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## Curriculum Vitae

### Personal Information:

Date of Birth: 13.5.1977  
Place of Birth: Rosenheim, Germany

### Career:

Since March 2009      **SNF Postdoctoral Fellowship**, Geological Sciences, Brown University  
*Quaternary Climate Reconstructing using Lipid Biomarkers and Compound-Specific Isotope Analyses in Paleosols (Argentina, Kilimanjaro, Eurasia)*  
Prof. Y. Huang and J. Russell

March 2008 – Feb 2009      **Visiting Scientist / SNF Postdoctoral Fellowship**  
University of Pittsburgh and University of Washington  
*Compound-specific Isotope Analyses on Lake Sediments in the Andes*  
Prof. M. Abbott and J. Sachs, respectively

June 2006 – March 2008      **Research Assistant (PostDoc)**, University of Bern, Switzerland  
Research topics: exposure dating, soil and lake sediment analyses, Late Quaternary landscape and climate reconstruction. Teaching: laboratory course, excursions, supervision of students on bachelor, master and PhD level

June 2006      **PhD; Dr. phil.-nat.** (grade 6 = excellent)  
Geographical Institute, University of Bern, Switzerland  
Group on Paleogeology and Landscape Reconstruction  
Title: *Glacier and Climate Reconstruction in the Central Andes based on <sup>10</sup>Be Surface Exposure Dating*  
Prof. H. Veit

Oct 2003 – Feb 2004  
**Marie Curie Fellowship** at the University of Bergen, Norway:  
Research/course topics: methods for quantitative climate reconstruction from lake sediments, environmental magnetism

- March 2003           **Diploma Geoecology** (Master) at the University of Bayreuth, Germany  
(gpa: 1.1 = excellent)  
Majors : Geomorphology, Soil Science  
Minors: Ecological Economics, Agroecology, Dendrology  
Title of the Diploma Thesis: *Landscape and Climate Reconstruction in the Pamir Mountains: Moraine and Landslide Dating in the Area of Lake Yashilkul using in-situ cosmogenic <sup>10</sup>Be* (grade: 1.0 = excellent)
- August 2000 – May 2001  
Studies at the School of Public and Environmental Affairs, Bloomington, USA  
(scholarship of the Indiana University)
- 1996-1999           **Prediploma Geoecology** (Bachelor), University of Bayreuth (gpa: 1.3 = excellent)
- 1987-96             Allgemeine Hochschulreife, Finsterwalder-Gymnasium Rosenheim  
(gpa 1.0 = excellent)

General interests:

- 2002                 Participation at the „European Youth Conference 2002“, Sofia
- 2002                 Participation at the „Global Youth Forum 2002“, Denmark
- Since 2001         Member of the „Studienstiftung des deutschen Volkes, e.V.“
- 1999                 Organisation/Participation: student exchange Bayreuth-Moscow (Apollo e.V.)
- Since 1996         Member of the „Bayreuther Initiative für Wirtschaftsökologie, e.V. / oikos Bayreuth“. From 1999 to 2004: Geschäftsführer of „oikos Bayreuth“ (e.g.: organisation of a workshop on ‘*Climate Change and Trade*’ in Bled/Slovenia 2001)

Language skills:

German: mother tongue; English: fluent; Spanish: intermediate; French and Russian: basic

List of Referees:

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J. Russell ([James\\_Russell@brown.edu](mailto:James_Russell@brown.edu), +1 401-863-6330)  
- Hosts and supervisors at Geological Sciences, Brown University

Prof. J. Smith (College of Saint Rose, [smithj@strose.edu](mailto:smithj@strose.edu), +1 518-485-3756)  
- Co-Author

Prof. M. Vuille (University of Albany, [mathias@atmos.albany.edu](mailto:mathias@atmos.albany.edu), +1 518-442-4472)  
- Co-Advisor, PhD Thesis

