HERCYNIAN AND ALPINE STRIKE–SLIP TECTONICS — A DOMINANT ELEMENT OF TECTONIC DEVELOPMENT OF THE INNER WESTERN CARPATHIANS

V. BEZÁK

Geological Survey of Slovak Republic, Mlynska dolina, 817 04 Bratislava, Slovakia; bezak@gssr.sk

Abstract: Tectonic units, from which the Inner Western Carpathians are composed, originated within the compressional tectonics of the Hercynian and Alpine orogen. However, the present structure of the Western Carpathians was influenced mainly by strike-slip tectonics. We present the most significant Hercynian and Alpine strike-slips in the middle part of the Western Carpathians. In most cases Hercynian and Alpine shear zones are identical.

Key words: Western Carpathians, Hercynian, Alpine, strike-slips

Introduction

The tectonic units, of which the Inner Western Carpathians (south of the Klippen Belt zone) are composed at present, originated during long-dated development of the Hercynian and Alpine orogen. From the point of view of all-European context of correlations they oiginated in various areas. However, in spite of that development of these orogens had common features. It was mainly a transition from collisional compressional tectonics to transpressional tectonics and to the end to extensional disintegration. Distinct manifestation of strike-slips at shear zones in certain periods (mainly the Late Paleozoic, Late Cretaceous, Neogene) is a feature of great importance in the development of both orogens. Tectonics of strike slips was of greatest influence on present-day distribution of tectonic elements in the Western Carpthians.

Strike-slips zones in the central part of the Western Carpathians

Structure of the Inner Western Carpathians consists of several thrusting crustal units (Tatricum, Veporicum, Gemericum and supracrustal nappes) originated in Paleoalpine stage of the tectonic development (mostly Cretaceous). First three units are composed of crystalline

basement and Upper Paleozoic and Mesozoic cover.Similarly, in the structure of the basement traces of overthrust and superposition of large Hercynian crustal lithotectonic units 4-6 km thick have been preserved (Bezák et al., 1997). This results from field observation as well as analysis of deep seismic profiles. This is valid for the basement of the Tatricum and Veporicum as well as Gemericum. However, the Gemeric segment in the Early Paleozoic was enplaced in other area and had a different composition and development of units (Vozárová, 1998).

Most conspicuous, however, in the basement of the Inner Carpathians are distinct shear zones tens – hundreds meters of thicknesses with extensive manifestations of diaphthoresis and mylonitization mostly in greenchist facies. Structural marks (subvertical foliations, subhorizontal lineations, assymetric structures) prove for these zones mostly strike-slip type of movements. Also thrust boundaries of the large nappe units are often superimposed by strike-slips (fig.2).

In the Inner Western Carpathians there is a series of such subvertical shear zones. From the point of view of latest knowledge we shall characterize as an example the most significant of them (fig.2) occurring in the central part of the Western Carpathians in the area between the Nízke Tatry Mts. and the Ľubeník line (Fig.1).

Nízke Tatry Mts. (Tatric part)

Špíglová shear zone is mostly Alpine shear zone NE-SW oriented. The zones of low temperature blastomylonites are ore mineralized (Adamia et al. 1992). Older W-Au mineralization is of stockwork-impregnation character, biotite at the margins of ore veins is dated back to 300 Ma by K/Ar method. Hercynian shear zones of E-W direction in the environment of banded and eyed orthogneisses are connected with mylonitization and ore mineralization (Bystrá zone). The age of newly formed muscovites in the shear zones is 332 Ma (Ar/Ar method, Dallmeyer et al.), 1993. Trangoška zone is Neogene strike-slip based on inherited structures from Paleoalpine stage.

Northern Veporicum

Kolba shear zone is NE-SW oriented zone of blastomylonites with Cu-mineralization and intrusions of Permian granite-porphyries. The ore mineralization does not pass into the Mesozoic envelope. It is obvious, that this is a Upper Paleozoic shear zone, however, movements along it were also repeated in the Cretaceous. In the parallel Osrblie zone in strike-slips superimposed on Alpine slices also Mesozoic rocks are present. Pohorelá and

Vydrovo zones are parallel NE-SW striking zones of blastomylonites which utilised the intrusions of Permian to Triassic A-type granites (Petrík et al. 1995, Putiš et al. 2000). Muscovites from these shear zones are dated back to 256 Ma (Dallmeyer et al. 1996). Movements and mylonitization on these zones repeated also in the Cretaceous (testified by wedged in Triassic rocks, Hók and Hraško 1990).

