

Detrital Zircon Record on the Stratigraphy of Meta-Carbonate Rocks in the Circum-Rhodope Belt: U-Pb LA-ICP-MS Geochronology Data from the Mandritsa Unit, Bulgaria

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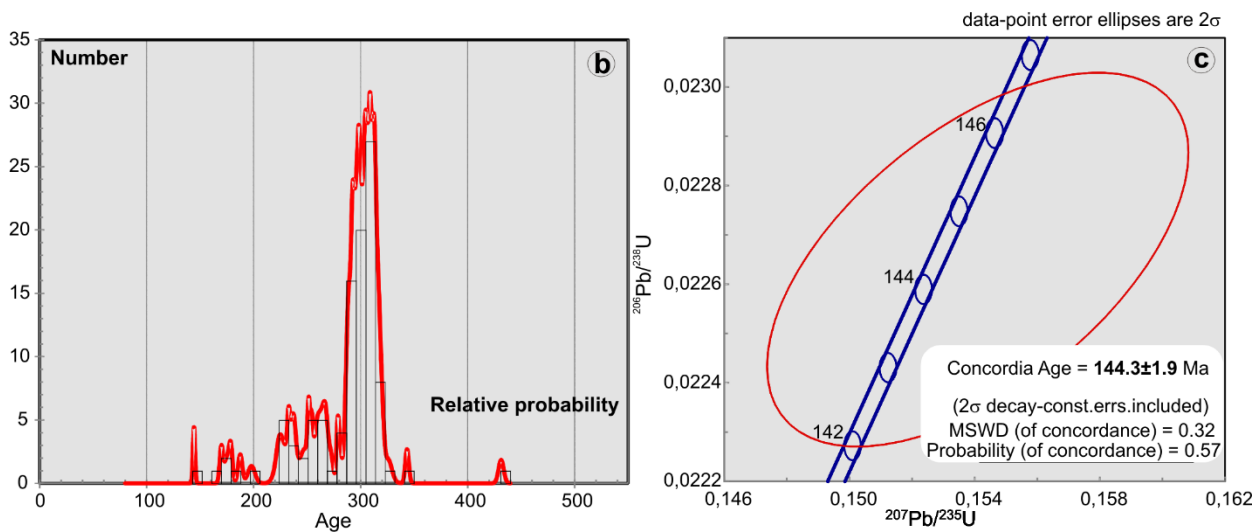
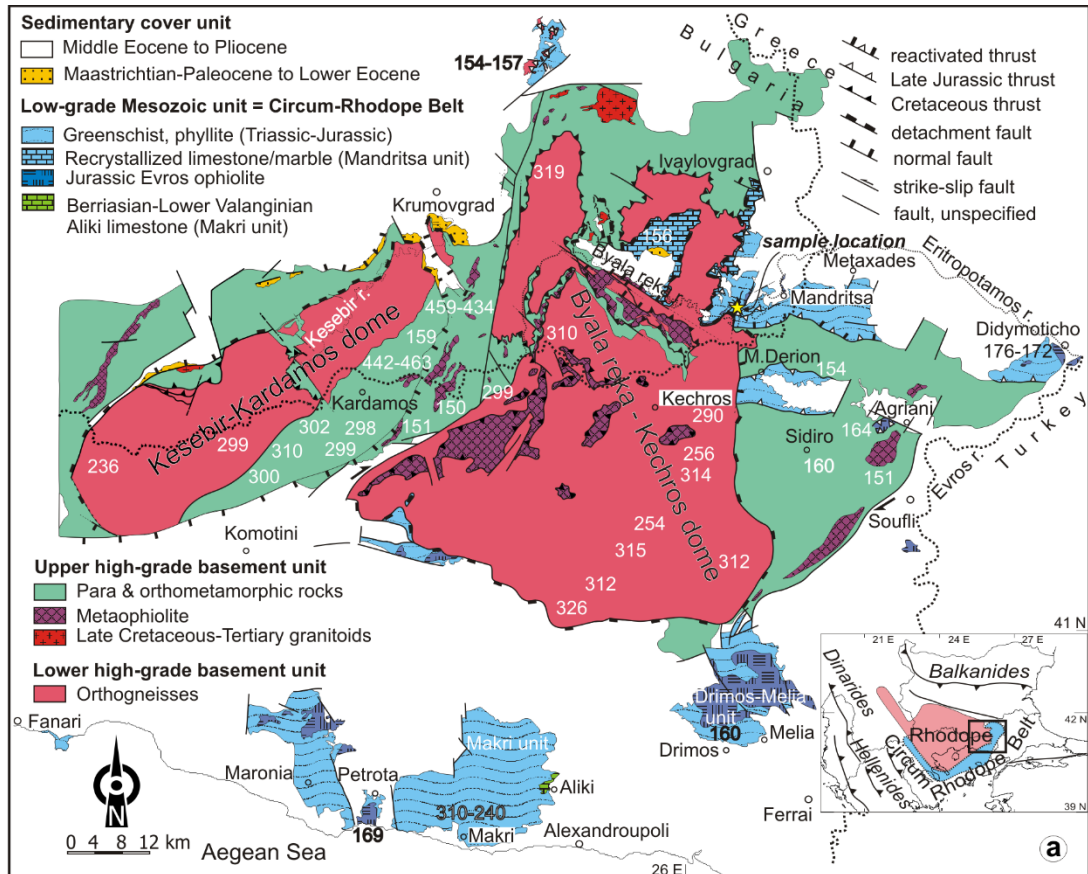


