NCL

Netherlands Centre for Luminescence dating

NCL Symposium Series, Volume 6
Jakob Wallinga & Joep Storms (eds.)

Hosted by Delft Earth (TUDelft)
April 17, 2009

Netherlands Centre for Luminescence dating

The Netherlands Centre for Luminescence dating is a collaboration of the Universities of Delft, Leiden (Centre for Art & Archaeological Science), Utrecht and Wageningen, the Geological Survey (TNO/Deltares) and the RACM.

The main aims of the NCL are to make luminescence dating widely available to Netherlands research and to develop new and improved luminescence dating methods. Research and facilities of the NCL at the Reactor Institute Delft of the TU Delft are partly financed by NWO-ALW and STW.

The NCL Symposium Series publishes abstracts of talks presented at the yearly NCL symposium. In addition the highlights of NCL activities and output of 2008 are presented.

More information on the NCL is available at www.ncl-lumdat.nl

SYMPOSIUM NETHERLANDS CENTRE FOR LUMINESCENCE DATING

Date: **Friday April 17, 2009**
Venue: **Delft University of Technology**
CT building, room 0.96
Stevinweg 1
2628 CN Delft

Participation is free; registration is not needed.
Drinks will be available after the symposium (from 16.30)

PROGRAMME:

14.30 Alastair Cunningham (NCL – TUDelft; abstract p. 1)
Dating of storm surge sediments: a test case from the Netherlands.

14.50 Ingwer Bos (UU; abstract p. 3)
Filling gaps - dating lake sediments.

15.10 Martijn Manders (RACM; abstract p. 6)
Optical dating: potentially a valuable tool for underwater cultural heritage management.

15.30 Tea Break

15.45 Noortje Hobo (UU / WUR; abstract p. 9)
Reconstruction of recent sedimentation rates in the Rhine embanked floodplains using OSL-dating.

16.05 Candice Johns (NCL – TUDelft; abstract p. 12)
When did lightning strike; dating fulgurite associated with a Roman pot with coins.

16.25 Jakob Wallinga (NCL – TUDelft; abstract p. 13)
Expected developments in luminescence dating methodology and applications.

16.30 Drinks (sponsored by Delft Earth)

Optically stimulated luminescence dating of storm surge sediments: a test case from the Netherlands

A. C. Cunningham[1], J. Wallinga[1], S. van Heteren[2], M. A.J. Bakker[2], B. van der Valk[2], A. P. Oost[2] and A. van der Spek[2]

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The prediction of extreme storm surge levels is of paramount importance in low lying coastal regions, especially in regions where relative sea level is expected to rise. Sedimentary records of extreme storm surges have the potential to improve the accuracy of these predictions, since they provide evidence of surge heights which do not appear in the observational (tide-gauge) record. To this end, accurate dating of such deposits is vital, and this may also allow improved correlation of storminess with other climate variables.

We are testing the applicability of optically stimulated luminescence (OSL) dating to storm surge deposits, using an example from the North Holland. The use of OSL dating for such deposits has the advantage that the material of interest, sand-sized grains of quartz, is usually abundant. Furthermore, the method can be used to date sediments over a large age range of ~10 a to >100 ka. On the other hand, since the OSL signal is light-sensitive, dark or gloomy conditions during the storm surge may prevent the OSL signal from being fully reset at the time of deposition, and this can lead to an overestimate of the age.

Fig. 1. Shell layer exposed in the coastal dunes of North Holland, recognized as a storm-surge sediment.

