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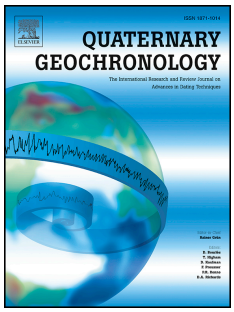

Multiple varve chronologies for the last 2000 years from the sediments of Lake Żabińskie (northeastern Poland) – Comparison of strategies for varve counting and uncertainty estimations

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Multiple varve chronologies for the last 2000 years from the sediments of Lake Żabińskie (northeastern Poland) – comparison of strategies for varve counting and uncertainty estimations

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Abstract:

This study compares different methods to count biogenic varves in Lake Żabińskie in northeastern Poland. To perform this comparison, we used 2000 years-long varved sediment record from this lake because of the well-preserved laminations as well as the independent age controls, i.e. 29 AMS ^{14}C dates, ^{137}Cs activity peaks and volcanic glass shards (1875 AD Askja cryptotephra). Microscopic investigations of thin sections allowed us to identify six major varve microfacies along the sediment profile. Using these microfacies, we tested three counting methods and different approaches of counting uncertainty estimation. These methods provided comparable numbers of varves (1943 ± 30, 2034 ± 34, 2028 $^{+34}/_{-53}$) and similar shapes in the age-depth relations. However, in two methods, we found possible disadvantages in arbitrary assumptions and subjective decisions in the process of chronology building, procedures leading to age underestimation as well as problems with reliable and objective estimations of counting uncertainty. Based on these results, we propose the counting method which include analyses of major varve microfacies and three independent counting without the need for varve-by-varve microscopic investigations. This method provided acceptable results (< 5