

MOBILITA URANU V DŮLNÍCH VODÁCH A PŘEDPOKLÁDANÉ PŮSOBENÍ nZVI

Josef Zeman

Miroslav Černík, Irena Šupíková, Pavla Filipská

Minerály uranu

■ Koncentrace:

- v kůře 1–2 ppm
- v půdách 0,7–11 ppm
- v oceánské vodě 3 ppb

■ primární:

uraninit UO_2 , smolinec U_3O_8
($\text{UO}_3 \cdot \text{U}_2\text{O}_5$), coffinit $\text{U}(\text{SiO}_4)_{1-x}(\text{OH})_{4x}$

sekundární:

fosforečnany, vanadičnany,
křemičitany

■ oxidační stav:

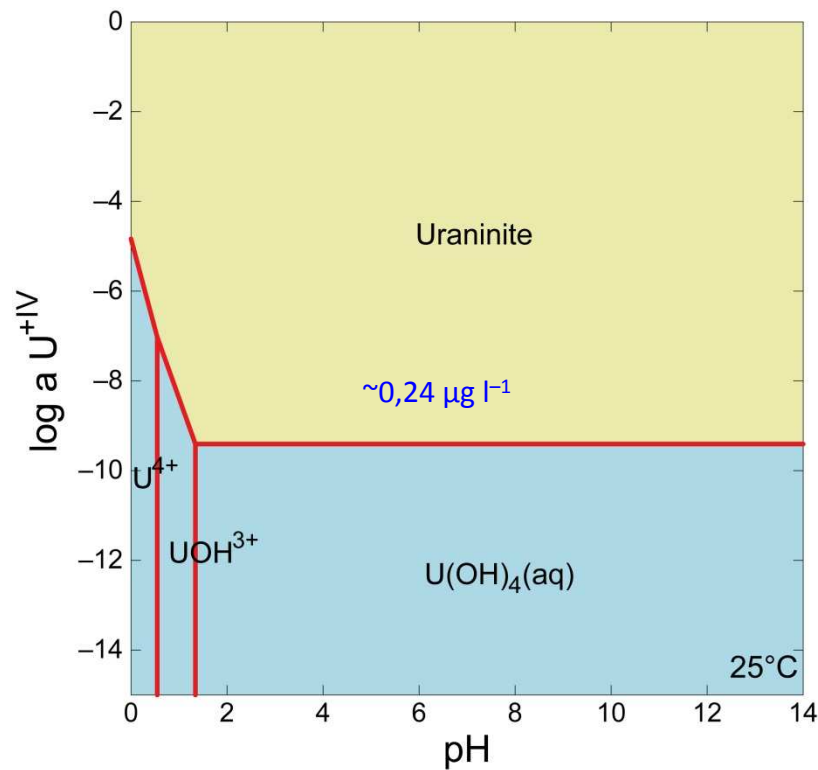
U^{+IV} a U^{+VI} (U^{+V} nestabilní, U^{+III}
rozkládá vodu)