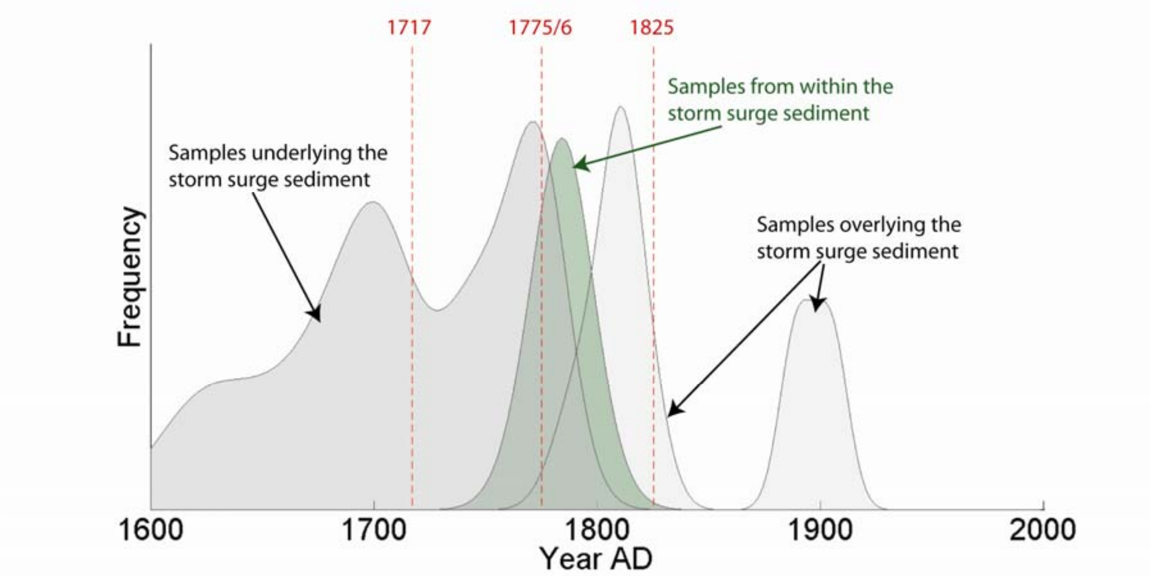

Fig. 2. Distribution of ages obtained from all OSL samples from the site. Samples have been categorized by sedimentology as originating before, during or after the storm surge. Dotted red lines indicate documented storm surges in the region.

Testing of this method has been carried out on a storm surge sediment from Heemskerk in North Holland, which initial measurements suggest was deposited in the late 18th century. The storm surge sediment can be found within coastal dune sand, and consists of convoluted sand and shells with occasional pieces of brick and coal. The sediment layer is 10 – 20 cm thick, and undulates in height over a distance of several hundred metres with a maximum elevation of over 6 m above mean sea level.

We will present the results of over 25 OSL dates from the site, which relate to samples taken from the storm surge layer itself, and also the surrounding dune sand. The OSL dates are internally consistent, and indicate a depositional age for the storm surge of 1770-1800 AD (Fig. 2). Documentary sources indicate major storm surges occurred in the North Holland region in 1775 and 1776, and we propose that one (or both) of these events is responsible. By specifying the likely storms responsible for these sediments, meteorological records from the event can be employed to reconstruct the storm surge magnitude.

Filling gaps, dating clastic lake fills in the Rhine delta (The Netherlands)

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Clastic lake fills are sediment units within fluvio-deltaic successions. They essentially are fluvial deposits that filled gaps – lakes – on the floodplain. Recently, clastic lake fills have been recognized (Weerts et al. 2002) and described (Bos submitted) in the Holocene Rhine-Meuse delta. They essentially comprise organic lacustrine deposits at the bottom, overlain by clastic succession that shows a general coarsening upwards trend from clayey facies to sandy mouth bar facies. It is important to have time control on the formation of these sediments as it contributes to the understanding of floodplain aggradation and overbank sedimentation. However, clastic lake fills – other than the modern examples in the Cumberland Marshes, Canada (e.g., Smith and Pérez-Arlucea 1994) – have not been dated so far. Dating of clastic lake fills by application of 14C-dating is inappropriate, both concerning the onset and end of sedimentation. Because their lower boundary often is erosive, dating of the peat underneath clastic lake fill deposits would overestimate the age. The end of sedimentation can only be determined when the abandoned channels or relative low points on the clastic lake fill surface can be identified. However, when clastic lake fills are buried, the morphology becomes obscured, which subsequently hampers site selection. A promising alternative is OSL-analyses as it directly determines the time since burial.

