MAIN ASPECTS OF THE GEOLOGICAL-EDUCATIONAL MAP OF THE VIHORLATSKÉ VRCHY MTS., SLOVAK REPUBLIC.

B. ŽEC[1], M. STERCZ[1], K. ŽECOVÁ[1], E. KALIČIAKOVÁ[1], L. ROVŇÁK[2], L. PALKO[2]

[1]*Geological Survey of Slovak Republic, Jesenského 8, Košice 040 01, Slovakia*

[2]*State protection of environment of Slovak Republic, Fraňa Kráľa 1, Michalovce , Slovakia*

Abstract: The Miocene volcanic field of the Vihorlatské vrchy Mts. (easternmost part of the Slovak Republic) covers an area of aproximately 500 km^2, extending over 22 km in W–E direction and from north to south 23 km. The Vihorlat Landscape Protected Area, as well as a lot of nature protected areas and reserves of other categories, are located within their territory.The presented new publication comprises a geological–educational map and a booklet with text explanations (localities etc.) to the map.

Key words: Neogene volcanics, geological–educational map, Vihorlatské vrchy Mts.

Introduction

The Vihorlatské vrchy Mts. are dominant because of their steep, deeply incised furrowy slopes with a wide range of geological phenomena, wide-spread beech forests, rare vegetation and wildlife associations. The whole region is important from the viewpoint of water management, soil protection, geology, flora and fauna protection, as well as forestry.

Geological setting

The geological setting of the Vihorlatské vrchy Mts. is rather complicated (Žec et al., 1997a, b). Here the rocks of the Humenné Mesozoic (approximately 245–65 Ma), Klippen Belt Mesozoic (approximately 150–65 Ma), “Klippen Belt” Paleogene (approximately 45–34 Ma), Inner Carpathian Paleogene (approximately 40–34 Ma), Neogene (approximately 21–9 Ma) and Quaternary (approximately 1,8 Ma to present) are exposed. The Magura Paleogene (approximately 50-30 Ma) crops out north to the above geological units and belongs to the Outer Carpathians.

From the geologic point of view area of the Vihorlatské vrchy Mts. represents our easternmost volcanic mountains (Fig. 1), which originated in Tertiary – during Neogene, when the calc–alkaline lavas erupted. The volcanic activity in this area started during Lower Badenian (approximately 16–15 Ma) and volcanic products are represented by rhyodacite fine ash tuffs crop out near the Oreské Village and south of the Podhoroď Village (similar to Hrabovec tuffs exposed by the Nižný Hrabovec Village). The volcanic activity continued 12,5 Ma ago (in the Middle Sarmatian) by an intrusion of the volcanic bodies of rhyodacite composition, into older Paleogene sandstones and claystones. One of such bodies crops out north of the Beňatina Village, in the valley of the Beňatinská voda Brook. In the south-western part of the region, the similar volcanic character produced morphologically distinct large-dimensional andesite extrusive bodies (domes) of the Vinné Complex.

The most violent volcanic activity started in the Late Sarmatian and ended to the Lower Pannonian (approximately 12,5–9,5 Ma). The common feature of this volcanic activity is its explosive offset, prevailingly, with gradual increment of effusive activity. Its end is characterised by the intrusions of volcanic (so-called intrusive) bodies. The explosive activity was of Strombolian, Vulcanian and Plinian types. Similar eruptive characteristics were documented in the central Slovak Neogene volcanic field (Šimon, 1999; Konečný et al., 2001).

In the course of the above explosive–effusive activity two distinct andesite stratovolcanoes chains were formed. The eastern one, striking from the south–east to the north–west comprises morphologically isolated stratovolcanoes Popriečny, Diel and Morské oko. The easternmost volcanic structure of the Vihorlatské vrchy Mts. is the Popriečny Stratovolcano. It is situated in the area delineated by Inovce and Podhoroď villages (on the north), Choňkovce and Tibava villages (on the west), Vyšné Nemecké (on the south) and the national borderline with Ukraine (on the east). Its major part lies out off our territory, in the Ukraine. The geological evolution of the stratovolcano is characterised by two formations – Popriečny (a fundamental part of the Popriečny Stratovolcano) and Petrovce (the upper volcanic structure), that are represented by fallen pyroclastic products (breccias and agglomerates) alternating with andesite lava flows, the washout, re-deposited pyroclastic and epiclastic deposits. The Diel Stratovolcano represents a relatively well–preserved volcanic structure situated north–west of the Popriečny stratovolcano, between the Beňatinská voda Brook valley (on the south) and Barlahov Brook valley (on the north).

