

## Víctor Vilarrasa's CV

e-mail: victor.vilarrasa@upc.edu



### Current position

Postdoc at the Lawrence Berkeley National Laboratory (since January, 2013).

**PhD studies:** Technical University of Catalonia (UPC), Spain.

- Title: Thermo-Hydro-Mechanical Impacts of Carbon Dioxide (CO<sub>2</sub>) Injection in Deep Saline Aquifers.
- Thesis defended 20 July 2012.

**Civil Engineering degree:** Technical University of Catalonia (UPC), Spain.

- Master thesis developed at the Royal Institute of Technology (KTH), Sweden (September 2004 – June 2005): Numerical modelling of fluid flow and particle transport in a rough rock fracture during shear.
- Degree completed June 2006.

### Other courses

- 42<sup>nd</sup> International Course of Hydrogeology, FCIHS, UPC, Barcelona, Spain (2008).

### Publications in Scientific Journals

1. Pool, M., Carrera, J., Vilarrasa, V., Silva, O. and Ayora, C., 2013. Dynamics and design of systems of injecting dissolved CO<sub>2</sub>. *Advances in Water Resources*, doi: 10.1016/j.advwatres.2013.10.001.
2. Saaltink, M., Vilarrasa, V., de Gaspari, F., Silva, O., Carrera, J. and Rötting, T.S., 2013. A method for incorporating equilibrium chemical reactions into multiphase flow models for CO<sub>2</sub> storage. *Advances in Water Resources*, doi: 10.1016/j.advwatres.2013.09.013.
3. Vilarrasa, V., Carrera, J., Bolster, D. and Dentz, M., 2013. Semianalytical solution for CO<sub>2</sub> plume shape and pressure evolution during CO<sub>2</sub> injection in deep saline formations. *Transport In Porous Media*, 97: 43-65.
4. de Simone, S., Vilarrasa, V., Carrera, J., Alcolea, A. and Meier, P., 2013. Thermal coupling may control mechanical stability of geothermal reservoirs during cold water injection. *Physics and Chemistry of the Earth*, 64: 117-126.
5. Vilarrasa, V., Silva, O., Carrera, J. and Olivella, S., 2013. Liquid CO<sub>2</sub> injection for geological storage in deep saline aquifers. *International Journal of Greenhouse Gas Control*, 14: 84-96.
6. Vilarrasa, V., Carrera, J. and Olivella, S., 2012. Hydromechanical characterization of CO<sub>2</sub> injection sites. *International Journal of Greenhouse Gas Control*, doi:10.1016/j.ijggc.2012.11.014.

7. Pujades, E., Carrera, J., Vázquez-Suñé, E., Jurado, A., Vilarrasa, V. and Mascuñano-Salvador, E., 2012. Hydraulic characterization of diaphragm walls for cut and cover tunneling. *Engineering Geology*, 125: 1-10.
8. Jurado, A., de Gaspari, F., Vilarrasa, V., Bolster, D., Sánchez-Vila, X., Fernández-García, D. and Tartakovsky, D.M., 2012. Probabilistic assessment of groundwater-related risks at subsurface excavation sites. *Engineering Geology*, 125: 35-44.
9. Vilarrasa, V., Olivella, S. and Carrera, J., 2011. Geomechanical stability of the caprock during CO<sub>2</sub> sequestration in deep saline aquifers. *Energy Procedia*, 4: 5306-5313.
10. Vilarrasa, V., Carrera, J., Jurado, A., Pujades E. and Vázquez-Suñé, E., 2011. A methodology for characterizing the hydraulic effectiveness of an annular low-permeability barrier. *Engineering Geology*, 120: 68-80.
11. Vilarrasa, V., Koyama, T., Neretnieks, I. and Jing, L., 2011. Shear-induced flow channels in a single rock fracture and their effect on solute transport. *Transport In Porous Media*, 87: 503-523.
12. Vilarrasa, V., Bolster, D., Olivella, S. and Carrera, J., 2010. Coupled hydromechanical modeling of CO<sub>2</sub> sequestration in deep saline aquifers. *International Journal of Greenhouse Gas Control*, 4: 910-919.
13. Vilarrasa, V., Bolster, D., Dentz, M., Olivella, S. and Carrera, J., 2010. Effects of CO<sub>2</sub> compressibility on CO<sub>2</sub> storage in deep saline aquifers. *Transport In Porous Media*, 85: 619-639.

