7. Internet Applications of Exploration Areas, Deposits and Old Mining Works in the Slovak Republic

DUŠAN KÚŠIK[1], STANISLAV ŠOLTÉS[1]

[1]State Geological Institute of Dionýz Štúr, Mlynská dolina 1, 817 04 Bratislava 11, Slovak Republic, dusan.kusik@geology.sk

Abstract: The paper is devoted to the history and creation of registers of exploration areas, deposits, old mining works and deposits exploration. It describes the Internet applications of deposits registers and their functionality and shows possibilities of development of Internet applications in the future. The assessment of the importance of deposits applications for different user groups is presented.

Key words: Deposits, exploration areas, deposits applications, old mining works, deposits exploration level

7.1. Introduction

The raw mineral deposits Internet applications developed by SGIDŠ were discussed in brief in the previous issue of SGM (Káčer et al., 2015). However, we think that this SGM issue, which is thematically focused on the results of economic geology in Slovakia, should discuss the deposits problematics in detail to complement the mosaic of knowledge. In the present article, we will go back into the history of deposits registers creation, which are the basis of the recent Internet applications. We will try to bring forward our vision for the potential development of applications in the future.

The registers and their creation are directly defined in the Act. 569/2007 on Geological Works (Geological Act), as amended by further legislation. Deposits (exclusive and non-reserved) and old mining workings are described in detail in the Act. 44/1988 Coll. on the Protection and Utilization of Mineral Resources (hereinafter referred to as the Mining Act).

In a Department of Geological Exploration there are kept 10 registers of various themes within geology. Of this number three registers were published by April 15, 2009, through Internet applications. These registers were associated with raw mineral deposits, namely the registers of Exploration Areas, Deposits and Old Mining Works (Kúšik, 2010). In 2014 the last Internet application was launched – deposits exploration level.

7.2 History of deposit registers

7.2.1. Register of Exploration Areas

The institute of exploration area was introduced in the geological legislation of the Slovak Republic. The exploration area (EA) shall be determined for organizations applying for a permission to survey a proposed territory for selected exclusive raw mineral(s). The whole process from design to licensing or rejecting the EA is supervised by the Ministry of Environment of the Slovak Republic (MoE), Section of Geology and Natural Resources, through administrative proceedings. The Department of Geological Exploration is authorised to keep a register of proposed, determined, blocked/cancelled EAs. Since the launching of the register the process of digitisation of EAs layer for the needs of statements on the proposals for determination has begun. At the end of the 90s of the 20th century it was created the first fully functional geographic information system (hereinafter referred to as GIS) of EAs, which with minor modifications (due to the then software options) is functional today. Currently (by October 2015) the register keeps 9 proposed EAs and 97 determined EAs.

7.2.2. Deposits Register

Deposits Register currently keeps the records of the exclusive deposits (deposits of reserved minerals; the deposits are the property of SR) and deposits of non-reserved raw minerals (the deposit is the property of the owner of the land). This register was developed since the establishment of Geofond, i.e. since the beginning of 60s of the 20th century. The whole register was kept in analogue form on passports of deposits in which there were processed data about individual raw minerals. Mining areas (MAs), protected deposit areas (PDAs), as well as the calculated blocks of exclusive deposits were drawn in military maps at 1:25 000 scale. First attempts with digitisation of this information layer are dated back to 90s, but complete GIS was established only in 2002 in the scope of the geological project "Relationship between Rock Environment and Nature and Landscape Protection" (Kúšik, Lamoš, 2002), whose main objective was to create layers of mining areas (MA) and the protected deposit areas (PDAs) and finding their intersections with protected areas of nature and landscape (small scale and large scale protected areas). Register of reserved deposits is a "living" system (new deposits are incorporated, some deposits are cancelled, and some deposits are changing their boundaries, owners, etc.) and therefore it was necessary to ensure regular updating of data in a digital version (Kúšik, 2010). This shall be ensured on the basis of the decision to change the boundaries of MAs, PDAs and depreciation of reserves that

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are within the competence of individual district mining offices (DMO), as well as the statistical statements Geo 3-01 that are regularly sent out by the Department of Geological Exploration to mining organizations at the beginning of calendar year. Based on them "Balance of Deposits of Exclusive Raw Minerals in SR" is published each year. In 2006 a layer of non-reserved minerals (NRM) was added into the GIS, which are the property of the land owner (Kúšik, Mižák, 2009). The layer of non-reserved mineral deposits is compiled based on statistical statements Geo 3-01 that are regularly sent to mining organizations at the beginning of the calendar year. On their basis "Evidence of Deposits of Non-Reserved Minerals in SR" is issued yearly. Currently (by October 2015), the register consists of 641 exclusive deposits and 497 non-reserved deposits.

7.2.3. Register of Old Mining Works

The register in its present form has been built based on the results of the project "Slovakia - Design of Remediation of Old Mining Works (OMW) – Inventory, Search Survey, as of 31.12.1996" (Repčiak et al., 1996), whose main pur-

of galleries courses as a line layer, which has been integrated into the GIS (Fig. 7.7). Other old workings are kept as a point layer. Currently (by October 2015), the register consists of 19,068 objects.

