Varve-Related Publications in Alphabetical Order (version 15 March 2015)
Please report additional references, updates, errors etc. to Arndt Schimmelmann (aschimme@indiana.edu)


Afshar S (2011) High-Resolution Windows into Abrupt and Millennial-Scale Changes in Climate and Ocean since the Mid-Pliocene Transition, Santa Barbara Basin, California. M.Sc. Thesis, California State University, Long Beach, 134 p. https://docs.google.com/a/umich.edu/file/d/0B_44KqD6U_zwco2hcE1JTM56bXM/edit?usp=drive_web; Two high-resolution, multi-proxy records for ~5-kyr windows at ~290 ka and ~735 ka from marine piston cores, Santa Barbara Basin, California, abrupt millennial- to sub-millennial-scale oscillations in total organic carbon, carbonate and biogenic silica. Note: the claimed presence of varves in deeper core sections was partially revised by Hendy et al.‘s (2012) new interpretation of laminations.


Anderson RY (1986) The varve microcosm: propagator of cyclic bedding. *Paleoceanography* 1 (4), 373-382. [http://dx.doi.org/10.1029/PA001i004p00373](http://dx.doi.org/10.1029/PA001i004p00373); example of cyclic bedding in the form of marine varves from the Permian Castile Formation, skipping of climatic cycles by bedding response may lead to erroneous estimates of frequency.


Anderson RY, Dean WE (1988) Lacustrine varve formation through time. *Palaeogeoography, Palaeoclimatology, Palaeoecology* 62 (1-4), 215-235. [http://dx.doi.org/10.1016/0031-0182(88)90055-7](http://dx.doi.org/10.1016/0031-0182(88)90055-7); different types of varved sediments through time, iron-rich laminations were common in the middle Precambrian, glaciolacustrine varves, carbonate-rich varves in the Precambrian and Phanerozoic, diatom laminae.


Anderson RY, Dean WE Jr, Kirkland DW, Snider Hl (1972) Permian Castile varved evaporite sequence, West Texas and New Mexico. Geological Society of America Bulletin 83 (1), 59-86. http://dx.doi.org/10.1130/0016-7606(1972)83%5F1::AID-GSAB6.0.CO;2; marine varves are correlative for distances up to 113 km, 260,000-varve sequence, Bell Canyon Formation = about 50,850 varve couplets, etc., Castile, Salado.


Anderson RY, Kirkland DW (1960) Origin, varves, and cycles of Jurassic Todilto formation, New Mexico. Bulletin of American Association of Petroleum Geologists. 44 (1), 37-52. http://aapgbull.geoscienceworld.org/content/44/1/37.abstract; marine varved sequence of limestone and gypsum, southwestern New Mexico, periodicities:10-13-year sunspot cycle, 60, 85, 170- , and 180-year cycles, varved cycle is nearly complete in the Todilto sequence and is present in the Green River basin of Colorado and Wyoming, the Delaware basin of Texas and New Mexico, the Paradox basin of Utah and the Four Corners region, and in most other evaporite deposits.


Andrén T (1996) The Younger Dryas-Preboreal transition as recorded in varved glacial clay sequences in the NW Baltic Sea. GFF 118 (supplement 004), 79. http://dx.doi.org/10.1080/110358999609546378


Andrén T, Björck J, Johnsen S (1999) Correlation of Swedish glacial varves with the Greenland (GRIP) oxygen isotope record. Journal of Quaternary Science 14 (4), 361-371. http://dx.doi.org/10.1002/(SICI)1099-1417(19990711)14:3<361::AID-JQSS4463.0.CO;2-R; mean varve thickness curve for part of the Swedish varve chronology from the northwestern Baltic proper, correlation with δ18O from GRIP ice-core using the Younger Dryas–Preboreal climate shift, pollen analyses, suggesting a large error in the Swedish varve chronology in the part younger than ca. 10300 clay-varve yr BP.

Andrén T, Sohlenius G (1995) Late Quaternary development of the north-western Baltic Proper — Results from the clay-varve chronology, varve thickness, correlation with Swedish Time Scale, 11530 to 10250 varve years BP, grain size, chemistry, diatoms, color.

http://dx.doi.org/10.1111/j.1502-3885.2002.tb01069.x; Baltic Sea, Yoldia Sea, clay-varve chronology, varve thickness, correlation with Swedish Time Scale, 11530 to 10250 varve years BP, grain size, chemistry, diatoms, color.


varves, stable isotopes, Younger Dryas, Poland.


varve analysis of Lake Holzmaar, Germany. Foraminiferal evidence of a Late Holocene westward shift of the Aleutian low pressure system. The Journal of Foraminiferal Research 43 (2), 127-142.

mid- to late Holocene climatic changes at Lake Holzmaar, West-Eifel (Germany). Quaternary International 113, 81–96.

mid- to late Holocene, diatoms, chrysophytes, water circulation, paleoclimate, human impact, seasonal resolution, iron Age.


Barrell J (1917) Rhythms and the measurements of geologic time. Bulletin of the Geological Society of America 28 (1), 745-904, http://dx.doi.org/10.1130/GSAB-28-745; early thoughts about laminations: “Nature vibrates with rhythms, climatic and diastrophic, those finding stratigraphic expression ranging in period from the rapid oscillation of surface waters, recorded in ripple-mark, to those long-deferred stirrings of the deep imprisoned titans which have divided earth history into periods and eras…” etc.


Barnekow L, Possnert G, Sandgren P (1998) AMS 14C chronologies of Holocene lake sediments in the Abisko area, northern Sweden – a comparison between dated bulk sediment and macrofossil samples. GFF 120 (1), 59-67, http://dx.doi.org/10.1080/1103589801201059; AMS-radiocarbon dates of bulk sediment compared terrestrial plant macrofossils, ages of the radiocarbon dated terrestrial macrofossils are in close agreement with the lamina chronology in Lake Vuolpe Njakajare, bulk sediment samples always give erroneous older radiocarbon ages.


Baumgartner TR, Soutar A, Ferreira-Bartrina V (1992) Reconstruction of the history of the Pacific sardine and northern anchovy populations over the past two millennia from sediments of the Santa Barbara basin, California. *California Cooperative Oceanic Fisheries (CalCOFI) Investigations Report* **33**, 24-40. http://www.calcofi.org/publications/calcofireports/v33/Vol_33_Baumgartner_etal.pdf; North America, marine sediment, Pacific Ocean, California Current, fish scales, sardine, anchovy, reconstruction of fish stocks. Note that the varve chronology of the last 2,000 years was revised by Hendy et al. (2012) leading to potentially different interpretations.


Behl RJ, Kennett JP (1996) Brief interstadial events in the Santa Barbara basin, NE Pacific, during the past 60 kyr. *Nature* **379**, 243-246. http://dx.doi.org/10.1038/379243aa; Santa Barbara Basin, California, North America, marine sediment, Pacific Ocean, recognition of Dansgaard–Oeschger events in the form of laminated (i.e. partially varved) sediment intervals versus massive intervals. Note: this paper was published before the recognition that not all laminated sediment in Santa Barbara Basin is necessarily varved; the recognition has no impact on the paper's conclusions.


Berger WH, Schimmelmann A, Lange CB (2004) Tidal cycles in the sediments of Santa Barbara Basin. Geology 32 (4), 329-332. http://dx.doi.org/10.1130/G20249.2; California, North America, marine sediment, Pacific Ocean, California Current, varve thickness, fish scales, solar forcing, tidal cycles. Note that the varve chronology of the last 2,000 years was revised by Hendy et al. (2012) leading to potentially different interpretations.


Bergström R (1968) Stratigrafi och isrecesion i södra Västerbotten. Sveriges Geologiska Undersökning, Series C, 634, 1-76, ISSN 0082-0024. Årskö/ Sveriges Geologiska Undersökning 63 (5), ISSN 0082-0016; Stratigraphy of glaciolacustrine varves and ice recession in the southern part of Västerbotten County, Sweden.


http://dx.doi.org/10.1029/2008GL033950: lake sediment, Lower Mystic Lake, Boston, Massachusetts, North America, flood layer, history and frequency of hurricanes.


Biondi F, Lange CB, Hughes MK, Berger WH (1997) Inter-decadal signals during the last millennium (AD 1117-1992) in the varve record of Santa Barbara basin, California. Geophysical Research Letters 24 (2), 193-196. http://dx.doi.org/10.1029/96GL03813: varve thickness, interdecadal oscillation, singular spectrum analysis, inter-decadal oscillations. Note that the varve chronology of the last 2,000 years was revised by Hendy et al. (2012) leading to potentially different interpretations. Biondi et al. (1997) reported a significant change around 1600 AD, which roughly coincides with the transition from older laminated to younger varved sediment.


Björck S, Dennegård B, Sandgren P (1990) The marine stratigraphy of the Hanö Bay, SE Sweden, based on different sediment stratigraphic methods. Geologiska Föreningen i Stockholm Förhandlingar 112 (3), 265-280. http://dx.doi.org/10.1080/11035899009454774: most complete stratigraphies at depths greater than 75 m, clayey diamicton is overlain by grey varved clay and reddish varved clay, glaciolacustrine deposition probably occurred during the Baltic Ice Lake (BIL) stage and possibly also during the earliest part of the Yoldia stage.


Blais-Stevens A, Bornhold BD, Kemp AES, Dean JM, Vaan AA (2001) Overview of Late Quaternary stratigraphy in Saanich Inlet, British Columbia, and its paleoseismic implications. Canadian Journal of Earth Sciences 34 (10), 1345-1357. http://dx.doi.org/10.1139/e17-107: 8 piston cores of marine sediment spanning the last 1500 years, cesium-137, 210Pb, 14C ages, varve counts to date and correlate massive layers, not all massive layers correlate from core to core and are seismically generated deposits.

Blais-Stevens A, Clague JJ, Bobrowsky PT, Patterson RT (1997) Late Holocene sedimentation in Saanich Inlet, British Columbia, and its paleoseismic implications. Canadian Journal of Earth Sciences 34 (10), 1345-1357. http://dx.doi.org/10.1139/e17-107: 8 piston cores of marine sediment spanning the last 1500 years, cesium-137, 210Pb, 14C ages, varve counts to date and correlate massive layers, not all massive layers correlate from core to core and are seismically generated deposits.


http://dx.doi.org/10.1007/s10498-008-9026-3: sediment trap, dimictic hardwater lake, comparison with limnological and meteorological parameters, biochemical calcite precipitation, organic matter production, total particle flux, dominated by autochthonous organic matter and biologically precipitated calcite, lake sediment, water column stratification, diatoms.  
http://dx.doi.org/10.4081/jlimnl-2009-257: seasonal evolution of chemical and physical water properties, particle fluxes, oxygen and carbon stable isotopes, strontium/calcium and magnesium/calcium ratios in authigenic calcites, sediment trap, eutrophy during spring and summer.  

http://dx.doi.org/10.1007/978-94-009-4047-5_44: X-ray radiography, varve record since 1977, effect of eutrophication, oxygen deficit in Lilla Ullfjärden since ca. 1885.  

http://dx.doi.org/10.2973/dsdp.proc.15.app2.1973: organic carbon and carbonate analyses, Carica Basin, 3 samples within the upper 8 meters, Holocene, tropical Atlantic.  

http://dx.doi.org/10.1016/j.sedgeo.2005.05.001: review of impregnation methodology, post-treatment disturbances, polymerization, thin section, varve dating, epoxy resin.  

http://dx.doi.org/10.1007/s10933-007-9119-9: El Niño Southern Oscillation (ENSO), South America, Chile, varve-thickness record, Lago Puyehue (40°S), the last 600 years, annual sediment accumulation rate, varve-counting, thin sections, varve thickness correlates with austral autumn/winter precipitation, Medieval Warm Period, spectral analysis.  

http://dx.doi.org/10.1007/s10933-007-9118-x: Southern Hemisphere, last deglaciation, southern Chile, varve chronology, Lago Puyehue, continuous ~17,100 to 10,800 cal. year BP varve-thickness measurements, thin section, Lake District, grey scale, termination I, Younger Dryas.  

http://dx.doi.org/10.1007/s10933-011-9515-z: lake sediment, heavy metal, pollution history, reference elements, titanium (Ti), zirconium (Zr), aluminum (Al), rubidium (Rb), freeze core, Lake Nylandssjön, Sweden, X-ray fluorescence (XRF) spectroscopy, anthropogenic lead (Pb), diageneisis, enrichment factor.  

http://dx.doi.org/10.1016/0025-3227(94)00129-9: computed axial tomography, pseudo-3D representation of sedimentary cores, tomodensitometer (CAT-scanner), Illinoian-Sangamonian transition series from St. Lawrence estuary in Québec, Canada, bed thickness and numerical processing of CT number series are used to characterize lamina, sub-annual longer periodocities, annual light-dark rhythms.  

http://dx.doi.org/10.1002/2013PA002579: high-resolution record of winter monsoon variability for the late Holocene via alkenone-derived sea surface temperature (SST) variations and proxies of primary productivity (organic carbon and δ18N) in a well-laminated marine sediment core from the Pakistan continental margin, since 400 BC.  


Bradley WH (1937) *Non-glacial varves with selected bibliography*. *National Research Council Annual Report. Report of the Committee on the measurement of geologic time*, 32-42. [http://books.google.com/books?id=ckIrAAAAAAY&pg=PA32&dq=Non-glacial+varves+with+selected+bibliography&source=b&ots=CCldYwL_q8&sig=XYh_qYW7RKQ6RC7isJEYkLI1B8&hl=en&sa=X&ei=PWMRUI77MbE9HwKxXVwCw&ved=0CFAQ6AEwAA#v=onepage&q=Non-glacial%20varves%20with%20selected%20bibliography&f=false](http://books.google.com/books?id=ckIrAAAAAAY&pg=PA32&dq=Non-glacial+varves+with+selected+bibliography&source=b&ots=CCldYwL_q8&sig=XYh_qYW7RKQ6RC7isJEYkLI1B8&hl=en&sa=X&ei=PWMRUI77MbE9HwKxXVwCw&ved=0CFAQ6AEwAA#v=onepage&q=Non-glacial%20varves%20with%20selected%20bibliography&f=false); review of 1930s’ knowledge about non-glacial varves, large body of early relevant publications, including many of De Geer on p. 12-13.


Brännvall ML, Bindler R, Renberg I, Emteryd O, Bartnicki J, Billström K (1999) The Medieval metal industry was the cradle of modern large-scale atmospheric lead pollution in northern Europe. *Environmental Science & Technology* **33**, 4391-4395. [http://dx.doi.org/10.1021/es990279n](http://dx.doi.org/10.1021/es990279n); heavy metals, pollution, atmospheric deposition, lead concentrations, stable lead isotope ratios $^{206}$Pb/$^{207}$Pb, lake sediment, four lakes in northern Sweden, Lakes Kassjön, Lake Norrtjärnsjön, Lake Koltjärn, Lake Gränåstjärn, atmospheric lead pollution for the last 3000 years, airborne pollution from Greek and Roman cultures 2000 years ago, Medieval pollution.


techniques, radiocarbon, $^{230}$Th disequilibrium, luminescence, cosmogenic nuclides, incremental varve counting, recommendations for minimum standards of uncertainty and age datum reporting.


http://www.worldcat.org/title/geowissenschaften/oclc/6211943; Eifel, Germany, map of maar lakes, Lago di Monticchio, Italy, Lake Holzmaar, solar periodicities, biogenic and lithogenic/clastic varves, varve chronology, thin section, spectral analysis.


http://dx.doi.org/10.1038/NGEO263; Lake Meierfelder Maar, Eifel, Germany, storminess, North Atlantic westerlies, deglaciation.


http://dx.doi.org/10.1016/j.palaeo.2007.10.003; Piànico paleolake, European Alps, lake sediment, authigenic calcite, wavelet analysis, solar activity, debris flows.


Brauer A, Wulf S, Mangili C, Moscariello M (2007) Tephrochronological dating of varved interglacial lake deposits from Piànico-Sèllere (Southern Alps, Italy) to around 400 ka. *Journal of Quaternary Science* 22 (1), 85-96. http://dx.doi.org/10.1002/jqs.1014; paleolake Piànico, Italy, new dating by tephrochronology. This study was subsequently criticized by Pinti et al. (2007), and the critique was rebutted by Brauer et al. (2007; see above).


http://dx.doi.org/10.1016/j.quasirev.2011.05.017; western Greenland, lake sediment, Little Ice Age, Holocene, glacier.

http://dx.doi.org/10.1016/j.quasirev.2011.05.017; marine sediments containing Azolla fern remains show alternating laminae of dark organic-rich and lighter siliceous laminae that are interpreted to be varves.

http://dx.doi.org/10.1029/GL013i008p00753; marine sediment, comparison of Nuclear Magnetic Resonance NMR imaging to X-ray analysis.

http://dx.doi.org/10.1007/s10933-014-1979-4; Laguna or Lake Chichój, deep permanent lake in the central highlands of Guatemala, $^{210}$Pb and $^{137}$Cs inventories, varve counting, turbidites and flood layers.

http://dx.doi.org/10.1007/s10933-014-1979-4; marine sediments, comparison of Nuclear Magnetic Resonance NMR imaging to X-ray analysis.

http://dx.doi.org/10.1016/j.quasirev.2011.05.017; marine sediment, comparison of Nuclear Magnetic Resonance NMR imaging to X-ray analysis.

http://dx.doi.org/10.1016/j.quasirev.2011.05.017; marine sediment, comparison of Nuclear Magnetic Resonance NMR imaging to X-ray analysis.

http://dx.doi.org/10.1016/j.quasirev.2011.05.017; marine sediment, comparison of Nuclear Magnetic Resonance NMR imaging to X-ray analysis.

http://dx.doi.org/10.1016/j.quasirev.2011.05.017; marine sediment, comparison of Nuclear Magnetic Resonance NMR imaging to X-ray analysis.

http://dx.doi.org/10.1016/j.quasirev.2011.05.017; marine sediment, comparison of Nuclear Magnetic Resonance NMR imaging to X-ray analysis.

http://dx.doi.org/10.1016/j.quasirev.2011.05.017; marine sediment, comparison of Nuclear Magnetic Resonance NMR imaging to X-ray analysis.

http://dx.doi.org/10.1016/j.quasirev.2011.05.017; marine sediment, comparison of Nuclear Magnetic Resonance NMR imaging to X-ray analysis.

http://dx.doi.org/10.1016/j.quasirev.2011.05.017; marine sediment, comparison of Nuclear Magnetic Resonance NMR imaging to X-ray analysis.

http://dx.doi.org/10.1016/j.quasirev.2011.05.017; marine sediment, comparison of Nuclear Magnetic Resonance NMR imaging to X-ray analysis.


analyzed using scanning electron microscope techniques, presumed interannual variability of marine production and coastal runoff, backscatter electron imagery to measure components of varves, periodicities of 3.1 and 8.4 yr in varved sequences, periodicities of 3.5 and 7.6 yr in varved sequences, El Niño, cross-spectral analysis of the tussren and diatomaceous records, El Niño has been a persistent feature of late Quaternary climate variability.