#### Conference abstracts

1. Vilarrasa, V., Rutqvist, J. and Zheng, L., 2013. Implementation and application of a dual structure model for simulating the behavior of expansive soils. *2013 AGU Fall Meeting*, San Francisco, California, USA, 9-13 December 2013.
2. Vilarrasa, V., Carrera, J., Silva, O. and Olivella, S., 2013. Impacts of cold CO<sub>2</sub> injection in deep saline aquifers on the rock mechanical integrity. *American Rock Mechanics Association 47<sup>th</sup> US Rock Mechanics/Geomechanics Symposium*, San Francisco, California, USA, 23-26 June 2013, p. 13-253.
3. de Simone, S., Vilarrasa, V., Carrera, J., Alcolea, A. and Meier, P., 2013. Thermo-hydro-mechanical modeling of water circulation in a geothermal reservoir. *Conference on Technological and Hydrogeological Aspects of Geothermal Resources*, Barcelona, Spain, 18-19 April 2013.
4. de Simone, S., Vilarrasa, V., Carrera, J., Alcolea, A. and Meier, P., 2013. Modeling the effects of hydraulic stimulation on geothermal reservoir. *EGU 2013, Geophysical Research Abstracts*, Vol. 15, Vienna, Austria, 7-12 April 2013.
5. Carrera, J., Vilarrasa, V., Silva, O., Rötting, T. and Olivella, S., 2012. CO<sub>2</sub> injection, better liquid than supercritical. *3<sup>rd</sup> French-Spanish Symposium on Geological Storage of CO<sub>2</sub>*, Orleans, France, 17-19 October 2012.

