

# Brad D. Wolaver

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## ACADEMIC EXPERIENCE

The University of Texas at Austin

Ph.D. Geology, 2008

Dissertation: “Hydrogeology of the Cuatrociénegas Basin, Coahuila, Mexico: an integrative approach to arid karst aquifer delineation”

Advisor: Dr. John M. Sharp, Jr.

The University of Arizona, Tucson

M.S. Hydrology, 1999

Thesis: “Comparison of Snow Distribution Methods in the Echaurren Basin, Chilean Andes”

Advisor: Dr. Roger C. Bales,

Associate in Entrepreneurship, 1999

Pontificia Universidad Católica de Chile

Fulbright Scholar in Environmental Sciences, 1996–97

Project: “Quantification of snow melt runoff in Chilean Andes using NOAA satellite imaging”

The University of Texas at Austin, B.S. Geology with Special Department Honors, 1995

## RESEARCH INTERESTS

Applied research in sustainable groundwater management for people and the environment, particularly in semi-arid and arid environments, focusing in three unified research themes:

**Sustainable Aquifer Management:** Groundwater flow, transport, and recharge processes.

**Water, Energy, and Minerals:** Effective groundwater management for energy and mining.

**Ecohydrology:** Springs, groundwater-dependent ecosystems, and surface-groundwater interactions.

## PROFESSIONAL EXPERIENCE

2011– The University of Texas at Austin, UTemp

Consulting Research Hydrogeologist in the Bureau of Economic Geology

- Performed original and independent research on: (1) Gulf Coast aquifer groundwater monitoring at carbon dioxide geologic sequestration sites in Brazoria and Jackson Counties, (2) rapidly evolving regulations pertaining to groundwater monitoring issues at carbon dioxide enhanced oil recovery (CO<sub>2</sub> EOR) in Texas, and (3) investigated novel groundwater sources for hydraulic fracturing from previously unstudied Paleozoic aquifers in north central Texas for Barnett Shale Play.
- Wrote reconnaissance level hydrogeologic characterization reports for groundwater monitoring at two CO<sub>2</sub> EOR facilities in the Texas Gulf Coast.
- Wrote report on groundwater monitoring implications of new Texas CO<sub>2</sub> EOR regulations that will be expanded to a peer-reviewed journal article.
- Performed subsurface correlation of thin sand units in the Chicot and Evangeline aquifers of the Texas Gulf Coast using Petra software to optimize groundwater monitoring network design with the goal of demonstrate containment of CO<sub>2</sub> enhanced oil recovery (EOR) projects to meet federal and state regulations.

Consulting Research Hydrogeologist, Bureau of Economic Geology (continued):

- Used ArcMap GIS software to map North Central Texas Paleozoic aquifer sand bodies for use as a novel Barnett Shale hydraulic fracturing water supply because currently no Groundwater Availability Model (GAM) exists for this part of Texas — a critical State of Texas groundwater management gap this research fills.
- Integrated potentiometric, water quality, geologic, stratigraphic and other data into GIS spatial databases to facilitate creation of hydrogeologic conceptual models of the Gulf Coast aquifer near CO2 EOR sites and Paleozoic aquifers for Barnett Shale water supply.
- Synthesized historic pumping test data from North Central Texas domestic groundwater wells to characterize hydraulic properties of under-utilized Paleozoic aquifers for novel Barnett Shale water supply.
- Evaluated emerging regulations for CO2 EOR projects in Texas to inform effective groundwater management strategies.
- Wrote two proposals presented by Michael Young at the recent Latin American Forum in Cartagena, Columbia for collaborative research with Mexican government water management agencies, CONAGUA and IMTA, in groundwater depletion of aquifers along the Texas border and arsenic contamination related to unsustainable agricultural groundwater production in Northeast Mexico.
- Preparing proposal for collaborative, applied research with the Texas State University River Systems Institute on improving the Lower Colorado River Authority's groundwater management approach for rice farms on the Gulf Coast.
- Outside of regular work hours, I have done substantial writing for three publications: (1) I have revised an article submitted to Water Resources Research, (2) Completed and circulated a co-authored review draft of a paper for submission to GSA's Geosphere, and (3) Integrated initial co-author review comments for a second paper from my post doctoral research that will be submitted to Hydrogeology Journal in collaboration with Andrew Love and Craig Simmons.

