

TIZIANA VANORIO

ASSOCIATE PROFESSOR

Department of Earth and Planetary Sciences

by courtesy Civil and Environmental Engineering and Geophysics

Stanford University

tvanorio@stanford.edu**ACADEMIC HISTORY**

- 2010 *Qualified to be appointed to full professor (Qualification aux fonctions de professeur des universités)*, Université de Nice Sophia Antipolis (France)
- 2008 *Habilitation à diriger des recherches (HDR)*, Formal qualification (post-degree thesis) to supervise research and hold a professorship position, Université de Nice Sophia Antipolis (France)
- 1998 Ph.D. Geophysics and Volcanology, University of Naples Federico II (Italy)
- 1992 B.S. and M.S. (Honors) Geological Science, University of Naples Federico II (Italy)

ACADEMIC AND ADMINISTRATIVE APPOINTMENTS

- 2020-pres Sr. Associate Dean for Educational Affairs
- 2019-pres. Associate Professor, Geophysics Department, Stanford University
- 2013-2019 Assistant Professor, Geophysics Department, Stanford University
- 2010 Invited Professor, Center for Carbonate System and Reservoir Geology, Université de Provence Aix Marseille (France)
- 2005–2013 Senior Research Scientist, Geophysics Department, Stanford University
- 2002–2005 CNRS Researcher, Géosciences Azur, Université de Nice Sophia Antipolis (France)
- 1999–2001 Post-doctoral Researcher, Geophysics Department, Stanford University

UNIVERSITY AND PROFESSIONAL SERVICE**University Service (past 7 years)**

- 2021-pres Accreditation Advisory Committee
- 2021-pres Summer Programs Committee
- 2021-pres. VPUE Undergraduate Advisory Council
- 2021-pres. University Post-Baccalaureate committee
- 2021-pres. Digital Education Strategy Group
- 2021-pres. University First Year Governance Board (*ex officio*)
- 2021-pres. SE3, Jr. Faculty Mentoring Program
- 2020-pres University Committee on Health and Safety
- 2020-pres. Sr. Associate Dean for Educational Affairs
- 2019-2020 Geophysics, Associate Director Graduate Studies
- 2018-2019 University, NanoFacility Design Committee, Stanford Long-Range Planning
- 2018-2019 Geophysics, Graduate Admission Committee
- 2017 Invited speaker for Classes Without Quizzes, Reunion Homecoming Weekend, Stanford Alumni Association
- 2017-2018 Geophysics Faculty Search Committee
- 2016-2017 Geophysics Faculty Search Committee
- 2016 Invited speaker for Stanford Admit Weekend
- 2015-2016 Geophysics Faculty Search Committee

- 2015-pres. Geophysics Long-term Planning Committee
- 2014-2015 Geophysics, Graduate Admission Committee
- 2014-pres. Geophysics Outreach Committee
- 2013 SE3, Teaching Task Force Committee

Professional Service (past 7 years)

- 2022 Chair, Award Committee, European Association of Geosciences and Engineering (EAGE)
- 2019 Review Panelist, Norwegian Research Council,
- 2019 Co-Chair, Technical Program, *Geophysics – What’s New and Innovative*, ACE AAPG
- 2019 Co-Chair, Award Committee European Association of Geosciences and Engineering (EAGE)
- 2017 NSF Review Panelist, National Science Foundation
- 2016 Session Chair, SEG-AGU Summer Workshop, Upper Crust Physics of Rocks, Hilo, Hawaii
- 2015 DOE CAREER Award review panelist, Department of Energy
- 2014 Marie Curie Fellowship Review Panelist, European Community
- 2013 Session Co-Chair, Measuring, Imaging, and Computing to Probe Multi-scale Rock Processes, AGU Fall Meeting
- 2013 Session Chair and Technical Committee Member, 2nd Summer Rock Physics Research Workshop, Southampton, UK

