

Catalyzing Opportunities for Research in the Earth Sciences (CORES): A Decadal Survey for NSF's Division of Earth Sciences

Committee

James A. Yoder

Chair

James (Jim) A. Yoder is Dean Emeritus of Woods Hole Oceanographic Institution (WHOI) and professor emeritus of the Graduate School of Oceanography (GSO), University of Rhode Island (URI). He served as dean at WHOI from 2005-2017. Dr. Yoder was a professor of oceanography at GSO from 1989-2005, where he conducted research involving satellite and aircraft measurements to study ocean processes, taught graduate courses, and advised M.S. and Ph.D. students. He also served 5 years as associate dean in charge of the graduate program in oceanography. Dr. Yoder started his career in 1978 at the Skidaway Institution of Oceanography. Dr. Yoder held temporary positions in the federal government including as director of the National Science Foundation's (NSF) Division of Ocean Sciences (2001-2004) and as a program officer at NASA (1986-1988 and 1996-1997). During his time at NSF, Jim chaired the National Ocean Partnership Program's Interagency Working Group. Dr. Yoder has served on many national and international committees and panels. He was a member of the National Academies of Sciences, Engineering, and Medicine's Decadal Survey of Ocean Sciences (2013-2015); co-chaired the Ecosystem Panel for the Decadal Survey for Earth Science and Applications from Space (2016-2017); member (2009-2013) of the Ocean Studies Board; and chaired (2011-2012) the Committee on Assessing Requirements for Sustained Ocean Color Research and Operations. He is a former member and former chair of the International Ocean Colour Coordinating Group which seeks cooperation among the international space agencies for satellite measurements of ocean color radiometry. He was a recipient of a URI Distinguished Achievement Award in 2008 and was elected Fellow of The Oceanography Society in 2012. Dr. Yoder received his B.A. degree in botany from DePauw University and his M.S. and Ph.D. degrees in oceanography from GSO.

Gregory C. Beroza

Member

Gregory (Greg) C. Beroza is the Wayne Loel Professor of Earth, Energy, and Environmental Sciences in the Department of Geophysics at Stanford University. His research concerns earthquake science broadly, with a focus on developing techniques for analyzing seismograms to understand how earthquakes work and to help quantify the hazards they pose. Since 2007 he has been first deputy-director then co-director of the Southern California Earthquake Center (SCEC). His principal responsibility in that role is to chair the planning committee, which guides and coordinates the core research program of the SCEC collaboration. Since 2013 he has also been co-director of the Stanford Center for Induced and Triggered Seismicity. His current research includes using ambient field measurements for ground motion prediction, developing data-mining and machine-learning methods for earthquake detection and characterization, and understanding the systematics of induced, slow, and intermediate-depth earthquakes. He has authored over 150 peer-reviewed scientific journal articles. Dr. Beroza was an NSF Presidential Young Investigator, has been fellow of the American Geophysical Union since 2008, was the IRIS/SSA Distinguished Lecturer in 2012, and was awarded the Beno Gutenberg Medal of the European Geosciences Union in 2014 for outstanding contributions to seismology. He holds a B.S. in Earth Sciences from UC Santa Cruz, and a Ph.D. from MIT.

Tanja Bosak

Member

Tanja Bosak is the Hayes Associate Professor of Geobiology in the Department of Earth, Atmospheric and Planetary Sciences at the Massachusetts Institute of Technology. She is an author of more than 50 papers and book chapters that focus on the parallel evolution of life and microbial metabolisms, microbial fossils, biogeochemical patterns, and other biosignatures that can be expected on the early Earth or Mars. Her lab explores these questions using experimental geobiology, which integrates microbiology, sedimentology and geochemistry. For this work, and her work with graduate students and undergraduates, Dr. Bosak received the Subaru Outstanding Woman in Science award by the Geological Society of America, the Macelwane Medal from the American Geophysical Union, the Edgerton Award for young faculty at MIT, the Undergraduate Research Opportunities for Undergraduates Mentor of the Year award by MIT, and the Award for Outstanding Contributions and Dedication to Geobiology and Geomicrobiology from the Geobiology and Geomicrobiology Division of the Geological Society of America. Dr. Bosak is a fellow of the American Geophysical Union, a member of the Simons Foundation Collaboration on the Origins of Life, and its steering committee. She chaired the Gordon Research Conference in Geobiology and was a member of the organizing committee for the NAS Workshop "Detection of Life Across Space and Time". Dr. Bosak was born in Croatia and graduated from the Zagreb University with a degree in geophysics. She earned a Ph.D. in geobiology from the California Institute of Technology and spent two years at Harvard as a Microbial Initiative Postdoctoral Fellow before joining the faculty at MIT.

