Trace Elements Concentrations and Occurrence of Metallurgical Slag Particles in Bed Sediment Cores from Lake Roosevelt, Washington

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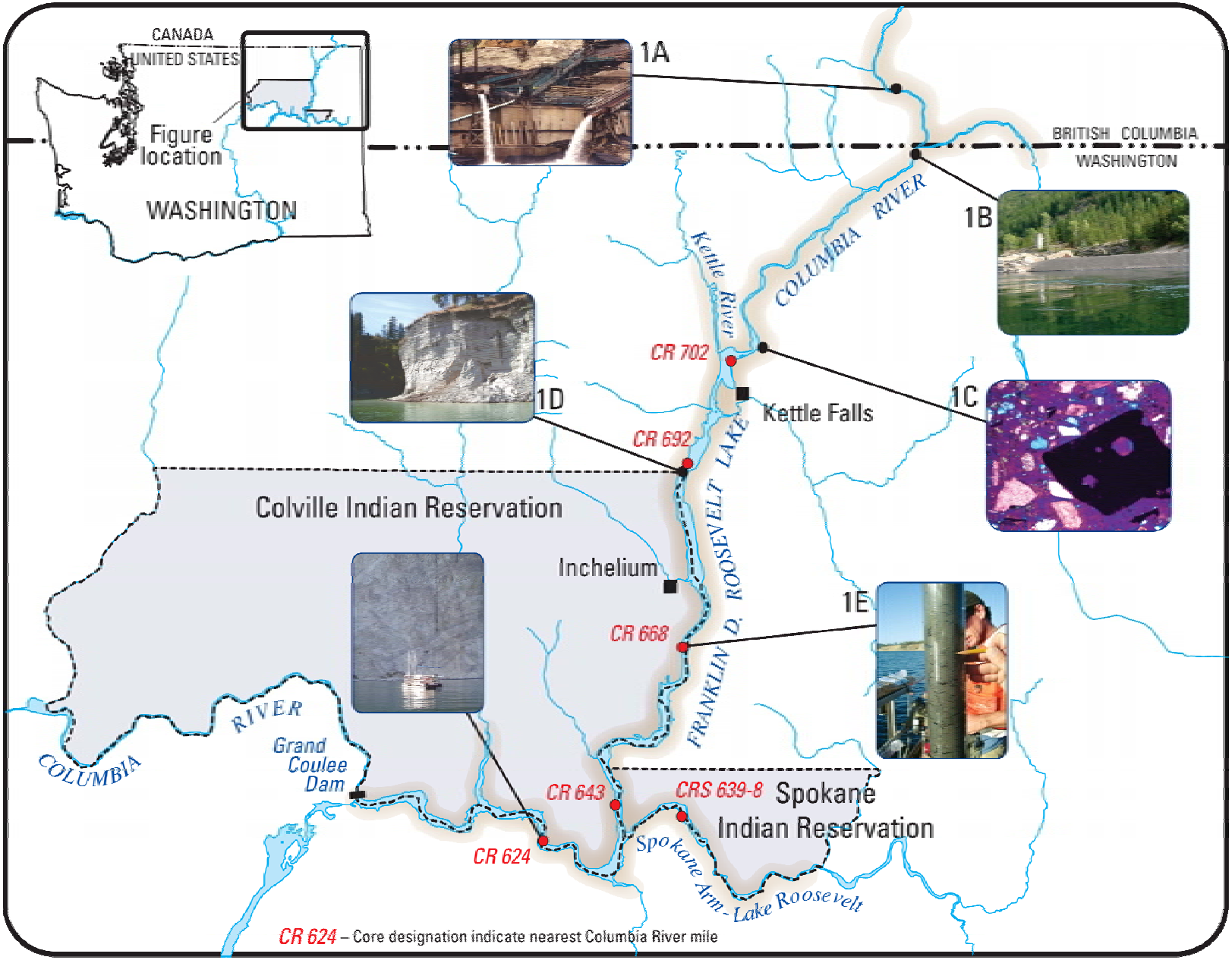
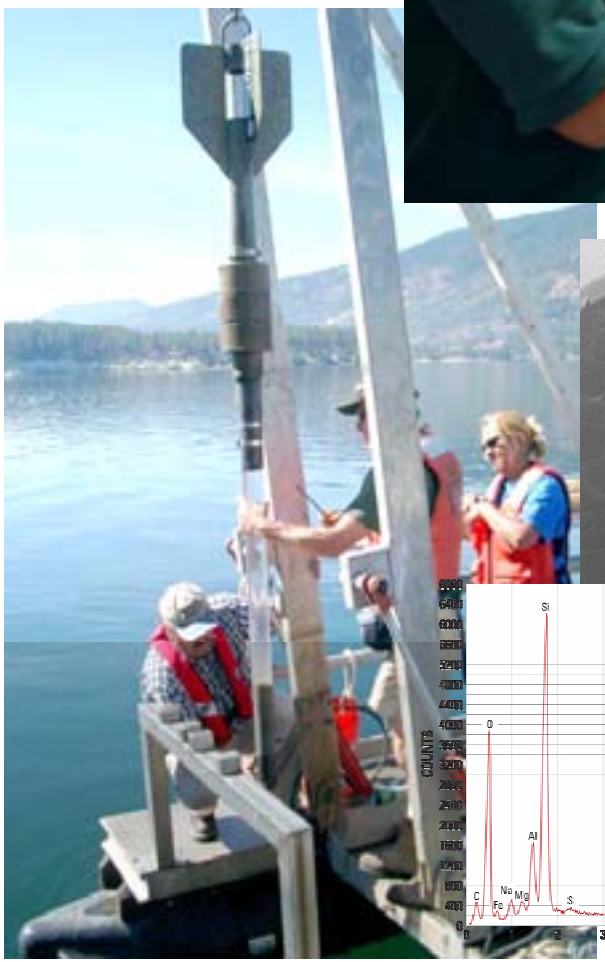
Outline

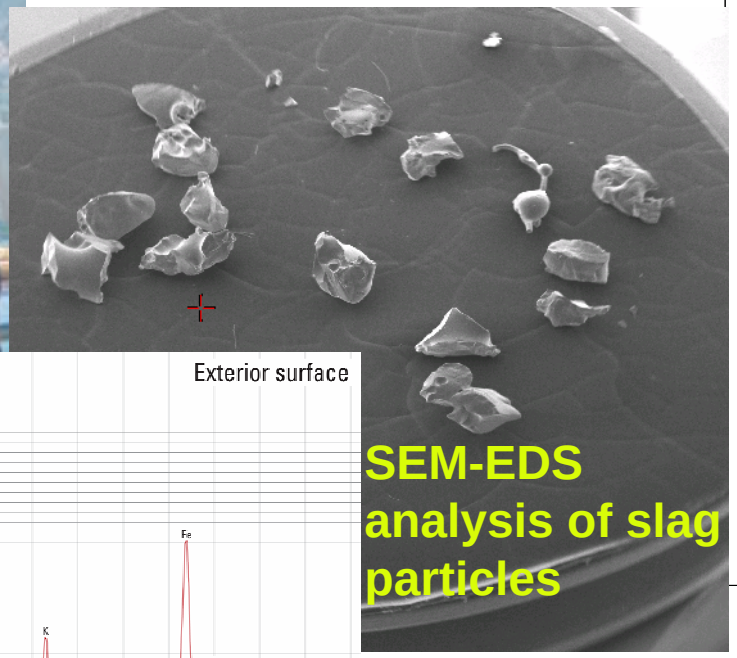
- Summary of cores collected
- Multi-element concentrations profiles in individual cores & sources of variability
- Comparison of element profiles from different location in Lake Roosevelt
- Observations on the occurrence of slag in Lake Roosevelt bed sediments