AWARDS, HONORS, AND NOMINATIONS

- 2022 Inaugural Stanford Teagle Fellow in Liberal Education, Stanford University
- 2018 [Alfred Wegener Award](#), European Association of Geosciences and Engineering “*for her innovative scientific and technical contributions to petroleum geoscience and engineering*”
- 2016 [Editor’s Choice by the journal SCIENCE](#) “*Printing Out The Pores*”
- 2015 [Cover of the journal SCIENCE](#) “*Concrete Connection*”
- 2015 [Stanford VPTL, Spotlight on Innovation](#) *Through a grant from the Vice Provost for Online Learning (VPOL), [Tiziana] integrates her online materials into her pre-lab lessons so that her students can use their lab time, which is limited due to the instruments’ cost and complexity, more effectively*
- 2015 [NSF CAREER Award](#), National Science Foundation
- 2015 [Stanford's Year of Learning](#), Nominee to the Stanford "Great Teaching Showcase", Stanford University, “[Tiziana] *demonstrated a highly realistic and dynamic 3D simulation she’s designed to introduce students to her Rock Physics lab. In the past, she’s had to use valuable class time to teach how to use its many instruments. With the new simulation, that can be done before her students ever step foot in the lab*”
- 2014 [SPE Innovative Teaching Award](#), Society of Petroleum Engineering. The award recognizes faculty who demonstrated innovative teaching techniques and who encourage and equip others in academia to use similar techniques: “*Vanorio recently developed online tools that can dramatically shorten the learning curve for using complicated laboratory instruments*”
- 2011 [Editors' Citation for the Brightspots of Geophysics](#), SEG
- 2010 Best Paper of SEG and D&P Forum, SEG
- 2005 [EURYI Award, European Young Investigator Award](#), European Science Foundation, *top 5 outstanding young researchers in France (declined to move to US)*
- 2002–2005 Marie Skłodowska-Curie Fellow, European Commission
- 2000 National Research Council (Italy), NATO Fellowship
- 1999 National Research Council (Italy), Study Abroad Fellowship

Keynotes, Invited Conference Presentations and Lectures (past 5 years)

- 2022 Keynote Speaker, ACerS, 12th Advances in Cement-Based Materials
- 2021 Invited Lecture, Northern California Geological Society (NCGS)
- 2019 Invited Lecture, Workshop – Clays: New Perspectives, Challenges & Opportunities, MIT
- 2019 Invited Lecture, Department of Petroleum and Geosystems Engineering, UT Austin
- 2019 Invited Lecture, Stanford University, Civil and Environmental Engineering
- 2018 Invited Speaker (two talks), American Geophysical Union, Washington, D.C.
- 2018 Heiland Lecture, Geophysics Department, Colorado School of Mines
- 2018 Pierce Lecture, School of Civil and Environmental Engineering, MIT
- 2018 Invited Lecture, Chinese Academy of Science, China
- 2018 Keynote Speaker, SEG-CPS International Geophysics Conference, China
- 2017 Invited Speaker, American Geophysical Union, Washington, D.C.
- 2017 Invited Lecture, University of California at Berkeley, Berkeley Seismological Laboratory
- 2017 Invited Lecture, Northwestern University, Civil Engineering, IL
- 2017 Invited Lecture, Physics Colloquium, Toronto, University of Toronto, Canada
- 2017 Invited Lecture, USGS Pacific Region Colloquium, Menlo Park, CA
- 2016 Invited Lecture, Hubbert Quorum, USGS, Menlo Park, CA
- 2016 Invited Speaker, Geological Society of America, Denver, Colorado
- 2016 Keynote Speaker, 88th Congress of the Italian Geological Society, Italy
- 2016 Invited Speaker, SEG-AGU Summer Workshop, Upper Crust Physics of Rocks, Hilo, Hawaii
- 2016 Invited Speaker, EGU General Assembly, Vienna, Austria
- 2016 Invited Lecture, Peninsula Geological Society, CA
- 2015 Invited Lecture, University Joseph Fourier, Grenoble, France
- 2015 Invited Lecture, Geophysics Department, University of Pisa, Italy
- 2015 Invited Lecture, USGS, Menlo Park, Earthquake Science Center
- 2014 Invited Speaker, ICDP Workshop, Vestmannaeyjar, Iceland
- 2014 Invited Speaker, Gordon Research Conference Evolving Rock Structure: From Grain-Scale to Planet-Scale,
- 2014 Invited Lecture, School of Civil and Environmental Engineering, Georgia Tech.
- 2013 Keynote Speaker, SPE Workshop on Advanced Carbonate Reservoir Characterization, Dubai

PUBLICATIONS

Authors are listed in descending order of contribution and leadership. Graduate and undergraduate students are noted with an asterisk while postdoctoral/research associate advisees are noted with two asterisks. The authorship of papers involving a large group mostly follows an alphabetical order.

