Timing of Cu-Au-Te-PGE porphyry-style mineralisation in northern Greece and Bulgaria and its relationship to metamorphic core complex exhumation

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Project description: The increasing global interest and investment in green technologies such as wind turbines, solar energy collectors, and electric cars, has created new demand for previously underutilized elements such as Te and Se for photovoltaic energy production and platinum group elements (PGE) for autocatalytic convertors and fuel cells. These elements are commonly enriched in areas of Cu, Mo, or Au mineralisation associated with high-level potassic and calc-alkaline magmatism. Typically, the anatomy of this mineralisation at the deposit scale is porphyry and epithermal in style, but on a regional scale, enrichment in Te, Se, and PGE appears to be connected with post-subduction high-K to shoshonitic magmatism. Thus, a key area for research is to understand the regional geodynamic setting for this mineralisation; in particular, the generation and timing of fertile magmas and the structural pathways that control their emplacement. Advances in this field will significantly aid mineral resource exploration through the development of new genetic models for this relatively poorly understood mineral deposit type.

A globally important region for porphyry- and epithermal-style Cu-Au-Te-PGE deposits is the Rhodope Massif of northern Greece and southern Bulgaria (Figs. 1-3), which forms the hinterland to the Hellenic orogen [1]. The PhD will focus on a detailed geo- and thermochronology study of the emplacement, mineralisation and exhumation of the Moronia–Sappes–Leptokaria magmatic corridor in NE Greece, a sequence of Eocene–Miocene mineralised and barren subvolcanic plutons plus the Biala Reka–Kekros Dome, part of the Rhodope metamorphic core complex into which the plutons are intruded [e.g. 2]. Key research questions to be addressed are: (1) How does magma petrogenesis influence magma metal fertility, (2) how does the timing and duration of mineralization processes affect the size of mineral deposits and (3) can rates of exhumation and erosion be used to determine regional potential for ore deposit preservation.

The PhD will involve two field seasons in the Rhodope Massif, a programme of laboratory work that includes trace element geochemistry, geo- and thermochronology (U-Pb, Ar-Ar, (U-Th)/He) and computer modelling. The project will provide excellent research training in field skills, analytical techniques and numerical analysis. Work will be primarily undertaken at the University of Bristol and the British Geological Survey, with potential for visits to other laboratories for additional analyses. Fieldwork support will also be provided by experts in the Universities of Thessaloniki and Athens.

[1] Voudouris, 2006, Min. & Pet., v. 87, p. 241–275. [2] Marton et al., 2001, Tectonophysics, v. 483, p. 240–254.

Figure 1. MODIS satellite image of central Greece showing the location of the Rhodope Massif and some key copper-gold deposits

Figure 2. View of the Rhodope Massif from the Sappes copper-gold deposit, Greece

Figure 3. Copper staining in the Skouries porphyry copper-gold deposit, Chalkidiki Peninsula, Greece