Konzalová, Vavrdová, pers. comm.) were found in the JRU Lower Carboniferous Jítrava Group syntectonic sediments. The pebbles may indicate that the Complex was a source area for the Tounaisian flysch during the westward migration of the deformation front (Kachlík and Patočka, 1998, 2001; Marheine et al., 2000, in press).

According to the structural position of the Early Palaeozoic metagranitoid bodies (thrust over the JRU Middle to Upper Devonian limestones), the KJT nappe stacking post-dated the Late Devonian and may correspond to Early Carboniferous times (cf. Marheine et al. 2000, in press). Rheological inhomogeneities along boundaries of metagranitoid bodies and greenschist-grade complexes were convenient places ready for initiation and development of the Variscan thrust planes. Access of fluids during the greenschist-facies metamorphism made the deformation of metagranitoids more effective due to deformation softening at higher crustal levels. According to this explanation, the metagranitoids in the KJT acted as important horizons for channelling of strain and played an important role during tectonic stacking of the KJT in a regional scale.

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Petrogenesis of Gneiss Mylonites from the Niemcza Zone – New Evidence Based on Morphology and Morphometry of Zircons

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The Niemcza Shear Zone, extending along the eastern edge of the Góry Sowie Massif, was interpreted by Scheumann (1937) to contain mylonitized gneisses. Based on detailed study, Mazur and Puziewicz (1995) showed that the Niemcza Zone represented a 5 km wide, left-lateral strike-slip ductile shear belt, separating the Góry Sowie Massif from the Kamieniec Metamorphic Belt. The Niemcza mylonites were derived from the Góry Sowie Gneiss (Scheumann, 1937; Mazur and Puziewicz, 1995; but see e.g. Franke and Żelaźniewicz, 2000, for alternative interpretation of the Niemcza Zone rocks as metagreywackes) and include minor lenses of non-mylonitic gneisses, amphibolites and quartzo-graphitic schists. The mylonites occur as high- and low-temperature varieties, formed in amphibolite and greenschist facies conditions, respectively (Mazur and Puziewicz, 1995). The Niemcza Shear Zone contain numerous small bodies of undeformed to little deformed Lower Carboniferous granitoids and syenites/diorites.

The aim of this work is to provide new data concerning the petrogenesis of different mylonite varieties occurring within the Niemcza Zone. Our investigations were based on morphology analysis of zircon crystals found in the study rocks. We made an attempt to evaluate the influence of mylonization intensity on morphology and morphometry of zircon crystals inherited from the protolith. Typological analysis of examined zircons and their comparison with those from the Góry Sowie gneisses are presented in a separate paper (Klimas et al., this volume).

Rocks selected for zircon analysis mainly consists of plagioclase, quartz and micas. They were interpreted by Mazur and Puziewicz (1995) as mylonites derived from the Góry Sowie gneisses. Some of the studied samples represent the high temperature variety of mylonites developed under amphibolite facies conditions (Tab. 1 – localities 1, 6, 8, 9, 11). They contain significant amount of synkinematic fibrolite. Furthermore, in samples 8, 9 and 11 abundant fibtolite is accompanied by cordierite. The remaining samples 5 and 19 represent the low temperature variety of mylonites which were formed under greenschist facies conditions. Besides quartz, plagioclase and micas, they contain synkinematic chlorite. Garnet was found in samples 5, 8 and 19. Particularly garnet-rich is the sample 8 which is lacking of zircon. Several samples representing different degree of mylonitization were selected for zircon analysis from both the high- and low- temperature varieties of mylonites.

Characteristics of zircons outlined in Table 1 provides clear evidence for much higher degree of deformation and grinding of zircons from mylonites of the Niemcza Zone in comparison to those from non-mylonitized gneisses of the adjacent Strzelin Crystalline Massif. Features indicative for zircons from mylonitized gneisses can be summarized in the following points:

1. Small dimensions of zircon grains.
2. Low number of euhedral and subhedral crystals among over 100 examined zircons from the each sample.
3. Low elongation of zircons.
4. Low value of the standard deviation of length, width and elongation.
5. High quantity of broken and angular grains being fragments of much larger crystals.
6. Great number of grains cut across by fractures transverse to their elongation.