However, a major part of the eastern structure had been denuded. Its evolution is characterised by Bystrá, Vavrová, Diel Formations and Central Zone Complex. The Morské oko Stratovolcano crops out at the north–eastern edge of the Vihorlatské vrchy Mts. and is part of the largest volcanic structures of the region. It is located at the intersection of two fault systems, the north-west–south-east and the north-east–south-west directions. The Stratovolcano is markedly truncated by intense erosion. The rocks of the volcanic cone lack in the central volcanic zone. A cauldron–like depression has been formed on its place, exposing intrusive, altered rocks. The Stratovolcano is considerably reduced by erosion from the eastern and northern side, which had influenced its relative uplift during the volcanic activity. Due to this uplift, the Stratovolcano was primarily asymmetric. Most of its volcanic products accumulated in its southern part. The Hámre Formation creates the fundamental structure of the Stratovolcano. The upper Sninský kameň Formation covers much of the Hámre Formation by its effusive members (lava flows). The western chain of stratovolcanoes, striking from the north–east to the south–west, is composed of morphologically contiguous stratovolcanoes Vihorlat, Sokolský potok and Kyjov. Rather eccentric is the explosive volcano Kamienka, covered by lava flows of Kyjov, Sokolský potok and Morské oko stratovolcanoes. The evolution of the individual stratovolcanoes of the eastern chain started with an explosive activity during the Late Sarmatian. The Vihorlat Stratovolcano is situated south-west of the Morské oko Stratovolcano and forms its superincumbent. The highest altitude of the Vihorlatské vrchy Mts. reaches the Vihorlat elevation (1075,4 m a.s.l.). The stratovolcano is characterized by periclinal dippings of lava flows around the central protrusion in the area of the top of the Vihorlat Hill. Two stages of them have been distinguished in the stratovolcano evolution. The Sokolský potok Stratovolcano is the next member of the volcanic chain when continuing to the west. To the south, the volcanic structure of the Sokolský potok Stratovolcano is overlain by Neogene basin sediments. The dominant structural members are andesite lava flows (also divided into two evolution stages). The Kyjov Stratovolcano represent the westernmost situated composite volcano. On the north–west rim its volcanic products partially overlie the Humenné Mesozoic, the Inner Carpathian Paleogene and the Neogene sediments, as well. To the south, the stratovolcano continuation is covered by the deposits of Neogene basin. The dominant structure members of the stratovolcano are andesite lava flows of two evolution stages. In its western part, epiclastic volcanic rocks and redeposited pyroclastics crop

out. On the north–western edge of the Vihorlatské vrchy Mts., approximately 1 km east of the Kamienka Village, a synonymous stratovolcano crops out. The Kamienka Stratovolcano structure is exposed at the erosion cut of the Kamenica Brook valley (former Riki). The pyroclastic products (pyroclastic breccias and agglomerates) are exposed on the both slopes of the valley. The volcano`s superincumbent is represented by the lava flows of the Morské oko, Sokolský potok and Kyjov stratovolcanoes.

