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**ORGANIZATION OF THE BUCHIM's Cu DEPOSIT ANTHROGHENE ACCESS
DATABASES, REPUBLIC OF N. MACEDONIA**

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Abstract: An extensive mining history and presence are indisputable fact here in the Republic North Macedonia. The mining has been related to several polymetallic mineral deposits (Toranica, Sasa, Zletovo, Buchim), which are important for the country's economy. Our paper focuses on efforts we made to organize Microsoft Access database with the most representative data related to the tailing dam in the only copper mine in the country, the Buchim Mine near the city of Radovich. First of all we compiled enormously high amount of data from the mine and adjacent mine facilities, then with the help of "Microsoft Access" software we organized database with the most important information such are geological, metallogenic and economic features of the deposit. However, we were highly aware of the fact that more than a four decades of mine exploitation has been followed with production of significant anthropogenic input to the environment, so we have concentrated more on the anthropogenic part of the database (tailing dam part). The database was adapted for simple and sophisticated querying of particular anthropogenic features and allows edition of reports and a geographic display of the queried information. Data available for querying was structured in several independent entities: general information, wastes and products, comments, iconography and bibliography. This Access database for the Buchim Mine's tailing dam will enlighten qualitative-quantitative parameters and eventual possible valorization of metals that were subject to the establishment of the database, in accordance with professional as well as environmental and economic viability of the particular tailing dam material enclosed in form of an anthropogenic concentration Access database

Keywords: copper deposit, tailing dam, Access database, potential, anthropogene introduced, economy.

1. INTRODUCTION

During the last four decades the Buchim Mine, located in the eastern part of country, is the major copper producer, but it is one of the major emission sources of particular heavy metals in the area too. Within this paper we introduce our efforts to build Access database related to the Buchim Mine tailing dam and its features (Fig. 1). The mine and the ore processing plant have been functioning since 1979 and process 4 million tons of ore annually. It is assumed that the mine at the moment have about 2 million tons of ore reserves. Porphyry copper type mineralization within the Buchim deposit is related directly to the Tertiary andesite and latite sub-volcanic intrusions into the gneiss and amphibolite rocks of the Pre-Cambrian age (Serafimovski et al, 1996). The content of copper in ore is at on the average of 0.3 % Cu. Characteristic metallic minerals are chalcopyrite, pyrite, and bornite, with small amounts of galena, sphalerite, magnetite, hematite, and cubanite (Serafimovski et al., 1996; Alderton et al., 2005; Serafimovski et al., 2016). Open pit mine processing results in a fact that waste material is disposed in the open waste dump in the vicinity of the mine facilities. Copper ore is processed within the flotation facility and while copper concentrate is sent abroad for smelting, the flotation tailings are deposited on flotation dam in the vicinity of the Topolnica village (Fig. 1).

After four decades of uninterrupted copper production from the mine, it was deposited more than 150 Mt of material within the waste dump and more than 140 Mt of material at the tailing dam (Serafimovski et al, 2005a; 2005b; Serafimovski et al., 2018). That enormous piles of material were left at open under constant action of air flow and winds resulting in irregular distribution of fine contaminated dusty material in the area (Barandovski et al., 2008, 2012; Balabanova et al., 2010; Serafimovski et al., 2018).

We were aiming to organize anthropogenic database (tailing dam) with information about some of the most representative Buchim deposit/mine features, regarding natural and anthropogenic issues. The database should be in accordance to the European directives, although there is an initiative in ours Ministry of Economy that such database(s) should be prepared and included in similar modern European databases (ex. BRGM Mineral database).



Fig. 1. Location of the Buchim mine and its anthropogenic input point, the tailing dam and waste dump

Bearing in mind that the Buchim deposit and the Buchim mine have a long history of exploration and exploitation, we knew that building aforementioned database is not an easy task to fulfill. We had to systematize data from exploration longer than six decades and exploitation longer than 40 years. Also, we were aware of the problem with environmental pollution around the Buchim deposit vicinity. There, increased concentrations of copper and some other heavy metals could pose serious risk for the human environment and health as in some other Macedonian localities (Vrhovnik et al., 2017; Tasev et al., 2017). Organization of the Access databases was carried out under several main topics, which are in accordance with the GIS related mineral databases principles given elsewhere Harris et al., (2001); Itard et al., (2002); Cassard and Itard (2003); Barnett and Williams (2006); Vuollo et al., (2010), Tasev et al, (2019) .

2. DISCUSSION

The particular mineral database itself was structured under the following main topics:

General information where has been enclosed information about the mining company, status, latitude/longitude, ore district name, comments etc. (Figure 2).

The screenshot displays a web-based database interface for site management. The main window is titled 'Description of the site' and shows details for 'MKD-A00007 Buchim (tailing dam)'. The 'General information' tab is active, showing fields for Identifier, Owner(s), District/province, Status, Country, Longitude, and Latitude. A metadata box on the right lists Author, Creation date, Controller, and Checking date. Below the main form, there are sections for 'Come from deposit' and 'Implemented processing(s)'. A sidebar on the right contains navigation buttons: 'Back to the main menu', 'Preview for this site', 'Add a new site', 'Duplicate this site', and 'Delete this site'. At the bottom, there are search and filter options.

