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155 - 159

THE CENTRAL SLOVAK FAULT SYSTEM - THE FIELD EVIDENCE OF A STRIKE SLIP

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Abstract: The main aim of this paper is to understand the tectonic activity of the Central Slovak Fault System during Late Eocene to Miocene period. During this time the strike-slip faults influenced the structure of the Western Carpathians. Both regional fault patterns and their kinematics are a result of the regional stress field. The fault analysis along the Central Slovak Fault System enables to reconstruct the distribution of paleostresses. NE - SW (Late? Paleocene - Middle Miocene) as well as NW - SE distensions (Middle - Late Miocene) have been identified.

Key words: Western Carpathians, structural geology, strike-slip faults, fault analysis, paleostress evidence.

Introduction

The Central Slovak Fault System (CSFS), also referred to as the Revúca-Staré Hory fault system, Zázrivá-Budapest system etc. belongs to significant Western Carpathian fault systems. It forms a fault zone of the north - south direction with approximate width of 20 - 25 km (Fig. 1). The western margin runs along the contact of the Malá Fatra Mts. with Turiec Basin and along the Žiar Basin margin. The eastern margin can be traced from the eastern fault-bound slopes of the Beskid Slaski (Sikora & Zytko 1959) through the sharp sigmoidal flexure of the Klippen Belt at Dolný Kubín along N - S fault zones (Potfaj 1977). The system continues through the Choč Mts., Revúca river valley and the Central Slovak Neovolcanics to Krupina. Another branch of the fault system runs from the area of Hronská Breznica through Banská Štiavnica to the Hurbanovo fault. From the inspection of derived gravimetric maps and results of seizmic measurements on regional profiles it is obvious that the western margin of the fault zone between Turiec and Žiar Basins down to the Hurbanovo fault reaches the Moho-discontinuity and other faults of this zone reach the lower crust (Kvitkovič & Plančár 1977).

The purpose of this work is to determine the sense and age of the movements in the Central Slovak Fault System on the basis of structural measurements of fault populations in different stratigraphic levels of geological structure.

Characterization of the Central Slovak Fault System in individual zones of the Western Carpathians

The area of the Choč Mts. and the western margin of the Nízke Tatry Mts.

In the area of the Choč Mts. is the fault zone represented by NNE - SSW oriented faults and by a system of subsidence faults forming grabens filled up by Paleogene rocks (Kováč & Filo 1992). Such an orientation of faults corresponds to a dextral movement of blocks of the fault zone in the N - S direction (Kubíny 1962; Maheľ 1969, 1986).

The most significant geophysical anomaly in the western part of the Choč Mts. showing a substantial gravity gradient change is the Revúca fault (Szalaiová in Gross et al. 1979).

The orientation of strain fields (Fig. 2a) in the Choč Mts. shows an extension approximately from NW to SE.

The syn-sedimentary tectonics, iniciated by tectonic movements, is represented by sliding of partially lithificated Upper Eocene nummulite limestones into the sediments of basal Paleogene (Gross et al. 1980). Another syn-sedimentary feature is the occurrence of sub-marine alluvial cone sediments, the Pucov conglomerates (Gross et al. 1982). These phenomena make it possible to date the movement of the CSFS in the Choč Mts. to Upper Eocene.

In the area of the eastern part of the Malá Fatra Mts. and the western boundary of the Nízke Tatry Mts. the CSFS (Revúca-Staré Hory system) causes a direct contact of younger members of the Šiprúň series (Neocomian - Lower Cenomanian) with granitoid core (Bujnovský 1971, 1979).

The coulisse-like arrangement of faults has caused formation of narrow grabens and half-grabens, e.g. Korytnica graben. A dextral movement occurs in this area (Revúca river valley), Bujnovský (1979). The parallel running Sopotnica fault and the N - S branch of the Biela voda fault show, however, a character of sinistral movement. In earlier phases of tectonic activity the N - S fault system operated as sinistral, later as dextral (Marko 1986). The values of compressional and extensional axes measured at localities in the Revúca river valley support this assumption (Figs. 2a, 2b).

