

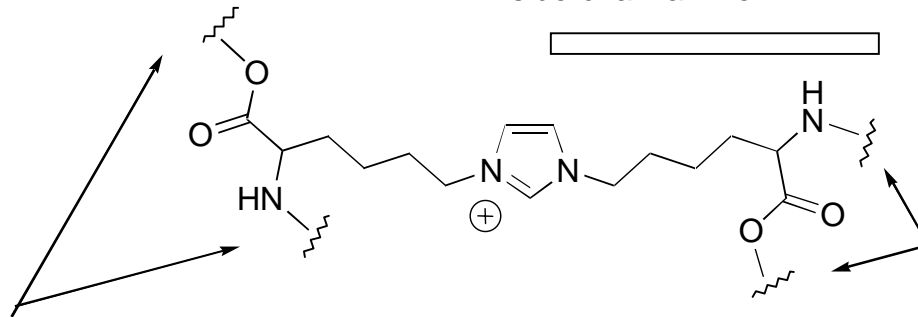
**“Sequestration of Heavy Metals in Mobile
Bay Sediments by Products of Maillard-
Reaction Protein Crosslinking”**

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The Maillard Cross-Linking of Proteins in Aging Tissue

Lysine residue incorporated into the imidazolium ion at the side-chain amine.



In the naturally occurring materials, these positions would be the points at which the imidazolium cross-link would be attached into the rest of the protein structure.

In the model compound(s), these positions would be simple groups such as ester at the carboxyl terminus and N-acetyl at the amine terminus.

SITE-PARTITIONING ANALYSES

SAMPLES FROM MOUTH OF THREE MILE CREEK

PHASE	%NICKEL	%COPPER	EXTRACTION METHOD
(1) Exchangeable Phase	0.2	1.7	0.2 MgCl ₂ - triethanolamine
(2) Carbonate Phase	6.6	5.1	Cation exchange resin
(3) Organic-complexed Phase	0.13	9.8	Acetylacetone in benzene
(4) Mn Oxy-hydroxide Phase (Easily Reducible Phase)	0.6	7.0	0.01 M HNO ₃
(5) Amorphous Fe Oxy-hydroxide Phase (Easily Reducible Phase)	11.4	17.4	0.2 M ammonium oxalate
(6) Crystalline Fe oxy-hydroxide citrate Phase (Moderately Reducible)	7.5	3.2	4% Na dithionate in 0.2M buffer
(7) Fe and trace metal sulfides	10.4	8.2	2% KClO ₃ in 0.5 N HCl
(8) Residual Phase HCl	62.9	47.5	48% HF - 70% HNO ₃ - 50% (microwave digestion)

Phase Stability and Bioavailability

EXCHANGEABLE

Easily extracted by biota under both oxidizing and reducing conditions

CARBONATE

Moderately stable under oxidizing conditions; easily extractable under reducing conditions

ORGANIC-COMPLEXED

Moderately stable under reducing conditions; extractable under oxidizing conditions

Mn OXY-HYDROXIDE (Easily Reducible)

Moderately to strongly stable under oxidizing conditions; unstable under reducing conditions

AMORPHOUS FE OXY- HYDROXIDE

Moderately stable under oxidizing conditions; very unstable under reducing conditions

CRYSTALLINE FE OXY- HYDROXIDE (Moderately Reducible)

Strongly stable under oxidizing conditions; weakly stable to unstable under reducing conditions

FE – TRACE METAL SULFIDES

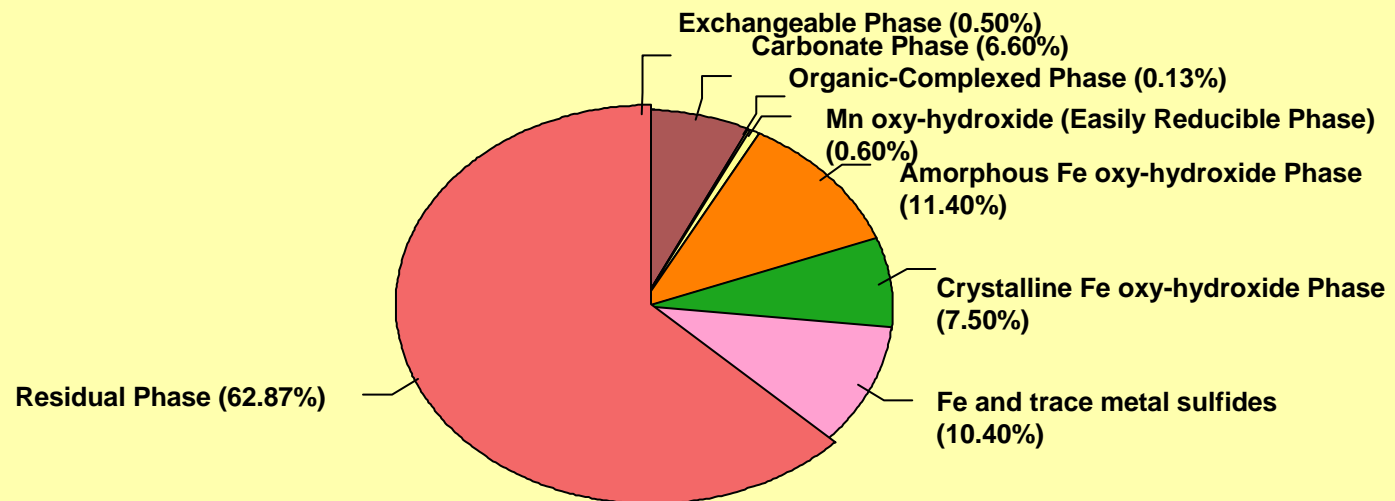
Stable under reducing conditions; weakly stable to unstable under oxidizing conditions

