

Dust Solubility

with Decreasing pH and by Centrifugation Separation



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Introduction

To evaluate the potential bioavailability, elemental solubility of laboratory-produced Patagonian and Namibian dust was investigated by:

- 1) sequential leaching: MilliQ → pH 5 → pH3 → pH1
- 2) centrifugation separation, dissolved fraction operationally defined as <0.2 μm fraction.

Why using centrifugation:

Gimbert et al. (2005) found that centrifugation method retain more dissolved mass in colloidal size fraction than filtration method.

Conclusion

- 1. Centrifugation method obtain much higher %dFe than filtration method in our study and in literature, while less difference was found for Mn, Ca. The retention of element in colloidal phase by membrane filtration varies with elements.
- 2. Solubility of elements increases with decreasing pH.
- 3. The difference between centrifugation and filtration decrease under lower pH.
- 4. Calcium-rich dust, probably due to the presence of carbonate, showed higher solubility of Ba, Ca, K, Mn and Sr.

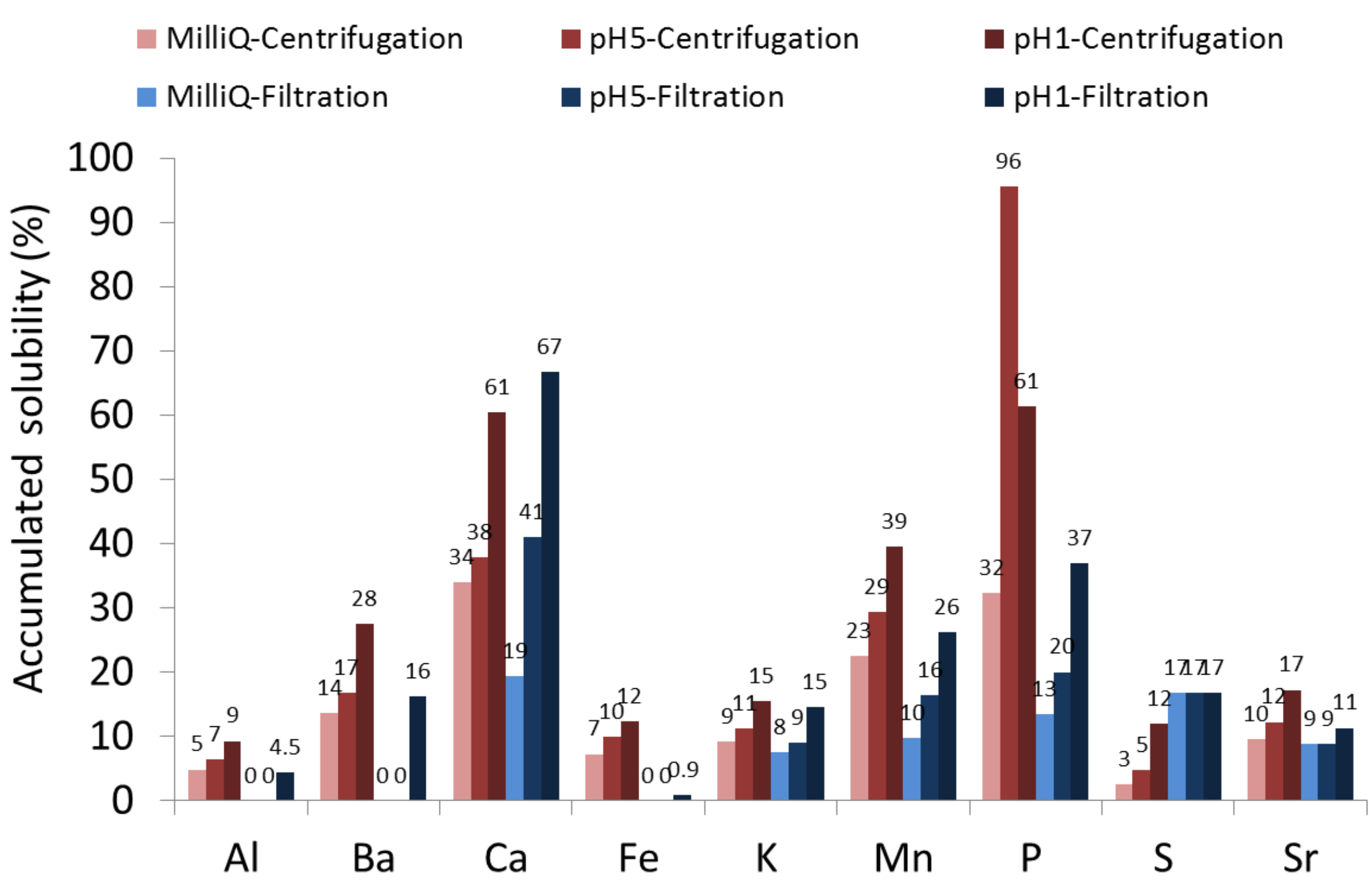


Fig.1 Centrifugation vs Membrane Filtration

- 1. %dFe (Centrifugation) >> %dFe (filtration method) & literature values,
- 2. Less difference of solubility for Ca, K, Mn, and Sr
- 3. Less difference of solubility under lower pH