Rozpustnost uranu

U^{+IV}

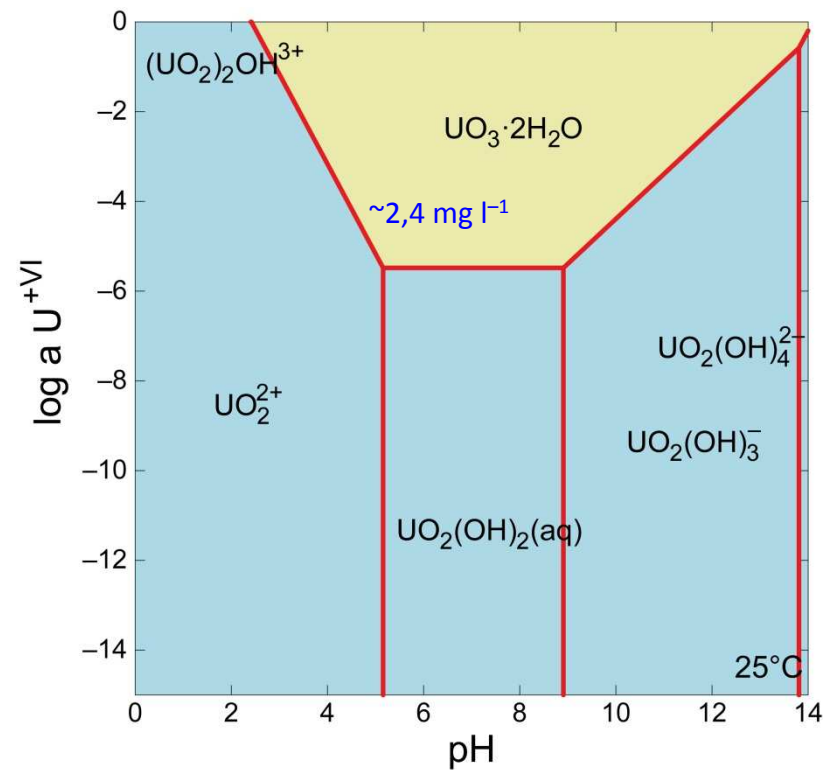
U^{+VI}

Obr. 2



$U^{+IV}: 10^{-9} \text{ mol l}^{-1} \sim 0,24 \mu g l^{-1}$

Obr. 1

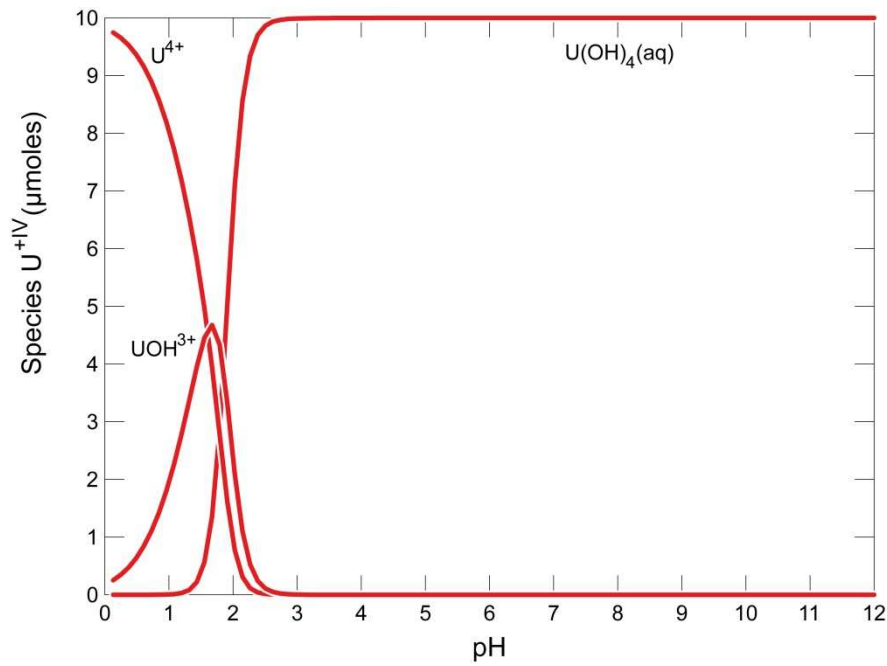


$U^{+VI}: 10^{-5} \text{ mol l}^{-1} \sim 2,4 \text{ mg l}^{-1}$
 $UO_3 \cdot 2H_2O = UO_2(OH)_2 \cdot H_2O$ (schoepit)

