

R. LAWRENCE EDWARDS  
Robert D. and Carol C. Gunn Professor  
Distinguished McKnight University Professor

#### Education

S.B	1976	Massachusetts Institute of Technology, Cambridge
M.S	1986	University of Michigan, Ann Arbor
Ph.D	1988	California Institute of Technology, Pasadena

#### Positions

2013 to present	Robert D. & Carol C. Gunn Professor, U. Minnesota
2008 to 2013	George & Orpha Gibson Chair of Earth Systems Science, U. Minnesota
2001 to present	Distinguished McKnight University Professor, University of Minnesota
1998 to present	Professor, University of Minnesota
1994 to 1998	Associate Professor, University of Minnesota
1988 to 1994	Assistant Professor, University of Minnesota

#### Honors and Awards

Highly Cited Researcher 2014, Thompson Reuters (1 of 159 in Geoscience worldwide; 1 of 20 at U. Minnesota, across all covered fields)

Geochemical Fellow (Geochemical Society & European Association of Geochemistry: [www.geochemsoc.org/awards/geochemicalfellows](http://www.geochemsoc.org/awards/geochemicalfellows)), 2014

Robert D. and Carol C. Gunn Professor, 2013 (inaugural professor)

Fellow of the American Association for the Advancement of Science, 2012

**Fellow of the National Academy of Sciences, 2011**

Arthur L. Day Prize, National Academy of Sciences (<http://www.nasonline.org/about-nas/awards/arthur-l-day-prize.html>), 2011

Among top ten most cited earth scientists worldwide (past decade, [www.isiknowledge.com](http://www.isiknowledge.com)), 2010 to present (**2nd-most cited earth scientist in the world** as of Feb. 2015)

**John Simon Guggenheim Fellow, 2009** ([www.gf.org](http://www.gf.org))

George & Orpha Gibson Chair of Earth Systems Science, 2008 (1 of 2 inaugural chairs)

Science Innovation Award (N.J. Shackleton Medal), inaugural recipient, European Association for Geochemistry, 2008 (Citation & Response: GCA 73, S15-S17, 2009)

Fellow of the American Geophysical Union, 2008

**Fellow of the American Academy of Arts and Sciences, 2004** ([amacad.org](http://amacad.org))

Distinguished McKnight University Professor, 2001 to present

Claire C. Patterson Award, 1999 (The Environmental Geochemistry Medal of the Geochemical Society; Citation and Response: GCA 64, 755-761, 2000)

Taylor Distinguished Research Award, 1995 (for outstanding research, College of Science and Engineering)

Best Instructor Award, College of Science and Engineering Student Board, 1994 (outstanding teaching in Department of Earth Sciences)

McKnight Land-Grant Professorship, 1990-1993

"Salute", for role in development of high precision <sup>230</sup>Th dating, Quaternary Science Reviews 6, 181, 1987.

National Science Foundation Graduate Fellow, 1981-1984.

## Research Interests and Activities

Larry Edwards studies climate change using the principles of isotope geochemistry. He is known for his role in the development of modern uranium-thorium (or Th-230) dating methods and his application of these methods to the study of climate history and ocean chemistry. His approaches have improved the accuracy of radiocarbon dating, with the long-sought goal of a complete calibration of the radiocarbon timescale now in sight. The accuracy of the radiocarbon ages of many natural and cultural processes is ultimately based upon his work. Edwards' strategies are renowned for improving the precision and accuracy with which we can establish the timeline of climate history.

Edwards champions cave deposits as recorders of historic and pre-historic climate. Along with his collaborators, he has pieced together a remarkable record of the last 600,000 years of monsoon history, decade by decade. Using innovative strategies, he has related his cave monsoon history to climate records from ocean sediments and from ice cores, thereby establishing patterns of changing climate in time and space. These patterns further our understanding of "abrupt climate change" and "ice age terminations". Large abrupt shifts in climate, covering good portions of the globe, can and have taken place in less than a decade. Terminations, the rapid melting of ice sheets at the end of glacial cycles, are the most prominent examples of natural global warming in recent earth history. Edwards' work has and continues to help us understand the causes of both of these phenomena.

Edwards is also interested in the relationship between climate change and cultural history. He and his colleagues have drawn plausible links between global shifts in rainfall patterns and major cultural changes. For example, their cave records suggest that dry conditions contributed to the demise of the Tang, Yuan, and Ming Dynasties in China. Their records also suggest that ample rainfall in the early decades of the Northern Song Dynasty contributed to the large expansion of rice cultivation and population increase in this era when rice became a staple of the Chinese diet.

Edwards' and colleagues' cave records also show a close relationship between changes in the East Asian Monsoon and those in the climate of the North Atlantic region, a pattern that has remained remarkably consistent for hundreds of thousands of years. However, for the last half of the 20<sup>th</sup> Century, this relationship breaks down. This anomaly is one of the strongest pieces of evidence yet for human-induced climate change.

In carrying out this research program, Edwards has *collaborated with over 400 scientists from over 200 institutions worldwide*. At the University of Minnesota, he has secured *\$13.3 million in funding through 57 funded grant proposals*. Edwards is one of the most-cited earth scientists, *currently the second most cited earth scientist in the world*.

## Climate Research, Climate Policy, and Outreach Highlights

Edwards' studies of climate history provide a natural baseline from which to compare changes in climate over the last century and on into the future. Furthermore, his studies illustrate a range of possible climatic conditions on earth, and the rapidity with which the earth's climate can change. The most rapid, extreme, and geographically widespread examples of the latter are now termed "abrupt climate change", the study of which is one of the foci of Edwards' work. This research is pertinent to climate policy and of interest to policy-makers and the general public.

The public has had access to his research through reports in *Smithsonian Magazine*, *The Economist of London*, *New Scientist*, *Minnesota Public Radio*, *The Times of London*, and *BBC News*, among others. The BBC report, by Roger Harrabin, BBC's Environment analyst, was aired in the context of the United Nations – sponsored climate talks in Tianjin, China in 2010. Harrabin's piece highlighted the research by Edwards and colleagues, which suggests that the late 20<sup>th</sup> Century diminution of Chinese rainfall was caused by humans.

Because of the relationship of his work to climate policy, Edwards was asked and accepted an invitation to participate in the most recent (5<sup>th</sup>) climate assessment report of the Intergovernmental Panel on Climate Change (IPCC). *The IPCC was created by the United Nations and charged with providing "the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts"*. The IPCC shared the Nobel Prize with Al Gore. Its assessments are important in guiding climate policy worldwide.

For the past 6 years, Edwards has also served as a Board Member for the UNESCO International Research Center on Karst in Guilin, China. This is the first UNESCO-endorsed earth science research center in the world. Among other regions, the center performs research on furthering our *understanding of and preservation of the South China UNESCO World Heritage Site*, a vast region of southern China characterized by spectacular landscapes.

Beyond these United Nations – related activities, other highlights of Edwards' service nationally and internationally include:

Serving as an invited speaker at the "*Starving Tigers: Impact of Climate Change on South East Asia*" workshop. This workshop was sponsored by the Earth Observatory of Singapore, the Monitor Group, and the School of International Studies, Nanyang University in 2010.

Serving as an invited delegate and speaker at the Leverhulme Trust Climate Symposium: "*Earth's Climate, Past, Present, and Future*". This symposium took place at the University of Cambridge and the Royal Society, London in 2008.

Serving as an invited participant in the National Academy of Sciences – National Research Council Workshop on "*Understanding Climate's Influence on Human Evolution*". This workshop took place at the Beckman Center of the National Academies, Irvine, CA in 2008.

Presentation of the Arthur L. Day Lectures of 2013, “*Deciphering Climate History from Caves*”. Edwards presented a 3-lecture series at Oberlin College. The series was sponsored by the National Academy of Sciences in connection with Edwards’ receipt of the Arthur L. Day Prize and Lectureship of the National Academy of Sciences. The Day Prize is one of, if not *the* top Earth Sciences award bestowed by the Academy and is “***awarded to a scientist making lasting contributions to the study of the physics of the Earth***”.

Serving as one of 20 members of the “*Changelings*”. The Changelings are a membership group of scientists supported by the Gary Comer Science and Education Foundation, dedicated to exploring and advancing the broad field of abrupt climate change. The group has worked to share the insights on abrupt climate change with policymakers and the broader public. The group meets regularly at a Foundation retreat. Edwards has been a member for 6 years.

## Research - Publications

According to the Web of Science, ISI Web of Knowledge: Citations on publications last decade: 10,518, **2nd in world in Geosciences.**

According to Google Scholar: H-index: 70; Total Citations: 31,341; past 5 years: 18,806

Publications include: 33 publications in the journals Nature and Science and co-authorship on a chapter of the recently released report by the Intergovernmental Panel on Climate Change. This report summarizes our current knowledge of climate history and predictions of future climate change, with a key focus on the attendant uncertainties. This document is used by governments and policy-makers worldwide. The Intergovernmental Panel on Climate Change shared the Nobel Peace Prize with Al Gore in 2007.

### 1985 to 1989

1. Edwards, R.L. and Wasserburg, G.J. 1985. The age and emplacement of obducted oceanic crust in the Urals from Sm-Nd and Rb-Sr systematics. *Earth Planet. Sci. Lett.*, *72*, 389-404.
2. Chen, J.H., Edwards, R.L. and Wasserburg, G.J. 1986. U-238, U-234, and Th-232 in seawater. *Earth Planet. Sci. Lett.*, *80*, 241-251.
3. Edwards, R.L., Chen, J.H. and Wasserburg, G.J. 1987. U-238, U-234, Th-230, Th-232 systematics and the precise measurement of time over the past 500,000 years. *Earth Planet. Sci. Lett.*, *81*, 175-192.
4. Edwards, R.L., Chen, J.H., Ku, T.-L. and Wasserburg, G.J. 1987. Precise timing of the last interglacial period from mass spectrometric determination of Th-230 in corals. *Science*, *236*, 1547-1553.
5. Edwards, R.L., Taylor, F.W., Chen, J.H. and Wasserburg, G.J. 1987. High precision thorium-230 dating of corals using thermal ionization mass spectrometry: applications to paleoseismology. In Proceedings of Conference XXXIX, "Directions in Paleoseismology," Crone, A.J. and Omdahl, E.M., eds. U.S.G.S. Open File Report 87-673, 30-38.
6. Edwards, R.L. and Essene, E.J. 1988. Pressure, temperature, and C-O-H fluid fugacities across the amphibolite-granulite transition, NW Adirondacks, New York. *Jour. Petrology*, *29*, 39-72.
7. Edwards, R.L., Taylor, F.W. and Wasserburg, G.J. 1988. Dating earthquakes with high precision thorium-230 ages of very young corals. *Earth Planet. Sci. Lett.*, *90*, 371-381.

