

## Information technologies in montaneous tourism

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### ABSTRACT

To illustrate how to use information technologies in montane tourism, in article are presented examples of its use in defining network of medieval salt routes in Slovakia, as well as example of visualization of historical mining works around the historical mining town Gelnica. The article deals with the application of information technologies primarily in the field of montane tourism. Evidently, the use of these technologies is possible in the whole spectrum of geotourism.

**Keywords:** Identification, retrogression, categorisation, visualisation, geographical information system, georeferences, 3D presentation

### IDENTIFICATION OF THE MEDIEVAL SALT TRADE ROUTE IN THE TERRITORY OF SLOVAKIA

Data related to the topic are available in various forms and on different media. They can be found mainly in books and other written documents, such as historical entries, maps, geological and mining profiles, sketches, engravings, altar paintings, numerical data, data stated in-situ, data come from oral tradition, as well as other forms of data. Developing a historic salt trade route in the territory of Slovakia we have tracing back the places of salt production, salt producing technology developments, and simultaneously tracing relevant trade routes. It is apparent from the above, that data have to be summarized, categorized, classified, and eventually represented in the unified system, e.g., by means of geographic information system - GIS.

#### Method of retrogression

Some scientists prefer to solve a problem like identification of historic trade route to use the method of retrogression, i.e., researching earlier, in the particular case, as early as pre-medieval routes, in order to be

able to reconstruct medieval trade routes. To achieve clear results require a thorough study lot of archaeological and historical documents. Obtained results are presented in graphical form in Figures 1 to 5. For each image are displayed settlements belonging to studied pre-historical/historical period. Even in prehistoric times there had to exist some form of trading with the salt, because the salt had to be one of the first marketed (exchanged) article. Assuming later trade routes mirrored and expanded trade routes from earlier historical periods, we have created network of medieval trade routes on territory of Slovakia [1] (Fig. 6).

#### Method of categorization

In order to create a net of medieval salt routes in the territory of contemporary Slovakia and immediate vicinity, we had operated with data that were ultimately divided into three categories. Table 1 presented data categorization by evaluation of the particular mining, historical, geographical and other pieces of information according to their content value and credibility [1].

While reconstructing historical route network, we analyzed predominantly historical documents. In this case we