2008–10

Flinders University, Earth Sciences Department, Adelaide, Australia  
Research Fellow; Largest ever Australian government-funded groundwater project

- Created hydrogeologic conceptual model of regional aquifer and spring complex in Great Artesian Basin western margin to guide groundwater development and preserve spring discharge. This work has important implications for groundwater management because I identified a very low recharge aquifer previously unreported in the open literature that will now be managed actively.
- Submitted and currently revising a paper for Water Resources Research on a novel analytical model that uses thermal spring discharge rate and temperature to estimate aquifer source depth without using complicated and error-prone geothermometry.
- Integrated initial co-author review comments for a paper that will be submitted to Hydrogeology Journal that discusses sustainable groundwater management approaches in very-low recharge, sole source aquifers with increasing mining groundwater extraction and groundwater-dependent ecosystems.
- Developed the first GIS geospatial database for the Central Australian study area by synthesizing diverse stratigraphic, structural, hydrochemical, and environmental tracer data.

Flinders University, Earth Sciences Department, Adelaide, Australia (continued):

- Provided monitoring and management recommendations to regulatory agencies for optimum management of very low recharge Central Australian aquifers to provide sole-source groundwater for economically important mines while preserving groundwater-dependent, spring-fed ecosystems.
- Used geophysical surveys of gravity and time domain electromagnetics to evaluate ephemeral stream recharge in an ungauged central Australian river that provides the only modern aquifer recharge.

2006–07

AOA Geophysics, Moss Landing, CA  
Independent Technical Support Consultant

- Provided technical support as an independent contractor for a legacy gravity geophysical processing software package I used for my Ph.D. research.

2005

Sandia National Laboratories, Albuquerque, NM  
Sandia Water Initiative Intern with Dr. Vincent C. Tidwell

- Developed a basin-scale, groundwater-surface water simulation model for a generic basin to evaluate water supply alternatives among competing water uses and presented results at a state groundwater conference.

2002–04

Geoscience Support Services, Inc., Claremont, CA  
Geohydrologist

- Acquired and evaluated pumping test data to estimate aquifer parameters.
- Sampled groundwater in monitoring and municipal production wells to assure compliance with federal and state drinking water standards and regulations.
- Investigated rural and suburban groundwater aquifer storage and recovery (ASR) sites that were the first in Southern California to use treated effluent sources.
- Designed and oversaw installation of groundwater monitoring and production wells for novel brackish and high-nitrate groundwater demineralization facilities.
- Wrote numerous well completion and groundwater monitoring reports.
- Wrote or co-wrote proposals resulting in over \$200,000 in new project work.

1999–02

Montgomery Watson Harza, Inc., Pasadena, CA  
Hydrogeologist

- Created hydrogeologic conceptual models, evaluated groundwater production, and assessed artificial recharge in Southern California aquifers using surplus canal water from the Colorado River.
- Developed initial well depths based on exploratory Carrizo aquifer boreholes in support of the San Antonio Water System's Twin Oaks ASR facility well field.
- Contoured sand tops in a GIS environment supporting the design of an ASR well field for the City of Laredo, Texas that would inject surplus water.
- Installed soil lysimeters to assess storm water recharge into sub-grade storm water infiltration galleries – the first of their kind in Southern California.
- Wrote a community relation plan for the U.S. Army Corps of Engineers investigating perchlorate-contaminated groundwater at a weapons depot near McGregor, Texas located between tributaries of the Brazos River.
- Developed labor- and cost-loaded schedules for over \$300,000,000 water infrastructure capital improvement projects as a special consultant to the Metropolitan Water District of Southern California.