- [70] Monteiro P., Xu K., A. Tremsin, **T. Vanorio**, Ushizma, D., 2022, Self-Healing of Roman Marine Concrete, *In preparation*
- [69] Ding J.**, A. Clark**, **T. Vanorio**, 2022, Integrated acoustic characterization of brittle deformation across scales, *Frontiers Earth Sci., Sec. Earth and Planetary Materials*, Volume 10 - 2022
<https://www.frontiersin.org/articles/10.3389/feart.2023.1052431/full>
- [68] Malenda M. * and **T. Vanorio**, 2022, The Role of Mineral Composition and Microstructure in Affecting Changes in Permeability and Acoustic Velocity from Thermal Stress, *Frontiers Earth Sci., Sec. Earth and Planetary Materials*, Volume 10 - 2022
<https://www.frontiersin.org/articles/10.3389/feart.2022.1054469/full>
- [67] **Vanorio T.**, J. Chung*, and S. Siman Tov, A. Nur, 2023, Fault Healing and Fibrous Cementitious Material: The Role on Strength and Mode of Failure, *Frontiers Earth Sci., Sec. Earth and Planetary Materials*, Volume 10 - 2022 | <https://doi.org/10.3389/feart.2022.1052447>
- [66] MacFarlane J.*, **T. Vanorio**, J. P. Oleson, G. Williams*, D. Zakhidov, A. Salleso, 2022, The Source for the Lime in Roman Concrete: Igneous or Sedimentary Rock?

