

GEOCHRONOLOGY, GEOCHEMISTRY AND ISOTOPE TRACING OF THE CRETACEOUS MAGMATISM OF EAST-SERBIA AS PART OF THE APUSENI-TIMOK-SREDNOGORIE METALLOGENIC BELT

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The Timok magmatic complex and the Ridanj-Krepoljin belt represent a part of the Carpatho-Balkan Segment (CBS) of the "Tethyan Eurasian Metallogenic Belt" (TEMB) - a north-south elongated structure of Cretaceous-Tertiary magmatic activity. It can be traced from the Apuseni Mountains to the west to Iran to the east (Jankovic, 1976 and 1977). A great number of important ore-deposits (mainly Cu-Au-Mo, Majdanpek, Bor, Elatsite, Chelopech) are associated with this belt.

The upper Cretaceous and Paleocene magmatic products are best represented in the Apuseni-Banat (in Romania), Timok zone (in East Serbia) and along the whole Srednogorie zone (in Bulgaria) from the Nishava River valley to the Black Sea coast. They are prevailing of alkaline to high-K calc-alkaline character. The magmatic products are represented in extrusive as well as in the intrusive facies and at many sites (Timok Massif, Central and Eastern Srednogorie) they are arranged in large volcano-plutonic complexes.

In the Serbian part of the CBS of TEMB Karamata et al. (1997) concluded that the calc-alkaline Upper Cretaceous-Paleogene rocks were subduction related, but pointed to a potential difference in age of emplacement with slightly younger rocks (75 - 60 Ma) in the western part of the belt (Ridanj-Krepoljin trend) compared to the eastern part of the belt (91 - 65 Ma, Timok trend). Products of basaltic-andesite lavas characterize the beginning of volcanism; the magma differentiations follow a calc-alkaline trend, minor a tholeiitic one. From the field observation dykes as well as intrusions are crosscutting the volcanic bodies. These intrusions – diorite, monzonite and granodiorite – are related to the main ore formation in East-Serbia.

