

Geochemical Characteristics of Longxing Bauxite in Northern Guizhou, China

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Abstract. Revealed the chemical characteristics of Longxing bauxite through field geological research and elements analysis: 1) Longxing bauxite displays an overall U-shape distribution; 2) Main minerals contained in the ores are diaspores, clay minerals, iron minerals and titanium minerals; 3) The formation of Longxing bauxite is the process of enrichment of Al, Si and loss of Si, Fe; 4) Elements with aluminum affinity from parts of the area such as Ga and Li may concentrate to form ores.

1. Introduction

Longxing in the northern area of Guizhou province is rich in bauxite, which is part of the Wuchuan-Zheng'an-Daozhen bauxite. A large number of researches and reports focus on the bauxite in the northern region of Guizhou (Wu et al., 2008; Du et al., 2013, 2014; Liu et al., 2008, 2010; Wang et al., 2013; Zhang et al., 2013), while independent studies of Longxing areas are relatively less. The ores from Longxing bauxite are of good quality, and Longxing bauxite is located in the central part of Wuzhengdao bauxite metallogenetic region. Researches based on its deposit basic characteristics and geochemical characteristics reveal the bauxite ore-forming mechanism, and provide new information for studies on bauxite in northern part of Guizhou, which is of great instructive meanings for the next exploration work.

2. Geological background

Longxing bauxite is located in northern Guizhou (Fig.1). The study area is exposed from the old to the new: Cambrian, Ordovician, Silurian, Carboniferous, Permian and Jurassic. The tectonic lines in the area are NNE, and the Cambrian strata are mainly distributed in the core of anticlines. The Triassic and Jurassic are mainly distributed in the core of synclines. Overlying strata of Longxing bauxite is Permian Liangshan Formation (P_2l) or Qixia Formation (P_2q), and the Lower strata is Carboniferous Huanglong Formation (C_2h) or the Silurian shale of Hanjiadian Formation, all of them are parallel unconformity. The spatial distribution of bauxite in Wuchuan-Zhengan-Daozhen area is controlled by Daizheng, Datang, Luchi - Liyuan, Taoyuan, Anchang, Huanxi, Xinmo and Zhangjiayuan synclines.



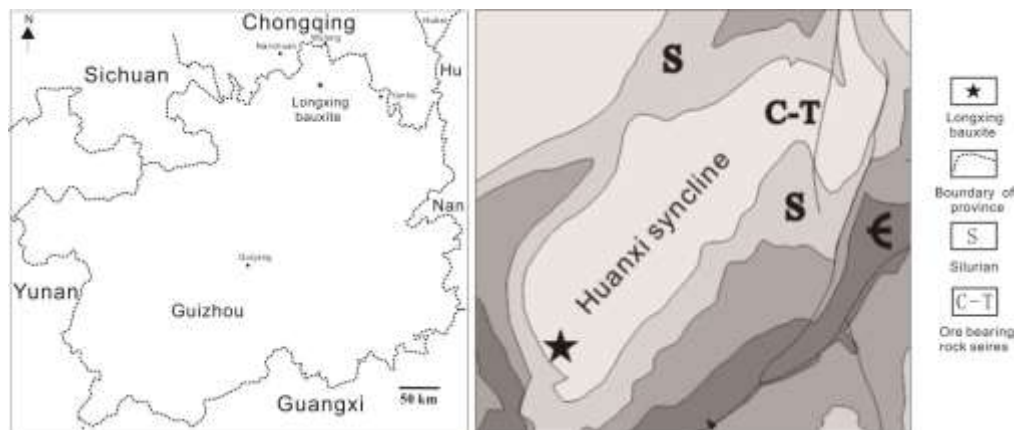


Fig.1 The location of Longxing bauxite[modified form Wang et al.,2013]

3. Ore body characteristics

Longxing bauxite is a sedimentary type of diasporic bauxite deposit. The ore body is generated from Huanxi syncline both wings and its southern twist, which displays an overall “U”-shape distribution. The output layer is located in the middle-upper parts of Dazhuyuan formation of Lower Permian (P_1d). Ore body internal structure is of medium complexity, with stable thickness variation, which belongs to medium sized bauxite deposits.

