

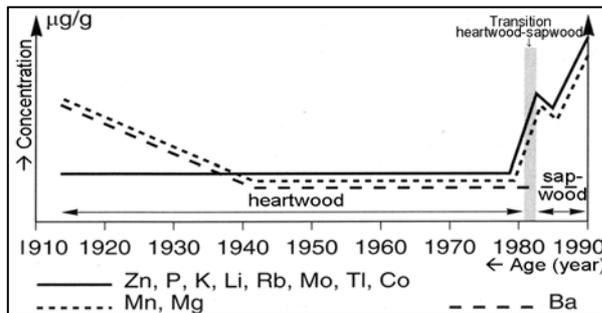
Tree rings – a questionable indicator of heavy metal pollution in air or soil

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Tree rings serve as an indicator for climate, soil conditions, health of the tree and represent an absolute basis for dating. Several decades scientists believed that tree rings serve well as an indicator for the development of air pollution. Our study shows that this is an invalid simplification.

An oak tree (*Quercus robur* L.) was felled 1993 10 km E of Hannover (Germany), 18 m away from a highly frequented freeway (1990: 57000 cars/day)[1]. Single tree rings, comprising the years 1913-1992, were sampled from a trunk slice at 1.4 m height and analysed by ICP-MS after complete digestion in a clean lab. The soil is a loamy cambisol with rising pH-values from 5.9 (humus layer) to 6.4 (0.44 m depth).



Results: **1.** The elements Li, Na, K, Rb, Cs, Tl, Mg, Ca, Sr, Ba, Mn, Co, Ni, Cu, Zn, Cd, Ag, Mo, P, Y, and La show evidence of redistribution inside the sapwood or in the transition area between sapwood and heartwood (see Figure); Ti, Cr, Sn, Ag, Pb, and Sb are not redistributed. **2.** The contents of Li, Cs, Ca, Sr, Ba, Cr, Co, Ni, Cu, Zn, Cd, Pb, Ag, Mo, Sb, Ti, Y, and La decrease with increasing tree ring width. **3.** Positive relations exist between the concentrations of Rb, Cs, Ca, Sr, Co, Ni, Cu, Zn, Sb, Sn, Y, and La in tree rings and the amount of precipitation. **4.** The indicators for traffic emissions such as Pb, Cd, Zn, Cr, Ni, and Cu in trees are not correlating with increasing traffic (highway opening: 1936). **5.** The contents of Mn, Mg, and partially of Ba in the tree rings indicate a decrease with rising pH-values in the soil profile.

We assume that the positive correlation between heavy metals and air/soil pollution, as measured by many authors, are primarily caused by the simultaneously rising acidification of the soils, which facilitates the uptake of the metals by plants. In summary, many interrelated factors determine element contents in tree rings such as soil pH and composition, climate, growth rate, redistribution of elements etc. An air or soil pollution chronology by tree rings is ill-founded.

References:

[1] Wischow, D. and Ruppert, H. (1995): Umweltgeologie heute 5, 59-65.