

# Alejandro Cardona

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## I. EDUCATION

Ph.D. 2020	Energy Resources and Petroleum Engineering	KAUST, Saudi Arabia
MSc. 2016	Earth Sciences and Engineering	KAUST, Saudi Arabia
BSc. 2015	Petroleum Engineering	UNAL, Colombia

## II. EMPLOYMENT

11/2020-Present	Postdoctoral Fellow	UT Austin, USA
08/2015-10/2020	Graduate Research Assistant	KAUST, Saudi Arabia
07/2014-01/2015	Wellbore Stability Intern	Equion Energia, Colombia
08/2013-06/2014	Research Assistant	UNAL, Colombia

## III. PUBLICATIONS

### Theses

- Cardona A. (2020). Fluid Transport in Fractured Carbonate Rocks, PhD Dissertation, KAUST.
- Cardona A. (2014). Software Construction to Generate Mechanical Earth Models from Well Logs, Engineering Thesis, UNAL (Universidad Nacional de Colombia), Colombia (in Spanish).

### Publications (referred journals)

1. Cardona A., and Santamarina J.C. (2021), Immiscible Fluid Displacement in Fractured Media, *Water Resources Research*, under review.
2. Cardona A., Finkbeiner T. and Santamarina J.C. (2021), Natural Rock Fractures: From Aperture to Fluid Flow, *Rock Mechanics and Rock Engineering*, in press, doi: 10.1007/s00603-021-02565-1.
3. Cardona A. and Santamarina J.C. (2020), Carbonate rocks: Matrix permeability estimation, *AAPG Bulletin*, v.104 (1), p 131-144 doi: 10.1306/05021917345.

### Others (technical reports, book chapters, and conferences)

1. Price A., Flemings P., Thomas C., Cardona A., Murphy Z., Garcia A., Savage A., Houghton J., and Pettigrew T. (2021). GOM2 Pressure Coring Tool with Ball Valve (PCTB) Land Test III Report.
2. Cardona A., Finkbeiner T. and Santamarina J.C. (2020). Numerical Study of Fractured Reservoirs: Hydromechanical Analysis of the Permeability Tensor. *Extended Abstract, 4<sup>th</sup> Naturally Fractured Reservoir Workshop*, Ras Al Khaimah, UAE.
3. Santamarina J.C., Park J., Terzariol M., Cardona A., Castro G., Cha W., Garcia A., Hakiki F., Lyu C., Salva-Ramírez M., Shen Y., Sun Z., Chong S.H. (2019). Soil Properties: Physics Inspired, Data Driven, in: *Lu N., Mitchell J. (eds) Geotechnical Fundamentals for Addressing New World*

*Challenges*, Springer Series in Geomechanics and Geoengineering, Springer, doi: 10.1007/978-3-030-06249-1\_3.

4. Araujo E., Alzate, G., Arbelaez A., Cardona A., Pena S., Naranjo A. (2014). Analytical Prediction Model of Sand Production Integrating Geomechanics for Open Hole and Cased Hole – Perforated Wells. SPE 171107-MS. *Conference Paper presented at SPE Heavy and Extra Heavy Oil Conference: Latin America*, Medellin, Colombia, 24-26 September.

#### **Publications in preparation (based on completed research)**

1. Cardona A., Fang Y., O’Connell J., and Flemings P.B., Triaxial device for hydrate-bearing sediment pressure cores: validation of hydro-geomechanical properties (*to be submitted to Energies*)
2. Cardona A., Liu Q., and Santamarina J.C., Numerical Study of Capillary Pressure Curves for Single Fractures (*to be submitted to Geophysical Research Letters*)
3. Cardona A., Santamarina J.C., A Simple Device to Measure Matrix Permeability (*to be submitted to Geotechnical Testing Journal*)
4. Cardona A., Finkbeiner T., Santamarina J.C, Numerical Study of Fractured Reservoirs: Hydromechanical Analysis of the Permeability Tensor (*to be submitted to Journal of Rock Mechanics and Mining Sciences*)

#### **IV. TEACHING EXPERIENCE**

##### **Teaching Assistantships**

- Experimental Methods for Research & Digital Signal Processing, *Summer 2020*, KAUST
- Rock Mechanics for Energy Geo-Engineering, *Fall 2019*, KAUST
- Well logging, *Spring and Fall 2013*, UNAL

##### **Conference Presentations**

- Capillarity vs. Saturation in Fracture-Matrix Systems. *InterPore 2020, Online Format*
- Numerical Study of Fractured Reservoirs: Hydromechanical Analysis of the Permeability Tensor. *4th EAGE Workshop on Naturally Fractured Reservoirs, 2020, Ras Al Khaimah, United Arab Emirates*

