Meet the Authors

Ronald I. Dorn received a PhD in geography from the University of California at Los Angeles (USA) in 1985, was a faculty member of Texas Tech University (USA) from 1983 to 1988, and has been at Arizona State University (USA) since 1988. It was in graduate school that he started working on the origin and characteristics of manganiferous rock varnish and, since then, his research has expanded to all types of rock coatings, including dust films, heavy-metal skins, iron films, oxalate crusts, and silica glazes and their interface with the underlying decaying rock in the form of case hardening. He studies these deposits from the perspectives of their basic characteristics and origins, their role at the critical zone, and the paleoenvironmental history recorded in their layering patterns.

Geoffrey M. Gadd is a geomicrobiologist whose main research is on geomycology: the role of fungi in processes relevant to geology. He received his PhD in 1978 from University College Cardiff (Wales) and thereafter moved to the University of Dundee (Scotland), where he currently holds the Boyd Baxter Chair of Biology in the School of Life Sciences. His research concentrates on metal–mineral–microbe interactions, especially the processes underlying metal accumulation, detoxification and tolerance, and the mechanisms that alter metal(loid) mobility, including biomineralization. Recent and current geomycology projects include biodeterioration of concrete in the context of nuclear decommissioning; transformations and biomineralization of lead, uranium, cobalt, manganese, selenium and tellurium; microbially induced metal carbonate precipitation; and microbial biomineralization as a route for the production of novel biomimetic materials.

James R. Hein received a PhD from the University of California at Santa Cruz (USA) in 1973 and has been a marine geologist with the U.S. Geological Survey (USGS) since 1974. In 1976, he began working on marine mineral deposits as a member of the Deep Ocean Mining and Environmental Studies (DOMES) team, studying Ni- and Cu-rich ferromanganese nodules from the Clarion–Clipperton Fracture Zone of the Eastern Pacific Ocean. Since then, his research has expanded to include all types of marine mineral deposits throughout the world’s oceans, including ferromanganese nodules and crusts, seafloor massive sulfides/sulfates, phosphorite, barite, and potential land-based analogs of these deposits. He studies these deposits from three perspectives: their potential as metal resources, their role in the geochemical balance of the oceans, and the paleoceanographic history recorded in ferromanganese crusts. He has participated in and led many oceanographic research cruises and currently runs the Marine Minerals Program at the USGS.

Andrea Koschinsky is a marine geochemist who specializes in the biogeochemistry and chemical speciation of trace metals in marine systems. In 1993, she received her PhD in geochemistry from the Free University of Berlin (Germany) for research on the formation mechanisms and metal associations of marine ferromanganese crusts. During a following postdoc, she worked on several marine research projects, which involved research cruises that focused on environmental consequences of future manganese nodule mining. In 2002, she finished her habilitation in geochemistry at the Free University Berlin and, since 2003, she has been a professor of geoscience at Jacobs University Bremen (Germany). She not only researches the geochemistry of hydrothermal fluids and their interactions with the biosphere but also participates in the international GEOTRACES biogeochemical cycles program.

David H. Krinsley is a courtesy professor in Earth sciences at the University of Oregon (USA). He retired from teaching and research at Arizona State University (USA) in 1991, where he headed the Department of Geology for six years. His first and second assignments after his PhD at the University of Chicago (USA) were a postdoc at Columbia University (USA) and an appointment as an instructor at Queens College, CUNY (USA). He initiated the Department of Geology at Queens College and rose through the ranks to become provost. He ran Queens College during the Vietnam riots, and then left to take an appointment as an Overseas Fellow in the Department of Geology at Churchill College, University of Cambridge (UK). His research has involved the surface textures of sand grains, rock varnish, diagenetic processes, and recent meteor impacts in Italy.

William C. Mahaney is emeritus professor of geography at York University (Canada). He is a specialist in glacial geology and geomorphology and President of Quaternary Surveys, a company specializing in Quaternary geology and environmental geomorphology. Professor Mahaney is based in Toronto (Canada) and has undertaken investigations on every continent, his most recent research involving the geology/geomorphology of the Punic invasion route from Spain to Italy during the Hannibalic Wars, the latter resulting in publication of The Warmaker: A Novel (2008, iUniverse) and the non-fiction Hannibal’s Odyssey: Environmental Background to the Alpine Invasion of Italia (2008, Gorgias Press). Hannibal’s Odyssey provides a scientific analysis of the geological evidence from all major localities/battlefields visited by the Carthaginians during the invasion of Italia and up to the Battle of Cannae (216 BC), where Hannibal showed his true tactical genius.

