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Upper Cretaceous-Tertiary subduction dynamics from the Balkan to the Aegean and W-Anatolia region: input of mineralization and related magmatism

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In the eastern Mediterranean, the dynamics of the Tertiary subduction of African plate below Eurasia is still largely debated, notably in the region extending from the Balkan to the Aegean and western part of Anatolia. To understand this evolution since the late Cretaceous, an additional feature should be considered: the spatial and temporal evolution of arc- and back-arc-related ore deposits. Indeed, the type of mineralization, their magmatic environment and their relationships with large-scale structures, can provide insights on subduction-related processes from deep mantle to surface. In the eastern Mediterranean, a clear evolution through time can be observed.

First, during the late Cretaceous and Paleocene, magmatism and mineralization were located in the Balkans with dominant calc-alkaline rocks and related porphyry Cu deposits. These syn-extensional occurrences emplaced in a back-arc environment that developed in response to a low slab retreat.

In opposition, from 35-30 Ma, slab retreat accelerated, inducing a significant back-arc extension from the Rhodope massif to the south Aegean domain. Analysis of metallogenic data demonstrates that, during this second stage, mineralization consists mainly in low-sulphidation epithermal Au deposits related to shoshonitic volcanism in NW-Anatolia. The Au stored in the lithospheric mantle during the first stage was remobilized by melting of the lithospheric mantle, thus suggesting a significant thermal event that could result from wide lithospheric extension, possible slab breakoff and asthenospheric influx. From the middle Miocene, alkaline volcanism appeared in western Anatolia and progressively developed in the east of the Aegean domain and some syn-extensional plutonic intrusions were emplaced in the Cyclades up to the upper Miocene. Associated ore deposits are variable with porphyry, skarn and epithermal occurrences and late hydrothermal veins, depending upon various parameters such as the depth of the intrusions. These occurrences developed during the fast clockwise rotation of the western Aegean that is a probable consequence of the slab tear shown by tomographic models below western Anatolia. The related major asthenospheric influx followed the rotating slab and invaded the whole Aegean domain from $\sim$17 Ma ago until 9 Ma. This mantle flow induced the partial melting of the base of continental crust to form the Cycladic plutonic intrusions and related ore deposits.