

DAN BREECKER

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EDUCATION

Ph.D. Earth and Planetary Sciences, University of New Mexico	2008
M.S. Earth and Planetary Sciences, University of New Mexico	2004
B.A. Geology, Amherst College (Amherst, MA)	2001

PROFESSIONAL EXPERIENCE

Assistant Professor, University of Texas at Austin	2009-present
NSF Earth Science Post Doctoral Fellow, University of Arizona	2008-2009

RESEARCH INTERESTS

Critical zone biogeochemistry: modern calibrations of terrestrial paleoclimate proxies, the relationships between climate and soil chemistry, gas chemistry of the critical zone, biological respiration in the critical zone, technique development for stable isotope measurements. Focus over the next three years: pedogenic carbonate in modern soils, carbon and oxygen isotope ratios in cave and soil CO₂, soil carbon sequestration, and soil incubation experiments. Junyeon Yoon (current PhD student) is studying pedogenic carbonate in Vertisols, incoming PhD student John Warden may be interested in cave research, incoming MS student Nate Meyer will work on soil carbon sequestration project, incoming MS student Lacey Pyle will work on soil incubations and incoming student Kyle Meyer may work on playa lakes in West Texas, soil organic matter in Tibetan soils, or carbonate nodules from the Chinese Loess Plateau.

HONORS AND AWARDS

NSF Earth Sciences Postdoctoral Fellowship	2008-2009
Outstanding Ph.D. student (UNM E&PS)	2008
Vincent C. Kelley Graduate Fellowship (UNM E&PS)	2004-2007
Outstanding M.S. student (UNM E&PS)	2004
Outstanding Teaching Assistant (UNM, university-wide)	2004
Frank E. Kottlowski Award (New Mexico Geological Society)	2004
Robert Wellnitz Scholarship for excellence in field research (New Mexico Geological Society)	2003
Outstanding Beginning Teaching Assistant (UNM E&PS)	2002/2003
John Mason Clarke 1877 Fellowship (Amherst College)	2002-2004
Magna cum Laude, Amherst College	2001
Pond Prize for Most Distinguished Thesis in Geology (Amherst College)	2001

TEACHING, MENTORING AND
TEACHING DEVELOPMENT

Physical Geology (GEO 401) Course Instructor Survey scores attached

Graduate student supervision (current/total): Masters (0/0), Ph.D. (1/1)

Graduate student committees

Chair
Junyeon Yoon (Ph.D.)

Member
Brian Cowan (M.S.)
Aaron Jones (M.S.)

Outside Examining Member
Bruce Frederick (Ph.D.)
Engin Alkin (Ph.D.)

Undergraduate student mentoring

Chair of Undergraduate Honors Thesis Committee

Warren Huffman, "Numerical modeling of transient state soil CO₂ profiles"

Member of Undergraduate Honors Thesis Committee

Ashley Quinn, "Carbon Isotope Analysis of the Sources and Mechanisms of CO₂ Input and Removal from Central Texas Cave Systems" May 2010.

NSF REU mentor

Carolyn Ball, "Tracing cave CO₂ in central Texas caves using stable carbon isotope ratios" 2010

Marissa Tremblay, "Comparison of the carbon isotope composition of soil respired CO₂ and bulk soil organic matter" 2010

Reviewer for Pearson Education/Prentice Hall Publishers ("How Does Earth Work?" by Smith and Pun, 2nd edition)

Participant, "Interactive Techniques for Large Classes," hosted by DIIA (Division of Instructional Innovation and Assessment), University of Texas at Austin Fall 2009

SERVICE

Department:

Department Safety Officer 2010-

GSC Curriculum Committee 2010

Climate Systems Science Website representative Fall 2009-

Bid review committee for Barnes/Breecker/Shanahan/Quinn laboratory renovation (Fall 2009)

Host for visiting scientist Yong Wang (professor and Southwest University, BeiBei District, Chongqing, China) during his 2010 stay at UT.