Prof. H. Veit (University of Bern, [veit@giub.unibe.ch](mailto:veit@giub.unibe.ch), +41 (0)31-631-8561)  
- Advisor, PhD Thesis

## Summary of Recent Research Achievements:

The scientific aim of my PhD project was to determine the timing of the local Last Glacial Maximum (LGM) along a N-S transect across the Central Andes. Establishing glacial chronologies has long been a major challenge, particularly in arid high-mountain regions, due to the lack of suitable organic material for radiocarbon dating. However, recent developments in surface exposure dating seemed to promise important new insights into the climatological forcing of asynchronous glacial advances. I had previously learned and applied the new technique during my diploma thesis (master) in the Pamir Mountains, Central Asia. There, the local LGM occurred early during the last glacial cycle (~60 ka) rather than during the temperature minimum of the global LGM (~20 ka), which could be explained by increasingly more arid conditions and less moisture advection by the westerlies.

Our results then indeed showed that the local LGM in the southern Central Andes significantly predated the global LGM, whereas the local LGM in the northern Central Andes occurred during the Late Glacial. Again, varying moisture availability was responsible for the asynchronous glacial advances. This has been corroborated in collaboration with Ch. Kull, who developed glacier climate models to investigate the sensitivity of glacial mass balances to precipitation and temperature, respectively. Accordingly, we concluded that the southern-hemispheric westerlies provided more humidity to the southern Central Andes at ~35 ka, which is particularly interesting with regards to the highly controversial discussion over palynological, marine sedimentological and modelling data concerning the position of the southern westerlies during the LGM. On the other hand, the Late Glacial advances in the northern Central Andes coincide with lake transgression phases on the Altiplano and document a southward shift and/or intensification of the tropical circulation in response to cold Heinrich events in the North Atlantic.

A major drawback of surface exposure dating is its high uncertainty (>20%) at low latitudes and high altitudes, which still prevents sound paleoclimatic conclusions on millennial timescales. The second, still ongoing SNF project therefore aims at finding sites where independent radiocarbon age control can be obtained to compare and check the exposure ages and to refine the exposure age calculations. We are in contact with the CRONUS Earth initiative, in order to test whether the two sites that we have been working on during the last two years are suitable for calibrating exposure ages.

Although the large potential of glacial chronologies for climate reconstruction has clearly been demonstrated, they can only provide snapshots in time. Combining exposure dating with high-resolution lake sediment or paleosol studies is therefore indispensable to improve our understanding of Quaternary climate changes. Applying a variety of pedological and geochemical analyses on a 15 m high, 240 ka permafrost soil profile in northeast Siberia, for example, revealed a much more continuous record than the glacial chronology alone. Our major findings there are that (i) soils accumulated poorly degraded organic material during glacial periods, but experienced much more intensive degradation and weathering during warm interglacials, and (ii) trees were very likely not limited by cold temperatures during the penultimate glaciation, and the 'mammoth steppes' typical for the last glaciation were favoured by a combination of cold AND very arid conditions. Implications for both carbon sequestration on glacial-interglacial timescales and climate change biologists are significant.

## Academic and Research Goals:

We have only just started to acknowledge what glacial chronologies can tell us about past temperature and precipitation changes. Further reducing the current uncertainties of surface exposure dating is one obvious goal of the research community, and I would like to be part of it. Simply establishing more chronologies is, however, also necessary in order to corroborate and refine the existing results. In that context, I am particularly interested in continuing the research in Central Asia.