### 1990 to 1994

8. Taylor, F.W., Edwards, R.L., Frohlich, C. and Wasserburg, G.J. 1990 Seismic recurrence intervals and the timing of aseismic slip inferred from emerged corals, Vanuatu Frontal Arc. *Jour. Geophys. Res.*, *95*, B1, 393-408..
9. Chen, J.H., Edwards, R.L., and Wasserburg, G.J. 1992. Mass spectrometric measurements of uranium series nuclides and applications to geologic problems. Chapter in *Uranium Series Disequilibrium: Applications to Earth, Marine, and Environmental Sciences*, Harmon, R.S. and Ivanovich, M. eds., Oxford University Press, 2nd edition, 174-206.
10. Burr, G.S., Edwards, R.L., Donahue, D.J., Druffel, E.R.M., and Taylor, F.W. 1992. Mass spectrometric C-14 and U-Th measurements in coral. *Radiocarbon*, *34*, 611-618.
11. Beck, J.W., Edwards, R.L., Ito, E., Taylor, F.W., Recy, J., Rougerie, F., Joannot, P., and Henin, C. 1992. Sea surface temperature from coral skeletal Sr/Ca Ratios. *Science*, *257*, 644-647.
12. Edwards, R.L. 1993. Thorium-230 Geochronometry. *McGraw-Hill Yearbook of Science and Technology*, 95-97.
13. Edwards, R.L. and Gallup, C.D. 1993. Dating of the Devils Hole Calcite Vein (comment). *Science*, *259*, 1626-1627.
14. Baker, A., Smart, P.L., Edwards, R.L., and Richards, D.A. 1993. Annual growth banding in a cave stalagmite. *Nature*, *364*, 518-520.
15. Edwards, R.L., Beck, J.W., Burr, G.S., Donahue, D.J., Druffel, E.R.M., and Taylor, F.W. 1993. A large drop in atmospheric  $^{14}\text{C}/^{12}\text{C}$  and reduced melting during the Younger Dryas, documented with  $^{230}\text{Th}$  ages of corals. *Science*, *260*, 962-968.
16. Taylor, F.W., Quinn, T.M., Gallup, C.D., and Edwards, R.L. 1994. Quaternary plate convergence rates at the New Hebrides Island Arc from the chronostratigraphy of Bougainville Guyot (Site 831). *Proc. Ocean Drilling Program, Scientific Results 134*, 47-57.
17. Richards, D.A., Smart, P.L., and Edwards, R.L. 1994. Sea levels for the last glacial period constrained using  $^{230}\text{Th}$  ages of submerged speleothems. *Nature* *367*, 357-360.
18. Gallup, C.D., Edwards, R.L. and Johnson, R.G. 1994. The timing of high sea levels over the past 200,000 years. *Science* *263*, 796-800.

## 1995

19. Edwards, R.L. 1995. Paleotopography of glacial-age ice sheets (comment). *Science*, 267, 536.
20. Baker, A., Smart, P.L., Barnes, W.L., Edwards, R.L., and Farrant, A. 1995. The Hekla 3 Volcanic Eruption recorded in a Scottish Speleothem? *Holocene*, 5, no. 3, 336-342.
21. Baker, A., Smart, P.L., and Edwards, R.L., 1995. Palaeoclimate implications of mass spectrometric dating of a British flowstone. *Geology* 23, no.4, 309-312.
22. Min, G.R., Edwards, R.L., Taylor, F.W., Recy, J, Gallup, C.D., and Beck, J.W. 1995. Annual cycles of U/Ca in corals and U/Ca thermometry. *Geochem. Cosmochim. Acta.* 59, no. 10, 2025-2042.
23. Mann, P., Taylor, F.W., Edwards, R.L., and Ku, T.-L. 1995. Actively evolving microplate formation by oblique collision and sideways motion along strike-slip faults: An example from the northeastern Caribbean plate margin. *Tectonophysics* 246, 1-69.
24. Chen, J.K., Taylor, F.W., Edwards, R.L., Cheng, H., and Burr, G.S. 1995. Recent emerged reef terraces of the Yenkahe Resurgent Block, Tanna, Vanuatu: Implications for volcanic, landslide and tsunami hazards. *Jour. Geol.* 103, 577-590.
25. Asmerom, Y. and Edwards, R.L. 1995. Uranium-series evidence for the origin of continental basalts. *Earth Planet. Sci. Lett.* 134, 1-7.
26. Moran, S.B., Hoff, J.A., Edwards, R.L., Buessler, R.A., and Landing, W.M. 1995. TIMS measurements of Th-230 and Th-232 in the Norwegian Sea. *Geophys. Res. Lett.* 22, 2589-2592.
27. Paola, C., Alexander, E.C., Edwards, R.L., Hudleston, P.J., Ito, E., Karato, S.-I., Kelts, K.R., Kleinspehn, K.L., Moskowitz, B.M., Person, M., Seyfried, W.E., Sloan, R.E., Stout, J., Tikoff, B., and Teyssier, C. 1995. Geodynamics: The center of a new Earth Sciences curriculum, and the theme of a new undergraduate laboratory. *J. Geo. Edu.* 43, 485-491.

## 1996

28. Baker, A., Smart, P.L., and Edwards, R.L. 1996. Mass spectrometric dating of flowstones from Stump Cross Caverns and Lancaster Hole, Yorkshire: Palaeoclimate implications. *Jour. Quat. Sci.* 11, 107-114.
29. Galewski, J., Silver, E.A., Gallup, C.D., Edwards, R.L., and Potts, D.C. 1996. Foredeep tectonics and carbonate platform dynamics in the Huon Gulf, Papua New Guinea. *Geology* 24, 819-822.

30. Banner, J., Musgrove, M., Asmerom, Y., Edwards, R.L., and Hoff, J.A. 1996. Strontium isotope variations in speleothem calcite: a high-resolution record of Holocene groundwater evolution. *Geology* 24, 1049-1053.

### 1997

31. Beck, J.W., Récy J., Taylor F.W., Edwards R.L. and Cabioch G. 1997. Abrupt changes in early Holocene tropical sea surface temperature from coral records. *Nature* 385, 705 - 707.
32. Edwards, R.L., Cheng, H., Murrell, M.T., and Goldstein, S.J. 1997. Protactinium-231 dating of carbonates by thermal ionization mass spectroscopy: implications for the causes of Quaternary climate change. *Science* 276, 782-786.
33. Moran, S.B., Hoff, J.A., Edwards, R.L., and Landing, W.M. 1997. Distribution of Th-230 in the Laborador Sea and its relation to ventilation. *Earth Planet. Sci. Lett.* 150, 151-160.

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34. Edmonds, H.N., Moran, B.S., Hoff, J.A., Smith, J.N., and Edwards, R.L. 1998. Pa-231 and Th-230 abundances and high scavenging rates in the western Arctic Ocean. *Science* 280, 405-407.
35. Adkins, J.F., Cheng, H., Boyle, E.A., Druffel, E.R.M., and Edwards, R.L. 1998. Deep-sea coral evidence for rapid change in ventilation of the deep north Atlantic at 15.4 ka. *Science* 280, 725-728.
36. Cabioch, G., Taylor, F.W., Récy, J., Edwards, R.L., Gray, S.C., Faure, G., Burr, G. and Corrège, Th. 1998. Environmental and tectonic influences on growth and internal structure of a fringing reef at Tasmaloum (SW Espiritu Santo, New Hebrides island arc, SW Pacific). *Special Publications International Association of Sedimentologists* 25, 261-277.
37. Burr, G.S., Beck, J.W., Taylor, F.W., Recy, J., Edwards, R.L., Cabioch, G., Correge, T., Donahue, D., and O'Malley, J.M. 1998. A coral based radiocarbon calibration between 11.7 and 12.4 ky B.P. derived from Th-230 ages of corals from Espiritu Santo Island, Vanuatu. *Radiocarbon* 40, n.3 (INTCAL 98: Calibration Issue), 1093-1106.
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39. Cheng, H., Edwards, R.L., Murrell, M.T., and Goldstein, S. 1998. The systematics of uranium-thorium-protactinium dating. *Geochem. Cosmochim. Acta* 62, n.21, 3437-3452.
40. Dorale, J.A., Edwards, R.L., Gonzalez, L., and Ito, E. 1998. Climate and vegetation history of the midcontinent from 75 to 25 ka: a speleothem record from Crevice Cave, Missouri, USA. *Science* 282, 1871-1874.



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41. Zachariasen, J., Sieh, K., Taylor, F.W., Edwards, R.L., and Hantoro, W.S. 1999. Submergence and uplift associated with the giant 1833 Sumatran subduction earthquake: Evidence from coral microatolls. *Jour. Geophys. Res.* 104, n. B1, 895-919.
42. Hearty, P., Kindler, P., Cheng, H., and Edwards R.L. 1999. Evidence for a +20 m sea level in the mid-Pleistocene. *Geology* 27, 375-378.
43. Grant, L.B., Mueller, K.J., Gath, E.M., Cheng, H., Edwards, R.L., and Kennedy, G.L. 1999. An active blind thrust fault in Orange County, southern Los Angeles basin, California. *Geology* 27, 1031-1034.
44. Cabioch, G., Taylor, F.W., Corrège, T., Récy, J., Edwards, R.L., Burr, G.S., Le Cornec, F., and Banks, K. 1999. Occurrence and significance of microbialites in the uplifted Tasmaloum Reef (S.W. Espiritu Santo, S.W. Pacific). *Sedimentary Geology* 126, 305
45. Denniston, R.F., Gonzalez, L.A., Baker, R.G., Asmerom, Y., Reagan, M.K., Edwards, R.L., and Alexander, E.C. 1999. Speleothem evidence for a sharp and long-term prairie-forest ecotone at the northeast border of the Middle Holocene prairie peninsula. *Holocene* 9, 671-676.

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47. Asmerom, Y.A., Cheng, H., Thomas, R., Hirschmann, M., and Edwards, R.L. 2000. Melting of the earth's lithospheric mantle inferred from by protactinium-thorium-uranium isotopic data. *Nature* 406, 293-296.
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## 2001

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54. Beck, J.W., Richards, D.A., Edwards, R.L., Smart, P.L., Donahue, D.J., Hererra-Osterheld, S., Burr, G.S., Calsoyas, L., Jull, A.J.T., and Biddulph, D. 2001. Extremely large variations of atmospheric C-14 during the last glacial period. *Science* **292**, 2453-2458.
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## 2002

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62. Thomas, R.B., Hirschmann, M.M., Cheng, H., Reagan, M.K., and Edwards, R.L. 2002. ( $^{231}\text{Pa}/^{235}\text{U}$ )-( $^{230}\text{Th}/^{238}\text{U}$ ) of young mafic volcanic rocks from Nicaragua and Costa Rica and the influence of flux melting on U-series systematics of arc lavas. *Geochim. Cosmochim. Acta* 66, no.24, 4287-4309.
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### 2003

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68. Valero-Garces, B.L., Delgado-Huertas, A., Navas, A., Edwards, R.L., Schwalb, A., and Ratto, N. 2003. Patterns of regional hydrological variability in central-southern Altiplano ( $18^{\circ}$  –  $26^{\circ}\text{S}$ ) lakes during the last 500 years. *Palaeogeography, Palaeoclimatology, Palaeoecology* 3069, 1-20.
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157. Taylor, F.W., Frohlich, C., Mann, P., Burr, G.S., Beck, J.W., Edwards, R.L., and Phillips, D.A. 2003. Episodic Forearc Uplift Related to Subduction of the Woodlark Basin, Western Solomons Arc: Intermittent Aseismic Slip or Multi-Century Earthquake Recurrence Intervals? American Geophysical Union Fall Meeting, San Francisco.
158. Vacco, D., Clark, P., Mix, A., Cheng, H., and Edwards, R.L. 2003. A Speleothem Climate Record of the Last Deglaciation From Southwestern Oregon. American Geophysical Union Fall Meeting, San Francisco.
159. Cheng, H., Edwards, R.L., and Seltzer, G. 2003. Dating of lake sediments. Workshop for drilling in Qing Hai Lake. Oct. 20-24, Xian, China.
160. Lepley, S.W., Dorale, J.A., Edwards, R.L. 2004. A U-Th dated record of Holocene sedimentation in Crevice Cave, Missouri. GSA 38th Annual North-Central Meeting, St. Louis, April 1-2.
161. Taylor, F.W., Edwards, R.L., Cutler, K.B., Cheng, H., Burr, G.S., Beck, J.W., Cabioch, G., Recy, J., and Chappell, J. 2004. Results from a Land-Based Strategy for Drilling the Coral