William E. Dietrich

Member

William (Bill) E. Dietrich (NAS) is professor of Earth and Planetary Science at the University of California, Berkeley. Dr. Dietrich's research focuses on the processes that underlie the evolution of landscapes. His research group and collaborators have developed geomorphic transport laws for soil production, weathering and transport, and for river and debris flow incision into bedrock. They have explored the processes that control the sorting of sediment in river bends, rates of river migration, the transport of sediment in steep, coarse bedded channels, the routing of sediment through river networks, the influence of sediment supply on river morphodynamics, and the dispersion and deposition of sediment across floodplains. He has led intensive investigations of hydrologic processes at the hillslope scale at sites along the Pacific Coast Ranges. He is part of the Mars Science Laboratory Mission (Curiosity Rover). Dr. Dietrich is Director of the Eel River Critical Zone Observatory, and co-founder (in 2003) and co-Director of the National Center for Airborne Laser Mapping. He earned his Ph.D. in geology from the University of Washington. His most recent NRC service is a member of the steering committee of the 2017-2027 Decadal Survey for Earth Science and Applications from Space.

Timothy H. Dixon

Member

Timothy (Tim) H. Dixon is a professor in the School of Geosciences at the University of South Florida. His research uses satellite geodesy and remote sensing data to investigate changes in the Earth's land and water surfaces. These geodetic data allow study of a variety of natural and anthropogenic processes, including strain accumulation on faults, volcano deformation, mountain building, coastal subsidence, ground water extraction, and glacier motion. He has conducted geological field investigations on several continents, participated in sea-going campaigns, organized GPS field programs, conducted glacier studies in Iceland and Greenland, and conducted volcano deformation studies in Central and South America. He is a fellow of the American Geophysical Union, the Geological Society of America (GSA), and the American Association for the Advancement of Science. He is the 2010 recipient of GSA's Woollard Award for excellence in geophysics. He previously worked at NASA's Jet Propulsion Laboratory and at NASA Headquarters. Dr. Dixon received a B.Sc. with honors in geology from the University of Western Ontario and a Ph.D. from Scripps Institution of Oceanography.

Andrea Dutton

Member

Andrea Dutton is a professor in the Department of Geoscience at the University of Wisconsin-Madison and is a recently named MacArthur Fellow. Dr. Dutton is an international expert in the study of past climate and sea level change using carbonate sedimentology and isotope geochemistry. Her research program focuses on understanding the rates, magnitudes, sources, and drivers of past sea level change to facilitate improved understanding of the climate system and of projections for the future. Dr. Dutton has served in leadership positions for several disciplinary working groups and has an active role in science communication on climate change and sea-level rise. She has received numerous awards and is a fellow of the Geological Society of America. Dr. Dutton received her M.S. and Ph.D. from the University of Michigan in Ann Arbor and was a postdoctoral fellow and research fellow at the Australian National University.

Alejandro N. Flores

Member

Alejandro (Lejo) N. Flores is an associate professor in the Department of Geosciences at Boise State University. His research focuses on understanding mountain watersheds as regional Earth systems where large-scale patterns emerge as a product of interactions between and among biophysical processes and human action. His research synthesizes numerical models of and data characterizing regional climate, ecohydrology, and human, land, and water management activities in order to assess how perturbations propagate across scales and through component systems. At Boise State he is the principal investigator and director of the LEAF group, which researches the intersection of water, energy, nutrients, policy, and human activity. His work has been published in journals such as Water Resources Research, Geophysical Research Letters, and the Remote Sensing. He is a recipient of a National Science Foundation CAREER award and an Army Research Office Young Investigator Program award. He is a Co-Principal Investigator on the NSF's Reynolds Creek Critical Zone Observatory. Dr. Flores holds B.S. and M.S. degrees in civil and environmental engineering from Colorado State University. He received his Ph.D. in hydrology from the Massachusetts Institute of Technology in 2009.

