SEG 2017 Conference

The White Mountain gold deposit, northeastern North China Block: Genesis and relation to Late Mesozoic magmatism and extension

Halley A Keevil*, Thomas Monecke, Richard Goldfarb, Gregory Collins, Tao Feng, Timothy Baker, Nigel Kelly, Andreas Möller

*Colorado School of Mines, Denver, USA, CO, Email: hkeevil@mymail.mines.edu

The White Mountain sediment-hosted gold deposit is located in the mineral-rich Hunjiang basin of Jilin Province, NE China. The Hunjiang basin is situated in the Paleoproterozoic Jiao-Liao-Ji Belt of the Eastern Block of the composite North China Block and is underlain by Paleoproterozoic to Paleozoic sedimentary rocks with abundant igneous intrusive and extrusive rocks. A diversity of mineral deposits within the basin have been exploited by more than 100 past and producing mines of various sizes, but White Mountain remains the most economically significant deposit in the basin, with a total endowment of 1.86 Moz of Au at an average grade of 3.24 g/t Au. The deposit is hosted by hydrothermal breccias along the contact between foot-wall dolomite and hanging-wall sandstone. Determining the genesis of the White Mountain deposit is essential for both in-mine and brownfields exploration, and can also provide insight into the broader tectonic history of the Hunjiang basin and the Jiao-Liao-Ji Belt. Data will be presented from field studies at White Mountain and within the Hunjiang basin as well as from laboratory work on samples collected at the White Mountain mine. In addition, twenty igneous, porphyritic, volcanic, and volcaniclastic rocks were collected from within the basin and analyzed by U-Pb LA-ICP-MS on magmatic zircons to constrain the timing of magmatic activity in the basin in relation to gold deposition.

The dominant alteration minerals at White Mountain are low temperature clays, namely kaolinite and dickite. The alteration mineralogy in combination with low-temperature fluid inclusions indicate that ore formation occurred at temperatures of < 200°C from moderately acidic fluids. The ore-hosting polymictic breccia is interpreted to have formed by hydrothermal brecciation and minor collapse brecciation. LA-ICP-MS geochronology from zircons in the magmatic rocks predominantly yielded Middle Jurassic to Early Cretaceous magmatic ages. For example, a mineralized Au-Cu-rich porphyritic intrusion ~10 km from White Mountain yielded a concordant magmatic age of 166.02 ± 0.81 Ma, while an altered but seemingly unmineralized porphyritic intrusion that cuts the stratigraphy at the White Mountain mine yielded a concordant magmatic age of 132.47 ± 0.65 Ma. The Early Cretaceous volcaniclastic rocks in the basin are flat-lying and unconformably overlying moderately dipping sedimentary rocks, suggesting that large-scale tectonic activity in the basin had ceased by this time. Additionally, some of the Early Cretaceous rocks dated elsewhere in the basin are mineralized, suggesting that the magmatic-hydrothermal mineral deposits in the Hunjiang basin (likely including White Mountain) formed during late Mesozoic regional extension. This is coincident with the timing of lithospheric delamination of the eastern North China Block, as well as with the timing of many gold deposits of various hypothesized origins throughout this region. Based on mineralization and alteration assemblages, cathodoluminescence signatures, fluid inclusions, and field relationships, the White Mountain deposit is interpreted to be a distal disseminated magmatic-hydrothermal gold deposit that is related to late Mesozoic extension, magmatism, and widespread hydrothermal activity within this part of northeastern China.