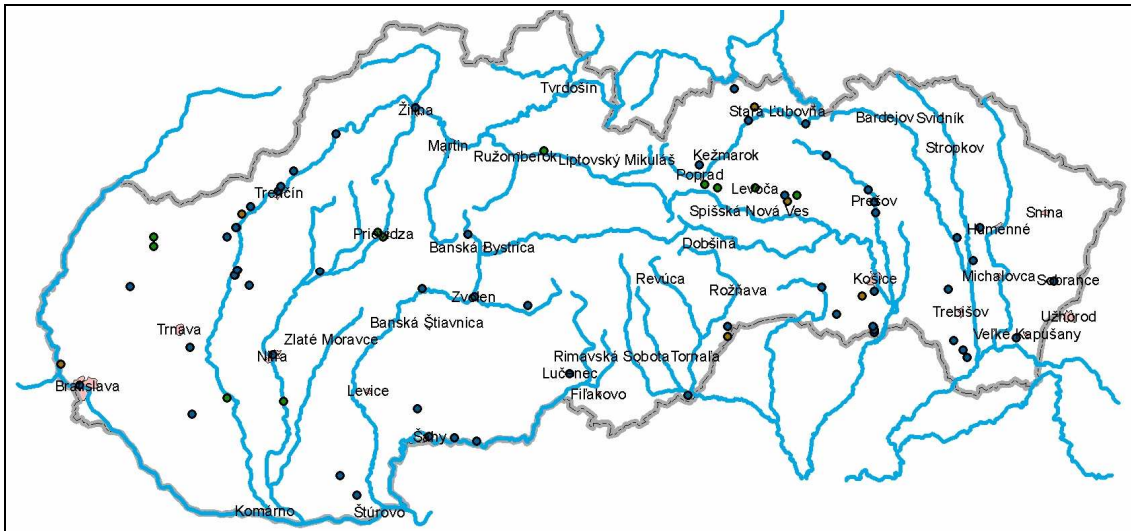


Fig. 1 Network of Paleolithic settlements in the territory of Slovakia

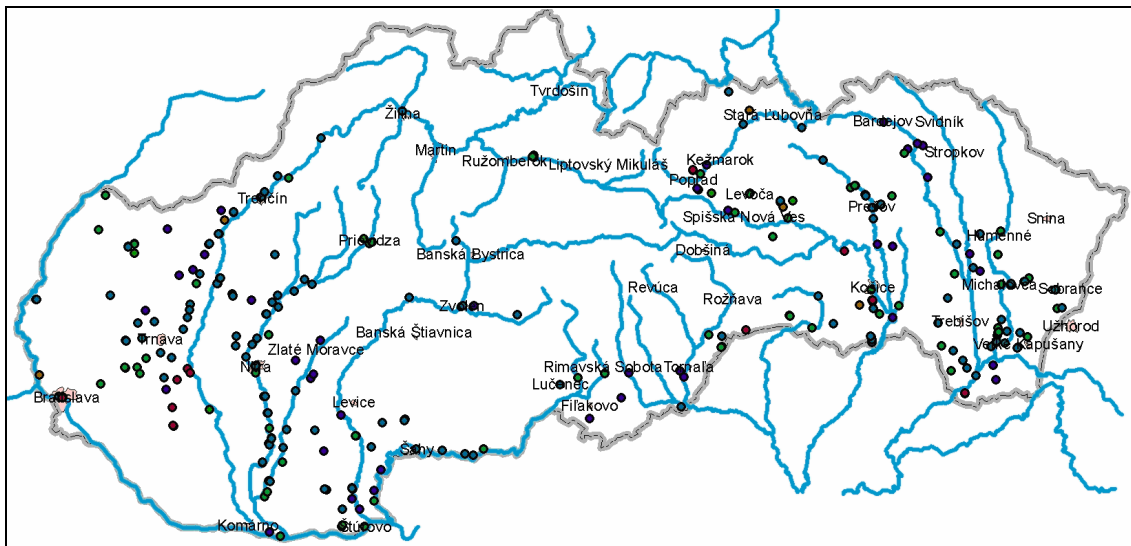


Fig. 2 Network of Neolithic settlements in the territory of Slovakia

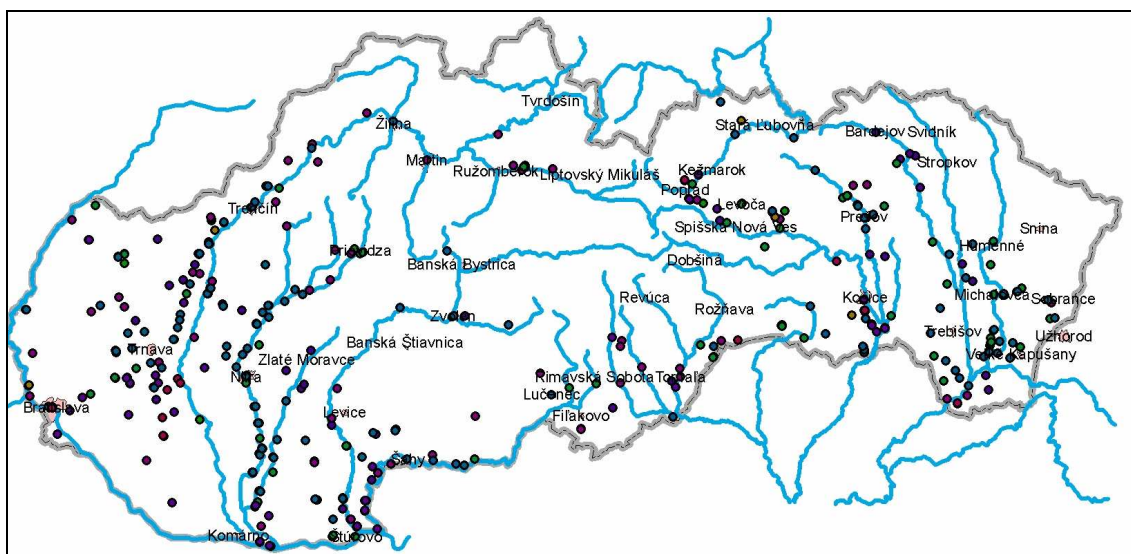


Fig. 3 Network of Bronze Ages settlements in the territory of Slovakia

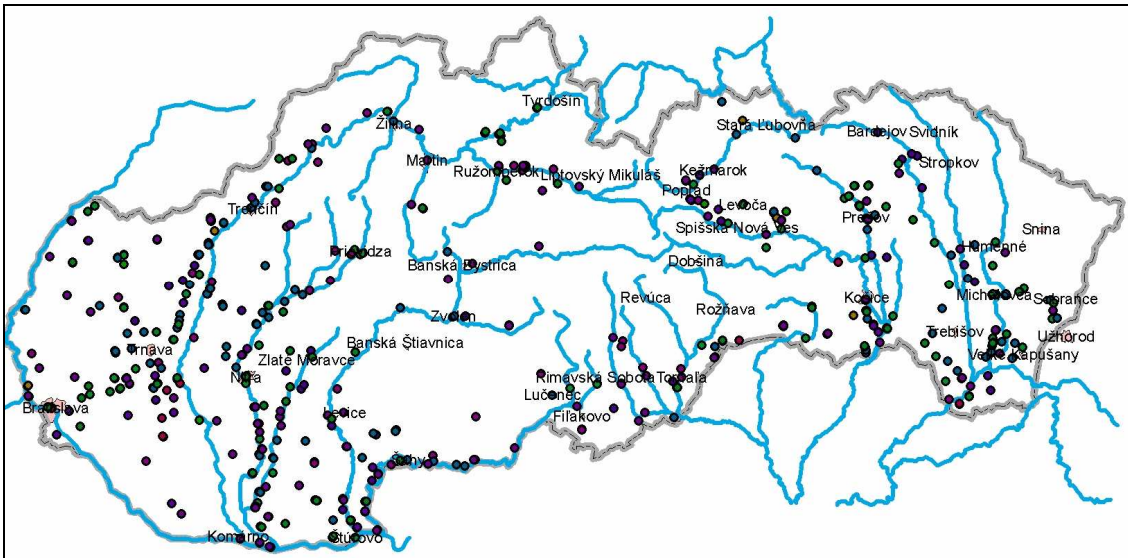


Fig. 4 Network of Iron Ages settlements in the territory of Slovakia

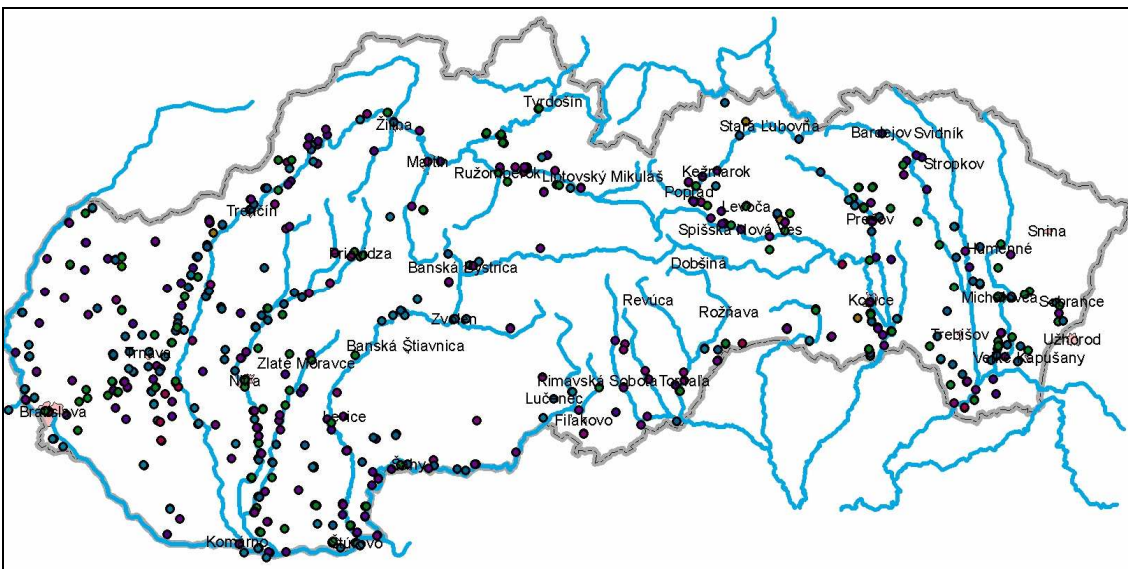


