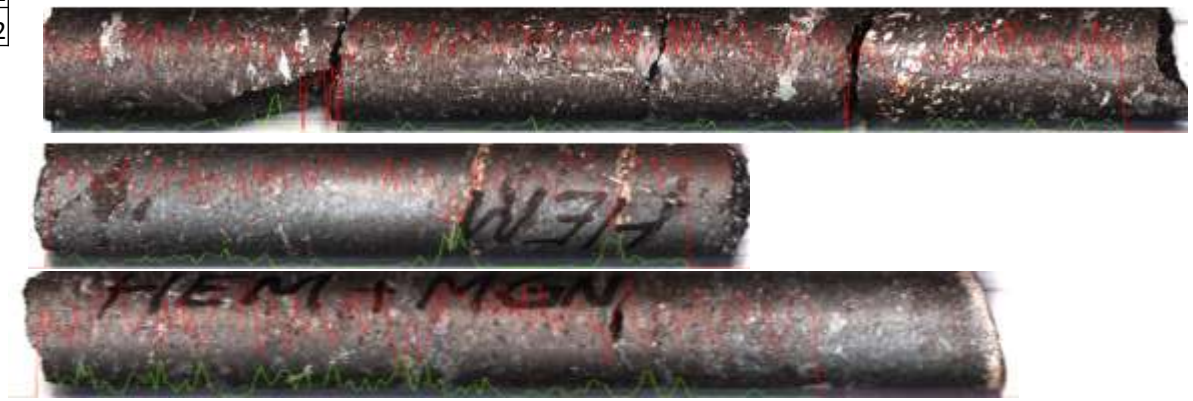
Application note on Fe ore – content, distribution and phase analysis

elements	concentrations (%)
Al2O3	8.2
SiO2	6.0
P2O5	7.0
S	0.17
Cl	0.09
K2O	0.065
CaO	6.0
TiO2	0.31
V	0.098
MnO	0.010
Fe2O3	68.5
Ni	0.009
Zn	0.006
Sr	0.015
Y	0.011
Zr	0.002

Table 1

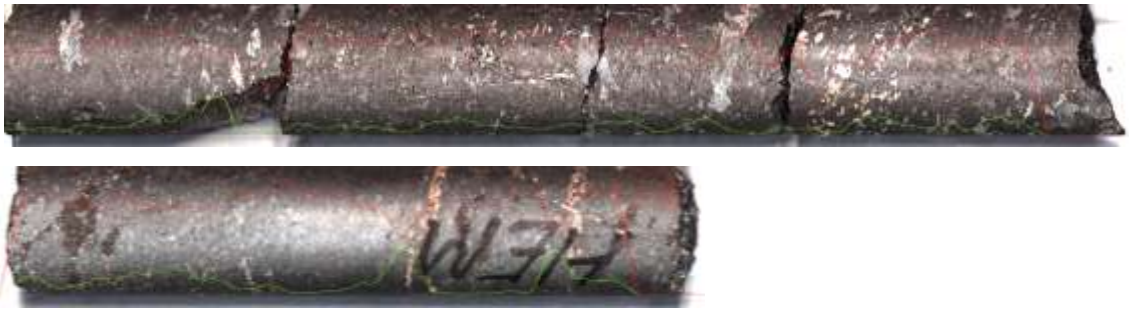
The data-set recorded from cores (from LKAB) taken from the iron rich area at Malmberget, Sweden provides an excellent example how the Itrax scanner operates. The scanner quickly provides average concentrations for a large number of elements (see table 1) over the core. Moreover, it records the concentrations of elements, down to trace amounts, at a large number of points over the entire core lengths. In this way the concentration profiles over the core can be visualized superimposed of the high resolution image taken during the scan. Due to the high speed recording of XRF data (Itrax scanner can record up to 1.600 000 cps and spends only 1 second/point) large number of data points can be recorded with just a few minutes. The time to scan one meter is two minutes. By using elemental correlation analysis it is also possible to relate various elements to each other and thus identify mineral phases.

In this case we scanned three sections of cores, one of Magnetite (top), one of Hematite (middle and one mixed (bottom). The variation along the cores is displayed as graphs superimposed on the cores in the figure below.

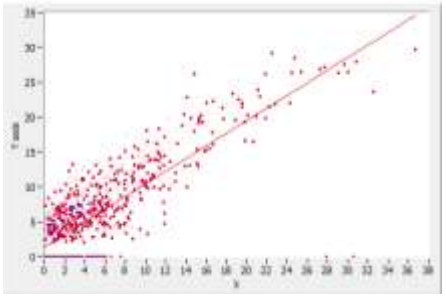


The elemental profile of Ca (green) and Fe (red) along the three core sections core in 1 mm resolution.

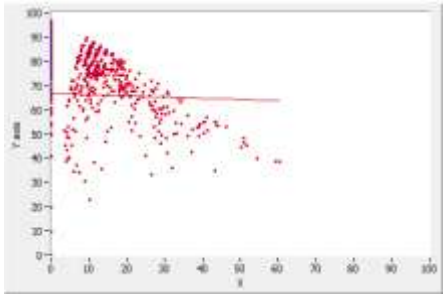
The Fe_2O_3 concentrations (note; all Fe conc. is given as Fe_2O_3) varied from maximum 80% down to 50% and sometimes even below that, while the Ca profile seems to counter-match that variation. There is a strong correlation between Ca and P indicating that they belong to the same mineral phase. The elemental ratio between P/Ca is close to the stochiometric value for Apatite, while it's reasonable to assume that Apatite is the dominating mineral phase besides the Fe_2O_3. In Hematite (bottom) and the mixed sections these two minerals seems to add up quite well to almost 100%, but not in Magnetite (top) where Si is more prominent. Si seems to appear as SiO_2 as it adds up with Fe_2O_3 to 100% at several points (see correlation graph to the right). Y also seems to correlate with the Apatite but only in the Hematite – and the mixed section.



The variation of Apatite (green) and Fe2O3 (red) along the core in 5 mm resolution.

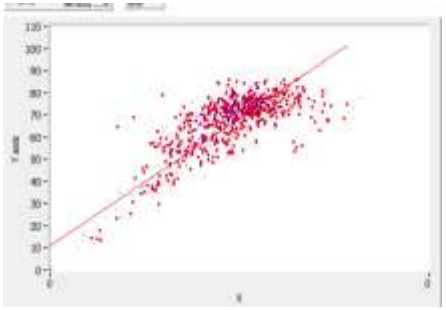


The Ca – P correlation



The Fe_2O_3 – SiO_2 correlation

It is clear that V correlates to Fe, or at least some sub-fraction of Fe_2O_3, according to the correlation diagram to the right. The same characteristic is shown by S, which is nowhere higher then 0.75% of Fe_2O_3 concentration. None of the other elements analysed (about 25) showed any distinct correlation or any indication of other mineral phases.



The Fe – V correlation

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