University:

ESI NSF REU

Faculty review committee for program applicants

Communication skills feedback session

Seminar to REU group

National:

Ad-hoc reviewer for proposals to Federal agencies

National Science Foundation
EAR Postdoctoral Fellowship program
Tectonics Program
Sedimentary Geology and Paleobiology Program
P2C2 program

Ad-hoc reviewer for peer reviewed journals

Biogeochemistry
Chemical Geology
Earth and Planetary Science Letters
Geochimica Cosmochimica Acta
Geology
Journal of Sedimentary Research
Palaeogeography, Palaeoclimatology, Palaeoecology
Quaternary Science Reviews
Rapid Communications in Mass Spectrometry
Reviews in Mineralogy and Geochemistry

Community:

Guest Speaker at Highlands High School, Albuquerque, NM, December 12, 2008. Spoke to 9th and 10th grade students about climate change and renewable energies.

UNM special awards Judge for 2007 Intel International Science and Engineering Fair (Albuquerque, NM)

Lecture to NSF-REU students (undergraduates) at the Sevilleta National Wildlife Refuge, summer 2007, Studying soil respiration using below ground measurements: Monitoring the concentration and carbon isotope composition of soil CO₂.

SPONSORED RESEARCH

Planned for submission January 9 2011: "Carbon fluxes in New Mexico biomes" National Science Foundation, Ecosystem Science, PIs: M.E. Litvak and **D.O. Breecker**.

In prep for submission October 15, 2010: "PaleoVertisols of the Fort Hancock Formation and modern playa lake analogs" National Science Foundation, Paleo Perspectives on Climate Change, PIs: S.G. Driese and **D.O. Breecker**.

In review: "Speleothem Fluid Inclusion Gas Analysis: A New Approach to Evaluating Paleoclimate and Geomicrobiological Signals" National Science Foundation, Geobiology and Low Temperature Geochemistry, PIs: P. Boston, N. Blamey, **D.O. Breecker**, J. Banner.

In review: "Modeling calcic soil development using the NCAR community land model" National Science Foundation, Geomorphology and Land Use Dynamics, PIs: **D.O. Breecker** and L. Yang.

In review: Acquisition of an isotope ratio mass spectrometer for analyzing critical zone gases" National Science Foundation, EAR-IF (\$174,129), sole PI: **D.O. Breecker**.

Funded for 2010-2011: "Grassland Carbon Sequestration" United States Fish and Wildlife Service Challenge Cost Share (16,000), PIs: **T. Menard and D.O. Breecker**.

Declined for 2010-2011: "ETBC: Acquisition of an isotope ratio mass spectrometer for analyzing critical zone gases" National Science Foundation, EAR-IF (\$174,129), sole PI: **D.O. Breecker**.

Funded for 2009-2012: "Collaborative Research: Calibrating the paleosol carbonate CO₂ barometer for vertic paleosols by monitoring soil CO₂ in modern Vertisols" National Science Foundation, Geobiology and Low Temperature Geochemistry (\$195,243, portion awarded to UT), PI: **D.O. Breecker**, co PIs: S.G. Driese, L. Nordt.

Funded for 2008-2009: "Calibrating the Paleosol CO₂ Barometer by Monitoring Modern Calcic Soils" National Science Foundation, EAR-PF (\$80,000), sole PI: **D.O. Breecker**.

INVITED LECTURES

Southern Methodist University, Huffington Department of Earth Sciences, Spring 2010, Modern soils and ancient atmospheric CO₂: calibrating the paleosol carbonate CO₂ barometer.

University of Hawaii, Department of Geology and Geophysics, Spring 2010, Modern soils and ancient atmospheric CO₂: calibrating the paleosol carbonate CO₂ barometer.

Baylor University, Department of Geology, Spring 2010, Modern soils and ancient atmospheric CO₂: calibrating the paleosol carbonate CO₂ barometer.

University of Texas at Austin, Bureau of Economic Geology, Fall 2009, The stable isotope composition of CO₂ in soils and caves: investigating processes in the critical zone.

University of Texas at Austin, Department of Geological Sciences, Fall 2009, The stable isotope composition of CO₂ in soils and caves: investigating processes in the critical zone.