## PROFESSIONAL REGISTRATION

California Professional Geologist #7494 (applying for Texas license)

## PROFESSIONAL AFFILIATIONS

American Geophysical Union (AGU)

Geological Society of America (GSA)

International Association of Hydrogeologists (IAH)

National Ground Water Association (NGWA)

## GRANTS AND AWARDS

- 2011 Prepared proposal presented by Michael Young at Latin American Forum for joint groundwater collaboration with Mexican government agencies and BEG.  
Preparing proposal for collaborative research with Texas State University River Systems Institute on Lower Colorado River Authority groundwater management.
- 2008 Banks Fellowship, San Antonio Area Foundation
- 2007 BHP Billiton Geoscience Scholarship
- 2006–07 Houston Geological Society (HGS), Calvert Scholarship
- 2006 Geological Society of America (GSA), Research Grant
- 2005–06 Gulf Coast Association of Geol. Soc. (GCAGS), Research Grant
- 2005 Tinker Foundation, Inc., Field Research Grant
- 2005 Jackson School of Geosciences, Field Research Scholarships
- 1996–97 Fulbright Scholar in Environmental Sciences, Santiago, Chile

## PROFESSIONAL SERVICES

- 2007–11 Reviewer, Environmental Earth Sciences, Ground Water, Hydrogeology Journal
- 2006–07 Vice President, Austin Geological Society (AGS)
- 2005–08 Lead hydrogeology research and teaching field trips to northeast Mexico.
- 2005 Coordinated Hydrogeology Seminar Series, UT Dept. Geol. Sci.

## PUBLICATIONS

### PEER-REVIEWED ARTICLES

- 2011 **Wolaver**, B.D., Diehl, T.M., Control of regional structural styles and faulting on Northeast Mexico spring distribution. *Environmental Earth Sciences*. 62(7):1535–1549.  
*doi 10.1007/s12665-010-0639-7*
- 2008 **Wolaver**, B.D., Sharp, J.M. Jr., Rodriguez, J.M., Ibarra, J.C., Delineation of regional arid karstic aquifers: an integrative data approach. *Ground Water* 46(3):396–413.  
*doi 10.1111/j.1745-6584.2007.00405.x*
- 2007 **Wolaver**, B.D., and Sharp, J.M. Jr., Thermochron iButton: Important limitations of an inexpensive, small-diameter temperature logger. *Ground Water Monitoring and Remediation*. 27(3):127–128.  
*doi 10.1111/j.1745-6592.2007.00158.x*

## **PEER-REVIEWED ARTICLES (continued):**

**Wolaver**, B.D., Robinson, N.I., Love, A.J., Simmons, C.T., Estimating aquifer depths from thermal spring measurements of temperature and discharge

*Submitted to Water Resources Research; in revisions with favorable reviews*

**Wolaver**, B.D., Crossey, L.J., Karlstrom, K.E., Banner, J.L., Cardenas, M.B.R., Gutiérrez Ojeda, C., Sharp, J.M. Jr., Strontium and helium isotope analysis of spring water in Cuatrociénegas Basin and implications of mantle-derived fluids and fault controls on northeast Mexico groundwater chemistry.

*Submittal in June 2011 to GSA's Geosphere; internal review draft currently with co-authors*

**Wolaver**, B.D., Love, A.J., Simmons, C.T., Managing groundwater in very low recharge aquifers with mines and groundwater dependent ecosystems: Dalhousie Springs, Central Australia.

*In preparation for submittal to Hydrogeology Journal, summer 2011*

**Wolaver**, B.D., Tidwell, V.C., Sharp, J.M. Jr., An approach to map recharge in arid, intermontane aquifers using groundwater chloride balance, temperature, and noble gas data.

*In preparation*

Berens, V., **Wolaver**, B.D., Halihan, T., Love, A., Brunner, P., Rousseau-Gueutin, P., Wohling, D., Priestley, S., Fulton, S., Hydrogeophysical investigation of an isolated recharge event on a Central Australia ephemeral river.

