Tao Wen

Postdoctoral Scholar, Earth and Environmental Systems Institute (EESI)
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EDUCATION

University of Michigan (UM) Ann Arbor, Michigan
Ph.D., Earth and Environmental Sciences Department *April 2017*
M.S., Earth and Environmental Sciences Department *April 2014*

University of Science and Technology of China (USTC) Hefei, China
B.S., School of Earth and Space Science *July 2011*

POSITIONS HELD

- **Postdoctoral Scholar, EESI at Penn State University (February 2017 – Present)**
- **Graduate Student Researcher, Noble Gas Laboratory at University of Michigan (2011 – 2017)**
- **Undergraduate Researcher, Institute of Polar Environment at USTC (2009 – 2011)**
- **Undergraduate Researcher, Advanced Laboratory for Environmental Research and Technology at Suzhou, China (2009 Summer)**

AWARDS AND SCHOLARSHIP

Best Student Poster Presentation
American Institute of Professional Geologists Michigan Section, December 2016
Scott Turner Research Awards
University of Michigan Department of Earth and Environmental Sciences, Fall 2015, 2016
Stewart R. Wallace Fellowship
University of Michigan Department of Earth and Environmental Sciences, Fall 2012
Rackham Conference Travel Grant
University of Michigan, Fall 2012, 2013, 2014, 2015, 2016
Excellent Undergraduate Researcher Award
University of Science and Technology of China, 2011
Guanghua Education Scholarship
University of Science and Technology of China, 2010
Outstanding Student Scholarship
University of Science and Technology of China, 2008, 2009

PUBLICATIONS

Peer Reviewed Publications

13. **Wen, T.**, Liu, M., Zheng, G., Li, Z. and Brantley, S.L., Applying Machine Learning to Predict Missing Methane Data and Detect Anomalous Methane in Groundwater. *In preparation*.

12. Woda, J., **Wen, T.**, Oakley, D., Yoxtheimer, D., Engelder, T., Castro, M.C. and Brantley, S.L., Detecting and Explaining Why Some Aquifers Become Degraded Near Hydraulically Fractured Shale Gas Wells. *To be submitted*.
11. Zheng, G., Liu, M., **Wen, T.**, Wang, H., Yao, H., Brantley, S.L. and Li, Z., Targeted Source Detection for Environmental Data. *Under review*.
10. **Wen, T.**, Niu, X., Gonzales, M., Zheng, G., Li, Z. and Brantley, S.L., "Big data" reveal rare contamination incidents but otherwise improving groundwater quality in a heavily developed Marcellus Shale region. *In revision*.
9. Niu, X., **Wen, T.**, Li, Z. and Brantley, S.L., 2018. One Step toward Developing Knowledge from Numbers in Regional Analysis of Water Quality. *Environmental Science & Technology*.
8. **Wen, T.**, Pinti, D.L., Castro, M.C., López-Hernández, A., Hall, C.M., Shouakar-Stash, O. and Sandoval-Medina, F., 2018. A Noble Gas and $^{87}Sr/^{86}Sr$ Study in Fluids of the Los Azufres Geothermal Field, Mexico – Assessing Impact of Exploitation and Constraining Heat Sources. *Chemical Geology*.
7. Brantley, S.L., Vidic, R.D., Brasier, K., Yoxtheimer, D., Pollak, J., Wilderman, C. and **Wen, T.**, 2018. Engaging over data on fracking and water quality. *Science*, *359*(6374), pp.395-397.
6. **Wen, T.**, Castro, M.C., Nicot, J.P., Hall, C.M., Pinti, D.L., Mickler, P., Darvari, R. and Larson, T., 2017. Characterizing the noble gas isotopic composition of the Barnett Shale and Strawn group and constraining the source of stray gas in the Trinity Aquifer, north-central Texas. *Environmental Science & Technology*, *51*(11), pp.6533-6541.
5. **Wen, T.**, Castro, M.C., Nicot, J.P., Hall, C.M., Larson, T., Mickler, P. and Darvari, R., 2016. Methane Sources and Migration Mechanisms in Shallow Groundwaters in Parker and Hood Counties, Texas - A Heavy Noble Gas Analysis. *Environmental Science & Technology*, *50*(21), pp.12012-12021.
4. **Wen, T.**, Castro, M.C., Ellis, B.R., Hall, C.M. and Lohmann, K.C., 2015. Assessing compositional variability and migration of natural gas in the Antrim Shale in the Michigan Basin using noble gas geochemistry. *Chemical Geology*, *417*, pp.356-370.
3. **Wen, T.**, Castro, M.C., Hall, C.M., Pinti, D.L. and Lohmann, K.C., 2016. Constraining groundwater flow in the Glacial Drift and Saginaw aquifers in the Michigan Basin through helium concentrations and isotopic ratios. *Geofluids*, *16*(1), pp.3-25.
2. Boucher, C., Pinti, D.L., Roy, M., Castro, M.C., Cloutier, V., Blanchette, D., Larocque, M., Hall, C.M., **Wen, T.** and Sano, Y., 2015. Groundwater age investigation of eskers in the Amos region, Quebec, Canada. *Journal of Hydrology*, *524*, pp.1-14.
1. Nie, Y., Liu, X., **Wen, T.**, Sun, L. and Emslie, S.D., 2014. Environmental implication of nitrogen isotopic composition in ornithogenic sediments from the Ross Sea region, East Antarctica: $\Delta^{15}N$ as a new proxy for avian influence. *Chemical Geology*, *363*, pp.91-100.