Fig. 5 Towns and villages in the Roman Age in the territory of Slovakia

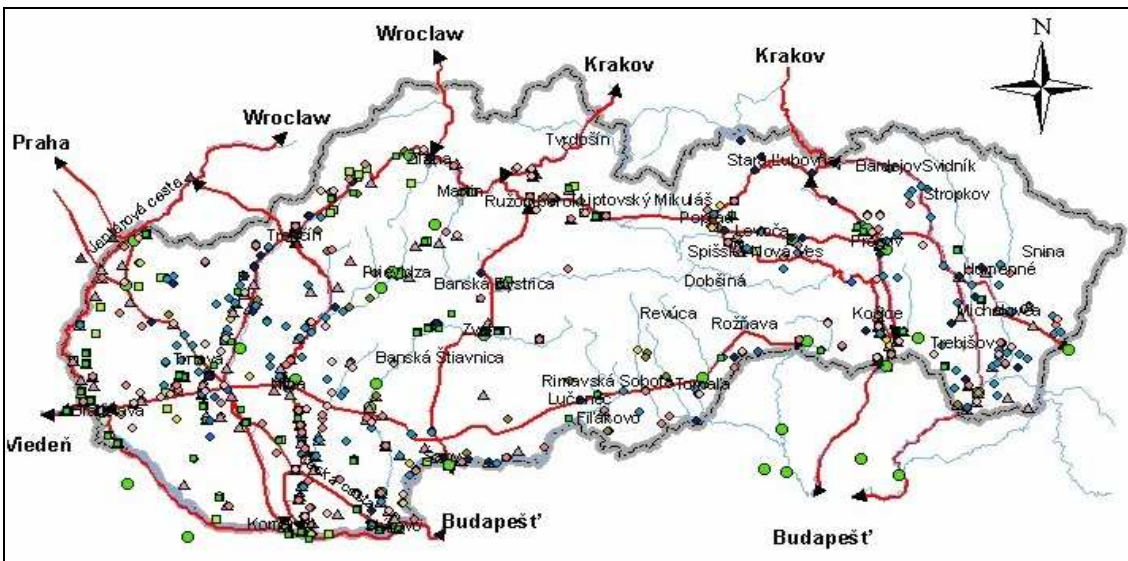


Fig. 6 Reconstructed network of historical trade routes in the territory of Slovakia by the method of retrogression

depicted the routes by means of geographical information systems (GIS), reaching thus transparent geographical projection, and in addition, we were able to implement the route network, taking into consideration geomorphologic classification of the landscape [1].

