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**MINERAL AND ANTHROGHENE ACCESS DATABASES ORGANIZATION
FOR ALSHAR POLYMETALLIC DEPOSIT AND WASTE DUMP,
REPUBLIC OF MACEDONIA**

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ABSTRACT

The Republic of Macedonia has an extensive mining past and presence, related to several polymetallic mineral deposits, which is important for its economy. This paper focuses on efforts we made to organize Microsoft Access database with the most representative data for the across the World well known Alshar polymetallic deposit in the Republic of Macedonia. At the very beginning, with the software package “Microsoft Access” we have organized database with information of the most important geological, metallogenic and economic features of the deposit. Also, we have not omitted the fact that, although limited, mine exploitation has been followed with production of significant anthropogenic input to the environment, so we have structured and anthropogenic database too. Both databases were adapted for simple and sophisticated querying of particular deposit and anthropogenic features and allows edition of reports and a geographic display of the queried information.

Keywords: Au-Ag-As-Sb-Tl deposit, Access database, reserves, anthropogenic input, economy

INTRODUCTION

At the territory of the Republic of Macedonia there are several polymetallic deposits that has been exploited during several last decades. Mainly those were lead-zinc, copper and nickel deposits, followed by some other deposits of smaller economic significance. Here we would like to give an accent to the old mine with former underground operations Alshar, which ceased its activities in 1965. The Alshar area is characterized by increased concentrations of arsenic, antimony and thallium. Increased arsenic and thallium concentrations have also been found in some plants such as Thimus and Viola [1], [2]. It can generally be said that the Alshar deposit contains about 500 000 tones of antimony ore (with 2.50 Sb) and about 1.50% As. Increased concentrations of thallium of 0.2% Tl (or some 40 tones of thallium ore) have also been determined.

The problem with environmental pollution around the Alshar mine has been generally related to several open adit waste dumps, whose contaminated water drained directly into Madenska River, which at particular places passes through or by open adit waste dumps where continuous decay of arsenic minerals (realgar, auripiment etc.) pollutes fresh waters with As, Sb, Hg, Tl etc. It is of note that earlier mining waste dumps with large amounts of waste material that resulted from mining activities have been found in the riverbed of Majdanska. Increased concentrations of trace elements have been

determined in the material and in the river sediments. To be honest, up to date, in the Republic of Macedonia there weren't professional databases that should be in accordance to the European directives, although there is an initiative in our Ministry of Economy that such database(s) should be prepared and included in similar modern European databases (ex. Mineral database at the BRGM, France).

We were aiming to organize both databases with an information about some of the most representative Alshar deposit features, regarding natural and anthropogenic issues. Bearing in mind that the Alshar deposit and former mine have a long history of exploration and exploitation, we knew that building aforementioned databases is not an easy task to fulfill. We had to systematize data from exploration longer than seven decades and exploitation longer than half a century. Also, we were aware of the problem with environmental pollution around the Alshar deposit and former mine adits, which in general is related to waste water outflow to River Majdanska, which empties into Blasnica and later the water flows into Lake Tikvesh, where increased arsenic, antimony and thallium concentrations are a risk for the human environment. Organization of the both Access databases was carried out under several main topics, which are in accordance with the GIS related mineral databases principles given elsewhere [1], [2], [3], [4], [5], [6], [7], [8], [9].

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 1).

The screenshot displays a software window titled "Description of the deposit" for the identifier "MKD-00023" and name "Alshar". The interface is organized into several sections:

- General information:** Includes fields for Identifier (MKD-00023), Mining company, District (Southern Macedonia, Kozuf-Anidea district, southern margin of the Vardar zone), Status (Dormant deposit), Longitude (21.94610), and Latitude (41.15310). A "Controlled coordinates" checkbox is checked.
- Country(ies):** A dropdown menu is set to "FORMER YUGOSLAV REPUBLIC OF MACEDONIA".
- Author information:** A table-like section with fields for Author (J. Montheil), Creation date (14-Jun-00), Controller (Deschamps Y.), and Checking date (02-Mar-05).
- Ore-deposit names:** A list box containing "Alshar", "Kozuf", "Alshar", and "Alshar".
- Comment:** A text area containing detailed information: "Unique deposit in the world because of its high thallium content. Thallium minerals: Lorandite, Bernardite, Paraperrotite, Picotpaulte, Ragunite, Vrbate, etc. Hydrothermal alteration of wallrocks with jasperoids and argillization. Average gold values are close to 1 and 3 g/t. 180 t of Thallium. Sb and As: 300 000 t @ 2% Sb and 2% As. Grade of individual orebodies ranges from 6.0% Sb, 3.3% As and 0.12% Tl to 1.1% Sb, 0.8% As and 0.05% Tl (S. Jankovic-1993)".
- URL and Source:** Two empty text input fields.
- Database name and Identifier in the database:** A table with one row: "Carte Métallogénique de l'Europe" and "26-160".
- Navigation and Actions:** Buttons for "Back to the main menu", "Preview for this deposit", "Add a new deposit", "Duplicate this deposit", and "Delete this deposit".
- Footer:** A status bar showing "Record: 14 of 23 of 101" and a search field.