Southern Veporicum

Shear zones in the Southern Veporicum are mostly NE oriented. They are superimposed to older E-W zones (Raztočno zone) conected with intrusions of porphyric granites (Lexa and Bezák, 1996) younger than collisional granites of 350 Ma and older then I-type Sihla granites of 300 Ma. Wide zones of blastomylonites of NE-SW direction on the Divín fault are characterized by postkinematic formation of orthoclase (Ondrášik et al. 1987) and on the Zdychava fault by intrusions of Hercynian granites, diorites and special type of Permian granites (Hraško et al. 1997). Movements along these shear zones were also repeated in the Alpine orogen, because in the area of Divín also Mesozoic complexes of the envelope of crystalline rocks are caught in the strike-slip (Bezák, 1988). The last manifestations on the Muráň fault is normal faulting superimposed to Paleoalpine strike-slip (Marko, 1992).

Conclusions

The middle part of Western Carpathians is characterised by several subvertical shear zones with prevailingly strike-slip character of movement. The movements along them took place either within Hercynian orogen (proved by radiometric datings, Hercynian granitoid intrusions into shear zones, Hercynian ore- mineralization linked to shear zones), as well as within Alpine orogen (radiometric datings occurrences of Mesozoic rocks within shear zones). In most of cases Hercynian and Alpine shear zones are indentical. There is evidence of long-living faults, some are even active up to present time. The strike-slips always followed after the compressional phase of the orogen. The extent of movements along them cannot be established because of lacking geological markers.

Identified have been older Hercynian shear zones of E-W direction dated on newly formed muscovites about 330 Ma by Ar/Ar method and by intrusions of porphyric granites. They are often linked with ore mineralization. Younger shear zones are mostly of NE-SW directions dated by Ar/Ar method around 250-260 Ma.In these zones ore mineralization is developed, but they are also an environment of emplacement of Permian magmatites .

In the Alpine orogen movements along inherited shear zones repeated – mainly shear zones of NE-SW orientation wery utilised, but, naturaly, also new ones were formed. The movements took place under conditions of lower grade greenschists facies, they were also connected with extensive circulation of fluids, ore mineralization and mylonitization.

References

Adamija, S., Abesadze, M., Chkhouta, T., Kekelia, M. and Tsimakuridze, G. 1992: Tectonices in the Variscan crystalline assemblages of the Greater Caucasus and Ďumbier massif of the Western Carpathians. Spec. Vol. IGCP 276, GÚDŠ, Bratislava 7-19.

Bezák, V. 1988: Tektonický vývoj juhozápadnej časti veporika. Miner.Slov. (Bratislava), 20, 131-142 (in Slovak with English summary).

Bezák, V., Jacko, S., Janák, M., Ledru, P., Petrík, I. and Vozárová, A. 1997: Main Hercynian lithotectonic units of the Western Carpathians: In Grecula, P., Hovorka, D. and Putiš, N. (Eds.): Geological evolution of the Western Carpathians. Mineralia Slov., Monograph., Bratislava, 261-268.

Dallmeyer, R.D., Neubauer, F. and Putiš, M. 1993: $^{40}Ar/^{39}$ mineral age controls for the Pre-Alpine and Alpine tectonic evolution of nappe complexes in the Western Carpathian. Excursion guide, PAEWCR Conference, 199, 11-20.

Dallmeyer, R.D., Neubauer, F., Handler, R.,Fritz, H., Műlller, W., Pana, D. and Putiš, M. 1996: Tectonothermal evolution of the internal Alps and Carpthians: Evidence from $^{40}Ar/^{39}Ar$ mineral and whole-rock data. Eclogae. Helv., 89, 203-227.

Hók, J. and Hraško, L. 1990: Deformation analysis along western part of the Pohorelá line. Miner. slov., 22, 5, pp. 69-80.

Hraško, L., Bezák, V. and Molák, B. 1997: Postotogénne perluminózne dvojsľudné granity a granitové porfýry v kohútskej zóne veporika (oblasť Klenovec-Zlatno). Miner. Slov. 29, 2, 113-135.

Lexa, O. and Bezák, V. 1996: Porphyric granitoids in the western part of Slovenské rudohorie Mts.: Emplacement and deformation in shear zones. Slovak Geol. Mag., Bratislava, 3-4, 189-197.

Marko, F. 1993: Kinematics of Muráň fault between Hrabušice and Tuhár village. In Geodynamický model a hlbinná stavba Západných Karpát (Rakús, M., Vozár, J. ed.), 253-261.

Ondrášik, R., Hovorka, D. and Matejček, A. 1987: Prejavy muránsko-divínskej poruchovej zóny vo veporickom kryštaliniku v štôlni PVE Ipeľ. Miner. slov., 19, 29-44.

Petrík, I., Broska, I., Bezák, V. and Uher, P. 1995: The Hroncok typy granite, a Hercynian A-type granite in shear zone. Mineralia slov. 27, 351-363 (in Slovak with English summary).