As mentioned above, glacial chronologies are per se not continuous climate records. On shorter, deglacial and Holocene timescales, lake sediments provide suitable, alternative archives. On longer, orbital timescales, loess and paleosol sediments are invaluable, but still poorly explored archives. I have been involved in and followed respective 'high-resolution' studies for several years, e.g. of lake and piedmont sediments along the Andes, lake and loess sediments in Central Asia, and of the frozen loess-like sediments in Siberia. I am well aware how challenging it is to obtain meaningful and reliable paleo-environmental and -climate proxies from such archives. Recent developments in lipid biomarker and compound-specific stable isotope analyses now provide innovative, new tools for Quaternary geologists. Just as exposure dating has revolutionized glacial reconstruction, lipid biomarkers and compound-specific deuterium and oxygen isotope analyses are about to allow us entering a new research era in organic geochemistry. I am currently producing MBT temperature and alkanes/acids  $\delta D$  precipitation records for Argentina (1.1 Ma loess-paleosol profile), Mount Kilimanjaro in East Africa (~80 ka paleosols), and Northeast Siberia (240 ka permafrost soils). The preliminary results are very promising, and I am highly interested in further applying and refining these new methods.

Working at the cutting edge of two innovative, new analytical methods for Quaternary geologists – cosmogenic nuclides and biomarker/ compound-specific isotope analyses – is not an achieved state; it reflects an attitude. I strongly believe that inter- and cross-disciplinary research and keeping up with methodological developments is THE way to address scientific questions and problems today. Humankind is facing a potentially dramatic threat: Climate Change. Nevertheless, our knowledge about the natural variability of Quaternary climate change is very limited. We still do not even know what caused the ice ages and the 100 and 40 ka periodicity of Quaternary glaciations. I am curious, and I want to contribute solving some of the questions our research community has.

As a PostDoc, I have clearly reached a state in my career where scientific progress is constrained by the limited possibilities to have access to funding and to build up an own research group. Additionally, I always enjoyed spreading awareness for ecological and scientific problems. Discussing climate and paleoclimate changes with students and colleagues can simply be so much fun ☺. I would greatly enjoy leading a young, innovative research team in Christchurch, collaborating locally and internationally, within and across traditional scientific disciplines, in order to jointly solve some of the 'last' remaining questions in Quaternary Geology and Paleoclimatology, and to find new questions, of course, as well.

## List of Publications (June 2009)

### Accepted – submitted:

Zech, R., Smith, J. and Kaplan, M. "Chronologies of the LGM and its Termination in the Andes based on Surface Exposure Dating". In: F. Vimeux, F. Sylvestre and M. Khodri (Eds.). Past climate variability from the Last Glacial Maximum to the Holocene in South America and Surrounding regions. Springer. in press.

Zech, R. "Pleistocene climate changes and glaciation in Nepal and High Asia". In: Miehe, G. "Flora of Nepal", accepted.

May, H., Zech, R., Schellenberger, A., Kull, Ch. and Veit, H. "Quaternary environmental and climate changes in the Central Andes". In: Salfity, J. (Eds.). Cenozoic of the Andes: accepted.

Ilgner, J., Zech, R. and Veit, H. "Scaling matters - exposure age uncertainties from a user's point of view." submitted.

Ilgner, J., Zech, R., Kubik, P.W. and Veit, H. „Glacier and climate reconstruction at Tres Lagunas, NW Argentina, based on <sup>10</sup>Be surface exposure dating“ submitted.

Zech, M., Andreev, A., Zech, R., Müller, S., Hambach, U., Frechen, M., Zech, W. „Quaternary vegetation changes derived from a permafrost palaeosol sequence in NE-Siberia using alkane biomarker and pollen analyses: contradicting vegetation history versus climate history?“ Boreas, submitted.

### 2009

Zech, R., Zech, M., Kubik, P. W. Krishna, K., and Zech, W. (2009). "Deglaciation and landscape history around Annapurna, Nepal based on <sup>10</sup>Be surface exposure dating." Quaternary Science Reviews 28: 1106-1118.

Zech, W., Zech, M., Zech, R., Peinemann, N., Morras, H., Moretti, L., Ogle, N., Kalim, R., Fuchs, M., Schad, P. and Glaser, B. (2009). "Late Quaternary palaeosol records from subtropical (38° S) to tropical (16° S) South America and palaeoclimatic implications." Quaternary International 196: 107-120.

