Resolving the evolution of a subduction zone: Eastern Srednogorie, SE Europe

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Eastern Srednogorie zone is the easternmost part of the mineralized ABTS (Apuseni-Banat-Timok-Srednogorie) belt in SE Europe. This belt is a former Late Cretaceous island arc that was formed during the process of northward subduction of the Tethyan ocean beneath the European platform. Compared to the other parts of the belt, magmatic products exhibit the most variable composition. However, the zone is the least studied, and here we present new geochemical, isotope and geochronological data with the aim to understand the genesis of the magmatism. We try to isolate the most primitive initial magmas that fractionated and assimilated parts of the crust to produce the abundant Late Cretaceous magmatism, and to trace the across-and along-arc change in the age and composition of the magmatism.

Magmatic products in the Eastern Srednogorie show the entire spectrum of rocks typical for island-arc environments. Based on their chemical composition three main regions are subdivided from south to north; (1) tholeiitic to calc-alkaline, basic to acid intrusives in the southern; (2) predominantly potassic to ultrapotassic mafic-intemediate volcanis in the central and (3) calc-alkaline basic-intermediate volcanics in the northern part. Trace and REE distribution patterns argue for subduction related magmatism for all rock varieties.

TIMS and LA-ICPMS dating of single zircon grains shows that magmatic activity started at about 86 Ma with few intrusions but the climax of the magmatism was in the Campanian (81-78 Ma). Whole-rock Pb and Sr isotopes of most mafic magmas show the least radiogenic compositions ($^{87}Sr/^{86}Sr_i$ of 0.7040, $^{206}Pb/^{204}Pb_i$ 18.38, $^{207}Pb/^{204}Pb_i$ 15.57 and $^{208}Pb/^{204}Pb_i$ 38.27). These values are less radiogenic compared to Late Cretaceos magmatic rocks of the adjacent Central Srednogorie zone. In addition, the majority of the analysed rocks contain Cretaceous zircons with positive εHf at 80 Ma (from 0 to +12), suggesting a mantle-dominated origin. However, these rocks contain variable amounts of inherited zircons with negative, crustal-like εHf at 80 Ma This fact clearly show that the rocks suffer some contamination by crustal-derived lithologies. The amount of crustal contamination increases with time. Potential candidates for the contaminants are the Carboniferous and Permian basement rocks, as revealed by the U-Pb single zircon ages of the inherited crystals. The DM model Hf ages of inherited zircons and zircons from the basement rocks cluster around 900 Ma.

Chronological history of UHP rocks from the Chinese Continental Scientific Drilling: A multi-methodical approach

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Ultrahigh pressure (UHP) rocks from the Chinese Continental Scientific Drilling (CCSD) program were chosen to study the Sm-Nd and Lu-Hf isotope systems in combination with U-Pb LA-ICP-MS and SHRIMP dating of distinct zircon domains. Comprehensive studies of the different lithologies on various sections of the drill hole should provide a better understanding of the metamorphic evolution of the Sulu terrane. Additionally, our multi-methodical approach provides the opportunity to compare the different chronometers and test their robustness and limitations (e.g. mineral inclusions, incomplete equilibration, resetting). Multistage zircon growth can be observed in most Sulu-Dabie UHP rocks. Inherited and metamorphic zircons were distinguished on the basis of transmitted light microscopy, cathodoluminescence (CL) imaging, trace element contents, Hf isotope composition and mineral inclusions. Inherited zircon of middle Neoproterozoic age have variable trace element pattern that are considerably different from that of metamorphic zircon domains. Based on CL, mineral inclusion and U-Pb ages up to three phases of Triassic zircon growth or re-crystallisation can be identified in a single sample. The ages are interpreted to date the time of (1) prograde and (2) UHP metamorphism during subduction, and (3) later retrograde metamorphism during exhumation.

Metamorphic domains from a single sample have commonly a uniform Hf isotope composition indicating isotope equilibration in the decimetre-scale during the Triassic UHP event. This composition varies between different samples and is generally significantly more radiogenic than that of the inherited cores and thus the bulk rock. Its respective value is controlled by the percentage of dissolved or re-crystallized inherited zircon, with low Lu/Hf and relatively unradiogenic $^{176}Hf/^{177}Hf$, and the bulk rock composition.

Analyses of the Lu-Hf and Sm-Nd system of mineral separates (garnet, clinopyroxene …) are currently in progress. According to SHRIMP and LA-ICP-MS U-Pb ages of metamorphic zircon from the same and various other UHP rocks ([1-3] and references therein) lasted the metamorphic evolution of the Sulu-Dabie terrane around 30 Myr, with about 20 Myr of HP or UHP metamorphism.

References

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