Fig. 1. General information datasheet of the database

For example on our sample of the Alshar deposit gave an accent that it is a former mine and prospective deposit with certain potentials in regards to gold, thallium, antimony, arsenic and silver. That information was followed by detailed coordinates and name of the company owner of the mine and production facility, as well as familiar names used by locals for the mine and short general comments.

Deposit features sheet is organized in a manner that should be given details about the parameters: deposit type, main morphology and secondary morphology (Figure 2).

On our example deposit, Alshar, we have entered data about the deposit's combined type where we have pointed out the Carlin-type sediment-hosted vein and disseminated replacement with elements of atypical epithermal deposit type morphology.

The screenshot shows a software window titled "Description of the deposit" for record ID MKD-00023, named "Alshar", with commodity "Au". The "Deposit" tab is selected, showing a list of deposit types and morphologies. The "Deposit type" section includes D31 (Carlin-type sediment-hosted vein and disseminated replacement deposit) and D60 (Atypical or unspecified high- or low-sulphidation epithermal deposit). The "Main morphology" section includes A32 (Stratabound envelope of disseminated ore) with fields for Azimut, Dip, Length (m), Width (m), and Down dip (m). The "Secondary morphologies" section includes A32, B31 (Discordant mass (cylinder, sheet, cone, etc.) with filling commonly brecciated), and B50 (Stockwork (or network) of stringers or veinlets (thickness < 50 cm), discordant on the strata).

Fig. 2. Deposit features datasheet of the database

Mineralization/Rocks data sheet usually should contain data about age (supposed and absolute), ore mineralogy, gangue mineralogy, hydrothermal alteration, host rock (age supposed/absolute, host rock formation, name and lithology). All of them being grouped into separate main windows (Figure 3).

The screenshot shows the "Mineralisation/Rocks" tab active. It contains several sections: "Age" with fields for Sup. (Ma) (N2, Pliocene, 1.806), Inf. (Ma) (N2, Pliocene, 5.332), Absolute age (0), Error (0), and Unit; "Ore mineralogy" with a list of minerals including M061 (Arsenopyrite), M145 (Cinnabar), M378 (Marcasite), M436 (Gold), M437 (Orpiment), and M438 (Stilbite); "Gangue mineralogy" with M075 (Barite), M114 (Chalcedony), M115 (Calcite), and M499 (Quartz); "Hydrothermal alteration" with A10 (Acide = Altération argileuse "ava"), N10 (Silicification), and H (Sulfuration); and "Host rock" with Age (Dac, Dacian, 4.1), Inf. (Ma) (Dac, Dacian, 5.6), Absolute age (5.5), Error (1), and Unit (Million Year). It also lists "Host-rock formation names" and "Host-rock lithology" with various rock types like Schist, Marble, Limestone, Dolomite, and Volcaniclastic rocks.

Fig. 3. Mineralization-rocks information datasheet of the database

Here we have entered a significant amount of data regarding the mineralization age (relative 5.3-1.8 Ma; absolute 5.3), ore mineralogy (arsenopyrite, cinnabar, marcasite, gold, orpiment, stilbite, etc.), gangue mineralogy (barite, chalcedony, calcite, quartz etc.)

and diverse hydrothermal alterations (scarification, silicification, sulfidation, kaolinization etc.). After that followed an information about the host rock age (relative 5.6-4.1 Ma; absolute 5.5, K/Ar method) and host rock lithology (schist, marble, limestone, dolomite, tuff etc.).

Economy data sheet was planned to provide an information about ore type, grade unit, former production, average grade of production, years of exploitation, reserves, average grade, type of reserves, resources, average grade of resources, type of resources organized in windows named exploitation type, main commodity and commodity (Figure 4).

Fig. 4. Economy information datasheet of the database

So, here for the Alshar deposit, we gave an about the the fact that it mainly unworked deposit where the main commodities are represented gold, silver, thallium, antimony, arsenic etc. Also, reserves has been quoted as proved mineral reserves of 20 000 000 t (gold concentration of 2 g/t Au) as well as indicated reserves of four additional commodities (Ag, Tl, Sb, As) given as separate records within this datasheet (metal production, not the raw ore).