Speciace uranu

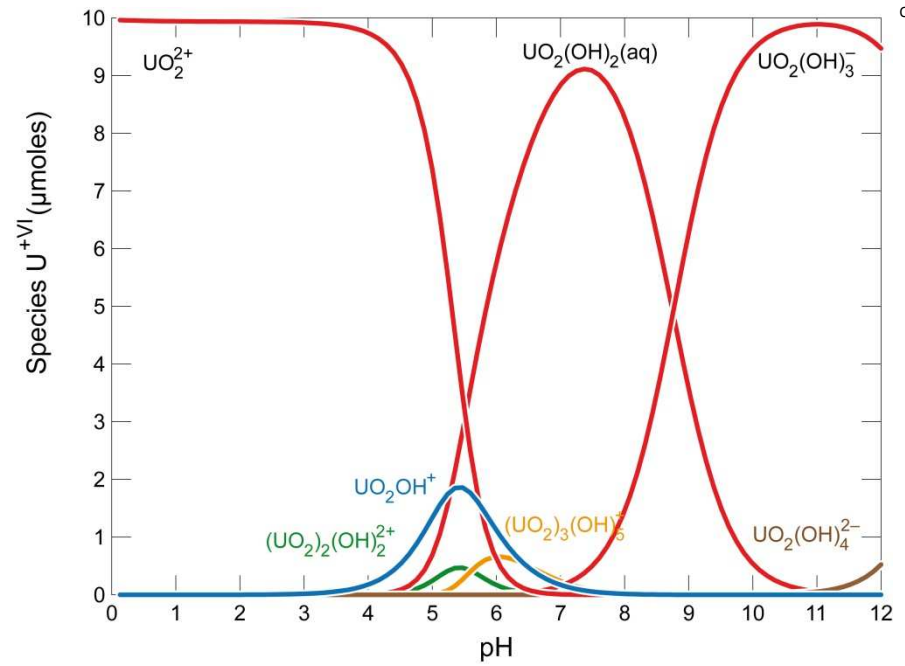
U^{+IV}

Obr. 4



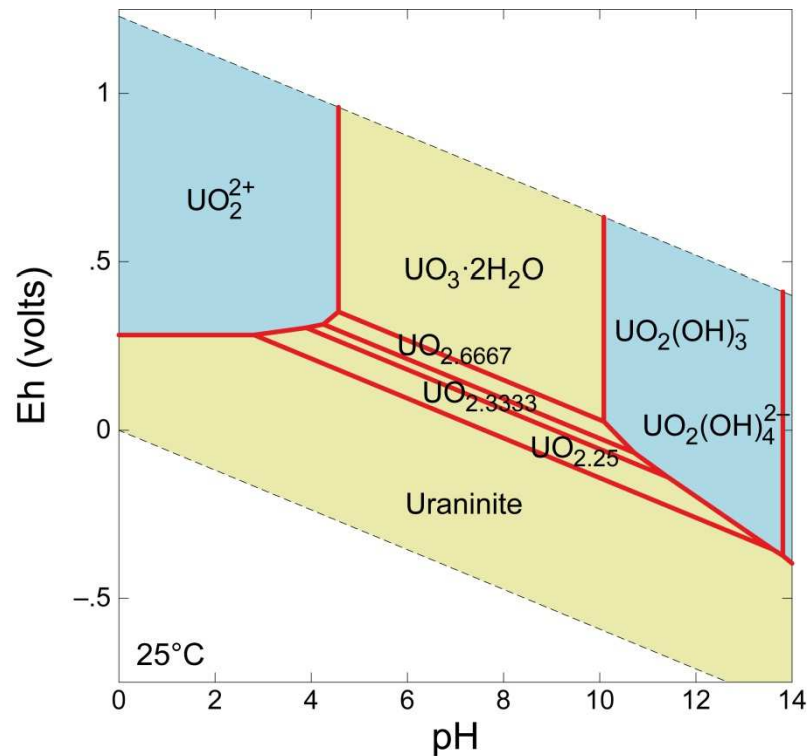
U^{+VI}

Obr. 3



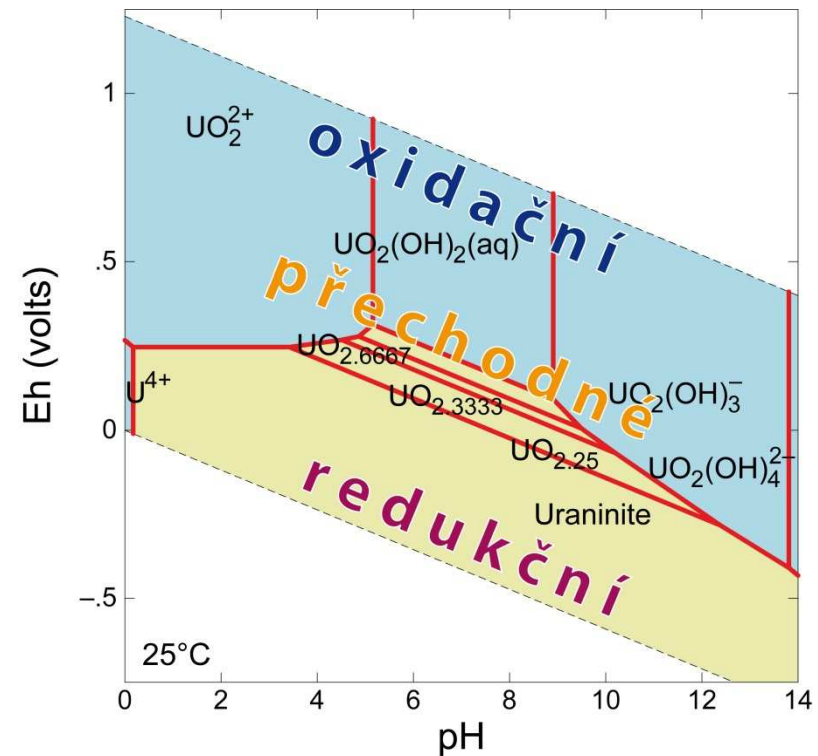
Závislost na redox podmínkách

Obr. 5



U: $5 \times 10^{-5} \text{ mol l}^{-1} \sim 11,9 \text{ mg l}^{-1}$
 $\text{UO}_3 \cdot 2\text{H}_2\text{O} = \text{UO}_2(\text{OH})_2 \cdot \text{H}_2\text{O}$ (schoepit)

