of rocks belonging to different lithostratigraphic units, only the results from the nearest wells were compared.

The characteristics of VPEQ and RHEQ variability was performed for selected wells and stratigraphic series. One can observe a great variability of studied parameters, even for the same series and the same lithology. Results of estimated elastic parameters and bulk densities, presented in this paper, characterize a rock model with much varied lithostratigraphy.

Natural reservoir systems in the Tertiary section of the East Rhodope depression and perspectives for storage of natural gas and carbon dioxide

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The East Rhodope Depression situated in South Bulgaria is a Paleogene superimposed structure. It is mostly filled with Tertiary sedimentary, sedimentary-volcanogenic, and