Burke IT, Grigorov I, Kemp AES (2002) Microfabric study of diatomaceous and lithogenic deposition in laminated sediments from the Gotland Deep, Baltic Sea. Marine Geology 183 (1-4), 89-105. http://dx.doi.org/10.1016/S0016-7037(01)00290-3; anoxic diatomaceous sediments at intervals throughout the last 8000 yr, scanning electron microscope study, couplets, triplets and quadruplets of diatomaceous and lithogenic laminae are observed with an average thickness of approximately 700 μm, diagenetic Ca-rhodochrosite laminae, diatom assemblages suggest that bundles of laminae represent varves, varve record often interrupted by diffusely laminated and homogenous sediments.


Caissie BE, Brigham-Grette J, Lawrence KT, Herbert TD, Cook MS (2010) Last Glacial Maximum to Holocene sea surface conditions at Umnak Plateau, Bering Sea, as inferred from diatom, alkenone, and stable isotope records. Paleoceanography 25 (1), PA1206. http://dx.doi.org/10.1029/2008PA001671; deglaciation was characterized by laminated, partially varved intervals with productive and diverse diatom assemblages.


Carstensen J, Andersen JH, Gustafsson BG, Conley DJ (2014) Deoxygenation of the Baltic Sea during the last century. *Proceedings of the National Academy of Sciences of the United States of America (PNAS)* **111** (15), 5628-5633. http://dx.doi.org/10.1073/pnas.1321315111; Baltic Sea is the largest anthropogenically induced hypoxic area in the world, 10-fold increase of hypoxia in the Baltic Sea, references to varves and laminations.


http://dx.doi.org/10.1080/11035897.2013.788550: synchrotron radiation X-ray fluorescence for nondestructive in situ analysis of elements, 1300 year time-series from varved lake sediments; Medieval Warm Period, Little Ice Age, principal component analysis, spectral analysis.


Cockburn JMH, Lamoureux SF (2008) Inflow and lake controls on short-term mass accumulation and sedimentary particle size in a High Arctic lake: implications for interpreting varved lacustrine sedimentary records. *Journal of Paleolimnology* 40 (3), 923-942. http://dx.doi.org/10.1007/s10933-008-9207-5: Canadian High Arctic, rate of sediment accumulation changed over short distances down lake, grain size measures may not be representative proxies of inflow competence, grain size indices based on a measure of the coarser fraction may be more appropriate link between contemporary runoff processes and sedimentary characteristics.


http://www.pages.unibe.ch/download/docs/working_groups/vwg/2011_2nd_VWG_workshop_programs_and_abstracts.pdf: 5,221 year varve record, Lower Murray Lake, Ellesmere Island, Canadian Arctic, varve thickness, event deposits.


Cooper MC, O’Sullivan PE, Shine AJ (2000) Climate and solar variability recorded in Holocene laminated sediments - a preliminary assessment. Quaternary International 68-71, 363-371. http://dx.doi.org/10.1016/S1040-6190(00)00059-8; 1321–1963 AD laminations in lake sediment from Loch Ness, Scotland, United Kingdom, lamination thickness correlates with the number of ice weeks off Iceland, the index of the North Atlantic Oscillation (NAO), and with Zurich sunspot number, power spectra, low frequencies compatible with the NAO, the “11-year” sunspot cycle, the Hale (or “double sunspot”) cycle, and the Gleissberg (88 year) solar cycle, solar variability.


Corella JP, Benito G, Rodríguez-Lloveras X, Brauer A, Valero-Garcés BL (2014) Annually-resolved lake record of extreme hydro-meteorological events since AD 1347 in NE Iberian Peninsula. Quaternary Science Reviews 93, 77–90. http://dx.doi.org/10.1016/j.quascirev.2014.03.020; extreme rainfall events interpreted from detrital layers and turbidites interbedded within a varved sediment record since the 14th century in Montcortès Lake, NE Spain, high-resolution geochemical and sedimentological analyses.


Crusius J, Anderson RF (1992) Inconsistencies in accumulation rates of Black Sea sediments inferred from records of laminae and 210Pb. Paleodonomy 7 (2), 215-227. http://dx.doi.org/10.1029/92PA00279; AMS radiocarbon dating does not compare well with marine varve counts [Degens et al., 1980; Hay, 1988], sediment accumulation rate, lead-210, dating discrepancy exists because (a) it is difficult to count very fine laminae and (b) because a complete couplet is not deposited every year; estimate of the age of a distinct black marker horizon across the entire abyssal plain to be 150 ± 8 years (deposited in 1838 ± 8 A.D.).

Crusius J, Anderson RF (1995) Evaluating the mobility of 137Cs, 239+240Pu and 210Pb from their distributions in laminated lake sediments. Journal of Paleolimnology 13 (2), 119-141. http://dx.doi.org/10.1007/BF00678102; post-depositional mobility of 137Cs cesium, 239+240Pu plutonium, 210Pb lead-210, use of varved lake sediments for superior chronologic control, no evidence of mobility of 210Pb, significant mobility of 137Cs, 239+240Pu is a more reliable sediment chronometer than 137Cs because it is significantly less mobile, radionuclides.


Cuven S, Francus P, Lamoureux S (2011) Mid to Late Holocene hydroclimatic and geochemical records from the varved sediments of East Lake, Cape Bounty, Canadian High Arctic. *Quaternary Science Reviews* 30 (19-20), 2651-2665. http://dx.doi.org/10.1016/j.quascirev.2011.05.019; Melville Island, 4200 year-long clastic varve record, micro X-ray fluorescence (μ-XRF), progression from marine in the mid-Holocene, to estuarine from 2195 BC to 243 AD, to fully lacustrine source after 244 AD, correlation with local meteorological data, varve thickness correlates with snow depth and Sept–May temperatures, paleoecological reconstruction, Little Ice Age.


Dallimore A, Jmieff DG (2010) Canadian west coast fjords and inlets of the NE Pacific Ocean as depositional archives. In: (Howe JA, Austin WEN, Forwick M, Paetzel M, Eds.) *Fjord Systems and Archives*. Geological Society of London, Special Publications 344, 143-162. http://dx.doi.org/10.1144/SP344.12; summary of Canadian west coast fjord environments, (1) mainland fjords drain high mountains and ice fields with sediment input from snowmelt and glacier runoff in spring and summer, (2) inlets on Vancouver Island are in a milder marine climate, sediment input mostly during rains of autumn and winter, shallow sills at the mouth of some Vancouver Island inlets trigger anoxic bottom waters, marine mixed varves.


Darsh A, Kalugin IA, Ivanov EI, Karabanov EB, Osuhovskaya YN, Ovchinnikov DV, Shaporenko AD (2008) Geochemical indicators of climate change in the sediments of Lake Telmen (Northern


Daryin AV, Kalugin IA, Smolyaninova LG, Zolotarev KV, Vologina EG, Ptitsyn AB, Andreev AA, Tserendash N (2006) Geochemical time series from lake sediments of the Central Asia as chronologic evidence of environmental change over the Late Holocene. *Chinese Journal of Geochemistry* 25 supplement, 6. [http://dx.doi.org/10.1007/BF02839742](http://dx.doi.org/10.1007/BF02839742); more than 50 lakes with varved records found in Finland, varve thickness, X-ray density, mineral content, grain size, geochemical parameters, XRF scanning, Lake Lehmilampi, epoxy impregnation.

Daryin AV, Saarinen TJ (2006) Geochemical records seasonal climate variability from varved lake sediments. *Chinese Journal of Geochemistry* 25 supplement, 6-7. [http://dx.doi.org/10.1007/BF02839743](http://dx.doi.org/10.1007/BF02839743); more than 50 lakes with varved records found in Finland, varve thickness, X-ray density, mineral content, grain size, geochemical parameters, XRF scanning, Lake Lehmilampi, epoxy impregnation.


Davies A, Kemp AES, Pike J (2009) Late Cretaceous seasonal ocean variability from the Arctic. *Nature* 460, 254-258. [http://dx.doi.org/10.1038/nature08141](http://dx.doi.org/10.1038/nature08141); seasonally resolved Cretaceous sedimentary record from the Alpha ridge of the Arctic Ocean, biological carbon pump, diatom, production occurred within stratified water column, marine sediment, seasonal sea ice signal in varves.


de Jong R, Kamenik C, Grosjean M (2013) Cold-season temperatures in the European Alps during the past millennium: variability, seasonality and recent trends. *Quaternary Science Reviews* 82, 1–12. [http://dx.doi.org/10.1016/j.quascirev.2013.10.007](http://dx.doi.org/10.1016/j.quascirev.2013.10.007); proxy-based, quantitative reconstruction of cold-season (mean October to May) air temperatures covering nearly the entire last millennium (AD 1060–2003, some hiatuses) based on subfossil chrysophyte stomatocyst remains in the varved sediments of high-Alpine Lake Silvaplana, eastern Swiss Alps. (46°27′N, 9°48′E, 1791 m a.s.l.), 5-yr resolution, Little Ice Age, since AD 1980 summer and cold season temperatures show a simultaneous, strong increase, which is unprecedented in the context of the last millennium.


Dean WE (2006) The geochemical record of the last 17,000 years in the Guaymas Basin, Gulf of California. Chemical Geology 232 (3-4), 87-98. http://dx.doi.org/10.1016/j.chemgeo.2006.02.017; calcium carbonate, organic carbon, cadmium, molybdenum, Pacific Ocean, marine varves, North America, Mexico, sediments deposited over the last 17,000 years in the western Guaymas Basin can be divided into five intervals, oxygen minimum zone.

Dean WE, Anderson RY (1973) Trace and minor element variations in the Permian Castile Formation, Delaware basin, Texas and New Mexico, revealed by varve calibration. 4th Symposium on Salt, Cleveland, Northern Ohio Geological Society 275-285. Additional information needed. Electronic link? Keywords?


Dean WE, Gardner JV, Anderson RY (1994) Geochemical evidence for enhanced preservation of organic matter in the oxygen minimum zone of the continental margin of northern California during the Late Pleistocene. Paleoceanography 9 (1), 47-61. http://dx.doi.org/10.1029/93PA02829; Pacific Ocean off California and Oregon, oxygen minimum zone (OMZ) between 600 and 1200 m, laminated and varved sediments are preserved in upper Pleistocene sections, Point Conception, upper Pleistocene varved marine sediments contain more abundant lipid-rich “sapropelic” (type II) organic matter than the overlying bioturbated, oxidized Holocene sediments, preservation.


Dean WE, Pride C, Thunell R (2004) Geochemical cycles in sediments deposited on the slopes of the Guaymas and Carmen Basins of the Gulf of California over the last 180 years. Quaternary Science Reviews 23 (16-17), 1817-1833. http://dx.doi.org/10.1016/j.quascirev.2004.03.010; box cores, marine varves, Pacific Ocean, Mexico, North America, molybdenum, sulfate reduction, bottom waters of the Gulf have become more oxygenated over the last 100 years, box core, cyclicity with periodicities of 10-20 years, 20-year cycles in the more mafic components (e.g., titanium, particularly in sediments deposited during the 19th century), titanium cycles in agreement with warm phases of the Pacific Decadal Oscillation (PDO), El Niño, higher winter precipitation, riverine influx of volcanic rock debris from Sierra Madre.


De Geer EH (1951) Conclusions from C 14 and De Geer’s chronology Daul-Gotiglacial, with datings. Geologiska Föreningen i Stockholm Förhandlingar 73 (4), 557-570. http://dx.doi.org/10.1080/11035895109452854; asserting simultaneous last E—W and N—S Pleistocene deglaciations back to 20,000 B.P.


De Geer EH (1957) Old and new datings of Swedish ice lakes and the thermals of Bölling and Alleröd. Geologiska Föreningen i Stockholm Förhandlingar 79 (1), 93-100. http://dx.doi.org/10.1080/11035895709449124; criticizes Borell and Offerberg (1955) for trying to revise the Storedan and Singsån by 84 varve years.

De Geer G (1884). Lecture at the Geological Society in Stockholm on "ishavslersans varvighet". Geologiska Föreningen i Stockholm Förhandlingar 7. Page numbers? This citation seems to err with regard to volume number or journal title.


De Geer G (1916) Om internationell användning av den svenska kvartärkronologien. Geologiska Föreningens i Stockholm Förhandlingar (GFF) 38, 17-21. This citation seems to err with regard to volume number or journal title.

De Geer G (1921) Correlation of late glacial annual clay-varves in North America with the Swedish time scale. Geologiska Föreningens i Stockholm Förfallningar (GFF) 43 (1-2), 70-73. http://dx.doi.org/10.1080/11035892109443889


De Geer G (1940) Geochronologia Suecia Principes. Kungliga Svenska Vetenskapsakademiens Handlingar, 3rd, 18 (6), 1-360. “From the obvious similarity with the regular, annual rings of the trees I got at once the impression that both ought to be annual deposits” (1940, p. 13). Additional information needed: Electronic link? Keywords?


Degens ET, Stoffers P (1976) Stratified waters as a key to the past. Nature 263, 22-27. Note: copy and paste the following URL directly into your browser; ciliating may not work: http://dx.doi.org/10.1038/263022a0; sapropel formation began 2,300 years after forming on the bottom of the Black Sea, marine sediment; a comparison of modern sediments with sediments formed since the Cambrian reveals that the ancient sea has been stratified a number of times.


DeMaster DJ (1978) 210Pb, 32Si, and 14C chronologies in a varved Gulf of California sediment core. EOS (American Geophysical Union Transactions) 59 (12), 1118 (abstract O 205). http://dx.doi.org/10.1029/EO059i12p01235; excess 210Pb, marine varve chronology, sediment accumulation rate of 0.19 cm/yr in a one meter long box core, varve thickness unchanged over the entire length of the core, indicating a constant rate of sediment accumulation, 32Si specific activities measured on biogenic silica from sequential layers, half life of 32Si calculated to 276±32 years; 14C measurements on the organic fraction.

DeMaster DJ (1980) The half life of 32Si determined from a varved Gulf of California sediment core. Earth and Planetary Science Letters 48 (1), 209-217. http://dx.doi.org/10.1016/0012-821X(80)90182-X; the half life of silicon-32 is 272 ± 32 years based on a marine varved sedimentary record in the Gulf of California, excess 210Pb, varve chronology, sediment accumulation rate of 0.19 cm/yr in a one meter long box core, varve thickness unchanged over the entire length of the core, indicating a constant rate of sediment accumulation, 32Si specific activities measured on biogenic silica from sequential layers, half life of 32Si calculated to 276±32 years.


Desloges JR (1999) Geomorphic and climatic interpretations of abrupt changes in glaciolacustrine deposition at Moose Lake, British Columbia, Canada. GFF 121 (3), 202-207. http://dx.doi.org/10.1080/11035899901213202; Holocene, basal diamicts unconformably overlain by turbidites in ice-dammed lake during final retreat of Wisconsinan ice, transition from the Altithermal to Neoglacial coincident with the formation of varves, upper Fraser and Moose river watersheds, comparison of the sediment record with tree-rings.

Desloges JR, Gilbert R (1994) Sediment source and hydroclimatic inferences from glacial lake sediments: the postglacial sedimentary record of Lillooet Lake, British Columbia. Journal of Hydrology 159 (1-4), 375-393. http://dx.doi.org/10.1016/0022-1694(94)90268-2; Canada, glaciolacustrine varves accumulate at a rate of up to 28 mm year−1 in the north and decline to less than 0.9 mm year−1 in the south.


Gulf of California were compared to varves of the Santa Barbara Basin. Additional information needed: Electronic link?

**Keywords**

Donegan D, Schrader H (1982) Biogenic and abiotic components of laminated hemipelagic sediments in the central Gulf of California. *Marine Geology* 48 (3-4), 215-237. [http://dx.doi.org/10.1016/0025-3227(82)90098-6](http://dx.doi.org/10.1016/0025-3227(82)90098-6); marine sediment, Pacific, difference between light and dark laminae, mode of deposition, oxygen minimum zone intersects the sediment—water interface, Guaymas Basin, opal micro-floral assemblage, textural character, trace metal and bulk chemical (Cu, Mn, Fe, Ni, Zn, Ca, K, Al, SiO₂ and C-org) content, mineralogy, diatom, light laminae apparently represent sedimentation during the dry winter season of northwesterly winds, whereas the dark laminae represent the wet summer season of southeasterly winds.