The ore block is 0.86-1.66m thick, with an average thickness of 1.30m, which contains Al_2O_3 of 56.01-65.05% (average 58.84%), SiO_2 of 8.25-14.82% (average 12.24%), A/S of 3.89-7.89 (average 4.81), Fe_2O_3 of 4.11-10.83% (average 7.26%), and TS of 0.04-4.08% (average 3.32%).

4. Ore structures and tectonics

The ore structures and tectonic features of Longxing bauxite are studied according to the core and outcrop samples (Fig. 2).

4.1. Ore structures

Ore structures can be classified into clastic texture, mud-crystal structure and pink-crystal structure based on the mineral collection shape, as described below:

Clastic texture: is the main ore structure, composed of debris and cement, whose boundaries are clear. The debris is of angular and sub-angular shape, some of which is round or ellipsoidal shaped. The particle size is of large differences, which is generally 0.005-0.008mm, and the bigger one can be 5-8mm. It can be divided into sand-like structure (<0.1mm) and gravel-like structure (>2mm) according to the particle size. The primary composition of the debris is granular semi-automorphic crystal diasporic, flake and scale like kaolinite, hydromica and other clay minerals, and pyrite, hematite, trace amounts of chlorite and anatase. Cement composition is of <0.005mm clay minerals or bauxite, whose debris content accounts for more than 70%.

Pink-crystal structure: is composed of 0.005-0.008mm granular diasporic, which contains debris of irregular shapes. The debris composition is semi-automorphic crystal diasporic combined with lamellar and flake like kaolinite and hydromica mixture. It is the secondary structural types of census area.

Mud-crystal structure: is composed of <0.005mm granular diasporic, whose particle size is uniform, forming automorphic and semi-automorphic crystal combined with little hydromica and limonite, which is the secondary structural types of census area.

4.2. Ore tectonics

Block tectonics: is the main tectonics type. The ore shape is even block, whose particle size is uniform, which has no clear orientated and laminated striation.

Semi-earthly tectonics (Fig.2, b): The mineral is grey, dark grey and is of mud-crystal structure, with debris content of generally <5%. The ore section is smooth and dense, with good hardness and weak water absorption.

Massive tectonics: is the rare tectonics type and distributes locally. The mineral is grey, light grey and yellow-gray, most of which is debris structure. The debris is angular and sub-angular shape with poor sorting, a few of which is mud-crystal or pink-crystal structure.

Oolitic tectonics: is another important structure types after the debris structure, consisting of beans, oolitic and cement. Oolitic has core and the concentric layers, and generally the concentric layers is 1-3 layers. Core of oolitic and beans is composed of diasporite, clay minerals, pyrite or siliceous. Concentric layers consist of crossed bauxite and clay minerals. Cement consists of <0.005mm granular semi-automorphic crystal bauxite or flake like hydromica. Beans content is 15-30%, while oolitic content is 30-50%.