*Awaiting preparation by co-author; Wolaver writing emailed*

## **REPORTS**

2011 A novel Barnett Shale hydraulic fracturing water source: previously under-utilized north-central Texas Paleozoic aquifers

*In preparation as a BEG report and peer-reviewed journal article with J.P. Nicot*

Evolving regulations for carbon dioxide enhanced oil recovery in Texas and the implications for groundwater monitoring

*In preparation as an internal report and peer-reviewed journal article with Becky Smyth*

Reconnaissance-level hydrogeologic characterization of the Hastings field, Brazoria County, Texas.

*Internal report*

2010 **Wolaver**, B.D., and Love, A.J., Hydrogeology of Dalhousie Springs, South Australia: With recommendations for groundwater monitoring and management to preserve spring discharge. Australian Government National Water Commission, National Water Initiative Report (Final Draft complete; Pending publication at project end in 2011).

99–04 As a practicing hydrogeologist, I wrote numerous technical reports and proposals, including: ground water demineralization, desalination, and watershed water quality investigations, artificial recharge evaluations (storm, ground, and surface water), surface and ground water monitoring and management plans, well specifications, well reports, and water treatment plant construction schedules (labor & cost) for projects in U.S. & Mexico.

## PRESENTATIONS

- 2010 Wolaver, B.D., Robinson, N.I., Love, A.J., Simmons, C.T., Estimating aquifer depths from hot spring measurements of outflow temperatures and flow rates. National Groundwater Conference, Canberra, Australia.
- 2009 Wolaver, B.D., Love, A.J., Halihan, T., Berens, V., Brunner, P., Rousseau-Gueutin, P., Wohling, D., Priestley, S., Fulton, S., Hydrogeophysical investigation of an isolated recharge event on a central Australia ephemeral river: Abst. with Prgms, Geol. Soc. Am., v. 41, no. 7, p. 349. Online presentation: [gsa.confex.com/gsa/viewHandout.cgi?uploadid=397](http://gsa.confex.com/gsa/viewHandout.cgi?uploadid=397)  
Wolaver, B.D., Halihan, T., Berens, V., Love, A.J., Brunner, P., Rousseau-Gueutin, P., Wohling, D., Priestley, S., Fulton, S., Geophysical investigation of an ephemeral recharge event, Finke River, Northern Territory: Australian Society for Limnology, abstract #112.
- 2007 Wolaver, B.D., Sharp, J.M. Jr., Rodriguez, J.M., Hendrickson, D.A., An integrative approach to sustainable ground water and associated ground water-dependent system management in arid karst aquifers: Cuatrociénegas Basin, Mexico: 35th Congress, International Association of Hydrogeologists, Lisbon, Portugal.  
Wolaver, B.D., Aquifer delineation for groundwater management in a developing arid karstic basin: Cuatrociénegas, Coahuila, Mex.: Abst. with Prg., Geol. Soc. Am., v. 39, no. 6.  
Wolaver, B.D., Ground water recharge evaluation in semi-arid northeast Mexico in response to projected climate change. Eos, Transactions, Am. Geophys. U., 88(52).  
Wolaver, B.D., Sharp, J.M. Jr., Tidwell, V.C., Ground water model development in regional aquifer systems with sparse hydrogeologic data: Cuatrociénegas Basin, Coahuila, Mexico. National Ground Water Association (NGWA) Groundwater Summit, Albuquerque, NM.
- 2006 Andring, M.J., Wolaver, B.D., Sharp, J.M. Jr., Banner, J.L., Analyzing ground water flow paths in a karstic basin using cross-plots of major ions: Cuatro Ciénegas Basin, Coahuila, Mexico: Abstracts with Programs - Geological Society of America, vol. 38, no. 7, p. 288. (*Wolaver-supervised NSF REU summer intern project*)  
Wolaver, B.D., Sharp, J.M. Jr., Rodriguez, J.M., Gravity geophysical analysis of spring locations in a karstic desert basin, Cuatro Ciénegas Basin, Coahuila, Mex.: Gulf Coast Assoc. Geol. Soc. Conf. Predgs, v. 56, Lfyte, LA.  
Wolaver, B.D., Sharp, J.M. Jr., Rodriguez, J.M., Regional flow system delineation in arid karstic basins with sparse hydrogeologic data: Cuatro Ciénegas Basin, Coahuila, Mexico. Eos, Transactions, Am. Geophys. U., 87(52).
- 2005 Wolaver, B.D., Banner, J.L., Sharp, J.M. Jr., Ground water recharge in the Cuatro Ciénegas Basin, Mexico: Insights from strontium isotope and trace element analyses: Abst. with Prgms, Geol. Soc. Am., v. 37, no. 7, p. 361.  
Wolaver, B.D., Tidwell, V.C., Sharp, J.M. Jr., Water resource modeling using system dynamics: A modular simulation approach: 2005 New Mexico Water Research Symposium, 4<sup>th</sup> Ann. Mtg., Socorro, NM, Abst., p. C-22.
- 1999 Wolaver, B.D., Bales, R.C., McConnell, J., Elder, K., Escobar, F., Energy balance snowmelt modeling in the Echaurren Basin, Chilean Andes: Sixth International Conference on Southern Hemisphere Meteorology and Oceanography, American Meteorological Society, Abstract P3.17.
- 1998 Wolaver, B.D., Bales, R.C., McConnell, J., Elder, K., Escobar, F., Comparison of snow distribution methods in the Echaurren basin. Eos, Transactions, Am. Geophys. U., 79(45):F272, 1998.

