Fluro Cannilloite from Carbonatite Complex of Tiruppattur, Tamil Nadu, India

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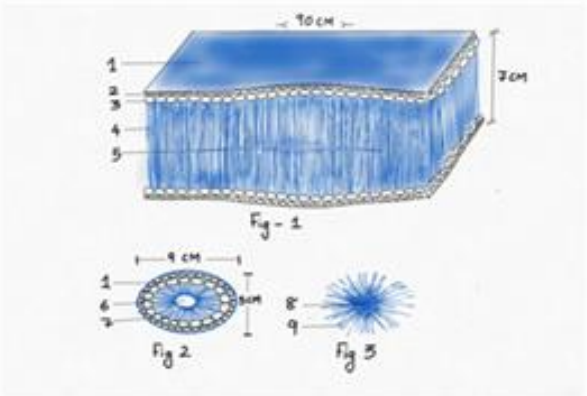
Abstract: *A rare variety of fibrous hyper calcic amphibole 'fluro cannilloite' in beforsite is reported from carbonatite complex of Tiruppattur, Tamil Nadu. Its chemical composition is SiO_2 43.59. TiO_{2+} 13.22, $Al_2O_3$8.58, $Fe_2O_3$3.85, FeO 2.05, MnO 0.71, MgO 7.77, CaO 20.08, Na_2O 0.08, K_2O 0.08 (wt. %). Structural formula on the basis of 23 (OH, F) is $(Si_{6.185}\ Ti_{1.411}\ Al^{4+}_{0.404})_8$ $(Al^{3+}_{1.031}\ Fe^{3+}_{0.412}\ Fe_{0..243}\ Mn_{0.085}Mg_{1.643})_{3.414}$ $(Na_{0.022}\ Ca_{2.052}K_{0.014})_{2.088}$ $(Ca_1)_1$ It indicates that cannilloite might have been formed by entry of Ca atoms in magnesioriebeckite by replacing Na, K atoms in A and B sites and causing deficiencies in C and T sites under high P_{CO2} and P_{HF}. The release of Na, K, Al and Si produces miarolitic alkali pegmatites in ultramafic rock.*

Keywords: *Amphibole, Cannilloite, Beforsite, Miarolitic cavities, Carbonatite complex of Tiruppattur Tamil Nadu.*

1. INTRODUCTION

The carbonatite complex of Tiruppattur includes several differentiated sequences of co-magmatic alkali syenites carrying accessory minerals alkali amphiboles varying from ferro-hastingsite, richterite, arfvedsonite, eckermannite, katophorite and magnesioriebeckite at late magmatic rocks [1-3]. Magnesioriebeckite is the notable accessory mineral in highly differentiated alkali syenites and carbonatites. It is present in significant volume in agpaitic miarolitic pegmatites and aplites and in ferro carbonatite and beforsite.

Fibrous aggregate of hyper calcic amphibole intimately mixed with calcite, quartz and apatite is collected from the carbonatite complex of Tiruppattur, Tamil Nadu. The mineral occurs as fibrous grayish white bundles. The bundles often subjected to creeping and sliding by local movements and dislocations. It has vitreous silky luster. Streak is white. The diameter or thickness of fibril varies from 100 to 20µm. The length varies depending up on the nature and width of vein from 1 to 10 cm grown from mafic patches. It is found in a vein with pinching and swelling structure up to 90 x 7 cm (Fig.1) tapering at both ends in a miarolitic beforsite. The beforsite emplaced in ultramafic rock is located about 500 m west of Mottusulakkarai village and 5 km east of Pochampalli Town. Miarolitic cavities filled with fibrous amphiboles which are grown towards (Fig, 2) central cavities [2] from peripheral mafic outline. Following mafic outline, fine-grained aplitic calcite and coarse-grained pegmatitic calcite are subsequently developed consuming H_2O and CO_2 filled in cavities and fibrous amphibole develops towards the center.



