Geochronometria

Conference Abstracts Series

Volume 1

ISBN 978-83-904783-3-3

12th International Conference
"METHODS OF ABSOLUTE CHRONOLOGY"
11-13th May 2016
Gliwice – Paniówki, Poland

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2016

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Institute of Physics – CSE

Silesian University of Technology
Gliwice, Poland
2016

12th International Conference

"METHODS OF ABSOLUTE CHRONOLOGY"

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Gliwice – Paniówki, Poland

ABSTRACTS & PROGRAMME

The conference is organised by

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Institute of Physics CSE

Polish Academy of Sciences

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Conference venue

"Biały Dom" Hotel
Karola Darwina 50, 44-177 Paniówki, Poland

12th International Conference "Methods of Absolute Chronology"
Gliwice – Paniówki 11-13th May 2016

Overview of the Conference Programme

Wednesday 11th May	Thursday 12th May	Friday 13th May
8:00 -10:00 Registration / welcome coffee		
10: 00 Opening		
10:15 - 11:00 Invited speach		
11:00 - 12:15 Session 1: Holocene terrestrial chronologies		
Coffee		
12:45 - 14:30 Session 2: Holocene terrestrial chronologies		
Conference photo 1 Lunch		
15:30 - 16:30 Session 3: ^{210}Pb & ^{137} Cs		
Coffee		
17:00 - 18:30 Session 4: Dating methods in Earth Sciences – part 1		
19:00 - 21:00 Poster session no. 1 / Ice breaker		
	9:00 - 11:00 Session 5: Archaeology	
	11:00 - 12:30 Poster session no. 2 / Coffee	
	12:30 - 14:00 Session 6: Archaeology	
	Lunch	
	Transport	
	Conf. photo 2 / Coffee	
	16:00 - 17:30 Session 7: Methods	
	Visit to GADAM Centre Labs	
	Transport	
	20:00 - 22:00 Conference dinner	
		9:30 - 11:00 Session 8: Dating methods in Earth Sciences – part 2
		Coffee
		11:30 -13:30 Session 9: Terrestrial archives - trees
		Lunch
		14:30 - 16:00 Session 10: Terrestrial archives - aeolian
		Discussion
		Awards / Closing remarks

Conference programme

Wednesday 11th May 2016

8:00 – 10:00 Registration & welcome coffee

10:00 – 10:15 Conference opening

10:15 – 11:00 Invited speech

INVITED SPEECH:

Time	Author	Title
10:15	Anders Svensson	Comparing marine and terrestrial records to ice-core records during the last glacial period

SESSION 1: Holocene terrestrial chronologies – Challenges in palaeo-studies

Time	Authors	Title
11:00	Ott Florian, Wulf Sabine, Serb Johanna, Słowiński Michał, Obremska Milena, Tjallingii Rik, Błaszkiewicz Mirosław, Brauer Achim	Differential dating based on varve counting from Lake Czechowskie (N Poland) reveals the time span between the early Holocene Askja-S and Hässeldalen tephras
11:30	De Vleeschouwer François, Thomas Roland, Piotrowska Natalia, Vanneste Heleen, Bertrand Sébastien, Dmitri Mauquoy, Maarten Blaauw, von Scheffer Clemens, Le Roux Gaël	Refining the Holocene tephra stratigraphy of Southern South America

12:00	Chuxian Li, De Vleeschouwer François, Piotrowska Natalia, Van Beek Pieter, Souhaut Marc, Le Roux Gaël, Nathalie Van der Putten, Sonke Jeroen	Peat bogs from Amsterdam Island (South Indian Ocean): Preliminary results on Holocene environmental changes
12:30	Danuta J. Michczyńska, Włodzimierz Margielewski, Katarzyna Korzeń, Adam Michczyński, Ryszard K. Borówka, Julita Tomkowiak, Andrzej Obidowicz	Palaeoenvironmental changes of Orawa-Nowy Targ Basin in the Late Glacial and Holocene recorded in sediments of Grel raised bog

13:00 – 13:10 Conference photo no. 1

13:10 – 14:00 Lunch

SESSION 2: Holocene terrestrial chronologies – Challenges in palaeo-studies - *continued*

Time	Authors	Title
14:00	Fatima Pawełczyk, Leszek Chróst, Tadeusz Magiera, Adam Michczyński, Jarosław Sikorski, Konrad Tudyka, Ewelina Zając	Changes in the sediment accumulation rate and lead and other heavy metals concentration in Wolbrom peat bog
14:30	Marco Antonio Aquino Lopez	Bayesian Lead Dating Model
15:00	Le Roux Gaël, Mazier Florence, Claustres Adrien, Enrico Maxime, Cuvier Alicia, von Scheffer Clemens, Galop Didier, Heimburger Lars-Eric, Van Beek Pieter, Souhaut Marc, Baron Sandrine, Sonke Jeroen, De Vleeschouwer François	Dating the Anthropocene in peat archives

15:30 – 16:00 Coffee break

SESSION 3: ^{210}Pb & ^{137}Cs Methods & Applications

Time	Authors	Title
16:00	Róbert-Csaba Begy, Szabolcs Kelemen, Luminita Preoteasa, Hedvig Simon	Investigation of sedimentation rates and sediment dynamics in Danube Delta lake system (Romania) by ^{210}Pb dating method
16:30	Szabolcs Kelemen, Róbert-Csaba Begy, Luminita Preoteasa, Hedvig Simon	Sedimentation processes and heavy metal pollution history in central Danube Delta (Romania)

17:00 – 17:30 Coffee break

SESSION 4: Applications of Dating Methods in Earth Sciences and Environmental Research – part 1

Time	Authors	Title
17:30	Kazimierz Klimek, Beata Woskowicz-Ślęzak	Age of fossil tree trunks as an indicator of tectonic activity. Bierawka river catchment, Upper Silesia Upland
18:00	Ewa Smolska, Piotr Szwarczewski, Marta Szal, Mirosława Kupryjanowicz, Mariusz Wyczółkowski	Rates, variability and conditions of sedimentation in various depressions on examples from Kętrzyn area (NE Poland)
18:30	Piotr Szwarczewski, Ewa Smolska, Jonas Mazeika, Karasiński Jakub, Bulska Ewa	Human impact record in the sediments filling the river valley (a case study from Radom, Central Poland)

19:30 – 21:30 POSTER SESSION no. 1 & Ice-break dinner

Thursday 12th May 2016

SESSION 5: Applications of Dating Methods in Archaeology

Time	Authors	Title
9:00	Dariusz Bobak, Marta Połtowicz-Bobak, Zdzisław Jary, Jerzy Raczyk, Piotr Moska	Chronology of the the Middle to Upper Palaeolithic Transition site of Lubotyń 11 in the light of bayesian age modelling
9:30	Aleksandra Lisowska-Gaczorek, Beata Cienkosz-Stepańczak, Jacek Pawlyta, Krzysztof Szostek	Oxygen isotopes in Rodent bone and teeth phosphate- a new model for paleoanthropological researches
10:00	Danuta Michalska	Prospects for mortars dating
10:30	Marek Nowak, Magdalena Moskal-del Hoyo, Aldona Mueller-Bieniek, Maria Lityńska-Zając, Krzysztof Kotynia	Chronology of Early and Middle Neolithic archaeological sites from Poland, Slovakia and Hungary based on radiocarbon dating of archaeobotanical materials: benefits and weaknesses

11:00 – 12:30 POSTER SESSION no. 2 & Coffee break

SESSION 6: Applications of Dating Methods in Archaeology - *continued*

Time	Authors	Title
12:30	Andrzej Wiśniewski, Zdzisław Jary, Piotr Moska	Epigravettian and Magdalenian in Poland: New chronological data and old problem

13:00	Alicja Chruścińska, Anna Cicha, Natalia Kijek, Krzysztof R. Przegietka, Piotr Palczewski, Krystyna Sulkowska-Tuszyńska	Dating the foundations of the gothic Saint James Church in Toruń by the OSL method
13:30	Antoine Zink, Elisa Porto, Rocco Rante	Attempt at luminescence dating of mudbricks from Romitan (Bukhara Oasis, Uzbekistan)

14:00 – 15:00 Lunch
15:00 – 15:30 Bus to Gliwice, Conference photo 2
15:30 – 16:00 Coffee break

SESSION 7: Dating Methods

Time	Authors	Title
16:00	Krzysztof R. Przegietka	Recognizing partial bleaching in OSL dating of sediments
16:30	Orsolya Tóth, György Sipos, Tímea Kiss	Luminescence properties of quartz in fine and coarse grain modern floodplain sediments along the Hungarian section of the Danube
17:00	Konrad Tudyka, Sebastian Miłosz, Alicja Ustrzycka, Sebastian Barwinek, Wojciech Barwinek, Agata Walencik-Łata, Grzegorz Adamiec, Andrzej Bluszcz	Prototype low level multicell liquid scintillation spectrometer for high throughput ^{14}C dating

17:30 – 19:00 Visit to GADAM Centre of Excellence Laboratories
Institute of Physics – Centre for Science and Education
Silesian University of Technology
Konarskiego 22B, 44-100 Gliwice
19:00 – 19:30 Bus to “Biały Dom” hotel, Paniówki
20:00 – 22:00 Conference dinner

Friday 13th May 2016

SESSION 8: Applications of Dating Methods in Earth Sciences and Environmental Research – part 2

Time	Authors	Title
9:30	Leszek Starkel, Danuta J. Michczyńska, Piotr Gębica	Reflection of climatic changes during Interpleniglacial in geoecosystems of Southern Poland
10:00	Wojciech Stankowski, Piotr Moska, Grzegorz Poręba	Luminescent techniques applied in dating the fall of meteorites in Morasko
10:30	Anna Agatova, Roman Nepop	Problems of absolute dating the Pleistocene glacial deposits by the example of the Chagan section, Russian Altai

11:00 – 11:30 Coffee break

SESSION 9: Terrestrial archives of environmental changes - trees

Time	Authors	Title
11:30	Peter Barta	Dendrochronological research of chieftain's grave in Poprad-Matejovce: current state of things
12:00	Roman Nepop, Anna Agatova	Applying dendrochronological approach in paleoseismogeological investigations by the example of the SE Altai
12:30	Sławomira Pawełczyk	Intrinsic water-use efficiency for trees growing in Carpathian Mountains estimated on the basis of $\delta^{13}C$ as a record of anthropopression
13:00	Barbara Sensuła, Sławomir Wilczyński, Laurence Monin, Natalia Piotrowska, Mohammed Allan, Anna Pazdur, Nathalie Fagel	Trees' response to climatic and anthropogenic environmetnal changes: multiproxy analysis in bio-monitoring of industrial area nearby nitrogen factories in Kędzierzyn Koźle (Poland)

13:30 – 14:30 Lunch

SESSION 10: Terrestrial archives of environmental changes – aeolian deposits

Time	Authors	Title
14:30	Piotr Moska, Grzegorz Adamiec, Zdzisław Jary Andrzej Bluszcz	OSL chronostratigraphy for loess deposits in Poland based on a detailed study of four loess profiles in Złota, Biały Kościół, Tyszowce, Strzyżów
15:00	György Sipos, Orsolya Tóth, Slobodan Markovic, Alexia Balla, Miliovoj B. Gavrilov	The timing of the phases of eolian activity in the Deliblato Sands, Serbia
15:30	Jingran Zhang, Sumiko Tsukamoto, Melanie Sierralta, Manfred Frechen	Luminescence chrononolgy of the middle and upper Pleistocene loess-palaeosol sequences along the River Ob in southern Siberia

16:00 – 17:00 Discussion / Awards / Closing remarks

POSTER PRESENTATIONS

Wednesday 11th May 2016

19:30 – 21:30 POSTER SESSION no. 1

No	Authors	Title
1	Viacheslav Andreychouk, Jacek Pawlyta, Piotr Kotula, Leszek Marynowski	Biogenic Iron-Manganese Formations from Zoloushka Cave: Pilot Study
2	De Vleeschouwer François, Le Roux Gaël, Sonke Jeroen, Van Beek Pieter, SOuhaut Marc, Pourcelot Laurent, Masson Olivier, Guarriaran Rodopho, Hughes Paul, Piotrowska Natalia, Tanimizu Masaharu, Hotes Stefan	Japanese PEat records of ATmospheric deposition of artificial radionuclides (J-PEAT): Impacts of Fukushima accident and implications for radiochronology
3	De Vleeschouwer François, Vanneste Heleen, Piotrowska Natalia, Bertrand Sébastien, Coronato Andrea, Mauquoy Dmitri, Le Roux Gaël	Fuegian Peatlands: Recorders of Environmental Changes since the last deglaciation
4	Agnieszka Gontaszewska, Małgorzata Szczepaniak, Danuta Michalska	On the problem of the age of organic deposits from Słubice (W Poland)
5	Nikolina Ilijanić, Slobodan Miko, Ozren Hasan, Koraljka Bakrač	A multiproxy analysis of Holocene lake sediments on the Eastern Adriatic coast

6	Stanislav Laukhin, Fedor Maksimov, Larisa Savelieva, Sergey Larin, Vladislav Kuznetsov, Aleksey Petrov, Vasily Grigoryev, Khikmatulla Arslanov, Dmitry Kobylkin	New geochronological data on time and conditions of organic-rich sediments formation in the bottom of the Belyi Yar-2 sequence (the eastern part of the Tunka rift basin, SE Siberia)
7	Enikő Lázár, György Sipos, Péter Hernesz, Zoltán Kern, Mátyás Árvai	Radiocarbon dating of Holocene driftwoods from two sites in the Carpathian Basin
8	Hao Long, Hongyi Cheng	Luminescence dating of Holocene highstand in Jinchang paleolake, NE Tibetan Plateau and links to monsoon precipitation
9	Renata Mikalauskiene, Jonas Mazeika, Rimantas Petrosius, Piotr Szwarczewski	Comparison of beta (LSC) and gamma spectrometric (HPGE) methods for lead-210 in chronological study
10	Piotr Moska, Grzegorz Adamiec, Zdzisław Jary, Andrzej Bluszcz, Grzegorz Poręba, Natalia Piotrowska, Marcin Krawczyk, Jacek Skurzyński	OSL chronostratigraphy for the loess deposits in Złota, Poland
11	Piotr Moska, Zdzisław Jary, Grzegorz Adamiec, Andrzej Bluszcz	High resolution dating of loess profile from Strzyżów
12	Natalia Piotrowska, Alicja Ustrzycka, Alicja Bonk, Wojciech Tylmann	Isotopic investigations of contemporary carbonate sedimentation in 50 lakes from N Poland
13	Grzegorz Poręba, Zbigniew Śnieszko, Piotr Moska	Influence of the size of an aliquot on the interpretation of the results of OSL dating. (based on the analysis of late Holocene colluvial sediments)
14	Grzegorz Poręba, Paweł Prokop	Using fallout cesium-137 and lead-210 measurements to estimate soil erosion in small catchment under manual cultivation system in the monsoonal climate on Maghalaya Plateau (India)
15	Grzegorz Poręba, Zbigniew Śnieszko, Manfred Frechen	Using Cs-137, Pb-210 and soil properties to assess soil redistribution on loess slope

16	Grzegorz Poręba, Zbigniew Śnieszko, Piotr Moska, Przemysław Mroczek	A stratigraphic study of Holocene slope sediments in the profile from Szyszczyce (South Poland) based on luminescence, radioisotope and micromorphology studies
17	Grzegorz Poręba, Ireneusz Malik, Łukasz Ciesielski	Using dendrochronology and radioisotopes measurement to study soil erosion in loess gully near Poręba village (Southern Poland)
18	Arndt Schimmelmann Carina B. Lange, Juergen Schieber, Pierre Francus, Antti E.K. Ojala, Bernd Zolitschka	Global Compilation of Marine Varve Records
19	Jarosław Sikorski	The results of concentration ^{210}Pb and depth-age model for the Wolbrom peatland
20	Jarosław Sikorski	Methodology of creating the young peat profiles chronology, dating with different sampling rate
21	Andreja Sironić, Jadranka Barešić, Nada Horvatinčić, Ines Krajcar Bronić, Igor Felja, Jovana Nikolov, Nataša Todorović, Jan Hansman, Miodrag Krmar	Response of Carbonate Deposits of Plitvice Lakes, Croatia, to the Bomb-Produced ^{14}C
22	Joanna Sławińska, Ryszard K. Borówka, Matthias Moros, Natalia Berlińska	Problems with gravity and multi cores of marine sediments correlation – on the example cores: EMB046/6 Norwegian Trench and M86/ 24 Bornholm Basin
23	Sławomir Superson, Piotr Gębica, Adam Michczyński, Piotr Kołaczek, Kazimierz Szczepanek	Chronostratigraphy of the Holocene alluvia of the Wisłok river in the light of the radiocarbon datings and palynological analysis (example from Wola Dalsza sandpit near Łańcut, Sandomierz Basin)
24	Alicja Ustrzycka, Natalia Piotrowska, Alicja Bonk, Janusz Filipiak, Wojciech Tylmann, Martin Grosjean	Isotopic composition of water and contemporary sediments of Lake Żabińskie, NE Poland
25	Elya Zazovskaya, Sergey Goryachkin, Vasiliy Shishkov, Nikita Mergelov, Andrey Dolgikh, Olga Chichagova, Alex Cherkinskiy	Radiocarbon age of the soils in extremal conditions in Arctic and Antarctic

26	Maurycy Żarczyński, Wojciech Tylmann, Alicja Bonk, Tomasz Goslar	An annually resolved chronology for the last two millennia: potential of the varved sediments from Lake Żabińskie, northeastern Poland

Thursday 12th May 2016

11:00 – 12:30 POSTER SESSION no. 2

No	Authors	Title
27	Peter Barta, Zuzana Grolmusová, Mária Kociánová, Pavol Jelínek, Martin Bača, Jana Hlavatá, Radoslav Beňuš, Jacek Pawlyta, Pavel Veis	Budmerice and Senica: ^{14}C dating and stable isotopes analysis of human and animal remains from Maďarovce Culture, Slovakia
28	Zdzisław Jary, Adam Michczyński, Piotr Moska, Agnieszka Fiut, Marcin Krawczyk, Fatima Pawełczyk, Kamila Ryzner, Aleksandra Skuła, Jacek Skurzyński	Aeolian phases in an inland dunes area within Niemodlin Plateau
29	Zuzanna Kabacińska, Ryszard Krzyminiewski, Magdalena Wencka	Defects in calcite generated by UV light – implications for EPR dating of calcite
30	Natalia Kijek, Alicja Chruścińska	Testing the lower temperature of the OSL measurement in the SAR protocol applied for dating the medieval brick
31	Magdalena Kozicka	Absolute Chronology of the Zedmar Culture with a special look at its final stage

32	Marek Krąpiec, Elżbieta Szychowska-Krąpiec, Joanna Barniak, Danuta J. Michczyńska, Adam Michczyński, Jacek Pawlyta, Natalia Piotrowska, Tomasz Goslar, Bogusława Waliszewska	Radiocarbon dated late-glacial Scots pine (Pinus sylvestris L.) chronology from Central Poland
33	Danuta Michalska, Andrzej Krzyszowski	Chronology of settlement in southern Wielkopolska (Greater Poland) based on the multicultural site of Sowinki
34	Danuta Michalska, Justyna Czernik, Roma Szczeszek	How to choose the appropriate mortar fraction for dating?
35	Magdalena Natuniewicz-Sekuła Beata Cienkosz-Stepańczak, Krzysztof Szostek, Katarzyna Mądrzyk, Aleksandra Lisowska-Gaczorek,Tomasz Goslar, Jacek Pawlyta	Oxygen Isotopic Variability in Human and Animal Bones Extracted Phosphate from Wielbark Culture Cemetery at Weklice, North-East Poland – Preliminary Results
36	Magdalena Niedziałkowska, Maciej Sykut, Sławomira Pawełczyk, Natalia Piotrowska, Krzysztof Stefaniak, Karolina Doan, Bogumiła Jędrzejewska, Anna Stankovic	Habitat preferences of European red deer (Cervus elaphus) in different time periods and environmental conditions since the Late Pleistocene until today
37	Sławomira Pawełczyk, Barbara Sensuła, Anna Pazdur	$\delta^{13}C$ in spruce α-cellulose – a case study for Sudeten, Tatras and Eastern Carpathian
38	Sławomira Pawełczyk, Barbara Sensuła, Anna Pazdur	Stable isotopes in tree rings from Southern Poland and Eastern Carpathian: temporal stability of climatic signal versus pollution emissions
39	Anna Pazdur, Sławomira Pawełczyk, Natalia Piotrowska, Andrzej Rakowski, Barbara Sensula, Konrad Tudyka	Human activity recorded in carbon isotopic composition of atmospheric CO_2 in Gliwice urban area and surroundings (Southern Poland)

40	Anna Pazdur, Tadeusz Kuc, Slawomira Pawelczyk, Natalia Piotrowska, Andrzej Rakowski, Kazimierz Różanski, Barbara Sensuła	Imprint of CO_2 emission in atmosphere and biosphere in Southern Poland on the basis of ^{14}C and ^{13}C measurements
41	Andrzej Z. Rakowski, Matthias Huels, John Meadows	Data analysis: From AMS measurement to radiocarbon age
42	Andrzej Z. Rakowski, Marek Krąpiec, Matthias Huels, Jacek Pawlyta, John Meadows	Rapid increase of radiocarbon concentration in tree rings from Kujawy (SE Poland) in VIIIth and Xth century AD
43	Barbara Sensuła, Natalia Piotrowska	Bio-monitoring of CO_2emission: Suess effect and Water Use Efiiciency in pine growing near the combined heat and power plant in Laziska Górne (Poland)
44	Barbara Sensuła, Sławomir Wilczyński	Response of Scots Pine to climate and industrial emission in the most industrialized part of Poland
45	Barbara Sensuła, Sławomira Pawełczyk	Stable isotopes in tree rings: glucose, α-cellulose, wood
46	György Sipos, Orsolya Tóth, Dávid Filyó	Thermoluminescence dating of bricks from the buried Castle of Szeged, Hungary
47	Artur Szramowski, Alicja Chruścińska	Thermally modulated optically stimulated luminescence (TM-OSL) of quartz
48	Konrad Tudyka, Sebastian Miłosz, Andrzej Bluszcz, Grzegorz Adamiec	Prototype compact system for ^{238}U,^{235}U and ^{232}Th dose measurements in small environmental samples
49	Adam Walanus	Does calibration curve influence the sample frequency method?

