Phosphates from Brissago granitic pegmatites (Canton Ticino-Switzerland)

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A prospecting program conducted along Valle di Ponte, near the village of Brissago allowed the discovery, sheltered into a boulder, of a nearly complete section of a granitic pegmatite dike containing several phosphate masses more than 10 cm in length. This exceptional finding permitted us to give a description of the granitic pegmatite and to carry out a chemical characterization of these "graftonite" masses.

The phosphate-bearing pegmatites are closely related to a pegmatitic and micro-granitic to dioritic swarm embedded in the Kinzigitic Complex of the Ivrea-Verbano Zone (IVZ), a suite of Palaeozoic metamorphic rocks belonging to the crystalline basement of the central Southern Alps. During Permian and lower Triassic age continental rifting the uplift of Kinzigitic Complex allowed the emplacement of a Mafic Complex and slabs of sub-continental mantle peridotites. The high temperature magmas at the base of the continental crust caused an extended melting into high grade meta-pelites (kinzigites). As a consequence the continental crust was interested by a widespread calc-alkaline magmatic activity testified by the emplacement of mafic to intermediate dikes, "Graniti dei Laghi" plutons, acid sub-volcanic complexes and acid dikes.

The pegmatite dike enclosed into the boulder shows an asymmetrical zoned structure composed by 4 main units: 1) fine grained granodiorite; 2) megacryst plagioclase zone (blocky albite); 3) plagioclase+quartz graphic zone containing schorl and minor K- feldspar; 4) quartz core with muscovite, garnet, phosphate masses and accessories (ferrocolumbite, uraninite, zircon). The most abundant accessories are represented by phosphates gathered in elongated masses.

Backscattered electron images of "graftonite" polished sections evidenced the presence of a great number of micro granules (from 50 to 100 μm in size) different in composition from the phosphate ground mass. Micro granules are scattered and randomly oriented into the ground mass, only one of the studied samples showed a lamellar structure.

Chemical data show that graftonite represents the main primary phosphate forming the ground mass. The ground mass contains micro granules of triphylite, jahnsite-(CaMnFe), jahnsite-(CaMnMn), F-rich hydroxhylapatite, ludlamite, mitridatite, vivianite and ferrohagendorfite.

Chemical composition of graftonite is near to the Fe end-member of graftonite-beusite series with high content of CaO (10.59-12.50 wt %) (Tab. 1). The other identified primary phosphates (i.e. triphylite) represent a low fraction (5-10%) of the total phosphate mass.

Jahnsite-(CaMnFe) can substitute big portions of graftonite-triphylite masses and vivianite originates intergranular films or little nodules at the border of graftonite-jahnsite-(CaMnFe). Mitridatite is very rare and present as micro granules with F- rich hydroxhylapatite and jahnsite-(CaMnFe). Likely mitridatite represents a medium to low temperature hydrothermal transformation of Jahnsite-(CaMnFe) due to Ca supply from pegmatitic fluids (Tab. 1). Moreover, hydrothermal activity is indicated by the presence of secondary phosphates crystals filling micro cavities (Weiss et al., 2004) and medium to low temperature phases in the phosphate masses.

The hydrothermal activity caused pervasive metasomatism from primary to secondary phosphates with the transformation of phosphate masses into polycrystalline structures as observed on thin sections.

From literature data and our investigations we can say that the rare element granitic pegmatites from Brissago are of the beryl, columbite and phosphates subtype and belong to the LCT petrogenetic family. The high Ca and Fe content and the high Fe /(Fe+Mn) ratio in primary phosphates and associated garnets, combined with low contents of Li in the most abundant accessories, suggest an anatectic environment as melt source (ČERNÝ et al., 1998).

References

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