

## **ESTIBALITZ UKAR**

University of Texas at Austin, Jackson School of Geosciences, Bureau of Economic Geology  
10100 Burnet Road, Austin TX 78758

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### **PROFESSIONAL EXPERIENCE:**

- 2013–present    Research Associate, Bureau of Economic Geology, The University of Texas at Austin
- 2011–2013      Research Associate, Division of Physical Sciences, American Museum of Natural History
- 2011–2013      Postdoctoral Fellow, Bureau of Economic Geology, The University of Texas at Austin
- 2010–2011      Visiting Assistant Professor of Petrology, Colorado College

### **EDUCATION:**

B.Sc,	2003	Universidad del País Vasco (Spain)	Geology (tectonics)
Ph.D.,	2010	The University of Texas at Austin	Geological Sciences
TASSEP	2001–2002	The University of Texas at Austin	Geological Sciences

### **RESEARCH INTERESTS:**

Combining microstructural analysis and large-scale deformation characterization to understand the structural-diagenetic evolution of naturally fractured rocks; structural diagenesis of carbonate, shale, and sandstones; application of electron beam instruments to microtextural analysis of fracture fill; structural modeling of reservoir-scale structures in fold-and-thrust belts; metamorphic and structural evolution of subduction zones.

### **EXTERNAL RESEARCH FUNDING (SINCE 2016)**

- Lead Carbonate Initiative for Fracture Application and Research Consortium (total consortium income ~\$650,000 per year)
- 2018-2019: Principal Investigator: Structural-diagenetic characterization of natural fractures in the Lajas Formation, Neuquén Basin, Argentina, YPF S.A. Argentina (\$231,813.31)
- 2016-2018: Co-Principal Investigator: Formation mechanism of paleokarst in the Ordovician carbonates in the Halahatang area, Tarim Basin, China, CNPC USA Corporation (\$895,012.80)

### **HONORS AND AWARDS**

- 2015 The American Association of Petroleum Geologists Award of Excellence “Top 10” Poster Presentation
- 2015 GDL Foundation Fellowship Grant, Structural Diagenesis research
- 2012 GDL Foundation Fellowship Grant, Structural Diagenesis research
- 2009 R.L. Folk/E.F. McBride Petrography Award, Jackson School of Geosciences, the University of Texas at Austin

- 2008 Texas Exes Teaching Award, The Senate of College Councils, The University of Texas at Austin
- 2004-2007 full Predoctoral Scholarship for the Education of Future Researchers from the Basque Government, Spain
- 2006, Geological Society of America Research Grant
- 2001, TASSEP (US-EU Sciences) Scholarship from the BBK (Bilbao Bizkaia Kutxa), Spain

## **PUBLICATIONS**

### *Peer-reviewed*

- Ukar, E., Lopez, R.G., Hryb, D., Gale, J.F.W., Manceda, R., Fall, A., Brisson, I., Hernandez, E., Weger, R., Marchal, D., and Zanella, A., 2019, Natural fractures in the Vaca Muerta Formation: from core and outcrop observations to subsurface models. AAPG Memoir 120, Chapter 14, in press.
- Ferraro, F., Agosta, F., Ukar, E., Grieco, D. S., Cavalcante, F., Belviso, C., and Prosser, G., Structural diagenesis of carbonate fault rocks exhumed from shallow crustal depths: an example from the central-southern Apennines, Italy. *Journal of Structural Geology*, v. 122, 58–80.
- Ukar, E., Laubach, S.E., and Hooker, J. N., Outcrops as guides to subsurface natural fractures: example from the Nikanassin Formation tight-gas sandstone, Grande Cache, Alberta Foothills, Canada. *Marine and Petroleum Geology*, v. 103, 255–275.
- Ukar, E., Lopez, R. G., Laubach, S. E., Gale, J.F.W., and Manceda, R., 2017, Microfractures in bed-parallel veins (beef) as predictors of vertical macrofractures in shale: Vaca Muerta Formation, Agrio Fold-and-Thrust Belt, Argentina. *Journal of South American Earth Sciences*, v. 79, 152–169.
- Ukar, E., Lopez, R. G., Laubach, S. E., Manceda, R., and Gale, J.F.W, 2017, New type of kinematic indicator in bed-parallel veins, Late Jurassic-Early Cretaceous Vaca Muerta Formation, Argentina: E-W shortening during Late Cretaceous vein opening. *Journal of Structural Geology*, v. 104, 31–47.
- Fall, A., Ukar, E., and Laubach, S. E., 2016, Origin and timing of Dauphine twins in quartz cement in fractured sandstones from diagenetic environments: insight from fluid inclusions. *Tectonophysics*, v. 687, 195–209.
- Ukar, E., and Laubach, S. E., 2016, Syn- and postkinematic cement textures in fractured carbonate rocks: Insights from advance cathodoluminescence imaging. *Tectonophysics*, v. 690, 190–205.
- Ukar, E, Laubach, S. E., and Marrett, R., 2016, Quartz c-axis orientation patterns in fracture cement as a measure of fracture opening rate and a validation tool for fracture pattern models. *Geosphere*, v. 32 (2), 400–437.
- Ukar, E., Ozkul, C., and Eichhubl, P., 2016, Fracture abundance and strain in folded Cardium Formation, Red Deer River anticline, Alberta Foothills, Canada. *Journal of Marine and Petroleum Geology*, v. 76, 210–230.

