Vol. 88 Supp. 2 ACTA GEOLOGICA SINICA (English Edition) Aug. 2014
http://www.geojournals.cn/dzxben/ch/index.aspx http://mc.manuscriptcentral.com/ags

LIU Yan, 2014. Alteration of Syenite in Syenite-Carbonatite Complex with Regards to the REE Mineralization in Dalucao REE Deposit, Sichuan Province. *Acta Geologica Sinica* (English Edition), 88(supp. 2): 912-.915

Alteration of Syenite in Syenite-Carbonatite Complex with Regards to the REE Mineralization in Dalucao REE Deposit, Sichuan Province

LIU Yan

Institute of Geology, Chinese Academy of Geological Sciences, Beijing 100037, China

1 Introduction

The Dalucao deposit is located in western Sichuan area of southwest China and in the western Yangtze Craton Craton tectonically. The deposit is also one of giant and large rare earth element deposits in the Himalayan Mianning–Dechang rare earth element belt. The deposit is the only deposit identified in the southern part in the Mianning–Dechang (MD) rare earth element (REE) belt and this hydrothermal ore deposit is closely associated with the cryptoexplosive breccia syenite-carbonatite complex. This area contains No.1, No, 2 and No.3 orebodies. Both No. 1 and No. 3 orebodies in this deposit are hosted by two breccias pipes respectively in syenite-carbonatite complex