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164. Wang, X.-F., Auler, A., Edwards, R.L. and Cheng, H. 2004. Pluvial events and the oxygen isotopic composition of precipitation over portions of the last 250,000 years in Brazil. Comer Foundation Meeting, April, IBM Center, NY.
165. Cheng, H., Edwards, R.L., Kelly, M., Dykoski, C. and Wang, X.-F. 2004. The oxygen isotopic composition of Asian Monsoon precipitation over the last 250,000 years. Comer Foundation Meeting, April, IBM Center, NY.
166. Li, H.-C., Ku, T.-L., You, C.-F., Cheng, H., and Edwards, R.L. 2004.  $^{87}\text{Sr}/^{86}\text{Sr}$  and Sr/Ca in speleothems for paleoclimate reconstruction. GSA National Meeting, Denver, Nov. 7-11.
167. Lepley, S.W., Dorale, J.A., and Edwards, R.L. 2004. A high-resolution record of Holocene El Nino cyclicity from Crevice Cave, Missouri. GSA National Meeting, Denver, Nov. 7-11.
168. Sieh, K., Natawidjaja, D.H., Chlieh, M., Galetzka, J., Avouac, J.-P., Suwargadi, B., Edwards, R.L., and Cheng, H. 2004. The giant subduction earthquakes of 1797 and 1833, West Sumatra: Characteristic couplets, uncharacteristic slip. American Geophysical Union Fall Meeting, San Francisco.
169. Dominguez Villar, D., Martin-Chivelet, J., Edwards, R.L. 2004. Microfacies analysis in an early Holocene speleothem from Kaite Kave, Northern Spain, and their paleoclimatological implications. Colloque international Han-2004. Les séries sédimentaires endokarstiques. Memories de l'environnement. Han-Sur-Lesse, November 28, 2004.
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171. Wang, X.F., Edwards, R.L., Auler, A.S., Cheng, H., and Ito, E. 2004. Atmospheric moisture seesaw: comparison of speleothem records between South Brazil and East China. AGU Fall Meeting San Francisco.
172. Kelly, M.J., Edwards, R.L., Cheng, H., Yuan, D.X., Cai, Y., Zhang, M.L., Lin, Y., and An, Z.S. 2004. High resolution characterization of the Asian Monsoon between 146,000 and 99,00 years B.P. from Dongge Cave, China and global correlation of events surrounding Termination II. AGU Fall Meeting, San Francisco.
173. Quinn, T., Taylor, F.W., Cheng, H., and Edwards, R.L. 2004. Select, High-Resolution Windows into Sub-Centennial-Scale Climate Variability in the Western Pacific Warm Pool between ~7 and 12 ka. AGU Fall Meeting San Francisco.
174. Sinha, A., Cannariato, K.G., Stott, L.D., Li, H.C., You C.F., Cheng, H., Edwards, R.L. 2004. Evidence for Decadal and Centennial Variability of Southwest Indian Monsoon Precipitation During the Bølling-Ållerød. AGU Fall Meeting San Francisco.
175. Riker-Coleman, K., Gallup, C.D., Silver, E., Cheng, H., and Edwards, R.L. 2004. Sea level and tectonic subsidence from submerged corals from the Huon Gulf, Papua New Guinea. AGU Fall Meeting San Francisco.
176. Natawidjaja, D.H., Sieh, K.S., Galetzka, J., Suwargadi, B.W., Edwards, R.L, and Cheng, H. 2004. Crustal vertical motions from paleogeodetic data of the Sumatran subduction zone, 1950 to 2003: Steady vs. episodic strain accumulation. AGU Fall Meeting San Francisco.
177. Valero-Garces, B., Saez, A., Pueyo, J.J., Taberner, C., Bao, R., Edwards, R.L., Schnurrenberger, D., Myrbo, A., Shapley, M., Herrera, C., and Schwalb, A. 2004. A Holocene record of hydrological fluctuations in the Chilean Altiplano (Lago Chungara). . AGU Fall Meeting San Francisco.
178. Shen, C.-C., Chiang, H.-W., Li, K.-S., Chen, Y.-G., Sieh, K., Wang, X-F., and Edwards, R.L. 2005. Application of coral geochemical tracers to understanding environmental changes. Annual Taiwanese Coral Reef Conference. Taipei, January.
179. Taylor, F.W., Quinn, T.M., Scott, R.S., Holland, C.L., Cheng, H., Edwards, R.L., and Burr, G.S. 2005. Paleoclimate of the Western Pacific Warm Pool: 75-year  $\delta^{18}\text{O}$  and Sr/Ca coral record from 13 ka for the northeast (Huon Peninsula) coast of Papua New Guinea. Chapman Conference: Tropical-Extratropical Climatic Teleconnections, A Long-Term Perspective, U. Hawaii, Honolulu, Feb. 8 – 11.
180. Laprida, C., Valero Garces, B., Ratto, N., Orgeira, M.J., Navas, A., Edwards, R.L., Ito, E., Huertas, A.D., and Moreno, A. 2005. The complex hydrological signature of the Little Ice Age from the Puna to the Pampa reconstructed from lake records. ICSU-IGCP-

- sponsored conference on Holocene Environmental Catastrophes in South America: from the Lowlands to the Andes. Laguna Mar Chiquita, Argentina, March 11-15.
181. de Geest, P., Verheyden, S., Cheng, H., Edwards, R.L., and Keppens, E. 2005. High-resolution speleothem records from Soqotra Island, Yemen: an approach to reconstruct Indian Ocean Monsoon Variability? EUG, Vienna.
  182. Dorale, J., Lepley, S., and Edwards, R.L. 2005. The ultimate flood recorder: flood-deposited sediments preserved in stalagmites. Keynote speech, EUG, Vienna.
  183. Kong, Xinggong, Wang, Yongjin, Edwards, R. Lawrence, Cheng, Hai, and Wang, Xianfeng, 2005. The altitude effect on the oxygen isotope composition of stalagmite. NC GSA, Minneapolis.
  184. Ray, Sushmita, Edwards, R. Lawrence, Alexander, E. Calvin Jr., and Dorale, Jeffrey A., 2005. A 1400-year history of extreme rainfall events from stalagmites from Spring Valley Caverns, Southeastern Minnesota. NC GSA, Minneapolis.
  185. Edwards, R.L. 2005. Keynote Address: Thorium-230 dating of late Quaternary cave calcite: Establishment of the timing of climate change and world-wide correlation. NC GSA, Minneapolis.
  186. Dykoski, C.A., Edwards, R.L., Cheng, H., Yuan, D.X., Cai, Y.J., Zhang, M.L., Lin, Y.S., Qing, J.M., An, Z.S. and Revenaugh, J. 2005. Abrupt Holocene changes in the Asian Monsoon recorded in stalagmite calcite from Dongge Cave, China. NC GSA, Minneapolis.
  187. Kelly, M.J., Edwards, R.L., Cheng, H., Wang, Y.J., and Yuan, D.X. 2005. Global correlation of events surrounding Termination II using U-Th dated stalagmite records from Hulu and Dongge Caves, China. NC GSA, Minneapolis.
  188. Wang, X.F., Auler, A.S., Edwards, R.L., Cheng, H., Ito, E., and Solheid, M. Mirror-image late Quaternary speleothem oxygen isotopic records from caves in Southern Brazil and Eastern China. NC GSA, Minneapolis.
  189. Lepley, S.W., Dorale, J.A., and Edwards, R.L. 2005. A high-resolution Holocene El Niño record from flood deposited sediments preserved in speleothems. NC GSA, Minneapolis.
  190. Knight, C., Dorale, J.A., Baker, R.G., Gonzalez, L., and Edwards, R.L. 2005. A continuation of the Coldwater Cave speleothem record back to 11,000 years BP. NC GSA, Minneapolis.
  191. Cohen, A.S., Balch, D.P., Helfrich, L.C., Schnurrenberger, D.W., Haskell, B.J., Valero Garces, B.L., Beck, J.W., Cheng, H., Edwards, R.L., and Dettman, D.L. 2005. A 280 ka paleoecologic and paleoclimatic record for the Bonneville Basin derived from the

- GLAD800 drilling campaign at Great Salt Lake. GSA Annual Meeting, October 16-19, Salt Lake City.
192. Williams, A., Rowe, H., Springer, G., Cheng, H., and Edwards, R.L. 2005. Interpreting trace-metal and stable isotopic results from a Holocene stalagmite from Buckeye Creek Cave, West Virginia. GSA Annual Meeting, October 16-19, Salt Lake City.
  193. Sinha, A., Cannariato, G., Stott, L.D., Cheng, H., Yadava, M.G., Edwards, R.L., Ramesh, R., Li, H.-C., and Singh, I-B. 2005. Possible Solar Forcing of Late Holocene Mega-Droughts in India. Third Solar Radiation and Climate Experiment Meeting, Durango, Sept. 14-16.
  194. Shen, C.-C., Cheng, H., Edwards, R.L. 2005. Isotopic measurements of natural uranium and thorium by high-resolution ICP-MS with desolvating nebulizer systems. 2nd Omaha Workshop & Sixth International Conference on Magnetic Sector Field ICP-MS. Aug. 15-18, Omaha.
  195. Wang, X.F., Cheng, H., Edwards, R.L. 2005. Applications of U-Th dating to paleoclimate studies. 2nd Omaha Workshop & Sixth International Conference on Magnetic Sector Field ICP-MS. Aug. 15-18, Omaha.
  196. Dasgupta, S., Edwards, R.L., Alexander, C.A., Cheng, H., and Dorale, J.A. 2005. A high resolution absolute-dated oxygen isotope record of the past 7000 years from Spring Valley Caverns, Southeastern MN, USA. Fall AGU meeting, San Francisco, Dec. 5-9.
  197. Dykoski, C.A., Edwards, R.L., Cheng, H., Yuan, D.X., and Wang, Y.J. 2005. Characterization of the Asian Monsoon during Marine Isotope Stages 8 and 9 from stalagmite calcite collected from Dongge Cave, China, AGU meeting, San Francisco, Dec. 5-9.
  198. Riker-Coleman, K., Gallup, C.D., Clague, D., Webster, J., Edwards, R.L., and Cheng, H. 2005. New Th-230 ages from the -400 m reef of northwestern Hawaii. AGU meeting, San Francisco, Dec. 5-9.
  199. Wang, X.F., Auler, A.S., Edwards, R.L., Cheng, H., Ito, E., and Solheid, M. 2005. Interhemispheric anti-phased climate changes during the last deglaciation. AGU meeting, San Francisco, Dec. 5-9.
  200. Cobb, K.M., Charles, C.D., Cheng, H., and Edwards, R.L. 2005. Fossil coral snapshots of ENSO and tropical Pacific climate over the late Holocene. AGU meeting, San Francisco, Dec. 5-9.
  201. Ruscitto, D., Hirschmann, M.M., Edwards, R.L., Walker, J.A., Cheng, H., Cameron, B.I., and Roggensack, K. 2005. Uranium-thorium isotopic analyses of basalts from behind the volcanic front, southeastern Guatemala. AGU meeting, San Francisco, Dec. 5-9.