Michael Foote

Member

Michael Foote is a professor in the Department of the Geophysical Sciences, the Committee on Evolutionary Biology, and the College at the University of Chicago. He is also a fellow of the Paleontological Society. He studies the geological history of biological diversity and evolutionary rates, mainly in marine animals. His research has focused on documenting major evolutionary trends and on developing methods for analyzing diversity and rates in the face of an incomplete fossil record. Principal areas of research have included the evolution of morphological diversity, rates of taxonomic origination and extinction, dynamics of diversification, mathematical modeling of evolution, and determinants of extinction risk. He contributed to the early development of the Paleobiology Database, served on its steering committee, and taught in its summer course. Dr. Foote teaches Earth history for undergraduates and multivariate data analysis for graduate students. He has served as master of the Physical Sciences Collegiate Division, chair of the Department of the Geophysical Sciences, and Deputy Dean for Academic Affairs in the Physical Sciences Division. He taught at Wake Forest University and the University of Michigan before joining the faculty at Chicago. Dr. Foote received his A.B. in geological sciences from Harvard University and his Ph.D. in evolutionary biology from the University of Chicago.

Shemin Ge

Member

Shemin Ge is a professor and chair of the Department of Geological Sciences at the University of Colorado, Boulder. Her research involves studying groundwater in the Earth's crust with a focus on the interaction of groundwater flow with other geologic processes and how these interactions advance science and offer insights on societally relevant issues. She studies earthquake-induced groundwater flow as natural experiments to reveal the hydrologic properties of geologic systems and explores the mechanisms of seismicity induced by reservoir operation and wastewater injection. Another thread of Dr. Ge's research relates to groundwater resources and surface-groundwater interactions under a changing climate, with a focus on headwater regions. She was chair of the Hydrogeology Program Planning Group for the Ocean Drilling Program from 1999 to 2002. She has also served as editor and associate editor for publications such as Hydrogeology Journal, Geofluids, and Journal of Ground Water. From 2012-2014, Dr. Ge served as a program director for the Hydrologic Sciences Program at the National Science Foundation. In recognition of her pioneering research and leadership in the field, the Hydrogeology Division of the Geological Society of America awarded Dr. Ge the 2018 Meinzer Award and named her as the 2016 Birdsall-Dreiss Lecturer, an honor awarded based on a scientist's outstanding reputation, excellence in research, and ability to communicate effectively. Dr. Ge received her Ph.D. in hydrogeology from the Johns Hopkins University in 1990. She holds an M.S. from the University of British Columbia and a B.S. from the Wuhan University of Technology.

George E. Gehrels

Member

George E. Gehrels is a professor of geosciences at the University of Arizona. His primary area of expertise is in the application of U-Th-Pb geochronology to study the origin of mountain belts and sedimentary basins, as well as the resources found in these areas. Dr. Gehrels also oversees the Arizona LaserChron Center, an NSF-supported facility that provides research assistance for U-Th-Pb geochronology/thermochronology, Hf isotope geochemistry, and scanning electron microscope imaging and chemical analysis. Dr. Gehrels has recently served the geochronology community through co-authorship of "It's About Time", a white paper with recommendations concerning geochronologic infrastructure in the U.S., and as one of the leaders in establishing a new Geochronology Division within the Geological Society of America. Each year, Dr. Gehrels teaches university courses with roughly 1000 students; these courses emphasize science literacy and responsibility and also encourage the involvement of under-represented populations in science and technology fields. He is a fellow of the American Geophysical Union and was awarded the Arthur L. Day Medal from the Geological Society of America. Dr. Gehrels received B.S., M.S., and Ph.D. degrees in geology from the University of Arizona, the University of Southern California, and the California Institute of Technology, respectively.