ORAL PRESENTATIONS

Invited Speech

Comparing marine and terrestrial records to ice-core records during the last glacial period

Anders Svensson[1]

[1]*University of Copenhagen, Niels Bohr Institute, Ice and Climate, Juliane Maries Vej 30, 2100 København Ø, Rockefeller, Building: 216*

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There is a growing interest in comparing glacial paleo-records dated by radiometric or OSL techniques to ice-core records dated by a combination of annual layer counting and ice-flow modelling. Such comparisons allow for placing marine and terrestrial paleo-records in the climatic context provided by high-resolution ice-core records from both Hemispheres. Comparison of records placed on independent chronologies are however not always straightforward and there is a number of caveats to consider.

The nature of layer-counted and radiometric time scales are fundamentally different. Whereas the accumulative nature of layer-counted ice-core chronologies generally have large absolute uncertainties and well-constrained event durations (low accuracy, high precision) most other dating techniques provide accurate absolute ages while interval durations are less well constrained (high accuracy, low precision). Sometimes synchronization to ice-core records is possible through tephra isochrones, but often the comparison will rely on the applied time scales alone.

This presentation reviews recent advances in stratigraphic ice-core dating for Greenland and Antarctica focusing on the last glacial period. Antarctic ice cores are layer-counted back to 31 ka (WAIS Divide ice core) whereas Greenland ice cores are dated back to 60 ka (NGRIP ice core, GICC05 time scale). Greenland and Antarctic ice core records are linked by gas profiles, at the Laschamp geomagnetic excursion (41 ka), and at the Toba eruption (74 ka). Beyond 60 ka annual layers are thin and layer counting is more uncertain, but currently there is progress in the development of a bipolar layer-counted time scale for Marine Isotope Stage 4 (60-75 ka).

A second part of the presentation discusses recent examples from the literature where ice-core and non-ice-core profiles are compared in various contexts. In particular, the relationship between the most recent IntCal calibration curve and the Greenland ice core chronology is investigated.

SESSIONS 1 & 2

Holocene terrestrial chronologies Challenges in palaeo-studies

Conveners: François De Vleeschouwer
Nikolina Ilijanić,
Natalia Piotrowska

Differential dating based on varve counting from Lake Czechowskie (N Poland) reveals the time span between the early Holocene Askja-S and Hässeldalen tephras

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Robust chronological framework is a crucial necessity for paleoclimate reconstructions. The combination of dating techniques such as annual layer (varve) counting and radiocarbon dating allows can be used to establish well-constrained time scales. The implementation of volcanic ash deposits (tephra) provide isochronous time marker that can be utilized as tie-lines to synchronize sedimentary archives and to decipher climatic teleconnections. Recent advances in the detection and identification of non-visible (crypto-) tephra, often transported over thousands of kilometers, also allows identifying ash deposits even in distal records. We report the first findings of coexisting early Holocene Hässeldalen and Askja-S cryptotephras in a varved sediment record in Lake Czechowskie (JC, northern Poland). Varve counting was used to establish a varve chronology and micro-facies analyses, relative calcium (Ca) and titanium (Ti) concentrations were used to decipher between lake productivity and detrital flux. Here we focus (i) on the determination of the time span between both tephras, (ii) revised age estimates for the Askja-S tephra and (iii) the sedimentological response of the JC record to the Preboreal Oscillation (PBO), a short lived cold episode during the early Holocene.
A differential dating approach revealed a time span of 152 +11/-8 varve years counted in the JC sediment record between both tephras. Since the varved interval of the JC sediment record comprising the tephras is floating, we anchored the floating varve chronology to an absolute timescale by using the radiocarbon-dated Hässeldalen Tephra (11,380 ± 216 cal a BP, Wohlfarth et el., 2006) and the biostratigraphically defined Younger Dryas-Holocene boundary. The resulting age for the Askja-S of 11,454-11,002 cal a BP is, even considering the rather large uncertainties, a few decades to several hundred years older than most radiocarbon based age models, but it supports the original age model from Hässseldala port. The sediment response to the PBO cold period is seen only in a slight decrease in titanium, a proxy for detrital matter flux. Varve micro-facies did not change during this interval confirming a weak impact of the PBO on the sedimentation regime in Lake Czechowskie.
This study is a contribution to the Virtual Institute of Integrated Climate and Landscape Evolution Analyses – ICLEA – of the Helmholtz Association, grant number VH-VI-415.

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Refining the Holocene tephra stratigraphy of Southern South America

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Southern South America has seen numerous eruptions taking place through the last 12 kyrs. While major tephras have been recorded in several peat bogs, lake and fjord records, there is still a lack of an integrative view of the volcanic history of this area. Moreover, due to the location of both volcanoes and tephra archives within the major wind directions, most of the records only provide a discontinuous tephra stratigraphy. Additionally, the potential of cryptotephras (ie. tephras which are not visible to the naked eye) has been overlooked and underestimated in Southern South America. Because of these various issues, the attempts to integrate the available tephra records resulted in several approximations, such as dates spanning 4 kyrs for a single eruption.
In this contribution, we present a multiproxy study of a 12.5-kyr old, 7.3-m long peat core retrieved from the ombrotrophic bog of Magellanes, in South Chilean Patagonia. Using a combination of ash content, laser grain size measurements and electron microprobe analyses, we were able to detect the various major tephras and cryptotephras on more than 600 samples. A high-resolution age-depth model on 55 AMS dates from Sphagnum macrofossils provides the very first integrative and continuous Holocene tephra stratigraphy of Southern South America. It puts an end to some debates on the ages of some of the major eruptions in the area. Moreover, it offers the potential to calculate an accurate reservoir age for marine cores in Southern South America.Bayesian Lead Dating Model

Peat bogs from Amsterdam Island (South Indian Ocean): Preliminary results on Holocene environmental changes

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Peat bogs can produce high-resolution records of environmental and climatic changes. Because almost exclusively constituted of organic matter, peat bogs provide low uncertainty chronologies (^{14}C, ^{210}Pb, ^{137}Cs, ^{241}Am) that allow recovering high-quality paleo-information over the Holocene and beyond. Although they have been abundantly used to monitor past atmospheric pollution, less attention has been given to pre-anthropogenic signals, especially in the Southern Hemisphere and in the sub-Antarctic.
This paper presents preliminary geochemical data together with short-lived radionisotopes and radiocarbon dating results on a peat core from Amsterdam Island, French Austral Territories. Located in the middle of the Indian Ocean (37° 50′ 742″ S, 77° 32′ 898″ E) and at the crossroads of African, Australian and southern American dust trajectories, Amsterdam Island is a volcanic island displaying Sphagnum peatlands at its top.
For the very first time, we will present chronological and geochemical results on a Sphagnum-dominated peat core taken on this island. Macrofossils from 8 samples (above-ground plant only) were dated by radiocarbon AMS method and revealed a steady peat accumulation rate starting around 7000 cal BP (at 4.5 m depth). ^{210}Pb, ^{241}Am, ^{137}Cs measurements and inorganic geochemistry (lithogenics, REE) complement our dataset and give the first insights of dust origin in the middle of the Indian Ocean. Our long-term goal is to investigate the paleodust fluxes and signatures in such remote locations in order to extend our knowledge of the dust-climate-environment interplays.

Palaeoenvironmental changes of Orawa-Nowy Targ Basin in the Late Glacial and Holocene recorded in deposits of Grel raised bog

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The Grel raised bog is located in the Ludźmierz village vicinity in the Orawa-Nowy Targ Basin. This raised bog, has a heavily degraded peat dome covered with numerous post excavation pits which are the results of peat extraction for local purposes. The peat bog is overgrown by birch and pine forests. A first palynological study of the peat depositional sequence was performed by Koperowa (1962). The beginning of the peat bog formation was then attributed to the Oldest Dryas. Consequently the Grel is the oldest peat bog in the peatland of the Orawa-Nowy Targ Basin.

Several drillings were made in the deepest part of the peat bog basin (N 49° 28.733 ', E19° 59.293', 601 m asl) because, as compared to the 1960's study, there was a significant compaction of the peat deposit and a drastic reduction in thickness of the peat bog (from the initial ca 8 m in the 1960's, to about ca 4 m today), which is the result of a significant drainage and desiccation.

Two cores were examined by means of loss on ignition (Heiri *et el.*, 2001) and palynological, as well as geochemical analyses. The type of peat was determined based on macroscopic analysis. Mineral sediments were identified on the basis of Bouyoucos-Casagrande analysis modified by Prószyński (Mycielska-Dowgiałło, Rutkowski 1995). These were accompanied by over 20 radiocarbon dates using AMS and conventional techniques and an age-depth model was prepared using the P_Sequence model in OxCal software (Bronk Ramsey 2006) and IntCal13 calibration curve (Reimer *et el.* 2013).

Palynological analysis showed that the mineral sediments underlaying the peat bog represent the overbank deposits of the Czarny Dunajec River, characteristic for river marshes (possibly of a crevasse character) accumulated during the Oldest Dryas. Only the part of the Late Glacial and Holocene climatic changes are clearly marked within the peat bog sequence. The Late Glacial sequence is dominated by mineral deposits (mainly sandy silty clay) with thin organic inserts. The beginning of the accumulation of minerogenic, fen-type peat underlying *Sphagnum* and *Eriophorum* ombrogenic peat (predominating in the sequence) is ascribed to the upper Allerød. Mineral inserts (illuvial horizons) in the ombrogenic peat indicating increases in humidity of the climate (related to periodic floods of the nearby Czarny Dunajec River), were associated with the decline of the Younger Dryas (permafrost melting), as well as the upper part of the Preboreal Phase and the Boreal Phase of the Holocene. Human impact is very slightly marked in the palynological diagram. Pollen grains of cereals, weeds and other anthropogenic indicators occur only in the top of the sequence (uppermost 30 cm of the log), which may indicate the removal of the upper, Subatlantic part of the sequence of sediment because of the peat extraction.

This study was partly supported by means of grant no. N N306 034040 (Polish National Science Centre grant).

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Changes in the sediment accumulation rate and lead and other heavy metals concentration in Wolbrom peat bog

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Peat bogs form important archives to reconstructing past environmental changes, sometimes caused by human activity. In order to examine these changes, a one-meter long peat core was taken from the low bog in Wolbrom (Cracow-Częstochowa Upland, Southern Poland). The analysis of the botanical composition showed that Wolbrom is a low bog. Vegetation species such as Carex rostrata, Phragmites australis and Calamagrostis neglecta have been found. Also ash content has been tested. It has been between 7 and 30% - so high ash content is characteristic for low bogs. An age-depth model was generated using 8 radiocarbon dates (LSC method) and 15 lead-210 dates from the upper part of deposit. According to the model, we can estimate the age of the bog. The oldest part of the bog comes from a depth of 1,05 meter and is 5940 ± 95 BP. The mean accumulation rate varies between approximately 0,053 mm and 1,1 mm yrs-1. The core has been tested for the presence of trace metals, e.g. Pb, Cd, Cu, Zn and other metal elements using ICP-OES. There are considerable variations in the concentrations of tested metals – in many cases the concentration starts to rise at a depth about 40 cm (2040 ± 85 BP) and may be connected to human activity.

Bayesian Lead Dating Model

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Age-depth models are important tools to study the history of our planet. In this sense, lead-210 models such as the commonly used Constant Rate of Supply (CRS), play an important role in many studies of environmental changes during the past centuries. Unfortunately these models are very unfriendly to non-experts, because they rely greatly on the appropriate, manual calculation of supported activity. This task may be difficult to achieve and can lead to the discarding of valuable and costly data. Another point when using lead models is that they were not created in a statistical framework, which has caused problems when estimating the variability. Also the fact that lead models weren't created in a statistical framework makes the interaction with statistically framed age-models (e.g. BACON software) quite difficult to achieve. Here I aim to solve these problems by creating a Bayesian age-depth model for lead-210 dates.

Dating the Anthropocene in peat archives

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Significant environmental disturbances due to humans in recent centuries highlight the importance of environmental reconstructions during this period. Environmental archives like peat, lake or tree rings provide the opportunity to reconstruct past environmental changes. High resolution chronologies are needed for the last 500 years to reconstruct pollutant depositions and calibrate atmospheric transport models, investigate biodiversity changes in the past, understand long term sequestration of organic matter and carbon, validate and calibrate environmental archives-based paleoclimate records with instrumental and monitoring data.
Traditional age dating using conventional radiocarbon for the deepest layers and ^{210}Pb for the upper layers of sediments are the common used geochronological methods. Additional chronomarkers like ^{137}Cs pulse or relative change in one exotic pollen taxon are also frequently used. Despite that, there are some issues on the precision and the quality of the ages provided by those techniques. There is a need to develop a common approach using traditional age dating methods and combine them in a unique conceptual and numerical approach. In addition there is a need for new and innovative chronomarkers like isotopic tracers of geochemical pulses to validate the environmental high-resolution reconstructions.
We are reviewing and testing relatively new geochemical chronomarkers like plutonium isotopes (derived from nuclear aerial weapon tests) or emerging pollutants (i.e. platinum group elements derived for example from automobile catalysts) in two different areas: Pyrenees and Tierra del Fuego. Other promising tools are the use of Nd isotopes as tracer of crypto-tephra and of Hg isotopes as potential marker of major global volcanic eruptions and industrial emissions.

SESSION 3

^{210}Pb & ^{137}Cs Methods & Applications

Investigation of sedimentation rates and sediment dynamics in Danube Delta lake system (Romania) by ^{210}Pb dating method

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The Danube Delta is the second largest river delta in Europe, having a surface of 5800 km^2. The water of the Danube River starts to spread in a fan-like distribution starting from the location Tulcea. The river is divided here from into three main branches, namely Chilia(forms the border between Romania and Ukraine), Sulina and Sf. Gheorghe, which mark the three main zones of the delta. Each of these is characterized by sub-branches, brooks and channels, which connect several inner lakes and swamps. The aim of this study is to apply the ^{210}Pb radiometric dating method on Danube Delta lake sediments for the first time in order to determine the sedimentation rates and sediment dynamics in the studied lakes and to identify and assess the anthropogenic influences of the man-made structures, especially the construction of the Iron Gate hydro-energetic power plant in 1972-1983.In order to assess the changes on the Danube Delta,seven lakes were analyzed: Merhei (6 cores), Cruhlig (5 cores), Iacob and Isac (4 cores each), Matita and Uzlina (3 cores each) and Cuibida (2 cores).Cores were sectioned into 1-2 cm slices, weighted and dried (72°C, 24 h). After determining the dry masses, porosity and water content was determined.Gamma spectrometric measurements using a GMX type HpGe detector were carried out for the determination of the in situ^{210}Pb component by ^{226}Ra and the ^{137}Cs for the validation of the method. The total ^{210}Pb content of the sediment layers was determined via ^{210}Po, the alpha particle emitting progeny of ^{210}Pb. The subsamples were added ^{209}Po tracer for the determination of the chemical yield and put to acidic digestion. Samples were spontaneously deposited on stainless steel discs. And ^{210}Po activity concentrations were determined by PIPS detectors.
Both porosity and water content vary in the 21.3-96.1% range, having higher concentrations in the upper layers. The maximum total ^{210}Pb values vary in the 42-210 Bq/kgrange, the highest values being accounted to the Cruhlig Lake, the lowest to the Matita Lake. The average supported ^{210}Pb content of the lakes was 19 Bq/kg.The building of the Iron Gates shows its effects on the three lakes (Cruhlig, Isac and Uzlina): the sedimentation rates decrease with 32% in 1973-1976. The other four lakes show an average increasing of 42%. 52% of the sediment cores show the flooding events of the last 14 years and 47% show the flood from 1980.

Sedimentation processes and heavy metal pollution history in central Danube Delta (Romania)

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Danube Delta is the second largest delta in Europe, having surface of 4152 km^2. Both natural and anthropogenic factors lead to its continuous changes on different time-scales. The biggest human intervention on the upstream of the Danube, was the construction of the Iron Gate hydro-energetic power plant I and II (1972-1983). The objective of the present study is to identify both natural and anthropic effects on deltaic lakes using the ^{210}Pb radiometric dating method and to investigate heavy metal contamination.
In order to achieve this, four lakes were chosen from between the Sulina and Sf. Gheorghe branches of the Danube: Uzlina Lake (3 cores), Isac Lake (3 cores), Cuibida Lake (2 cores) and Iacob Lake (4 cores). All sediment cores were taken with a gravity corer. After measuring dry and wet weights, physical parameters were calculated. LOI measurements were carried out for organic matter and inorganic carbon content determination. The supported ^{210}Pb was measured through ^{226}Ra activity concentration with high resolution gamma spectrometry (HPGe detectors). The total ^{210}Pb content was measured via its alpha emitting progeny, ^{210}Po, using an PIPS detectors system. The geochronology of the sediments and their sedimentation rates were calculated using the CRS model. Heavy metal concentrations were determined for one core by ICP-MS, the measured elements being Li, Mg, Al, K, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Cd, Hg and Pb.
The ^{226}Ra (in situ ^{210}Pb) activity concentration of the sediment cores was 15-24 Bq/kg, with an average of 20 Bq/kg, while the total ^{210}Pb activity concentration ranged from 47 to 251 Bq/kg. The mass sedimentation rate maximum was 1.31 g/cm^{2}y between 2000-2012 in the Uzlina Lake 1.48 g/cm^{2}y between 1982-1993 in the Isac Lake, 1.78 g/cm^{2}y between 2004-2008 in the Cuibida Lake and 1.26 between 2000-2007 in the Iacob Lake . After 1972 (Iron Gates construction) the sedimentation rates was approximately two times lower (0.21 g /cm^{2}y) than in the years before (0.52 g/cm^{2}y) meaning 59% decrease which appears only one sedimentation core. Heavy metal concentrations show high values for Hg in the first 10 cm of the core (up to 450 ppb) and Cd values show an average of 478 ppb throughout the entire core.

SESSION 4

Applications of Dating Methods in Earth Sciences and Environmental Research

Age of fossil tree trunks as an indicator of tectonic activity. Bierawka river catchment, Upper Silesia Upland

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The Bierawka river catchment drains the western margin of the Silesian Upland (260-300 m a.s.l.) and a part of the sandy Koźle Plain. In the older substratum there occurs the contact zone of the Moravian overthrust on the Upper Silesian coal basin. These structures coincide with the course of lineaments of the older substratum (Żeleźnikiewicz *et el.* 2011) reflected in the pattern of 1st order valleys dissecting the elevated part of the catchment. The 25 km long middle river course, covered by Tertiary sediments and Quaternary glacigenic deposits, related to the Scandinavian ice-sheet which covered this area twice during the Pleistocene. The differences in the sub-Quaternary surface confirm the hypothesis on neo-tectonic activity of the older substratum in this part of the Bierawka valley (Buła *et el.* 2007).

A map on the scale of 1:25,000, >190 years old, informs that during this time a partly meandering Bierawka channel ran at the right side of the valley, but the valley floor had backswamp topography drained by small streams. Later engineering training of the main channel increased its longitudinal slope resulting in higher energy of flowing water. This caused deepening of the channel. A detailed investigation was carried out in the alluvial sequence of the 1.6 km long meandering section of the river channel. The same section of the channel is accompanied by fragments of a natural levee, 1-1.2 m high, whose lee slope descends toward the backswamp depression. In the two undercuts of the river banks, up to 3 m high, the outcrops of vertical sequence were analysed. In its lowermost part occur laminated silty clays with an intercalation of fine sands. In the Trachy site the vertically standing alder stumps (Alnus glutinosa) with a diameter of 10-15 cm were identified. The lowest of them have their roots above the mean water level and more than 1 m above the channel bottom. The ^{14}C dating (MKL Lab. Kraków) indicates their age between 3670±40 and 3310±40 BP. The younger ones, standing on higher levels of the sediment complex, were dated at 1120±60 BP. A similar clay complex of alder roots was identified ~0,8 km downstream the Trachy exposure. Due to the river channel slope, the lowermost horizon of this silty sequence is elevated ~0,6 m above the mean water level. Its ^{14}C dating indicated the age 3000±40 BP. This signifies that in this section of the valley floor the para-limnological alder swamps environment existed for at least 2.6 ka. As mentioned before the investigated part of the Bierawka valley crosses an active tectonic zone dissected by faults, on which continuous neo-tectonic activity occurs (Buła *et el.* 2007). Even with very slow subsidence of ≤1.0 mm/year during 2-3 ka this section of the Bierawka valley could subside by 2-3 m. Most probably in the few km of the middle course of the valley the environment of alder forest existed here until the Early Middle Ages, when forest clearance started within the upstream part of catchment.

Analysis of trace elements: Cd, Cu, Pb, Mn and Zn concentrations in these deposits (fraction <63 μm), indicates a stable level. It resembles the alluvia of the neighbouring Oder tributary-the Ruda river- deposited since 3000 BP until the Medieval Period, as well as Cd and Pb concentrations in the alluvia of the Przemsza river and the upper Vistula valley between 2900-1200 BP (Macklin & Klimek 1992).

The Silesia Upland slope, drained by Bierawka source tributaries, transformed the hydrological regime of the Bierawka river and started eroded soil delivery to its valley. In its middle course the para-lacustrine deposits are covered with alluvia deposited by running water. These alluvial sequences increase the river discharge caused by the growing area of forest clearance for croplands fields. Within these vertical sequences of alluvia the concentration of trace elements, especially Cd, Cu and Zn, is higher by ~1 order of magnitude. The concentration of Mn reaches up to 650 ppm. This indicates intensive soil erosion. The uppermost sequences of sandy alluvia

contain hard coal particles witch inform about the age of its deposition - the beginning of hard coal mining and washing away of coal waste-heaps.