202. Shen, C.C., Li, K.S., Sieh, K.S., Natawidjaja, D., Wang, X.F., Cheng, H., and Edwards, R.L. 2005. Limits and application of high precision coral Th-230 dating techniques. AGU meeting, San Francisco, Dec. 5-9.
203. Freiberger, N.C., Gallup, C.D., Taylor, F.W., Edwards, R.L., and Cheng, H. 2005. New dates and revelations on the last interglacial terrace, Barbados, West Indies. AGU meeting, San Francisco, Dec. 5-9.
204. Kelly, M.J., Edwards, R.L., Cheng, H., Yuan, D.X., and Wang, Y.J. 2005. Global and regional climate correlations during Marine Isotope Stage 7 and Termination III using a stalagmite oxygen isotopic record from Dongge Cave, China. AGU meeting, San Francisco, Dec. 5-9.
205. Ludwig, K.A., Kelley, D.S., Shen, C.C., Cheng, H., and Edwards, R.L. 2005. U/Th geochronology of carbonate chimneys at the Lost City hydrothermal field. AGU meeting, San Francisco, Dec. 5-9.
206. Edwards, R.L. 2005. Worldwide correlation of events near Termination II, starting with Asian Monsoon speleothem records. The 2nd Abrupt Climate Change Roundtable. October 19-22, Palisades, NY.
207. Cheng, H., Wang, X.F., Kelly, M.J., Dykoski, C.A., Dorale, J.A., and Edwards, R.L. 2005. Speleothem records of the Asian Monsoon and sub-tropical Brazil covering portions of the last 3 glacial cycles: evidence of low-latitude interhemispheric anti-phasing of precipitation. The 2nd Abrupt Climate Change Roundtable. October 19-22, Palisades, NY.
208. Dasgupta, S., Dykoski, C., Cheng, H., and Edwards, R.L. 2005. Climate reconstruction from speleothem calcite during the Holocene and deglacial period: case studies from East Asia and the North American mid-continent. The 2nd Abrupt Climate Change Roundtable. October 19-22, Palisades, NY.
209. Qin, J.M., Yuan, D.X., Lin, Y.S., Zhang, M.L., Zhang, C., Zhang, H.L., Wang, H., Feng, Y.M., Tu, L.L., Yang, Y., Cheng, H., Edwards, R.L., Ran, J.C., and Chen, H.M. 2005. A high resolution paleoclimate record of the last 1,200 years from stalagmites of the Longquan Cave, Guizhou, China. Past Global Changes (PAGES) Second Open Science Meeting, August 10-12, Beijing, China.
210. Edwards, R.L. 2005. Cave calcite oxygen isotope records and the absolute timing of late Quaternary climate change. Invited lecture, Symposium on New Directions in Isotope Geochemistry, Mainz, Germany, November 6 – 8.
211. Cheng, H., Fleitmann, D., Edwards, R.L., Wang, X.F., Dykoski, C.A., Auler, A.S., Mangini, A., Wang, Y.J., Kong, X.G., Burns, S.J., Matter, A. 2006. Timing of the 8.2 ka cooling event inferred from oxygen isotope records of three stalagmites from Brazil, China, and Oman. Geophysical Research Abstracts, EGU General Assembly, v.8, 03128.

212. Wang, Y., Kong, J., Wu, J., Cheng, H., Edwards, R.L. 2006. Precessional cycles and millennial-scale climate variability of the East Asian Monsoon over the past 225,000 years. *Geophysical Research Abstracts*, EGU General Assembly, v.8, 00272.
213. Hall, R., Zahn, R., Moran, S.B., Peck, V.L., Knutz, P.C., Shen, C.C., and Edwards, R.L. 2006. High-resolution records of progressive AMOC reduction from the NE Atlantic prior to H1: response to NW European ice sheet instabilities? *Geophysical Research Abstracts*, EGU General Assembly, v.8, 05785.
214. Ersek, V., Cheng, H., Edwards, R.L., Clark, P.U., and Mix, A.C. 2006. Episodic speleothem growth at Oregon Caves National Monument and paleoclimatic implications. *Geophysical Research Abstracts*, EGU General Assembly, v.8, 05297.
215. Moreno, A., Valero Garces, B.L., Navas, A., Mata, P., Machin, J., Delgado Huertas, A., Gonzalez Samperiz, P., Schwab, A., Morellon, M., Cheng, H., and Edwards, R.L. 2006. The Laguna Taravilla record as a paleoflood indicator in the Central Iberian Range (Spain) during the last 2000 years: interactions of climate and human activities in the watershed. 10th International Paleolimnology Symposium, June 25-29, Duluth, MN.
216. Clementz, M.T., Fox, D.L., and Edwards, R.L. 2006. Stable Isotope Evidence for the Evolution of Different Feeding Strategies within the Neoceti. Society of Vertebrate Paleontology, Fall meeting.
217. Edwards, R.L., Yuan, D.X., An, Z.S., Wang, Y.J., Auler, A., Cheng, H., Rowe, H., Wang, X.F., Kelly, M.J., and Dykoski, C.A. 2006. Timing and nature of late Quaternary climate change from cave deposits. Invited Keynote Lecture. Goldschmidt Conference, Melbourne, Australia, August.
218. Wang, X.F., Auler, A.S., Edwards, R.L., and Cheng, H. 2006. High-latitude forcing of interhemispheric anti-phased precipitation during the last glacial-interglacial cycle. Goldschmidt Conference, Melbourne, Australia, August.
219. Dykoski, C.A., Edwards, R.L., Cheng, H., Yuan, D.X., Wang, Y.J., and Rowe, H. 2006. Marine Isotope Stage 8 millennial-scale variability as observed in the Asian monsoon. Goldschmidt Conference, Melbourne, Australia, August.
220. de Geest, P., Keppens, E., Verheyden, S., Cheng, H., and Edwards, R.L. 2006. High-resolution Holocene speleothem records from Soqotra Island, Yemen as a tool for Indian Ocean climate reconstruction. *Climate Change and the Karst Record*, Romania, May 26-30.
221. Southon, J., Edwards, R.L., Cheng, H., Smith, E., Hardt, B. 2006. Radiocarbon results from Hulu Cave Speleothems. Second Carlsberg Dating Conference, Copenhagen, Nov. 15 – 17. Invited Paper.
222. Edwards, R.L. 2006. Thorium-230 Dating of Carbonates: Implications for Radiocarbon Calibration and the Establishment of an Absolute Timescale for the last 60,000 Years. Second Carlsberg Dating Conference, Copenhagen, Nov. 15 – 17. Invited Paper.

223. Dasgupta, S., Edwards, R.L., Shen, C.C., and Alexander, C.A. 2006. Determination of Initial  $^{230}\text{Th}/^{232}\text{Th}$  Ratios in a Speleothem from Spring Valley Caverns, Minnesota, Using Fluorescent Annual Banding. AGU Fall Meeting, San Francisco.
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407. Richards DA, Nita DC, Moseley GE, Hoffmann DL, Standish CD, Smart PL, Edwards R (2013), Correcting for initial Th in speleothems to obtain the age of calcite nucleation after a growth hiatus, Abstract PP13B-1881 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.

408. Edwards R, Cheng H (2013), Invited: Millennial-Scale Variability in the Asian Monsoon from Chinese Cave Records, Abstract PP12A-05 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
409. Voarintsoa NG, Railsback LB, Liang F, Brook GA, Cheng H, Edwards R (2013), Evidence of past climate change in the Little Ice Age and of the Pacific Decadal Oscillation periodicity in Africa: comparison between two neighbor stalagmites from Namibia and Botswana (preliminary results), Abstract PP31B-1864 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
410. Krause CE, Gagan MK, Dunbar G, Hellstrom J, Phipps SJ, Cheng H, Edwards R, Hantoro WS, Abram NJ, Rifai H (2013), Interaction Between Orbital and Millennial Forcing of the Australasian Monsoon Over the Last 40,000 Years, Abstract PP31E-03 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
411. Cross M, McGee D, Broecker WS, Quade J, Cheng H, Edwards R (2013), Development of a high-resolution record of Great Basin climate change during MIS 5, 6, and 7, Abstract PP33A-1906 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
412. Scroxton NG, Gagan MK, Ayliffe LK, Hellstrom J, Cheng H, Edwards R, Zhao J, Hantoro WS, Rifai H, Scott-Gagan H, Cowley JA, Suwargadi BW (2013), Speleothem carbon isotopes in the tropics: a proxy for vegetation and what they reveal about the demise of *Homo floresiensis*, Abstract PP33C-1935 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
413. Cai Y, Fung IY, Edwards R, An Z, Cheng H, Lee J (2013), Variability of Indian summer monsoon over the past 252 kyr revealed by stalagmite record in Southwest China, Abstract PP43C-06 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
414. Edwards R, Cheng H (2013), Invited: Thorium-230 Dating: Technical Capabilities and Cave Climate Records, Abstract PP13B-1885 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
415. Vara MA, Quinn TM, Taylor FW, Partin JW, Gorman MK, Maupin CR, Edwards R, Cheng H, Inoue M, Nokedau D (2013), Investigating ENSO Variability in the mid-Holocene using a Fossil Coral from the South Pacific, Abstract PP31A-1842 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
416. Van Rempelbergh M, Verheyden S, Cheng H, Edwards R, Keppens E, Claeys PF (2013), Sub-seasonally resolved  $\delta^{18}\text{O}$ ,  $\delta^{13}\text{C}$ , Mg, Sr, Ba, U, and Zn records from a Belgian speleothem covering the last 700 years, Abstract PP31A-1856 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
417. Ray CJ, Gao Y, Schwartz BF, Suarez MG, Rowe H, Cheng H, Edwards R (2013), Stable isotopes of a speleothem from Helictite Cave, Virginia, Abstract PP33A-1909 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.



418. Wang X, Auler A, Edwards R, Cheng H, Dorale JA (2013), A tale of two cave records from the Amazon lowlands, Abstract PP33C-1944 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
419. Retrum JB, Gonzalez LA, Edwards R, Cheng H, Tincher SM, Urbani F (2013), A High-Resolution Stalagmite Holocene Paleoclimate Record from Northern Venezuela with Insights into the Timing and Duration of the 8.2 ka Event, Abstract PP33C-1948 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
420. Kanner LC, Burns SJ, Cheng H, Edwards R (2013), Invited: South American Summer Monsoon variability over the Late Pleistocene: a proxy perspective, Abstract PP43C-08 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
421. Hardt BF, Doctor DH, Gao Y, Rowe HD, Cheng H, Edwards R (2013). Millennial-scale features in  $\delta^{18}\text{O}$  from a stalagmite in the eastern United States, Abstract PP44A-07 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
422. Steponaitis E, McGee D, Quade J, Andrews A, Edwards R, Hsieh Y, Broecker WS, Cheng H (2013), High-resolution records of Bonneville Basin paleohydrology offer new insights into changing atmospheric circulation patterns over North America from 26 ka through the Holocene, Abstract PP44A-08 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
423. Apaéstegui JE, Cruz FW, Sifeddine A, Guyot JL, Santos R, Cheng H, Espinoza J, Edwards R, Strikis NM (2013), Holocene hydroclimate reconstruction from the northwestern Amazon basin based on high resolution isotope analysis of speleothems from Cascayunga cave, Peru, Abstract PP53E-06 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
424. Sha L, Cheng H, Cai Y, Edwards R, Yin J, Sifeddine A, Cruz FW, Bouchaou L, Beraaouz E, Apaéstegui JE (2013), The Holocene climate variability in Southwestern Morocco and its link to the North Atlantic Oscillation, Abstract PP33C-1941 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
425. Orland IJ, Cheng H, Edwards R, Kozdon R, Cross M, Valley JW (2013), Resolving seasonal variability of the Asian Monsoon at the end of the Younger Dryas from a Chinese speleothem, Abstract PP43C-03 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
426. Li Z, Lu Y, Sinha A, Ma Z, Tan M, Edwards R, Cheng H (2013), The Last Interglacial Climate Variability in Northern China, Abstract PP51C-1975 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 15-19 December.
427. Wendt, K, Wang XF, Edwards RL, Cheng H, Auler A (2013), Heinrich Stadial Event 4 recorded in Brazilian stalagmites, Abstract 258-4 presented at 2013 Annual Meeting, GSA, Denver, CO, 27-30 October.

