Composition of Ba-Cl-rich micas and other uncommon phases related to metasomatism of garnet pyroxenite

(Gföhl Unit of the Moldanubian Domain, Bohemian Massif)

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This presentation participates in OSPP

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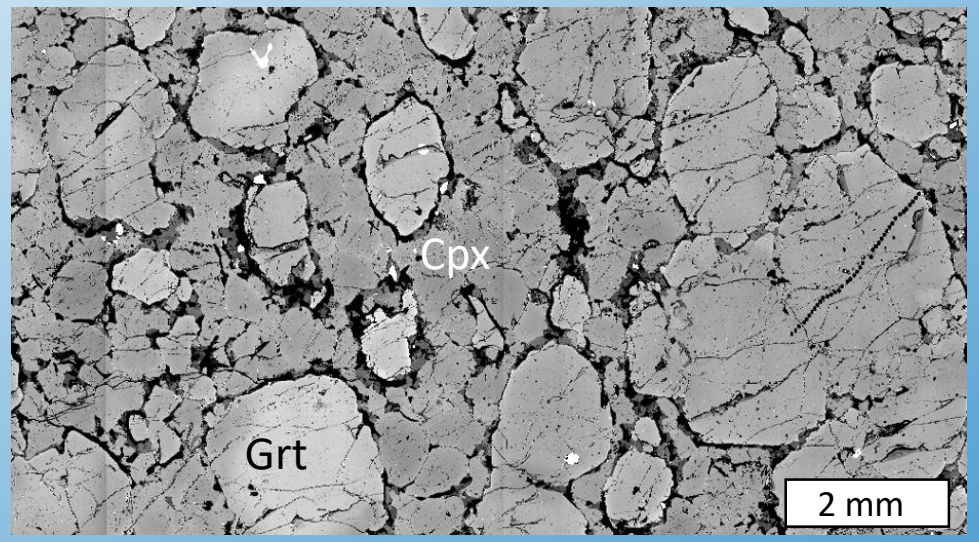
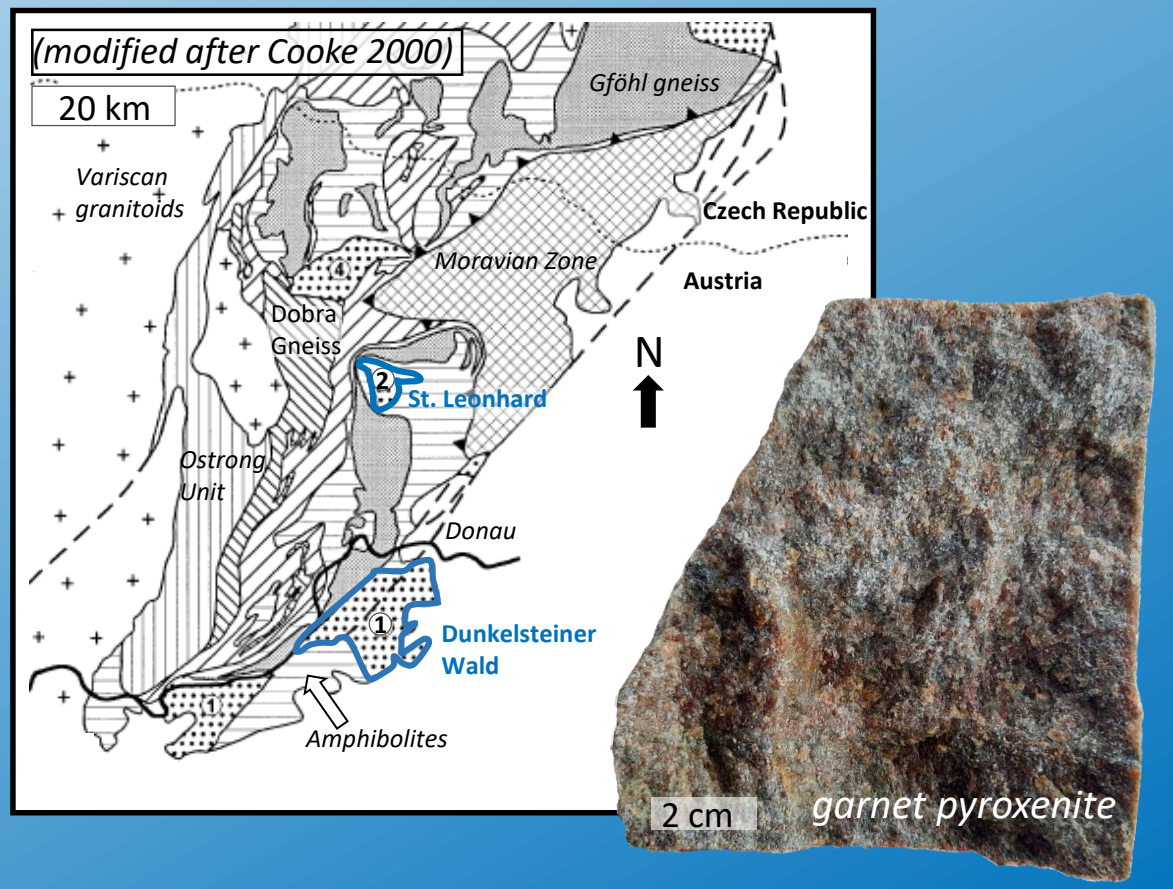
Studied samples