Central Slovak Neovolcanics

In the area of the Central Slovak Neovolcanics the fault zone attains 25 km. Its axis runs between Kremnica, the center of the Žiar Basin, and villages of Rudno, Brehy and Čajkov (Štohl 1976). At present it appears as a combination of horsts, grabens and basins. Connected temporally and spatially with the fault is volcanic activity (Böhmer & Štohl 1968). The onset of volcanism was accompanied by activisation of block movements which

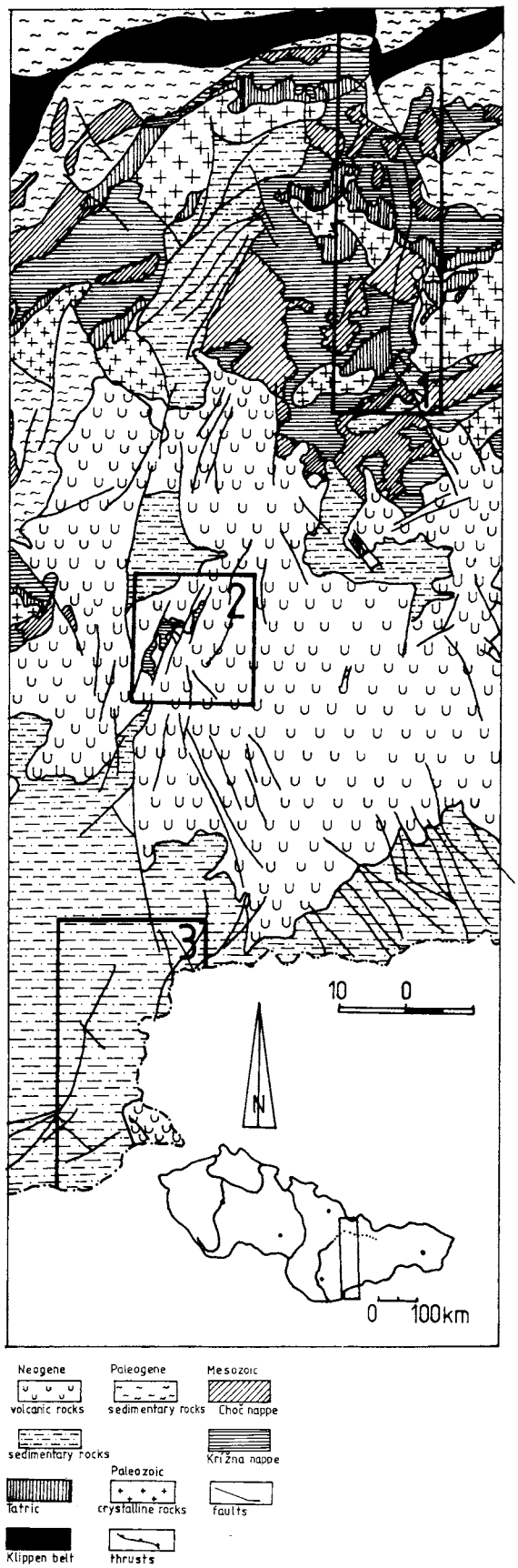

Fig. 1. Simplified geological map of a part of the Western Carpathians.