Duman M (1994) Late Quaternary chronology of the southern Black sea basin. Geo-Marine Letters 14 (4), 272-278. http://dx.doi.org/10.1007/BF01274063; varve counting in southeastern Black Sea cores shows the chronology of the O2/H2S interface, Holocene sapropel along the eastern margin ranges from 4000 to 1000 yr BP in deep water and 2500–1000 yr BP in shallow water, marine sapropel formation started at 3650 yr BP at a water depth of 2200 m.


Dzens-Litovskiy Al (1934) Complex hydrogeological study of salt and mud lakes and lagoons. In: Trudy 1 Vsesoyuznogo Gydrogeologicheskogo S'ezda, 159-196, Moscow, ONTI (in Russian). (Дзенс-Литовский АИ (1934) Комплексное гидрогеологическое изучение соляных и грязевых озер и лиманов. Труды 1-го Всесоюзного Гидрогеологического Съезда,159-196. Москва, ОНТИ). Holocene, salt lakes of Crimea, Ukraine; lithology, geochemistry, origin of the lakes, origin of varves in the Crimean lakes, varve counts. Additional information needed: Electronic link?


Enkin RJ, Dallimore A, Baker J, Southon JR, Ivanochko T (2014) A new high-resolution radiocarbon Bayesian age model of the Holocene and Late Pleistocene from core MD02-2494 and others, Effingham Inlet, British Columbia, Canada; with an application to the paleoseismic event chronology of the Cascadia Subduction Zone. *Canadian Journal of Earth Sciences* 50 (7), 746-760. http://dx.doi.org/10.1139/cjes-2012-0150; 42 m varved marine sediments record from the present to about 14 ka 14C BP (17 ka cal BP), anchored by recent freeze core, Mazama Ash, varve counting. 21 Effingham seismite ages are 169 ± 206 years older than turbidite ages estimated largely by radiocarbon analysis of foraminifera.


-700,000 yr record of gray marine sediment layers interspersed in olive, partially laminated and varved sediment. Note: the claimed presence of varves in deeper core sections was partially revised by Hendy et al.’s (2012) new interpretation of laminations.


Field DB, Baumgartner TR (2000) A 900 year stable isotope record of interdecadal and centennial change from the California Current. Paleooceanography 15 (6), 695-708. http://dx.doi.org/10.1029/1999PA000480; Santa Barbara basin, California, marine sediment, interdecadal and centennial record (5 yr intervals) of foraminiferal oxygen isotope record. Neogloboquadrina dutertrei. Note: the findings of this study were partially revised by Hendy et al.’s (2012) new chronology for deeper sediment.

fluctuations, 20th-century warming has already affected lower trophic levels of the California Current. Supporting material: www.sciencemag.org/cgi/content/full/311/5757/63/DC1. Note: the findings of this study were partially revised by Hendy et al.’s (2012) new chronology for deeper sediment.


Francus P (1998) An image-analysis technique to measure grain-size variation in thin sections of soft elastic sediments. *Sedimentary Geology* **121** (3-4), 289-298. [http://dx.doi.org/10.1016/S0037-0738(98)00079-5](http://dx.doi.org/10.1016/S0037-0738(98)00079-5); simple and fast image-analysis technique, grain-size variation in thin sections of soft clastic sediments, optical and backscattered electron microscope photographs are digitised from thin sections, cut by freeze-drying to avoid disturbing the sediments, granulometry.


Francus P, Saarinen T (1999) Advances in varved sediment studies help paleoclimate reconstructions. *EOS Transaction of the American Geophysical Union (AGU)* **80** (37), 422-424. [http://dx.doi.org/10.1029/99EO00312](http://dx.doi.org/10.1029/99EO00312); definition of varve, relevant proxy data (e.g., pollen, diatoms, stable isotope geochemistry, microchemical analysis), value of varves.

Fraser HJ (1929) An experimental study of varve deposition. Transactions of the Royal Society of Canada 23, Sect. 4, 49-60. Additional information needed: Keywords? Link?


Friedrich M, Kromer B, Kaiser BF, Spurk M, Hughen KA, Johnsen SJ (2001) High-resolution climate signals in the Bølling–Allerød Interstadial (Greenland Interstadial 1) as reflected in European tree-ring chronologies compared to marine varves and ice-core records. Quaternary Science Reviews 20 (11), 1223-1232. http://dx.doi.org/10.1016/S0277-3791(00)00148-7; a 1051-year tree-ring chronology from Central and Southern Europe's Late Glacial was radiocarbon-dated and wiggle-matched to the INTCAL98 calibration curve, then compared with the marine varve record of the Carico Basin.


Fromm E (1938) Geochronologisch datierte Pollendiagramme und Diatomeenanalysen aus Angermanland. Geologiska Föreningens i Stockholm Förhandlingar 60, 365-381. Additional information needed: Keywords? Link?


Gajewski K, Hamilton PB, McNeely R (1997) A high resolution proxy-climate record from an arctic lake with annually-laminated sediments on Devon Island, Nunavut, Canada. Journal of Paleolimnology 17 (2), 215-225. http://dx.doi.org/10.1023/A:1007984617675; varves in the deepest part of the basin, lead-210, 14 cm encompass 150 years, dark layers represent biogenic components deposited in summer, light inorganic layers represent clastic deposition from allochthonous sources, diatom, varve thickness, Canadian Arctic Archipelago.


marine varves in Frederick Sound in the Seymour–Belize Inlet Complex, varves consist of light-colored diatom-rich summer and
dark-colored mineral-rich winter laminae, most common from ~2840 cal. yr BP to ~1820 cal. yr BP.

Galloway JM, Wigston A, Patterson RT, Swindles GT, Reinhardt E, Roe HM (2013) Climate change and
decadal to centennial-scale periodicities recorded in a late Holocene NE Pacific marine record:
http://dx.doi.org/10.1016/j.palaeo.2013.06.031; Frederick Sound in the Seymour–Belize Inlet Complex of British Columbia,
Canada, laminated (presumably varved) intervals are most common from ~2948–2708 cal. yr BP to ~1992–1727 cal. yr BP,
spectral and wavelet analyses are compared to sunspot number data of Solanki et al. (2004).

http://dx.doi.org/10.1007/s10933-005-5952-x; Lake Koltjärnen, Lake Nylandssjö, comparison of basins of Lake Nylandssjön,
varve thickness, water content, annual accumulation rate, organic matter and nitrogen, grey-scale curves, lake productivity,
land-use, climate change, image analysis.

Gálman V, Rydberg J, Bigler C (2009) Decadal diagenetic effects on δ13C and δ15N studied in varved lake
sediment, long-term 27 yr effects of sediment aging on stable carbon and nitrogen isotope values, collection of eight freeze
cores from 1979 to 2007, Lake Nylandssjön, Sweden, δ13C increased by 0.4–1.5% during the first 5 yr, δ15N gradually
decreased by 0.3–0.7% over the entire 27-yr period.

http://dx.doi.org/10.1007/s10933-008-9267-6; role of iron (Fe) and sulfur (S) in the appearance of varves in
sediments from Lake Nylandssjön in northern Sweden, freeze cores from 1979 to 2004, long-term changes in iron and sulfur
during diagenesis, X-ray fluorescence spectroscopy (XRF), modelling of Fe and S, iron cycling.

during aging of lake sediment: Changes over 27 years studied in varved lake sediment. *Limnology
Sweden, long-term loss of carbon (C) and nitrogen (N) from 1979 to 2007 as sediment ages, 23% loss of C and 35% loss of N,
C:N ratio changes.

Gan SQ, Scholz CA (2012) A batch method for retrieving primary and derived datasets of laminae in
sediment core images. In: (Besonen MR, ed.) *Second Workshop of the PAGES Varves Working
http://www.pages.unibe.ch/download/docs/working_groups/vwg/2011_2nd_VWG_workshop_programs_and_abstracts.pdf;
algorithm for lamina analyses, batch method to identify laminae and extract lamina properties automatically from sediment core
images, image enhancement, 2-D lamina connectivity analyses.

during late Pleistocene to early Holocene. Geology **14**(8), 691-694. http://dx.doi.org/10.1130/0091-76131986.14.691.1. EFASOZ-2.0. CO;2; 18 marine deep-sea cores collected along the central California continental slope have
‘varve-like’ sediment at depth, last global deglaciation to early Holocene, oxygen-minimum zone along the northeastern Pacific
Ocean was stronger than at present, intensified upwelling.

Paropkari AL, Guptha MVS, Ittekkot V (2005) Stable nitrogen isotopic ratios of sinking particles and
http://dx.doi.org/10.1016/j.marchem.2005.02.001; nitrogen stable isotope ratios in modern marine laminated to varved
sediments, Bay of Bengal, Arabian Sea.

Gerasimenko NP (2007) Environmental-climatic changes in Ukraine during the last 2.5 thousands years.
warm periods, correlation with paleoclimatic records from Ukraine. Additional information needed: Electronic link?

Gerasimenko N (2009) Cyclicity in pollen-fall derived from the steppe and mountain forest of the Crimea,
Ukraine. In: *The 7th International Meeting of Pollen Monitoring Programme*, extended abstracts,
Thessaloniki, 16-18. Saki Lake, monthly observation on pollen-fall, comparison with meteorological data from the Saki
station and with past pollen records in varved beds. Additional information needed: Electronic link?

Gerasimenko N, Kukla G (1998) Past droughts in Eastern Ukraine recorded by pollen and salts in lake
Saki in Crimea. In: *High-Resolution Lake Sediment Records in Climate and Environment Variability
Studies. 6th Workshop of the European Lake Drilling Programme ELDP*. Programme, List of


Gerasimenko N, Subetto D, Bakhmutov V, Dubis L, Gladyrevska M (2011) New data on the Middle and Late Holocene environmental changes from the Saki Lake, Crimea (Ukraine). In: (Gilbert A, Yanko-Hombach V, eds.) The Sixth Plenary Meeting and Field Trip of IGCP-521 Project “Black Sea - Mediterranean Corridor During the Last 30 ky: Sea Level Change and Human Adaptation”, Gelendzik-Kerch, extended abstracts, 92-93. Radiocarbon dating, magnetostratigraphy, pollen, quartz micromorphology, climatic cyclicity. Additional information needed: Electronic link?


Antarctica, marine varves, subannually resolved marine sediment cores MD03-2601, IODP- 318-U1357B, Dumont d’Urville Trough, epoxy resin-embedded polished thin sections, diatom, microfabric, SEM backscattered electron imagery.


Grönlund E (1991) Sediment characteristics in relation to cultivation history in two varved lake sediments from East Finland. *Hydrobiologia* **214** (1), 137-142. [http://dx.doi.org/10.1007/BF00050942](http://dx.doi.org/10.1007/BF00050942); Lake Heinälampi, Lake Suurjärvi sediment quality variables and pollen analysis data, changes in agricultural land-use patterns studied with canonical correspondence analysis (CCA).


Gruszka B, van Loon AJ (2007) Pleistocene glaciolacustrine breccias of seismic origin in an active graben (central Poland). Sedimentary Geology 193 (1-4), 93-104. http://dx.doi.org/10.1016/j.sedgeo.2006.01.009; varved glaciolacustrine Early Saalian sediment in Belchatów mine (central Poland), description of deformations, half-varve deformation affects clayey lamina of a varve, multi-varve deformation affects several varves, clast-supported breccia beds with varve fragments in a quasi-horizontal position within a clayey matrix, deformed beds resulting from subsequent plastic deformation and folding, deformed beds are interpreted as seismites derived from earthquakes related to deep graben structure.


Guyard H, Chapron E, St-Onge G, Labrie J (2013) Late-Holocene NAO and ocean forcing on high-altitude proglacial sedimentation (Lake Bramant, Western French Alps). *The Holocene* 23 (8), 1163-1172. http://dx.doi.org/10.1177/0959683613483616; proglacial Lake Bramant, France, Holocene, varves reflect glacier mass balance in the watershed, clastic sedimentation over the last 4150 years, pluriannual variability at frequencies compatible with NAO.


Hallam A, Bradshaw MJ (1979). Bituminous shales and oolitic ironstones as indicators of transgressions and regressions. *Journal of the Geological Society* 136, 157-164. [http://dx.doi.org/10.1144/jgs.136.2.0157](http://dx.doi.org/10.1144/jgs.136.2.0157); Jurassic postulated marine varves eustatic model characterised by moderately rapid rises and falls of sea level, separated by longer phases of stillstand. This study was criticized by Wignall et al. (2005) who claim that silt laminae event beds are recording a much more aperiodic style of deposition than varves: Wignall PB, Newton RJ, Little CTS (2005) The timing of paleoenvironmental change and cause-and-effect relationships during the Early Jurassic mass extinction in Europe. *American Journal of Science* 305, 1014-1032. [http://dx.doi.org/10.2475/ajs.305.10.1014](http://dx.doi.org/10.2475/ajs.305.10.1014).


Haltia-Hovi E, Nowaczky N, Saarinen T, Plessen B (2010) Magnetic properties and environmental changes recorded in Lake Lehmilampi (Finland) during the Holocene. *Journal of Paleolimnology* 43 (1), 1-13. [http://dx.doi.org/10.1007/s10933-009-9309-8](http://dx.doi.org/10.1007/s10933-009-9309-8); standard mineral magnetic measurements, magnetic susceptibility, Holocene sediment cores from Lake Lehmilampi, clastic-organic varves in deep basin, Finland, the last ~9,700 years, total organic carbon (TOC), Lake Lehmilampi connected with Lake Pielinen, magnetic mineralogy dominated by ferrimagnetic minerals, magnetosome production in Lake Lehmilampi controlled by lake productively.


Hansen MA, Lian OB, Clague JL (2012) *The sequence and timing of large late Pleistocene floods from glacial Lake Missoula.* *Quaternary Science Reviews* 31, 67-81. http://dx.doi.org/10.1016/j.quascirev.2011.11.009; Washington, varved sequence from Lake Missoula compared to sediments at Ninemile Creek 26 km to the northwest, draining of glacial Lake Missoula repeatedly exposed the lake floor and caused erosion and deformation of varved glaciolacustrine sediment, desiccation cracks, varve counting constrains the age of the floods to 15.1 ± 0.6 ka at the base of Ninemile exposure, and 14.8 ± 0.7 and 12.6 ± 0.6 ka at rail line exposure.


Hausmann S, van Leeuwen J, Lotter AF, Ohlendorf C, Sturm M (1999) *Étude à haute résolution des derniers siècles dans les sédiments laminés du lac subalpin de Seeberg (Suisse).* *Cryptogramie Algologie* 20, 111-112. Additional information needed: Electronic link? Keywords?


Hendy IL, Dunn L, Schimmelmann A, Pak DK (2013) Resolving varve and radiocarbon chronology differences during the last 2000 years in the Santa Barbara Basin sedimentary record, California. Quaternary International 310, 155-168. http://dx.doi.org/10.1016/j.quaint.2012.09.006; California Current, marine sediment prior to 18th century was not continuously varved, but instead was occasionally merely laminated, leading to incorrect varve count-ages, radiocarbon dating of terrestrial macrofossils, drought periods may have starved the basin of sediment and provided insufficient lithic material to deposit winter laminae.


Hoffmann P, Pätzold J (2002) The stabilisation of wet sediment cores by means of a polyethylene glycol/freeze-drying treatment for display and permanent storage. *Geo-Marine Letters* **21** (4), 245-252. [http://dx.doi.org/10.1007/s00367-001-0085-3](http://dx.doi.org/10.1007/s00367-001-0085-3); reversible method to transform waterlogged sediment cores into dry and stable specimens; archiving, stabilization, wet sediment core segments are bath-impregnated with polyethylene glycol (PEG), freeze-drying, PEG forms bonding porous structure. Impregnation times vary from 2 weeks for coarse sand to 6-10 weeks for more compacted sediments, color changes, the processed samples are lighter in appearance and the contrasts are enhanced, PEG can be re-dissolved and washed out of the sediments.

Hogbom AG (1889) *Om relationen mellan kalcium-och magnesiumkarbonat i qvartara aflägringar*. *Geologiska Föreningen i Stockholm Förhandlingar* **11**, 263-273. Additional information needed: Keywords? [Link](http://dx.doi.org/10.1126/science.184.4142.1197);


Holmquist B, Wohlfarth B (1998) An evaluation of the Late Weichselian Swedish varve chronology based on cross-correlation analysis. *GFF* **120** (1), 35-46. [http://dx.doi.org/10.1080/11035899801201035](http://dx.doi.org/10.1080/11035899801201035); some visual ‘correlations’ of varve-thickness diagrams are statistically weak or invalid and need to be corroborated.


Höstmönst A (1964) Ångermanlands Kustland Undér Isavsmåttningensskedet. *Geologiska Föreningen i Stockholm Förhandlingar* **86** (2), 181-205. [http://dx.doi.org/10.1080/11035896409448897](http://dx.doi.org/10.1080/11035896409448897); Holocene shoreline of the Bothnian Sea in ångermanland, Finiglacial coastal area, evaluation of shore line in northeast ångermanälven by glacial varved clays, pollen, diatoms, paleosalinity.


17th century European land clearance, 1950s increased residential development in the watershed, cultural eutrophication apparent in both stable nitrogen isotope values as well as in productivity proxies.