- Garnet pyroxenites from granulite massifs St. Leonhard and Dunkelsteiner Wald

⇨ Tectonically incorporated fragments of the upper mantle into the crust during the Variscan orogenesis

Mineral assemblage: Grt-Cpx-Opx (Pl-Sp-Spr)





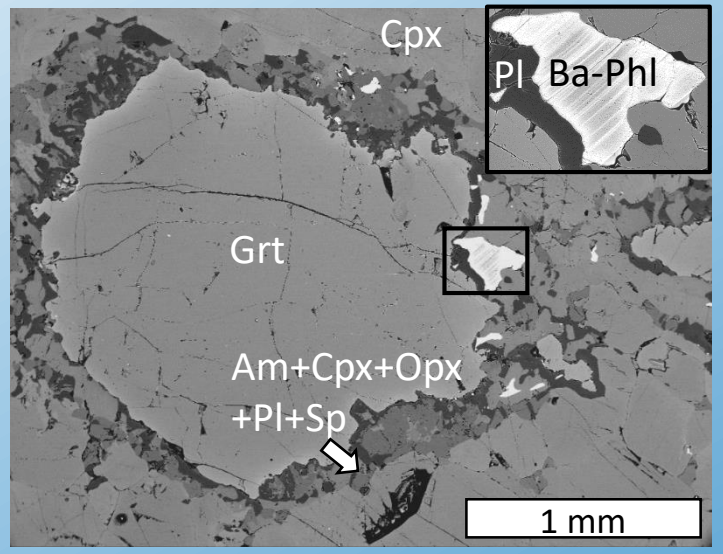
Ba-Cl rich micas

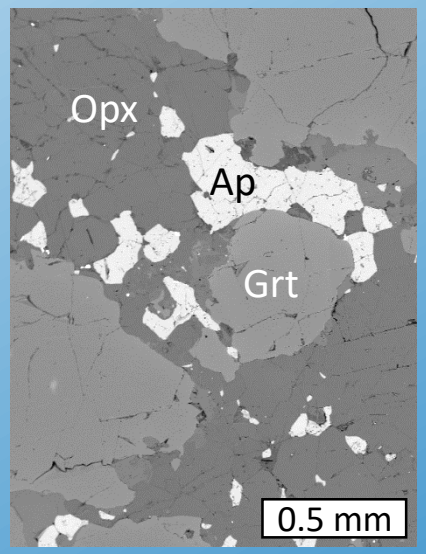
- **(Ba)-phlogopite** – $(K,Ba)(FeMg)_3(AlSi_3O_{10})(OH,F)_2$ - *(Ba-Phl) prevails in the matrix*
- **Chloroferrokinoshitalite** - $(Ba,K)(Fe,Mg)_3(Al_2Si_2O_{10})(Cl,OH,F)_2$
- **Oxykinoshitalite** - $(Ba,K)(Mg,Ti,Fe)_3((Si,Al)_4O_{10})(O,OH,F)_2$

} *(Kns) prevail is polyphase inclusions in garnets*

Micas is the matrix

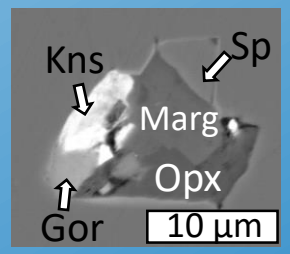
- Associated with hydroxyapatite with low Cl content and occasionally with celsian