Douglas Hollett

Member

Douglas (Doug) Hollett is president of Melroy-Hollett Technology Partners, which focuses on advanced technology and policy solutions in the aerospace and energy sectors, and is senior energy advisor at Nova Systems, an Australia systems engineering provider in the energy, aerospace and defense sectors. Additional engagements include advisor with SmartUQ, a Wisconsin uncertainty quantification company; advisor to FERVO, a California geothermal company; member of the Sandia National Laboratory Energy and Homeland Security Board; and the CSIRO Energy Advisory Committee (Australia). Mr. Hollett is the former Acting Assistant Secretary and Principal Deputy Assistant Secretary in the Office of Fossil Energy at the U.S. Department of Energy (DOE, 2016-17). Previously, he served as Deputy Assistant Secretary for Renewable Power in the Office of Energy Efficiency and Renewable Energy, where he oversaw research and development in solar, wind, geothermal, hydro, marine hydrokinetics and grid modernization. At DOE, Mr. Hollett also conceived and implemented the FORGE EGS test project for geothermal energy, and was co-chair of the SubTER geologic research initiative. Prior to government service, Doug had over 29 years in the oil and gas sector including Director Unconventional New Ventures, Manager International Exploration, and GM and VP Atlantic Canada with Marathon Oil. He holds a B.A. in geology from Williams College and an M.S. in geology from the University of Utah.

Bruce Houghton

Member

Bruce Houghton is the Gordon A. MacDonald Professor of Volcanology at the University of Hawaii at Manoa and the State Volcanologist of Hawaii. He is also the science director for the Federal Emergency Management Agency-funded National Disaster Preparedness Training Center at the University of Hawaii. Dr. Houghton's research focuses on understanding the mechanisms of explosive eruptions by constraining the nature of the eruptions and their products in near real time. His natural hazards research examines knowledge, perceptions, and preparedness for volcanic eruptions, tsunamis, and flooding. Dr. Houghton has served on numerous committees focused on different aspects of volcanism, and is currently an executive member of the IAVCEI (International Association of Volcanology and Chemistry of the Earth's Interior) Commission on Tephra Hazard Modeling and Commission on Cities on Volcanoes. He was awarded the 2017 Thorarinsson Medal by IAVCEI. He is a fellow of the American Geophysical Union and the Geological Society of America, and a former president of the Geological Society of New Zealand. He is a fellow of the Royal Society of New Zealand. He received a B.Sc. in geology from the University of Auckland, and a Ph.D. in volcanology from the University of Otago, New Zealand.

Katharine W. Huntington

Member

Katharine (Kate) W. Huntington is an associate professor in the Department of Earth and Space Sciences at the University of Washington, where she holds the Endowed Professorship for the College of the Environment in Earth Systems. Her research focuses on the interactions of tectonics, erosion and climate in shaping Earth's surface and crust over million-year to human timescales. Dr. Huntington's work has made contributions to understanding the dynamic interactions of surface and deep-Earth processes; paleoclimate and paleotopography; soil processes and geochemistry; and the role of extreme floods in landscape evolution. She has also developed new approaches using geochronology and isotope geochemistry to quantify erosion patterns, basin thermal histories, and fluid movement through fault zones. Dr. Huntington serves as a mentor in the Sparks for Change National Science Foundation Leadership in Diversity program. Recently she was lead author and co-coordinator of the "2018 Tectonics Community Vision Document" prepared for the National Science Foundation. Dr. Huntington is a fellow of the Geological Society of America. She is the recipient of the National Science Foundation CAREER Award and the Donath Medal of the Geological Society of America., Dr. Huntington earned her B.S. in Geology and Economics from the University of North Carolina at Chapel Hill and completed her Ph.D. in geology at the Massachusetts Institute of Technology.

