Tracing Anthropogenic sources of Tantalum in Skellefteå Bay Sediments

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Tantalum usage has been increasing with the growing demands as a critical component in consumer electronics. This increase poses a risk for high Ta contamination released into natural environments. However, our knowledge of the fate and behavior of Ta in different environmental systems has been limited due to our inability to measure its concentrations in different environmental media. Increases in concentrations in natural systems could be possible due to the rise of indirect emissions from the processing of electronic waste near electronic smelters. Furthermore, developments in analytical methods such as ICP-SF-MS make it possible to measure lower concentrations than was measured previously. This study aims to evaluate temporal trends of Ta in bay sediments near a sulfide ore smelter in Northern Sweden. The study further tries to identify if Ta, or it's geochemical twin Nb, can be used as tracers for the contamination of electronic waste for future studies. Lastly, the correlations between Ta and major redox elements (Mn, Fe, and S) in the sediment are also investigated.

A sediment core profile was taken from the Skellefteå bay outside the Rönnskär Cu-Pb-Zn smelter in Northern Sweden. A secondary core profile was also taken from the Bothnian Bay for comparative purposes. Both cores were analyzed using Inductively Coupled Plasma – Sector Field Mass Spectrometry (ICP-SF-MS). The cores were dated using 137Cs, known event markers and paleomagnetic signatures. A grain size analysis was performed using a laser diffraction particle size analyzer and mineralogical content was analyzed using an X-ray diffractometer.

Results indicate concentrations of Ta increase in the time coinciding with the beginning of electronic waste processing at the Rönnskär smelter. Conversely, Nb concentrations remained stable at background levels throughout the core. The ratios between Ta and Nb changed, presumably from an increase of anthropogenic input of Ta into the bay sediments. The Nb and natural background Ta show a similar trend as the aluminosilicates in the core. However, the introduced anthropogenic tantalum indicated an association closer to Fe oxides in the sediment.