The first category routes, depicted in the graphic form as category 1, are documented by historically proved details, and in this manner they remain undoubted (Fig. 7 and 8).

The category 2 roads were designed according to historical maps that do not have the necessary altitude accuracy at the present time. However, they do have the documented literary value, as well as still existing point data, e.g., strongholds. A great deal of the category 2 route networks copy interconnections of the first category routes, which confirms the suitability of

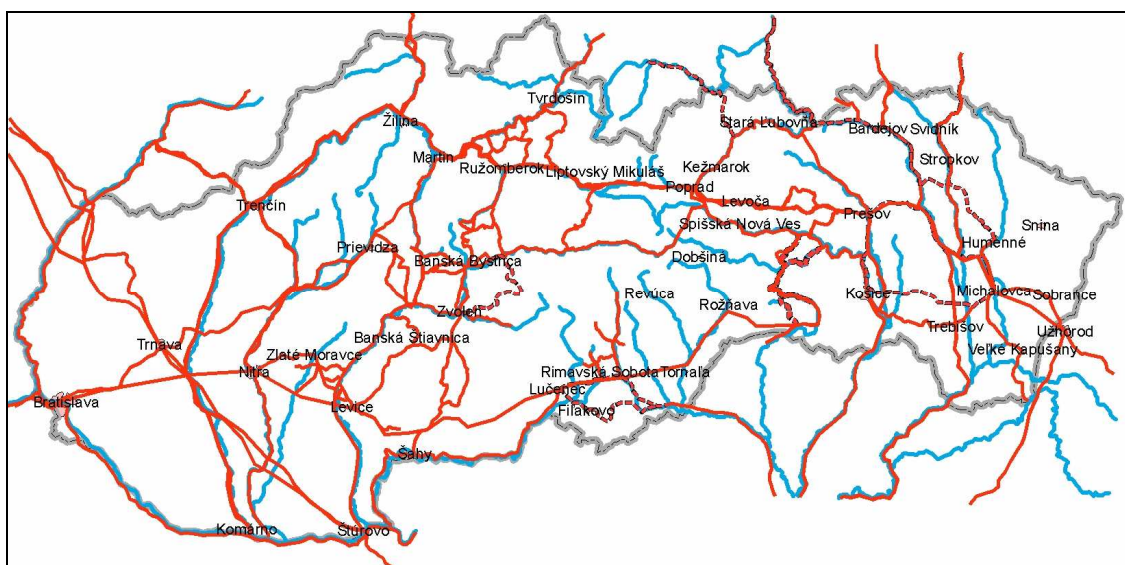
the chosen method, and this kind of the route network completion proves to be right (Fig. 9).

Category 3 routes were made with the help of relief analysis and logical presupposition of the existence of such routes. The category 3 routes analysis was based on the natural dispositions of the territory, e.g., river valleys, depressions, but also mountain passes which played a key role in crossing mountainous areas. This category was not supposed to view solely the country relief, but also its population, which was drawn into a graphic form, and in this way simplified and made the process of finalizing the road network much more effective (Fig. 10).

In order to reconstruct network of historical salt routes, it was necessary to create network of historical trade routes in general (Fig. 10).

**Table 1** Data categorization according to the occurrence of historical trade routes

	Line data	Point data
<b>CATEGORY 1</b>	<b>Road communications documented by authentic sources</b> (monographs, expert publications, anthologies, designs)	<b>Significant settlements built alongside road communications</b> (watch strongholds and fortified settlements, tollgates, markets, taverns, horse swapping junctions)
<b>CATEGORY 2</b>	<b>Road communications documented from archive materials and older road connections</b> (historical maps)	<b>Notable residences documented from the earlier historical eras</b> (habitats, burial sites, settlements)
<b>CATEGORY 3</b>	<b>Contemporary topographical maps</b> (depressions, basins, river valleys)	<b>Contemporary topographical maps</b> (mountain passes)



