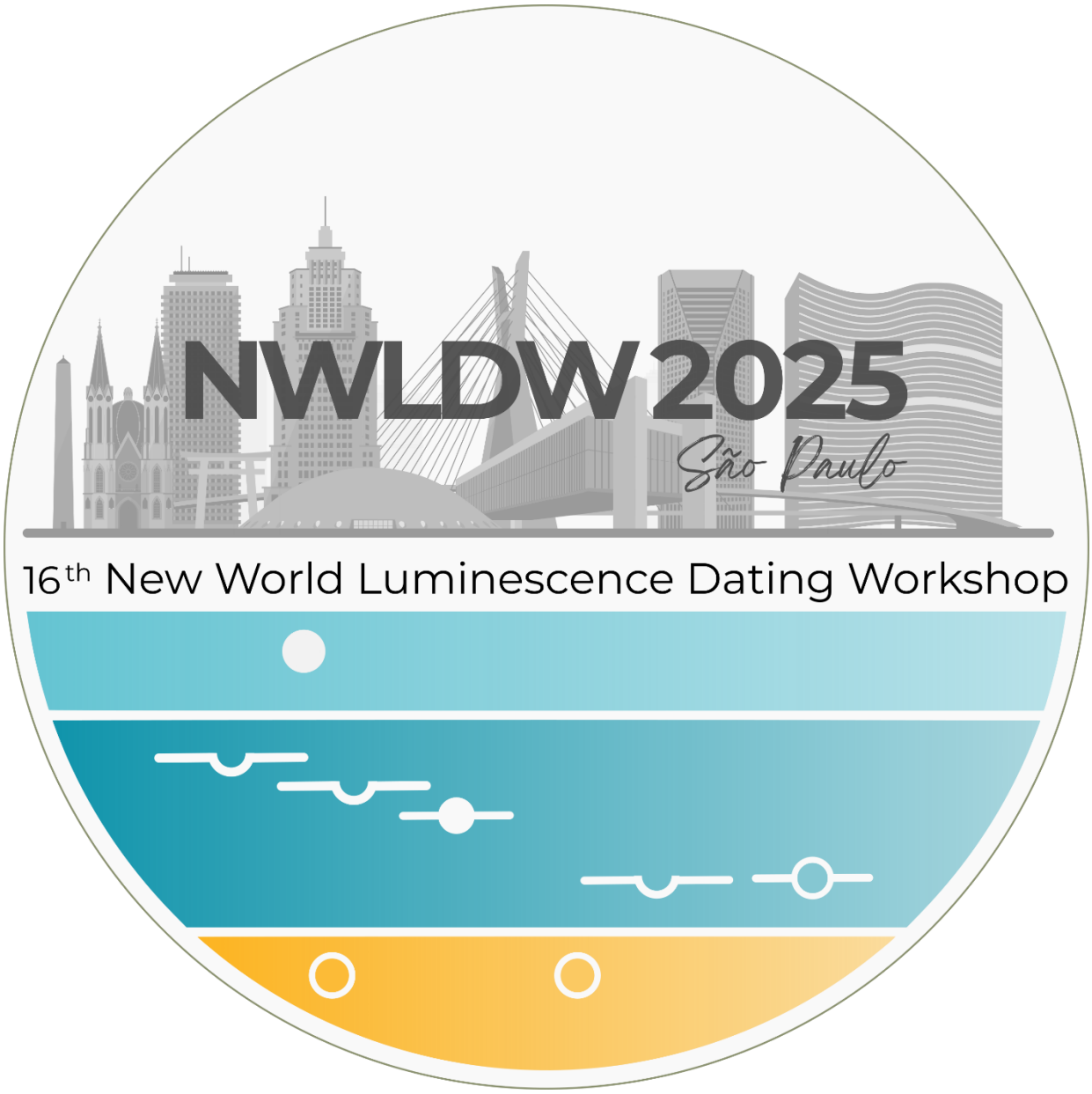
BOOK OF ABSTRACTS



July 21-23, 2025 in São Paulo, Brazil

Summary

WORKSHOP HISTORY

16th New World Luminescence Dating Workshop, University of São Paulo, São Paulo, Brazil, 2025. Hosts: André Oliveira Sawakuchi, André Zular, Fabiano do Nascimento Pupim, Fernanda Costa Gonçalves Rodrigues, Priscila Emerich Souza, and Thays Desirée Mineli.

15th New World Luminescence Dating Workshop, Desert Research Institute, Reno, Nevada, 2024. Hosts: Amanda Keen-Zerbert, Kathleen Rodrigues, and Christina Neudorf.

14th New World Luminescence Dating Workshop, USGS, Palisade, Colorado, 2022. Hosts: Shannon Mahan and Harrison Gray.

13th New World Luminescence Dating Workshop, University of Illinois at Urbana-Champaign, 2019. Host: Sebastien Huot.

12th New World Luminescence Dating Workshop, East Carolina University Greenville NC, 2018. Host: Regina DeWitt.

11th New World Luminescence Dating Workshop, University of Nebraska at Lincoln, Nebraska, 2016. Host: Paul Hanson.

10th New World Luminescence Dating Workshop, Kansas State University, Manhattan Kansas, 2015. Host: Joel Spencer.

9th New World Luminescence Dating Workshop, Utah State University, Logan, Utah, USA, 2013. Hosts: Tammy Rittenour and Michelle Nelson.

8th New World Luminescence Dating Workshop, UCLA in West Los Angeles, USA, 2012. Host: Ed Rhodes.

7th New World Luminescence Dating and Dosimetry Workshop, Universite du Quebec a Montreal, Canada, 2010. Host: Michel Lamothe.

6th New World Luminescence Dating and Dosimetry Workshop, University of Washington at Seattle, 2009. Host: Jim Feathers.

5th New World Luminescence Dating and Dosimetry Workshop, University of Illinois at Chicago, 2007. Host: Steve Forman.

4th New World Luminescence Dating Workshop, Denver, USGS, 2006. Host: Shannon Mahan.

3rd New World Luminescence Dating Workshop, Halifax, Dalhousie University, Canada, 2004. Host: Dorothy Godfrey-Smith.

2nd North American Luminescence Dating Workshop, Albuquerque, Los Alamos National Laboratories, 2003. Host: Ken Lepper.

1st North American Luminescence Dating Workshop, Oklahoma State University (Tulsa campus), 2001. Host: Steve McKeever.

ORGANIZATION

SPONSORS

PROGRAM

Monday, 21st July 2025

08:15 – 08:45	Registration & Poster organization
08:45 – 9:00	Opening
9:00 – 09:45	Keynote speaker Tammy Rittenour: *Quartz luminescence sensitivity: Insights from global distributions and local fingerprints of fire and residence time within the Critical Zone*
09:45 – 10:00	Diego Montecino Jara: *Tracing Dust Provenance in Southern South America Using Feldspar Luminescence Signals: Insights from Pampean Loess*
10:00 – 10:15	Priscila Souza: *Pitfalls in deriving quartz OSL relative sensitivity from dating data: causes and solutions*
10:15 – 10:45	*Coffee break*
10:45 – 11:00	Anna-Maartje de Boer: *Tracing nourished sand in a dynamic tidal delta using single-grain luminescence signals*
11:00 – 11:15	André Sawakuchi: *Quartz OSL sensitivity through the geological time*
11:15 – 11:30	Roheyatou Ceesay: *Uncovering Hidden Histories: Chronological Analysis of Providence Island Occupation Using Single-Grain Luminescence Dating*
11:30 – 11:45	Victoria Castle: *Exploring the Landscape Innovation of Las Mesillas, Oaxaca, Mexico, through Single Grain Optically Stimulated Luminescence*
11:45 – 12:00	Joe Rotunda: *Dual laser single grain OSL unit*
12:00 – 14:00	*Lunch*
14:00 – 14:15	Diana Valenzuela Davila: *Quantifying Multi-Scale Erosion Rates of California Ventifacts Using OSL Depth Profiles and In-Situ Cosmogenic Nuclides Analysis*
14:15 – 14:30	Brooklyn Dib: *Using OSL of Archaeological Pottery to infer wildfire intensity in the Southwestern US*
14:30 – 14:45	Joel Spencer: *Assessment of purity of biogenic silica samples for luminescence analysis*
14:45 – 15:15	*Group picture*
15:15 – 15:45	*Coffee break*
15:45 – 18:00	Poster Session I

Tuesday, 22nd July 2025

08:15 – 09:00	Registration & Poster organization
09:00 – 09:45	Keynote speaker Nathan Brown: *Luminescence thermochronology shows a transient landscape response to a changing southern San Andreas fault*
09:45 – 10:00	Gloria I. López: *The Newly discovered Pre-Columbian Terraces of the Sierra Nevada de Santa Marta, Northern Colombia: first attempt to understand Tairona Culture stone masonry construction based on OSL*
10:00 – 10:15	Renan Brito: *Luminescence techniques applied to the paleogeographic reconstruction of the Negro River, Amazon*
10:15 – 10:45	*Coffee break*
10:45 – 11:00	Jose Luis Antinao: *OSL/IRSL and cosmogenic 10 Be depth profile dating in MIS 2 and MIS 6 Laurentide Ice Sheet glaciofluvial sediments from Michigan and Indiana*
11:00 – 11:15	Cindy Lou Skipper: *Influence of snow cover on luminescence rock surface exposure dating of glacial moraine boulders*
11:15 – 11:30	Paul Hanson: *Luminescence Dating of Late Quaternary Alluvial Deposits in Nebraska, USA*
11:30 – 11:45	Dayane B. Melo: *Chronology and dynamics of the Carbon Cycle over the Amazon River Delta*
11:45 – 12:00	*Ancient TL Announcements*
12:00 – 14:00	*Lunch*
14:00 – 14:15	Carlos Ortiz: *Optimizing OSL measurement protocols for dating mineral grains entrapped in basal ice in Greenland*
14:15 – 14:30	Karissa Cordero: *Update on dating hydrothermal explosions in the Yellowstone Plateau Volcanic Field with quartz red TL and K-feldspar post-IR IRSL techniques*
14:30 – 14:45	Konrad Tudyka: *Real-time observation of quartz and feldspar etching and quantitative etching depth estimation for trapped charge dating*
14:45 - 15:15	Bidding for the next NWLDW
15:15 – 15:45	*Coffee break*
15:45 – 17:45	Poster Session II
17:45 – 18:00	Closing
19:00 – 23:00	*Conference dinner*

Wednesday, 23rd July 2025

08:30 – 17:00 *Atlantic rainforest day trip*

24th to 28th July 2025: Amazon field trip

Poster session I, 21st July 2025

ID	Participant	Abstract title
1	Anarda Simões	Optically Stimulated Luminescence techniques applied in Quaternary fluvial sediments from the Amazon Basin, Peru
2	André Zular	An attempt to correlate cathodoluminescence spectral data of quartz single grains depicted in chromaticity diagrams with OSL sensitivity
3	Anzhela Vasilieva	The first luminescence chronology for the Verkhoyansk glacial history (Northeastern Siberia)
4	Beatriz Machado	Linking the chronological gaps and truncations patterns in delta plain evolution: Example in Paraíba do Sul River Delta
5	Camila Althaus	Revealing the origin of Cretaceous and Paleogene fluvial deposits from eastern Amazonia through quartz luminescence
6	Daniel Sousa	Dating cave sediments at Chapada Diamantina by feldspar post-infrared infrared stimulated luminescence at 290 °C
7	Fabiano Pupim	Decoding river sediments: low luminescence sensitivity variability across the upper Amazon tributaries
8	Fernando Villela	Quaternary Deposits in Pediments of Southeastern Brazil
9	Gabriela Torre	Dust flux estimates through OSL methods for the last glacial-interglacial cycle in southern South America based on loess-paleosols deposits
10	Isadora Nogueira	Optically Stimulated Luminescence dating of ceramics and sediments from an Amazonian archeological site (Sambaqui)
11	Júlia Grigolato	Precipitation patterns in the Amazon Basin for the last 60 thousand years using luminescence scanner
12	João Ferrari	Validating a Newly Developed OSL Scanner for Marine Sediment Analysis
13	Mariana Elias	Feasibility assessment of the application of luminescence methods in forensic geology
14	Mateus Cagnin	OSL Dating Revealing the Depositional Ages of Unconsolidated Sediments in the Southern Serra do Espinhaço, Minas Gerais (Brazil)

15	Roberto Martins	Time-Resolved Infrared Photoluminescence (TR-IRPL) signal via Multi-Elevated Temperature (MET) protocol in amazonite
16	Quillen Thornton	Determining the Age of the Camas Prairie Ripples, NW Montana: A Combined Approach of Optically Stimulated Luminescence (OSL) and 10 Be Cosmogenic Dating
17	Thais Silva	Chronology and provenance of the São Francisco River mouth eolian system by quartz optically stimulated luminescence (OSL)
18	Tristan Bench	LSED by AGES-TRaCE: An open access info and tool repository for luminescence surface exposure dating
19	Xiaodong Miao	OSL dating of the Paleoflood sediments of the Yihe-Shuhe River, East China and archaeological implication
20	Yewubinesh Reba	Luminescence of detrital quartz and feldspar to track provenance of the upper Juruá River deposits, western Amazonia

Poster session II, 22nd July 2025

ID	**Participant**	**Abstract title**
1	Amanda Reis	Decoding luminescence ages through pedogenesis: Vertisols in a semiarid sedimentary basin
2	Angislaine Costa	Ceramics Under the Light of Time: The OSL Technique in Amazonian Archaeology
3	Ayush Joshi	Investigating geologic controls on TL thermochronology-derived erosion rates in the San Gorgonio Pass region
4	Caleb Walcott-George	Exploring the application of luminescence rock surface dating to glaciated bedrock in Greenland
5	Carolina Cruz	Dating fluvial sediments of the Huallaga River, central Andes (Peru), based on feldspar pIR IRSL signals
6	Giorgio Battistella	The development of a luminescence scanner for sediment cores
7	Isaac Jamil Sayeg	Determination of potassium content in feldspar by SEM-EDS to improve luminescence dating
8	Isadora Duque	Dating Amazonian Ceramics Using OSL: Preliminary Results from the Rio Negro Basin
9	Jesus Rangel	Chronology and Evolution of Holocene Coastal Eolian Systems in the Paraguaná Peninsula, Venezuela
10	João Bueno	Library for Luminescence Sensitivity Statistics and Data (LSSD): A Python package for data analysis in luminescence sediment provenance
11	Joanna Rocznik	µDOSE+ System: Dose rate precision evaluation for 200 mg and 3.00 g samples

12	Mariana Sontag-González	Infra-red radiofluorescence (IR-RF) stability tests with corrections for sensitivity changes
13	Mauricio Parra	Quartz sensitization trends over geological time in the Northern Andes: insights into quartz OSL sensitivity as a provenance tracer
14	Matheus Nunes	Design and Implementation of an Integrated System for Stimulated Luminescence Analysis in Materials
15	Patrícia Mescolotti	The chronology of a major channel incision in one of the largest megafans on Earth: the Taquari Megafan in the Brazilian Pantanal
16	Pedro Cheliz	Contributions of OSL analyses to the characterization of associations between geomorphological transformations and early human occupation in alluvial plain of southeastern Brazil
17	Sonia Tatumi	OSL dating applied to the paleodunes of the Middle Rio Negro, Northern Amazon, Brazil
18	Tatiana Campese	Exploring the potential of planktonic foraminiferal thermoluminescence for reconstructing sea surface temperature
19	Thays Mineli	A standard for quartz luminescence sensitivity sediment provenance analysis: testing quartz and feldspar candidates
20	William Henrichs	Quartz luminescence sensitization in a soil profile from eastern Amazonia upland forest
21	Xiaomei Nian	Quartz luminescence characteristics of modern Yangtze River sediments and their implications

Quartz luminescence sensitivity: Insights from global distributions and local fingerprints of fire and residence time within the Critical Zone

Tammy M. Rittenour[1]*

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Luminescence sensitivity of quartz, recorded as the brightness of the optically stimulated signal generated per applied dose of radiation, has been shown to vary between geologic terrains and rock types, providing a promising tool for provenance analysis. However, observations also suggest that quartz sensitivity may be enhanced by sediment-transport, exposure to fire and bio-physio-chemical weathering within the critical zone. Although the mechanisms that generate quartz sensitization are not fully understood, data are presented that suggest that longer residence time within the critical zone leads to enhanced quartz sensitivity, likely due to greater cumulative heat and light exposure of grains while at the Earth's surface. The repeated exposure to optical, mechanical, and thermal energy can release trapped charge from strongly held traps (defects) and open geologically filled recombination centers within the crystal lattice, enhancing luminescence sensitivity.

A global survey of quartz sensitivity (>2000 samples) indicates an apparent linkage between climate and tectonic setting, with greater sensitivity commonly from tectonically stable and lower latitude and elevation sites. Scatter in this global data suggests that other geological and environmental factors play a role. Results of sediment from the same geologic provenance but exposed to different climate regimes or fire exposure and quartz processed directly from bedrock produce order of magnitude differences in quartz sensitivity. These results suggest that geologic provenance, and therefore inherent mineral defects at the time of crystallization, plays a minor role in quartz luminescence sensitivity.

Local studies in the western US are explored to test the influence of fire exposure and residence time within the critical zone on quartz sensitivity. Results suggest burn severity and rates of sediment generation linked to climate-mediated soil thickness and weathering processes impart a large influence on quartz luminescence sensitivity. Concluding observations suggest that residence time within the critical zone, leading to greater cumulative exposure to bleaching cycles from exposure to light and heat (fire), lead to enhanced quartz sensitivity in sediment.

Keywords: quartz luminescence sensitivity, critical zone, fire, erosion rate, climate

Luminescence thermochronology shows a transient landscape response to a changing southern San Andreas fault

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Luminescence dating is commonly used to constrain when sediment was last exposed to sunlight. For mineral grains within the dark interior of a rock outcrop, however, the luminescence signals relate to thermal exposure. For example, with grains kept at a constant temperature for time periods longer than several hundred thousand years, luminescence signals can be used to estimate that storage temperature over a wide range, from upper-crustal through atmospheric temperatures (i.e., paleothermometry). Conversely, grains which have changed temperature recently can embed information about their time-temperature history (thermochronology). In this presentation, I will review the basic principles underlying luminescence thermochronology and then illustrate how this technique can reveal landscape evolution with a case study from the San Andreas fault of Southern California.

Recent work suggests that the several strands of the southern San Andreas fault system that were long considered inactive, may have been active in the late Pleistocene and Holocene. This would have important implications for seismic hazards in the greater Los Angeles Basin. However, past efforts to resolve offset along these fault strands have been limited by poor fault exposure and few datable offset units within the mountainous, rocky terrain.

In this study, I show how thermoluminescence (TL) ultra-low-temperature thermochronology reveals a complex history of landscape evolution near these faults. Erosion rates in this region show a general deceleration of erosion from 100 to 10 ka, with the exception of samples from the western Yucaipa Ridge tectonic block, which maintain erosion rates near 10^3 mm/ka during this interval. Comparison with nearby apatite (U-Th)/He ages and catchment-averaged cosmogenic ^{10}Be erosion rates reveals general agreement among all techniques. Yet, the *in situ* TL erosion rates capture spatial variability obscured in the other datasets, including greater erosion rates at low elevations, a positive correlation between erosion rates and relief and transient erosional features in the landscape, including a migrating knickpoint that was likely caused by tectonic reorganization. Our results are consistent with a recently active western Mill Creek - Galena Peak fault configuration, a scenario that is compatible with observations of unfaulted late Pleistocene sediments observed across the eastern Mill Creek fault and with recent claims for Holocene activity on the Mission Creek fault. This case study demonstrates the promise of TL thermochrology as a novel tool for reconstructing dynamic landscapes in the late Quaternary.