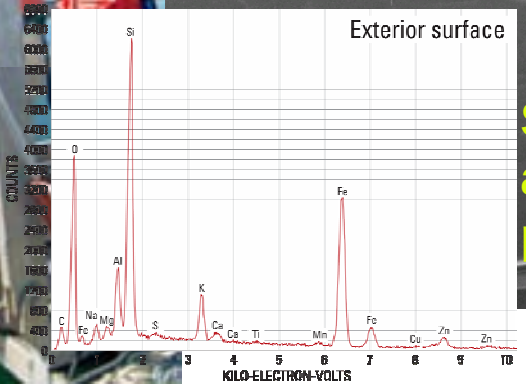

CANADA
UNITED STATES
Figure location
WASHINGTON
1A
BRITISH COLUMBIA
WASHINGTON
1B
COLUMBIA RIVER
Kettle River
CR 702
Kettle Falls
1C
1D
CR 692
LAKE ROOSEVELT
Colville Indian Reservation
Inchelium
1E
CR 668
FRANKLIN D.
COLUMBIA RIVER
Grand Coulee Dam
CR 643
CRS 639-8
Spokane Indian Reservation
CR 624
Spokane Arm - Lake Roosevelt
CR 624 – Core designation indicate nearest Columbia River mile

Study Methods

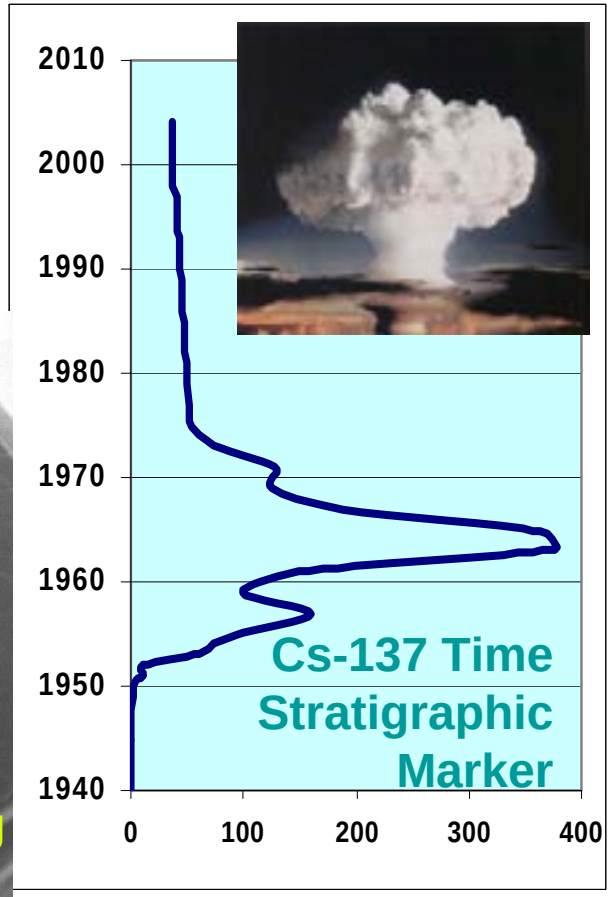
ICP-MS analysis of 4-acid digestion for 53 trace elements: As, Cd, Cu, Pb, Zn plus CVA for Hg







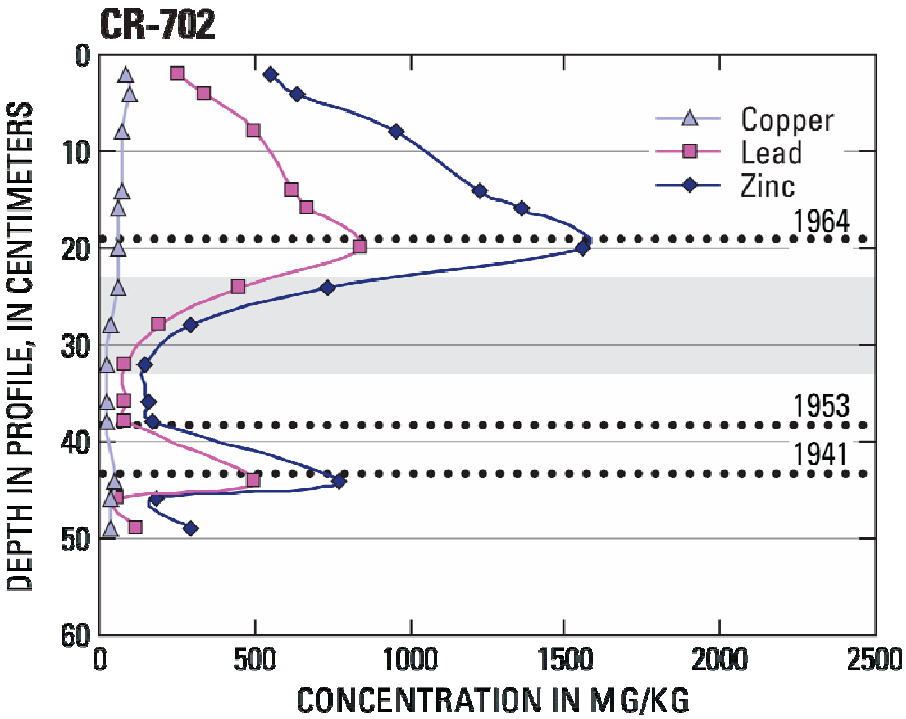
SEM-EDS analysis of slag particles

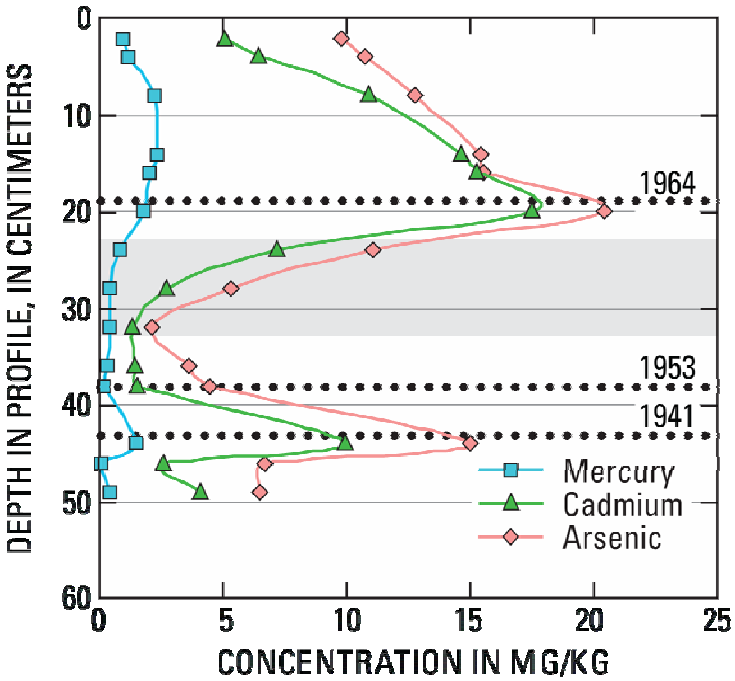


Summary of Cores Analyzed

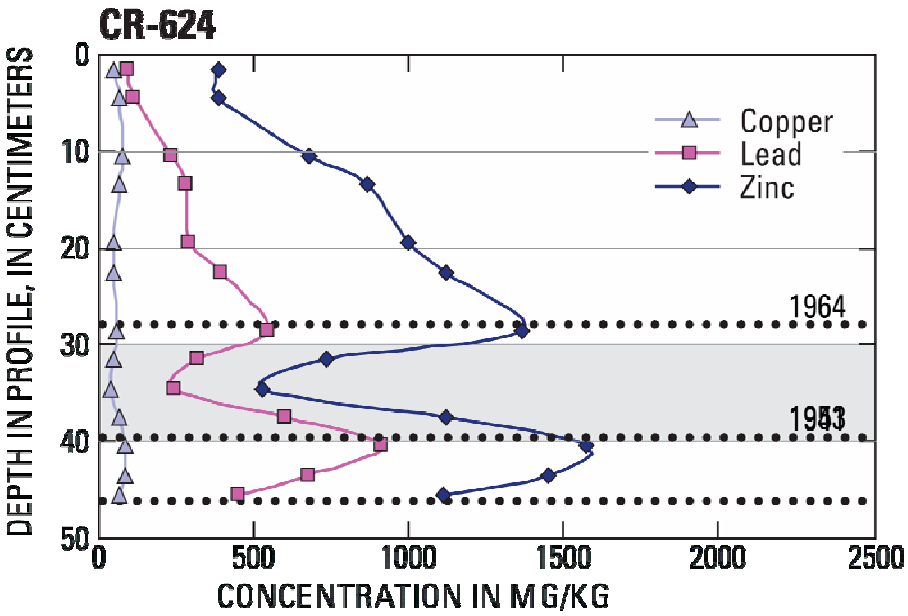
Core	Length (cm)	Elevation of core	Section intervals	Depth to interval w	Accum. Rate	Accum. Rate
		surface (feet)	Sections Analyzed	Cs-137 peak	Vertical (cm/yr)	Mass (g/cm^2 per year)
CR-702	49	1220	24/13	18-20	0.80	.25-1.35
CR-692	38	1134	19/12	26-28	0.79	0.6
CR-668	164	1065	33/19	100-105	2.80	1.55
CR-643	57	1040	19/12	48-51	1.54	0.8
CR-624	46	998	16/11	27-30	0.79	0.4
CR-639-8	90	1179	28/16	60-63	1.88	1.4

