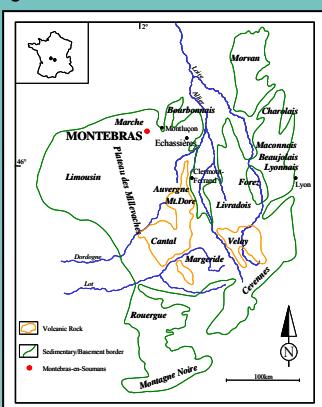


Alteration sequences of aluminium phosphates from Montebras Pegmatite, Massif Central, France

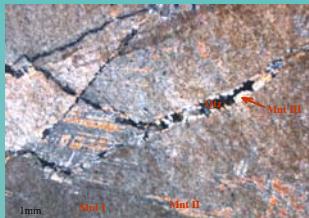
C.PIRARD^{1,2}, F.HATERT¹ & A.-M. FRANSOLET¹

Introduction

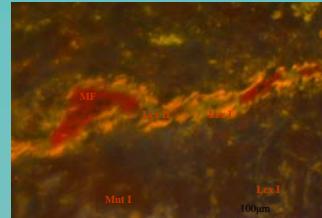
Historic samples from the famous Montebras pegmatite have been investigated to establish alteration sequences of minerals from amblygonite-montebrasite series. Four stages have been identified so far, with their own chemical and mineralogical features.



Schematic map of Massif Central (Aubert, 1969)



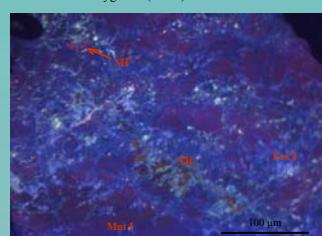
Primary (Mnt I) and secondary (Mnt II) amblygonite are shown with tardive veins of montebrasite (Mnt III)



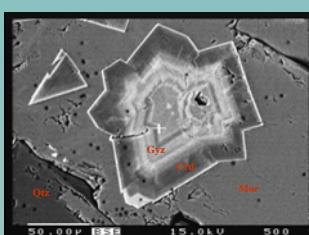
Vein of lacroixite (Lex I and Lex II) and mineral F (MF) in an altered amblygonite (Mnt I)



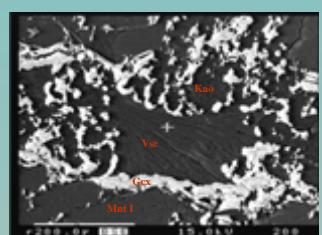
Destabilization of morinite (Mor) in fluorapatite (Fap)



Vivianite (Vit) patches in altered amblygonite (Mnt I)

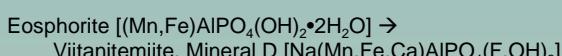
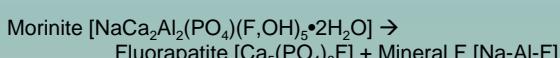


Zoned crystal of crandallite (Crd) and goyazite (Gyz) in morinite (Mor)

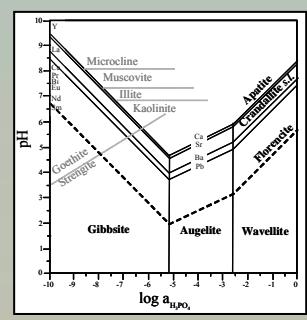
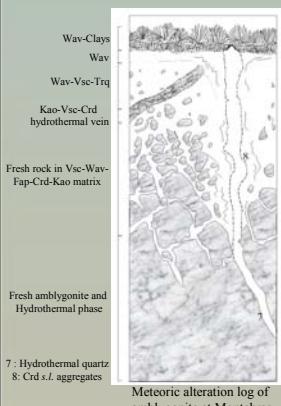
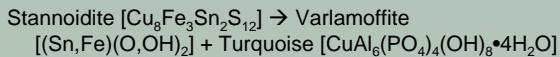
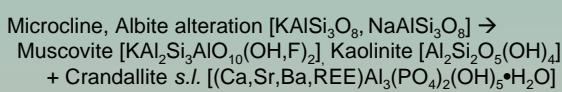


Gorceixite (Gcx) aggregates in a vein of variscite (Vsc) and kaolinite (Kao) through amblygonite (Mnt I)

Metasomatic reactions



Hydrothermal reactions



pH and a_{LiAlPO_4} conditions for some hydrothermal minerals (Schwab *et al.* 1996 Dill *et al.* 1991, Stofregen & Alpers, 1987, Correia-Neves *et al.* 1987)

	magmatic	metasomatic/greisen	LT hydrothermal	deep water	meteoric water
Amblygonite I	—	—	—	—	—
Triplite	—	—	—	—	—
Amblygonite II	—	—	—	—	—
Quartz	—	—	—	—	—
Muscovite	—	—	—	—	—
Eosphorite	—	—	—	—	—
Lacroixite	—	—	—	—	—
Fluorapatite	—	—	—	—	—
Montebrasite III	—	—	—	—	—
Mineral D	—	—	—	—	—
Morinite	—	—	—	—	—
Wardite	—	—	—	—	—
Viananitemiite	—	—	—	—	—
Mineral F	—	—	—	—	—
Stannoidite	—	—	—	—	—
Chalcopyrite	—	—	—	—	—
Tantelite	—	—	—	—	—
Hübnerite	—	—	—	—	—
Cassiterite	—	—	—	—	—
Kaolinite	—	—	—	—	—
Crandallite	—	—	—	—	—
Goyazite	—	—	—	—	—
Gorceixite	—	—	—	—	—
Turquoise	—	—	—	—	—
Varlamoffite	—	—	—	—	—
Ixiolite	—	—	—	—	—
Variscite	—	—	—	—	—
Wavellite	—	—	—	—	—

Mass-balance In phosphates

Alteration sequences and mineral succession in amblygonite bearing pods of Montebras Pegmatite.

Conclusions

- Alteration products of amblygonite-montebrasite are numerous and often confined to particular conditions
- Primary minerals are mainly lithium aluminium phosphates with very high F-content (e.g. $\text{Amb}_{87}\text{Mnt}_{13}$) .
- Metasomatic minerals are characterized by $\text{F} \leftrightarrow \text{OH}$, $\text{Li} \leftrightarrow \text{Na}$ substitution and then enrichment in Na, Ca and Mn.
- Late hydrothermal alteration free ions from previous mineral phases to form Ca, Sr, Ba, REE or Cu phosphates.
- Meteoric stage enters in that trend but leaching and hydration are predominant processes.

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