Obr. 6

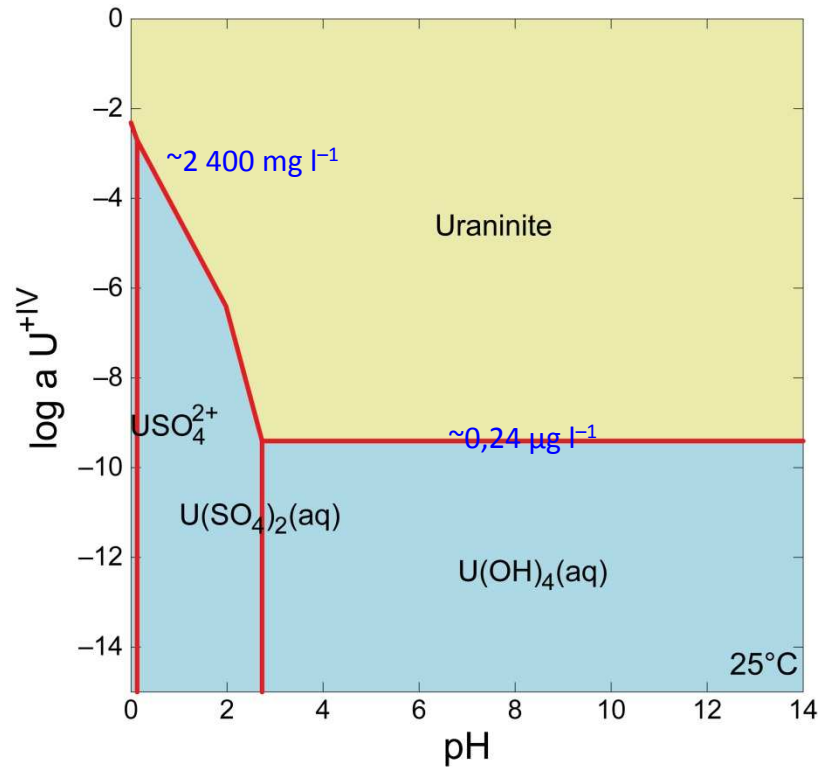


U: $3 \times 10^{-6} \text{ mol l}^{-1} \sim 0,71 \text{ mg l}^{-1}$

Přítomnost dalších aniontů



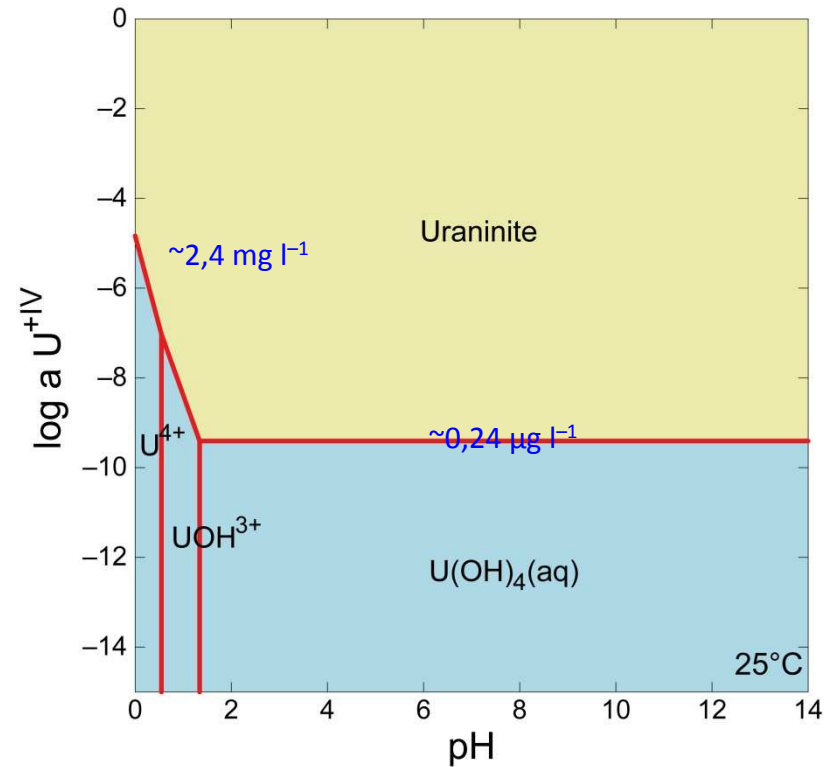
Obr. 11



SO₄²⁻: 1 000 mg l⁻¹

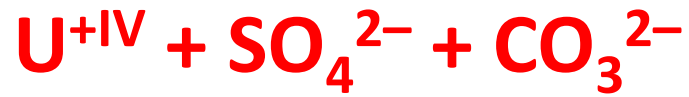