**Fig. 7** Historical trade route network based on the system of data categorisation, line data, Category 1 (Tab. 1)

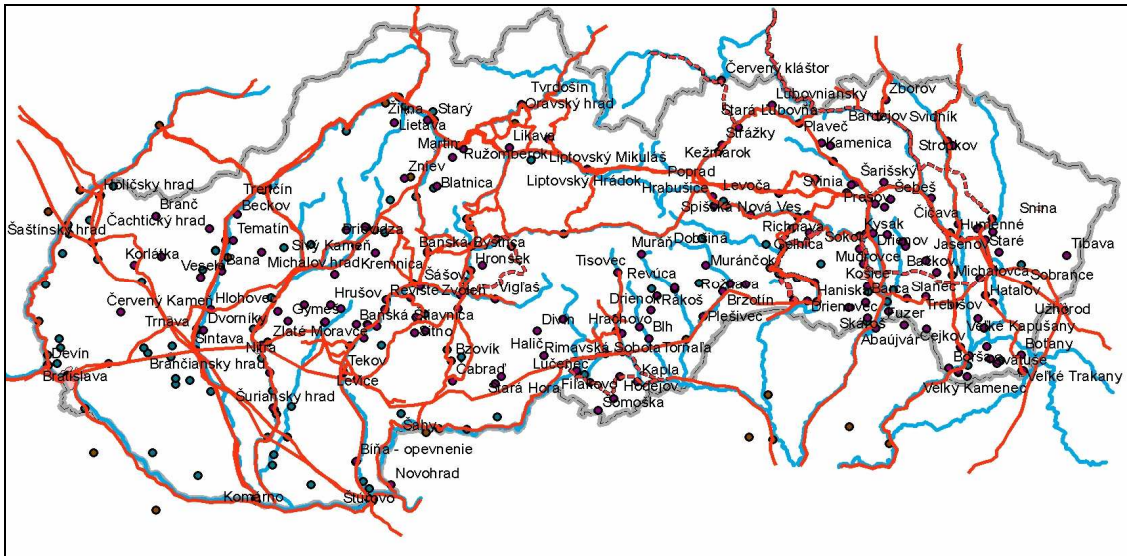


Fig. 8 Historical trade route network based on the system of data categorisation, line & point data, category 1 (Tab. 1)

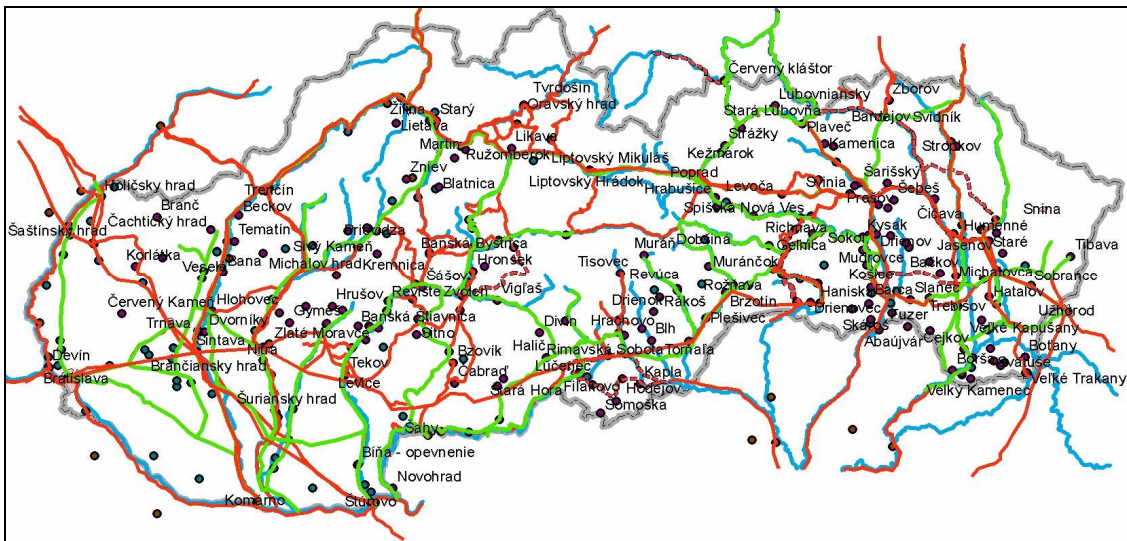


Fig. 9 Historical trade route network based on the system of data categorisation, category 1 data plus line and point data belonging to the category 2 (Tab. 1)

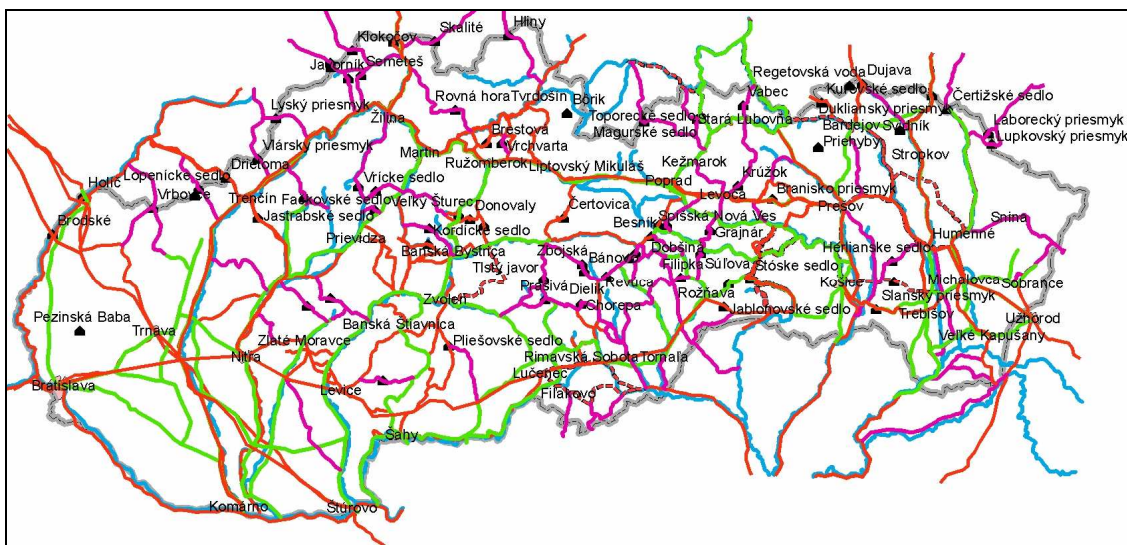


Fig. 10 Historical trade route network based on the system of data categorisation, all categories from tab. 1