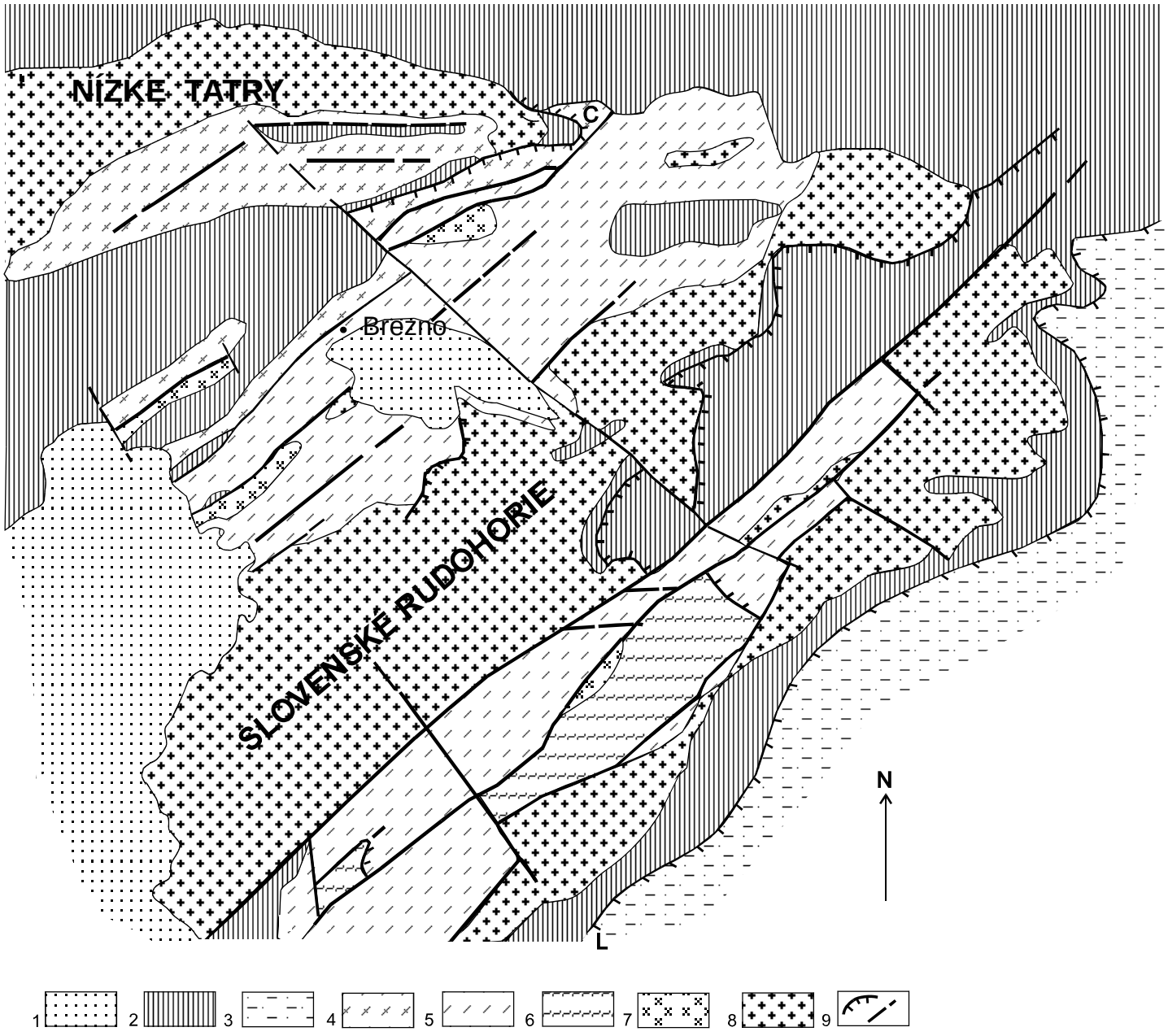
Vozárová, A. 1998: Hercynian development of the external-Gemeric zone. In Rakús , M. ed.:Geodynamic development of the Western Carpathians, Geological Survey of Slovak Republik, 47-61.

