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To cite this article: Tao Cui 2018 IOP Conf. Ser.: Mater. Sci. Eng. 394 052076

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Geological features of antimony ores in western guizhou province

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Abstract. Geological features of antimony ores are summarized based on previous studies. Stibnite ores and pyrites are major minerals of these ores. Although the ore bodies are diverse in shapes, they are mostly strati form-like and their formation is significantly controlled by their structures.

Keywords: Scandium, geological features, south-western guizhou province.

As a kind of crucial strategic resources, antimony ores occupy a critical position in national economic growth. In Guizhou Province, antimony ores are mainly distributed in southwestern and southeastern Guizhou Province. In southwestern Guizhou Province, there are large-scale antimony deposits, which were studied to certain extent (Yuan, 1997; Wang, 2002; Wang, 2009; Xing, 2013; Wang, 2016; Yu, 2017). In this paper, geological features of antimony ores in southwestern Guizhou Province are explored based on previous studies, thus supplementing fundamental data of basic research about antimony ores.

1. Transport and Location of Ores
Mainly distributed in Qing Long County, antimony ores of southwestern Guizhou Province are near 320 National Highway and Zhenning-Shengjingguan Highway, so the traffic is convenient (Fig.1).

Figure 1. Traffic position of Qing long county, guizhou province
2. Geological Backgrounds
In these ores, exposed strata are Permian, Triassic or quaternary, which are generally in uncomfortable contacts, and angular unconformity does’t exist between the quaternary system and its underlying strata (Guizhou province geology and mineral bureau, 1987). The Permian system is mostly Middle and Upper, where the Ixia Formation and the Marko Formation are in the Middle, particularly made up of carbonates. There are apparent gaps between the Upper formations and the underlying Marko Formation. As a consequence, erosion surfaces are rugged. The Upper part is mainly composed of Longman 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 “Dashing beddings”. Sedimentation of faces on shallow-sea pesetas is a predominant feature of Triassic system. The Lower system contains Yelling Formation and Yenning Town Formation. Guiling Formation is in the Middle, which is mainly made up of carbonates. On the Lower part, there are Lulu Formation and Zayn Formation. The quaternary system, which is distributed in areas with gentle slopes, low-lying areas and on both sides of rivers, mainly comprising of residual slope accumulation. Concerning their lithological characters, alluvia mainly include gravels, gravelly clay and clay.

3. Features of Ores
There are two kinds of natural ores, namely sulfide ores and oxidized-semi oxidized ores. Metallic minerals are major sulphides of antimony. Rarely developed, antimony oxides mainly exist on near the surface of the earth and crushed zones. Stibnite ores, pyrites and florets are main minerals of the ores. There is a great variety of gangue minerals, particularly including quartz, followed by barites, calcites and gyps (Guizhou province geology and mineral bureau, 2014; Zhu, 2010; Yu, 2017). Antimony ores are mostly massive, brecciated and vein-type ores, which mostly have disseminated and dressy structures; there are mainly dimorphic and hypidiomorphic ores if classified according to structures (Non-ferrous metals geological exploration bureau of Guizhou, 2009; Yu, 2017).

4. Distribution of Antimony Ores
In Guizhou Province, antimony ores mainly exist in four counties, namely Qing long, Dustan, Dongxiang and Henning, in which antimony ores account for more than 90% of total antimony ores in the whole province. In southwestern Guizhou Province, these ores are mostly distributed in Qing long County.

5. Wall Rock Alteration
Alternations of wall rocks are relatively monotonous, especially including intensive solidification, Claymation, pyritization and carbonization, followed by fluoritization, gypsification and salinization. Wall rocks mostly develop along strata, which might be closely associated with primitive volcanic eruption (Wang, 2014; Hu, 2011). Solidification is classified into digenetic solidification, metallogenic solidification and post-metallogenesis solidification (Chen, 1984; Liao, 1990).

6. Features of Ore Bodies
6.1. General features of ore bodies
In southwestern Guizhou Province, ore bodies are stratiform-like, which are mainly hosted on Dashing Stratum. Based on previous studies (Wang, 2002; Wang, 2009; Xing, 2013; Wang, 2016; Huizhou province geology and mineral bureau, 2014), Dashing Stratum develops through three lithological intervals, namely the interval of intensive solidification, the interval of basaltic debris and the interval of clay rocks. On the lower interval of intensive solidification, the top of highly silicified brecciated rocks is the major part where antimony ores are produced. On the middle interval of basaltic breccia, highly silicified brecciated clay rocks are main ore-bearing parts. On the upper interval of clay rocks, altered basalts are leading ore-bearing parts.
6.2. Typical features of deposits
Dashing Antimony Deposit is large. Stibnite ores, pyrites and stibiconites are major minerals of the ores; gangue minerals mostly include quartz, calcite, yellow calcite and fluorite (Xing, 2013; Yu, 2017). In these ores, exposed strata include Permian Middle Marko Formation, Dashing Stratum, Emeishan Basalt Formation, Longtan Formation, Triassic lower Yelling Formation and sporadic quaternary system. Dashing Stratum is an ore-bearing stratum, which is in uncomfortable contacts with the underlying bed. The folds are mostly synclinal to Dashing in these ores, in which faults develop from the north to the east, mainly including Yezhutang Fault and Qinghai Town Fault. The antimony on “Dashing Stratum” has the same mode of occurrence as strata, namely gentle inclination and significant impacts of regional structures upon ore bodies (Liao, 1990; Dial, 2008). There are ore bodies on upper, middle and lower parts of the Dashing Stratum, where stratiform-like ore bodies exist in silicified basalts on the upper part; politic or reticulated ore bodies exist in the middle; and massive ore bodies are distributed on highly silicified limestones of the lower part (Chen, 1984; Tang et al., 2009; Wang, 2016). The more intense the solidification and alteration, the higher the thickness of Dashing Stratum and antimony ore bodies. Strata, lithological characters, structures and wall rock alteration are main prospecting indicators.

7. Discussions
Antimony ores are mostly distributed on the Dashing Stratum. So far, no large or medium-sized antimony ore has been discovered on other strata. The production of antimony ores is related to silicified rocks and altered basalts, which suggests that the formation of antimony ores is associated with hydrothermal activity. Antimony ores develop through a complex process and geological features are crucial indicators for prospecting these ores. However, with the decrease of ores on the surface of the earth, it will be inevitable to prospect antimony ores deeply, fairly significant to explore metallogenesis of the ores and necessary to study metallogenic mechanism of these ores systematically. After a thorough analysis of geological features, good outcomes may be attained in future prospecting utilizing methods such as remote sensing and prospecting.

8. Conclusion
In southwestern Guizhou Province, antimony ores are relatively large. In combination with previous studies, conclusions are reached as follows: 1) in southwestern Guizhou Province, antimony ores are mostly distributed on the Dashing Stratum and significantly impacted by their structures. Strata differ in shapes of ores and mineral composition; 2) at present, prospecting indicators are mostly used as routine methods for prospecting. However, with the advancement of technologies, comprehensive prospecting and survey may be performed by combined use of different techniques such as remote sensing, physical and chemical prospecting.

Acknowledgements
This work was supported by the Key support disciplines of Mineral prospecting and Exploration from Guizhou Province (ZDXK [2014]20), The Startup Projects of High-level Talents of Guizhou Institute of Technology (No.XJGC20140702), the joint fund of the science and technology department of Guizhou province (Noel [2014]7358).

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