

## EVALUATION AND UTILISATION OF LIGNITE DEPOSITS OF THE CZECH REPUBLIC

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### ABSTRACT

Tens of billion crowns were investigated after the 2<sup>nd</sup> world war in prospecting, exploration and exploitation of Czech lignites. During this period an immense quantity of information has been collected but not systematically evaluated. It is reality that hitherto synoptic evaluation of geology, mining, deposits and coal preparation are non-systematic as well as its scope is rather limited. The aim of the project was systematic evaluation of all results according to uniform criteria which would lead to obtaining of general synopsis of all lignite basins of the Czech Republic both in view of their structure and development and from the viewpoints of deposits and their mining. The obtained results summarized in the book written in Czech with the title: „Lignite deposits in the Czech Republic and their utilisation“ can be applied by state administration bodies and institutions administered by them for assessing of coal resources. They can be applied also for solving of ecological problems connected with mining activity.

**KEYWORDS:** lignite, deposit, geology, mining, composition, utilization

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### 1. INTRODUCTION

Tertiary lignite is extracted mostly from large open-cast mines (99 %) in the North Bohemian (NBB) and Sokolov basins (SB) and from one underground mine in the North Bohemian Basin and the South Moravian coal district of the Vienna Basin. Other deposits in Cheb, Žitava, České Budějovice and Uhelná basins, and the Czech and Moravian Tertiary relics were closed. The attention was also paid to the evaluation of Cretaceous coals from the deposits near Moravská Třebová and in Prague-Hloubětín. The results of project provide a critical assessment of a collection of information on geological, hydrological and mining conditions in deposits, on results of the palynological, petrological and geochemical records from all the Tertiary and Cretaceous coal basins in the Czech Republic which have been summarized in monography prepared in print. The collection was created through the acquisition of published or stored in archives, including calculations of coal reserves held by the

Czech Geological Survey-Geofond (the state organization responsible for storing unpublished reports and manuscripts). These data were supplemented by the petrological, geochemical and technological parameters of 70 new lignite samples.

### 2. RESULTS AND CONCLUSIONS

1. The monography with the title „Ložiska hnědého uhlí na území České republiky a jejich využití“, was accepted to print by the publishing department of the Czech Geological Survey in Prague. It contains 283 pages, 92 tables and maps and 86 pictures, and it is composed from follows chapters:

- Introduction – J. Pešek
- Brief geological characteristics of the Czech Republic area – R. Brzobohatý, J. Pešek
- Volcanic rocks – J. Ulrych
- Cretaceous and Tertiary climate - Z. Kvaček, J. Kvaček, V. Teodoridis, K. Holcová

- Krušné Hory Piedmont basins
    - The North Bohemian (Most) Basin - **A. Elznic**, **V. Macůrek**, B. Brož, O. Fejfar, J. Dašková, J. Krásný, Z. Kvaček, R. Mikuláš, J. Pešek, ed., J. Spudil, I. Sýkorová, V. Teodoridis, F. Titl
    - The Sokolov Basin - **P. Rojík**, J. Dašková, J. Krásný, Z. Kvaček, J. Pešek, ed., I. Sýkorová, V. Teodoridis
    - The Cheb Basin - **P. Rojík**, O. Fejfar, J. Dašková, J. Krásný, Z. Kvaček, J. Pešek, ed., I. Sýkorová, V. Teodoridis
  - Hrádek part of the Žitava Basin and carbonaceous Tertiary relics in the area of the Bohemian Massif – **S. Opluštil**, J. Dašková, J. Krásný, Z. Kvaček, J. Pešek, ed., I. Sýkorová, V. Teodoridis
  - South Bohemian Basins - **J. Spudil**, J. Dašková, K. Holcová, J. Krásný, Z. Kvaček, J. Pešek, ed., M. Svobodová, I. Sýkorová, V. Teodoridis
  - The continental and marine Tertiary relics in the area of the Bohemian Massif - **J. Spudil**, Z. Kvaček, J. Pešek, I. Sýkorová, V. Teodoridis
  - The Carpathians fordeep and Neogene in its surroundings - **P. Pálenský**, J. Adámek, R. Brzobohatý, Š. Hladilová, Z. Jurová, O. Krejčí, J. Pešek, ed., J. Šíkula, L. Švábenická, P. Tomanová-Petrová
  - Vienna Basin - **J. Honěk**, **J. Franců**, I. Cicha, N. Doláková, R. Mikuláš, J. Pešek, ed., R. Pipík, I. Sýkorová, P. Tomanová-Petrová
  - The Carpathians flysh - **M. Bubík**, J. Krásný, R. Mikuláš, J. Pešek, ed., L. Švábenická
  - Overview of deposits and mineral sources fixed of freshwater Cenomanian and Tertiary basins in the area of the Czech Republic - B. Brož, J. Spudil.
  - Reference and Index.
2. Thirty seven samples from the mined Tertiary basins (the North Bohemian Basin, Sokolov Basin, the South Moravian Coal Field), twenty six samples from the seven closed Tertiary deposits and seven samples from three Cretaceous deposits have been studied using organic petrographic analyses, proximate and ultimate analyses, activation analyses (INAA and IPAA) methods and scanning electron microprobe with energy dispersive X-ray microanalyses. The bed moisture, calorific values and mean reflectance classify the majority of Czech Cenomanian, Oligocene and Miocene coals as brown coal respectively as lignite and sub-bituminous coals. The high coalified brown coal as a sub-bituminous coal was identified in central parts of the North Bohemian and Sokolov Basins. The highest reflectance values up to 0.56 % have been found in Cenomanian coals and in char-rich coals

