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Analysis on the Construction of Huayuan MVT Lead - Zinc Ore Field in Zhangjiajie of the Western Hunan, China

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Abstract

Huayuan lead-zinc ore field in Zhangjiajie of western Hunan, is a large-sized, and the ore bodies algal limestones the margin of the shallow platform in the lower part of the Early Cambrian Qingxudong Formation. The authors expounded the ore-hosting lithology, sedimentary environment and petrographic evolution of Huayuan lead-zinc ore field. According to the metallogenic characteristics of the Huayuan lead-zinc ore field, the formation and evolution of the ore field is divided into the First construction (geological processes), the secondary construction (lithofacies characteristics) and the third-level construction (basic rock unit).

Keywords: construction analysis, MVT type, lead-zinc ore field

1. Introduction

The prospective reserves of MVT Lead - Zinc Ore Field in Zhangjiajie of Western Hunan have more than 10 million tons in China. The tectonic position is the junction of the upper Yangtze platform fold belt and the south Tielong two Tertiary tectonic units on the southeastern margin of the Yangtze block (Ren, 1990) (Fig. 1A). The tectonic-sedimentary environment is a kind of self-generated carbonates in the shallow margin of the Middle-Cambrian. The ore field is located in the north-eastern section of the Xiangqian Pb-Zn metallogenic belts. The ore deposits are located on both sides of the Huayuan-Chaodong fault zone, and on the northwest side of the fault zone deposits are less, the southeastern side is more. For this reason, author uniquely based on the analysis of construction to discusses the metallogenic feature of ore field (Lv, 2015; Sakya, 1986; Kubrat, 1989). The predecessors have made deep researches on them in many aspects (Zhou, 2011; Liu, 2000; Yang, 2007; Xia, 2010; Feng, 2001).

2. Geological Overview of Ore Field

The crustal tectonic moving in the study area have experienced four development stages: Wuling period, Xuefeng-Caledonian period, Hercynian period, Indosinian-Yanshanian period. In study area fold and fault structure were developed, but there was no obvious angular unconformity between formations. The direction of the regional tectonic line is NNE and NE-trending vein, which form the arc-shaped structural belt of Western Hunan (Fig 1B).

