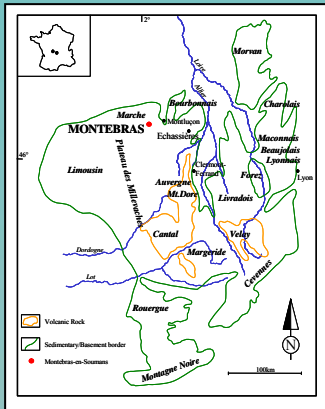


C. PIRARD^{1,2}, F. HATERT¹ & A.-M. FRANSOLET¹

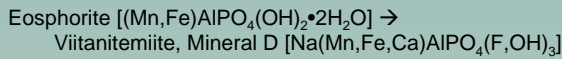
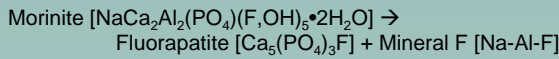
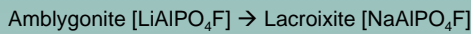
Introduction

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

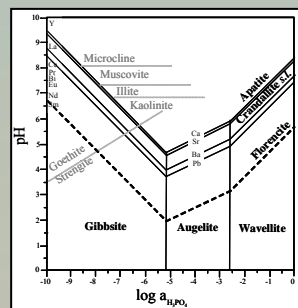
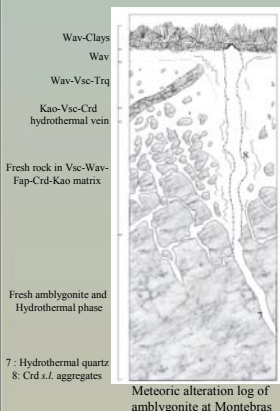
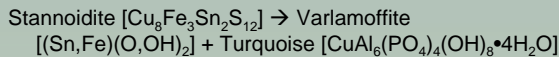
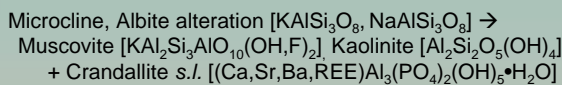


Schematic map of Massif Central (Aubert, 1969)

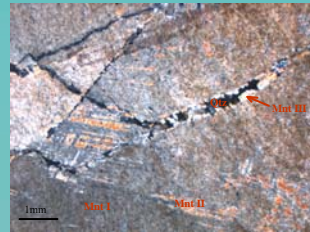
Metasomatic reactions



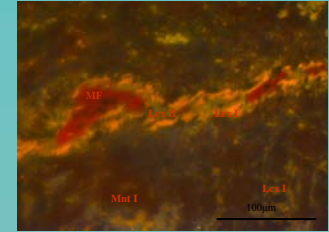
Hydrothermal reactions



pH and a_{H_2O} conditions for some hydrothermal minerals (Schwab *et al.* 1996 Dill *et al.* 1991, Stoffregen & Alpers, 1987, Correia-Neves *et al.* 1987)



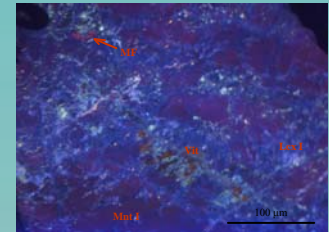
Primary (Mnt I) and secondary (Mnt II) ambygonite are shown with tardive veins of montebbrasite (Mnt III)



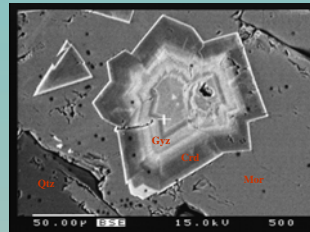
Vein of lacroixite (Lcx I and II) and mineral F (MF) in an altered ambygonite (Mnt I)



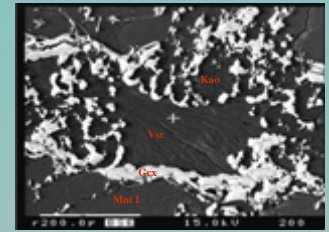
Destabilization of morinite (Mor) in fluorapatite (Fap)



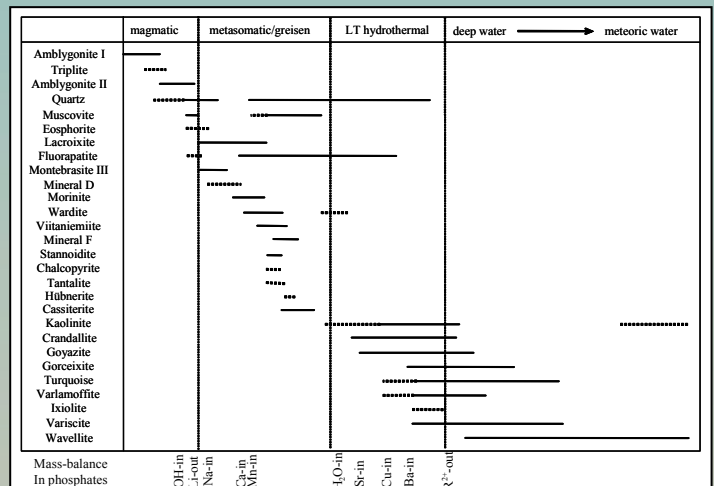
Vitaniemiite (Vit) patches in altered ambygonite (Mnt I)



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



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



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

Conclusions

- Alteration products of ambygonite-montebbrasite are numerous and often confined to particular conditions
- Primary minerals are mainly lithium aluminium phosphates with very high F-content (e.g. Amb₈₇Mnt₁₃)
- Metasomatic minerals are characterized by F ↔ OH, Li ↔ 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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