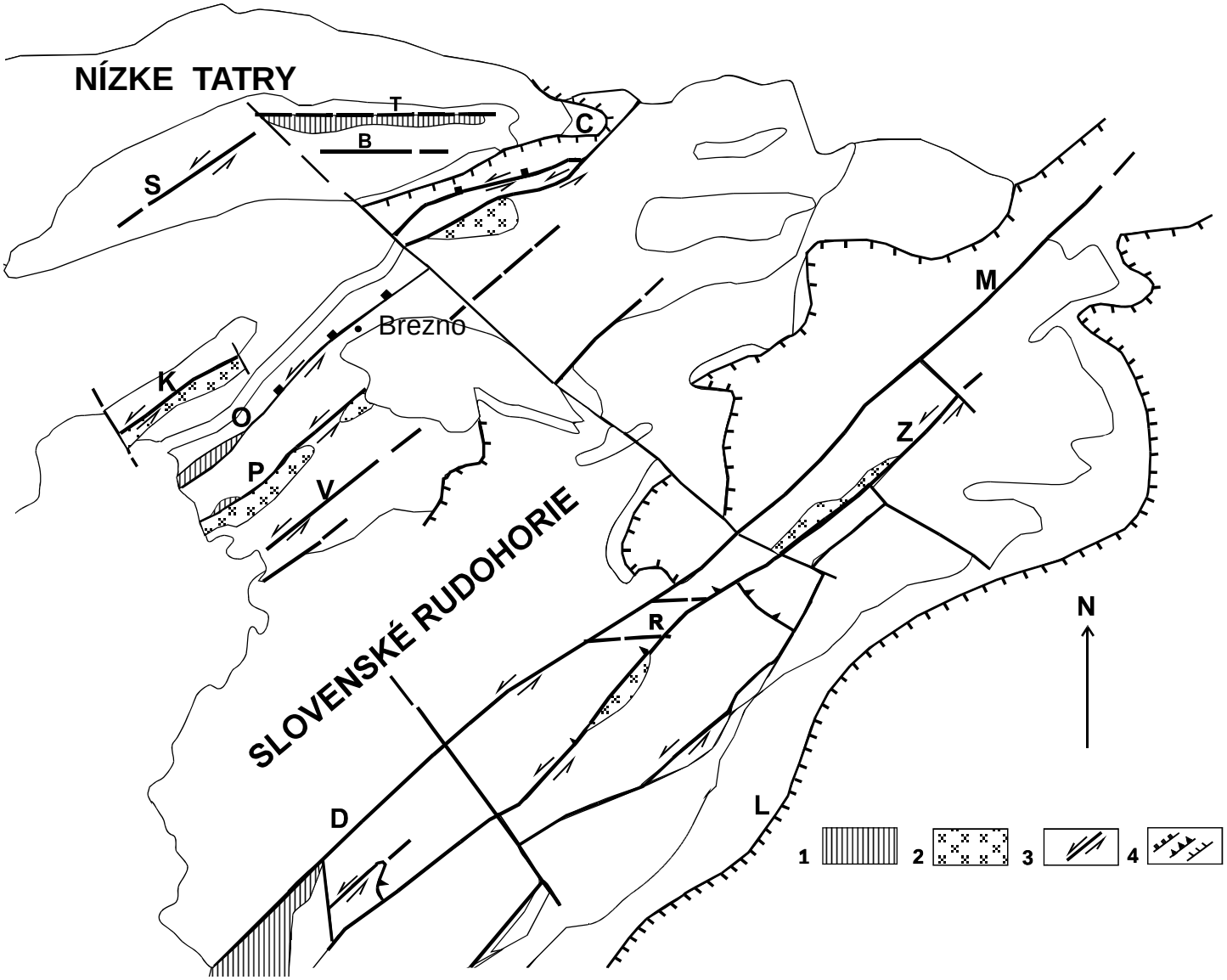
Fig.1. Tectonic scheme of the central part of the Western Carpathians.

Explanations: 1- Tertiary sediments and volcanics; 2- Upper Paleozoic and Mesozoic units; 3- Gemericum; Hercynian lithotectonic units: 4- Upper unit, 5- Middle unit, 6- Lower unit; 7- Permian magmatites; 8- Hercynian granitoids undiferentiated; 9-a) thrusts; b) faults and shear zones with combined sense of movements (mostly strike- slips); C- boundary between Tatricum and Veporicum (Čertovica line); L- boundary between Veporicum and Gemericum (Ľubeník line).

Fig.2. Hercynian and Alpine strike-slips in the central part of the Western Carpthians.

1- faults of mostly strike-slip character: S- Špiglová, K- Kolba, O- Osrblie, P- Pohorelá, V- Vydrovo, D- Divín, M- Muráň, Z- Zdychava; 2- thrusts: a) Paleohercynian, b) Mesohercynian, c) Paleoalpine (C-Čertovica line, L-Lubeník line).


NÍZKE TATRY
C
Brezno
SLOVENSKÉ RUDOHORIE
N
L
1
2
3
4
5
6
7
8
9


NÍZKE TATRY
T
B
C
S
Brezno
K
O
P
V
M
Z
SLOVENSKÉ RUDOHORIE
R
N
D
L
1
2
3
4