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

DING Teng, MA Dongsheng, LU Jianjun and ZHANG Rongqing, 2014. Apatite in Granitoids of Polymetallic Deposits in Southeast Hunan Province, China: Implications for Petrogenesis and Metallogenesis. *Acta Geologica Sinica* (English Edition), 88(supp. 2): 710-711.

Apatite in Granitoids of Polymetallic Deposits in Southeast Hunan Province, China: Implications for Petrogenesis and Metallogenesis

DING Teng, MA Dongsheng, LU Jianjun and ZHANG Rongqing

State Key Laboratory for Mineral Deposits Research, Department of Earth Sciences, Nanjing University, Nanjing 210093, China

1 Introduction

Apatite, $Ca_5(PO_4)_3(OH,F,Cl)$, is the most abundant accessory mineral in igneous rocks because of its wide stability in geological processes (Watson, 1980) and can contain a number of other trace elements by substitutions in both anion and cation sites (Sha, 1999). In this paper, abundant major and REE concentrations of apatites of six mineralized granitic rocks from southeast Hunan province, i.e. granodiorites associated to Cu-Pb-Zn deposits (Baoshan and Tongshanling) and biotite granites related to skarn W deposits (Xitian and Xintianling) and Sn deposits (Furong and Hehuaping), have been analyzed by using electron microprobe and laser-ablation ICP-MS. The main objective is to figure out whether the chemical compositions of apatite in granitic rock which associated to ore deposit can be the proxy of petrogenesis and mineralization types and to indicate the regional metallogeny and tectonic evolution in southeast Hunan province, China.

2 Results

Analyzed results show that the apatites in the granitiods related to Cu-Pb-Zn deposits generally contains more Cl and less F than the apatites of W deposits and Sn deposits (Fig.1). Total REE contents are mostly enriched in apatites of Sn deposits, followed by W deposits while apatites from Cu-Pb-Zn deposits contains the least total REE content. The REE distribution patterns of apatites of Sn deposits are characterized by the strong Eu depletion, while the W deposits show HREE slightly upward tilted (Fig.2).

3 Discussion and Conclusion

The distinct differences of halogens contents of apatites suggest the slab dehydration environment for Cu-Pb-Zn deposits while partial melting of crust triggered by asthenosphere upwelling for W and Sn deposits. The reasoning is as follows: (1) sedimentary rock will significantly loss Cl than F during weathering process and will lead to the F concentrated while Cl depleted in the residues (Brehler, 1974), this halogen compositions of residues could have been inherited by the W and Sn deposits; (2) generally neither sedimentary rock nor mantle contains high Cl (Sha, 1999), but the subducted slab will provide sufficient Cl by the way of hydrothermal recycling and serpentine dehydration (Kendrick, 2011).

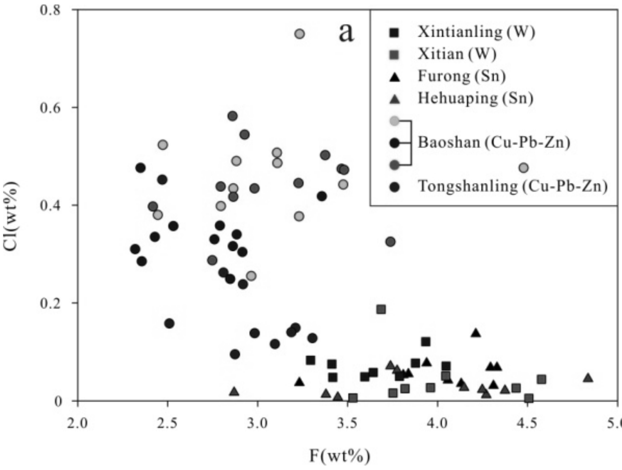

Fig. 1. (a) Cl vs. F contents of apatites and (b) Ce vs. Eu anomalies of apatites.

