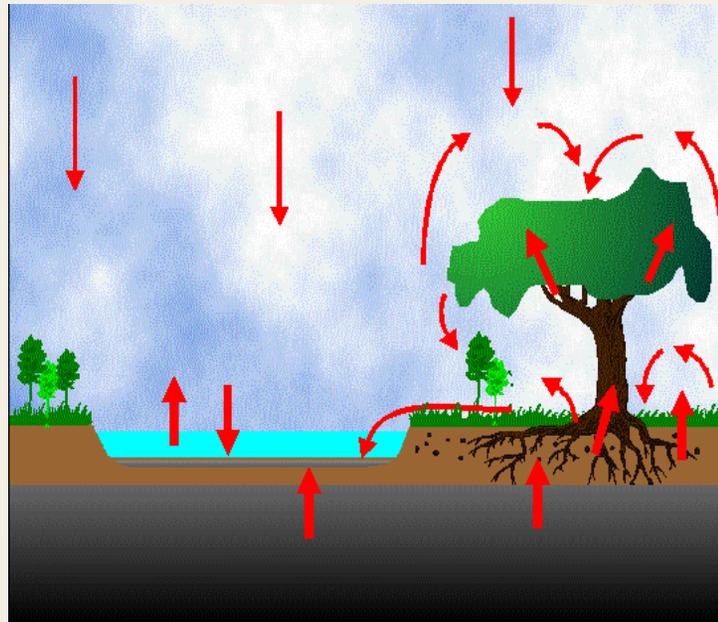




# Biogeochemical Variation

A.N. Rencz

Natural Resources Canada – Geological Survey of Canada



Workshop on the Role of Geochemical Data in Ecological and Human Health Risk Assessment  
Halifax, NS; March 17-18, 2010

