

Scientific researcher III Dr. Daniela Constantin-narrative CV

Tapping into quartz light to refine the precision and accuracy of geochronology worldwide

Daniela Constantin is a scientific researcher level III at the Environmental Radioactivity and Nuclear Dating Centre at Babeş-Bolyai University (BBU) in Cluj-Napoca, Romania. She developed an early interest in luminescence techniques and their applications in environmental sciences starting at the bachelor level at the Luminescence Laboratory at the Environmental Radioactivity and Nuclear Dating Centre at Babeş-Bolyai University. She began by using thermoluminescence (TL) for measuring environmental radioactivity doses and during master's she proceeded to optically stimulated luminescence (OSL) techniques applied to date quartz extracted from a variety of Quaternary sediments in Romania. She earned her Ph.D. in geology in 2015 with a thesis focused on establishing an absolute chronology framework for loess deposits in Romania. This is imperative for securely constraining the timing of major Late Quaternary paleoclimate fluctuations recorded in loess-paleosol alternations. These studies also proved the occurrence at large spatial scale of a phenomenon firstly reported in the literature on two loess sites in Romania. That is a discrepancy in the luminescence ages yielded by different grain-sizes of quartz extracted from the same sample, for ages beyond 40 ka. Thus, Daniela Constantin was involved in novel methodological investigations into the luminescence properties of quartz and reported natural luminescence dose response curves and their divergence from the laboratory constructed dose response curves. Such studies are extremely rare in luminescence dating. Daniela Constantin carried out the above work during her master and PhD as part of the young teams research project "*Dating the Romanian Part of the European Loess Belt Using Luminescence*" lead by Alida Timar-Gabor at Babeş-Bolyai University. As a postdoctoral researcher in the European Research Council (ERC) Starting Grant „*INTERTRAP-Integrated dating approach for terrestrial records of past climate using trapped charge methods*”, awarded to Alida Timar-Gabor and implemented at the Babeş-Bolyai University, Daniela Constantin was in charge of the application part of the project which involved dating the Pleistocene-Holocene climatic transition using the magnetic susceptibility signal as a paleoclimate proxy in loess sites from China, Europe and North America. Daniela Constantin and team members reported that the magnetic susceptibility signal increased gradually from the Pleistocene loess to the Holocene soil. The initiation of magnetic susceptibility enhancement and consequently the onset of Pleistocene-Holocene climatic transition was dated prior to ~11.7 ka, around 14–17.5 ka and was not synchronous among all of the investigated sites. The timing of this transition generally agreed with the ~17.5 ka date for Termination 1 in oxygen isotopes record in marine sediments from North Atlantic and to the global sea-level rise event Meltwater Pulse 1A dated to 14.7 ka. The high-resolution ages on quartz proved the continuity of dust accumulation over the Last Pleistocene loess deposition into Holocene soil

formation. This provided empirical evidence, for the first time in the literature, of accretionary pedogenesis in Holocene topsoil in loess sites at mid-latitudes, with important implications for the interpretation of magnetic susceptibility and other paleoclimatic proxies.

During the INTERTRAP project, an extremely novel sampling strategy was adopted by collecting doublet coeval samples, which allowed the observation of unexpected differences in the luminescence results. This inspired Daniela Constantin to investigate the variability in the luminescence ages by applying a novel sampling strategy involving multiple coeval sediment samples, in the postdoctoral research grant PRECLUM “*To what extent can uncertainties on luminescence ages be reduced: a field study on the variability of ages obtained on coeval sedimentary samples*” having Alida Timar-Gabor as mentor. This was the first empirical dataset obtained on luminescence ages of multiple coeval samples and revealed that the scatter in the ages is dictated by the scatter in the environmental radiation dose rates. The novel sampling strategy allowed to quantify a maximum attainable precision of 1.1% (0.5 ka) using quartz luminescence in a sedimentary context dated to ~40 ka. These empirical data confirmed that obtaining a total uncertainty below 5-6 % for an OSL age is very difficult and might indicate an underestimation of the systematic sources of uncertainty.