- [65] Ding J.**, A. Clark**, **T. Vanorio**, J. Bargar, A. Jew, 2022, Elastic anisotropy of shales: modeling crack alignment and compliance ratio, *GEOPHYSICS*, <https://doi.org/10.1190/geo2021-0517.1>
- [64] Ding J.**, **T. Vanorio**, A. Clark**, J. Bargar, A. Jew, 2022, Acoustic velocity and permeability of acidized and propped fractures in shale, *GEOPHYSICS*, 87, 1, [10.1190/geo2020-0873.1](https://doi.org/10.1190/geo2020-0873.1)
- [63] Clark A.**, **T. Vanorio**, V. Y. Zaitsev, and A. V. Radostin, 2021, Assessing crack-induced compliance in low porosity rocks damaged by thermo-hydro-chemo-mechanical processes. *J. GEOPHYS. RES. SOLID EARTH*, 126, e2021JB023217. <https://doi.org/10.1029/2021JB023217>
- [62] Ding J.**, A. Clark**, **T. Vanorio**, J. Bargar, A. Jew, 2021, Rock physics modeling of crack-induced stress sensitivity, *SEG Tech. Expand. Abstr.*, <https://doi.org/10.1190/segam2021-3584214.1>
- [61] Clark A.**, **T. Vanorio**, V. Y. Zaitsev, and A. V. Radostin 2021, Avoiding biases of geometric crack representations in rocks, *Applied Geosci. & Energy Expand. Abstr.* <https://doi.org/10.1190/segam2021-3581072.1>
- [60] Ding J.**, S. Mighani **, A.C. Clark**, **T. Vanorio**, 2021, Monitoring Chemo-Mechanical Fracture Behavior through Engineering Geophysics Experiments, *EAGE Extended Technical Abstract*, (1), 1-5.
- [59] Malenda M.*, **T. Vanorio**, S. Mignani**, J. Ding**, and J Chung*, 2021, Rock Physics and Experimentation in Decarbonizing the Future, *THE LEADING EDGE* in Special Section: *The role of geophysics in a net-zero-carbon world*, doi.org/10.1190/tle40040306.1 Featured in *SEISMIC SOUNDOFF, THE SEG PODCAST*
- [58] MacFarlane J.*, **Vanorio T.**, and Monteiro P., 2020, Multi-scale imaging, strength and permeability measurements: Understanding the durability of Roman marine concrete, *Construction and Building Materials*, 272, doi.org/10.1016/j.conbuildmat.2020.121812.
- [57] El-Husseiny, A*., **Vanorio, T.**, Mavko, G (2019) Predicting porosity of binary mixtures made out of irregular nonspherical particles: Application to natural sediments *ADVANCED POWDER TECHNOLOGY*. 2019; 30 (8): 1558–66
- [56] Macente A. *, **Vanorio T.**, Miller K.**, Fousseis F., I. Buttler, (2019) Dynamic Imaging and Evolution of Permeability in Response to Chemo-Mechanical Compaction, *J. GEOPHYS. RES. SOLID EARTH*, [doi: 10.1029/2019JB017750](https://doi.org/10.1029/2019JB017750)
- [55] **Vanorio T.**, MacFarlane J.*, and A. Clark**, The Alchemies of Lime, Alkali, and Sulfur in Forming Concrete-Like Rocks in Calderas, *FRONTIERS EARTH-SCI*
- [54] Suwannasri K*., and **Vanorio T.**, A. Clark** (2019), Data-Driven Elastic Modeling of Organic-Rich Marl During Maturation, *GEOPHYSICS*, [doi:10.1190/geo2018-0883.1](https://doi.org/10.1190/geo2018-0883.1)
- [53] Suwannasri K*., and **Vanorio T.**, A. Clark**, (2018) Monitoring the Changes In The Microstructure, Elastic And Transport Properties of Eagle Ford Marl Caused By *Ex-Situ* Maturation, *GEOPHYSICS*, 83 (5): MR263-MR281, [doi: 10.1190/geo2017-0797.1](https://doi.org/10.1190/geo2017-0797.1)
- [52] Head D.*, **Vanorio T.**, Clark A.**, (2018) Elastic Softening of Limestone Upon Decarbonation with Episodic CO₂ Release. *J. GEOPHYS. RES. SOLID EARTH*, 123, [doi: 10.1029/2018JB015733](https://doi.org/10.1029/2018JB015733)
- [51] Miller K**., **Vanorio T.**, Yang S., Xiao X., (2018) A Scale-Consistent Method for Imaging Porosity and Micrite in Dual-Porosity Carbonate Rocks, *GEOPHYSICS*, [DOI: 10.1190/geo2017-0812.1](https://doi.org/10.1190/geo2017-0812.1)
- [50] Clark A**, MacFarlane J.*, and **Vanorio T.**, (2018) Permeability evolution of a cemented volcanic ash during carbonation and CO₂ depressurization, *J. GEOPHYS. RES. SOLID EARTH*, 123, [doi: 10.1029/2018JB015810](https://doi.org/10.1029/2018JB015810)
- [49] David C., J Wassermann, F Amann, J Klaver, C Davy, J Sarout, L Esteban, E H Rutter, Q Hu, L Louis, D A Lockner, A P S Selvadurai, **T Vanorio**, A Amann Hildenbrand, P G Meredith, J Browning, T M Mitchell, C Madonna, J Billiotte, T Reuschlé, D Lasseux, J Fortin, R Lenormand, D Loggia, F Nono, G Boitnott, E Jahns, M Fleury, G Berthe, P Braun, D Grégoire, L Perrier, P Polito, Y Jannot, A Sommier, B Krooss, R Fink, A Clark, (2018) KG²B, a collaborative benchmarking exercise for estimating the permeability of the Grimsel granodiorite — Part 2: modeling, microstructures and complementary data, *GEOPHYS. J. INT.*, 215, 2, 825–843,