7.2.4. Register of Deposits Exploration

The register of deposits exploration has been developed along with the deposit register since the beginning of 60s of the 20th century. It was formed based on final reports with the calculation of reserves and deposits studies. It includes deposits written-off from the register of deposits of reserved minerals, forecast of deposits sources as well as other non-balanced deposits, occurrences, negative surveys and worked-out deposits (historical sites). The register is kept in analogue form on passports and situations are plotted in military maps at 1:25,000. The first attempts of a complex processing of the register into a functional GIS are dated back at the turn of the 20th and 21st centuries. The register in GIS environment was completed in 2013. At present (by October 2015), the register consists of 7,922 objects of deposits exploration, plotted in the form of polygons, points and lines.
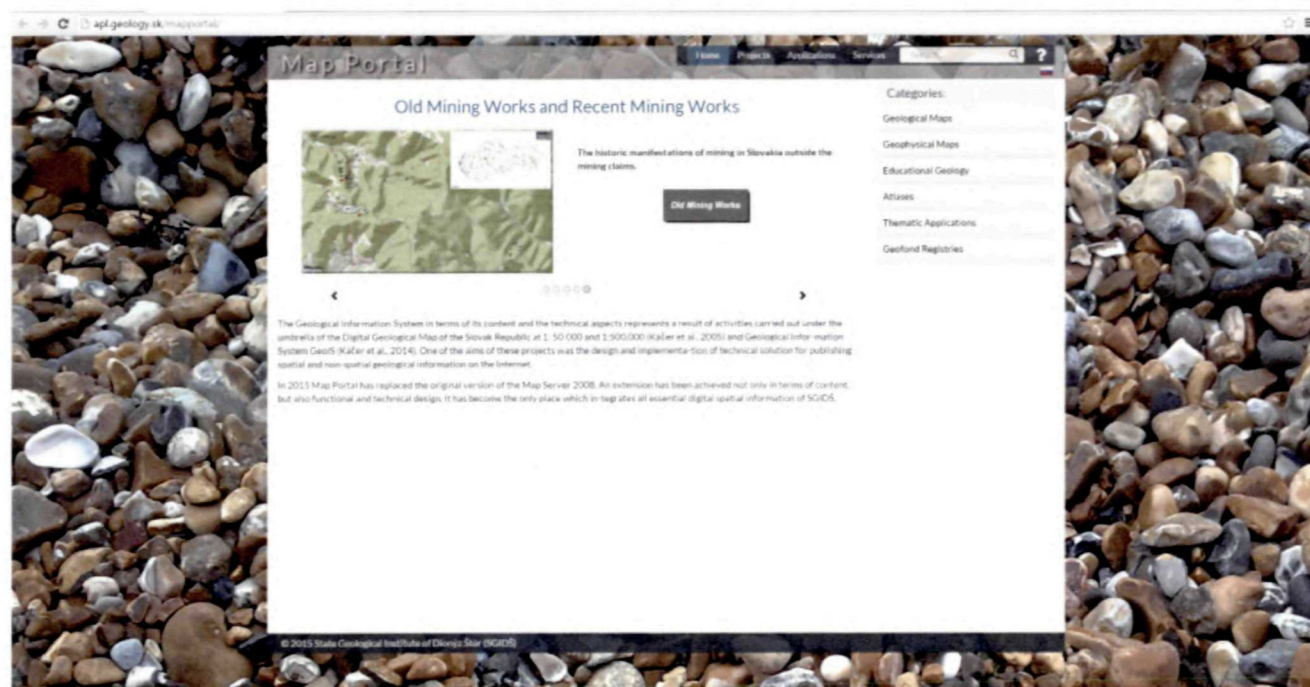

Fig.7.1 "Gateway" of redesigned Map Portal of SGIDŠ on www.geology.sk.

pose was assessment and inventory of OMW occurrences throughout the country outside the designated MAs, evaluation of their impact on the environment and design of remediation in the case of their current negative status and manifestations at the surface. After the project completion the results of the inventory were digitally processed in Geofond Bratislava. When updating the register in the following years we have tried to incorporate in the register the mining works located within determined MAs, for example, Kremnica, Banská Štiavnica, Liptovská Dúbrava, which are currently under the Mining Act perceived as the main mining works. Within the determined MAs, we have managed to process the portion of mine works in the form

7.3. Internet Applications of Deposits Registers

All of the register applications are included on the Map Portal of SGIDŠ under button "Geofond Registries".

We will not discuss the technical solutions, cataloguing and data models in this article because these issues were described in detail in the previous issue of the SGM magazine (Káčer et al., 2015). We would like to point out that all the applications presented in the article are viewable without any installation and using any web browser.