Fig. 2. General information datasheet of the database

For example on our sample of the Buchim deposit we gave an accent that it is a producing industrial mine with certain potentials in regards to copper and gold. That information was followed by detailed coordinates and name of the entity/company owner of the mine and production facility, as well as familiar names used by locals for the mine and short general comments. Also, in regards to the related anthropogenic concentrations in the Buchim mine and its tailing dam, we stressed out that is a an active plant/mine with concentrator-mill facility with description of implemented processing methods.

Wastes and products sheet is organized in a manner that should be given details about the parameters: type of storage (surface storage type), type of waste (flotation tailing type), volume and surface occupied as well as tonnage and density of a particular waste-product, waste mineralogy, particular commodity and affected water area (Figure 3). Here potential of specific commodities as the anthropogene products (e.g. Cu, Au and Ag) related to certain host minerals was given, as well as grades (i.e. minimum, maximum and average grade) and abundance of host minerals in anthropogenic products. For the Buchim tailing dam, we entered data about all different kinds of minerals found in the waste (chalcopyrite, pyrite, magnetite, hematite, goethite, enargite, chalcocite, covellite, quartz, feldspar, biotite etc.). There the accent was given to the significant potential quantities of copper, gold and silver with eventually available metal quantities of 24480 t, 14.3 t and 49 t, respectively.

Wastes and products

SITE

Type of storage	Volume (m3)	Surface (m²)	Tonnage (t)	Density
Surface storage	60,000,000.00 m3	1,396,967.00 m²	81,600,000.00 t	1.36

Waste mineralogy

- M133 Chalcocopyrite
- M490 Pyrite
- M372 Magnetite
- M292 Hematite
- M358 Goethite (Ironite)
- M210 Enargite
- M130 Chalcocite
- M167 Covellite
- M499 Quartz
- M223 Feldspar
- M088 Biotite

Commodity	Min.	Max.	Ave.	Unit	Date	Accuracy	Potential
Cu Copper (metal)	0.015	0.045	0.030	%	04-Feb-12	95.00%	24,480.0 t
Au Gold (metal)	0.080	0.270	0.175	g/t	04-Feb-12	95.00%	14.3 t
Ag Silver (metal)	0.500	0.700	0.600	g/t	04-Feb-12	95.00%	49.0 t

Impacts

Dust

Surface (km²): 20.00

Volume of water affected(m3): 0

Seepage water or effluents to groundwater

Surface (km²): 12.00

Volume of water affected(m3): 100,000

WARNING: An estimated accuracy has to be entered [0-100%] for each input data

Fig. 3. Wastes and products datasheet of the anthropogenic database

Also, in this information sheet we enclosed facts such are environmentally impacted area by dust (20 km²), seepage water or effluents to groundwater (12 km²) and affecting more than a 100 000 m³ of groundwater)..

Comments sheet, which is composed of space where it is possible to write free texts describing details about geology and/or details about economy of a particular deposit related to the anthropogenic concentrations gives a fine opportunity to describe particular concentrations in more details (Figure 4). However, due to administrative limitations of some ongoing EU projects (RIS-CuRE and RIS-RECOVER) and mine management team instructions, although the level of knowledge is significant, at the moment we were not able to make some significant input here especially in regards to eventual representative economic features.

Comments

The tailing dam of the Buchim mine and its filtration mill is located east of the mine, in the valley of the river Toponica, upstream from the village Toponica. The tailing dam comprises a dam which is built by slag/substrate, reservoir for collecting the liquid slag deposit (the finest fractures/granules) and a slope which spreads south from the dam on which the larger particles/fractions are being accumulated. The dam of the slag disposal site is placed on the river Toponica with orientation East-West. The crown of the dam, at the moment is at an altitude of 642 meters above sea level, while the lowest point is 511 m. a.l. and is located immediately above the village of Toponica. The absolute height of the dam, as of February 2012, is 132 meters. According to this numbers, this is the highest dam of the type/character, not only in the area, but in the wider region as well.

Fig. 4. Comments information datasheet of the anthropogenic database

Iconography sheet has been elaborated in order to attach images with an anthropogenic concentration (Figure 5). The first step being definition of paths of the image directory and the image viewer (e.g. Photo Editor, Windows picture viewer, Picasa...) by clicking on “Configuration” button quite similar to the mineral database above.

