SEG-MJD 2016 Conference

Geologic Setting and Tectonic Evolution of Porphyry Cu-Au, Polymetallic Replacement, and Sedimentary Rock-Hosted Au Deposits in the Northwest Timok Magmatic Complex, Serbia

Richard Tosdal,[1,*] Matias Knaak,[2] Istvan Márton,[3] Justin Van Der Toorn,[4] Sean Hasson,[5] Dragana Davidovic,[4] Ivan Strmbanovic,[4] Mladen Zdravkovic,[4] and Jelena Ivanovic[6]

[1]PicachoEx LLC, Folly Beach, SC, USA
[2]Domlogic Geoservice, Cologne, Germany
[3]Stockwork Geoconsulting Ltd., Cluj Romania
[4]Avala Resources Ltd, Bor, Serbia
[5]Seefin Capital Ltd., Sofia, Bulgaria
[6]Mineral Deposit Research Unit, University of British Columbia, Vancouver, BC, Canada

*Corresponding author: e-mail, rtosdal@gmail.com

A northerly trending zone of porphyry Cu-Au, porphyry Au, polymetallic replacement Pb-Zn-Au-Ag, and sedimentary rock-hosted Au deposits along the northwest margin of the Late Cretaceous Timok magmatic complex forms a part of the Bor metallogenic zone in eastern Serbia. The porphyry Cu-Au and polymetallic replacement deposits in the northwest Timok magmatic complex represent parts of zoned magmatic-hydrothermal systems that are linked to Late Cretaceous oxidized, hornblende-biotite diorite porphyry intruded over a ~5- to 6-million-year period between 83.6 ± 0.5 and 78.5 ± 1.3 Ma (U-Pb SHRIMP-RG ages on zircon), making them slightly younger than the larger Late Cretaceous (89–83 Ma) porphyry Cu-Au and high-sulfidation Cu-Au deposits on the eastern margin of the Timok magmatic complex. The low-temperature sedimentary rock-hosted Au deposits in the northwest Timok magmatic complex lie spatially near but are always separated by faults from the polymetallic replacement and porphyry Cu-Au deposits. The common but not ubiquitous spatial association between the sedimentary rock-hosted Au deposits and the zoned porphyry Cu-polymetallic replacement deposits, coupled with available exploration geochemical vectors evident in soil geochemistry, does, however, suggest a genetic linkage between all the hydrothermal deposits. An important component required to fit the three deposit types into a zoned magmatic hydrothermal model is a revised geologic and tectonic understanding that can also be extended to the entire Timok magmatic complex. A component of the revised model emphasizes the role of the post-Cretaceous faults formed during oroclinal bending of the region. Two fault generations are significant. Postmineral, easterly trending normal faults bounding basins filled largely by Miocene sedimentary rocks preserved the low-temperature sedimentary rock-hosted Au deposits and helped preserve deposits in the eastern Timok magmatic complex. These faults accommodated elongation of the Timok magmatic complex kinematically linked to dextral strike-slip faults such as the Timok fault with as much as 100 km of displacement. Major, postmineral, NW-trending faults dismembered deposits in the northwest Timok magmatic complex and accommodated sinistral transtensional and transpressional strain that, on a larger scale, facilitated rotation between large crustal blocks as well as Timok magmatic complex scale shortening normal to the complex. The end result of the postmineral deformation during oroclinal bending and extensional and strike-slip deformation is the preservation of different crustal levels, not just in the northwest Timok magmatic complex but also throughout the region. The deformation, furthermore, enhanced the preservation of Cretaceous ore deposits beneath younger

rocks. As the Timok magmatic complex was constructed over a highly faulted Variscan and older basement terrane, it is possible that reactivation of the pre-Cretaceous basement faults in the basement beneath the Timok magmatic complex, such as the Variscan Blagojev-Kamen-Rudaria fault systems, played a role in the Late Cretaceous history of the Bor metallogenic zone and controlled post-Cretaceous deformation in the Timok magmatic complex.