All deposit applications offer a navigation menu that is almost the same for all applications, slight variations are explained in the individual applications. The naviga-
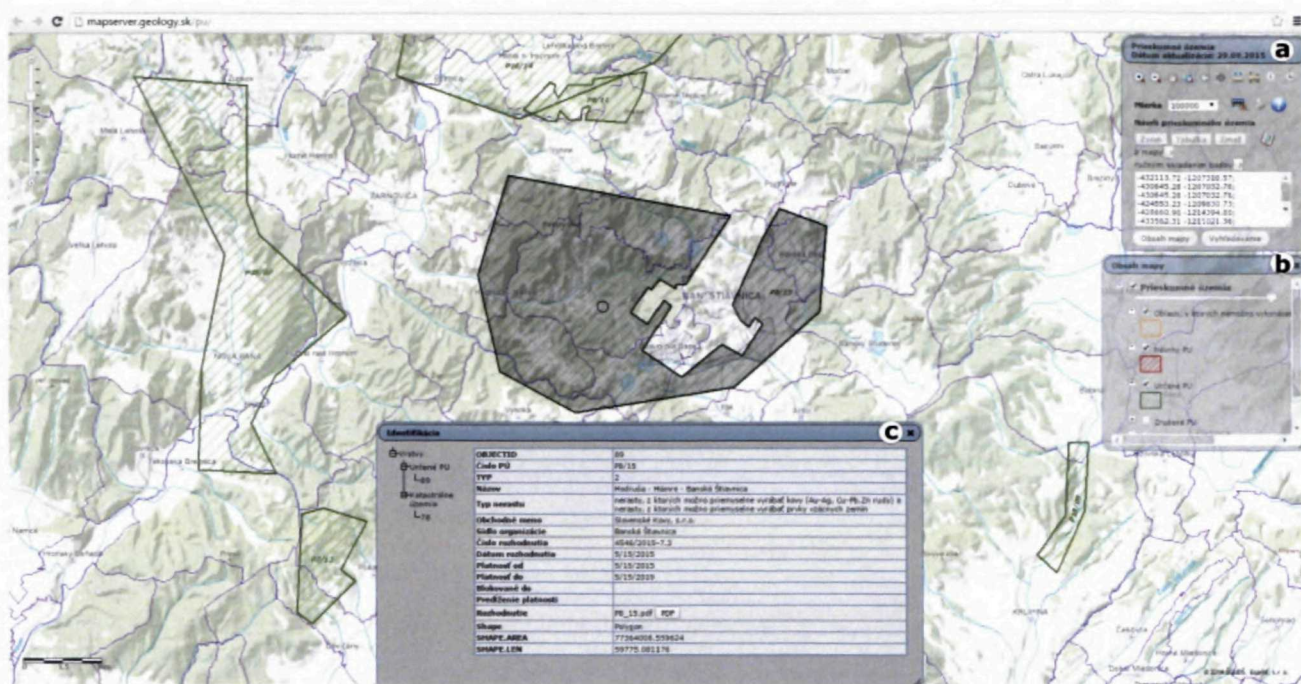
Fig. 7.2 Visualisation of exploration area Hodruša – Hámre – Banská Štiavnica. a – Navigation menu of Exploration Areas; b – Map Legend; c – Identification – fundamental attribution table with the "explanation" of the reference.

tion menu contains: the zoom function (magnifying glass "zoom in"), distancing function (magnifying glass "zoom out"), the function enabling to shift a map with hand (pan), the function return to the initial screen depiction (full extent), function of previous display (zoom previous), function of next display (zoom next), function distance measurement, function of measurement of areas, key ID when pressed pops attribution table, key identification for the selected area by pressing pops attribution table of all objects in a designated area, the fixed scale, function SQL search box, button printing and with the question mark button that redirects us to the metadata for the application.

7.3.1. Internet Application – Exploration Areas

The first application is also a symbolic first step in finding the accumulation of reserved minerals - mineral deposits. The basic EAs division is also respected in the present application, with separate layers of proposed, designed, blocked/cancelled EAs (Fig. 7.2.a,b). Separate information layer represent areas without a permission to carry out geological exploration for deposits of oil and natural gas. For each object (polygon) in the designated EAs it is assigned a simple base table (Fig. 7.2.c) with the following information on EA: ID of EA, Name, Type of mineral, the Name of the holder of EA and its seat, Number of the decision on the determination, Decision date, Valid from to, Blocked until, Extension. To the base table there is attached all written agenda (scanned documents on the determination, modification, cancellation of EA) in the pdf.format (Acrobat Reader). Part of the application is also SQL search according to selected various search criteria, as well as other interesting tools useful especially for the applicants of EAs. A unique tool that enables a rapid design of map annexes to the proposed EA is a key Draft of exploration area on the map, or

manual insert of points (Fig. 7.3 a,b). This button also allows the calculation of the percentage of municipalities and areas intersecting with proposed EA after drawing a polygon on the map and pressing the "Tabuľka" [Table] button (Fig. 7.3 c). Application for less experienced users also includes a key "Príručka" [Manual] (Fig. 7.3 a) in which there are described all the possibilities for applications. The application is constantly updated – the date of the last update is part of the application. (Kúšik, 2010).

7.3.2. Internet Application - Deposits

Deposits application is represented by layers of mining areas (MAs), protected deposit area (PDAs), deposits with issued certificates on exclusive deposit (CED), which fall within the category of exclusive deposits. Specific layer displays deposits of non-exclusive minerals. For each object (polygon) there is assigned a simple base table with the following information on the deposit: ID of a deposit from the publication BZVL SR (Balance of Reserves of Exclusive Minerals Deposits of SR), Name of deposit, Mineral, Organization name and address, Recent status of the deposit in terms of its exploiatation. In the external table (Fig. 7.4. b), which is linked to the basic one by pushing the key "Chemická kvalita" [Chemical quality] we will get essential data on industrial minerals. The button "Prevod" [Transfer] (Fig. 7.4 c) allows the user to get an overview of transfers among mining organizations. Legal status is represented by buttons "Určenie" [Designation], "Zmena" [Amendment] and "Zrušenie" [Cancellation of EA/PDA], reserves Z and ABC. Key "Z rozhodnutia" [Decision] gives us information on reserves as of the Decision approving the reserves at a certain date (these are freely available) and the current reserves of the last BZVL SR hide the button "Aktuálne" [Current] (these are intended only to authorized users). The