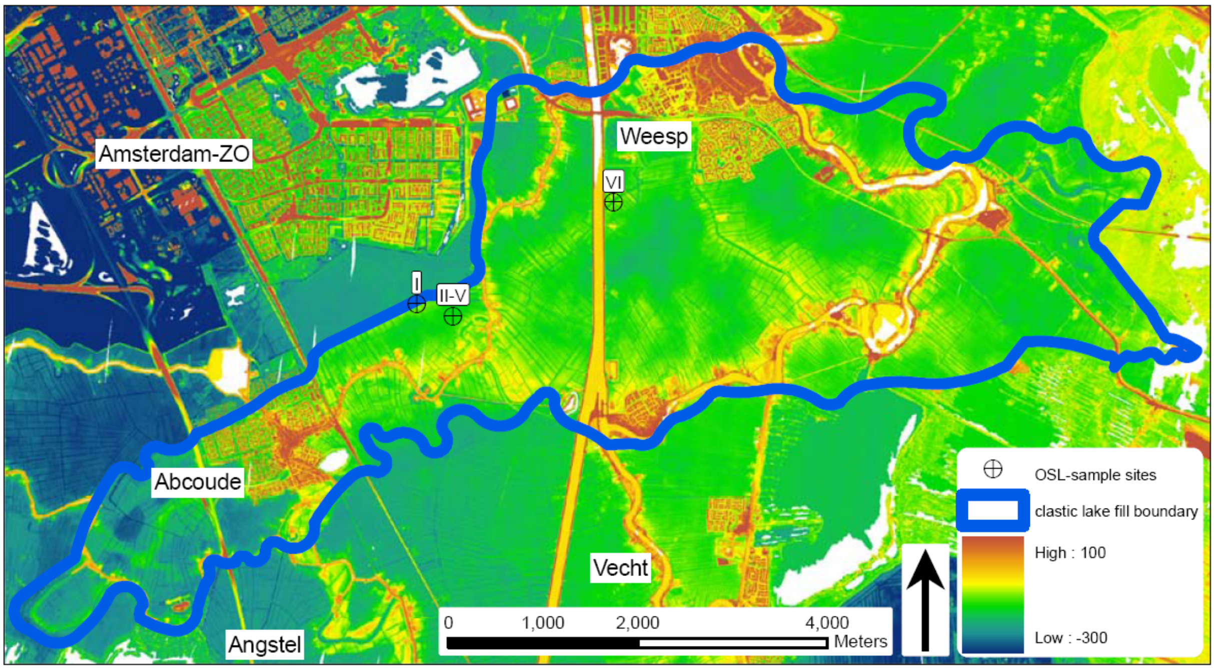

Fig. 1. Study area. Indicated is the boundary of the Aetsveldse clastic lake fill – blue line - as well as the location of the OSL-samples. The background colours represent surface elevation (AHN, from Rijkswaterstaat-AGI).

We studied the Aetsveldse clastic lake fill (Fig. 1), which is located in between Abcoude and Weesp and is part of the Angstel-Vecht system in the downstream zone of the Rhine-Meuse delta. In this area time control is excellent due to the presence of a paleogeographic reconstruction (Bos et al. submitted). Moreover, due to its position near the top of the Holocene sequence, the deposits still have a morphological expression, which provided good site-selection opportunities. We collected 6 OSL samples (Fig. 1, Tab. 1). Two samples (NCL-3206026 and -27) were taken from similar settings, being distributary channel deposits underneath well-dated abandoned-channel deposits. Four samples (NCL-3206022 to 25) were collected from one core and covered the complete clastic lake fill sequence at that location. OSL-dating of samples from heterogeneous sediments is not straightforward as the dose rate highly depends on the clay and water content in the vicinity of the sample. Therefore, in addition to normal procedures, we paid special attention to the identification of sand and clay laminae thicknesses as well as on the appropriate application in the measurements. For instance, gamma dose rates for samples that were part of heterogeneous deposits (i.e. including sandy and clayey beds) were estimated using measurements not only on the sample itself but also on the deposits directly underlying and overlying the sample.

The results indicate that all samples were well bleached before burial. Results for the four samples in a vertical sequence (core 25G1057; samples NCL-3206022 to 25) are in correct stratigraphical order (within uncertainties). OSL ages for the upper two samples are identical (both ~ 2.8 ka) (Tab. 1), which agrees with anticipated rapid deposition of a coarse facies in a mouth bar. The OSL age obtained on associated deposits of distributary channel Gd1 (core 25G1054; sample NCL-3206026) is identical to those obtained on the mouth-bar deposits (2.84 ± 0.14 ka).

Table 1. Results of OSL dating

Nr[a]	NCL lab-nr[b]	OSL-age ± 1σ (ka)[c]	Dose rate (Gy/ka)	Equivalent dose (Gy)	Coordinates[d] (x / y) (m)	surface elevation (m±O.D.)	Depth below surface (cm)	Relevance
I	3206026	2.87 ± 0.16	1.73 ± 0.07	4.91 ± 0.15	128144 / 477486	-1.10	228-240	Last active phase of Gd1
II	3206022	3.49 ± 0.21	1.64 ± 0.07	5.22 ± 0.14	128526 / 477358	-1.30	406-446	Suspended load input in lake
III	3206023	3.16 ± 0.17	1.76 ± 0.07	5.51 ± 0.16	128526 / 477358	-1.30	324-357	Suspended load input in lake
IV	3206024	2.80 ± 0.13	1.69 ± 0.06	4.74 ± 0.12	128526 / 477358	-1.30	234-239	active phase of Gd1
V	3206025	2.83 ± 0.14	1.68 ± 0.06	4.76 ± 0.15	128526 / 477358	-1.30	163-176	active phase of Gd1
VI	3206027	2.45 ± 0.12	1.70 ± 0.06	4.13 ± 0.15	130220 / 478551	-1.35	157-170	Last active phase of Gd2

[a] In Fig. 1.
[b] Laboratory number of the Netherlands Centre for Luminescence Dating (NCL), Delft University of Technology.
[c] Analyses carried out in 2006.
[d] In Dutch coordinate grid (Rijksdriehoekstelsel).

The deposits in the Aetsveldse clastic lake fill have been supplied by the Angstel-Vecht system for which the onset of clastic sedimentation has been radiocarbon dated at 2970±100 (cal yr BP; 2σ) (Bos et al. submitted). The 2σ-range of the oldest OSL-age (NCL-3206022, Tab. 1) only just overlaps with the oldest possible beginning of fluvial sedimentation. As the OSL-sample was completely reset prior to burial, we attribute the overestimation of the age to incorrect estimations of the dose rate, probably due to erroneous water content assumptions or beta and gamma dose origin (Wallinga and Bos, submitted).

We conclude that OSL can be a powerful tool for age determination of clastic lake fill sedimentation. Especially sandy samples returned ages that are is good agreement with age constraints provided by 14C-analyses. The approach proposed in our study for dating OSL samples from heterogeneous sediments may also be applicable on tidal channel sediments because of large similarities as far as the lithological composition is concerned.

