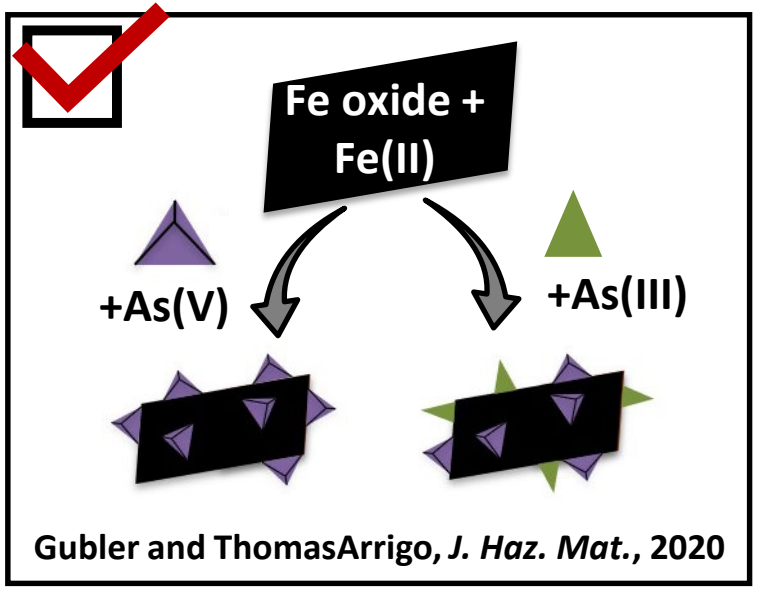
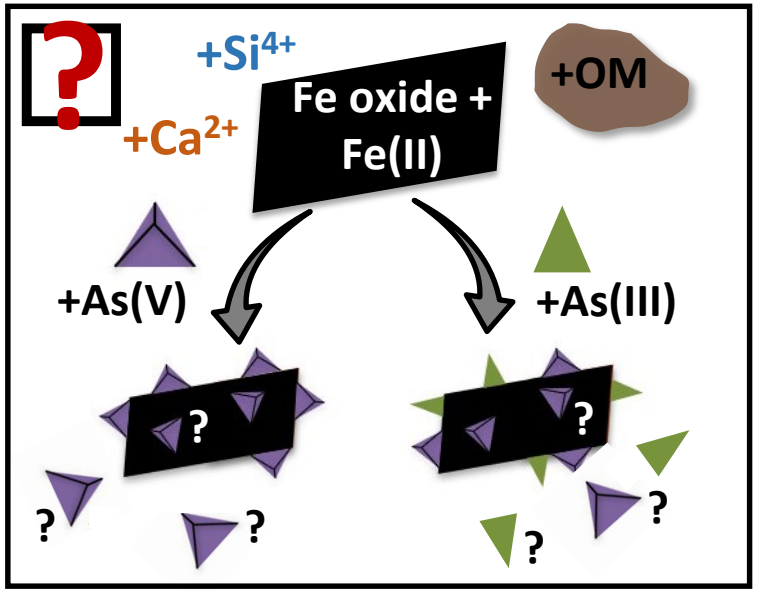
# Arsenic sorption onto Fe oxides: The impact of $Ca^{2+}$, $Si^{4+}$, and organic matter

MSc thesis with the Soil Chemistry Group




Gubler and ThomasArrigo, *J. Haz. Mat.*, 2020




## Background

Elevated concentrations of arsenic (As) affect the daily lives of millions of people worldwide, many of whom rely on As-contaminated ground- and surface-waters for drinking, cooking, and irrigation of crops. Because the sorption behavior of As changes with As redox speciation, the mobility and toxicity of As (as arsenate or arsenite) is greatly dependent on As biogeochemistry.

In anoxic aquifers, secondary Fe minerals (Fe oxides) support As sorption, leading to the removal of As from solution. However, under reducing conditions, the microbially-mediated reduction of Fe(III)-oxides also leads to dissolved ferrous Fe (Fe(II)) in solution. Recently, we showed that in systems comprising the Fe oxide magnetite (Mgt) and Fe(II), As sorption was enhanced compared to an Fe(II)-free system (Gubler and ThomasArrigo, *J. Haz. Mat.*, 2020). In addition, the presence of Fe(II) led to the oxidation of surface-adsorbed arsenite. These results suggest that Fe(II)+magnetite systems may be a viable pathway for long-term As sequestration in anoxic environments.

However, natural groundwaters also contain appreciable dissolved ionic species (e.g. $Ca^{2+}$, $Si^{4+}$) and organic matter. The impact that these additional species exert on As sorption and oxidation onto magnetite or other Fe oxides is unclear.

## The thesis project:

*Objectives:*

- **setup and conduct anoxic model studies involving synthetic Fe oxides, Fe(II), As, and ionic species (e.g. $Ca^{2+}$, $Si^{4+}$) or organic ligands (e.g. humic acid, polygalacturonic acid)**
- **measure concentrations and/or speciation of Fe, As, ionic species and C in liquid and solid phases**
- **evaluate data to investigate the influence of ionic species and/or organic matter on the sorption and oxidation of As onto magnetite**

*Approach:* With our help, you will define your target questions, plan and conduct appropriate laboratory experiments, and learn analytical techniques (e.g. X-ray diffraction, UV-vis, ICP-OES).

*Timing:* Spring/Summer/Fall 2021

*Interested in As sorption and mobility? Contact us!*

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