Keywords: Thermochronology, TL, active tectonics, landscape evolution

Decoding luminescence ages through pedogenesis: Vertisols in a semiarid sedimentary basin

Amanda Dias dos Reis[1]*, Matheus Santos Silva Figueiredo[1], Grace Bungenstab Alves[1], Fabiano do Nascimento Pupim[2] and Sheila Aparecida Correia Furquim[3]

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Optically Stimulated Luminescence (OSL) has been applied to investigate soil development, including those with a high pedoturbation capacity, such as Vertisols. However, the results of such analyses are often interpreted solely as deposition phases without considering pedogenetic processes and their relationship with surface processes dynamics. This study investigates the meaning of OSL ages taken along a Vertisol and their implications for pedogenic and surficial processes in the formation of these soils. We analyzed a Vertisol profile developed in a semiarid environment within the Rio do Peixe Sedimentary Basin (BSRP), located in Sousa, Paraíba (Brazil). The following methods were employed: (a) particle-size analysis to determine the quantity and predominance of soil fractions and assess the suitability of quartz for OSL; b) OSL in the Bv1, Bv2, BC and C/Cr horizons to determine the age of the material and discuss whether it resulted from pedogenesis or morphogenesis; c) chemical alteration index (CIA), to determine the degree of chemical weathering and d) soil micromorphology, to assess the degree of development (pedality) and its composition. We investigated a Vertissolo Háplico Órtico típico with horizons Ap (0-11cm), Bv1 (11-75cm), Bv2 (75-97cm), BC (97-135), C/Cr (135-162), Cr/C (135-162cm), Cr1 (162-190cm) and Cr2(170-190). We found that the sand content was concentrated in the A and B horizons, at no more than 23%, and that the fine fractions predominated, accounting for 90% of the material below 135cm, indicating a strong contribution from the original material in these horizons. The OSL results showed equivalent doses from 0.97 ± 0.05 to 10.10 ± 0.44 Gy, overdispersion from 19 to 37%, dose rates from 2.42 ± 0.16 to 2.97 ± 0.19 Gy/ka, and OSL ages from 0.40 ± 0.34 to 3.95 ± 0.31 ka. These Holocene ages coincide with the stabilization of the current semi-arid conditions in Northeast Brazil and with colluvial deposition events in the highlands. The CIA indicates highly weathered materials (>70%), especially in the more pedogenized horizons (Bv1, Bv2, and BC). Micromorphology indicated that the Cr1 horizon has fine material composed of a subparallel crystalline birefringent plant, while the Bv2 horizon has an undifferentiated birefringent plant, with the presence of coarse material, suggesting transportation and deposition from adjacent terrains to the profile, in contrast to the original material in which the soil developed. Furthermore, a high degree of pedogenetic development was observed, which was marked by significant soil mixing due to pedoturbation. These findings suggest that the profile received external material contributions; however, the ages obtained are due to the movement of this material in the profile due to pedoturbation. (FAPESP #2020/16446-1)

Keywords: OSL dating, pedoturbation, Northeast Brazil

Optically Stimulated Luminescence techniques applied to Quaternary fluvial sediments from the Amazon Basin, Peru

Anarda Simões[1]*, Fabiano Pupim[2], Carolina Cruz[1], Gabriella Campos[3], Renan Brito[1], Caio Breda[1], Priscila Souza[2], Daniel Souza[4], Willem Viveen[4], André Sawakuchi[1]

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The Amazon Basin is the largest fluvial system on Earth, playing a highly dynamic role in the distribution of animal and plant species. Quaternary hydroclimatic changes have been essential in structuring the complex landscape in this region, particularly through variations in precipitation patterns and river flow dynamics. These processes influence the spatial distribution and evolutionary dynamics of Earth's most diverse biota. Aiming to investigate the effects of late Quaternary hydroclimatic changes on paleoerosion rates and sediment provenance from the eastern Andes to its foreland basins in Amazonia, we have applied in situ cosmogenic nuclides (^{10}Be and ^{26}Al; TCN) associated with OSL dating on sediment deposits from different parts of the Amazon basin. The upstream portion is represented by samples from the Peruvian Huallaga and Iquitos basins. We analyzed four floodplain samples from Huallaga River and 17 fluvial samples from Iquitos region, including floodplain, terraces, and outcrops on non-flooding terrains. Here, we present the first OSL data that we have obtained to the moment. The OSL analysis was carried out on pure quartz aliquots 63-250 μm or 180 -250 μm. Dose recovery tests performed on representative samples (one sample from Huallaga and two from Iquitos) yielded best ratios (10% within a unity) employing preheat (/cutheat) temperatures of 200/160ºC and 180/160ºC, subtracting an early background and without a hot bleach at the end of the SAR cycles. Linear modulated (LM) OSL curves of quartz aliquots from some representative samples were also acquired to identify the dominant component in the OSL signal and, thus, to help to choose the best analysis method. Continuous-wave (CW) OSL curves measured along the SAR cycles (to estimate Equivalent doses, ED) were also used to obtain quartz OSL relative sensitivity (%BOSL1s) [1]. The deconvolution analysis of both LM and CW curves showed that most samples are dominated by the fast component. First results on sensitivity show scattered %BOSL1s values for Huallaga samples, ranging between 23 and 69% (median = 40%). For Iquitos samples, %BOSL1s values range from 30 and 60% and, apparently, there is a pattern: higher altitudes exhibit higher sensitivity. Preliminary estimations on ED values for Huallaga samples are in the range of 20 and 120 Gy. One sample from Huallaga was fully dated already, yielding an age of 7.8±2.2 ka. ED and respective environmental dose rates of all other samples, including those from Iquitos, will soon be available. In general, we expect to find younger ages in Iquitos terraces than in Huallaga terraces. At the NWLDW2025 event, we will present additional age estimates and a more comprehensive understanding of Amazonian landscape transformation during the Late Quaternary. This study is part of a PhD research project funded by FAPESP (grant #2023/16001-8).

Keywords: OSL, quartz, fluvial sediments, dating, geomorphology.

References

1. Souza, P. E. et al. (2023). doi: 10.1016/j.quageo.2023.101422

Quartz OSL sensitivity through the geological time

André O. Sawakuchi[1]*, Fernanda C.G. Rodrigues[1], Thays D. Mineli[1], Priscila E. Souza[2], William M. Henrichs[1], Thaís A. Silva[1], and Fabiano N. Pupim[2]

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The sensitivity of the fast optically stimulated luminescence (OSL) component of quartz is key for sediment dating and is also used in sediment provenance analysis. It is well known that tectonic stable regions distant from plate boundaries, such as Brazil and Australia, have widespread Quaternary sediments with "bright" high OSL sensitivity quartz, while sediments from orogenic areas close to plate boundaries have "dim" low OSL sensitivity quartz with relatively high contribution of medium and slow OSL components. This geological pattern is observed in South America, where Quaternary sediments from Brazilian sources have high OSL sensitivity quartz and sediments from Andean sources have low OSL sensitivity quartz. However, sediments deposited in Paleozoic and Mesozoic cratonic basins in Brazil show quartz with reduced OSL sensitivity compared to their overlying Quaternary cratonic sediments. Hence, quartz with high OSL sensitivity, widespread in Quaternary soils and sediments in Brazil, is absent in the geological record of cratonic sedimentary basins. This geological time pattern suggests a shift in surface processes, leading to quartz OSL sensitization during the Cenozoic. We hypothesize that: I. the sensitization of quartz OSL is due to wildfires heating the upper soil layer; II. the amount of sensitized quartz grains supplied to sedimentary systems depends on soil mixing rate and soil stability; III. the OSL sensitization potential in soils of cratonic settings increased in parallel with the global expansion of grass vegetation, which reduces soil erosion and fuels wildfires, and of the biota, which promotes soil mixing; IV. the OSL sensitivity of quartz sediment grains is preserved during long term burial diagenesis and uplift in sedimentary basins. Tracing high OSL sensitivity quartz in the geological record could shed light on soil evolution through the geological time. The hypotheses I to IV will be appraised in terms of the OSL sensitivity of quartz from the Phanerozoic sedimentary record in Brazil.

Keywords: quartz sensitization; luminescence characteristics; surface processes.

An attempt to correlate cathodoluminescence spectral data of quartz single grains depicted in chromaticity diagrams with OSL sensitivity

André Zular[1,2]*, Paulo César Fonseca Giannini[1], Vitor Ângelo Paulino Aguiar[3], Ifat Kaplan-Ashiri[4], Maya Oron[5,6], Omry Barzilai[6] and Elisabetta Boaretto[2]

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The link between the cathodoluminescence (CL) color of quartz grains and provenance is well established. However, studies on the association of optical CL and quartz source rocks are constrained by the visual perception of each observer. To eliminate this subjective factor, we introduce a novel approach using single-grain CL spectral data to generate a chromaticity diagram that provides a cartesian coordinate system for color mapping. To illustrate this method, we analyzed samples previously dated from the Nahal Aqev archeological site in Israel1. Using the CL chromaticity diagram, associated with CL spectral energy-emission components at 1.7, 1.9, 2.3, 2.7, and 3.4 eV, we noticed a segregation of samples that agrees with the segregation obtained from single-grain OSL sensitivity analyses. Both luminescence analyses rely on detecting photons emitted from the same luminescence centers under stimulation, although at distinct energies and ranges (6.2–1.5 eV and 4.4–3.3 eV for CL and OSL emissions, respectively). However, even when the detection range overlaps, a direct correlation between the methods is hindered by the lack of OSL spectral data. Still, we can hypothesize that one of the multiple factors that could explain the agreement in the segregation of the samples in both luminescence methods might relate to the intense OSL emission center at 3.4–3.3 eV2, which correlates to the deconvoluted CL spectra at 3.4 eV. In CL analysis, this emission reflects a genetic imprint of intrinsic and extrinsic defects in the crystal lattice3. Such defects comprise positions in O3≡Al:M-O-Si≡O3 in which M+ is Li+, Na+, K+, or H+. By linking the CL and OSL data, we suggest by association that an imprint of the source rocks is also detected in the OSL sensitivity analysis of our samples. Although further studies and OSL spectral data are required to confirm this hypothesis, our assumption contributes to the ongoing debate on the meaning of the OSL sensitivity signal. We thank Dr. Naomi Porat for providing the analyst data used for dating1 and grains of quartz for the CL analysis.

Keywords: Quartz provenance, Spectral CL color mapping, OSL sensitivity-CL correlation.

References

1. Barzilai, O., Oron, M., Porat, N., White, D., Timms, R., Blockley, S., Zular, A., Avni, Y., Faershtein, G., Weiner, S., and Boaretto, E., 2022. Expansion of eastern Mediterranean Middle Paleolithic into the desert region in early marine isotopic stage 5. Scientific Reports 12, 4466.
2. Huntley, D.J., Godfrey-Smith, D.I., Haskell, E.H., 1991. Light-induced emission spectra from some quartz and feldspars. International Journal of Radiation Applications and Instrumentation. Part D. Nuclear Tracks and Radiation Measurements 18, 127–131.
3. Stevens-Kalceff, M.A., 2009 and references therein. Cathodoluminescence microcharacterization of point defects in α-quartz. Mineral. Mag. 73, 585–605.

Ceramics Under the Light of Time: The OSL Technique in Amazonian Archaeology

Angislaine Freitas Costa[1]*, Sonia Hatsue Tatumi[2], Isadora Augusta Machado Duque[2], Noemi Aguiar Silva[2] and Márcio Yee[2]

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In archaeological interpretation, chronology is one of the fundamental pillars, especially in complex contexts such as those found in the Amazon [1, 2]. However, it is not always possible to find suitable organic materials, such as charcoal, for radiocarbon dating – a method commonly used in archaeological research. In this context, the present study aims to demonstrate the potential of Optically Stimulated Luminescence (OSL) in dating Amazonian archaeological ceramics. OSL allows for the estimation of the last time the minerals within the sediments and ceramic matrix were exposed to light or heat, offering an alternative or complement to traditional dating methods [3]. This study presents preliminary results of OSL analyses applied to ceramic fragments from archaeological sites located in the Rio Negro basin, highlighting the methodological challenges involved. It is known that ceramic pastes from the region were made with the addition of a tree bark called "Licania spp", also known as "Caraipé", and freshwater sponge named "Spongila spp" or "Cauixi". These materials are siliceous and interfere with the thermoluminescence signal, making it impossible to date it using this technique. For this reason, the OSL technique was tried with the SAR protocol [4] and successful age results were obtained. Two fragments were investigated, one historical and the other prehistoric, giving ages of 364 ± 36 and 884 ± 24 years, with very low overdispersion values of 2.0 and 1.6 %, respectively.

Based on these data, we discuss how the technique can contribute to refining regional chronologies, identifying phases of ceramic production, and reassessing previously established cultural sequences. The integration of physicochemical methods with archaeological approaches points to promising pathways for building more robust and context-sensitive chronologies in the study of Amazonian ceramics.

Keywords: OSL, quartz, ceramic, Amazônia

References

1. Neves, E.G. (2022). Under the Times of the Equinox: Eight Thousand Years of History in Central Amazonia. Ubu Editora.
2. Lima, H. P. (2015). Ceramic Analyses in Amazonian Archaeology: Contributions from Central Amazonia to the Long-Term Trajectory and Debates. Revista de Arqueologia, 28, 1, 3-29.
3. Wang, X.L., Wintle, A.G., Adamiec G. (2012). Improving the reliability of single-aliquot regenerative dose dating using a new method of data analysis, Quaternary Geochronology, 9, 65-74.
4. Tatumi S.H., Rossetti D.F, Soares E.A.A. (2020), Optically Stimulated Luminescence (OSL) Dating in the Amazonian Wetlands, Cambridge Scholars Publishing, UK.

Tracing nourished sand in a dynamic tidal delta using single-grain luminescence signals

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Understanding sediment transport pathways in dynamic coastal systems is essential for predicting geomorphic responses to natural and human-induced changes. In the TRAILS (TRacking Ameland Inlet Living lab Sediment) project, we explore the potential of luminescence properties of sand-sized minerals as natural sediment tracers in the Dutch Wadden Sea, specifically in the context of a large-scale nourishment at the Ameland Inlet ebb-tidal delta. Our approach builds on the principle that incomplete luminescence signal resetting, due to limited sunlight exposure during transport, retains information about sediment history. By comparing fast- and slow-to-bleach luminescence signals obtained from individual grains, we aim to distinguish native from nourished sediments and infer transport pathways. Previous work has demonstrated the applicability of this method in beach settings [1], but its utility in subaqueous tidal environments remains underexplored. To evaluate subaqueous resetting potential of luminescence signals, we conducted a one-day field experiment at the Ameland Inlet, measuring the underwater light climate across depths and tidal stages. Using spectrometers, we recorded the intensity and spectral composition of light over time, revealing pronounced tidal modulation of light penetration, with UV and blue light most attenuated during low tide when suspended sediment concentrations peaked. By combining this measured light climate dataset with photoionization cross-section data [2], we quantified the bleaching efficiency, a wavelength-specific rate (1/s) describing the potential for luminescence signal resetting, for both feldspar and quartz. This allowed us to move beyond qualitative assessments and derive quantitative predictions of bleaching rates for signals with differing sensitivities. Light-sensitive feldspar IRSL and quartz OSL signals showed relatively high bleaching efficiencies, particularly in the near-UV to visible range, while post-IR IRSL required more prolonged or intense exposure. Even after 13.5 hours of daylight exposure, including subaerial intervals, none of the pIRIR signals were fully reset, underscoring the persistence of residual luminescence and its potential use in sediment tracing. Building on these insights, we analyzed over 50 sediment samples from the delta using EMCCD-based single-grain luminescence imaging. Initial results reveal contrasts in luminescence signal characteristics between the samples analyzed. Ultimately, we aim to integrate our luminescence observations with Lagrangian sediment transport modeling to better constrain our estimates of sediment pathways across the ebb-tidal delta. This work contributes to the development of luminescence as a quantitative sediment tracing tool for complex subaqueous environments and provides guidance for coastal nourishment strategies.

Keywords: Sediment tracing, bleaching efficiency, single-grain, EMCCD measurements, coastal nourishment

References

1. Reimann, T., Notenboom, P. D., De Schipper, M. A., & Wallinga, J. (2015). Testing for sufficient signal resetting during sediment transport using a polymineral multiple-signal luminescence approach. Quaternary Geochronology, 25, 26-36.
2. Spooner, N. A. (1994). The anomalous fading of infrared-stimulated luminescence from feldspars. Radiation measurements, 23(2-3), 625-632.

The first luminescence chronology for the Verkhoyansk glacial history (Northeastern Siberia)

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The scale and chronology of Pleistocene glaciation of Northeastern Siberia is one of unsolved topics of the Quaternary history of Eurasia. Glaciation reached its greatest extent on the western slope of the Verkhoyansk Ridge. We have conducted comprehensive research in the Undyulyung River valley, in which several Quaternary moraines are recorded. During field research and the study of satellite images, we identified 5 complexes of terminal moraines of different thickness and length and collected 31 samples from overlapping aeolian and alluvial sediments for luminescence dating: 13 from the third, 7 samples from the fourth, 11 from the fifth terminal moraine. To obtain fractions of quartz and K-feldspar we processed samples according to a standard procedure.

To obtain ages for both minerals, in order to compare the results and determine the degree of bleaching at the time of sedimentation, we measured the luminescence of quartz and K-feldspar. Equivalent doses (De) were measured at the Nordic Laboratory for Luminescence Dating at Riso (DTU, Denmark) using a Risø TL/OSL DA-20 reader. For quartz, De was estimated using a single aliquot regenerative dose (SAR) protocol, with 8-mm diameter aliquots mounted on stainless steel disks, for K-rich feldspar measurements we used 2-mm diameter aliquots mounted on stainless steel cups, and a post-IR IRSL SAR protocol.

The quartz OSL is characterized by weak signal, fast-component dominated and dose response curves are reproducible. The average dose recovery ratio (0.95 ± 0.05; $n = 45$) demonstrates that our chosen protocol can be used to reliably measure a known dose given before any heating of the sample. The ages obtained correspond to the chronological order and are confirmed by the results of radiocarbon dating.

Our results indicate that: 1) aeolian deposits covering the III glacial complex accumulated in the period 113-38 ka (MIS 5d-3); 2) The aeolian sand on the IV glacial complex accumulated occurred during 29-13.9 ka (end of MIS 3-2); 3) Sediments overlying the moraines of the V complex accumulated in MIS 2. Obtained ages do not indicate glacial chronology, but rather indicate strong aeolian activity during MIS 2, as a result of which extensive dune massifs were accumulated.

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Keywords: moraines, aeolian deposits, OSL dating, the Lena River, Yakutia

Investigating geologic controls on TL thermochronology-derived erosion rates in the San Gorgonio Pass region

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The San Gorgonio Pass (SGP), located within the southern San Andreas Fault zone, is a structurally complex region that plays a crucial role in controlling earthquake rupture propagation, making it a key area for seismic hazard assessment (Kendrick et al., 2015). However, a significant knowledge gap persists regarding fault activity over the past 1 to 100 thousand years, particularly along the Mill Creek and Galena Peak faults, which traverse the Mill Creek catchment in the San Bernardino Mountains. In this study, we use thermoluminescence (TL) thermochronology (Brown and Rhodes, 2022) to assess tectonic activity along these faults by quantifying bedrock erosion rates. To investigate whether erosion rates are controlled by differences in tectonic uplift patterns or other factors, we compare these erosion rates with topographic metrics such as hillslope, aspect, local relief, steepness index, curvature, distance to fault strands, and lithology. Our results suggest a positive correlation between topographic relief and erosion rates within the Mill Creek catchment. Additionally, the landscape near the western segment of the Mill Creek fault is eroding more rapidly than near the eastern segment, suggesting enhanced tectonic activity in the west. We also observe a transient erosional signal propagating upstream within the catchment. This signal corresponds to the upstream migration of a knickpoint, consistent with fluvial adjustment to a drop in base level, presumably caused by tectonic uplift. We estimate the lateral migration speed of this knickpoint using erosion rates derived from TL thermochronology. This study demonstrates the unique ability of TL thermochronology to quantify in situ bedrock erosion rates that can compare with topographic metrics and reveal spatially dynamic erosional patterns.