Zech, M., Zech, R., Glaser, B., Morrás, H. and Moretti, L. M. (2009). "Late Quaternary environmental changes in Misiones, subtropical NE Argentina, deduced from multi-proxy geochemical analyses in a palaeosol-sediment sequence." Quaternary International 196: 121-136.

### 2008

Zech, R., May, J.-H., Kull, C., Ilgner, J., Kubik, P. and Veit, H. (2008). "Timing of the Late Quaternary Glaciation in the Andes from ~15 to 40°S." Journal of Quaternary Science 23: 635-647.

Kull, C., Imhof, S., Grosjean, M., Zech, R. and Veit, H. (2008). "Late Pleistocene glaciation in the Central Andes: Temperature versus humidity control — A case study from the eastern Bolivian Andes (17°S) and regional synthesis." Global and Planetary Change 60: 148-164.

Zech, M., Zech, R., Zech, W., Glaser, B., Brodowski, S. and Amelung, W. (2008). "Characterisation and palaeoclimate of a loess-like permafrost palaeosol sequence in NE Siberia." Geoderma 143: 281-295.

May, J.-H., Zech, R. and Veit, H. (2008). "Paleosol-sediment-sequences and their implications for the Late Quaternary landscape evolution along the Andean piedmont (Eastern Bolivia)." Geomorphology: 98, 34-54.

## 2007

Zech, R., Kull, C., Kubik, P. and Veit, H. (2007). "LGM and Late Glacial glacier advances in the Cordillera Real and Cochabamba (Bolivia) deduced from  $^{10}\text{Be}$  surface exposure dating." *Climate of the Past* Discussions 3: 839-869.

Zech, R., Kull, C. and Veit, H. (2007). "Exposure dating of Late Glacial and pre-LGM moraines in the Cordillera Dona Rosa, Northern Chile ( $\sim 31^\circ\text{S}$ )." *Climate of the Past* 3: 1-14.

Zech, M., Zech, R. and Glaser, B. (2007). "A 240,000-year stable carbon and nitrogen isotope record from a loess-like palaeosol sequence in the Tumara Valley, Northeast Siberia." *Chemical Geology* 242: 307-318.

## 2006

Zech, R. (2006). *Glacier and Climate Reconstruction in the Central Andes based on  $^{10}\text{Be}$  Surface Exposure Dating*. PhD thesis. University of Bern. Institute of Geography. pp. 101.

Zech, R., Kull, C. and Veit, H. (2006). "Late Quaternary glacial history in the Encierro Valley, Northern Chile ( $29^\circ\text{S}$ ), deduced from  $^{10}\text{Be}$  surface exposure dating." *Palaeogeography, Palaeoclimatology, Palaeoecology* 234 (2-4): 277-286.

Zech, R., Kull, C. and Veit, H. (2006). "Expositionsdatierung in den Zentralen Anden: Quartäre Gletscher- und Klimarekonstruktion mittels in-situ  $^{10}\text{Be}$ ." *Geographica Helvetica* 61 (2): 77-90.

Abramowski, U., Bergau, A., Seebach, D., Zech, R., Glaser, B., Sosin, P., Kubik, P. W. and Zech, W. (2006). "Late Pleistocene palaeoglaciations of Central Asia: a new chronology based on  $^{10}\text{Be}$  surface exposure ages of erratic boulders from the Pamir (Tajikistan), Alay and Turkestan Ranges (Kyrgyzstan)." *Quaternary Science Reviews*: 25, 1080-1096.

## 2005 and before

Zech, R., Glaser, B., Sosin, P., Kubik, P. W. and Zech, W. (2005). "Evidence for long-lasting landform surface instability on hummocky moraines in the Pamir Mountains from surface exposure dating." *Earth and Planetary Science Letters* 237: 453-461.