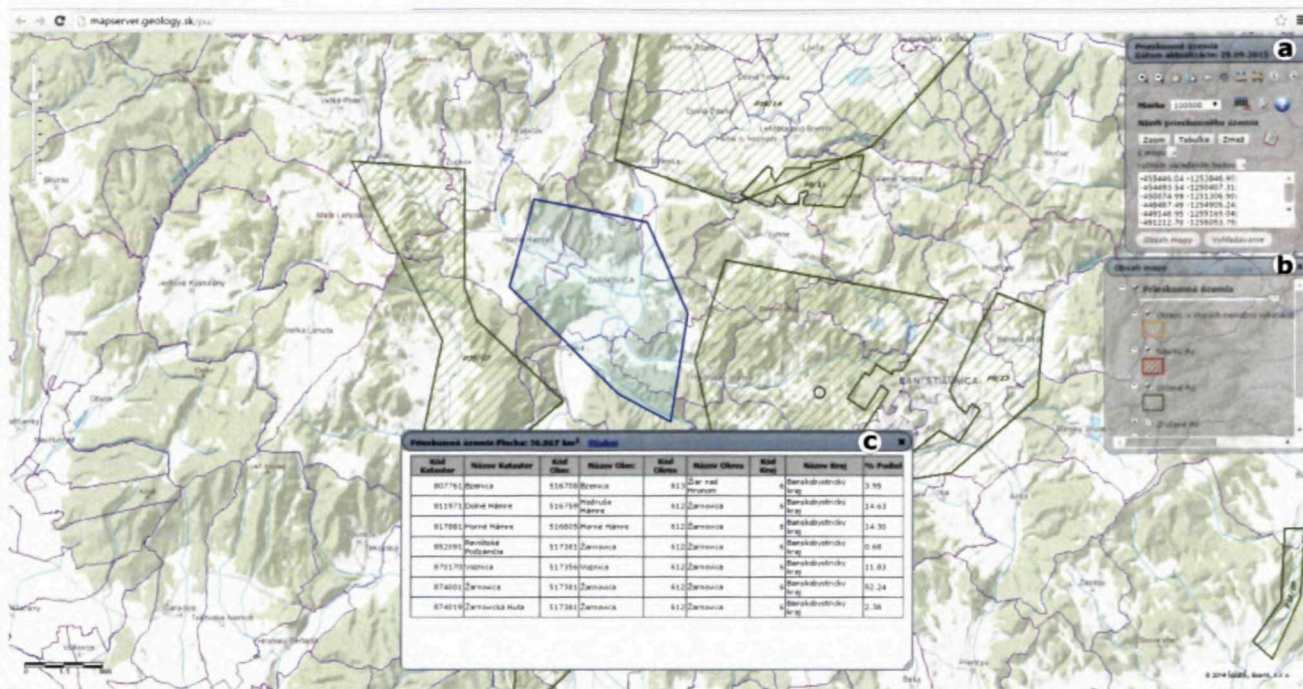Slovak Geol. Mag., 15, 2 (2015), 145 – 152

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Fig. 7.3 A simple example of the map data to EA design to the table shares villages a – Navigation menu of Exploration Areas; b – Map Legend; c – Identification – fundamental attribution table.
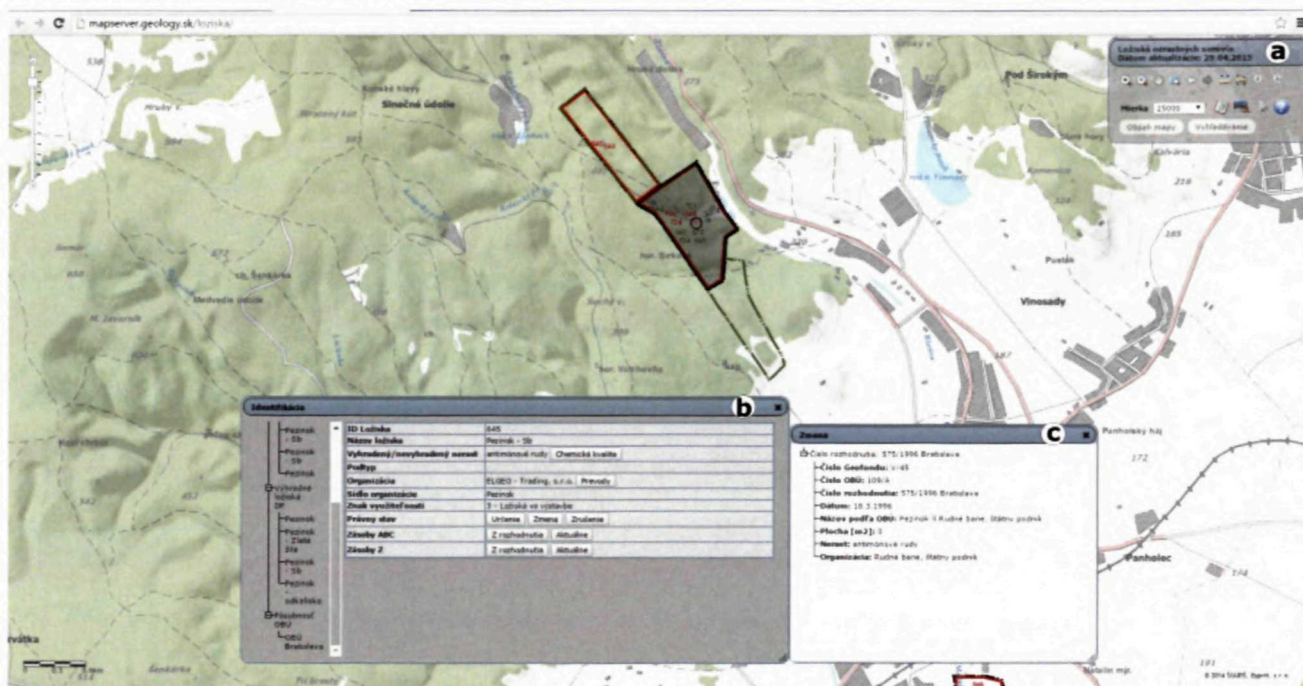

