

Geological Features of Scandium Deposits in Southwestern Guizhou Province

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Abstract. Geological features of scandium in southwestern Guizhou Province are explored according to previous studies. Scandium coexists with titanium and both of them have similar geological features. Prospecting indicators of anatase can be used for prospecting scandium mines. Scandium ores are mostly earthy oxidized ores and ore-bearing strata are quaternary unconsolidated sediments. Ore-controlling space is a micro-sized karst depression, with great prospect for exploration and development in southwestern Guizhou Province.

Keywords: Scandium, Geological Features, Southwestern Guizhou Province.

1. Introduction

Emeishan basalt is widely distributed in Guizhou, and the formation of many kinds of ores is related to it. (Zhang et al., 2003; Li et al., 2005; Song et al., 2005; Zhang et al., 2008; Jiang et al., 2009; Xu et al., 2002; Hu et al., 2005; Nie, 2007, 2014; Qian et al., 2007; Zhu et al., 2011; Meng et al., 2015; Li, 2014). There are abundant rare-earth minerals in China, where much rare earth contains scandium. China possesses abundant resources of scandium and tremendous mineral reserves related to scandium. Nevertheless, scandium mostly appears as associated element, whereas there is a relatively small amount of independent scandium deposits. Over a long period, no independent deposit of scandium was discovered until independent scandium-rich anatase deposits were detected in Guizhou in 2013 (Nie et al., 2011). Further research suggests that the tenor of scandium is relatively high and in line with the standards for independent scandium deposits, with great prospect for exploration and development, so it is necessary to further investigate scandium. In this study, geological features of scandium deposits are comprehensively analyzed based on different data, thereby providing basic data for subsequent research and prospecting.

2. Transport and Location of the Mine

Situated in Shazi Town, Qinglong County, Guizhou Province, the mine is under the jurisdiction of Shazi Town, which is adjacent to 320 China National Highway and Zhenning-Shengjingguan Highway. Being 8km away from Qinglong County, it is connected to 320 National Highway and Zhenning-Shengjingguan Highway, so the traffic is convenient there (Fig.1).



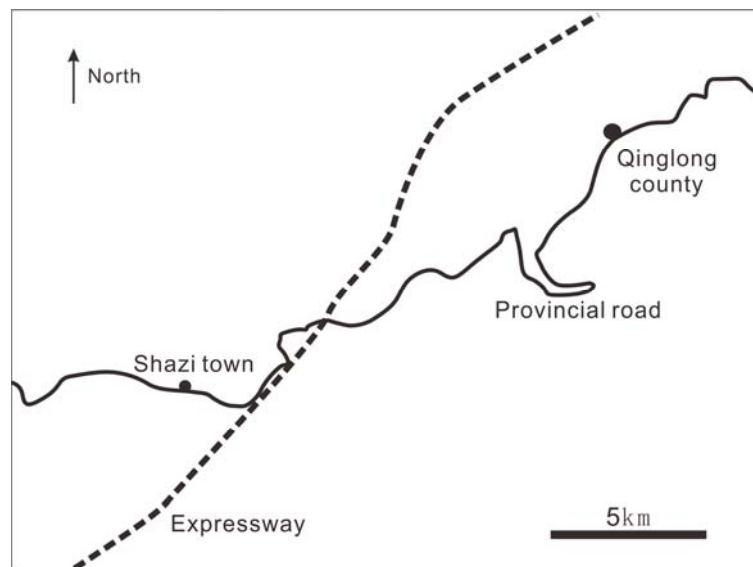


Fig.1. Location map of Scandium deposit

3. Geological Backgrounds

The mine lies in the north of Youjiang Orogenic Belt, in which regional Bihenying Formation is a pericline anticline to the northwestern margin and destructed by a range of fractures(Fig.2). To be exact, north-east fault formations are the most developed fractures. The nearby equidistantly distributed north-east faults are torsional, tensile and compressive, forming wrench faults, normal and reverse faults. In addition, approximately east-west and north-west faults develop for tectonic development of faults. Laowanchang, located at the intersection between north-east and east-west faults, is just where large-scale laterite anatase develops. Weathered residual titanium deposits in titanium mines of Shazi Town of Qinglong County originate from nearby areas of north-east faults.

