

List of Contributors

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James Barker is a senior industrial minerals geologist and associate director at New Mexico Bureau of Geology and Mineral Resources and adjunct faculty member, Department of Earth and Environmental Science and Department of Mineral Engineering. He studies the important roles that marketing and transportation play in successful industrial mineral ventures. His work at the bureau has included development of the perlite lab, which is the main perlite testing facility in North America. He has studied in detail the state's deposits of perlite, zeolite, potash, aggregate, pumice, humate, barite, cement, dimension stone, and others. Before joining the bureau, he taught geology and worked as a geologist for several mining companies. Barker has written and edited well over two hundred articles, papers, reports, books, posters and abstracts on industrial minerals. James is an honorary member in the New Mexico Geological Society and a distinguished member of Society for Mining, Metallurgy, and Exploration. Barker received a B.S. in Geology from the University of California, Los Angeles, and an M.A. in Geology from the University of California, Santa Barbara.

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Julia Barnes is currently working for the state of New Mexico as a staff member of the Office of Public Facilitation. This state government office works with state agencies to promote the use of collaborative processes, particularly on larger public policy issues. The office is administratively attached to the Environment Department. Since its inception in January 2002, the Office of Public Facilitation has worked with all three branches of government, in many departments and divisions of state government. Barnes trains state personnel and court volunteers in mediation and facilitation techniques in addition to providing process expertise to agencies. Barnes has been a practicing attorney since 1989, a mediator since 1990, and a facilitator since 2000. Barnes received an undergraduate degree from Stanford University and a law degree from the University of Colorado at Boulder.

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Paul Bauer is a senior geologist and associate director at the New Mexico Bureau of Geology and Mineral Resources and adjunct faculty member, Department of Earth and Environmental Science. He has spent twenty-five years investigating the sublime geology and landscapes of New Mexico. His current research is focused on using field studies and structural geology to describe the geologic evolution of the mountains and basins of north-central New Mexico. He has co-authored a series of geologic quadrangle maps of southern Taos County and has published a wide variety of books and articles on the geology of the region. He is Program Coordinator for the Decision-Makers Field Conferences, a five-year-old program that attempts to bridge the gap between science and policy in New Mexico. Paul received a B.S. in geology from the University of

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Doug Bland has worked for the New Mexico Bureau of Geology and Mineral Resources since 2004, primarily as technical coordinator and trip leader for the Decision-Maker's field conference. He served as director of the Mining and Minerals Division of the New Mexico Energy, Minerals and Natural Resources Department from 1998 through 2002, where he was responsible for overseeing environmental protection and permitting of mine sites under the New Mexico Mining Act and Coal Surface Mining Act. He also held various technical and managerial positions in Mining and Minerals Division between 1989 and 1998. His experience includes twelve years in the mining and petroleum industries. He holds B.S. and M.S. degrees in geology from Virginia Tech and the University of Wyoming.

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Bill Brancard has worked extensively on New Mexico mining issues for more than a decade as a government official and as a public and private attorney. Brancard is the governor's representative to the Interstate Mining Compact Commission and the Western Interstate Energy Board Reclamation Committee. He was the first general counsel to the New Mexico Mining Commission when the commission was created in 1993 and later served as vice chair of the commission. Brancard was an assistant attorney general from 1991 to 1997, and from 1997 to 1999 he was an Assistant Land Commissioner for Policy and Legislation at the State Land Office. Before attending law school, he worked as an archaeologist in New Mexico and Arizona and did graduate studies in archaeology at the University of New Mexico. He has been listed in *Who's Who in American Law* and has published legal articles in the *Harvard Journal on Legislation* and the *New Mexico Law Review*. Brancard has a B.A. in anthropology and history from Hamilton College, a J.D. from Harvard Law School and also attended the London School of Economics.

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Michael Coleman has been a geoscientist in the Surface Water Quality Bureau, New Mexico Environmental Department since 1994. He has worked as a geologist, surface mine reclamation specialist, and environmental specialist. Before joining the Surface Water Quality Bureau, he worked twenty-two years in the mining industry. He has extensive local and regional geologic and structural mapping, reconnaissance, and resource evaluation experience, and has participated in numerous energy, precious metals, and industrial minerals exploration and development projects, including all levels of reclamation work. In his current position as Watershed Protection team leader, his assignments include Clean Water

Act Section 319 grant project management, mine permitting and reclamation, watershed and stream restoration efforts, and he is presently actively involved in innovative erosion control and stream geomorphology projects in the challenging Rio Puerco Watershed. He received his geology degree from the University of New Mexico, and has done graduate work at UNM and the University of Nevada's Mackey School of Mines, in Reno.