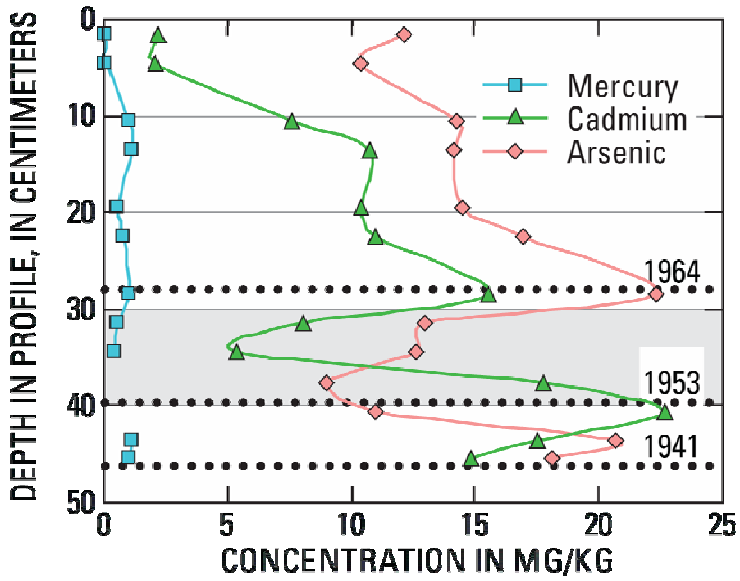
Concentration profiles of As, Cd, Cu, Hg, Pb, and Zn in core CR 702