Rates, variability and conditions of sedimentation in various depressions on examples from Kętrzyn area (NE Poland)

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In the area of Kętrzyn there were conducted the studies of the sediments accumulated in the Salęt Wielki and Salet Mały lakes and in small depressions located in the vicinity of Poganowo and Poganówek. In the Salęt Wielki lake there were sampled and analyzed the deposits from such sites as: the central part of the lake, from the shallowness closer to the shore and from the bay that is separated by islands from the open lake. Another core was collected from the northern, smaller part of the lake (called Salęt Mały) which is separated by a narrowing from the southern part. The cores were taken also from two small peaty depressions near the Poganowo and from one vast, shallow depression in the Poganówko area.
The aim of the study was to identify the types of deposits, their age and main sedimentological and geochemical features. Particular attention was paid to the variability of sedimentation, both in time (vertical profiles) and space (lateral variability).
The cores from the lakes were taken using the Więckowski auger; mineral, gyttia and peat deposits were taken from local depressions with the use of Eijkelcamp gouge and peat augers. Radiocarbon dating were done for selected samples. The obtained ^{14}C datings were combined with palynological, geochemical and archaeological data.
The thickness of the lake deposits were as follows: 10.25 m from the central part of the Salęt Wielki lake (depth of the water - 8.9 m), 13.75 m from the bay site of Salęt Wielki lake (depth of the water - 4.55 m), 15.7 m from Salęt Mały lake – depth of the water 15 m (Szal *et el.* 2014). The thickness of the sediments taken from the depressions was not very big reaching maximum 2.6 m. The oldest ^{14}C date - 12120 ± 300 BP (14650-13600 cal BP; 68.2%.) was obtained from the peat at the base of one of the small depressions located in the vicinity of Poganowo. These local depressions are now quite small in size, but after the melting of dead ice they were the part of a significant big depression with a varied in configuration bottom. The accumulation started yet at the dead ice and except from the thin layer of sandy peat, it was generally a sand of various grain size with admixture of both coarse (fine gravel) and finer (dust and clay) fraction. A similar sequence was recorded in the bottom of the sediments filling the Salęt Wielki lake, both in the bay and in the central part of the lake. The peat occurring at the base of lacustrine sediments in the bay was radiocarbon dated for 11150 ± 120 (11160-10900 cal BP; 62.8%).
In the Salęt Wielki lake, both in its central part and in the bay, there occur the gyttja deposits, in the bottom part with a predominance of mineral material (except for basal layer of peat), whose average share is respectively 59% in central and 76% in the bay part of the lake. The share of carbonates is as follows: 27.5 and 13.5%, a loss on ignition indicate for 13 and 9% organic matter contents respectively. The bulk of the lacustrine sediments is mineral-carbonate-algae gyttja (37.1: 34.5: 28.4) in the middle of the deep part of the lake and carbonate-mineral-algae gyttja (42: 30.5: 27.7) in the bay. A clear change of sedimentation type associated with anthropopressure marks in the bay at a depth of 0.85 while in central part of the lake is 0.5 m (without a layer of low compaction – 16.5 cm). In the bay part of the lake there is almost 2-fold increase in the share of the mineral part (64.5%), slight reduction of the content of organic matter (23.7%) and 3-fold decline in the carbonate share (to 11.8%). In the central part of the Salęt Wielki

lake it is also mineral-algae-carbonate gyttja (60:32:8). The calculated average sedimentation rate before human activity in both parts of the Salęt Wielki lake is similar and reaches 1.19 mm per year in the bay and 1.04 mm in the center of the lake. Taking into account the period from the first anthropogenic deforestation, ie. from the early Bronze Age the rate of sedimentation is smaller and give some 0.64 mm/year in the bay and 0.21 in the central part of the lake.

In the northern part of the lake known as Salęt Mały lake, where it is the deepest, sedimentation rate was much faster and reached for the period prior to human economic activities 1.28 mm/year and in the period from the late Bronze Age to the early Middle Ages 1.2 mm/year. From the early Middle Ages there was the accumulation of some 3.3 m of sediment, what gives the rate of 4,1 mm/year. Probably an increased sedimentation rate is associated with the shape of the lake basin (deep kettle type with steep slopes) and the presence of 3 small tributaries ending in the lake.

Small size depressions, with prevailing peat sedimentation and periodically mud deposition are characterized by a much slower rate of accumulation than the lakes i.e. 0.08-0.17 mm/year in natural conditions and 0.13-0.37 mm/year from the Iron Age, due to progressively increasing human economic activity.

The study was financed by the Polish Ministry of Science and Higher Education/ National Science Centre of Poland through the project no DEC-2011/01/B/HS3/04167.

Human impact record in the sediments filling the river valley (a case study from Radom, Central Poland)

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The contemporary look of the Mleczna river in Radom and the facial differentiation of the sediments filling the valley bottom is the result of complex natural and anthropogenic processes that took place in the Holocene. Economic development of Radom and villages located in its vicinity led to the change in natural environment (eg deforestation and the increase in the area occupied by the arable fields) and in the organization of surface water (numerous regulations trough, construction of fish or mill ponds). Forcefully growing industry and crafts (especially defence and leather industries) led to the release to the environment various contaminants that were accumulated in sediments (especially heavy metals such as As, Cd, Co, Cu, Ni, Pb, Zn). Contemporary boggy valley floor of Mleczna river in the central part of Radom has been used through the last 2-3 hundred years as a, to some extent, waste disposal site – there were deposited there tannery and household wastes, concrete and brick rubble or the soil taken from foundation trenches. Stratigraphy of sediments (particularly, waste and artifacts) filling the river valley on studied section is a record of the economic history of the city through the last few hundred years.
Geochemical studies of sediment and radiocarbon dating made possible to distinguish different lithological-geochemical levels, which were created in the different phases of human activity in the investigated area. There are the following main levels/phases (from the base to the top): the level of geochemical background formed under natural conditions during the Late Glacial and early Holocene periods, the level associated with the first phases of erosion on deforested slopes in the vicinity of the Mleczna river valley, the level associated with human economic activity in the early Middle Ages (the Piotrówka stronghold), the level associated with the period of 19/20 centuries industrial revolution, the level influenced by the intensive development of the city of Radom after the second half of the 50s of 20th century and the present phase covering the last 20-30 years.

SESSIONS 5 & 6

Applications of Dating Methods in Archaeology

Chronology of the the Middle to Upper Palaeolithic Transition site of Lubotyń 11 in the light of bayesian age modelling

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Lubotyń 11 is currently one of the most well preserved szeletian sites in Poland and one of the best examined sites of this culture. Research conducted since 2006 on the area of 110 square meters has provided almost 14 thousand of lithic artefacts and led to the discovery of the relics of fireplaces. The site is located in the southern part of Głubczyce Plateau in Silesia. It is located on the top of a vast hill, one of the highest points in the area (309.8 m. a.s.l.), built of fluvioglacial sediments of the Odra glaciation. The sediments were later covered by loess (currently partially eroded) at the end of the second vistulian pleniglacial. The area where remains of szeletian settlement were found is cut by the frost- or ice-wedge pseudomorphosis, which were created before the settlement. Fluvioglacial sediments with depressions which were remnants of the wedges were the original living floor. After the settlement, the cultural layer was partially displaced, but partially left intact and covered by sediment flowing into depressions. It led to a good preservation of the lithics distribution as well as the fireplaces. The samples of charcoal from the fireplaces were radiocarbon dated and series of 6 dates were obtained and the following 8 samples are being processed in the lab now. Also, OSL dating of the sediment were conducted. Together with the analysis of the planigraphy, the dates allow us to state that the site is a palimpsest - place of overlying traces of multiple visits of human groups during a long period of time.
Bayesian age modelling of the dates from Lubotyń 11 allowed to determine the beginning and the end of the human settlement on the site as well as to frame the chronology of the environmental events predating and following the settlement.
The study is supported by the National Science Centre (decision no. DEC-2012/05/N/HS3/01533) and the Provincial Heritage Office in Opole.

Oxygen isotopes in Rodent bone and teeth phosphate - a new model for paleoanthropological researches

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Oxygen isotopic analysis of human skeletons can provide information on local vs. non-local origin, migration and mobility of individuals. The research are based on assumption, that there is a relationship between the isotopic concentration of oxygen in environmental (drinking) water and the oxygen isotope ratio in mineral fraction of bone tissue of individuals who consumed local water. On the grounds of comparison between oxygen isotope concentration of bone phosphates and local- environmental oxygen isotopes ratio it is possible to determine the individuals origin.
It is known, that people subjected water to thermal processing as early as Neolithic period. The main aim of the investigations was to determine the influence of thermal processing of water on final isotopic composition of oxygen in bone and teeth apatites using rats as an animal based model.
The experiment was performed on 40 rats that were divided into two groups according to the type of consumed water (tap water and water thermally processed). A femurs and a complete sequence of teeth were collected from each sacrificed rats. Phosphates were isolated from bone and teeth samples and oxygen isotopic analysis was carried out using a continuous flow isotope ratio mass spectrometer (CF-IRMS).
Analysis of the results showed, that there was a statistically significant difference between the isotopic composition of phosphates in both studied group of rats.

Prospects for mortars dating

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All building materials based on carbonaceous fractions, as mortars and plasters, absorb the atmosperic CO_2 during the hardening process and for this reason the ^{14}C should reflect the time of building construction (Baxter and Walton, 1970; Heinemeier *et el.*, 1997; Michalska and Szczepaniak, 2014). However, mortars may contain carbon from diferent origin, carbonate contaminations as limestone aggregate, lime lumps, recrystalisation or not totally burnt fragments of limestone, affecting radiocarbon dating results (Lindroos *et el.*, 2007; Michalska *et el.*, 2013). The knowledge of geological structures coupled with the research results allow to indicate the provenance of the raw materials used for mortars production. Precise geomorphological and geological analyses of the area may give additional information about the conditions influencing the preservation state of samples.

The methodology used for moratrs and plaster preparation for dating vary (Marzaioli *et el.*, 2013; Nawrocka *et el.*, 2009; Nonni *et el.*, 2013) depending on their mineralogical components, environmental conditions and preservation state.

Mortar is a mixture of binder and aggregate in different proportion. Analysing the influence of different carbonaceous containants on the ^{14}C measurement results, separate radiocarbon dates were made on bulk samples, grain factions from mortars, binder separated by freezing and thawing process, fraction from suspension and charcoal fragments. The analyses were made for samples coming from diferent climatic, environmental conditions and for samples with different petrographic composition.

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Chronology of Early and Middle Neolithic archaeological sites from Poland, Slovakia and Hungary based on radiocarbon dating of archaeobotanical materials: benefits and weaknesses

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Radiocarbon dating is crucial for the construction of chronological models of archaeological sites. Therefore, a selection of suitable organic samples from precisely localized layers is an important task, which need to be performed carefully in each excavation. Charcoals and cereal grains are among the most routinely dated plant materials, which, however, are not frequently taxonomically identified. Our presentation is focused on the necessity of such identification of botanical samples prior to radiocarbon dating as a tool for choosing the most relevant materials and for detecting possible taphonomic problems. The most appropriate specimens should be selected using the knowledge about typical plants for each chronological period in a given region, including wild and cultivated ones. For more accurate dating results, cereal grains, fruits and seeds, which reflect a single vegetative season, are preferred. Among wood, fragments determined as twigs, branches and external rings should mainly be taken into account, while those of trunks belonging to long-lived trees should be avoided. The presence of unexpected taxa, from the perspective of the history of local flora and cultivation practices, may indicate some taphonomic problems. They should be excluded from the group of samples that are the most adequate for radiocarbon dating of a given site. The benefits and weaknesses of dating of taxonomically identified samples will be commented based on some case studies from Polish (Mozgawa, Gwoździec, Ludwinowo), Slovak (Moravany) and Hungarian (Polgár-Bosnyákdomb, Polgár-Csőszhalom) archaeological sites, dated to the Neolithic period. These examples may better illustrate the significance of the detailed botanical identification since plant materials of the Neolithic age include only a limited number of cultivated species (e.g. hulled wheats) and typically do not contain remains of late arrived and late used plants (e.g. Carpinus betulus, Fagus sylvatica, Avena sativa). Finally, besides the absolute chronology of archaeological features and artefacts, AMS radiocarbon dating of identified plant remains might significantly contribute to the history of local vegetation and food production systems.

Epigravettian and Magdalenian in Poland: New chronological data and old problem

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An increase in number of chronological data from the Late Palaeolithic sites of Poland resulted in changes of timespan of such cultures as Gravettian, Epigravettian, Magdalenian and Hamburgian (Kabaciński, Sobkowiak-Tabaka 2010; Kozłowski *et el.* 2012; Bobak *et el.* 2013; Bobak, Bobak-Połtowicz 2014; Wilczyński *et el.* 2012). The question, which emerged from new chronological frameworks, is whether the chronological overlapping of some sites are representing different cultural units.
At this work we discuss the issue of presence of Epigravettian and Magdalenian simultaneously in south Poland during the late Last Glacial Maximum. We would like to consider whether overlapping chronological data may indicate the coexistence of groups of hunters and gatherers who representing different traditions, or "the coexistence" is a result of inaccuracies in the age assessment of the archaeological remains.
In the light of new chronometric data supported financially by National Centre of Science (UMO-2014/13/B/HS3/04906) the age of cultural units was determined with the use of radiocarbon method and optical luminescence method.
Preliminary results indicate that the concept of co-existence of people representing different cultures cannot be denied. Archaeological records, however, did not provide any evidence of interaction between both groups. There is no clear proof for techno-typological diffusion. Despite the fact that mentioned groups could explore the same environmental zones and use the same or similar resources it seems that both groups in some cases could use different strategies of territorial organization.

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Dating the foundations of the gothic Saint James Church in Toruń by the OSL method

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Archaeological research at Saint James Church in Toruń, which is one of the most valuable gothic monuments in Poland, have been carried out for several years. In the years 2010 - 2015, altogether 20 samples of bricks for luminescence dating were collected from the foundations in 10 excavations located around the church. The date of the beginning of the construction of the present church is known from medieval sources. Construction of the church's present body started with presbytery in 1309, then aisles and the western part were completed (Freymuth, 1981; Kluczwajd, 2009; Sulkowska-Tuszyńska, 2010). The first motivation of dating the bricks from the Saint James Church was to solve the problem with an inconsistency in the construction of the foundations found at the north-western side of the present presbytery. The buttresses resting on the foundation are built slantwise to the axis of the church but the deepest part of their foundations is not constructed in a similar way but perpendicularly to the axis. This suggests that there could exist another building in this place before the present seven hundred-year-old temple was build. Such a thesis is confirmed by the dating results obtained for the bricks originating from the foundations of the south-eastern side of presbytery. In this part of the church the foundations are not deep and they are constructed consequently but the majority of the bricks were produced significantly earlier than the works on the present church were started. Only two bricks taken from this side of the presbytery originate from the fourteenths century. The comparison of radiometric results, obtained by means of the gamma spectrometry and used for the calculation of annual doses, shows that the older bricks could be produced from the same clay. The concentrations of the individual radionuclides in these samples are similar and differ from these concentrations measured for the younger bricks.

The samples from the Saint James Church in Toruń make a considerable set of bricks collected from one object and dating of them was a good opportunity for a few works concerning the methodology of dating. First of all, it turned out that TL is not a useful tool for dating in this case (Chruscińska *et el.*, 2014). The OSL ages referred to the historical context properly so the OSL method was applied to all samples and also the SAR OSL protocol was a subject of methodological tests concerning the proper temperature of OSL measurements in SAR protocol. Results of these works prompted to use the lower temperatures of OSL detection. The correction in SAR protocol allowed to distinguish two clear phases of the production of bricks from presbytery foundations. A good number of samples used for dating encouraged to apply the statistical approach that allowed to reduce the uncertainties of the age of phase. The dating results indicate that the significant part of bricks used for the construction of the Saint James Church originated from an older building that was dismantled. The foundations of this building were used as the part of foundations of the present church.

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Attempt at luminescence dating of mudbricks from Romitan (Bukhara Oasis, Uzbekistan)

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The Uzbek-French archaeological mission in the oasis of Bukhara, Uzbekistan (MAFOUB), headed by the Department of Islamic Art - Louvre Museum and the Samarkand Institute of Archaeology, aims to study human occupation and urban phenomenon in the oasis and in the largest regional context of the Great Khorasan and margins of the Iranian world.
This project includes both the geomorphological study of the dynamics of the formation of the oasis and the evolution of palaeo-channels in connection with the urban settlement (Fouach *et el.*, Submitted) and the study of archaeological sites in various environmental contexts: Romitan and Iskijkat, in the heart of the oasis; Paykend, in a micro-oasis located between the Kyzyl Kum ("Red Desert") and the Kara Kum ("Black Desert"). These sites are believed to have been founded in the beginning of our era and have persisted beyond the conquest of Islam.
They comprise citadel, one or more lower-towns (Sharistan) and several suburbs (rabad). The use of architectural terracotta is extremely rare. Apart from the later phases, the architecture is earthen. We do not have any problem to use luminescence dating on the site of Paykend, where we sampled mainly pottery workshops (pottery scraps and burned earth walls). For Romitan, where we tried to date the foundation of the site and its different parts, the scarcity of ceramic related to architectural structures has led us to try to work on adobe bricks.
To use luminescence dating of mud bricks, it is assumed that the preparation of the clay enable to expose enough grain to light to bleach the geological signal. A first attempt to date without special preparation proved encouraging. We get slightly older dates (few centuries) than those obtained on terracotta from the same contexts. To reduce the contribution of poor bleached component, we use the fast component of blue-OSL from quartz fine grains. The result agrees with the archaeological records and potsherds dates.

SESSION 7

Dating Methods

Recognizing partial bleaching in OSL dating of sediments

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Simple phenomenological model was used in order to predict, how the quality of bleaching influences the distribution of equivalent doses (De) measured in SAR OSL procedure. The model was verified by experiments involving simulations of optical bleaching and burial dose in laboratory controlled conditions. The OSL measurements on large aliquots were carried out and the results were analyzed and compared to the model outcome. It derives that the better bleaching quality, the lower the overestimation and the spread and asymmetry of De results.
Distribution of De can be used for assessing the quality of optical bleaching of OSL signal in sediment if other sources influencing scatter of De can be neglected. For that purpose a new method of analysis of De distribution was proposed. It automatically takes into consideration the intrinsic distribution of OSL sensitivity and effect of the aliquot size. The analysis is based on the idea of Equivalent Bleaching, which is defined as optical bleaching performed in laboratory which effects on OSL results are equivalent to that observed for natural OSL. In order to characterize bleaching quality in a quantitative way a new numerical coefficient was introduced.
For given sample the series of experimental bleaching simulations were performed with help of luminescence reader equipped in Blue Light emitting LEDs and beta radiation source. These results were analyzed and compared to the outcome of standard SAR OSL measurements. This approach enabled to evaluate Equivalent Bleaching and determine the degree of bleaching in geological deposit. Then appropriate correction for equivalent dose De could be applied in order to eliminate OSL age overestimation.

Luminescence properties of quartz in fine and coarse grain modern floodplain sediments along the Hungarian section of the Danube

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The successful application of luminescence dating on fluvial sediments is determined by several actors, such as appropriate resetting, the mode of transportation, the different behaviour of different grain size fractions, mineralogical properties and the phenomenon of thermal transfer (Alexanderson 2007). The Danube is the largest river of the region, it has formed extensively the landscape of the Carpathian Basin, therefore Danube sediments build up most of the lowland territories in the basin. In order to perform investigations of the Holocene and Late Pleistocene history of the river it is necessary to assess the luminescence properties of its sediments. The Hungarian section of the Danube is unique in the sense that it crosses several uplifting and subsiding areas changing the erosional character of the river, and therefore affecting its sedimentary characteristics. In the meantime, there are long reaches without significant tributaries. Although anthropogenic factors may also affect the properties of sediments (Fiebig and Preusser 2007), the above mentioned factors make the chosen 417 km long river reach an excellent section to test the longitudinal change of parameters such as residual doses, recuperation and thermal transfer.
During the field campaign 32 sites were visited when it was possible both fine grain and coarse grain sediment samples were collected. In all 49 samples were taken. The investigated sediments were deposited during the record flood of 2013, which presumably relocated vast amounts of sediments in the system. The preparation of quartz samples followed conventional techniques.

At present detailed measurements on thermal properties were performed on 5 pairs of coarse and fine grain samples. As a first step preheat and cutheat tests were performed, to have an idea on proper thermal settings, secondly thermal transfer was investigated with several procedures. Based on the results, the value of residual dose was determined in each sample. Results were assessed by comparing fine and coarse grain samples and by interpreting the spatial distribution of data.
It was found that thermal transfer is negligible in case of the selectedcoarse grain samples up till 240°C, while the best SAR results were received using 200°C preheat and 160°C cutheat temperatures. Consequently, thermal transfer is not an issue during the routine dating of these samples. On the other hand fine grain samples exhibited a considerable thermal transfer affecting measurements even at lower temperatures. Concerning the equivalent doses of the fine and coarse fractions tendencies determined in the literature were confirmed, however, the usual dose received for fines was hardly exceeding 2 Gy, meaning that in dating studies on older sediments the problem is limited. The presence of different erosional states along the river seems to have an effect on residual doses experienced in case of coarse grain sediments, namely its value slightly increases downstream of incising sections. The luminescence behaviour of the investigated samples in general suggest that sediments along the river can provide reliable ages in the future.

Prototype low level multicell liquid scintillation spectrometer for high throughput ^{14}C dating

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In liquid scintillation radiocarbon measurements there are two limitations. Firstly, an accurate ^{14}C measurement takes several days using a conventional LSC spectrometer and only one sample can be measured at any given time. Secondly, environmental samples are often heavily contaminated with ^{222}Rn isotope. The subsequent decays of ^{222}Rn cause artificial counts which can be falsely classified as decays of ^{14}C. This usually is solved by storing benzene sample for *ca.* 30 days before the actual LSC measurement, during which ^{222}Rn decays almost completely. These two factors seriously limit the throughput of a laboratory equipped with such spectrometers.

In this work, we propose a low level multi-cell LSC spectrometer which allows overcoming these limitations. The multi-cell LSC spectrometer is capable of measuring five samples simultaneously which increases the throughput by the same factor. The electronics of the MC-LSC spectrometer comprises the additional module measuring time between subsequent pulses. In that way, information about amplitude and time associated with each pulse is available for further processing and identifying pulses caused by subsequent decays of ^{222}Rn daughter products. This unique feature allows for simultaneous measurement of five ^{14}C samples immediately after the production of benzene. The software controlled high voltage power supply provides a high stability voltage for PMT's in each counting cell. The counting chambers are enclosed in a high purity copper and lead shield which significantly decreases the instrument background counting rate.