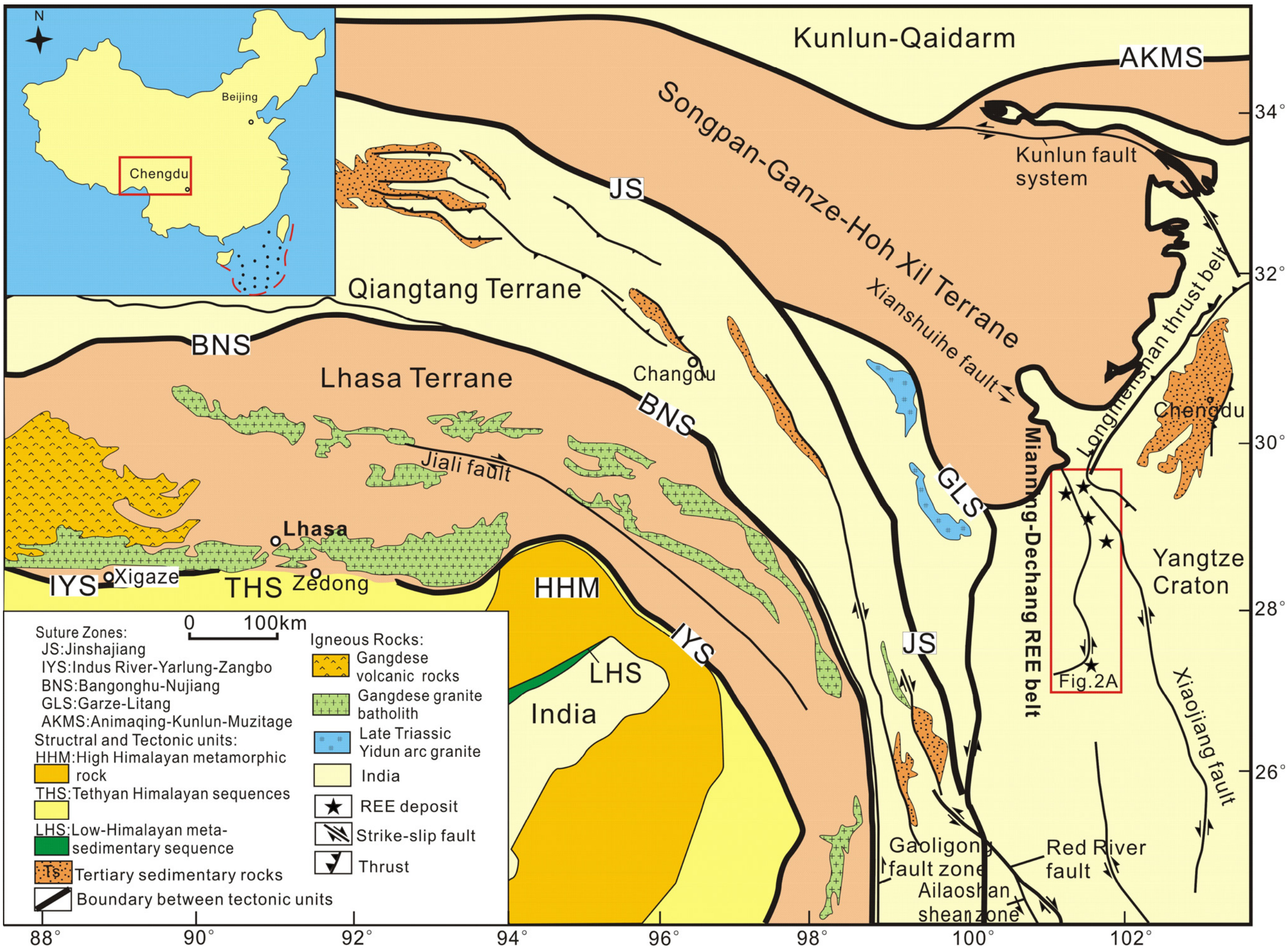

Fig. 1. Simplified tectonic map of the Himalayan–Tibetan Orogen (modified after Hou et al. 2009)

