SPECTACULAR FABRIC BUT LITTLE DISPLACEMENT: EARLY ALPINE SHEAR ZONES FROM ZLATISHKA STARA PLANINA, CENTRAL BALKANIDES

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The Balkanides are traditionally regarded as a north vergent fold-thrust belt (Boncev, 1986; Dabovski et al., 2002), yet there is an obvious lack of modern data about the kinematics and the amount of translations along the major thrust zones. Such north vergent thrusts have been known for years in Zlatishka Stara Planina in the central part of the Balkanides (Kuikin et al., 1971; Antonov, Jelev, 2002). One of them – Kashana thrust is regarded as main tectonic boundary in the area (Fig. 1) and emplaces low-grade Paleozoic rocks over Triassic sediments. Despite a large number of specialized research and prospecting works, significant controversies exist about the exact trace of the Kashana thrust. In fact, the thrust is well-defined only in the area of Zlatitsa pass, and to the east several interpretations have been proposed (Kuikin et al., 1971), including existence of imbricate small-scale thrust system instead of a single continuous fault (Antonov, Jelev, 2002).

Our reexamination of the area occupied by Kashana thrust demonstrated that the displacement-related deformation is not restricted to a narrow fault zone but is distributed in a fairly thick rock volume. Moreover, field data suggest that the deformation in this zone was ductile or brittle-ductile and because of this we are using the term "shear zone" to refer to the rocks that display spectacular shear fabric in the area of Kashana thrust (Fig. 1). The presented data are not only important in regard of better understanding of the kinematics and age of the thrust system in the Balkanides, but also bear some implications for general problems as fabric recycling in shear zones and possibilities to form complicated structural patterns during a single shearing event.

On the basis of age, fabric and field relations three rock assemblages can be distinguished in the studied area – Variscan basement, Permian-Triassic (meta)sediments and Upper Cretaceous sediments and magmatic rocks. The oldest unit is represented by undated very low-grade metasediments (phyllites, metaaleurolites, metasandstones) containing lenses of metabasic rocks. Traditionally, these rocks are regarded as part of Diabase-phyllitoid Complex (DFC) or as part of the Berkovitsa Group (Haydoutov, 1991). To the north, the low-grade fabric of these rocks is gradually overprinted by static recrystallization, due to the emplacement of the Vezhen pluton (Upper Carboniferous – Kamenov et al., 2002). The emplacement-related recrystallization often erases completely previous fabric (e.g. in black isotropic hornfels) however in some places it is obvious that static annealing is overprinting strongly foliated and folded phyllites.

The Permian-Triassic (meta)sediments crops out in two distinct areas – within the Kashana shear zone (or structurally below it) and in the footwall of the Svishti Plaz allochthon (Antonov, Jelev, 2002). In the area of KSZ Permian-Triassic sediments form a WSW-ENE elongated fragment with preserved lower transgressive contact with hornfelses. The lowermost levels are represented by unmetamorphosed breccias and conglomerates, containing clasts from Vezhen pluton and DFC. Violet or reddish sandstones and aleurolites above them are foliated and completely recrystallized. The uppermost levels of Triassic succession are also reworked and observed in isolated outcrops of recrystallized limestones and calc-phyllites in the area just north of Zlatitsa pass. Another discontinuous strip of Permian-Triassic rocks is traced just below the granitoids of Svishti Plaz allochton. They occur as thin (up to 15 m) lenses built up by weakly metamorphosed and foliated conglomerates, sandstones and aleurolites.

The Upper Cretaceous rocks are represented by various dykes mainly with intermediate composition.

In the field KSZ is defined by the occurrences of weakly metamorphosed and foliated Triassic sediments along with strongly deformed rocks of DFC (metasandstones with platy fabric displaying evidence for quartz ductility, phyllites with penetrative S_1/C' fabric). The footwall of the zone is built up by unmetamorphosed Permian-Triassic sediments or hornfelses (DFC). The boundaries of the KSZ are