6. Vilarrasa, V., Olivella, S., Silvia, O. and Carrera, J., 2012. Non-isothermal simulation of CO<sub>2</sub> storage in deep saline deformable formations. *European Congress on Computational Methods in Applied Sciences and Engineering*, Vienna, Austria, 10-14 September 2012.
7. Vilarrasa, V., Olivella, S., Silva, O. and Carrera, J., 2012. Coupled thermo-hydro-mechanical modelling of CO<sub>2</sub> injection in deep saline aquifers. *Proceedings of 2<sup>nd</sup> Workshop on Advanced Scientific Results from IDAEA, CSIC*, Roquetes, Tarragona, Spain, 14-16 May 2012.
8. de Simone, S., Vilarrasa, V., Carrera, J., Alcolea, A. and Meier, P., 2012. Coupled thermo-hydro-mechanical modelling of cold water injection in a fractured hot rock. *Proceedings of 2<sup>nd</sup> Workshop on Advanced Scientific Results from IDAEA, CSIC*, Roquetes, Tarragona, Spain, 14-16 May 2012.
9. Vilarrasa, V., Olivella, S., Silva, O. and Carrera, J., 2012. Extension of CODE\_BRIGTH to simulate non-isothermal CO<sub>2</sub> injection in deep saline aquifers. *Proceedings of 4<sup>th</sup> Workshop of CODE\_BRIGTH Users*, UPC, Barcelona, Spain, 3 May 2012.
10. de Simone, S., Vilarrasa, V., Carrera, J., Alcolea, A. and Meier, P., 2012. Thermo-hydro-mechanical simulation of geothermal reservoir stimulation. *Proceedings of 4<sup>th</sup> Workshop of CODE\_BRIGTH Users*, UPC, Barcelona, Spain, 3 May 2012.
11. Saaltink, M., Vilarrasa, V., de Gaspari, F., Silva, O. and Carrera, J., 2012. A method for incorporating chemicals reactions into CODE\_BRIGTH. *Proceedings of 4<sup>th</sup> Workshop of CODE\_BRIGTH Users*, UPC, Barcelona, Spain, 3 May 2012.
12. Vilarrasa, V., Carrera, J. and Olivella, S., 2012. High pressure injection test for hydromechanical and onset of induced microseismicity characterization of CO<sub>2</sub> injection sites. *EGU 2012, Geophysical Research Abstracts*, Vol. 14, Vienna, Austria, 22-27 April 2012.
13. Vilarrasa, V., Olivella, S., Silvia, O. and Carrera, J., 2012. Numerical simulation of non-isothermal CO<sub>2</sub> injection using the thermo-hydro-mechanical code CODE\_BRIGTH. *EGU 2012, Geophysical Research Abstracts*, Vol. 14, Vienna, Austria, 22-27 April 2012.
14. de Simone, S., Vilarrasa, V., Carrera, J., Alcolea, A. and Meier, P., 2012. Fracture instability caused by cold water injection. *EGU 2012, Geophysical Research Abstracts*, Vol. 14, Vienna, Austria, 22-27 April 2012.
15. Pool, M., Vilarrasa, V. and Carrera, J., 2012. Dynamics of dissolved CO<sub>2</sub> injection systems: optimal design. *EGU 2012, Geophysical Research Abstracts*, Vol. 14, Vienna, Austria, 22-27 April 2012.
16. Saaltink, M., Vilarrasa, V., de Gaspari, F., Silva, O. and Carrera, J., 2012. A method for incorporating chemicals reactions into multiphase flow models for CO<sub>2</sub> injection. *EGU 2012, Geophysical Research Abstracts*, Vol. 14, Vienna, Austria, 22-27 April 2012.
17. Carrera, J., Silva, O., Rötting, T., Vilarrasa, V., Carbonell, R., Pérez-Estaún, A. and CIUDEN's research group, 2011. Instrumentation and monitoring techniques at the

- Hontomín CO<sub>2</sub> injection site (Spain). *2<sup>nd</sup> Spanish-French Symposium on Geological Storage of CO<sub>2</sub>*, Ponferrada, Spain, 24-26 October 2011.
18. Carrera, J., Cubillo, B., de Gaspari, F., Martínez, L., Rötting, T., Silva, O., Slooten, L. J. and Vilarrasa, V., 2011. Hydrological and hydrogeochemical characterization tests planned at the Hontomín CO<sub>2</sub> storage Technology Demonstration Plant (Spain). *2<sup>nd</sup> Spanish-French Symposium on Geological Storage of CO<sub>2</sub>*, Ponferrada, Spain, 24-26 October 2011.
  19. Vilarrasa, V., Olivella, S. and Carrera, J., 2011. Coupled hydromechanical processes during CO<sub>2</sub> sequestration in deep saline aquifers. *IV International Conference on Computational Methods for Coupled Problems in Science and Engineering*, Kos Islands, Greece, 20-22 June 2011.
  20. Vilarrasa, V., Olivella, S. and Carrera, J., 2011. Hydromechanical behaviour of the aquifer and caprock under high pressure injection. *6<sup>th</sup> Trondheim CCS Conference*, Trondheim, Norway, 14-16 June, 2011.
  21. Silva, O., Carrera, J. and Vilarrasa, V., 2011. An efficient injection concept for the geological storage of CO<sub>2</sub>. *6<sup>th</sup> Trondheim CCS Conference*, Trondheim, Norway, 14-16 June, 2011.
  22. Carrera, J., Silva, O., Rötting, T., Carbonell, R., Vilarrasa, V., Pérez-Estaún, A. and CIUDEN's Research Group, 2011. Characterization and working programme of Hontomin CO<sub>2</sub> injection site (Spain). Monitoring, hydrogeochemical characterization and injection tests. *6<sup>th</sup> Trondheim CCS Conference*, Trondheim, Norway, 14-16 June, 2011.
  23. Vilarrasa, V., Olivella, S. and Carrera, J., 2011. CO<sub>2</sub> Injection in deep saline sloping aquifers through a vertical well. *Proceedings of 3<sup>rd</sup> Workshop of CODE\_BRIGHT Users*, UPC, Barcelona, Spain, 2 June 2011.
  24. Vilarrasa, V., Olivella, S. and Carrera, J., 2011. Hydromechanical characterization test for CO<sub>2</sub> sequestration in deep saline aquifers. *EGU 2011, Geophysical Research Abstracts*, Vol. 13, Vienna, Austria, 3-8 April 2011.
  25. Jurado, A., de Gaspari, F., Vilarrasa, V., Sánchez-Vila, X., Fernández-García, D., Tartakovsky, D.M. and Bolster, D., 2010. A probabilistic risk assessment of groundwater-related risks at excavation sites. *2010 AGU Fall Meeting*, San Francisco, California, USA, 13-17 December 2010.
  26. Vilarrasa, V., Olivella, S. and Carrera, J., 2010. Effects of the initial stress state on the geomechanical stability of the caprock during CO<sub>2</sub> sequestration in deep saline aquifers. *1<sup>st</sup> French-Spanish Symposium on Geological Storage of CO<sub>2</sub>*, Pau, France, 22-24 November 2010.
  27. Vilarrasa, V., Olivella, S. and Carrera, J., 2010. Geomechanical stability of the caprock during CO<sub>2</sub> sequestration in deep saline aquifers. *10<sup>th</sup> International Conference on Greenhouse Gas Technologies*, Amsterdam, Netherlands, 19-23 September 2010.