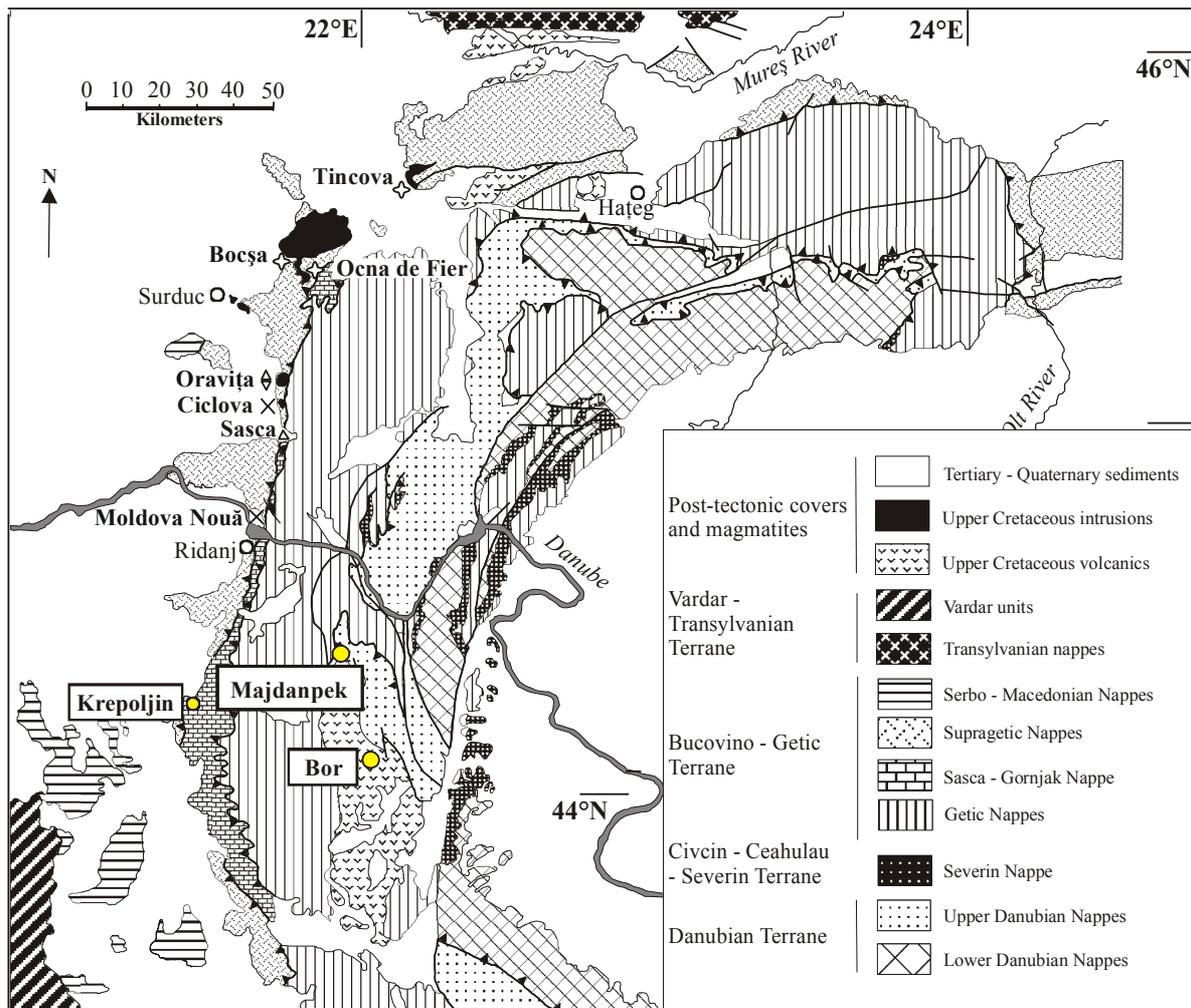


Fig.1: Geological overview of the Banat-Timok- Ridanj-Krepolin belt

The complexity of the magmatic-tectonic and metallogenic characteristics of the CBS of the TEMB is reflected in the variety of the existing geodynamic models. In the most of them it is assumed that the evolution of the belt is influenced by the processes of northward/northeastward subduction that took place in front of the southern margin of the Eurasian plate (Bocalleti et al., 1974; Ivanov et al., 1979; etc.). Bocalleti et al. (1974) give the most integral reasons proving that convergent movement between African and Eurasian plates took place and that it was associated with the consumption of the Vardar Ocean within the range of the Hellenic trench-arc. They suppose that on the Bulgarian territory almost a complete island-arc system was formed - with a-magmatic arc (the Rhodope massif), volcanic arc with sedimentary basins (Srednogorie zone) and back-arc thrust belt (the Balkanides). The same authors considered back-arc rifting processes in the range of the Eastern Srednogorie, which reaches its peak with the formation of the Black Sea.

Meanwhile many authors emphasized the role of the extension for the formation of the Upper Cretaceous-Paleocene sediments and magmatic rocks in the CBS of the TEMB. First Antonievic et al., (1974) set forth the idea for the existence of a well-defined Late Cretaceous rift in East Serbia. According to them its eastern continuation can be traced to the southeast on the territory of Bulgaria within the range of the Srednogorie zone. So they motivate the existence of "Timok-Srednogorie rift system". Later Popov (1987) considered "one big rift", named Banat-Srednogorie, the onset being placed after the closure of the Vardar ocean during a pre-orogenic stage of the Balkanide-Dinaride evolution. This rift was formed as a result of postcollisional orogenic collapse (Popov et al., 2000).

The time interval of magmatic activity and related ore-formation in the CBS is 92-60 Ma (Late Cretaceous-Paleocene). K-Ar whole rock and mineral geochronological data prevail in the literature. Published Rb/Sr whole rock data are scattering, calculated isochron ages are not very precise and their interpretations are controversial. The initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratios indicate a participation of young crust materials and/or an input of mantle source material. Available initial $^{87}\text{Sr}/^{86}\text{Sr}$ data from Berza et al. (1998), Jankovic and Jelenkovic (1997) and Karamata et al. (1997) are: 0.705 – 0.709 for Apuseni Mountains, 0.703 – 0.706 for Banat, 0.706 – 0.710 for Timok and 0.704 – 0.705 for Srednogorie.

