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Formation of the Huoqiu Banded Iron Formation (BIF), Western Anhui Province

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1 Introduction

The Huoqiu iron ore field is located in the northwest Huoqiu County, trending in a N-S direction from Taoba to Zhongxinji areas. The length of ore field is ca. 40 km in the NS direction, and 2-8 km in width. The Huoqiu ore field is composed of more than 10 iron deposits with total proven reserves of ca. 23×10^8 t (contained Fe metal), and probable reserves of ca. 30×10^8 t.

2 Regional Geology

The Huoqiu iron ore field was explored in 1960s by the No. 337 Geological Team of Anhui Provincial Bureau of Geology. Successive exploration work was carried out focusing on the defined deposits and surrounding areas of exposures by drill and detailed field mapping. The geophysical work was undertaken using airborne magnetic surveys, ground electrical and gravity surveys, which covered the entire Huoqiu ore field region.

The Huoqiu iron ore field is proven to be a large ore field characterized by BIF, consisting of quartz, magnetite and hematite (or specularite) phases hosted in amphibole schist, plagioclase gneiss, and amphibolite. According to the rock associations, the Huoqiu Group can be divided into two series and three succession formations (i.e. Huayuan Fm., Wuji Fm. and Zhouji Fm.). The protolith of Huoqui Group is considered to be formed by a basic volcanic- sedimentary cycle.

3 Huoqiu BIF Series

The Huoqiu BIFs were first established up by a drill section of the D3 line during the iron ore exploration. Core logging data suggest that some iron ore-bearing layers are present in the lower part of the Zhouji Fm., which was termed as the C iron ore belt (No. 313 Geol. Team, 1995).

The Huoqiu Group has rhythmic sequences of volcanic-sedimentary cycle, as shown especially in the Wuji and Zhouji formations (No. 337 Geol. Team, 1986).

Regionally, the Huoqiu Group, Wuhe Group (eastern Anhui), and Taihua-Dengfeng Groups (Henan) are thought to form in the same period (Fig.1). However, their metamorphic grades are different (No.313 Geol. Team, 1995).

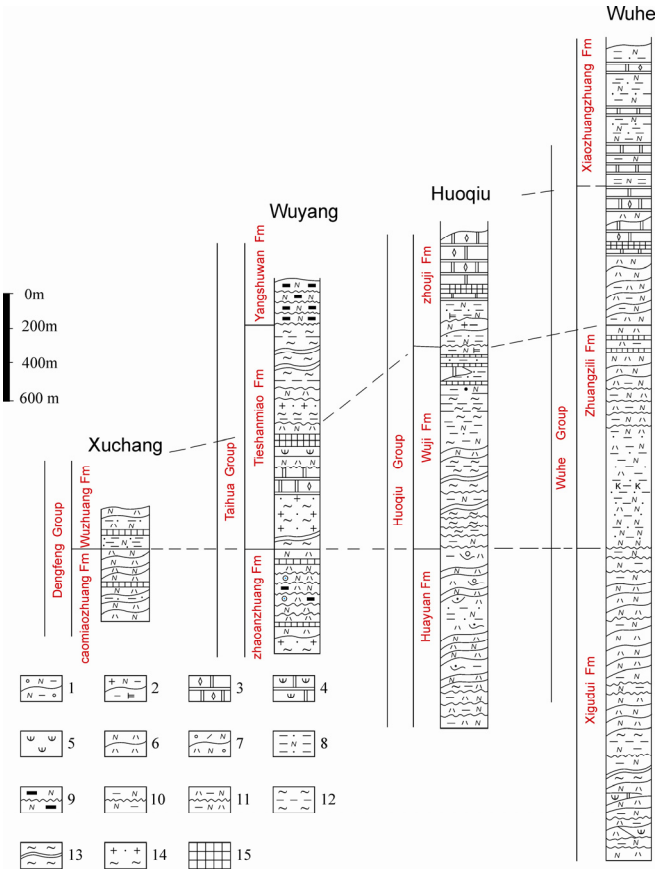

Fig.1 Comparative strata cross sections of the Huoqiu Fm. and its adjacent regions (after BGMRA, 1987, 1997; BGMRH, 1989)