28. Vilarrasa, V., Olivella, S. and Carrera, J., 2010. Caprock hydromechanical changes during CO<sub>2</sub> sequestration in deep saline aquifers. *XVIII International Conference on Computational Methods in Water Resources*, Barcelona, Spain, 21-24 June 2010.
29. Vilarrasa, V., Olivella, S. and Carrera, J., 2010. Coupled hydromechanical modelling of CO<sub>2</sub> injection in deep saline aquifers. *Proceedings of 1<sup>st</sup> Workshop on Advanced Scientific Results from IDAEA, CSIC*, Blanes, Barcelona, Spain, 9-11 June 2010.
30. Vilarrasa, V., Bolster, D., Olivella, S. and Carrera, J., 2010. Coupled hydromechanical modelling of radial CO<sub>2</sub> injection in deep saline aquifers. *Proceedings of 2<sup>nd</sup> Workshop of CODE\_BRIGHT Users*, UPC, Barcelona, Spain, 6-7 May 2010.
31. Vilarrasa, V., Bolster, D., Dentz, M., Olivella, S. and Carrera, J., 2010. Semianalytical solution for CO<sub>2</sub> plume and pressure evolution during injection of compressible CO<sub>2</sub> in deep saline aquifers. *Conference CCS Ready to go?*, Rotterdam, Netherlands, 19-22 April 2010.
32. Jurado, A., de Gaspari, F., Vilarrasa, V., Bolster, D., Sánchez-Vila, X., Fernández-García, D., Vázquez-Suñé, E. and Tartakovsky, D.M., 2009. Probabilistic risk analysis of groundwater related problems in subterranean excavations. *2009 AGU Fall Meeting*, San Francisco, California, USA, 14-18 December 2009 (Eos Trans. AGU, 90(52), Fall Meet. Suppl.).
33. Vilarrasa, V., Olivella, S. and Carrera, J., 2009. Coupled hydromechanical modeling of CO<sub>2</sub> sequestration in deep saline aquifers. *EGU 2009, Geophysical Research Abstracts*, Vol. 11, Vienna, Austria, 19-24 April 2009.
34. Vilarrasa, V., Vázquez-Suñé, E., Carrera, J., Jurado, A. and Pujades, E., 2008. A method for characterizing the hydraulic effectiveness of annular low-permeability enclosures. *Proceedings of the Symposium on Water and Infrastructures in Underground Media*, Barcelona, Spain, 24-26 November 2008, pp. 103-109.
35. Vilarrasa, V., Jurado, A., Vázquez-Suñé, E., Carrera, J. and Pujades, E., 2008. Modeling as a key element in the hydrogeological monitoring of the Spanish High Speed Train – Stretch La Torrassa - Sants. *Proceedings of the Symposium on Water and Infrastructures in Underground Media*, Barcelona, Spain, 24-26 November 2008, pp. 235-241.
36. Jurado, A., Pujades, E., Vilarrasa, V., Vázquez-Suñé, E. and Carrera, J., 2008. Development of a method for solving the drainage of excavations between diaphragm walls. *Proceedings of the Symposium on Water and Infrastructures in Underground Media*, Barcelona, Spain, 24-26 November 2008, pp. 55-61.
37. Pujades, E., Mascañano-Salvador, E., Jurado, A., Vilarrasa, V., Vázquez-Suñé, E. and Carrera, J., 2008. Detection of open joints in drained linear excavations. *Proceedings of the Symposium on Water and Infrastructures in Underground Media*, Barcelona, Spain, 24-26 November 2008, pp. 71-77.
38. Vilarrasa, V. and Carrera, J., 2008. Hydrogeology and civil engineering: the role of jet-grouting. *Workshop Challenges in Hydrogeology Modeling and Investigation*