Enormous amount of the Quaternary deposits occurs on the northern and southern submontane parts of the Vihorlatské vrchy Mts. Toward the end of Pliocene (approximately 1,8 až 5 Ma), the lake below Vihorlatské vrchy Mts. had gradually changed into the swamps and marshes with the deposition of various organic sediments. The climatic conditions frequently changed. In the colder periods during Pleistocene (approximately 1,8 až 0,1 Ma) a huge amount of material was loosen due to intense mechanical weathering. The dissected relief led to the gravitational transport. This way, stony “seas” and blocky fields originated. In the adjacent regions the loess deposited, today termed loessy loams. Approximately 100 000 years ago, during the last glacial period, formation of peat started in the “Šírava depression” and has continued further on. The lakes have formed in the Vihorlatské vrchy Mts., starting to be filled by organic or inorganic material. In this way, the peat bogs Postavka, Hypkania and Ďurova mláka originated. The Morské oko Lake is dated back to this period, too.

The recollected geology of the region is presented in the front side of the map (Žec et al., 2001). Tourist routes, ethnographic curiosites and other remarkable sites are outlined (Fig. 2). The reverse side of the map includes information on geological setting of the region, as well as on fauna and regional ethnography. The booklet provides text explanations to the map and some description to the selected localities (75 locs.) of the objective region.

Interesting fauna, flora and ethnographic curiosities

The Vihorlatské vrchy Mts., due to its extent and geographic position, provides shelter for multifold fauna and flora species. From the fauna point of view they create an interface of West and East Carpathians, and this is why species of both provinces are present. From the phytogeographical point of view the mountain range is situated

on Pannonian and Carpathian interface. The occurrences of several species typical for these regions have been recorded. The main task for state nature protection is to preserve and protect this unique wealth with typical representatives of rare and protected species associations of flora and fauna. The Vihorlatské vrchy Mts. provides biotope for nearly 2 000 species of invertebrates, among of them 25 species are protected. Differing geomorphological setting, vertical range and various climatic and soil conditions have impacted origin and extent of vegetation associations. This fact influences the abundance of individual plant species. The attention attracts mostly endemite species, which occur only at limited extents. In the Vihorlatské vrchy Mts. these are Aconitum moldavicum, Symphytum cordatum, Dentaria glandulosa. Important are Balkanian – East Carpathian species Scopolia Carniolica, Telekia speciosa, etc. Among East Carpathian species these are Tithymalus sojakii, Aconitum lasiocarpum. The interaction between climatic conditions and forest vegetation is represented by the forest stage, depending on climatic changes due to altitude changes.

Volcanic mountains with its natural sources lured man to settle here also in further ages. The up to date research has evidenced settlements of Scythian, Thracian, Celtic, Dacian and, finally, Slav people. The settlement is known from prehistoric times in this area. The numerous archaelogical findings confirm the continuation of this past and traditions in folk culture up to present. Their interdigitation has faded a lot of specific features of the former folk cultures of these ethnic groups, so there is no significant difference among them, with only exceptions of language and partially of clothes. Agriculture of this area had been unadvanced, due to frequent floods, swamping meadows, pastures and fields under crops. During droughts soil desiccated and cracked. That was one from impulses for emigration. The Vihorlatské vrchy Mts. slopes had been one of the most significant vineyard regions spreading from Trnava through Vinné, Kaluža, Priekopa up to Petrovce. In the villages close to carbonates, the lime was produced (Krivošťany, Oreské, Ladmovce, Podhoroď). More than 400 years old tradition of pottery supplied the whole Zemplín region with its goods, even the markets in Užhorod and Hungary. One of the most precious monuments of the area were architectonical gems – preserved sacral wooden buildings (churches). Within the Vihorlatské vrchy Mts. such churches we can see in Hrabová Roztoka, Ruská Bystrá and Inovce villages.

Concluding remarks

The environment of the Vihorlatské vrchy Mts. together with many elements of human activity give the country a specific complexity full of unusual charm and uniqueness. Main purpose of the geological-educational map of the objective region is to make available new knowledge on geological setting, on nature phenomena and on biotic and abiotic compounds of nature within Slovakian regions.

References

Konečný, V., Lexa, J., Šimon, L. and Dublan, L. 2001: Neogénny vulkanizmus stredného Slovenska (Neogene volcanism of the Central Slovakia, in Slovak). In: Šimon, L., Konečný, V., and Lexa, J., (Eds.) Banská Štiavnica-City upon volcano. Mineralia Slovaca 33, 3, s. 159-178.