Rensselaer Polytechnic Institute, Spring 2008, Extreme conditions of pedogenic carbonate formation: Implications for reconstructing paleoenvironments.

University of Houston, Spring 2008, Extreme conditions of pedogenic carbonate formation: Implications for reconstructing paleoenvironments.

University of Texas at Austin, Spring 2008, Extreme conditions of pedogenic carbonate formation: Implications for reconstructing paleoenvironments.

Los Alamos National Laboratory, Fall 2008, Calibrating pedogenic carbonate as a paleoenvironmental indicator.

New Mexico Institute of Mining and Technology, Fall 2008, Improved understanding of soil carbonate formation reveals sensitivity of Earth's climate to atmospheric CO₂.

PUBLICATIONS

MANUSCRIPTS

(* indicates student author)

Brecker, D.O. and Banner, J.L. The flux of CO₂ into Earth's atmosphere from caves and fractured bedrock. In prep. for Nature Geoscience.

*Quinn, A.; **Brecker, D.O.**; Banner, J. Comparison of soil CO₂ and cave atmosphere CO₂ in central Texas caves. In prep for ??

Kirk, M.; Martini, A.; **Brecker, D.O.** Constraining rates of methanogenesis in a shale aquifer using hydrogen isotope mass balance. In prep for ??

Isotope mass balance modeling

Brecker, D.O.; Quade, J.; Mizer, J.D. The source of CO₂ in the atmosphere of Cave of the Bells, southern Arizona. In prep for Geophysical Research Letters.

Developed ideas, conducted some of the field and laboratory work, interpretation, wrote paper

Brecker, D.O.; *Powers, H., McDowell, N. Moisture stress does not alter the δ¹³C value of soil respired CO₂ in incubations of soil from a Piñon Woodland. In prep for Journal of Geophysical Research.

Interpreted data, wrote paper

Brecker, D.O.; McFadden, L.D.; Sharp, Z.D.; Litvak, M.E. Seasonal variations in the δ¹³C value of soil respired CO₂ in mixed C₃-C₄ ecosystems from central New Mexico. In prep for Biogeochemistry.

Developed ideas, conducted the field and laboratory work, interpretation, wrote paper

Quade, J., **Brecker, D.O.**, Daëron, M., Eiler, J., in review, The Paleothermometry of Tibet: An Isotopic Perspective. *Earth and Planetary Science Letters*.

Developed some of the ideas, conducted some of the field and laboratory work, some of the interpretations, helped substantially revise paper

Mintz, J.S., Driese, S.G., Ludvigson, G.A., and **Brecker, D.O.**, in review, Influence of changing hydrology on pedogenic calcite precipitation in Vertisols, Dance Bayou, Brazoria County, TX: Implications for estimating paleoatmospheric pCO₂. *Geology*

Monte Carlo Simulations, interpretation, helped substantially revise paper

Brecker, D.O., in press, Improving paleosol carbonate based estimates of ancient atmospheric CO₂. *Geochemical News* INVITED PAPER

Brecker, D.O., Sharp, Z.D. and McFadden, L. (2010) Atmospheric CO₂ concentrations during ancient greenhouse climates were similar to those predicted for A.D. 2100. *Proceedings of the National Academy of Sciences of the United States of America*: 107, 576-580.

Press:

Lovett, R.A. Soils give clean look at past carbon dioxide, *Nature News*, Published online 30 December 2009. doi:10.1038/news.2009.1168.

Royer, D.L. (2010) Fossil soils constrain ancient climate sensitivity. *Proceedings of the National Academy of Sciences of the United States of America*: 107, 517-518.

Newton, A. Insights from earth, *Nature Reports Climate Change*, Published online 14 January 2010. doi:10.1038/climate.2010.03.

Developed ideas, conducted the literature research, interpretation, wrote paper

Brecker, D., Sharp, Z.D. and McFadden, L. (2009) Seasonal bias in the formation and stable isotope composition of pedogenic carbonate in modern soils from central New Mexico. *GSA Bulletin*: 121, 630-640.

