Phosphate minerals from the Nanping pegmatite, SE China

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ABSTRACT

Nanping pegmatite has complex associations of phosphates. This pegmatite shows complete evolution zones from the border to inner. Phosphate minerals could be divided into primary and secondary type. The formation of phosphates suggests Mg, Fe, Ba, Sr become more abundant during the evolution processes of granitic pegmatite.

Keywords: *Phosphates, pegmatite, Nanping, China.*

INTRODUCTION

Nanping pegmatite is located in Fujian Province, SE China. This rare-element pegmatite is actually exploited for tantalum, lithium and beryllium.

A complete internal zoning is observed, and includes, from border to core, (I) quartz-albite-muscovite zone, (II) green-color mica zone, (III) quartz-muscovite zone, (IV) quartz-albite zone, (V) quartz-spodumene-microcline-cleavelandite zone, (VI) quartz-spodumene-montebrasite zone, (VII) quartz-(spodumene)-microcline zone, and (VIII) blocky quartz–microcline core (Yang et al., 1987).

PHOSPHATE MINERALS

Nanping pegmatite is also remarkable for its complex associations of phosphate minerals. Up to now, more than twenty species of phosphates have been determined. Among them, primary phosphate minerals include montebrasite, Mn-rich fluorapatite, triphylite, and secondary phosphates consist of Sr-rich apatite, palermoite-bertossaite, augelite, lazulite, kulanite, ferrisicklerite, etc (Wang et al., 1987).

1 Primary phosphates

Montebrasite is the most common and representative phosphate mineral in Nanping pegmatite. It occurs as light grey blocks several centimetres even to one meter in size. All analyzed chemical compositions correspond to montebrasite, with F < 0.58wt%. Frequently, primary montebrasite appears strongly altered to other secondary phosphate minerals.

Apatite had been found in all the zones of pegmatite. It occurs as sap green-celandine green, medium sized granulate-short prismatic. Chemically, primary apatite belongs to fluorapatite and contains up to 4.82 wt% MnO.

Triphylite is observed as pale green veinlets cutting primary massive montebrasite, and associated with muscovite, Mn-bearing apatite. It has 38.83wt% FeO, close to Fe end member.

2 Secondary phosphates

Secondary apatite is obviously different from primary apatite in chemical composition. With the evolution of the pegmatite, Sr content in apatite becomes higher and is up to 11.35-15.24wt%, corresponding to Sr-bearing apatite (Table 1). The other secondary phosphates are numerous and all closely associated with primary apatite and montebrasite. Palermoite is observed as replacement of primary montebrasite. It is associated with kulanite. Bertossaite is another secondary mineral of strontium, but it formed after augelite, and is associated with lazulite and goyazite.

Based on phosphate association, the alteration sequence of phosphate minerals can be established in Figure 1.

TABLE 1. Chemical analyses of the secondary phosphates

	Sr-apt	kulan	lazu	berts	palerm
Na_2O		0.04		0.01	0.02
MgO	0.03	1.99	11.15	0.02	0.11
Al_2O_3		15.96	32.70	31.40	27.89
SiO_2			0.04	0.21	0.43
P_2O_5	39.83	34.24	46.87	45.01	42.25
K_2O	0.01	0.05	0.02	0.01	
CaO	42.28	0.20	0.08	8.17	4.26
TiO_2	0.01	1.30			0.07
MnO	0.38	10.57	0.06	0.19	0.21
FeO^T	0.04	11.18	1.64	0.71	0.70
SrO	15.24	0.07		0.95	7.75
BaO		20.22	0.04	0.19	0.09
F	4.01	0.17		0.79	1.22
F=O	1.69	0.07		0.33	0.51
Total	100.13	95.92	92.58	87.32	84.48

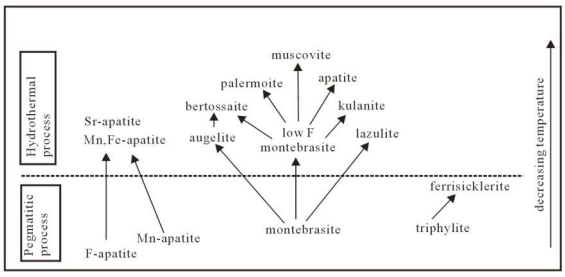

FIGURE 1. Diagram showing alteration sequences of phosphate minerals.

CONCLUSIONS

Phosphorus behaves as a high-field-strength incompatible element. During the pegmatite crystallization stage, the melt may gradually become saturated in P and is also Li-riched; phosphate minerals such as fluorapatite, Mn-rich apatite and montebrasite precipitated and occurred in lower-evolved border and intermediate zone. In contrast, the inner zone shows the complex phosphate mineral associations, such as the

abundance of Sr, Mg, Fe, Ba phosphate mineral. It suggests that the content of Mg, Fe, Ba, Sr become more abundant in hydrothermal transformation with the evolution of pegmatite.

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