Apart from her work involving dating applications on quartz extracts, Daniela Constantin has a constant interest for understanding the fundamental processes related to the luminescence signals in quartz as well as acquiring new skills and learning new techniques. She is able to pursue these interests as a team member in the European research Council (ERC) Consolidator Grant, awarded to Prof. Alida Timar-Gabor, “*PROGRESS - Reading provenance from ubiquitous quartz: understanding the changes occurring in its lattice defects in its journey in time and space by physical methods*”. She currently explores the potential of the quartz luminescence sensitivity as indicator for the provenance of sediments.

The research conducted by Daniela Constantin materialized in 1 article in a journal ranked in Q1 and 2 articles in journals ranked in Q2 published as main author in the last 5 years. She has an *h*-index=12 and 497 citations according to Google Scholar. She is a reviewer for the major journals in the luminescence dating field, e.g., Quaternary Science Reviews, Quaternary Geochronology, Radiation Measurements. Besides research activities Daniela Constantin enjoys teaching and working with students. She has been a member in the guidance committee of 7 PhD students, co-supervised 4 master and 2 bachelor theses. Daniela Constantin built her entire academic career at the Environmental Radioactivity and Nuclear Dating Center at Babeş-Bolyai University and valued national and international collaborations as reflected by the diversity of co-authors in her publishing record.

Annex- Career timeline and listed achievements

Personal Information

Family name, First name: **Constantin Daniela**

Date of birth: 12 February 1987

Researcher unique identifier(s) ORCID 0000-0003-0060-371X, Scopus ID 55323653200,

Google Scholar: <https://scholar.google.com/citations?user=qdpmVhYAAAAJ&hl=en>

h-index=12 (since 2019)

Education

2015: PhD in geology, Babeş-Bolyai University, Cluj-Napoca, Romania, supervised by Prof. Dr. Codrea Vlad. PhD thesis title: *“On the dating of the last glacial cycle in loess deposits using quartz optically stimulated luminescence.”*

2012: Master’s degree, Faculty of Environmental Science and Engineering, Babeş-Bolyai University, Cluj-Napoca, Romania. Master thesis title: *“SAR-OSL dating of a sedimentary section in southern Romania interbedding the Campanian Ignimbrite/Y5 ash layer”* Supervisor: Prof. Dr. Alida Timar-Gabor.

2010: Bachelor’s degree in environmental science, Faculty of Environmental Science and Engineering, Babeş-Bolyai University, Cluj-Napoca, Romania.

Current positions

2016-present: Scientific researcher III, Environmental Radioactivity and Nuclear Dating Center at the Institute for Interdisciplinary Research in Bio-Nano-Sciences, Babeş-Bolyai University, Cluj-Napoca, Romania.

2023-present: Postdoctoral researcher in European research Council (ERC) Consolidator Grant 101043356, HORIZON EUROPE, *„PROGRESS - Reading provenance from ubiquitous quartz: understanding the changes occurring in its lattice defects in its journey in time and space by physical methods”*, 2023-2027, awarded to Prof. Alida Timar-Gabor.

Previous positions

2020-2022: Principal Investigator of the project *“PRECLUM - To what extent can uncertainties on luminescence ages be reduced: a field study on the variability of ages obtained on coeval sedimentary samples. UEFISCDI PN-III-P1-1.1-PD-2019-0895”*. Mentor Prof. Alida Timar-Gabor.

2016-2020: Postdoctoral researcher in „*INTERTRAP- Integrated dating approach for terrestrial records of past climate using trapped charge methods*”, 2016-2021, European Research Council (ERC) Starting Grant 678106, HORIZON 2020, awarded to Prof. Alida Timar-Gabor.

2019-2020: Postdoctoral researcher in the project “*Cave deposits as archives of climate and environmental changes. A Center of Excellence in speleological research*”, EEA-RO-NO-2018-0126 lead by. Dr. Silviu Constantin.

2016–2020 (intermittently): Postdoctoral researcher in Premiarea H2020 “*Integrated absolute dating approach for terrestrial records of past climate using trapped charge (INTERTRAP)*”. UEFISCDI PN-III-P3-3.6-H2020-2016-0015 lead by Prof. Dr. Alida Gabor

2015–2016: Postdoctoral researcher in the project “*Habitat, environment and natural resources in the Lower Danube Basin in pre- and proto-history.*” UEFISCDI PN-II-PT-PCCA-2013-4-1308 lead by Acad. Dr. Alexandru Vulpe.