References

BOS, I.J., submitted, Architecture and facies distribution of clastic lake fills in the Rhine-Meuse delta, The Netherlands: submitted to Journal of Sedimentary Research.

BOS, I.J., FEIKEN, H., and BUNNIK, F.P.M., submitted, Paleogeography of a distal part of the Rhine-Meuse delta (The Netherlands), controlled by organics and clastic lake fills: submitted to Palaeogeography, Palaeoclimatology, Palaeoecology.

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WALLINGA, J., and BOS, I.J., submitted, Optical dating of clastic lake-fill sediments - a feasibility study in the Holocene Rhine delta (western Netherlands): submitted to The Holocene.

WEERTS, H.J.T., CLEVERINGA, P., and GOUW, M.J.P., 2002, De Vecht/Angstel, een riviersysteem in het veen: Grondboor en Hamer, v. 3/4, p. 66-71.

Optical dating: potentially a valuable tool for underwater cultural heritage management.

M.R. Manders & B.J.H. van Os

Rijksdienst voor Archeologie, Cultuurlandschap en Monumenten

The knowledge of sediment dynamics is of great importance for the management of shipwrecks on the seabed. On the one hand, transport of sediment will allow for rapid burial of the wreck. On the other hand, sediments transported by currents can be highly erosive which can eventually lead to the complete destruction of a wreck site. In a recent study within the MACHU project we have investigated the applicability of an integrated approach including optically stimulated luminescence (OSL) dating, grain size analysis and anthropogenic metal analysis, to determine the sediment dynamics in and around a ship wreck. The effectiveness of in situ preservation using polypropylene netting – which has been applied on a few underwater sites in high dynamic zones has also been investigated.

The aim of our research is to determine the time of deposition of the sand below, beside and on top of the shipwreck. Why could this information be a helpful tool for preservation of shipwrecks? By accurately dating sand, the age of when the wreckage occurred could be narrowed. Additionally, the depositional age of sand in and on top of the ship could give us an indication how fast and when a ship is buried beneath the sediment and if there is a history of erosion and sedimentation on the site. Furthermore, if younger sand is found below a shipwreck, the ship probably moved after sinking or the environment in which the shipwreck is lying is highly dynamic. This can be important for assessment of the value or priority of the ship for in- situ preservation or salvage. The possible cargo will likely be affected under such conditions.

Finally, it is important to know if the in-situ preservation which has been applied is working well. By knowing something more about sediment transport and burial rates, preservation methods like for example the use of polypropylene netting could be improved.

Optical dating is the most versatile tool to determine the time of deposition and burial of sandy deposits. However, application of the method to sediments in the Wadden Sea is not straightforward, because light exposure of the grains prior to deposition and burial may be too limited to completely reset the OSL signal ('set the OSL clock to zero'). It is therefore unique this has been done and even more that it has been successful.

In this study we not only applied OSL dating but also used grain size distribution and anthopogenic metals to investigate sedimentation processes and the provenance of the deposits. By studying grain size distribution, questions such as if sedimentation is continuous or occurs during events or if sediment is transported through waves (fining upward sequences), or is deposited from the water column during periods of low energy, has been answered. In addition to grain size analyses, anthropogenic trace metals and stable lead isotopes has been investigated. By studying metal profiles in the sediment, the onset of the industrial revolution, the introduction and use of anti-knock agent and the last 20 years can be dated.

Fig. 1. 'Fieldwork' photo impression (Photo's: Highzone fotografie)

The results so far

The grain size follows the lithology reasonably well. The observed changes in grain size distributions are also reflected in the geochemical patterns. At the top of core 9108 the clay mineral content is somewhat higher, also reflected in the finer grain size. It is interesting to note that the increase in heavy minerals is coinciding with the in-situ preservation net. It is possible that the net trapped the heavier particles leading to the observed heavy mineral enrichment. Anthropogenic metals in general show a decrease going from the top to the bottom of the cores. The content of these metals, however, are very low and fall in the natural variation of these elements.

An OSL profiling study was carried out to select the most promising samples for full optical dating analysis. Some 20 samples from the two cores were investigated for a 'quick and dirty' investigation. Unfortunately, results were too scattered to convincingly guide sample selection. The profiling study indicated an increase of optical age with depth, but also showed that OSL signals of a significant part of the grains was not reset at the time of deposition. After this, ten samples were selected for full analysis.

Using standard techniques we were able to purify quartz grains from the samples. The luminescence properties of the grains were good, and suitable measurement parameters were determined based on a number of characterization tests. Optical ages indicate that at the site of the core inside the wreck the upper metre of sediment was deposited during the last century. Several metres of sediment were deposited about 300 years ago, around the time when BZN 10 sunk at this location. The sediment layer below this level is all younger than 1000 years, indicating that our core did not reach Pleistocene deposits. The other core shows a similar but much more rapid increase of age with depth. No deposits of around 300 years of age were found at that site, which is placed outside the wreck. The reason can be that the area outside of the wreck has been constantly under erosion, while inside the wreck, the wooden structure has been protecting the sand/silt layers, covering the ships content in the wreck for centuries.

