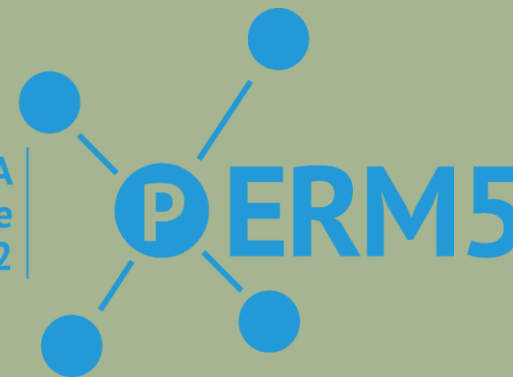


The influence of phosphate on Fe(II) catalyzed ferrihydrite transformation under oscillating redox condition

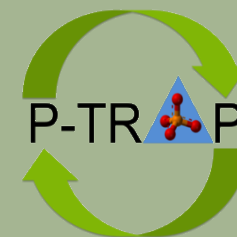
Xingyu Liu, University of Bayreuth, Germany

22.06.2022

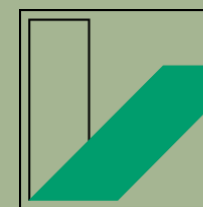
VIENNA
22 June
2022



Phosphorus
in Europe
Research
Meeting



Diffuse phosphorus input to surface waters
- new concepts in removal, recycling and management -



UNIVERSITÄT
BAYREUTH



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Background

Ferric (hydr)oxides (FHO) play a key role in controlling redox active species

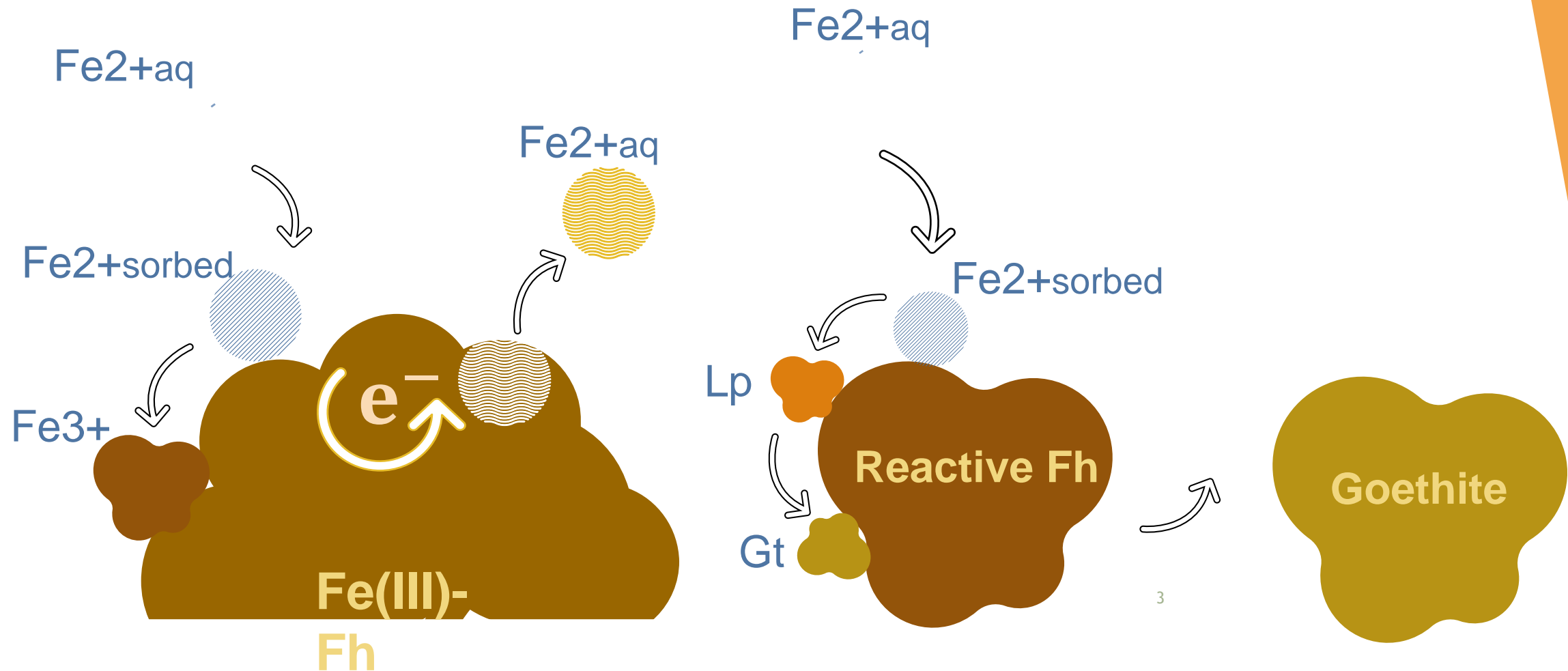
Dynamic environments experience repeated redox fluctuations

prominent effect of Fe on the mobility of nutrients and contaminants at hydrological interfaces