- Ukar, E., and Cloos, M., 2016, Graphite-schist blocks in the Franciscan mélangé, San Simeon, California: Evidence for high-pressure metamorphism: *Journal of Metamorphic Geology*, v. 34, 131–208.
- Ukar, E., and Cloos, M., 2015, Magmatic origin of low-T mafic blueschist and greenstone blocks from the Franciscan mélangé, San Simeon, California. *Lithos*, v. 230, 17–29.
- Ukar, E., and Cloos, M., 2014, Low-temperature blueschist-facies mafic blocks in the Franciscan mélangé, San Simeon, California: Field relations, petrology, and counterclockwise P-T paths. *Geological Society of America Bulletin*, v. 126, no. 5/6, 831–856.
- Ukar, E., and Cloos, M., 2013, Actinolitic rinds on low-T mafic blueschist blocks in the Franciscan shale-matrix mélangé near San Simeon: Implications for metasomatism and tectonic history. *Earth and Planetary Science Letters*, v. 377-378, 155–168.
- Ukar, E., Cloos, M., and Vasconcelos, P., 2012, First <sup>40</sup>Ar-<sup>39</sup>Ar ages from low-T blueschist blocks in the Franciscan mélangé near San Simeon: Implications for initiation of subduction. *Journal of Geology*, v. 120, 543–556.
- Ukar, E., 2012, Tectonic significance of low-temperature blueschist blocks in the Franciscan mélangé at San Simeon, California. *Tectonophysics*, v. 568-569, 154–169.

#### *Guidebooks*

- Ukar, E., Gale, J.F.W., and Baques, V., 2016, Fractures and Faults in Cretaceous carbonates, Canyon Lake Gorge, Comal County, Texas, Fracture Research and Application Consortium Meeting, Lost Pines, Texas, 20–22 September.
- Gale, J.F.W., Marrett, R., and Ukar, E., 2014, Fracture spatial organization field workshop, Pedernales Falls State Park, Fracture Research and Application Consortium Meeting, Texas Hill Country, 14–17 September.
- Ukar, E., Fermor, P., and Eichhubl, P., 2013, Fractured unconventional reservoirs in the Alberta Foothills, Canada: Guidebook for the FRAC IA Consortium Annual Meeting September 12–14, 2013 Field Trip, with contributions by D. Meloche and R. Marrett 59 pp.

#### *Extended abstracts*

- Ukar, E., Lopez, R. G., Gale, J. F. W., and Manceda, R., 2019, Outcrop to core comparison of natural fractures in the Vaca Muerta Formation, Argentina. To be presented at Sixth EAGE Shale Workshop, 28 April–2 May, 2019, Bordeaux, France.
- Gale, J. F. W., Ukar, E., and Laubach, S. E., 2018, Gaps in DFN models and how to fill them. 2nd International Discrete Fracture Network Engineering Conference, American Rock Mechanics Association, no. DFNE 18-857, Seattle, Washington, USA, 20–22 June 2<sup>nd</sup>, 9 p.
- Ukar, E., Lopez, R.G., Fall, A., Manceda, R., Gale, J. F. W., and Laubach, S. E., 2017, Vertical fractures and a new type of kinematic indicator in bed-parallel veins (beef) at Arroyo Mulichinco, Neuquen Basin, XX Congreso Geológico Argentino Extended Abstracts, p. 163–165.