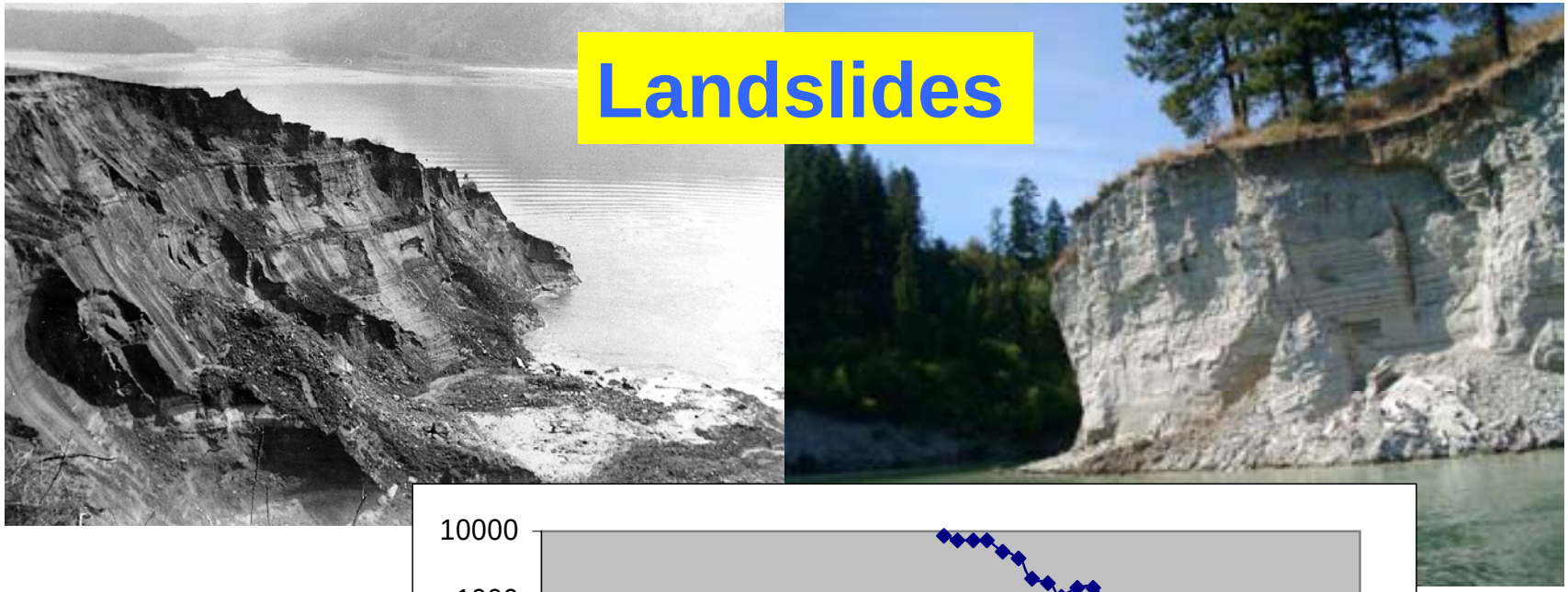


Concentration profiles of As, Cd, Cu, Hg, Pb, and Zn in core CR-624

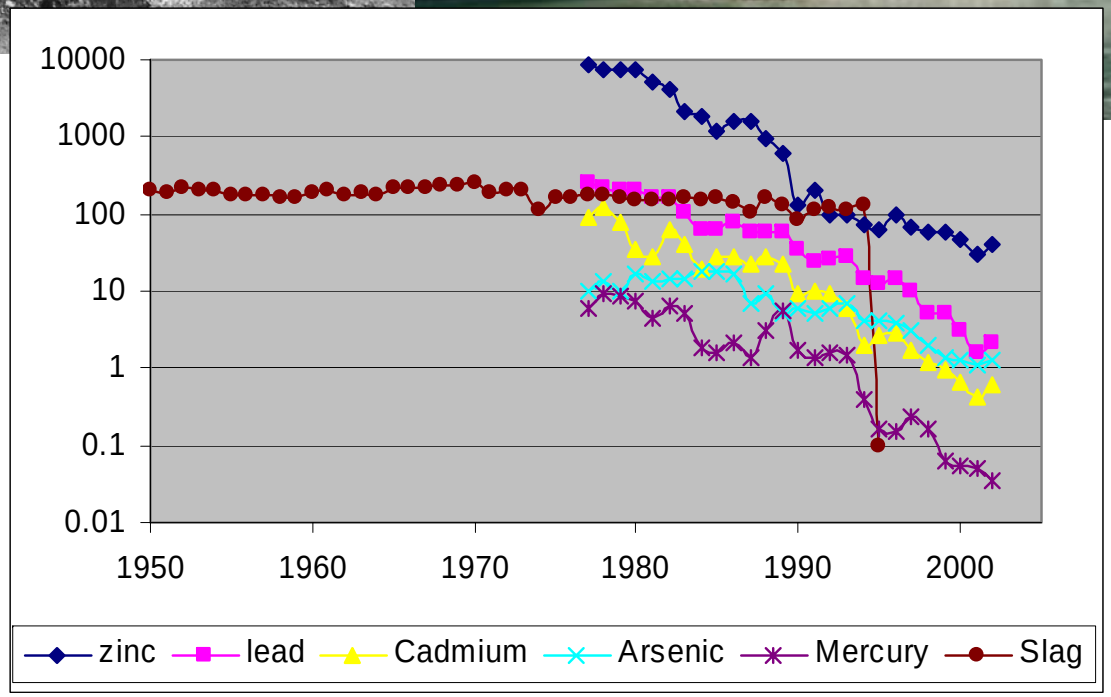




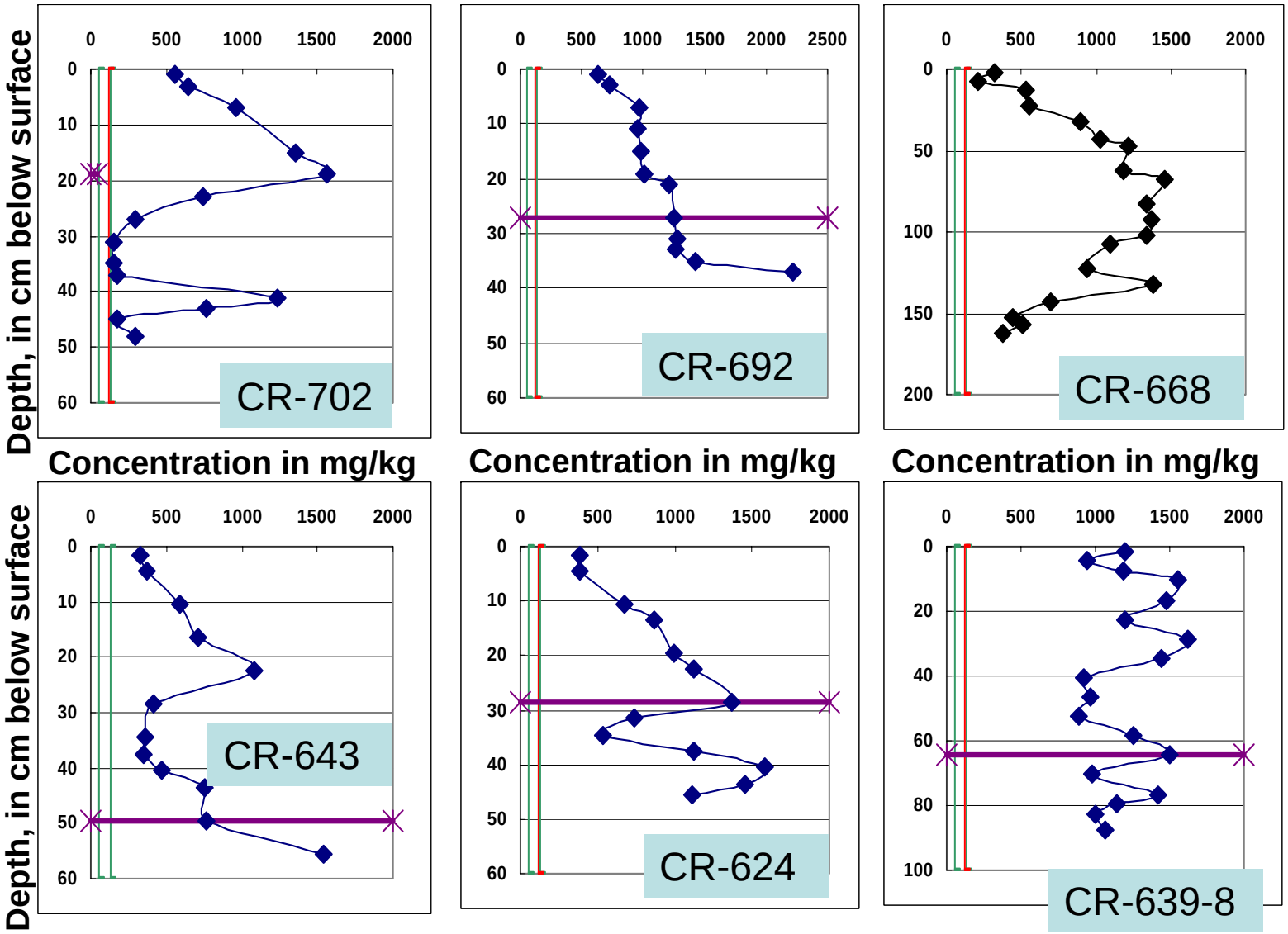
Causes of variations in concentration profiles