Fig. 7.4 Basic table with "highlighted" Sb ore deposit Pezinok on the map. a – Navigation menu of Raw Minerals Deposits; b – Identification – fundamental attribution table, c – Attribute table documenting any amendments of status.

application includes also the SQL search by various selected search criteria, as well as printing of a displayed map window with an automatically generated Legend (deposits located in the reporting cutout, Fig. 7.5 b). The application is being continuously updated – last updated is part of the application (Kúšik, Mižák, 2009).

7.3.3. Internet Application – Old Mining Works and Recent Mining Works

The Old Mining Works (OMW) application introduces the manifestations of historical mining activities in the Slo-

vak Republic with the exemption of Exploration areas and Mining areas as of 1996 (for clarity they are included in the application as separate layers). For the purpose of the application the tags (Fig. 7.6 b) were created for different types of OMWs, which are based on mining geodesy regulations. Each object (point, line) has assigned a simple base table with the basic characteristic of OMW: Object ID, Name, Object Type, Specification of raw materials, Remediation and Estimated size of the object (Fig. 7.6 c). Similarly to previous applications there can be used SQL search and printing of displayed composition (Kúšik, 2010).

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7.3.4. Internet Application – Deposit Exploration Level

Application Deposit Exploration Level is a component of particular application Exploration Degree along with the geological mapping and geophysical works. For each object (polygon, line and point) there is assigned a simple attribution table with the following information on the deposit: Object ID, Type – distinguishing among the U-ores, industrial minerals, coal, ores and construction materials, Mineral – further geological characteristics according to the Geological Law, Category – Prognose, Deposits with reserves, Occurrences, Negative exploration, Object`s name, Archival number and map sheet (Fig. 7.8 c). The field Archive Number displays in the form of a text string all the final reports applicable to a given deposit object. In the event that we do not want to view the objects one by one, but we want to get information on a larger area, this is enabled by the key "Formulár" [Form] (Fig. 7.9 c). The user shall press the icon polygon to select the area of interest and draw the map of the territory from which he
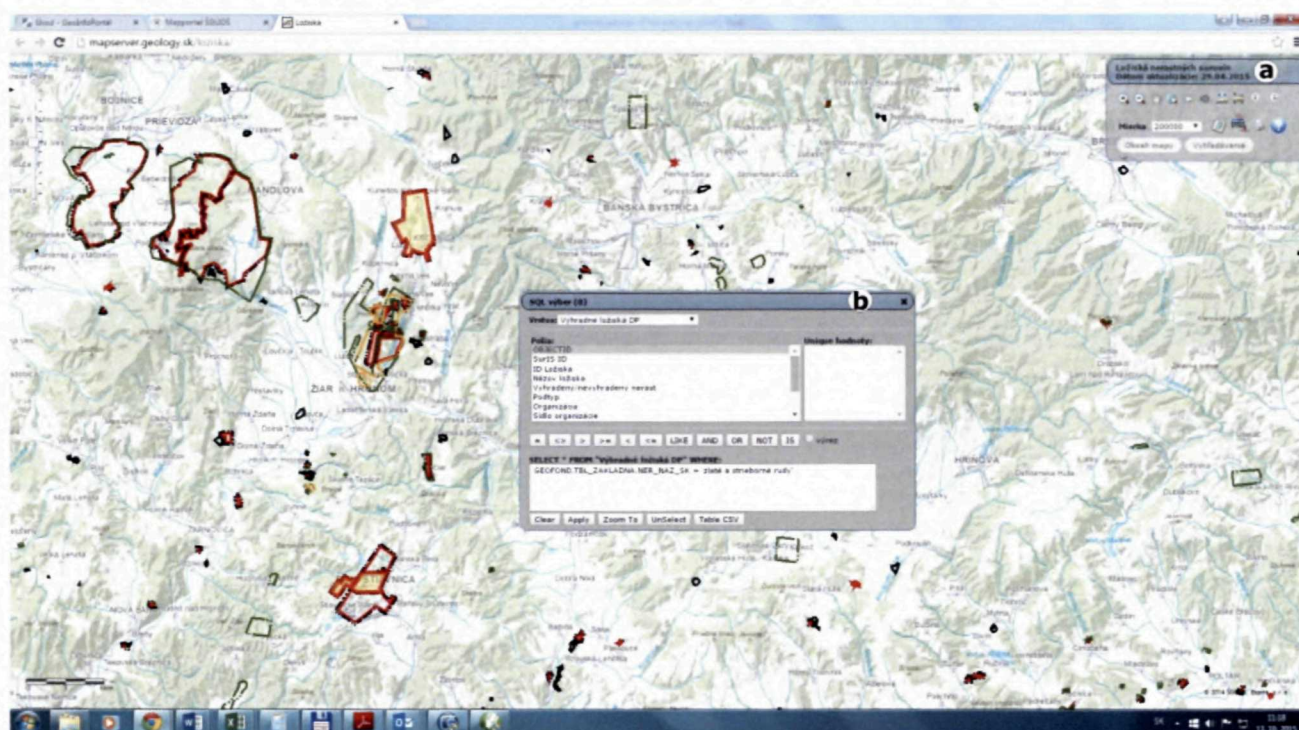