Keywords: San Andreas Fault, TL Thermochronology, topographic analysis, seismic hazard, knickpoint migration

References

1. Brown, N. D., & Rhodes, E. J. (2022). Developing an internally consistent methodology for K-feldspar MAAD TL thermochronology. Radiation Measurements, 153, 106751.
2. Kendrick, K. J., Matti, J. C., & Mahan, S. A. (2015). Late quaternary slip history of the Mill Creek strand of the San Andreas fault in San Gorgonio Pass, southern California: The role of a subsidiary left-lateral fault in strand switching. Bulletin of the Geological Society of America, 127(5–6), 825–849. https://doi.org/10.1130/B31101.1

Linking the chronological gaps and truncations patterns in delta plain evolution: example in Paraíba do Sul River Delta

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The Paraíba do Sul River Delta (PSRD) is a good example of an asymmetrical wave-dominated delta formed during the Holocene sea-level fall [1,2]. Beach ridges (BR) are a common feature in this kind of delta and have been widely used as paleoenvironmental records of deltaic evolution. Not rarely, the geomorphological expression along the updrift delta plain is characterized by a series of beach ridge sets (BRS) that present erosional truncations and disconformity in sedimentary architecture. This process reveals the asymmetrical characteristics on the southern side of the river mouth, changing the geochronological behavior of BRS. This study aims to investigate the relationship between chronological gaps and truncation patterns in PSRD. To achieve this, we mapped and analyzed erosive episodes throughout the Holocene evolution using quartz optically stimulated luminescence (OSL) along BRS in the updrift part of PDRD. The geochronology obtained by OSL (SAR protocol) suggests that the beach ridge set on the inner delta plain was deposited over the last 6.0±0.4 ka, with ages decreasing towards the present. However, the beach ridge sequences in PSRD exhibit a millennial-scale chronological gap [3], dating 3.7±0.2 ka and 1.9±0.1 ka, suggesting an interruption in deposition based on representative truncation in deltaic evolution. The hypothesis for this gap is that, during the erosion phase in delta evolution, the river flows decrease, and wave climate assumes the main driver for sediment transport, distributing sediments on both sides of the river mouth. Subsequently, following the cessation of episodic erosion, depositional processes occur, which are observed by the formation of the deltaic lobe. Future research will address the challenges associated with OSL dating in contexts of erosional truncations in beach ridges, setting the evolution of these features.

Keywords: OSL Dating, Wave-dominated delta, delta evolution, and Beach ridge set.

References

1. Martin, L., Dominguez, J.M.L., Bittencourt, A.C.S.P**.,** 2003. Fluctuating Holocene sea levels in eastern and southeastern Brazil: Evidence from multiple fossil and geometric indicators. *Journal of Coastal Research* 19, 101–124
2. Rocha, T.B., Vasconcelos, S.C., Pereira, T.G., Fernandez, G.B., 2019. Datação por luminescência opticamente estimulada (LOE) nas cristas de praia do delta do rio Paraíba do Sul (RJ): Considerações sobre a evolução geomorfológica entre o Pleistoceno Superior e o Holoceno. *Rev. Bras. Geomorfol.* 20(3), 563–580.
3. Nott, J., Forsyth, A., Rhodes, E., & O'Grady, D., 2015. The origin of centennial-to millennial-scale chronological gaps in storm emplaced beach ridge plains. *Marine Geology*, *367*, 83-93.

Using OSL of Archaeological Pottery to infer wildfire intensity in the Southwestern US

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The size and frequency of wildfires have increased recently, impacting ecosystems, communities, and human health [1-3]. My research will use the heat-sensitive luminescence signals of quartz sand temper within archaeological pottery to record past wildfire conditions. Pottery from surface sites in New Mexico and Arizona were collected from different fire contexts (no fire exposure, historical fires, prescribed burns, and modern wildfires). After isolating the internal 150-250 μm quartz sand grains within the sherd, small aliquots will be dated using OSL (Optically Stimulated Luminescence).

The luminescence signal of individual quartz grains in pottery temper from each fire context will be used to test my hypothesis that recent fire intensity (heat and duration) is greater than historical wildfires. Limited observations support my hypothesis, pottery exposed to recent high-intensity fire has produced modern (reset) luminescence signals, while ceramics exposed to centuries of historical fires will retain their archaeological age [4,5]. Such results may indicate that modern fires are burning hotter and longer due to decades of fuel accumulation in response to forest management practices of suppression, and drier, more flammable fuels and longer burn seasons due to anthropogenic climate change.

Keywords: OSL, Archaeology, Wildfire Intensity, Climate Change

References

1. Stephens, et al., 2016 Forest Restoration and Fuels Reduction: Convergent or Divergent?
2. Li et al., 2022, The impacts of wildfires of different burn severities on vegetation structure across the western United States rangelands: Science of Total Environment, v. 845Burke, et al., 2021
3. Burke et al, 2021, The changing risk and burden of wildfire in the US: Proceedings of the National Academy of Sciences, v. 118.
4. Idecker, et al., 2017, Single-grain optically stimulated luminescence dating of quartz temper from prehistoric Intermountain Ware ceramics, northwestern Wyoming, USA
5. Roos, et al., 2020, Fire Suppression Impacts on Fuels and Fire Intensity in the Western U.S.: Insights from Archaeological Luminescence Dating in Northern New Mexico

Exploring the application of luminescence rock surface dating to glaciated bedrock in Greenland

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Geologic records of past Greenland Ice Sheet fluctuations can help refine ice sheet models that are used to generate future predictions of ice-sheet change and sea level rise. Many of the tools geologists commonly use – including satellite records, cosmogenic nuclide dating, and radiocarbon dating – have distinct advantages useful for generating records of past ice sheet behavior. These available methods generally allow for constraints on either ice sheet cover or ice sheet absence, although requirements unique to each approach can limit its application. Luminescence rock surface dating is a trapped charge dating technique that can constrain multiple periods of exposure and burial of rock surfaces on Holocene timescales in non-erosive environments, thereby offering an additional dating tool. Here, we conduct an experiment at the modern ice margin in Inglefield Land, NW Greenland – where we have a priori knowledge of Holocene ice sheet history – to test whether luminescence rock surface dating of glaciated bedrock can resolve ice sheet histories. We generated luminescence profiles from two contrasting rock surfaces – both deglaciated ~7 ka, but only one was buried by cold-based during the Little Ice Age. Apparent exposure ages are orders of magnitude lower than the expected exposure duration. We posit that the presence of a weathering rind and/or lichen cover can complicate luminescence systematics in these rocks. The burial duration recorded in one of our samples is longer than expected based on regional constraints of the ice-margin history, perhaps indicating the effects of snow burial and/or a weathering rind. We suggest luminescence rock surface dating may eventually be viable but requires additional investigation into luminescence signal resetting processes in Arctic field settings.

Keywords: luminescence rock surface dating, ice sheets, Greenland

Revealing the origin of Cretaceous and Paleogene fluvial deposits from eastern Amazonia through quartz luminescence

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The Cretaceous and potentially Paleogene strata, originally grouped under the Alter do Chão Formation, extend across a large portion of the Amazonas Basin in northern Brazil. Understanding sediment provenance not only contributes to paleogeographic reconstructions but also provides insights into the origin and evolution of the Amazonian river systems and their associated biotic environments. Thirteen riverbank outcrops, distributed along a basin-transverse profile that exposes the full stratigraphic succession, were described using facies analysis. In addition, pure quartz aliquots from forty-five samples were analyzed for optically stimulated luminescence sensitivity (OSL), using blue OSL (BOSL) measurements. Sample preparation and analysis followed the procedures outlined in Sawakuchi et al. (2018). Two distinct lithological units were identified in the studied profile, each exhibiting contrasting BOSL responses: i) Lower unit - composed of medium, cross-stratified sandstone, possibly equivalent to the Jazida da Fazendinha Formation, characterized by lower BOSL sensitivities; ii) Upper unit - consisting primarily of coarse to pebbly sandstone, equivalent to the Alter do Chão Formation, showing higher BOSL sensitivities. Seven sedimentary facies were characterized, indicating depositional environments interpreted as fluvial systems dominated by sandy bar formations (Almeida et al., 2024). The low BOSL sensitivity observed in the lower unit may suggest a sediment source area with high erosion and limited recycling within the basin, whereas the high sensitivity of the upper unit may reflect lower erosion rates and higher sediment recycling, possibly a cratonic source. To further investigate the shift in sediment source areas drained by fluvial systems, the luminescence data will be integrated with neodymium (Nd) isotopic analyses.

Keywords: Amazonas Basin, Alter do Chão Formation, Amazonas River, Tapajós River

References

1. de Almeida, R. P., Althaus, C. E., Janikian, L., Gomes, P. V. O., Figueiredo, F. T., Sawakuchi, A. O., ... & da Silva, L. H. G. 2024. Reappraisal of the Cretaceous and Paleogene paleogeography of eastern Amazonia based on systematic paleocurrent measurements. *Cretaceous Research*, *163*, 105948.
2. Sawakuchi, A.O., Rodrigues, F.C.G., Mineli, T.D., Mendes, V.R., Melo, D.B., Chiessi, C.M., Giannini, P.C.F. 2020. Optically Stimulated Luminescence Sensitivity of Quartz for Provenance Analysis. Methods and Protocols 3, 6.

Optimizing OSL measurement protocols for dating mineral grains entrapped in basal ice in Greenland

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The Greenland Ice Sheet (GrIS) has undergone a complex history of glaciation and deglaciation due to climatic oscillations throughout the Quaternary. Understanding the evolution of the GrIS and thus identifying when Greenland was ice-free in the past is critical input for climate models predicting the future evolution of the ice sheet, its mass loss and contribution to the sea level rise [1]. In this context, optically stimulated luminescence (OSL) dating on mineral grains entrapped in the basal ice provides a powerful tool to constrain the timing of the last ice-free period in Greenland. Ice cores have been drilled in Greenland for the past 55 years but the deepest ice containing basal material has been preserved, waiting for sufficient methodological advances to extract information on the age, duration and environmental conditions when Greenland was last ice-free [2,3]. From an OSL perspective, the main advantage of using grains entrapped in the basal ice compared to subglacial sediments, is that the external dose rate from the ice is negligible [4], which enables an extension of the OSL age range to >1 Ma, depending on mineral and accurate determination of the internal dose rate on a grain-by-grain basis. Quartz has previously been found to be insensitive or lacking a fast-component in this region [4,5], so attention will mainly be focussed on single-grain feldspar. However, despite significant methodological improvements in feldspar dating [6], there are still major challenges such as the test dose dependence [7] and the lack of correlation between the internal potassium content and equivalent dose at the single-grain level [8]. To address these challenges, this study investigates the performance of different feldspar OSL protocols using different preheat temperatures and test dose sizes on a variety of samples, some with independent age control. Both multigrain and single-grain measurements are used. This approach allows an assessment of the reliability and accuracy of equivalent dose estimates across multiple luminescence signals measured. This work aims to contribute to the development of more robust OSL dating protocols for silty ice in the GrIS.

Keywords: Greenland Ice Sheet, OSL dating, feldspar, single grains

References

1. Blard et al. (2023). *Journal of Glaciology*, 69(276), 1011-1029. https://doi.org/10.1017/jog.2022.122
2. Blard et al. (2016). *Nature*, 540(7632): 202–203, 2016. https://doi.org/10.1038/540202a
3. Schaefer et al (2016). *Nature*, 540(7632):252–255, 2016. https://doi.org/10.1038/nature20146
4. Willerslev et al. (2007). *Science*, 317(5834):111–114, 2007. https://doi.org/10.1126/science.1141758
5. Christ et al. (2023). *Science*, 381(6655), 330-335. https://doi.org/10.1126/science.ade4248
6. Buylaert et al. (2012). *Boreas*, 41(3), 435-451. https://doi.org/10.1111/j.1502-3885.2012.00248.x
7. Yi et al. (2016). *Boreas*, Vol. 45, pp. 644–657. https://doi.org/10.1111/bor.12185
8. Buylaert et al. (2018). *Radiation Measurements*, 120, 181-187. https://doi.org/10.1016/j.radmeas.2018.06.003

Dating fluvial sediments of the Huallaga River, central Andes (Peru), based on feldspar pIR IRSL signals

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Post-infrared infrared stimulated luminescence (pIR IRSL) dating of feldspar from sand layers in gravel deposits from orogenic belts show significant challenges and limitations due to complex sedimentological processes during transport and deposition and to the frequent occurrence of poor bleaching. The high energy of these depositional environments can prevent feldspar grains from being sufficiently exposed to sunlight to reset the luminescence signal. Furthermore, the heterogeneity of the fluvial sands may imply having grains from multiple sources, each with different exposure histories to light, making it difficult to obtain accurate pIR IRSL age estimates. Although challenging, applying the pIR IRSL to these types of deposits can help to understand climatic and tectonic changes that occurred in the past that influenced the sedimentary dynamics of a sedimentary basin. This study aims to apply luminescence dating to conglomeratic sediments from Quaternary fluvial deposits from the Huallaga River in the sub-Andean zone of central-north Peru. We employed the pIR IRSL protocol using stimulation temperature at 225 °C (pIRIR225) to potassium feldspar grains (180-250 microns). Preliminary results indicated that the feldspar grains showed strong pIRIR225 signals, yielding equivalent dose (ED) values between 404 and 1052 Gy, while the IRSL signals at 50 ºC (IR50) yielded ED values between 342 and 1006 Gy. Fading correction factors (g-values) ranged from 2 to 2.6% and from 3.8 to 5.8% for the pIRIR225 and IR50, respectively. Thus, fading-corrected ages ranged from ~128 to 228 ka (pIRIR225) and from ~ 170 to 370 ka (IR50) - dose rates were between 3.63 and 4.58 Gy/ka. The characteristic dose (D0) of pIRIR225 signals ranged from 405 to 1010 Gy, suggesting signal saturation or close to the saturation level. Given the type of depositional system under investigation, we suggest that poor bleaching due to rapid deposition, which is favored by high energy or high erosion rates, has taken place and is now reflected in the pIRIR225 signal saturation. The next steps of this research include exploring other signals, i.e., blue optically stimulated luminescence (BOSL) signals from quartz (that bleach faster in nature) and pIR IRSL signals from feldspar at a higher stimulation temperature (pIRIR290, which shows insignificant fading). Hopefully, the additional data will help constrain our results and, thus, allow us to assess the depositional history of the Huallaga River deposits. (FAPESP grants 2022/03007-5; 2023/16031-4; 2021/14022-2).

Keywords: luminescence dating; Andean fluvial sediments; bleaching behavior

Influence of snow cover on luminescence rock surface exposure dating of glacial moraine boulders

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Morainal boulders are chunks of bedrock which get incorporated into advancing glaciers. In North America, glaciers and ice sheets have melted in the warming climate since the Last Glacial Maximum, depositing morainal boulders and exposing them to sunlight. This exposure bleaches away the luminescence signal from the surface of the boulders inwards. With time, the luminescence signal empties to greater depths. We date several boulders using luminescence rock surface dating, finding how long the boulder has been exposed to sunlight. There are many important assumptions involved, such as how varying degrees of seasonal snow cover might influence the apparent exposure age of samples. Although previous research has overlooked this possibility, we use numerical simulations in MATLAB to simulate fluctuating levels of snow cover through time to reveal any biasing effects on apparent exposure age. We determine whether the varying number of sunny months per year produces measurably different luminescence depth profiles, and then test whether this effect changes with exposure duration. We also simulated different hypothetical snow cover histories to quantify the potential bias in apparent exposure age.

We also collected a series of IRSL rock surface dating samples from morainal boulders in a glaciated cirque of the Beartooth Mountains, in Montana and Wyoming, just north of Yellowstone National Park. These boulders have been previously exposure dated with in situ cosmogenic Be-10 and found to form a recessional time transect from about 2.2 ka to several hundred years ago (Barth et al., 2022). Samples were taken to the University of Texas at Arlington Luminescence Lab for preparation and analysis. We then compared measured IRSL and post-IR IRSL depth profiles with our simulations. By combining numerical predictions with empirical measurements from an independently dated boulder series, we hope to more accurately estimate periods of glacial retreat from specific regions. This will help us better reconstruct past responses of glaciers to past climate changes, which then allows geologists to better constrain future melting scenarios of land ice in response to warming scenarios.

Keywords: OSL, quartz, feldspar, coastal sediments, provenance

References

1. Barth, A. M., Ceperley, E. G., Vavrus, C., Marcott, S. A., Shakun, J. D., and Caffee, M. W.: ^{10}Be age control of glaciation in the Beartooth Mountains, USA, from the latest Pleistocene through the Holocene, Geochronology, 4, 731–743, https://doi.org/10.5194/gchron-4-731-2022, 2022.

Dating cave sediments at Chapada Diamantina by feldspar post-infrared infrared stimulated luminescence at 290ºC

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Chapada Diamantina in southern Northeast Brazil (sNEB) hosts several iconic geological and paleontological sites in Brazil, containing copious caves, countless records of Pleistocene megafauna fossils, and well-preserved Quaternary sedimentary sequences. This work aims to date the fluvial sediments preserved in the largest cave in Chapada Diamantina, the Lapa Doce system that comprise Lapa Doce I and Lapa Doce II caves. Nine sediment samples were collected using aluminum tubes in two trenches in Lapa Doce II for luminescence dating. Since most of the samples showed quartz optically stimulated luminescence (OSL) signals in saturation, luminescence dating was performed using feldspar post-infrared infrared stimulated luminescence at 290ºC (pIRIR290). Equivalent doses (D_e) were determined using the $pIRIR_{290}$ protocol applied to total feldspar concentrates (<2.62 g/cm3) due to the reduced amount of potassium feldspar. Measurements were performed on aliquots mounted in steel cups using a Risø OSL/TL reader equipped with a beta source and Schott BG-39 filter for light detection in the blue band. Dose rates were calculated using radionuclides concentrations determined using high-resolution gamma ray spectrometry. The pIRIR290 protocol was chosen due to its low probability of fading during burial. Preliminary results show that the top of the sequence 1 located in a conduit orthogonal to the main gallery from Lapa Doce II has deposition age of 32.7 ± 2.44 ka (10 cm depth) and 26.9 ± 3.2 ka (50 cm depth) at the end of the Marine Isotope Stage 3 (MIS3), possibly related to the Heinrich Stadial 4. Sequence 2, located in the main gallery, points to older deposits, with ages between 65.1 ± 5.0 ka (5 cm depth) and 92.4 ± 15.4 ka (50 cm depth) related to the MIS4. This difference in ages for the studied profiles may be related to depositional gaps. These are the first pIRIR290 ages obtained for clastic sediments in caves of sNEB, which could shed light on the dynamics of the cave fluvial systems. Complementary quartz OSL sensitivity analysis may reveal source areas for the sediment pulses.