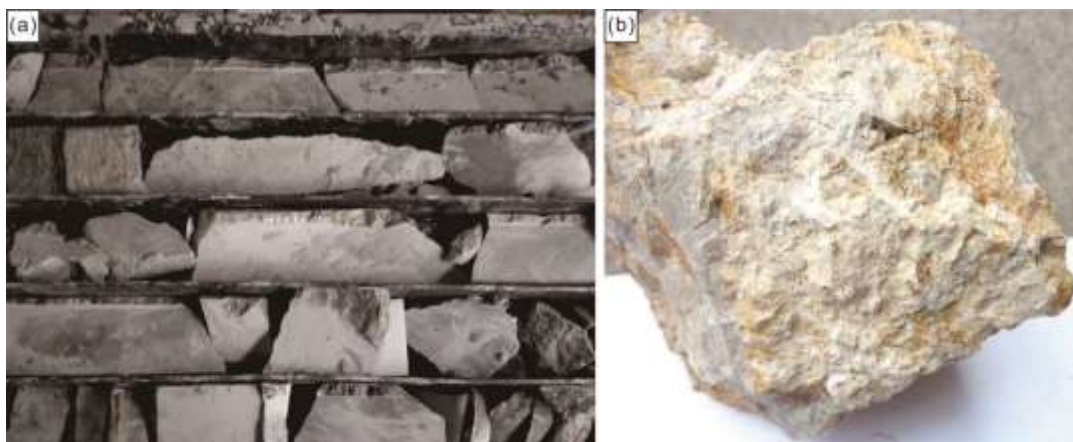


Fig.2 a. core of Longxing bauxite b. high quality ore

5. Chemical constituents of the ores

5.1. Mineral component of the ores

By test analysis, mining bauxite is composed of 23 kinds of minerals, of which the diasporite is the main type, followed by clay minerals, then the iron and titanium minerals. The four kinds of above mineral accounted for more than 98% of the total ore minerals (table.1). 1) diasporite: the main ore mineral, which is needle like or plate-shaped, cylindrical or granular, and vertical lines are common cylinder. Diasporite is automorphic and semi-automorphic crystal aggregation, with particle size of general 0.005-0.008mm and up to 0.6mm. 2) hydromica: A scale and flake-like output. The mineral is colorless and transparent, and the interference color is bright. Particle size is less than 0.005mm, mainly in the clay minerals. The highest mineral content is 10%. 3) Kaolinite: small particle size, with aphanitic, a grainy and film output. Kaolinite is mainly silicon containing minerals in bauxite, with the mineral content of 0-10%. 4) Chlorite: including iron chlorite, lepto-chlorite, oolitic chlorite and so on. It has flaky and grainy output, mainly concentrated in the bottom of the ore-bearing rock series, making up the chlorite rock and chlorite-clay rock. 5) Pyrite: rhombohedral crystal, a nodule or granular aggregate output, is the main gangue minerals in bauxite.

Table 1 Ores mineral component of Longxing bauxite

bauxite	diaspores
clay minerals	Hydromica, kaolinite, chlorite, white mica
iron minerals	limonite, hematite and magnetite
titanium minerals	anatase, rutile, sphene, leucosphenite, jurinite
zirconium minerals	Zircon and baddeleyite
sulfide mineral	Pyrite, pyrrhotite
Other minerals	Barite, taltalite, hussakite, kietyoite, akanthikon, edwardite

5.2. Characteristics of main elements

Main chemical constituents of bauxite are Al_2O_3 , SiO_2 , Fe_2O_3 , TiO_2 , TS. Minor chemical constituents are MgO , CaO , K_2O , Na_2O , V_2O_5 , P_2O_5 , RE_2O_3 , and CO_2 and so on. Trace amount elements are Li, Ga, Ge, Ba, Sr, Nb, Ta, Zr, Cr, Mn, Pb, Cu, Zr, V, Sn, Be and Au.

According to statistics of 149 marginal grade samples, the main chemical constituents in the bauxite region demonstrate significant or obvious correlation. Among them, Al_2O_3 and SiO_2 are significantly negatively related with coefficient of correlation of -0.777 (Fig. 3), and Al_2O_3 and Fe_2O_3 are significantly negatively related with coefficient of correlation of -0.508 (Fig. 4), and Al_2O_3 and TiO_2 are significantly positively related with coefficient of correlation of 0.462 (Fig. 5).

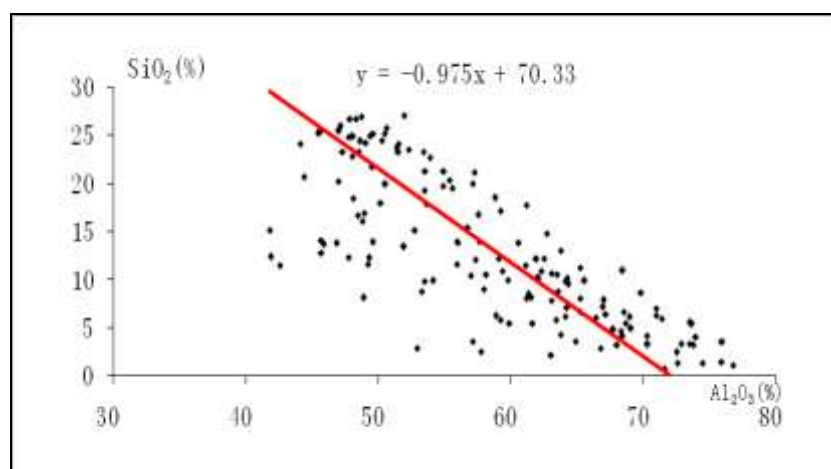


Fig.3. Regression curves and scatters plots of Al_2O_3 - SiO_2 in Longxing bauxite (According to 149 samples)

