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Urbino Summer School in Paleoclimatology

University of Urbino, Italy

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Report

The Urbino Summer School in Paleoclimatology (USSP) was set up to provide students at different stages of their career with a profound understanding of climate variability, climate reconstruction and modeling techniques. As I am currently working on my Ph.D. in Paleoclimatology and Paleoceanography, my personal motivation to attend the USSP was to broaden and deepen my knowledge in this area. As leading senior scientists from around the world are involved in active teaching and mentoring in Urbino, I was eager to get to know them and thus broaden my scientific network.

The first week provided us with an overview of past climate variability, orbital forcing and the use of paleoclimatic archives. The analysis of the long-term Carbon cycle and its implications in the understanding of present and future climates was intensively taught. A short introduction to climate modeling was given, including a practical session. We were able to work directly with a modeling program. During the 4th day we went for a field excursion to the famous K/T Boundary, which is well exposed along the Contessa Highway, close to Urbino. Additionally, a stratigraphic sequence of Eocene time had to be recorded by the students and was later analyzed by AnalySeries to reconstruct orbital cycles during that time period.

The second week was addressed to time periods important for climate reconstructions and modeling. Therefore, the Cretaceous greenhouse world was discussed as well as the greenhouse to icehouse transition. Further detailed lectures were given about the Quaternary and Holocene. Different paleobiological and geochemical proxies were taught in great detail and their benefit for the reconstruction of past sea surface temperatures, salinities or ice volume was discussed. The highlight during the first half was the „Cioppino Conference“, where the attending scientists gave short talks

about the latest, not yet published research. This provided the students with information about ongoing research and up-to-date results from institutions and universities around the world. During parallel sessions, we had the opportunity to choose between different lectures and therefore concentrate on a particular topic, e.g. the study of marine nannoplankton (dinoflagellates, planktic and benthic foraminifera, siliceous microfossils) or especially important time periods in earth history (Paleocene-Eocene Thermal Maximum, Cretaceous-Paleogene Boundary).

The emphasis of the third week was on climate modeling and the reliability of different model data outputs. We also learned how to run a model and were given the opportunity to do so on our own computers. The final two days concentrated on the importance of past climate reconstructions on future climate predictions. Global warming, sea level rise, ocean acidification and the biotic response were discussed with active participation of the students.

In general, the summer school contained not only lectures, but on several occasions practical exercises on different areas if paleoclimatology, e.g. biogeochemical cycling, paleoceanography, and all aspects of deep time climate modeling. Additionally, regular discussions were included which provided us with the excellent opportunity to ask the leading experts of their field about the latest research. Sometimes we had the chance to follow and contribute to very controversial discussions, as not all the present scientists necessarily had the same opinion on current issues.

The Urbino Summer School on Paleoclimatology offered me new insights into different paleoclimate proxies and provided me with deeper knowledge and understanding. I will be able to apply this knowledge in my future studies and will also be able to interpret new data more comprehensively and bring the results into a broader paleoceanographic and paleoclimatic context. I have met the leading scientists in my field of expertise from all around the world as well as other Ph.D. students working on the same field. During the poster session, I was able to present the current research data of my Ph.D. and discuss it with lecturers and students alike. This gave me new inputs and deeper understanding of my own research work. The posters of more than 60 participants provided me with a broad overview of current research from all around the world.

In summary, the Urbino Summer School on Paleoclimatology was especially promoting my in-depth knowledge in this field. I had an intensive and effective training that could not have been obtained at my home university. Therefore, it will have a lasting effect not only on my career as competent and qualified scientist but also on strengthening and expanding my international collaborations.

