

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

volcanic rocks. The tectonic low-order elements distinguished in it are specific volcano-tectonic, block, and block-fold structures. The subjects of our study are the aquifer layers (reservoir systems) situated in these structures investigated from the point of view of the possibilities, if other favorable conditions for storage of natural gas and carbon dioxide (CO₂) exist. Special studies carried out by the authors in the limits of the perspective structures are concentrated mostly on the: lithological-physical segmentation of the Tertiary section; defining of permeable and hard-permeable formations and their studying (structure, lithology, reservoir and sealing parameters, spatial behavior); defining of natural reservoirs and studying their spatial relationships; prognosis of possible types of local structures and natural traps. Because of the restricted volume and the absence of specialized information for a number of important geological preconditions and parameters, prognostic assessments are made with the use of indirect data, based on the contemporary ideas about the geological evolution of the examined region. Such are the structural-tectonic, the seismotectonic and the hydrogeological (hydrochemical, hydrodynamic) and the thermo-baric conditions. The prognoses concerning the perspectives for storage of natural gas and CO₂ are related to the sunken areas within the Dzhebel and Krumovgrad depressions.

Loss of ⁴⁰Ar(rad) from leucite-bearing basanite at low temperature: implications on K/Ar dating

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The Bakony-Balaton Highland Volcanic Field (BBHVF) is located in the central part of Transdanubia, Pannonian Basin, with over 50 alkali basaltic volcanoes. The volcanism was related to the post-extensional tectonic processes in the middle part of the Pannonian Basin. The basanite plug of Hegyestű erupted in the first phase of volcanic activity. It overlies Triassic limestone and dolomite forming a double hill. Since there is no clear evidence of explosive eruption history, Hegyestű is likely either a remnant of a dominantly lava emitting volcanic vent, or remnant of a lava derived from some sources nearby.

Ar/Ar [1] and K/Ar [2] ages were published on the alkali basalt rocks of the BBHVF. Conflicting K/Ar (5.97 ± 0.41 Ma, isochron) and Ar/Ar (7.78 ± 0.07 Ma, isochron, 7.94 ± 0.03 Ma, plateau) ages were measured on the leucite-bearing basanite of Hegyestű. As it has been shown, this effect is caused by the special Ar retention feature of leucite in this basanite.

In a new study 18 K/Ar ages were measured on subsamples of HT-4 and on its fractions produced by magnetic and heavy liquid separation. 18 K/Ar ages measured in the usual way were 25 – 45 % younger, but after HF or HCl treatment of the rock, or after reducing the baking temperature of the argon extraction line from 250 °C to 150 °C, they became similar to the Ar/Ar ages.

HCl treatment dissolved olivine, nepheline, leucite, magnetite and from 1-1 sample analcime or calcite. K dissolution studies on 6 samples from different locations of Hegyestű have shown that K content is mostly ~2 %, but it may decrease to ~0.3 %. HCl treatment dissolved 19 – 32 % of the rocks, 28.0-63.5 % of the K content, reduced the K concentration of the residue to 1.1 – 0.3 %, and for the dissolved part of samples with ~2 % K, the calculated K concentration was 4.02 – 6.42 %. These data and EMP analysis suggest leucite is the responsible mineral for the low temperature loss of ⁴⁰Ar(rad) during baking the extraction line, though a minor role of nepheline can not be excluded.

Ar may release at low temperature from very fine-grained mineral, or when the Ar release mechanism changes. A ⁴⁰Ar(rad) degassing spectrum has been recorded in the 55 –