428. Grothe PR, Cobb KM, Bush SL, dos Santos G, Southon J, Cheng H, Edwards RL (2013), A comparison of rapid-screening  $^{14}\text{C}$  dates and U-Th dates from fossil corals: implications for paleoclimate reconstruction, Abstract 303-9 presented at 2013 Annual Meeting, GSA, Denver, CO, 27-30 October.
429. McGee D, Steponaitis E, Quade J, Andrews AL, Edwards RL, Hsieh Y-T, Broecker WS, Cheng H (2013), New insights into Bonneville Basin hydrology over the last 25 ka from U/Th-dated cave and lake carbonates, Abstract 308-3 presented at 2013 Annual Meeting, GSA, Denver, CO, 27-30 October.
430. Rhodes, R., Brook, E., Chiang, J., Blunier, T., Cheng, H., Edwards, R.L., Maselli, O., McConnell, J., Romanini, D., Severinghaus, J., Sowers, T., and Stowasser, C. 2014. Continuous methane record of abrupt climate change 10-68 ka: sighting Heinrich events in the ice core record. EGU 2014-7984, Vienna, April.
431. Moreau, M., Correge, T., Cole, J., le Cornec, R., Edwards, R.L., Cheng, H., and Charlier, K. 2014. Comparison of last centuries variability in the eastern and central Pacific reconstructed from massive coral geochemical tracers. EGU2014-823, Vienna, April.
432. Krause, C.E., Gagan, M.K., Hopcroft, P., Dunbar, G.B., Hellstrom, J.C., Cheng, H., Edwards, R.L., Hantoro, W.S., Valdes, P.J., Beerling, D.J., and Rifai, H. 2014. New insights on tropical vegetation productivity and atmospheric methane over the last 40,000 years from speleothems in Sulawesi, Indonesia. KR7 Conference, Melbourne, September-October.
433. McGee D, Steponaitis E, Andrews A, Quade J, Edwards L, Broecker W & Cheng H (2014) Merging Lake and Cave Archives of Past Climate Change in the U.S. Great Basin *Goldschmidt Abstracts* **2014** 1646
434. Stoll H, Moreno A, Cacho I, Mendez-Vicente A, Cheng H & Edwards RL (2014) Interpreting Climatic Signals from Stalagmite Trace Element and Isotopic Records Using Simple Geochemical Models and Growth Rate Constraints *Goldschmidt Abstracts* **2014** 2392
435. Huang K-F, Robinson LF, Auro ME, Anderson RF, Hayes CT, Fleisher MQ, Edwards RL, Cheng H, Lu Y & Moran SB (2014) Seawater Th Isotopes in the U. S. North Atlantic GEOTRACES Transect: Sources, Sinks and Cycling *Goldschmidt Abstracts*, **2014** 1056
436. Bernal JP, Strikis N, Cruz FW, Catunda MC, Ortega C, Cheng H, Edwards RL & Auler A (2014) The Internal Structure of Millennial-Scale Abrupt Climate Change Events; Insights from LAICPMS Sr/Ca and Mg/Ca Records *Goldschmidt Abstracts* **2014** 186
437. Hardt BF, Doctor DH, Gao Y, Min A, Cheng H, & Edwards RL (2014) Evidence for the Younger Dryas and Dansgaard-Oeschger Events from Stalagmites in the Mid-Atlantic Region of the Eastern United States *Geological Society of America Abstracts with Programs* **46** (6) 697

438. Gao Y, Rowe H, Buckles J, Cheng H, and Edwards, RL (2014) Late Pleistocene to early Holocene climate variability from a high-resolution speleothem record in the southeastern Appalachian region *Geological Society of America Abstracts with Programs* **46**, (6) 699
439. Voarintsoa NG, Railsback LB, Liang F, Brook G, Cheng H, & Edwards, RL (2014) Control of solar radiation over climate variability in Southern Africa: Isotopic and petrographic evidence from Namibia and Botswana stalagmites *Geological Society of America Abstracts with Programs* **46** (6) 126
440. Orland I, Edwards RL, Cheng H, Kozdon R, & Valley J (2014) Seasonal-Resolution  $\delta^{18}\text{O}$  in Speleothems by Ion Microprobe: Revealing Asian Monsoon Dynamics *American Geophysical Union 2014 Fall Meeting* PP31B-1132 13766
441. Cross M, McGee D, Broecker W, Quade J, Cheng H, & Edwards RL (2014) Stable Isotope and Trace Element Records of Parts of MIS 5 and MIS 6 from Stalagmites from Lehman Cave, Nevada, USA, *American Geophysical Union 2014 Fall Meeting* PP31B-1139 31053
442. Buckles J, Gao Y, Wang X, Rowe H, Cheng H, & Edwards RL (2014) Climate Change during Marine Isotope Stages 10 & 11 based on High-Resolution Speleothem Records from Eastern North America *American Geophysical Union 2014 Fall Meeting* PP31B-1140 25108
443. Nick S, Gagan M, Dunbar G, Ayliffe L, Hantoro W, Chen C-C, Hellstrom J, Zhao J-X, Cheng H, Edwards RL, Sun H, & Rifai H (2014) Stalagmite Survival: 500kyr of Cyclical Growth and Natural Attrition of Stalagmites in Sulawesi *American Geophysical Union 2014 Fall Meeting* PP31B-1141 27560
444. Kathayat G, Cheng H, Sinha A, Spoetl C, Edwards RL, Liu W, Zhang H, Cai Y, & Breitenbach S (2014) The Indian Monsoon Variability over the Past 280,000 Years *American Geophysical Union 2014 Fall Meeting* PP43A-1442 11280
445. Sinclair D, Sherrel R, Rowe H, Wright J, Mortlock R, Hellstrom J, Cheng H, Min A, Edwards RL (2014) A speleothem record of South Pacific Convergence Zone dynamics during MIS 3 - Evidence for non-stationary coupling between the southern tropical Pacific and Greenland? *American Geophysical Union 2014 Fall Meeting* PP43A-1441 11140
446. Wendt K, Hauselmann A, Fleitmann D, Wang X, Auler A, Cheng H, & Edwards RL (2014) Pluvial Period over NE Brazil linked to Heinrich Stadial 4 *American Geophysical Union 2014 Fall Meeting* PP43A-1451 23052
447. Gao Y, Rowe H, Rao Z, Buckles J, Wang X, Cheng H, & Edwards RL (2014) Millennial-scale Climate Variability During the Last Interglacial Recorded in Two Speleothems from Eastern North America *American Geophysical Union 2014 Fall Meeting* PP43A-1457 30047

448. Bourne M, Feinberg J, Strauss B, Hardt B, Rowe H, Cheng H, & Edwards RL (2014) Changes in Seasonal Precipitation Recorded by Speleothem Rock Magnetism *American Geophysical Union 2014 Fall Meeting* GP11B-01 12948
449. Anderson R, Fleisher M, Pavia F, Vivancos S, Lu Y, Cheng H, & Edwards RL (2014) Scavenging of Thorium and Protactinium by Particles from the East Pacific Rise Hydrothermal Plume *American Geophysical Union 2014 Fall Meeting* OS22B-04 12929
450. Springer G, Rowe H, Hardt B, Cheng H, & Edwards RL (2014) A High-Resolution Stalagmite Record of East-Central North America Hydroclimates during Marine Isotope Stages 3-5 *American Geophysical Union 2014 Fall Meeting* PP21F-04 6183
451. Grothe P, Cobb K, Bush S, Cheng H, Santos G, Southon J, & Edwards RL (2014) A Comparison of Rapid-Screen  $^{14}\text{C}$  Dates and U/Th Dates from Fossil Corals: Implications for Paleoclimate Reconstruction *American Geophysical Union 2014 Fall Meeting* PP41D-1428 30646
452. Brendryen J, Edwards RL, Haflidason H, Cheng H, Grasmø K, & Sejrup H (2014) A Detailed Radiometric Chronological Framework for Nordic Seas Ocean–Ice Sheet Interactions Spanning 50-150 Ka BP *American Geophysical Union 2014 Fall Meeting* PP41D-1433 8298
453. Moreau M, Corregge T, Piga E, Edwards RL, & Cheng H (2014) Eastern Pacific Climate Variability Reconstructed from Porites Coral Geochemical Tracers over the Last Millennium *American Geophysical Union 2014 Fall Meeting* PP43B-1470 10136
454. Fleisher M, Hayes C, Anderson R, Lam P, Ohnemus D, Huang K-F, Robinson L, Lu Y, Cheng H, Edwards RL, & Moran S (2014) Proxy Applications of Pa/Th Investigated with Scavenging Chemistry in the North Atlantic *American Geophysical Union 2014 Fall Meeting* PP53C-1238 13027
455. Krause, C.E., Gagan, M.K., Hopcroft, P., Dunbar, G.B., Hellstrom, J.C., Cheng, H., Edwards, R.L., Hantoro, W.S., Valdes, P.J., Beerling, D.J., and Rifai, H. 2015. New insights on tropical vegetation productivity and atmospheric methane over the last 40,000 years from speleothems in Sulawesi, Indonesia. EGU presentation.
456. Vansteenberg, S., Verheyden, S., Cheng, H., Edwards, R.L., Keppens, E. and Claeys, P. 2015. Belgian speleothems from the Last Interglacial: insights in the onset of glacial conditions in north western Europe. EGU 2015-8911, Vienna, April.
457. Ma, Z.B., Cheng, H., Duan, W.H., Tan, M., Wang, L.S., and Edwards, R.L. 2015. Timing and climatic imprint of the 8.2 ka BP event from Kulishu Cave in northern China. EGU 2015-12520, Vienna, April.
458. Grant, K.M., Rohling, E.J., Ramsey, C.B., Cheng, H., Edwards, R.L., Florindo, F., Heslop, D., Marra, R., Roberts, A.P., Tamisiea, M.E., and Williams, F. 2015. A new chronology and probabilistic assessment of sea-level variability over five glacial cycles. EGU 2015-1979, Vienna, April.

459. Stoll, H., Moreno, A., Cacho, I., Vicence, A.M., Lemos, S.G., Casasayas, G.P., Cheng, H., Wang, X.F., and Edwards, R.L. 2015. Correcting speleothem oxygen isotopic variations for growth-rate controlled kinetic fractionation effects. EGU 2015-6709, Vienna, April.
460. Gokturk, O.M., Fleitmann, D., Badrtscher, S., Cheng, H., and Edwards, R.L. 2015. Late Holocene Winter Temperatures in the Eastern Mediterranean and Their Relation to Cultural Changes: The Kocain Cave Record. EGU 2015-794, Vienna, April.
461. Krause, C.E., Gagan, M.K., Hopcroft, P., Dunbar, G.B., Hellstrom, J.C., Cheng, H., Edwards, R.L., Hantoro, W.S., Valdes, P.J., Beerling, D.J., and Rifai, H. 2015. New insights on tropical vegetation productivity and atmospheric methane over the last 40,000 years from speleothems in Sulawesi, Indonesia. To be presented at the INQUA Congress, Nagoya, July-August.