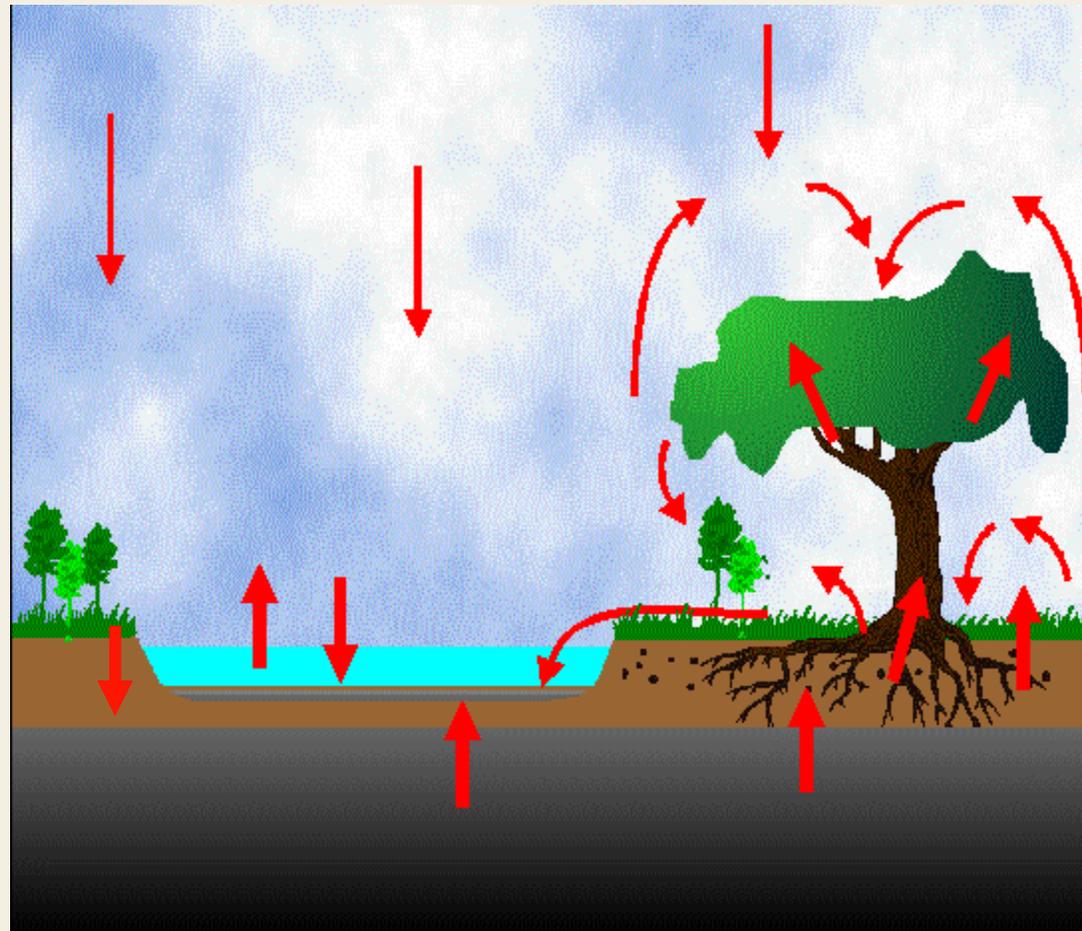




# Biogeochemical Variation

Earth Sciences Sector

There is element cycling through the different media in nature



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# Biogeochemical Variation



Snow and ice

## Sample **Media** for Geochemistry



Lake sediments/water



Groundwater



Stream sediments/water



Tree Rings

Vegetation



Soil, till and rock



Natural foods



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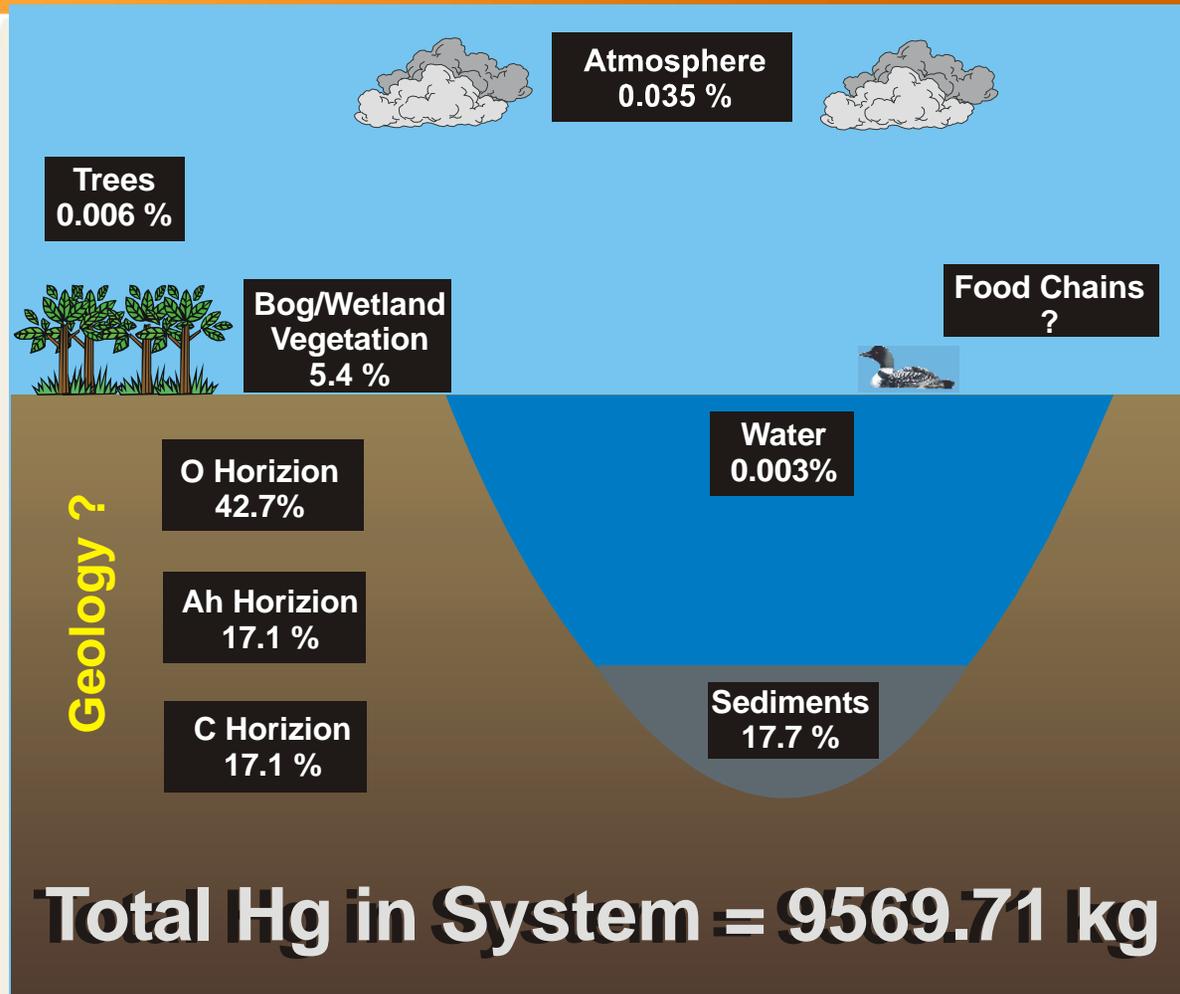
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Source: O'Driscoll et al., 2005