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Stephen D'Esposito became president/CEO of EARTHWORKS in January 1998. Before joining EARTHWORKS Steve served as vice president for policy and, from 1986 through 1992, was instrumental in building Greenpeace USA into one of the largest environmental groups in the U.S. From 1993 through early 1996, Steve served as deputy director and then executive director of Greenpeace International in Amsterdam, the Netherlands. During his tenure at Greenpeace International he launched the Brent Spar campaign to block Shell from dumping oil facilities in the North Sea. Before his work with Greenpeace, Steve was field director for the New York Public Interest Research Group. Steve received a bachelor's degree in political science from Tulane University in New Orleans.

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Robert W. Eveleth is associate curator of the bureau's mineral museum; manager of the Bureau's archival collections of mining and mineral-related data, photographs, manuscripts, and maps; and, since 1986, chairman or co-chairman of the annual New Mexico Mineral Symposium at Socorro. He also works closely with the New Mexico Abandoned Mine Lands Investigative Team. His experience includes substantial underground mining and open pit with various base and precious metal mines in the south-western U.S. He has conducted field studies of many New Mexico mines and districts, provided technical advice to small mine operators, prospectors, and exploration geologists; and been principal investigator on several data base projects for the U.S. Bureau of Mines and U.S. Geological Survey. He co-authored the U.S. Bureau of Mines New Mexico chapter in the Mineral Yearbook for many years. He received his degree in mining engineering from the New Mexico Institute of Mining and Technology.

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Robert Evetts is a civil engineer and has been the Abandoned Mine Land program manager in the New Mexico Mining and Minerals Division since April 1990. Evetts was the deputy secretary of the Energy, Minerals and Natural Resources Department in 1989. He is a licensed contractor in New Mexico and proprietor of R. M. Evetts Engineering and Construction in Tucumcari, New Mexico, founded in 1972. He has been listed in the Who's Who In American Pipeline Contractors and is a member of the New Mexico State University Academy of Civil Engineering. He was selected as a New Mexico State University Centennial Engineering Alumni in 2000. He is a licensed professional engineer in New Mexico, Colorado, and Texas. Evetts received his B.S. degree in Civil Engineering from New Mexico State University. He retired in 2004.

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Terence Foreback has current expertise in engineering activities related to the Mining and Minerals Division, Mining Act Reclamation Program including permitting, reclamation, slope stability, and financial assurance. Before joining the Mining and Minerals Division, he held various positions in the mining industry including general reclamation supervisor, general blasting supervisor, mine supervisor, and resident mine engineer. Terence received his B.S. degree in mining engineering from the Pennsylvania State University and is a registered professional engineer in Colorado and New Mexico.

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Pat Freeman is president of St. Cloud Mining Company where he has been employed since 1980. St. Cloud has explored, operated, and reclaimed several surface and underground base and precious metal mines in New Mexico and continues to produce natural zeolites and construction aggregates. The company also provides construction and mine reclamation services for the state of New Mexico and private concerns. He began his career as an underground mine geologist at the San Pedro Mine in southern Santa Fe County in 1968, worked domestically and internationally for Texasgulf, Inc. in mine evaluation and development. Freeman served as an industry representative on the New Mexico Mining Commission from 1996-2002. He is a member of the American Institute of Mining Engineers and a certified professional geologist. Freeman received his B.A. in geology from Monmouth College.

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Ned Hall has been with Phelps Dodge Mining Company's New Mexico Operations since 1994. He is currently the manager of the Environment, Land and Water Department and is responsible for reclamation and closure activities for Phelps Dodge's Chino, Tyrone and Cobre Mines in southwest New Mexico. Ned received his B.S. degree in engineering science from New Mexico Institute of Mining and Technology and his M.S. in environmental engineering from New Mexico State University

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Peter Harben has participated in more than two hundred assignments involving the market evaluation of the full spectrum of industrial minerals, certain inorganic chemicals, and selected metals. The work has included technical visits to over forty countries on behalf of clients ranging from major multi-nationals and the World Bank to individual landowners. Projects have included worldwide market evaluations, assessment of acquisition opportunities, the development of marketing plans, and participation in due diligence work. The firm works closely with professional associates whose expertise includes transportation, health and safety regulations, mineral processing, financial analysis, and glass technology. A former American editor of *Industrial Minerals*, Peter Harben has written and spoken extensively on the subject of industrial minerals and their markets. Texts include *Industrial Minerals: A Global Geology* (three editions), *The Industrial Minerals HandyBook—A Guide to Markets, Specifications and Prices* (four editions), *Manganese—Uses and Markets*, *Bauxite and Alumina—Uses and Markets*, *Sampling Industrial Minerals and Ores*, and the titles *Kaolin*, *Salt*, *Beryllium*, and *Industrial Diamonds* in a series of *Financial Times Executive Commodity Reports*.