Keywords: OSL, $pIRIR_{290}$ protocol, Feldspar, Cave sediments, Chapada Dimantina

Chronology and dynamics of the Carbon Cycle over the Amazon River Delta

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The coastal wetlands at the mouth of the Amazon River play a key role in the global carbon cycle, functioning as both carbon sinks and potential sources of greenhouse gases (GHGs). Given the significant climatic and sea level fluctuations that occurred in the Amazon region during the Holocene, this period serves as an important analogue for understanding and anticipating future environmental changes. However, its chronological framework remains poorly understood. This study conducted optically stimulated luminescence (OSL) on five sediment profiles sampled from the Amazon River's northwestern estuaries, across different floodplain areas. The profiles, which predominantly consist of clay to silt-sized grains, were analyzed for Optically Stimulated Luminescence (OSL) dating of quartz using a Single Aliquot Regeneration (SAR) protocol. The dose recovery test using a preheat temperature of 220ºC resulted in each dose ratio of 0.98 ± 0.02 for a given dose of 0.774Gy. The calculated equivalent doses ranged from 0.85 to 1.9 Gy (Central Age Model), with low (8.3%) to moderate (25.7%) overdispersion values. Dose rate values ranged from 2.2 to 2.4 Gy/ka. The resulting burial ages for these five profiles were from 327 to 806 years (ages by location and from top to bottom): Igarapé Limão do Curuá 477±39, 516±32 years; Igarapé Grande 425±34, 421±47, 723±49 years; Várzea do Céu 353±33 years; Pau Mulato 577±50, 573±47, 327±26, 739±55, 733±50 years; Amazon River north channel 642±117, 806±55 years. Analyses of total organic carbon and stable isotopes confirm that the sediments are enriched in organic matter, particularly in the upper layers, with C_3 vegetation representing the dominant source of biomass across all five profiles. The integrated OSL ages and geochemical analysis reveal complex spatiotemporal variations in sediment accumulation and emphasize the need for detailed sediment sampling and dating, to elucidate the evolutionary history of the coastal plain. The relatively young age of coastal floodplains compared to upstream counterparts, combined with their high sedimentation rates, points toward dynamic environments characterized by rapid carbon cycling and significant organic matter processing. FAPESP grants 2022/08025-1, 2022/06440-1 and 2023/15362-7.

Keywords: Holocene; Coastal wetlands; Carbon; Amazon

Quantifying Multi-Scale Erosion Rates of California Ventifacts Using OSL Depth Profiles and In-Situ Cosmogenic Nuclides Analysis

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Ventifacts are rock formations abraded by wind-driven sand in arid regions. These formations are records of long-term aeolian erosion processes at Earth's surface. However, few studies have reported measurements of the underlying erosion rates, partly because few techniques have been developed to quantify hard-rock erosion rates on Holocene timescales and at the necessary spatial scale. This study aims to provide multi-scale erosion rate estimates for two locations in southern California: Silver Lake, near Baker; and Garnet Hill, near Palm Springs. We use OSL rock surface depth profiles and in-situ cosmogenic nuclide (CRN) analysis to estimate erosion rates at different spatial and temporal scales.

OSL rock samples were extracted from across the surfaces of 10 ventifacts using a drill or angle grinder. Back in the luminescence lab, these samples were cored and wafered to ~1.2-mm-thick rock discs, using a water-cooled drill press and a diamond wafering saw. The IRSL and post-IRSL signals from these crushed wafers were then measured using an automated Risø TL/OSL reader. For CRN, several-centimeter-thick slabs (~200 cm^2) samples were taken from 10 ventifacts using an angle grinder and hammer drill. Samples were processed at the University of Vermont's NSF facility, where quartz were isolated for ^{26}Al, ^{10}Be, and ^{14}C extraction. AMS analysis is being conducted at Purdue University's PRIME Lab. Topographic shielding was estimated using a clinometer survey. Self-shielding was calculated using Balco's (2014) algorithm on 3-D SfM models.

Because of the differing integration depths and averaging times of OSL and CRN methods, we are able to resolve erosion histories across multiple spatial and temporal scales throughout the Holocene at these two sites, with implications for changes in the local climates.

Keywords: OSL, CRN, ventifacts, erosion rate, depth profiles

References

1. Balco, G. (2014). Simple computer code for estimating cosmic-ray shielding by oddly shaped objects. Quaternary Geochronology, 22, 175–182. doi: 10.1016/j.quageo.2013.12.
2. Sohbati, R., Liu, J., Jain, M., Murray, A., Egholm, D., Paris, R., & Guralnik, B. (2018). Centennial-to-millennial-scale hard rock erosion rates deduced from luminescence-depth profiles. Earth and Planetary Science Letters, 493, 218-230. https://doi.org/10.1016/j.epsl.2018.04.017

Tracing Dust Provenance in Southern South America Using Feldspar Luminescence Signals: Insights from Pampean Loess

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Understanding atmospheric dust provenance is crucial for reconstructing past climate dynamics. Identifying dust source signatures in Southern Hemisphere paleo-dust archives improves our understanding of atmospheric circulation patterns, particularly zonal wind behavior during glacial-interglacial transitions.

In southern South America (SSA), dust transport is mainly driven by the Subtropical Jet (STJ) and Southern Westerly Winds (SWW), which carry dust eastward from the arid and semi-arid lands of the "South American Arid Diagonal". The Pampean loess is the largest dust archive south of the Equator, providing key insights into past atmospheric circulation and environmental changes.

This study investigates changes in dust provenance across three Pampean loess profiles from the Late Pleistocene to Holocene using a novel approach based on feldspar infrared stimulated luminescence (IRSL) sensitivity signals to differentiate potential source areas and changes in the provenance over the time. We analysed 22 topsoil samples from six potential dust source areas and 75 loess samples across multiple grain size fractions of three profiles of the Pampean plain. A pIRIR-based measurement procedure was designed to assess various luminescence signals using four volume-standardized polymineral aliquots per sample. Preliminary results show that the feldspar IRSL sensitivity at different stimulation temperatures (e.g., %TL200, %IRSL125, %IRSL290) vary among source areas and over time within the loess profiles.

Our findings suggest that IRSL sensitivity signals can discriminate between dust sources with contrasting geological and denudation history. Temporal shifts in the luminescence signal patterns identify in the loess profiles could indicate 1) changing source contributions and therefore, changes in atmospheric circulation regimes or environmental history in source areas, especially across the glacial-interglacial boundary; and/or 2) changes in pedogenesis/weathering intensity over time, which could be correlated with the magnitude changes of the IRSL sensitivity signal in the loess profiles, biasing a primary stratigraphic signature. Differences related to grain size appear secondary, but in some cases may reflect distinct mechanisms of dust transport or source distance.

This research highlights the potential of luminescence-based provenance tools applied to paleo-dust record in SSA and lays the groundwork for future multi-proxy comparisons to better understand dust dynamics and climate variability in the Southern Hemisphere.

Keywords: IRSL sensitivity, feldspar, dust, provenance, Pampean Loess

Decoding river sediments: low luminescence sensitivity variability across the upper Amazon tributaries

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Optically stimulated luminescence (OSL) sensitivity refers to the amount of light emitted per unit mass and unit radiation dose. Recently, OSL sensitivity has been employed to investigate sediment provenance, surface processes, and paleoenvironmental changes across various environmental contexts. For example, studies in the Amazon River basin have demonstrated that quartz grains derived from cratonic source rocks exhibit significantly higher OSL sensitivity, measured using blue light stimulation and the first second of light emission ($BOSL_{1s}$), than those originating from Andean sources. This difference in OSL sensitivity is attributed to the thermal (e.g., fire events) and radiation (e.g., soil residence time) history of the sediments. Despite advances in OSL sensitivity applications that allow differentiation of end-member sediment sources, these techniques still need testing in more geologically homogeneous contexts. In this study, we measured quartz OSL sensitivity and feldspar infrared-stimulated luminescence (IRSL) in riverbed sands from major rivers draining the upper Amazon basin—namely the Madre de Dios, Ucayali, Marañón, and Solimões rivers. Our primary aim was to assess how quartz OSL sensitivity varies across this large-scale basin draining the Andean orogenic belt and to find possible correlations with environmental factors in source areas. Our initial results from pure quartz grains show absolute $BOSL_{1s}$ varying from 6 to 1016 cts Gy^{-1} mg^{-1} and relative sensitivity ($\%BOSL_{1s}$) from 4 to 57%. Low values of quartz $BOSL_{1s}$ (mean < 100 cts Gy^{-1} mg^{-1}) are dominant in sands from all investigated watersheds, except for the Madre de Dios basin, which has two samples with values ranging from 150 to 1016 cts Gy^{-1} mg^{-1}. For polymineral grains (quartz OSL measured after IRSL), $\%BOSL_{1s}$ ranges from 2 to 37% and the $IRSL_{1s}/BOSL_{1s}$ ratio (indicating feldspar content) varies from 0.02 to 6. There is a negative correlation between $IRSL_{1s}/BOSL_{1s}$ and $\%BOSL_{1s}$, indicating that quartz OSL sensitivity increases as feldspar content decreases in the sediments. These results support the idea that Andean-sourced sediments typically show low to medium OSL sensitivity, consistent with shorter burial times and recent exhumation histories. The distinct behavior of sediments from Madre de Dios might hint at heterogeneous source lithologies, longer soil residence time, or perhaps different fire/thermal histories in that sub-basin. Moreover, further exploration of spatial correlations between luminescence signals and environmental factors, such as lithology, topography, vegetation, soil, and climate, is needed. (FAPESP #2022/03007-5)

Keywords: Luminescence sensitivity, Sediment provenance, Amazon River, Andes

Quaternary Deposits in Pediments of Southeastern Brazil

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Large pediment surfaces capped by sedimentary covertures occur in front of the cuesta escarpments at the eastern border of the Paraná Sedimentary Basin (central and eastern South America). However, the origin of this material, described as unconsolidated sandy or sandy-clayey materials with a basal stone line, is still controversial. In order to elucidate this question, the material covering the pediments on front of the cuesta escarpment of São Pedro (Southeastern Brazil) was studied.

A large outcrop and a drill core (around 20.3 m in depth) were analyzed to identify grain size, chemical, mineralogical, morphoscopic, micromorphological, and geochronological (OSL) characteristics of these sediments. The surface deposits have minor grain size variations and comprise subrounded, polished quartz grains of fine sand with coarse levels. The studied materials are highly leached, predominating kaolinite in the clay fraction. Such chemical and mineralogical characteristics are related not only to the source areas, but also to pedogenetic processes, according to micromorphological data, which indicate clay migration (there are low content of clay in the surface levels, and clay coatings at the subsurface levels) and fragmentation of sand grains due to plasma infusion. The OSL data ranges from about 106.9 (± 20.25) to 10.76 (± 1.57) ka.

In this context, we consider that these deposits suffered short-distance fluvial transport during the dry periods of the Upper Pleistocene (115 to 12 ka). Finally, we conclude that the stone-lines are discontinuities and the sediments are allochthonous, originated from cuesta escarpments, structural highs, and buttes occurring in the Paulista Peripheral Depression.

Keywords: pediment surface, geochronology, Quaternary, climate changes

Dust flux estimates through OSL methods for the last glacial-interglacial cycle in southern South America based on loess-paleosols deposits

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Atmospheric dust influences the climate through mechanisms like nutrient cycling, albedo changes, radiative forcing, and cloud formation (1). However, its contribution to climate forcing remains poorly understood, creating uncertainties in climate model simulations (2). Loess-paleosol sequences in Argentina offer a valuable record of continental dust deposition in the Southern Hemisphere (3). This study investigates the dust cycle captured in these sequences by determining dust accumulation rates across past glacial-interglacial periods. By comparing dust fluxes from continental deposits to those in distant regions, such as the South Atlantic Ocean and the Antarctic Plateau, we aim to deepen our understanding of dust dynamics during the last glacial cycle.

Using optically stimulated luminescence (OSL) dating, we analyzed two elevated sequences: Las Carreras (~2290 m asl) and Vaca Corral (~1600 m asl). We collected and processed 20 samples under controlled conditions to isolate quartz and silt fractions. Although feldspar contamination posed challenges, we measured equivalent doses on silt-sized poly-mineral aliquots. High-resolution gamma-ray spectrometry provided dose rates, accounting for environmental factors like moisture and cosmic rays. These sites were specifically chosen to enhance the spatial resolution of previous studies conducted in lower-altitude plains (3). Their elevated locations function as natural dust traps, primarily influenced by the subtropical Jet Stream (STJ), and provide clear physical and geochemical records with minimal interference from coarse dust originating in low-lying areas. The inclusion of these records, which reflect the influence of STJ winds and low-level N-S flows east of the Andes, offers a unique perspective on atmospheric circulation patterns. The results will establish a robust chronological framework for the analyzed sections, facilitating comparisons with other Southern Hemisphere paleoclimate records. Ultimately, this research enhances our understanding of dust flux variability and its significance in climate systems, providing critical data for modeling glacial cycles and improving the resolution of paleoclimate studies in southern South America.

Keywords: OSL, loess-paleosols, dust, paleoclimate, Souther Hemisphere

References

1. IPCC (2021) Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, doi:10.1017/9781009157896.
0. Adebiyi, A. A., & Kok, J. F. (2020). Climate models miss most of the coarse dust in the atmosphere. Science advances, 6(15), eaaz9507.
3. Torre, G., Gaiero, D. M., Coppo, R., Cosentino, N. J., Goldstein, S., De Vleeschouwer, F., Le Roux, G., Bolge, L, Kiro, Y., & Oliveira-Sawacuchi, A. (2022). Unraveling late Quaternary atmospheric circulation in the Southern Hemisphere through the provenance of Pampean loess. Earth-Science Reviews 232, 104143. https://doi.org/10.1016/j.earscirev.2022.104143

The development of a luminescence scanner for sediment cores

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Marine sediment cores are key archives for reconstructing past environmental conditions, including continental precipitation, a crucial driver of climate variability. Traditionally, this parameter is inferred from the hydrogen isotopic composition of plant-wax compounds (n-alkane δD) or elemental ratios (e.g., ln(Fe/Ca)). However, these proxies can be limited by material availability and post-depositional or sea-level effects, respectively. Alternatively, luminescence sensitivity based on Optically Stimulated Luminescence (OSL) is more proportional to precipitation changes than other methods, providing a faster, simpler, and more reliable approach for measuring precipitation changes in marine sediment cores[1]. We developed a luminescence scanner to optimize the measurements, avoiding the need to collect samples from the marine sediment core. The scanner is equipped with an OSL reader device featuring infrared (850 nm) and blue (480 nm) LEDs, each with bandpass filters (780 nm and 420 nm, respectively), and a photomultiplier tube with an ultraviolet-transmitting and visible-absorbing filter (U340). An X-ray source regenerates the luminescence signal. The custom-developed software, Vagalume, allows control, real-time tracking of the measurements and automatically calculates key parameters, such as $BOSL_{1s}/BOSL_{total}$ and $IRSL_{1s}/BOSL_{1s}$ ratios. The reproducibility and reliability test of the method was conducted on MD23-3670Q marine sediment core[3]. The protocol, repeated four times, consisted of infrared stimulation (IRSL) followed by blue stimulation (BOSL) for 50 seconds each, after an x-ray dose and a 12-hour pause. Each meter of core was scanned at 1 cm resolution in 3 hours. The $BOSL_{1s}$ and $IRSL_{1s}$ were calculated as the integral of the first second emission of the respective OSL curve decay, and $BOSL_{total}$ as the integral of the entire blue OSL curve. The signals were background-corrected using the last 10 seconds of each respective curve. The reliability of the measurement was checked by comparing the data with the Fe/Ca elemental ratio obtained in an X-ray Fluorescence scanner (Avaatech) for the same marine sediment core. The results demonstrate the potential of this OSL scanner for high-resolution and faster reconstruction of past continental precipitation using luminescence proxies in marine sediment cores.

Keywords: OSL, sensitivity, OSL scanner, sediment cores

References

1. Mendes, V.R., Sawakuchi, A. O., Chiessi, C.M., Giannini, P. C.F., Rehfeld, K., & Mulitza, S. (2019). Thermoluminescence and optically stimulated luminescence measured in marine sediments indicate precipitation changes over northeastern Brazil. *Paleoceanography and Paleoclimatology*, 34.
2. Sawakuchi, A. O., Rodrigues, F. C. G., Mineli, T. D., Mendes, V. R., Melo, D. B., Chiessi, C. M., & Giannini, P. C. F. (2020). Optically stimulated luminescence sensitivity of quartz for provenance analysis. *Methods and Protocols, 3*(1), Article 6.
3. Govin, A., Chiessi, C. M., & cruise participants. (2024). *Cruise report of AMARYLLIS-AMAGAS II (VT180, MD241), Paramaribo (Suriname) – Recife (Brazil), 12/06/2023–03/07/2023* (283 pp.).

The Newly discovered Pre-Columbian Terraces of the Sierra Nevada de Santa Marta, Northern Colombia: first attempt to understand Tairona Culture stone masonry construction based on OSL

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The archaeological site of La Palma is an extensive Tairona Culture settlement (50 ha) located within a previously unstudied region of the Western Sierra Nevada de Santa Marta (SNSM), Northern Colombia. Part of a dense settlement system sprawling over more than 18 km^2, La Palma was inhabited for over a millennium (*ca*. 400-1600 CE). Its ancient inhabitants used rubble masonry to construct residential and public earth terraces sustained by impressive stone walls that have survived lush vegetation growth, modern agricultural practices, and the harsh weather conditions of the tropics over time, besides the eventual looters and treasure hunters. This engineered landscape demonstrates the sophisticated knowledge that the ancient societies of La Palma had of their geological and hydrological resources, and the sophisticated constructive technologies and techniques they developed.

The main purpose of this geoarchaeological research is to analyze the labor practices and constructive sequences by which ancient indigenous peoples built and maintained the stone infrastructure of La Palma. OSL-dating of sediment-infilled terraces and OSL-signal analyses (1) of >70 fine to medium-sized quartz- and feldspar-rich sediment and soil samples from 10 extensive excavations and a major stone wall from 7 residential terraces were collected between 2022 and 2024. Preliminary results show hopeful OSL signals across potentially different construction phases, some more seemingly reworked than others (incompletely zeroed). The use of OSL as combined dating and sediment proxy tools seem to give a favourable glimpse on how and when the Tairona may have built these large stone masonry terraces with which they intensively transformed the landscape of the SNSM.

Keywords: OSL, quartz, OSL-signal analyses, stone masonry terraces, Tairona Culture

References

1. Porat, N., López, G.I., Lensky, N., *et al.* (2019). Using portable OSL reader to obtain a time scale for soil accumulation and erosion in archaeological terraces, the Judean Highlands, Israel. Quaternary Geochronology, 49, 65-70.

Determination of potassium content in feldspar by SEM-EDS to improve luminescence dating

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The concentration of potassium (K) in feldspar sand grains (63-250μm) has considerable impact for luminescence dating. Infrared stimulated luminescence (IRSL) dating of feldspar relies on the determination of K content of feldspar grains to calculate internal radiation dose rates. Preparation of feldspar concentrates used in luminescence measurements aims to separate K-feldspar grains using heavy liquid solutions (lithium metatungstate, LMT). The K content in K-feldspar is presumably uniform (e.g. 12.5%), but the complexity of feldspar composition and polymineral sand grains lead to difficulties to isolate pure K-feldspar grains. Here we propose the use of scanning electron microscope (SEM) and X-ray energy dispersive spectroscopy (EDS) for quantifying the potassium content in feldspar grains used for equivalent dose estimation in luminescence dating.

Sand grains of K-feldspar used for luminescence measurements are fixed onto double-sized carbon conductive tape, on a ¼" stub. Subsequently, a carbon film is applied by evaporation prior to analysis in a LEO 440 high-vacuum SEM, equipped with a solid-state Si(Li) EDS detector and INCA 300 analysis software (Oxford Instruments). The analytical conditions include an EHT of 20 kV, a working distance of 25 mm, and a sample current of approximately 500 nA. The EDS is configured with a "process time" of 4, a live acquisition time of 100 s, a dead time around 12%, and a minimum count exceeding 150,000 cts across the entire spectral area.

Preliminary results from macromorphological analysis demonstrated that the heavy liquid separation process was efficient, with a predominance of alkali feldspar. However, the variability in K content, along with the presence of other minerals such as quartz, plagioclase, and unknown mineral aggregates, may introduce errors in feldspar dating protocols. Additional factors requiring consideration are sample texture and shadows in the solid angle of X-rays reaching the EDS detector, both still under investigation. Comparative studies employing next-generation EDS detectors, anticipated to mitigate these analytical interferences, are forthcoming. The goal of this study is to develop a routine method to measure K content in feldspar aliquots used for equivalent dose determination.