Acknowledgements: The development of MC-LSC spectrometer was financially supported with the grant LIDER/001/404/L-4/2013 by the Polish National Centre for Research and Development. The authors would like to express their gratitude to Mr. Aleksander Kolarczyk, Mr. Michał Strządała and Mr. Jan Holko for their help in the device design and construction.

SESSION 8

Applications of Dating Methods in Earth Sciences and Environmental Research – part 2

Reflection of climatic changes during Interpleniglacial in geoecosystems of Southern Poland

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The central part of Europe during the last cold stage was occupied by permafrost and twice invaded by the Scandinavian ice sheet, but about 70% of time was taken by transitional phases of continuous fluctuations of permafrost, which are reflected especially in type and thickness of slope, fluvial and aeolian deposits. Two very distinct changes took place: one during the relatively rapid aridisation of climate around 30-25 ka BP (with the ice sheet transgression, expansion of continuous permafrost and the start of loess deposition) and second rapid warmings at 14.8 and 11.7 ka with expansion of forest and change of the hydrological regime. The greatest transformations in the relief of slopes and river valleys (denudation of slopes, thick alluvial fills) took place not in coolest phases with stable permafrost but during Interpleniglacial. The authors exemplified number of sites in Southern Poland documenting frequent fluctuations of temperature and permafrost from that 30 ka long period. Calibrated dates of dated episodes correlate well with δ^{18}O NGRIP curve from Greenland with frequent warmings (more than 4 officially named). These rapid warmings are reflected in higher rate of aggradation in valley floors and thick colluvia, both combined with the retreat of permafrost. The authors also suggest to turn more attention to spatial diversity of sediments and forms depending on type of substratum, local relief and topoclimate as well as short episodes of higher intensity of processes, which some try to explain as products of longer phases. In palaegeographical reconstructions, we simplify too much the picture of changes both in space and in time. Therefore the comparison with δ^{18}O NGRIP curve is very valuable for establishing the chronology of events even for so vast area like Central-Eastern Europe.

Luminescent techniques applied in dating the fall of meteorites in Morasko

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The extra-terrestrial matter flight through the atmosphere results in strong heating of the surface of the objects, the interior of which remains cold. The surface of the meteorites is varied by the ablative niches with a thin layer/film of fusion. In the stone meteorites, there is also direct reset luminescence, while in the case of iron meteorites, only the status of the matter is changed. As a result of the fall of the iron meteorite on the mineral substrate, there is either a zone variety, thermal effects, leading to formation of the sintered layer, and also within the limited spatially "encapsulation" of the molten matter of the encountered meteorite mineral grains. Therefore, "semi-fusion unit" is formed, enabling the luminescent dating, due to existence of the mineral grains. Duration of the meteorites in the land, in turn, causes the aeration transformation of the contact zone of the meteorites with the surrounding deposits. Therefore, the generated shell layer of the meteorite is: fusion-aeration and sintered-aeration. Their thickness and the method of formation is characterized by considerable variety. Recognition of the layers: the right fusion with "semi-fusion" and sintered was documented with the SEM and ESD analyses of 970-g meteorite.
Attempts to use luminescent dating of the probable resetting time of the material from the places the meteorites fall in Morasko, was started several years ago with using the TL techniques for potential sintered/ sintered-aeration halos of four meteorites weighing from 10 kg to 20 kg, and few minor objects weighing from a few dozen grams to more than 1 kg. In all cases, the obtained TL dates were from > 4 to > 6 ka.
The authors obtained the OSL indicators of the age of the analysed meteorites shells (690 g, 970, 34 kg) and the mineral deposits of the direct environment of the largest meteorite of Morasko (261 kg), which are characterized by large variety. This proves the uneven zeroing, but due to existence of a relatively young indicators, it remains at the same time, in accordance with the primary age of the sediments of the fall places (>60 ka for Neogene sediments and > 17 and > 27 ka for the Quaternary sediments).
The highest value (~60 ka) was achieved for 34-kg meteorite crust, being in the Neogene sediments. However, for 970-g meteorite crust, extracted from the Quaternary sediments, the achieved indicator was ~ 27 ka. The other two dates for 34-kg meteorite crust (~ 23 and 21 ka), and another of its alleged fusion layer (~ 8 ka), also seem to indicate a young, though half-zeroing. While the last three dates (~ 7, 5 and 4 ka) are very close to the impact time in Morasko, the documented palaeobotanically and morfogenetically. At this point, it should be noted that a similar feature relates to the dates (~ 12 and above all > 6 ka) for the Quaternary sediments from 261-kg meteorite environment.
The luminescent dating indicates a young (~ 4-6 ka) age of the impact of Morasko.

Problems of absolute dating the Pleistocene glacial deposits by the example of the Chagan section, Russian Altai

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Reconstruction of patterns of Pleistocene glaciations in mountains of Southern Siberia, as well as correlating sediments within Central Asia collision belt and platform areas of Siberia, is not possible without absolute dating of glacial deposits, but these types of continental sediments are very complex to date absolutely. By now there is a wide arsenal of different numeric techniques. The application, precision and accuracy of each of them vary considerably.

Within the Russian Altai utilizing most of techniques are highly problematic. Organic material generally is not presented in ancient moraines and glacial sequences are beyond the radiocarbon timescale; geological materials suitable for other radiogenic dating methods are also absent; repeated developing giant ice dammed lakes within intermountain depressions complicates applying terrestrial cosmogenic nuclide dating. Moreover, there is a lack of finds of macro- and microfauna in regional reference sections and spices composition doesn't allow establishing the glacial sequences. Palynological analysis is ineffective because of the significant redeposition of the pollen. Thus the Quaternary of Russian Altai is still poorly understood with the number and chronology of glacial cycles unknown, and the proposed extent of glaciation varying widely between different authors. Luminescent methods are ones of the few that can be used for absolute dating ancient glacial landforms and deposits in the region, and geomorphological analysis remains the major approach to determine the number and extension of ancient glaciations.

The Chagan section is one of the reference sections of Pleistocene glacial, glacio-fluvial, and glacio-lacustrine deposits in Russian Altai. By now it was characterized by 8 TL and 3 ^{14}C dates. 3 TL ages form the basis for the formal Altai Pleistocene stratigraphic scale and depositional correlation schemes for Russian Altai, Altai foothill plains, and Siberia. In this study we present a broad set of new absolute dates (3 IRSL, 20 TL and 1 ^{14}C); discuss applicability of different luminescence techniques for dating Pleistocene glacial and associated sediments in the region; analyze tectonic and climatic factors that control the number and extension of the Pleistocene glaciations in different parts of Russian Altai.

Numerous absolute dating of glacial sediments in the Chagan section revealed a large spread in TL ages, which are sometimes poorly agree with the stratigraphic position. Generally, we approve that this method is poorly suited for dating glacial sediments and should only cautiously be used for making any reconstructions and correlations. The first experience of applying IRSL technique demonstrates its great potential. Small number of obtained IRSL ages does not allow complete construction of the Pleistocene glacial chronology, but gives the possibility for further experiments with different variation of OSL (IRSL) techniques. Analysis of physical properties of minerals-dosimeters reveals specific regional quartz features, which emphasizes the importance of the discussion about correct choosing the mineral-dosimeter (quartz versus feldspar). We can also assume a relatively low number of depositional cycles for the mineral grains in this section and short transport distance.

Thus the age of Pleistocene glacial sediments and landforms in Russian Altai remains a mainly relative determination and correlation schemes, based on the first TL dates, needs to be improved.

SESSION 9

Terrestrial archives of environmental changes – trees

Dendrochronological research of chieftain's grave in Poprad-Matejovce: current state of things

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The presentation introduces the current state of dendrochronological research of timbers sampled from the early Migration Period princely grave discovered in Poprad-Matejovce, north Slovakia. Both chambers of the grave were exceptionally well preserved as were rarely surviving perishable materials, e.g. textiles, leatherwork, basketry, and wooden furniture.
The grave consists of outer and inner chamber, both built from larch wood (Larix decidua). The outer chamber is a flat-roofed cabin built from beams and the inner one is a finely carpentered gable-roof structure. The whole grave rests on two halved stems.
For dendrochronological research, 26 timbers from the outer and 2 from the inner chamber were sampled by saw; 4 timbers retained sapwood and 3 of them the cambial ring. Tree-ring width was measured on 1–4 measuring paths per sample on transversal sections under stereomicroscope on TimeTable measuring device (VIAS Dendrolab) with 0.01 mm precision and acquired data were processed in PAST4 (SCIEM).
From the point of cambial rings, two archaeological events are definable, namely construction times of the inner and the outer chamber. The construction time of inner chamber (terminus a quo/ post quem) enables to investigate a roof plank with waney edge , the construction time of outer chamber (terminus a quo) two basal halved stems with retained bark.
Since the find precedes the beginning of standard chronology for larches from Slovak Republic, the acquired chronologies will be anchored to the absolute time scale by Bayesian modelling with radiocarbon dates.

This work was supported by DFG Project LA 2891/2-1 "The chamber grave of Migration Period at Poprad, Slovakia – an interdisciplinary research project for evaluation of an extraordinary find" and by the Slovak Research and Development Agency under the contract No. APVV-0598-10.

Applying dendrochronological approach in paleoseismogeological investigations by the example of the SE Altai

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Absolute age determination of ancient earthquakes is one of the key paleoseismogeological problems, which accurate solution allows properly understanding the seismic potential of a region, and assessing the associated seismic hazard. The period of instrumental seismological observations is insignificant in comparison with the recurrence interval of strong earthquakes. Thus historical data are being involved. Paleoseismogeology supplements historical and instrumental records of seismicity by characterizing strong prehistoric earthquakes. It is focused on studying ground effects (both primary - ruptures, and secondary - gravitational deformations) from past earthquakes preserved in the geologic and geomorphic environment.

In this context radiocarbon method is the most exploitable and widely applicable dating technique. It allows determining the age of soils, tree fragments and other organic materials which were deformed and/or buried during the earthquake. In case of spreading the forest vegetation in seismically active areas tree-ring analysis can be used as an additional or alternative approach. It has a great potential due to utmost precision of dating - annual and sometimes even seasonal resolution. Generally various seismically induced surface processes, rupturing, ground shaking, scarp formation *etc.* can affect vital activity of trees and cause their reaction on environmental changes. Thus rings of trees - witnesses of seismic events, could be potentially valuable nature archive containing both the evidence for the earthquake and its age. This forms the basis for precise dating seismically induced geomorphic processes, landforms and sediments produced or deformed by earthquakes.

In this study we demonstrate the possible applications of tree ring analysis in paleoseismogeological studies in the SE Altai (Russia) and present the results of dating strong prehistoric earthquakes here on the basis of dendrochronological analysis. This is a very promising tool and it has a great potential in regional paleoseismogeological investigations due to several reasons:

1) Seismically induced slope processes intrude into the forest stand zone in immediate vicinity with the modern upper timber limit;
2) Arid climate promotes good preservation of wood - up to two thousand years on stone surfaces;
3) Number of long absolute tree-ring chronologies has been developed for the SE Altai and adjusted regions;
4) 2003 Chuya earthquake (MS=7.3) gives unique opportunity to analyze the distribution patterns of wood penetrating injuries and other growth anomalies of specifically seismic origin.

Paleoseismogeological researches revealed the repeated reactivation of the same focal zones within the SE Altai. In addition to estimating the germination ages of trees growing on the bare surfaces of seismically triggered landslides we have also developed dendroseismological approach based on analysis of wood penetrating injures caused by seismically induced rock falls. The accuracy of such an approach was supported by data obtained after the 2003 Chuya earthquake. It should be emphasized that even after that, the dendrochronologically obtained dates of abrupt intensifications of rock falls are just supposed dates of earthquakes, which should be confirmed by alternative proxy data or absolute dating techniques.

Suggested approach can be used as an additional and/or alternative approach in regions where instrumental seismic records or historical accounts are not available.

Intrinsic water-use efficiency for trees growing in Carpathian Mountains estimated on the basis of $\delta^{13}C$ as a record of anthropopression

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The annual growth rings of trees provide a valuable source of past environmental information. Human activities have altered atmospheric composition and climate. It has implications for plants physiology and physical response. Carbon isotopic composition ($\delta^{13}C$) in tree rings has been widely used to estimate temporal and spatial variations in intrinsic water use efficiency (iWUE), which is defined as the ratio of photosynthetic carbon assimilation (A) to stomatal conductance (g). The $^{13}C/^{12}C$ ratio in trees is controlled at the leaf level by the ratio of intercellular (C_i) to ambient (C_a) CO_2 concentrations. If C_i is high relative to C_a, strong discrimination against ^{13}C yields isotopically light biomass. Conversely, if C_i is low - discrimination against ^{13}C results in higher $\delta^{13}C$ values. Therefore, any change in carboxylation and/or stomatal conductance that altered ratio C_i/C_a is recorded as a change in $\delta^{13}C$. Variations in atmospheric $\delta^{13}C$ should be taken into consideration and $\delta^{13}C$ in tree rings must be analysed in relation to atmospheric $\delta^{13}C$ at the moment of its assimilation.

Presented results concern measurements of $\delta^{13}C$ on alpha-cellulose extracted from trees annual growth rings for mountain regions. The selected research areas: Sudeten, Tatras and Eastern Carpathians represent mountains regions with various intensification of anthropopression. Carbon isotopic composition of α-cellulose samples was determined using the continuous flow isotope ratio mass spectrometer coupled to the elemental analyser. Values of $\delta^{13}C$ in tree rings were used for assessing changes in iWUE.

Numerous studies have reported widespread increases in iWUE coinciding with rising atmospheric CO_2 concentration over the past century. Investigations for mountain regions confirm that the intrinsic water use efficiency of trees (the ratio between carbon uptake and water loss through transpiration) increases as stomatal conductance decreases in response to elevated CO_2. Differences in iWUE, calculated from data sets, representing three mountain regions are signifficant. This is connected with different degrees of pollution emissions and different climatic conditions affecting process of photosynthesis.

This research was a part of:
“Trees as isotope archives of climate and human impact on environment in Central Europe mountain areas” funded by the National Science Centre allocated on the basis of decision number1557B/P01/2009/37.

Trees' response to climatic and anthropogenic environmetnal changes: multiproxy analysis in bio-monitoring of industrial area nearby nitrogen factories in Kędzierzyn-Koźle (Poland)

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Data of pine tree cores collected from the area nearby chemical and nitrogen factories in Kędzierzyn-Koźle show increasing levels of pollution, linked to the increasing of industrial activities in Poland and subsequent dust fallout around the site. We report significant changes in tree ring width, carbon and oxygen stable isotopes, radiocarbon and chemical composition (^{23}Na, ^{26}Mg, ^{56}Fe, ^{60}Ni, ^{65}Cu, ^{66}Zn, ^{208}Pb) of living pines (Pinus sylvestris L.). The conifers investigated in this study covered the period from 1920s to 2010 AD.

The combined usage of tree ring width and dendrochemical composition data provides historic records of anthropogenic impact on the environment and allows to identify the behaviour adaptation to the pollution. This study evidences that tree rings can be used as complementary archive of past environmental contamination.

The research was a part of:
- BIOPOL project "Trees as bioindicators of industrial air pollution during implementation of pro-environmental policy in the Silesia region" - funded by the National Science Centre allocated on the basis of the decision number DEC-2011/03/D/ST10/05251
- BKM/507/2013 - Biomonitoring zmian środowiska: spektrometryczna analiza zmian składu izotopowego węgla i azotu w rocznych pędach sosny w strefach zagrożeń zakładów azotowych ZAK w Kędzierzynie (akronim IZOPĘD) - funded by the Ministry of Science and Higher Education ; BKM/509/2014- Metody izotopowe i jądrowe w geologii, geofizyce, górnictwie i ochronie środowiska - spektrometryczna analiza zmian składu izotopowego węgla w rocznych pędach sosny w strefach zagrożeń zakładów azotowych ZAK w Kędzierzynie- funded by the Ministry of Science and Higher Education;
- BKM/513/2015 - Metody fizyczne w badaniu nanostruktur, elementów elektroniki molekularnej oraz ochronie środowiska: Biomonitoring zmian środowiska - spektrometryczna analiza zmian składu izotopowego węgla i azotu w rocznych pędach sosny w strefach zagrożeń zakładów przemysłowych- funded by the Ministry of Science and Higher Education DEC: 209848/E-367/M/2015
- two projects of birateral agreements between Poland and Belgium: "Enregistrement et chronologie de la pollution atmosphérique en Europe au cours du dernier millénaire: Etude comparée d'archives sédimentaires et biologiques" (WBI 2010-2012) and "Historique de la pollution régionale dans les tourbières en Europe: Niveau de contamination en éléments traces métalliques, chronologie et traçage isotopique des sources de pollution" (WBI 2014-2016)

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Sensuła 2016. $\delta^{13}C$ and water use efficiency in the glucose of annual pine tree-rings as ecological indicators of the forests in the most industrialized part of Poland. Water, Air, Soil Pollut., DOI: 10.1007/s11270-016-2750-1

SESSION 10

Terrestrial archives of environmental changes – aeolian deposits

OSL chronostratigraphy for loess deposits in Poland based on a detailed study of four loess profiles in Złota, Biały Kościół, Tyszowce, Strzyżów

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Loess formations in Poland display a close relationship with cooling and warming periods of the Northern Hemisphere during the Pleistocene. Loess sequences sensitively record regional palaeoclimatic and palaeoecological changes. In general, loess is typical for cold and dry, periglacial climate and environment. The intercalated palaeosols are indicators of warmer and more humid climate representing interstadials or interglacials. The silty and sandy aeolian material originates mainly from weathered rock surfaces affected by frost shattering or from glaciofluvial/fluvial deposits of river flood plains. In Poland, loess and loess-like formations occur in the southern part of the country, mostly in the south polish uplands, i.e. in the Lublin, Sandomierz, and Cracow Uplands. In addition, such deposits are found in the forelands and foothills of the Carpathians and Sudetes. At present, luminescence dating provides the greatest number of chronostratigraphic data concerning loess deposits. According to our project we report luminescence ages of loess from the last glacial cycle in SE Poland (up to about 100 ka), obtained in the Gliwice Luminescence Laboratory. Four different loess profiles from different regions in SE Poland were chosen for this investigation. For each profile (Biały Kościół, Złota, Tyszowce, Strzyżów) about 20 samples for luminescence dating and six for radiocarbon dating were collected. Two different fractions were investigated, the polymineral fine grains fraction (4-11μm) and medium quartz grains (45-63μm). For the fine fraction equivalent doses were determined using post-IR $IRSL_{290}$ and for medium quartz SAR OSL was used. Obtained OSL chronostratigraphy for the last 40 k years was also confirmed by radiocarbon dating. Ages obtained for different fractions differ, especially for the oldest part of the loess profiles medium sized quartz yields younger ages than polimineral fine grains and what would be expected from the geological point of view. In addition for all loess profiles samples were collected in a vertical section at close intervals of *ca.* 5 cm and documented in respect of their sedimentology, palaeopedology and stratigraphy. In addition to high resolution OSL dating, grain-size distribution, carbonate and organic carbon contents, geochemical composition and magnetic susceptibility were determined.

All presented result were obtained with support of Polish National Science Centre, contract number 2011/01/D/ST10/06049

The timing of the phases of eolian activity in the Deliblato Sands, Serbia

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The Deliblato Sands is among the largest uniform fixed sand dune areas of Europe, with dune forms outstanding concerning horizontal extension and relative height. These morphological characteristics reflect intensive eolian processes in the past. As such, the Deliblato Sands is considered to be a sensitive landscape, and therefore it can provide important information for understanding paleoenvironmental changes not just in its vicinity, but in the Pannonian Region as well.
Previous research, in the lack of numerical age data, hypothesised various timing in terms of major aeolian phases. Consequently, the aim of the present paper is to determine the morphological units of Deliblato Sands by analysing the spatial distribution of different dune forms and their horizontal morphological parameters, and to provide the first ages for the identified dune associations.
Morphological mapping was made by using topographical and military maps and satellite images. Formation ages were assessed by OSL. In all 26 samples were collected from 4 drill cores, being 5-8 m deep and representing major dune types. To assess the suitability of Deliblato sediments for luminescence dating several tests have been performed concerning thermal treatment, signal characteristics, dose recovery and dose distributions at different aliquot size.
Based on the morphological investigations, a longitudinal and a transversal dune association have been identified in the area, the later being morphologically superimposed on the previous one. Longitudinal forms fit well to the present day prevailing SE wind, Kosava, however transversal forms assume a slightly different direction during their formation. The luminescence properties of the samples were adequate for age determination. The ages received for longitudinal dunes are older than previous authors suggested and place the development of these forms to the Boreal and Preboreal. Meanwhile the transversal dune association proved to be very fresh, ages varied between the Middle Ages and the 18th century, which thought to be earlier the major formation time of the entire Deliblato landscape. These new findings raise further questions concerning the stability and the development rate of dunes and concerning the role of Danube shifts in providing source material for dune initiation.

Luminescence chrononolgy of the middle and upper Pleistocene loess-palaeosol sequences along the River Ob in southern Siberia

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Loess and loess-like deposits with intercalated palaeosols are widely distributed in Siberia, particularly in the major river basins (e.g. the Ob, Yenisei, Irtysh, Lena and Angara River), which have provided invaluable evidences of Quaternary climate changes in the central and eastern Eurasia. Intensive efforts have been made in correlating the palaeoclimatic records documented in these loess-palaeosol sequences with other records, reported from marine and ice cores and from other terrestrial loess sequences. However, the chronostratigraphic reconstruction of the loess-palaeosol sequence in Siberia has long been largely relied on relative chronologies based on pedocomplex type, palaeomagnetic susceptibility, grain size variation and TL dating. Owing to the lack of robust and reliable numerical dating, the correlation of the Siberian loess-palaeosol chronostratigraphy, especially the last interglacial palaeosol, to the marine isotope stage (MIS) is still controversial. Therefore, more chronological studies are of critical importance in refining the chronostratigraphy of Siberian loess-palaeosol sequences and reinforcing its correlation with other palaeoclimatic records.

