The Dongshan magnetite-apatite deposit is located in the middle part of the Ningwu volcano-sedimentary basin in the Middle-Lower Yangtze River Valley in Eastern China. It is a typical representative of the numerous magnetite-apatite deposits distributed in the Ningwu and the adjacent Luzong volcano-sedimentary basins. The orebody with a shape of bell is located in the uppermost protuberant part of the dioritic porphyrite intrusion that is exposed at the surface. The magnetite ore is found within diopside (actinolite)-apatite-magnetite pegmatite and large apatite crystals with 0.5–10 cm are widespread.

This paper establishes the thermal history from emplacement to exhumation for the Dongshan magnetite-apatite deposit based on the multiple thermochronometers including the zircon U-Pb dating (131.1 ± 3.1 Ma, Fan et al., 2010), actinolite 40Ar-39Ar dating (126–129 Ma, Ma et al., 2010), apatite U-Pb dating (128.8 ± 7.2 Ma, Liu et al., 2014), apatite FT (fission track) dating (106.3 ± 5.4 Ma, Liu et al., 2014), and apatite (U-Th)/He dating (52.9 ± 3.0 Ma). The apatite (U-Th)/He age is first reported in this paper. The established thermal history using the software 4DTHERM (Fu et al., 2010) indicate a fast magmatic-hydrothermal cooling until the orebody and country rocks reach a final thermal equilibrium under a steady-state geothermal gradient (50 °C/km), and then a slow exhumation cooling until the orebody reaches the surface (Fig. 1).

The modeling result indicates the orebody emplaced at a very shallow depth of 1.60 km, which is one of the basic features of the “porphyritic iron deposit”. The magmatic-hydrothermal cooling from the emplacement of 131.10 Ma at 1000 °C to the cooled point of 130.06 Ma at 135.2 °C shows an average cooling rate of 836.95 °C/Ma, and then the exhumation cooling began and continued into now with an average rate of 1.04 °C/Ma. The average exhumation rate is 15.3m/Ma, and the orebody began to expose at the surface at 24.30 Ma.

These data indicate a very shallow emplacement and moderate exhumation for the Dongshan iron deposit, which result in the shallow buried status of the deposit at present that benefits the mine exploration. The adjacent Washan deposit should have the similar thermal history because these two deposits of close distance emplaced in the same dioritic porphyrite intrusion.

References