Features similar to those described above seem to be indicative for zircons occurring in mylonites subjected to differentiated but generally high strain (e.g. Boullier, 1980; Wayne and Krishna Sinha, 1988). Inspection of thin sections confirms that several features of examined zircons, extracted from the mylonites, were produced during their deformation and were not inherited after detritic clasts of this mineral. For instance, in the mylonite from the locality 5, subhedral and partly rounded zircon crystals are split into smaller parts by fractures transverse to their elongation. One of these fractures is filled with synkinematic chlorite.

The study samples, in particular those taken from the highest strained mylonites (nos 5,6), contain great number of tiny zircon grains (average length of 0.06 mm) of perfectly ovoid or spheroid shape. They may represent detritic zircons inherited from a sedimentary protolith or, alternatively, primary magmatic crystals disintegrated during early stages of mylonitization under low metamorphic conditions. They were subsequently recrystallized during the amphibolite-grade metamorphism into football-shaped zircons, otherwise well-known from some types of granulites (e.g., Vara et al., 1996, 1999). Such zircons could also crystallize from anatectic melts possibly associated with deformations under upper amphibolite facies conditions (e.g., G2, G3 and A forms or, hitherto rarely described in literature, crystals similar to AB2-AB5 types on the typologic frequency distribution diagram of Pupin, 1980). Concentric and ellipsoidal fractures in zircon crystals, resulting in origin of tiny and perfectly ellipsoidal grains, were produced during the metamictization of zircons (Lee and Tromp, 1995). They are inclusion free and elongated parallel to the crystallographic c-axis. Elucidation which of the briefly mentioned above processes was responsible for the origin of small ovoidal and spheroidal grains in the mylonites requires further studies that are currently in progress. They include examination of the internal structure of ball-shaped grains in cathodoluminescence images and analysis of the inclusions composition in zircons.

Hitherto investigations of morphology and morphometry of zircons extracted from the mylonites of the Niemcza Zone suggest that this mineral, otherwise resistant for chemical reactions and magmatic corrosion, is fragile and, therefore, sensitive for brittle deformation. The number of zircons showing effects of deformation and ellipsoidal zircons increase in the study mylonites together with the total strain of these rocks. Among several differences between morphological features of zircons extracted from the high- and low-temperature mylonites, the most characteristic seems to be the common occurrence of

Morphology and morphometry of zircons	Amphibolite-grade mylonites					Greenschist-grade mylonites			Gneisses**	
Sample	1*	6*	8*	9*	11*	5*	19*	S-5	S-6	W-1
Quantity of investigated zircons	100.00	100.00	0	100.00	50.00	100.00	100.00	100.00	100.00	100.00
Euhedral and subhedral crystals in %	20.00	0.00	-	24.00	12.00	0.00	27.00	39.00	54.00	51.00
Subrounded forms in %	57.00	9.00	-	35.00	28.00	24.00	37.00	37.00	38.00	27.00
Rounded grains in %	5.00	88.00	-	18.00	54.00	69.00	28.00	15.00	0.00	5.00
Angular forms in %	18.00	3.00	-	23.00	6.00	7.00	8.00	9.00	8.00	17.00
Broken zircons in %	10.00	1.00	-	17.00	8.00	12.00	4.00	8.00	16.00	10.00
Fractured zircons in %	2.00	5.00	-	0.00	0.00	4.00	4.00	0.00	1.00	3.00
Zircons with "extinction angle" in %	8.00	22.00	-	6.00	8.00	22.00	4.00	9.00	12.00	3.00
Mean length in mm	0.06	0.06	-	0.08	0.07	0.07	0.10	0.13	0.10	0.10
Standard deviation of length in mm	0.02	0.02	-	0.02	0.02	0.02	0.02	0.40	0.01	0.50
Mean width in mm	0.04	0.04	-	0.05	0.04	0.04	0.05	0.08	0.04	0.06
Standard deviation of width in mm	0.01	0.01	-	0.01	0.01	0.01	0.02	0.02	0.02	0.03
Mean elongation	1.80	1.50	-	1.80	1.60	1.60	1.90	1.90	2.50	2.00
Standard deviation of the elongation	0.50	0.30	-	0.50	0.40	0.50	0.50	0.50	1.10	0.80