In the current study, two loess-palaeosol sequences, named Krivosheino and Belovo that are located both along the River Ob, have been systematically investigated using multiple approaches of luminescence dating. The applicability of quartz optically stimulated luminescence (OSL) and feldspar infrared stimulated luminescence (IRSL) dating was tested for the loess samples from both sections. Quartz OSL signals of samples post-dating the last glacial were close to or in saturation which might result in age underestimation. For the feldspar IRSL dating, the post-IR IRSL technique at elevated temperature of 225°C ($pIRIR_{225}$) was employed. The $pIRIR_{225}$ signal showed a great potential in dating the loess samples back to the middle Pleistocene. Based on the luminescence ages, a new loess-palaeosol chronostratigraphy for the middle-upper Pleistocene along River Ob is established. Our preliminary results demonstrate that the last interglacial “Kazantzevo soil” (MIS5e) from the Krivosheino section, which has been widely recognized in Siberia loess-palaeosol stratigraphy, might be younger than previously considered and very likely formed during the time of MIS5a-c.

Poster presentations

Poster no 1

Biogenic Iron-Manganese Formations from Zoloushka Cave: Pilot Study

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Zoloushka Cave belongs to the biggest maze caves in the world (the first in terms of its total volume and the third according to the total length - more than 90 km) developed in gypsum. The cave labyrinth was uncovered by the quarry. Mining of gypsum and deepening of the quarry was accompanied by pumping off underground water. Drainage of gypsum and cavities in it occurred in several stages, each time provoking numerous and various processes, connected with graduate change of hydrogeochemical conditions and redox geochemistry of gypsum aquifer. One of the most interesting among the geological processes was deposition in large amount of Fe and Mn sediments. It was established that iron bacteria (thiobacilli) and nonidentified fungus-like microorganisms played key role in their deposition. In order to establish the mechanism of deposition, chemical and isotopic study of organic carbon were realized. They allowed to formulate the hypothesis and to propose the model of biogenic deposition of Fe and Mn compounds. According to model, autotrophic iron bacteria precipitated Fe-hydroxides assimilating carbon from CO2-rich cave atmosphere. Depending on special conditions, organic matter from Fe-hydroxides used by fungus-like microorganisms to build the another type of hydroxides (colonies) or by heterotrophic bacteria forming Mn-rich sediments.

Poster no 2

Japanese PEat records of ATmospheric deposition of artificial radionuclides (J-PEAT): Impacts of Fukushima accident and implications for radiochronology

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On March 11th, 2011, the most powerful earthquake in Japan history and the subsequent tsunami caused significant damages in the Fukushima-Daiichi Nuclear Power Plant. Artificial radionuclides were released into the environment and to the atmosphere, transported by air masses and deposited on continental surfaces. Despite their harmful effects in terrestrial ecosystems and potential risks to human health, few studies evaluated the total deposition of artificial radionuclides from this accident in low-impact (i.e. natural) areas.
Their exclusive atmospheric nutrients/pollutants supply and high binding capacity render peat bogs suitable to study radionuclide deposition. A reliable chronology of their records allows the temporal reconstruction of fluxes of atmospherically deposited elements. These fluxes can be used to obtain information on emission rates as well as global/local impacts on pristine environments. Japan has numerous relatively pristine peatlands that constitute ideal environments to investigate the immediate regional impact of the Fukushima-Daiichi accident.
The J-PEAT project will couple environmental geochemistry, pollution impacts and radioecology, to investigate the spatial and temporal variability of the atmospheric deposition of artificial radionuclides in Japanese low-impact areas using a multiproxy approach based on the analyses of peat cores. This innovative project will provide, for the first time, estimations of emission rates and total inventories of artificial radionuclide before and after the Fukushima-Daiichi accident. In this poster, we will present the first results of pre-Fukushima radionuclide and chemical element deposition in two peat sections from Hokkaido Island. We will also detail the future objectives of J-PEAT. For instance, the influence of long-range atmospheric transport on the distribution of the radionuclides will be evaluated and new environmental chronometers using artificial radionuclides will be discussed to develop a single approach as far back as the last 500 years, which will benefit the entire research community working on local and global environmental changes.

Poster no 3

Fuegian Peatlands: Recorders of Environmental Changes since the last deglaciation

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Little attention has been given to Holocene pre-anthropogenic dust records in terrestrial environments, especially in the Southern Hemisphere. Yet they are important to 1/ better understand variations in particle provenance, 2/ tackle the linkage between atmospheric dust loads and climate change and 3/ better understand the impact of dust onpalaeoclimate and palaeoenvironments in an area critical for ocean productivity. Here, we explored the use of trace elements and radiogenic isotopes (Pb, Nd) as dust proxies in three peat bogs from southern Patagonia and Tierra del Fuego to assess dust-climate interactions in southern South America since the deglaciation. The distribution of trace elements within the cores indicates, besides tephra layers, episodes of increased mineral dust deposition during the Holocene and beyond. Our main results show that, after an infcreased dust flux during the Antarctic Cold Reversal and the Younger Dryas, the glacial-interglacial transition can be observed in the oldest record (at *ca.* 11,500 cal yr BP), marked by a drop in dust flux from 102 g.m-2.yr-1 to 10 g.m-2.yr-1. The most significant episode of mineral dust deposition during the Holocene is concentrated at ~1,600 cal yr BP with a maximum dust flux of 108 g.m-2.yr-1. Its neodymium isotopic signature of -1 suggests crustal admixing, compared to the εNd values of □2 for tephra layers. This episode is related to neoglacial activities in the Cordillera Darwin (southern Andes). Our results show not only that Fuegian peatlands are efficient recorders of dust fluxes over time, but also that variations in the dust fluxes and provenance can provide clues on paleoclimatic and paleoenvironmental changes.

Poster no 4

On the problem of the age of organic deposits from Słubice (W Poland)

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The majority of the Słubice City area (W Poland), including its historic centre, is situated within the Odra river valley. The remaining part of the town, located on a moraine plateau, is separated from the Odra valley by a visible morphological edge.
In the Słubice shallow subsoil, usually analyzed for the need of building engineering, there are common occurrences of several intercaled layers of organic and silty/clayey sediments (incl. peats and alluvium).
Due to the location of the town in a large river valley, these deposits are mostly interpreted as the Holocene alluvial soils (flood facies sediments), even if visible admixture of organic matter is not observed.
However, the geotechnical studies conducted in several locations in Słubice, have questioned this interpretation (Kotowski and Kraiński 2000a,b). Based on the presence of a clay layer devoid of organic matter impurities in the top of organic deposits, these authors drew two new hypotheses. The first one presumes an interglacial (possibly Eemian) age of the discussed peats and silts, while the second hypothesis stands for their origin in either ice-dammed lake or swamp environment. The assumption, that the organic sediments previously described as alluvial soils, are older than Holocene, seems to be confirmed also by geotechnical analysis of sediments. The main argument were the values of preconsolidation ratio in the range of 0.8 to 5.4, which may suggest that in the past the analyzed sediments were covered by an ice sheet.
Gontaszewska (2010) assumed in the Słubice area the presence of a monadnock built by the older sediments, which resisted against erosional activity of the Odra river. Morover, similar geological structure as well as analogous deposits, were documented a few kilometers from the town. In that area, the presumed the pre-Holocene age of deposits was confirmed by palynological data (Urbański and Winter 2005). Kotowski and Kraiński (2000c) interpreted part of the silty/clayey sediments from the of the Słubice area to be ice-dammed lake sediments. In their opinion, this conclusion is supported by distinct layering of the sediments coupled with their low content of organic matter. However, it must be stressed, that also alluvial soils can be characterized by a lamination and small amount of organic matter. This open question have motivated to undertake further research.
To verify these two hypotheses, six samples from six different boreholes (drilled in the Odra river valley, in Słubice) were collected. To resolve the doubts about the age of considered deposits, the samples were used for ^{14}C dating. The sediments from the boreholes had been previously identified and described during the geotechnical investigations. From over a dozen of accessible boreholes conducted in Słubice, only those with more than one layer of organic deposits (peat or organic alluvial sediment) were selected for age determination. The samples were taken from depth of 5 to 7 meters below ground level.
The obtained radiocarbon dating results allowed to verify the geological knowledge about the research area.

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Poster no 5

A multiproxy analysis of Holocene lake sediments on the Eastern Adriatic coast

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Croatian karst region on the Eastern Adriatic coast is characterised by karstic features that lack permanent water bodies, like lakes. Their occurrence is valuable source for paleoenvironmental research using undisturbed sediment cores. Holocene climate dynamics lack of well resolved and dated records in the Eastern Adriatic. Along the coast, from north to south, during the past few years, we have recovered more than 50 m of sediment cores that needed exact chronological time frame. Sediment cores were dated using radiocarbon absolute dating of shells, charcoals or plants, deposited in the sediments. Lake sediments were studied using multidisciplinary approach, combining sedimentological, mineralogical and geochemical analysis with paleontological proxies like pollen, ostracods or diatoms. The most of the lakes cover the end of Pleistocene and beginning of the Holocene and show the evolution of the lakes and environmental changes during the last 12.000 years. Paleolimnological research was conducted on Lake Vrana on the Island Cres, Bokanjačko blato, Lake Vrana near Biograd and Lake Baćina-Crniševo. Lakes represent typical karst lakes dominated by carbonate sedimentation, with periodic siliciclastic input. Due to the proximity of the sea and permeable karst, the lake levels are influenced significantly by the sea level rise during the Holocene. Deposition of the siliciclastic material in Lake Vrana near Biograd lasted until 9.1 ka BP, when carbonate lake sedimentation started and the lake was formed. The marine influence on the Lake Vrana sediments is visible after 6.1 ka BP, and additionally, gradually increase of siliciclastic components is a result of deforestation, which allowed increased soil erosion and input to the lake. At 3 ka BP started the deposition of the carbonate mud. In Lake Baćina deposition of the siliciclastic material was very intense from 11.7 to 10 ka BP, and then gradually decline until 7.5 ka BP. Dominant carbonate deposition lasted from 7.5 until 4.5 ka BP, when intensive changes in the sediments began, observed by the high sand fraction until 2.5 ka BP, and in between the alternate intervals were developed with calcite and quartz and those in which only calcite is present. From that time (4.5 ka BP) the slow increasing of the siliciclastic material were observed, indicating the increasing human impact and deforestation. In Bokanjačko blato the deposition of siliciclastic material lasted from 10.3 to 6.1 ka BP and then gradually decreases until 5.2 ka BP, when carbonate deposition began. In Lake Vrana on the Island Cres, the beginning of the Holocene is characterized by the deposition of the siliciclastic material, but which continues to the middle Holocene, until 4.5 ka BP when the carbonates appear. During the Holocene contrasting climate pattern has been identified in the central Mediterranean: north of around 40°N of latitude was characterised by a wetter early Holocene, followed by relatively drier conditions during the middle Holocene and gradually increased moisture in the Late Holocene, while south of 40°N there is opposite trend, very dry conditions in the first half of the Holocene and wettest period during the Mid Holocene followed by a progressive aridification. Investigated lakes on the Eastern Adriatic correlate well with the lakes situated above 40°N. The work presents four paleoenvironmental lake reconstructions that show evidence for Holocene climate changes associated with Mediterranean climate dynamics and Adriatic Sea level changes.

Poster no 6

New geochronological data on time and conditions of organic-rich sediments formation in the bottom of the Belyi Yar-2 sequence (the eastern part of the Tunka rift basin, SE Siberia)

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The Belyi Yar-2 key section (51°42' N, 102°37' E) located in the eastern part of the Tunka rift basin is a well known sequence but its chronology is discussible question up to now. The upper 13-15 m of the outcrop is composed by sands and the underlying lacustrine-alluvial deposits ~2 m thickness contain organic-rich layers. In the 60-s of the last century it was considered that these organic-rich layers were formed throughout the Early Pleistocene (Ravskyi, Golubeva, 1960). Later their age was correlated with the Late Pleistocene (marine isotope stage 3, MIS-3) (Adamenko *et el.*, 1975; Shchetnikov *et el.*, 2015). Latter conclusion was based on a number of ^{14}C dates from ~41 kyr to ~26 kyr of vegetation remnants and bones.

Our study was addressed on clarification of numerical age and environmental conditions of the lower part of the Belyi Yar-2 formation. The organic-rich samples were collected in 2013-2015 from the lower lacustrine-alluvial layer ~1.6 m thickness. The samples collected in 2013 yielded the finite ^{14}C dates from ~46 kyr to ~38 kyr as well as ages ≥45.7 kyr and ≥46.4 kyr which were behind the ^{14}C dating limit (Maksimov *et el.*, 2015). The next number of samples collected in 2015 yielded three ^{14}C dates ≥51 kyr, ≥51.3 ka and ≥53.7 kyr also behind the ^{14}C dating limit. We assumed that the lacustrine-alluvial layer was formed earlier than 50 kyr ago whereas the finite ^{14}C dates were rejuvenated.

We used the ^{230}Th/U method for dating gyttja samples from the lower 50 cm of the lacustrine-alluvial layer. We applied leachate alone (L/L) and total sample dissolution (TSD) analytical techniques (Maksimov, Kuznetsov, 2010). The agreement between the isochronously-corrected L/L and TSD dates allowed us to estimate the age of the lacustrine-alluvial layer in the bottom of the Belyi Yar-2 sequence. Both ^{230}Th/U dates in the range of ~130-100 kyr, obtained using two different techniques, indicate the first half of the MIS-5. Our pollen data obtained for the same samples do not contradict earlier pollen results and confirm relatively warm and humid conditions of the lacustrine-alluvial layer formation.

New geochronometric data could also indicate the beginning of the overlying sand strata formation which is found in other sequences in the Tunka rift basin. According to the ^{230}Th/U and ^{14}C dates, the sand layer formation in the Belyi Yar-2 could begin earlier Karganian time (MIS-3).

This study was partially supported by a scientific project No. 18.37.141.2014 granted by St. Petersburg State University, project No. 9 SB RAS and RFBR No. 14-05-00956.

Poster no 7

Radiocarbon dating of Holocene driftwoods from two sites in the Carpathian Basin

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Subfossil driftwoods can provide valuable data concerning the climate, development and fluvial activity of a catchment. Sediments accumulated near the apex of the alluvial fans of Carpathian Basin rivers host a great amount of drift logs, being recovered usually by cut banks and mining activity. By the growing number of collected and analysed subfossil trees (Nechita *et el.* 2014, Árvai *et el.* 2015) there is a chance in the long run to build up floating chronologies that can be used in the region for environmental reconstruction. However, especially in the beginning drift woods need to be dated by other methods as well.
The LSC radiocarbon laboratory of Szeged has been set up in 2014. Since then laboratory and measurement procedures were calibrated to external standards and tested through interlaboratory comparisons, which were partly performed on driftwoods. For the present study several pieces of wood were collected and sampled from the sediments of the Mura River (SW Hungary – Slovenia) and the Maros River (SE Hungary and Romania). The pieces, weighing around 10 g were converted into benzene, using the synthesis line of Atomkomplex Prylad. Measurements were carried out on a Quantulus 1220™ ultra low level liquid scintillation beta spectrometer.
Conventional ages have confirmed the procedures applied in the Szeged laboratory and were in a good accordance to the results received in external laboratories (Debrecen AMS laboratory and Kiiv LSC laboratory).
The dated subfossil fragments represented several periods from the Medieval times to the Early Holocene. At present we regard results as preliminary as the overlapping of dendrochronological information can only be successful if further measurements are done.

The work was supported by the following grants: HURO/1101/126, LP2012-27/2012

Poster no 8

Luminescence dating of Holocene highstand in Jinchang paleolake, NE Tibetan Plateau and links to monsoon precipitation

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Lake shoreline beach ridges and their sediments have often been investigated as palaeoenvironmental indicators in the arid northern China. Robust chronology is crucial to utilize this archive for palaeoenvironmental reconstruction and interpretation. This study conducts the luminescence dating using both quartz and K-feldspar fractions of three samples from the highest wave-built beach ridge from Jingchang paleolake at the NE margin of the Tibetan Plateau. The applicability of the selected measurement procedures is validated by a set of internal tests on luminescence characteristics such as preheat plateau test and dose recovery test, and the reliability of the resulting three pairs of luminescence ages are also confirmed by agreement with three independent ^{14}C ages. The beach ridge is dated to around 8-6.5 ka based on the luminescence ages. This constructed chronologies are also thought to be robust in the stratigraphic context. The results are interpreted as a distinct period of lake highstand, which has also been identified in other lakes nearby. The Holocene highstand of Jinchang paleolake could be correlated to the regional moisture condition which is dominantly regulated by the Asian summer monsoon precipitation.

Poster no 9

Comparison of beta (LSC) and gamma spectrometric (HPGE) methods for lead-210 in chronological study

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The initial results on the recent lake sedimentation chronology study based on Pb-210 will be presented. For the Pb-210 and other radionuclides determination two analytical techniques were applied. The first technique is based on radiochemical lead separation and measuring of Pb-210 activity via its beta emitting daughter Bi-210 using liquid scintillation counter (LSC) after reaching radioactive equilibrium, while the second technique is based on non-destructive determination of Pb-210 by measuring its gamma activity by low-background gamma-ray spectrometer with well HPGE detector. In this study, we investigated a few chemical preparation procedures involved in sample preparation to determine Pb-210 by LSC. The methodology of Pb-210 analysis is based on sequential separation of Pb-210 and Bi-210 using an anion exchange resin in Cl- form (Eichrom). The steps of chemical procedures were checked in order to ensure the accuracy of Pb separation conditions for the adequate performance of LSC. For this purpose, several model samples prepared from lake sediment core below 40 cm depth were analyzed. In order to estimate chemical yield and radiochemical recovery of applied procedures, Pb_{2+} carrier and Pb-210 tracer have been added to sediment and digested using wet acid combustion. Following Pb elution, sulfuric acid was added to form a $PbSO_4$ precipitate. The precipitate is dissolved with sufficient of EDTA/NaOH or ammonium acetate mixtures, optional. Afterwards the dissolved measuring form was mixed with scintillation cocktail (Optiphase HiSafe 3, Perkin Elmer) in a 20 ml vial and the activity was determined using LSC (Quantulus 1220, Perkin Elmer) with alpha / beta discrimination. The results were analyzed with respect to chemical yield, solvent suitability, homogeneity of prepared measuring cocktails and counting efficiency. The chemical yield of lead was determined gravimetrically, while radiochemical recovery and counting efficiency was evaluated using Pb-210 tracer solution at secular equilibrium with the Pb-210 daughter Bi-210. The activity concentration of Pb-210 in sediment samples was determined using both analytical techniques and compared for several sediment cores. Pb-210 dating of cores was performed according to Constant Rate of Pb-210 Supply (CRS) model with some modification and estimating dating uncertainty by first-order-analysis.

Poster no 10

High resolution dating of loess profile from Strzyżów

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The Strzyżów loess profile is located close to the Polish-Ukrainian border in the northern part of the Sokal Plateau-Ridge, which is a latitudinal cretaceous hump with thick (10-30 m) loess cover. From the north and south the region is limited by distinct morphological edges to over 10 meter high. The loess sequence at Strzyżów is located at the height of 216 m above sea level in the northern margin of the loess cover, close to the Bug River about 40 m above the modern valley bottom. The Strzyżów loess profile has not been investigated so far because it was discovered at the end of 2013 and in our investigations it was proved that it does not contain all the units characteristic for loess-soil sequence. Above the palaeosol S1 we can only distinguish about 12 m of L1L1 loess deposits and about 1 m of modern soil. There are no remains of the L1S1 soil and L1L2 loess deposits. Nineteen samples were collected from the almost 14m loess profile in Strzyżów (λ = 24°0'E, φ = 50°51'N). Combined infrared (post-IR IRSL for the deepest part of the profile) and blue light stimulated luminescence dating were applied to the polimineral fine grains (4-11μm) and medium grained quartz fraction (45-63μm). The obtained OSL chronostratigraphy was also confirmed by radiocarbon dating. Ages obtained for different fractions are very similar and only the result from one sample from the S1 soil is different. For a more complete picture of the changes in this profile, dating results have been complemented by grain-size distribution, carbonate and organic carbon contents, geochemical composition and magnetic susceptibility determinations.

All presented results were obtained with the support of the Polish National Science Centre, contract number 2011/01/D/ST10/06049

Poster no 11

OSL chronostratigraphy for the loess deposits in Złota, Poland

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Loess formations in Poland display a close relationship with cooling and warming trends of the Northern Hemisphere during the Pleistocene. Loess sequences sensitively record regional palaeoclimatic and palaeoecological changes. The Złota loess profile (21°39'E, 50°39'N; Moska *et el.*, 2015) provides a unique opportunity to reconstruct climate conditions in the past in this part of Poland. This continuous sequence of loess and palaeosol deposits allows to distinguish between warmer and more humid climate which is favourable for soil development and much colder and dry periods which are conducive to loess accumulation. The silty and sandy aeolian material originates mainly from weathered rock surfaces affected by frost shattering or from glaciofluvial/fluvial deposits of river flood plains. In Poland, loess and loess-like formations occur in the southern part of the country, mostly in the south polish uplands, i.e. in the Lublin, Sandomierz, and Cracow Uplands. We used different techniques to establish a chronological framework for this site. 21 samples for luminescence dating were collected from the investigated loess profile in Złota. Combined infrared (post-IR IRSL for the deepest part of the profile) and blue light stimulated luminescence (OSL) dating were applied to the polymineral fine grains (4-11μm) and medium grained quartz fraction (45-63μm), respectively. Radiocarbon dating was performed for snail shells and humid acid extracted from loess and palaeosol deposits. The dating results are accompanies by detailed analyses of the grain-size distribution, carbonate and organic carbon content, geochemical composition and magnetic susceptibility. Based on such a large stratigraphic dataset Bacon (Blaaw and Christen, 2011) age-depth model has also been constructed for this site.

