

## **Sediments of lakes, ponds and floodplains as archives of environmental changes using $^{210}\text{Pb}$**

Edyta Łokas<sup>1</sup>, Kazimierz Klimek<sup>2</sup>, Adam Kotarba<sup>3</sup>, Przemysław Wachniew<sup>1</sup>,  
Beata Ostachowicz<sup>1</sup>

<sup>1</sup>AGH – University of Science and Technology, Kraków, Poland,

e-mail: vlokas@novell.ftj.agh.edu.pl

<sup>2</sup>University of Silesia, Faculty of Earth Sciences, Sosnowiec, Poland

<sup>3</sup>Department of Geomorphology and Hydrology, Institute of Geography and Spatial Organisation, Polish Academy of Science, Kraków, Poland

Sediments from lakes, ponds and rivers record events caused by man and by natural processes and, by using radioactive tracers, their timing can be determined (W. R. Shell, 1982).  $^{210}\text{Pb}$  method has been widely used for dating of lacustrine and marine deposits, peats and glacier ice. Recently this method has been used for riverine overbank sediments (Walling & He, 1999). The use of  $^{210}\text{Pb}$  method allows for retrospective (for last 100-150 years) estimates of sedimentation rates. This paper presents attempts to use this technique to estimate rates of sediment deposition in various environments: the Pisia and the Swider rivers (central Poland), Morskie Oko and Zelene Pleso lakes (Tatra Mountains) and a pond in the Ruda river valley (Upper Silesia, Poland). Rivers selected for the study fulfil the requirement of regular flooding in the studied reaches what is a prerequisite for estimations of overbank sedimentation rates by use of  $^{210}\text{Pb}$  (He & Walling, 1996a).

Rates of overbank sedimentation on floodplains and their spatial variability significantly influence suspended solids budget in a catchment and long-term evolution of the floodplain (Walling, 1999). Due to importance of overbank sediments in the assessment of the anthropogenic environmental change there is an increasing need for information regarding rates and spatial patterns of overbank deposition. The Pisia and the Swider are small lowland rivers characterized by different flood regimes and rates of overbank sedimentation. Catchments of both rivers underwent significant anthropogenic changes over last 150 years reflected, among others, in varying sedimentation rates, sediment compositions and metal contents.

High mountain lakes trap unconsolidated slope covers which are subject to downslope transfer due to mass movements and fluvial transport. Sediment transfer changes spatially and temporally depending on slope morphology and covers and the degree of its stabilization by vegetation. Therefore, similar thermal and precipitation regimes result in different sedimentary responses for lakes located in two postglacial valleys. Results from the Morskie Oko and the Zelene Pleso lakes illustrate this difference. Sediment rates derived by use of the  $^{210}\text{Pb}$  method are 0.037 and 0.044 cm/year, respectively. (Baumgart-Kotarba, et al. 1993; Kotarba et al., 2002).

Sediments of the pond in the Ruda river valley represent a specific sedimentation environment. The artificial pond was operational in the second half of the XIX century. Its bottom sediments are buried underneath younger fluvial deposits. The  $^{210}\text{Pb}$  method was applied to the pond sediments. The average sedimentation rates was estimated at 3.0 g/cm<sup>2</sup> year what corresponds to 0,5 cm/year.

The  $^{210}\text{Pb}$  method appeared to be a useful tool in studies of environmental changes as recorded in sediments of different lacustrine and fluvial environments.

### *Acknowledgements*

The presented work was supported by National Grant KBN-11.11.220.01, by KBN statutory founds 10.10.140.038 and financial support from the Kosciuszko Foundation, Inc., American Center for Polish Culture, with funds provided by the Alfred Jurzykowski Foundation.

### **References**

Baumgart-Kotarba, M., Kotarba, A. & Wachniew, P., 1993. Młodoholocenekie osady jeziora Morskie Oko Tatrzach Wysokich i ich datowanie za pomocą  $^{210}\text{Pb}$  i  $^{14}\text{C}$ . Dokumentacja Geograficzna 4-5, 45-61.

He, Q., Walling, D.E., 1996. Use of fallout Pb-210 measurements to investigate longer-term rates and patterns of overbank sediment deposition on the floodplains of lowland rivers. Earth Surface Processes and Landforms 21, 141 – 154.

Klimek, K., Kocel, K., Łokas, E., Wachniew, P., 2003. Osady denne stawu w dolinie Rudy; metody kartograficzne i radioizotopowe w określaniu czasu sedymentacji. [W:] J.M.Waga i K.Kocel (Red.) Człowiek w środowisku przyrodniczym – zapis działalności. Polskie Towarzystwo Geograficzne, Sosnowiec 2003.

Kotarba, A., Łokas, E., Wachniew, P., 2002.  $^{210}\text{Pb}$  dating of young Holocene sediments in high-mountains lakes of the Tatra mountains. *Geochronometria* 21, 73-78

Shell, W. R., 1982. Dating recent (200 Years) Events in Sediments from Lakes, Estuaries, and Deep Ocean Environments Using Lead-210. Reprinted from ACS SYMPOSIUM SERIES 176

Walling, D.E., 1999. River floodplains as sediment sinks. In: *River Sedimentation*, Jayawardena, Lee & Wang (eds.) 465 – 474

Walling, D.E., He, Q., 1999. Changing Rates of Overbank Sedimentation on the Floodplains of British Rivers during the Past 100 Years. In: *Fluvial processes and Environmental Change*, Brown, A.G., Quine, T.A. (eds). John Wiley & Sons Ltd.

# ZOBODAT - [www.zobodat.at](http://www.zobodat.at)

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Berichte des Institutes für Geologie und Paläontologie der Karl-Franzens-Universität Graz](#)

Jahr/Year: 2004

Band/Volume: [8](#)

Autor(en)/Author(s): Lokas Edyta, Klimek Kazimierz, Kotarba Adam, Wachniew Przemyslaw, Ostachowicz Beata

Artikel/Article: [Sediments of lakes, ponds and floodplains as archives of environmental changes using  \$^{210}\text{Pb}\$ . 88-90](#)