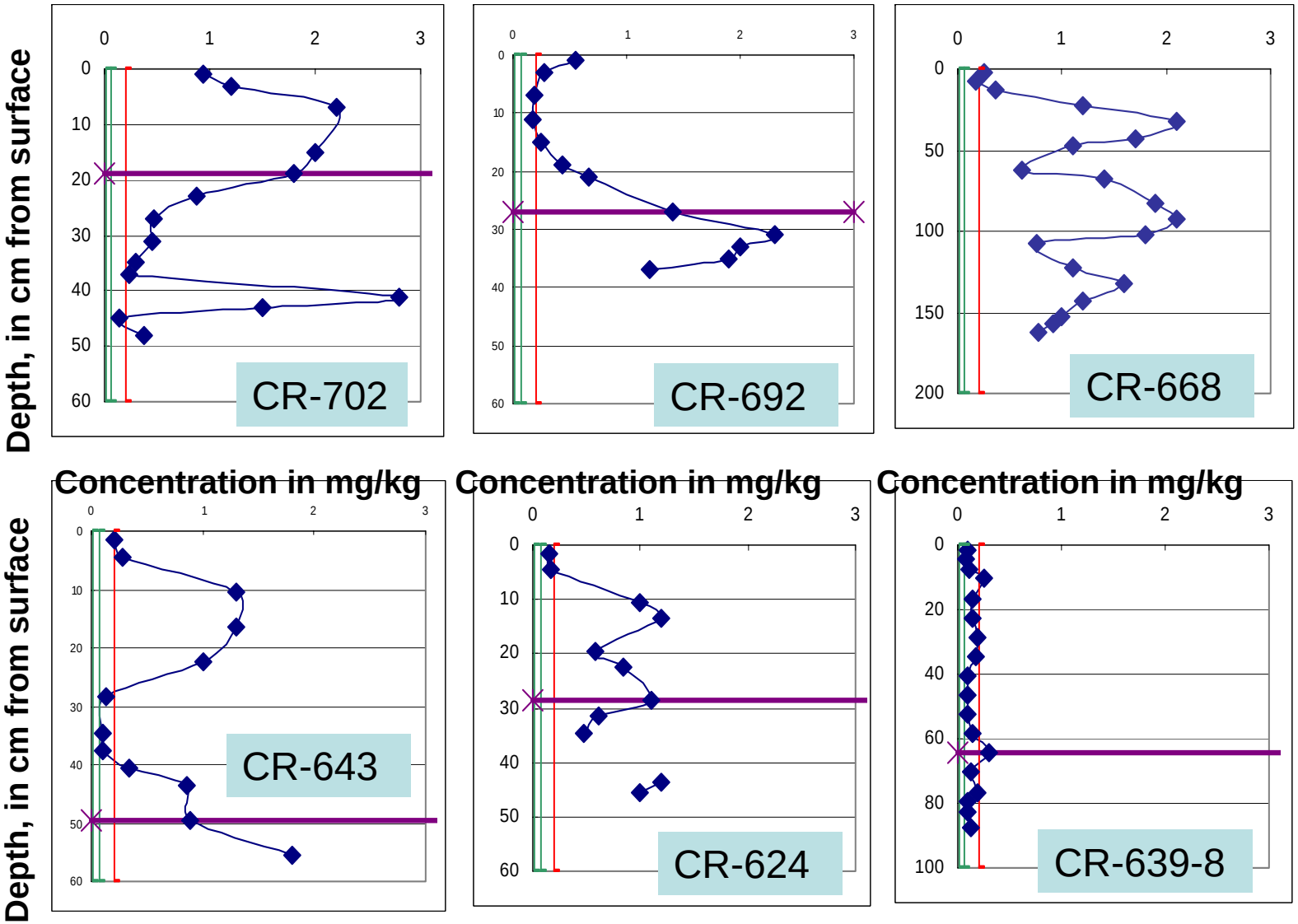
Decreasing input of trace elements



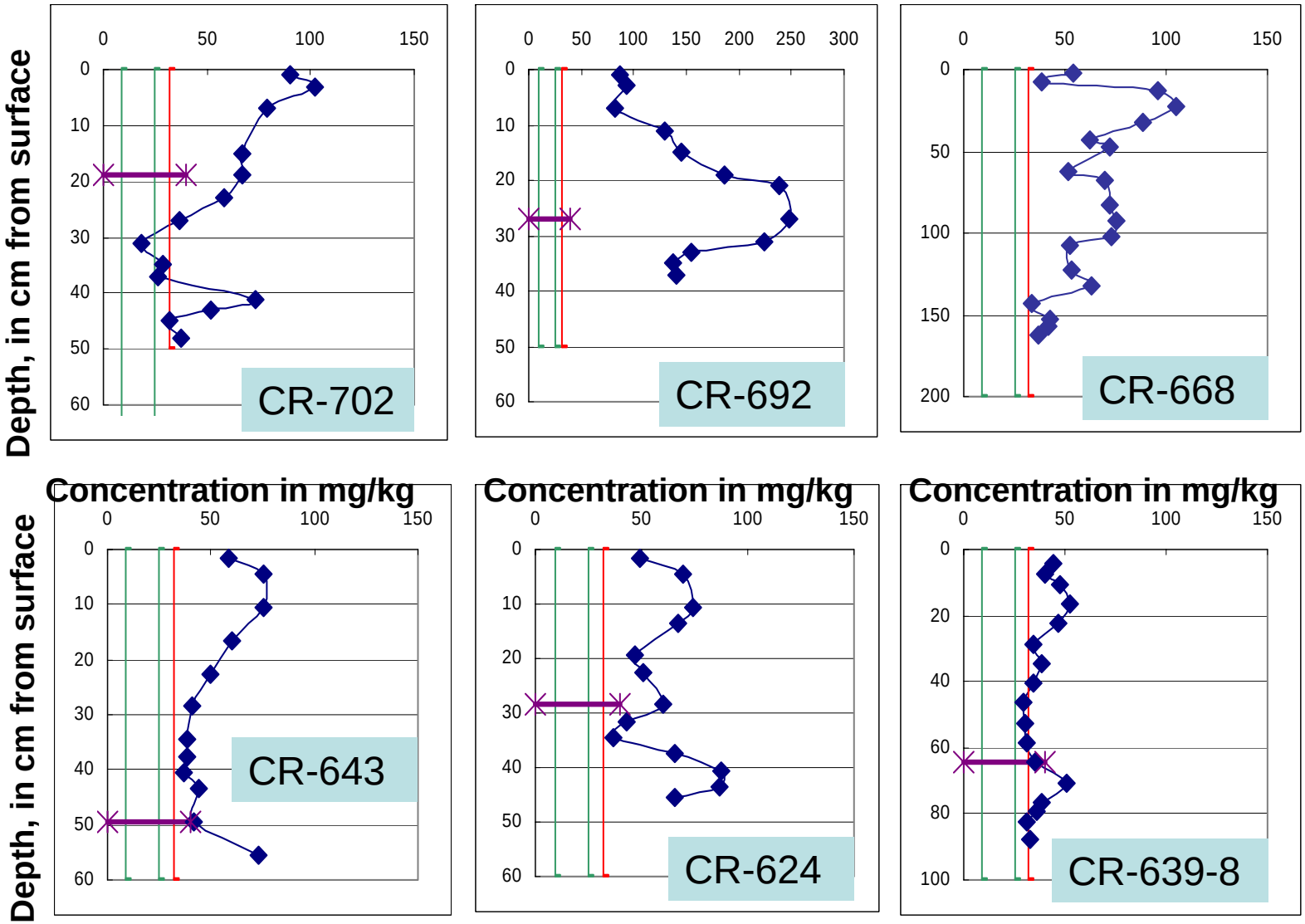
Concentration of zinc in 6 sediment cores



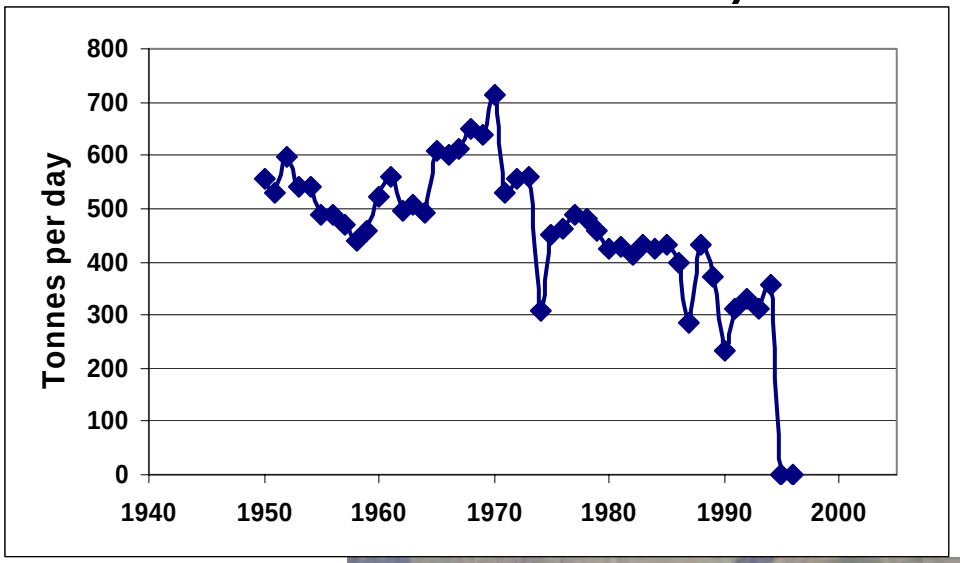
Concentration of mercury in 6 sediment cores



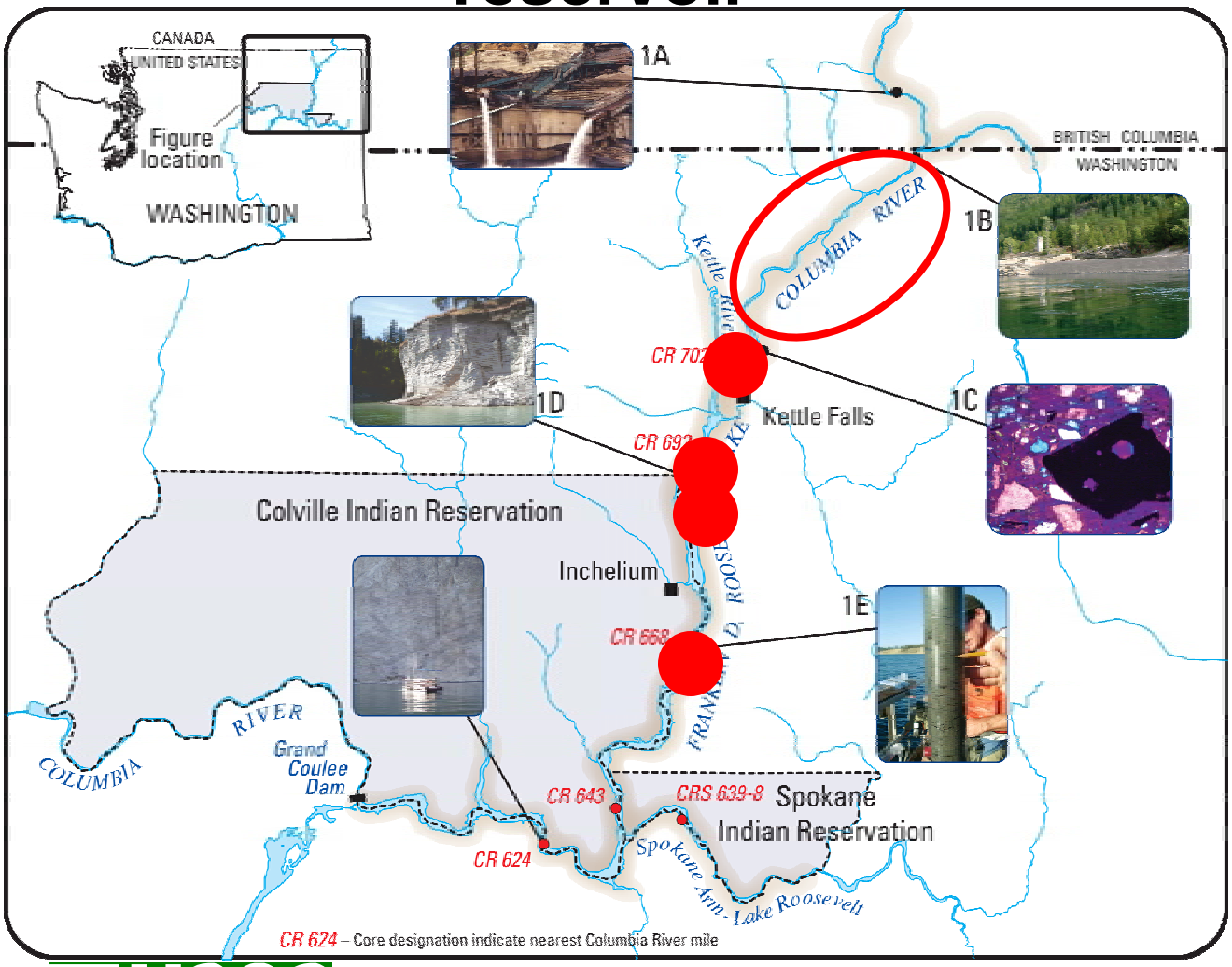
Concentration of copper in 6 sediment cores