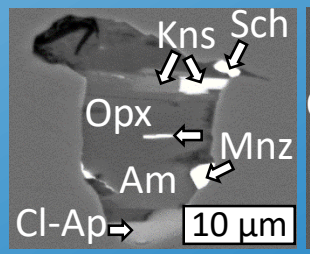


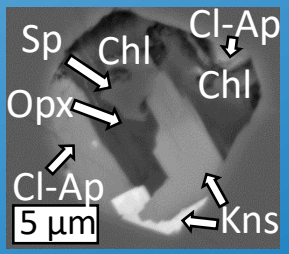


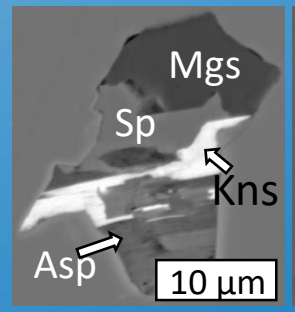
Micas is polyphase inclusions in garnets

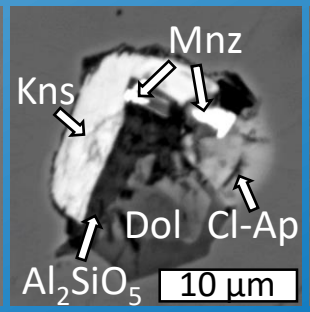
- with: **carbonates** , Cl-Ap (1.4-7.3 wt% Cl), Spl, Am, Opx, Cpx
- Less common phases: margarite, aspidolite, scheelite, cordierite, scapolite, norsethite, Al_2SiO_5
- Rare phase: goryainovite $(Ca2(PO_4)Cl)$

