

Excess Fluorine at Boliden AS

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- Fluorine enters the process mainly through the Zinc Oxide clinker at the direct leaching step, and loops further into the other processes.
- As a first step, precipitates from the neutral leaching thickener (Dorr 1) were analysed

- XRD and EMPA analyses on precipitate from Dorr1 show main phases:

Franklinite, $\text{ZnFe(III)}_2\text{O}_4$ (spinel)

Zincite, ZnO

Beaverite, $\text{Pb(Fe}^{3+}, \text{Cu}^{2+}, \text{Al)}_3 (\text{SO}_4)_2 (\text{OH})_6$ (resembling jarosite)

Sphalerite, $\text{Zn}_{0.81}\text{Fe(II)}_{0.19}\text{S}$ (zink ore)

Minor phases:

Goetite, Fe(III)OOH

Willemite, Zn_2SiO_4

Pseudobrookite, Fe(III)AlTiO_5

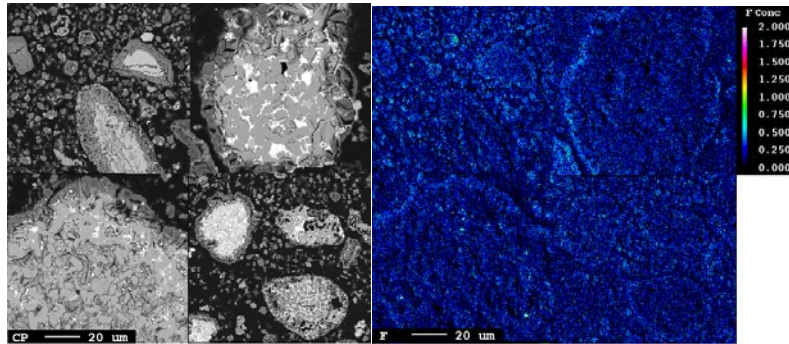
Anglesite, PbSO_4

Zink stannate, Zn_2SnO_4

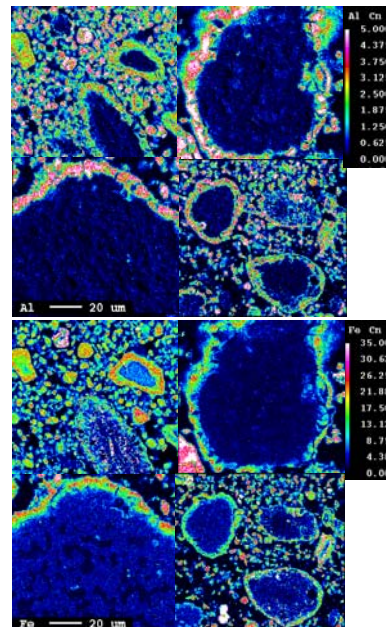
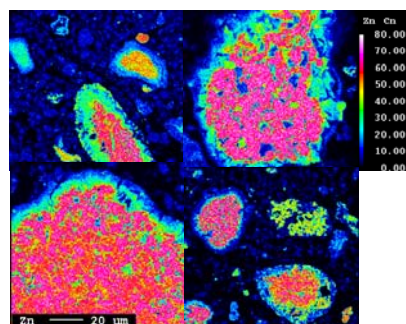
Silica phases

No obvious F scavengers.

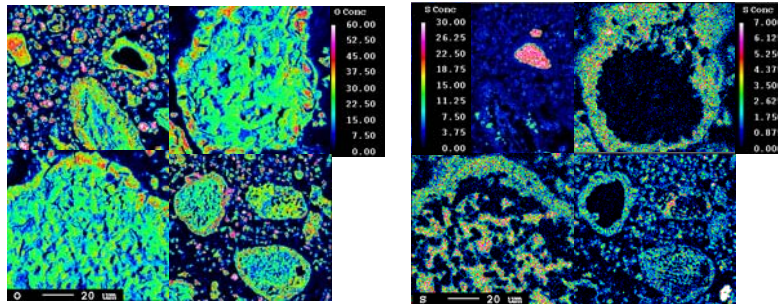
- Element mapping on precipitate extracted from Dorr1:
- F concentration < 1 atom%
- Fluorine is slightly associated with precipitated Fe and Al, but rather evenly distributed throughout the precipitate
- Adsorbed rather than existing as compounds?



- Element mapping on major cation elements Zn – Fe - Al
- Large grains consist of unreacted zinc concentrate, partly reacted with Al and Fe on the surfaces : "jarosite"
- Small-sized participate mainly contains Al/Fe - precipitated jarosite.



- Anion distribution on the precipitates:
- One grain of unreacted ZnS core spotted
- Other large grains mainly ZnO



- Precipitate F as CaF_2 by adding $\text{Al}_2(\text{SO}_4)_3$ is not feasible due to the high Al - levels

Concentration of
 $\text{HF} + \text{F}^-$ (aq)
 Al^{3+} (aq)
 AlF_3 (s)
 at 80°C as function of
 added amount of $\text{Al}_2(\text{SO}_4)_3$
 to a solution of 1000g H_2O
 + 50g H_2SO_4 + 296g
 ZnSO_4 + 0.97g NaF.