Keywords: dating, feldspar, IRSL, SEM, EDS.

Dating Amazonian Ceramics Using OSL: Preliminary Results from the Rio Negro Basin

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This study presents initial results from the application of Optically Stimulated Luminescence (OSL) dating to ceramic fragments recovered from two archaeological sites located in the Rio Negro basin. OSL enables the estimation of the last time mineral grains within the ceramic matrix or associated sediments were exposed to light or heat, providing a viable alternative in contexts where radiocarbon dating is not possible [1]. Amazonian ceramics are frequently manufactured with the addition of cauixi (*Spongilla* spp.) and caraipé (*Licania* spp.), both silica-rich materials that interfere with thermoluminescence (TL) signals, limiting the effectiveness of this technique. OSL, using the SAR (Single Aliquot Regenerative dose) protocol (2), produced reliable age estimates for the two fragments: one from a historical context (364 ± 36 years) and another from a prehistoric context (884 ± 24 years), both with low overdispersion values (<2%). These results align with proposed models of human occupation in the region, highlighting the potential of OSL to support the construction and refinement of archaeological chronologies. Work financed by FAPESP (2022/15495-4)

Keywords: Amazonian ceramics, OSL, quartz, archaeological sites

References

1. Wang, X.L., Wintle, A.G., Adamiec G. (2012). Improving the reliability of single-aliquot regenerative dose dating using a new method of data analysis, Quaternary Geochronology, 9, 65-74.
2. Tatumi S.H., Rossetti D.F, Soares E.A.A. (2020), Optically Stimulated Luminescence (OSL) Dating in the Amazonian Wetlands, Cambridge Scholars Publishing, UK.

Optically Stimulated Luminescence dating of ceramics and sediments from an Amazonian archeological site (Sambaqui)

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Optically Stimulated Luminescence (OSL) dating has been widely used successfully in recent decades for various purposes. In archaeology, it is particularly useful for determining the burial age of quartz grains in sediments and the manufacturing age of ceramic artifacts. The luminescence signal from quartz grains is proportional to the time since their last exposure to sunlight (burial), while for ceramics, it reflects the time since they were last heated [1]. This study presents the application of the Optically Stimulated Luminescence method on quartz grains from sediments and ceramics, using the RISØ TL/OSL Reader and Lexsyg Smart TL/OSL devices. The samples were collected in an archaeological site located in the Amazon region categorized as a *sambaqui*. *Sambaquis* are pre-Columbian shell mounds built by Indigenous peoples along the coast and in different areas of the South American lowlands, often containing artifacts, human burials, and evidence of ancient subsistence practices [2]. The results were obtained following the established Single Aliquot Regenerative-Dose (SAR) protocol [3]. As a scientific contribution, this work was able to determine the first datings of the archaeological site, registering ceramic objects aged between 1,176 and 2,900 years and sediments between 542 and 4,078 years, which will help to expand the understanding of the behavior of the indigenous people who inhabited the Amazon region and their relationship with the environment, as well as migration patterns, artistic evolution, and ceramic object making practices. Besides the OSL ages themselves, the overdispersion of the samples also helped to improve the knowledge of the building processes of the shell mounds. Some clay layers presented overdispersion higher than 70%, hindering age determination but indicating that the layer was likely deposited artificially.

Keywords: OSL, ceramic dating, sediments, archaeology, SAR protocol

References

1. Roberts, H. M., Duller, G.A.T. (2004). Standardised growth curves for optical dating of sediment using multiple-grain aliquots. ScienceDirect. v. 38, n. 2, p. 241–252.
2. Furquim, L. P. (2021). Facing Change through Diversity: Resilience and Diversification of Plant Management Strategies during the Mid to Late Holocene Transition at the Monte Castelo Shellmound, SW Amazonia. Quaternary, v. 4, n. 1, p. 8.
3. Wintle, A. G., Murray, A. S. (2006). A review of quartz optically stimulated luminescence characteristics and their relevance in single-aliquot regeneration dating protocols. Radiation measurements, 41(4), 369-391.

Chronology and Evolution of Holocene Coastal Eolian Systems in the Paraguaná Peninsula, Venezuela

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The Paraguaná Peninsula, in Falcón State, is the northernmost continental region of Venezuela, surrounded by the Caribbean Sea and connected to the mainland by a narrow NNW-oriented isthmus up to 1 km wide. This research focuses on the morphology and chronology of coastal eolian deposits and their implications for climatic and relative sea-level (RSL) changes. Methods included: a) mapping of coastal eolian geomorphological units, and b) dating by quartz optically stimulated luminescence (OSL) and radiocarbon (^{14}C). Some samples were dated using both methods, revealing discrepancies due to weak luminescence signals in quartz grains, possible post-depositional remobilization (e.g., blowouts), or characteristics of the carbonate material in ^{14}C-dated samples, such as reworking or cementation of bioclasts, despite efforts to avoid such biases. The shoreline behaviour during the Holocene in Paraguaná region transitioned from stationary-transgressive in the south to regressive, evidenced by a strandplain in the north. The coastal eolian system reflects this transition: it changes from a tripartite configuration (beach-foredune, deflation plain and dune fields), more sand-saturated, in the southern sector, to a minimal configuration (only foredunes) in the north. In the intermediate sector, represented by the isthmus, the dune field advances and becomes partially isolated in the middle of the gulf waters to the west. If in the north the paleobeach deposits are supposedly under the foredune ridges that constitute the strandplain, in the southern isthmus, they occur as beachrocks next to the current foreshore. The beachrocks ages range and position relative to the present shoreline indicate coastal stability since 6.6 cal ka BP (^{14}C) or 4.8 ka (OSL). In turn, the paleodunes north of the isthmus, dated between 2.3 and 1.3 ka BP, formed during a drier period with a lower RSL and were later submerged and isolated due to RSL rise or paleogeographic changes. The stabilized foredunes on the peninsula strandplain occur in two sets of ridges, with distinct morphological patterns and progradation rates; the inner set, formed between 4.0 ka and 2.4 ka BP with a progradation rate of 1.25m/a, is associated with a climatic phase characterized by precipitation fluctuations; the outer, marked by a decline in progradation rate to 0.27 m/a, coincides with increasingly drier conditions over the last 2.4 ka. The definitive closure of the isthmus occurred between 2.8 and 2.4 ka BP, shaping a paleogeographic configuration more similar to the present one. This study reinforces the importance of the transgressive versus regressive character of the coast in the morphology and sand-saturation degree of eolian systems. In this case, the increase in progradation towards the north is associated with the net longshore drift in that direction. Additionally, it suggests an intensification of eolian sedimentation over the last 2.4 ka favored by the precipitation decline in the region.

Keywords: coastal geomorphology, coastal ridges, beachrock, quaternary paleoclimate.

μDOSE+ System: Dose rate precision evaluation for 200 mg and 3.00 g samples

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Luminescence dating requires accurate and precise quantification of the environmental dose rate for the calculation of reliable luminescence ages. Low-level environmental dose rates originate from ionising radiation of the decay of natural radionuclides (^{40}K, ^{87}Rb) and radioactive chains (mother nuclides ^{238}U, ^{235}U, ^{232}Th and daughter nuclides) present in the surrounding sediment body. Traditionally, concentrations are determined by low-level gamma-ray spectrometry, alpha counting, beta counting and other techniques for element and radionuclide determination. The μDOSE system makes use of a combined alpha- and beta-decay-sensitive scintillation technique with layers of plastic scintillator for beta-decay monitoring and ZnS:Ag for alpha-particle detection. Counts from U and Th are discriminated by the paired decays [1,2,3]. Recently, we introduced an upgraded version of the original system: μDOSE+. The new system is equipped with passive and active shielding and a continuous ^{222}Rn removal system, and uses a state-of-the-art machine learning algorithm for improved pulse classification [4].

We present a precision evaluation of dose rate values obtained using the μDOSE+ system. Measurements were performed on 200 mg and 3.00 g samples, including low-activity environmental materials and samples commonly used by several laboratories as reference materials (Nussi and Volkegem loess). Results are compared with literature values and high-resolution gamma-ray spectrometry (HRGS) data assessing the precision and reliability of the μDOSE+ system for accurate dose rate determination.

We found that dose rate values estimated using μDOSE+ measurement data are in agreement with both literature and HRGS-derived values. These results demonstrate the system's applicability for reliable dose rate evaluation even for scarce amounts of sample material, making it a suitable tool for luminescence dating and a good alternative for other well-established measurement methods.

Keywords: dose rate, α and β counting, luminescence dating, measurement accuracy, μDOSE+ system

References

1. Miłosz, S., Tudyka, K., Walencik-Łata, A., Barwinek, S., Bluszcz, A., Adamiec, G. (2017). DOI: 10.1109/TNS.2017.2731852
2. Tudyka, K., Miłosz, S., Adamiec, G., Bluszcz, A., Poręba, G., Paszkowski, Ł., Kolarczyk, A. (2018). DOI: 10.1016/j.radmeas.2018.07.016
3. Tudyka, K., Bluszcz, A., Poręba, G., Miłosz, S., Adamiec, G., Kolarczyk, A., Kolb, T., Lomax, J., Fuchs, M. (2020). DOI: 10.1016/j.radmeas.2020.106310
4. Tudyka, K., Kłosok, K., Gosek, M., Kolarczyk, A., Miłosz, S., Szymak, A., Pilśniak, A., Moska, P., Poręba, G. (2024). DOI: 10.1016/j.measurement.2024.114854

Library for Luminescence Sensitivity Statistics and Data (LSSD): A Python package for data analysis in luminescence sediment provenance

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In recent years, a considerable number of works has been published using Thermoluminescence (TL) and Optically Stimulated Luminescence (OSL) of quartz in sediment provenance analysis (e.g [1]). The sensitivities of TL 110°C peak and OSL fast component of quartz are the main characteristics used in sediment provenance analysis so far and they can be determined from specific measurements protocols (e.g. [2]) or using measurements from luminescence dating protocols (e.g. [3]). Given the substantial volume of geoscience big data, which is increasing exponentially annually, it is imperative to employ statistical tools to interpret trends and patterns that support the scientist hypothesis.

A common and intuitive approach is to generate basic statistics parameters to represent quartz TL or OSL sensitivity distribution. Geologic data often lacks normal or parametric distributions, necessitating complex analyses that are time-consuming and limited by software tools.

The Library for Luminescence Sensitivity Statistics and Data (LSSD) is an open-source Python package that facilitates the integration with other codes and programs, ensuring the accessibility and auditability of the code.

In consideration of the present state of the library, it is possible to open directly BINX files from Risø readers and export the data to a spreadsheet format. The user can also perform basic operations with raw read values (e.g. integrals, derivative and classifications). Furthermore, the usage of built-in functions facilitates the graph plotting and statistics analysis (e.g. bootstrap for samples with few aliquots. The results can be easily integrated into machine learning algorithms. Additionally, it is necessary to create a better user-program interface and improve the support for Lexsyg reader files.

Keywords: Statistic analysis, Python package, Luminescence, Bootstrap

References

1. Gray, H. J., Jain, M., Sawakuchi, A. O., Mahan, S. A., & Tucker, G. E. (2019). Luminescence as a Sediment Tracer and Provenance Tool. Reviews of Geophysics, 57(3), 987–1017. https://doi.org/10.1029/2019RG000646
2. Sawakuchi, A. O., Jain, M., Mineli, T. D., Nogueira, L., Bertassoli, D. J., Häggi, C., Sawakuchi, H. O., Pupim, F. N., Grohmann, C. H., Chiessi, C. M., Zabel, M., Mulitza, S., Mazoca, C. E. M., & Cunha, D. F. (2018). Luminescence of quartz and feldspar fingerprints provenance and correlates with the source area denudation in the Amazon River basin. Earth and Planetary Science Letters, 492, 152–162. https://doi.org/10.1016/j.epsl.2018.04.006
3. Souza, P. E., Porat, N., Sawakuchi, A. O., Cruz, C. B. L., Breda, C., Rodrigues, F. C. G., Oliveira, S. C., & Pupim, F. N. (2024). Using quartz OSL signals from SAR cycles for sediment provenance studies. Quaternary Geochronology, 83, 101574. https://doi.org/10.1016/j.quageo.2024.101574

Validating a Newly Developed OSL Scanner for Marine Sediment Analysis

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The luminescence sensitivity of quartz (proportion of the first second of emission over the entire curve) has been successfully used as a proxy of continental precipitation in marine sediment cores. This proxy is applied along the marine sediment core, and its changes through time are somehow related to precipitation cycles on the continent, mainly due to sediment source changes. Currently, luminescence signal readings are performed using commercial equipment such as the Risø TL/OSL reader, which stimulates samples with infrared and blue light. Although these analyses can be conducted with existing commercial readers, their use entails long processing times, increasing the cost of the method, and reducing sample resolution. In this context, the first optically stimulated luminescence scanner in the world was developed by the QuaterCost laboratory, at the Federal University of São Paulo. This device operates on the same principles as established readers, but aims to provide greater speed, portability, and reproducibility in research, allowing it to be transported on field expeditions or to different locations. The objective of this study was to compare the data obtained with the newly developed scanner to those from the Risø reader. For this purpose, core M125-95-3 (10.94° S, 36.20° W, 1897 m depth), collected near the mouth of the São Francisco River, was analyzed for quartz luminescence sensitivity using both devices. The generated data were normalized and compared using linear correlation, yielding a strong correlation ($r = 0.71$). These results provide promising prospects for the development of the equipment, which, even in its early stages, has demonstrated the capability to match the performance of established market readers. By enabling faster and more efficient luminescence measurements, this scanner offers new opportunities for reconstructing past precipitation patterns and improving paleoclimate studies based on marine sediment records.

Keywords: quartz, feldspar, precipitation proxy, luminescence scanner

Dual laser single grain OSL unit

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Spatially resolved luminescence measurements with an EMCCD camera allow single grain dose determination while still using multiple grain discs and applying common measurement protocols like SAR of quartz or pIRIR SAR of feldspar. The EMCCD camera is also capable of making single grain radio luminescence measurements.

Recently, a dual laser single grain OSL unit has been developed by Freiberg Instruments in Freiberg, Germany. The standard OSL module can be operated with the single grain unit in place. OSL modules with two stimulation wavelengths are not limited, but the number of LED/Laser diode may need to be reduced if three stimulation wavelengths are required. Either of the two lasers can be used at low power to detect the position and orientation of the sample disc. This allows, for example, IR position detection before green stimulated OSL of quartz.

The hardware mechanism, both mechanical and optical, as well as luminescence results will be discussed in this talk.

Assessment of purity of biogenic silica samples for luminescence analysis

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At the Copenhagen LED2023 conference we demonstrated that OSL, IRSL, and TL signals can be measured from opal phytolith mineraloids. The phytoliths were separated from sediments and soils using density separation (<2.37 gcm^{-3}) and Stokes' law settling methods, and we used SEM techniques to make qualitative assessment of the morphology and purity of the samples. A suite of biogenic silica samples, including phytoliths extracted from commercial straw using dry ashing (up to ~550°C) techniques, and a series of phytolith and diatom standard and reference materials, show similar OSL, IRSL, and TL signals. Our SEM analyses suggested a range in sample purity, with samples extracted from sediment being the least pure, emphasizing the difficulty of extracting pure samples from sediment deposits with floatation techniques (1).

In the work presented here we have been investigating methods to identify and quantify "contaminant" minerals in our phytolith and biogenic silica materials, ultimately with the aim to determine the extent to which the luminescence derives only from biogenic silica. We have conducted XRD and Raman spectroscopy to assess the relative proportion of amorphous to crystalline components to determine a crystallinity or purity index, and the extent to which the OSL signals are thermally quenched to indicate the presence of quartz. Results of these assessments of purity for the biogenic silica samples will be discussed.

Keywords: opal phytoliths, biogenic silica, luminescence, assessment of purity

References

1. Spencer, J.Q.G., Sanderson, D.C.W., Rader, M., Fitzgerald, S., Rex, C.L., Sprynskyy, M., & Staff, R.A. (2024). Luminescence and thermometry studies of plant opal phytoliths. Quaternary Geochronology, 82, 101544.

OSL/IRSL and cosmogenic ^{10}Be depth profile dating in MIS 2 and MIS 6 Laurentide Ice Sheet glaciofluvial sediments from Michigan and Indiana

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Luminescence dating of samples from ice-marginal glaciofluvial settings has always been a challenging endeavor. Partial bleaching, low sensitivity and unstable signals have been documented as responsible for over- and underestimation of age in these sediments. A multi-technique approach is warranted to address stratigraphic problems in these sediments.

We studied sites distributed throughout ice-marginal and valley train areas along the Laurentide ice sheet margin in Indiana and Michigan for both MIS 2 and MIS 6 and compared both quartz OSL and feldspar post-IR IRSL dating to pedostratigraphic and cosmogenic depth profile age data. We expand in this study our previous results regarding OSL signal stability and sensitivity in the region, fading characteristics of the post-IR IRSL signal, and match with cosmogenic ages. We also present here three dated sample sets in deep (>50 m) unconsolidated cores from boreholes in glaciofluvial sediment stacks.

A set of sites along the MIS 6 margin in central Indiana show that quartz ages consistently, but not always, underestimate post-IR IRSL ages, which align better with cosmogenic depth profile data and pedostratigraphic information. Underestimation of 20-30% in age is common, caused by an unstable signal related to an ultrafast component. Efforts to reduce this signal before observing standard OSL included: more stringent preheat settings, short-shine low-intensity blue illumination, and elevated temperature IR illumination.

Two sites in southern Michigan and northern Indiana with MIS 2 proximal glaciofluvial fans were studied with depth profile dating and OSL/IRSL dates, with general agreement of the techniques. Older OSL age populations appear in specific beds, and correlate with anomalously high cosmogenic ^{10}Be in a depth profile through these beds, suggesting a common sediment reservoir as source.

Dating in cores mirror all observations mentioned above. We conclude that vertical and horizontal sample ensembles and coupled dating techniques are optimal strategies for dating these sediments. Detailed pedological analyses and cross cutting relationships derived from landform mapping must be combined with these dating results to make sense of landform ages. Our results also indicate that geochronology problems might be intractable when testing core samples recovered from proximal glaciofluvial settings.

Keywords: OSL, PIRIR, quartz, feldspar, glaciofluvial

Precipitation patterns in the Amazon Basin for the last 60 thousand years using sediment core luminescence scanning

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Variations in the Atlantic Meridional Overturning Circulation (AMOC) control the mean position of the Intertropical Convergence Zone and the intensity of the South American Monsoon System (SAMS), directly affecting precipitation patterns in the Amazon Basin. The projected reduction in AMOC intensity, driven by anthropogenic climate change, poses a significant threat to the stability of the largest tropical forest on the planet. During millennial-scale events, known as Heinrich Stadials (HS), the AMOC has experienced substantial weakening. Previous studies have associated these slowdowns with positive precipitation anomalies in the Amazon Basin, although the impacts vary spatially within the region, which has motivated sectoral approaches in the analyses. In this context, this work investigates precipitation patterns in the Amazon Basin over the last 60 thousand years, based on luminescence data from a marine sediment core (MD23-3652Q), collected under strong influence of Amazonian sediments, near French Guiana, at 2518 m depth. The analyses were conducted using a Luminescence Scanner, an innovative, non-destructive technique developed to generate high-resolution data from the ratio between infrared stimulated luminescence (IRSL) from feldspar and optically stimulated luminescence (OSL) of quartz signals (IRSL/OSL). OSL was measured using blue LEDs after IRSL and it is presumably derived from quartz within the bulk sediment core. The IRSL/OSL ratio is a proxy for feldspar content and it is of particular interest since the Amazon Basin has two distinct sediment sources, one from the Andes, with a high feldspar content, and another from the lowlands, with quartz of higher OSL sensitivity. Thus, IRSL/OSL tracks mineralogical maturity and then the sediment sources. Preliminary results reveal a strong correlation between the IRSL/OSL ratio and the summer insolation curve at 3°N, indicating higher precipitation in the Andes during periods of maximum insolation, associated with the strengthening of the SAMS and increased river input. Subsequent steps include the analysis of variations in this signal during HS, with the aim of understanding how AMOC weakening events affected precipitation patterns in the Amazon Basin. In parallel, discrete samples are being analyzed in the laboratory to validate and calibrate the data obtained by the scanner, ensuring the robustness of the results.