Šimon, L., 1999: Volcanism and sedimentation in the north-western part of the central Slovak neogene volcanic field. Geologica Carpathica, vol. 50, Special issue, 1999, Geologica Carpatica, 137-140, Bratislava.

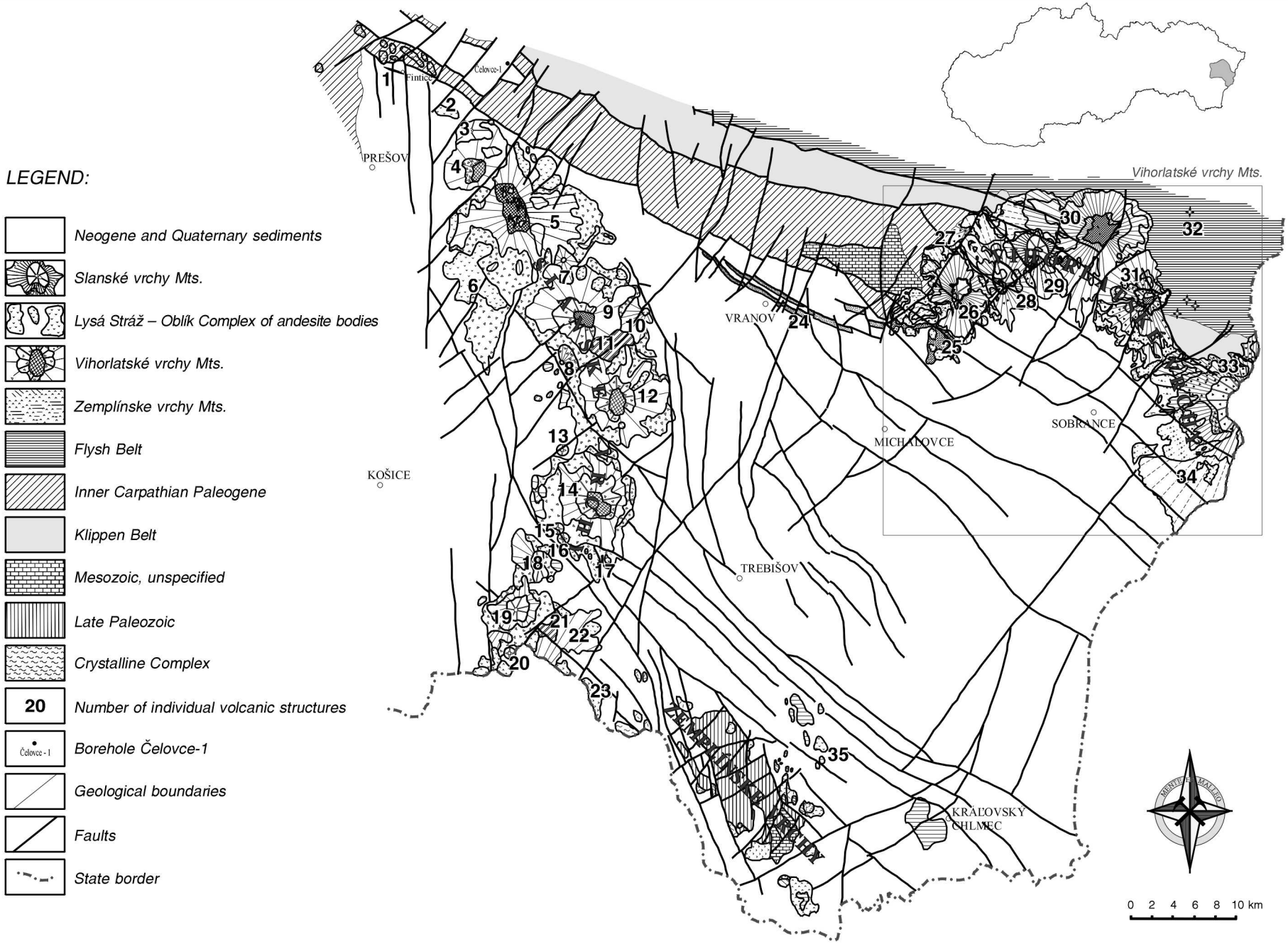
Žec, B., Kaličiak, M., Konečný, V., Lexa, J., Jacko ml., S., Baňacký, V., Karoli, S., Potfaj, M., Rakús, M., Petro, Ľ., Spišák, Z., Bodnár, J., Jetel, J., Boorová, D., Zlinská, A.: Explanations to the geological map of the Vihorlatské vrchy Mts. and Humenské vrchy Mts., M 1 : 50 000, GS SR, Bratislava, 1997a, 254 p.