* labels of samples equivalent to numbering of mylonite exposures after Mazur and Puziewicz (1995 - Fig. 1)

** S-5 - gneiss sample from Gościęcice - Strzelin Crystalline Massif

S-6 - gneiss sample from Skalice - Strzelin Crystalline Massif

W-1 gneiss sample from Wilamowice Ząbkowickie (Lipowe Hills) - Strzelin Crystalline Massif

Tab. 1. Summary of morphological and morphometric characteristics of zircons extracted from the mylonites of the Niemcza Zone in comparison to zircons from non-mylonitized gneisses of the Strzelin Crystalline Massif.

euhedral crystals in the mylonites developed under greenschist facies conditions.

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Laser-probe 40Ar/39Ar Study of Pseudotachylite and its Host Rock from the Tatra Mountains (Western Carpathians, Slovakia)

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Understanding of the tectonic evolution of orogenic belts and intracratonic areas depends on our ability to determine the age of tectonic features, e.g. ductile shear zones and brittle faults on a variety of crustal scales. Pseudotachylite is dark aphanitic fault-related rock composed of friction-derived melt material interspersed with clasts and crystals from the host-rock, and is thought to be formed in response to seismic activity either meteorite impacts, rapid tectonic faulting or landslides (e.g., Philpotts, 1964; Sibson, 1975; Magloughlin and Spray, 1992; Reimold, 1995). High potassium content of the melt material, derived from the host-rock micas and/or amphiboles makes pseudotachylite an ideal candidate for $^{40}Ar/^{39}Ar$ dating (e.g., Reimold et al., 1990; Sherlock and Hetzel, 2001). Although pseudotachylites were recently described from the Tatra Mts. (Petrík and Reichwalder, 1996; Petrík and Janák, 2001) their age was unknown until now.

The Tatra Mountains are located in northern Slovakia, near the border with Poland, and represent so-called core mountains within the Tatric superunit of the Western Carpathians. The crystalline basement of the Tatra Mts. is composed of pre-Mesozoic metamorphic and granitic rocks, overlain by Mesozoic and Cenozoic sedimentary cover sequences and nappes. Pseudotachylites occur in several places in the Tatra Mts. (e.g., Bystrá Valley in Western Tatra Mts., Velická Valley and Batizovské Lake just on the foothill of Mount Gerlach in the High Tatra Mts.). On the southern slope of Gerlach pseudotachylites are related to several NNE striking faults with a steep dip of 75–90° to ESE and WNW. Pseudotachylite is composed of matrix (crystallised melt) consisting of hematite, albite and K-feldspar, and clasts dominated by feldspars and quartz. It is, inferred that primary melt originated by preferential dehydration melting of biotite (Petrík and Janák, 2001). Several pseudotachylite samples were collected and five were selected for laser-probe $^{40}Ar/^{39}Ar$ study together with two samples of host-rock granitic rocks. The samples were analysed at The Open University Milton Keynes (UK) using a focused CW Nd-Yag infrared laser combined with noble gas mass spectrometer MAP 215–50, according analytical procedure by Sherlock and Hetzel (2001).

The biotite tonalite host-rock yielded a narrow range of ages (322 ± 2 to 331 ± 2 Ma), which were derived from laser spot analyses of biotite only. Weighted mean of spot analyses give an age 328 ±4 Ma, which is in good agreement with previous $^{40}Ar/^{39}Ar$ ages from granitic rocks in the high Tatra Mts. (Maluski et al., 1993), and/or CLC single grain zircon U-Pb data 311 ±16 Ma respectively 314 ± 4 Ma (Poller and Todt, 2001) from the High Tatra Mts. Since the emplacement ages are comparable with the argon cooling ages, it should be noted that the granitic rocks have not experienced any significant argon-loss subsequent to their formation. Ages for the pseudotachylite samples range from 24 to 164 Ma, although ages greater than 65 Ma are related to heterogeneous ^{37}Ar distribution, very variable atmospheric argon component and/or very low potassium (^{39}Ar) con-