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Geochemical Characteristics and It's Geological Implications of Jurassic Gacangjian Volcanics in the Middle of Bangongco-Nujiang Ocean Belt, North Tibet

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The Bangongco metallogenic belt is hosted by the Bangongco-Nujiang suture zone, which is a 30~90 km wide and 2000 km long zone extending from Myanmar Mogok to Bangongco, which is the second giant ultra-basic rock belt after Tibet's Yarlung Zangbo suture zone (Shi, 2008). It is worth noting that the subduction polarity of the Bangongco-Nujiang Neo-Tethys ocean has been under considerable debating, ranging from northward subduction during the Late Triassic-Early Cretaceous (Kapp et al., 2003) to southward subduction during the Late Jurassic-Early Cretaceous (Mo et al., 2005; Zhu et al., 2009) to bidirectional subduction during the Late Jurassic-Early Cretaceous (Pan et al., 2004; Du et al., 2011). In this study, major, REE element and rare element composition have been reported. we discuss the geochemistry of the Gacangjian volcanics as well as implications on the tectonic setting of the Bangongco metallogenic suture.

The Gacangjian volcanics sampled from Duomagongba and Zhaqu town in Anduo County, middle of the Bangongco-Nujiang ocean Belt. The Gacangjian volcanics belong to the low-K calc-alkaline and calc-alkaline series. The major elements of the volcanics are characterized by high Al_2O_3 (14.78wt%~16.25wt%), poor TiO_2 (0.44wt%~1.46wt%), poor MgO (0.51wt%~6.97wt%) and K_2O (0.10wt%~2.00wt%), and $Na_2O > K_2O$. They are peraluminous, with A/CNK [molar ratios of $Al_2O_3/(CaO + Na_2O + K_2O)$] = 0.50~1.01. In the TAS diagram (omitted), samples fall into dacite and rhyolite range except two samples into trachydacite, which belongs to the low potassium and calcium alkali series volcano rock series.

The Duomagongba volcanic have low content of ΣREE , a weak negative Eu anomaly or no Eu anomaly ($\delta Eu = 0.83-1.15$, with a mean of 1), Chondrite-normalized REE diagrams show weak-LREE-enriched patterns (LREE/

HREE=1.8-2.46, averaging 2.12). And the Zhaqu REE patterns show enrichments in light REE relative to heavy REE (LREE/HREE=7.97-12.11, averaging 8.55), with a weak negative Eu anomaly ($\delta Eu = 0.71-1.33$, averaging 0.94). Trace elements for Duomagongba are enriched in Ba, U, Hf, Ta, La and Ce, depleted in Rb, K, Nb, P and Ti; and Zhaqu volcanic are enriched in Rb, Th, U, Zr, Hf and K; depleted in Ba, Sr, Nb, Ta, and Ti. All the volcanic are enriched in large ion lithophile element and depleted in high-field strength elements (Nb, P and Ti), which show essential characteristics of island arc volcanic rocks (Condie, 2001).

From the rock composition, the island-arc volcanic rocks are traditionally characterized by low potassium, middle potassium calc-alkaline andesite and volcanics, which are consistent with the Gacangjian volcanics. The ratio of La/Yb can indicate the thickness of the crust and magma source depth. Basic and intermediate-acid volcanic rocks with low La/Yb ratio, respectively (1.48~2.79, with an average of 2.30) and (2.26 to 3.57, average 2.61), which suggested that they may have similar depth of magma formation, but the crust thickness is lower than the Duoni Formation volcanics in northern Lhasa block (average La/Yb ratio of 8.08) (Zhu et al., 2009). Nb is depleted compare to La and K, showing that the original magma have a large number of continental crust materials. Trace elements in rocks are relatively enriched in Ta, Hf and Zr, suggesting that the intermediate-basic rocks are most likely derived from the partial melting of enrichment mantle wedge. Felsic volcanics has two possible genesis: one is the products of Mantle-Derived mafic magmas underwent extensive crystallization differentiation and assimilation (Ingle et al., 2002); the other is the dehydration and remelting of the crustal materials with the heat from mantle-derived mafic magma (Guffanti et al., 1996), which

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is characterized by enrichment of Al, Th and LREE.