Figs1-3: Modes of occurrence of amphibole,

1: top and bottom layers are composed of mafic patches, 2. fine-grained calcite layer 3. coarse-grained calcite layer, 4. fibrous aggregates of amphibole 5. intersecting slip-plane displaces fibers Fig.2. carbonatite ocellie, 6 outer layer of mafic patch, 7. fibrous ocellar amphibole points towards central cavity [4]. Fig.3 around mafic patch star like growth of fibers is projecting outwards A bundle of fibrous amphibole is seen in Fig.4.

Fig4: A bundle of fibrous greyish white asbestos is the study material.

2. METHODOLOGY

Fibrils of amphibole mixed with calcite (unable to separate physically as individual minerals) were

submitted for wet gravimetric chemical analysis in the Geochemical Laboratory, Faculty of Geology, Moscow State University, Russia during the year 1978. The bulk chemical composition is SiO_2 6.50, TiO_2 1.68, Al_2O_3 1.09, Fe_2O_3 0.49, FeO 0.26, MnO 0.09, MgO 0.85, CaO 50.84, Na_2O 0.01, K_2O 0.01, P_2O_5 0.02 and CO_2 37.86 (wt. %). Excessive normative chemical composition [5] of calcite, quartz and apatite were detected from the bulk composition and the chemical composition of fibrous amphibole alone recalculated. In the wet gravimetric analysis both combined water and F content were not determined.

Therefore, the structural formula on the basis of 23(O, OH, F) is calculated [6]

A-site is composed a maximum amount of 1 apfu

B site (Na0.022Ca2.052K0.014)2.088

C site (Mg1.643 Mn0.085 Fe0.243 Fe0.4123+Al3+ 1.031) 3.414

T site (Si6.185Ti1.414 Al0.404)8

(OH-F) site 2

A site is generally filled with Na+K atoms in alkali amphiboles but extensive replacement of Na+K by Ca. A site is completely filled with Ca atoms [7] per formula unit (apfu) is 1. Maximum amount Ca atoms enter into B-site replacing Na+K ions from B site which needs the alkali ions to balance for 2 apfu. Excessive Ca ions enter into B site accommodates 2.088 apfu. Commonly alkali atoms exceeds over 2 apfu in most of alkali amphiboles like magnesioriebeckite, eckermannite, and akermannite6, In this amphibole Ca 2.052 apfu occupies in B-site with very low concentration of Na+K replacing almost all alkali ions to compensate its structural position. Due to insufficient quantities of Mg, Fe2+, Mn, Fe3+ and Al3+ in C site (C3.414) contains very low concentration of apfu and insufficient to balance its structural state. It requires a large quantity of divalent and trivalent ions to balance its C-site. Ti and Al4+ enter into T site which is highly deficient in tetrahedral Si.

3. CONCLUSION

The structure of the amphibole studied is very similar to the structural position of magnesioriebeckite which appears to be formed at very late magmatic stages. However, alkali ions in A site are completely replaced by entry of Ca ions at late magmatic stages by increasing of PCO2 during emplacement of carbonatites in ultrabasic rocks. Therefore, magnesioriebeckite is transformed into cannilloite. A large quantity of Ca enters into the molecular structure by activities of high fugacity of PCO2 and PHF. In carbonatite-alkali complex of Tiruppattur such types of carbonate metasomatism is common with formation of calcite, quartz, wollastonite, garnet and scapolite bearing rocks at late magmatic stages. Release of Na, K, Al and Si produces alkali pegmatites which are emplaced along fracture zones of ultrabasic rocks. EDAX analyses show most of ultramafic magmatic rocks7 (including phoscorite) contain F in significant quantity up to 1.53 and Cl 0.07 (wt. %) [1, 2, 3, 9, 10]. The hyper calcic fibrous amphibole completely filled with Ca is belongs to cannilloite and its possible enrichment of F in hydroxyl site, it may be assigned as fluro cannilloite a rare mineral occurring in the carbonatite complex of Tiruppattur, Tamil Nadu.

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