Obr. 12

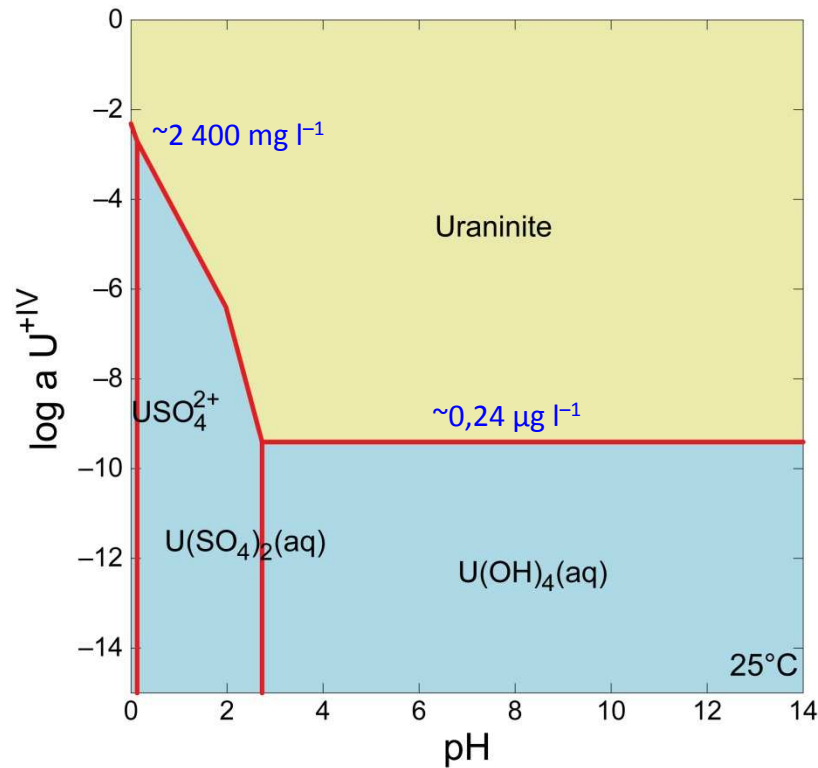


CO₃²⁻: 500 mg l⁻¹

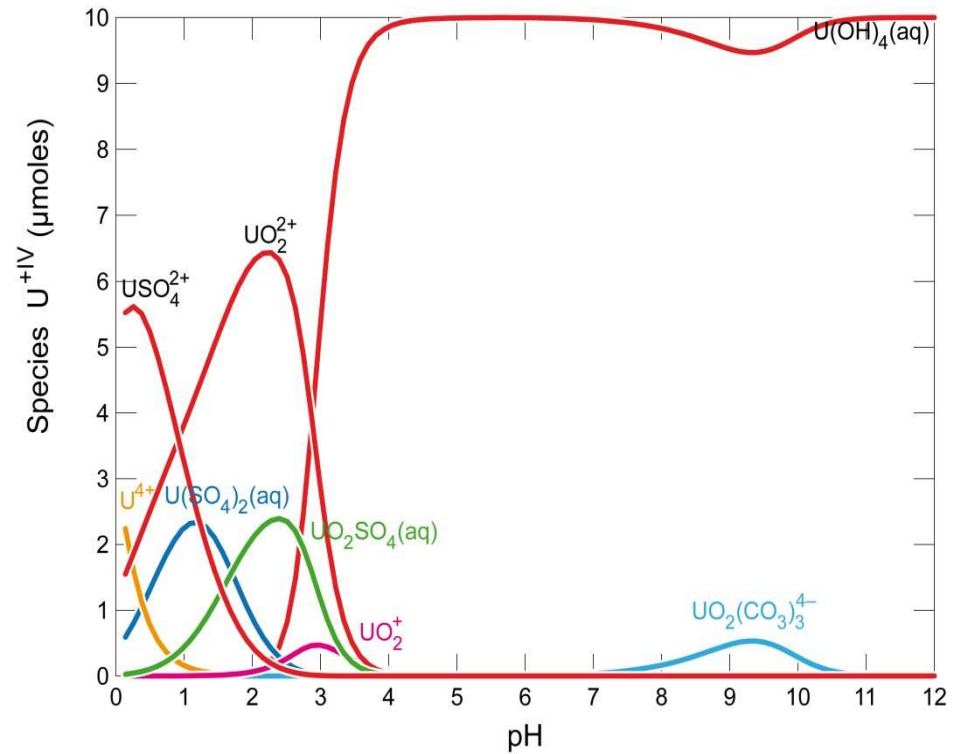
Přítomnost dalších aniontů



Obr. 13



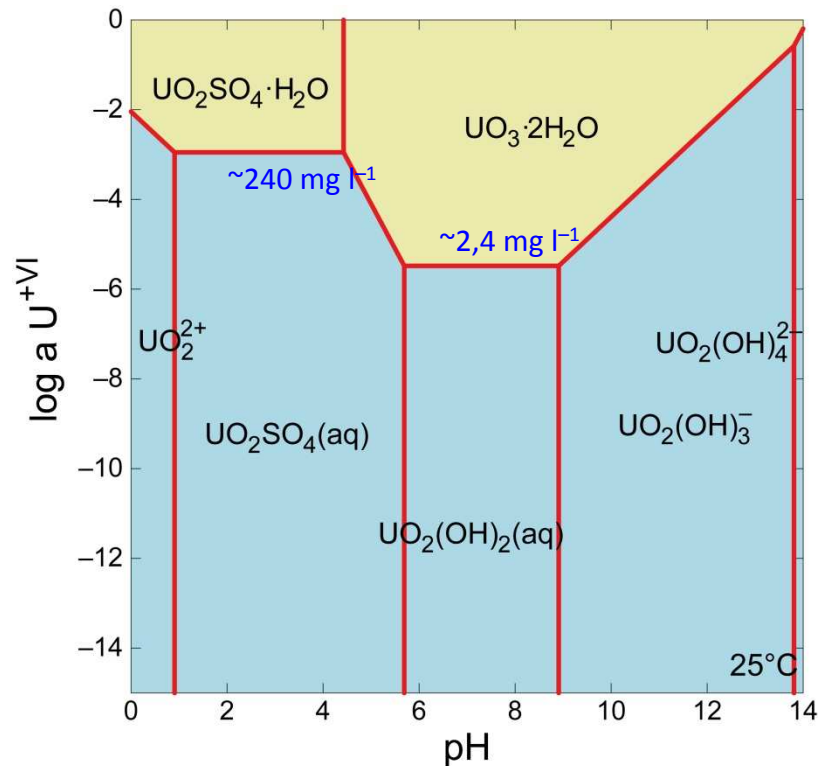
Obr. 14



Přítomnost dalších aniontů