- [doi: 10.1093/gji/ggy305](https://doi.org/10.1093/gji/ggy305)
- [48] David C., J Wassermann, F Amann, D A Lockner, E H Rutter, **T Vanorio**, A Amann Hildenbrand, J Billiotte, T Reuschlé, D Lasseux, J Fortin, R Lenormand, A P S Selvadurai, P G Meredith, J Browning, T M Mitchell, D Loggia, F Nono, J Sarout, L Esteban, C Davy, L Louis, G Boitnott, C Madonna, E Jahns, M Fleury, G Berthe, P Delage, P Braun, D Grégoire, L Perrier, P Polito, Y Jannot, A Sommier, B Krooss, R Fink, Q Hu, A Clark, (2018) KG²B, a collaborative benchmarking exercise for estimating the permeability of the Grimsel granodiorite – Part 1: measurements, pressure dependence and pore-fluid effects, *GEOPHYS. J. INT.*, 215, 2, 799–824, [doi: 10.1093/gji/ggy304](https://doi.org/10.1093/gji/ggy304)
- [47] **Vanorio T.**, 2018, Challenges and Recent Advances in Rock Physics, *SEG International Geophysical Conference Expanded Abstracts*, 1290-1292, [doi: seg_IGC2018-316](https://doi.org/seg_IGC2018-316).
- [46] Suwannasri K*, **T. Vanorio**, and A.C. Clark**, 2018, Data-driven elastic modeling of organic-rich marl during maturation, *SEG Technical Program Expanded Abstracts 2018*, 3473-3477, [doi: seg_segam2018-2995177.1](https://doi.org/seg_segam2018-2995177.1).
- [45] Wollner U.* and **T. Vanorio**, A. Kiss, (2017) Can Rock Microstructures Exhibit An Auxetic Behavior? *Int. J. of Sol. Struct.*, 130-131; Journal Issue: C; Journal ID: ISSN 0020-7683
- [44] Miller K.**, **T. Vanorio**, and Y. Keehm, (2017) Evolution of Permeability Due to Rock-Fluid Interaction: Numerically Simulated and Experimentally Measured Dissolution, *J. GEOPHYS. RES. SOLID EARTH*, 122, 4460–4474, [doi: 10.1002/2017JB013972](https://doi.org/10.1002/2017JB013972).
- [43] El Hussein A*, and **T. Vanorio**, (2017) Porosity-Permeability Relationship in Dual-Porosity on of Carbonate Analogs, *GEOPHYSICS*, Vol. 82, No. 1, MR65-MR74, [doi: 10.1190/GEO2015-0649.1](https://doi.org/10.1190/GEO2015-0649.1)
- [42] Suwannasri K*, **T. Vanorio**, and A.C. Clark**, (2017), Monitoring the changes in elastic and transport properties of Eagle Ford marl upon maturation, *SEG Technical Program Expanded Abstracts 2017*, 3593-3597, [doi: seg_segam2018-2995167.1](https://doi.org/seg_segam2018-2995167.1).
- [41] Head D*, and **T., Vanorio**, (2016) Experimental and Simulated Permeability of Controlled, 3D-Printed Rock Microstructures, *GEOPHYS. RES. LETT.*, 43, 7494–7502, [doi: 10.1002/2016GL069334](https://doi.org/10.1002/2016GL069334), [Paper selected as an Editor’s Choice by the journal Science](#)
- [40] Clark A.** and **Vanorio T.**, (2016) The rock physics and geochemistry of carbonates exposed to reactive brines, *J. GEOPHYS. RES. SOLID EARTH*, 121, 1497–1513, [doi: 10.1002/2015JB012445](https://doi.org/10.1002/2015JB012445).
- [39] Allan A.*, Clark, A.**, **Vanorio, T.** Kanitpanyacharoen, W.*, Wenk, H.R., (2016) On the Evolution of the Elastic Properties of Organic-Rich Shale upon Pyrolysis-Induced Thermal Maturation, *GEOPHYSICS*, DOI: [10.1190/geo2015-0514.1](https://doi.org/10.1190/geo2015-0514.1)
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- [37] Arson, C. and **Vanorio, T.**, (2015) Chemo-mechanical evolution of pore space in carbonate microstructures upon dissolution: linking pore geometry to bulk elasticity, *J. GEOPHYS. RES. SOLID EARTH*, 120, 6878–6894, [doi: 10.1002/2015JB012087](https://doi.org/10.1002/2015JB012087).
- [36] **Vanorio T.**, and W. Kanitpanyacharoen**, (2015) Rock Physics of Fibrous Rocks Akin to Roman Concrete Explains Uplifts at Campi Flegrei Caldera, *SCIENCE*, vol. 349 no. 6248 pp. 617-621. [Paper featured on the cover of Science](#)
- [35] **Vanorio, T.**, (2015) Recent Advances in Time-Lapse, Laboratory Rock Physics For The Characterization and Monitoring of Fluid-Rock Interactions, *GEOPHYSICS*, Vol. 80, No. 2, pp. WA49-WA59, [10.1190/GEO2014-0202.1](https://doi.org/10.1190/GEO2014-0202.1)