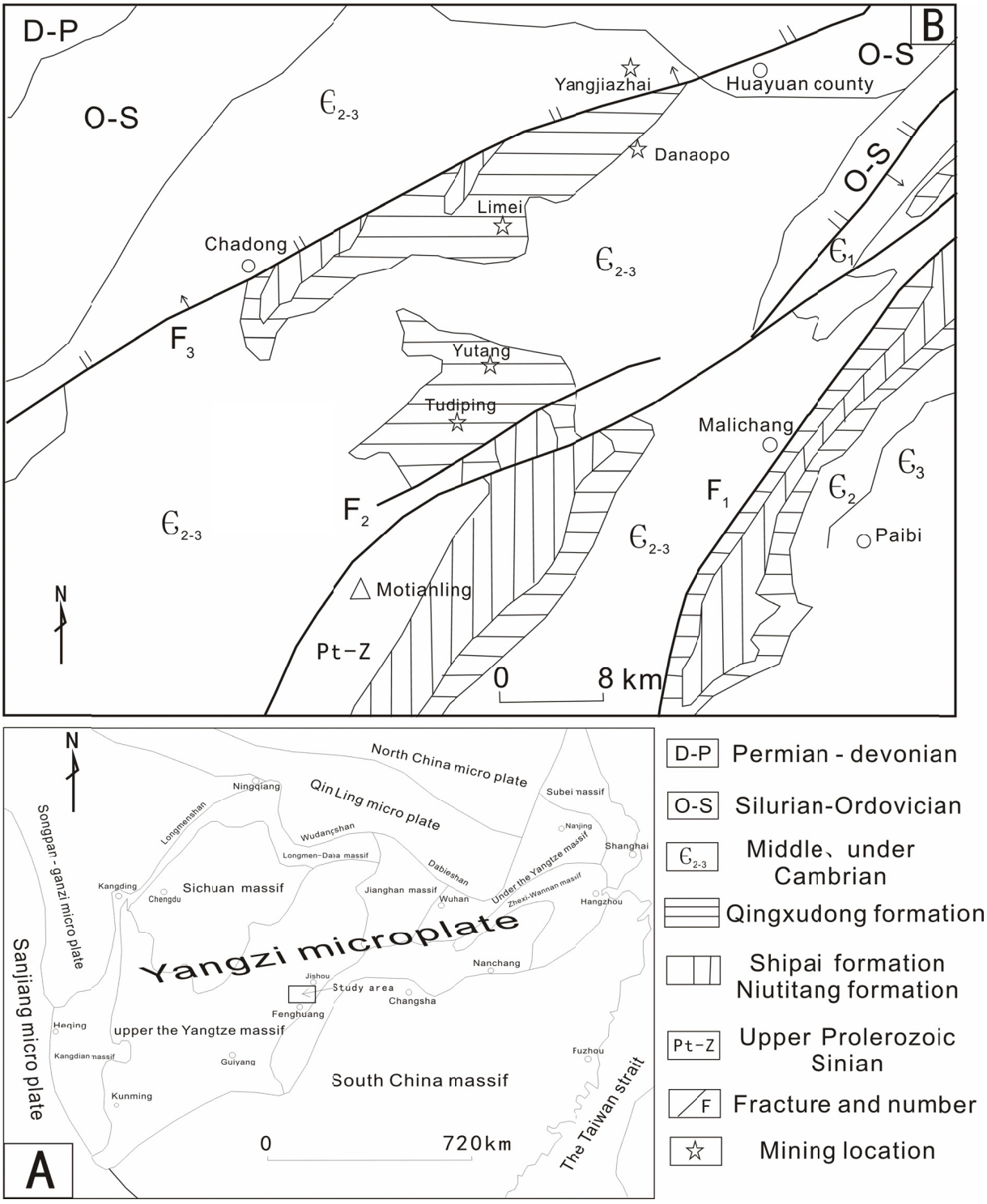

Figure 1. Geology diagram of the Huanyuan lead-zinc ore field (after Liu, 2000)

The Huayuan lead-zinc ore field is located on both sides of the Huayuan-Chaodong fault belt, and the ore-bearing structure is mainly NNE and NE-trending gentle short axis anticline and geological vault in the south-east of the fault zone. The regional Huayuan-ChaDong fault zone is the main ore-bearing structure in the ore field and the fracture system in the reservoir layer, including the expanded suture, algae-porosity, intergranular pore and tectonic fissures are favorable ore-bearing structures in the ore field (Liu, 2000; Yang, 2007). Ore layer exist in the Cambrian Qingxudong group，the Pb-Zn mineralization is mainly distributed in the light-gray massive algal limestones in the upper part of the Qingxudong Formation, and a few of them are

distributed in the light gray thick lamellar crystal sand - ooids - Karyotype limestones which overlying the Qingxudong Formation. Generally, the thicker the alginate limestone is, the more favorable is the mineralization, and the ore layer is multilayered (Xia, 2010; Zhou, 2011). The wall rock alteration of the Ore field is less, and the scale is small, mainly silicification, fluorite, barostic, pyrite.

3. The concept of ore field construction

Ore field construction refers to a combination of rocks associated with (magmatic, sedimentary, and metamorphic) genetic linkage of specific tectonics zone. (geosyncline, platform and tectonic belt). The main task is to analyze low-grade lithofacies, which is equivalent to subphase (Lv, 2012).

Generally, the ore field construction belongs to the tectonic use range, but also refers to the specific and local geological body combination. The primary classification of the construction is geological process, such as deposition, metamorphism, magmatic rock formation and so on. The second-level classification of the construction can be called “lithofacies”. The lithofacies refer to middle-scale geological body section and are often referred to as tectonic facies belts because of their zonal distributions, for example, carbonate-hosted reef facies, metamorphosed greenschist facies or exploded volcanic breccia facies. The third-level classification is the basic unit of lithofacies composition and can be called the rock unit (Lv, 2012).

4. Ore construction analysis

The formation of Huayuan lead-zinc ore field is a complex process of mineralization and ore field construction analysis is of great significance to determine the basic regional background, construction type, tectonic environment and further prospecting exploration in the known ore field.

Now we respectively analyze the first, the second and the third construction i the ore field scope:

The first stage of the construction, Huayuan lead-zinc ore field geological processes experienced are the deposition of carbonate rock construction. On the early Cambrian period, the Huayuan area is in the shallow continental shelf facies carbonate platform and platform margin, deposited a thick layer of various types of carbonate rock. On the early Paleozoic period, this area is located in the transition zone of southeast edge of the Yangtze and the jiangnan massif north rim. seabed is high in the northwest and low in the southeast. Westward, the rising Kangdian ancient land provides the source of land debris. Eastward, being intermittent Jiangnan islands and deep water area. On the early and middle Cambrian period, the palaeogeographic contours were similar to those of late Sinian. On the basis of the shallow ocean-margins marine sediments of the late Sinian, the area was composed of coastal and shallow continental shelf areas. On early Cambrian to middle-late Cambrian belongs to platform shoal, tidal shoal, tidal bar, platform front slope or platform, mainly carbonate sedimentary area, local reef, Which directly provided the ore-bearing space for the distribution of lead-zinc deposits. On early Ordovician, the area belongs to the platform and platform edge shoal, high energy tidal flat shoal, mainly for the detrital, bioclastic carbonate depositional areas, control the Huayuan lead-zinc ore field distribution. On Late Ordovician, the depositional area shrink into the coastal wetland basin and continental shelf stagnant basin.Occurred in the late period of the Ordovician "Yichang rise", the region witnessed a wide range of oscillation lift.Forming a complete sedimentary cycle of the Early Paleozoic.

