Geophysical Research Abstracts
Vol. 16, EGU2014-12350, 2014
EGU General Assembly 2014

Unravelling Copenhagen's stride into the Anthropocene using lake sediments

Norman Schreiber (1), Thorbjørn J. Andersen (1), Robert Frei (1), Peter Ilsøe (2), Patrick Louchouarn (3,4), Kenneth Andersen (2), Svend Funder (2), Peter Rasmussen (5), Camilla S. Andresen (5), Bent Odgaard (6), and Kurt H. Kjær (2)

(1) Department of Geosciences and Natural Resource Management, University of Copenhagen, Copenhagen, Denmark, (2) Centre for GeoGenetics, Natural History Museum of Denmark, University of Copenhagen, Copenhagen, Denmark, (3) Department of Marine Science, Texas A&M University at Galveston, Galveston, United States of America , (4) Department of Oceanography, Texas A&M University, College Station, United States of America, (5) Geological Survey of Denmark and Greenland (GEUS), Copenhagen, Denmark, (6) Institute for Geoscience, Aarhus University, Aarhus, Danmark

Industrialization including the effects of expanding energy consumption and metallurgy production as well as population growth and demographic pressure increased heavy-metal pollution loads progressively since the Industrial Revolution. Especially the burning of fossil fuels mobilizes heavy metals like lead and zinc on a large scale. By wet and dry deposition, these loads end up in the aquatic environment where sediments serve as sinks for these contaminations. In this study, we examine the pollution history of Copenhagen, Denmark. A sediment core was retrieved for the lake in the Botanical Gardens in central Copenhagen using a rod-operated piston corer. The water body used to be part of the old town's defence-wall system and was turned into a lake by terrain levelling in the mid 17th century. After initial X-ray fluorescence core scanning, element concentrations were determined using emission spectroscopy. The onset of gyttja accumulation in the lake is assumed to start immediately after the construction of the fortification in approximately AD 1645. An age model representing the last approximately 135 years for the uppermost 60cm was established by lead-210 and cesium-137 dating. The older part was dated via recognition of markedly increased levels of levoglucosan which are interpreted to be linked with recorded fires in Copenhagen. Similarly, two distinct layers interstratify the sediment column and mark pronounced increases of minerogenic material inflow which can be linked to known historical events. Significant pollution load increases are evident from the 1700s along with urban growth and extended combustion of carbon carriers fuels such as wood and coals. However, a more pronounced increase in lead and zinc deposition only begins by the mid-19th century. Maxima for the latter two pollutants are reached in the late 1970s followed by a reduction of emissions in accordance with stricter environmental regulations. Here, especially the phasing-out of tetraethyl lead from gasoline and increased cleaning of the emissions from local power plants have had an effect. Also a change of fuel from coal to natural gas in the power plants has been very important. The present study shows how a detailed record of past levels of air pollution in large cities may be achieved by analyzing the sediment accumulated in urban lakes provided that a reliable chronology can be established.