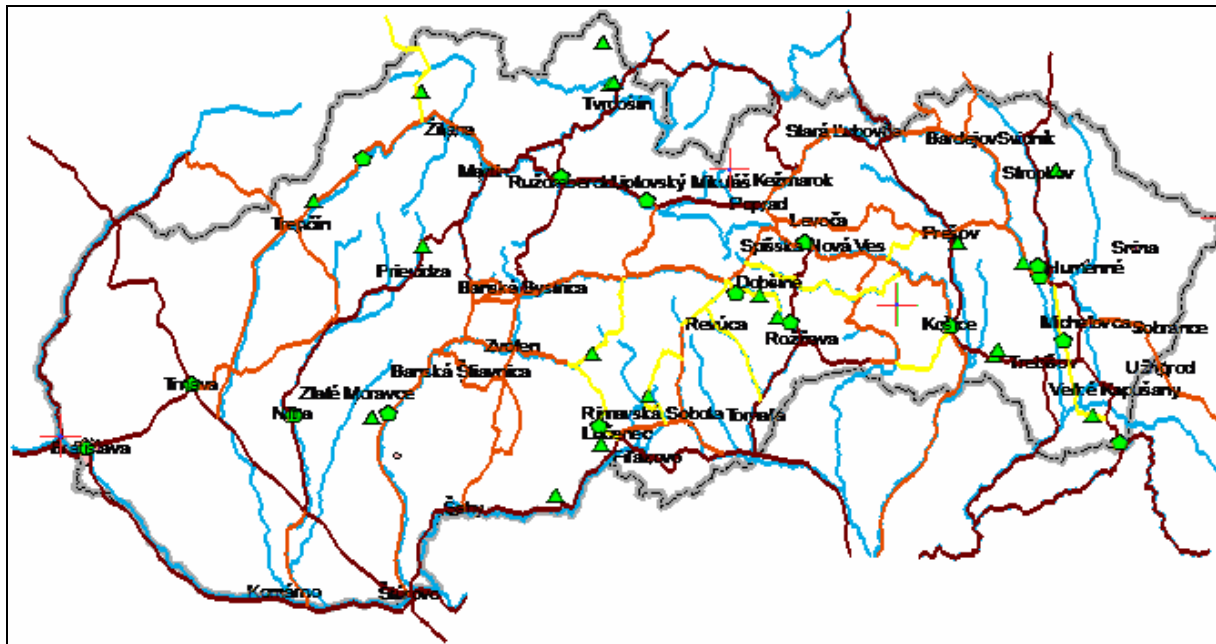


Fig. 11 Network of mediavel salt routes in the territory of Slovakia, based on all categories of the data categorisation - Table 2

Table 2 Data categorization according to the occurrence of salt routes

	Salt routes	Line data	Point data
<b>CATEGORY 1</b>	Road connections documented by historical and contemporary sources	Road connections documented by credible sources (monographies, expert publications, anthologies, studies)	Important settlements built alongside road connections (watchtowers and strongholds, toll houses, markets, taverns, swapping stations)
<b>CATEGORY 2</b>	Important trade connections (linked trade centers) salt point data	Road connections documented by archive materials and earlier road connections (historical maps)	Important settlements documented from previous periods (excavations, burial sites, residences)
<b>CATEGORY 3</b>	Road connections based on assumptions, Natural conditions and salt point data	Contemporary topographical maps (depressions, basins, river valleys)	Contemporary topographical maps (mountain passes)

To this network we were adding route lines used for salt transportation. Because of the lack of sufficient historical knowledge, it was impossible to depict a complete network of the salt trade routes; that is why we have used the method of creating data categories again, filling them with pieces of information, depending on their statement value and credibility (Tab. 2). The first category is represented by salt routes available in the historical reports or in the books that used to deal with salt trade in the Medieval Ages. The second category of salt trade routes is created by means of roads of the international significance, leading from salt mines to the territory of Slovakia or through this area, also to the important centers of the medieval European space. Although trade route files do not provide any direct evidence of salt transportation, it is very likely that salt had been transported along with other commodities, which explains why the routes are not presented as the salt ones.

As a result, by operating in GIS, we obtained a map of individual routes which surprisingly respected the point interpretation of the development of settlements and trading towns from pre-historic times until the Roman period (Fig. 1 - 4).

## VISUALIZATION OF MINING WORKS AROUND THE HISTORICAL MINING TOWN GELNICA

Another approach, different starting point and different data processing required visualisation of historical mining works. Sources gathered for this purpose where, above all, map materials, books, geological annual reports, historical records from mining archives and museums, along with inaccurate and sometimes even unknown localizations (Fig. 12), data from mining projects, annual reports with incorporated summaries of accomplished mining works, from measurements and observations in situ, etc.