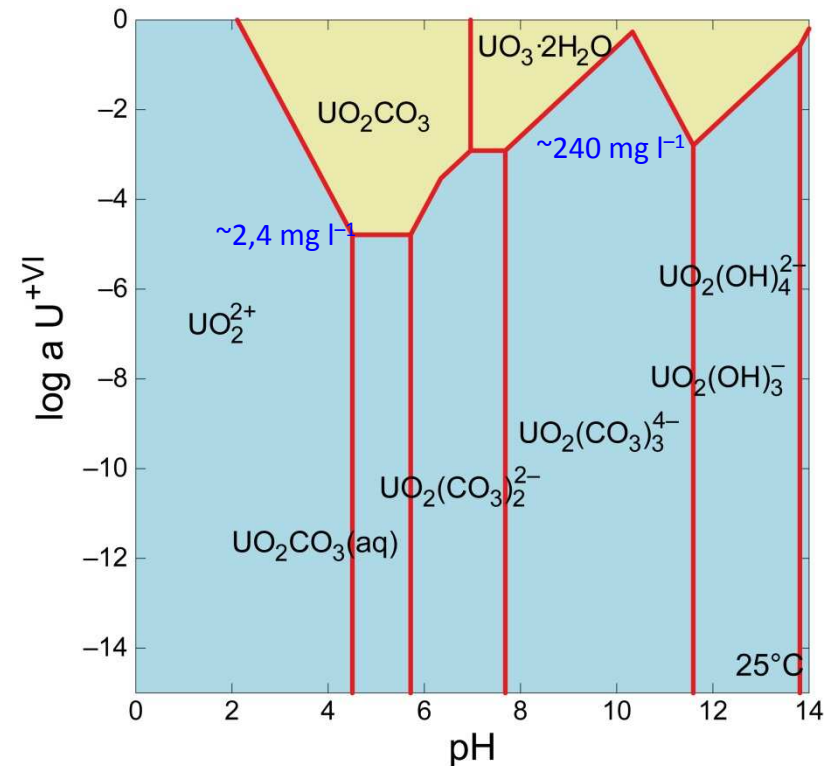
Obr. 7



SO_4^{2-} : 1 000 mg l^{-1}

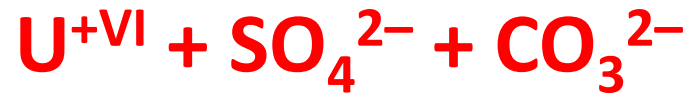


Obr. 8

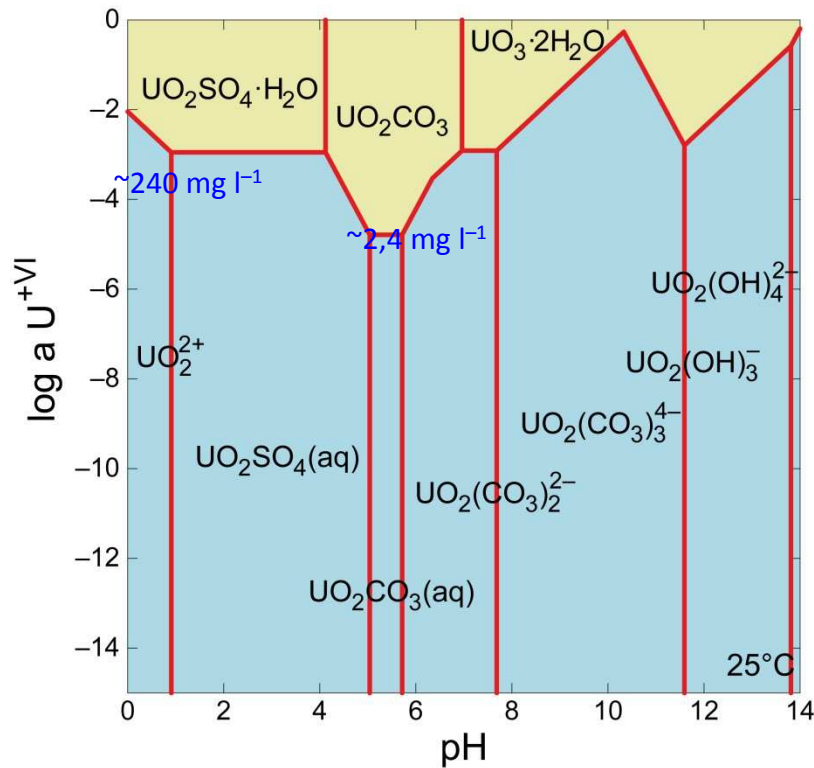


CO_3^{2-} : 500 mg l^{-1}

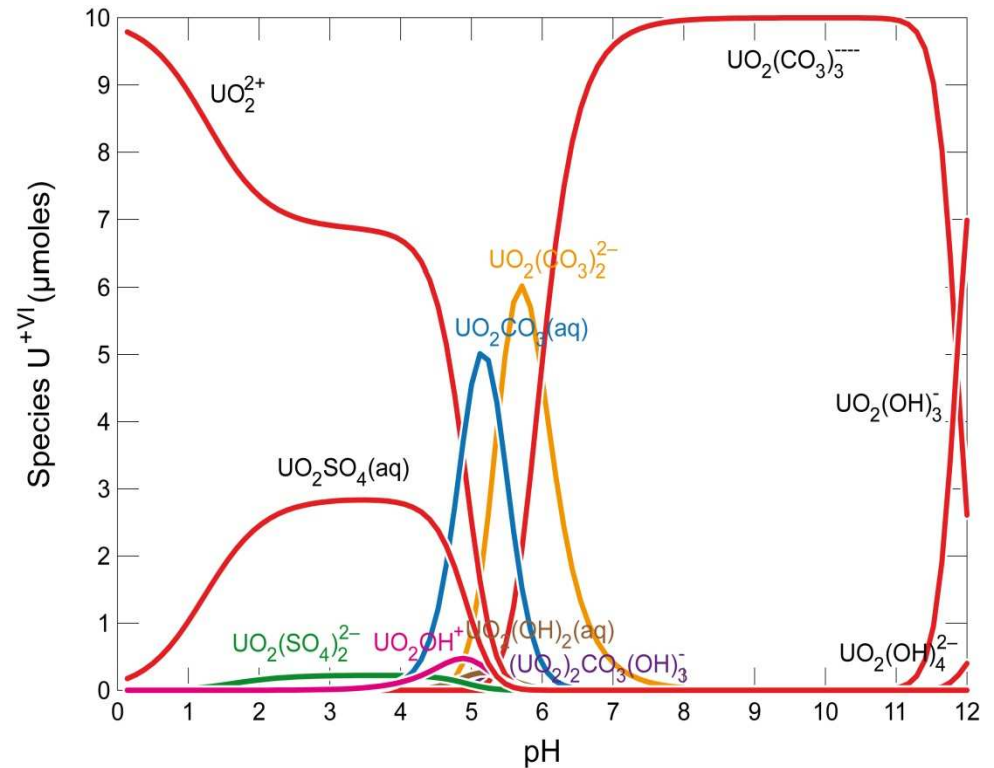