## CONFERENCE PROCEEDINGS

- 2007 **Wolaver**, B.D., Sharp, J.M. Jr., Rodriguez, J.M., Hendrickson, D.A., An integrative approach to sustainable ground water and associated ground water-dependent system management in arid karst aquifers: Cuatrociénegas Basin, Mexico: 35th Congress, International Association of Hydrogeologists, Lisbon, Portugal.
- 2006 **Wolaver**, B.D., Sharp, J.M. Jr., Rodriguez, J.M., Gravity geophysical analysis of spring locations in a karstic desert basin, Cuatro Ciénegas Basin, Coahuila, Mex.: Gulf Coast Assoc. Geol. Soc. Conf. Prcdgs, v. 56, Lfytte, LA.

## INVITED SEMINARS

### *<sup>1</sup>Presentations given in Spanish*

- 2011 Presented two seminars on Australian postdoctoral research and selected projects from professional consulting experience to Suzanne Pierce's introductory hydrogeology course, Dept. Geol. Sciences, Univ. Texas at Austin.
- 2009 The School of Earth and Environmental Sciences, The University of Adelaide, Adelaide, Australia. Presented doctoral research on Northeast Mexico groundwater management.
- 2008 <sup>1</sup>Instituto Mexicano de Tecnología del Agua, Mexico City, Mex.  
<sup>1</sup>Comisión Nacional del Agua, Mexico City, Mex.
- Both presentations for possible collaborative research between the BEG and Mexican agencies in groundwater depletion and arsenic mobilization.
- 2007 The University of Texas at Arlington, Department of Earth & Environmental Sciences  
Presented doctoral research on Northeast Mexico groundwater management.  
<sup>1</sup>Asoc. Geohidrológica Mexicana, 6<sup>th</sup> Cong. Nac. de Aguas Subterráneas, P. Vallarta, Mex.  
Presented doctoral research on Northeast Mexico groundwater management at a Mexican national groundwater conference.  
<sup>1</sup>Segundo Congreso de Investigadores de Cuatrociénegas, Cuatrociénegas, Mex.  
Public outreach lecture on sustainable groundwater management that balances needs of agriculture and groundwater-dependent ecosystems in Northeast Mexico.
- 2006 Dept. of Geography and the Environment, Univ. Texas at Austin  
Presented initial findings of doctoral research.  
<sup>1</sup>Foro Nacional de Cuatrociénegas, Instituto Mexicano de Tecnología del Agua, Mexico City, Mex.  
Presented initial doctoral research results at a national research forum on Cuatrociénegas groundwater management hosted at the Mexican Water Technology Institute south of Mexico City.
- 2004 Hydrogeology Brown Bag Department Seminar, Dept. Geol. Sciences, Univ. Texas at Austin, San Antonio Water System (SAWS) Carrizo Aquifer storage and recovery (ASR) program: a Texas water resources solution.