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Blaauw, M., Christen, J.A., 2011. Flexible paleoclimate age−depth models using an autoregressive gamma process. Bayesian Analysis 6, 457–474.
All presented result were obtained with support of Polish National Science Centre, contract number 2011/01/D/ST10/06049

Poster no 12

Isotopic investigations of contemporary carbonate sedimentation in 50 lakes from N Poland

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The study area of NE Poland is a region of most pronounced seasonal climatic contrasts and best preserved varved sediments in lakes. Within the project "Climate of northern Poland during the last 1000 years: Constraining the future with the past (CLIMPOL)" the isotopic investigations have been performed aiming at the creation of transfer functions for the reconstruction of temperature in the past.
The presented study will be focused on the results of isotopic measurements (δ^2H, $\delta^{13}C$ and $\delta^{18}O$) for samples of water and contemporary carbonates collected from the lakes along the West-East transect in northern Poland, which have been chosen to form the CLIMPOL training set for calibration space-for-time. The measurements have been performed with use of continuous-flow IRMS Isoprime coupled with automated carbonate/water preparation device Multiflow.
The measurements of $\delta^{18}O$ for lake water (47 samples) demonstrate variability of values from -7.7 to -1.9‰ (VSMOW) and show a general W to E gradient. The δ^2H measurements have been performed so far for 22 samples and the results vary from -71 to -19‰ (VSMOW). The plot of δ^2H versus $\delta^{18}O$ reveals linear correlation with the equation: $\delta^2H = 7.9\delta^{18}O - 4.6$ ($R^2 = 0.80$), which slope is identical to GMWL, while intercept is *ca.* 15‰ lower.
The $\delta^{18}O$ and $\delta^{13}C$ of carbonates from sediment traps have been determined for 35 samples, and the results range from -13.1 to -6.1‰ ($\delta^{18}O$, VPDB) and from -10.6 to +0.15‰ ($\delta^{13}C$, VPDB).
The obtained results have been used to calculate temperatures from $\delta^{18}O$ according to so-called "temperature equation" (Kim and O'Neil, 1997), which produced exotic results of 35°C on the average. These results demonstrate that during the $CaCO_3$ precipitation the isotopic equilibrium is not present. On the other hand, the correlation between $\delta^{18}O$ in water and $\delta^{18}O$ in carbonates ($R^2 = 0.76$) suggests that carbonates record the isotope composition of water in which they are formed.
It seems that temperature signal can be recovered from the isotope dataset, as the values of $\delta^{18}O$ in sediment trap carbonate and summer temperature (June, July, August) are correlated ($R^2 = 0.38$). This simple linear equation was tested as a transfer function to reconstruct the temperature for CLIMPOL master site record from Lake Zabinskie. The comparison of calculated temperatures and instrumental record for the last 120 years shows that generally the average temperature can be reconstructed, but the inter-annual variability is poorly reflected in the reconstructions.

The presented study is a part of the project "Climate of northern Poland during the last 1000 years: Constraining the future with the past (CLIMPOL)", funded within Polish-Swiss Research Programme.

Poster no 13

Influence of the size of an aliquot on the interpretation of the results of OSL dating (based on the analysis of late Holocene colluvial sediments)

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The OSL age studies are based on the determination of the time of the last exposure of the analyzed quartz grain samples to sunlight. Before accumulating colluvial sediment, quartz grains were first bleached on the slope by sunlight during natural pedoturbation, then by agricultural processes during the mixing of the subsurface soil layers and finally on the slope during washing processes. In previous studies, quartz grains were mounted on the steel disks with a 6 mm masking plate. Each aliquot contained about 2500 to 3000 grains of which about 2 to 3% had luminescence properties. To determine the influence of the grains not exposed in the last stage, obtained dating results were examined with the OSL SAR procedure for the smaller aliquot (steel disks with a masking plate of 1.2 mm) consisting of 100-120 grains. Analysis of smaller aliquots indicates the presence in colluvium sediments grains that were not exposed during the last exposure to sunlight. During the agricultural use of the slope over time, the number of unbleached grains gradually decreased. The ranges of OSL dates for the larger aliquot in the investigated samples coincide with the OSL dates of the minimum ages obtained for the smaller aliquot. Obtained results for indicate that the most appropriate method for determining the final age of the samples is the MAM for smaller aliquots and the CAM for bigger aliquots.

Financial support of this study throw the founds of the National Science Centre – Poland (Grant DEC-2011/02D/ST10/05788).

Poster no 14

Using dendrochronology and radioisotopes measurement to study soil erosion in loess gully near Poręba village (Southern Poland)

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Soil erosion is a serious problem on agricultural areas. Especially the loess areas are susceptible for rill erosion and gullies formation. Although in the last decades studies on erosion at gullies has been carried out by researchers, few studies have specifically addressed the use dendrochronological analysis of roots in sediments or soil simultaneously with analysis of Cs-137 and Pb-210 radioisotopes in the same sediment or soil layers.
For this work a three series samples of samples from one of the numerous gullies of the Proboszczowicka Plateau (Polands, South,) were collected. This is a comprehensive study of soil erosion and sedimentation at gullies by two method dendrochronology and radioisotopes Cs-137 and Pb-210. Moreover for all collected samples a gran size were established. The sediment samples were collected from the bottom of the gully (7 cores), from the slopes /wall of the gully/(9 cores) and from the undisturbed areas as a reference site (4 cores). For all collected samples the activity of Cs-137 and Pb-210 were determined by the semiconductor gamma spectrometry.
Simultaneously from the bottom of the gully and slopes were collected the samples to dendrochronology study. To dendrochronology study were collected a samples of roots growing within depositional landfroms in the gully bottom as well as roots samples from the slopes (sidewall) of the gully.
To determine the age of the roots, it was assumed that it equals the minimum age of particular sediment horizons. In case of eroded sidewall of gully we determined by the time at which the roots where exposed by soil erosion.
Results of the study indicate that analysed landforms developed during the last 50 years. Diverse age of roots growing in sediment horizons allowed to determine at least 3 significant geomorphic events resulting in deposition of material in the gully bottom during the last 50 years. Also sheet erosion occurred on the slopes, in rate approximately 0,5-1,5 cm/year. This suggests that relief of gullies could be shaped surprisingly fast, despite forest cover contemporary occurring there.
Studies confirmed the potential value to use dendrocgronological analysis of the age of roots growing within dated sediment horizons or exposed roots on eroded slopes simultaneously with analyses of Cs-137 i Pb-210 in sediment or soil.

Financial support of this study throw the founds of the National Science Centre – Poland (Grant DEC-2011/02D/ST10/05788).

Poster no 15

Using Cs-137, Pb-210 and soil properties to assess soil redistribution on loess slope

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The loess areas are susceptible to water erosion especially an agricultural lands. In this context is the need for knowledge of the intensity of soil erosion. As a study area was selected an agricultural loess slope located on the South of Poland (near Ujazd village). To study soil erosion were used a fallout radionuclides ^{137}Cs and $^{210}Pb_{ex}$ as a tracers. To detailed study were collected 30 soil cores from a study slope. Moreover were collected 3 soil cores from undisturbed areas as a reference values. A sediment cores were sectioned into 10 cm intervals and activities of ^{137}Cs and $^{210}Pb_{ex}$ were measured. Beside this for a 6 soil cores from a slope an additional geochemical analysis were done as well as: grain size distribution, organic matter, Fe_{dith}, Fe_{ox}, Al, Mn and pH value. Those analysis were done also for one reference core.
The results obtained for the study area confirm the potential for using ^{137}Cs to study medium term soil erosion on agricultural areas. For longer timescale than ^{137}Cs the fallout of ^{210}Pb could be used. Detailed geochemical study confirmed that fallout of ^{137}Cs and ^{210}Pb is rapidly and strongly adsorbed by clay minerals on the surface of soil and its redistribution on slope could occur in association with mobilized soil particles.

Financial support of this study throw the founds of the National Science Centre – Poland (Grant DEC-2011/02D/ST10/05788).

Poster no 16

A stratigraphic study of Holocene slope sediments in the profile from Szyszczyce (South Poland) based on luminescence, radioisotope and micromorphology studies

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The present study presents the results of OSL dating , ^{137}Cs measurement and micromorfology study of colluvial sediments samples. The study area is located in the south Poland loess area. It is widely known that areas used for agriculture located in the loess are the most susceptible to mechanical denudation associated with atmospheric precipitation. The process of soil erosion on the Polish loess areas began with the beginning of the Neolithic and continued intermittently until today. Areas used for agriculture located in the loess are the most susceptible to mechanical denudation associated with atmospheric precipitation. As a result, at the foot of the slopes and bottoms dry loess valleys have been accumulated reaching up to several meters thick Holocene sediments of various ages.
This work presents the results of Optically Stimulated Luminescence (OSL) dating of Holocene slope sediments from Szyszczyce (near Działoszyce, South Poland). For luminescence study were collected 13 samples. Simultaneously with OSL dating the ^{137}Cs isotope measurement was done to find modern (last 50 years) sediments and activities of natural radionuclides in whole sediment profile were measured. In addition, to the OSL sampling, the samples for micromorphology study were taken as well as for measure physic-chemical properties of the sediment.
The studied sediment profile from Szyszczyce contains two layers of Holocene slope sediments. The Szyszczyce profile is located just 8 km from the Neolithic settlement in Bronocice.
It coul be told that Holocene colluvial sediments containing grains of quartz can be dated with certain approximation using the OSL dating method. Despite its some restrictions, it remains the only method suitable for direct dating of colluvial sediments.

Financial support of this study throw the founds of the National Science Centre – Poland (Grant DEC-2011/02D/ST10/05788).

Poster no 17

Using fallout cesium-137 and lead-210 measurements to estimate soil erosion in small catchment under manual cultivation system in the monsoonal climate on Maghalaya Plateau (India)

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The Meghalaya Plateau is an area where human activity has caused deforestation which, in the extreme monsoonal rainfall conditions, has led to expansion of grasslands at higher altitudes. The shortening of the shifting cultivation cycle resulting from the demographic growth in the recent decades, is generally considered to be the major cause of agricultural expansion onto marginal land. Both, forest demise and tuber crop cultivation have facilitated soil erosion on steep slopes (up to 25-30^{o}) and deposition of eroded material in the flat valley floors.
A small catchment (2.58 ha) at an altitude of 1850 m a.s.l. with brown soils and 2500 mm of annual rainfall was selected for the soil erosion study. To assess soil erosion and sediment accumulation on the study area two fallout radioisotopes were used: ^{137}Cs and ^{210}Pb. The ^{137}Cs is an artificial radioisotope with gets to atmosphere mainly as a nuclear weapon test or nuclear power plant accident whereas ^{210}Pb is a natural isotope which is a part of nuclear ^{238}U decay series. Both radionuclides as a radioactive fallout get to soil surface and then are rapidly and strongly adsorbed on the surface of soil particles. Measurements of ^{137}Cs and ^{210}Pb in soil could be used to soil erosion and sediment accumulation. Those methods allow to assess mid-term soil erosion (50-150 years).
In this work a total of 20 soil cores were collected from different slope position as well as from different type of land use (cultivated and permanent grassland). The soil cores were sectioned, dried, homogenized and stored to obtain radioactive equilibrium for about 4 weeks.
The activity in soil samples were measured by gamma-ray spectrometry using HPGe detector. To obtain soil erosion were used models proportional as well as mass balance. The obtained results of soil erosion are in wide range from 0.5 t/ha/yr in case of degraded grasslands up to 100 t/ha/yr in case of cultivated fields. Soil erosion and deposition patterns are predominantly influenced by land use. Within the same land use category, soil erosion rates are strongly related to slope steepness.

Poster no 18

Global Compilation of Marine Varve Records

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Marine varves contain highly resolved records of geochemical and other paleoceanographic and paleoenvironmental proxies with annual to seasonal resolution. We present a global compilation of marine varved sedimentary records throughout the Holocene and Quaternary covering more than 50 sites worldwide. Marine varve deposition and preservation typically depend on environmental and sedimentological principles, such as a sufficiently high sedimentation rate, severe depletion of dissolved oxygen in bottom water to exclude bioturbation by macrobenthos, and a seasonally varying sedimentary input to yield a recognizable rhythmic varve pattern. Additional oceanographic factors may include the strength and depth range of the Oxygen Minimum Zone (OMZ) and regional anthropogenic eutrophication. Modern to Quaternary marine varves are not only found in those parts of the open ocean that comply with these principles, but also in fjords, embayments and estuaries with thermohaline density stratification, and nearshore 'saline lakes' with strong hydrologic connections to ocean water. Marine varves have also been postulated in pre-Quaternary rocks. In the case of non-evaporitic laminations in fine-grained ancient marine rocks, such as banded iron formations and black shales, laminations may not be varves but instead may have multiple alternative origins such as event beds or formation via bottom currents that transported and sorted silt-sized particles, clay floccules, and organic-mineral aggregates in the form of migrating bedload ripples.
Modern marine ecosystems on continental shelves and slopes, in coastal zones and in estuaries are susceptible to stress by anthropogenic pressures, for example in the form of eutrophication, enhanced OMZs, and expanding ranges of oxygen-depletion in bottom waters. Sensitive laminated sites may play the important role of a 'canary in the coal mine' where monitoring the character and geographical extent of laminations/varves serves as a diagnostic tool to judge the environmental conditions and longer-term trends of benthic ecosystems. Analyses of modern varve records will gain importance for simultaneously providing high-resolution and longer-term perspectives. Especially in regions with limited resources or at remote sites, the comparatively low cost of high-resolution sediment analyses for environmental monitoring is an essential advantage over continuous monitoring of oceanographic conditions in the water column.

Poster no 19

The results of concentration ^{210}Pb and depth-age model for the Wolbrom peatland

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The goal of described measurements will be establishing an accumulation peat model, for industrial anthropogenic changes, peat bog.
The main aim of the study is developing and improvement of method of using ^{210}Pb to study peat erosion and accumulation on modern peat land areas.
Important aim is also to use of the technique of the alpha spectrometry measurement in application to measurements of ^{210}Pb isotope concentration especially in peat samples as well as to learn other dating or measurement techniques possible to use to study modern geomorphological processes.
Details of activities: General overview of measure procedures used in the alpha and gamma spectrometry with special regards on the procedure of measure and calculating ^{210}Pb in environmental samples. Calculating of sample age use lead dating method for 'Wolbrom' (southern Poland) peatland.

Poster no 20

Methodology of creating the young peat profiles chronology, dating with different sampling rate

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The mathematical models used in lead dating method typically require determination of ^{210}Pb concentration in each centimeter thickness layer along the profile.
The most appropriate and most factually correct procedure in environmental research is cutting of sampling core for centimeter slices and measure the specific activity ^{210}Pb for each of them. This in turn guarantees to obtain accurate - with centimeter precision results calculated the age from the model. This simple, obvious cutting of the core in the dating practice and determining the chronology is not applied very often. It is common practice to date sediment every second layer and then to make an approximation by averaging ^{210}Pb radioactivity for adjacent layers along the profile. That is done for the peatlands Bagno Mikołeska and Bagno Bruch from the southern Polish, presented on poster.
Even more difficult research problem arises when we are sampling too short core.
When there is no possibility of re-collecting profile or when for any other reason it is impossible to take the core again, it is necessary approximate the activity for deeper samples, and after this to obtaine the age model.
This problem we had for profiles TW1 and TW2 from peatbog Durne Bagno located in the Polesie National Park - eastern Poland. The measurement of the activity and concentrations of lead ^{210}Pb have shown that radioactive lead goes deeper than 20 cm (the length of collected core). It was necessary to use the method of approximation to estimate activities for deeper samples.
And after this, calculating age – depth model. Range of a lead method to these cores is 28 and 29 cm (respectively for the TW1 - 1798 and TW2 - 1802).

Poster no 21

Response of carbonate deposits of Plitvice lakes, croatia, to the bomb-produced ^{14}C

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Global contamination of the atmosphere by thermonuclear bomb-produced ^{14}C in the 1960s has been reflected in Earth's natural environment such as tree-rings, soils, speleothems, lake sediments, corals, but with different intensity and with some delay depending on length of carbon exchange processes in the nature. In this work we studied recent lake sediments (in the last ~ 150 yr) and tufa (in the last ~ 40 yr) collected in the Plitvice Lakes, Croatia.
Activity of radioactive isotopes ^{14}C, ^{137}Cs and ^{210}Pb as well as ratio of stable isotopes $^{13}C/^{12}C$ were measured in lake sediments, top 40 cm, of two big lakes Prošće and Kozjak (~0.8 km^2, max depth 37 m and 46 m, respectively) and two small lakes: Gradinsko (~0.08 km^2, max depth 8 m) and Kaluđerovac (~0.02 km^2, max depth 14 m). Frozen sediment cores were cut out into 1 to 2 cm-thick fragments and dried prior to analyses. $a^{14}C$ and $\delta^{13}C$ were measured separately in carbonate and organic fraction. Recent tufa deposit was collected in the stream of the Korana River which outflows from the Plitvice Lakes. $a^{14}C$ and $\delta^{13}C$ in tufa deposit were measured along 20 cm, on points ~2 cm apart, following the natural tufa lamination.
Sedimentation rates of the lake sediments were estimated based on the unsupported ^{210}Pb and ^{137}Cs activity. The starting point for the tufa deposition was determined as the time a wooden pillar on which the tufa grew was submerged in water. The $d^{13}C$ values showed that the carbonate fraction in sediments was mostly authigenic, i.e. precipitated from dissolved inorganic carbonate. Distribution of $a^{14}C$ showed simultaneous increase to the depth of ~10 cm in big lakes and to the depth of ~20 cm in small lakes in both carbonate and organic fractions. It can be interpreted as a delayed and damped response to the bomb-produced ^{14}C in the atmosphere. The $a^{14}C$ increase/peak was also observed in the tufa sample from the Korana River.
The delay of the atmospheric ^{14}C signal was 25 years in the Korana River, 28 and 32 years in lakes Gradinsko and Kaluđerovac and ~36 years in lakes Prošće and Kozjak. The peak increase of $a^{14}C$ in carbonate sediments was 12% in the big lakes, 15% in the small lakes and 20% in tufa. The delay and dampening intensity of the atmospheric ^{14}C bomb peak response in the sediments/tufa increased exponentially with the lakes' size, i.e. the sampling depth.
Since the water of Plitvice lakes shows seasonal temperature stratification, this is probably a result of the vertical seasonal mixing of the lake waters. Thermocline is observed in water of big/deep lakes Prošće and Kozjak (during summer-autumn) and in small/shallow lakes Gradinsko and Kaluđerovac the water is well mixed during all seasons. The autogenic calcite that precipitates mostly in euphotic zone of the lake waters takes time to deposit in water column. Along with the influence of seasonal water mixing, the newly deposited calcite is mixed with calcite produced during a previous season/s, resulting in delaying and dampening of ^{14}C signal from the atmosphere, which is emphasized in the big and deeper lakes, not as well-mixed as the small and shallower.

The work was performed within the project with the Plitvice Lakes National Park and within the HRZZ project 1623 financed by Croatian Science Foundation.

Poster no 22

Problems with gravity and multi cores of marine sediments correlation – on the example cores: EMB046/6 Norwegian Trench and M86/ 24 Bornholm Basin

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In the paleoclimate or paleoceanography research one of the most important goals is to obtain a good material for further research. The study of sediments in which cores excavated from the seabed are analyzed, is a good example here.
There are various methods of core collection to obtain such material.
While getting long sediment cores (length from a few to several meters) by gravity, some of the upper part of material, highly hydrated and with unknown thickness, is being lost.
Therefore, to obtain continuity of sediments in the location up to the sediment surface, multicores are additionally collected; these often are highly hydrated or semi-liquid and represent the youngest interval of geological time (usually late Holocene).
The next step in the research is the analysis of the obtained material. In order to get the continuous record of environmental change (for example, paleoclimate change) in the study area, there is a need for correlation of collected cores. However this is not as simple matter as it might seem at first glance.
The area of core collection is considered rather difficult - marine environment, usually great depth, waves, wind – therefore it is not easy to collect material exactly at the same place by using various methods. .
Cores are correlated mainly based on the curves of the changes of content of the selected geochemical parameters of sediments (Bronk Ramsey, 2009, Husum & Hald (2002) and Hald *et el.* (2003), Sharapova *et el.* (2008), Davies et al. (2012), Ohlendorf *et el.* (2015)), such as: organic matter, calcium carbonate, mercury, lead-210, caesium-137, carbon-14, tephra.
In addition, visual correlation can be a good help.
In this presentation the authors highlight the problems they encountered in their studies basing on the example of two cores EMB046/6 - Norwegian Trench and M86/24 - Bornholm Basin, collected in the framework of the research “CLIMLINK” project.

Poster no 23

Chronostratigraphy of the Holocene alluvia of the Wisłok river in the light of the radiocarbon datings and palynological analysis (example from Wola Dalsza sandpit near Łańcut, Sandomierz Basin)

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The determination of chronostratigraphy of the Holocene alluvia of the Wisłok River in a context of historical changes of its channel was the objective of this research. The study performed in the Wola Dalsza sandpit concerns fragment of the floodplain 5-6 m high and the terrace 7-8 m high of the Wisłok River, situated in the northern part of the Fore-Carpathian Trough between Łańcut and Przeworsk. The description of the geological sequences outcropped in the sandpit to the depth of 7-8 m supplemented by the analysis of the archival bore-hole logs, made possible the dating of alluvial fills using palynological analysis and radiocarbon method. 13 samples of peat, organic mud, tree trunks and other wood fragments were taken. 5 of them were dated by the radiocarbon method. The taxonomic (tree) categorisation of charcoal particles was also determined. Moreover, the peat log for palynological analysis was sampled.
The oldest alluvia within the terrace 7-8 m high are formed of channel sediments with clay insert bearing wood fragments dated at a depth of 4.6 m at 10100±140 BP (GdS-1920). The large abundance of pine (Pinus silvestris), birch, elm and willow pollen in the peat fragment excavated in the northern part of floodplain allows us to attribute this peat to the Boreal Phase, which is confirmed by the radiocarbon dating (9085±65 BP, GdS-3056). The activeness of the Wisłok channel in the Boreal Phase in the area located to the west of the sandpit is proved by the channel alluvia with a tree trunk dated at 9290±50 BP (MKL-2786). The peat deposited in the oxbow lake, occurring within the floodplain (5-6 m high), at a depth of 3.23-3.80 m bears the pollen spectrum typical for the Preboreal and the Boreal Phases. At the top of the terrace 7-8 m high clay sediment filling shallow depression with horizon of charcoal fragments was discovered. At a depth of 0.6-0.8 m charcoal fragments of oak, elm and ash were found, however the amount of this material was too small for the radiocarbon dating. At a depth of 1.5 m, under the sequence of flood rhythmite, coal silt at the surface and inside of hard clay aggregates resembling burnt-out wood partings occurs. The age of this sediment was determined using the palynological analysis at the Subboreal and/or Subatlantic Phase. In the northern part of the plain (*ca.* 70 m far from the current riverbed) young sand-silt levee sediments bearing wood fragments (not yet dated) occur. In the 70-ties of the 19th century the meandering Wisłok channel undercut the edge of the Vistulian terrace *ca.* 1 km north of the current riverbed. Over the sandpit area the river channel, moving to the south, truncated the early Holocene oxbow-lake sediments and simultaneously aggraded the floodplain. At the turn of the 19th and 20th centuries new wider, braided-type channel formed. A map from the 30-ties of the 20th century shows further migration of the channel and the narrowing of the active zone of the Wisłok River.
The preservation of organic sediments representing the Early Holocene within the floodplain

indicates the prevailing migration of the channel during the last 200 years and the truncation of the extensive erosional plain subsequently aggraded with young overbank alluvia. In the 20th century, simultaneously to the aggradation of the floodplain, the deepening of the Wisłok riverbed developed.