Detailed schedule

1st week

13 July	14 July	15 July	16 July	17 July	18 July
Paleoclimate Archives – *Mark Leckie*	Time and Stratigraphy – *Mark Leckie, Stephen Schellenberg*	Carbon Cycle – Dynamics and Patterns II – *Andy Ridgwell*	Field Excursion	Free Day	Field analysis (Cyclostratigraphy)
Stable Isotopes – *Howie Spero*	Biomagnetostratigraphy of the Paleocene-Eocene Thermal Maximum (PETM) - *Mark Leckie, Stephen Schellenberg*	Carbon Cycle – Dynamics and Patterns III – *Andy Ridgwell*			
Introduction to past climate variability – *Maureen Raymo*	Investigating complex systems – *Andy Ridgwell*	Cyclostratigraphy – Theory – *Luke Lourens*	Field Work		Cyclostratigraphy of Field Sections - *Luke Lourens, Maureen Raymo*
Orbital Forcing – *Maureen Raymo*	Carbon Cycle – Dynamics and Patterns I – *Andy Ridgwell*	Exploration of Ocean Drilling Data and Field Overview - *Mark Leckie, Stephen Schellenberg, Simone Galeotti*			Cyclostratigraphy of the PETM - *Luke Lourens, Maureen Raymo*
	K/T Boundary – *Jan Smit*				

2nd week

19 July	20 July	21 July	22 July	23 July	24 July	25 July
Stable Isotopes I – Theory and Systematics – Eelco Rohling, James Zachos	The Greenhouse World – Mark Leckie	Discussion and Integration: Age models, isotopes, carbon cycle, and Earth History	Proxies IV: Organic Chemistry Principles – Marc Pagani, Richard Pancost	Parallel Sessions	Cioppino Conference	Free Day
Stable Isotopes II – Applications and Interpretations – Eelco Rohling, James Zachos	Greenhouse to Icehouse transition – James Zachos	Proxies I: Marine Inorganic - Yair Rosenthal, Gert-Jan Reichart	Proxies IV: Organic Chemistry Proxies – Marc Pagani, Richard Pancost			
Stable Isotopes III: Problem Set and Data from Field Sections – Eelco Rohling, James Zachos	The Quaternary – Thomas Cronin	Proxies II: Marine Inorganic - Yair Rosenthal, Gert-Jan Reichart	Proxies VI: Terrestrial – Gabriel Bowen			
	The Holocene – Yair Rosenthal		Proxies III: Marine Biota - Stephen Schellenberg			
			Paleo-pH and Paleo-pCO2 – Marc Pagani	Poster presentations		

3rd week

26 July	27 July	28 July	29 July	30 July	31 July	1 August	2 August
Discussion and Integration: Proxies, parallel sessions, and Cioppino	Climate Models I: Principles and Practices - Robert DeConto, Paul Valdes, Anna Von der Heydt	Climate Models III: Cretaceous - Robert DeConto, Paul Valdes	Climate Models VII: Cryosphere Dynamics and sea level – Bert Vermeersen	Benthic foraminifera – Frans Jorissen	Free Day	Past to Future I: Meet The Anthropocene - Robert DeConto	Past to Future V: Global Warming – Ken Caldeira
Geochemical Modeling I: Fundamental Concepts – Richard Zeebe		Climate Models IV: Cretaceous - Robert DeConto, Paul Valdes		Discussion and Integration: Geochemical and Climate Modeling		Past to Future II: Ocean Acidification – Ken Caldeira	Past to Future VI: Biotic Responses - Middleburg
Geochemical Modeling II: Advanced Methods – Richard Zeebe	Climate Models II: Principles and Practices - Robert DeConto, Paul Valdes, Anna Von der Heydt	Climate Models V: Miocene-Pliocene - Robert DeConto, Paul Valdes	Climate Models VIII: Quaternary Climate Models – Robert DeConto, Paul Valdes	Anatomy of a tipping point – Luke Skinner		Past to Future III: Sea Level Rise - Stocchi	Past to Future VII: Paleoclimatology, Politics, Policy – Robert DeConto
Geochemical Modeling III: Calculations and Simulations - Richard Zeebe		Climate Models VI: Biosphere Dynamics - Robert DeConto, Paul Valdes	Climate Models IX: Non-Linearities - Robert DeConto, Paul Valdes			Past to Future IV: Panel and Discussion	