*Conference abstracts*

- Eichhubl, P., Gale, J. F. W., Laubach, S.E., Fall, A., and Ukar, E., 2019, What Drives the formation of natural fractures in unconventional reservoirs? AAPG ACE, San Antonio, May 19–22.
- Stefano, G. D., Ferraro, F., Agosta, F., Ukar, E., Cavalcante, F., Belviso, C., and Prosser, G., 2018, Diagenetic evolution of carbonate fault rocks associated to extensional normal faults of central and southern Apennines. 2018 Meeting of the Italian Geological Society, Catania, Italy, 12–14 September.
- Cloos, M., and Ukar, E., 2017, Tectonic flow mélange and olistostromes in the Franciscan Complex: which is more abundant? Geological Society of America Abstracts with Programs. v. 49, No. 6, doi: 10.1130/abs/2017AM-301300.
- Baques, V., Ukar, E., Zhang, L., Yuan, W., Laubach, S. E., Forstner, S., Fall, A., and Sun, C., 2017, Decameter-scale bit drops at 7 km depth in the Yijianfang Formation, Halahatang Oilfield, Tarim Basin, China: Fault-related deep-seated dissolution, Geological Society of America Abstracts with Programs. v. 49, No. 6, doi: 10.1130/abs/2017AM-305841.
- Elliott, S., Fisher, D. M., Ukar, E., Ramirez, G., and Forstner, S., 2017, Slip behavior of a subduction zone: preliminary inferences from quartz and calcite filled veins (hydrofractures) in an exhumed accretionary wedge, Shimanto belt, Japan. Geological Society of America Abstracts with Programs. v. 49, No. 6, doi: 10.1130/abs/2017AM-306581
- Fall, A., Ukar, E., Lopez, R. G., Gale, J. F. W., Manceda, R., and Laubach, S.E., 2017, Combined effects of overpressure and bed-parallel contraction on the formation of bed-parallel and vertical fractures in the Vaca Muerta Formation, Argentina. Geological Society of America Abstracts with Programs. v. 49, No. 6, doi: 10.1130/abs/2017AM-301560
- Fall, A., Ukar, E., Lopez, R. G., Gale, J. F. W., Manceda, R., and Laubach, S.E., 2017, Bed-parallel beef veins and cross-cutting vertical fractures in the Vaca Muerta Formation, Argentina: a fracture opening and cementation history. ECROFI 2017, Nancy, France.
- Fall, A., Ukar, E., Lopez, R.G., Gale, J. F. W., Manceda, R., and Laubach, S. E., 2017, Timing of opening and cementation of bedding-parallel and vertical fractures, Vaca Muerta Formation, Argentina. AAPG Annual Meeting, Houston, March 2-5, 2606490.
- Ukar, E., Lopez, R.G., Fall, A., Manceda, R., Gale, J. F. W., and Laubach, S. E., 2017, New type of kinematic indicator in bedding-parallel veins and vertical fracture abundance and timing in Vaca Muerta Formation, Argentina. AAPG Annual Meeting, Houston, March 2-5, 2608925.
- Gale, J. F., Ukar, E., Wang, Q., and Elliott, S. J., 2016, Bedding-parallel fractures in shales, Search and Discovery Article #90259, 2016 AAPG Annual Convention and Exhibition, Calgary, Alberta, Canada, June 19-22.
- Ukar, E., Laubach, S. E., and Marrett, R., 2016, How to measure fracture opening rates using quartz c-axis orientations. EBSD 2016, Tuscaloosa, Alabama, May 24-26.
- Cloos, M., and Ukar, E., 2015, Blueschist blocks in the sale-matrix mélange and San Simeon, California: Metamorphism, deformation, age: Geological Society of America Annual Meeting, Baltimore, 1-4 Nov.

