

# GeoWell: Geochemical assessment of cement durability in the supercritical domain

Adeline Lach, L.J. Wasch, Philippe Blanc, Laurent André, P. Pipilikaki,  
Pierre Durst

## ► To cite this version:

Adeline Lach, L.J. Wasch, Philippe Blanc, Laurent André, P. Pipilikaki, et al.. GeoWell: Geochemical assessment of cement durability in the supercritical domain. German Geothermal Congress, Nov 2018, Essen, Germany. hal-01881780

HAL Id: hal-01881780

<https://hal-brgm.archives-ouvertes.fr/hal-01881780>

Submitted on 26 Sep 2018

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## GeoWell: Geochemical assessment of cement durability in the supercritical domain

A. Lach, L.J. Wasch, P. Blanc, L. André, P. Pipilikaki and P. Durst

Within the H2020 GeoWell project, that aims to develop reliable technologies for high-temperature geothermal wells ( $>400^{\circ}\text{C}$ ), it is necessary to assess the durability of cements under such thermal stress, especially regarding mineralogical evolution.

For modelling above  $300^{\circ}\text{C}$ , the geochemical database and modelling codes need to be extended. This starts by using the HKF model (1, 2), which computes standard molal thermodynamic properties (heat capacity, volume, Gibbs free energy) for aqueous species at temperature and pressure in the supercritical domain. In some cases, the parameters used in the model were determined by Sverjensky et al (3) correlation.

A tool was built allowing the calculation of a PHREEQC-V2 (4) database between 0 to  $600^{\circ}\text{C}$  along specific P-T profiles. After comparing the resulting calculations with literature data and other geochemical codes, we focussed on the selection of thermodynamic properties for the relevant cement mineral phases. This was done consistently with the IDDP1 (Iceland Deep Drilling Project) well cement samples analyses and the results of lab experiments. The PHREEQC-V2 calculations with the upgraded database allows predicting potential cement evolutions during temperature and pressure changes in term of mineral phase transitions and their effect on volume and water content.

*This research was performed within the EC Horizon 2020 project GeoWell “Innovative materials and designs for long-life high-temperature geothermal wells“ under the grant agreement No. 654497.*

### References:

- (1) Helgeson, H. C.; et al. Am. J. Sci. 1981, 281, 1249–1516 10.2475/ajs.281.10.1249.
- (2) Johnson, J.; et al. Comput. Geosci. 1992, 18 (7), 899–947 10.1016/0098-3004(92)90029-Q.
- (3) Sverjensky, D. A.; et al. Geochim. Cosmochim. Acta 1997, 61 (7), 1359–1412 10.1016/S0016-(4) 7037(97)00009-4.
- (4) Parkhurst, D. L.; Appelo, C. A. J. User’s Guide to PHREEQC (Version 2) : A Computer Program for Speciation, Batch-Reaction, One-Dimensional Transport, and Inverse Geochemical Calculations; U.S. Geological Survey, 1999.