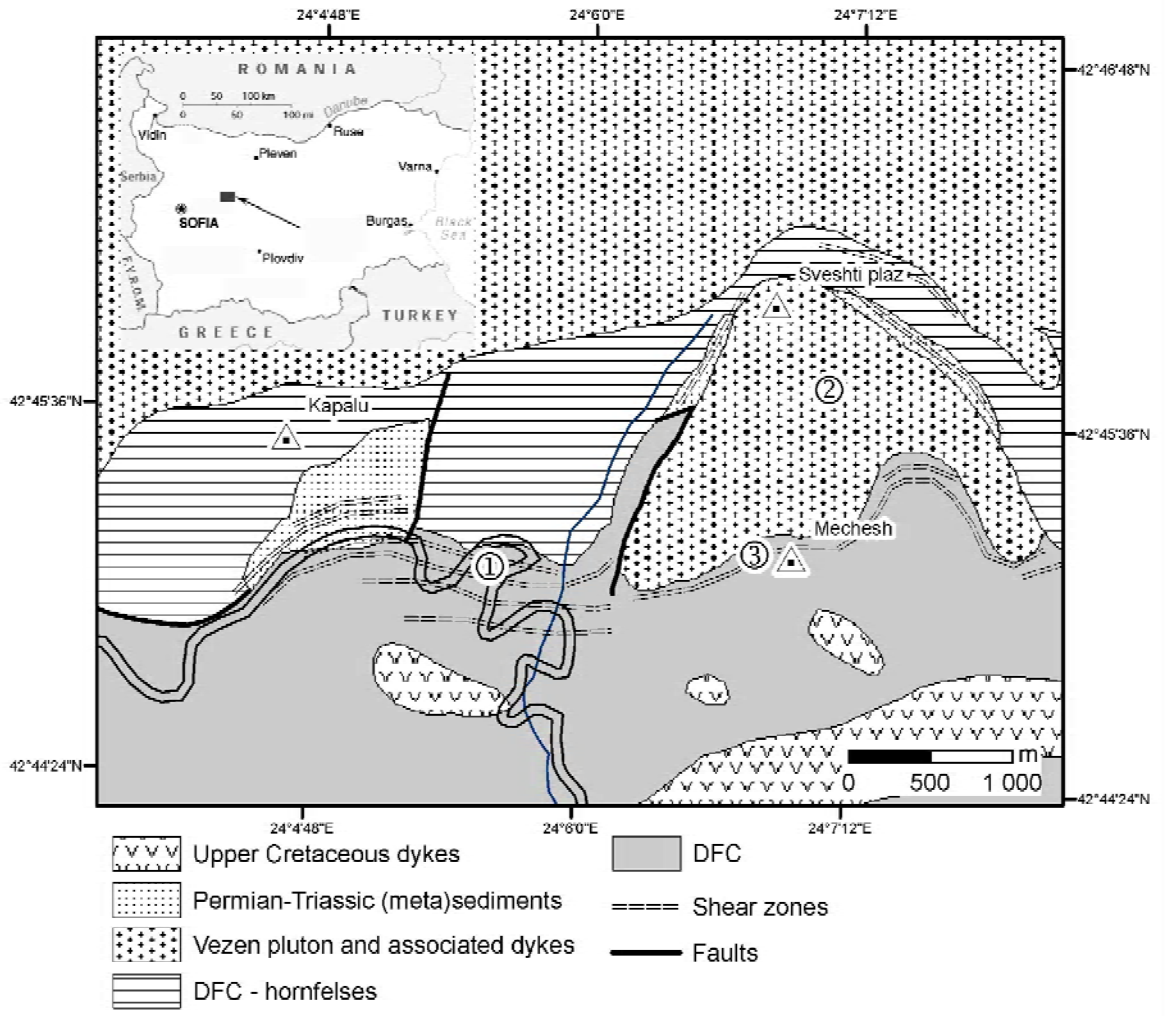

Fig. 1. Simplified geological map of the studied area. 1, Kashana shear zone; 2, Svishti Plaz allochthon; 3, Mechesh shear zone.

gradual, and it is common to observe low-strain domains within the shear zone. The foliation within the Triassic metasediments is defined by alignment of micas and also by quartz veins. In metaalleurolites the foliation completely obliterates earlier fabric, but in metasandstones E-W trending folds with foliation parallel to the axial surfaces are observed. Such competent lithologies acted as strain heterogeneities and often around them foliation is strongly folded. Some fold patterns are extremely complex and resemble fold interference structures well-known from multiple deformed terrains. From structural point of view the most spectacular structural feature of KSZ is the presence of numerous shear bands (C', terminology of Passchier, Trouw 1996) and lineated micro faults. The shear bands are several millimeters thick meso-scale shear zones that deflect foliation and usually dip shallowly to the south or are subhorizontal (Fig. 2). Their surfaces are decorated by quartz slickenfibres dipping SW, S and SE. The quartz slickenfibres are also common on numerous polished micro-fault surfaces, which often display corrugated geometry. The slikenfibres terminations indicate top-to-the North shear sense, consistent with the transport direction displayed by S_1/C' fabric. Using orientation of the shear bands as a reference frame (Fig. 3), comparatively shallow dip of the shear zone can be deduced.