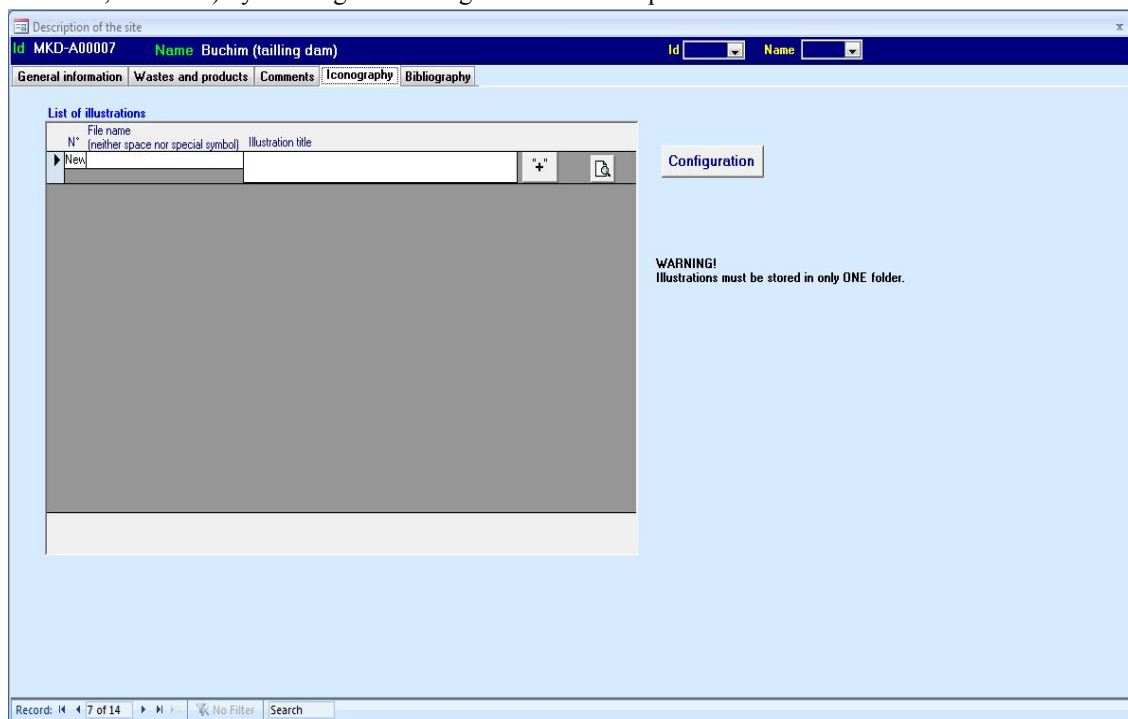


Fig. 5. Iconography datasheet of the anthropogenic database

Bibliography data sheet for particular anthropogenic concentrations was intended to give an overview of available bibliography (references relating to the anthropogenic concentrations) and economical bibliography (references relating to economic data of the anthropogenic concentrations) and was quite similar to the database seen at Figure 6.

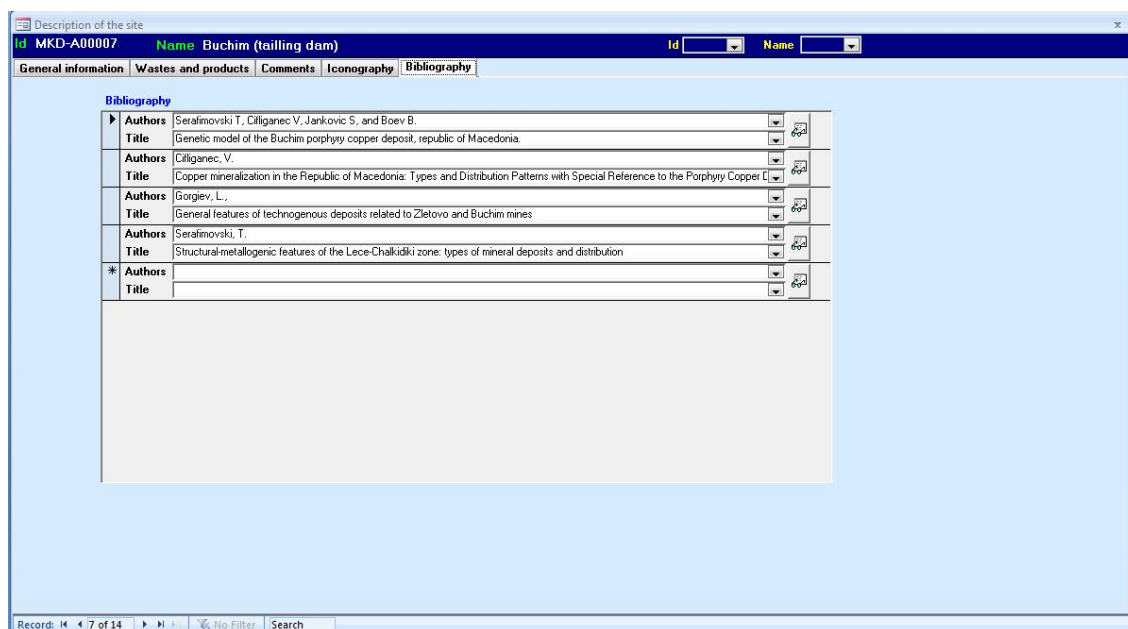


Fig. 6. Bibliography datasheet of the anthropogenic database

3. CONCLUSION

As proved itself the initial build of the Access database for the Buchim Mine's tailing dam anthropogenic reflections, had its major accents in the qualitative-quantitative parameters and natural indicators in function to present and future valorization of metals that were subject to the establishment of the database, in accordance with professional as well as environmental and economic viability of the particular tailing dam material enclosed in form of an anthropogenic concentration Access database.

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