## Research – External Funding

Note: Much of the funding below has driven a very active research program for more than 25 years and contributed to the building of perhaps the world's top research laboratory of the sort. However, Edwards also was a steering committee member on two NSF Training Grants headed by former Regents Professor and now fellow National Academy member, Margaret Davis. This \$2.5 million of funding supported students across four U. Minnesota colleges (CBS, CSE, CLA, and CFANS), for more than a decade.

Total: **\$13.3 million** in 57 grants procured over 26 years.

Duration	Project Title	Granting Agency	Amount
3/89 - 8/91	Acquisition of a solid source mass spectrometer with a 30 cm energy filter	NSF-EAR	\$209,000
2/90 - 1/93	Detailed sea level and initial <sup>14</sup> C records from high precision <sup>230</sup> Th ages of Huon Peninsula Corals, Papua New Guinea	NSF-EAR	\$70,000
8/89 - 7/92	Collaborative research: Paleoseismic histories of southwest Pacific plate boundaries from precise mass spectrometric <sup>230</sup> Th dating of uplifted corals	NSF-EAR	\$50,000
3/90 - 2/93	The application of thermal ionization mass spectroscopy to the study of thorium scavenging in the oceans	NSF-OCE	\$85,000
9/90 - 8/95	Paleorecords of Global Change ( M. Davis, P.I.; Edwards one of eight steering committee members)	NSF-BIR	\$1,519,802
7/90 - 6/93	McKnight Land-Grant Professorship	McKnight Found., U of M	\$49,500
5/91- 5/93	Collaborative Research: Detailed records of initial C-14 and sea level during deglaciation by drilling into a rapidly uplifting reef on Vanuatu	NSF-ATM	\$171,000
3/91- 3/92	Acquisition of an inductively coupled plasma spectrometer (Seyfried, W.E., P.I., Edwards and Engstrom, D.R., co-P.I.s)	NSF-EAR	\$110,000
3/1/91- 3/1/92	Investigation of possible interglacial double high sea stand (Edwards, P.I., Johnson, R.G., co-P.I.)	Nat. Geographic Society	\$7,887

10/92 - 7/97	The Application of in-situ CFF and TIMS to the study of ocean particle dynamics	NSF-OCE	\$279,441
10/92- 10/93	Quaternary sea levels from Barbados coral terraces	Nat. Geographic Society	\$9,153
6/94 - 6/98	The marine $^{234}\text{U}/^{238}\text{U}$ record and the timing of the marine $^{18}\text{O}/^{16}\text{O}$ record (Edwards, P.I., Ito, E., co-P.I.)	NSF-OCE	\$437,129
9/94- 8/96	Collaborative research on the Sumatran Subduction Zone and the Great Sumatran Fault	NSF-EAR	\$85,952
8/94- 8/96	TIMS Pa-231 dating: testing high resolution records of global climate change	ACS-PRF	\$50,000
9/96- 8/97	Collaborative research on the Sumatran Subduction Zone and the Great Sumatran Fault	NSF-EAR	\$16,872
9/94 - 9/98	Request for technical support for the Minnesota Isotope Laboratory (Edwards, P.I., Ito, E., co-P.I.)	NSF-EAR	\$120,000
9/95- 9/01	Paleorecords of Global Change (RTG renewal, M. Davis, P.I.: Edwards one of eight steering committee members)	NSF-BIR	\$966,482
9/95- 9/99	Acquisition of mass spectrometers for retrieval of high-resolution records of global climate change (Edwards - P.I., E. Ito - co-P.I.)	NSF-ARI	\$500,000
9/95- 9/99	Collaborative Research: The temperature history of the Western Pacific Warm Pool over the past 30 ka	NSF-ESH	\$305,000
9/97 - 9/99	Request for technical support for the Minnesota Isotope Laboratory (renewal; Edwards, P.I., Ito, E., co-P.I.)	NSF-EAR	\$100,000
4/98- 3/01	Th-230 and Pa-231: Tracers of particle flux and ventilation in the Atlantic	NSF-OCE	\$181,580
1/99- 1/03	Combined $^{230}\text{Th}$ and $^{231}\text{Pa}$ Dating: Establishing the Absolute Timing of Late Quaternary Climate Change and Calibrating the $^{14}\text{C}$ Timescale	NSF-ESH	\$253,000

1/99- 1/03	Melting and mass transfer in the Central American arc from Pa-231, Th-230, and Ra-226 systematics (Hirschmann, P.I., Edwards, co-P.I.)	NSF-EAR	\$153,000
8/99- 7/02	Paleoseismology and Paleogeodesy of the Sumatran Subduction Zone	NSF-EAR	\$64,933
12/00- 11/03	Constraining Water Mass Age and Particle Flux in the Arctic Ocean Using Pa-231 and Th-230 as Tracers	NSF-OPP	\$58,290
9/01- 9/04	Acquisition of a Multi-collector Inductively Coupled Plasma mass Spectrometer for Research and Training in the Earth and Environmental Sciences (Edwards, p.i., Gallup and Hirschmann, co-P.I.'s)	NSF-MRI	\$500,000
7/01- 6/06	Distinguished McKnight University Professor Award	University of Minnesota	\$100,000
7/02- 7/05	Paleoseismology and Paleogeodesy of the Sumatran Subduction Zone	NSF-EAR	\$127,108
10/02- 10/05	The ocean-atmosphere carbon cycle and climate change: constraints from radiocarbon and climate history	NSF-Integrated carbon cycle program	\$100,000
8/02- 9/05	A high-resolution absolute-dated history of the Asian Monsoon over two glacial-interglacial cycles: Links between tropical and high northern latitude climate. (Edwards p.i., H.Cheng co-p.i.)	NSF-ESH	\$299,355
8/03- 8/06	Rates, timing, and causes of abrupt changes in the Asian Monsoon and their relationships to abrupt climate change in other regions.	Comer Science & Education Grant – CC8	\$320,000
4/04- 3/06	A high-resolution record of climate and vegetation from Amazonian Caves	National Geographic Society	\$19,930



5/04- 5/07	Collaborative Research: A high resolution speleothem record of Holocene, Last Glacial, and Last Interglacial climate and vegetation from the North American Mid-continent	NSF ESH	\$97,754
6/04- 5/07	Holocene/deglacial abrupt climate change and variability of the Western Pacific Warm Pool from multi-decadal to century-scale coral climate records	NSF OCE	\$78,325
7/04- 6/05	Collaborative Research: Temporal and spatial variation in magma generation and slab influence across an active subduction zone. M. Hirschmann, PI; Edwards, co-PI.	NSF EAR	\$39,507
8/05- 7/11	High resolution absolute-dated histories of northern and southern low latitude precipitation: links between low and high latitude climate over glacial-interglacial cycles	NSF ESH	\$688,420
8/05- 7/08	Collaborative Research: Full-Holocene decadal-scale isotopic paleoclimate record from speleotherms, Oregon Coast Range	NSF ESH	\$105,398
9/05- 8/07	Evolution of marine mammal foraging behavior Based on Ca and C isotope ratios in bioapatite (co-PI with David Fox)	NSF EAR	\$150,000
10/06- 9/08	Acquisition of a stable isotope ratio mass spectrometer system for environmental and paleoclimate research (co-PI with Emi Ito, David Fox, Bill Seyfried)	NSF EAR	\$250,000
8/06- 7/11	Collaborative Research: Project PALEOVAR- Past Climate Variability: Understanding mechanisms and interactions with the mean state	NSF ESH	\$150,000
8/06- 8/08	The timing and correlation of abrupt climate shifts worldwide	Gary Comer Science & Education Foundation	\$220,000
2/06 1/09	The 2004-2005 giant earthquakes and the seismic cycle	NSF EAR	\$104,000
8/08- 8/10	Improving the Hulu Cave timescale, a look into the Termination II 'Mystery Interval' in North America, and reconnaissance work	Gary Comer Science and Education Foundation	\$76,855

2/08- 1/10	Collaborative Research: GEOTRACES Intercalibration of $^{230}\text{Th}$ , $^{231}\text{Pa}$ , $^{10}\text{Be}$ , REE, Nd isotopes and selected man-made radionuclides	NSF Chemical Oceanography	\$90,000
9/08- 9/10	Mid-latitude precipitation and abrupt climate change in western North America and East Asia	Gary Comer Science and Education Foundation	\$50,000
9/09- 9/11	High-resolution cave records of paleohydrology in the Bonneville Basin, northern Utah (D. McGee, PI)	NOAA 2-year postdoctoral fellowship for Dr. David McGee	
9/10- 9/12	High-resolution paleoclimate reconstruction of the 8200-year Event from northern Venezuelan speleothem stable isotope records: possible atmospheric-oceanic linkages (J. Retrum, PI)	NSF 2-year postdoctoral fellowship for Dr. Julie Retrum	
9/9- 9/12	Collaborative Research: Global Change and the Terrestrial Paleoclimate Record from Eastern North America: 600,000 years BP to present	NSF EAR	\$109,845
9/9- 9/12	Collaborative Research: Growth of the Tibetan Plateau and Eastern Asia Climate: Clues to Understanding the Hydrological Cycle	NSF EAR	\$258,000
4/10- 4/13	Collaborative Research: U.S. GEOTRACES North Atlantic Section: Analysis of $^{230}\text{Th}$ , $^{232}\text{Th}$ and $^{231}\text{Pa}$	NSF OCE	\$405,023
3/10- 3/12	Turkish Cave Records	Gary Comer Science & Education Foundation	\$46,800
7/11- 6/15	Northern and Southern Low-Latitude Precipitation Histories: Testing Ideas about Millennial and Orbital-Scale Climate Change	NSF ATM	\$557,957
7/11- 6/14	Collaborative Research: Absolute-dated records of Late Quaternary paleohydrology in the Bonneville Basin, western U.S., from novel cave archives	NSF ESH	\$180,953
1/13- 12/14	High resolution cave climate records from secondary ionization mass spectroscopy oxygen isotope measurements (I. Orland, PI)	NSF 2-year postdoctoral fellowship for Dr. Ian Orland	

1/13 1/16	Collaborative research: U.S. GEOTRACES Pacific Section, analysis of Th-230, Th-232 and Pa-231	NSF	\$410,000
8/13- 7/16	MRI: Acquisition of a Multi-collector Inductively-coupled Plasma Mass Spectrometer for Research and Education in the Earth and Environmental Sciences Co-PIs: J. Bailey, J. Feinberg, H. Cheng, T. Johnson	NSF	\$894,906
8/13- 7/15	Paleomagnetic Analysis of Speleothems and High Precision Dating of Geomagnetic Records J. Feinberg, PI; I. Lascu, R.L. Edwards, Co PIs	NSF	\$298,314
1/15- 12/17	Collaborative Research: U.S. GEOTRACES Arctic Section: $^{230}\text{Th}$ , $^{232}\text{Th}$ and $^{231}\text{Pa}$ tracers of trace element supply and removal Co-PI: H. Cheng		\$454,947