- Cloos, M., and Ukar, E., 2015, Blueschist blocks in the shale-matrix mélange of the Franciscan Complex of California: Metamorphic aureoles and subduction channel upwelling, Geoprisms Meeting, California, Oct 12-14.
- Fall, A., Ukar, E., and Laubach, S. E., 2015, Dauphiné twin planes in quartz trap fluid inclusions and indicate paleosress in tight-gas sandstone reservoirs: European Current Research on Fluid Inclusions (ECROFI-XXIII), Leeds-UK, 27-29 June.
- Gale, J. F. W., Ukar, E., Elliott, S., and Wang, Q., 2015, Bedding-parallel fractures in shales: characterization, prediction and importance (abs.): AAPG Annual Meeting, Denver, Colorado, 31 May-3 June.
- Cloos, M., and Ukar, E., Blueschist blocks in the shale-matrix mélange of the Franciscan Complex of California: Metamorphic Aureoles and Subduction Channel Upwelling. Presented at EGU General Assembly 2014, Vienna, Austria, 27 April-2 May.
- Ukar, E., Laubach, S. E., Fall, A., and Eichhubl, P., Synkinematic quartz cementation in partially open fractures in sandstones. Presented at EGU General Assembly 2014, Vienna, Austria, 27 April-2 May.
- Ukar, E., Ozkul, C., Eichhubl, P., and Fall, A., 2014, Structural-diagenetic evolution of fractures in folds: Nikanassin and Cardium Formations, Alberta Foothills, Canada: to be presented at American Association of Petroleum Geologists Annual Convention and Exhibition, Houston, Texas, 7-9 April
- Ukar, E., Laubach, S.E., Fall, A., and Eichhubl, P., 2014, Synkinematic quartz cementation in partially open fractures in sandstones: to be presented at the European Geophysical Union General Assembly, Vienna, Austria, 27 April-2 May
- Cloos, M., and Ukar, E., 2014, Blueschist blocks in the shale-matrix mélange of the Franciscan Complex of California: Metamorphic aureoles and subduction channel upwelling: to be presented at the European Geophysical Union General Assembly 2014, Vienna, Austria, 27 April-2 May
- Cloos, M., and Ukar, E., 2013, Subduction channels and the incorporation of blueschist blocks in the shale-matrix mélange of the Franciscan Complex of California, Geological Society of America Bulletin Abstracts with Programs, v. 45, p. 886.
- Ukar, E., Eichhubl, P., Fall, A., Structural-diagenetic evolution of fractures in folds: A TGS example from the Alberta Foothills, Canada (abs): Goldschmidt Conference 2013, Italy, Mineralogical Magazine, v. 77, p. 2375.
- Ukar, E., Eichhubl, P., Fall, A., and Hooker, J.N, 2013, Outcrop to core comparison of natural fractures in a tight gas sandstone reservoir, Alberta Foothills, Canada (abs): American Association of Petroleum Geologists Annual Convention and Exhibition, Pittsburgh, Pennsylvania, May 19-22, Search and Discovery Article #90163.
- Ukar, E., Eichhubl, P., Fall, A., and Hooker, J. N., 2013, Structural-Diagenetic Controls on Fracture Opening in Tight Gas Sandstone Reservoirs, Alberta Foothills: European Geosciences Union General Assembly 2013, Vienna, Austria, 07–12 April 2013, Geophysical Research Abstracts, v. 15, EGU2013-13327.