Přítomnost dalších aniontů



Obr. 9



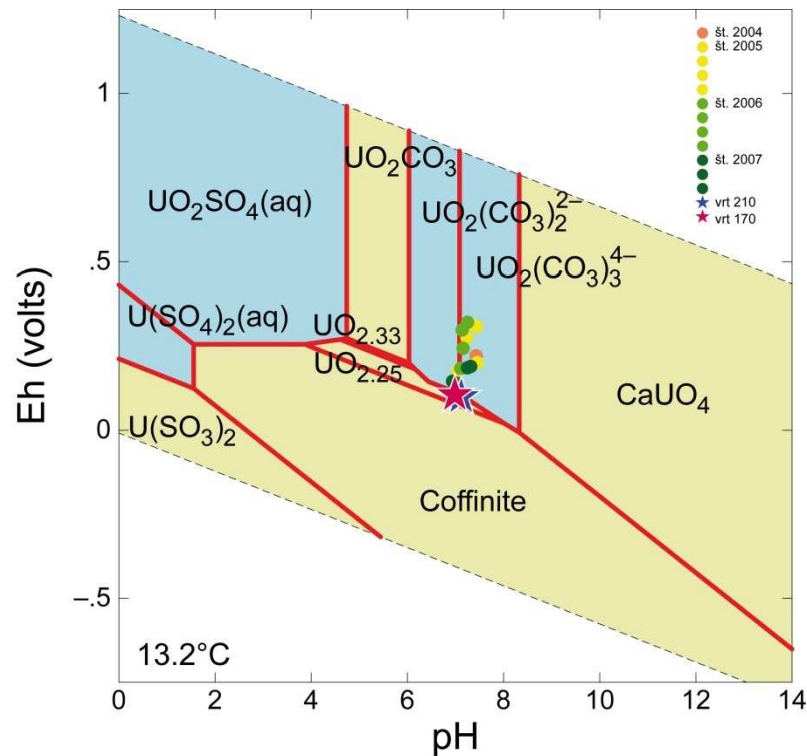
Obr. 10



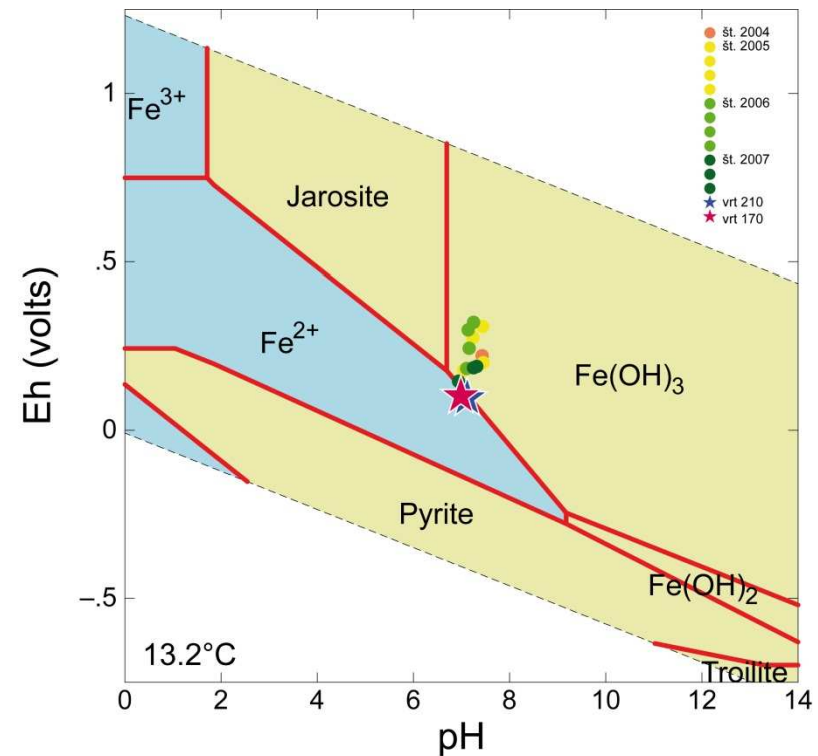
Reálné vody – Olší-Drahonín

Vrt: U ~ 15 mg l⁻¹, Fe ~ 8 mg l⁻¹

Obr. 15



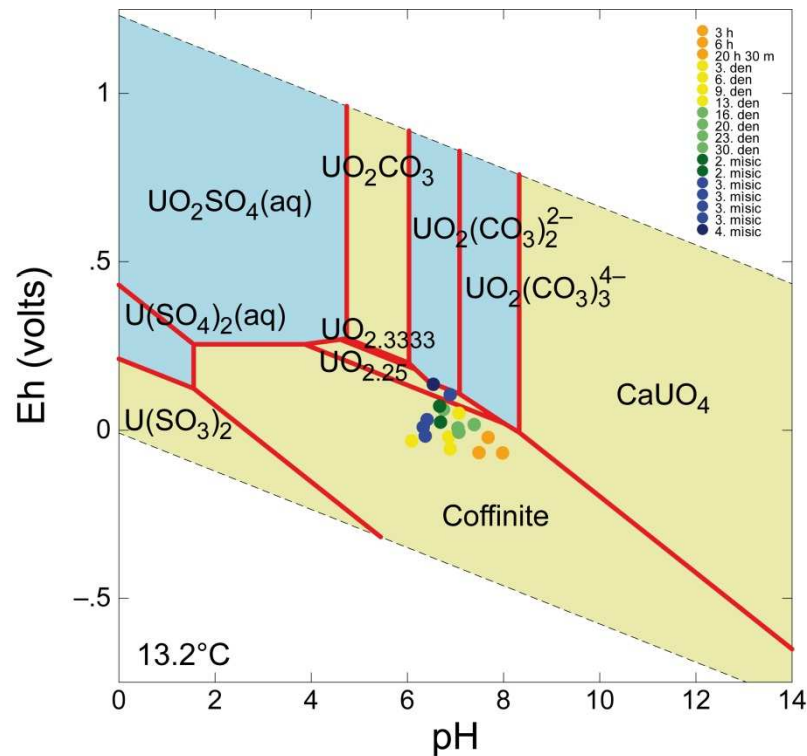
Obr. 16