Non-Peer Reviewed Publications

4. **Wen, T.**, 2017. *Development of Noble Gas Techniques to Fingerprint Shale Gas and to Trace Sources of Hydrocarbons in Groundwater* (Doctoral dissertation, University of Michigan).
3. Nicot, JP., et al., 2015. *Understanding and Managing Environmental Roadblocks to Shale Gas Development: An Analysis of Shallow Gas, NORM, and Trace Metals* (Technical Report,

http://www.rpsea.org/projects/11122-56/).

2. **Wen, T.**, 2014. *Constraining groundwater flow in the Glacial Drift and Saginaw Aquifers in the Michigan Basin through helium concentrations and isotopic ratios* (Master thesis, University of Michigan).
1. **Wen, T.**, 2011. *Analysis on nitrogen species and isotopic composition of the ornithogenic sediments from Cape Bird, Ross Island, East Antarctica* (Bachelor thesis, University of Science and Technology of China).

CONFERENCE PRESENTATIONS

22. **Wen, T.**, Niu, X., Pollak, J., Brazil, L., Li, Z., and Brantley, S.L., Using Shale Network Database to Assess the Water Quality Data in Marcellus Shale Area. UCOWR-NIWR Annual Water Resources Conference, Pittsburgh, PA, 06/2018. [**Invited Talk**]
21. **Wen, T.**, A Multi-disciplinary and Multi-stakeholder Framework to Evaluate Environmental Impacts of Shale Gas Production. Energy Days Conference, University Park, PA, 05/2018. [Oral]
20. **Wen, T.**, Zheng, G., Liu, M., Niu, X., Gonzales, M., Woda, J., Li, Z., and Brantley, S.L., Applying Machine Learning to Detect Anomalous Methane in Groundwater. PA Groundwater Symposium, State College, PA, 05/2018. [Oral]
19. **Wen, T.**, Niu, X., Gonzales, M., Li, Z., and Brantley, S.L., Applying Data Mining Techniques to Chemical Analyses of Pre-drill Groundwater Samples within the Marcellus Formation Shale Play in Bradford County, Pennsylvania. AGU Fall Meeting, New Orleans, LA, 12/2017. [Poster]
18. Pinti, D.L., **Wen, T.**, Castro, M.C., López-Hernández, A., Hall, C.M., Shouakar-Stash, O. and Sandoval-Medina, Using noble gases and $^{87}Sr/^{86}Sr$ to constrain heat sources and fluid evolution at the Los Azufres Geothermal Field, Mexico. AGU Fall Meeting, New Orleans, LA, 12/2017. [Poster]
17. **Wen, T.**, Castro, M.C., Nicot, J.P., Hall, C.M., Pinti, D.L., Mickler, P., Darvari, R. and Larson, T., Barnett Shale or Strawn Group: Identifying the Source of Stray Gas through Noble Gases in the Trinity Aquifer, North-Central Texas. AGU Fall Meeting, New Orleans, LA, 12/2017. [Oral]
16. **Wen, T.**, Niu, X., Gonzales, M., Li, Z., and Brantley, S.L., Using Data Mining Techniques to Assess Water Quality within the Marcellus Shale Play. Geochemistry Forum, State College, PA, 12/2017. [Oral]
15. Brantley, S.L., Gonzales, M., Guarnieri, M., Niu, X., **Wen, T.** and Li, Z., Investigating Chemical Analyses of Ground Waters Sampled by Shale-gas Industry Consultants Before Gas-well Drilling in Pennsylvania. Pennsylvania Groundwater Symposium, State College, PA, 05/2017. [Oral]
14. **Wen, T.**, Castro, M.C., Nicot, J.P., Hall, C.M., Larson, T., Mickler, P. and Darvari, R., Methane Sources and Migration Mechanisms in the Shallow Trinity Aquifer in Parker and Hood Counties, Texas – a Noble Gas Analysis. Shale Network Workshop, University Park, PA, 05/2017. [Poster]
13. **Wen, T.**, Pinti, D.L., Castro, M.C., Hall, C.M., Shouakar-Stash, O. and López-Hernández, A.,