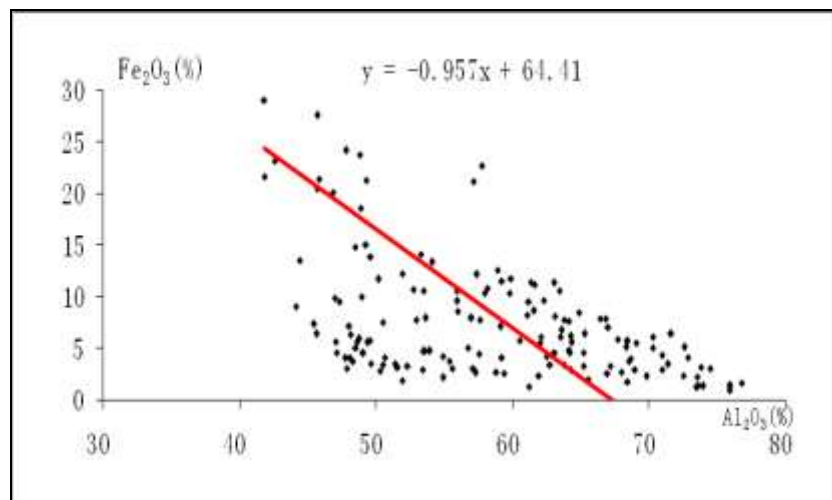


Fig.4. Regression curves and scatters plots of Al_2O_3 - Fe_2O_3 in Longxing bauxite (According to 149 samples)

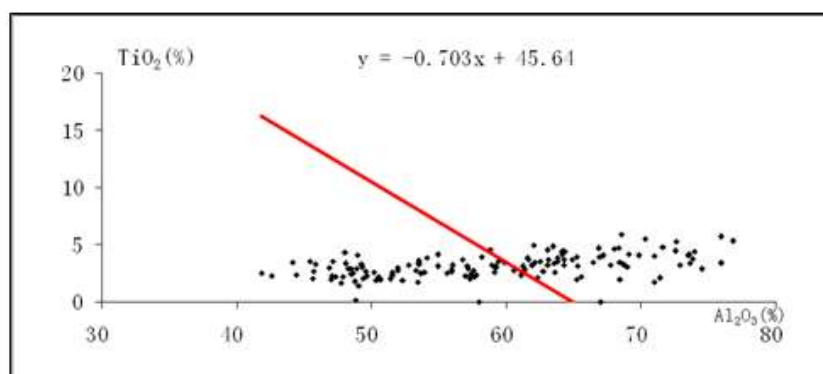


Fig.5 Regression curves and scatters plots of Al_2O_3 - TiO_2 in Longxing bauxite (According to 149 samples)

6. Discussion

The characteristics and geochemical characteristics of Longxing bauxite ore show that the formation is a process of continuous leaching and leaching. In this process, the loss of elements such as Al and Ti is small, and the loss of Si and Fe is large. The different structures and tectonic characteristics of the ore show that the metallogenic progress of the bauxite in the Longxing area is inconsistent. Due to the difference of the metallogenic progress, the different structure and tectonic of the ores occur simultaneously. The structure and tectonic characteristics of Bauxite show that it leaching process plays an important role in the formation of bauxite similar to that of bauxite in the rest of Wuchuan-Zheng'an-Daozhen area(Wang et al., 2013; Yu et al., 2013; Huang et al., 2014). The formation of bauxite is Al, Ti, Si, Fe and other elements of the migration process, pro-aluminum elements such as Ga, Li, etc. in some areas may be integrated into an independent deposit, and mineralization area has a greater comprehensive development and utilization value.

7. Conclusion

According to the comprehensive analysis, the following conclusions are drawn: 1) Ore body of longxing bauxite is produced in the inclined section of the Huanxi syncline and its southern turning end, and the whole is "U" spreading. 2) Longxing bauxite mineral is mainly diaspor, clay minerals, iron minerals, titanium minerals, four minerals accounted for 98% of the total mineral minerals. 3)

Al_2O_3 is positively correlated with TiO_2 , Al_2O_3 is negatively correlated with SiO_2 and Fe_2O_3 , indicating that the formation process of Longxing bauxite is the relative enrichment of Al and Ti elements and the relative loss of Si and Fe. 4) Pro-Aluminum elements may be enriched in mineralization.

8. Conferences

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