Secondary construction, equivalent to the ore field sedimentary facies. Based on the analysis of the cores of the ore deposits in the orefield, the authors established a cylindrical cross section of the Huaguan MVT lead-zinc orefield (Fig. 2).Marine sedimentary facies in western HuNan developed carbonate platform, mesa edge, slope and basin sedimentary lithofacies characteristics in succession from the northwest to the southeast.The study area is mainly distributed in the lithofacies of the platform margin. The sedimentary facies belts in the platform margin can be divided into two types, namely shoal facies and algal limestone facies. Sedimentary lithology of shoal facies is mainly sandstone limestone, oolitic limestone, sandy dolomitic limestone, dolomite and stratified dolostone (Fig.2.II).The size of the rock deposit is large, and it is well sorted, which reflects the repeated fluctuation of the shallow sea water.In the shoal deposits, various sedimentary structures have been developed under high energy conditions, such as trough interlaced bedding, oblique bedding and lamellar staggered bedding.The main lithologies of the algal limestones are algal limestone, sand dolomite limestone, breccia limestone and banded limestone, etc. (Fig. 2.I), the rock layer was thick layer.

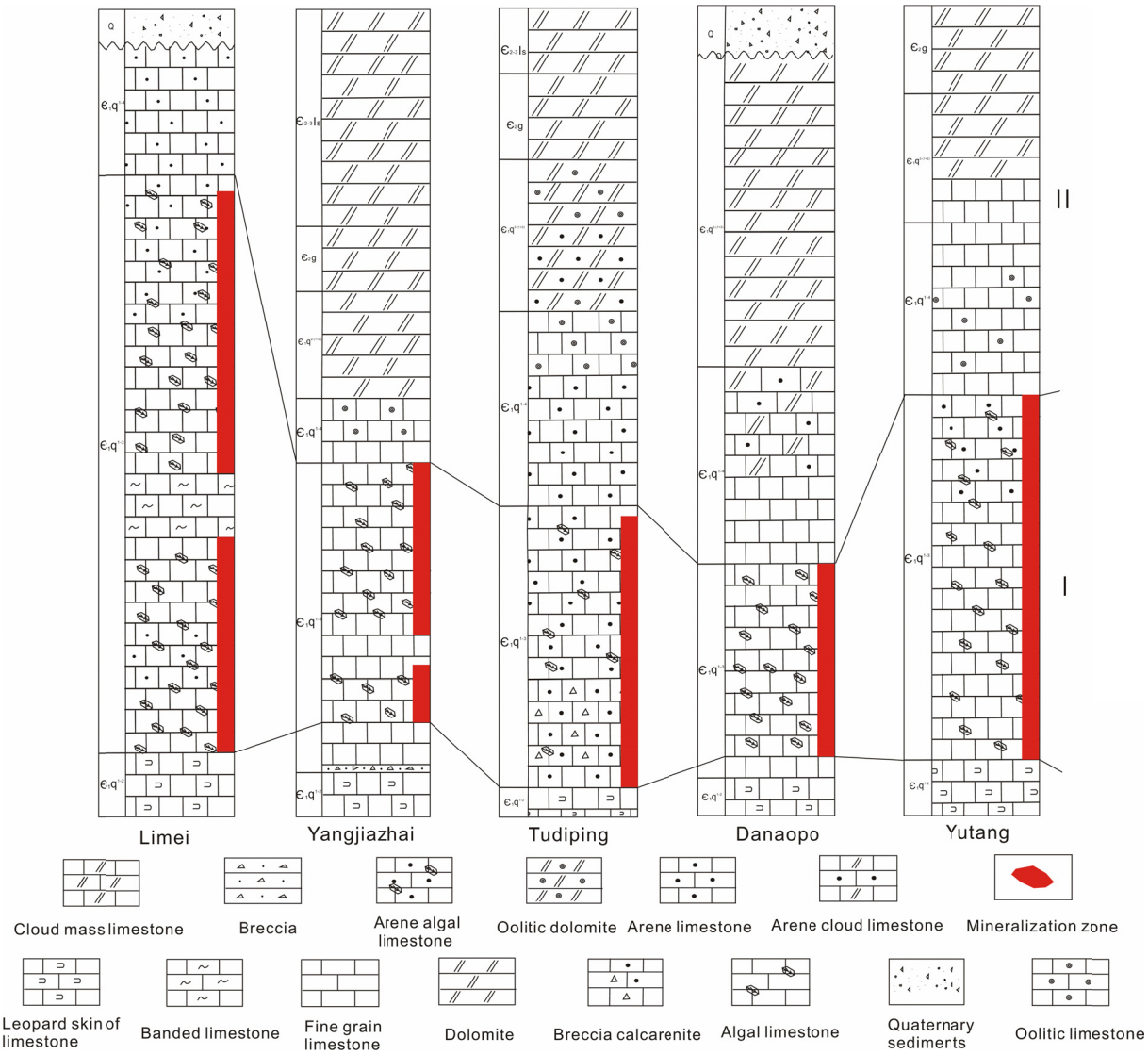

Figure 2. Stratigraphic section of MVT deposits in Huayuan ore field

Third-level construction,the rock units are composed of lithofacies. The Shoal rock are mainly composed of oolitic limestone, sandstone and dolomite and so on. Oolitic limestone: with block structure, oolitic structure, the size of about 1-2mm oolite. The rocks are mainly composed of ooids and calcite,the ooloid nucleus is mainly composed of black algae, ooloid content of about 40%,with 1-2 concentric ring structure, base-type cement. The calcite content is about 50%. The rocks are formed in a turbulent environment (Fig. 3a).Abrasive limestone: with massive structure, fine sand structure, can be seen lumps of calcite veins, diameter 