U-Pb datting of detrital zircons from low-grade metasedimentary rocks in the Klokotnitsa village area, SE Bulgaria

U-Pb датиране на детритни циркони от нискостепенни метаседиментни скали в района на с. Клокотница, Югоизточна България

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The metasedimentary succession in the area of Klokotnitsa village (Thracian lithotectonic unit, Sarov, 2012) is considered part of the Triassic terrigenous-carbonate association of the Sakar type (Zagorchev, Budurov, 2009). The outcrops are dominated by carbonate and silicate-carbonate rocks. Scarce layers of quartz-mica schists, derived from arenaceous sedimentary protoliths, contain detrital heavy minerals. U-Pb geochronology of detrital zircons is a powerful tool for sedimentary provenance studies. The rock of study (TV-13) is a quartz-muscovite schist metamorphosed at greenschist facies (Vladinova et al., 2017), and located SE of the Klokotnitsa village (N 42°03'04.00, S 24°38'43.89).

Methodology and results

Zircon extraction and sample preparation followed standard techniques. The selected grains (100–200 μm) are consistent with the LA-ICP-MS laboratory analytical conditions of U-Pb dating at the Geological Institute of BAS. The zircon population comprises colourless, pale to deep pink grains of variable external morphology dominated by subrounded grains with smaller proportions of euhedral prismatic to short-prismatic and completely rounded ones. The CL images (Fig. 1) display three types of internal textures: (1) xenocrystic cores mantled by osscilatory zoned magmatic rims (Fig. 1a, b); (2) concentric zoned grains commonly with unzoned euhedral cores and osscilatory rims (Fig. 1c, d, e); (3) complex textured grains of recrystallized or newly grown convolute zones due most probably to late and post-magmatic modification of magmatic zircon (Fig. 1f).

The zircon ages vary between ~400 Ma and ~1400 Ma with a major cluster ~455 Ma (concordant to subconcordant) and several grains of older subconcordant to discordant ages (580 to 707 Ma and 903 to 1430 Ma) (Fig. 2.). The Proterozoic ages refer to xenocrystic cores and single grains of igneous or high-grade metamorphic origin (Th/U 0.07–0.67). The group of concordant Ordovician age includes: 405 to 481 Ma with a concordia age of 461.1±2.9 Ma and mean Th/U 0.27 for euhedral cores; 440 to 473 Ma with an weighted average of 457±10 Ma and mean Th/U 0.25 for oscillatory zoned rims; 410 to 461 Ma with a corcordia age of 452±2,6 Ma and mean Th/U 0.20 for complex textured grains (Fig. 3).

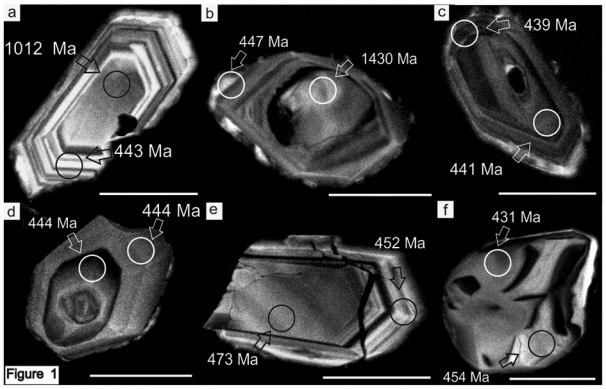

Fig. 1. Cathodoluminescence images of detritial zircons from quartz-muscovite schist:
a and *b*, xenocrystic cores mantled by osscilatory zoned magmatic rims; *c*, *d* and *e*, concentric zoned magmatic grains with unzoned euhedral cores (e) and osscilatory rims (c, e); *f*, complex textured grain of recrystallized or newly grown convolute zones. The scale bar is 100 μm.

Conclusions

The summarized results of detrital zircon dating indicate a dominant magmatic provenance source of Ordovician age. The presence of older Neo- and Mesoproterozoic zircons, some of which are xeno-

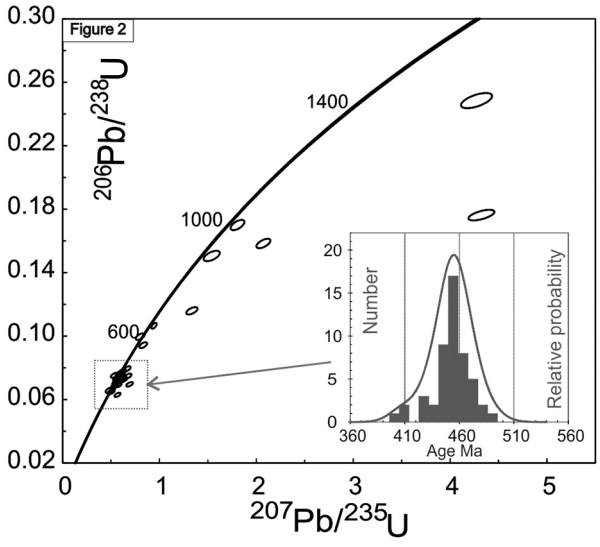

Fig. 2. Concordia diagram showing dispersion of concordant to subconcordant ages between ~400 Ma and ~1400 Ma with an inset of probability density plot for concordant $^{206}Pb/^{238}U$ ages in the range of 400 to 500 Ma

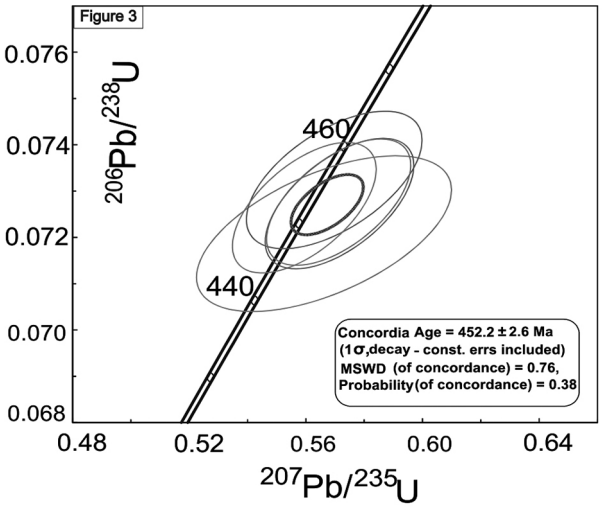

Fig. 3. Concordia age of 452.2±2.6 Ma for the most frequent data represented by oscillatory zoned rims and complex textured grains

crystic cores in Ordovician magmatic grains, does not exclude multiple crystalline sources. The whole rock geochemistry of the studied sample corresponds to a provenance area of typical upper continental crustal composition (Vladinova et al., 2016). Similar Proterozoic and Ordovician ages were reported by Naydenov et al. (2009) for orthogneisses in the Thracian lithotectocin unit (Parvenets complex), and compared to the metamorphic basement of the Central Srednogorie. Late-Palaeozoic and/or Mesozoic time of sedimentation should be suggested in accordance with the interpretation of Čatalov (1961). The greenschist facies metamorphism was not accompanied by observable resetting and new zircon growth.

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