Fe²⁺ catalyzed Fh transformation

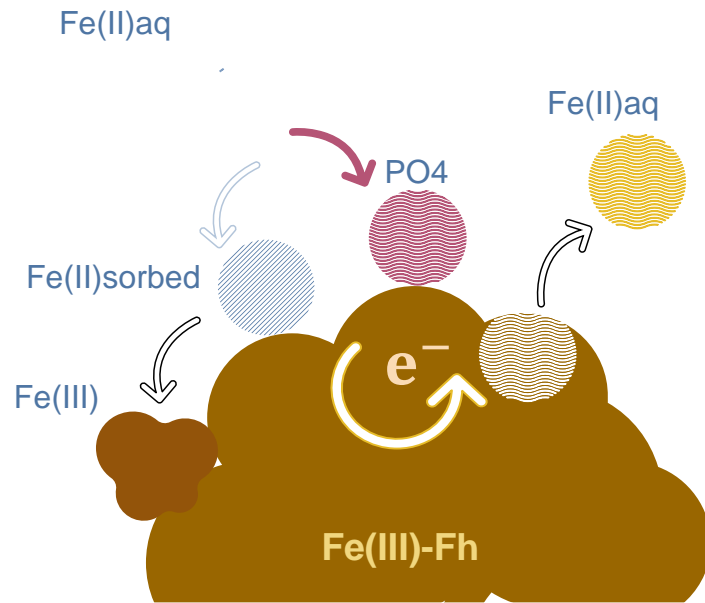
Transformation of Fh to more crystalline phase

electron transfer



Impact of PO₄ and redox oscillation

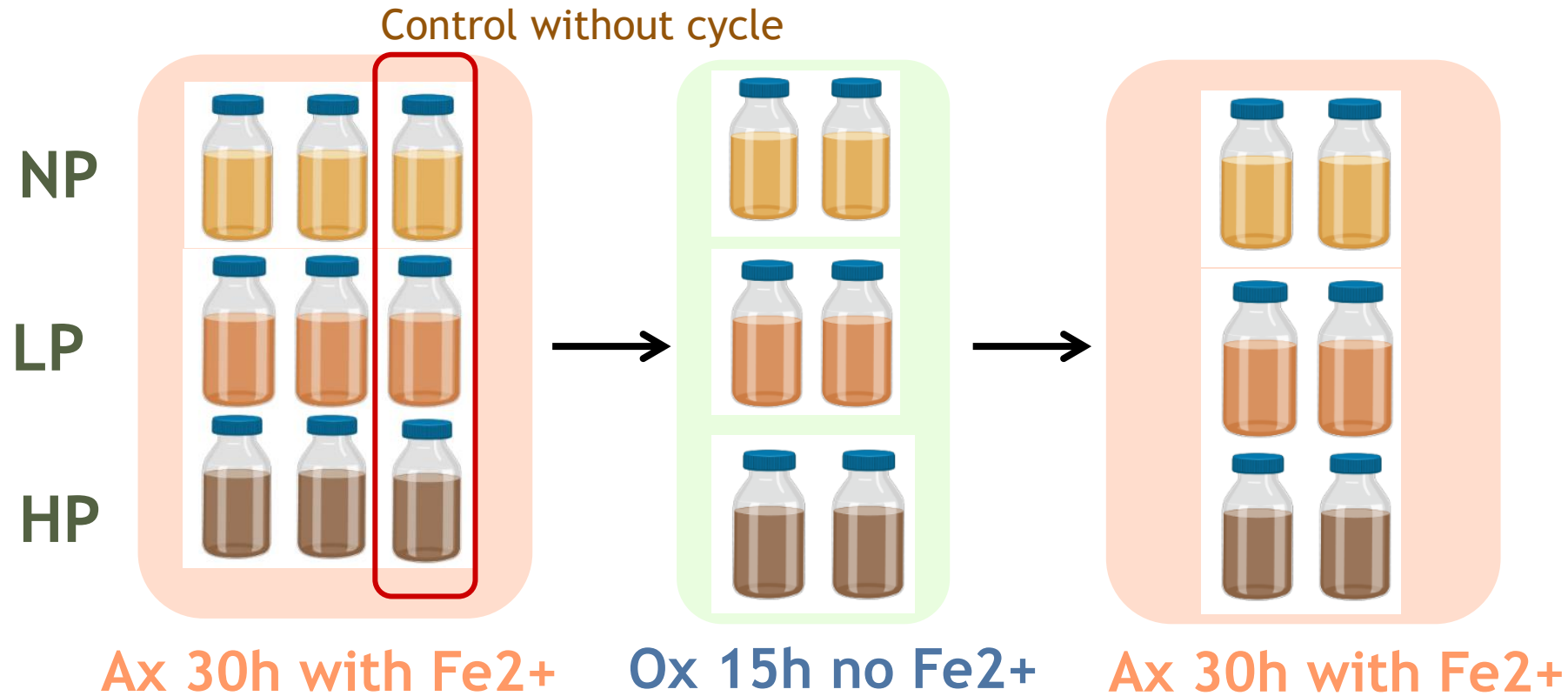
- Impact of PO₄ adsorption
 - Passivation of Fh surface
 - Decrease Fh dissolution rate
 - On Fe²⁺ catalyzed Fh transformation?