* Corresponding author. E-mail: ly@cugb.edu.cn

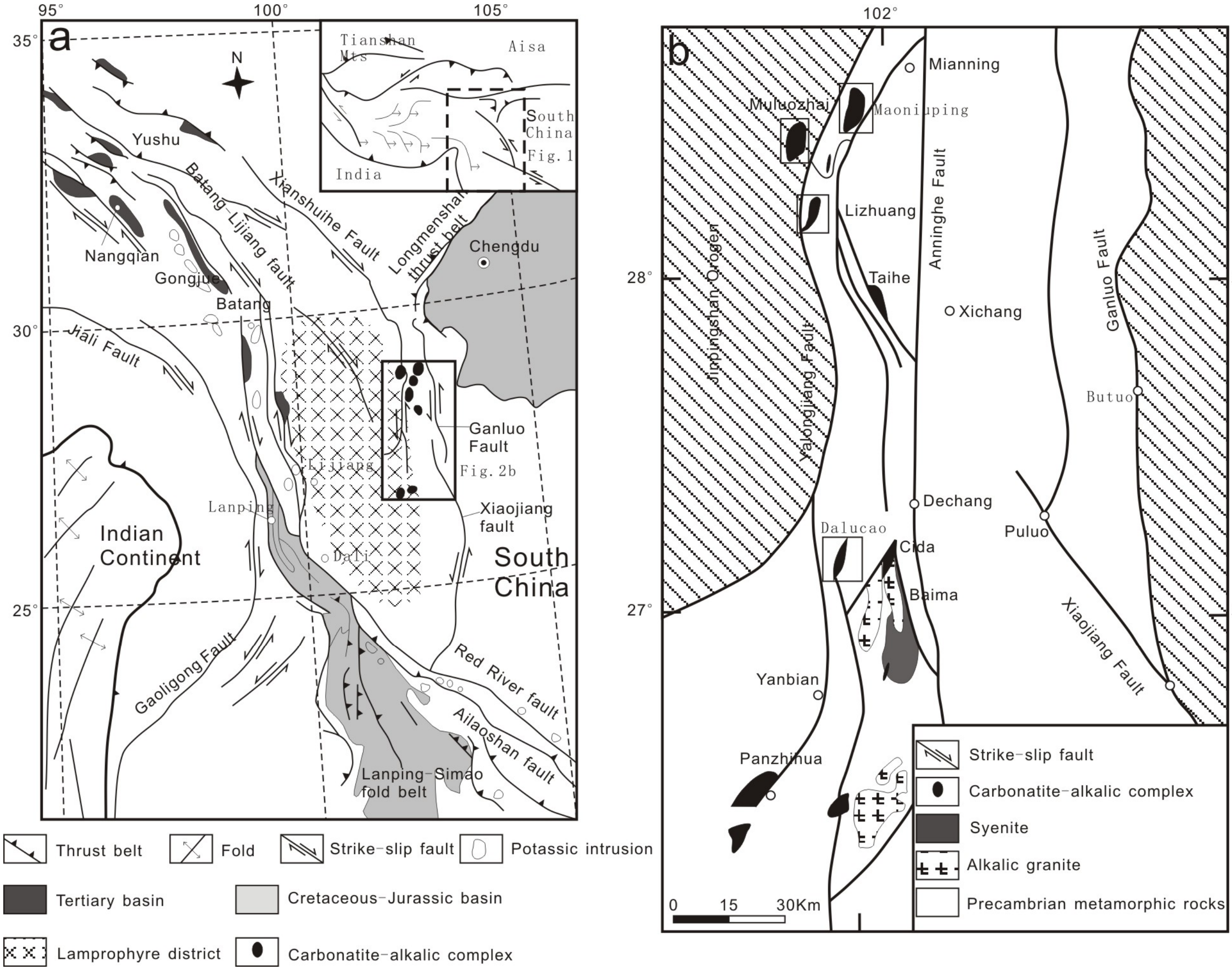

Fig. 2. (a). Cenozoic tectonic map of eastern Tibet (Wang et al. 2001), showing the distribution of the Himalayan potassic rock belt, shoshonitic lamprophyre district, and carbonatite–alkalic complex belt, which form a Cenozoic semi-discontinuous igneous province in the eastern Indo-Asian collision zone; (b). Sketch tectonic map showing distribution of the Himalayan carbonatite–alkalic complexes controlled by reactivated faults in western Sichuan(modified from Yuan et al. 1995).

and two breccias pipes record four cryptoexplosive brecciation events.

2 Geological Setting

The Himalayan MD REE belt is located on the western margin of the Yangtze craton (Fig. 1), a Cenozoic EIACZ. Available age date defines a Himalayan metallogenic epoch (40–10 Ma) for REE mineralization associated with Cenozoic carbonatite–alkaline complexes (Hou et al. 2009). The basement of the Yangtze craton consists of Archaean high-grade metamorphic rocks, Proterozoic meta-sedimentary rocks and overlying Phanerozoic clastic and carbonate sequences (Cong. 1988; Luo et al. 1998). The Dalucao REE deposit is the second largest in the MD REE belt, and contains about 0.76 Mt REO, grading 5.0% REO on average. About 667 analytical samples outline the No.1 orebody with an average grade of 1.0–4.0% REO, 194 analytical samples outline the No.3 orebody with an average grade varying from 1.0% to 4.5% REO (Shi and Li. 1996).

3 Deposit Geology of Dalucao Deposit

The Dalucao deposit is located in the southern segment of the MD REE belt, and is controlled by the Dalucao strike-slip fault (Fig.2). Due to regional uplift, a Proterozoic quartz diorite pluton with a surface exposure area of 70 km^2 was exhumed. Jurassic sandstones outcrop in the eastern part of the district. The Himalayan nordmarkite and aegirine-augite syenite stocks mainly intrude the quartz diorite pluton and associated carbonatite sills intrude along structural fissures formed by strike-slip faulting (Fig.3). Two breccia pipes associated with REE mineralization were developed in the nordmarkite stock; their long-axial diameters vary from 200 to 400 m, short-axes vary between

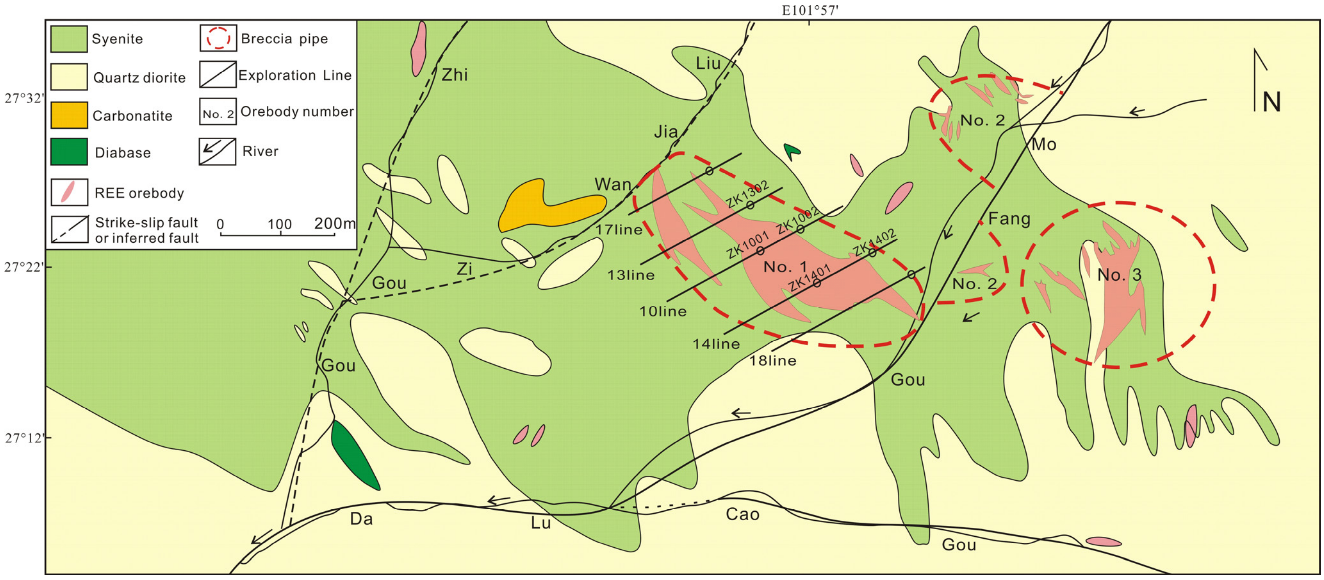

Fig.3. Sketch geological map showing the features of carbonatite-syenite complex and associated REE orebodies at Dalucao (modified from Hou et al., 2009).