## Service - Professional

### Boards, Symposia, Workshops, Committees

Workshop on Tibet tectonics and climate, Estes Park, CO, invited speaker, 2014  
 Presentation of the Arthur L. Day Lectures of 2013, a series of three lectures on “Deciphering Climate History from Caves”, sponsored by the National Academy of Sciences, hosted by Oberlin College, November 2013.  
 2013 William Smith Meeting: the First Century of Isotope Geochronology, the Legacy of Frederic Soddy and Arthur Holmes, invited speaker, Geological Society of London, June 2013.  
 Earthtime Workshop; Geological Society of London, June 2013, invited member.  
 Editorial Board, Journal of Earth’s Environment, 2013 to present.  
 Kaplan Symposium: *Paleoceanography and Paleoclimatology: New Approaches to Old Problems*. Invited member. Jerusalem, 2012  
 Workshop on “Sea level changes into MIS 5” NSF-sponsored workshop. Invited member, Mallorca, 2012  
 Workshop on Tibet tectonics and climate, Jackson Hole, WY, 2011, workshop member  
 Advisory Board for scientific center proposal for the Danish National Research Council, 2011  
 Workshop on Tibet tectonics and climate, Longmont, CO, 2010, workshop member  
 Workshop: *Starving Tigers?: Impact of Climate Change on South East Asia*, sponsored by the Earth Observatory of Singapore, the Monitor Group, and the School of International Studies, Nanyang University, invited speaker, 2010.  
 Scientific Advisory Board, Earth Observatory of Singapore, 2010  
 Board Member, Academic Committee, *UNESCO International Research Center on Karst*, Guilin China, 2009 to present  
 Outside Evaluator, Karst Hydrogeology Training Course, UNESCO International Research Center on Karst, Guilin China, 2009  
 Department of Energy, Office of Basic Sciences Research Program, Guest Panelist, 2009  
 Workshop on Quaternary Dating Methods, European Science Foundation, Piran, Slovenia, April 2008, invited lecturer  
 Leverhulme Trust Climate Symposium 2008: *Earth’s Climate, Past, Present, and Future*, University of Cambridge and the Royal Society, London, March 2008, invited delegate.  
 National Academy of Sciences – National Research Council Workshop on *Understanding Climate’s influence on Human Evolution* (Feb. 2008, Beckman Center of the National Academies, Irvine, CA), invited participant  
 European Science Foundation sponsored workshop: Euroclimate, Heidelberg Academy of Sciences, 2007, invited participant  
 Second Carlsberg Dating Conference, Copenhagen, 2006; invited participant  
 Editorial Board, Quaternary Science Reviews, 2006-2014.  
 National Science Foundation Committee managing allocation of high-purity thorium-229 to uranium-series researchers, 2005-2010  
 National Science Foundation Panel for Director’s Award: Distinguished Teaching Scholars, 2004  
 AGU VGP Macewane Committee, 2001-2002  
 Department of Energy, Office of Basic Sciences Research Program, Guest Panelist, 2000  
 Geochemical Society Program Committee, 1994 - 2000; Chair, 1996-1997

Ocean Drilling Project - Committee on Shallow Water Drilling, 1998 - present  
 Panel member NSERC site visit, mass spectrometry facility, McMaster U. (1990)  
 Panel member, NSF Chemical Oceanography (1993-1994), (2000), (2002)  
 Panel member NSERC site visit, mass spectrometry facility, U. Quebec at Montreal  
 (1997)

### Manuscript Reviews

Science, Nature, Geochimica Cosmochimica Acta, Geology, Earth & Planetary Science  
 Letters, Chemical Geology, Quaternary Research, Geophysical Research Letters

### Book Reviews:

Turekian, Global Environmental Change (1995)  
 Press and Siever, Understanding Earth (1996)

### Proposal Reviews:

National Science Foundation  
 American Chemical Society—Petroleum Research Fund  
 National Environment Research Council (Great Britain)  
 National Oceanic and Atmospheric Administration  
 Natural Sciences and Engineering Research Council (Canada)  
 Department of Energy

### Invited lectures

Carleton College, University of Chicago (2), Free University (Amsterdam), University of Illinois, University of Iowa, Lamont Doherty Earth Observatory, Mankato State University, University of Michigan, University of Minnesota - Duluth, Geological Society of Minnesota (2), NOAA Workshop on Climate Reconstruction from Corals, Northwestern University, San Diego State University, University of Southern California, United States Geological Survey-Reston, United States Geological Survey Workshop on Paleoseismicity 1987, United States Geological Survey Workshop on Paleoseismicity 1994, Woods Hole Oceanographic Institution, 3rd Nier Symposium - Featured Speaker 1997, Yale University, University of Texas, Symposium on Coastal Response to Sea Level Changes - Keynote Speaker 1999, Patterson Medal Acceptance Speech, 1999; Lamont-Doherty Earth Observatory of Columbia University, 2003; Lamont-Doherty Earth Observatory of Columbia University, 2003; Lamont-Doherty Earth Observatory of Columbia University and IBM Center, 2004; Lamont-Doherty Earth Observatory of Columbia University, 2004; Keynote Speaker, North Central GSA, Minneapolis, 2005. Holocene workshop, AGU and NSF, 2005; Lamont-Doherty Earth Observatory of Columbia University, 2005; Max-Planck Institute/University of Mainz, 2005; University of Michigan, 2006; Iowa State University, 2006; Keynote Speaker 2006 Goldschmidt Conference; Second Carlsberg Dating Conference, Copenhagen, 2006; European Science Foundation workshop, Euroclimate, Heidelberg Academy of Sciences, 2007; University of Wisconsin, 2007; Lamont Doherty Earth Observatory (2), 2007, Goddard Institute of Space Sciences, 2007; U. Kansas, 2007; 3rd Gary Comer Abrupt Climate Changes Conference, 2007, AGU Union session, 2007; Yale University (2), 2008; Leverhulme

Climate Symposium, University of Cambridge and the Royal Society, 2008; Workshop on Quaternary Dating Methods, Piran, Slovenia, 2008; Plenary Lecture, Goldschmidt Conference, Vancouver, British Columbia, 2008; Abrupt Climate Change Conference, Leeward Farm, 2008; AGU invited lecture, 2008; Chinese Academy of Sciences, Beijing, 2009; Institute of Earth's Environment, Xian, 2009; UNESCO Institute for Karst Studies, Guilin, 2009; Abrupt Climate Change Conference, Leeward Farm, 2009; Earth Observatory of Singapore, 2010; U. Utah, 2010, Goldschmidt Conference, Knoxville, Keynote talk, 2010, Abrupt Climate Change Conference, Leeward Farm, 2010; U. Minnesota, 2011; Abrupt Climate Change Conference, Leeward Farms, 2011; Invited Keynote lecture (I), Kaplan Workshop, Ein Gedi, Israel, 2012; Invited Keynote lecture (II), Kaplan Workshop, Ein Gedi, Israel, March 2012; Invited Keynote lecture, NSF Sponsored Workshop on Sea Level at the beginning of the last glacial period, Mallorca, 2012; Abrupt Climate Change Conference, Leeward Farms, 2012; Invited Keynote Lecture American Quaternary Association Annual Meeting, Duluth, June 2012; Invited Keynote William Smith Meeting of 2013: the First hundred years of isotope geochronology, the legacy of Frederic Soddy and Arthur Holmes; The Arthur L. Day Prize Lectures of the National Academy of Sciences, Oberlin College, 2013; Goldschmidt Conference, Sacramento, 2014; U. Minnesota Duluth, 2014; Brown University, 2015.

## **Service – University of Minnesota**

### University-wide and College of Science & Engineering

Strategic Planning headed by Provost Hanson: *Grand Challenges Research* issue team member. Team proposed initial university-wide grand challenges and mechanisms for soliciting ideas from the University community for further challenges, 2014.

Review Committee for NSF Major Research Instrumentation proposals on behalf of the Office of Vice President for Research, 2013

CSE Promotion and Tenure Committee, 2000 - 2003.

Graduate School Grant-in-Aid Review Committee, 2001 - 2007.

NSF Research Training Grant: *Paleorecords of Global Change*, Steering Committee Member. This grant headed by Prof. Margaret Davis, funded graduate student stipends and research (\$2.5 million total external funding) across 4 colleges (CBS, CSE, CLA, and CFANS) for more than a decade. Edwards was a Steering Committee Member for the lifetime of the project and contributed to the writing of the original proposal and the renewal proposal, 1990 to 2002.

CSE Single Semester Leave Committee, 1999 - 2002

Graduate School Committee to review travelling fellowships, 1995

Graduate School Committee to review NSF Academic Research Infrastructure proposals, 1996 and 1997

### Department of Earth Sciences

Committee for recommending George Gibson Chair candidates, 2013

Tate Renovation Building Committee, 2012 to present

Faculty Awards Committee, 2012 to present

Analytical Committee, 2010 to present

Chair Search Committee Head Winchell School of Earth Sciences, 2005 - 2006

Director of Graduate Studies, 2004 - 2007, 2011 - 2012

Executive Review Committee, 1999 - 2002, 2007 - 2009

Graduate Studies Committee, 1993 - 1997, 2001 - 2007, 2011 - 2014

Awards Committee Chair, 1991-1997, 2013-2014

Search Committee for Limnological Research Center Director, 2001 - 2002

Search Committee for Surficial Processes Faculty Member, 2000 - 2001

Chair Review Committee for Earth and its Environments Course Coordinator, 2000

Undergraduate Studies Committee, 1989 - 1993, 1997 – 2001, 2010 - 2011

Search Committee for Limnological Research Center Director, 1989 - 1990

Department Seminar Committee, Winter 1989, Spring 1991, Spring 1999

Search Committee for Earth and its Environments Course Coordinator, 1994

Awards Committee Member, 1989-1991, 1997-2009



## Teaching - Courses

Edwards enjoys teaching at all levels and has made a concerted effort to reach and motivate students at an introductory level.

Over his career at Minnesota, he has taught:

**Earth and its Environments**, ESci 1001, 4 credits, an introduction to the earth and environmental sciences, 22 times, with a total enrollment in the range of 5000 students.

**Geochemical Principles**, ESci 3303W, 4-credits, a writing intensive class, covering a range of topics in the earth sciences from a chemical perspective, aimed at Earth Science majors at the junior level, 17 times, with a total enrollment of more than 300 students.

**Isotope Geology**, ESci 5302, 3 credits, a course designed for graduate students and upper level undergraduate students, covering applications of isotopic measurements to the study of the earth sciences, including the longterm evolution of the earth and the environmental history of the earth, 14 times, with a total enrollment of more than 100 students. Sections of this course were often co-taught with Emi Ito.

**Seminar courses on climate change and on geochemistry**, a total of 14, including 2 freshman seminars and 12 graduate-level seminars, with topics generally related to climate change and geochemistry.

**Mineralogy**, ESci 2301, a 4-credit course for undergraduate majors, including laboratory instruction, 4 times, with a total enrollment of about 150 students.

**Geochronology and Earth History**, Geo 3401, a 3-credit course designed for undergraduate majors, covering isotopic dating methods and the history of the earth's surface environment, taught once (co-taught with Tony Runkel), enrollment 18.

