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Subduction related rocks in Medet Cu-porphyry deposit: Sources and magma evolution

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The Europe's world-class porphyry-copper deposit Medet is situated in the Central part of the Srednogorie zone (Bulgaria). The region of the deposit is characterized by high-metamorphic continental basement rocks, crosscut by Variscan granitoids. This succession is intruded by Late Cretaceous subduction related calc-alkaline basic to intermediate igneous rocks, bearing the deposit. The aim of this study is to constrain the age and the isotope-geochemical characteristics of the basement rocks and the Cretaceous magmatites and to evaluate the role of both, the crustal protoliths and the subcontinental mantle lithosphere as magma sources.

ID-TIMS techniques are used for the precise U-Pb single zircon (zr) and Rb/Sr-Sm/Nd for whole rock samples, MC-ICPMS - for the Hf isotopes. Zircons of the Medet gabbro reveal an age of 305.6 ± 0.50 Ma, which is very close to the Smilovene graniodiorite (305.3 ± 1.3 Ma). U-Pb monazite age of the adjacent Koprivshtitsa granite gives an age of 304.8 ± 0.8 Ma. Furthermore the gabbro shows mixed crustal-mantle characteristics, according to the εHf (300) zircon value of +0.14 and whole-rock initial strontium ratio of 0.7043. These data fit very well together with the I-type affinity of the Smilovene and Koprivhtitsa Variscan plutons.

The gabbro-diorite from the deeper parts of the deposit represents the oldest Upper Cretaceous rock variety: concordant zircons reveal a mean $^{206}Pb/^{238}U$ age of 90.36 ± 0.48 Ma (pre-ore formation). Old inherited zr grains and cores define a discordia line with an upper intercept age of 456.5 ± 5.5 Ma. The εHf (460) of the same zircons of +8.04 to +9.88 suggest mantle source of the old protoliths. It is noteworthy that the εHf (90) values for the old and young zircons are scattering in a narrow range between -0.81 and +2.12, whereas no correlation between inheritance and the negative values was found. The ore-related Q-monzodiorite of the Medet deposit shows an intrusion $^{206}Pb/^{238}U$ age of 89.61 ± 0.26 Ma. εHf (90) values of the concordant zircons change between +1.24 and +4.42 indicating additional input of mantle magma. One grain with an inherited core marks the assimilation of Lower Palaeozoic basement rocks with crustal characteristics (εHf_{90} of –3.78).

Based on Sr-, Nd- and Hf-zircon isotope data at least two magma sources for the Cretaceous rocks in the Medet deposit could be constrained: the subcontinental enriched mantle and the pre-Variscan basement, which reveals mantle as well as crustal characteristics.

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Timing of Mesozoic magmatism in Khingan-Okhotsk volcano-plutonic belt (Russian Far East)

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The Khingan-Okhotsk volcano-plutonic belt is one of the most significant structures of the eastern margin of Asia but doubt remains about the succession and geodynamic setting of the magmatism. Recent $^{40}Ar/^{39}Ar$ data show two stages of magmatic activity (111-105 Ma and 101-99 Ma) within the Khingan-Okhotsk belt. The first is responsible for eruption of a basalt-andesite-dacite association, while the second is responsible for an acid-subalkaline and alkaline magmatism.

Andesite, basaltic andesite and first stage dacite correspond to calc-alkali high-K series characterized by moderate Rb (50-150 ppm) and Ba (430-700 ppm). These increase in the basaltic andesite-dacite series, while Sr (170-640 ppm) decreases. Zr (130-400 ppm), Hf (3-7 ppm), Nb (7-30 ppm) increase with increase of SiO_2. REE pattern is characterized by $(La/Yb)_n$=8.2-14.8. Andesite and basaltic andesite have $(Eu/Eu^*)_n$ = 0.98-0.95, but this ratio in dacites is 0.6-0.4. The age datings range from 111 to 105 Ma.

The overlying volcanic series are primarily composed of acid rocks with formation age of 101 to 99 Ma. According to chemical composition they are divided into three groups:

I. Subalkaline rhyolites, SiO_2=72-75%, Na_2O/K_2O=0.4–0.7 %, ASI=1-1.25. Geochemical peculiarities lie in moderate contents of Rb (120-170 ppm), Ba (410-630 ppm), Th (11-13 ppm), Nb (28-38 ppm,) Hf (7-8.3 ppm), Zr (230-270 ppm), and in low Sr content (56-90 ppm). REE distribution is characterized by $(La/Yb)_n$ = 5.1-7.8, and $(Eu/Eu^*)_n$ = 0.3-0.6.

II. Subalkaline rhyolites, SiO_2=75-78%, Na_2O/K_2O=0.5–0.7 %, ASI=1-1.8. They are characterized by high content of Rb (120-320 ppm), Th (12-25 ppm), Nb (37-72 ppm,) Hf (8-14 ppm), and by low Sr contents (< 30 ppm), Ba (12-60 ppm). REE distribution is characterized by $(La/Yb)_n$ = 5.8-11.5 and $(Eu/Eu^*)_n$<0.1.

III. Alkaline trachydacite with K_2O+Na_2O>10%. These rocks are characteristic of high content of Ba (1400-1700 ppm), Zr (610-660 ppm), Nb (70-80 ppm), Hf (18-19 ppm), and moderate Rb (134-139 ppm), Sr (120-160 ppm). REE distribution is characterized by $(La/Yb)_n$=4.5–5 and $(Eu/Eu^*)_n$ = 0.7-0.8.

Subalkaline and alkaline granite-porphyry and syenite-porphyry are very important in the structure of the belt. Compositionally, they are identical to alkaline trachydacites. The age of one of the samples is 100.3±0.2 Ma.

The peculiarities of these rocks indicate the possible participation of a source similar to enriched magma in the primary magmatic melt.