Keywords: Amazon Basin, luminescence scanner, OSL, marine sediments, provenance

Update on dating hydrothermal explosions in the Yellowstone Plateau Volcanic Field with quartz red TL and K-feldspar post-IR IRSL techniques

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The Yellowstone Plateau Volcanic Field hosts an active hydrothermal system that has produced some of the largest hydrothermal explosions in the world. This is a continuing hazard, as demonstrated by the recent explosion of Black Diamond Pool on July 23, 2024 that closed Biscuit Basin for the season and covered an area roughly 0.03 km^2 with ejecta and debris. Hydrothermal explosions occur when shallow confined hydrothermal systems rapidly depressurize, causing violent explosions of water, steam, and rock. These hydrothermal explosions can be triggered by events like earthquakes, deglaciations, outburst flooding, and overpressure rupturing of surbsurface caprocks – all of which induce pressure variations. Hydrothermal activity in the Yellowstone Plateau Volcanic Field has been nearly continuous through recent glaciations (~160-130 and ~22-14.5 ka) and has resulted in up to 20 explosion craters with crater diameters >100m throughout the volcanic field.

The ages of these craters are poorly constrained, especially with direct dating methods. We used luminescence dating as part of a larger geochronological study to date explosion craters in Yellowstone Plateau Volcanic Field. Single aliquot regenerative post-infrared infrared stimulated luminescence (post-IR IRSL) dating of K-feldspar grains and red thermoluminescence (RTL) dating of quartz grains are used to constrain the explosion timing. These measurements estimate cooling ages for sediments that experienced elevated temperatures in hydrothermal reservoirs prior to the explosions. We focus on two craters, one without previous geochronologic constraints (Pocket Basin) and one with a previously determined radiocarbon age as a control on method accuracy (Mary Bay). Pocket Basin, which is within Lower Geyser Basin, is a large explosion crater that is surrounded by associated explosion breccias. Mary Bay, at the northern end of Yellowstone Lake, is the largest know hydrothermal explosion in the world at 2.6 km in diameter (1). Initial results suggest good agreement between our luminescence ages of the Mary Bay event with radiocarbon age control, building confidence in our luminescence ages for Pocket Basin events.

Keywords: OSL, hydrothermal explosions, post-IR IRSL, red TL

References:

1. Morgan, L.A., Shanks, W.C., & Pierce, K.L. (2009). Hydrothermal Processes Above the Yellowstone Magma Chamber: Large Hydrothermal Systems and Large Hydrothermal Explosions.

Real-time observation of quartz and feldspar etching and quantitative etching depth estimation for trapped charge dating

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In trapped charge dating, quartz and feldspar samples are typically etched with 40% or 10% hydrofluoric acid (HF) to remove non-target minerals and eliminate outer layers affected by alpha radiation. In this study, we present the real-time observations of HF etching using a dedicated imaging setup, offering new insights into the etching process and its homogeneity across individual grains.

We analyzed five representative samples:

- Sample A: K-feldspar (150–250 µm, 40% HF) from the Upper Rhine Graben, Germany [1] https://doi.org/10.5446/69826
- Sample B: Mixed quartz and K-feldspar (200–300 µm, 40% HF) from Sylt, Germany [2] https://doi.org/10.5446/69827
- Sample C: K-feldspar (200–300 µm, 10% HF) from Sylt, Germany [2] https://doi.org/10.5446/69828
- Sample D: Quartz (180–200 µm, 40% HF) from Ludwików, Poland [3] https://doi.org/10.5446/69829
- Sample E: Quartz (180–200 µm, 40% HF) from Ludwików, Poland [3] https://doi.org/10.5446/69830

The etching dynamics recorded for these samples demonstrate significant variability in etching depth and rate, with implications for dose rate corrections. The quantitative depth estimates derived from these observations improve the reliability of age calculations in archaeological and geological applications.

Keywords: quartz, feldspar, HF etching, etch depth, etch rate

References

1. Li, Y., Tsukamoto, S., Frechen, M., and Gabriel, G. 2018: Timing of fluvial sedimentation in the Upper Rhine Graben since the Middle Pleistocene: constraints from quartz and feldspar luminescence dating, Boreas, 47, 256–270, https://doi.org/10.1111/bor.12266
2. Reimann, T. and Tsukamoto, S. 2012: Dating the recent past (<500 years) by post-IR IRSL feldspar – Examples from the North Sea and Baltic Sea coast, Quat. Geochronol., 10, 180–187, https://doi.org/10.1016/j.quageo.2012.04.011.
3. Poręba, G., Tudyka, K., Szymak, A., Pluta, J., Rocznik, J., Świątkowski, J., Osadnik, R., and Moska, P. 2022: Evaluating the effect of HF acid etching on quartz grains using microscope image analysis, laser diffraction, and weight loss particle size estimate, https://doi.org/10.2478/geochr-2022-0001.

Feasibility assessment of the application of luminescence methods in forensic geology

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Forensic geology is the study field that applies geological knowledge to aid in solving crimes. Part of its approach involves analyzing samples from different sources and determining their compatibility—this can be particularly useful in identifying a suspect's presence at a crime scene by comparing sediment or soil samples found both at the scene and on the suspect.

Although it is a relatively new area, forensic geology has been successfully employed in criminal investigations since the 20th century and relies on an extensive range of techniques. This work aims to evaluate the feasibility of using optically stimulated luminescence (OSL), thermoluminescence (TL) and infrared stimulated luminescence (IRSL) methods in forensic geology.

Luminescence of quartz (OSL and TL) and feldspar (TL and IRSL) are widely used techniques in geosciences, applied to date sediments and characterize mineral materials based on their light emission after being exposed to ionizing radiation in nature or in the laboratory and "stimulated" by light (OSL and IRSL) or heat (TL). This study seeks to validate the effectiveness of OSL, TL and IRSL of polymineral samples in classifying and distinguishing surface sediments, soils, and street dust from different locations. For this purpose, a systematic sampling grid was established across São Paulo and its metropolitan region. The data collected will support the creation of a map — referred to as the "Lumiscape"— which will present an overview of the luminescent response of the geological materials covering the study area.

So far, a total of 18 soil samples have been analyzed using a quartz OSL sensitivity protocol for polymineral aliquots (Sawakuchi *et al.*, 2018). Six aliquots per sandy sample (180–250 μm fraction) were measured using a Risø TL/OSL reader - model DA-20, equipped with blue and infrared LEDs, β radiation source (~0.07 Gy/s) and a Hoya U-340 filter for light detection in the ultraviolet range (200–400 nm).

Preliminary results showed varying responses to blue OSL (BOSL) and IRSL, revealing differences in both quartz OSL sensitivity and mineral composition (feldspar content). Measures of BOSL of the first second of light emission relative to the total 100s emission (%$BOSL_{1s}$) ranges from 11.27% to 63.87%; $BOSL_{1s}$ ranges from 120 $ctsGy^{-1}mg^{-1}$ to 8348 $ctsGy^{-1}mg^{-1}$ and $IRSL_{1s}/BOSL_{1s}$ proportion varies from 0.16 to 142.33. Up to now, the data obtained helps to display the large variation in the luminescence characteristics of sediments along the State of São Paulo, demonstrating the potential of these techniques in the forensic context.

Keywords: forensic geology, OSL, TL, sensitivity, polymineral

References

1. A.O. Sawakuchi, M. Jain, T.D. Mineli, L. Nogueira, D.J. Bertassoli, C. Häggi, H.O. Sawakuchi, F.N. Pupim, C.H. Grohmann, C.M. Chiessi, M. Zabel, S. Mulitza, C.E.M. Mazoca, D.F. Cunha (2018). Luminescence of quartz and feldspar fingerprints provenance and correlates with the source area denudation in the Amazon River basin. Earth and Planetary Science Letters, v. 49, 152-162 pp.

Infra-red radiofluorescence (IR-RF) stability tests with corrections for sensitivity changes

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The radiofluorescence (RF) emission of K-feldspar centered at ~880 nm is the basis of the IR-RF dating method, a promising method to obtain relatively high equivalent doses of up to 1000–1500 Gy [1]. The main advantage of this method lies in the signal's reported long-term stability, which allows for equivalent dose (D_e) calculation without fading corrections. This is primarily evidenced by several relatively high D_e values obtained from Middle Pleistocene samples or older e.g., [2]. However, very few specific tests for signal stability have been published to date. A study using a gamma-irradiated sample supports the claim of stability up to 1000 Gy but reports instability above this dose [3]. More research is needed to ascertain whether this is a sample-dependent characteristic.

Here, we present a fading test protocol with several beta irradiation and delayed measurement steps (up to ~100 days). Additionally, we present a pulse annealing protocol. Both protocols use the vertical slide correction and reference curves to account for possible sensitivity changes. Since each aliquot undergoes several irradiation and bleaching cycles, quality criteria can be implemented, such as checking for charge carry-over. These approaches will increase our understanding of the possible variability of signal stability and the onset of dose saturation in different samples.

Keywords: feldspar, fading, pulse annealing, sensitivity changes

References

1. Murari, M.K., Kreutzer, S., King, G., Frouin, M., Tsukamoto, S., Schmidt, C., Lauer, T., Klasen, N., Richter, D., Friedrich, J., Mercier, N., Fuchs, M. (2021). Infrared radiofluorescence (IR-RF) dating: A review. Quaternary Geochronology, 64, 101155.
2. Wagner, G.A., Krbetschek, M., Degering, D., Bahain, J.-J., Shao, Q., Falguères, C., Voinchet, P., Dolo, J.-M., Garcia, T., Rightmire, G.P. (2010). Radiometric dating of the type-site for *Homo heidelbergensis* at Mauer, Germany. Proc. Natl. Acad. Sci. 107, 19726–19730.
3. Kreutzer, S., Mercier, N., Lamothe, M. (2022). Infrared-radiofluorescence: Dose saturation and long-term signal stability of a K-feldspar sample. Radiation Measurements, 156, 106818.

OSL Dating Revealing the Depositional Ages of Unconsolidated Sediments in the Southern Serra do Espinhaço, Minas Gerais (Brazil)

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Chemical weathering in tropical climates generates thick profiles, influenced mainly by rock types and climate, although relief, land use and time of exposure of rocks on Earth also play important roles in their development. The resulting weathering profiles are easily transported and deposited in lowland areas by erosional processes and fluvial dynamics, which are affected by climatic, tectonic, and lithological changes [1,2]. This study aims to understand the depositional ages of unconsolidated sediments in the southern Serra do Espinhaço in the state of Minas Gerais (SE Brazil), close to the São Francisco River Basin. The Serra do Espinhaço is primarily composed for Paleo-Mesoproterozoic quartzites, with Neoproterozoic pelites and carbonates. Four unconsolidated deposits were studied and a total of 10 samples were dated by OSL using the SAR method [3]. Deposit 1 possesses ages ranging from 39.0 ± 3.2 to 4.9 ± 0.3 ka, overlain by a massive silt-sand layer dated to 1.9 ± 0.2 ka. Deposits 2 and 4 have ages between 47.5 ± 3.7 and 25.8 ± 2.5 ka, covered by a massive unit dated at 7.6 ± 0.5 ka. Deposit 3 were dated from 18.5 ± 1.1 to 10.4 ± 0.9 ka. Deposit 1 is interpreted as a fluidal sediment flow, while the deposits 2 and 4 are associated with a braided fluvial deposit, being the deposit 3 deposited in a lake environment. The results indicate that between ~ 47 and ~ 39 ka, the climate was drier in the study area. Wetter and cooler climatic conditions prevailed at ~ 26 ka, associated with the beginning of the Last Glacial Maximum (LGM). Subsequently, a transitional phase between dry and humid climates occurred between ~ 19 and ~ 10 ka due to end of LGM and the Heinrich 1 and Younger Dryas events. At ~ 8-7 ka, the sediments overlain the Deposits 2 and 4 were deposited under wetter conditions than the previous period, but the absence of sedimentary structures limits detailed interpretations. Finally, the most recent depositional interval (~ 5-2 ka), found in the overlain of Deposit 1, corresponds to the initial stages of current climatic conditions established from ~ 5 ka.

Keywords: OSL, fluvial sediments, climatic changes, intracratonic tectonics.

References

1. Thomas, M.F. (1994). Geomorphology in the tropics. New York, John Wiley & Sons, 460 p.
2. Campos, D.S., Santos, M., Marques, K.P.P., Silva, A.C., Vidal-Torrado, P. (2023). Impact of tectonic topographic rejuvenation in landscapes with high bedrock/duricrust strength: Insights from geomorphic evidence in a post-rifted region (SE Brazil). Geomorfology, 435, 108749.
3. Wintle, A.G. & Murray, A.S. (2006). A review of quartz optically stimulated luminescence characteristics and their relevance in single-aliquot regenation dating protocols. Radiation Mensurements, 41 (1), 369 – 391

Design and Implementation of an Integrated System for Stimulated Luminescence Analysis in Materials

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The development of integrated luminescence measurement systems is essential for dosimetry and radiation detection applications. In this context, we present LUMI-22, a custom-built, modular system designed for Thermoluminescence (TL), TL spectroscopy, Radioluminescence (RL), RL as a function of temperature, and the implementation of Optically Stimulated Luminescence (OSL). The system incorporates a heating unit based on Kanthal® A1 alloy (FeCrAl), controlled via a microcontroller that regulates temperature ramps (1–5 ºC/s). The RL excitation is provided by an X-ray tube (Moxtek 50 kV, 50 μA), with a sample dose rate of 0.43 Gy/min, while light detection relies on a photomultiplier tube (Hamamatsu H10493-012:HA, 185–850 nm) and a miniature fiber optic spectrometer (Ocean Optics QE65000, 200–1100 nm) coupled with a 1000 μm fiber (QP1000-2-UV-VIS) for TL and RL spectroscopy.
To extend its capabilities, an OSL stimulation system was integrated, employing a 450 nm blue LED (90 mW, 5 mm diameter), controlled via an Arduino UNO and interfaced with LABVIEW software. This enhancement allows for the investigation of luminescence properties in simulated lunar and Martian minerals, provided by NASA, as well as natural minerals such as olivine ($(Mg^{2+}, Fe^{2+})_2SiO_4$), which is found on Earth, Mars, and the Moon and has been studied for luminescence dating. The system's performance was evaluated using Al_2O_3:C, Al_2O_3:C,Mg, and TLD-100 phosphors, well-established materials in dosimetry, with results consistent with literature data.

Keywords: LUMI22, custom-built, Thermoluminescence, Optically Stimulated Luminescence.

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Quartz sensitization trends over geological time in the Northern Andes: insights into quartz OSL sensitivity as a provenance tracer.

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Optically stimulated luminescence (OSL) sensitivity in quartz has emerged as a promising proxy for sediment provenance analysis. The rationale behind its application lies in two key observations: i) quartz OSL sensitivity is low in quartz crystals of igneous and metamorphic source rocks or detrital grains in immature deposits [1], and ii) quartz OSL sensitization in nature is primarily controlled by the rates and intensity of surface processes occurring mainly in sediment source areas [2]. This is evident in modern sedimentary systems, where regions sourcing high-sensitivity quartz are characterized by slow denudation and are composed of sedimentary rocks and cratonic provinces. In contrast, low-sensitive quartz is generally released from regions undergoing rapid denudation, typically composed of crystalline rocks exhumed from deep crustal levels [3].

Within this framework, quartz OSL sensitization trends preserved in the stratigraphic record should reflect major shifts in sediment provenance and long-term recycling, linked to the residence time of sediments on the Earth's surface [4]. To test this, quartz OSL sensitivity measured, at both multigrain and single-grain levels, in Devonian to Pliocene sandstones from the Northern Andes was compared with independent provenance proxies, including zircon U-Pb geochronology, sandstone petrography, and shale geochemistry. The results show that insensitive quartz is associated with source areas characterized by rapid denudation of crystalline and volcanic rocks in both extensional and compressional settings. In contrast, increasing OSL sensitivity corresponds to gradual influxes of sediment from stable cratonic sources, with the highest sensitivity linked to the recycling of sedimentary rocks originally derived from cratonic regions.

These results are consistent with the main shifts in source areas documented in the Northern Andes and align with observations made in Quaternary sediments and modern depositional systems. Consequently, this work reinforces the potential of quartz OSL sensitivity in the sediment provenance analysis, not only in modern sediments but also within sedimentary sequences beyond the Quaternary period.

Keywords: quartz, luminescence sensitivity, provenance, Northern Andes, source areas

References

1. Mineli et al. (2021). Variation of luminescence sensitivity, characteristic dose and trap parameters of quartz from rocks and sediments. Radiation Measurements, 144, 106583.
2. Tanski et al. (2024). Quartz luminescence sensitivity enhanced by residence time in the critical zone. Quaternary Geochronology, 84, 101613.
3. Sawakuchi et al. (2018). Luminescence of quartz and feldspar fingerprints provenance and correlates with the source area denudation in the Amazon River basin. Earth and Planetary Science Letters, 492, 152-162.
4. Ortiz et al. (2024). Tracing uplift and erosion in orogenic settings using quartz luminescence sensitivity: Insights from the Northern Andes uplift.

The chronology of a major channel incision in one of the largest megafans on Earth: the Taquari Megafan in the Brazilian Pantanal

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The active Sedimentary Basin of the Pantanal, located within the Upper Paraguay River Basin, host one of the largest tropical wetlands on Earth. It features a sedimentary succession exceeding 500 meters thick, primarily composed of siliciclastic and psammitic deposits, interbedded with soils and paleosols. These layers serve as valuable records of central South America's Cenozoic environmental and hydrological evolution. The Taquari River, approximately 800 km long, is one of the major tributaries of the Paraguay River and forms a megafan that covers an area of about 50,000 km² across the Pantanal wetland. This study focuses on a 4.2-meter sedimentary section exposed due to fluvial incision near the Coxim city, in Mato Grosso do Sul, Brazil. The site is located where the river is meandering and incised over abandoned lobes, just before transitioning into the distributary system of the megafan. Sedimentary facies, pedological analysis and five Optically Stimulated Luminescence (OSL) age were performed, representing the first chronological framework obtained for the Taquari River. The quartz-rich samples exhibited high OSL sensitivity, well-defined single exponential dose-response curves, and relatively low overdispersion values (11–17%), enabling reliable age estimation using the Central Age Model (CAM). The resulting ages range from 44.15 ± 3.1 to 11.39 ± 0.83 ka and indicate the presence of an erosional unconformity at around 1 meter depth. This feature marks a significant depositional hiatus between ~36 ka and 11 ka. Below the unconformity, the deposits consist of upward-fining fluvial sands with trough cross-bedding and granules in foresets. Toward the upper part of this interval, pedogenic overprinting becomes increasingly intense, culminating in ferricrete formation and the development of an erosional surface on the top. The four OSL ages obtained from this lower section are stratigraphically consistent and suggest a phase of rapid aggradation within the Taquari megafan. The presence of the erosional surface indicates a period of incision, likely driven by climatic shifts between the Last Glacial Maximum and the onset of the Holocene. Above the unconformity, Holocene sands containing ferricrete clasts were deposited. The current entrenched meandering belt, likely formed after ~11 ka in response to channel incision during the early Holocene. This drainage reorganization, also recognized in other Pantanal rivers, is probably linked to regional precipitation and vegetational changes recorded by independent paleoclimatic proxies.

Keywords: Quaternary, active sedimentary basin, wetland, Upper Paraguay River Basin.

