

Detection of Pb from natural sources in the Tropical Atlantic

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It is well established that anthropogenic Pb emissions to the oceans completely overwhelmed natural Pb sources over the past century, predominantly due to the usage of leaded petrol. For example, Pb in Tropical Atlantic surface waters was completely dominated by anthropogenic sources in the 1980's and 90's, despite receiving potentially large inputs of Pb from natural sources (North African mineral dust and the Amazon basin). Since then, leaded petrol has been phased out nearly everywhere. Here we present Pb isotope composition and concentration data for Tropical Atlantic surface waters collected during two GEOTRACES cruises (GA02, leg 2, 2010 and GA06, 2011) in order to reassess the relative importance of natural and anthropogenic Pb sources to this region.

Relative maxima (of ~30-40%) in the contribution of Pb from North African mineral dust to surface waters are observed at different latitudes (~10°N and ~15-20°N) for the two cruises, consistent with the seasonal migration of the North African dust plume. This is the first time a significant amount of Pb from natural sources has been detected in Atlantic surface waters, as a testament to the success of the global effort to reduce anthropogenic Pb emissions starting more than 40 years ago.

However, Pb isotope compositions and elemental concentrations for aerosols collected during the GA06 cruise reveal that anthropogenic sources still contribute at least 50% of the Pb in the aerosols, and completely dominate the fraction of Pb that is soluble in a dilute ammonium-acetate leaching solution (pH 4.7). These results seem in contrast to the observed mineral dust Pb contributions to surface waters. Since anthropogenic pollutants are typically contained in finer particles than mineral dust, the reoccurrence of Pb from mineral dust in surface waters points to predominantly dry deposition in the region. This observation is consistent with the prevailing atmospheric circulation and could offer unique constraints for global models of dust deposition.