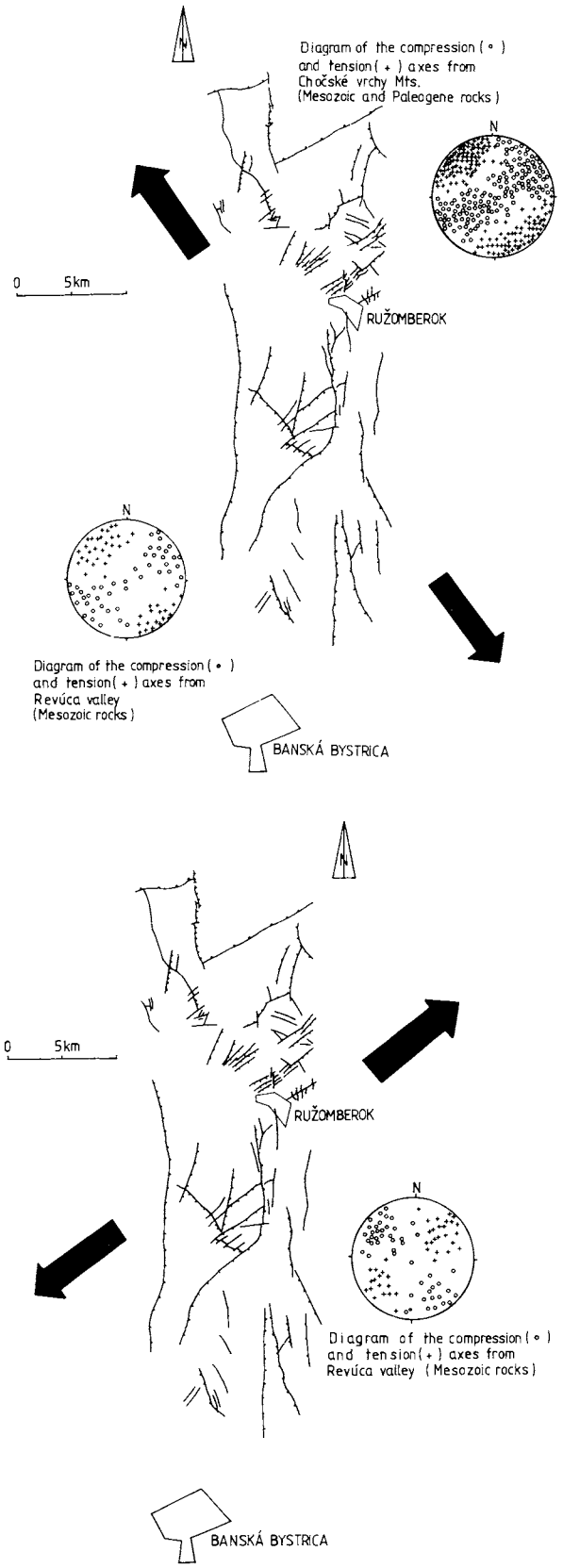

Fig. 2. Detailed map of faults in the studied area with diagrams of compressional and extensional axes for fracture surfaces and their *striae*. The main extension direction (arrows) is for:
a - Upper (?) Eocene - Lower Miocene; **b** - Middle - Upper Miocene.