Fluids in the Los Azufres Geothermal Field, Mexico traced by noble gas isotopes and $^{87}Sr/^{86}Sr$. GAC-MAC Meeting, Kingston, Canada, 05/2017. [Poster]

12. **Wen, T.**, Development of noble gas techniques to fingerprint shale gas and to trace hydrocarbons in groundwater. China University of Geosciences, Wuhan, China, 03/2017. [Invited, Oral]
11. **Wen, T.**, Castro, M.C., Nicot, J.P., Hall, C.M., Mickler, P. and Darvari, R., Methane Sources and Migration Mechanisms in the Shallow Trinity Aquifer in Parker and Hood Counties, Texas – a Noble Gas Analysis. AGU Fall Meeting, San Francisco, CA, 12/2016. [Oral]
10. **Wen, T.**, Castro, M.C., Nicot, J.P., Hall, C.M., Larson, T., Mickler, P. and Darvari, R., Methane Sources and Migration Mechanisms in the Shallow Trinity Aquifer in Parker and Hood Counties, Texas – a Noble Gas Analysis. AIPG Michigan Section, Ann Arbor, MI, 12/2016. [Poster]
9. Castro, M.C., **Wen, T.**, Nicot, J.P., Hall, C.M., Mickler, P. and Darvari, R., Methane Sources in Shallow Groundwaters in Parker and Hood Counties, Texas – A Heavy Noble Gas Analysis. Goldschmidt, Yokohama, Japan, 06/2016. [Oral]
8. **Wen, T.**, Castro, M.C., Nicot, J.P., Hall, C.M., Mickler, P. and Darvari, R., Identifying the Sources of Methane in Shallow Groundwaters in South-central Texas through Noble Gas Signatures. AAPG ACE, Calgary, Canada, 06/2016. [Oral]
7. **Wen, T.**, Castro, M.C., Ellis, B.R., Hall, C.M. and Lohmann, K.C., Assessing Compositional Variability and Migration of Natural Gas in Antrim Shale in the Michigan Basin Using Noble Gas Geochemistry. AGU Fall Meeting, San Francisco, CA, 12/2015. [Poster]
6. Castro, M.C., **Wen, T.**, Nicot, J.P., Hall, C.M., Mickler, P. and Darvari, R., Identifying the Sources of Methane in Shallow Groundwaters in Parker and Hood Counties, Texas through Noble Gas Signatures. AGU Fall Meeting, San Francisco, CA, 12/2015. [Oral]
5. **Wen, T.**, Castro, M.C., Ellis, B.R. and Hall, C.M., Using Noble Gases to Assess the Compositional Variability and Sources of Natural Gas in the Antrim Shale, Michigan Basin, USA. AAPG Eastern Section Meeting, Indianapolis, IN, 09/2015. [Poster]
4. **Wen, T.**, Castro, M.C., Ellis, B.R., Hall, C.M., Lohmann, K.C. and Bouvier, L., Assessing the Compositional Variability and Migration of Natural Gas in Antrim Shale in the Michigan Basin Using Noble Gas Geochemistry. AAPG ACE, Denver, CO, 06/2015. [Oral]
3. **Wen, T.**, Castro, M.C., Ellis, B.R., Hall, C.M., Lohmann, K.C. and Bouvier, L., Noble Gas Signatures in Antrim Shale Gas in the Michigan Basin-Assessing Compositional Variability and Transport Processes. AGU Fall Meeting, San Francisco, CA, 12/2014. [Poster]
2. **Wen, T.**, Castro, M.C. and Hall, C.M., Constraining Groundwater Flow in the Michigan Basin Through Helium Concentrations and Isotopic Ratios in the Saginaw Aquifer, Southern Michigan. AGU Fall Meeting, San Francisco, CA, 12/2012. [Poster]
1. **Wen, T.**, Liu, X. and Sun, L., Variations of $\delta^{15}N$ values in ornithogenic sediments on tropical Dongdao Island of South China Sea and their influencing factors. The 18th International Conference on Environmental Indicators, Hefei, China, 2010. [Poster]

TEACHING

Workshop Instructor in Shale Network Workshop, Pennsylvania State University *May 2018*

- *Computer module demonstration and hands-on exercise:* Created and prepared learning material; taught water chemistry about Marcellus-related spills for over 40 participants.
- *Field trip to mock spill event:* Organized and led field trip to mock spill; demonstrated sample collection from surface water.