2011–2014: Assistant researcher in “*Dating the Romanian Part of the European Loess Belt Using Luminescence.*” TE/ CNCS-UEFISCDI PN II-RU-TE-2011-3-0062 lead by Dr. Alida Timar-Gabor.

Supervision of graduate students

Member in the guidance committee of doctoral students (year of graduation given in brackets): Avram Anca (2021), Laura del Valle Villalonga (2021), Tecşa Viorica (2020), Groza Mădălina (2020), Grecu Şerban (currently), Pănescu Vlad (currently), Kelemen Szabolcs (currently). Co-supervisor of 2 bachelor and 4 master`s dissertations.

Reviewing activities

Reviewer in relevant journals in the field of luminescence dating: Quaternary Science Reviews, Radiation Measurements, Quaternary Geochronology, Palaeoecology Palaeoclimatology Palaeogeography, Catena, Geochronometria and Quaternary International.

Memberships of scientific societies

Member of European Geosciences Union (EGU),

Scientific research grants

PI in “PRECLUM - To what extent can uncertainties on luminescence ages be reduced: a field study on the variability of ages obtained on coeval sedimentary samples” *grant*, UEFISCDI PN-III-P1-1.1-PD-2019-0895, 2020-2022.

List of Publications

Book Chapters

Alida Timar-Gabor, Cristian Panaiotu, Daniel Veres, Cristian Necula, **Daniela Constantin**, chapter “The lower Danube loess, new age constraints from luminescence dating, magnetic proxies and isochronous tephra markers” in volume Landform Dynamics and Evolution in Romania, **Springer 2016**, 679-697.

https://link.springer.com/chapter/10.1007/978-3-319-32589-7_29

Articles in indexed journals

1. Timar-Gabor, A., Kabacińska, Z., **Constantin, D.**, Dave, A., Buylaert, J.P., 2023. Reconstructing dust provenance from quartz optically stimulated luminescence (OSL) and electron spin resonance (ESR) signals: Preliminary results on loess from around the world. *Radiation Physics and Chemistry*, 111138.
<https://www.sciencedirect.com/science/article/pii/S0969806X23003833>
2. Avram, A., **Constantin, D.**, Hao, Q., Timar-Gabor, A., 2022. Optically stimulated luminescence dating of loess in South-Eastern China using quartz and polymineral fine grains. *Quaternary Geochronology*, 67, 101226
<https://www.sciencedirect.com/science/article/pii/S1871101421000765>
3. **Constantin, D.**, Mason, J., Veres, D., Hambach, U., Panaiotu, C., Zeeden, C., Zhou, L., Marković, S., Gerasimenko, N., Avram, A., Tecsa, V., Groza-Sacaciu, S.M., del Valle Villalonga, L., Begy, R.C., Timar-Gabor, A., 2021. OSL-dating of the Pleistocene-Holocene climatic transition in loess from China, Europe and North America, and evidence for accretionary pedogenesis. *Earth-Science Reviews*, 221, 103769.
[https://www.sciencedirect.com/science/article/pii/S0012825221002701\(FI=12.413\)](https://www.sciencedirect.com/science/article/pii/S0012825221002701(FI=12.413))
4. Avram, A., **Constantin, D.**, Veres, D., Kelemen, S., Obreht, I., Hambach, U., Marković, S.B., Timar-Gabor, A., 2020. Testing polymineral post-IR IRSL and quartz SAR-OSL protocols on Middle to Late Pleistocene loess at Batajnica, Serbia. *Boreas*, 49 (3), 615-633.
<https://onlinelibrary.wiley.com/doi/full/10.1111/bor.12442>
5. Tecsa, V., Mason, J.A., Johnson, W.C., Miao, X., **Constantin, D.**, Radu, S., Magdas, D.A., Veres, D., Markovic, S.B., Timar-Gabor, A., 2020. Latest Pleistocene to Holocene loess in the central Great Plains: Optically stimulated luminescence dating and multi-proxy analysis of the enders loess section (Nebraska, USA), *Quaternary Science Reviews*, 229, 106130.
<https://www.sciencedirect.com/science/article/pii/S0277379119305967?via%3Dihub>