Žec, B., Kaličiak, M., Konečný, V., Lexa, J., Jacko ml., S., Karoli, S., Baňacký, V., Potfaj, M., Rakús, M., Petro, Ľ., Spišák, Z.,: Geological map of the Vihorlatské vrchy Mts. and Humenské vrchy Mts., M 1 : 50 000, GS SR, Bratislava, 1997b.

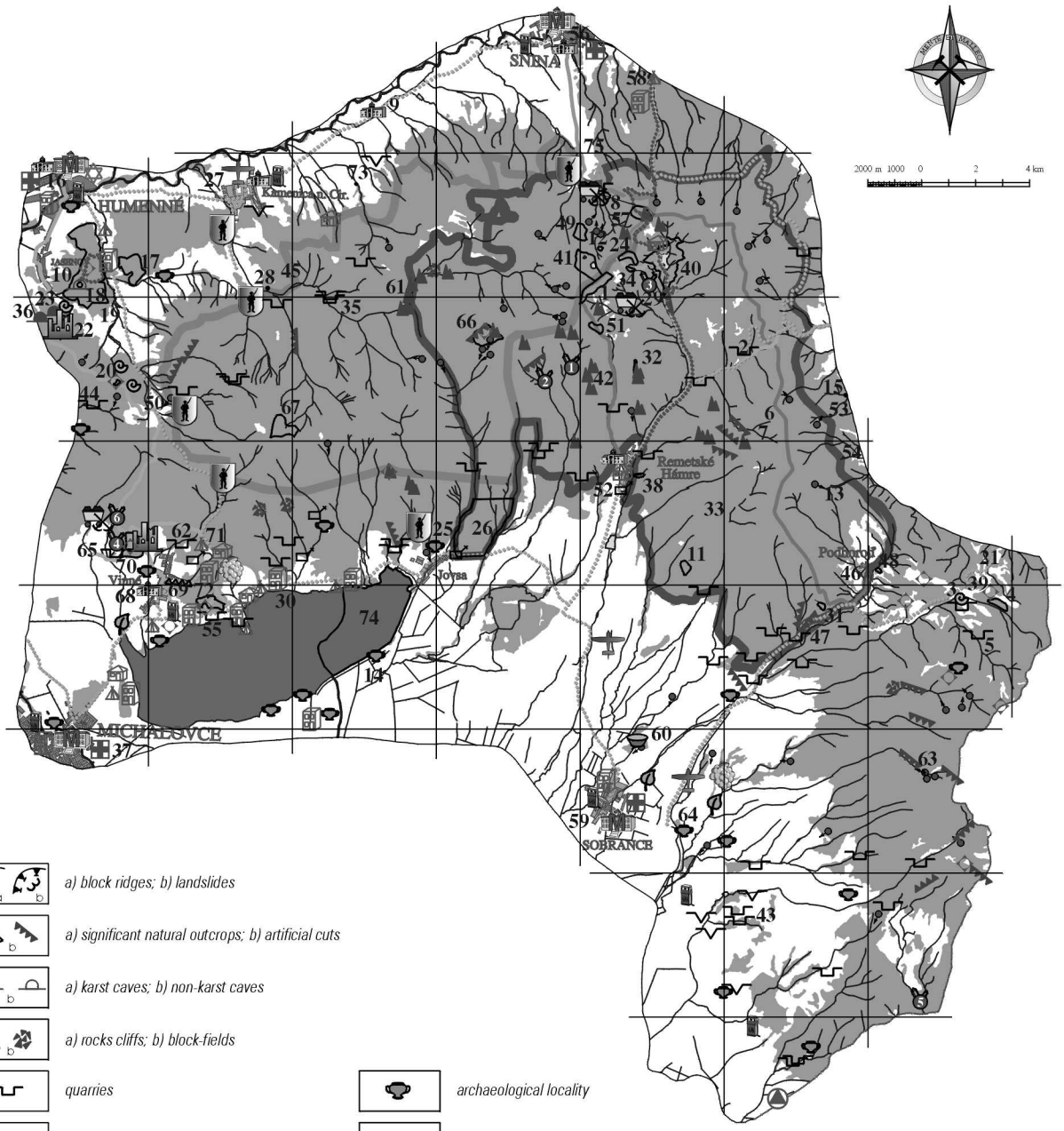
Žec, B., Kaličiaková, E., Žecová, K., Stercz, M., Rovňák, L., Palko, L.: Geological – educational map of the Vihorlatské vrchy Mts. (map and a booklet with explanations /31 p./), GS SR, Bratislava, 2001.