Poster no 24

Isotopic composition of water and contemporary sediments of Lake Żabińskie, NE Poland

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Seasonal monitoring of the conditions of a lacustrine environment is significant for the understanding of mechanisms affecting isotopic composition of lake water and, as a consequence, isotopic composition of sediments. We conducted a study in 2012–2014 on a monthly resolution to monitor the changes in the hydrological and climatic conditions of Lake Żabińskie (Mazurian Lakeland, NE Poland). $\delta^{18}O$ values of water samples from the lake, its inflows, outflow, precipitation, and sediments collected from sediment traps were measured and temperature and precipitation determined for the study site. Information about $\delta^{18}O$ values in individual water sources was supplied with $\delta^{2}H$ measurements. A compilation of the relationship between both deltas compared to Global Meteoric Water Line (GMWL) allowed to identify the modification of water isotopic composition as the effect of evaporation and designation of the Local Evaporation Line (LEL). The limnological measurements of temperature and water oxygenation changes with depth were supplemented by the $\delta^{18}O$ variability in the water column, which delivers more information on seasonal changes in water mixing in the lake.
The aim of this study was to understand the factors influencing the isotopic composition of water in the lake and to explore the mechanism responsible for recording climatic signal in the sediments deposited in Lake Żabińskie. The dependency between $\delta^{18}O$ values of the sediment from sediment traps and $\delta^{18}O$ values of rainfall water demonstrate a statistically significant correlation. Moreover, we observed a strong dependency between the temperature variability and the amount of precipitation and $\delta^{18}O$ in the sediment.

Poster no 25

Radiocarbon age of the soils in extremal conditions in Arctic and Antarctic

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Radiocarbon dating of soil organic matter is extensively used both for the decision of problems of soils evolution and for paleogeography reconstructions. The radiocarbon analysis can be applied in soil ecology. The soils radiocarbon dates characterize the mean residence time (MRT) of carbon in the soils organic matter. The MRT of carbon for soils in the different nature zone it is well known. But in extremal climate and landscape conditions the speeds of soils formed process generally slowly than that in the other soils. We study soils in Arctic and Antarctic ecosystems. The objects of the study are soils and soils like systems of oases in East Antarctic, recent soils in arctic ecosystem located from Spitzbergen archipelago to Wrangel Island. Totally the samples were taken from 25 places. The radiocarbon dates were obtained by liquid scintillation counting method in the Radiocarbon Laboratory of the Institute of Geography of the Russian Academy of Sciences (IGAN) and by accelerator mass spectrometry (AMS) in the Center for Applied Isotope Studies, University of Georgia. The sample preparation for AMS (i.e., graphitization, pressing and mounting on a target) was performed in the Radiocarbon Laboratory of the Institute of Geography. Although Antarctica is known for the coldest climate on Earth, there are still some possibilities for soil formation and accumulation of products of organo-mineral interactions within the oases. In Antarctic oases organic matter of endolithic and hypolithic systems, soils of wind shelters, soils under moss-algae vegetation with micro and macro profiles was dated. In Arctic ecosystem organic matter of zonal soils and azonal soils, for example soils of the rookeries was dated. The longest formation time under conditions of East Antarctica have the soils formed in windshelters and endolithic soil-like systems. According to our data, the maximal duration of modern pedogenesis within the oases of East Antarctica is 500 years. The absence of older soils, comparable in age with deglaciation of the study sites, can be due to the extreme conditions including catastrophic events of soil erosion either by strong katabatic winds or by torrential melt waters. The rates of organic matter transformation and accumulation in Antarctic terrestrial ecosystems are significantly different from those in Arctic ecosystems. As a result of the received data analysis in the Arctic the following conclusions have been made. Soil organic matter needs n*100 years to reach equilibrium with the environment. The rate of renovation of litter carbon is higher than that of humic acids. Depending on topographic position soil organic matter renovation rate can differ by the mathematical order: the highest rates are characteristic for well-drained soils - in over moistening conditions the rate of carbon renovation decreases. The rate of soil carbon renovation depends also on the type of parent material: on calcareous rocks the rate of humic acids renovation is lower; the rate of humus renovation is the highest in soils developing on sands. In soils of the rookeries the rate of carbon renovation of soil organic matter is lower than in the soils in the similar geomorphic positions without the rookeries (natural background).
This work has been supported by the Russian Science Foundation, project No.14-27-00133

Poster no 26

An annually resolved chronology for the last two millennia: potential of the varved sediments from Lake Żabińskie, northeastern Poland

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High-resolution and quantitative paleoenvironmental reconstructions from northern Poland are still sparse. Recently, the CLIMPOL project provided the paleoclimate reconstruction for the last millennium based on varved sediments of Lake Żabińskie in northeastern Poland. In our study we aim to extend the chronology for that sediment record to support the planned reconstruction of environmental change during the last two millennia.
The 1000-yr long chronology of the Lake Żabińskie sediments was based on varve counting and ^{14}C (AMS) dating, additionally supported by other chronostratigraphic methods (^{137}Cs, ^{210}Pb, 1875 AD Askja tephra). To extend this chronology we use a 6.2 m long and continuously laminated composite sediment profile. The entire core was sampled for thin sections which allowed for recognition of the varve microfacies and estimation of the sediment age. Samples of terrestrial macrofossils were also collected for ^{14}C dating. In the next step, subsampling for multiproxy analyses (CNS, biogenic silica, diatoms, chironomidae) will be carried out with 3-year resolution. Finally, the results will be merged with the CLIMPOL data to obtain 2000-yr long paleoenvironmental reconstructions for northeastern Poland.

Poster no 27

Budmerice and Senica: ^{14}C dating and stable isotopes analysis of human and animal remains from Maďarovce Culture, Slovakia

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Evolved and late stages of the Early Bronze Age (EBA, 1700–1450 cal BC) in the northern part of the Middle Danube represent large fortified settlements – typically ditched circular enclosures with planned use of space or early urbanisation, developed agriculture, bronze metallurgy, and evidence of ritual practices involving human remains. These, often viewed as administrative regional or supra-regional centres, are coeval with large and long-used flat inhumation cemeteries implying social stratification on the community level. While archaeological record from both types of sites is well published, detailed absolute-chronological questions are as a rule not being addressed and stable isotope research is absent.

In our presentation, we focus on ^{14}C dating and stable isotopes analysis of human and animal bones from two sites of Maďarovce (i.e. Maďarovce-Věteřov-Böheimkirchen, further MVB) culture spreading through west Slovakia, Moravia, and Lower Austria in time-window 1700–1450 cal BC. Two recently excavated sites were sampled: a fortified settlement Budmerice and a coeval cemetery Senica.

The aim of our research was twofold. As for ^{14}C dating, we wanted to date ritual practises at the settlement and investigate the time lag, if any, between interment and secondary manipulation with human bones suggested for Budmerice. As for stable isotopes, δ^{13}C and δ^{15}N values of human and animal bone collagen were to characterize the environment and the diet of MVB human population. Since the complex society of MVB may well have determined significant dietary differences visible in isotopic signatures, we have investigated three different types of human remains: (1) ritually manipulated isolated bones from the fortified settlement, (2) a regular burial from the fortified settlement, and (3) regular burials from the coeval cemetery.

The δ^{13}C and δ^{15}N analyses of collagen, which was extracted in Gliwice (GADAM) and in Miami (BETA), were performed in Bratislava (SGIDS) by means of Delta V Advantage IRMS

spectrometer from Thermo Fisher. For sample combustion the peripheral unit Flash HT 2000 was connected to IRMS spectrometer. The radiocarbon determinations of human bone collagen and carbonised grains of barley (Hordeum vulgare) were measured at the BETA Laboratory. Bayesian models were constructed in OxCal Program using IntCal13 calibration dataset.

This work was supported by the Slovak Research and Development Agency under the contract No. APVV-0598-10 and by the Scientific Grant Agency VEGA, contract No. 1/0964/13.

Poster no 28

Aeolian phases in an inland dunes area within Niemodlin Plateau

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In the end of the last glaciation vast areas of the periglacial zone were strongly affected by aeolian processes. Late Pleistocene dust and sand deposits formed so called European loess and sand belts (Jary and Ciszek, 2013; Zeeberg, 1998). Niemodlin Plateau (SW Poland) is located within these two belts. There are thin isolated covers of loess and coversands. However, the last aeolian phases were dominated by inland dune formations (Pernarowski, 1968).
The aim of the recent research was to delimit different types of aeolian deposits on Niemodlin Plateau and to examine the lithological properties and age of these deposits. We would like to compare new data with former results which indicate Late Glacial and Holocene phases of aeolian activity in Poland (Nowaczyk, 2002).
In the end of 2015 five excavations have been prepared in the vicinity of the villages Siedliska and Przechód. Samples have been taken to analyse grain size, roundness and other lithological properties. OSL (11 samples) and radiocarbon (4 samples) dating have been also performed.
Inland dunes in this area have been developed during 2-3 phases of Late Glacial aeolian activity separated by stable periods of podsols development. In the lower part of the majority of sequences coversands have been noted which start an aeolian sedimentation.
The results of dating as well as laboratory analysis will be presented as the foundation for further discussion concerning evolution of the aeolian sedimentary environments in the Niemodlin Plateau soon after the Last Glacial Maximum.

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Poster no 29

Defects in calcite generated by UV light – implications for EPR dating of calcite

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The effect of gamma radiation on carbonates is well described in the literature and allows for dating of carbonate materials, e.g. shells, speleothems, bones and tooth enamel [1]. There have been a number of papers concerning the influence of UV light on tooth enamel and its implications to the accuracy of EPR dating (e.g. [2], [3]). It has been shown that exposure to sunlight or the light of UV lamp creates defects in tooth enamel similar to those generated by gamma radiation, and therefore can affect the age determination. The same may be true for other carbonates, however, only few works (e.g. [4], [5]) on UV effect on calcite has been published and the knowledge about this subject remains very limited.
The aim of this work is to investigate the generation and recombination of defects created by UV radiation in calcite powders in comparison to γ-induced defects. The results may be of great significance considering the abundance of calcium carbonate in nature and its importance in dating of archaeological and geological objects.
EPR measurements were conducted on natural and synthetic samples of calcite, subjected to UV irradiation from low pressure Hg lamp and gamma irradiation using Co^{60} source. The analysis of EPR measurements shows that the UV light creates similar defects in calcite as the γ radiation. Moreover, our observations show that both the morphology of the crystals and their size have a significant influence on the presence of the particular types of defects with characteristic geometries generated by the γ and the UV radiation in calcite. Namely, isotropic symmetry of CO_{2-} defect (g-factor 2.0007) is favoured in the case of samples with less regular morphology – spherical and 'cigar-like' aggregates of smaller crystals, while the ortorhombic CO_{2-} defect (g_x = 2.0030, g_y = 2.0017, g_z = 1.9973) is more abundant in samples of well-defined rhombohedral crystals. The effect of the UV light appears to be the weakest (comparing to the γ rays) in the case of less regular synthetic samples of calcite.

Acknowledgements:
This work was supported by the Operational Program 'Human Capital' - PO KL 4.1.1, 'Proinnowacyjne kształcenie, kompetentna kadra, absolwenci przyszłości'. The authors would like to express their gratitude to Omya and Solvay Chemicals companies for providing some of the samples and dr Barbara Peplińska for her assistance in SEM measurements.

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Poster no 30

Testing the lower temperature of the OSL measurement in the SAR protocol applied for dating the medieval brick

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Recently, the OSL method, next to the TL method is more frequently applied in the ceramics dating [Guibert *et el.*, 2009]. The SAR protocol, which is used in dating, was developed for sediments [Wintle, Murray, 2006]. Although in both methods, TL and OSL, quartz is applied, it is commonly known that the luminescent properties of quartz annealed during the pottery production in high temperature differ from the properties of quartz originating from sediments [Petrov, Bailiff, 1997; Kijek el al., 2013]. Therefore, some caution should be maintained in using the same protocol for sediment and ceramics dating. In the standard dating procedure, the OSL signal is read out at 125°C. In order to examine the influence of the temperature on the dating results, the measurements of the De were carried out for three temperatures T OSL during readout of the OSL signal in SAR protocol: 25, 70 and 125°C. Before a proper OSL measurement the preheat test was applied, in order to choose the optimal temperature for each sample. Besides the observation of the dependence of De on the temperature, the repeatability of the results the recycling test, the recovery test and IR test were studied. The investigations were carried out for quartz originating from medieval bricks. The age was determined for the total of 18 samples which were collected in 2010-2015. In the quartz collected from the ceramics, the value of De is strongly dependent on the temperature of the OSL measurements. Equivalent dose estimation by the SAR protocol for the temperatures of OSL measurement lower than 100°C allows to obtain better results of recycling and recovery tests. The obtained results of the dependence of De on the temperature of the OSL measurements were used to determine the age of the sample for each temperature of the OSL investigations. The comparison of the age assigned to various temperatures allows to conclude that the results for lower temperatures make it possible to obtain better correlation in groups of the samples which represent specified stage of building investigated object. Results for OSL measurements at 70°C allow to separate two groups of bricks: the bricks produced about 1200 and after 1300, that clearly indicate two construction phases of the church. Data from OSL measurements at 125°C do not lead to such clear distinction of the brick ages. The obtained dating results are actually consistent with the historical knowledge, but also allow to put forward a thesis concerning unknown fate of the church. It turned out that the samples originating from the lower part of the foundations of the church are older than the remaining part of the building, which shows that before the currently existing church there had existed an earlier brick construction at the same place and the brick from its demolition are the foundations of today's temple.

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Poster no 31

Absolute Chronology of the Zedmar Culture with a special look at its final stage

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For one hunderd years researchers from various countries have devoted quite a lot of attention to the inquiry on the Zedmar culture (later ZC). Nonetheless, it remains very enigmatic. Archaeological inventory of this subneolithic culture is quite varied. There are only a few archaeological sites with distinguished materials of the ZC. They all are settled in three microregions of the Kaliningrad Oblast and North-East Poland. And they all are peat bog sites. It makes any statements of ZC even more difficult to create. Some researchers even do not identify it as a separate taxon. There definitely are issues which need to be studied with more careful look. There are radiocarbon datings published for those few sites (ca 50), in majority estimated for materials obtained on two sites. Thanks to this it is possible to use Bayesian statistic to create age-depth models and consequently more precise chronology of ZC. However, due to peat bog's lack of clear startigraphy, so called “old wood effect” and not enough quantity of taken samples from other sites it is hard to make any unquestionable statements. In spite of all gaps of the radiocarbon dating and statistic modelling it seems to remain the best tool for testing thesis.
There are many different theories about ZC genesis and its interactiocs with other archaeological cultures in the course of several hunderds of years. Specially as every hunter-gatherer-fishers culture with ceramic pots it rises question about contacts with agricultural societies and origin of pottery. Also there are many problems with final stages of the ZC.
It seems like when ZC, due to received results, should have ended there were several archeological cultures which could participated in its disapearing in one way or another. In neighbouring there were sites of subneolithic Narva and Neman culture and agricultural Funnel Beaker culture. After taking into consideration the youngest date also Globular Amphora, Corded Ware cultures or even Rzucewo culture. No matter how much mosaic world of second half of 4^{th} millennium BC in the South-East Baltic seems to be, the study on the chronology of ZC and comparison with dated sites of other taxons from region perhabs will enable to cast aside at least a few hypotheses about the ZC and its end.

Poster no 32

Radiocarbon dated late-glacial Scots pine (Pinus sylvestris L.) chronology from Central Poland

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Dendrochronologically dated wood of subfossil trunks of trees presents the basic material used at construction of the calibration curve. In the last years numerous studies have been aimed at construction of chronologies covering the late-glacial period (Kaiser *et el.* 2012).
At present, Koźmin (Dzieduszyńska *et el.* 2014) and Kwiatków (Kolska Basin, Central Poland) proved to be very perspective sites, in which wood from the end of Allerød and Younger Dryas was recognized. A level of organic deposits with so-called 'fossil forest' was encountered within the late-Vistulian terrace of the low valley of the Warta river.
In Kwiatków over 300 pieces of wood were documented. Abundant trunks and short stumps of trees have been very well preserved in a series of organic sediments, up to 0.5 m in thickness. Felled trunks are up to 4 m in length and up to 20 cm in diameter. In straight majority the pieces analysed represented narrow-ringed wood. At most of the samples examined the average increment width was below 1 mm. Only about 20% samples exhibited somewhat wider growth rings (above 1 mm in average), and in a few cases values of the average growths amounted to 2 mm or more. Most probably these last pieces came from redeposited trunks, which had grown in more favourable conditions. Dendrochronological analysis of over 250 samples complying to the requirements of the method allowed, at the present stage of the research, to construct a chronology spanning almost 300 years. It was absolutely dated with the wiggle-matching technique, on the basis of 6 samples of selected annual growth rings, dated relatively with the dendrochronological method. The chronology covers the period 11800-11500 (±45) cal BC.
Before the measurements of radiocarbon ages for whole sequence, the authors investigated several methods of chemical pretreatment. The different methods of production of holo-cellulose and alpha-cellulose were tested in three laboratories in order to find the most stable, repeatable and reliable one (Nemec *et el.*, 2010). The prepared samples were analysed using chromatography and measurements of $\delta^{13}C$ were done for them. Moreover selected samples were checked using measurements of radiocarbon by the high precision AMS technique.

This study was supported by means of grant no. 2013/09/B/ST10/02249 (Polish National Science Centre grant).

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Poster no 33

How to choose the appropriate mortar fraction for dating?

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Different mortars samples were compared in context of carbonates decomposition during the leaching reaction as one of the chemical pretreatment steps. These mortars were divided into two groups mainly due to different content of carbonates components. One group represents the samples with a high content of carbonates, the presence of crushed shells and limestone and basalts as aggregate. Other group consists of mortars with a much lower content of carbonates and mainly quartz sand as aggregate. A major problem in methodological aspect of mortars radiocarbon dating is the presence in this group, carbon of different origin e.g. unburnt fragments of limestone, lime lumps and recrystallization. This recrystallization becomes particularly evident within the pores and on the surface of the samples.
The analysed mortars also differ in terms of hydraulic properties, which significantly affects the behavior of the mortar in both the the natural environment and the chemical pretreatment.
Therefore, taking into account the composition, both groups contain ingredients which could significantly influence the results of radiocarbon measurement.
The observations of the course and rate of leaching reaction of mortars in acid, combined with the microscopic characteristics of both groups help to choose the grains fractions most appropriate for radiocarbon dating. These experimental tests of carbonates decomposition toghether with SEM-EDS results (scanning electron microscope with electron dispersive spectrometer) allow to veryfie the previous dating interpretations for choosen group of mortars, obtaining before new pretreatment protocol were established.
These experimental tests of carbonates decomposition together with SEM-EDS results (scanning electron microscope with electron dispersive spectrometer) allow to veryfie previous interpretations of dating results of selected mortars samples, obtained before establishingthe new protocol of pretreatment.

Poster no 34

Chronology of settlement in southern Wielkopolska (Greater Poland) based on the multicultural site of Sowinki

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Sowinki is a village located 35 km south of Poznań, where archaeological research has revealed the remains of settlement from different archaeological periods, ranging from the Mesolithic (*ca.* six thousand years BC) to the Late Medieval period (*ca.* 15th century AD). This area, therefore, provides a record of the history of Wielkopolska (Poznań) region, tracing back to about seven and a half thousand years ago. Samples of charcoals, wood and human bones were collected from different features, including mostly cellar pits, refuse pits and grave pits. Eight of the samples, all collected from grave pits, were selected for radiocarbon dating. The obtained ^{14}C measurements have confirmed previous findings concerning different cultures registered in the studied area, and additionally, they have helped to clarify chronology of the early medieval cemetery. The presented results are the first isotopic measurements taken for the site of Sowinki. Previously, chronological frameworks of this site were determined on the basis of relative chronology, according to stratigraphy of sediments, examination of metal finds, pottery and flint objects. The deposition depth of the analysed charcoals did not exceed 100 cm below ground level. According to the analysis, all the samples date to the time of the early Piasts' dynasty. The obtained data have allowed to define two chronological phases of the early medieval cemetery. This is an important archaeological site both in terms of its spread and the long time of existence. In addition, it provides a valuable background for the study on the emergence of early medieval elites and the formation of the Polish "early feudal" state.

Poster no 35

Oxygen Isotopic Variability in Human and Animal Bones Extracted Phosphate from Wielbark Culture Cemetery at Weklice, North-East Poland – Preliminary Results

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We present preliminary results of archaeological, anthropological and isotopic investigations of selected human and animal bones excavated from cemetery at Weklice, Site 7, Elbląg Comm., Warmińsko-Mazurskie Voivodeship, North-East Poland. The necropolis at Weklice is birytual cemetery of so-called Wielbark Culture from the Roman Period (1st-4th AD). The cemetery at Weklice (located on the eastern margin of Vistula Delta) has a unique position in the archeology of the European Barbaricum. Its unique character, apart from finds which are typical for the Wielbark Culture, is manifested inter alia by numerous Roman imports and ornaments in the style of Scandinavia and the Black Sea region.
The investigated graves were radiocarbon dated by AMS method in Poznań Radiocarbon Laboratory. Charcoal and wood from coffins were taken for radiocarbon dating. Human bones (inhumations and cremations) were subjected to anthropological investigations. From some of them phosphates were extracted in the Institute of Zoology of Jagiellonian University. Oxygen isotopic composition of obtained silver phosphates were analysed by means of continuous flow isotopic ratio mass spectrometry in Institute of Physics, Silesian University of Technology. The preliminary results give some brief view of the history of site.
Research conducted under the grant from the National Science Centre no. 2013/11/D/HS3/02473.