Hughen KA, Overpeck JT, Lehman SJ, Kashgarian M, Southon J, Peterson LC, Alley R, Sigman DM (1998) Deglacial changes in ocean circulation from an extended radiocarbon calibration. Nature 391, 65-68. Note: copy and paste the following URL directly into your browser; clicking the link may not work: http://dx.doi.org/10.1038/34150; effort to extend 14C timescale, Cariaco Basin marine varved sediments, Caribbean Sea.


Hughen K, Southon J, Lehman S, Bertrand C, Turnbull J (2006) Marine-derived 14C calibration and activity record for the past 50,000 years updated from the Cariaco Basin. Quaternary Science Reviews 25 (23-24), 3216-3227. http://dx.doi.org/10.1016/j.quascirev.2006.03.014; Cariaco Basin, Venezuela, South America, tropical Atlantic Ocean, expanded 14C varve chronology is tied to 40Ar/39Ar-dated Hulu Cave speleothem records, from 45 to 15 ka Δ14C remains anomalously high, indicating that the distribution of radiocarbon among ocean reservoirs was different.


Irmler R, Daut G, Mäusbacher R (2006) A debris flow calendar derived from sediments of lake Lago di Braies (N. Italy). *Geomorphology* 77 (1-2), 69-78. [http://dx.doi.org/10.1016/j.geomorph.2006.01.013](http://dx.doi.org/10.1016/j.geomorph.2006.01.013); high resolution 2250 year record of debris flow events in varve record, neither a debris flow magnitude–frequency relationship nor a strong reaction of debris flow activity to past climate changes was identifiable.


varve units, separated by a sand layer deposited in the North Sea during the catastrophic drainage of the Baltic Ice Lake (BiL), stratigraphy suggests that the BiL drainage lasted < 1 year.


Kemp AES, Baldauf JG (1993) Vast Neogene laminated diatom mat deposits from the eastern equatorial Pacific Ocean. Nature 362, 141-144. http://dx.doi.org/10.1038/362141a0; upwelling region, increased equatorial primary production between 15 and 4.4 million years ago, diatom Thalassiothrix mats, marine sediment.


Kemp AES, Pike J, Pearce RB, Lange CB (2000) The “Fall dump” - a new perspective on the role of a “shade flora” in the annual cycle of diatom production and export flux. Deep-Sea Research II 47 (9-11), 2129-2154. http://dx.doi.org/10.1016/S0967-0645(00)00019-9; concept developed from the analysis of laminated marine sediments, diatom flux, scanning electron microscope techniques, sediment trap, diatoms able to generate substantial production at depth, may represent a “shade flora” adapted to grow in low-light conditions and/or to regulate their buoyancy to move between a deep nutrient source and the euphotic zone, “fall dump” is the sedimentation of a long-lived episode of production (lasting the duration of the seasonal thermocline) and triggered by the fall/winter mixing that breaks down stratification, may produce much of export production.


Keywords?


Kennedy JA, Brassell SC (1992) Molecular records of twentieth century El Niño events in laminated sediments from the Santa Barbara basin. Nature 357, 62-64. http://dx.doi.org/10.1038/357062a0; marine sediment, Pacific, California, El Niño, alkenone, Emiliania huxleyi, coccolithophorid. Note that subsequent radiocarbon compound-specific studies proved that a significant fraction of biomarkers derives from older, re-suspended sediments. Mixing of old with new biomarkers influences the biochemical signal in accumulating varves (e.g., Mollenhauer and Eglington, 2007).


Kennett JP, Ingram BL (1995) A 20,000-year record of ocean circulation and climate change from the Santa Barbara basin. Nature 377, 510-514. http://dx.doi.org/10.1038/377510a0; Pacific Ocean, oscillations of the benthic environment between low-oxygen conditions (laminated sediments) during periods of warm climate, and higher-oxygen conditions (non-laminated, bioturbated sediments) during cool intervals.


King SC, Kemp AES, Murray JW (1995) Benthic foraminifer assemblages in Neogene laminated diatom ooze deposits in the eastern equatorial Pacific Ocean (Site 844). In: (Pisias NG, Mayer LA, Janecek TR, Palmer-Julson A, van Andel TH, eds.) *Proceedings of the Ocean Drilling Program (ODP), Scientific Results* 138, College Station, Texas, 665-673. [http://dx.doi.org/10.2973/odp.proc.sr.138.137.1995](http://dx.doi.org/10.2973/odp.proc.sr.138.137.1995); laminated *Thalassiothrix* diatom mat deposits in Neogene marine sediments from the eastern equatorial Pacific Ocean, diatom meshwork was of sufficient tensile strength and impenetrability to suppress infaunal benthic activity.

King SC, Murray JW, Kemp AES (1998) Palaeoenvironments of deposition of Neogene laminated diatom mat deposits from the eastern equatorial Pacific from studies of benthic foraminifera (sites 844, 849, 851). *Marine Micropaleontology* 35 (3-4), 161-177. [http://dx.doi.org/10.1016/S0377-8398(98)00020-6](http://dx.doi.org/10.1016/S0377-8398(98)00020-6); *Thalassiothrix longissima* forming marine laminated diatom mat deposits, 15 to 4.8 m.y. ago, benthic foraminifera used to reconstruct benthic environment, preservation of laminated in the diatom mat deposits is due to the physical exclusion of macro endobenthos rather than oxygen depletion of the bottom waters.


Kirilova EP, Bluszcz P, Heiri O, Cremer H, Ohlendorf C, Lotter AF, Zolitschka B (2008) Seasonal and interannual dynamics of diatom assemblages in Sacrower See (NE Germany): a sediment trap study. *Hydrobiologia* 614 (1), 159-170. [http://dx.doi.org/10.1007/s10750-008-9504-z](http://dx.doi.org/10.1007/s10750-008-9504-z); sediment trap, comparison with limnological and meteorological data, Canonical Correspondence Analysis, precipitation, air and water temperatures, epilimnetic calcium, pH, and total phosphorus concentrations together explained 70% of the variance of the diatom data.


Kirkland DW (2003) An explanation for the varves of the Castile evaporites (Upper Permian), Texas and New Mexico, USA. Sedimentology 50 (5), 899-920. http://dx.doi.org/10.1046/j.1365-3091.2003.00588.x; laterally persistent marine varves in Castile evaporites occur as singlets (calcite laminae), couplets (calcite laminae interstratified with anhydrite laminae), thick couplets (calcite laminae interstratified with thin anhydrite beds) and triplets (calcite and anhydrite laminae interstratified with thin halite beds) in a deep (initially =550 m), persistently stratified, saline lake separated from the ocean by a reef, different varve types recur with a period of 1800–3000 years reflecting climatic changes on a millennial time scale.


Klaminder J, Appleby P, Crook P, Renberg I (2012) Post-deposition diffusion of 137Cs in lake sediment: Implications for radiocaesium dating. Sedimentology 59 (7), 2259-2267. http://dx.doi.org/10.1111/j.1365-3091.2012.01343.x; radiocaesium in lake sediments infers ages of sediment deposited from nuclear bomb testing or the 1986 Chernobyl accident, varved lake sediments have a clear and well-resolved peak in the 1986 varve, Chernobyl 137Cs incorporated into the 1986 varve diffused downwards, the weapons fallout marker is likely to be of little use for determining 137Cs dates in areas strongly affected by high levels of Chernobyl fallout.


Köppen V (1928) Mehrjährige Temperaturchwankungen vor 8 bis 18 Jahrtausenden. Meteorologische Zeitschrift 45, 263-265 (in German). Additional information needed: Electronic link? Keywords?

Korn H (1938) Schichtung und absolute Zeit. Neues Jahrbuch der Mineralogie Geologie Paläontologie 74A, 50-186 (in German). Additional information needed: Electronic link? Keywords?


Kotilainen AT, Vallius H, Rybachuk D (2007) Seafloor anoxia and modern laminated sediments in coastal basins of the eastern Gulf of Finland, Baltic Sea. Geological Survey of Finland Special Paper 45, 49–62. Baltic Sea, many basins have been continuously or seasonally anoxic for at least 10 years, overall shallowing of anoxia since 1950’s, marine varves also in the shallow basins.


Kuehn T, Niederreiter R (2003) Freeze coring of soft surface sediments at a water depth of several hundred meters. *Journal of Paleolimnology* **29** (2), 257-263. [http://dx.doi.org/10.1023/A:1023208632092](http://dx.doi.org/10.1023/A:1023208632092); freeze corer for water depth of up to 1000 meters, successful test at 200 m depth, high pressure resistant housing with vacuum insulated jacket for ethanol which can be chilled by separate cooling agents, electrical pump, freezing wedge 100 cm long.

Lajat M, Saliot A, Schimmelmann A (1990) Free and bound lipids in recent (1835-1987) sediments from Santa Barbara Basin. *Organic Geochemistry* 16, 793-803. [http://dx.doi.org/10.1016/0146-6380(90)90118-J](http://dx.doi.org/10.1016/0146-6380(90)90118-J); California, North America, marine sediment, Pacific Ocean, California Current, lipids, varve thickness, steroids, biodegradation, fatty acids, El Niño. Note that subsequent radiocarbon compound-specific studies proved that a significant fraction of biomarkers derives from older, re-suspended sediments. Note that subsequent radiocarbon compound-specific studies proved that a significant fraction of biomarkers derives from older, re-suspended sediments. Mixing of old with new biomarkers influences the biochemical signal in accumulating varves (e.g., Mollenhauer and Eglington, 2007).

Lamoureux SF (2010) Embedding unfrozen lake sediments for thin section preparation. *Journal of Paleolimnology* 10 (2), 141-146. [http://dx.doi.org/10.1007/BF00682510](http://dx.doi.org/10.1007/BF00682510); method for subsampling and embedding unfrozen sediments, thin section techniques preserve very fine structural detail without interruption due to ice-crystal casts, dewatering with acetone, embedding with Spurr epoxy resin.


Lane CS, Brauer A, Blockley SPE, Dulski P (2013) Volcanic ash reveals time-transgressive abrupt climate change during the Younger Dryas. *Geology* **41**(12), 1251-1254. http://dx.doi.org/10.1130/G34867.1; atmospheric proxy signals of the resumption of thermohaline circulation midway through the Younger Dryas occurred 100 yr before deposition of ash from the Icelandic Veddesh eruption in a German varve lake record, and 20 yr after the same isochron in western Norway, synchronization of two high-resolution continental records uses Veddesh Ash layer (12,140 ± 40 varve yr B.P.).


http://www.calcofi.org/publications/calcofireports/v38/Vol_38_Lange_etal.pdf; marine sediment, Pacific, sediment traps, lithogenic flux, plankton, diatoms, radiolarians, silicoflagellates, upwelling vs. non-upwelling conditions, preservation.


http://dx.doi.org/10.1080/02664763.2011.579543; Nonlinear and non-Gaussian state–space models (SSMs) fitted to time series, homogeneous and seasonal time series, glacial varve data, Poisson, Bernoulli, gamma and Student-t distributions, approximated likelihood of a finite-state hidden Markov model (HMM).


http://dx.doi.org/10.1007/s10933-012-9611-8; grain-size, image analysis system, scanning electron microscope, particle-size distribution, coarse grain size correlated with summer rainfall, instrumental data from nearby stations, varve thickness weakly correlated with particle-size distribution, High-Arctic.


http://dx.doi.org/10.1007/s10933-008-9229-0; late Holocene, non-biting midges, meteorological data, numerical methods, dating errors, chironomids, Engadine, Alps, Europe, lake sediment, reconstruction of mean July air temperature.


http://dx.doi.org/10.1016/j.quascirev.2015.01.001; lacustrine varves, chironomids, reconstructed mean-August air temperature since 1896 AD at annual (1949–2011 AD) and at 3–4 year resolutions (1896–1948 AD), transfer functions for temperatures in northeastern Canada and Poland.


http://dx.doi.org/10.1177/0959683609348253; late Holocene, non-biting midges, meteorological data, chironomids, Engadine, European Alps, Europe, lake sediment, reconstruction of mean July air temperature, validation with early instrumental data, dendrochronology, biogenic silica.


http://dx.doi.org/10.1016/j.quascirev.2010.04.018; subfossil chironomids (non-biting midges) from varved Lake Silvaplana, European Alps, reconstruction of mean July air temperatures during the last millennium, Medieval Climate Anomaly (MCA), Little Ice Age.


http://dx.doi.org/10.1016/j.palaeo.2010.11.008; late Holocene, non-biting midges, Lake Silvaplana, Engadine, Switzerland, European Alps, lake sediment, reconstruction of mean July air temperature, two models for reconstructions over 1000 years.


http://dx.doi.org/10.1016/j.quascirev.2011.04.008; late Holocene, non-biting midges, European Alps, lake sediment, reconstruction of mean July air temperature, comparison of two models for reconstructions, anoxia.


http://dx.doi.org/10.1016/j.quascirev.2012.03.010; late Holocene, non-biting midges, Lake Seebergsee, comparison with Lake Silvaplana, European Alps, lake sediment, anoxia, reconstruction of mean July air temperature, comparison of two models for reconstructions, Little Ice Age, Medieval Climate Anomaly.

Lehndorf E, Wolf M, Litt T, Brauer A, Amelung W (2015) 15,000 years of black carbon deposition – A post-glacial fire record from maar lake sediments (Germany). *Quaternary Science Reviews* **110**, 15-


Leroy SAG (2010) Pollen analysis of core DS7-1SC (Dead Sea) showing intertwined effects of climatic change and human activities in the Late Holocene. *Journal of Archaeological Science* 37 (2), 306-316. http://dx.doi.org/10.1016/j.jas.2009.09.042; Dead Sea, pollen, human impact, Holocene, Israel, vegetation 2500-year record, high-resolution palynological study of individual laminae (aragonite and gypsum in the summer versus detritics in winter) confirms the seasonal character of the laminae, but throws a note of caution as for their regular annual character.


Leroy SAG, Zolitschka B, Negendank JW, Seret G (2000) Palynological analyses in the laminated sediment of Lake Holzmaar (Eifel, Germany): duration of Lateglacial and Preboreal biozones. *Boreas* 29 (1), 52-71. http://dx.doi.org/10.1111/j.1502-3885.2000.tb01200.x; lake sediment, Holocene, Older Dryas, Younger Dryas, pollen, continuous varve chronology for the last 3500 varve years, floating varve chronology back to more than 22500 y BP, palynology, environmental changes, biozonation for Lake Holzmaar below the Laacher See Tephra, 15 pollen subzones grouped in four biozones defined by cluster analysis, Bolling, Allered 883-y long, Preboreal 702-yr-long, the chronology of Holzmaar may require revision below the middle of the Younger Dryas, comparison with the varve record of Meerfelder Maar suggests adding 320 varve years below 12025 varve years.


units identify mechanisms of Antarctic ice sheet recession, jumbo piston cores from four sites along the East Antarctic margin (Iceberg Alley, Nielson Basin, Svenner Channel, Mertz-Ninnis Trough), deglaciation, transition between the Last Glacial Maximum and the Holocene is characterized by varved couplets deposited during a short interval of extremely high primary productivity in a fjordlike setting, diatom, radiocarbon-based chronologies.


Lewy Z (2009) Early Precambrian banded iron formations: Biochemical precipitates from highly evaporated hydrothermal solutions of polar region lakes. *Carbonates and Evaporites* 24 (1), 1-15. [http://dx.doi.org/10.1007/BF03228053](http://dx.doi.org/10.1007/BF03228053); BIFs accumulated during the Lower Precambrian in shallow depositional settings in lakes of warm hydrothermal solutions during intensive evaporation and mineral concentration in cold Polar Regions, after half a year of insolation, cyanobacteria oxygenic photosynthesis deposited iron oxides with silica (geyserite) followed by a lamina of silica only, forming recurrent annual varves.


Liden R (1938) Den senkvartara strandforskjutningens forlopp och kronologi i Ångermanland. *Geologiska Föreningen i Stockholm Förhållningar* 60, 397-404. [Additional information needed. Key words? Link?]


Lindeberg G, Ringberg B (1999) Image analysis of rhythmites in proximal varves in Blekinge, southeastern Sweden. *GFF* 121 (3), 182-186. http://dx.doi.org/10.1080/1103589990123182; Image analysis, proximal varves in the bottom bed of the Bredäkra glaciolacustrine delta, greyscale and color profiling on digital images, summer layers consist of ca. 50 diurnal couplets during intense melting period of c. 50 days during the Late Weichselian deglaciation of the Bölling Chronozone (G1-e).


Paleolimnology 50, 387-398. http://dx.doi.org/10.1007/s10933-013-9733-7: Fourier transform infrared spectroscopy (FTIR) and scanning X-ray fluorescence (XRF), relative abundances of carbonates, organic matter, biogenic silica, Lake Malawi, Lake Qinghai, calcium:titanium (Ca/Ti), incoherent/coherent X-ray scatter intensities (Inc/Coh), silicon:titanium (Si/Ti), the relationship between XRF-ratios or FTIR-absorbances and abundances of corresponding sedimentary components can vary with sediment source and lithology.


Lotter AF (1999) Late-glacial and Holocene vegetation history and dynamics as shown by pollen and plant macrofossil analyses in annually laminated sediments from Soppensee, central Switzerland. *Vegetation History and Archaeobotany* **8** (3), 165-184. [http://dx.doi.org/10.1007/BF02342718](http://dx.doi.org/10.1007/BF02342718); Lake Soppensee, European Alps, lake sediment, pollen, 15,000 year record, biostratigraphy, vegetation history, plant macrofossils, radiocarbon, varve count, Iron Age, Older Dryas, Younger Dryas, Neolithic.