6. **Constantin, D.**, Veres, D., Anechitei-Deacu, V., Groza, S.M., Begy, R., Kelemen, S., Buylaert, J.-P., Panaiotu, C., Hambach, U., Marković, S.B., Gerasimenko, N., Timar-Gabor, A., 2019. Luminescence age constraints on the Pleistocene-Holocene transition recorded in loess sequences across SE Europe. *Quaternary Geochronology*, 49, 71-77.
<https://www.sciencedirect.com/science/article/pii/S1871101417302388>
7. Timar-Gabor, A., Buylaert, J.-P., Guralnik, B., Trandafir-Antohei, O., **Constantin, D.**, Anechitei-Deacu, V., Jain, M., Murray, A.S., Porat, N., Hao, Q., Wintle, A.G., 2017. On the importance of grain size in luminescence dating using quartz. *Radiation Measurements*, 106, 464-471.
<http://www.sciencedirect.com/science/article/pii/S1350448717300446>
8. Timar-Gabor, A., **Constantin, D.**, Buylaert J.P., Jain M., Murray A.S., Wintle A., 2015. Fundamental investigations of natural and laboratory generated SAR dose response curves for quartz in the high dose range. *Radiation Measurements*, 81, 150-156.
<http://www.sciencedirect.com/science/article/pii/S1350448715000141>
9. **Constantin, D.**, Buylaert, J.P., Jain M., Murray A.S., Timar-Gabor A., 2015. Quartz luminescence response to a mixed alpha - beta field: Investigations on Romanian loess. *Radiation Measurements*, 81, 110-115.
<http://www.sciencedirect.com/science/article/pii/S1350448715000025>
10. **Constantin D.**, Camenita A., Panaiotu C., Necula C., Codrea V., Timar-Gabor A., 2015. Fine and coarse-quartz SAR-OSL dating of Last Glacial loess in Southern Romania. *Quaternary International*, 357, 33-43.
<http://www.sciencedirect.com/science/article/pii/S1040618214005229>
11. Timar-Gabor A., **Constantin D.**, Markovic S. B., Jain, M., 2015. Extending the area of investigation of fine versus coarse quartz optical ages from the Lower Danube to the Carpathian Basin. *Quaternary International*, 388, 168-176.
<http://www.sciencedirect.com/science/article/pii/S104061821400723X>
12. **Constantin D.**, Begy R., Vasiliniuc S., Panaiotu C., Necula C., Codrea V., **Timar-Gabor A.**, 2014. High resolution OSL dating of the Costinești section Romania using fine and coarse quartz. *Quaternary International*, 334-335, 20-29.
<http://www.sciencedirect.com/science/article/pii/S1040618213003492>
13. Corcea, C., **Constantin, D.**, Anechitei, V., Timar-Gabor A., Filipescu S., 2013. OSL dating of 63-90 μm quartz extracted from an Eemian (presumably lacustrine) sedimentary section at Florești on the Someșu Mic Valley. *Carpathian Journal of Earth and Environmental Sciences*, 1, 139-145.
<http://www.ubm.ro/CJEES/>

14. Veres D., Lane C., Timar-Gabor A., **Constantin D.**, Szakacs A., Hambach U., Fullig A., Onac B. P., **2013**. The Campanian Ignimbrite tephra layer - a regional stratigraphic marker for the MIS 3 loess deposits of Romania, *Quaternary International*, 293, 22-34.
<http://www.sciencedirect.com/science/article/pii/S1040618212001231>
15. **Constantin D.**, Timar-Gabor A., Veres D., Begy R., Cosma C., **2012**. SAR-OSL dating of quartz of different grain sizes extracted from a loess section in southern Romania embedding the Campanian Ignimbrite/Y5 tephra layer, *Quaternary Geochronology*, 10, 81-86.
<http://www.sciencedirect.com/science/article/pii/S1871101412000143>
16. Timar-Gabor A., Vasiliniuc S., Vandenberghe D., **Constantin D.**, Cosma C., Luminescence dating of archaeological materials and sediments in Romania using quartz, **2011**. *Romanian Reports in Physics*, 63, 929-939. <http://www.rrp.infim.ro/>