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Western Tethyan Metallogeny in the Mediterranean Realm

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Triassic rifting and opening of the Alpine Tethys in the western Mediterranean was initiated by the eastward propagation of the Central Atlantic rift. In the eastern Mediterranean, opening of the Vardar Ocean was generated by the westward migration of the Permo-Triassic Neotethyan rift. The metallogeny of rifting/advanced rifting stages is characterized by SEDEX-type Fe-Mn-Ba-Hg-base metal deposits in the Dinarides and metasomatic Fe-Ba-F-base metal and magnesite deposits in the eastern Alps and Dinarides. MVT-type stratiform-stratabound Pb-Zn(-Ba-F) deposits formed in the Triassic platform carbonate sequences of the passive continental margins in the eastern Alps, Dinarides, Betic Cordillera, and Atlas Mountains. Convergence commenced during the Early Cretaceous in the Alpine Tethys. The oceanic crust of the narrow basins was largely consumed in the southward-oriented subduction zones, or the obducted remnants were mostly covered by nappes. These circumstances may explain the absence of significant podiform chromite deposits and relatively rare occurrences of Fe-Cu(-Zn) VMS deposits in the Alpine Tethys, whereas the large outcropping belts of obducted ophiolites of the Vardar Ocean are well endowed with these mineral resources. In the Vardar Ocean, the Late Cretaceous convergence between the European Plate and microcontinents generated N-oriented subduction in the South Carpathian-North Balkan area. The most significant Cu-Mo(-Au)-porphyry deposits of Europe together with Fe-Cu(-Pb-Zn)-skarn and epithermal-Au deposits are located in this area, in the ~1,500-km-long Apuseni-Banat-Timok-Srednogorje belt consisting of syn- to postcollisional intrusions and volcanic complexes. In the remnants of the Vardar Ocean, the E-oriented subduction and the Eocene-Oligocene collision of the Adria microplate of African origin with other microplates triggered the formation of the Serbomacedonian-Rhodope syn- to postcollisional magmatic arc of Oligocene-Miocene age and exhumation-extension of the Rhodope Mountains. These areas also form an important metallogenetic belt of Cu-Mo(-Au)-porphyry(-skarn) and epithermal-Au(-Ag-Pb-Zn) deposits. In the Miocene, the southward migration of this collision zone and subduction rollback initiated the formation of the Aegean back-arc basin, where subduction, volcanism, and hydrothermal processes are still going on. Porphyry-(skarn)-epithermal systems are absent in the deeply eroded postcollisional Paleogene magmatic arc in the Alps. In the western and eastern Alps, exhumation of metamorphic complexes was associated with formation of orogenic gold deposits in the Oligocene. The SW- and W-oriented Carpathian subduction, consuming the easternmost remnants of the Alpine Tethys, was initiated by the lateral extrusion of microplates from the collision zones in the Alps and Dinarides. These plates avoided deep erosion and transported Eocene-Oligocene porphyry-epithermal complexes into the Carpathian realm. Due to the shallow level of erosion in the syn- to postcollisional, ~700-km-long Miocene-Quaternary Carpathian volcanic arc, the epithermal Au-base metal systems are well preserved, but known porphyry deposits are rare. Subduction rollback in the Carpathian arc led to the formation of the Pannonian back-arc basin. In the westernmost Alpine Tethys, change of subduction polarity in the Oligocene was followed by the retreat of the NW-facing subduction front into the still active Eolian arc. This led to the formation of the Balearic and Tyrrhenian back-

arc basins, where the outcropping volcanic complexes are less endowed with epithermal systems in comparison with the Carpathian and Aegean arcs.