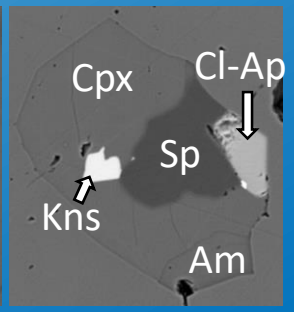




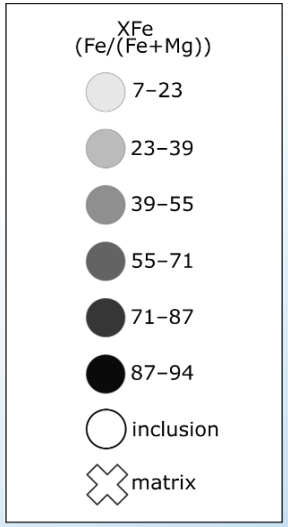




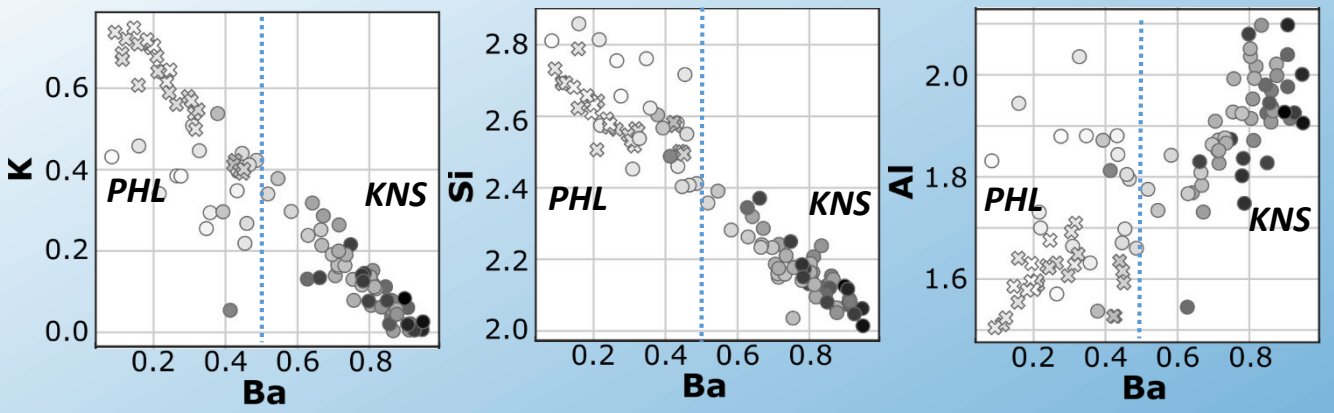




Key findings



- **Substitution:** $Ba_1Al_1K_{-1}Si_{-1}$ links phlogopite and kinoshitalite

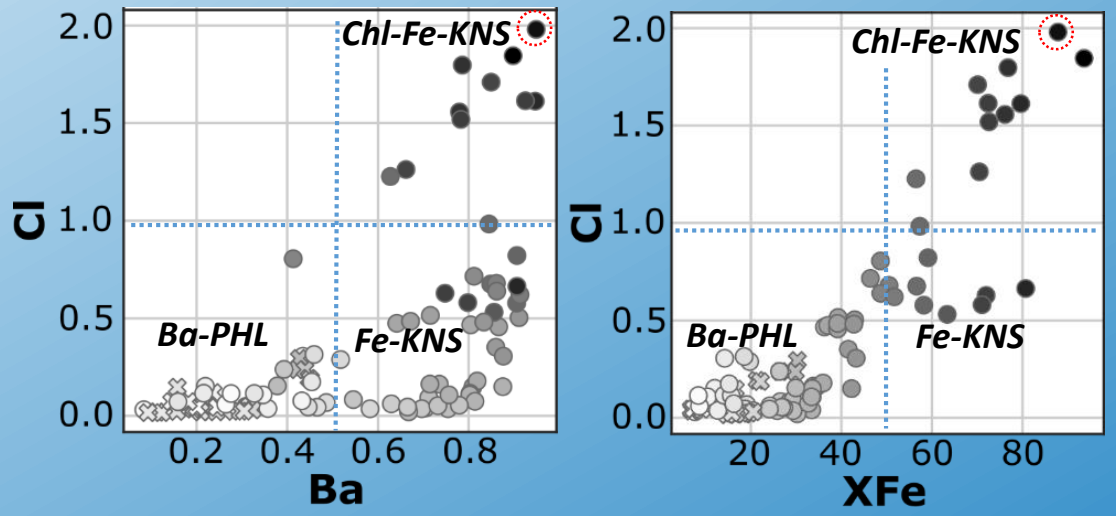


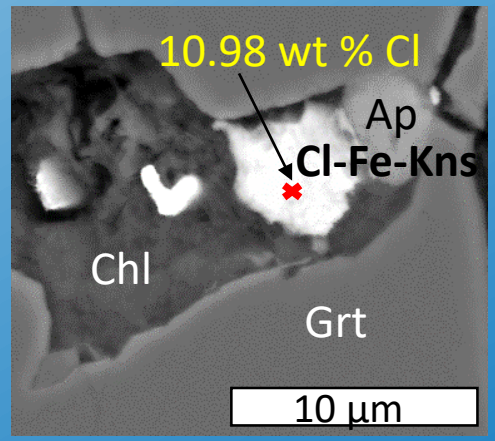
$Ba_1Al_1K_{-1}Si_{-1}$

phlogopite **K**$Mg_3(Si_3Al)O_{10}(F,OH)_2$

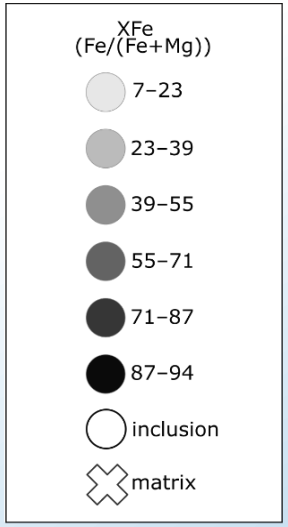
kinoshitalite **(Ba,K)**$(Mg,Mn,Al)_3(Al_2Si_2O_{10})OH_2$

- Possitive correlation of **Cl** with **Ba** and with the **XFe** ratio (Fe/(Fe+Mg)) mica with 10.98 wt % classified as Chloroferrokinoshitalite ⇨ **possibly one of the most Cl rich micas yet described**