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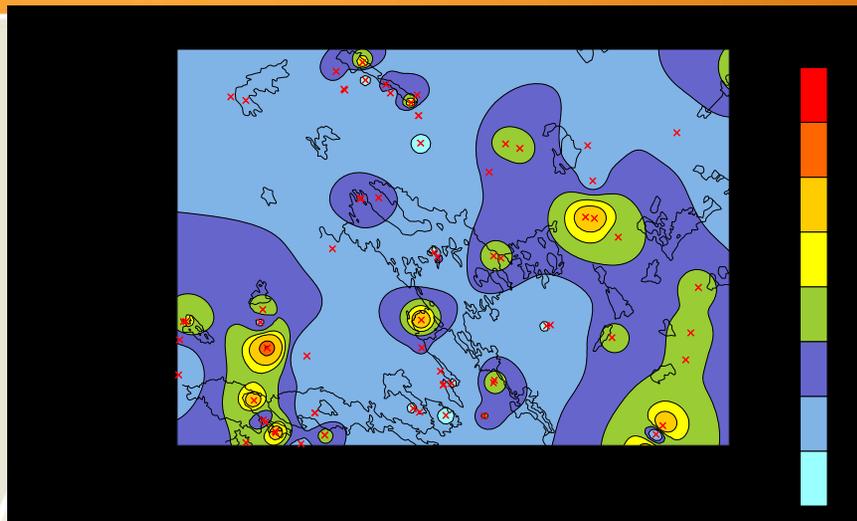
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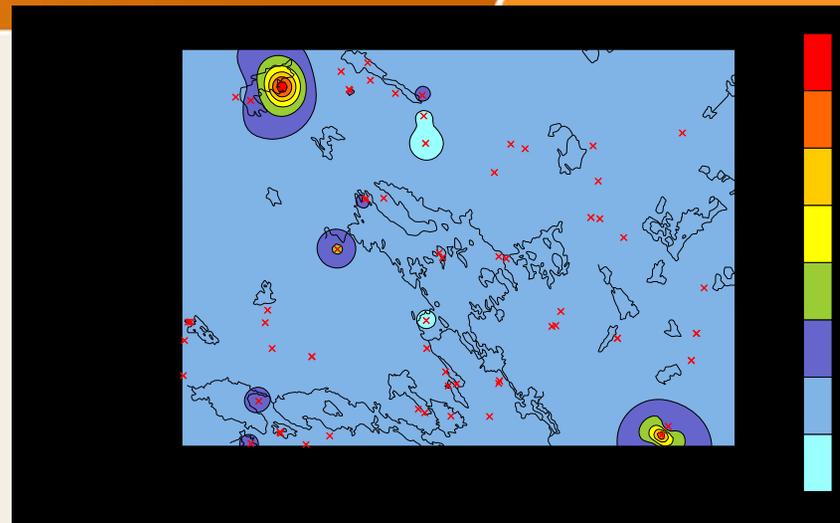