We know through our latest results – which have just been delivered – that OSL of Holocene sediments constantly under water in the Wadden Sea can be successful. Now we are putting together all the information we have gathered through OSL, the grain size analyses and chemical proxies in order to answer the questions we have asked ourselves regarding the use of OSL in the assessment and monitoring of sites. But for now we can conclude by saying that optical dating can be a valuable tool for underwater cultural heritage management.

See for more information on the MACHU project: www.machuproject.eu

Reconstruction of recent sedimentation rates in the Rhine embanked floodplains using OSL-dating

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Since the river Rhine in the Netherlands is laterally fixed by groins, no lateral accretion or erosion processes occur anymore, and vertical accretion is the dominant process in the embanked floodplains. These vertical accretion processes cause the discharge capacity of the river to decrease. Due to climate change however, discharges are expected to increase, so the reducing discharge capacity severely threatens the safety of the hinterland. To maintain safety level, landscaping measures are planned in the embanked floodplains that aim to enhance the discharge capacity. These measures are part of a more dynamic floodplain management strategy that also aims to restore nature values, and includes mining of clay, sand and gravel.

To determine the potential impacts of landscaping measures in the dynamic floodplain management strategy, insight into the rate of silting-up of the floodplains is essential. This insight can be obtained by reconstruction of historical sedimentation rates, on a decadal time scale. The goal of our study is to do this reconstruction using four different methods. One of these methods is OSL-dating. The second is flood bed interpretation, which involves a chronostratigraphic correlation of individual sediment layers to events in the flood record. Thirdly, ^{137}Cs dating, which relies on correlation of ^{137}Cs peaks in a vertical sediment profile to peak years of ^{137}Cs deposition. Finally, heavy metal analysis, which relates varying metal concentrations in a vertical sediment profile with the known pollution history of the river. Here we focus on the OSL-dating results compared to other method results.

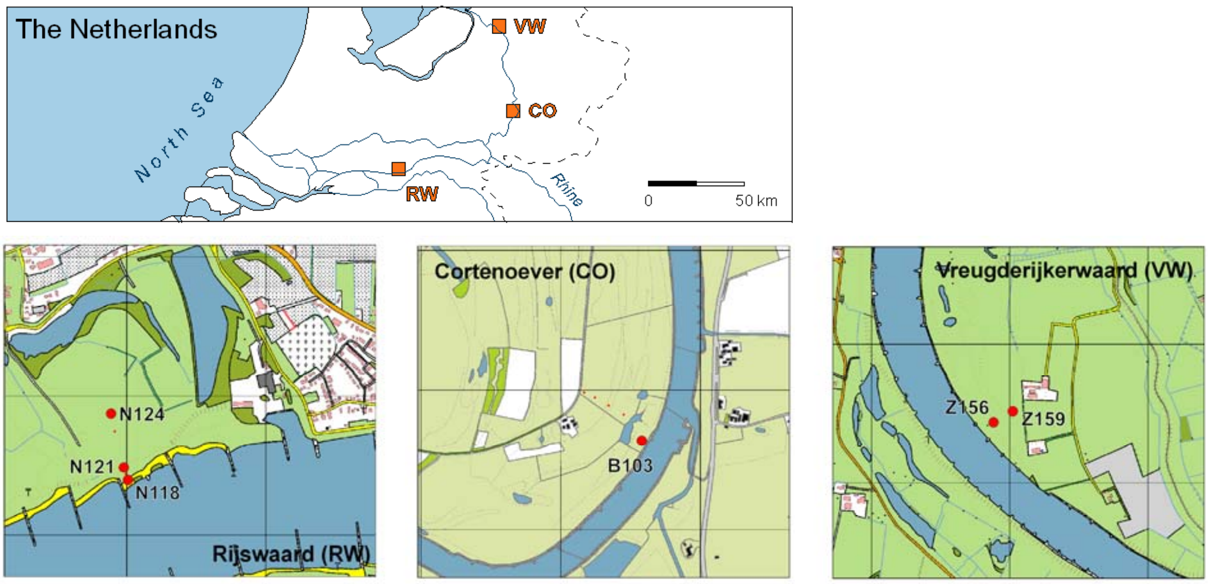

Fig. 1: Sampling locations

OSL dating is a relatively new technique to estimate decadal sedimentation rates, and application to these young fluvial deposits is challenging. Limited light exposure in the turbid river water may reset the OSL signal incompletely, which causes an age overestimation which will be relatively large for young deposits. To improve dating of these deposits we developed a measurement protocol, based on a single-aliquot regenerative dose (SAR) procedure, and applied this method on several samples in every vertical soil core.
We applied our methods on three undisturbed floodplain sites along the Waal (Rijswaard (RW)) and the IJssel (Cortenoever (CO) and Vreugderijkerwaard (VW)), where we collected 10-cm-diameter vertical soil cores from the upper meter of the floodplain, at six different sampling locations (Fig. 1).

