

Magnetite-Apatite Deposits in the Middle-Lower Yangtze River Valley Metallogenic Belt, Eastern China

Taofa Zhou,* Yu Fan, Feng Yuan, Shiwei Wang, Dayu Zhang, and Noel White

Ore Deposits and Exploration Centre, School of Resources and Environmental Engineering,
Hefei University of Technology, Hefei 230009, China

*E-mail, tfzhou@hfut.edu.cn

The Middle-Lower Yangtze River Valley is one of the most important Cu-Fe polymetallic belts in China. It contains many volcanic basins, such as Li-Shui, Li-Yang, Ning-Wu, Fan-Chang, Lu-Zong, Huai-Ning, and Jin-Niu basins, in which are found many magnetite-apatite deposits (named “porphyry iron deposits” in the Chinese literature), including the world-class Nihe, Meishan, Washan, and Gushan iron deposits. These deposits are characterized by magnetite-apatite-actinolite assemblages and are exclusively found in the volcanic basins. The continental volcanic and subvolcanic host rocks have been intruded by diorite porphyries that are closely related to iron mineralization. Dating of the host rocks shows they formed in the early Cretaceous (135–123Ma). The geological and geochemical characteristics of the deposits indicate that they are genetically closely related to subvolcanic rocks (diorite porphyry) and diorite intrusions, and also controlled by volcanic structures and the basal Triassic gypsum-rich sedimentary beds in the basement to the volcanic basin.

Wall-rock alteration associated with the iron deposits is zoned with (1) an upper light-colored zone of argillic, siliceous, and pyritic alteration with abundant anhydrite; (2) a middle dark-colored zone of diopside, magnetite, anhydrite, phlogopite, garnet, epidote, chlorite, and apatite; and (3) a lower light-colored zone of extensive alkali-feldspar alteration, which is dominantly albitic. The iron orebodies occur as lenses at the contact between diorite porphyry and volcanic rocks or basement sedimentary rocks, or in the middle dark-colored alteration zone in volcanic rocks. Dating shows that all the magnetite-apatite deposits formed in a short interval around 130 Ma. Fluid inclusions and isotope geochemistry suggest that the ore-forming fluids are mostly magmatic fluids that mixed with basinal brines and meteoric water.

The rocks in the volcanic basins occur in four regionally extensive formations. The geological and geochemical features of the volcanic rocks indicate that they may have been generated by partial melting of the lower crust related to lithospheric thinning, asthenospheric upwelling attributed to magmatic activity in an intracontinental setting, or partial melting of metasomatized mantle, which maybe affected by the far field subduction of the paleo-Pacific plate belonging to part of the circum-Pacific metallogenic belt. Also, there are magnetite deposits in the Chilean iron belt in the east Pacific margin, which occurred at the same time as the magnetite deposits in the Middle-Lower Yangtze River Valley metallogenic belt. Nevertheless, there is still a great deal to learn about the relationships between them.