Lotter AF, Ammann B, Hajdas I, Sturm M, van Leeuwen J (1996) Faulenseemoos revisited: New results from an old site. In: (Robertsson AM, Hackens T, Hicks S, Risberg J, Äkerlund A, eds.) *Landscaes and Life. European Study Group on Physical, Chemical and Mathematical Techniques applied to Archaeology* (PACT) **50**, 133-144. [http://cat.inist.fr/?aModele=afficheN&cpsidt=2877837](http://cat.inist.fr/?aModele=afficheN&cpsidt=2877837); re-investigation of "classical site of limnic laminations", pollen, magnetic susceptibility, late glacial, Europe, Switzerland, microstratigraphy, pollen curve of beech, the re-investigation did not yield evidence for expected late-glacial laminated sediments.


Lotter AF, Birks HJB (1997) The separation of the influence of nutrients and climate on the varve timeseries of Baldeggersee, Switzerland. *Aquatic Sciences* **59** (4), 362-375. [http://dx.doi.org/10.1007/BF02522364](http://dx.doi.org/10.1007/BF02522364); lake sediment, variance partitioning, redundancy analysis, multiple linear regression, eutrophication, freeze-core, Lake Baldeggersee, Switzerland, European Alps, varve thickness, annual precipitation versus summer precipitation.

Lotter AF, Birks HJB, Hofmann W, Marchetto A (1997) Modern diatom, cladocera, chironomid, and chrysophyte cyst assemblages as quantitative indicators for the reconstruction of past environmental conditions in the Alps. 1. Climate. *Journal of Paleolimnology* **18**, 395-420. [http://dx.doi.org/10.1023/A:1007982008956](http://dx.doi.org/10.1023/A:1007982008956); transect of 68 small lakes along an altitudinal gradient from 300 to 2350 m, Switzerland, 43 environmental variables, physical limnology, geography, catchment characteristics, climate, water chemistry, canonical correspondence analyses (CCA), Monte Carlo permutation tests, transfer functions for individual proxies, cross-validation, summer temperature, training set.


Lücke A, Brauer A, Kleimann A, Merkt J, Schleser GH (2005) Abrupt climate changes of the Late Glacial and seasonality: Evidences from varved lake sediments of Western Europe. In: The Climate of the Next Millennia in the Perspective of Abrupt Climate Change During the Late Pleistocene - PAGES/DEKLM Conference, 7-10 March, 2005, Mainz, Germany, Abstracts Volume 162-163. Additional information needed: Electronic link? Keywords?

carbon isotopes, algal lacustrine primary production, ecosystem reorganizations, deforestation, reforestation, runoff changes, human impact.


Ludlam SD, Feeney S, Douglas MSV (1996) Changes in the importance of lotic and littoral diatoms in a high arctic lake over the last 191 years. Journal of Paleolimnology 16 (2), 187-204. http://dx.doi.org/10.1007/BF00176935; diatom habitat preferences and community associations, varve-counted dates of major turbidites relate to exceptionally thick varves and the concentration of valves, concentration of valves appears to be a proxy for sediment deposition from turbidity currents.


Maddison EJ, Pike J, Dunbar R (2012) Seasonally laminated diatom-rich sediments from Dumont d'Urville Trough, East Antarctic Margin: Late-Holocene Neoglacial sea-ice conditions. The Holocene 22 (8), 857-875. http://dx.doi.org/10.1177/0959683611434223; diatom-rich laminated marine sediments from Dumont d'Urville Trough, East Antarctic Margin, Antarctica, changes in environmental conditions on the continental shelf from 1136 to 3122 cal. yr BP, scanning electron microscope backscattered electron imagery (BSEI), secondary electron imagery, diatom, formation of each of 9 lamina types is controlled by seasonal changes in sea ice cover, nutrient levels and water column stability, sea ice cover.


Maddison EJ, Pike J, Leventer A, Domack EW, Manley P, McClennen C (2006) Post-glacial seasonal diatom record of the Mertz Glacier Polynya, East Antarctica. Marine Micropaleontology 60 (1), 66-88. http://dx.doi.org/10.1016/j.marmic.2006.03.001; marine sediment, ultra-high-resolution post-glacial laminated sediment record from Mertz Ninnis Trough, East Antarctic Margin (EAM), Antarctica, SEM backscattered electron imagery, secondary electron imagery, quantitative diatom abundance, four biogenic diatom ooze laminae types, one diatom-bearing terrigenous lamina type, one diatom-bearing terrigenous sub-lamina type, lamina types are controlled by seasonal changes in nutrients, oceanographic regimes and Mertz Glacier Polynya dynamics.


McG
McElhinny MW, Opdyke ND (1968) Annual proxy data from Lago Grande di Monticchio (southern Italy) between 76 and 112 ka: new chronological constraints and insights on abrupt climatic oscillations. *Climate of the Past* **10**, 2099-2114, [http://dx.doi.org/10.5194/cp-10-2099-2014](http://dx.doi.org/10.5194/cp-10-2099-2014); sub-annual element scanner data, pollen assemblage, six major abrupt stadial oscillations during the early phase of the last glaciation, chronology MON-2014, tephrochronology, Mediterranean.


McArthur JM, Algeo TJ, van de Schootbrugge B, Li Q, Howarth RJ (2008) Basinal restriction, black shales, Re-Os dating, and the Early Toarcian (Jurassic) oceanic anoxic event. *Paleoceanography* **23** (4), [http://dx.doi.org/10.1029/2008PA001607](http://dx.doi.org/10.1029/2008PA001607); comparisons among Lower Toarcian black shales, Cleveland Basin, Yorkshire, United Kingdom, Posidonia shale, Germany, Switzerland, some black shales show alternating dark organic-rich and lighter siliceous laminae that have been interpreted as marine varves; give citations about conflicting interpretations, e.g.: Posidonia shale is not varved according to: Röhl HU, Schmid-Röhl A, Ochmann W, Fimmel A, Schwark L (2001) The Posidonia shales (lower Toarcian) of SW Germany: An oxygen depleted ecosystem controlled by sealevel and palaeoclimates. *Palaeogeography, Palaeoclimatology, Palaeoecology* **169** (3-4), 273-299. [http://dx.doi.org/10.1016/S0031-0182(01)00201-2](http://dx.doi.org/10.1016/S0031-0182(01)00201-2); Lower Toarcian Posidonia Shale laminations reflect events at intervals of several tens to hundreds of years.

McElhinny MW, Opdyke ND (1968) Paleomagnetism of some Carboniferous glacial varves from central Africa. *Journal of Geophysical Research* **73** (2), 689-696. [http://dx.doi.org/10.1029/JB073i002p00689](http://dx.doi.org/10.1029/JB073i002p00689); 5 sites from Dwyka (Carboniferous), glacial varves in Rhodesia, Zambia, southern Tanzania, Permo-Carboniferous poles from Africa and Australia, upper Paleozoic marine polar movement from west to east across Gondwanaland.


Menounos B, Clogue JJ (2008) Reconstructing hydro-climatic events and glacier fluctuations over the past millennium from annually laminated sediments of Cheakamus Lake, southern Coast Mountains, British Columbia, Canada. *Quaternary Science Reviews* 27 (7-8), 701-713. http://dx.doi.org/10.1016/j.quascirev.2008.01.007; North America, late Holocene environmental conditions, rhythmically varved clayey silt, seven types of varves, couplet thickness, different types of floods, glacier runoff, Little Ice Age, glacier activity, thickest varves coincide with times of rapid glacial retreat and periods when air temperatures were warmer than average.


Spanish/Early American period, pollen, precipitation reconstructed from tree rings. Large fires at the end of wet periods and beginning of droughts. Note: the findings of this study were partially revised by Hendy et al.’s (2012) new chronology.


Meriläinen JJ, Kustula V, Witick A, Haltia-Hovi E, Saarinen T (2010) Pollution history from 256 BC to AD 2005 inferred from the accumulation of elements in a varve record of Lake Korttajärvi in Finland. Journal of Paleolimnology 44 (2), 531-545, http://dx.doi.org/10.1007/s10933-010-9435-3; varved lake sediment, varve counting (256 BC to AD 2005), metallurgical activities of the Roman Empire, accumulation rates of individual elements (Cd, Sn, Pb, Si, Ni, B, Cu, Zn, Sr, Na, K, Sr, Ca, Cr, U, Mg), earliest lead pollution AD 1055–1114, trace elements.


Merkt J (1975) Interpretation der älteren Sedimente von Schleinsee, Degersand und Muttelsee hinsichtlich ihrer Bildungsbedingungen und ihre Eignung für die Korrelationsforschung. Final report part B - Archivbericht, Niedersächsisches Landesamt für Bodenkunde, Hannover, Germany, 25 pp. (In German). Additional information needed: Keywords?


Merkt J, Müller H (1995) Laminated sediments from Neolithic to the Hallstatt period in South Germany. European Study Group on Physical, Chemical and Mathematical Techniques Applied to Archaeology (PACT) 41 (II.1), 101-116, http://rdap02pdu.dev.ocl.cn/6251/identities/lccn-n82-79995; Additional information needed: Electronic link? Keywords?


Merkt J, Müller H (1999) Varve chronology and palynology of the Lateglacial in Northwest Germany from lacustrine sediments of Hämelsee in Lower Saxony. Quaternary International 61 (1), 41-59, http://dx.doi.org/10.1016/S1069-872X(99)00016-6; Lake Hämelense is a dolina from a collapse over Permian salt at the end of the Pleniglacial, 18 m of lacustrine sediment, multidisciplinary studies of the microfossils from thin sections, geochemistry, pollen, chironomids, Lateglacial biozones, rapid climatic changes, Allerød sediment 625 yr seasonally varved, Laacher-See tephra (12,900 cal BP) had a 10 yr impact on the climate, 50 yr transition from Allerød to Younger Dryas, abrupt change at the end of the Lateglacial (11,560 cal BP) occurred within less than 10 yr.


temperature in 8 m presumably varved sediment core covering the last 1800 years, chironomid fauna, Dark Age Cold Period (DACP), the Medieval Warm Period (MWP), Little Ice Age (LIA).

http://dx.doi.org/10.1016/S0031-0182(98)00021-2; Eocene, lake sediment, periodicity, maar lakes, paleolimnology. Eocene, comparison of sediment types and lake development of a Tertiary (subtropical) maarlake with recent maarlakes, origin of laminations, periodicities, laminated oils, haltes, partly laminated bituminous siltstones, turbidites, diatomaceous laminites, organic carbon ca. 8.5%, darker and lighter sublaminae, probably varves, counting of ca. 700 oil shale laminae.

http://dx.doi.org/10.1016/j.quaint.2004.02.014; 8 maar- or crater lakes with water depths between 15 and 127 m examined, pollen of the last 900 years in Lake Shihallongwan show stable vegetation cover, except for the last 150 years with increasing anthropogenic influence, no evidence for Little Ice Age.

http://dx.doi.org/10.1007/s10933-006-9035-4; versatile piston corer for recovering continuous sediment sequences with superior accuracy and quality, up to 95 m, examples of lake sediment profiles.

http://dx.doi.org/10.1016/j.quaint.2004.02.001; 78,000 year record of magnetic susceptibility, some ‘varve-like laminae’, the last 4000 years enhanced human activity.


http://www.biogeoosciences.net/7/3901/2010/bg-7-3901-2010.pdf; marine laminated (varved ?) sediment, enhanced organic matter preservation under anaoxic conditions, sinking particles, surface sediments, eight spatially distributed core records of the youngest sapropel S1 (10-6 ka) and older sapropels (S5, S6).

http://dx.doi.org/10.1002/2013JB010738; varved sediment from lakes Villarrica and Calafquén, Chilean Lake District, lacustrine turbidites, paleoseismic record.

http://dx.doi.org/10.1016/j.margeo.2005.07.007; Celtic margin, Bay of Biscay, Atlantic, off France, postulated deep-sea varves formed by an annual cycle of meltwater and iceberg release from the disintegrating BIS generating cascading plumes of dense turbid meltwater coeval with IRD release.

http://dx.doi.org/10.4319/lo.2007.52.2.0558; compound-specific radiocarbon (14C) contents, stable carbon isotopes, lipid biomarkers, alkenones, fatty acids, Santa Barbara Basin, Pacific Ocean, marine sediment, radiocarbon, planktic foraminifera, alkenones are systematically depleted in radiocarbon with respect to foraminifera, preferential preservation of terrestrially derived fatty acids, short-chain fatty acids tend to be more 14C-enriched relative to alkenones in core-top sediments, longer-chain homologues are generally the most radiocarbon depleted lipids, lower 14C content of more refractory compounds reflects a larger proportion of laterally supplied preaged material, selective degradation.

http://dx.doi.org/10.1080/11035896209449211; ‘De Geer moraines’ (introduced by Hoppe, 1959), varve-measurements within a De Geer moraine series.

http://dx.doi.org/10.1021/es950895i; profiles of P and $^{206}\text{Pb}/^{207}\text{Pb}$ ratios in sediment cores, relationship to Pb emissions from gasoline.

Moore JJ, Hughen KA, Miller GH, Overpeck JT (2001) Little Ice Age recorded in summer temperature reconstruction from varved sediments of Donard Lake, Baffin Island, Canada. Journal of Paleolimnology 25 (4), 503-517. http://dx.doi.org/10.1023/A:1011181301514; clastic varved sediments, Cape Dyer, 1250 yr record of decadal-to-centennial scale climate variability, summer melting of the Caribou Glacier, radionuclide date on moss fragments in agreement with varve-count age, varve thickness correlates with average summer temperature from nearby Cape Dyer, varve thickness was used to reconstruct average summer temperatures for the past 1250 years, abrupt shifts and large amplitude decadal-to-centennial scale variability, Little Ice Age.

Morford JL, Russell AD, Emerson S (2001) Trace metal evidence for changes in the redox environment associated with the transition from terrigenous clay to diatomaceous sediment, Saanich Inlet, BC. Marine Geology 174 (1-4), 355-369. http://dx.doi.org/10.1016/S0025-3227(00)00160-2; redox-sensitive trace metals (Mn, V, Mo, U, Cd and Re) in sediments from ODP Leg 169S Hole 1033B, British Columbia, marine varves. See also: http://dx.doi.org/10.1016/S0025-3227(00)00159-6

Mörner NA (1975) Palaeomagnetism and the relation between the Bredåkra delta and the Fjärås Stadial and the Gothenburg Magnetic Excursion. Geologiska Föreningen i Stockholm Förhandlingar 97 (3), 298-301. http://dx.doi.org/10.1080/11035897509454317; Gothenburg Magnetic Excursion in Fjärås Stadial 12,350–12,400 BP, 3 varved clay sequences. Note: This work has been criticized by Ringberg (1976), prompting a reply by Mörner (1976).

Mörner NA (1975) The genesis of the Bredåkra delta and its relation to the Fjärås Stadial. Geologiska Föreningen i Stockholm Förhandlingar 97 (3), 294-297. http://dx.doi.org/10.1080/11035897509454316; revision of Ringberg’s idea that the Bredåkra delta (in south-eastern Sweden) was deposited right in front of the receding ice for topographical reasons. Note: This work has been criticized by Ringberg (1976), prompting a reply by Mörner (1976).


Mörner NA (1977) Varve chronology on Södertörn: Recording and dating of the “drainage” of the Baltic Ice Lake and correlation with the Finnish varve chronology. Geologiska Föreningen i Stockholm Förhandlingar 99 (4), 423-425. http://dx.doi.org/10.1080/11035897709455050; Short-distance varve correlations across the Södertörn area have extended the continuous Swedish Time Scale back to about varve -1500 (about 10,400 B.P.). Varve -1073 (= 9,965 varves B.P.) is represented by a distinct drainage varve and a change from diatactic to symict varves, recording the “drainage” of the Baltic Ice Lake at Billingen and the invasion of the sea into the Baltic.


Mörner NA (1995) The Baltic Ice Lake-Yoldia Sea transition. Quaternary International 27, 95-98. http://dx.doi.org/10.1016/1040-6182(94)00065-D; Baltic Ice Lake, Yoldia Sea, Ancylus Lake, Littorina Sea are the 4 classical stages in the postglacial evolution of the Baltic basin; 300 years of ‘Yoldia’ Lake stage suggested between Baltic Ice Lake and Yoldia Sea right after the drainage of the Baltic Ice Lake and before the ingress of salt water.

Mörner NA (1996) Liquefaction and varve deformation as evidence of paleoseismic events and tsunamis. The autumn 10,430 BP case in Sweden. Quaternary Science Reviews 15 (8-9), 939-948. http://dx.doi.org/10.1016/S0277-3791(96)00571-1; liquefaction and deformation of varves provide information on paleoseismic events, varve chronology, liquefaction structures and seismic varve deformation dated to autumn 10,430 varve years BP.


Mörner NA (2013) Drainage varves, seismses and tsunamies in the Swedish Varve Chronology. *GFF, special issue "Varve Genesis, Chronology and Paleoclimate"* **135**(3-4), 308-315. [http://dx.doi.org/10.1080/11035897.2013.764546](http://dx.doi.org/10.1080/11035897.2013.764546); testing of possible synchronicity of deformations and turbidites over wide areas using varves, high-magnitude earthquakes, varve events previously interpreted as “drainage varves” areseismically induced marker-beds and should be renamed seismses; layers formed by tsunami should be termed tsunamies.


