Atmospheric $^{14}CO_2$ and Suess effect: ^{14}C contents in pine needles grown from 1983 to 2014 at the Higashiyama Campus, Nagoya University

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^{14}C contents were measured for needle leaves from pine trees grown from 1983 to 2014 at several locations on the Higashiyama campus of Nagoya University, in the east suburbs of Nagoya city, central Japan, to investigate the atmospheric $^{14}CO_2$ variations. In particular, we focused on Suess effect, i.e., the global as well as local effect of diluting ^{14}C content in the atmosphere with ^{14}C-free CO_2 exhausted in combustion of fossil fuel in recent years.

Pine needles formed in the previous year were collected in early spring before starting the formation of any new needles. The pine-needle samples were rinsed chemically and combusted in a quartz tube to produce CO_2. The CO_2 was purified in a glass vacuum line, and the graphite finally produced was measured with a Tandetron AMS system at Nagoya University. The measured ^{14}C content was expressed in $F^{14}C$ according to Reimer et al. (2004).

The following results were obtained: (1) ^{14}C contents of the needles decreased gradually from 1983 to 2014, in accordance with the decrease of atmospheric ^{14}C (Levin et al. 2008). (2) ^{14}C contents were lower for the needles grown at the place along the road with heavy traffic by about 1-2.5% than those grown at other places far from the road in the campus. This is caused by the local dilution of atmospheric $^{14}CO_2$ with ^{14}C-free CO_2 exhausted from motor vehicles. (3) The $F^{14}C$ values in average for the needles grown in the Higashiyama Campus were lower by 3% and 5% in 1998 and 2005, respectively, compared to the $F^{14}C$ values of clean atmospheric CO_2 observed at Jungfraujoh Observatory (levin et al. 2008). (4) The decrease of $F^{14}C$ of the needle samples in 1998 to 2005 was about 5%, and this decrease could be the results of gradual enhancement of the Suess effect.

Ref: Levin I, et al 2008 Science of the Total Environment, 391, 211-216; Reimer PJ, et al 2004. Radiocarbon 46(3), 1299–304.