Fig. 7.5 SQL search demonstrated by the example of the yellow highlighted mining areas Kremnica and Banská Hodruša Au, Ag ores. a – Navigation menu of raw minerals deposits; b – Identification – fundamental attribution table.
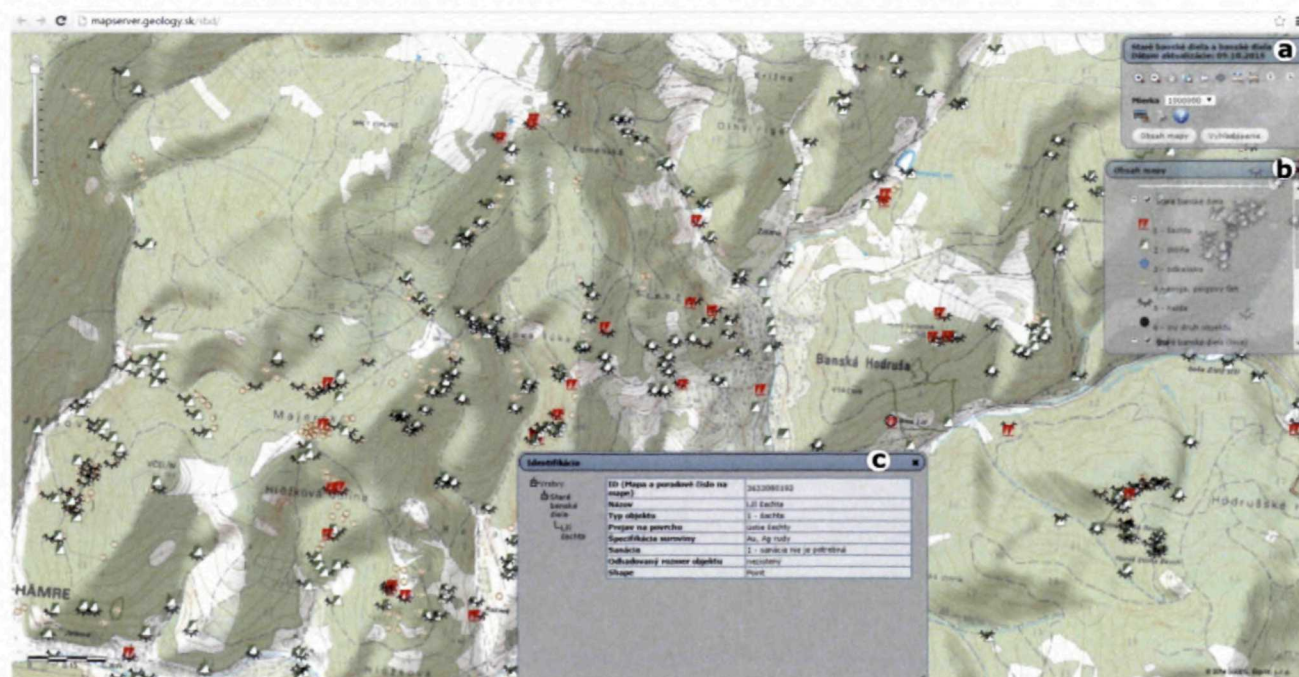

Fig. 7.6 Basic attribution table for historical shaft Lill exploited for Au, Ag ores. a – Navigation menu of Old Mining Works; b – Map Legend; c – Identification – fundamental attribution table.
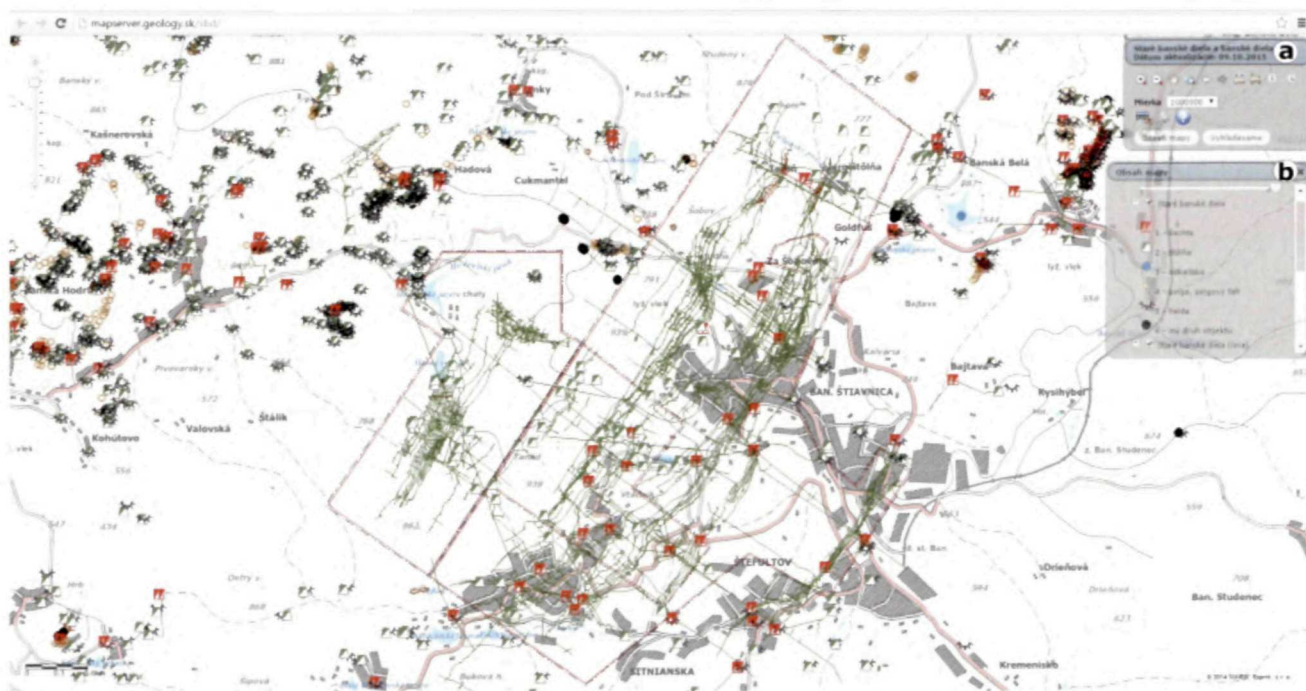
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Fig. 7.7 Processing of mining workings in the determined mining area Banská Štiavnica in the form of point and line layers. a – Navigation menu of Old Mining Works; b – Map Legend.