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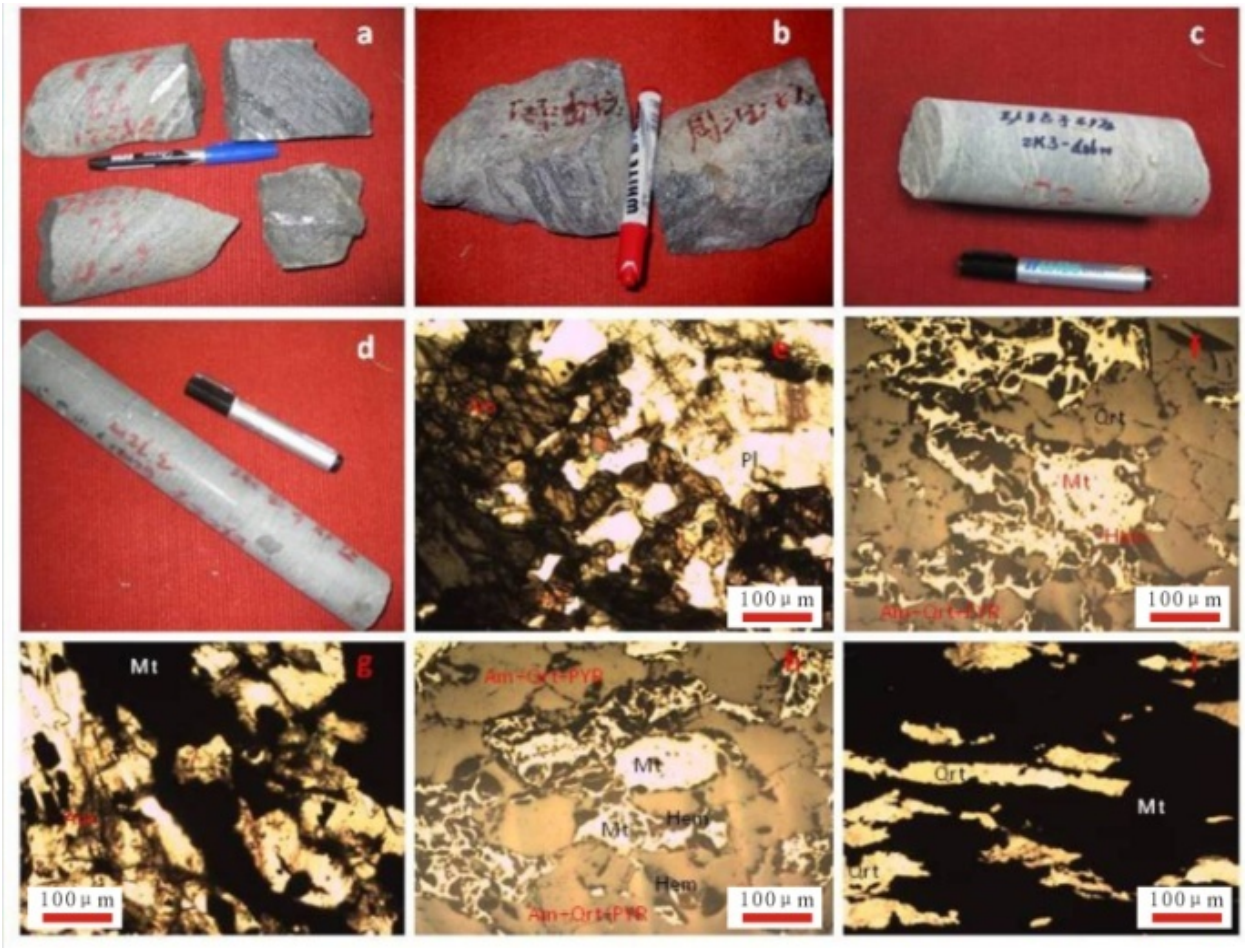

Fig.2 The characteristics of mineral assemblages from different types of iron ores in the Huoqiu iron deposit (sacle for e-i is 100 μ m) (after Yang et al., 2014)

(a)-quartz + magnetite; (b)-quartz + specularite ore; (c)-gneiss; (d)-amphibolite; (e)-micrograph of amphibolite; (f)-quartz + magnetite + specularite iron ore; (g)-quartz + magnetite + silicate (amphibole, gruenerite-cummingtonite, actinolite- tremolite and diopside); (h)-quartz + magnetite iron ore + specularite + silicate (amphibole, actinolite-tremolite and diopside); (i)-micrograph of quartz + magnetite. Mt-magnetite; Hem-hematite; Pl-plagioclase; Am-hornblende; Qrt-quartz