Moscariello A, Ravazzi C, Brauer A, Mangili C, Chiesa S, Rossi S, de Beaulieu JL, Reille M (2000) A long lacustrine record from the Piànico Basin (Southwest Italy): high resolution studies of dinoflagellate cysts as a proxy for ‘red tide’ production. *Quaternary International* **73/74**, 47-68. [http://dx.doi.org/10.1016/S0169-5891(00)00064-1](http://dx.doi.org/10.1016/S0169-5891(00)00064-1); Middle–Upper Pleistocene, lake sediment, varved carbonates, pollen, microstratigraphy.


http://www.worldcat.org/title/start-of-a-glacial/oclc/26587896; Additional information needed: Electronic link? Keywords?

http://dx.doi.org/10.1023/A:1020319923164; 1745 varves in the Villarroya Pliocene Basin, Spain, periodicities of about 12, 6-7 and 2-3 years, sunspot cycles, El Niño-Southern Oscillation (ENSO), North Atlantic Oscillation (NAO), Quasi-biennial Oscillation (QBO).

http://dx.doi.org/10.1016/j.chemgeo.2013.06.006; review of sedimentary and geomorphic evidence for main glacial lakes inferred during the Middle and Late Pleistocene, Lake Bosworth, low-level Lake Humber, varve chronologies have been correlated with the Greenland ice-core record.


http://dx.doi.org/10.1080/08120099.2011.574735; Abercrombie Quarry, Kiaman Superchron, characteristic remanence directions from 11 sites spanning 1150 varves.

http://dx.doi.org/10.1080/07438140809354845; geochemical analyses of varved sediments in eutrophic and oligomictic lake.

http://dx.doi.org/10.1016/j.chemgeo.2013.06.006; redox dynamics of manganese in varved lake sediment, high-resolution XRF core scanning, bi-annual lamination and calcite precipitation cycles, Mn maxima coincide with annual maximum deep-water oxygen spring concentrations, Fe signal due to calcite dilution, semi-quantitative reconstruction of bottom water oxygenation.

http://dx.doi.org/10.1016/j.orggeochem.2013.11.002; varved lake sediment, glycerol dialkly glycerol tetraethers (GDGTs), lipid biomarkers, fatty acids (FAs), sterols, hopanoids, phytol, acetyloclastic methanogens, eutrophication, methanogenesis.

http://dx.doi.org/10.1016/j.orggeochem.2012.05.014; eutrophication, microbial community, lipid biomarkers, trace metals, Lake Rotsee, diatoms, bacterial biomass, methanogenic Archaea, altered BIT index (Bitch) indicates changes in terrestrial organic matter supply.


http://dx.doi.org/10.1016/j.quascirev.2004.06.022; reconstructed deglacial climate history, climate in Japan was linked to low-latitude Pacific Sea Surface Temperatures, orbital forcing, Younger Dryas.


86


http://www.ncbi.nlm.nih.gov/pmc/articles/PMC184555/


Nipkow HF (1927) Über das Verhalten der Skelette planktischer Kieselalgen im geschichteten Tiefenschlamm des Zürich- und Baldeggersees. PhD Dissertation, ETH Zürich. http://dx.doi.org/10.3929/ethz-a-000115971; Additional information needed: Keywords?


Nykänen M, Vakkilainen K, Liukkonen M, Kairesalo T (2009) Cladoceran remains in lake sediments: a comparison between plankton counts and sediment records. *Journal of Paleolimnology* 42 (4), 551-570. http://dx.doi.org/10.1007/s10933-008-9304-5; year-to-year and seasonal comparisons of contemporary zooplankton data and cladoceran remains in varves of Lake Vesijärvi, southern Finland, deposition of remains differed significantly among taxa, some species are under-represented in sediment due to poor preservation, results of cladoceran analyses should be expressed in several ways (relative abundances, per unit dry weight, per unit organic matter, net accumulation values), taphonomy.


O’Sullivan PE, Moyeed R, Cooper MC, Nicholson MJ (2002) Comparison between instrumental, observational and high resolution proxy sedimentary records of Late Holocene climatic change—a discussion of possibilities. Quaternary International 88 (1), 27-44. http://dx.doi.org/10.1016/S1040-6182(01)00071-4; discussion of variability, long-term changes are known only from proxies, whereas shorter periodicities are identified in instrumental and observational data, less well known centennial periodicities in varved lake sediments.


transmission electron microscopy, four possible origins of ultralaminae, algal and bacterial cell walls, thylakoids, and filamentous organisms, importance of ultralaminae for paleoenvironmental interpretation.


Peacock JD (2003) Late Devensian marine deposits (Errol Clay Formation) at the Gallowflat Claypit, eastern Scotland: new evidence for the timing of ice recession in the Tay Estuary. *Scottish Journal of*

http://dx.doi.org/10.2973/odp.proc.sr.138.143.1995; scanning electron microscope (SEM)-based analyses of laminated diatom ooze of ODP Leg 138, three major laminae types, pennate diatom mats, Thalassicloths longissima, marine sediment.


Pérez-Cruz L, Urrutia-Fucugauchi J (2010) Holocene laminated sediments from the southern Gulf of California: geochemical, mineral magnetic and microfossil study. Journal of Quaternary Science 25 (6), 989-1000. http://dx.doi.org/10.1002/jqs.1386; Holocene laminated sequence from the Alfonso Basin, northern Bay of La Paz, Gulf of California, authors suggest that dark/light laminae result from oceanographic and climatic cyclic processes forming a non-annual depositional system, in contrast to the varved sediments characteristic of the central Gulf of California basins.


Pike J, Crosta X, Maddison EJ, Stickley CE, Denis D, Barbara L, Renssen HJ (2009) Observations on the relationship between Antarctic coastal diatoms Thalassiosira antarctica Comber and Porosira glacialis (Grunow) Jørgensen and sea ice concentrations during the Late Quaternary. Marine Micropaleontology 73 (1-2), 14-25. http://dx.doi.org/10.1016/j.marmicro.2009.06.005; late Quaternary seasonally laminated marine diatom ooze from coastal Antarctic sites, sub-laminae dominated by specific diatoms are nearly always deposited as the last sediment increment of the year, Dumont d’Urville Trough, Adélie Land, mid-Holocene autumnal sub-laminae dominated by certain diatom species, Svenner Channel, Princess Elizabeth Land, diatom climate proxy, East Antarctica, sea ice.


Pike J, Kemp AES (1997) Early Holocene decadal-scale ocean variability recorded in Gulf of California laminated sediments. Paleoceanography 12 (2), 227-238. http://dx.doi.org/10.1029/96PA0312; Scanning electron microscopy, Holocene marine laminated sediment from Guaymas Basin, Gulf of California, Pacific, Mexico, up to five depositional events per year, backscattered electron imagery, pomatosaccoid analysis, diatom mat laminae, periodicitites in the deposition of mat laminae at ~50 years, ~11 years, and 22-24 years, ~50-year cycle in fish populations related to changing North Pacific ocean/atmosphere circulation, California Current, solar cycles.


Pike J, Stickley CE (2007) Diatom records: Marine laminated sediments. In: (Elias S, ed.) Encyclopedia of Quaternary Science, Elsevier, 557-566. http://dx.doi.org/10.1016/B0-44-452747-6/00238-6; History of marine laminated sediment research, nature of diatom records from Quaternary laminated marine sediments, marine diatom ooze, sedimentary preservation of the seasonal succession of surface water diatom blooms, semi-enclosed seas (e.g., Gulf of California, Mexico), silled basins (e.g., Santa Barbara Basin, California margin and Iceberg Alley, MacRobertson Shelf, Antarctica), open continental margin (e.g., Peru margin).

Pike J, Stickley CE (2013) Diatom records: Marine laminated sediments. In: (Elias SA, ed.) Encyclopedia of Quaternary Science (2nd Edition), Elsevier, pp. 554-561. [ISBN: 9780444536426] History of marine laminated sediment research, nature of diatom records from Quaternary laminated marine sediments, marine diatom ooze, sedimentary preservation of the seasonal succession of surface water diatom blooms, semi-enclosed seas (e.g., Gulf of California, Mexico), silled basins (e.g., Santa Barbara Basin, California margin and Iceberg Alley, MacRobertson Shelf, Antarctica), open continental margin (e.g., Peru margin).

PilskaIn CH, Pike J (2001) Formation of Holocene sedimentary laminae in the Black Sea and the role of the benthic flocculent layer. Paleoceanography 16 (1), 1-19. http://dx.doi.org/10.1029/1999PA000469; Geochemical data, backscattered electron imagery (BSEI), sedimentological relationships between the benthic flocculent layer and the formation of underlying laminated unit I sediments, permanent benthic fluff layer as a geochemical transition layer, all sedimentary particles are hydraulically sorted and subject to dissolution or organic remineralization prior to deposition in varve, particle residence time within the benthic fluff layer is key factor in determining sedimentary microfabric and geochemical composition of laminated unit I sediments, marine.


Prasad S, Vos H, Negendank N, Waldmann N, Goldstein SL, Stein M (2004) *Evidence from Lake Lisan of solar influence on decadal- to centennial-scale climate variability during marine oxygen isotope stage 2*. *Geology* **32** (7), 581-584. [geology.gsapubs.org/content/32/7/581]: varved lacustrine sediments of Lake Lisan, Dead Sea Rift, for ca. 26.2-17.7 (calendar) ka, floating varve chronology anchored to radiometric dates, small ice-rafting and Heinrich events in the North Atlantic are associated with Eastern Mediterranean arid intervals, seasonal sub-laminae, periodicities centered at 1500 yr, 500 yr, 192 yr, 139 yr, 90 yr, and 50-60 yr, solar forcing, Near East.


Geologie und Paläontologie, Monatshefte, 400-413.  http://www.worldcat.org/title/geoologie-und-palaontologie-monatshefte/oclc/1759692; additional information needed. Electronic link? Keywords?


Raspopov OM, Dergachev VA, Ogurtsov MG, Kolström T, Jungner H, Dmitriev PB (2011) Variations in climate parameters at time intervals from hundreds to tens of millions of years in the past and its relation to solar activity. *Journal of Atmospheric and Solar-Terrestrial Physics* **73** (2-3), 388-399. [dx.doi.org/10.1016/j.jastp.2010.02.012](http://dx.doi.org/10.1016/j.jastp.2010.02.012); varved sediment analyzed to reveal periodicities in climatic processes at tens to hundreds of millions of years, periodicities are compared with solar and climatic periodicities observed at present, solar activity.


Reimer PJ (2012) Refining the radiocarbon time scale. *Science* **338** (6105), 337-338. [http://dx.doi.org/10.1126/science.1228653](http://dx.doi.org/10.1126/science.1228653); Lake Suigetsu limnic sediment, Japan, ~50,000 year varve record, leaves and seeds provide detailed radiocarbon record for improving the radiocarbon dating accuracy, perspective on Ramsey et al. (2012).


Reinkainen P, Meriläinen JJ, Virtanen A, Veijola H, Äyöstö J (1997) Accuracy of $^{210}$Pb dating in two annually laminated lake sediments with high Cs background. *Applied Radiation and Isotopes* **48** (7), 1009-1019. [http://dx.doi.org/10.1016/S0969-8043(96)00337-5](http://dx.doi.org/10.1016/S0969-8043(96)00337-5); $^{210}$Pb, $^{226}$Ra, $^{137}$Cs, $^{137}$Cs in varved Finnish sediment, human activity has greatly increased the variability of $^{210}$Pb flux and reduced the reliability of $^{210}$Pb dating.


Renberg I, Hansson H (1993) A pump freeze corer for recent sediments. Limnology and Oceanography 38 (6), 1317-1321. http://www.aslo.org/lo/toc/vol_38/issue_6/1317.pdf; pump unit, thin wedge-shaped freeze container, methanol or ethanol, dry ice in thermos, cold alcohol pumped down into freeze wedge, less disturbance of sediment stratigraphy and thicker crust of frozen sediment, cores up to 50 cm long, operates from ice-covered lakes but could be modified for coring from boat, pump concept could allow freeze coring in ~200 m deep lakes or on the continental shelf.


Renberg I, Hansson H (2010) Freeze corer No. 3 for lake sediments. Journal of Paleolimnology 44 (2), 731-736. http://dx.doi.org/10.1007/s10933-009-9378-8; coring from lake ice, thermos connected to thin freeze wedge filled with 4 liter of ethanol, 6-8 kg dry ice kept in thermos by trapdoor that is opened by messenger after blade has entered sediment.


Ribouilleau A, Bout-Roumazeilles V, Tribovillard N (2014) Controls on detrital sedimentation in the Cariaco Basin during the last climatic cycle: insight from clay minerals. Quaternary Science Reviews 94, 62-
73. [http://dx.doi.org/10.1016/j.quascirev.2014.04.023](http://dx.doi.org/10.1016/j.quascirev.2014.04.023); marine varves, clay–mineral content spanning the last climatic cycle, changing intertropical convergence zone (ITCZ) influences fluctuations of the smectite and kaolinite contents.


Ringberg B (1984) Cyclic laminaton in proximal varves reflecting the length of summers during Late Weichsel in southernmost Sweden. In: (Mörner NA, Karlén W, eds.) *Climatic Changes on a Yearly to Millennial Basis*, 57–62. Springer. [http://dx.doi.org/10.1007/978-94-015-7692-5_5](http://dx.doi.org/10.1007/978-94-015-7692-5_5); proximal varves in the bottomset beds of glacioluvial flitas in the provinces of Skåne and Blekinge, 43 and 56 ‘day varves’ have been observed in the summer layers and the number of ‘day varves’ are supposed to represent the length of summers.


Ripepe M, Roberts LT, Fisher AG (1991) Enso and sunspot cycles in varved Eocene oil shales from image analysis. *Journal of Sedimentary Research* **61** (7), 1155-1163, [http://dx.doi.org/10.1306/D4267857-2B26-11D7-8648000102C1865D](http://dx.doi.org/10.1306/D4267857-2B26-11D7-8648000102C1865D); varve thickness in three core segments from distal lacustrine oil shales (Tipton and Laney members) of the Green River Formation, image analysis program, two strong bimodal periodicities, 4.8-5.6 years interpreted as an El Niño type (ENSO) phenomenon, 10.4-14.7 years interpreted as sunspot cycle, suggestion that some but not all of the oil shale of the Green River Formation is varved.


Romero-Viana L, Keely BJ, Camacho A, Vicente E, Miracle MR (2010) Primary production in Lake La Cruz (Spain) over the last four centuries: reconstruction based on sedimentary signal of photosynthetic pigments. *Journal of Paleolimnology* **43** (4), 771-786, [http://dx.doi.org/10.1007/s10933-009-9367-y](http://dx.doi.org/10.1007/s10933-009-9367-y); photosynthetic pigments in varved sediment of meromitic lake, primary productivity over the last four centuries, chlorophyll a and b, algal carotenoids, zeaxanthin, lutein, alloxanthin, diadinoxanthin, diatoxanthin, biomarker, phototrophic
sulfur bacteria, bacteriophaeophytins d, bacterial carotenoids, oklenone, chlorobactene, diageneric processes of pigment alteration, green sulfur bacteria, bacteriovirdin, solar activity, picocyanobacteria, meromix, solar forcing.


Rowell HC, Bopp RF, Peng F, Velinsky DJ, Bloomfield JA (2015) Annually laminated sediments from Onondaga Lake, New York (USA) provide a basis for high-resolution studies of lake degradation and recovery. *Journal of Paleolimnology* **53** (1), 107-121. [http://dx.doi.org/10.1007/s10933-014-9811-5](http://dx.doi.org/10.1007/s10933-014-9811-5); lacustrine varves preserved due to high sedimentation rate, 137Cs, correlation with historical impacts, onset of laminations correlates to an 1822 change in lake level.

Rozanski K, Klisch MA, Wachniew P, Gorczyca Z, Goslar T, Edwards TWD, Shemesh A (2010) Oxygen-isotope geothermometers in lacustrine sediments: New insights through combined 18O analyses of aquatic cellulose, authigenic calcite and biogenic silica in Lake Göscia2, central Poland. *Geochimica et Cosmochimica Acta* **74**, 2957–2969. [http://dx.doi.org/10.1016/j.gca.2010.02.026](http://dx.doi.org/10.1016/j.gca.2010.02.026); water-based oxygen-isotope geothermometers (calcite–cellulose, silica–cellulose) across five intervals, decadal resolution, Younger Dryas, subsequent periods of relative stability during the early, middle and late Holocene, the calcite–cellulose geothermometer may be influenced by kinetic effects during rapid carbonate precipitation, which offsets temperature-dependent fractionation and thus leads to high temperature estimates, the silica–cellulose geothermometer may be affected by the production of diatom silica early in the spring, prior to seasonal warming and isotopic enrichment of the epilimnion, thus generating low temperature estimates.


Rowell HC, Bopp RF, Peng F, Velinsky DJ, Bloomfield JA (2015) Annually laminated sediments from Onondaga Lake, New York (USA) provide a basis for high-resolution studies of lake degradation and recovery. *Journal of Paleolimnology* **53** (1), 107-121. [http://dx.doi.org/10.1007/s10933-014-9811-5](http://dx.doi.org/10.1007/s10933-014-9811-5); lacustrine varves preserved due to high sedimentation rate, 137Cs, correlation with historical impacts, 200-year record began due to lake level change.


Saarinen T (1998) High-resolution palaeosecular variation in northern Europe during the last 3200 years. *Physics of the Earth and Planetary Interiors* **106** (3-4), 299-309. [http://dx.doi.org/10.1016/S0301-9208(97)00113-1](http://dx.doi.org/10.1016/S0301-9208(97)00113-1); declination, inclination, relative paleointensity of Earth's magnetic field during the last 3200 yr, sediments in Lake Pohjajärvi, Finland, uniform magnetic mineralogy, magnetite of pseudo-single-domain (PSD) grain size, relative paleointensity curve correlated accurately with archaeomagnetic data from Central Europe, palaeosecular variation; paleomagnetism, Holocene, Northern Europe, lake sediment.