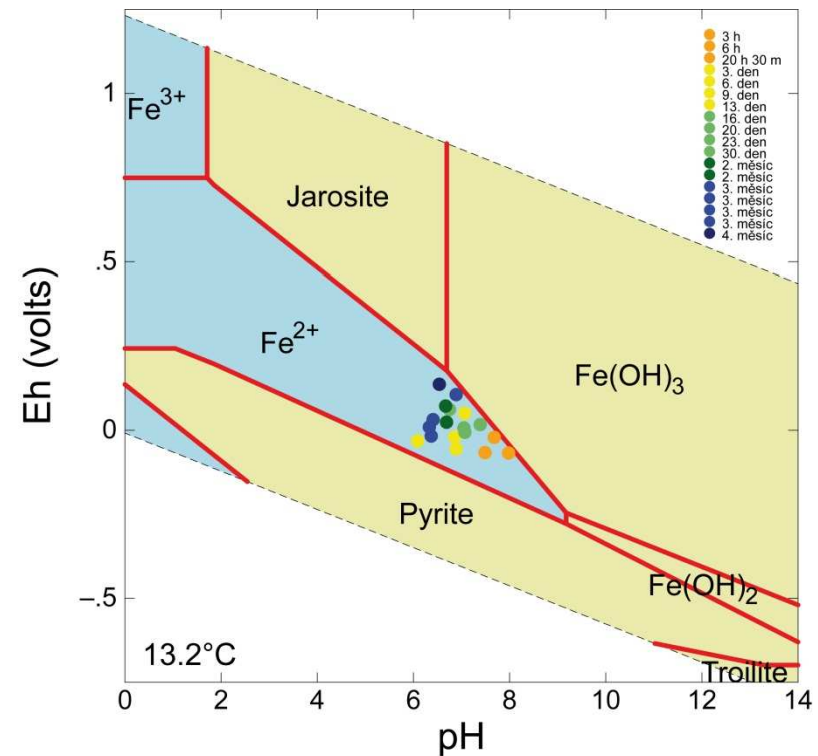
Působení nanočástic Fe^0

$n\text{Fe}^0$ 8 mg l^{-1} udrží 4 měsíce vhodné podmínky

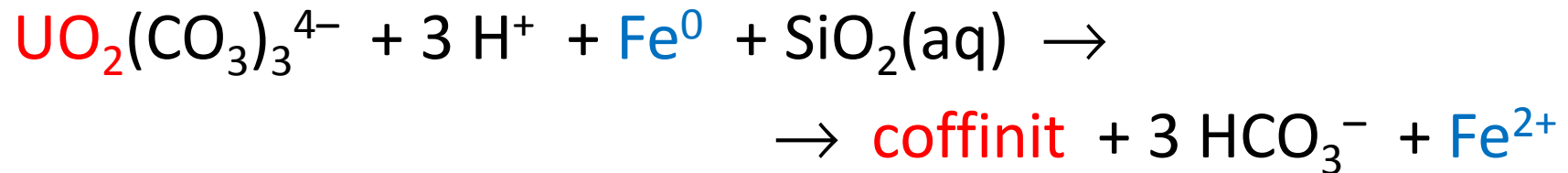
Obr. 17



Obr. 18



Působení nanočástic Fe⁰



nFe⁰ 8 mg l⁻¹ ~ U 34 mg l⁻¹

Přeji hezký den