Luminescence Dating of Late Quaternary Alluvial Deposits in Nebraska, USA

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This project outlines the characteristics of luminescence dating samples collected from alluvial deposits in Nebraska. Over the past several decades luminescence ages, most of which were dated using OSL, were acquired from alluvium deposited primarily by the larger rivers in the state including the Loup, Niobrara, and Platte Rivers, but also from smaller ephemeral stream systems. Most ages date to the last ~50 ka, with the majority falling within the last ~20 ka. These suites of ages are unfortunately not in most cases supported by independent numerical dating methods, but in many cases the OSL ages are internally consistent and when evaluated using relative dating controls they do appear to provide reasonably accurate age estimates in these settings. Key findings from these chronologies have proven useful in quantifying rates of aggradation in the Platte River system over the last glacial cycle as well as incision in the Niobrara River Valley over the past ~15 ka. While most ages older than ~ 5 ka are only modestly impacted by partial bleaching, younger ages, and particularly those younger than ~1.5 ka are adversely impacted by partial bleaching even when analyzed using small aliquots. Single-grain analyses have been beneficial for dating these younger deposits, but the accuracy of these younger ages are difficult to assess without independent age control.

Keywords: OSL, alluvium, single-grain analysis, ephemeral streams

Contributions of OSL analyses to the characterization of associations between geomorphological transformations and early human occupation in alluvial plain of southeastern Brazil

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In order to expand the knowledge about the interrelationships between ancient dynamics of human occupation and geomorphological changes in southeastern Brazil, OSL analysis (SAR) was performed on sediment samples of quartz taken from excavation units of an archaeological site located on an alluvial plain in the center of the state of São Paulo. The main motivation for using OSL was due to new investigations of the site characterizing the association of flaked rock artifacts with what appeared to be an older and exhumed river terrace, associated with clayey soils formed under conditions of good drainage. This morphosedimentary-pedological-archaeological association proved to be significantly different from that of gravel deposits and sandy soils linked to conditions of poor drainage described as correlatives of lithic artifacts previously recorded at the same site. Nine sediment samples were collected from three new different excavation units, one of which was related to parental materials previously characterized chronologically by two other laboratories, and the other two were linked to the section without previous chronological characterization. The dose recovery test featured almost full agreement between the values of the given dose and the measured doses, with a ratio between measured dose and given doses between 1.03 and 0.99. The samples associated with the previously characterized lower terrace deposits obtained equivalent doses distributed between 8.1 and 7 Gy, and dose rates between 0.80 and 0.65 Gy/ka, leading to the interpretation of ages between 12.3 and 8.7 ka. This is a result quite similar to the chronological data already obtained in the same deposits in previous studies. The samples of parent materials associated with the lower terrace linked to well-drained soils showed equivalent doses between 61.7 and 10.7 Gy, and dose rates between 0.54 and 0.45 Gy/ka, as well as low dispersion (<15%), implying depositional ages between 115 and 18 ka. The integration of the OSL data with the morphosedimentary, pedological, and archaeological data allowed characterizing that the local levels of human occupation occurred at least partially contemporary with the establishment of lower terraces with older (115–18 ka) deposits and paleosols linked to good drainage conditions and higher terraces with newer (12.4–8.0 ka) deposits and paleosols linked to poor drainage conditions. This pattern of connections between terrace levels, soil types, ages of deposits, and human lithic remains is different from that previously registered in the alluvial plains of southeast Brazil.

Keywords: quartz, alluvial plain sediments, geoarchaeology

Pitfalls in deriving quartz OSL relative sensitivity from dating data: causes and solutions

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In recent years we have proposed a new approach to characterize quartz OSL sensitivity for provenance studies using data previously measured for dating purposes [1]. This approach consisted in deriving samples' "quartz OSL relative sensitivity", formerly named $\%BOSL_F$ but now $\%BOSL_{1s}$, from OSL signals recorded over cycles of the Single Aliquot Regenerative (SAR) protocol, which is broadly employed for quartz OSL dating. The $\%BOSL_{1s}$ is given in relative terms (%) because it corresponds to the contribution of the quartz fast component, represented by the net signal within the first second of the OSL stimulation curve (presumably dominated by the fast component), to the net signal recorded over the total stimulation time. We have reported our findings first presenting the idea using only test dose signals recorded over the first SAR cycle signals of fluvial samples [1], then we expanded the study including samples of more varied contexts and demonstrated that, in many cases, all other OSL SAR signals (i.e., from both test (Tx) and regenerative doses (Lx)), could yield samples' $\%BOSL_{1s}$ representative values [2].

The practicability of repurposing existing data (instead of performing new measurements) to obtain useful information for provenance investigations has motivated us and other labs elsewhere to revisit the OSL databases and calculate $\%BOSL_{1s}$ values. In our case, it means that hundreds of samples of varied geological contexts and ages have been characterized in terms of $\%BOSL_{1s}$, giving us the opportunity to test the boundaries of our approach and, thus, to identify some pitfalls. In our experience, most $\%BOSL_{1s}$ data obtained from SAR OSL signals yield trustworthy results, useful to distinguish between samples. However, we have identified cases in which the calculated $\%BOSL_{1s}$ values are unrealistic (e.g., >100%) and/or that do not seem to represent properly the signal being analyzed. Why is that? Why does our approach not seem to work out sometimes? How can we identify and/or avoid problematic cases and, thus, avoid misinterpretations? The objective of this work is to find the reasons why the quartz OSL relative sensitivity derived from signals recorded over SAR cycles may fail. We will present and compare the data (OSL curves and respective $\%BOSL_{1s}$ values) of both successful and off cases, which suggest that the problems we have observed are mainly related to signals characterized by poor signal-to-noise ratios. Finally, we will provide some practical guidelines (i.e., including "filters" in the data analysis R scripts) to identify and reject signals that may jeopardize the analysis outcome. This work is part of the postdoctoral research project under the scholarship FAPESP 2021/14022-2.

Keywords: $\%BOSL_{1s}$, provenance, OSL dating, signal-to-noise ratio

References

1. Souza et al., 2023. Quartz OSL sensitivity from dating data for provenance analysis of pleistocene and holocene fluvial sediments from lowland Amazonia. *Quaternary Geochronology*, *74*, 101422
2. Souza et al., 2024. Using quartz OSL signals from SAR cycles for sediment provenance studies. *Quaternary Geochronology*, *83*, 101574.

Determining the Age of the Camas Prairie Ripples, NW Montana: A Combined Approach of Optically Stimulated Luminescence (OSL) and ^{10}Be Cosmogenic Dating

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The Camas Prairie Ripples, located in NW Montana, are massive ripple-like features that are hypothesized to be the result of glacial outburst flooding from the impounded waters of Glacial Lake Missoula. However, while it is hypothesized these features formed from glacial outburst flooding, there is still a question as to the age and number of flooding events that caused these features. While there are challenges to dating these types of features from high-energy, proximal, and turbid water environments, there have been studies that have attempted to date similar features, with some success, using a combination of OSL and cosmogenic nuclide dating [1,2].

To understand the chronology of these flooding events for these dunes, it is important to sample at key points where stratigraphic evidence indicates conditions that could reflect multiple flooding events or ideal OSL bleaching conditions [3]. It is also important to sample at depth stratigraphically within the feature and at points farther from the ripple structure that represent waning flood stages [3]. The three primary methods of analyses will be: (1) small aliquot and single grain OSL analysis on sand-sized laminated-beds or landform matrix quartz and feldspar minerals; (2) OSL analysis on gravel-sized particles (rock-surface luminescence); and (3) ^{10}Be cosmogenic nuclide dating on gravel-sized particles.

These features are significant in relation to the Quaternary history of Glacial Lake Missoula and the greater Channeled Scablands in the northwestern United States. So, while there is agreement that these features are the result of glacial outburst flooding, this project will put these features' history in the greater context of the formation of the Channeled Scablands and Quaternary geologic history of the area.

Keywords: OSL, cosmogenic dating, glacial outburst flooding, rock-surface luminescence, Camas Prairie Ripples

References

1. DeLong, S., Arnold, A. (2007). Dating alluvial deposits with optically stimulated luminescence, AMS ^{14}C and cosmogenic techniques, western Transverse Ranges, California, USA. Quaternary Geology, 2, 129-136.
2. Owen, L., Caffee, M., Bovard, K., Finkel, R., Sharma, M. (2006). Terrestrial cosmogenic nuclide surface exposure dating of the oldest glacial successions in the Himalayan orogen: ladakh Range, northen India. GSA Bulletin, 118, 383-392.
3. Kalińska, E., Weckwerth, P., Alexanderson, H., Piotrowski, J., Wysota, W. (2025). OSL dating of glacial outburst flood deposits in NE Poland and their bleaching problem inferred from the landform-sediment associations and regional context. Quaternary Research, 124, 26-46.

Luminescence techniques applied to the paleogeographic reconstruction of the Negro River, Amazon

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Fluvial terraces are key geological deposits for reconstructing the Quaternary history of the Amazon. Optically Stimulated Luminescence (OSL) is widely used in studies of river terraces, floodplains, and alluvial fan sequences. Sediment dating using OSL on quartz and post-Infrared Infrared Stimulated Luminescence (pIRIR) on feldspar have significantly expanded the Amazonian chronological dataset. Also, quartz OSL sensitivity has been a useful method for provenance, being able to distinguish Amazonian sediments between orogenic and craton sources. However, terrace outcrops are scarce in the middle reach of the Negro River, western Amazon. To address the lack of chronological data in this region, we conducted an extensive field campaign to collect samples from terraces and floodplains along the middle Rio Negro and its left-margin tributaries: the Jaú, Carabinani, Unini, and Cuiuni rivers. We applied the single-aliquot regenerative-dose (SAR) protocol for OSL dating to ten quartz samples, and the pIRIR at 225 °C ($pIRIR_{225}$) protocol to four feldspar samples. OSL sensitivity measurements were conducted on 17 quartz samples. Quartz samples showed dating challenges due to saturation, feldspar contamination, OSL non fast-component interference, high recycling values (> 10%), and high scatter (> 30%). The fast ratio was incorporated in the analysis to estimate the dominance of the fast component in the OSL signal, while quartz ages were calculated by subtracting both early background and late background. The equivalent dose (De) obtained from quartz OSL measurements ranged from 104 to 132 Gy for terrace deposits, and from 2 to 28 Gy for floodplain deposits. The OSL signal was saturated in three samples from older terraces (considered as minimum ages). Terraces' quartz OSL chronology was complemented by $pIRIR_{225}$ ages of four feldspar samples, which provided $pIRIR_{225}$ De values ranging from 412 to 579 Gy, with g-values between 1.72 and 2.47%. The IR_{50} signals yielded De values ranging from 311 to 417 Gy, with g-values between 4.37 and 6.69%. The corrected ages varied from 302 to 390 ka ($pIRIR_{225}$) and from 332 to 410 ka (IR_{50}). The quartz OSL relative sensitivity in the area is low ($\%BOSL_{1s}$ ~ 20%) but higher in the floodplains of the Rio Jaú and Rio Unini ($\%BOSL_{1s}$ = 36–50%). Since the floodplain deposits are mostly derived from the erosion of Andean-sourced terrace sediments (known to be characterized by low OSL sensitivity), we argue that the relatively higher $\%BOSL_{1s}$ values found in Jaú and Unini floodplain samples are likely due to quartz sensitization from deposition-erosion cycles and the incorporation of sediments from the Prosperança Formation and Jauaperi Metamorphic Suite (characterized by higher quartz OSL sensitivity). OSL ages and sensitivity will allow the interpretation of the region's fluvial dynamics by correlating the depositional ages of terraces/floodplains with Quaternary river changes, helping to improve the knowledge about the paleogeography of the Negro middle river during this period. (FAPESP 2023/10430-4; 2024/07848-0).

Keywords: Quaternary, OSL dating, pIRIR dating, sensitivity, fluvial terraces.

Time-Resolved Infrared Photoluminescence (TR-IRPL) signal via Multi-Elevated Temperature (MET) protocol in amazonite

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Several protocols have been developed for optical dating applications using feldspars. One such protocol is the post-IR IRSL proposed by Thomsen *et al*., (2008) [1] and its modifications such as multi-elevated temperature (MET) approach proposed by Li, B. & Li, S. [2]. Another promising approach utilizes the infrared photoluminescence signal (IRPL). In the subsequent work, Kumar *et al*., (2020) [3] identified two distinct IRPL emission bands centered at ~1.3 eV and ~1.4 eV. Despite representing a significant advancement in optical dating, the origin of these emissions remains unclear.

This study presents preliminary results on the effects of pre-heating on the post-stimulation time-resolved IRPL (TR-$IRPL_{1.3eV}$ and TR-$IRPL_{1.4eV}$) to verify its stability under partial depletion of acceptor-donors' populations in amazonite. Measurements were carried out in a luminescence reader (Risø DA-20), using a $^{90}Sr/^{90}Y$ beta radiation source (dose rate of 0.35 Gy/s). TR-IRPL stimulation was achieved using a 1.5 mW/cm^2, 830 nm TTL modulated IR laser with a ground-glass diffuser to ensure uniform stimulation at the sample position. The TR-IRPL signals were detected using two modes: (i) A red-sensitive Hamamatsu PMT H7421-50 (380-890 nm) with BP880 + LP850 detection filters and (ii) a Hamamatsu H10330C-25 NIR PMT detector using BP950 + LP925 detection filters. Mode (i) captures the $IRPL_{1.3eV}$ emission and mode (ii) captures the $IRPL_{1.4eV}$ emission. The TR-IRPL curves were fitted using an exponential model to calculate the lifetime components. The sample studied was an amazonite crystal, a microcline K-feldspar, ground to powder (< 75 μm) and annealed at 500°C for 1 h.

The TR-IRPL curves were successfully fitted with fast, medium and, slow lifetime components. TR-$IRPL_{1.4eV}$ lifetimes during stimulation (ON-time) were relatively stable following the MET protocol; with characteristic lifetimes of ~24 μs (slow), ~ 4 μs (medium) and ~0.2 μs (fast). In contrast, the TR-$IRPL_{1.3eV}$ lifetimes showed noticeable reductions after heating above 150°C. These supports previous suggestions that TR-$IRPL_{1.4eV}$ and TR-$IRPL_{1.3eV}$ signals originate from distinct sites.

Keywords: Time-resolved luminescence, photoluminescence, feldspar, amazonite, dating

References

1. Thomsen, K. J., Murray, A. S., Jain, M. & Botter-Jensen, L. (2008). Laboratory fading rates of various luminescence signals from feldspars-rich sediments extracts. Radiation Measurements, 43(9-10), 1474-1486.
2. Li, B. & Li, S. (2011). Luminescence dating K-feldspar from sediments: A protocol without anomalous fading correction. Quaternary Geochronology, 6, 468-479.
3. Kumar, R., Kook, M. & Jain, M. (2020). Understanding the metastable states in K-Na aluminosilicates using novel site-selective excitation-emission spectroscopy. Journal of Physics D: Applied Physics, 53.

Uncovering Hidden Histories: Chronological Analysis of Providence Island Occupation Using Single-Grain Luminescence Dating

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In 1822, free Black Americans escaping racial prejudice established, with the support of the American Colonization Society, a settlement on Providence Island, Liberia [1]. While limited documentation of prior occupations on the island exists, local oral traditions suggest that Indigenous peoples inhabited the area long before the arrival of these settlers. This raises an important question: *Is Providence Island's historical significance to Liberia rooted solely in its association with the settlement and later nation, or has it long been a vital location for local communities?* In 2018, the inception of the Back-to-Africa Heritage and Archaeology (BAHA) initiative aimed to shed light on the historical narratives of Black Americans and their contributions to the cultural and historical fabric of Liberia.

Since then, multiple excavation seasons have led to the discovery of imported and locally-made ceramics, providing invaluable data to explore the multiple pasts of this significant heritage site. Utilizing Optically Stimulated Luminescence (OSL) techniques, we aimed to determine whether these artifacts predated the Black American freetown settlement or if they are remnants of an overlooked indigenous group. Due to the site's young target age (~200 years), it was necessary to develop a robust methodology for deriving the equivalent dose of our samples. Single-grain OSL measurements using the single-aliquot-regenerative dose (SAR) protocol [2] were applied to quartz from both sediment samples and associated ceramic fragments to assess luminescence signal detectability and directly determine depositional age. In our presentation, we will discuss the challenges encountered while working with young sediments and the strategies employed to overcome these obstacles to obtain final ages.

Keywords: Liberia, OSL, Single-grain, Young quartz, Pottery

References

1. Reilly, M. C., Banton, C. A., Stevens, C., & Laurore, C. L. (2024). The Archaeology of Providence Island: Liberian Heritage beyond Settlement. American Antiquity, 89(4), 647–663. https://doi.org/10.1017/aaq.2024.46
2. Murray, A. S., & Wintle, A. G. (2000). Luminescence dating of quartz using an improved single-aliquot regenerative-dose protocol. Radiation Measurements, 32(1), 57–73. https://doi.org/10.1016/S1350-4487(99)00253-X

OSL dating applied to the paleodunes of the Middle Rio Negro, Northern Amazon, Brazil

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OSL dating has been highly effective for establishing Late Quaternary chronologies in Brazil, particularly in tropical regions where radiocarbon dating is limited by poor organic matter preservation. This limitation is especially pronounced in the Amazon lowlands due to high temperatures and rainfall. However, the abundance of quartz in fluvial and aeolian sediments makes OSL a suitable method in the region (1,2).

In the present study paleodunes samples collected in the Middle Rio Negro region (Brazil) were dated using Optically Stimulated Luminescence (OSL) method with Single-Aliquot Regenerative dose (SAR) protocol (3). The results revealed identification of two distinct phases of dunes deposition: an older phase, ranging from 169.74 ± 1.01 ka to 124.38 ± 0.91 ka, and a more recent phase, from 18.89 ± 0.88 ka to 14.75 ± 0.77 ka; the equivalent doses were determined using the Central Age Model, with overdispersion from 18 to 27% and annual dose rates were low due to the lack of K-40, ranging from 0.25 to 0.57 Gy/ka. The older interval represents the first reported in the Amazon, with no previously documented correlated sediment. In contrast, the younger phase correlates to the interval of paleo-dune fields of the region called "dry corridor" during the Late Pleistocene - Holocene. The genesis of paleodunes was associated with the results of the reworking of alluvial deposits of the Negro and Demini rivers, due to the seasonality of the rivers in the Pleistocene-Holocene. Work financed by FAPESP (2022/15495-4)

Keywords: OSL, quartz, paleodunes, Amazonia

References

1. Tatumi S.H., Rossetti D.F, Soares E.A.A. (2020), Optically Stimulated Luminescence (OSL) Dating in the Amazonian Wetlands, Cambridge Scholars Publishing, UK.
2. Souza, P. E., Pupim, F. N., Mazoca, C. E.M., Río, I. del, Mineli, T. D., Rodrigues F.C.G., Porat N., Hartmann G. A., Sawakuchi A.O.(2023). Quartz OSL sensitivity from dating data for provenance analysis of pleistocene and holocene fluvial sediments from lowland Amazonia, Quaternary Geochronology,Volume 74,101422
3. Wang, X.L., Wintle, A.G., Adamiec G. (2012). Improving the reliability of single-aliquot regenerative dose dating using a new method of data analysis, Quaternary Geochronology, 9, 65-74.