Literature values for source dust (with filtration) :

Spokes and Jickells, 1995

Fe: 0.1% at pH8, 4.7% at pH2
Mn: 7.5% at pH8, 54% at pH2

Aghnatie et al., 2014

0.04% in MilliQ, 0.07% at PH5, 0.93% at pH1
1.1% in MilliQ, 2.6% at PH5, 22.7% at PH1

Fig.2 Effects of pH on solubility

Solubility of elements increases with decreasing pH

Geometric mean solubility:

Fe: 5.4% in MilliQ, 7.1% at pH5, 7.4% at pH3, 9.6% at pH1
Mn: 19% in MilliQ, 24% at pH5, 29% at pH3, 31% at pH1

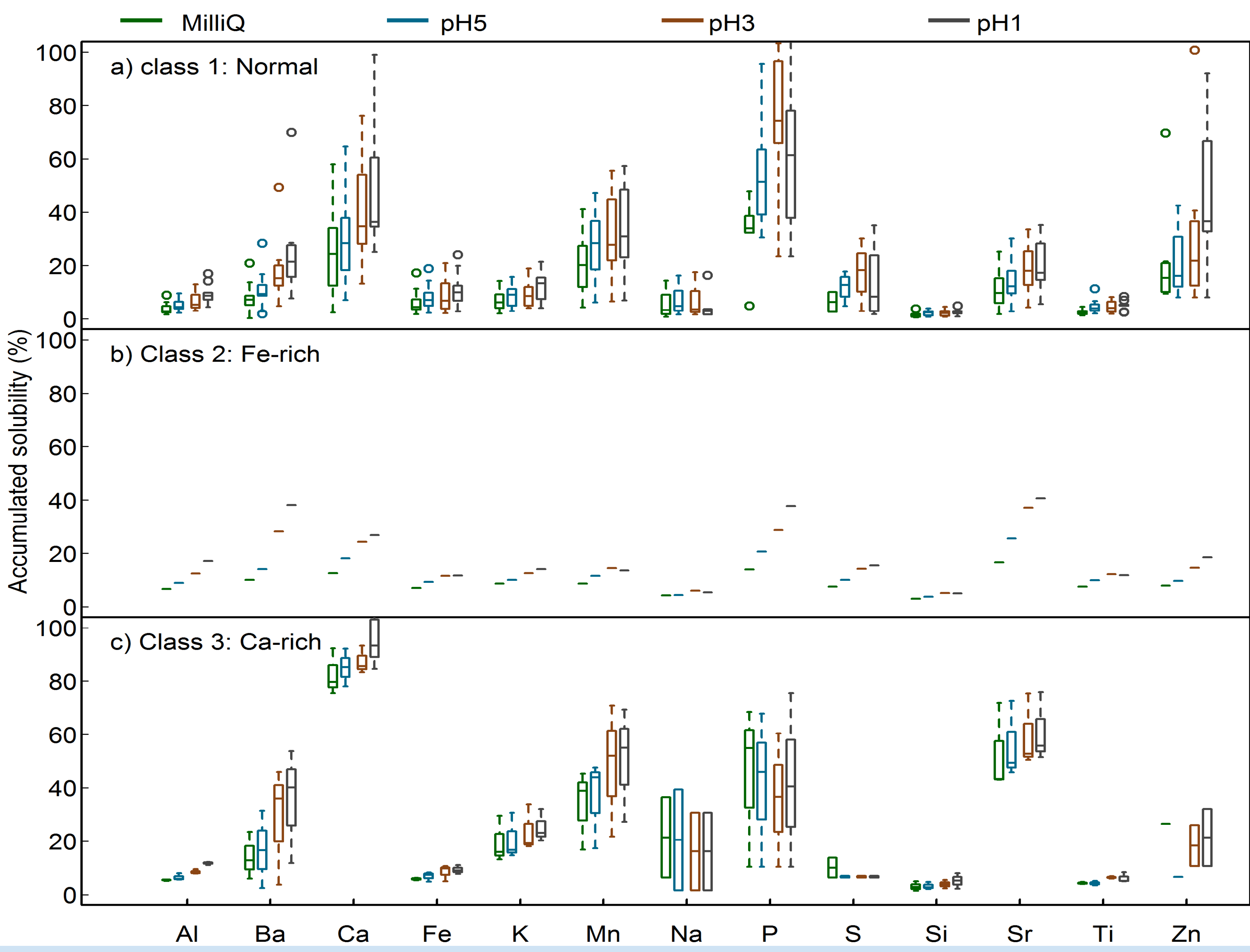


Fig.3 Solubility varies with dust type

Calcium-rich dust showed higher solubility of Ba, Ca, K, Mn and Sr