1-2cm.The rocks are mainly composed of calcite and black algae. The calcite content is about 50%, the black algal mud content is about 30% and the sand dust content is about 5% (Fig. 3b).Dolomite rock: dolomite content of about 80%, particle size of about 0.5mm-1mm, the way for the contact between the particles of contact cement and embedded cement. The interparticle filling material is muddy (Fig. 3c).

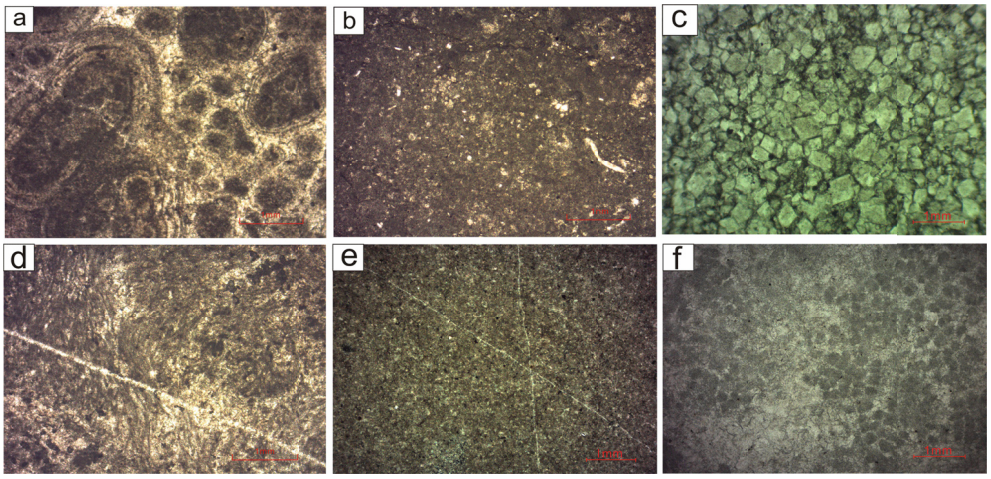

Figure 3. Carbonate rock fabric characteristics under the mirror in Huayuan ore fields

Rock composition of algal limestone facies mainly algal limestone, sand dolomite limestone, granular algae limestone. Algal limestone: a block structure, fine grain structure, gangue calcite was lumpy distribution ,rock mainly composed of calcite and algae, algae content of about 45%, Algal bioclastic separation and grinding round are poor, morphological preservation is better, in situ accumulation. Calcite content of about 30%-50% (Fig.3d).Sand dolomite limestone: gray-black, mud crystal content of about 80%, shale content of about 5%, less or no particles. Showing thin slender calcite veins, form in late stage (Fig.3e).Formed in an environment of weak hydrodynamic conditions. Granular algae limestone: algae grain content of about 10%, bright crystal calcite particles accounted for about 80%, clay content of about 5%. The algae particles are filled with bright calcite, the size of the algae particles is about 0.5mm, and the particles are sorted and rounded better (Fig.3f).

5. Conclusion

From the analysis of the Huayuan lead-zinc ore field, it can be concluded that the Huayuan lead-zinc ore field is formed on the margin of the platform in the shallow sea, and gradually becomes shallow as the seawater recedes. From the algal limestone facies to the shoal facies, and the seawater power gradually increases. Ore-bearing rocks are mainly algal limestones. Pointed out the search sign for the next step of prospecting exploration (algal limestones).

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