Exploring the potential of planktonic foraminiferal thermoluminescence for reconstructing sea surface temperature

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Luminescence emitted by minerals has long been used in paleoenvironmental studies. In particular, thermoluminescence (TL) emitted by carbonates has been the focus of several investigations. The crystallization temperature of calcite controls the type and quantity of defects in the crystal lattice, which may act as charge traps responsible for TL emission. This relationship suggests that TL emission could serve as a proxy for calcite crystallization temperature. It is believed that the presence of impurities substituting Ca in calcite (e.g., Mg, Mn, Sr) plays a role in the charge trapping-recombination processes responsible for the intensity of TL from calcite. Previous works suggest that the amount of impurities correlates directly with crystallization temperature, where calcite formed at higher temperatures tends to incorporate more impurities and exhibit higher TL compared to those formed at lower temperatures. Here, we investigate whether the TL intensity emitted by the calcite of the planktonic foraminifera *Globigerinoides ruber white sensu stricto* (250-350 μm) can serve as a proxy for sea surface temperature in the range below 30°C. The hypothesis is based on two key points: (i) the incorporation of Mg during calcite crystallization is temperature-dependent and influences charge traps and/or recombination centers responsible for TL emission, and (ii) the incorporation of Mg in planktonic foraminiferal calcite (estimated through the Mg/Ca ratios in their shells) is also temperature-dependent, with higher calcification temperatures leading to higher Mg/Ca ratios. Consequently, changes in local calcification temperature may alter the TL signals of foraminifera. To test this hypothesis, the TL sensitivity (light emitted per unit mass and unit radiation dose) of *G. ruber white sensu stricto* from marine sediment core CDH-89 (western equatorial Atlantic) is being analyzed and compared to previously published Mg/Ca-based sea surface temperature (SST) data from the same core. TL sensitivity was measured on three aliquots per sample, each containing 10 powdered foraminiferal shells. Measurements were performed in an automated Risø TL/OSL reader DA-20 with a built-in $^{90}Sr/^{90}Y$ beta source (0.063 Gy/s), photomultiplier and a BG39 filter for light detection in the blue band. Analyses were carried out at the Luminescence and Gamma Spectrometry Laboratory (LEGaL), Institute of Geosciences, University of São Paulo, Brazil. The measurement protocol included the following steps: TL until 250°C, irradiation dose of 200 Gy, TL until 250°C, TL until 400°C, irradiation dose of 200 Gy and TL until 400°C. TL was performed with a heating rate of 0.5 °C/s. The resulting TL glow curves consistently displayed two prominent peaks around 65 °C and 110 °C, both of which were used to calculate TL sensitivity. The results suggest a positive correlation between TL sensitivity and SST; however, further systematic testing is needed to confirm these observations.

Keywords: Development of proxy, thermoluminescence, sea surface temperature, foraminifera.

Chronology and provenance of the São Francisco River mouth eolian system by quartz optically stimulated luminescence (OSL)

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The coastal plain associated with the São Francisco River (SFR) mouth is home to the largest active and inactive dune fields related to the arrival of a big river on the eastern Brazilian coast. The SFR drains a large area (600.000 km²) in Eastern South America with latitudes ranging from 7º to 23ºS. The main aim of this work is to investigate how changes in precipitation, relative sea level (RSL), and coastline direction influence the fluvial sediment input and, consequently, coastal eolian supply. The following methods were applied: (a) mapping of eolian units (generations); (b) establishing the chronology of the eolian deposits of different generations by quartz optically stimulated luminescence (OSL) ages determined using the single-aliquot regenerative dose protocol in multigrain aliquots (180-250 microns); (c) Bayesian modeling of OSL ages; (d) characterizing sand provenance using quartz OSL sensitivity (first second of light emission, 180-250 microns).

Four eolian generations (G1, G2, G3, G4) were identified. They include not only dunes, but also sand sheets formed by the surface reworking of the coastal sand barrier formed during Marine Isotopic Stage (MIS) 5e. G1 includes the eolian sand sheets over the MIS5e barrier and dune fields that climbed sea cliffs carved on the Barreiras Formation (Miocene). Quartz OSL ages varied between 18.7 and 13.5 kyr. Its formation may have occurred during the Last Glacial Maximum (LGM) when the coastline was dozens of kilometers away and climate conditions were dryer. Subsequent increase in precipitation during Heinrich Stadial 1 (HS1) led to the stabilization of G1 sand sheets. G2 is composed of foredune ridges with ages ranging from 7.6 to 4.3 kyr. It was formed during the Mid-Holocene stabilization of RSL, combined with wetter conditions in the SFR basin, that led to an increase in the fluvial sand input. This favored progradation over coastal eolian supply. G3 corresponds to inactive dune fields with OSL ages between 3.7 and 0.7 kyr, while G4 is the active dune field. Both were formed when dryer conditions downstream the basin led to a decrease in fluvial sand input to the coastal system and, hence, a reduction in the progradation rate and increase in the eolian sediment supply.

The quartz OSL sensitivity measured in sediments of the SFR and different eolian generations show that throughout the Holocene, there was an increase in fluvial input from the upstream sector of the basin (higher sensitivity) at the expense of the downstream sector (lower sensitivity). With the strengthening of the Nordeste Low, downstream sectors of the basin became drier during the Late Holocene, which led to a decrease in the fluvial sand input.

In conclusion, variations in the input of sandy sediments to the coastal eolian system controlled the development and morphology of the system. These variations, in turn, were influenced both by local factors, such as changes in coastline direction and net longshore drift, and by regional factors mainly associated with changes in precipitation patterns within the SFR basin from the LGM to the Holocene.

Keywords: coastal dunes, quartz sensitivity, precipitation, northeastern Brazil

A standard for quartz luminescence sensitivity sediment provenance analysis: testing quartz and feldspar candidates

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The optically stimulated luminescence (OSL) and thermoluminescence (TL) sensitivities (light intensity per unit mass per unit radiation dose) of quartz have been successfully used to track sediment sources areas, which is known as "sediment provenance analysis". The OSL and TL sensitivities of quartz sediment grains can vary by several magnitude orders from igneous or metamorphic rocks to mature quartz-rich sands, which allow discriminating sediments with different origins.

Evaluating quartz OSL and TL sensitivity results obtained using different luminescence readers and laboratories is essential with the increasing advancement of regional and global geological studies on sedimentary systems. Thus, it is important to use a standard sample for reporting of OSL and TL sensitivities due to variation in light detection in different readers.

An ideal sample used as standard should be homogeneous, accurate and reproducible regarding OSL and TL sensitivities. This sample should also be easy to obtain through time and in sufficient quantity for distribution.

In a previous work, we have evaluated the use of bright quartz as a standard for sensitivity measurements. A major drawback of the tested bright quartz is the significant variation of OSL and TL sensitivity among aliquots of the same sample, which difficulties the obtention of homogeneous standard. Now, we evaluate the use of feldspar as a standard for OSL and TL sensitivities measurements in quartz. The main advantage of feldspar is the relatively higher homogeneity of its infrared stimulated luminescence (IRSL) compared to quartz OSL or TL.

This work involves testing of feldspar samples from the sediment dating database of the Luminescence and Gamma Spectrometry Laboratory (LEGaL) at the University of São Paulo and feldspar samples from granites of the São Paulo State. Thus, a sensitivity index relative to the standard could be calculated by comparing OSL or TL sensitivity of quartz samples to IRSL or TL sensitivity of a feldspar standard sample. This includes the evaluation of homogeneity and stability of feldspar luminescence signals. Feldspar and quartz luminescence data will be compared in terms of their advantages and drawbacks for use as a standard. This study will propose a standard sample capable of globally comparing quartz luminescence sensitivity measurements used in sediment provenance analysis.

Keywords: Luminescence sensitivity, quartz, feldspar, OSL, TL

LSED by AGES-TRaCE: An open access info and tool repository for luminescence surface exposure dating

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Luminescence surface exposure dating is a developing geochronology technique that offers the ability to determine the exposure age of rock surfaces, yet the lack of public resources on how to perform the technique have provided a barrier in its development, use and growth. A public repository, *LSED by AGeS-TRaCE*, funded by the Geological Society of America, offers easily accessible resources and tools needed to perform and propose luminescence surface exposure dating applications. Specific items currently available in the repository are codes which can extrapolate spatially resolved datasets into luminescence depth profiles, as well as tools for fitting age models and retrieving associated luminescence parameters from depth profiles. Users are invited to contribute with their own analytical codes to the user moderated repository. The repository adheres to BaJEDI (Belonging, Justice, Equity, Diversity and Inclusion) principles, currently endorsed by the AGeS-TRaCE program, in making geochronology tools and information accessible across all educative and professional formats.

Keywords: exposure dating, spatially resolved luminescence, imaging, depth profile, BaJEDI

References

1. https://github.com/bencht24/LSED/wiki

Exploring the Landscape Innovation of Las Mesillas, Oaxaca, Mexico, through Single Grain Optically Stimulated Luminescence

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In the Oaxaca Valley of Mexico, the Indigenous Zapotec civilization prospered from 500 B.C.E. to 800 C.E. [1]. Recent excavations exposed extensive prehispanic structures in the rural southern mountains of Oaxaca from the ancient village of Quiechapa. Despite its small size, evidence suggests that the inhabitants of Quiechapa fortified their community and erected architectural monuments over several generations. The hypothesis is that these efforts enabled Quiechapa to endure the turbulent period surrounding the fall of Monte Albán and continue to thrive afterward. An example of this type of resilient architecture is the monumental structure "Las Mesillas," which underwent a fortification period and is the subject of the present study. Within this structure, six sediment samples were collected from Operation A) a mounded architecture and internal patio (2007 m a.s.l) and Operation B) an elevated platform atop a fortified terrace (1953 m a.s.l).

These sediments were prepared and analyzed for single-grain optically stimulated luminescence dating, a technique particularly adapted to establish the chronology of architectural structure by dating the last time mineral grains contained in the sediment were exposed to light. In the luminescence dating laboratory, the sediment samples were first analyzed for granulometry and mineralogical and geochemical analysis. Equivalent doses (De) were determined using a single-aliquot regenerative-dose (SAR) protocol [2] for OSL on quartz single grains. Dose rates (Dr) were calculated from the radionuclide concentrations of the sediments, as measured by Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The burial age of the sediment samples was computed utilizing the Dose Rate Age Calculator (DRAC), by the ratio De/Dr [3]. At the symposium, we will present the OSL analyses and discuss the ages of the Las Mesillas fortification in its historical context.

Key Words: Mexico, Zapotec, OSL, Quartz, Single-grain

References

1. Winter, Marcus. (2001) Palacios, templos y 1300 años de vida urbana en Monte Albán. Reconstruyendo la ciudad maya: El urbanismo en las sociedades antiguas, 2001, pp. 277-301. Sociedad Española de Estudios Mayas.
2. Murray, A. S., & Wintle, A. G. (2000). Luminescence dating of quartz using an improved single-aliquot regenerative-dose protocol. Radiation Measurements, 32(1), 57–73. https://doi.org/10.1016/S1350-4487(99)00253-X
3. Durcan, J. A., King, G. E., & Duller, G. A. T. (2015). DRAC: Dose Rate and Age Calculator for trapped charge dating. Quaternary Geochronology, 28, 54-61. https://doi.org/10.1016/j.quageo.2015.03.012

Quartz luminescence sensitization in a soil profile from eastern Amazonia upland forest

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Brazilian biomes display differences in biota acting on soil mixing and biomass available for burning (e.g. shrublands and grasslands). Both soil mixing and biomass burning are presumably related to sensitization of quartz blue optically stimulated luminescence (BOSL) and thermoluminescence (TL) in the soil profile. As a first approach to evaluate the quartz BOSL and TL sensitization in soils, this work focuses on quartz fine sand grains (180-250μm) retrieved from a top hill soil profile over a gneiss-migmatite bounding the Xingu River in eastern Amazonia, Brazil. The profile was sampled until 1.33 m depth and 23 samples were collected with a manual auger, including one sample from the gneiss-migmatite parent rock underneath the soil. The extraction of pure quartz grains included sieving, treatment with H_2O_2 35% and HCl 10%, density separation with lithium metatungstate (LMT) solutions at 2.62 and 2.75 g/cm^3, treatment with with HF 40% for 40 min with additional HF 10% (12 h) if a significant infrared stimulated luminescence (IRSL) signal was observed and an additional HCl 10% wash, to eliminate possible fluorides formed as product of HF treatments.

The results of infrared stimulated luminescence (IRSL) in the quartz concentrates fall in the background level, indicating absence of feldspar contamination. BOSL of the first second of light emission relative to the total 100 s emission (%$BOSL_{1s}$) ranges from 2% to 85% for quartz crystals from the gneiss-migmatite and quartz grains from the soil sample at 0.65m depth, respectively. Quartz BOSL1s ranges from 9 $ctsGy^{-1}mg^{-1}$ (gneiss-migmatite) to 4,000 $ctsGy^{-1}mg^{-1}$ (soil sample at 0.12m depth) while the TL110 ºC peak sensitivity varied from 48 $ctsGy^{-1}mg^{-1}$ (gneiss-migmatite) to 35,000 $ctsGy^{-1}mg^{-1}$ (soil sample at 0.78m depth). We found an upward increasing trend in the mean values of the $BOSL_{1s}$ and TL110 ºC sensitivity, both in relative and absolute sensitivity.

Quartz grains from five samples were tested for thermal stability of the $BOSL_{1s}$ signal: 0.07 m, 0.43 m, 0.95 m, 1.33 m depth and the gneiss-migmatite. The shallower soil sample has a stable BOSL corrected signal (BOSLc, Lx/Tx) signal until 260 ºC, while the BOSLc of the other samples is thermally stable until 240 ºC and BOSLc of quartz from the gneiss-migmatite is stable until 220 ºC. The thermal stability curves are more related to sensitization by heating, as evidenced by an abrupt decrease in BOSLc versus temperature [1].

Preliminary results indicate quartz OSL and TL sensitization by heating due to wildfire events in the Amazon biome. Importantly, the samples were collected *in situ*, thus the grains were submitted only to local sensitization processes (e.g. bioturbation, soil residence time, wildfire heating). Differences in the thermal stability of the BOSLc signal might indicate sensitization process, along with soil evolution, presenting a potential proxy for increase of sensitivity related to natural heating.

Keywords: sensitivity, OSL, soil, wildfire, Amazon

References

1. Moayed, N.K., Fattahi, M., Autzen M., Haghshenas, E., Tajik, V., Shoaie, Z., Bailey, M., Sohbati, R., Murray, A.S. (2024) The sensitisation of quartz extracted from andesite. Radiation Measurements 170, 107048. https://doi.org/10.1016/j.radmeas.2023.107048

OSL dating of the Paleoflood sediments of the Yihe-Shuhe River, East China and archaeological implication

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The Haidai and Dongyi cultures, deeply rooted in the history of Shandong Province, East China, form a significant part of ancient Chinese civilization. A prime example of their influence is evident in the Yihe-Shuhe River Basin. This area, rich in cultural heritage, also witnessed the mysterious decline of the Longshan Culture around 4,000 years ago (4 ka). Until now, this decline is puzzling, partly due to the scarcity of abnormal flood records in prehistoric times and a lack of extensive research into the chronology and paleoclimatology of the sediments found here. To shed light on this enigma, we conducted an intensive study of several natural sections near key Longshan historical ruins. Luminescence dating reveals that the quartz in the Yihe-Shuhe River Basin emits a strong luminescence signal. This signal fades to background levels within about one second of stimulation, a characteristic suggesting that quartz dating here is reliable. Interestingly, luminescence dating of the Hantou section hints at possible flood events spanning the entire Holocene. However, our preliminary reconstruction of the Holocene flood records in the Yihe-Shuhe River Basin provide only weak supporting evidence of a significant paleoflood around 4 ka that could explain the abrupt decline of the Longshan culture. This intriguing gap in our understanding underscores the need for further research in this captivating area of ancient Chinese history.

Keywords: OSL, Paleoflood sediments, Yihe-Shuhe River, 4 ka Event

Quartz luminescence characteristics of modern Yangtze River sediments and their implications

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The luminescence signals of mineral grains hold significant potential for tracing sediment provenance and understanding transport processes in fluvial systems. In this study, we analyzed the spatial distribution of luminescence sensitivity in 33 modern riverbed samples along the middle to lower reaches of the Yangtze River. Coarse-grained quartz (180–250 μm) was measured using a single-grain EMCCD imaging system. Our results reveal a distinct increase in luminescence sensitivity downstream of the Three Gorges Dam (from Zhicheng to Dongting Lake), followed by a gradual decline towards the delta. The middle-lower reaches are dominated by low luminescence sensitivity quartz, with 30–60% of grains exhibiting sensitivities below 1 count/Gy. Only ~10% of grains show sensitivities above 10 counts/Gy; however, these high-sensitivity grains contribute 80–90% of the total luminescence signal. Comparison with luminescence data from Holocene deltaic deposits suggests that the midstream enrichment of high-sensitivity quartz is primarily driven by erosion and sediment remobilization induced by the Three Gorges Dam. This study demonstrates the utility of quartz luminescence sensitivity as a sensitive tracer of sediment pathways and showcases the potential of EMCCD-based luminescence techniques in large river systems affected by human modifications.

Keywords: Luminescence sensitivity, Yangtze River, Sediments provenance, Three Gorges Dam, EMCCD

Luminescence of detrital quartz and feldspar to track provenance of the upper Juruá River deposits, western Amazonia

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The Juruá River is one of the largest meandering rivers in the world, flowing northward through the southwestern Amazonian lowlands. Luminescence analysis was performed on detrital quartz and feldspar to discriminate sediments from different provenances collected from fluvial terraces and floodplains of the upper Juruá River. Our continuous wave (CW) blue optically stimulated luminescence (BOSL) sensitivity measurements identified sands (180-250 μm) with $\%BOSL_{1s}$ ranging from 5 to 48% in polymineral and from 22 to 43% in pure quartz aliquots. The $\%BOSL_{1s}$ in pure quartz aliquots correspond to $BOSL_{1s}$ between 9 x 10^4 and 2 x 10^5 cts mg^{-1} Gy^{-1}. Tukey test following ANOVA to evaluate differences in $\%BOSL_{1s}$ values of polymineral aliquots indicates significant differences among samples (p=0.001). A strong positive correlation (r=0.93) was found between the sensitivity of $\%BOSL_{1s}$ of polymineral and $\%BOSL_F$ of pure quartz. The sensitivities of the thermoluminescence 110^0C peak ($\%TL_{110^0C}$) and $\%BOSL_{1s}$ measured in polymineral aliquots were positively correlated (r=0.86). Infrared stimulated luminescence (IRSL) measurements were performed in polymineral aliquots to appraise the relative concentration of feldspar. The $\%IRSL_{1.2s}$ and $\%BOSL_{1s}$ (after IRSL) show an inverse relationship (r=-0.66), indicating that higher feldspar content is related to quartz with higher $\%BOSL_{1s}$. This relationship also suggests that higher mineralogical maturity sediments (lower feldspar content) host quartz with higher $BOSL_{1s}$ sensitivity pointing to sediments produced from different source rocks, varied weathering conditions or a combination of both. We also tested the thermal stability of the $BOSL_{1s}$ signal using five pure quartz samples. All samples show a thermally stable fast OSL component to preheat temperatures up to 260^0C. Additionally, we measured the LM-OSL of quartz from samples representative of the observed range of $BOSL_{1s}$ sensitivity. When comparing higher sensitivity samples with those of lower sensitivity, the corresponding LM-OSL curves revealed a higher contribution of medium and slow components for the latter. All LM-OSL curves show stable fast components, as demonstrated by the thermal stability tests, suggesting the sensitization of all quartz samples by heating. Overall, we found significant variations in the quartz luminescence sensitivity and feldspar content of the analysed sediments indicating diverse sources for the Juruá River deposits, that may be linked to provenance of Andean (low $\%BOSL_{1s}$, and high $\%IRSL_{1.2s}/BOSL_{1s}$), Cratonic (high $\%BOSL_{1s}$ and low $\%IRSL_{1.2s}/BOSL_{1s}$) and Mixed (medium $\%BOSL_{1s}$ and $\%IRSL_{1.2s}/BOSL_{1s}$) sources. These results may have implications in using quartz and feldspar luminescence as a proxy for understanding the fluvial paleogeography that influences and contributes to the stratigraphic record in western and central Amazonia.

Keywords: Luminescence sensitivity, Sediment Provenance, Upper Juruá River, Thermal stability.