- Ukar, E., Eichhubl, P., Fall, A., and Hooker, J. N., 2012, Structural-diagenetic controls on fracture opening in tight gas sandstone reservoirs, Alberta Foothills, Canada: AGU Fall Meeting, San Francisco, California, 3-7 Dec.
- Ukar, E. and Cloos, M., 2011, P-T-t paths and tectonic history of low-T blueschists from the Franciscan mélangé, San Simeon, California, Abstract presented at 2011 Fall Meeting, AGU, San Francisco, Calif., 5-9 Dec. (poster presentation).
- Hooker, J.N., Eichhubl, P., Xu, G., Ahn, H., Fall, A., Hargrove, P., Laubach, S., and Ukar, E., 2011, Effects of fracture reactivation and diagenesis on fracture network evolution: Cambrian Eriboll Formation, NW Scotland, Abstract presented at 2011 Fall Meeting, AGU, San Francisco, CA., 5-9 Dec. (poster presentation)
- Cloos, M., and Ukar, E., 2010, Subduction initiation along the California plate margin: Timing and thermal evolution of the Franciscan Complex: Geological Society of America v. 42, No 5 (oral presentation).
- Ukar, E., and Cloos, M., 2010, Tectonic evolution of blueschist-facies blocks in the Franciscan mélangé at San Simeon, California: Insights into subduction zone evolution: Geological Society of America International Meeting: Tectonic Crossroads, Ankara, Turkey, October 4-8, 2010 (oral presentation).
- Ukar, E., and Cloos, M., 2009, Mafic blueschist and associated graphite-schist blocks in the Franciscan Mélangé, San Simeon, California: Geological Society of America Abstracts with Programs, v. 41, No. 7, p. 590 (oral presentation).
- Ukar, E., and Cloos, M., 2008, Origin and metamorphism of blueschist blocks in the Franciscan Mélangé, San Simeon, California: Geological Society of America Abstracts with Programs, v. 40, No. 6, p. 205 (oral presentation).
- Ukar, E., and Cloos, M., 2007, Petrology of blueschist and graphite-schist blocks from the Franciscan Mélangé, San Simeon, California: Geological Society of America Abstracts with Programs, v. 39, No. 6, p. 394 (poster presentation).

## **INVITED TALKS**

- Ukar, E., Lopez, R.G., Gale, J. F. W., Fall, A., Manceda, R., and Hryb, D., 2019, The “beefy” Dead Cow: Natural Fractures in the Vaca Muerta Formation, Argentina. Imperial College, UK, May 8<sup>th</sup>.
- Ukar, E., Lopez, R.G., Gale, J. F. W., Fall, A., Manceda, R., and Hryb, D., 2019, Are Vaca Muerta Formation outcrops good guides to subsurface natural fractures? Aix-Marseille Université, France, May 3<sup>rd</sup>.
- Ukar, E., Lopez, R.G., Gale, J. F. W., Fall, A., Manceda, R., and Hryb, D., 2019, Characteristics, mechanisms, and timing of natural fractures in the Vaca Muerta Formation, Argentina. RWTH Aachen, Germany, April 25<sup>th</sup>.
- Ukar, E., Laubach, S. E., and Marrett, R., 2016, How to measure fracture opening rates using quartz c-axis orientations. EBSD 2016, Tuscaloosa, Alabama, May 24–26.
- Ukar, E., Laubach, S. E., and Gale, J. F. W., 2015, Synkinematic and postkinematic cementation of fractures in carbonate reservoirs: implications for porosity preservation. 77th EAGE

Conference and Exhibition, Workshop on Carbonate diagenesis and fractures – Controls on reservoir quality, Madrid, Spain, 1–4 June.

Elliott, S., and Ukar, E., 2015, Cathodoluminescence applications using a Zeiss Sigma field emission SEM, Texas Society for Microscopy Annual Meeting, Austin, Texas, February.

Cloos, M., and Ukar, E., 2014, Blueschist blocks in the shale-matrix mélangé of the Franciscan Complex of California: Metamorphic aureoles and subduction channel upwelling. GSA Annual Meeting, Vancouver, British Columbia, 19–22 October.

Ukar, E., Eichhubl, P., Fall, A., and Hooker, J. N., 2014, Distribución y características de fracturas naturales en reservorios siliciclásticos, Alberta, Canadá. Meeting de la Asociación Mexicana de Geólogos Petroleros, Villahermosa, México, 26 March.

### **SYNERGISTIC ACTIVITIES**

- 2019–present: AAPG Associate Editor
- 2019–present: Jackson School of Geosciences (JSG) Solid Earth & Tectonic Processes Division Lead
- 2019: AAPG Memoir 120 Chapter 14 Coordinator, Natural fractures in the Vaca Muerta Formation
- 2019: Session Chair, Vaca Muerta play: an integrated view, ICE Buenos Aires
- 2014–present: Zeiss Sigma FE-SEM, lab PI
- 2016–present: Sedimentology Laboratory, PI

### **MEMBERSHIPS IN PROFESSIONAL SOCIETIES:**

American Association of Petroleum Geoscientists

Geological Society of America

Mineralogical Society of America

European Association of Geoscientists and Engineers

European Association of Geochemistry