The graphs given in Fig. 2 show the results for the six floodplain cores. The OSL-derived age is plotted against sample depth. Other methods results are plotted in the same graphs. Sedimentation rates are calculated by fitting a trendline through the plotted data, which was forced through the origin (zero age at the surface). Sedimentation rates at the study sites vary between 0 and ~25 mm/yr. The highest rates are found on the levees (N118, B103, Z156), and the rates generally decrease with increasing distance from the river. In N121 and Z159 we found a good agreement in methods. At most sites however, the OSL derived sedimentation rates are lower than from other methods. An exception is N124, where ^{137}Cs dating results yield lowest sedimentation rates. At N118, flood bed interpretation and ^{137}Cs dating yield similar results, and at B103 heavy metal analysis ^{137}Cs dating agree with each other.

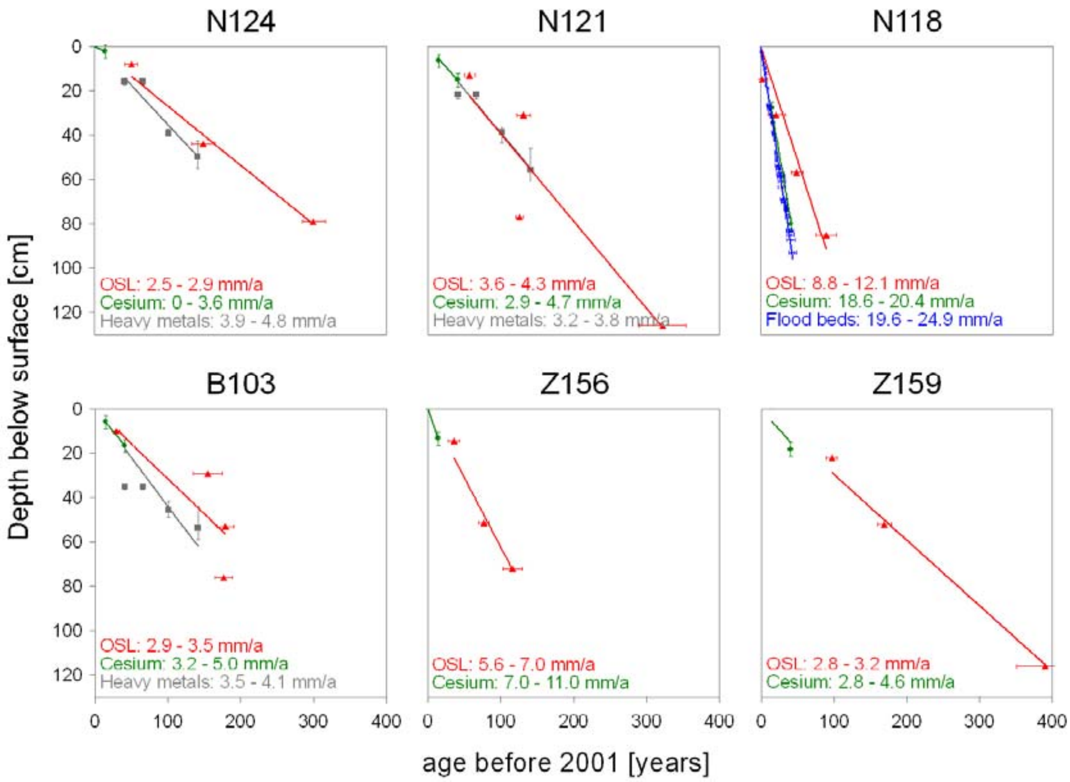

Fig 2: Dating results

A possible cause for the discrepancies between the results is post-depositional redistribution by physical soil mixing and chemical downward migration. The first one occurs especially in sandy deposits, and is responsible for the presence of reworked material from other ages in our samples. This can cause large age differences in the OSL samples, which take up a large depth interval. For ^{137}Cs dating and heavy metal analyses soil mixing causes smoothing of the vertical profile. The latter is important in ^{137}Cs dating, because it can cause depth overestimation of the peaks. We corrected this by the taking reference cores outside the floodplain; however, the process is still hard to quantify because of its large spatial variability. Other cause for the discrepancy may be the incomplete resetting of the OSL signal resulting in an overestimate of the sample age.

Based on the results, we can conclude that there is a considerable and measurable amount of sedimentation on the floodplains. Sedimentation is therefore important to take into account in floodplain management. At present, results show some discrepancies between different dating methods. Nevertheless, OSL dating seems a promising technique for dating sub-recent fluvial overbank sediments.

When did lightning strike? Dating fulgurite associated with a Roman pot containing coins

C. Johns[1], J. Wallinga[1], C. Helmich[2]

1. Netherlands Centre for Luminescence dating, Delft University of Technology, Delft.
2. Becker & Van de Graaf, Zevenaar.