Cassandra L. Marnocha is an environmental microbiologist with research interests in endoliths, microbe–mineral interactions, and microbial biogeochemical cycling. She received her BS in biology from the University of Wisconsin–Green Bay (USA) (2009) and her PhD in planetary sciences from the University of Arkansas (USA) (2013). During her graduate work, she investigated the bacterial communities of rock coatings from northern Sweden. Following completion of her PhD, she held a postdoctoral position at the University of Delaware (USA) where she studied extracellular biogenic sulfur produced and consumed by microbes. She joined the Department of Biology at Niagara University (USA) in 2016 as an assistant professor. She is currently investigating water–rock–microbe interactions and biogeochemical cycling of acidic freshwater springs.

Calogero M. Santoro received his PhD in anthropology and archaeology from the University of Pittsburgh (USA) in 1995, was on the faculty at the Universidad del Norte (Chile) (1976–1981), and is currently a professor at the Universidad de Tarapacá (Chile) (1982–present). His first research involved a long-term study of an ancient pre-Columbian funerary site in a coastal Pacific valley in northern Chile that had >400 burials, followed by archaeological explorations in the high Andes of northernmost Chile that focused on hunters and gatherers and rock art. Since then he has conducted several interdisciplinary archaeological studies in the Atacama Desert, focusing on late prehistoric farming societies, Inca-related groups, the long-term cultural process of hunting and gathering societies, and rock art. Over the last decade, he has developed an interdisciplinary study program on human cultural adaptations and environmental changes in the Atacama Desert, from the late Pleistocene to Inca times.
Michael Schindler is an environmental mineralogist working on nanoscale processes in soils, tailings, and uranium ore deposits. He received his PhD in mineralogy in 1997 from the University of Frankfurt (Germany) and, until 2004, worked on theoretical crystal chemistry projects at the University in Manitoba (Canada). He then decided to work in the field of environmental mineralogy, specializing in the use of X-ray photoelectron spectroscopy and atomic force microscopy. He is currently an associate professor at Laurentian University (Canada) and a “part time” researcher at the Nano-Earth facility at Virginia Tech (USA), where he uses the combination of focused ion beam technology and transmission electron microscopy to discover new chemical processes operating in the environment.

David M. Singer is an environmental mineralogist and geochemist. He received his BS in geological sciences from the University of Michigan (USA) (2002), his PhD in geological and environmental sciences from Stanford University (USA) (2008), and had a joint post-doctoral position in the Earth and Planetary Sciences Department at University of California, Berkeley (USA) and the Earth Sciences Division of Lawrence Berkeley National Laboratory (USA). In 2012, he joined the Kent State University (USA) faculty as an assistant professor in the Department of Geology. His research involves laboratory and field experiments on the fate and transport of trace metals in the environment, with a focus on water–energy systems. Recent projects include metal speciation and distribution in the Marcellus Shale of eastern North America; transformations of iron (oxy)hydroxides in acid-mine drainage settings; soil development on coal-mine tailings; and ion sorption and diffusion into natural and synthetic mesoporous materials.

Daniela Valenzuela is an archaeologist from the Universidad de Chile. She received her PhD in anthropology from the Universidad Católica del Norte (Chile) in 2013. Her research addresses the style, chronology, social context of production and uses of rock art in the northern deserts of Chile. Valenzuela currently teaches at the Universidad Alberto Hurtado in Santiago (Chile).

David S. Whitley received his PhD in anthropology, with an emphasis on archaeology, from University of California, Los Angeles (UCLA) (USA) in 1982. He served as Chief Archaeologist at UCLA from 1983 to 1987, taught at the University of the Witwatersrand (South Africa) from 1987 to 1989, and is currently a director at ASM Affiliates, Inc. (Tehachapi, California, USA). His dissertation was the first on North American rock art. His research has focused on the dating, interpretation, and conservation management of rock art. Although the emphasis of his research is western North America, he has also published on southern African and European Upper Paleolithic cave art, and his research has been translated from English into five languages. He is the editor of the Handbook of Rock Art Research (2001, Altamira Press) and the Introduction to Rock Art Research (2011, Left Coast Press, 2nd edition).
SLATE OR SHALE? IT MAKES A DIFFERENCE!

XRD PHASE IDENTIFICATION IN SLATE AND SHALE

The words “shale” and “slate” are often used interchangeably in non-scientific settings, but the two materials are not the same, even though they have similar outer appearances. Shale, a sedimentary rock, is a cheaper, softer material that is sometimes sold as higher-priced slate for landscaping (flagstones, retaining walls) and construction (chalkboards, roofing tiles, pool tables, etc.) uses. These shales have substantially reduced strength and are generally less durable compared to metamorphic slate.

Characterizing shale and slate materials is also of the utmost importance in the mining, petrochemical industries and large commercial construction projects. For example, in the drilling realm, clays in the formation will alter the viscosity of the fluid to be used. This could cause significant and costly mechanical problems. Also, from a waste disposal viewpoint, it is imperative to identify the slate and shale components after processing to meet stringent environmental and regulatory discharge laws.

Rigaku’s MiniFlex benchtop XRD system can be used to measure bulk pieces of slate or a ground powder form of shale to identify each material.