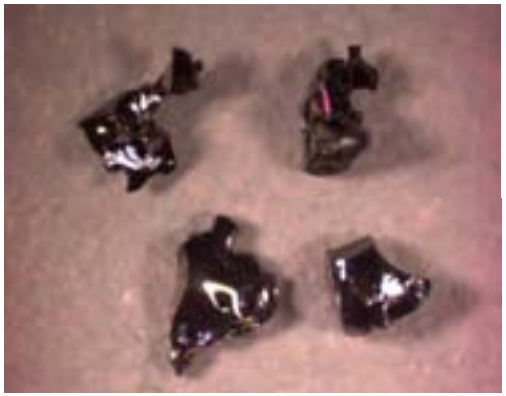


Slag discharged to the Columbia River from the smelter at Trail, BC

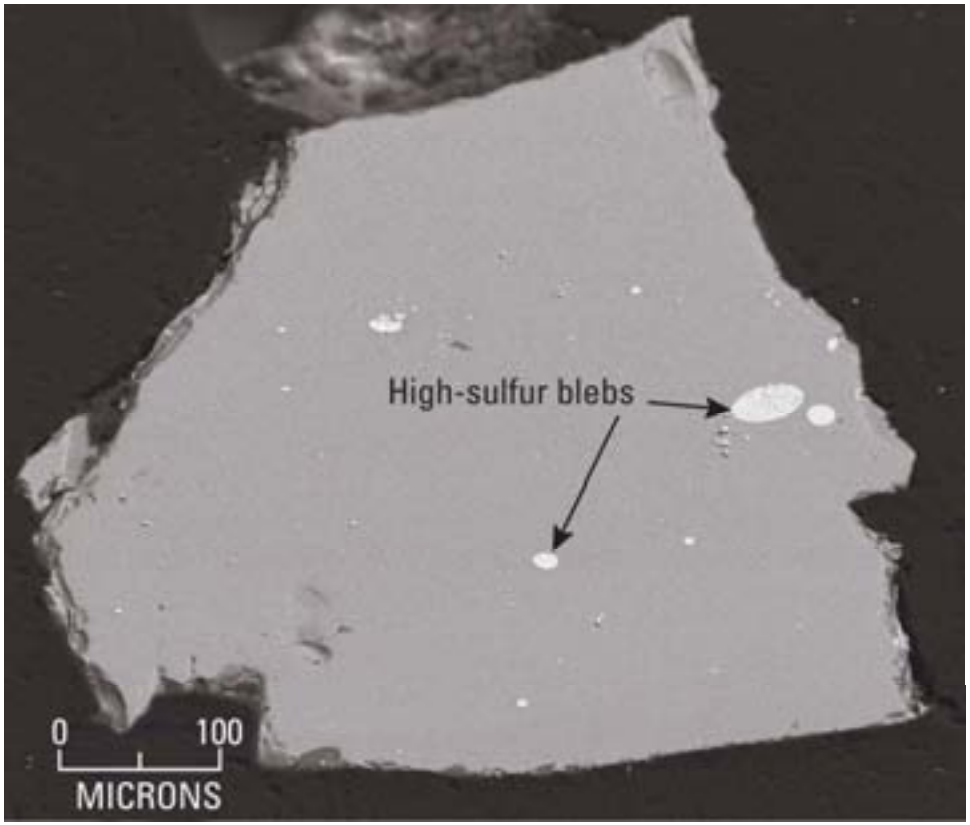


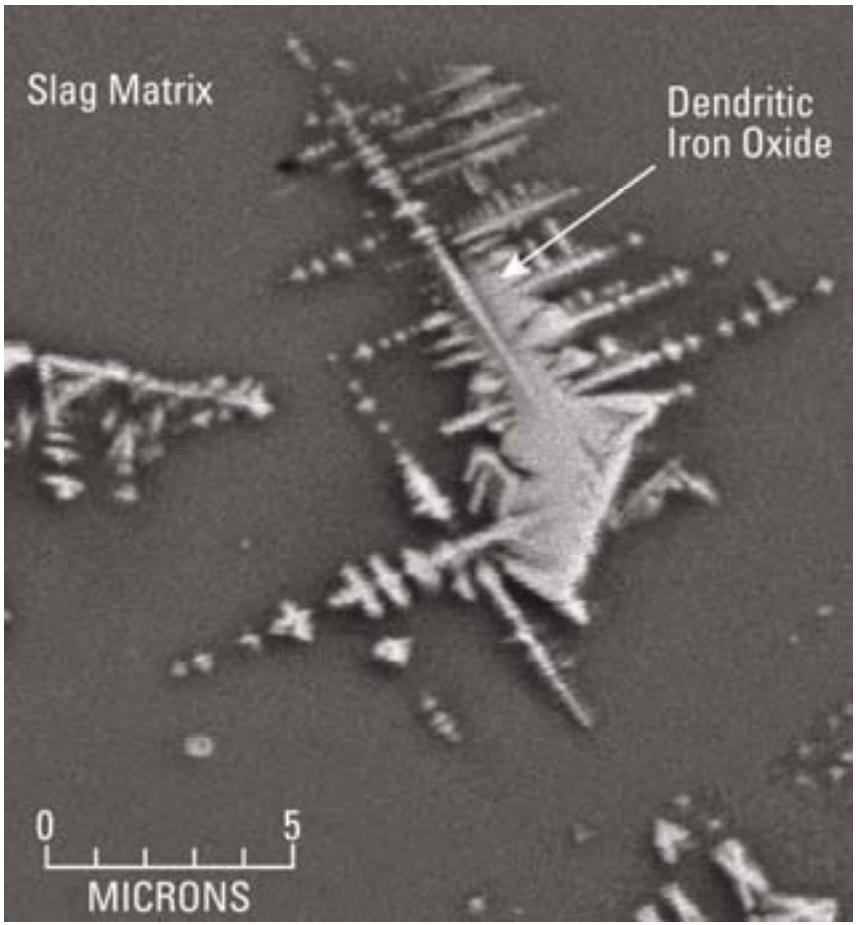
Slag particles found at locations in the upper & mid reaches of the reservoir