Saarinen T (1999) Paleomagnetic dating of Late Holocene sediments in Fennoscandia. *Quaternary Science Reviews* **18** (7), 889-897. [http://dx.doi.org/10.1016/S0277-3791(99)00037-7](http://dx.doi.org/10.1016/S0277-3791(99)00037-7); paleomagnetic secular variation curves, varve counts, dating of four Holocene lacustrine sediment sequences from central Finland and northwest Russia, geomagnetic declination and inclination fluctuations, relative paleomagnetic dating, dating error during the last 3200 yr is estimated to be less than ± 50 yr.


Sancetta C (1989) Processes controlling the accumulation of diatoms from British Columbiaan fjords. Paleooceanography 4 (3), 235-251. http://dx.doi.org/10.1029/PA004i003p00235; sediment traps over 3-year period at 4 sites in fjords of British Columbia, rates of marine sediment accumulation, biological rates of production and flux, comparison with surface sediment from box cores, preservation of deep-sea assemblages depends on water depth, accumulation rate, degree of bioturbation, modification of assemblages can occur within the upper 500 m.


Sauramo M (1923) Studies on Quaternary varve sediments in southern Finland. Bulletin de la Commission Géologique de Finlande 60, 164 p. Keywords: Quaternary, varve sediments, clay varves, chronology, deglaciation.


Schaller T, Moor HC, Wehrli B (1997) Sedimentary profiles of Fe, Mn, V, Cr, As and Mo as indicators of benthic redox conditions in Baldeggersee. *Aquatic Sciences - Research Across Boundaries* 59 (4), 345-361. [http://dx.doi.org/10.1007/BF02522363](http://dx.doi.org/10.1007/BF02522363); concentration profiles of Mg, K, La, Fe, Mn, V, Cr, As, Mo in freeze core from varved Lake Baldeggersee, Switzerland, European Alps, redox indicators, trace metals.

Schaller T, Moor HC, Wehrli B (1997) Reconstructing the iron cycle from the horizontal distribution of metals in the sediment of Baldeggersee. *Aquatic Sciences - Research Across Boundaries* 59 (4), 326-344. [http://dx.doi.org/10.1007/BF02522362](http://dx.doi.org/10.1007/BF02522362); distributions of solid phase Fe, Mn, V, Cr, As, Mo in different sediment strata reflecting various deep-water oxygen conditions, Fe cycling is inhibited by oxygen penetration into the sediment, metal distribution, geochemical focusing.


Scheidegger AE (1965) A theory of varve formation. *International Association of Scientific Hydrology. Bulletin* 10 (1), 68-73. [http://dx.doi.org/10.1080/02666659493374](http://dx.doi.org/10.1080/02666659493374); varve thickness relates to the time of deposition after the retreat of the ice.


Schettler G, Romer RL (1998) Anthropogenic influences on Pb/Al and lead isotope signature in annually layered Holocene Maar lake sediments. *Applied Geochemistry* 13 (6), 787-797. [http://dx.doi.org/10.1016/S0883-2927(98)00010-9](http://dx.doi.org/10.1016/S0883-2927(98)00010-9); Eifel volcanic field, Germany, Lake Meerfelder Maar, Lake Schalkenmehrner Maar, anomalously high lead with distinct isotope signature during first century AD, same isotopic composition as galena used for regional Roman lead refinement, airborne transport into Maar lakes, varve chronostratigraphy indicates 230 years of Roman lead input.


Schimmelmann, A, Hendy IL, Dunn L, Pak DK, Lange CB (2013) Revised ~2,000-year chronostratigraphy of partially varved marine sediment in Santa Barbara Basin, California. *GFF, special issue* "Varve Genesis, Chronology and Paleoclimate", 135 (3-4), 258-264. [http://dx.doi.org/10.1080/11035897.2013.773066](http://dx.doi.org/10.1080/11035897.2013.773066); California Current, marine sediment prior to 18th century was not continuously varved, but instead was occasionally merely laminated, leading to incorrect varve count-ages, radiocarbon dating of terrestrial macrofossils, drought periods may have starved the basin of sediment and provided insufficient lithic material to deposit winter laminae, declining oxygenation of bottom waters in Santa Barbara Basin and Santa Monica Basin.

Schimmelmann, A, Kastner M (1993) Evolutionary changes over the last 1000 years of reduced sulfur phases and organic carbon in varved sediments of the Santa Barbara Basin, California. *Geochimica et Cosmochimica Acta* 57 (1), 67-78. [http://dx.doi.org/10.1016/0016-7037(93)90469-D](http://dx.doi.org/10.1016/0016-7037(93)90469-D); North America, marine sediment, Pacific Ocean, California Current, El Niño, *Beggiatoa* bacterial mat, sulfur, total organic carbon, total nitrogen, sulfur geochemistry, diagenesis. Note: the findings of this study were partially revised by Hendy et al.’s (2012) new chronology.


Schimmelmann, A, Lange CB, Meggers BL (2003) Palaeoclimatic and archaeological evidence for a ~200-yr recurrence of floods and droughts linking California, Mesoamerica and South America over the past 2000 years. *The Holocene* 13 (5), 763-778. [http://dx.doi.org/10.1191/0959683603hl661rp](http://dx.doi.org/10.1191/0959683603hl661rp); California Santa Barbara Basin, Pacific Ocean, marine sediment, X-radiography, flood layers, turbidites, flood frequency, Mesoamerica, archaeological records. Note: the findings of this study were partially revised by Hendy et al.’s (2012) new chronology.


of glacial varve chronologies with tree-ring chronologies, examples of proxies for summer weather in the Late Glacial and in the past thousand years.


Schulz H, von Rad U (2014) Vertical and lateral flux on the continental slope off Pakistan: correlation of sediment core and trap results. Biogeosciences 11, 3107-3120. http://dx.doi.org/10.5194/bg-11-3107-2014; marine varves, Holocene, late Pleistocene, hemipelagic muds, microscopic and SEM studies, laminated due to seasonal changes of surface productivity and lateral supply of fine-grained sediment, oxygen minimum zone (OMZ), Arabian Sea, west of Karachi (Hab area), sediment trap, accumulation rates, flux rates, laterally advected fine-grained material.


Seibold E (1958) Jahreslagen in Sedimenten der mittleren Adria. Geologische Rundschau 47 (1), 100-117 (in German). http://dx.doi.org/10.1007/BF01803231; Bay of Mijet, former Yugoslavia, Mediterranean, Adriatic Sea, marine sediment, euxinic conditions, varves in deep center, historic events represented in sediment chronology, light summer lamina containing calcite, dark winter lamina contains organic matter, iron sulfide, quartz.


Shchukarev A, Gäldin V, Rydberg J, Sjöberg S, Renberg I (2008) Speciation of iron and sulphur in seasonal layers of varved lake sediment: an XPS study. Surface and Interface Analysis 40, 354-357. http://dx.doi.org/10.1002/sia.2704; Lake Nylandssjön, Sweden, lake sediment, iron speciation, sulfur speciation, analyses of seasonal layers of varves formed in 1968 and 2005 using X-ray photoelectron spectroscopy, organic (C, N, O, S) and inorganic (Al, Si, Ca, Fe, S) elemental compositions similar for all samples, chemical states of iron and sulfur differed depending on season, black color of the summer layer was caused by the precipitation of inorganic FeS, light layers contained only organic thiol (-SH) and sulfate together with Fe(III) hydroxides.


Shore-based Scientific Party (1994) Site 893, Santa Barbara Basin. Proceedings of the Ocean Drilling Program (ODP), Initial Reports, 146 (Pt. 2), College Station, Texas, 81pp. http://worldcat.org/oclc/165138436; Santa Barbara Basin, California Borderland, Pacific Ocean, marine sediment, X-radiography, core-to-core correlation, marine sediment, Macoma layer, Ocean Drilling program, sediment slabs, selected varved or laminated intervals. Note: the findings of this study were partially revised by Hendy et al.’s (2012) new chronology.


Shostakovich VB (1934) Lake silt bands and periodic oscillations in nature. Zapiski Gosudarstvennogo Gidrogeologicheskogo Instituta 13, 95-140 (in Russian). (Шостакович ВВ (1934) Иловые отложения озер и периодические колебания в явлениях природы. Записки Государственного гидрологического института 13, 95-140). Keywords: Holocene, Saki Lake, Crimea, Ukraine, varve counts, varve origin, dry and wet periods, climatic cyclicity.
Stratigraphy, element stratigraphies, biological remains (diatoms, cladocera, chironomids, sedimentary pigments) from Great Britain and Ireland, recorded within a continuous 96-varve sequence, monsoonal precipitation pattern, Hale solar cycle, ENSO frequency band.


Shvets GI (1974) Ледниковая изменчивость стока Днепра. Ленинград, Гидрометеоиздат, 33 с.; Dniepr River, hydrological observations on runoff, dry and wet seasons, correlation with Shostakovich's varve count in the Saki Lake deposits. Additional information needed: Electronic link?


Smith VC, Staff RA, Blockley SPE, Bronk Ramsey C, Nakagawa T, Mark DF, Takemura K, Danhara T, Suigetsu 2006 Project Members (2013) Identification and correlation of visible tephras in the Lake Suigetsu SG06 sedimentary archive, Japan: chronostratigraphic markers for synchronising of east Asian/west Pacific palaeoclimatic records across the last 150 ka. Quaternary Science Reviews 67,


Sohlenius G, Lindeberg G, Bjöörk J, Westman P, Risberg J (2003) The isolation age and history of Lake Sågsjön, Stockholm, based on different dating techniques. GFF 125 (2), 69-76. http://dx.doi.org/10.1080/11305690301252069; the last 1000 years or 14C dated (AMS, terrestrial macrofossils) varve record, diatom stratigraphy to determine the age of the isolation from the Baltic Sea to AD 1500 to 1600.


-500-year varve record of seasonal riverine sedimentation, comparison with varves from Harding ice field and Skilak Lake, Alaska. *Note: Stithler et al. (1992) showed that the laminations in Skilak Lake are not varves: [http://dx.doi.org/10.1130/0091-7613(1992)020<1019:VCVTAC>2.3.CO;2](http://dx.doi.org/10.1130/0091-7613(1992)020<1019:VCVTAC>2.3.CO;2)


methods to prepare samples from piston cores in preparation for X-ray radiography, varve counting, Guaymas Basin slope, Gulf of California, Pacific, marine sediment.


Sprenk D, Weber ME, Kuhn G, Wennrich V, Hartmann T, Seelos K (2014) Seasonal changes in glacial polynya activity inferred from Weddell Sea varves. Climate of the Past 10, 1239-1251. http://dx.doi.org/10.5194/cp-10-1239-2014; core PS1795 consists primarily of fine-grained silicilastic marine varves that were deposited on contourite ridges in the southeastern Weddell Sea during the Last Glacial Maximum (LGM), high-resolution XRF analysis and grain-size measurements on thin sections, two seasonal components of varves, bright relative coarser minerogenic laminae, dark laminae contain finer particles such as mica and clay, model of enhanced thermohaline convection in front of a grounded ice sheet, darker finer-grained layers were then deposited during less wintry season, mainly during summer, when coastal polynya activity was likely reduced.


Stanton T, Snowball I, Zillén L, Wastegård S (2010) Validating a Swedish varve chronology using radiocarbon, palaeomagnetic secular variation, lead pollution history and statistical correlation. Quaternary Geochronology 5 (6), 611-624. http://dx.doi.org/10.1016/j.quageo.2010.03.004; statistical correlation as a


Stevens R (1986) Glaciomarine varves and the character of deglaciation, Säveån valley, southwestern Sweden. Boreas 15 (4), 289-299. http://dx.doi.org/10.1111/j.1502-3885.1986.tb00934.x; glaciomarine varves primarily dependent upon sedimentation from meltwater overflow, Sweden, varve-thickness variation, ice-marginal deposition, glaciomarine varves provide a more continuous record of changes in the ice-front character than can be obtained from intermittent moraine positions.

Stevens LR, Dean WE (2008) Geochemical evidence for hydrologic variability over the last 2460 years from Crevice Lake in Yellowstone National Park, USA. Quaternary International 188, 139-148. http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1328&context=usgsstaffpub; oxygen isotope ratios of endogenic carbonates, Palmer Hydrologic Drought Index (PHDI), Pacific Decadal Oscillation (PDO), laminations are assumed to be lacustrine varves, counted varve chronology.


stratigraphic record of a deep lake on Boothia Peninsula, varve chronology verified by lead-210 and cesium-137, total organic carbon, C/N ratio, nitrogen stable isotope ratio, biogenic silica, changes in hydroclimatic conditions in the 20th century, Arctic.


Stickley CE, Pike J, Leverentz A, Dunbar R, Domack EW, Brachfeld S, Manley P, McClennen C (2005) Deglacial ocean and climate seasonality in laminated diatom sediments, Mac.Robertson Shelf, Antarctica. Palaeogeography, Palaeoclimatology, Palaeoecology 227 (4), 290-310. http://dx.doi.org/10.1016/j.palaeo.2005.05.021; last deglaciation, marine varves, Antarctica, East Antarctic Margin (EAM) laminated diatom-rich marine sediments, subseasonal to seasonal resolution, sublaminae of single diatom species, sublaminae formed by a combination of episodic diatom blooms and rapid deposition, Iceberg Alley, scanning electron microscope backscattered electron imagery, thin section, secondary electron imagery of sublamina fracture surfaces, 192 varves analyzed, retreat of the East Antarctic Ice Sheet, seasonal sea-ice changes along the EAM.

Stihler SD, Stone DB, Beget JE (1992) "Varve" counting vs. teprochronology and 137Cs and 210Pb dating: A comparative test at Skilak Lake, Alaska. Geology 20 (11), 1019-1022. http://dx.doi.org/10.1130/0091-7613(1992)020<1019:VCVTAC>2.3.CO;2; sedimentation rate, cesium-137, lead-210, North America, lake sediment, tephras, X-radiography, magnetic susceptibility, intensity of magnetization, microprobe analyses of volcanic glass shards, dating results indicate that rhythmic layers at Skilak Lake are not annual varves, earlier work on sunspot and climate changes thought to have been recorded in the 'varved' Skilak Lake needs to be reevaluated.

St. Jacques JM, Cumming BF, Sauchyn DJ, Smol JP (2015) The bias and signal attenuation present in conventional pollen-based climate reconstructions as assessed by early climate data from Minnesota, USA. PLoS ONE 10 (1), e0113806. http://dx.doi.org/10.1371/journal.pone.0113806; reconstructed record of past temperatures since AD 1116 from pollen counts of a lacustrine varve-dated record from Lake Mina, positive bias of 0.8-1.7°C based on non-native pollen.


Stockhausen H (1998) Geomagnetic palaeosecular variation (0-13 000 yr BP) as recorded in sediments from three maar lakes from the West Eifel (Germany). *Geophysical Journal International* **135** (3), 898-910. [http://dx.doi.org/10.1046/j.1365-246X.1998.00664.x](http://dx.doi.org/10.1046/j.1365-246X.1998.00664.x); Geomagnetic palaeosecular variation (PSV) profiles from three maar lakes with varve chronologies.

Stockhausen H, Zolitschka B (1999) Environmental changes since 13,000 cal. BP reflected in magnetic and sedimentological properties of sediments from Lake Holzmaar (Germany). *Quaternary Science Reviews* **18** (7), 913–925. [http://dx.doi.org/10.1016/S0277-3791(99)00005-0](http://dx.doi.org/10.1016/S0277-3791(99)00005-0); lake sediment, Eifel, magnetic properties dominated by paramagnetic minerals, remanence carrying ferromagnetic minerals dominated by low coercivity fraction, titanomagnetite, hematite, post depositional dissolution of titanomagnetite, authigenic growth of greigite, positive correlation between initial magnetic susceptibility (κ) and sediment accumulation rate and between κ and non-arboreal pollen percentage, κ and organic carbon content show negative correlation.


Stockhecke M, Anselmetti FS, Meydan AF, Odermatt D, Sturm M (2012) The annual particle cycle in Lake Van (Turkey). *Palaeogeography, Palaeoclimatology, Palaeoecology* **333-334**, 148-159. [http://dx.doi.org/10.1016/j.palaeo.2012.03.022](http://dx.doi.org/10.1016/j.palaeo.2012.03.022); lake sediment, modern varve formation, remotely-sensed total suspended-matter (TSMrs) concentrations, time-series of particle flux and water temperatures, turbidity, temperature and oxygen profiles, sediment trap, high particle fluxes during spring and fall, medium fluxes during summer, almost zero flux during winter, calcium carbonate flux mainly controlled by runoff, little laminae are produced from spring to fall, and dark laminae in winter.


Strömberg B (1989) Late Weichselian deglaciation and clay varve chronology in east-central Sweden. Sveriges geologiska undersökning, Ca 73, 1-70. Electronic link and key words needed.


Sturm M, Lotter AF (1995) Seesedimente als Umweltarchive. Was ist natürlich, was vom Menschen verursacht? EAWAG news 38 D, 6-9 (in German). Note: copy and paste the following link directly into your browser. Clicking on the link may not work: http://www.climategeology.ethz.ch/news/focusterra/EawagNews_1995.pdf; introducing the use of varves in paleoenvironmental research, for public outreach, example of Lake Soppensee, Switzerland.