180 and 200m, and the pipes extend downwards for 450 m. Clastic rocks in the breccia-pipes consist predominately of magmatic detritus and ore fragments hosted within a calcite -rich matrix with subordinate quartz and REE minerals. Post-ore strike-slip faulting led to displacement of the No.1 and No. 2 orebodies (Fig.3) (Hou et al. 2009).

4 Alteration of Wallrock

REE orebodies are hosted in syenite-carbonatite complex in the MD REE belt, the involvement of the syenite in the formation of these REE orebodies was neglected. Consequently, the relative contributions of syenite and carbonatite to REE mineralization in the Dalucao deposit remain unclear in previous study (Xu et al., 2008; Hou et al., 2009). In addition, no previous study has examined the differing types of REE minerals, ore petrography, the paragenesis of mineralization, or the processes that formed both the No. 1 and No. 3 orebodies within the Dalucao deposit. Therefore, the reasons for the slight difference in mineral assemblages (fluorite + barite + bastnäsite and fluorite + celestite + pyrite + muscovite + bastnäsite + strontianite) in both No.1 and No.3 orebodies in the Dalucao deposit remain unknown in previous studies (Xu et al., 2008; Hou et al., 2009).

In syenite, feldspar and albeit with minor plagioclase account for about 70% among rock-forming minerals. The amount of quartz ranges from 5 to 15% and muscovite is about 15 to 25%. Dark minerals are aegirine augite, biotite and amphibole but the amount is small. And associated minerals are apatite, zircon, allanite and bastnäsite.

The hydrothermal alteration halo is distributed along the fissures within syenite stocks. Systematic sampling along one cross section in the top part (6 meters up to the uppermost of the top in the No.1 orebody) (Fig.4), was undertaken in order to petrologically characterize hydrothermal alteration. Microscopic observations of these samples record a gradual alteration of fresh syenite (DL1-1 to DL1-8) into a biotite–sericite rock (DL1-8 to DL1-18) with feldspar and albeit were turned into sericite and biotite formed during the alteration. From the boundary to the centre of the transect (Fig.4), REE mineralization overprint this biotite–sericite alteration (DL1-8 to DL1-18).

Acknowledgements

This study is financially supported by the State Key Research Development Program of China (2009CB421008), the IGCP/SIDA 600 project, and The Natural Science Foundation of China (Grant 41102039).

References

Cong B L (1988) Formation and evolution of the Panxi paleo-rift. Beijing: Science Press. 1–427 (in Chinese with English abstract)

Hou ZQ, Tian SH, Xie YL, Yuan ZX, Yin SP, Yi LS, Fei HC, Zou TR and Bai G (2009) The Himalayan Mianning-Dechang REE belt associated with carbonatite-alkalic complex in the eastern Indo-Asian collisionzone, SW China. Ore Geol Rev 36:65–89

Liu, Y., Hou, Z.Q., Yang, Z.S.,Tian, S.H. (2013) Mineralization of the Dalucao REE Deposit at Himalayan Mianning-Dechang REE belt in the Eastern Indo-Asian Collision Zone, SW China. Proceedings of 12th Biennial SGA meeting, Uppsala, Sweden, 1435-1438.

Luo YN and Yu RL (2001) Major features and dynamic model of the Himalayan tectonic-magmatism in the introcontinental orogenic belt in Longmenshan-Jinpingshan, Sichuan Province.