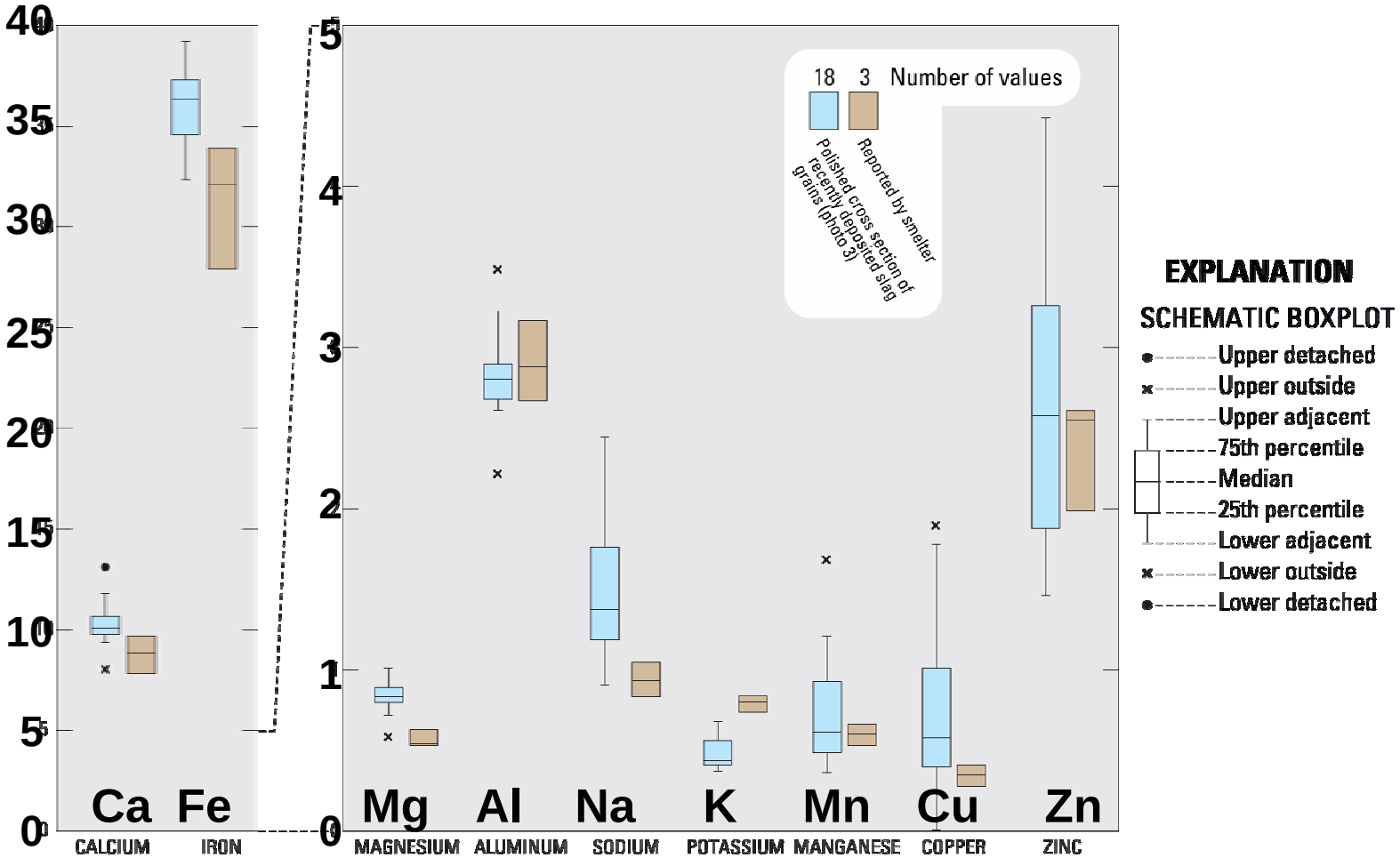


Cross-sectional surface of slag grains showing glassy matrix and limited internal structure

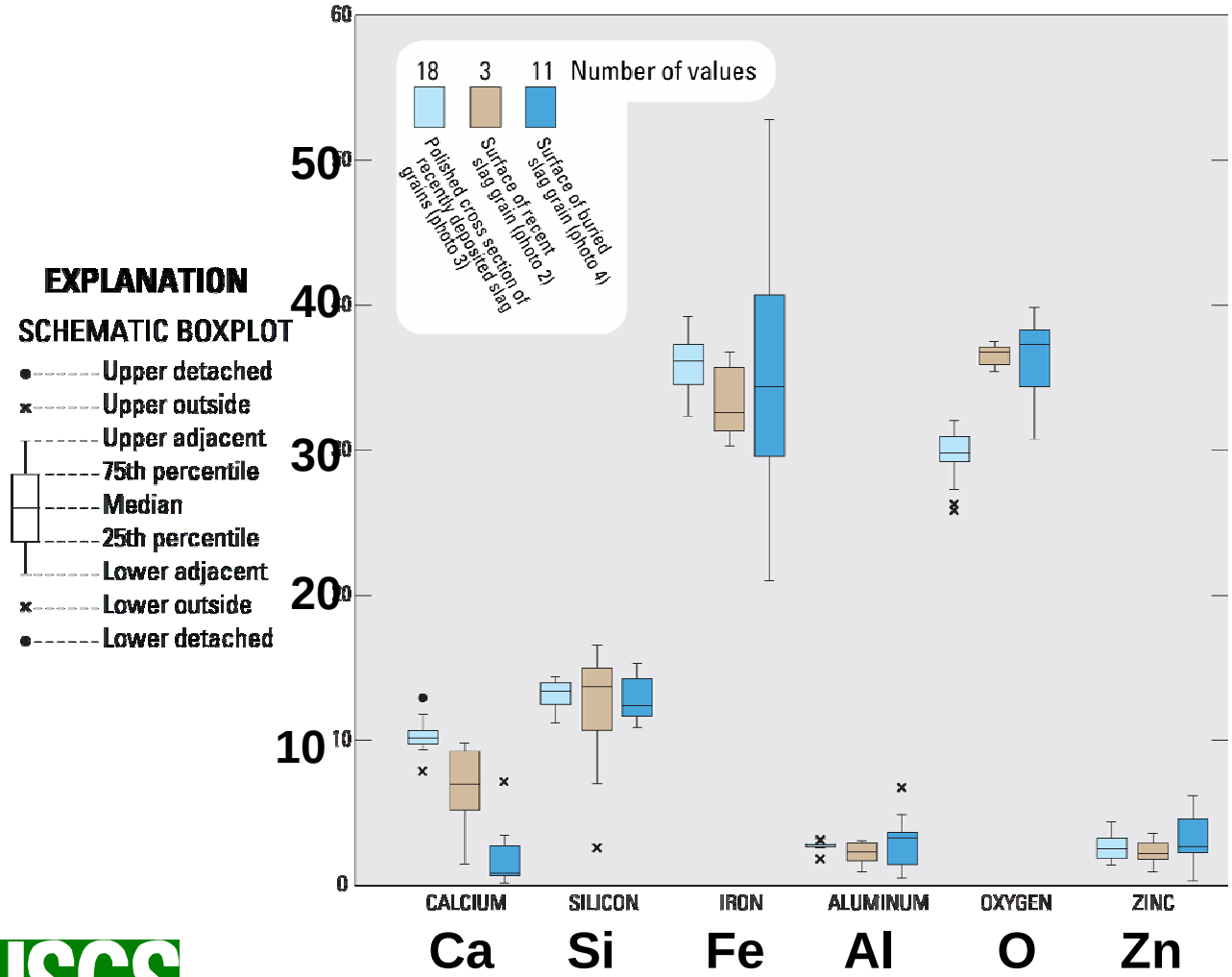




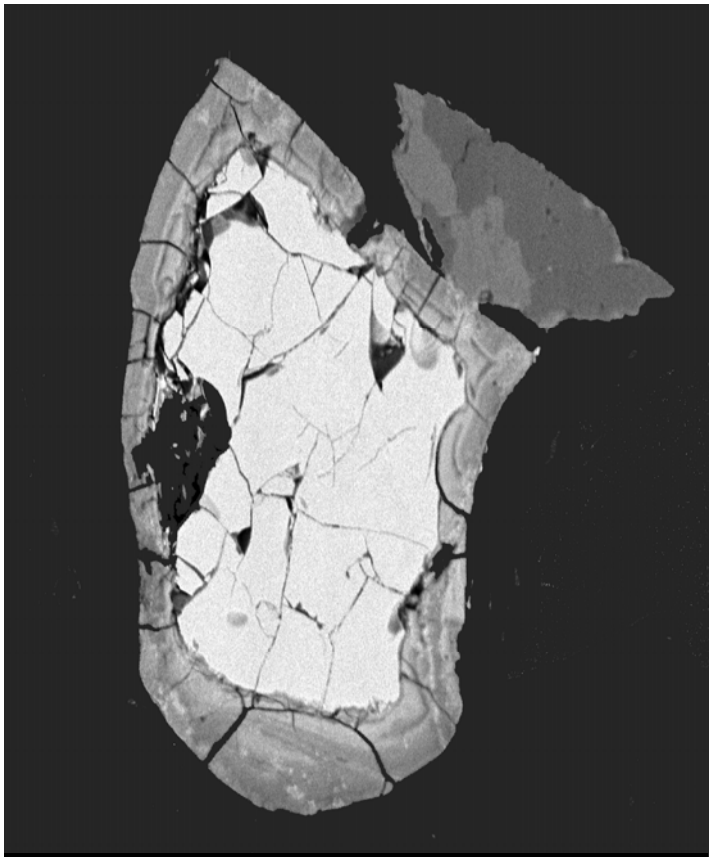
Comparison of slag chemistry: Smelter to river bank