4 Rock Associations and Mineralization Characteristics

4.1 Rock associations

Metamorphic rocks of the Huoqiu Group are summarized as: (1) marble and dolomitic marble (including magnesite that is only evident in the Lilaozhuang deposit); (2) schist (mainly for mica schist, with less amount of quartz schist and quartz-amphibole schist); (3) leptynite; (4) amphibolite (including magnesium amphibole rock); (5) plagioclase gneiss; (6) migmatite and migmatitic granite; (7) banded magnetite ores, consisting of quartz magnetite ore and amphibole magnetite ore. According to metamorphic mineral assemblages (hornblende, garnet, biotite, feldspar, magnetite, especially staurolite, kyanite, andalusite - sillimanite combinations) together with some paragenetic mineral thermometer, the temperatures of regional metamorphism were determined approximately at 550° C (kyanite-andalusite-sillimanite eutectic point) to 750° C (biotite-garnet mineral thermometer) (Qi and Yao, 1982). In addition, the appearance of olivine in marble indicates that regional metamorphic temperature must have been higher than 600°C (No. 313 Geol. Team, 1995).

4.2 Characteristics of iron mineralization

The industrial value of iron ores mainly stem from iron oxide phase formation, and apart from supergene hematite formed by weathering, the iron ores are subdivided into four types in terms of mineral assemblages: (1) quartz + magnetite (Fig. 2a,i); (2) quartz + specularite (Fig.2b); (3) magnetite + quartz + silicate (hornblende, iron amphibole - magnesium iron amphibole, actinolite, tremolite, diopside) (Fig.2g); (4) quartz + specular hematite iron ore + silicate (hornblende, actinolite, tremolite, diopside) (Fig. 2f, h).

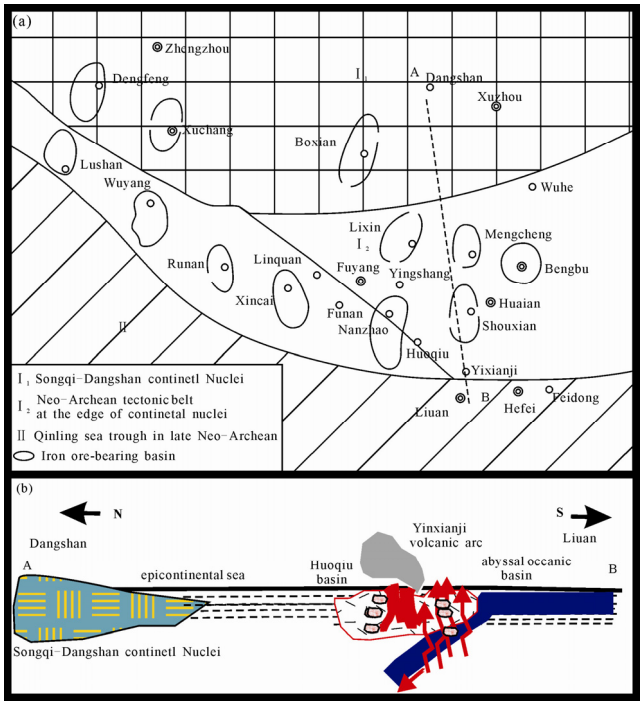

Fig.3 Tectonic evolution and iron ore formation model in Neoarchean- Later Paleoproterozoic in the Huoqiu iron deposit and its nearby region (after Yang et al., 2014) (a) plane map; (b) profile

5 Genesis of Huoqiu BIFs

From the regional geological background, the Huoqiu Group consists of metamorphic volcanic-sedimentary rocks which have undergone migmatization. The lower part of the Huoqiu Group is composed of argillaceous rocks, argillaceous sandstone and graywacke, marble, iron siliceous rocks and magnesium carbonate. The mineral assemblage of hornblende + almandine + plagioclase + quartz may indicate low amphibolite facies of regional metamorphism during metallogenic stages. In addition, local disseminated type ore formation and the emergence of serpentine (e.g., Lilaozhuang deposit) shows that metallogenic stage had undergone hydrothermal metasomatism (Sun, 2007), similar to those as reported for hydrothermal reformation in Anshan, Benxi BIFs deposits in northeastern China (Li and Zhao, 1999; Li, 2003; Zhang, 2005).

A model for tectonic evolution and Huoqiu BIF in Neoarchean to later Paleoproterozoic is set up as shown in Figure 3.

Acknowledgements

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