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- [33] Allan, A.*, W. Kanitpanyacharoen*, **Vanorio, T.**, (2015) A, Multiscale Methodology for the Time-Variant Analysis of Velocity Anisotropy in Organic-Rich Shale, *GEOPHYSICS*, 80, 4, C73-C88, [10.1190/GEO2014-0192.1](https://doi.org/10.1190/GEO2014-0192.1)
- [32] **Vanorio, T.**, Ebert, Y.**, Grombacher, D.* (2015) What Laboratory-Induced Dissolution Tell us About Natural Diagenetic Trends of Carbonate Rocks in Agar, S. M. & Geiger, S. (eds), *Fundamental Controls on Fluid Flow in Carbonates. Geological Society of London & AAPG, Special Publications*, 406 (v.4): 311-329
- [31] Allan A.M.*, A. C. Clark**, and **T. Vanorio**, (2015), Pyrolysis-Induced Evolution of the Elastic and Transport Properties of the Barnett Shale, *SEG Technical Program Expanded Abstracts 2015*. 3068-3073, [doi:seg_segam2015-5823323.1](https://doi.org/doi:seg_segam2015-5823323.1).
- [30] Allan A.M.*, W. Kanitpanyacharoen*, and **T. Vanorio**, (2014), Velocity anisotropy variation in organic-rich shale as a function of confining pressure, *SEG Technical Program Expanded Abstracts*, 2850-2855, doi: seg_segam2014-0031.1.
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- [28] Grude S.*, J. Dvorkin, A. Clark**, **T. Vanorio** and M. Landrø, (2013) Pressure effects caused by CO₂ injection in the Snøhvit Field First Break, *GEOPHYSICS*, Vol. 31, 12, DOI: 10.3997/2214-4609.20131604.
- [27] Allan A. M.*, **T. Vanorio**, and J.E. P. Dahl (2013), Thermal maturation-induced variation of P-wave anisotropy of organic-rich shale, *SEG Technical Program Expanded Abstracts 2013*, 2767-2772, [doi:seg_segam2013-0064.1](https://doi.org/doi:seg_segam2013-0064.1).
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- [23] Grombacher D.*, **Vanorio T.**, and Y. Ebert, 2012, Time-Lapse NMR, Acoustic, and Transport measurements monitoring dissolution trends of Carbonate Rocks, *GEOPHYSICS*, 77, WA169-WA179, [10.1190/GEO2011-0281.1](https://doi.org/10.1190/GEO2011-0281.1)
- [22] **Vanorio T.**, A. Nur, Y. Ebert**, 2011, Rock Physics Analysis and Time-Lapse Imaging of Geochemical effects Due to the Injection of CO₂ into Reservoir Rocks: *GEOPHYSICS*, 76, 23-33, [10.1190/GEO2010-0390.1](https://doi.org/10.1190/GEO2010-0390.1) *Highlighted in the Brightspots of Geophysics*
- [21] **Vanorio T.**, and Mavko G., 2011, Laboratory measurements of the acoustic and transport properties of carbonate rocks and their link with the amount of microcrystalline matrix: *GEOPHYSICS*, 76, 105-115, [10.1190/1.3580632](https://doi.org/10.1190/1.3580632)
- [20] Agersborg R., Johansen T. A., Mavko G., **Vanorio T.**, 2011, Modeling of elasticity effects of sandstones compaction using coated inclusions: *GEOPHYSICS*, 76, 69-79, [10.1190/1.3565050](https://doi.org/10.1190/1.3565050).
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- [16] Mavko G. and **T. Vanorio**, 2010, The Influence of Pore Fluids and Frequency on Apparent Effective Stress Behavior of Seismic Velocities, *GEOPHYSICS*, 75(1), 1-7, [doi:10.1190/1.3277251](https://doi.org/10.1190/1.3277251)
- [15] **T. Vanorio**, G. Mavko, S. Vialle**, and K Spratt, 2010, The Rock Physics Basis for 4D Seismic Monitoring of CO₂ Fate: Are we there Yet? THE LEADING EDGE, Special Section: CO₂ Sequestration, 29(2), 156-162, [doi:10.1190/1.3304818](https://doi.org/10.1190/1.3304818)
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- [12] **T. Vanorio**, C. Scotellaro, and G. Mavko, 2008, The Effect of Chemical Processes and Mineral Composition on the Acoustic Properties of Carbonate Rocks, *THE LEADING EDGE*, 27, 8.
- [11] Wolf K., **T. Vanorio**, and G. Mavko, 2008, Measuring and monitoring heavy-oil reservoir properties, *THE LEADING EDGE: Special section: Heavy oil*, 27(9), 1138-1147, doi.org/10.1190/1.2978976.
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