Sand fulgurite is the newly formed material remaining after lightning has struck a sandy deposit, and appears as a thin tubular structure in the sediment. Luminescence dating of these fulgurites has the potential to date the time of the lightning strike, since the extreme heat and light could reset the optical or thermal signals within the material. We have developed a protocol to date a fulgurite from Cuijk, the Netherlands, found by archaeologists together with a Roman pot which contained coins. Our results have helped us decipher the relationship between the pot of coins and the ancient people who buried it.

When lightening strikes the ground, sand grains are melted into a hollowed, vitrified tube, ringed by unmelted grains fused to the outside (Figure 1). For the Cuijk fulgurite, luminescence behavioural tests indicated that the inner (melted) and outer (fused grains) portions of the fulgurite had the characteristics of quartz, and would respond favourably to either thermally (TL) or optically (OSL) stimulated luminescence. The fulgurite could therefore be treated as quartz, allowing us to employ established testing methods. We measured both the OSL and TL properties, and dated both the melted and fused grains parts of the fulgurite. The TL results indicated that only the inner fulgurite section reached a temperature sufficient to reset the geologically stable TL signal, and this yielded an age estimate of about 1050 AD.

For the fused grains from the outer part of the fulgurite, we were able to apply standard optical dating methods. This yielded an OSL age of 1098 ± 60 AD, in good agreement with the TL derived age for the inner fulgurite. Although the fused grains also yielded a TL signal, they do not appear to have been thermally reset by lightening. Consequently, we observed that the heat of the lightning strike reset the TL signal to a distance of about 2 mm into the fulgurite, and the light from the event bleached the OSL signal of the fused grains from about 3 mm outward. Archeologically, the lightning strike post-dates the treasure by about 700 years, and removes the possibility that the burial was a human reaction to fear or worship of a thunder god.

Fig. 1: View down a fulgurite core. From center to outer-most part; hollowed center where heat and vapor pressure melted sand and forced it outwards, followed by a gas-bubble filled vitreous region which makes up the inner grains sample. Next is an area of partially melted relict grains (not dated) and then the outer, unmelted grains fused to the relict grains.

Expected developments in luminescence dating methodology and applications.

Jakob Wallinga, Adrie J.J. Bos, Alastair C. Cunningham, Candice A. Johns, Romée H. Kars, Alice J. Versendaal and NCL partners

Netherlands Centre for Luminescence dating, TUDelft.

Luminescence dating methods have matured over the past decade. The most important development was the design and establishment of the Single Aliquot Regenerative dose (SAR) method to reliably determine the absorbed dose in sand-sized quartz grains. This method is now widely used for geological and archaeological applications (Fig. 1) and has been shown to yield reliable results for sediments from a broad range of depositional environments (Fig. 2).

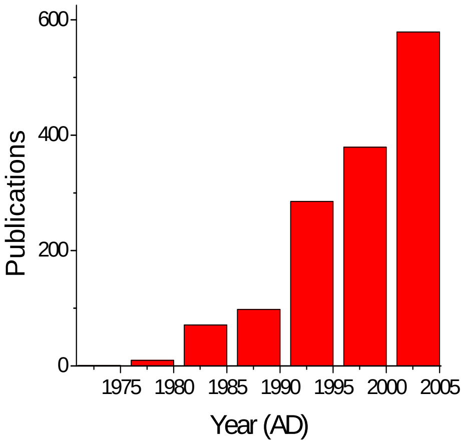

Fig 1: The strong increase in the number of scientific publications on luminescence dating methods and applications indicates the growing impact of the method over the past decades (source: ISI Web of Science).

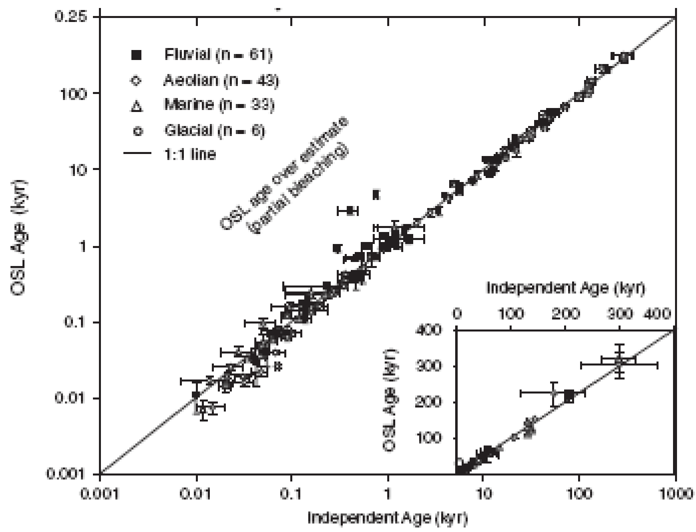

Fig. 2: Graph showing the OSL age estimates obtained using the quartz SAR method as a function of independent age information (from Rittenour, 2008).