Steven D. Jacobsen

Member

Steven (Steve) Jacobsen is Professor of Earth and Planetary Sciences at Northwestern University specializing in mineral and rock physics. He studies the role of volatiles, especially water and carbon, controlling geophysical processes driving the evolution of Earth's crust, mantle, and atmosphere. Jacobsen developed ultrasonic methods to measure acoustic velocities in materials at deep-mantle conditions, and by examining the influence of water on the structure and properties of minerals and melts he is working to map the distribution of water in the mantle from dense, regional seismic data. His research has broader implications for global geochemical budgets and the origin of Earth's water. Dr. Jacobsen is active in high-pressure science and technology development at large-scale DOE facilities including the Advanced Photon Source at Argonne National Laboratory and pulsed-power facilities at Sandia National Laboratories. His awards include a Presidential Early Career Award for Science and Engineering (PECASE), a David and Lucile Packard Fellowship, and a Distinguished Teaching Award from Northwestern University. He previously served on the Executive Committee of NSF-COMPRES and is currently Editor of Geophysical Research Letters. Jacobsen received his B.A. in geology and Ph.D. in geophysics from the University of Colorado at Boulder, and was the Barbara McClintock Postdoctoral Fellow at the Geophysical Laboratory, Carnegie Institution for Science in Washington D.C.

Dennis V. Kent

Member

Dennis V. Kent (NAS) is Board of Governors Distinguished Professor of Geological Sciences at Rutgers University and adjunct senior research scientist at Lamont-Doherty Earth Observatory. He is an author of more than 300 journal and book articles dealing with paleogeography and paleoclimate, the tempo of geomagnetic polarity reversals, and other aspects and applications of Earth magnetism, and is listed as an ISI Highly Cited Researcher. He is a member of the National Academy of Sciences and is a fellow of the Geological Society of America, American Geophysical Union (AGU), American Association for the Advancement of Science (AAAS), and the American Academy of Arts and Sciences. Dr. Kent was awarded the Arthur L. Day Medal from the Geological Society of America, the Vening Meinesz Medal from Delft University in Holland, the Petrus Peregrinus Medal from the European Geophysical Union, the William Gilbert Award from AGU, and received an honorary doctorate from the Institut de Physique du Globe de Paris-Sorbonne. He has served on the governing boards of the Joint Oceanographic Institutions and Integrated Ocean Drilling Program Management International; as president of the Geomagnetism, Paleomagnetism, and Electromagnetism Section of AGU; as elected member-at-large of the section on Geology and Geography of AAAS; and on the advisory board of the Elsevier journal Earth and Planetary Science Letters. He received his B.Sc. in geology from the City College of New York and his Ph.D. in marine geology and geophysics from Columbia University.

Carolina Lithgow-Bertelloni

Member

Carolina Lithgow-Bertelloni is the Louis B. and Martha B. Slichter Chair in the Geosciences in the Department of Earth, Planetary and Space Sciences at UCLA, which she joined in 2018. Prior to joining the UCLA faculty she was a professor at University College London and an assistant and associate professor of geophysics at the University of Michigan. She was the recipient of the Alfred P. Sloan and the David and Lucile Packard Fellowships and was selected as the 2018 Birch Lecturer of the American Geophysical Union. Dr. Lithgow-Bertelloni's research has focused on understanding how the motions in Earth's interior deform, shape, and move Earth's surface, from the large-scale motions of plates to smaller scale topography both today and through Earth's history. Her current efforts are geared towards understanding how Earth's material properties affect the internal dynamics of the mantle, its thermal evolution, and especially how those are reflected on Earth's surface record. Dr. Lithgow-Bertelloni's group employs observational, numerical and experimental techniques to study the fluid dynamics of Earth's mantle and lithospheric deformation. Together with her group they have developed state-of-the-art visualization and analysis techniques for understanding the dynamics, entrainment and evolution of mantle plumes in the laboratory and in the real Earth. She received her B.Sc. in geology at the University of Puerto Rico at Mayagüez and her Ph.D. at the University of California, Berkeley.