Nicolescu et al. (1999) published U-Pb zircon dating (CAMECA ion probe technique) of a granodiorite from Ocna de Fier in Banat, Romania, with an $^{206}\text{Pb}/^{238}\text{U}$ age of 75.5 ± 1.6 Ma and Ciobanu et al. (2000) published a Re-Os age for a molybdenite from the Dognecea skarn deposit of 76.6 ± 0.3 Ma, which are interpreted to reflect the ore formation with the emplacement of the granodiorite. Von Quadt et al. (2002) have shown using high-precise single zircon analyses that the duration of the ore-formation of the Cu-Au-PGE porphyry deposit Elatsite (Bulgaria) took place within 1.1 Ma; high-precise single zircon studies from the southern part of Panagyurishte show that the Cretaceous intrusion of different rock types (Peytcheva et al. 2001), this volume) took place within 12 Ma.

The authors have taken several samples from the Timok and Ridanj-Krepoljin belt for U-Pb zircon dating as well as for Pb-Sr-Nd tracing. One object may be the detection as well as the duration time of the Cretaceous magmatic evolution within this part of the CMB belt. The second important question is concentrated to the time life of the porphyry deposits and identification of the metal source within East-Serbia.

Preliminary high-precise single zircon analyses from granodiorite porphyry (sample AvQ-059) of the Veliki Kravelj deposit show an intrusion age of 86.6 ± 0.6 Ma (fig. 2). Five zircon plot within their analytical concordant and the mean value of the $^{206}\text{Pb}/^{238}\text{U}$ age of 86.6 ± 0.6 Ma is interpreted to reflect the time of the intrusion.

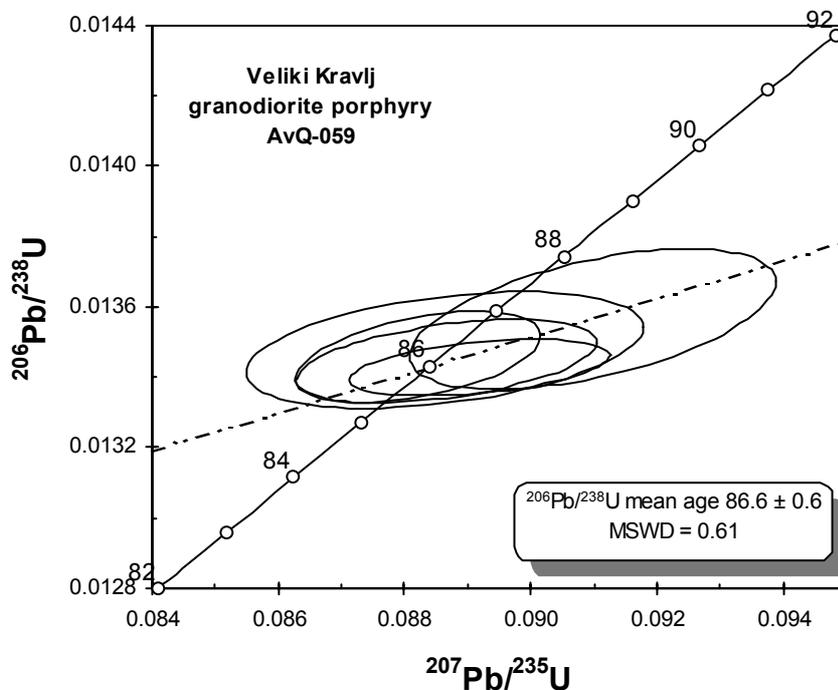


Fig. 2 . U-Pb isotope concordia diagram for granodiorite porphyry of Veliki Kravelj

A granite sample from the northern pit of the Majdanpek region give a concordant U/Pb age of 83.1 ± 0.1 Ma. Sr-tracing data from several magmatic rocks that belong to the Cretaceous evolution give $^{87}\text{Sr}/^{86}\text{Sr}$ ratios between 0.70388 and 0.706050 (corrected for T-85 Ma). These first preliminary data show that the time span for the magmatic evolution should be shorter as expected from the literature data. The low $^{87}\text{Sr}/^{86}\text{Sr}$ data reflect the dominance of mantle components and slight crustal contamination within the Cretaceous magmatic evolution.

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