# Mercury in Kejimikujik Park, NS

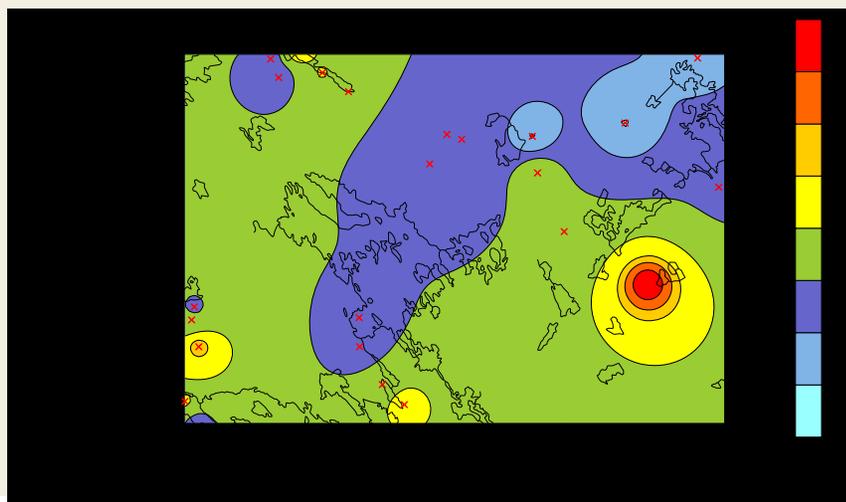
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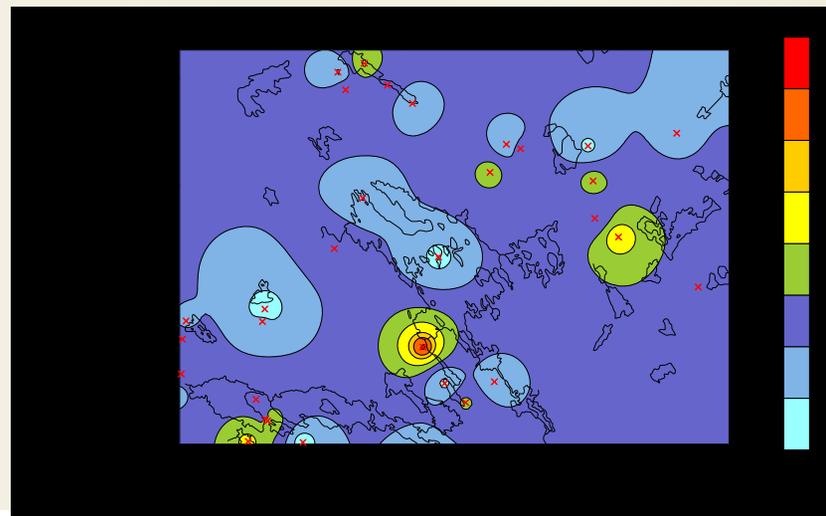
Sugar Maple



White Pine



200  
ppb



O Horizon

(from Rencz et al. 2003)

C Horizon <63um



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# Biogeochemical Variation

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Correlations  
between Hg in perch  
and vegetation and  
surficial media  
(Rencz et al. 2003)