from the Sokolov Basin. Most of coal samples represent humic coals with liptinite and inertinite contents lower than 15 vol. % and variable mineral admixtures. Sporinite, resinite and inertodetrinite are the most common macerals in liptobiolithes and sapropelites from the Sokolov, Uhelná and Žitava basins. The clay minerals, particularly kaolinite, quartz, pyrite, and siderite dominate in Czech lignite. Most of the studied major and trace elements are enriched in high-ash samples (up to 69.6 % A<sup>d</sup>), while Mn, W and U show relative enrichment in low ash samples. Correlation analysis record inorganic affinity for almost all the major and trace elements, except for sulphur (up to 13.5 % S<sub>t</sub><sup>d</sup>) and uranium which have a partly organic affinity. Elements such as Cr, Cs, K, REE, Sc, Ti, V, and Zn have been primarily associated with clay minerals while As, Fe, Sb, Co and Cu was probably concentrated in sulphides. Extremely high contents of As, Ba, Co, Cu, Ni, Sb, Th, Zn, Zr, were found only in the Odeř and Ruprechtov localities in the Sokolov Basin (Sýkorová et al., 2007 and Sýkorová et al., 2008).

3. The affinities of Ga and Ge in lignite from the North Bohemian Basin have been studied using sequential extraction (SE) method and element affinity calculation (EAC) based on data from sink-float lignite separation. We found out that more realistic data were obtained from the EAC method with higher affinities to organic matrix of lignite than the SE method. For the SE method it was assumed that there were complete dissolution of selected minerals and release of all incorporated. Discussion on founded significant differences of organic elements affinities of Ga and Ge warned on the problems connected with different dissolution of both elements in acid solvents during the SE method than correspond to their amounts in matching mineral phase (Klika et al., 2009).

#### ACKNOWLEDGEMENT

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TSOP, 59<sup>th</sup> ICCP Annual Meetings: Unconventional Petroleum Systems and Advances in Organic Petrology and Geochemistry, 19-25 August, 2007, Victoria, British Columbia, Canada, 44.

Sýkorová, I., Pešek, J., Mizera, J., Havelcová, M., Vašíček, M., Matysová, P. and Michna, O.: 2008, Petrology and geochemistry of Tertiary and Cretaceous coals in the deposits of the Czech Republic. Volume of abstracts, 11<sup>th</sup> Coal Geology Conference, May 26 to 30, 2008, Charles University in Prague, Faculty of Science, 34.

## ZHODNOCENÍ A VYUŽITÍ HNĚDOUHELNÝCH LOŽISEK ČESKÉ REPUBLIKY

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### **ABSTRAKT:**

Do vyhledávání, průzkumu a těžby ložisek uhlí a doprovodných surovin byly po 2. světové válce vloženy desítky miliard korun. Za tuto dobu se nashromáždilo množství informací, které nebyly souhrnně zhodnoceny. Je skutečností, že celkové zhodnocení geologických, ložiskových, hornických a úpravnických metod je jednak nesystematické, jednak značně nízké. Cílem tohoto projektu byla systematická analýza a zhodnocení všech poznatků podle jednotných kritérií, což umožnilo získat jednotný pohled na všechny hnědouhelné páneve ČR, jak z hlediska jejich stavby a vývoje, tak z ložiskového a hornického hlediska a možnosti dalšího využívání uhlí a doprovodných surovin. Získané výsledky soustředěné v knize s názvem „Ložiska hnědého uhlí na území České republiky a jejich využití“ budou využitelné orgány státní správy a jimi řízenými institucemi pro oceňování uhelných zdrojů a pro potřeby státní surovinové a energetické politiky. Mohou být také využity při řešení ekologických problémů spojených s těžbou.