Poster no 36

Habitat preferences of European red deer (Cervus elaphus) in different time periods and environmental conditions since the Late Pleistocene until today

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Red deer is an opportunistic species living in different environmental and climatic conditions.We are studying habitat selectivity by red deer in Europe since Late Pleistocene based on the analyses of stable isotopes of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$). The content of these isotopes in animal bones allows to reconstruct their environments and diets. In the first step, we are analysing the content of the isotopes in tissues of contemporary European red deer inhabiting various habitat in a gradient open terrain − closed forests, and belonging to different mtDNA lineages. The obtained results will be compared with the content of stable isotopes in bones of red deer found in the fossil materials and dated with AMS radiocarbon method, to reconstruct their paleoenvironments and paleodiets. The results of the analyses will be compared to the history of red deer populations, phylogeography of the species (based on ancient and contemporary mtDNA analysys), and data on climate and environmental changes in Europe from Late Pleistocene until today.

Poster no 37

$\delta^{13}C$ in spruce α-cellulose – a case study for Sudeten, Tatras and Eastern Carpathian

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Trees, because of their prevalence and the relative ease of dating, seem to be an excellent archive of past climatic and environmental change. Tree growth, photosynthesis, and the degree of carbon isotope fractionation as preserved in the tree rings, is influenced by defined climatic conditions like temperature, precipitation, humidity, light intensity and change in soil moisture. Since the beginning of industrial revolution environmental change caused by anthropopression is observed, which also affects physiological processes of trees and the stable isotope ratios. For example, the $\delta^{13}C$ of the atmospheric CO_2 has decreased due to emission of ^{13}C-depleted CO_2 from human activities such as fossil fuels burning. The so called Suess effect is reflected in tree rings $\delta^{13}C$. Emissions of SO_2, NOx, and other phytotoxic compounds lead to serious disturbances in tree physiology and metabolism and therefore change also isotopic composition of plant tissue. For example gaseous SO_2 can cause the closure of stomata and reduce negative carbon isotope composition.
The selected research areas: Sudeten, Tatras and Eastern Carpathians represent mountains regions with various intensification of anthropopression.
We present the results concerning measurements of $\delta^{13}C$ in tree rings α-cellulose of spruce for mountain regions. Isotopic composition of α-cellulose samples was determined using the continuous flow isotope ratio mass spectrometer coupled to the elemental analyzer.
Relationships between $\delta^{13}C$ and monthly climate data were modelled using bootstrapped correlation function in DendroClim2002. Using a moving interval technique, the temporal stability of correlation between isotope chronology and climate was investigated. These studies showed no climate signal stability for the years of the maximum industrial human activities. Additionally $\delta^{13}C$ were compared with local data of pollutants concentration.

This research was a part of: “Trees as isotope archives of climate and human impact on environment in Central Europe mountain areas” funded by the National Science Centre allocated on the basis of decision number1557B/P01/2009/37.

Poster no 38

Stable isotopes in tree rings from Southern Poland and Eastern Carpathian: temporal stability of climatic signal versus pollution emissions

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Trees are interactive monitor of environment. Because of their prevalence and the relative ease of dating, tree rings seem to be an excellent archive of past climatic and environmental change. Tree growth, photosynthesis, and the degree of carbon and oxygen isotope fractionation as preserved in the tree rings, is influenced by defined climatic conditions like temperature, precipitation, humidity, light intensity and change in soil moisture. Isotopic measurements in tree rings can be very useful in reconstructing past climate. However, such reconstructions may encounter some problems. One of these, especially at the present time, is environmental change caused by anthropopression, which also affects the stable isotope ratios. Since the beginning of industrial revolution, the $\delta^{13}C$ of the atmospheric CO_2 has decreased due to emission of ^{13}C-depleted CO_2 from human activities such as fossil fuels burning and land clearing. The so called Suess effect is reflected in tree rings $\delta^{13}C$. Emissions of SO_2, NO_x, and other phytotoxic compounds lead to serious disturbances in tree physiology and metabolism and therefore change also isotopic composition of plant tissue. For example gaseous SO_2 can cause the closure of stomata and reduce negative carbon isotope composition. It can also affect oxygen isotope composition.
The selected research areas: Sudeten, Tatras, Eastern Carpathians and Silesia region represent various forms of topography and diverse intensification of anthropopression. Sudeten and Silesia are examples of areas with significant human impact on the environment. Even for those areas air pollution emissions were not continually monitored and data is only available for the last 20 years.
We present the results concerning measurements of $\delta^{13}C$ and $\delta^{18}O$ in tree rings α-cellulose of pine for Silesia and spruce for mountain region.
Isotopic composition of α-cellulose samples was determined using the continuous flow isotope ratio mass spectrometer coupled to the elemental analyzer.
Testing the temporal stability of climate - stable isotopes relationships has fundamental implications not only for reconstruction of natural climate variability, but also for estimating changes associated with anthropogenic activity. Relationships between isotope values and monthly climate data were modelled using bootstrapped correlation function in DendroClim2002. Using a moving interval technique, the temporal stability of correlation between isotope chronology and climate was investigated. These studies showed no climate signal stability for the years of the maximum industrial human activities.

This research was a part of:
- "Trees as bioindicators of industrial air pollution during the implementation of the pro-environmental policy in the Silesia region (BIOPOL)" funded by the National Science Centre allocated on the basis of decision number DEC-2011/03/D/ST10/05251.
- "Trees as isotope archives of climate and human impact on environment in Central Europe mountain areas" funded by the National Science Centre allocated on the basis of decision number1557B/P01/2009/37

Poster no 39

Human activity recorded in carbon isotopic composition of atmospheric CO_2 in Gliwice urban area and surroundings (Southern Poland)

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The atmospheric CO_2 over urban areas and in their vicinity indicates seasonal variability in the isotopic composition of carbon caused by emission into the atmosphere of CO_2 from burning fossil fuels as well as changes in ecosystem respiration and also photosynthetic uptake. In Gliwice, especially high CO_2 emission is associated with the movement of the automobile communication and coal usage for house heating.
The measurements of the content of the isotopes ^{13}C and ^{14}C in atmospheric CO_2 were made in the air samples collected in years 2011-2013 on a weekly basis, on the roof of a building in the academic district of Gliwice. In addition, these measurements were made in the early wood and late wood from annual rings of pine, for years 2008-2013. The cores of trees came from five sites distant about 10-15 km from the place of atmospheric CO_2 sampling, evenly distributed in the area surrounding Gliwice. The measurements of the isotope ^{14}C concentration have been made by the AMS, and the ^{13}C isotope by mass spectrometry in Gliwice Radiocarbon Laboratory.
The concentration of the isotope ^{14}C is much lower in relation to the concentration of this isotope in the “clean air”, and in some periods of time reaches even more than 10 percent. A strong correlation between $\Delta^{14}C$ and $\delta^{13}C$ isotopes may also be noted. The concentration of carbon isotopes in seasonal increments of trees from different positions is conditioned by horizontal mixing of air (wind direction).

Poster no 40

Imprint of CO_2 emission in atmosphere and biosphere in Southern Poland on the basis of ^{14}C and ^{13}C measurements

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As is shown in the IPCC (Intergovernmental Panel on Climate Change) report, the observed climate changes are caused, among others, by human activity. Mainly emission of CO_2 to the atmosphere coming from the burning of fossil fuels, can have dire consequences for life on Earth and development of humankind. The report uses, among others, data obtained from isotopic measurements in the biosphere. Measurements of ^{14}C and ^{13}C concentration in modern atmospheric carbon dioxide and biosphere allow the determination of the decrease of the concentration of this isotope. Furthermore, the magnitude of emission to the atmosphere of carbon dioxide not containing the isotope ^{14}C can be estimated on this basis. Such emission stems from fossil fuel combustion – petroleum, natural gas and black coal. A sensitive bioindicator of the emission are annual tree rings. The measurements of ^{14}C concentration in tree ring material using AMS allow to see its seasonal changes.
Trees, treated as an archive of changes in conjunction with information about the isotopic composition of carbon can be used for monitoring of environment as sensitive bioindicators on local, as well as on the global scale. Regular investigations of isotopic composition of carbon in trees have been carried out in the GADAM Centre for the urban areas of both Poland and worldwide. This method can be applied in the study of the emission of CO_2 to the atmosphere and its spatial and temporal distribution connected with the production of energy by power plants based on fossil fuel combustion for the area of southern Poland. Modelling of CO_2 emission using both ^{14}C and ^{13}C carbon isotopes measured in pine tree rings from Niepolomice Forest on the background of climatic changes will be presented.
The national ecological policy in the era of global warming requires the manufacturers of energy to get involved in the development of methods suitable for monitoring the state of the environment. Hence, the interest in the area of monitoring the fossil fuel component in CO_2 in our region is raising. The measurements of ^{14}C (by AMS method) and ^{13}C isotopes are being carried out in atmospheric CO_2 and plants in the Gliwice city centre. A high decrease of both isotopes contents and their short-term seasonal changes during the year caused by human impact during the year are observed.

Poster no 41

Rapid increase of radiocarbon concentration in tree rings from Kujawy (SE Poland) in VIIIth and Xth century AD

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Miyake *et el.* (2012, 2013 and 2014) described a sudden increase of radiocarbon (^{14}C) concentration in annual tree rings of Japanese cedar (Cryptomeria japonica) and Hinoki cypress (Chamaecyparis obtusa) between AD 774 and 775 and between AD 993 and 994. In both analysed periods, the sudden increase was observed almost in a single year. The increase in the ^{14}C content was about 12‰ in the period AD 774-775 (Miyake *et el.* 2012) and about 11.3‰ in the period AD 993-994 (Miyake *et el.* 2013, 2014). Single-year samples of dendro-chronologically dated tree rings of deciduous oak (Quercus robur) from Kujawy, a village near Krakow (SE Poland), spanning the years AD 765-796 and years AD 908-1027, were collected and their ^{14}C content was measured using the AMS system in the Leibniz Laboratory. The results clearly show a rapid increase of 9.2±2.1‰ in the ^{14}C concentration in tree rings between AD 774 and 775, with maximum radiocarbon concentration of $\Delta^{14}C$ = 4.1±2.3‰ noted in AD 776, and increase of 6.2±1.6‰ in tree rings between AD 993 and 994, with maximum $\Delta^{14}C$ = -9.4±1.0‰ noted in AD 994.

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Poster no 42

Data analysis: From AMS measurement to radiocarbon age

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We have developed a method of correction for isotopic fractionation attributable to the ion source and the instability of the ion current for each sample. This is achieved by comparing the results for an unknown sample with results for NBS Ox II standard material with identical average values of the ion current for ^{12}C and ^{13}C. These values are obtained through fit-data function (ion current vs. isotopes ratio $^{14}C/^{12}C$ and $^{13}C/^{12}C$). Using this method it is possible to maintain high precision, even if the performance of the ion source is not stable during measurement. By applying this method we were able to decrease the scattering of the measurements.

Poster no 43

Stable isotopes in tree rings: glucose, α-cellulose, wood

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We present the first analysis of the carbon isotopes fractionation factors for total wood and two saccharides (glucose and α-cellulose) of pine wood. The conifers grew in the industrialized part of Poland and the annual rings covered a time span from 1975 to 2010. Glucose samples from acid hydrolysis of α-cellulose were extracted from annual tree rings.
Since the beginning of the 20th century there has been much discussion about how the external environmental factors affect the physiological processes that control tree growth. It has been reported that such effects are manifest in the width of tree rings, the wood density, the number and size of cells and the stable isotope composition of wood and its components.
Early studies of the stable isotope ratios in tree rings used whole wood to reconstruct climate change and to analyze the impact of human activity on the environment. Since the 1970s most palaeoclimate studies have concentrated on the analysis of α-cellulose, as the dominant and the most easily isolated component of wood. Experiments have shown that the stable isotopes of α-cellulose provide a more reliable proxy of past climate and that whole wood does not reflect the climate in the same way as α-cellulose. The immediate background to these analyses was dendrochronological research involving isotope ratio measurements on trees (glucose and cellulose) from Niepołomice Forest.

The research was a part of:
- BIOPOL project “Trees as bioindicators of industrial air pollution during implementation of pro-environmental policy in the Silesia region” - funded by the National Science Centre allocated on the basis of the decision number DEC-2011/03/D/ST10/05251

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Poster no 44

Response of Scots Pine to climate and industrial emission in the most industrialized part of Poland

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The conifer investigated in this study have grown for many years under the stress of industrial pollution. Despite this, the trees are preserved, to a large extent, sensitive to the natural climatic factors. We present a complex analysis of the climatic (sunshine, temperature, precipitation, humidity and wind circulation), and anthropogenic factors influencing the radial increment dynamics and stable isotope composition of Scots pine (Pinus sylvestris L.) growing in the vicinity of different factories in southern part of Poland:combined heat and power plant in Łaziska Górne, chemical and nitrogen plants in Kędzierzyn-Koźle, steelworks in Dabrowa Górnicza.
We analysed the spatiotemporal distribution of growth reductions, the depth of reduction with respect to the distance from the emitter, the relationship between tree growth and stable isotope composition and climate during the industry development period and during pro-ecological strategy application. Pines series of 3 positions, indicate that they have a similar sensitivity to most climatic elements of the previous and given year, but there is also a different rhythm between the studied populations of incremental growth of pines. The causes of diversity are due to the different types of habitat (site types) and industrial pollution.
The research was a part of:
- BIOPOL project “Trees as bioindicators of industrial air pollution during implementation of pro-environmental policy in the Silesia region” - funded by the National Science Centre allocated on the basis of the decision number DEC-2011/03/D/ST10/05251
- BKM-507/RIF/2013:Biomonitoring zmian środowiska: spektrometryczna analiza zmian składu izotopowego węgla i azotu w rocznych pędach sosny w strefach zagrożeń zakładów azotowych ZAK w Kędzierzynie; BKM-509/RIF/2014: Metody izotopowe i jądrowe w geologii, geofizyce, górnictwie i ochronie środowiska - spektrometryczna analiza zmian składu izotopowego węgla w rocznych pędach sosny w strefach zagrożeń zakładów azotowych ZAK w Kędzierzynie;
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Poster no 45

Bio-monitoring of CO_2 emission: Suess effect and Water Use Efiiciency in pine growing near the combined heat and power plant in Laziska Górne (Poland)

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We present the results of analysis of the anthropogenic factors influencing carbon stable isotopes and radiocarbon in Scots pine (Pinus sylvestris L.) growing in the vicinity of the combined heat and power station in Łaziska Górne.
The analysed samples covered the time span from 1975-2012 AD, the time period of the development of industrialization and the modernization in the industrial sector in Poland, similarly as in Eastern Europe. This modernization was connected with EU legislation and the implementation of restrictive governmental regulations on emissions. Since the 1990's, the emission of pollutants was reduced in a majority of Polish and developing country factories whereas the level of energy production was similar to that prior to the 1990s.
The carbon isotope discrimination has been proposed as a method for evaluating water use efficiency (the ratio between CO^2 assimilation and stomatal conductance). The measurements of stable carbon isotopes were carried out using the AE-IR-MS. In the period of time from 1975 and 2012, the water use efficiency values increased from 98 to 122µmol/mol.
The measurements of radiocarbon concentration have been performed with use of AMS. Resulting $\Delta^{14}C$ values indicated the presence of time-dependent local Suess effect.
The research was a part of:
- BIOPOL project "Trees as bioindicators of industrial air pollution during implementation of pro-environmental policy in the Silesia region" - funded by the National Science Centre allocated on the basis of the decision number DEC-2011/03/D/ST10/05251
- BKM-507/RIF/2013; BKM-509/RIF/2014;BKM-513/RIF/2015 projects funded by the Ministry of Science and Higher Education

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Poster no 46

Thermoluminescence dating of bricks from the buried Castle of Szeged, Hungary

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The remnants of the brick Castle of Szeged are among the most important built heritages of the city. However, after the Great Flood of the Tisza River in 1879 the damaged castle, representing Austrian primacy, was destroyed by the locals and most of its residues were used to fill up the downtown to prevent the city from future flooding. The remainings of the walls and the foundations lie 4-5 m below ground level at present. Consequently, only written records are available on its structure and extension (*ca.* 4 ha), and virtually no information concerning the first time of its construction. Currently, two theories are accepted concerning its age: either it was built during the Ottoman occupation in the 16th c. or it was built earlier by Hungarians in the 13th c. However, there is no definite proof for any of the theories.

The primary aim of the present study was to date by the means of TL those bricks which were retrieved from the underground ruins, since in the past few years the remnants were excavated at 4 sites (Southern Gate, Eastern wall, North-eastern wall) due to recent constructional activities in the area.

More than 10 bricks were dated using the TL multiple aliquot additive dose and regenerative dose protocols. For the measurements polymineral samples were used. Plateau tests were performed, which proved in almost all cases the suitability of the material for dating. Beside determining the equivalent dose fading tests were also made along with alpha efficiency measurements. Both the material of the bricks and the surrounding material were subjected to gamma spectroscopy to determine specific activities of radionuclides and consequently to assess dose rates.

Based on the results, most of the bricks refer to construction activities in the 16th century during the Ottoman period, and to 17th century renovations in the Habsburg times. Some Medieval bricks were also recovered, however, these appeared along with younger bricks. This refers to the recycling of older bricks and does not provide a clear evidence for the existence of entire medieval wall fragments. Nevertheless, further sites and brick samples will be necessary to provide a clear answer for the question of Medieval origin.

Poster no 47

Thermally modulated optically stimulated luminescence (TM-OSL) of quartz

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The optical cross-section of trap depends on the energy of photons used for optical stimulation and temperate of OSL measurement [1]. Recently a new optical stimulation method was proposed for optically stimulated luminescence measurements [2]. The thermally modulated optically stimulated luminescence (TM-OSL) method uses the dependency of the optical cross-section (OCS) on temperature for changing the probability of electron release from trap to the conduction band during the OSL experiment. In this method the continuous optical stimulation with light of a defined wavelength is used during the linear heating of a sample. Increasing the temperature during the optical stimulation enables such a modulation of the probability of electron excitation from traps to the conduction band that the ratio of these probabilities for different traps changes during the stimulation in a specific and advantageous manner. This provides an opportunity to separate the individual OSL components more efficiently than in the CW-OSL or LM-OSL methods. A big advantage of this method is the possibility of controlling the TM-OSL process and simultaneously the TM-OSL peak position by three different experimental parameters: the stimulation energy, the heating rate and by the photon flux. Another one is the possibility of direct determination of the optical trap depth and the parameters determining the strength of the electron-phonon coupling. Estimation of these parameters allows a direct correlation of the traps active in the OSL and TL processes.

Here, the first study of TM-OSL signal of quartz is presented. The special attention is paid to the traps used normally in OSL dating and responsible for the TL signal in quartz between 270 and 330°C. It is shown how they can be selectively depopulated during the TM-OSL experiment using the stimulation with light of the wavelength of 660 nm. A strong TM-OSL peak related to these traps can be observed below 200 °C when the experiment is carried out with the heating rate 1 K/s and stimulation wavelength of 660 nm after an initial preheat to temperature lower than 350°C. The observed peak changes its position in accordance with the rules presented earlier [1]. Increasing the stimulation energy or stimulation light intensity, or lowering the heating rate results in the shift of the TM-OSL peak into lower temperatures. The traps related to TL peaks at about 200, 240 and 350°C are not sensitive to the optical stimulation with the wavelength of 660 nm. The initial optical cleaning of the traps giving the strong TM-OSL signal below 200 °C enables to measure the TM-OSL peak related to these more resistant traps separately when much higher energy of stimulation is applied. Additionally to the first TM-OSL measurement results the preliminary analysis of the TM-OSL signal is presented. The trap parameters have been estimated by fitting the first kinetics TM-OSL peaks to the experimental curves.

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Poster no 48

Prototype compact system for ^{238}U, ^{235}U and ^{232}Th dose measurements in small environmental samples

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The accuracy and precision in environmental dose-rate measurement is required in many applications including OSL/TL/ESR dating. In state of the art measurements, the annual dose used in dating applications is usually obtained from an expensive γ HPGe spectrometry. A sample for such a measurement must have a mass of more than around 100 g. For smaller samples (for example, ceramic) alpha counting is commonly applied but this results in larger uncertainties.
Here we present a significantly improved low cost and compact system for α counting. The system is equipped with an experimental scintillator which removes the measurement bias arising from varying sample reflectance and enhances scintillation light collection. The system measures the time and amplitude of each individual pulse which allows for more sophisticated (comparing to conventional alpha-pair counters) data post-processing, finally resulting in better precision. The system may be equipped with PMT's with active areas of 6.3, 16.6 and 45 cm^2 to match variety of sample sizes and activities. The system presents the user with averaged radioactivities of ^{238}U, ^{235}U and ^{232}Th decay chains as well as the direct information on pair-counts in subchains of $^{220}Rn \rightarrow {}^{216}Po$ (half-life = 0.14 s) $\rightarrow {}^{212}Pb$ and $^{219}Rn \rightarrow {}^{215}Po$ (half-life = 1.8 ms) $\rightarrow {}^{211}Pb$.

Acknowledgements: The development of alpha-pair spectrometer was partially supported with the grant LIDER/001/404/L-4/2013 by the Polish National Centre for Research and Development. The authors would like to express their gratitude to Mr. Aleksander Kolarczyk and Mr. Michał Strządała for their valuable help in the device design and construction.

Poster no 49

Does calibration curve influence the sample frequency method?

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It seems it doesn't. Summary probability density function (PDF) resulting from the simply summing up (and normalizing) of many (calibrated) dates, reflects true distribution, not disturbed by the platteau and other wiggles of the calibration curve. That finding is strictly valid as long as the measurement sigma is well estimated. That requirement seems to be natural, however, it may be astonishing, how strong is the influence of any difference between true and estimated error on the shape of the PDF of the a priori equally distributed ages.

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