Zech, R., Abramowski, U., Glaser, B., Sosin, P., Kubik, P. W. and Zech, W. (2005). "Late Quaternary glacial and climate history of the Pamir Mountains derived from cosmogenic  $^{10}\text{Be}$  exposure ages." *Quaternary Research* 64 (2): 212-220.

Zech, R., Abramowski, U., Glaser, B., Sosin, P., Kubik, P. W. and Zech, W. (2005). "Expositionsdatierung mittels kosmogener Nuklide: Ausgewählte Beispiele aus dem Pamir und dem Himalaya." In: *Hochgebirge und ihr Umland*, Hrsg: Eidam, U., Schröder, H. and Winter, S., *Berliner Geographische Arbeiten* 100: 3-8.

Zech, R., Abramowski, U., Glaser, B., Sosin, P., Kubik, P. and Zech, W. (2003). "Potentials and limitations of surface exposure dating using in-situ production of cosmogenic  $^{10}\text{Be}$  in the Pamir." *Berliner Paläobiologische Abhandlungen* 02: 134-135.

## **Conferences (since 2005):**

### **2009**

Zech, R., Gao, L., Tazoro, R., Huang, Y., Russell, J., Hemp, A., and Zech, W. (2009). Climate and environmental change in East Africa recorded in a ~80 ka paleosol on Mount Kilimanjaro. ISOCOMPOUND, Potsdam.

### **2008**

Zech, R., Eisenhut, A., Kubik, P.W., Veit, H. (2008). Glacial chronologies along the Andes (~30-40°S) and the role of the Westerlies, AGU San Francisco.

Ilgner J., Zech R., Kubik P.W. and Veit, H. (2008). Systematic Uncertainties of Glacial Chronologies based on surface exposure dating, AGU San Francisco.

Zech, R., Ilgner, J., Kull, C., Kubik, P.W., Veit, H. (2008). Late quaternary glacial chronologies along the Andes and paleoclimatic implications, 4th Alexander von Humboldt International Conference, Santiago de Chile.

Ilgner J., Zech R., Bächtiger Ch., Kubik P.W. and Veit, H. (2008). The Tres Lagunas in NW Argentina – a potential calibration site for Surface Exposure Dating?, International Conference, Santiago de Chile.

Zech, R., Ilgner, J., Kull C., Kubik P.W., Veit H. (2008). Asynchronous glacial chronologies along the Central Andes (~10-40°S) and paleoclimatic implications, XII Reunión Argentina de Sedimentología, Buenos Aires.

Ilgner J., Zech R., Bächtiger Ch., Kubik P.W. and Veit, H. (2008). Surface exposure dating of moraines and lake sediment analysis at the Tres Lagunas, a potential calibration site in NW-Argentina, XII Reunión Argentina de Sedimentología, Buenos Aires.

Ch. Bächtiger, J. Ilgner, R. Zech and H. Veit (2008). Glacial landscape evolution at the Tres Lagunas, NW-Argentina: a potential calibration site for surface exposure dating, EGU Wien.

Ilgner J., Zech R., Veit H. (2008). Scaling matters – exposure age uncertainties from a user's point of view with examples from the Central Andes, EGU Wien.

Zech, R., Ilgner, J., Kull, C., Kubik, P.W., Veit, H. (2008). Asynchronous/synchronous Late Quaternary glaciation along the Andes, 17. Jahrestreffen des Arbeitskreis Hochgebirge, Passau.

Ilgner J., Zech R., Veit H. (2008). Calculating exposure ages in the tropical Andes – the uncertainties of scaling, 17. Jahrestreffen des Arbeitskreis Hochgebirge, Passau.

### **2007**

Zech, R., Kull, C., Kubik, P. W. and Veit, H. (2007). Insights into past atmospheric circulation from glacial chronologies along the Andes (15-40°S). INQUA, Cairns.

Zech, R., Kull, C., Kubik, P. W. and Veit, H. (2007). Glacial chronologies along the Andes (15-40°S) based on <sup>10</sup>Be Surface Exposure Dating. EGU, Wien.