## STUDENT WORK SUPERVISED

- 2011 Joy Mercier, UT DOGS undergraduate. ArcMap GIS digitizing of Paleozoic sand distribution maps from well logs for Barnett Shale gas water supply project with J.P. Nicot.  
Mary Hingst, UT DOGS MS. Assimilation of hard-copy TCEQ well pumping tests into digital format and calculation of north central Texas aquifer parameters with J.P. Nicot. Contacting groundwater conservation district to acquire long-term monitoring data in support of CO2 EOR project in Gulf Coast aquifer with Sue Hovorka.
- 2007 Dawn Saepia and Laura Merner. NSF REU Summer Intern with U. TX Env. Sci. Institute. Field deployment of diffusion gas samplers, which lead to Wolaver et al. paper currently in co-author review, submitting to GSA's Geosphere on northeast Mexico He and Sr isotopes.
- 2006 Megan Andring, Slippery Rock University, PA (Co-advised w. Dr. John M. Sharp, Jr.). NSF REU Summer Intern with U. TX Env. Sci. Institute Integration and evaluation of geochemical dataset, which led to Andring et al., 2006.
- 2005 Kim Nguyen (UT DOGS undergraduate), Philip Reikenberg (UT DOGS undergraduate), and Theresa Diehl (UT DOGS Ph.D.). Planning an implementation of land gravity geophysical surveys in northeast Mexico, leading to publication of Wolaver and Diehl, 2011.

## TEACHING

- 2009 Earth Sciences Field Camp, Flinders University, Adelaide, Australia (CPES 8022/8023). Collection of groundwater level and conductivity data to evaluate groundwater salinization from irrigated agricultural practices along the Murray River of South Australia.
- 04–07 Doctoral teaching assistantships at The University of Texas at Austin.  
Physical Hydrogeology & Aquifer Testing; Graduate-Level Hydrogeology Field Methods; Living with a Planet; Climate: Past, Present, and Future

## SHORT COURSES AND FIELD TRIPS

Carnegie Mellon University, Sustainability Teaching Workshop, Pittsburgh, PA  
Geochemist's Workbench, Canberra, Australia  
Structure and Stratigraphy, Monterrey Salient, Sierra Madre Oriental, Mexico, Dr. Randall Marrett  
Exxon Mobil: Sequence Stratigraphy; Integrated Basin Analysis  
Burlington Resources: 3-D Seismic Field Trip

## SELECTED INTERNATIONAL EXPERIENCE

- 2008–10 **Australia:** Post-doctoral research fellow Adelaide, South Australia, Flinders University
- 2004–08 **Mexico:** Doctoral research and technical presentations in Spanish in Coahuila and Mexico City (IMTA & CONAGUA) while at The University of Texas at Austin.
- 1997 **Brazil and Bolivia:** Six weeks overland from Bolivian Amazon to Northeast Brazil.
- 1996–97 **Chile:** Fulbright Scholar in Santiago, where worked with Chilean government hydrologists measuring alpine snow accumulation for river forecasting. Completed work as M.S. at the University of Arizona Dept. of Hydrology and Water Resources.
- 1996 **Mexico:** Informal translator for Western Geophysical to PEMEX client representatives for 3-D seismic survey off coast of Coatzacoalcos, Veracruz.

## FOREIGN LANGUAGES

Spanish (fluent), Portuguese (conversational and reading)