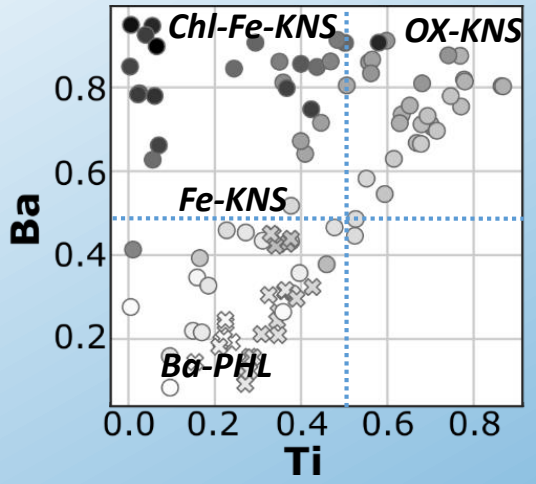
Key findings

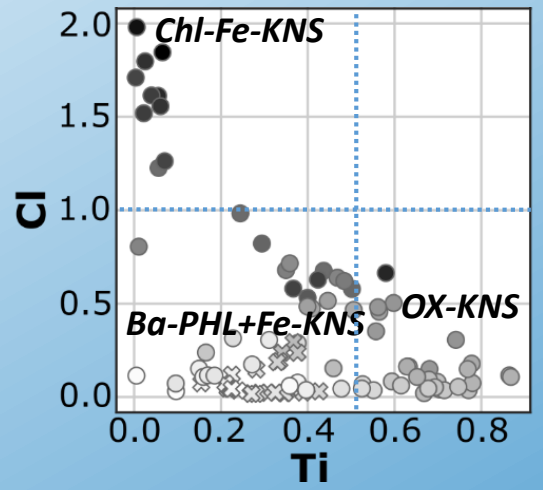


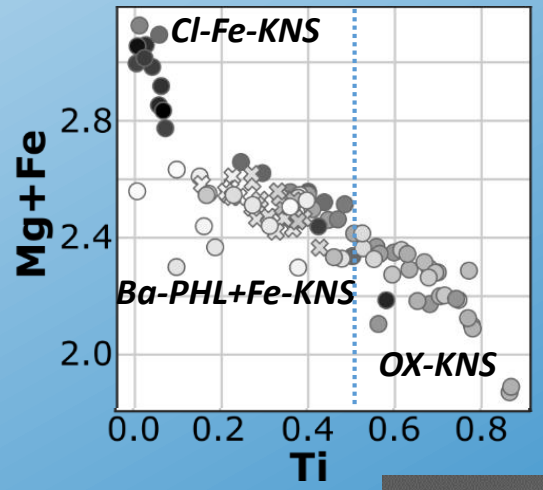
- **Positive correlation of Ti** with **Ba** and negative with **Cl** and **Mg+Fe**:

⇨ **Ti** is incorporated into the mica crystal lattice in coordination with O ($Ti_1O_2(Mg,Fe)_{-1}(OH)_{-2}$)

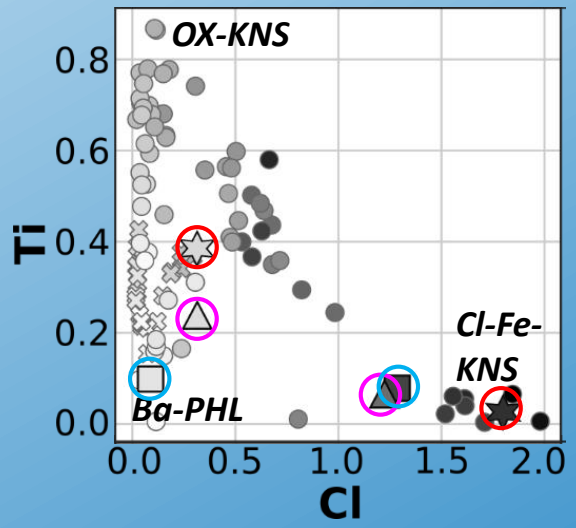
⇨ **formation of *oxykinoshitalite*** - $(Ba,K)(Mg,Ti,Fe)_3((Si,Al)_4O_{10})(O,OH,F)_2$

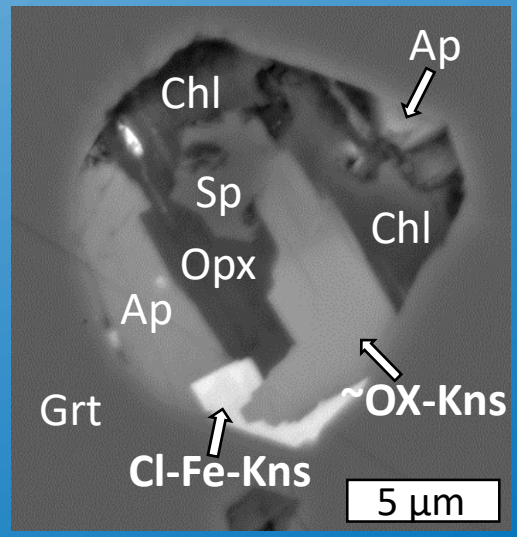






- Two diferent micas in one inclusion: immiscibility exists between the compositional trends of chloroferrokinoshitalite with oxykinoshitalite and Ba-phlogopite





Conclusions

Origin of Ba, Cl, and K-rich phases in garnet pyroxenites:

1) result of a fluid influx from crustal material during subduction or exhumation processes - *preffered*

or 2) previous mantle metasomatism

- The presence of almost pure Cl mica and Cl apatite endmembers and goryainovite together with carbonates
  ⇨ ***extremely high activity of Cl and CO_2 in the metasomatizing fluid***

- **XFe** can be the crucial factor controlling the ability of mica to incorporate Cl into its crystal lattice

References

- Cooke, R. A. (2000). High-pressure/temperature metamorphism in the St. Leonhard Granulite Massif, Austria: evidence from intermediate pyroxene-bearing granulites. *International Journal of Earth Sciences*, *89*(3), 631–651. https://doi.org/10.1007/s005310000123