Objective:

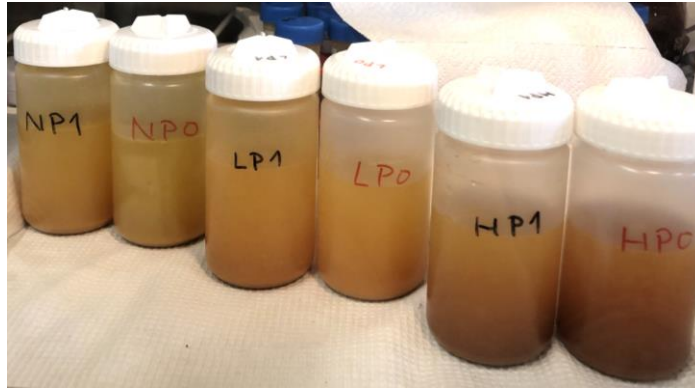
- investigate the influence of phosphate on Fe²⁺ catalyzed ferrihydrite transformation.
- determine the impact of fluctuating redox condition over 5 short redox cycles at two P concentrations

Experimental set up



- ❖ 200ml Fh suspension
- ❖ Fh: 25mM
- ❖ Fe²⁺: 1mM
- ❖ 0.1MKCl buffered in 10mM MOPS (pH 6.6)

-  Synthesized Fh by base titration
-  LP: 0.05mM, Fe/P= 500
-  HP: 0.5 mM P, Fe/P = 50