##### **Poster Presentations**

- The Hydro-Mechanical Response of a Single Carbonate Fracture. *International Petroleum Technology Conference IPTC, 2020, Dhahran, Saudi Arabia*
- Matrix Permeability in Carbonate Rocks. *KAUST Research Conference: Recovery of Difficult Hydrocarbons, 2018, Thuwal, Saudi Arabia*

##### **Invited speaker**

- Flow Phenomena in Geomaterials: Unraveling Processes and Behavior, UTIG, September 2021. <https://youtu.be/95oTnqe4yt8>

## V. RESEARCH PROJECTS

### Main Project for Post-doctoral Studies

- Deepwater Methane Hydrate Characterization in the Gulf of Mexico: Scientific Assessment and Production Potential (2015~2024)  
*Source:* DOE (DE-FE0023919)  
*PI:* Dr. Peter B. Flemings  
*Contribution:* research, progress reports, and presentations

### Academic Consulting Projects

- Hydromechanical Response of Fractured Carbonates (2016~2019)  
*Source:* Saudi Aramco - EXPEC ARC  
*PIs:* Dr. J. Carlos Santamarina and Dr. Thomas Finkbeiner  
*Contribution:* research, progress reports, and presentations

## VI. RESEARCH BACKGROUND – DEVICES AND METHODS

### Experimental Devices – Design, Construction, Operation

*(contributed in initiating/developing experimental hardware for laboratories)*

- Effective stress chamber for hydrate-bearing sediments at in-situ fluid pressure
- Matrix permeameter forunjacketed rock specimens
- Torsional shear and radial flow for pre-fractured specimens
- Large scale 2D flow sandbox model with optical measurements
- Micromodel fabrication using soft lithography with pressure and optical instrumentation

### Rock Physics and Geomechanics - Testing Experience

- Manipulation and testing of natural hydrate-bearing sediments under pressure and temperature
- High Pressure High Temperature: Core Flooding, Triaxial System, and Contact Angle and Interfacial Tension
- Mercury Intrusion Porosimetry (MICP)
- Surface Roughness by Interferometry

### Scientific Instruments - Training and Operation

- X-Ray Diffractometer (Rigaki Miniflex at EGEL Laboratory)
- X-Ray Computer Tomography (Tescan XRE)
- Nuclear Magnetic Resonance (Oxford Instruments, 12 MHz)
- Scanning Electron Microscopy SEM (Quanta 600 at KAUST Corelab)
- Gas Sorption Specific Surface (Micromeritics ASAP 2420)
- Mercury Porosimeter (Micromeritics AutoPore IV)
- White Light Interferometer (Nanovea ST400 and Nanovea JR25)
- Soft Lithography: Mask Maker (Heidelberg  $\mu$ PG501), Mask Aligner (EVG 6200), Plasma Cleaner (Plasma Etch PE-50)

## **Analytical and Numerical Tools**

- High level programming languages: Matlab, Mathcad, Mathematica
- Petroleum engineering software: GMI-Suite, Fracman, CMG, Eclipse, Petrel, Interactive Petrophysics, Fracman, Techlog, Matlab Reservoir Simulation Tool MRST
- FEM Software: COMSOL
- Image visualization: ImageJ
- Drawing and CAD software: Solidworks, AutoCAD

## **VII. HONORS AND AWARDS**

- 08/2015-10/2020           KAUST Fellowship for MS and PhD studies
- 01/2015                   Fellowship 4th Annual International Poster Research Competition
- 09/2013                   1st Place in Petro Cup SPE. XV Colombian Congress of Oil and Gas

## **VIII. SERVICE**

### **Journal Article Reviewer**

- Geophysical Research Letters
- Rock Mechanics and Rock Engineering

### **Conference Organization**

- Technical support and organization of the proceedings in form of annotated slides, *KAUST Athenaeum on Dissolution and Precipitation Implications for Energy Geo-Engineering, Feb 2016*

### **Membership in Professional Organizations**

- American Geophysical Union (AGU)
- The International Society for Porous Media (Interpore)
- Society of Petroleum Engineers (SPE)
- American Association of Petroleum Geologists (AAPG)
- European Association of Petroleum Geoscientists (EAGE)

## **IX. OTHERS**

### **Certificates**

- Laboratory Safety Trainings: chemical spills, cleanroom, compressed gas, emergency incident preparedness, fume hood, hazardous waste, laser, liquid nitrogen, pressurized vessel, radiation (KAUST)

### **Languages**

- Spanish (native speaker)
- English (full proficiency)