Fig. 1 Structural–volcanological scheme of the Eastern Slovakia Neogene Volcanics (updated according to Žec et al., 2001)

Fig. 2 Some typical geological, natural, tourist opportunities of the Vihorlatské vrchy Mts. (updated according to Žec et al., 2001)



The Slanské vrchy Mts.: *1 – Fintice rhyolite tuffs, 2 – Lysá Stráž - Oblík Complex of extrusive bodies, 3 – Šebastovka Volcano, 4 – Šťavica Volcano, 5 – Zlatá Baňa Stratovolcano, 6 – Brestov Complex of extrusive bodies, 7 – Ošvárska Volcano, 8 – Rankovské skaly Volcano, 9 – Makovica Stratovolcano, 10 – Vechec Volcano, 11 – Banské volcano-tectonic depression, 12 – Strechový vrch Stratovolcano, 13 – Košický Klečenov Volcano, 14 – Bogota Stratovolcano, 15 – Regeta Volcano, 16 – Slančík Volcano, 17 – Nomša Complex of dacite bodies, 18 – Hradisko Stratovolcano, 19 – Bradlo Stratovolcano, 20 – Poliaška Volcano, 21 – Slanská Huta volcano-tectonic depression, 22 – Veľký Milíč andesite lava flows and Kopáska extrusive bodies, 23 – Lipová rhyolite bodies; 24 – Hrabovec rhyodacite tuffs;* ***The Vihorlatské vrchy Mts.:*** *25 – Vinné Complex of extrusive andesite domes, 26 – Kyjov Stratovolcano, 27 – Kamienka Volcano, 28 – Sokolský potok Stratovolcano, 29 – Vihorlat Stratovolcano, 30 – Morské oko Stratovolcano, 31 – Diel Stratovolcano, 32 – Ladomírova and Podhoroď andesite necks and dykes, 33 – Beňatinská voda rhyodacite body, 34 – Popriečny Stratovolcano;* ***The Zemplínske vrchy Mts.:*** *35 – rhyolite and andesite volcanic products (undivided).*



a) block ridges; b) landslides

a) significant natural outcrops; b) artificial cuts

a) karst caves; b) non-karst caves

a) rocks cliffs; b) block-fields

quarries

gravel, sand and loam pits

abandoned mines

a) springs; b) mineral water springs and acidulous waters

finds of: a) fauna; b) flora

museum

manor house

wooden church

synagogue

castle ruins

archaeological locality

bath

vineyard

border crossing

fuel station

airport (sporting, agroairport)

hospital

forester's house

view point

bicycle trail

mineralogical localities

a) marked hiking trails; b) educational trails

hotel, housing facilities, camping

border of nature reserves

border of Protected Landscape Area

24 numbers of accounted objects

entrance into military area: a) permit; b) enter

border of military area