wants to receive an information. After the conclusion of the polygon we press the button "Formulár" [Form] and the table appears offering downloadable files for point, line and polygon layers (Fig. 7.9 d). The generated table in the MS EXCEL form displays information on deposits or deposit occurrences within the delineated territory of interest and the archive number of reports stored in Geofond (Fig. 7.10). For a better understanding of the application it is advisable to consult the enclosed Manual (in Slovak, Fig. 7.9 e).

7.4. Possibilities of Further Development of Deposit Applications

In 2016, we plan to launch the application of reports GEO 3-01 and 3-01 completion by the organizations directly via internet application Form GEO, which is currently being prepared. This would greatly simplify the process of communication with mining organizations, minimize the occurrence of errors in the accounts and, naturally, facilitate creating the publications "Balance of
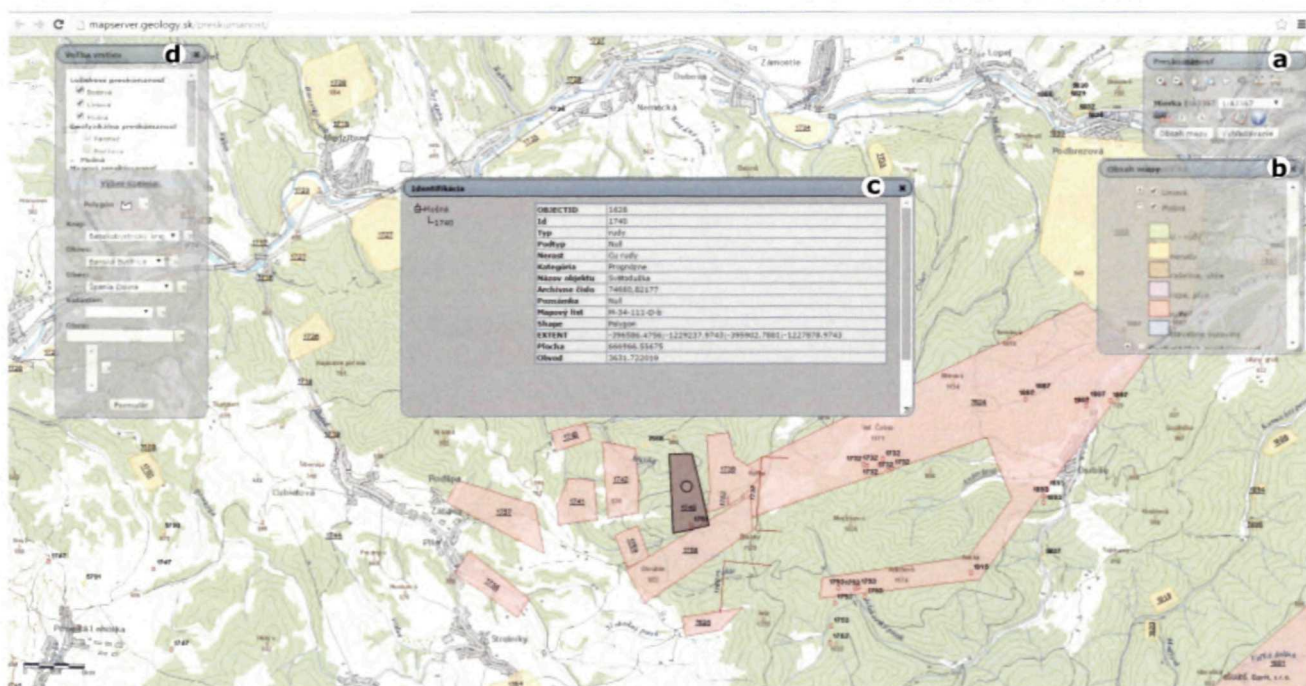

Fig. 7.8 Basic attribution table to the object of mining field Svätodušná in the district of historic mining of copper ores. a – Navigation menu of Deposits Exploration Status; b – Map Legend, c – Identification – fundamental attribution table, d – Panel of Forms creation.