## Teaching - Mentoring

<i>Postdoctoral &amp; Research Associates Advisees</i>	<i>Current Position</i>
Warren Beck	1/90-5/93 Research Scientist, U. Arizona
Sarah Gray (visiting from USGS)	2/92-8/92 Professor, U. San Diego
Yemane Asmerom	5/92-8/93 Professor, U. New Mexico
John Hoff	8/92-12/97 Research Scientist, McCrones, Inc.
Hai Cheng	9/93-3/12 Professor Xi'an Jiao Tong U.
David Richards (50% at Minnesota)	2/98-6/00 Senior Lecturer, Bristol U.
Jeff Adkins	6/98-2/00 Professor, Caltech
Chuang Chou Shen	8/98-9/01 Professor, Taiwan National U.
Jeff Dorale	9/00-8/01 Associate Prof., U. Iowa
Xianfeng Wang	6/06-8/09 Assistant Professor, Nanyang U. & Earth Observatory of Singapore
Mayuri Inoue (w/Matsumoto)	2/07-8/07 Assistant Professor, Tokyo University 1/08-3/08 1/09-2/09
David McGee	1/10-1/12 Assistant Professor, M.I.T.
Julie Retrum	9/10-12/13 Research & Teaching Associate, Petroleum Research Institute, UAE
Yanbin Lu	11/12-present
Ian Orland	1/13-present
Pu Zhang	6/14-present
Guangrong Min	11/13-present

### *Visiting Scholars Hosted*

Prof. Mark Regan, U. Iowa	1992-1993
Prof. Jay Banner, U. Texas	Summers 1992, 1993
Prof. Stein Erik Lauritzen, Bergen University (co-hosted with E.C. Alexander)	1993-1994
Prof. Kerry Sieh, Caltech	Fall 1994
Prof. Guanjun Shen, Guizhou University	Spring 1997
Dr. David Richards, Leeds University	Spring 1997
Dr. Hong Chuan Li, U. Southern California	Spring 1999
Prof. Tan Ming, Beijing University	1999-2000
Prof. Yemane Asmerom, U. New Mexico	2000-2001
Prof. Yongjin Wang, Nanjing Normal U.	Spring-Summer 2001
Prof. Jeff Dorale, U. of Iowa	Summers 2002, 2003, 2004, 2007
Prof. Chuang Chou Shen, Taiwan National University	Summers 2002, 2003, 2004, 2005, 2006, 2007, 2008
Prof. Xinggong Kong, Nanjing Normal U.	2003, 2005, 2011 Winter 2005, 2006, 2007
Prof. Javier Martin-Chivelet	2008, 2009, Summers 2010 through 2014
Prof. Maria Turrero	2008, 2009, Summers 2010 through 2014

Prof. Christoph Spötl	Fall 2008
Prof. Francisco W. Cruz	2008-2009, 2010, 2011
Dr. Yanjun Cai, Chi. Acad. Sci.	2007, 2008, 2009, 10, 11, 12, 13, 14
Dr. Martin Medina-Elizalde	2008
Dr. Fuyuan Liang	2008, 2009, 2010, 2011, 2012, 2013, 2014
Dr. Ronnie Boch	2008-2010, 2011
Prof. Fahu Chen, Lanzhou University	2009-2010
Prof. Heather Stoll, University of Oviedo, Spain	2009-2010
Ms. Ana Mendez, University of Oviedo, Spain	2009-2010, 2012
Dr. Ana Moreno, Pyrenean Institute of Ecology-CSIC,	2009, 2010
Dr. Kyoung Nam Jo, Kangwon Nat'l U., Korea	2009-2010, 2011
Dr. Yongli Gao, E. Tennessee State U.	2010-11, 12, 13, 14
Dr. Liangcheng Tan, Chi. Acad. Sci., Xi'an	2010, 2011, 2012
Dr. Xianfeng Wang, Nanyang U., Singapore	2010, 11, 12, 13, 14
Dr. Gina Mosely	2011, 2012, 2013, 2014
Prof. Binggui Cai, Chinese Academy of Science, Beijing	2012
Prof. Li Ting Yong, Southwest University, Chongqing, China	2012
Dr. Jo Brendryen, Bergen University	2014

### *Doctoral Students Mentored*

Jerry Magloughlin, 1993. (Associate Professor, Colorado State U.; co-advised with P. Hudleston), "A Nason Terrane Trilogy."

Christina Gallup, 1997. (Associate Professor, U. Minnesota, Duluth), "A history of late Quaternary sea levels"

Kirsten Cutler, 2000. (2001: American Geophysical Union Congressional Fellow, advisor to Senator Joseph Lieberman, now with U.S. Department of State), "Carbon-14 Calibration and Sea-Level History from High-Precision Thorium-230 and Protactinium-231 Dating of Corals"

Jeff Dorale, 2000. (Associate Professor, U. Iowa), "A high-resolution record of climate and vegetation change from Crevice Cave Missouri during the Last Interglacial-Glacial Cycle"

Guangrong Min, 2002. (Software analyst Wells Fargo and Research Scientist, U. Minnesota) "Strontium-Calcium, Oxygen Isotope, and Uranium/Calcium measurements in Corals: Applications to Late Quaternary Sea Surface Temperatures in the West Pacific Warm Pool"

Thomas, Rebecca, 2004 (Research Scientist, New Brunswick Laboratories). Thesis topic: U-series disequilibrium in Central American arc lavas: constraints on subduction-zone volcanism (co-advised with M. Hirschmann)

Wang, Xianfeng, 2006 (Assistant Professor, Nanyang U. Singapore & Scientist Earth Observatory of Singapore). Thesis topic: High resolution climate records from Brazilian cave deposits

Sushmita Ray, 2008 (Research Scientist, Schlumberger, Houston, TX). Thesis topic: The climate and vegetation history of the North American mid-continent.

Megan Kelly, 2010 (Research Scientist Minnesota Department of Natural Resources). Thesis topic: The history of the Asian Monsoon during over the last two glacial cycles.

Ben Hardt, 2010 (Research Scientist, M.I.T.). Thesis topic: Eastern North American climate over the last several glacial cycles.

Melissa Cross (current student). Thesis topic: The history of the hydrological cycle in the Great Basin, western U.S.

Mathieu Pythoud (current student). Thesis topic: The marine uranium cycle and ocean mixing times.

*Visiting doctoral students hosted*

Andrew Baker, 1993, U. Bristol, P.L. Smart, advisor, (now Reader, U. Birmingham), thesis title "The Timing and Rate of Speleothem Growth."

David Richards, 1995, U. Bristol, P.L. Smart, advisor, (now Reader, Bristol University), thesis title "Pleistocene Sea Levels and Palaeoclimate of the Bahamas based on Th-230 dating of Speleothems"

Judy Zachariassen, 1998, California Institute of Technology, K. Sieh, advisor, (now Scientist and Consultant, URS Corporation, Oakland, CA), thesis title "Paleoseismology and Paleogeodesy of the Sumatran Subduction Zone: A Study of Vertical Deformation Using Coral Microatolls"

Kim Cobb, 2002. Scripps Institution of Oceanography, U. California, San Diego, Chris Charles and Miriam Kastner, advisors, (now Associate Professor, Georgia Tech), thesis title: "Coral records of the El Nino - Southern Oscillation and tropical Pacific climate over the last millennium".

Yanjun Cai, 2004-2005. Chinese Academy of Sciences, Xi'an, Zhishen An, advisor, thesis topic: speleothem records of the East Asian Monsoon (now Research Scientist Chinese Academy of Sciences).

Xiaoshi Tan, 2005. Institute for Karst and Environment, Guilin, Daoxian Yuan, advisor, Thesis topic: speleothem records from Dongge Cave, China.

- Kris Ludwig, 2005-2006. U. Washington, Deb Kelley, advisor, thesis topic: Lost City hydrothermal vents.
- Stacy Rosner, 2005-2006. Kansas University, Luis Gonzalez, advisor, thesis topic: Deglacial and Holocene climate of Venezuela from cave deposits
- Andre Seidel, 2008-2009. University of San Paolo, Francisco Cruz, advisor, thesis topic: Tropical Brazilian Cave Climate Records
- Xiuyang Jiang, 2009. Nanjing Normal University, Yongjin Wang, advisor, thesis topic: Chinese Cave Climate Records.
- Dezhong Zhang, 2009. Lanzhou University, Pingzhong Zhang, advisor, thesis topic: Cave Climate Records from Western China.
- Xiaoyan Zhu, 2009. Institute of Karst, Chinese Academy of Geological Sciences, Zhisheng An, advisor, Cave Climate Records from Tibet.
- Nicolas Strikis, 2009, 2010. University of São Paulo, Francisco Cruz, advisor, thesis topic: Brazilian cave climate records
- Zhiguo Rao, 2009, 2010. Lanzhou University. Pingzhong Zhang, advisor. Western China Climate records.
- Kan Zhao, 2009. Nanjing Normal University. Yongjin Wang, advisor. Last glacial climate in central China.
- Dezhong Zhang, 2009, 2010, Lanzhou University. Pingzhong Zhang, advisor. Holocene climate of western China
- Xiaoyan Zhu, 2009, Institute of Karst, Chinese Academy of Geological Sciences. Daoxian Yuan, advisor. Climate history of southern China.
- Seraina Badertscher, 2010, University of Bern. Dominique Fleitmann, advisor. Climate history of Northern Turkey.
- Brittany Guzzo, 2009, 2010, University of Iowa. Jeff Dorale, advisor. North American mid-continent climate over several glacial-interglacial cycles.
- Lisa Kanner, 2010. University of Massachusetts-Amherst. Steven Burns, advisor. Holocene and late glacial history of the Peruvian Amazon lowlands
- Susanne Brandstaetter, 2010, University of Innsbruck, Austria, Christoph Spotl, advisor European cave climate records
- Ligia Falcao, 2011, Universidade de São Paulo, Instituto de Geociências, Brazil, Chico Cruz advisor, Brazilian cave climate records

Marcos Saito de Paula, 2010, Universidade de São Paulo, Instituto de Geociências, Brazil, Chico Cruz advisor, Brazilian cave climate records

Elena Steponaitis, 2012, Massachusetts Institute of Technology, David McGee advisor, Paleohydrology of the Great Basin

Haiwei Zhang, 2012, Institute of Earth Environment, Chinese Academy of Sciences (Xi'an, China), Yanjung Cai advisor, Recent monsoon variability in central China

Gayatri Kathayat, 2012, Xi'an Jiaotong University (Xi'an, China), Hai Cheng advisor, History of the Indian Monsoon

Miguel Bartolome, 2012, 2013, 2014 Departamento de Geología, Universidad de Oviedo, Heather Stoll advisor, Last Glacial period climate history of northern Spain.

#### *Masters Students mentored*

Carolyn Dykoski 2004. Thesis title: The deglacial and Holocene History of the Asian Monsoon system.

Erik Smith 2005. Thesis title: Organic carbon and the inorganic carbon isotopic record of Hulu Cave, Nanjing, China

Kathleen Wendt (current student). Thesis topic: Heinrich Events as viewed from caves in northeastern Brazil.

#### *Visiting Masters Students hosted*

Roger Gomez, U. Iowa, Summer and Fall 2003

Scott Lepley, U. Missouri, Fall 2003, Spring 2004

Alan Chu, Taiwan National University, Summer 2005, 2006

Claire Chen, Taiwan National University, Summer 2004, 2005

Hong-Wei Chiang, Taiwan National University, 2006-2007

Britanny Guzzo, Iowa University, 2007, 2008

Chung-Che Wu, National Taiwan University, Summer 2008

James Apaestegui, Universidade de São Paulo, Instituto de Geociências, 2012

Lijuan Sha, Xi'an Jiaotong University, Xi'an, China, 2012

Saul Gonzalez, Departamento de Geología, Universidad de Oviedo, 2012

Jessica Buckles, University of Texas at Arlington, 2012, 2013