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COMPARISON OF THE RESULTS OF CALCULATION OF GEOLOGICAL RESERVES OBTAINED BY MANUAL METHOD OF GEOLOGICAL BLOCKS AND CALCULATIONS BYMODERN SOFTWARE

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SUMMARY

This paper presents the results of the calculation of coal reserves obtained by classical method (calculation method of geological blocks), which were compared with the results obtained by the calculation using software. Since this area was explored for long period of time and elaborates were done in past, we came to an idea to compare results from Elaborate with results obtained through software supported analysis of deposit. The compared results indicate that the results gain through classical calculation and through use of software vary within the permissible tolerances for this kind of calculation.

Keywords: *coal reserves, modern software, comparison*

INTRODUCTION

For many years practice in world is to use modern software solutions for all analyzes and calculations related to geological information, to a maximum extent possible, while at us it is not the practice. The problem that arises when calculating the masses is accuracy of the chosen method and time required to obtain results. The easiest way to explain thisis when calculating reserves with method of parallel profiles at a distance ' x ' which is mostly for large mining objects at a distance greater than 100 m, which meaning that we entered into the unknown or we set a hypothesis that between two observed profiles is arithmetic average value of these profiles. This is when the largest errors occur.

The aim of this paper is to compare the results of these methods and identify possibilities and weaknesses of software applications. Theadvantages are speed, accuracy, fast analysis, reliability. Once formed, the database for a depositcan be updated and at any time, on request,we can obtain reserves, quality and other. In the era of information technology we all have possibility to use computers, only thing left to purchase a licensed software and training for the same. The price of such tools for example Rock Works 16 is about $5,000 (single license).

In the analyzed area of 4,5 km^2 belonging to the Sarajevo- Zenica coal basin of BIH processed are 237 boreholes of which data are used to create database. Since the paper treats only reserves, the most important data in the database are boreholes positions and thickness of drilled coal.

The processed data includes data from 237 boreholes drilled in past years in part of Sarajevo-Zenica Coal Basin. Database was developed in software „Rock Works“, which was used for development of 3D model of basin [1].

GEOGRAPHY OF BASIN

Sarajevo-ZenicaBasin is situated between two cities, extending from Sarajevo in the South-East to Zenica in the North-West, and between the two maintains, “Zvijezda“ atNorth-East and „Vranica“at South-West.Two rivers „Bosnia“ and„Lašva“ erodingbasin. The Basin is stretch in north-south axis. Project part of basin area is 4.499.111 m^2.

GEOLOGY OF SARAJEVO-ZENICA BASIN

Sedimentation started about ten million years ago, during the Miocene when the elevation of the Dinarid or Dinaric Alps (which form the mountainous skeleton of Bosnia) had already began. Formed lake was large and with massive sedimentation (about 2400m of deposits was formed). The oldest sediments belong to upper part of the Oligo-Miocene series. Sedimentsconsist of conglomerates, sandstones, marls and clays [2]. Limestone and coal beds are also found. Similar conditions occurred in the early Miocene, and were followed by sporadic volcanic activity. Endemic Congeriahad their main phase of evolution at this time. Middle Miocene deposits are similar to those of the early Miocene. The upper Miocene and Pliocene deposits are characterized by marls, clays, siltstones, sandstones, conglomerates, limestone and coal bed. Geological map shows part of Sarajevo-Zenicacoal basin coal deposits, Fig. 2, [3].