High-Tech Metals information sheet was divided into two different windows, which have been established in order to characterize (i) Potential of specific commodities or capacities (ii) where the anthropogenic products are processed. To characterize High-Tech metals, user has to enter a commodity (ex. Re, Se, Ga...), and then he will be able to give information about host minerals (e.g. molybdenite), grades (i.e. minimum, maximum and average grade) and abundance of host minerals in the ore. The right window give information about processing site(s) (e.g. concentrator, mill, smelter...). Due to relatively strong unworked nature of the deposit, we haven't entered any additional data regarding this information sheet of the database.

Comments sheet, which is composed of two windows where it is possible to write free texts describing details about geology and/or details about economy of a particular deposit gives a fine opportunity to describe particular deposit in more details (Figure 5). Here we have entered extensive free text data about the detailed geological and mineralization features of the deposit, not mentioned elsewhere in the database (Figure 5).

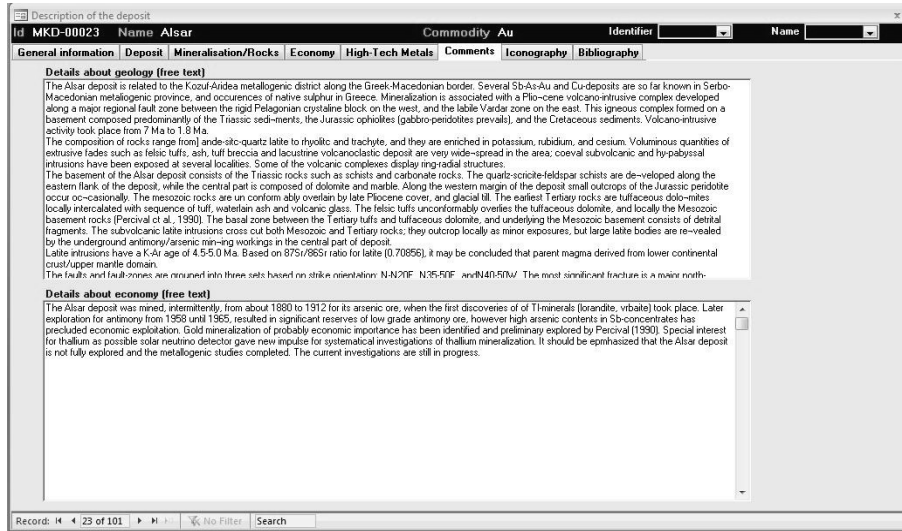


Fig. 5. Comments information datasheet of the database

In the lower window intended for data about the economy we have pointed out that the Alsar deposit was mined, intermittently, from about 1880 to 1912 for its arsenic ore, when the first discoveries of Tl-minerals (lorandite, vrbaite) took place, as well as the later exploration for antimony from 1958 until 1965. Also, we accentuated that gold mineralization of probably economic importance has been identified as well as the special interest for thallium as possible solar neutrino detector.

Iconography sheet has been elaborated in order to attach images with a deposit (Figure 6).

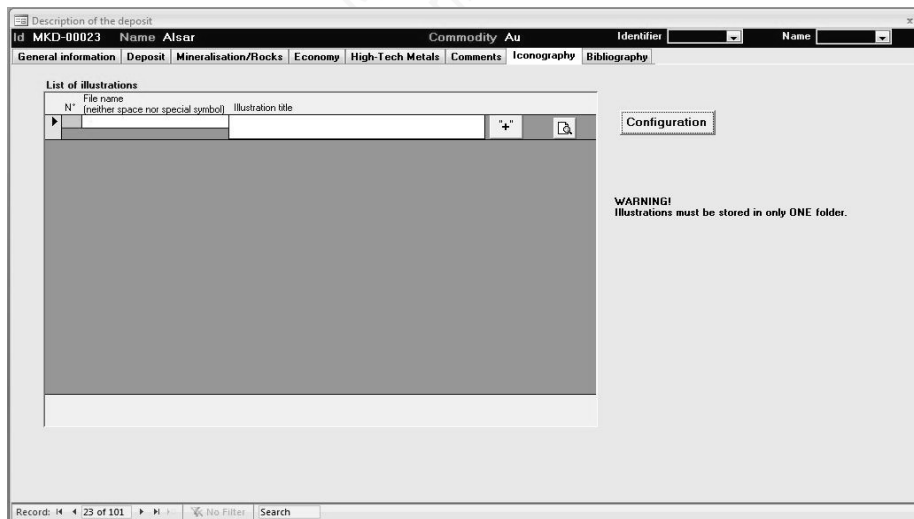


Fig. 6. Iconography information datasheet of the database

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 (Figure 6).

Bibliography data sheet for a particular deposits was intended to give an overview of geological bibliography (references relating to the geology of the deposit) and economical bibliography (references relating to economic data of the deposit) as can be seen at Figure 7.