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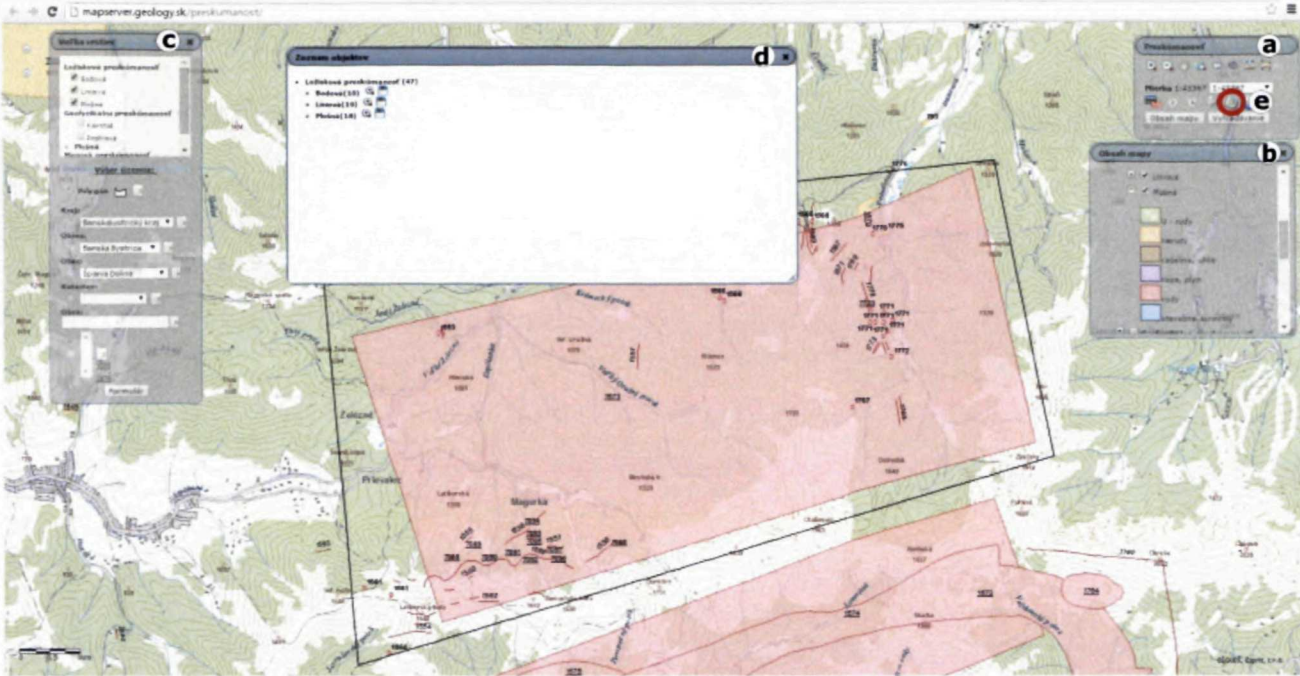
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Fig. 7.9 An example of generated form ready to be downloaded – mining field Liptovská Dúbrava and Magurka, historic mining of Sb and Au ores. a – Navigation menu of Deposits Exploration Degree; b – Map Legend, c – Panel of Forms creation, d – List of Objects, e – Manual.

Deposits of Exclusive Areas in Slovakia" and "Evidence of Non-Reserved Minerals in Slovakia". Data shall be inserted in the system by mining organizations using the Internet form through an authorized access. The new data will be checked and approved by a relevant annotator from the Department of Geological Exploration of SGIDŠ and incorporated into the parent database. This database will not be available in the online environment to non-authorized users, so it will not serve the public for viewing. It shall serve exclusively for the needs of the state geological administration and partly to the mining authority.

for elaboration of statements to the investments and spatial planning for municipalities (ÚPN O, in Slovak) and higher territorial units (ÚPN VÚC, in Slovak) under Law no. 50/1976 on land planning and building regulations (Building Act), as amended by further legislation. All Internet applications presented in this article are the unique source of information on the Slovak territory in terms of mineral resources. The application Exploration Areas is the only published Internet application of its kind in the whole of Europe, with specific functionality enabling quick preparation of proposals on determina-

	A	B	C	D
1	ID	NERAST	NAZOVOBJEKTU	ARCHIVNECISLORETAZEC
2	1775	Au rudy	Dúbrava odkalisko	28180
3	1564	stavebný kameň	Jasenie Latiborská II	3926,7817
4	1771	Fe rudy	Dúbrava Predpekelná	1709,1788,3569,3603,8160,8758,8901,11057,51954,75363
5	1568	stavebný kameň	Dúbrava Ľubela	1709,2477,3569,3603,8160,45865,52265,52276,79889,75363,77701,84789
6	1767	Sb rudy	Dúbrava pod Chabencom sever	1709,2477,3603,8160
7	1770	Au rudy	Dúbrava Dechtárka	3569,8160,8758,8901,11057,13696,52275,82808
8	1566	stavebný kameň	Dúbrava Sedlistá	744,1709,3603,8160
9	1561	štrkopiesky	Magurka hrebeň Prašivej I	3442
10	1553	keramické suroviny	Železnô, Malé Železnô	6724

Fig. 7.10 Demonstration of downloaded form from the query point layer made from the territory of the previous image. Columns: A – ID, B – Type of raw mineral, C – Object designation, D – Geofond reports archive numbers

7.5. Conclusion

The deposit applications presented in this article in their present form serve a broad professional and lay public as a geological-mining information on the Slovak territory. The most important subjects interested in the information on the deposits applications via Internet include the municipalities, regional governments and investment companies. The applications are also used

tion of exploration areas for organizations that are interested in obtaining a particular exploration area. The Internet deposits applications are also relatively frequently attended. Annually we register all together on average 20,000 unique entries outside SGIDŠ interested in the deposits applications. We will be very happy when there will not only increase the number of entries, but especially when it will be adequate extension of the services provided today by the unique Map Portal.

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Acknowledgements:

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