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A new time framefor the mineralisation in the Kassandra mine district, N Greece: deposit formation during metamorphic core complex exhumation

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The Kassandra mine district (KMD), Chalkidiki, N Greece, hosts different styles of spatially related magmatic-hydrothermal base and precious metal deposits. Mineralisation in the district is related to Oligocene-Miocene magmatism in the metamorphic hinterland of the Hellenic orogeny generated duringthe post-orogenic (gravitational) collapse of the Aegean wedge [1-2]. The KMD deposits form part of the economically important Serbomacedonian-Rhodope metallogenic province, a tectono-magmatic belt that spans across severaltectono-stratigraphic units between Serbia, Greece and Bulgaria. It has total mineable reserves of 7.7 moz Au, 68.8 moz Ag, 0.7 Mt Cu and 1.7 Mt Pb + Zn, making the KMD one of Europe's largest base and precious metal resources [3].

Stratoni(MademLakkos, MavresPetres) and Olympias are carbonate-replacement massive sulphide Pb-Zn (Ag-Au) depositslocated on the footwall of the Tertiary Stratoni-Varvara fault, which is the southern extension of the main detachment fault of the adjacent Rhodope metamorphic core complex [4]. Both deposits are interpreted to form the proximal and distal partof a fault-controlled exoskarn-type ore system triggered by nearby small-scaleintrusions close to the fault system [5-6].Skouries is a Cu-Au porphyry resource emplaced in a local intrusive belt on the hangingwall of the Stratoni-Varvara fault.

Deposit formation in the Serbomacedonian-Rhodope belt (including the KMD) is traditionally linkedto post-collisional Tertiary magmatism in an extensional back-arc setting along the strike of the present-day Hellenic subduction zone [2]. Slab roll-back and subsequent slab-tear and/ or slab-detachmentwere the trigger for the mineralisation-related magmatismin the belt withdecreasing magmatic ages from SE to NW [1-2].

A detailed geochronological study on the Tertiary intrusivesand the carbonate-replacement deposits in the KMD indicate a genetic link to the exhumation of the nearby Rhodope metamorphic core complex. A suite of barren and mineralised sub-alkaline to alkaline, high-K calc-alkaline volcanic arc/ syn-collisional plutonitesintruded the crystalline basement (Mesozoic or older) within a short magmatic interval between 30 and 20 Ma. These emplacement ages arediachronous compared to the subduction-related, orogenicplutonites in the region (40-57 Ma) and are synchronous with the granitic intrusions linked to core complex exhumation in the Greek Rhodopes (ca. 21-24 Ma, [7-9]). The granite, diorite and gabbro stocks were emplaced in a narrow (<10 km) intrusive belt within a local dilatational jog between two normal faults with dextral strike-slip, which acted as detachment for the exhumation of the Rhodope core complex [4]. With an intrusion age of 20.56±0.48 Ma (LA-ICP-MS single grain zircon U-Pb) and a mineralisation age of 19.9±0.9 Ma (Ar-Arbiotite, potassic core) the Skouries Cu-Au porphyry represents a late-stage, evolved member of this magmatic suite. Furthermore, an Re-Osisochron age of 26.1±5.3 Ma (arsenopyrites) from the Olympias deposit is the first ever in-situ mineralisation age for the carbonate-replacement deposits in the KMD and links the deposit formation to tectono-magmatic processes related to the core complex exhumation rather than post-subduction processes [9].

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