Paul E. Olsen

Member

Paul E. Olsen (NAS) is a professor at Columbia University and holds the Arthur D. Storke Chair in the Department of Earth and Environmental Sciences. Dr. Olsen is a broadly trained geologist and paleobiologist who has authored over 190 papers on projects examining patterns of evolution and extinction as a response to and cause of climate change, especially in early Mesozoic continental ecosystems, as well as mapping the chaotic history of the solar system using climate archives. His research methods include sedimentology, paleontology, geochemistry, geophysics, and time series analysis, frequently employing scientific drilling. He is an internationally known expert on early Mesozoic continental ecosystems, stratigraphy, paleoclimate, and environments with experience spanning more than 40 years. He has organized and hosted five international workshops and served on two National Academies of Sciences, Engineering, and Medicine reports: New Research Opportunities in the Earth Sciences and Scientific Ocean Drilling: Accomplishments and Challenges. He pioneered the use of scientific drilling to recover very long (over 10 million years) continental paleoclimate records in Triassic and Jurassic strata. Furthermore, has successfully demonstrated how those records reflect major events in Earth and life history, and precisely and accurately map the chaotic evolution of planetary orbits. His applied research has been on hydrocarbon exploration in eastern North American rift basins and carbon sequestration in the same area. He was awarded the Thomas Jefferson Medal for Outstanding Contributions to Natural Science in 2015 and has been a member of the National Academy of Sciences since 2008. Dr. Olsen received a B.A. in geology and an M. Phil. and Ph.D. in biology (ecology and evolution) from Yale University with a thesis on the evolution of lake ecosystems.

Donald L. Sparks

Member

Donald L. Sparks is the Unidel S. Hallock du Pont Chair, Francis Alison Professor, and director of the Delaware Environmental Institute at the University of Delaware. He is internationally recognized for his research in the areas of kinetics of biogeochemical processes and surface chemistry of natural materials. His research has focused on fate and transport of trace metals in soil and water, soil remediation, water quality, and carbon sequestration in soils. Dr. Sparks is fellow of five scientific societies, and he has been the recipient of major awards and lectureships including the Geochemistry Medal from the American Chemical Society, the Liebig Medal from the International Union of Soil Sciences, and an Einstein Professorship from the Chinese Academy of Sciences. Dr. Sparks served as president of the Soil Science Society of America and the International Union of Soil Sciences, has served on advisory committees for several national laboratories and national and international centers and institutes, and served as chair of the U.S. National Committee for Soil Sciences. Dr. Sparks received his B.S. and M.S. degrees from the University of Kentucky and his Ph.D. degree from Virginia Tech.

Donna L. Whitney

Member

Donna L. Whitney is a Distinguished McKnight University Professor and Head of the N.H. Winchell School of Earth Sciences at the University of Minnesota. Her research focuses on the chemical and physical processes of metamorphism in the deep crust using observations from the scale of mineral grains to mountain systems. A particular interest is the role of the metamorphosing crust in mantle-to-surface dynamics, such as when the deep crust rapidly ascends to the near-surface, influencing topography and heat flow. Dr. Whitney has made contributions to understanding the flow of the deep crust, including trajectory, magnitude, and rate, driving mechanisms, and the thermal, chemical, and mechanical consequences for continental evolution. She has also worked on metamorphic processes in subduction zones, with a focus on the interaction of deformation, fluid flow, and metamorphic reactions. She recently led a large, interdisciplinary and international team of geoscientists in an NSF Continental Dynamics project (CD-CAT) that investigated the dynamics of a subduction to collision to tectonic escape system. Dr. Whitney teaches courses in mineralogy, petrology, and introductory geology, including a freshman course on the interaction of geology and humans from pre-history to the present. She is a fellow of the Mineralogical Society of America and the Geological Society of America and she was a recipient of a National Science Foundation CAREER Award. She has been an editor of the Journal of Metamorphic Geology since 2005. Dr. Whitney received an A.B. in geology at Smith College and a Ph.D. in geological sciences at the University of Washington.

Deborah Glickson

Staff Officer

Deborah Glickson is a senior program officer with the Board on Earth Sciences and Resources. She has a background in marine geology, and worked at the Academies from 2008-2015 and from 2016-present. Dr. Glickson has worked on many Earth and ocean science studies, including such topics as scientific ocean drilling, ocean science research priorities and infrastructure, marine hydrokinetic energy, long-term coastal evolution, methane hydrates, and geoscience education. She received an M.S. in geology from Vanderbilt University and a Ph.D. in oceanography from the University of Washington. Her research focused on magmatic and tectonic contributions to mid-ocean ridge evolution and hydrothermal activity at the Endeavour Segment of the Juan de Fuca Ridge. From 2015-2016, Dr. Glickson served as the associate director of the NOAA Cooperative Institute for Ocean Exploration, Research, and Technology, based at Harbor Branch Oceanographic Institute-Florida Atlantic University.