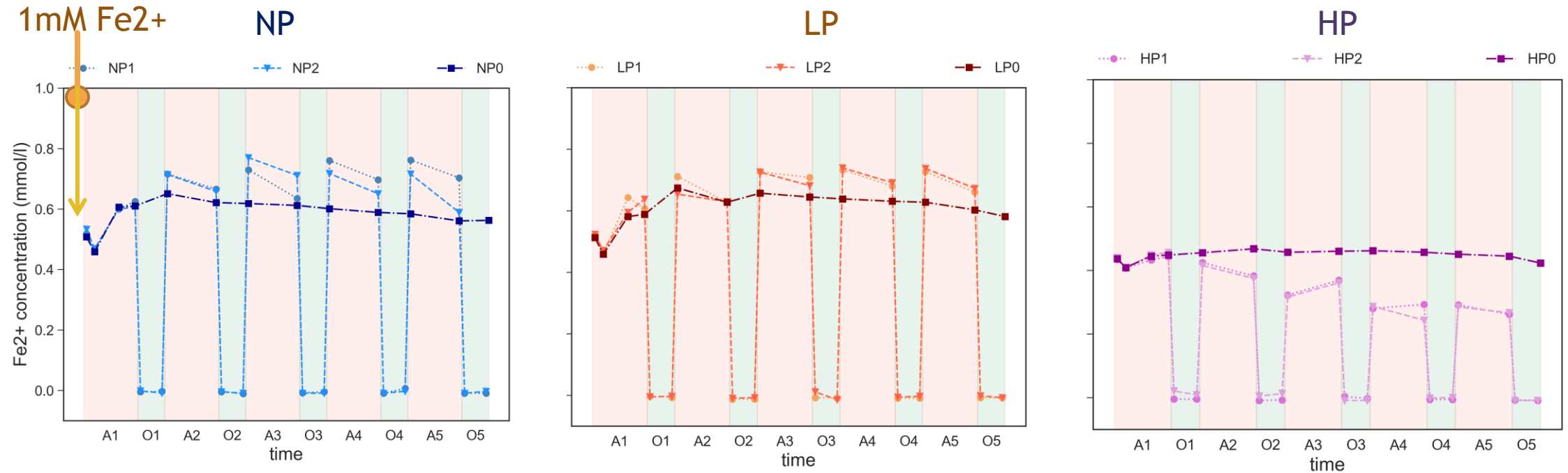
With cycle

control

Color development

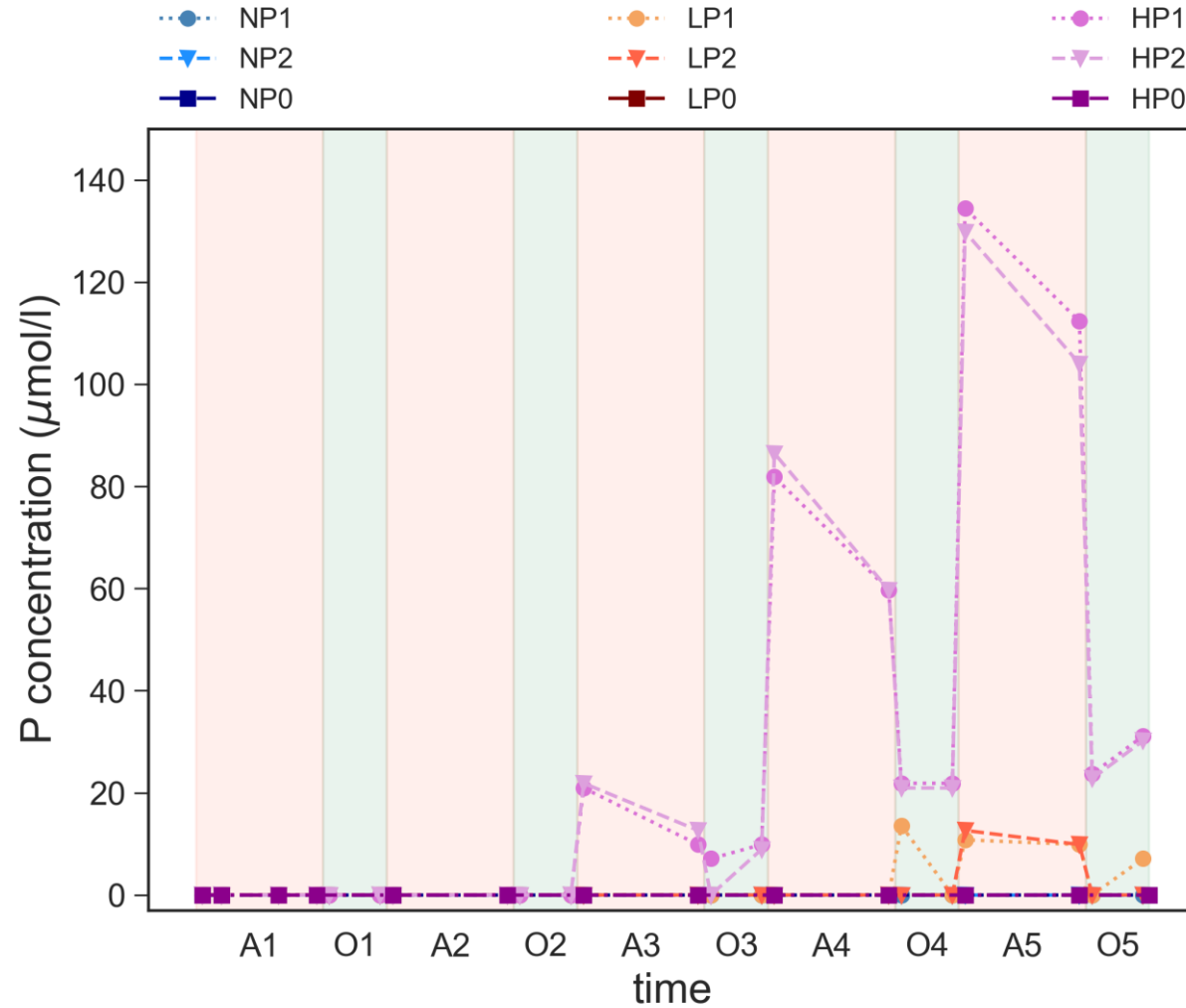
- Top left: start of Exp
- Top right: start of 2nd cycle
- Down: end of Exp

Temporal trends in aq. Fe²⁺



- ▶ Initial Fe²⁺ uptake by Fh (spiked Fe²⁺: 1mM)
- ▶ Rapid change of Fe²⁺ during first hours before reaching equilibrium
- ▶ Higher Fe²⁺ uptake in controls (NP, LP)
- ▶ HP: enhanced Fe²⁺ removal by redox cycles
 - ▶ Adsorption or precipitation?