Developed ideas, conducted the field and laboratory work, interpretation, wrote paper

Brecker, D. and Sharp, Z.D. (2008) A field and laboratory method for monitoring the concentration and isotopic composition of soil CO₂. *Rapid Communications in Mass Spectrometry*: 22, 449-454.

Developed ideas, conducted the field and laboratory work, interpretation, wrote paper

Brecker, D. and Sharp, Z.D. (2007) A monazite oxygen isotope thermometer. *American Mineralogist*: 92, 1561-1572.

conducted laboratory work, wrote paper

ABSTRACTS (13 TOTAL)
(* indicates student author)

Brecker, D.O., Sharp, Z.D., McFadden, L.D., Litvak, M. (2009) Photosynthetic discrimination drives seasonal variations in the δ¹³C value of soil-respired CO₂ in mixed C₃-C₄ ecosystems from central New Mexico. *Eos Trans. AGU*, 89(52) Fall Meet. Suppl., Abstract B53C-0419.

- *Osuna, R. **Brecker, D.O.**, Sharp, Z.D. (2009) Rate and $\delta^{13}\text{C}$ values of CO_2 produced during short-term online incubation experiments indicate two different processes with distinct carbon sources. *Eos Trans. AGU*, 89(52) Fall Meet. Suppl., Abstract B53C-0410.
- *Quinn, A.E., **Brecker, D.O.**, Banner, J.L. and *Cowan, B.D. (2009) Investigating cave ventilation in central Texas using seasonal variations in the $\delta^{13}\text{C}$ value and concentration of cave-air CO_2 . Geological Society of America *Abstracts with Programs*, 41(7) p. 471.
- Brecker, D.O.** and Quade, J. (2009) Tracing carbon transfer from soils to a cave using stable carbon isotopes. Geological Society of America *Abstracts with Programs*, 41(7) p. 398.
- Brecker, D.O.**, Sharp, Z.D., McFadden L.D., Quade, J. (2009) Revised Phanerozoic atmospheric CO_2 concentrations from paleosol carbonate. Goldschmidt Conference Abstracts 2009, p. A158.
- Brecker, D.O.**, Quade, J., Fischer, T.B., McFadden L.D., Sharp, Z.D. (2008) Seasonal biases in $\delta^{13}\text{C}$ values of soil and cave carbonates. Geological Society of America *Abstracts with Programs*, 40(6) p. 276.
- Brecker, D.**, Sharp, Z.D. Newell, D., Jessup, M., Cottle, J. (2007) Oxygen isotope composition of modern pedogenic carbonate from the southern margin of the Tibetan Plateau. *Eos Trans. AGU*, 88(52) Fall Meet. Suppl., Abstract PP23A-1084.
- Brecker, D.**, Sharp, Z.D. and McFadden, L. (2007) Extreme conditions of pedogenic carbonate formation and implications for paleoenvironmental reconstruction and paleosol $p\text{CO}_2$ barometry. Geological Society of America *Abstracts with Programs*, 39(6) p. 182.
- Brecker, D.**, Sharp, Z.D. and McFadden, L. (2007) Seasonal variation in the carbon isotope composition and concentration of soil CO_2 gives insight to the formation of modern pedogenic carbonate. *Geophysical Research Abstracts*, 9, EGU2007-A-05803.
- Brecker, D.**, Sharp, Z.D. and McFadden, L. (2006) Investigating the formation of pedogenic carbonate using stable isotopes. *Eos Trans. AGU*, 87(52), Fall Meet. Suppl., Abstract B22D-08.
- Brecker, D.** and Sharp, Z.D. (2005) High resolution carbon and oxygen isotope measurements of laminations in pedogenic carbonate. *Eos Trans. AGU*, 86(52), Fall Meet. Suppl., Abstract B11A-1012.
- Brecker, D.O.** and Sharp Z.D. (2004) A monazite oxygen isotope thermometer. Geological Society of America *Abstracts with Programs*, 36(5) p. 454.
- Brecker, D.O.** and Cheney, J. T. (2001) Mineral assemblages of high-pressure quartz-mica schists from Syros, Cyclades, Greece. Geological Society of America *Abstracts with Programs*, 33(1), p. A9.
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