

Ore-bearing strata and newly discovered gabbro diorite at Longqiao skarn iron deposit in the Lu-Zong basin, Anhui Province, China

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The Longqiao iron deposit is a large stratabound iron deposit (>100 Mt) in the Lu-Zong volcanic basin, Middle and Lower Yangtze River metallogenic belt, eastern China. The main orebody is hosted in a sequence of marl, brecciated limestone, and argillaceous siltstone, with a thickness of 20-150 m. Identification of the ore-hosting formation is important for both research and exploration, but distinguishing between two possible host units (Luoling and Dongmaanshan Formations) has been controversial. The iron ore is massive and disseminated and the ore minerals are mainly magnetite with minor pyrite and chalcopyrite. Wallrock alteration mostly consists of skarn minerals such as diopside, garnet, K-feldspar, quartz, chlorite, phlogopite, and anhydrite.

We collected sandstones from the Luoling Formation outside the deposit and a unit of uncertain stratigraphic affinities about 5 m above the orebody. Using detrital zircon U-Pb chronology we found that there were significant differences in zircon ages of the sandstones from the two locations. Zircon ages of a sample from the Luoling Formation outside the deposit are in the range 166.0 ± 1.4 Ma to 3842.6 ± 6.5 Ma; zircon ages of samples from the unit hosting the orebody are in the range 262.1 ± 3.2 Ma to 2589.8 ± 15.0 Ma (ZK109), 261.8 ± 1.9 Ma to 2520.1 ± 11.1 Ma (ZK309), 264.6 ± 2.0 Ma to 2947.2 ± 51.4 Ma (ZK007), and 257.1 ± 1.9 Ma to 2717.0 ± 21.0 Ma (ZK1603). These data and their age distributions indicate that the unit hosting ore at the Longqiao deposit differs from the Luoling Formation outside the deposit, and we infer that the host unit is not part of the Luoling Formation, but probably belongs to the Dongmaanshan Formation.

A syenite pluton (Longqiao intrusion) is situated below the deposit. Phlogopite coexisting with magnetite in the magnetite ores yielded a plateau age of 130.5 ± 1.1 Ma, whereas the LA-ICP MS age of the syenite intrusion is 131.1 ± 1.5 Ma. Previous researchers believed a syenite intrusion in the mining area was closely related to the mineralization, however, underground in the central deposit of the orebody we found gabbro diorite that provides new clues to the genesis of Longqiao deposit. Based on detailed field work, we studied the petrology, geochemistry, and chronology of the gabbro diorite. The gabbro diorite occurs as a stock, cut by the syenite pluton. Diopside skarn is developed between the intrusion and the iron orebody. The gabbro diorite is composed mainly of plagioclase (60%), K-feldspar (10%), augite (10%), and hornblende (5%). Whole rock analysis shows that compared to the syenite, the gabbro diorite has low silica and potash, and high iron content. Zircon LA ICP-MS dating shows its age is 133.5 ± 0.8 Ma. We believe that the gabbro diorite is closely related to the Longqiao mineralization, and magmatism and mineralization occurred at almost the same time. The syenite is a later intrusion that cut across the orebody. Combining these results with studies on other iron ore deposits in the Lu-Zong volcanic basin, we conclude that the syenite is unrelated to the iron mineralization, and diorite intrusions are the source of the major iron mineralization in the Lu-Zong volcanic basin.