Comparison of chemical composition of slag grains from source area, beach deposit at gage location and core CR-668

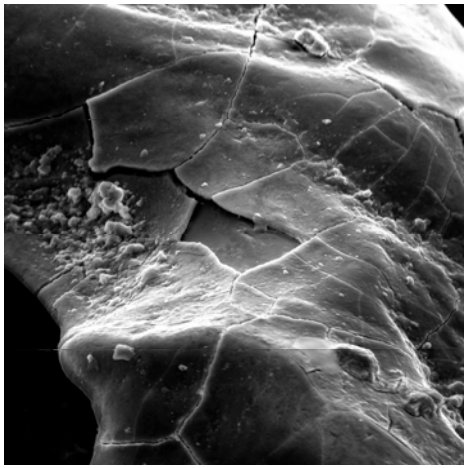


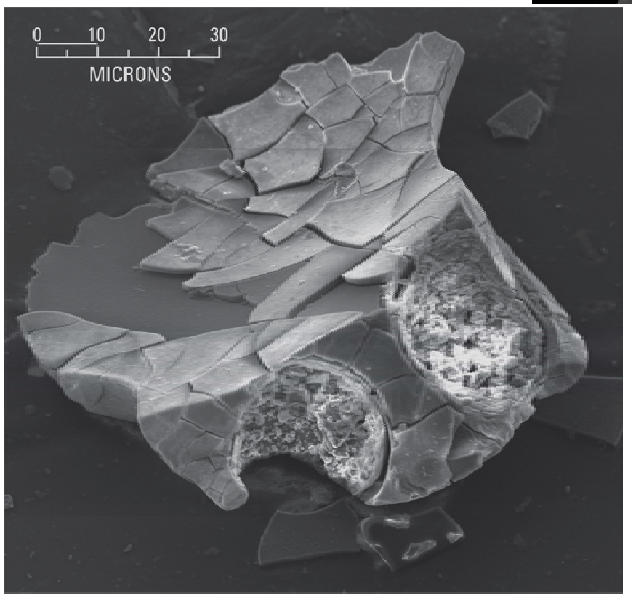
Alteration of the slag glass results in the development of weathering rind and exfoliation flakes



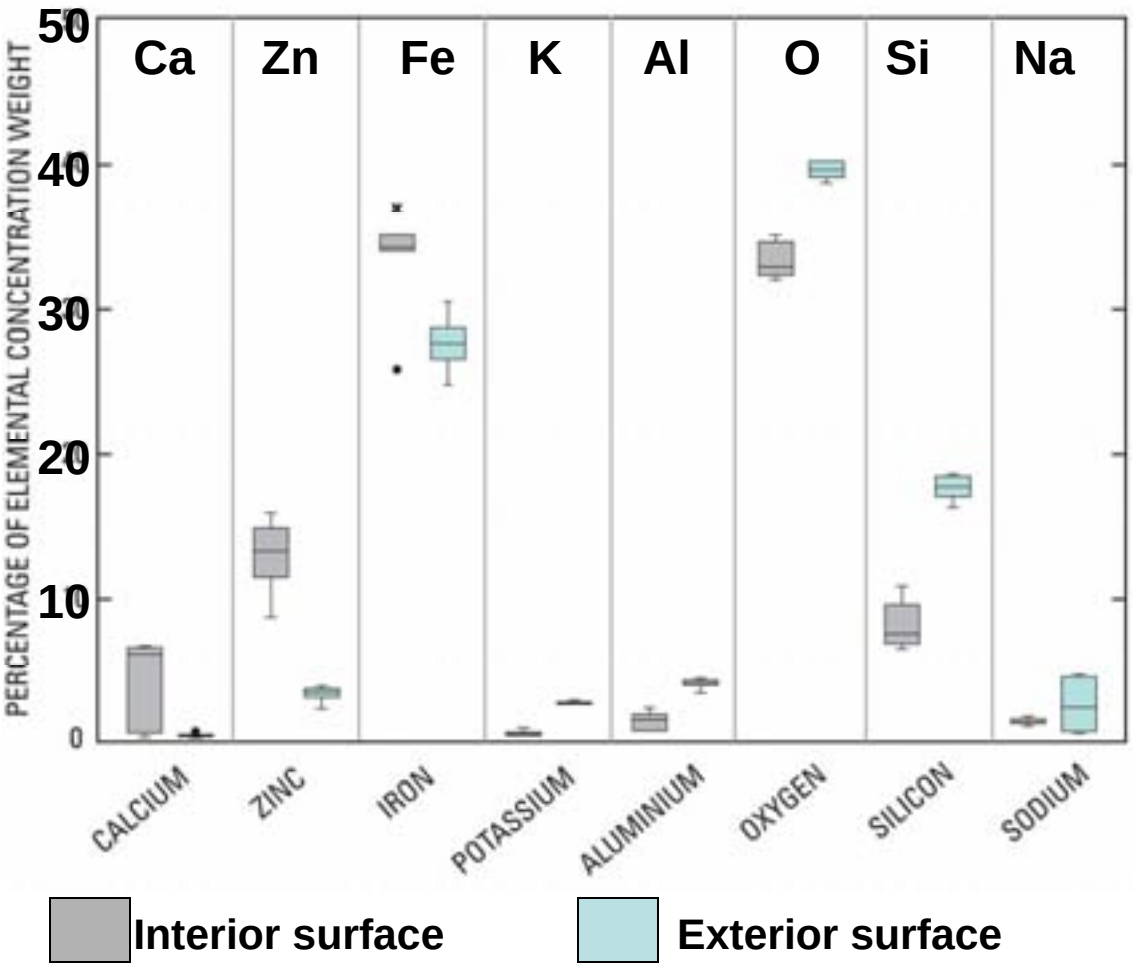
Polished cross-section of slag grain from pre-reservoir fluvial sand deposit

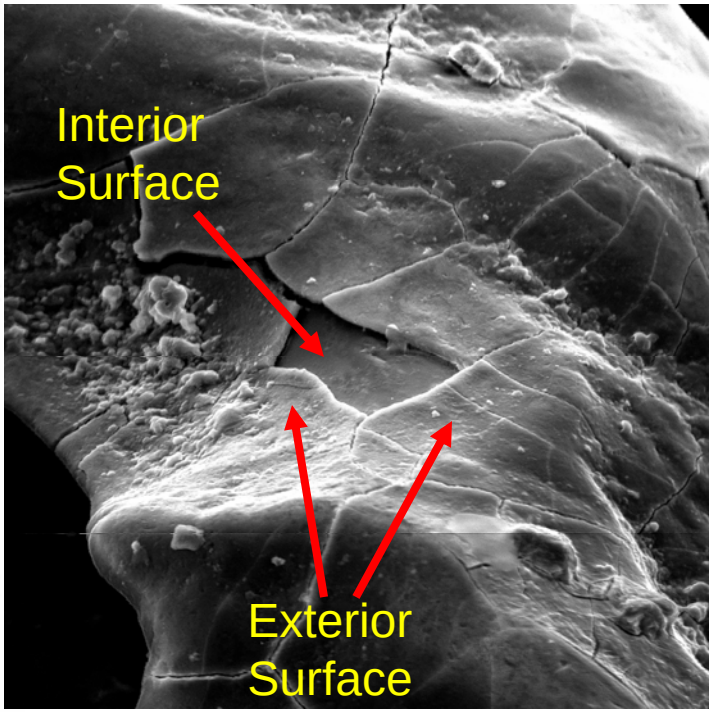
Surface of slag grains from interval 95-100 cm of core CR-668





Comparison of element concentration of surface of slag grains





Summary of information from concentration profiles

- Concentrations are variable with depth
- Highest concentrations typically at depth
- Concentrations declining in recent years and in some cases approaching CUL or reference concentrations
- Spokane Arm distinct from Columbia River channel
- Altered slag found in cores from mid reach

Report available at http://pubs.water.usgs.gov/sir20045090

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