Subetto DA, Stolba V, Neustrueva IYu, Sapelko TV, Kuznetsov DD, Gerasimenko NP, Bakhmutov VG, Ludikova AV, Davydova NN (2007) Environmental and Black Sea level changes in the Holocene as recorded in lakes Saki and Dzharylgach, Crimean Peninsula. In: (Gilbert A, Yanko-Hombach V, eds.), The 3rd Plenary Meeting and Field Trip of IGCP-521 Project “Black Sea – Mediterranean Corridor During the Last 30 ky. Sea Level Change and Human Adaptations”, extended abstracts, Gelendzik-Kerch, 157-159. Keywords: Holocene, the Saki and Dzharylgach lakes, varves in Lake Saki, lithology, varve count, radiocarbon dating, pollen, transformation of sea gulfs into lakes.


Sugawara K (1934) Liesegang’s stratification developed in the diatomaceous gyttja from Lake Haruna, and problems related to it. Bulletin of Chemical Society of Japan 9, 402-409. Additional information needed: Electronic link? Keywords?


Swierczynski T, Lauterbach S, Dulski P, Brauer A, Merz B (2014) Mid- to late Holocene flood frequency changes in the northeastern Alps as recorded in varved sediments of Lake Mondsee (Upper Austria). Quaternary Science Reviews 80, 78–90. http://dx.doi.org/10.1016/j.quascirev.2013.08.018; varved sediments of Lake Mondsee provide a 7100 yr record of spring/summer floods, event layers are detected by combination of thin section and micro-element scanning, flood frequencies indicate a variability on millennial to decadal time scales, main shift towards more flood events occurred after 1500 varve years BP; more floods in the northern pre-Alps during periods of alpine glacier advances.

Sylvan CA (1990) Paleomagnetism of glacial varves from the last glaciation maximum in Patagonia at Lago Blanco. Physics of the Earth and Planetary Interiors 64 (2-4), 143-152. http://dx.doi.org/10.1016/0031-9201(90)90034-U; paleomagnetic measurements on 78 glaciolacustrine varves, Argentina, last glaciation maximum, magnetic mineral composition determined by Simplex method, haematite (0.16%), magnetite (0.1%), magnetic susceptibility, declination shift, inclination shift, virtual geomagnetic pole (VGP) position.


sediment, bulk and clay mineralogy, major and minor elements, total organic carbon, stable isotope ratios of C, N, and O, pollen, charcoal, diatoms, and floral and faunal macrofossils, radiocarbon AMS dates of plant macrofossils, dated marker events, 822 varves in the lower 8 m of a piston core were deposited before 10,000 cal BP.


Tolhurst TJ, Underwood AJ, Perkins RG, Chapman MG (2005) Content versus concentration: Effects of units on measuring the biogeochemical properties of soft sediments. Estuarine, Coastal and Shelf Science 63 (4), 665-673. http://dx.doi.org/10.1016/j.ecss.2005.01.010; use of different units of expression (i.e. content and concentration) can change patterns in the expression of unconsolidated sediments, presentation and interpretation of data expressed as concentration is preferable to content for biogeochemical measurements in sediments, because content data is confounded by various factors (including core density/mass), leading to mistaken inference.


Tolonen M (1980) Comparison between radiocarbon and varve dating in Lake Lampellonjärvi, south Finland. Boreas 9, 11-19. http://dx.doi.org/10.1111/j.1502-3885.1980.tb01020.x; adhesive tape preparations of frozen lake sediment, varve counts AD 182 to AD 1513, some radiocarbon dates were older due to erosion of old organic terrestrial material via agriculture, varve chronology compared to tree rings, historical documents.


Tomkins JD, Antoniades D, Lamoureux SF, Vincent WF (2008) A simple and effective method for preserving the sediment–water interface of sediment cores during transport. Journal of Paleolimnology 40 (1), 577-582. http://dx.doi.org/10.1007/s10933-007-9175-1; transport of unfrozen sediment cores, polymer gel (sodium polyacrylate) applied above the sediment surface as stabilizer while preserving surface undulations, gel may react with organic material (e.g. algal mats), no detectable effects on total organic carbon or total nitrogen.


Tomkins JD, Lamoureux SF, Sauchyn DJ (2008) Reconstruction of climate and glacial history based on a comparison of varve and tree-ring records from Mirror Lake, Northwest Territories, Canada.


Trendall AF (1972) Revolution in earth history. *Journal of the Geological Society of Australia* **19** (3), 287-311. http://dx.doi.org/10.1080/00167617208728798; 900 m of banded iron formation in the 2,400-m thick Hamersley Group, 3 scales of stratification, termed macrobanding, mesobanding (the normal ‘banding’ of banded iron formation) and microbanding. Microbands are thin (0.2–2.0 mm) regular laminae, alternately rich and poor in iron, within chert mesobands. Microbands, mesobands and macrobands may all be correlated over the whole of the present outcrop. Microbands are believed to result from annual seasonal control of the primary precipitation in the basin, while alternations between microbanded chert mesobands and the adjacent non-microbanded chert-matrix are thought to reflect a 25-year environment cyclicity. There is also a higher-order cyclicity. The microbands are chemical evaporitic varves.


Udden JA (1928) Study of the laminated structure of certain drill cores obtained from Permian rocks of Texas. Carnegie Institution of Washington Year Book 27, 363 p. Additional information needed: Electronic link? Keywords?


Vuorinen J (1978) The influence of prior land use on the sediments of a small lake. Polski Archiwum Hydrobiologii (Polish Archive of Hydrobiology) 25 (1/2), 453-451. Lake Hännisenlampi, Finland, kettle lake, abrupt change from brown to 1.2 m thick topmost black sediment was varve-counted to 1504 AD, also change in sedimentation rate due to onset of hemp processing, copper and zinc concentrations.

Walker D (2011) The frequency of laminations in the sediments of Lake Barrine, tropical north-east Australia, during the last five millennia. Palaeogeography, Palaeoclimatology, Palaeoecology 299 (1-2), 214-226. http://dx.doi.org/10.1016/j.palaeo.2010.11.003; tropics, Holocene, uppermost sediment is composed of alternating detritus-poor and detritus-rich laminae, 4.5 mm long contains about 3000 individual laminations, marker bands represent periods of unusual turbulence in the water body, radiocarbon dates from 5 ka cal BP to 1987 AD.


Wall D, Dale B (1973) Paleosalinity relationships of dinoflagellates in the late quaternary of the black sea — a summary. Geoscience and Man 7 (1), 95-102. http://dx.doi.org/10.1080/07021395.1973.999973; Dinoflagellates in Late Quaternary sediments from deepwater cores in the Black Sea fall into two ecological categories that are dependent upon paleosalinity, transition at 7,000 years BP between euryhaline and freshwater species when saline water from the Mediterranean began to flow into the Black Sea.


Wan GJ, Santschi PH, Sturm M, Farrenkothen K, Lueck A, Werth E, Schuler C (1987) Natural (210Pb, 7Be) and fallout (137Cs, 239+240Pu, 86Sr) radionuclides as geochemical tracers of sedimentation in Greifensee,
**Weinheimer AL (1986)**


http://dx.doi.org/10.1016/j.palaeo.2012.03.001; alkaline lake, Yellowstone National Park, North America, pollen, charcoal, geochemistry, mineralogy, diatoms, oxygen stable isotopes, Holocene environmental history, northern Rocky Mountains, Holocene, Roman Warm Period, Medieval Climate Anomaly, Little Ice Age, episodes of extreme drought in the last 8 kyr.

http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1001&context=geoecosciencefagpub; 
http://dx.doi.org/10.1016/j.quaint.2007.06.005; geochemical, stable-isotope, pollen, charcoal, and diatom records, varved

http://dx.doi.org/10.1080/00288330.1998.9516838; Lakes Rotolit, Taupo, Ngahewa, Tikitapu, Okareka, Pukaki, Rotorua, Waikaremoana, Waikatipu, Tekapo, Ohau, Falls Dam, Central Otago, Pauatahanui inlet (Wellington), Lake Vanda (Antarctica), $^{210}$Pb and $^{210}$Po, $^{137}$Cs, $^{14}C$, $^{144}$Ce.

http://dx.doi.org/10.1016/S0025-3227(00)00154-7; organic-rich marine laminated sediment, ODP Sites 1033 and 1034, sulfate reduction, microbial methanogenesis via carbonate reduction, carbon stable isotopes, Pacific.

http://www.jstor.org/stable/2428830?seq=2; review of Lake Faulensee varved record over 12 m core, Switzerland, pollen survey.

http://dx.doi.org/10.1016/0031-0182(86)90036-2; Santa Barbara Basin, Pacific, comparison with Miocene Monterey Formation, radiolarian, California Counter Current, marine varves, Pacific.

http://dx.doi.org/10.1029/97PA00986; marine sediment, annual time series 1909-1991, polycystine radiolarians, annual radiolarian flux compared to instrumental data, total flux correlated with regional California sea surface temperature and the composite of sea level pressure.

http://dx.doi.org/10.1130/0091-7613(1999)027<1019:RISSWS>2.3.CO;2; marine sediment, radiolarian assemblages, warming of surface waters in the California Current since the 1950s, reduced upwelling of nutrient-rich waters, increased thermal stratification across the thermocline, oxygen stable isotopes of planktonic foraminifera, instrumental records.

http://worldcat.org/oclc/32635083; California, Pacific, marine sediment, annual time series 1954-1986, polycystine radiolarians, annual radiolarian flux compared to instrumental data, increase in percent warm water fauna consistent with a spin-down of the California Current System.


http://dx.doi.org/10.1029/97PA00986; marine sediment, annual time series 1909-1991, polycystine radiolarian assemblages, flux of a few representative species can be extrapolated to estimate fluxes of environmentally sensitive groups, subtle decadal-scale changes in assemblages, diversity, increase in percent warm water fauna consistent with a spin-down of the California Current System.

Flyr BB (2012) reduction, microbial methanogenesis via Ocean Drilling Program Leg 169S. 
http://dx.doi.org/10.1016/j.quaint.2007.06.005; multiple proxy records from Creviece Lake, Yellowstone National Park, USA. *Paleoecography, Palaeoclimatology, Palaeoecology* 331-332, 90-103. 
http://dx.doi.org/10.1016/j.palaeo.2012.03.001; alkaline lake, Yellowstone National Park, North America, pollen, charcoal, geochemistry, mineralogy, diatoms, oxygen stable isotopes, Holocene environmental history, northern Rocky Mountains, Holocene, Roman Warm Period, Medieval Climate Anomaly, Little Ice Age, episodes of extreme drought in the last 8 kyr.

http://dx.doi.org/10.1016/B0-12-227090-8/00305-5; basics and definition of varve, example from Santa Barbara Basin.


http://worldcat.org/oclc/32635083; California, Pacific, marine sediment, annual time series 1954-1986, polycystine radiolarians, annual radiolarian flux compared to instrumental data, total flux correlated with regional California sea surface temperature and the composite of sea level pressure.

http://dx.doi.org/10.1016/S0025-3227(00)00154-7; organic-rich marine laminated sediment, ODP Sites 1033 and 1034, sulfate reduction, microbial methanogenesis via carbonate reduction, carbon stable isotopes, Pacific.
lacustrine sediment lake, USA, climate variations at the forest-steppe transition, Medieval Climate Anomaly, fire activity, metal pollution, regional mining operations.

Whittaker EJ (1922) Bottom deposits of McKay Lake, Ottawa. *Proceedings and Transactions of the Royal Society of Canada, 3rd Series* 16, 141-156. Additional information needed: Electronic link? Keywords?

Whyte MA (1992) The use of “Photomount” adhesive as a medium for peels of unconsolidated sediments. *Journal of Sedimentary Research* 62 (4), 741-742. http://sedres.geoscienceworld.org/content/62/4/741.full.pdf+html; method to make sediment peels, surface needs to be smooth, then apply Scotch Photomount adhesive spray, dry for 20 min, slightly re-spray, wait a few minutes, apply strong paper, etc.


dry/wet conditions to the Alps, south-alpine flood frequency indicates changes in a paleo-NAO pattern, frequent S-alpine floods suggest a southerly position of the N-Atlantic circulation.


Wohlfart B, Possnert G (2000) AMS radiocarbon measurements from the Swedish varved clays. Radiocarbon 42 (3), 323-333. https://journals.uair.arizona.edu/index.php/radiocarbon/article/viewFile/3825/3250; Swedish varve chronology, Swedish Time Scale, glaciolacustrine varves in the Baltic Sea during the recession of the Scandinavian ice sheet, continued deposition of varved clays throughout the Holocene still going on in the estuary of River Ängermanälven in northern Sweden; AMS radiocarbon measurements on terrestrial plant macrofossils show that several hundreds of varve years are missing in the varve chronology.


Woodbridge J, Roberts N (2011) Late Holocene climate of the Eastern Mediterranean inferred from diatom analysis of annually-laminated lake sediments. *Quaternary Science Reviews* **30** (23–24), 3381-3392. [http://dx.doi.org/10.1016/j.quascirev.2011.08.013](http://dx.doi.org/10.1016/j.quascirev.2011.08.013); Nar crater lake, Turkey, diatom-conductivity transfer function, salinity, thin section, pollen, oxygen stable isotopes, drought, Medieval Climate Anomaly, Little Ice Age.


Young DR, Johnson JN, Soutar A, Isaacs JD (1973) Mercury concentrations in dated varved sediments collected off southern California. Nature 244, 273-275. http://dx.doi.org/10.1038/244273a0; anthropogenic mercury pollution, Santa Barbara Basin, marine sediment, Pacific Ocean, the past 150 yr, two layers estimated age 1,500 yr BP before mining activity, Los Angeles, California Current.


Zhao M, Eglinton G, Read G, Schimmelmann A (2000) An alkenone (U\textsuperscript{k-37}) quasi-annual sea surface temperature record (A.D. 1440 to 1940) using varved sediments from the Santa Barbara Basin. *Organic Geochemistry* 31, 903-917. [http://dx.doi.org/10.1016/S0146-6380(00)00034-6](http://dx.doi.org/10.1016/S0146-6380(00)00034-6): California Borderland, Pacific Ocean, marine sediment, alkenones, total organic carbon, El Niño, paleo sea surface temperature, SST, Little Ice Age. Note: the findings of this study were partially revised by Hendy et al.'s (2012) new chronology. Note that subsequent radiocarbon compound-specific studies proved that a significant fraction of biomarkers derives from older, re-suspended sediments. Mixing of old with new biomarkers influences the biochemical signal in accumulating varves (e.g., Mollenhauer and Eglinton, 2007).


Zolitschka B (1991) Absolute dating of late-Quaternary lacustrine sediments by high resolution varve chronology. *Hydrobiologia* 214 (1), 59-61. [http://dx.doi.org/10.1007/BF00050932](http://dx.doi.org/10.1007/BF00050932); high-precision absolute timescale, Lake Holzmaar, Lake Meerfelder Maar, Eifel, Germany, palynology, paleomagnetism, varve thickness, varve composition, Late Quaternary.


Zolitschka B (1992) Human history recorded in the annually laminated sediments of Lake Holzmaar, Eifel Mountains, Germany. In: (Saarnisto M, Kahra A, eds.) *Proceedings of the Workshop at Lammi Biological Station 4-6 June, 1990. Geological Survey of Finland, Special Paper* 14, 17-24. [http://arkisto.gtk.fi/sp/sp14/sp_014.pdf](http://arkisto.gtk.fi/sp/sp14/sp_014.pdf); microstratigraphy, lake sediment, Lake Holzmaar, Eifel, Germany, human history back to 10800 BC, four Neolithic periods recognized (Bandkeramik; Rössen, Michelsberg, Schnurkeramik), Urnenfelderzeit, Latène, Roman Empire, Middle Ages, earlier charcoal occurrences may be associated with Mesolithic and Palaeoalothic cultures, late Quaternary.


Zolitschka B (1996) Image analysis and microscopic investigation of annually laminated lake sediments from Fayetteville Green Lake (NY, USA), Lake C2 (NWT, Canada) and Holzmaar (Germany): a comparison. In: (Kemp AES, ed.) *Palaeoclimatology and Palaeoceanography from Laminated Sediments. Geological Society Special Publication* 116, London, 49-55. [http://dx.doi.org/10.1144/GSL.SP.1996.116.01.06](http://dx.doi.org/10.1144/GSL.SP.1996.116.01.06); digitization of thin sections, automated varve count, density variation, scanning, light transmission data alone do not allow the counting of varves, composite nature of laminations causes high-frequency noise which is hard to distinguish from thin varves without additional microscopic information, image analysis.


Zolitschka B (1998) A 14,000 year sediment yield record from western Germany based on annually laminated lake sediments. *Geomorphology* 22 (1), 1-17. [http://dx.doi.org/10.1016/S0169-555X(97)00051-2](http://dx.doi.org/10.1016/S0169-555X(97)00051-2); Lake Holzmaar, Eifel, flux rate of allochthonous minerogenic deposition for 13,840 years, Pleistocene/Holocene transition, human influence, soil erosion, catchment history.


Zolitschka B (2007) Varved lake sediments. In: (Elias SA, ed.) *Encyclopedia of Quaternary Science*. Elsevier, Amsterdam, 3105-3114. [http://dx.doi.org/10.1016/B0-44-452747-8/00065-X](http://dx.doi.org/10.1016/B0-44-452747-8/00065-X); definition of lacustrine varve, historic first definition of varves by De Geer (1912) was restricted to rhythmically deposited proglacial clays, a century later the meaning was extended to include all annually laminated sediments deposited on continents and in the ocean, modes of formation of varves, absolute dating, eutrophication.
wood associated with eruption, varve chronology provides an age of 10017 years VT (varve time in years before 1950) or 10
895 years corrected VT, high values of natural remnant magnetization intensity, increased values of total trace elements.

