Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.13929

Sources of Anthropogenic Lead (Pb) in Asia since the Industrial Revolution: Pb isotopic characterization in ice cores from Tibet and the Himalayas

ROXANA SIERRA-HERNÁNDEZ[1], FRANCO MARCANTONIO[2], DR. EMILIE BEAUDON[1], ELIZABETH M. GRIFFITH[1] AND LONNIE G. THOMPSON[1]

[1]The Ohio State University

[2]Texas A&M University

Presenting Author: sierra-hernandez.1@osu.edu

Lead (Pb) is a highly toxic heavy metal with negative and irreversible effects on children's development and behavior, and with several health effects in adults. Even though Pb has been used for millennia, it was not until the Industrial Revolution, and later when leaded gasoline was introduced in Europe and North America in the 1920s, that Pb from human activities surpassed its natural and pre-Industrial contribution by two orders of magnitude. Anthropogenic Pb emissions have decreased in North America and Europe since the 1970s after leaded gasoline was phased out. However, this has not been the case in Asia. The Ice Core Paleoclimatology Group at the Byrd Polar Climate and Research Center has extracted ice cores from five glaciers on the Tibetan Plateau and the Himalayas between 1987 and 2015. Recently, we developed 500-yr continuous high-resolution records of 29 trace elements (TEs) from the Guliya ice cap in Northwestern Tibet, the Puruogangri ice cap in central Tibet, and the Dasuopu glacier in the Himalayas. These TE records show temporal and spatial variation in the onset and degree of Pb pollution in the environment. To track the variability of Pb sources before and after the Industrial Revolution, we measured the Pb isotope composition (^{204}Pb, ^{206}Pb, ^{207}Pb, and ^{208}Pb) with an MC-ICPMS in 180 discrete samples using the same samples for which we have TE records. Samples were selected from the pre-Industrial (1500-~1850 CE) and Industrial (1850-1990s) periods for all ice cores, and from the 21st century (2000-2015) for the Guliya ice core at 20-year, 5- year, and annual resolutions, respectively. To establish a relative natural Pb isotopic background, 15 new samples covering ~10000 BCE to 3000 BCE, prior to the Bronze Age, were also measured. In addition, we measured Pb isotopes in 18 potential source area soil samples collected in the vicinity of the ice core drilling sites to distinguish between Asian sources of natural versus anthropogenic Pb. Preliminary results show that ^{206}Pb/^{204}Pb, ^{207}Pb/^{204}Pb, and ^{208}Pb/^{204}Pb isotope ratios range from 18.132-19.146, 15.605-15.804, and 38.196-39.318, respectively. Temporal trends along with deconvolution of the various sources through time and space will be discussed.