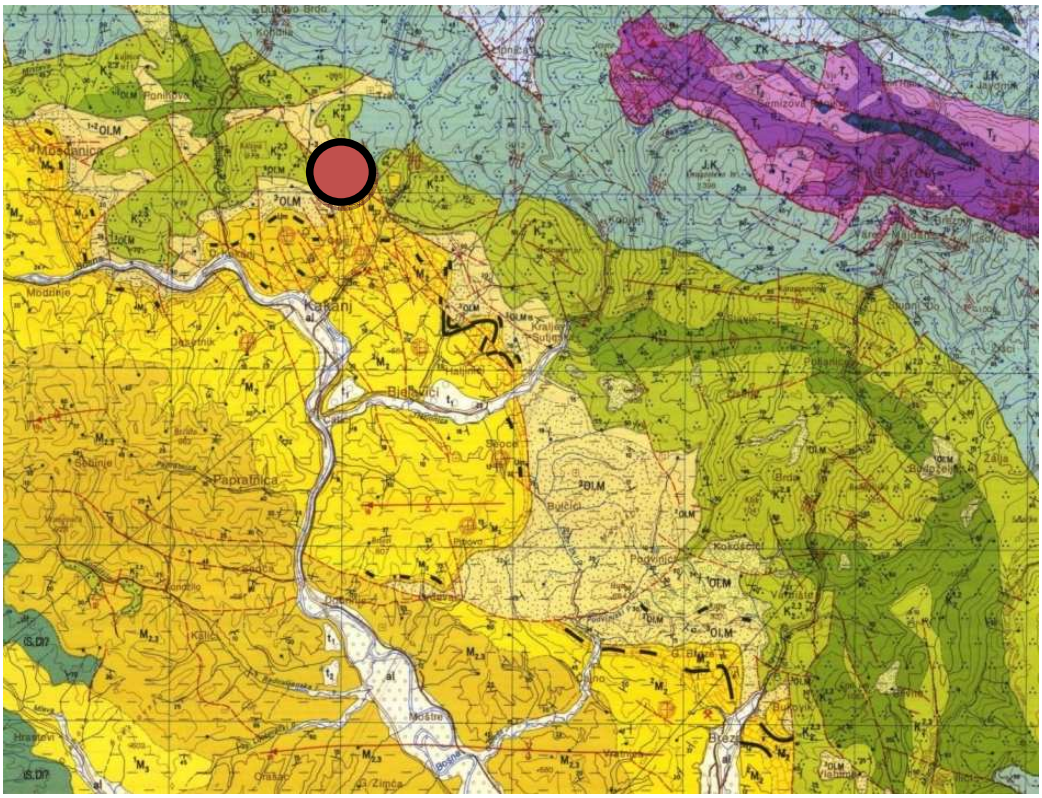

Figure 1 Part of Geological map of Sarajevo-Zenica Coal Basin with location of analyzed boreholes (Source: Basic geological map 1:100000).

CALCULATION BY METHOD OF GEOLOGICAL BLOCKS

Deposit is divided into the blocks based on numerous faults that are present. Method for calculation of blocks is based on average value of thickness of coal layer obtained from boreholes in that block which is multiplied with area of block.

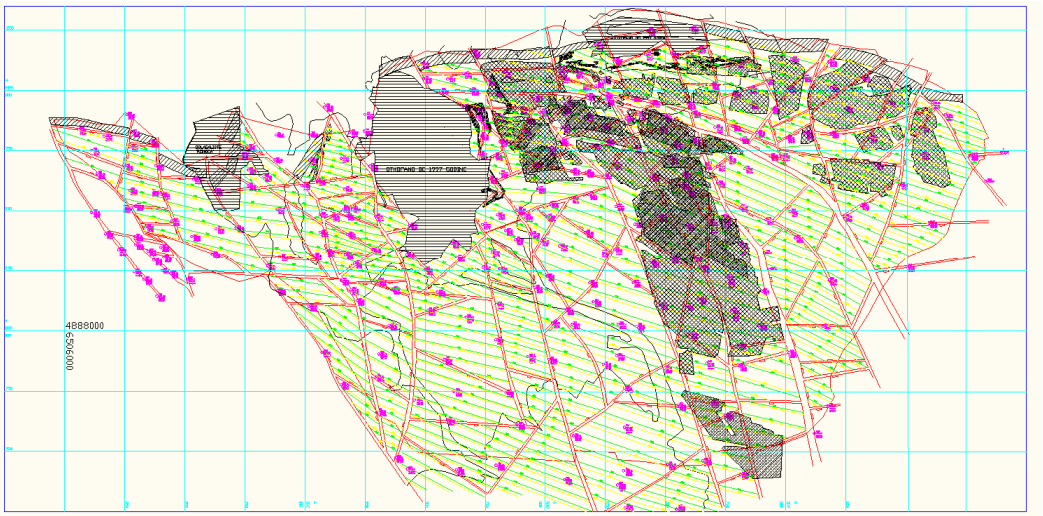

Figure 2 Structural map of deposit

DATABASE

Database consists of data obtained from 237 boreholes. Data includes coordinates of borehole, absolute vertical values of coal layer (top and bottom), data on quality of coal as heatingvalue, content of ash, water, sulfur etc. which are required for analysis of quality of coal.

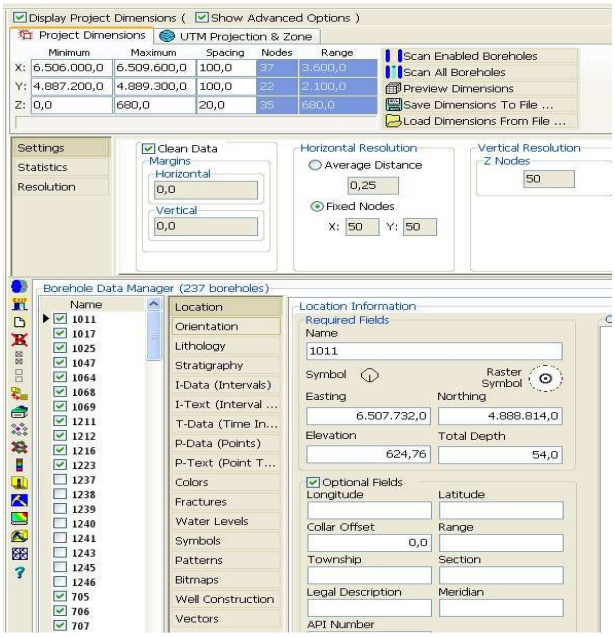

Figure 3 Databasein Rock Works

CREATING MODEL USING SOFTWARE

We used software with integrated geological data management, analysis, and visualization. Rock Works is specialized for visualization of subsurface data as logs, cross sections, diagrams, solid models, structural and isopach maps in both 2D and dynamic 3D windows.

