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The Chuminska shear zone – a greenschist mylonitic contact between Variscan high-grade metamorphic units, Central Sredna Gora, Bulgaria

Чуминска зона на срязване – зеленошистен милонитен контакт между херцински високостепенни единици, Централна Средна гора, България

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In the northern part of Central Sredna Gora Mountain, the Variscan high-grade metamorphic rocks are largely exposed. In regional scale, they belong to the Central Sredna Gora high-grade metamorphic complex (Gerdjikov et al., 2013), but locally 2 units have been distinguished – the Pirdop and the Koprivshtitsa one (see Zagorchev, 2008; Lazarova et al., this volume). The particular features of the units are still poorly studied, but their contact exposed in the vicinity of Koprivshtitsa town is well preserved and recently distinguished as the Chuminska Shear Zone (Antonov et al., 2010) – Fig. 1. Nevertheless, there is a lack of any detail data about the zone and the aim of our study is to fill this gap.

The Chuminska Shear Zone (ChSZ) is generally thin (up to 100–120 m) E–W trending and S-dipping structure exposed along strike for nearly 15 km. It is characterized by sharp boundaries with the host gneisses. The footwall is build up by the rocks of the Pirdop unit dominated by a migmatitic paragneisses with subordinate mafic orthogneisses, amphibolites, eclogites, and ultramafites. The hanging-wall includes the unmigmatized Koprivshitsa unit, where orthometamorphic rocks are most common varieties. The deformation is accommodated mainly by the footwall migmatitic paragneisses of the Pirdop unit, but several sub-parallel failures splay north- and southwards from the main zone within both metamorphic units. Along the zone and its splays, the gneisses are turned into greenschist mylonites with well-developed two planar fabrics – mylonitic foliation and C′ shear bands. The mylonitic foliation is E–W to NE–SW trending and is moderately to steeply dipping (45–80°) to the south. It is defined by a subparallel arrangement of

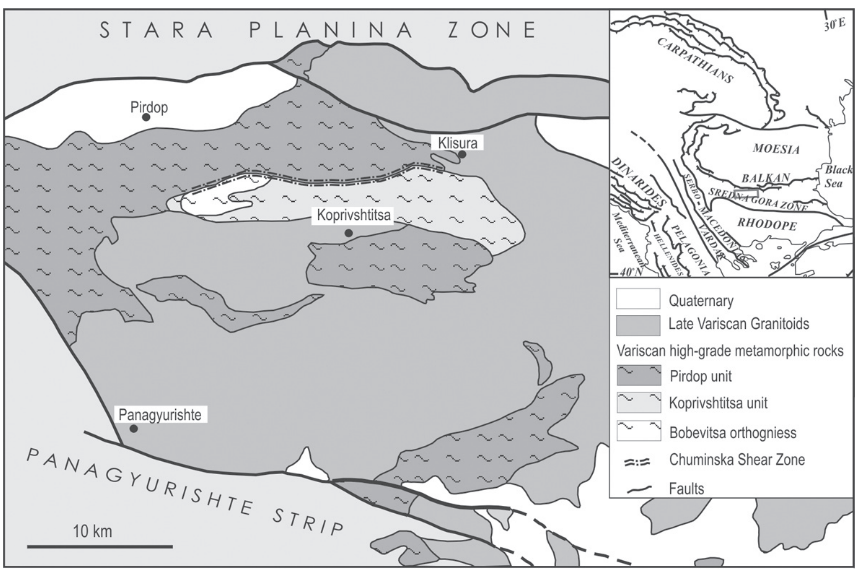

Fig. 1. Simplified geological map of a part of Central Sredna Gora (after Dabovski et al., 1966)

dark fine-grained phyllosilicate aggregates and quartz ribbons. The associated lineation fabric in a number of outcrops is difficult to be distinguished, but where it is better developed, it is defined by the alignment of elongated aggregates of sericite and chlorite or by fibrous quartz striae. The lineation has a generally moderate to steep down-dip plunge. The quartz linear fabric has the characteristics of low-temperature stretching lineation. The C′ foliation is defined by synkinematic sericite and chlorite, by the trails of mica fragments and by deflected strain-shadows of large felsic grains. The acute angles with the mylonitic foliation are in the range of 20 to 30°.

The microscale observations of several thin-sections from the mylonitized two-mica gneisses of the Pirdop unit give important information about both the deformation mechanisms and metamorphic conditions. Less deformed migmatitic gneisses are medium-grained rocks composed of plagioclase, K-feldspar, quartz (1), muscovite, biotite, ± garnet, and accessory apatite, zircon and rutile (?). They have a distinct high-temperature metamorphic foliation defined by the preferred orientation of feldspars and elongated large mica flakes. The imposed lower-grade mylonitization within the ChSZ caused retrograde shearing and formation of chlorite-sericite-quartz (2) mylonites with highly heterogeneous fabric. It is defined by the presence of varying in size and often fragmented porphyroclasts of feldspars and micas wrapped by fine-grained sericite-chlorite-fibrous quartz matrix. The feldspars, when preserved from a complete sericitization, show strong undulose extinction and brittle fracturing. Some of the fragments were rotated by a cataclastic flow and commonly have tails (“strain shadows”) of very fine-grained material. Synkinematic quartz recrystallization occurred by grain boundary bulging. Large quartz (1) porphyroclasts show strong, “sweeping” undulose extinction and deformation lamellae. Additionally, abundant quartz veins are emplaced along a net of micro-fractures parallel to the mylonitic foliation. Undulose extinction was also observed in mica porphyroclasts, but more often the large micas are fragmented and elongated along the mylonitic foliation planes or C′ shear bands. Recrystallization of synkinematic, very fine-grained mica was observed along the micro-fractures between the particular clasts and along the mylonitic planar fabrics. Several microstructures attest for a high fluid activity during mylonitization: the advanced process of replacement of the feldspar by secondary clay minerals and quartz; the abundance of quartz veins parallel to the planar shear-fabric; the presence of “strain shadows” and phyllosilicate overgrowths around porphyroclasts.

The microstructural characteristics of the ChSZ indicate a generally low-temperature greenschist facies deformation conditions, most probably at ca. 300–350 °C. The sense of shear criteria as S-C′ fabric, strain shadows, synthetic domino fragmentation of muscovite, etc. indicate top to the north and northwest direction of the tectonic transport, i.e. north-vergent reverse-fault kinematics.

The ChSZ represents a greenschist mylonitic boundary between two high-grade metamorphic units which have considerable differences in terms of lithology and grade of the Variscan metamorphic overprint. Important problem is to decipher the age of the shearing. Initially, it was suggested a Late Alpine age (Dabovski et al., 1966), but Antonov et al. (2010) assumed Variscan time of the deformation. However, the single age indicator is the fact that the ChSZ cuts the 336.5 ± 5.4 Ma (Carrigan et al., 2006) old migmatites of the Pirdop unit, thus unequivocally pointing to a late or post-Variscan time of the low-grade mylonitic deformation. In more regional aspect, striking similarities in terms of geometry, deformation facies and kinematics are found between the ChSZ and several Early Alpine north-vergent shear zones distinguished in the adjacent to the north Stara Planina Mountain area (for details see Lazarova, Gerdjikov, 2008; Gerdjikov et al., 2007 and references therein). Therefore, a possible correlation with these structures should also be assumed. This scenario does not preclude the possibility that the ChSZ represents a Variscan structure reactivated during the Early Alpine time. Future detailed mapping, structural study and geochronological data fixing the time of shearing are needed in order to evaluate these ideas.

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