## *Pearson Correlations*

- two-tailed normal distribution
- Significant at the 0.05 and 0.01 levels

			Perch	Water			
			Hg	Hg total	MeHg	Hg0	DOC
Water	Fish	Perch	-	-	-	-	-
		DOC	.417*	.868**	.703**	-	-
	Chemistry	Hg total	.558*	-	.723**	-	.868**
		MeHg	.556*	.723**	-	-	.703**
		Hg0					
	Cd	.577*	.571*				
Vegetation	Red Maple	Hg					
		P	.670**	.687*	.542*		.654**
	White Pine	Hg					.500*
		P	.540*				
	Tree Lichen	Hg					
		Au	-.580*				
Humus	<.177 mm	Hg					
		Au					
		P					
Ah Horizon	<.177 mm	Hg					
		Au					
		P			.562*		
	<.063 mm	Hg					
		Au					
		P			.767**		
C Horizon	<.177 mm	Hg		.755*	.575*		.720**
		Au					
		P		.769**	.775**		.784**
	<.063 mm	Hg					
		Au					
		P		.668*	.778**		.662**



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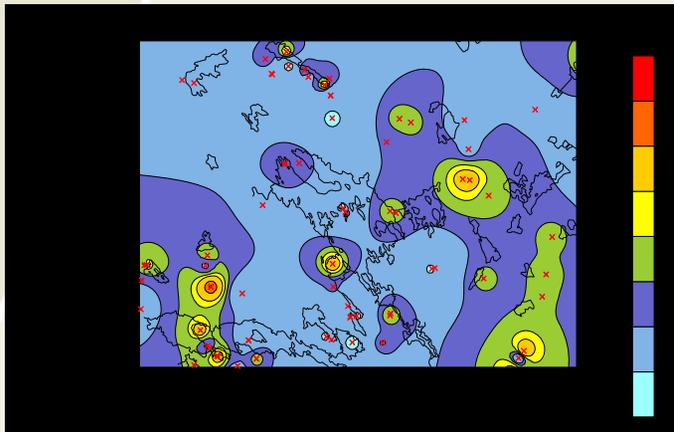
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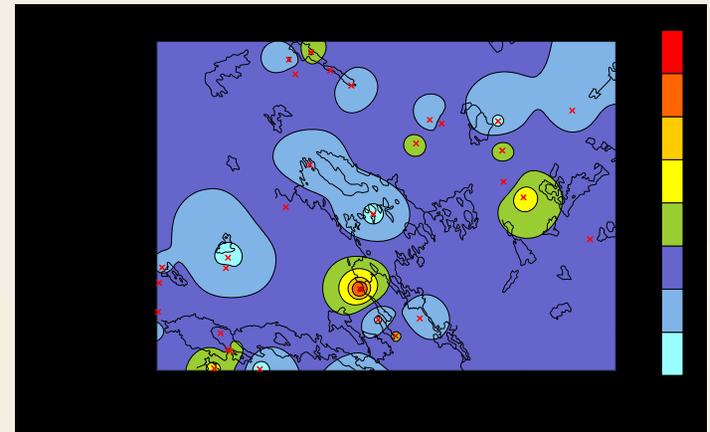


# Biogeochemical Variation

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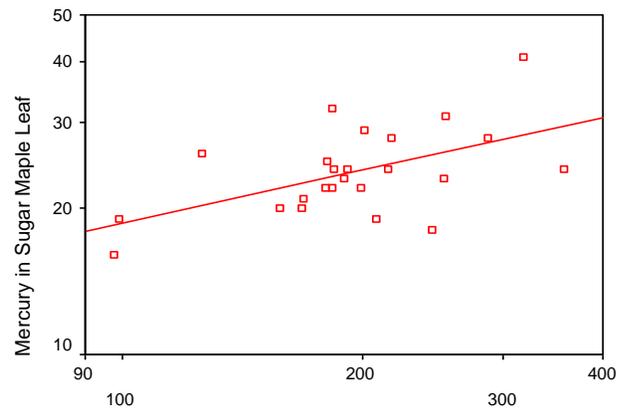