We assume the fabric in KSZ to be ductile, because: (1) Lack of brittle fault rocks as cataclasites and breccias; (2) The deformation is spread in a large rock volume; (3) The existence of S_1/C' fabric, interpreted to be formed in ductile conditions; (4) Some meso-scale indications for ductility of quartz.

Is it tempting to trace KSZ to the east in the strongly and penetrativelly deformed phyllites, hornfelses and granitoids in the area of Mechesh reverse fault (Antonov, Jelev, 2002). The most

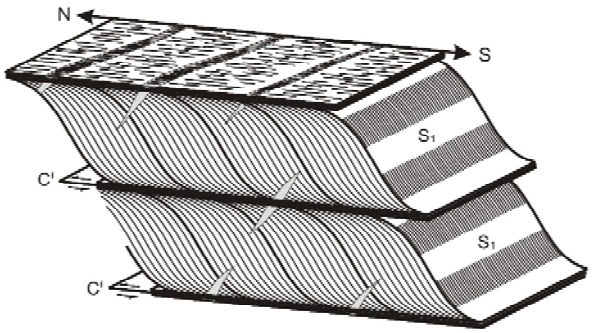

Fig. 2. S_1/C' fabric in the Kashana shear zone. Width of the sketch – 60 cm.

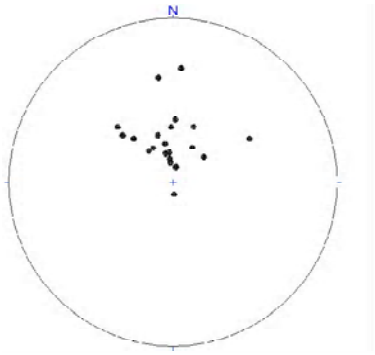

Fig. 3. Lower hemisphere stereographic plot of shear bands in the Kashana shear zone.

significant shearing appears to be related to the movements along the KSZ, but almost penetrative top-to-the north fabric was also observed in a number of places in the NE part of the studied area (Fig. 1).

Despite this spectacular meso-scale fabric, several lines of evidence suggest that the displacements along the described shear zones were small (less than several km) and they cannot be regarded as orogen-scale thrust zones: (1) The length of the shear zones is limited; (2) The widths of the zones are inconsistent; (3) The shear zones do not juxtapose contrasting rock units. Based on the lack of metamorphism and any ductile fabric in Upper Cretaceous rocks, as well as regional-scale data (Lilov, Zagorchev, 1993) we assume Early Alpine age for the shearing event.

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КОМПРЕСИОННИ МЕЗОСТРУКТУРИ, ПОРОДЕНИ ОТ МИНИМАЛНИ ТРАНСЛАЦИИ – РАННОАЛПИЙСКИ ЗОНИ НА СРЯЗВАНЕ ОТ ЗЛАТИШКА СТАРА ПЛАНИНА, ЦЕНТРАЛНИ БАЛКАНИДИ

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Отдавна е известно, че находищата на перм-триаски седименти в Златишка Стара планина маркират компресионни зони. Неотбелязан остава фактът, че тези седименти са засегнати от слаб метаморфизъм и интензивни пластични деформации. Тези процеси са най-ясно изявени в зоната на Кашанския навлак (Кашанска зона на срязване – КЗС), а също така и на редица места под Свещиплазкия алохтон. С изключение на базалните нива, перм-триаския разрез в КЗС е силно нашистен, а в метаалевролитовите нива е развит проникващ S_1/C’ строеж. Ивиците на срязване (C’) са декорирани от кварцови фибри, които оформят полегато потъваща към юг линейност. Устойчива северна посока на тектонския транспорт се маркира както от ивиците на срязване, така и от стъпалата, оформени от кварцовите фибри. Аналогичен S_1/C’ строеж е типичен и за най-долните нива на филитоидите от ДФК. Този факт недвусмислено показва, че в обхвата на КЗС се е осъществило значимо праработване на синметаморфните структури на по-некомпетентните скали от разреза на ДФК. На изток КЗС може да се трасира в зоната на Мечешкия възсед, която също се характеризира със северновергентни обемни деформации. Независимо от ясно изразения компресионен характер на срязванията, липсват каквито и да е било индикации за корово-мащабния характер на дискутираните зони. Основавайки се на липсата на подобни структурни феномени в тектонските зони, които засягат горнокредни скали, а също и на данни с регионален характер, възприемаме ранноалпийска възраст на нискостепенния метаморфизъм и свързаните с него обемни деформации, които са проявени в зони на срязване в южните склонове на Златишка Стара планина.