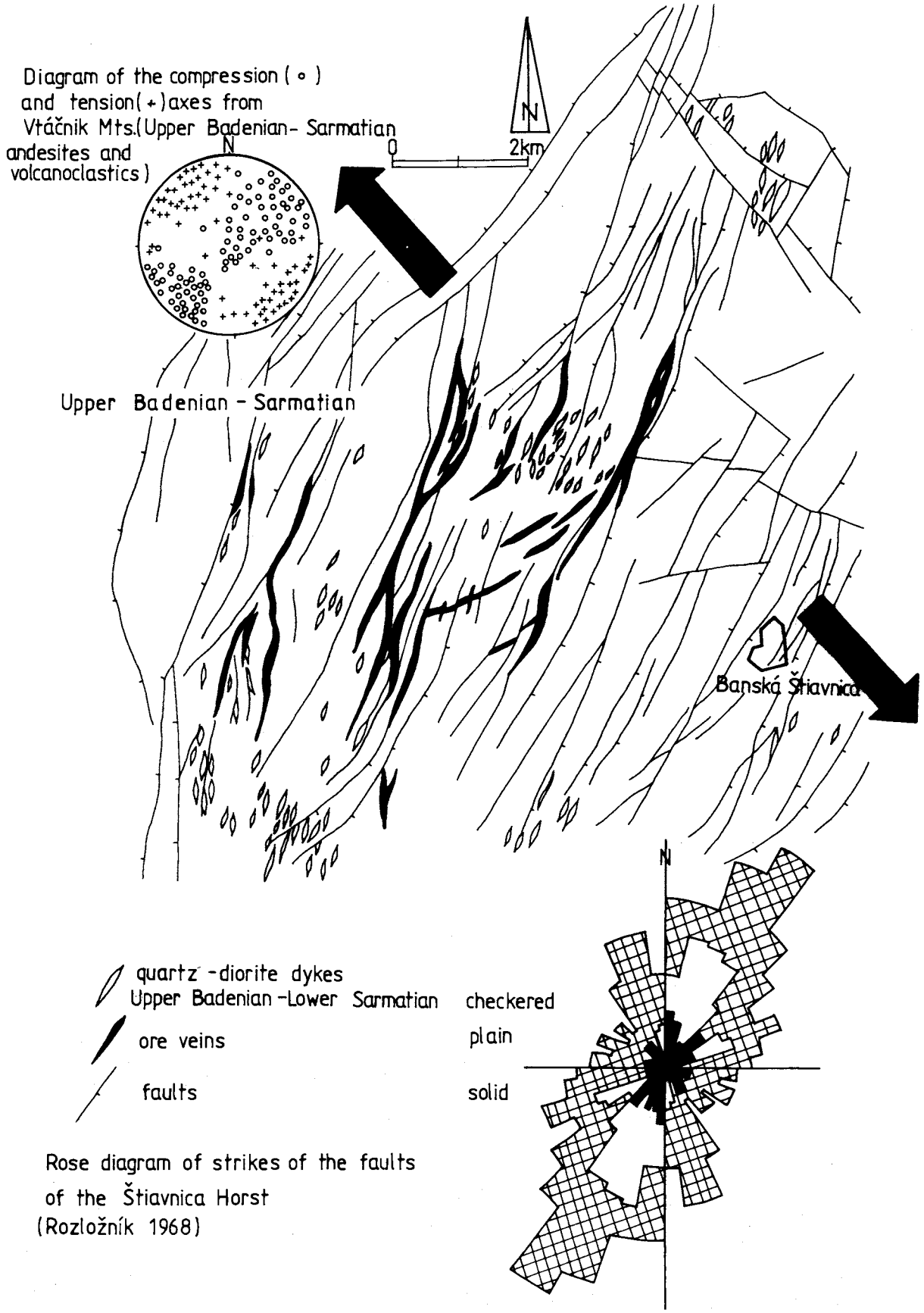

Fig. 3. Detailed map of faults, ore veins and quartz diorite dykes with rose diagram of their directions in the studied area. The diagram shows compressional and extensional axes for fracture surfaces and their scoriae. The main extension direction (arrows) is for Middle - Upper Miocene.

reached the peak intensity during Upper Badenian to Lower Sarmatian (Kaličiak et al. 1989). The assymetry of the most of horst and depression structures in western part of the region is considered a result of horizontal spreading. Results obtained from Upper Badenian to Lower Sarmatian andesites and volcanoclastics in the Vtáčnik Mts. and space orientation of volcanic structures of the same age suggest a NW - SE orientation of extension in Middle - Upper Miocene (Fig. 3). The compressional component rotated from a sub-horizontal to a sub-vertical position initiating horizontal displacements followed by normal faults (cf. Lexa & Nemčok 1990).

The Danube Basin

In the Danube Lowland area, from Želiezovce southward, the fault zone controls the flow of the river Hron and appears in Quaternary as a significant N - S fault: the northern part of the Kravany - Hron failure (Seneš 1960, 1962). Moreover, the fault controls the eastern margin of the present occurrence of Pannonian to Pliocene sediments in the Danube Lowland.

The CSFS was active in Eocene: it marked the limits of an unstable zone which served for the connection between the Budina and Inner Carpathian Paleogene (Vass 1981; Vass et al. 1979; Samuel 1973).

The fault system influences development of the Levice-Turov horst up to Badenian (Melioris & Vass 1982).

The orientation of strain fields measured at localities Burda (Lower Badenian andesites and volcanoclastics) and Nagymaros (Lower Badenian andesites), Fig. 4. shows an extension in ENE - WSW direction during Middle - Upper Miocene. In scale of the whole Pannonian basin a horizontal compression approximately in N - S direction can be considered during Carpathian to Pannonian (Bergerat 1989).

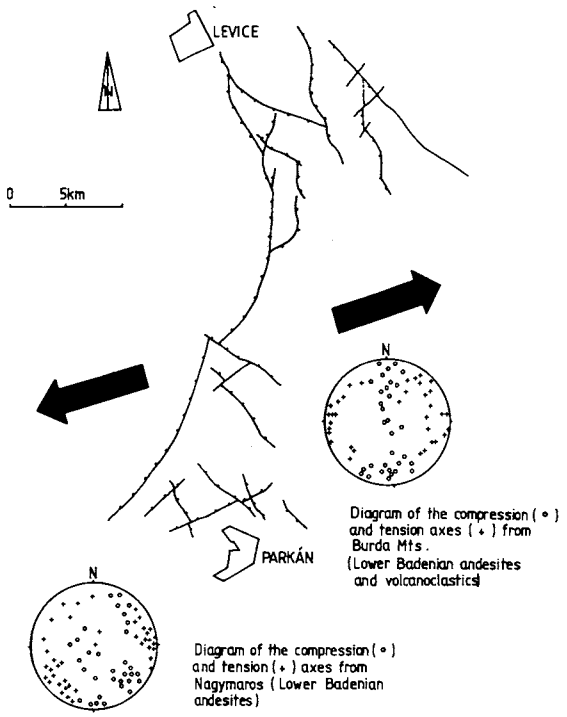

Fig. 4. Detailed map of faults in the studied area with diagrams of compressional and extensional axes for fracture surfaces and their *striae*. The main extension direction (arrows) is for:a - Upper (?) Eocene - Lower Miocene.