RESIDUAL

Non-extractable by biota under all but the most unusual environmental conditions

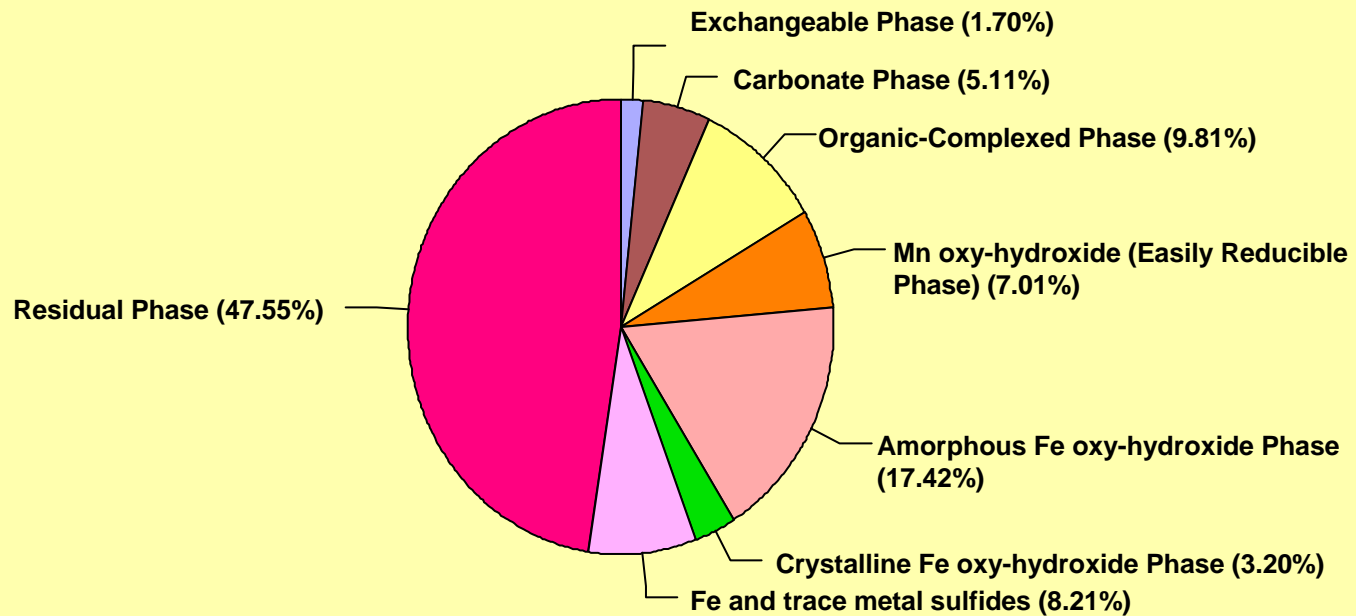
SITE PARTITIONING FOR NICKEL

(Proxy for Palladium & Platinum)



Biological consequences in Mobile Bay: minimal movement into biota

SITE PARTITIONING FOR COPPER (Proxy for Silver & Gold)



