GFF ›
Volume 135, 2013 - Issue 3-4: Varve Genesis, Chronology and Paleoclimate

Article

Construction and validation of calendar-year time scale for annually laminated sediments – an example from Lake Szurpiły (NE Poland)

Małgorzata Kinder, Wojciech Tylmann, Dirk Enters, Natalia Piotrowska, Grzegorz Poręba & Bernd Zolitschka

Pages 248-257 | Received 14 Nov 2012, Accepted 14 Jan 2013, Published online: 12 Jun 2013

Cite this article https://doi.org/10.1080/11035897.2013.785015

Full Article | Figures & data | References | Citations | Metrics
Reprints & Permissions | Read this article | Share

Abstract

The composite sediment profile (12.39 m) from Lake Szurpiły (NE Poland) represents an annually laminated organic-carbonaceous gyttja occasionally interrupted by turbidites and massive sand layers. This study focuses on the 7.58-m long and almost continuously varved top section of the profile, which produced a 8410-year long varve chronology with a cumulative counting error of ± 1.24%. The age-depth model was established by multiple microscopic varve counts and improved by the application of independent radiometric dating methods (^{210}Pb, ^{137}Cs). Ten additional AMS ^{14}C dates are consistent with varve counts. In some sections, missing varves were identified as a result of erosional processes related to turbidite deposition. Varve thickness ranges

from less than 0.1 to 13.7 mm (mean: 0.83 mm; std: 0.75 mm) with highest variability during the last 1500 years. The accuracy of the varve chronology depends mostly on the regularity of the varve thickness and the distinctness of varve boundaries, and was not influenced by the varve thickness itself. Even though manual and semiautomated varve counting show similar results of the total amount of varves, with the difference of only 0.56%, the comparison between those two methods in intervals of 200 years indicates potential problems, especially for sections with complex lamination and turbidites. We found that semiautomatic varve counting overestimated the varve boundaries in sections with erosive turbidites. Our results confirm the importance of validation of varve chronologies by independent dating methods and caution in relying on automated methods.

Keywords::

lacustrine sediments | biogenic varves | varve chronology | automatic varve counting | radiometric dating | age-depth model | north-eastern Poland

Acknowledgements

This research was supported by the Polish Ministry of Science and Higher Education grants to M. Kinder (N N306 009337) and to N. Piotrowska (N N306 291639). It is a contribution to the bilateral scientific programme “Northern Polish Lake Research” (NORPOLAR), a Polish-German research initiative funded by the Deutsche Forschungsgemeinschaft and the Polish Ministry of Science and Higher Education. The authors would also like to acknowledge the support and cooperation of the Suwałki Landscape Park. This paper stems from a presentation at the 3rd PAGES (Past Global Changes) Varve Working Group Workshop, held in March 2012 in Mandersheid, Germany.