Caroline Darcel

Scientist, P. Eng

Expertise	Fractured Rocks Hydrogeology and Geomechanics
Education	2002, PhD (Hydrogéologie), University of Rennes, France
	1998, Master (Hydrogeology, Hydrology, Geochemistry et Geostatistics), Université of Paris VI, Jussieu, France
	1996, Bachelor (Mathematic/ Physics), University of Rennes, France,

Professional Experience

2022 – Present	Itasca Consultants s.a.s., Rennes, France, Deputy Manager
2018- Present	Joint Laboratory Fractory, Université de Rennes, France Co-director
2010– Present	Itasca Consultants s.a.s., Lyon puis Rennes, France, Principal engineer
2002 – 2010	Itasca Consultants s.a.s., Lyon France, Research Engineer, Project manager
1999- 2002	CNRS, Université de Rennes, France PhD student / research engineer

Project Experience

Site modeling and development of Discrete Fracture Network (DFN) models. Conceptual modeling based on data analysis for the sites investigated from the perspective of deep disposal of spent fuel, including, in Sweden, the Äspö Hard Rock Laboratory and the Simpevarp area, the Laxemar/Oskarshamn area and the Forsmark site area; the Revell site in Canada; and the Olkiluoto site in Finland. Analyses of fracture trace maps from tunnel walls, surface outcrops and large lineament maps. Analyses of core logging data from shallow to deep boreholes. Multiscale and stereological analyses.
Adaptation of the modeling process to combine stochastic, deterministic and genetic components of DFN models together with local conditioning at repository depth with core logging (flow and structural) and tunnel mapping.

Site DFN modeling in the mining context. DFN models developed for various open pit or underground mining projects, e.g. Las Bambas mine in Peru, the Kiruna mine in Sweden, the Ridgeway Deeps mine in Australia, etc. Linking DFN and primary fragmentation prediction.

Flow and contaminant transport in fractured rocks for deep disposal safety assessment. Interpretations of flow logs (e.g. Posiva flow-logs) to select and calibrate DFN model properties. Flow and transport simulations. Interpretations of tracer test breakthrough curves. Flow channeling.

Impact of in-situ stresses on the rock mass permeability. Conceptual understanding Evaluation of the hydromechanical coupling term through the link between fracture transmissivity and stress state – the Permecability project. Application to local scenarios (tunnel vicinity), and regional scenarios (permeability depth dependency).

Rock mass mechanical properties from a DFN approach. Development of a quantitative and DFN based framework to predict effective elastic and strength properties of a rock mass, including stress spatial heterogeneity, size scale and anisotropy effects.

From DFN to Equivalent Continuous Medium representation. Methodological development of geometrical and flow-based upscaling and evaluation of the limits/biases of ECM approach when applied to fractured rocks.

DFN based modeling of a fault zone in the context of fracture reactivation and induced seismicity. Conceptual modelling and numerical interpretation.

DFN and Rock mechanical modelling methodology development of use in the Swedish program for deep disposal. Collaborative work with an international team and SKB.

A discrete fracture network modelling (DFN) framework to study sensitivity of fracture transmissivity under seismic triggering. Data interpretation and 3DEC based numerical modelling to study dynamically the role of pressure diffusivity and HM coupling during and after an earthquake.

Conceptual and numerical modeling of a rock mass and stress model, from a combined deterministic and stochastic DFN based geological model. The target model dimensions are about 5x5 km laterally and 1 km in depth. The project is lead in the context of a deep geological repository.