Temporal trends in aq. P



▶ HP: 0.5 mM P

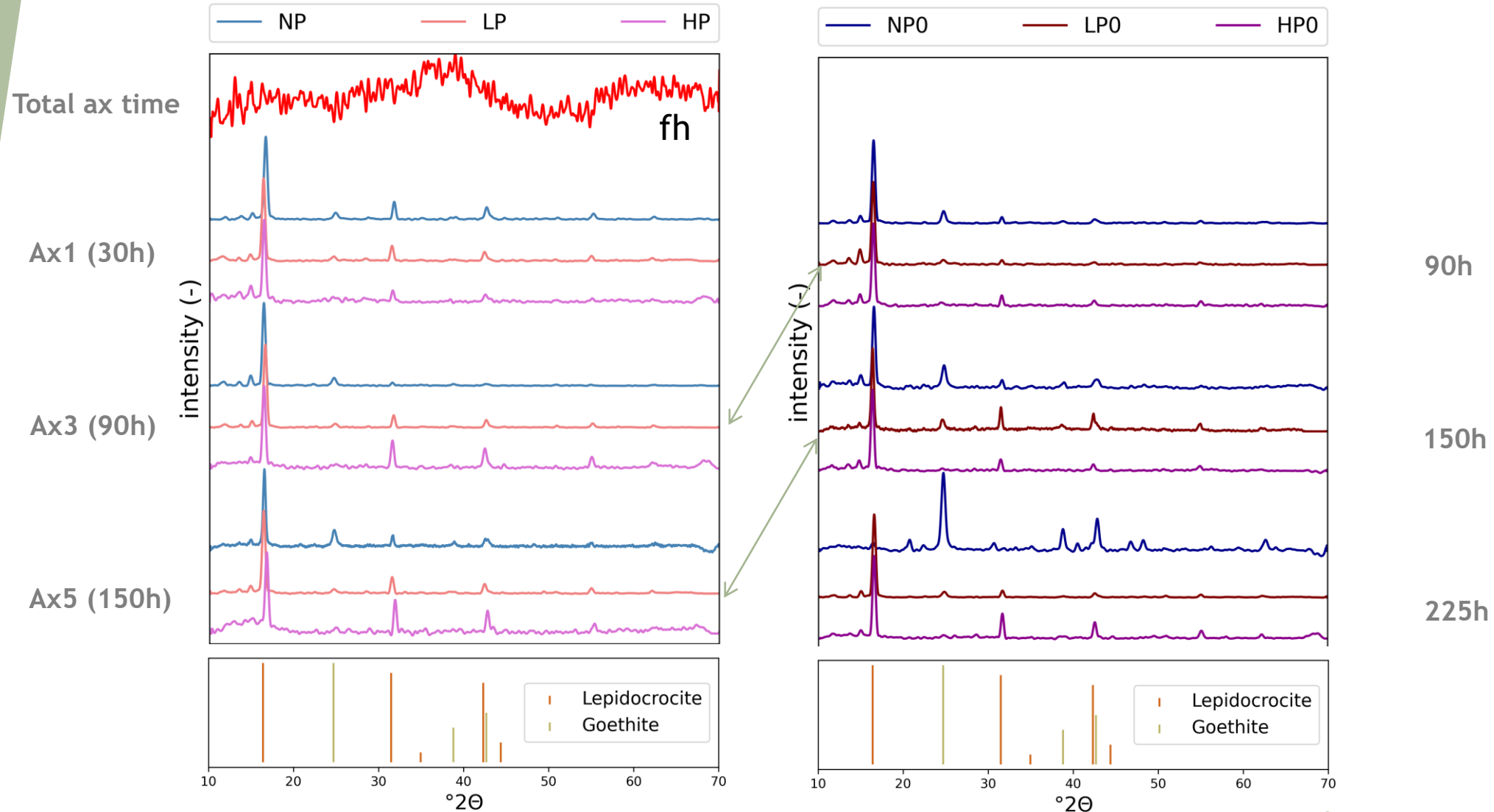
▶ LP: 0.05 mM P

• Confirm Mineral transformation

• Alter P and Fe^{2+} sorption

• Influence electron transfer

Evolution of mineral phases by Powder X-ray diffraction (XRD)



Summary



Adsorbed P limits the extent of ferrihydrite transformation



Redox fluctuations largely impede the transformation



Better understand biogeochemical cycling of Fe and P in redox active environments



Filter material for P-removal under anoxic condition

Thank you