Zech, R., Kull, C., Kubik, P. W. and Veit, H. (2007). Surface exposure dating of moraines in Bolivia: unrecognized uncertainties and paleoclimatic implications. EGU, Wien.

Eisenhut, A., Zech, R., Kubik, P. W. and Veit, H. (2007). Surface exposure dating on moraines in the Valle Rucachoroi (39°S, Argentina) and on Cerro Fredes Plateau (31°S, Chile). EGU, Wien.

Zech, R., Kull, C. and Veit, H. (2007). Glacial chronologies along the Andes (15-40°S) based on <sup>10</sup>Be Surface Exposure Dating. LAK 20, Kiel.

Zech, R., Kull, C., Kubik, P. W. and Veit, H. (2007). Quaternary climate reconstruction in the Andes using  $^{10}\text{Be}$  Surface Exposure Dating. Swiss Global Change Day, Bern.

## **2006**

Zech, R., Kull, C., Kubik, P. W. and Veit, H. (2006). Asynchronous Glacial Chronologies in the Central Andes (15-40°S) and Paleoclimatic Implications. INQUA workshop: Mountain Glaciation - From Tibet to the World, Xining, China.

Zech, R., Kull, C. and Veit, H. (2006). Exposure dating in the Central Andes: paleoclimatic implications of asynchronous glacial advances. EGU, Wien.

Zech, R., Kull, C. and Veit, H. (2006). Exposure dating in the Central Andes: paleoclimatic implications of asynchronous glacial advances. AGU, San Francisco.

Zech, R., Kull, C. and Veit, H. (2006). Glacier and Climate Reconstruction in the Central Andes based on  $^{10}\text{Be}$  Surface Exposure Dating. Cronus EU Summer School, Harkany, Hungary.

Zech, R., Kull, C. and Veit, H. (2006). Late Quaternary glacial chronologies in the Chilean and Argentinean Andes (30-40°S) based on Surface Exposure Dating. PAGES meeting, Malargue, Mendoza.

Zech, R., Kull, C. and Veit, H. (2006). Gletscher- und Klimarekonstruktion in den Zentralen Anden mittels  $^{10}\text{Be}$  Expositionsdatierung. ARGE, Zerne, Schweiz.

Zech, R., Kull, C. and Veit, H. (2006). Expositionsdatierung in den Zentralen Anden: Asynchrone Gletschervorstöße und paleoklimatische Konsequenzen. AGAQ - Deuqua ArbeitsGruppe Alpen Quartär, Heidelberg.

## **2005**

Zech, R., Kull, C. and Veit, H. (2005). Did the enhanced lateglacial monsoon trigger glacial advances south of the Arid Diagonal? EGU, Wien.

Zech, R., Kull, C. and Veit, H. (2005). Late Quaternary Glacial History in the Encierro Valley, Northern Chile (29°S), deduced from  $^{10}\text{Be}$  Surface Exposure Dating. GSA, Salt Lake City.

Zech, R., Manhart, A., Glaser, B., Solomon, D. and Zech, W. (2005). A High-Resolution Lateglacial Climate Record From Lake Sediments in the Ethiopian Bale Mountains. AGU, San Francisco.

Zech, R., Kull, C. and Veit, H. (2005). Late Quaternary Glacial History in the Encierro Valley, Northern Chile (29°S), deduced from  $^{10}\text{Be}$  Surface Exposure Dating. LAK 19, Potsdam.

Zech, R., Kull, C. and Veit, H. (2005). Late Quaternary Glacial History in the Encierro Valley, Northern Chile (29°S), deduced from  $^{10}\text{Be}$  Surface Exposure Dating. AGAQ - Deuqua ArbeitsGruppe Alpenvorland Quartär, Simbach.

Zech, R. (2005). Expositionsdatierung mittels  $^{10}\text{Be}$  zur Gletscherrekonstruktion in den zentralen Anden. Geographentag, Trier.