*Techniques as Support for Groundwater Management and Protection*, Murighiol, Romania, 8-10 October 2008.

39. Koyama, T., Vilarrasa, V. and Jing L., 2006. Tracer transport in a rough rock fracture during shear – a numerical study. *Proceedings of the 2<sup>nd</sup> International Conference on Coupled T-H-M-C Processes in Geo-Systems: Fundamentals, Modeling, Experiments and Applications, GeoProc 2006*, Nanjing, China, 22-25 May 2006, pp. 575-580.

#### **Grant Support**

- Fellowship of the Spanish Ministry of Science and Innovation (MCI) “Formación de Profesorado Universitario” (FPU) Program for PhD thesis (24 July 2008 – 23 July 2012).
- Funding of the “Colegio de Ingenieros, Caminos, Canales y Puertos – Catalunya” (Spanish Civil Engineers Society) for complementing the PhD fellowship of the Spanish Ministry of Science and Innovation (MCI) (24 July 2008 – 23 July 2012).
- Scholarship of the Spanish Ministry of Education and Science (MEC) for developing tasks of teaching assistant and writing of a text book in the Department of Applied Mathematics III of the Civil Engineering School, Technical University of Catalonia, Barcelona, Spain (1 October 2003 – 31 July 2004).
- Scholarship of the Technical University of Catalonia for being a teaching assistant in the Department of Construction Engineering of the Civil Engineering School, Technical University of Catalonia, Barcelona, Spain (1 September 2003 – 30 June 2004).
- Erasmus Scholarship granted by the Technical University of Catalonia for attending courses and performing the M Sc thesis at the Royal Institute of Technology (KTH), Stockholm, Sweden (1 September 2004 – 30 June 2005).

#### **Participation in Scientific Projects**

- MUSTANG Project from the European Union's 7<sup>th</sup> Framework Programme FP7/2007-2013 under grant agreement nº 227286, [www.co2mustang.eu](http://www.co2mustang.eu).
- PANACEA Project from the European Union's 7<sup>th</sup> Framework Programme FP7/2007-2013 under grant agreement nº 282900, [www.panacea-co2.org](http://www.panacea-co2.org).
- Compostilla OXYCFB300 project of the European Union through the “European Energy Programme for Recovery”.

#### **Short Stays**

- Stay at the Department of Energy Resources Engineering of the Stanford University from 16 October to 17 December 2009.