Because of historical data visualization we used the following information technologies: making up a file of digital maps of the explored locality, creating a written and pictorial data file regarding the characteristics of the main vein bodies, presentation of all newly acquired data in one map basis, utilizing so-called "georeferencing," which stands for the technique for the integration of geodetic data of different qualities, gauges, projection systems within the used geographic system (GIS) [2].

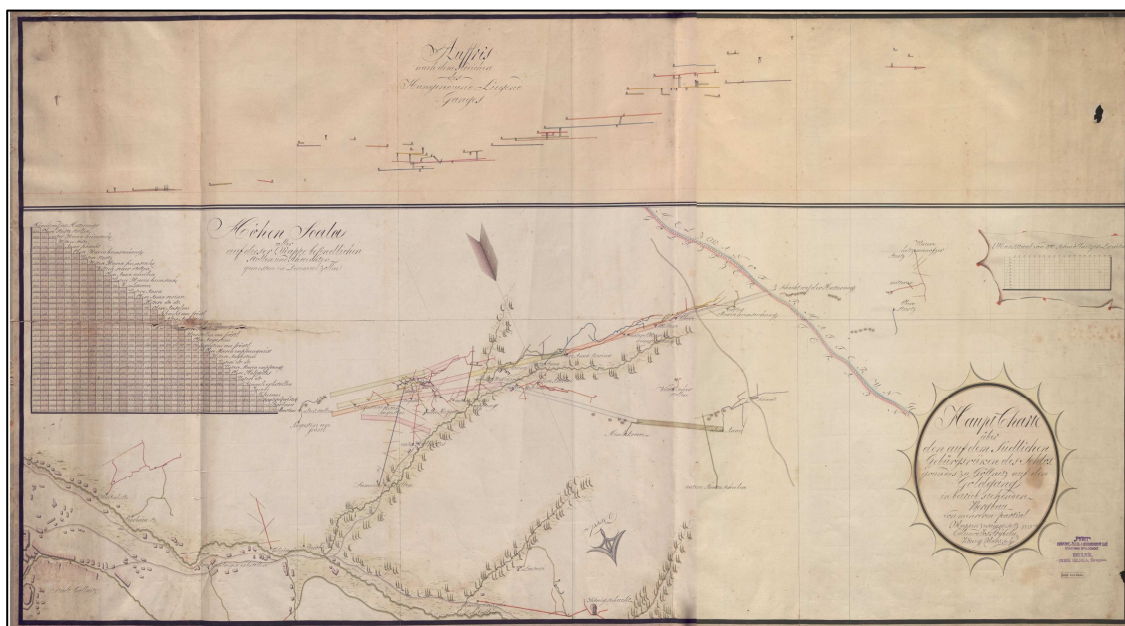


Fig. 12 Historical mining map, Mining Archive, ŠÚBA Banská Štiavnica

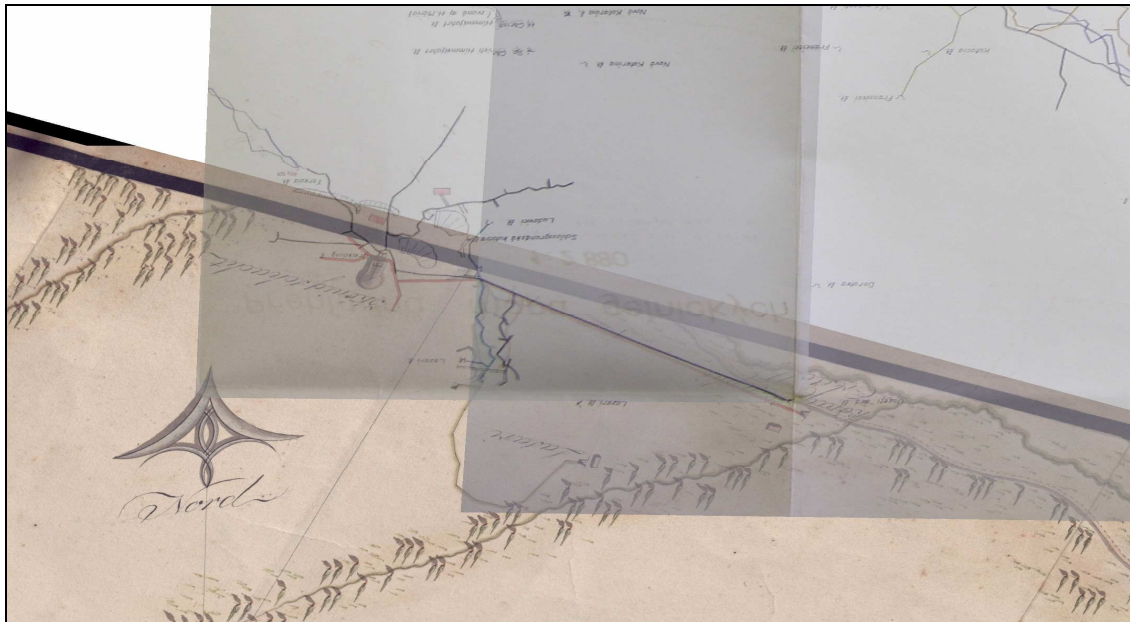


Fig. 13 Georeferencing of the historical mining map with a help of three default maps