Eu and Ce anomaly of apatite can be proxies of redox state of the original magma because apatite shows a remarkable preference for Eu^{3+} and Ce^{3+}, instead of Eu^{2+} and Ce^{4+} (Sha, 1999). Also the oxidized I-type magmas generally associated with addition of mantle material while partial melting of sedimentary rocks always generate reduced S-type magmas (Blevin, 1995). Baoshan and Tongshanling have the highest δEu values (0.2-0.65)

* Corresponding author. E-mail: 656754507@qq.com

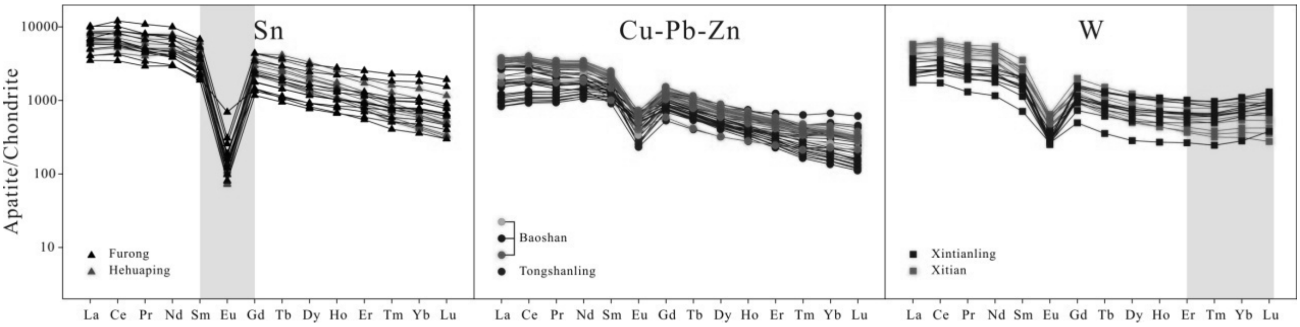

Fig. 2. Chondrite-normalized REE distribution patterns of apatites from southeast Hunan, China.

and lowest δCe values (1.04-1.12), suggestive of oxidized state of magmas, which are usually associated with addition of mantle materials. Xitian and Xintianling have the medium δEu values (0.16-0.44) and δCe (1.12-1.16), suggesting the skarn W deposits have medium oxygen fugacity and the decrease of mantle materials while increase of crust melt, Furong and Hehuaping have the lowest δEu values (0.02-0.09, except one outlier is 0.4) and highest δCe values (1.07-1.16), suggestive of reduced state of magmas, which are usually related to crust melting. The oxidization states are consistent with the halogen element features of apatites and further confirm the opinion that the tectonic environment of southeast Hunan have transformed from early continental arc (formation of Cu-Pb-Zn deposits) associated to subduction of Palaeo-pacific plate to later rifting environment (formation of W and Sn deposits) triggered by slab roll-back and mantle upwelling around late Jurassic (Jiang, 2007).

Acknowledgements

This work was financially supported by the National Basic Research Program of China (Grant No.2012CB416705).

References

Blevin, P.L., and Chappell, B.W., 1995. Chemistry, origin, and evolution of mineralized granites in the Lachlan Fold Belt, Australia: the metallogeny of I-and S-type granites. Economic Geology, 90: 1604-1619.

Brehler, B., and Fuge, R., 1974. Chlorine. In: Wedepohl, K. H. (ed.), Handbook of geochemistry. Berlin: Springer-Verlag, chapter 17, 1-36.

Jiang, Y.H., and Jiang, S.Y., 2009. Middle to late Jurassic felsic and mafic magmatism in southern Hunan province, southeast China: Implications for a continental arc to rifting. Lithos, 107: 185-204.

Kendrick, M.A., and Scambelluri, M., 2011. High abundances of noble gas and chlorine delivered to the mantle by serpentinite subduction. Nature Geoscience, 4(11): 807-812.

Sha, L.K., and Chappell, B.W., 1999. Apatite chemical composition, determined by electron microprobe and laser-ation inductively coupled plasma mass spectrometry, as a probe into granite petrogenesis. Geochimica et Cosmochimica Acta, 63(22): 3861-3881.

Watson, E.B., 1980. Apatite and phosphorus in mantle source regions: An experimental study of apatite/melt equilibria at pressures to 25 kbar. Earth and Planetary Science Letters, 51 (2): 322-335.