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## Industrial Lead Pollution in Modern Central Greenland Ice

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Emissions from mid-latitude industrial activities (e.g., mining, smelting, coal combustion) result in long-range atmospheric transport of lead (Pb) to the Arctic. While previous measurements of elemental concentrations and Pb isotopic ratios in ice and sediments have been used to suggest potential sources of toxic heavy metal pollution in these regions, high resolution Pb isotope records are largely unavailable due to the low Pb concentrations found in Arctic ice. Recent advancements in low-level measurements of lead (Pb) by high resolution inductively coupled plasma mass spectrometry (HR-ICP-MS) (e.g., Smith et al., 2019; Wensman et al., 2022), provide means for obtaining precise, high resolution Pb isotopic records.

Here we present and discuss approximately annual high-resolution records of Pb isotopes for 1759–2008 measured in two central Greenland ice cores (Summit\_2010 (Wensman et al., 2022) and NASAU); the only high-resolution Pb isotopic records in Greenland ice to include the First Industrial Revolution (1760–1840). Historical records of industrial activities coupled with Pb isotopic signatures for regional ores and coals suggest Pb pollution prior to the mid-19th century was dominated by emissions from the British Isles following technological advancements, which revolutionized coal mining. Rapid increases in Pb levels and decreases in  $^{206}\text{Pb}/^{207}\text{Pb}$  ratios in the mid-19th century coincided with expansion of coal consumption in Europe and North America. Significant influence of 20th century smelting of Australian Broken Hill Pb ores in Europe resulted in a less radiogenic Pb isotope signature. We also highlight the impact of air-quality legislation on Pb isotopic ratios, demonstrating the reduced influence of United States leaded gasoline emissions following the Clean Air Act and phase-out of leaded gasoline. The research also highlights the rising influence of long-range transport from Asian Pb emission sources, in the context of declining North American and European Pb emissions.

### References

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- Wensman, S.W., Shiel, A.E., McConnell, J.R. (2022). Lead isotopic fingerprinting of 250-years of Industrial Era pollution in Greenland Ice. *Anthropocene*.

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