The borehole data manager is used for easy entry of data: geophysical, geotechnical, geochemical measurements, observed lithology, stratigraphic contacts, water levels, fractures, downhole borehole surveys, all in linked spreadsheet windows. From this data it is possible to create points, contours, plan-view, and lithology/stratigraphy surface (geology) maps; logs; cross sections; and profiles. In addition there's an assortment of 3D diagrams:logs, surfaces, diagrams, and solid models.

3D model was developed using data from a network of exploration boreholes. Necessary data to create3D models are position of borehole (y,x),elevation, and base. Limits of the 3D model were set by data limitsY_{min}-Y_{max}, X_{min}-X_{max} andZ_{min}-Z_{max}. After determining the limits of "Borehole Manager" we are entering data from boreholes (coordinates, elevation, depth of borehole, etc.). In addition, these data can also be imported in software. Model was created after development of database and calculation of geological reserves was performed.
Picture 3- 3D model of this project.

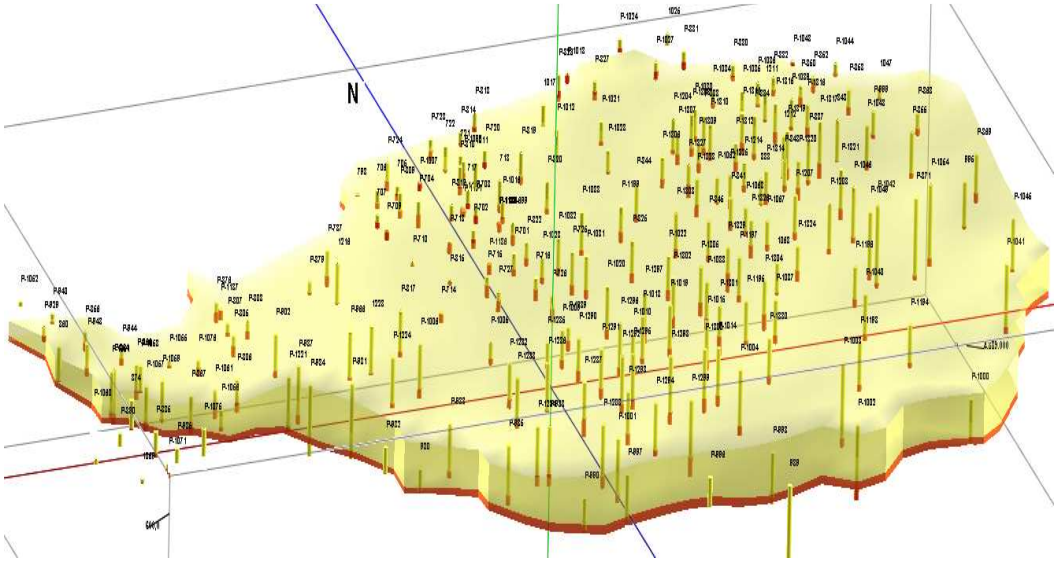

Figure 4 3D Model of analized part of Sarajevo-Zenica coal basin.

CALCULATION OF GEOLOGICAL RESERVES

Volumes in Rock Works are computed using a Delaunay triangulation method in which the samples are connected together in a network of triangles, a sample at each vertex. The volume of each triangle is computed, based on the thicknesses used as Z-values, and then the total volume added up.
Software is performed calculation of reserves based on the created model, where volume of coal bed is 84.132.679 m^3 but since faults were not included in this calculation so gain value can be reduced for faults in amount of 5%. That way we get volume of coal bed 79.926.045 m^3.

Result of calculation of geological reserves through manual method of geological blocks is 76,692,354m^3 [4].

The difference in the calculation is lessthan5%, which is within the permissible limits of the errors.

CONCLUSION

This work has demonstrated the possibility of using modern software solutions in the calculation of geological reserves. Differences that emerged in the calculation in relation to the basic classical method of geological blocks are within the acceptable limits, thus confirming the applicability of these software solutions in the calculations of reserves. Application of software tools enables faster, more efficient work with less possibility for calculation mistakes, the database can be easily updated with new findings, which provides easier operation for future calculations. In the world, use of different geological softwaredominating the classical manual calculation [5]. In future we expect wider application of this and similar software's in Bosnia and Herzegovina as well.

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