LAVOISIER H_2 GEOCONSULT

PHREEQC TRAINING

Water-rock-gas interaction with H_2 generation

Numerical modeling

Coach: Eric C. Gaucher (PhD)

Classical course	Custom course
4 days	5 days
In-person	In-person

Your Objectives:

You are a geoscientist, hydro-geochemist, hydrogeologist or process engineer wishing to acquire skills in geochemical numerical modeling. You have a basic knowledge of chemistry, geochemistry and basic notions of thermodynamic.

Learn basic and advanced skills of numerical modeling water-rock-gas interaction systems and become familiar with the widely-used PHREEQC software package.

LH_2G has developed a special course for the simulation of H_2-generation in selected geological environments.

Our Training goal

- Quality control of water chemistry and correction of the chemical composition
- Calculate the speciation of an aqueous solution and simulate water/rock/gas interactions in open or closed batch systems.
- Model the evolution of fluid composition as a function of temperature, pressure and salinity changes
- Follow the chemical composition of a fluid during dissolution/precipitation of solid phases.
- Generate H_2 from various type of rocks

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Training programs

If you are in a different time zone, the training is divided into half-days.

Day 1:

Introduction to Phreeqc

- Phreeqc Program History
- Main keywords
- Databases (Phreeqc, LLNL, Thermoddem, etc.)

Case study: Water-rock interaction in the context of a French sparkling mineral water: Badoit.

- including hydrogen production from granite.

Day 2:

Case study: Petroleum and geothermal waters (Carbonate & Clastic systems)

- LH_2G Method for verifying and correcting reservoir water analyses with PHREEQC.
- Temperature correction, regasification, mineral equilibrium etc.

Day 3:

Case study: Caprock Complex Systems Minerals + Clay surface

- Equilibrium with complex mineral assemblage
- Ion exchange

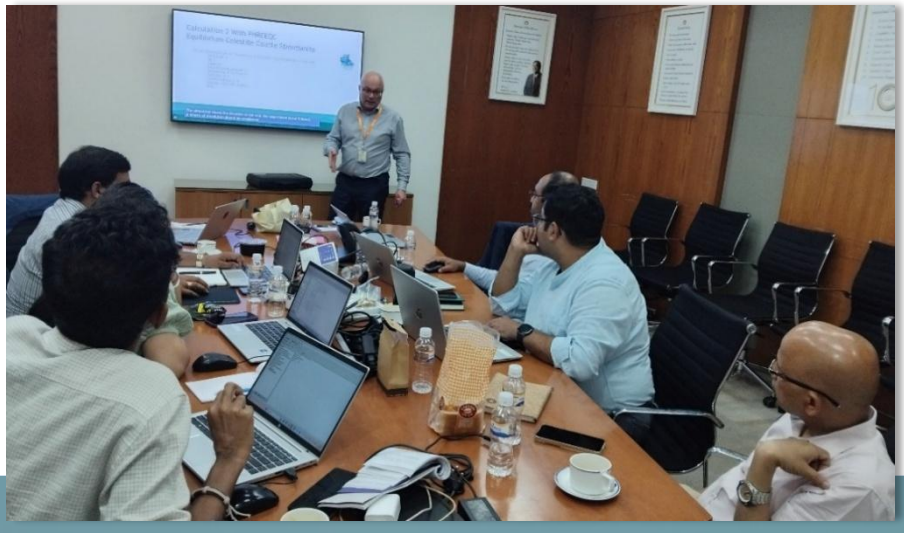
Day 4:

Case study: Source rock H_2 generation system

- Hydrothermal systems
- Serpentinization

Day 5: **Optional Custom course**

Develop your own model with the coach Dr. Eric Gaucher.



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Teaching resources

Case studies, exercises, and practical work on a variety of waters and H_2 generation systems.

Phreeqc: https://www.usgs.gov/software/phreeqc-version-3

Assessment methods: Measurement of progress throughout the course with exercises. The exercises become more complex to allow for a step-by-step approach.

Registration

Contact us to choose your training level. Quotation on request. **jean.gaucher@lavoisierH2.com**

For pedagogical reasons, we only organize in-person classes (In Chamonix, France or in your office).

Trainer

Training is provided by **Dr. Eric C. Gaucher**

Dr. Eric C. Gaucher: An expert geochemist in water-rock-gas interaction, Eric is a world leader in natural H_2 exploration, as leader of the Natural Hydrogen Task 49 of the International Energy Agency's Hydrogen TCP program. He was behind the discovery of natural hydrogen in the *Pyrénées-Atlantiques* region of France. This discovery has already given rise to 3 exploration licenses. A recognized researcher, Eric has published more than 130 articles in international journals (Nature Geoscience, Science Advances...) and has filed 3 patents. **A skilled teacher, he also received a Faculty Teaching Award from the University of Bern for the quality of his geochemistry training course on Phreeqc in April 2023.** He has been a member of the HNAT summit scientific advisory board in 2023 and 2024. **(Custom feedbacks)**

During his career with his team of researchers at BRGM, he developed a database for Phreeqc. THERMODDEM gathers the thermodynamic properties of mineral phases from wastes and natural environments, of aqueous species and of gases.

Blanc, P., Lassin, A., Piantone, P., Azaroual, M., Jacquemet, N., Fabbri, A., **Gaucher, E.C.** (2012) *Thermoddem: A geochemical database focused on low temperature water/rock interactions and waste materials.* Applied Geochemistry, 27 (10), pp. 2107-2116. 10.1016/j.apgeochem.2012.06.002

Debure M., Lassin A., Marty N. C., Claret F., Virgone A., Calassou S. and **Gaucher E. C.** (2019) *Thermodynamic evidence of giant salt deposit formation by serpentinization: an alternative mechanism to solar evaporation.* Scientific Reports. Vol. 9. P. 1-11. 10.1038/s41598-019-48138-9

Gaucher, E. C., Tournassat, C., Pearson, F. J., Blanc, P., Crouzet, C., Lerouge, C., & Altmann, S. (2009). A robust model for pore-water chemistry of clayrock. *Geochimica et Cosmochimica Acta, 73(21), 6470-6487.* 10.1016/j.gca.2009.07.021