In this area, exposed strata include Permian, Triassic and quaternary systems. In general, seemingly conformable contact exists among strata of different systems. No conformable contact is found between the quaternary system and its underlying strata. The permian system is mostly Middle and Upper, where the Qixia Formation and the Maokou Formation are in the Middle, particularly made up of carbonatites. There are apparent gaps between the Upper formations and the underlying Maokou Formation. As a consequence, erosion surfaces are rugged. The Upper part is mainly composed of Longtan Formation and Changxing Formation, where clastic rocks are the major components. At the bottom, there are non-continuous lenticular beddings, which are commonly known as “Dachang beddings”. Sedimentation of facies on shallow-sea mesetas is a predominant feature of triassic system. The Lower system contains Yelang Formation and Yongning Town Formation. Guanling Formation is in the Middle, which is mainly made up of carbonatites. On the Lower part, there are Luolou Formation and Ziyun Formation. The quaternary system, which is distributed in areas with gentle slopes, low-lying areas and on both sides of rivers, mainly comprises of residual slope accumulation. Concerning their lithological characters, alluvia mainly include gravels, gravelly clay and clay.

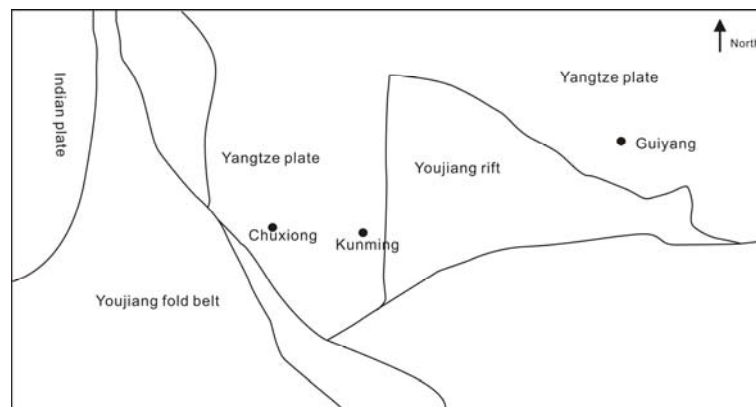


Fig.2. Geotectonic map of western Guizhou (modified from Gao, 2002)

4. Features of Ores

Tectonically, ores are mostly massive, also including some massive earthen, also including massive, alveolar and brecciated structures. Structurally, ores include pelitic textures, micro flaky textures, microcrystalline textures, blast porphyritic textures, pseudomorph textures, altered intergranular intersertal textures, find-sand textures and altered aleuronic textures. The ores are oxidized, which may be classified into five types, namely oxidized clay-style ores, siliceous oxidized clay-style ores, siliceous tuffaceous oxidized clay-style ores, siliceous oxidized clay-style ores with Fe-Mn oxides and siliceous oxidized kaolin ores.

5. Occurrence State of Scandium

Mineral ore specimens and $\text{Sc } 42.6 \times 10^{-6}$ (including $\text{Sc}_2\text{O}_3 58 \times 10^{-6}$) are used for studying occurrence state of scandium. After microscopic observation, electron probing analysis and chemical analysis of each mineral, it is discovered that scandium in ores are partially hosted in anatase by virtue of isomorphism, while some of them are hosted in other minerals, so the occurrence is relatively decentralized.

6. Features of Ore Body

The ore body stretches along the NW-SE direction, sectionally looking like stratiforms and appearing lenticular (Fig.3). Its formation is dated back to the upper swale of Maokou limestone in the Permian system. Graphically, the ore body is irregular, approximately 900m long at maximum, about 600m wide at most and 2.7m to 42m thick. Its features suggest that shapes of ores are dependent upon karst depression and scandium mines occur in micro karst depressions. Similar to karst bauxite, there is relatively great prospect for prospecting similar micro karst depressions.

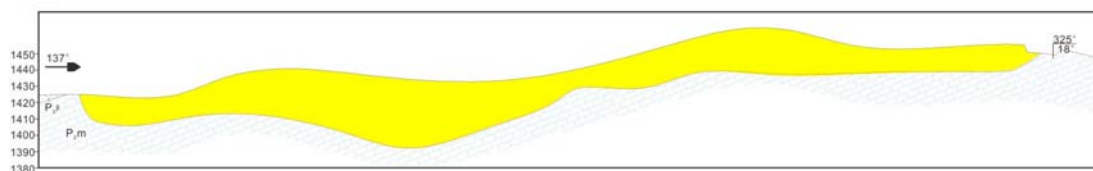


Fig.3. Profile of Scandium ore body

7. Conclusion

After comprehensive research, conclusions are reached as follows: 1) The average tenor of scandium is 70ppm, which meets the standard for the formation of independent scandium deposits; 2) ores are mostly earthen, massive and oxidized; 3) ores occur in quaternary micro karst depressions generally

not on a large-scale basis; 4) scandium ores coexist with titanium ores and common prospecting indicators may be used for both types of ores.

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