Mercury in Sugar Maple



Mercury in C Horizon <63um

Mercury in O Horizon vs  
Mercury in Sugar Maple Leaf



$R_{sq} = 0.2904$

Mercury in O Horizon



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# Biogeochemical Variation

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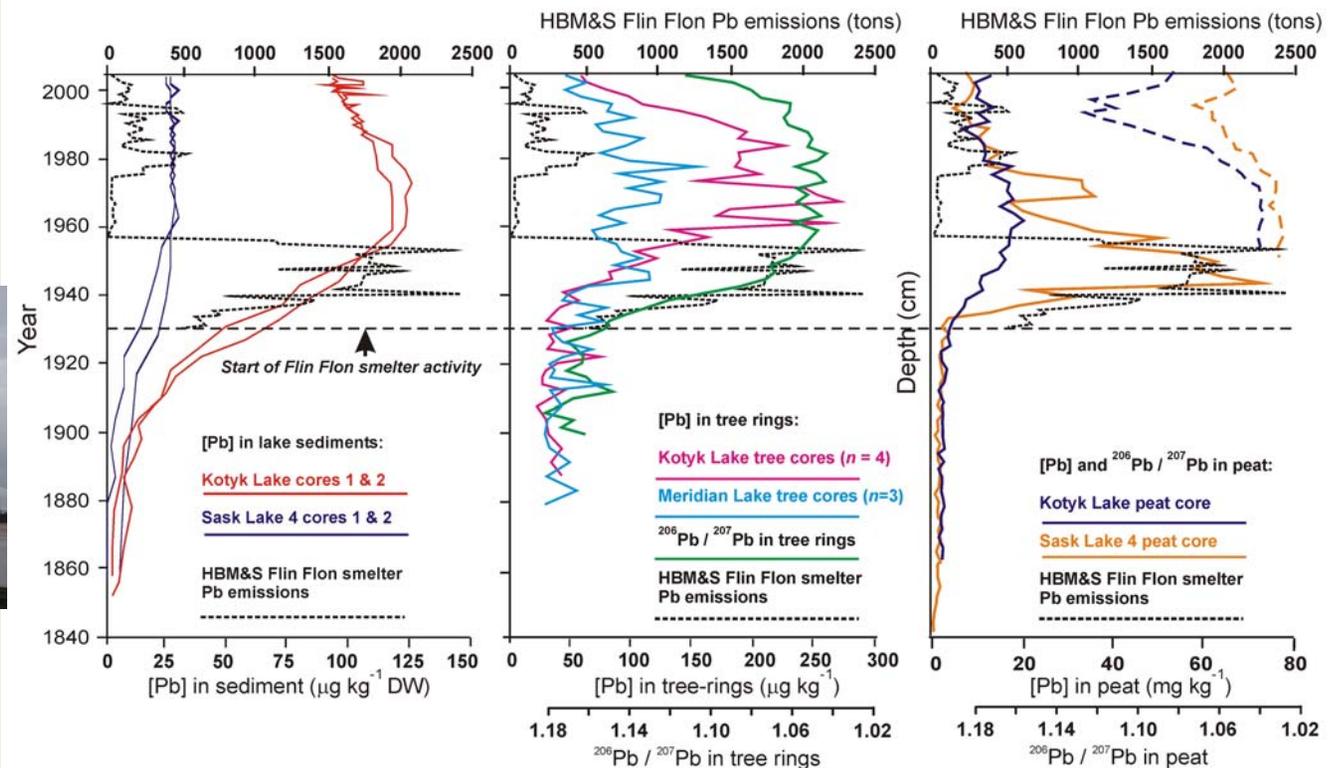
The chemical characteristics of the various sample media may vary with time.

- Comparison of the distribution of Pb in sediment, tree rings and peat.

From Savard et al., 2006



Smelter at Flin Flon, Manitoba



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# Biogeochemical Variation

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## Summary:

- There are relationships between patterns of concentration levels in various sample media within an ecosystem.
- There may be orders of magnitude of difference in concentration levels between the various media.
- Soils occur in most places and have no significant seasonal affects.
- Soils are a “direct” path to the biological system.



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# References

Earth Sciences Sector

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- Savard, M.M., Bonham-Carter, G.F., and Banic, C.M., 2006. A geoscientific perspective on airborne smelter emissions of metals in the environment: an overview : Exploration, Environment, Analysis; 2006; v. 6; issue.2-3; p. 99-109.



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