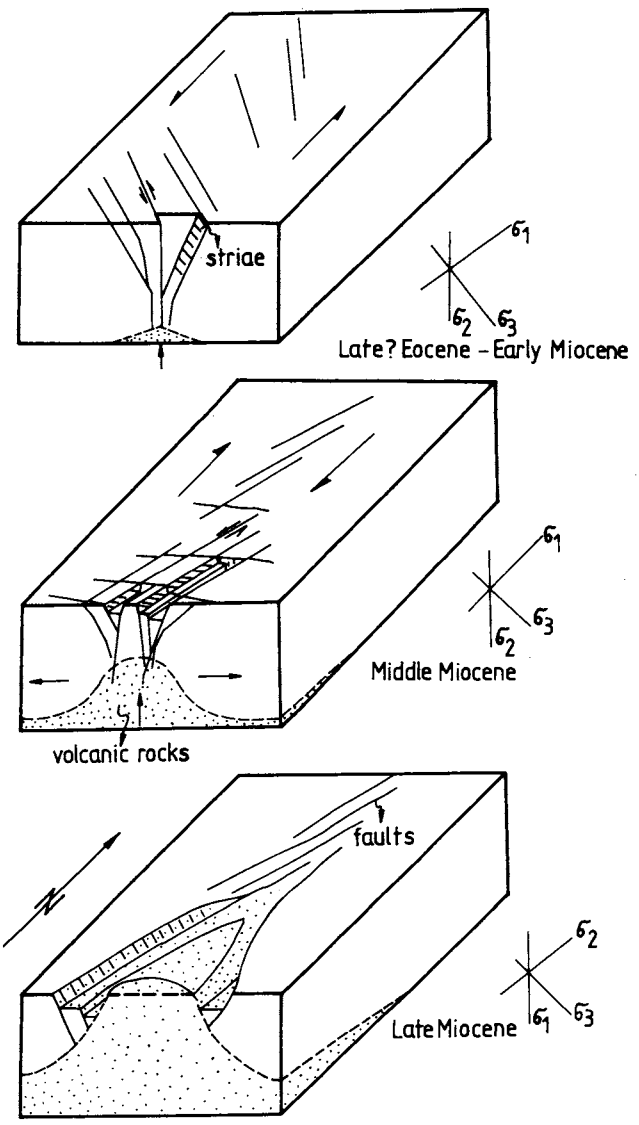

Fig. 5. A model of development of the Central Slovak Fault System.

Conclusions

- the CSFS is a zone of subsidence faults and horizontal displacements forming system of grabens and horsts;
- based on syn-sedimentary tectonics phenomena the tectonic activity in the CSFS can be dated to Upper Eocene (cf. Gross et al. 1982; Vass et al. 1979).
- since Upper Eocene until Middle Miocene the fault system has worked as a sinistral transtensional zone (Fig. 5);
- during Middle to Upper Miocene times the fault works as a transtensional zone with dextral displacement (Fig. 5);
- the change of kinematic character of the fault system is related to the regional strain field change. The orientation of compression rotated during Miocene from the NW - SE to NE - SW direction (cf. Nemčok & Kováč 1988; Marko et al. 1990);
- character of the fault zone controls the distribution of Miocene volcanic centres which, in turn, influence its nature (Fig. 5);
- during Upper Oligocene - Miocene was the tectonic structure of the Western Carpathians influenced by the formation of fault systems with differing amplitude and sense of rotation.

The extension of crust in ENE - WSW direction occurred during Oligocene, and horizontal displacements along with the basin formation owing to this E - W extension occurred during Miocene, in the area of the Eastern Alps and Western Carpathians (Ratschbacher et al. 1990).

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