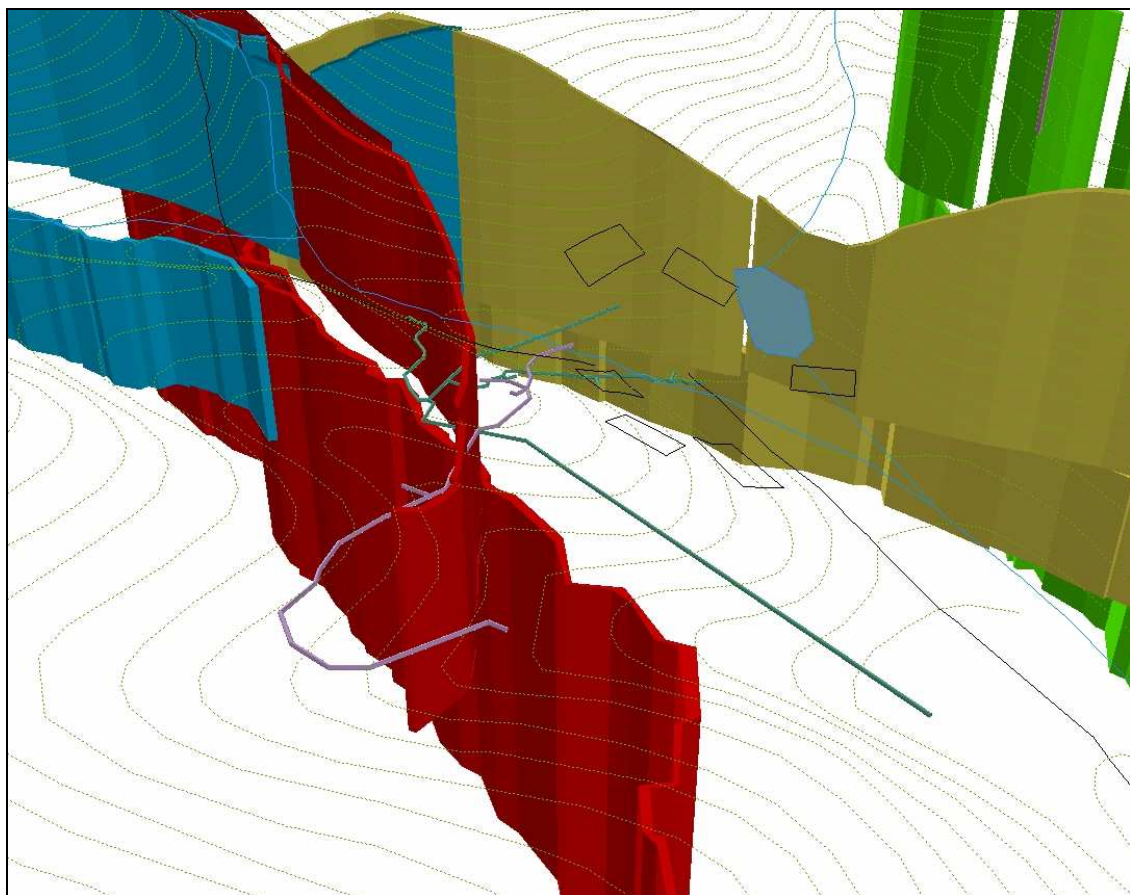


Fig. 14 The Lasari gallery (rounded pink), The Joseph drain tunnel.(blue-green). The surface contour lines and position of the Thursov valley and water reservoir clearly determine the position of historical mining works in the field. The main ore vein in the figure are as follows: Gelnická ore vein (red), Overlying ore vein (blue), Newore vein (yellow) and Cross ore vein (green).



The biggest problem in processing the various data was - to the surprise, harmonising heterogenous sources of mining and geological maps into one unit. Three-dimensional common presentation hit a routine having been used by geologists and miners, when written and drawn data all in all expressed only fragments of reality. Even the greatest mining and geological experts who had worked at Gelnica and surroundings for years, had to accept at the most geological cuts mutually not interconnected, while mining works in these cuts had been depicted also schematically. And vice versa, mining maps showed only continuation of the mining work in the vein deposit cut.

Fig. 14 shows in 3D projection the position of historical mining works – Lasari gallery and Joseph drain tunnel together with the leading ore veins main course of Gelnica ore field. The designed 3D map capturing simultaneously both: the development of leading ore veins in the

delimited area of Gelnica and surroundings along with the development of the mining works.

## CONCLUSION

Article presented very interesting methodology as well as achieved results in creation of network of historical salt routes in the territory of Slovakia, as well in a case of the visualisation of historical mining works on the historical very important mining city and vicinity – Gelnica.

## REFERENCES

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