Recent research at the NCL has yielded new approaches to date flood deposits formed during the past decades to centuries (see Cunningham et al. and Hobo et al., this volume). These approaches are also applicable to other samples where light exposure prior to sedimentation and burial is limited. In coming years we will extend this research towards optically stimulated luminescence (OSL) measurements on individual grains of quartz. Focus of this investigation is the unraveling of different sources of spread in equivalent dose estimates obtained on individual grains (STW funded VIDI project Jakob Wallinga, PhD study Alastair Cunningham).

OSL dating methods based on quartz are usually applicable up to ~150.000 years. Beyond this, the quartz OSL signal approaches saturation (Fig. 3) and OSL ages become less reliable, or even meaningless. As part of a new STW funded project we are exploring two lines to extend the luminescence dating age range to cover at least a million years and ultimately to cover the full Quaternary era

(~2.6 Ma). The first research line focuses on the use of the feldspar InfraRed Stimulated Luminescence (IRSL) signal. The IRSL signal saturates at much larger doses, and usually does not saturate before 1 million years. However, due to instability of the signal IRSL ages usually underestimate the true burial age. In our research we will investigate the causes of the signal instability by gaining understanding of the luminescence processes in feldspars, and use this information to develop reliable IRSL dating methods (PhD project Romée Kars). The second research line focuses on the development of reliable dating methods based on the thermal-transfer (TT-)OSL signal of quartz. The TT-OSL signal saturates at much larger doses, allowing TT-OSL based dating methods to cover the full Quaternary era. Initial investigations on Chinese loess sections yield promising results at least up to the Brunhes-Matuyama magnetic reversal (~730 ka). Our research will first determine the luminescence processes giving rise to the TT-OSL signal, and then design reliable and robust dating methods based on the acquired knowledge (post-doc project, vacancy).

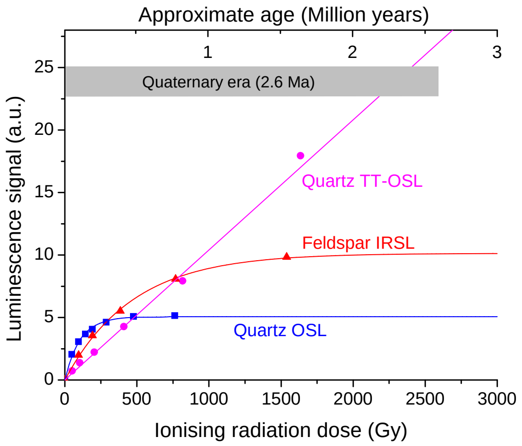

Fig. 3: Luminescence signals as a function of absorbed radiation dose. The age scale is given for a typical environment with an ambient dose rate of 1 Gy per ka; the actual age scale for potassium-rich feldspars differs slightly due to a contribution from internal beta radiation. Note that feldspar IRSL and quartz TT-OSL signals steadily increase in the dose region where the quartz OSL signal has reached saturation. Feldspar IRSL dating may be used up to 1 Ma, whereas quartz TT-OSL dating may be applicable for the full Quaternary era.

HIGHLIGHTS 2008

The Netherlands Centre for Luminescence dating (NCL)

In recent years a cutting-edge luminescence dating laboratory was established at the Reactor Institute Delft (TUDelft). Present NCL partners are the Universities of Delft (Delft Earth), Leiden (Centre for Art & Archaeological Science), Utrecht, and Wageningen, TNO – Netherlands Geological Survey, and the Rijksdienst voor Archeologie, Cultuurlandschap en Monumenten. The NCL aims to develop new and improved methods of luminescence dating and to make luminescence dating widely available to Netherlands' research. The NCL now processes more than 100 samples for optically stimulated luminescence (OSL) dating per year.

Dating flood deposits

In 2008 research of the NCL focussed on developing methods to accurately date flood deposits formed during the past decades to centuries. Two depositional environments were studied: Firstly, flood sediments on embanked floodplains along the major Netherlands rivers. Secondly, storm-surge deposits along the North-Sea coast. New methods were developed to isolote the optically stimulated luminescence (OSL) signal that is most rapidly reset by light, and to interpret scattered equivalent dose distributions. OSL ages determined using these methods are internally consistent, and agree favourably with external controls.

Extending the luminescence dating age range

New methods were developed to obtain reliable InfraRed Stimulated Luminescence (IRSL) ages from feldspar minerals. This signal has the potential to allow dating of sediments up to 1 million years old.

Grants and awards

Romée Kars, a student from Utrecht University who carried out her MSc thesis research at the NCL, was awarded the Shell sponsored Escher Prize for best Netherlands MSc thesis in Earth Sciences for her thesis '*Feldspar IRSL dating of Late Pliocene, Early and Middle Pleistocene Rhine fluvial sediments - A new approach towards the correction of anomalous fading*.' Romée also won a poster prize at the international Luminescence and Electron spin resonance Dating conference in Beijing (China). Finally, funding was granted by STW for the research project '*Unraveling the Quaternary era; optical dating of sediments up to 2.6 million years old*'. This allows us to offer Romée Kars a PhD position, employ a post-doc researcher for three years and purchase an additional luminescence reader.

Information

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