Fig. 7. Bibliography information datasheet of the database

For the Alshar deposit, we made significant input in regards to both types of bibliography, geological and economical ones. All the known and commonly used references to this particular deposit has been covered in this data sheet.

In regards to the *anthropogenic concentrations* Access database we would like to display its several organizational entities:

General information address information about the location, status, latitude/longitude, ore district name, comments etc. (Figure 8).

Fig. 8. General information datasheet of the anthropogenic database

For the Alshar deposit related anthropogenic concentrations, we stressed out that is a former facility with description of implemented processing methods, followed by coordinates, familiar names used by locals for the mine and short general comments.

Wastes and products sheet is organized in a manner that should be given details about the parameters: type of storage (surface, underground) type of waste (mine waste dump, slag,...) volume and surface occupied as well as tonnage and density of a particular waste-product, waste mineralogy, particular commodity and affected water area (Figure

9). Here potential of specific commodities in the anthropogenic products (e.g. Sb, As, Tl, Au ...) 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 our particular locality, Alshar, we have entered data about all different kinds of Sb-As-Tl-Au minerals (stibnite, realgar, orpiment, lorandite, vrbaite, ragnite etc.). There the accent was given to the significant quantities of antimony, arsenic, thallium and gold with potential of 9886 tons for antimony and arsenic individually, 2471 tons for thallium and 2 tons of gold potential.

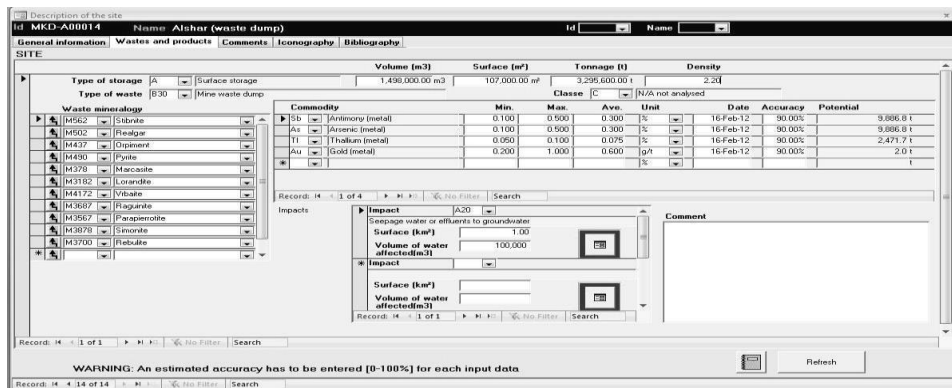


Fig. 9. Wastes and products datasheet of the anthropogenic database

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 10). For example for our location, anthropogenic concentrations, around the Alshar deposit, we have entered detailed, up to date findings, about the type, size, geology and geological setting of the deposit related to the anthropogenic concentrations, details about the mining history of the locality (since 1881 and lasted with interruptions until 1965) with their representative eventual economic features as well as many other features such are past annual mine capacity, quantitative-qualitative parameters of produced ore, facility (facilities) where the raw excavated ore has been processed etc (Figure 10).

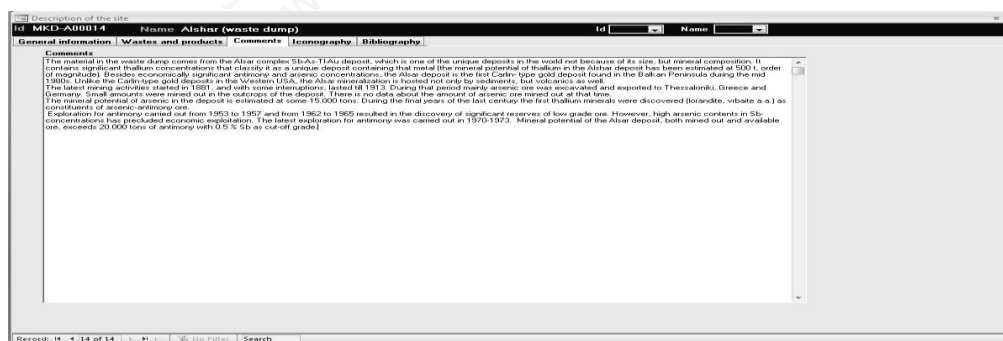


Fig. 10. Comments information datasheet of the anthropogenic database

Iconography sheet has been elaborated in order to attach images with an anthropogenic concentration. 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 (Figure 6).

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 organizationally was quite similar to the previous database seen at Figure 7.

CONCLUSION

The initial build of the Access database for the Alshar mineral deposit and its anthropogenic reflections, had their 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 mineral databases, as well as environmental and economic viability of the particular waste dump enclosed in form of an anthropogenic concentration Access database.

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