



Stable lead isotope ratios as stratigraphic markers in Eastern Canada

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The sedimentary record of an anoxic basin in the Pettaquamscutt River has revealed that stable Pb isotopes can provide a stratigraphic marker for the mid-1800s in North-Eastern United States (Lima et al., 2006, *Geochim. Cosmochim. Acta* 69:1813-1824). During this time period, which predates the burning of leaded gasoline and the widespread use of coal in the United States and Canada, the mining and smelting of highly radiogenic Pb ores from the Upper Mississippi Valley was the dominant North American source of atmospheric Pb. We present detailed profiles of Pb concentrations, stable Pb isotope ratios and ^{210}Pb activity in sediment cores from one perennially oxic and two seasonally anoxic lacustrine basins located in Eastern Canada, for which the sole anthropogenic inputs come from atmospheric deposition; these data confirm that the early period of smelting produced a clear anthropogenic Pb signal that can be detected over long distance. We demonstrate a sharp increase in the $^{206}\text{Pb}/^{207}\text{Pb}$, $^{206}\text{Pb}/^{208}\text{Pb}$ and $^{206}\text{Pb}/^{204}\text{Pb}$ ratios concomitant with a small increase in Pb concentrations below the depth of detectable excess ^{210}Pb in the sediments. This observation implies that minor amounts of radiogenic Pb were deposited in these sediments over a century ago. If we assume that the sediment accumulation rate was constant below the depth of detectable excess ^{210}Pb , the sharp isotopic Pb change would have occurred in the three lakes around 1850 ± 20 . Using a binary mixing model and assuming that natural Pb concentrations and isotopic composition are given by the oldest sediment in the cores, we find that the anthropogenic Pb added to the sediments at this time could only have come from the Upper Mississippi Valley. Given that our sampling sites are located more than 2000 km from the Mississippi Valley, we conclude that the industrial Pb signal from this source provides a widely distributed stratigraphic marker of the mid-1800s for non bioturbated sediments of Eastern North America.