#### **Teaching Services**

- Teaching assistant of the “Hydrogeology and Civil Engineering” master course, Technical University of Catalonia, Barcelona, Spain. The instructor of the course was Prof. Jesus Carrera (January 2011 – July 2011).
- Teaching assistant of the “Aquifer Mechanics” master course, Technical University of Catalonia, Barcelona, Spain. The instructor of the course was Prof. Jesus Carrera (January 2010 – July 2010).

### Reviewer of Scientific Journals

- Advances in Water Resources
- Bulletin of the Geological and Mining Institute of Spain
- Computers and Geosciences
- Energy and Fuels
- Engineering Geology
- Environmental Earth Sciences
- Environmental Science and Technology
- Hydrogeology Journal
- International Journal of Greenhouse Gas Control
- International Journal of Rock Mechanics and Mining Sciences
- Journal of Geophysical Research – Solid Earth
- Transport In Porous Media
- Water Resources Research

### Given seminars

- 'Thermo-Hydro-Mechanical Impacts of Geologic Carbon Storage in Deep Saline Formations', Earth Sciences Division's Modeling Forum, Lawrence Berkeley National Laboratory, Berkeley, California, USA, 3 April 2013.
- 'Hydromechanical Characterization for Site Selection in CO<sub>2</sub> Permanent Storage in Deep Saline Aquifers', UPC-CSIC Hydrogeology Group Seminar, Barcelona, Spain, 23 June 2011.
- 'Geomechanics in CO<sub>2</sub> Sequestration in Deep Saline Aquifers', UPC-CSIC Hydrogeology Group Seminar, Barcelona, Spain, 18 February 2010.
- 'Effects of CO<sub>2</sub> Compressibility on CO<sub>2</sub> Storage in Deep Saline Aquifers', SUPRI-B Group Seminar, Energy Resources Engineering Department, Stanford University, California, USA, 1 December 2009.
- 'Coupled Hydromechanical Modeling of CO<sub>2</sub> Sequestration in Deep Saline Aquifers', Seminar of the Hydrogeology Department, Earth Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, California, USA, 24 November 2009.
- 'Coupled Hydromechanical Modeling of CO<sub>2</sub> Sequestration in Deep Saline Aquifers', UPC-CSIC Hydrogeology Group Seminar, Barcelona, Spain, 5 February 2009.

### Collaboration in courses

- 'Examples of drainage between diaphragm walls' class in the master course 'Hydrogeology and Civil Engineering', UPC, Barcelona, Spain, 9 May 2011.
- 'CO<sub>2</sub> injection in a deep saline aquifer including mechanical interactions' class in the CO<sub>2</sub> Sequestration Modelling Course, Barcelona, Spain, 17-19 June 2010.
- 'Implementation of density and viscosity functions for CO<sub>2</sub>. Verification' class in the CO<sub>2</sub> Sequestration Modelling Course, Barcelona, Spain, 17-19 June 2010.
- 'Advective and non-advective fluxes. Multiphase flow and deformation. Two phase flow of water and CO<sub>2</sub>' class in the CO<sub>2</sub> Sequestration Modelling Course, Barcelona, Spain, 17-19 June 2010.
- 'Hydromechanical Coupling' class in the master course 'Aquifer Mechanics', UPC, Barcelona, Spain, 18 March 2010.

- 'Vadose Zone and Multiphase Flow' class in the master course 'Aquifer Mechanics', UPC, Barcelona, Spain, 11 March 2010.

#### **Professional Memberships**

- American Geophysical Union (AGU)
- American Rock Mechanics Association (ARMA)
- Spanish Civil Engineers Society (CICCP)

#### **Other Professional Experience**

- Head of Quality and Environment in the Technical Assistance of the construction of the Spanish High Speed Train in its arrival to Barcelona – Stretch Hospitalet - La Torrassa, in the company CYGSA, from August 2005 to August 2006.
- Head of Production in the construction of the connection and extension of the train stations of the Catalan Railways Sant Gervasi and Plaça Molina, Barcelona, in the company COMSA from September 2006 to September 2007.