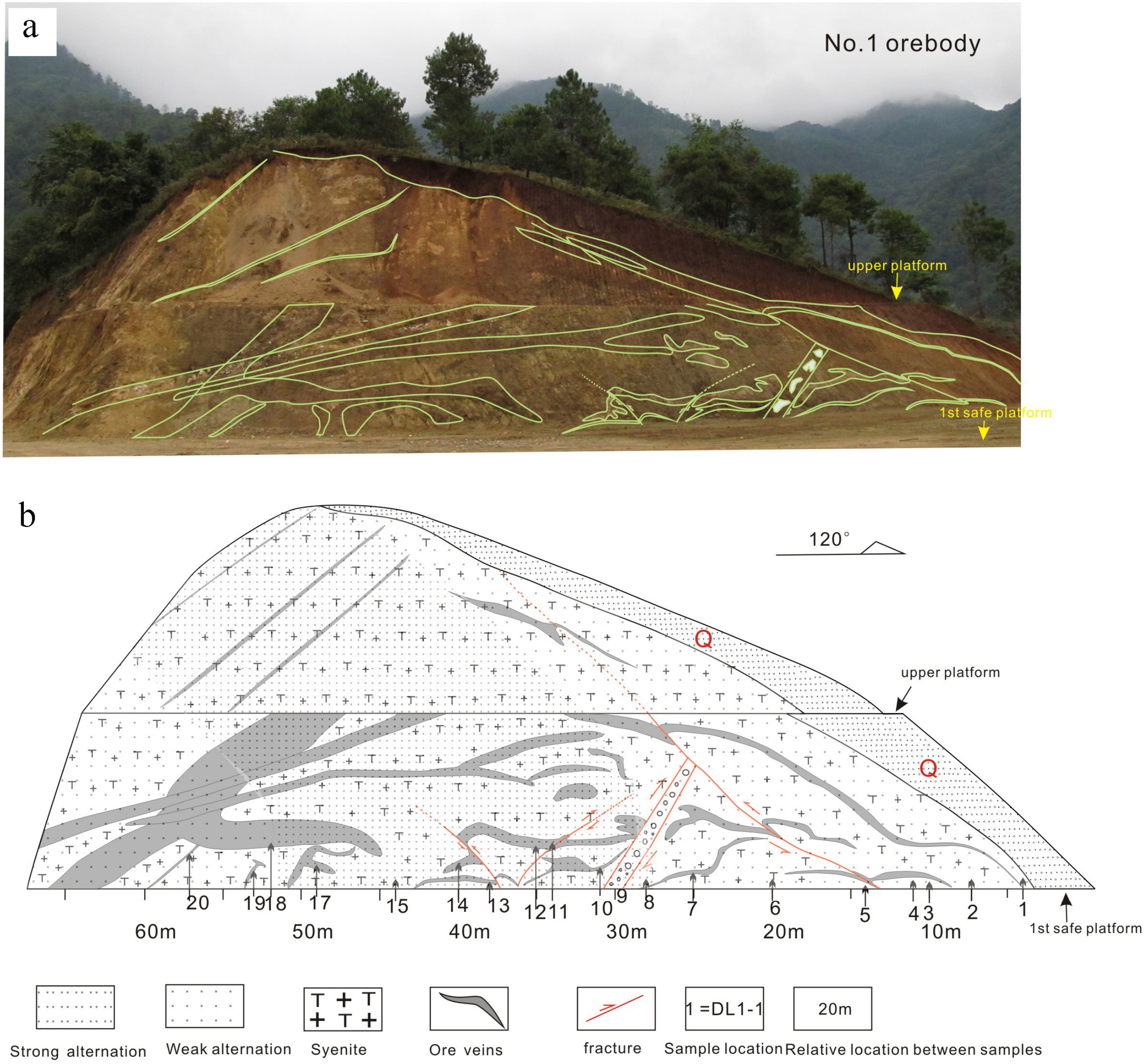

Fig. 4. (a) The first safe platform cross section from examination of alteration; (b) Alteration, ore veins, syenite, fracture, samples location and relative location between samples of the cross section. (From Liu et al., 2013)

In: Chen YC and Wang DH, eds. Study on Himalayan Endogenic Mineralization. Beijing: Seismological Press. 88–96 (in Chinese with English abstract)

Shi ZM and Li XY (1996) Geologic features and ore-forming conditions of alkali complex-hosted ore deposits of REE in Himalayan epoch in Panzhihua-Xichang region. Sichuan Geol Acta, 16 (1): 54–59 (in Chinese with English abstract)

Yang GM, Chang C, Zuo DH and Liu XL (1998) Geology and Mineralization of the Dalucao REE Deposit in Dechang County, Sichuan Province. Open file of China University of Geosciences, Wuhan, pp.1-89(in Chinese)

Yuan, Z.X., Shi, Z.M., Bai, G., Wu, C.Y., Chi, R.A., Li, X.Y., 1995. The Maoniuping rare earth ore deposit, Mianning county, Sichuan Province. Seismological Press, Beijing. pp.1–150 (in Chinese).