Figure 1. a) Geological map of the Eastern Rhodope-Thrace region of Bulgaria-Greece (adapted from Bonev et al., 2015a) and the U-Pb, 40Ar/39Ar and Rb-Sr geochronology there labeled by numbers in Myr., b) Density probability diagram, c) concordia diagram of the youngest detrital zircon in greywacke sample.

Background, Objectives and Methods

Latest Jurassic-Early Cretaceous sedimentary rocks and Jurassic arc/back-arc related ophiolitic rocks constitute various units of the Circum-Rhodope Belt (CRB) in Bulgaria and Greece (e.g. Meinhold and Kostopoulos, 2013, Ivanova et al.,

2015; Bonev et al., 2015a,b, and references therein). In Bulgaria, the basal strata of the Mandritsa unit of the CRB are built of recrystallized limestone to marble, which preserved their primary depositional layering (Fig. 1a). The marble hosts greywacke ranging in size from pebbles to blocks (Bonev, 2005). Both lithologies are metamorphosed to medium greenschist-facies and experienced ductile shear deformation (Bonev and Stampfli, 2011). These marble strata of the Mandritsa unit are considered to be Triassic in age by lithological similarity to fossil-bearing marble strata of the Makri unit exposed in the CRB of Thrace region in Greece (Boyanov et al., 1990). The depositional age of the basal marble strata in the Mandritsa unit is unknown. Here, we present U-Pb geochronology results from the greywacke hosted by marble, which provide necessary insights into the timing of the deposition of the marble strata at the base of the CRB Mandritsa unit, in Bulgaria. We applied U-Pb LA-ICP-MS technique on detrital zircons from the greywacke, following standard density and heavy liquids separation methods and cathodoluminescence (CL) imaging to obtain internal structure of the dated zircons. LA-ICP-MS analyses were performed in geochronology laboratory of the Geological Institute of the Bulgarian Academy of Sciences. Details on analytical procedures can be found in Bonev et al., (2019).

Results and Conclusions

Zircon grains range in size between 80 μm and 300 μm showing irregular fragments or crystals with a slightly rounded shape in CL images, which altogether suggest a short transport from the source area. In the CL images, the zircon grains display well-defined oscillatory zoning, as well as slightly obliterated homogeneous zoning patterns. The range of Th/U ratio in dated zircons varies between 0.11 and 0.75 except for two analyses in recrystallized zircon grains with Th/U ratios of 0.07 and 0.09. The obtained ages of detrital zircons range from 431.3 Ma to 144.3 Ma (Fig. 1b). Dominant age cluster comprises Carboniferous-Permian zircons whose analyses yielded concordant ages at 317.1 \pm 1.4 Ma to 257.1 \pm 2.9 Ma. Minor age clusters yielded Triassic ages (242.9 \pm 7.6 Ma, 233.7 \pm 3.6 Ma), a single Silurian age of 431.3 Ma and a concordant Jurassic age of 171.4 \pm 2.6 Ma defined by two analyses (Th/U=0.07 and 0.15). The only youngest zircon out of 105 zircon grains analyzed in the greywacke sample yielded an age of 144.3 \pm 1.9 Ma (Th/U=0.09), and hence, defines the maximum depositional age of the greywacke and the marble (Fig. 1c). The Paleozoic and Triassic detrital zircons age clusters are time-correspondent to the protolith ages of the meta-granitoids that build the Rhodope high-grade metamorphic basement underlying the CRB (Fig.1a). Jurassic arc-related magmatic rocks are also known from the CRB in Thrace region (Bonev et al., 2015a). Therefore, both Rhodope high-grade metamorphic basement and CRB magmatic rocks must have been the source for clastic sedimentary deposition of the greywacke in the basal marble of the Mandritsa unit. Berriasian ammonite of first appearance in Tithonian was reported in schist of the Makri unit of the CRB in Greece (Dimadis and Nikolov, 1997). Thus, biostratigraphic constraint and the maximum deposition radiometric age in this study reveal latest Late Jurassic sedimentation in the CRB of the Thrace region. Thus, we have reached the following conclusions:

- In the CRB of Thrace region, the basal marble of the Mandritsa unit deposited in latest Late Jurassic (Tithonian).
- Both Rhodope basement and CRB Jurassic rocks must have been the sedimentary source of continental provenance.

Acknowledgements

The study was supported by the National Science Foundation of Bulgaria through grant DN04/6.

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