Biological consequences in Mobile Bay: moderate movement into biota

Main Synthetic Approach: Transfer of NHC from Ag(I) Complex

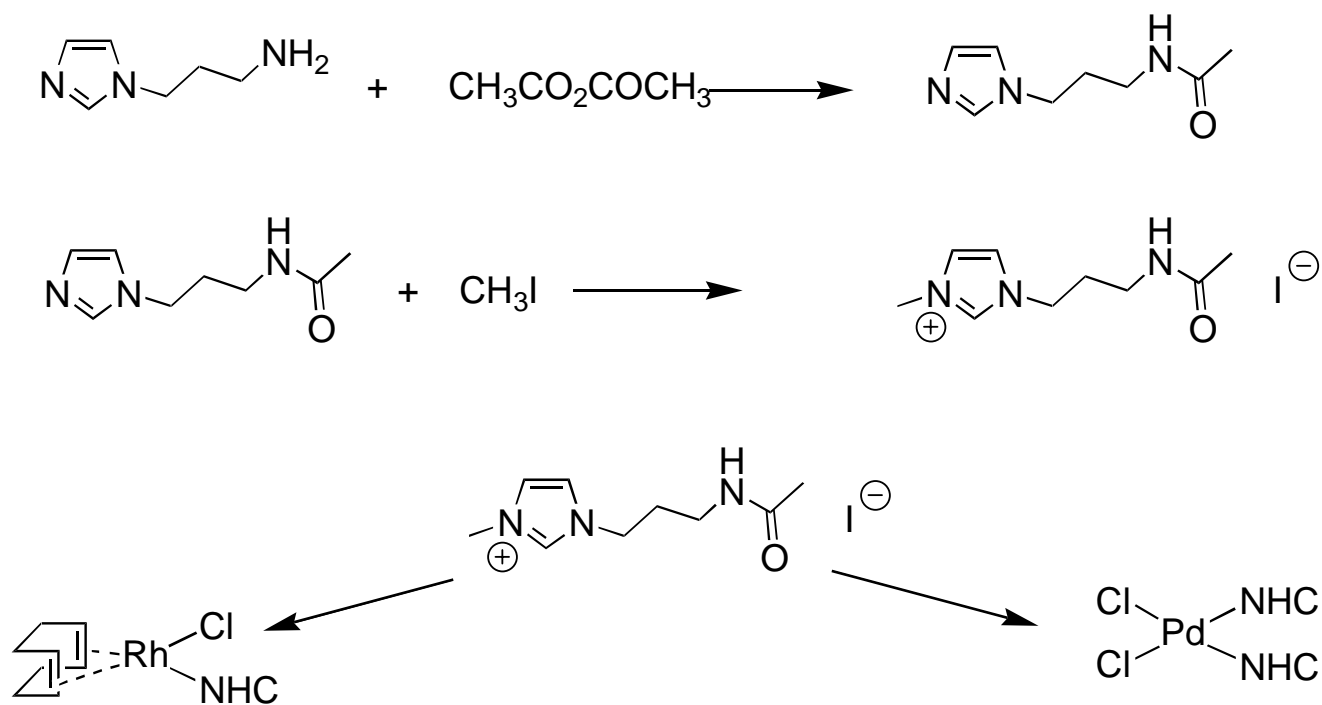


Complexes Prepared in Technique- Development Using $[\text{Ag}(\text{ImMe}_2)_2]^+ \text{AgI}_2^-$

All characterized by ^1H & ^{13}C NMR:



A First-Generation Maillard Model System

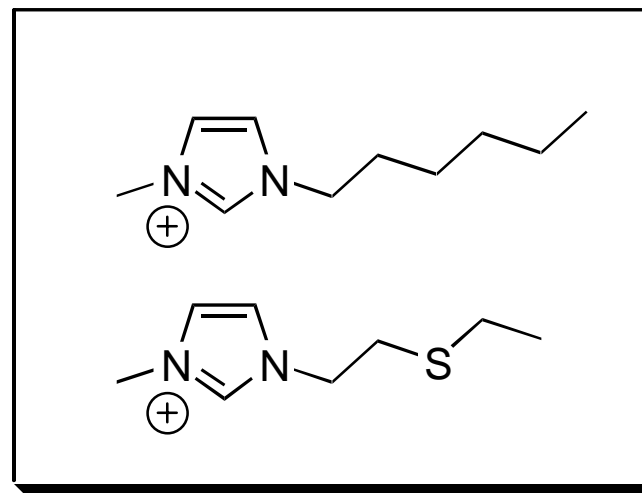


Looking at the Potential Environmental Impact of Imidazolium- Based Ionic Liquids

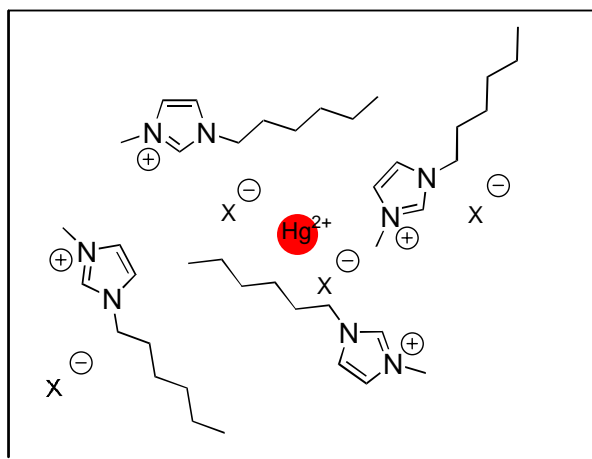
- Ionic liquids (IL) are salts that are liquid at low temperatures.
- IL can dissolve a range of organic and inorganic materials.
- IL are proposed for large-scale use as industrial solvents.
- The environmental fate of IL has not been extensively studied.

Question

Can certain IL mobilize metals in an estuarine environment?



Can Imidazolium-Type IL Mobilize Metals?



water \longrightarrow no ion-ion interaction

