Spatial variability of ^{14}C reservoir effects in Tibetan Plateau lakes

S. Mischke[1,2], M. Weynell[2], C. Zhang[3] And U. Wiechert[2]

[1] *Institute for Earth and Environmental Science, University of Potsdam, Germany*
[2] *Institute for Geological Sciences, Free University of Berlin, Germany*
[3] *School of Resources and Environmental Sciences, Lanzhou University, China*
smischke@geo.uni-potsdam.de

Radiocarbon dating of lake sediments is often hampered by the presence of a lake reservoir effect (LRE, also 'dead carbon' or 'old carbon' effect) especially in dry and cold regions with a sparse plant cover in the catchment. The Tibetan Plateau became a hotspot of the palaeoenvironmental and climate research community in recent years and the assessment of present-day LREs is a crucial prerequisite for the establishment of reliable radiocarbon age-depth relationships for lake sediment cores.

We here examine the spatial variability of LREs within individual lakes by a discussion of new data for Lake Donggi Cona and a compilation of previously published data for five additional lakes where LRE data are available for different sites. Lake reservoir effects for Lake Donggi Cona on the northeastern Tibetan Plateau were determined for shells of aquatic snails collected alive close to the lake's shore. The largest determined LRE of 20,000 ^{14}C years is significantly larger than previously reported LREs from the central part of the lake and actually larger than any previously published LRE for the Tibetan Plateau. Relatively low LREs in the central regions of lakes, higher LREs towards the margins, and high LREs in tributaries and spring waters are apparently a common pattern of Tibetan Plateau lakes. The differences in LREs within individual lakes or catchment areas are attributed to the more prolonged exchange of the lake water's dissolved inorganic carbon with the atmospheric CO_2 in central lake regions on the one hand and the increasing influence of ^{14}C free or poor stream and groundwater due to the dissolution of carbonaceous basement rocks towards its margins. Generally higher LREs were recorded in the three tectonically active lake regions of the six examined catchments and we speculate that rising crustal CO_2 further contributes to the LREs in these catchments.

In addition to these observations and inferences, we point out that elevated ^{14}C levels of the atmosphere as a result of nuclear bomb testing are often ignored if LREs for modern materials are reported by convention relative to the atmospheric ^{14}C activity of the year 1950. LRE data reported in this way represent unrealistic minimum estimates.

Key words: Lake reservoir effect; Radiocarbon dating; Post-bomb ^{14}C; Palaeolimnology; Tibetan Plateau