There are large-scale felsic volcanics in the middle Bangongco-Nujiang ocean and the rocks are enriched in Th and LREE. $Mg^\#$ is higher, the average value is greater than 40, may be caused by partial melting of mantle rocks. The felsic volcanics have no Eu anomaly or a weak negative Eu anomaly, indicate that the magma evolution did not experience significant plagioclase fractionation. The Gacangjian acidic volcanics have high content of Th (9.38~11.48 ppm, with an average of 9.60 ppm), which are consistent with the middle crust (Th=6.5 ppm) and upper crust (Th=10.5 ppm) (Rudnick and Gao, 2003). These characteristics indicate that Gacangjian acidic volcanics in the study area are most likely derived from partial melting of the lower crust.

The Gacangjian volcanics has the typical characteristics of island-arc volcanic rocks. The 1:25 000 regional geological survey results also show that the Jurassic and Cretaceous volcanic magmatic activity occurred mainly in the littoral, shallow sea, continental and paralic environment in the middle Bangongco-Nujiang ocean, which are important geological features of island arc belt. For spacing, the Gacangjian volcanics located in the north of the Bangongco-Nujiang suture, supporting northward subduction of the Bangongco-Nujiang suture. Combined with the volcanic rocks and granite in the northern Lhasa terrane are related to the southward subduction of Bangongco-Nujiang ocean (Zhu et al., 2009), it is held that the Jurassic Gacangjian volcanics are most likely related to the bidirectional subduction (southward subduction and northward subduction) of Bangongco-Nujiang ocean.

Keywords: volcanic rocks, geochemical characteristics, Bidirectional subduction Anduo

References

Kapp, P., Murphy, M.A., Yin, A., Harrison, M.T., Ding, L. and

- Guo, J. H., 2003. Mesozoic and Cenozoic tectonic evolution of the Shiquanhe area of western Tibet. *Tectonics* 22, 10-29.
- Shi Rendeng, Yang Jingsui, Xu Zhiqin and Qi Xuexiang. 2008. The Bangong Lake ophiolite (NW Tibet) and its bearing on the tectonic evolution of the Bangong-Nujiang suture zone. *Journal of Asian Earth Sciences*, 32 : 438-57.
- Condie, K.C. Mantle plume and their record in the earth history M. London: Cambridge University Press, 2001. *Geophysical Research*, 101 (B2) : 3003-3013.
- Zhu Dicheng, Mo Xuanxue, Niu Yaoling, Zhao Zhidan, Wang Liquan and Wu Fuyuan. 2009. Geochemical investigation of Early Cretaceous igneous rocks along an east-west traverse throughout the central Lhasa Terrane, Tibet. *Chemical Geology* 268 : 298-312.
- Mo Xuanxue, Dong Guocheng, Zhao Zhidan, Zhou Su, Wang Liquan, Qin Ruizhao and Zhang Fengqin. 2005. Spatial and temporal distribution and characteristics of granitoids in the Gangdese, Tibet and implication for crustal growth and evolution. *Geological Journal of China Universities*, 11 : 281-290 (in Chinese with English abstract).
- Pan Guitang, Wang Liquan and Zhu Dicheng. 2004. Thoughts on some important scientific problems in regional geological survey of the Qinghai-Tibet Plateau. *Geological Bulletin of China*, 23 : 12-19 (in Chinese with English abstract).
- Du Dedao, Qu Xiaoming, Wang Genghou, Xin Hongbo and Liu Zhibo. 2011. Bidirectional subduction of the Middle Tethys oceanic basin in the west segment of Bangonghu-Nujiang suture, Tibet: Evidence from zircon U-Pb LAICPMS dating and petrogeochemistry of arc granites. *Acta Petrologica Sinica*, 27 (7): 1993-2002 (in Chinese with English abstract).
- Rudnick, R.L. and Gao, S. 2003. The composition of the continental crust. In: Rudnick R.L. (ed). *The crust vol.3, treatise on geochemistry* (eds. Holland H.D. and Turekian K.K.), Elsevier, Oxford, 1-64.
- Guffanti, M., Clyne, M.A. and Muffler, L.J.P., 1996. Thermal and mass implications of magmatic evolution in the Lassen volcanic region, California, and constraints on basalt influx to the lower crust. *Journal of geophysical research*, 101: 3001-3013.
- Ingle, S., Weis, D. and Frey, F.A., 2002. Indian continental crust recovered from Elan Bank, Kerguelen Plateau (ODP Leg 183, Site 1137). *Journal of Petrology*, 43 (7) : 1241-1257.