Interim Instructor, Pennsylvania State University *April 2017*

- *GEOSC 560 – Kinetics of Geological Processes*: Taught basics of isotope geochemistry.

Teaching Assistant, University of Michigan *September 2013 – December 2016*

- *EARTH 100s – multiple introduction classes of earth sciences*.
- *EARTH 477 – Hydrogeology*: Guided 50+ students to understand the fate and transport of contaminants from Underground Storage Tanks via hands-on hydrogeological lab work and the interpretation of stratigraphic information.
- *EARTH 408 – Introduction to GIS in the Earth Sciences*: Taught 24 students to implement 2D & 3D spatial analysis in ArcGIS; received positive teaching evaluation (**rated at 4.5-5.0 out of 5.0**) from students and teachers.

FIELD EXPERIENCE

2017-2018 Groundwater, surface water, natural gas, and sediment sampling in Appalachian Plateau and Ridge and Valley area (monthly)
2013-2014 Natural gas sampling in the Antrim Shale area (Gas & Oil Wells), MI (1 week)
2012 Groundwater sampling in the Glacial Drift aquifer in Michigan Basin (3 days)
2010 Mountain Huangshan in Anhui, China (4 days)
2008-2009 Tai Lake, Chao Lake, Yancheng National Natural Reserve, China (1 month)

PUBLIC SERVICE AND PROFESSIONAL ACTIVITIES

Public Service

- Reviewer for Geochimica et Cosmochimica Acta, Water, Geological Society of America Today, Applied Geochemistry, Current Opinion in Environmental Science & Health, Advances in Polar Science
- Session convener and chair at Goldschmidt 2018: Using Geochemistry and Big Data to Understand the Biological-Geological Co-evolution of the Critical Zone - Including Human Impacts
- Judge for PSU Geosciences Graduate Student Colloquium (2018)
- Committee and Instructor for Shale Network Workshop at Penn State (2018)
- President of USTC Alumni Association in Greater Detroit area (2013-2015)
- Co-founder and Vice-president of AAPG student chapter at Uni. of Michigan (2015-2016)

Professional Affiliations

American Geophysical Union (AGU)	2012 – Present
Geological Society of America (GSA)	2014 – Present
American Association of Petroleum Geologists (AAPG)	2014 – Present
International Association of Hydrogeologists (IAH)	2014 – Present

Professional Development

- Sequence Stratigraphy short course attendee, AAPG, Denver, CO (2015)

- Data Science in Geochemistry workshop attendee, Goldschmidt, Boston, MA (2018)

SKILLS

Able to learn and understand tasks quickly while performing under pressure, both independently and as part of a team; excellent work ethic and strong ability towards detailing.

- **Expertise:** Strong hands-on experience in water chemistry, stable isotopes and noble gas labs; Proficient in ArcGIS and Microsoft Office suite; Groundwater modeling (MODFLOW); Geochemical modeling (MINEQL+ and PHREEQC); Field work planning and implementation; Collection of groundwater, surface water and shale gas samples; Geological mapping; Data synthesis and analysis; Document preparation including development of text, tables and figures for sampling and analysis plans, conference presentations and scientific papers writing
- **Programming:** Proficient in R, Python, MATLAB, LabVIEW; C, Fortran, Pascal
- **Language:** Fluent in English and Chinese

PROFESSIONAL REFERENCES

1. Professor Susan L. Brantley (**Postdoctoral research advisor**), Penn State University
   Mailing address: 2217 EES Building, Pennsylvania State University, University Park, PA 16802, USA
   Phone: 814-865-1619
   Email: sxb7@psu.edu

2. Associate Professor Zhenhui Li (**Postdoctoral research co-advisor**), Penn State University
   Mailing address: E331 IST Building, Pennsylvania State University, University Park, PA 16802, USA
   Phone: 814-863-6317
   Email: jessieli@ist.psu.edu

3. Professor M. Clara Castro (**PhD advisor**), University of Michigan
   Mailing address: 2534 C. C. Little Building, 1100 North University Avenue, Ann Arbor, MI, 48109-1005, USA
   Phone: 734-615-3812
   Email: mccastro@umich.edu

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