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David Hogge monitors and assesses surface water quality in New Mexico's rivers, lakes, and streams to determine if state surface water quality standards are met and to ensure that designated uses are supported. This effort includes development of total maximum daily loads for impaired waters and maintenance of an extensive database and Geographic Information System on the quality of the state's surface waters. David has worked thirteen years in the environmental field including work with Lockheed Environmental Systems and Technologies Company, Las Vegas, Nevada, contract laboratory program from 1990 to 1994. He holds a B.S. degree in community and public health and an M.S. degree in health administration from New Mexico State University.

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Peggy Johnson is a senior hydrogeologist with the New Mexico Bureau of Geology and Mineral Resources. She is currently working with the Office of the State Engineer on the hydrogeology of the Española Basin near Santa Fe. Results of one of her recent studies on the hydrogeology and water resources of the Placitas area of north central New Mexico provide the scientific framework for the area's regional water planning effort. She has eighteen years of consultant and research experience in ground water hydrology and related fields. Her diverse background includes practical research in basin hydrogeology, karst hydrology, mountain-front recharge, surface water and ground water resource assessments, isotope hydrology, and water resource management and policy. Johnson has considerable previous experience in private consulting and conducts hydrogeologic and water supply investigations for the New Mexico Office of the State Engineer, the Interstate Stream Commission, and various counties and municipalities throughout the state. She received her B.S. in geology from Boise State University (Idaho), and her M.S. in hydrology from New Mexico Institute of Mining and Technology.

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Gary King is in the private practice of law, specializing in environmental issues, water law, and land use planning. He previously served as the director of the Office of Worker and Community Transition at the U.S. Department of Energy (DOE), and as policy advisor to the DOE assistant secretary for environmental management. Before joining the DOE, he served as general counsel and senior environmental scientist for Advanced Sciences Inc. He served six terms in the New Mexico House of Representatives where he was the primary sponsor of legislation involving air and water quality, hazardous waste transportation and disposal, mine reclamation, and other environmental issues. In 2004 he was the Democratic nominee for Congress in the Second District of New Mexico. King is currently the chair of the New Mexico Mining Commission. He holds a B.S. degree in chemistry from New Mexico State University and a Ph.D. in organic chemistry from Colorado University. Dr. King earned his law degree at the University of New Mexico.

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Bill Langer has been a research geologist with the U.S. Geological Survey since 1971 and has been the U.S. Geological Survey resource geologist for aggregate since 1976. He is a member of the Society for Mining, Metallurgy, and Exploration, the American Society for Testing and Materials committees for Concrete Aggregate and Road and Paving Materials, and the International Association of Engineering Geologists Commission No. 17 on aggregates. Bill has conducted geologic mapping and field studies of aggregate resources throughout much of the United States. He has published over one hundred reports, maps, and articles relating to crushed stone and gravel resources including monthly columns about geology and aggregate resources in *Aggregates Manager* and *Quarry*.

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Warren McCullough is currently chief of the Montana Department of Environmental Quality's Environmental Management Bureau, which oversees the Metal Mine Reclamation Act and the Major Facilities Siting Act. He started working for the state in 1995 as a reclamation specialist/exploration geologist. Before that he accumulated over twenty years of industry experience in mineral exploration, oil and gas exploration and production, and corporate management. He has a B.A. in anthropology from Yale University, an M.S. in economic geology from Bowling Green State University (Ohio), and has studied at the University of Edinburgh (Scotland), University of Utah, Oklahoma State, and Montana Tech.

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Ginger McLemore came to the bureau in 1980 as a minerals geologist specializing in uranium deposits. Ginger is currently the lead investigator for the bureau in a multi-million-dollar project at Molycorp's Questa mine, on the characterization of the Questa rock piles. This cooperative project includes bureau staff, New Mexico Tech faculty and students, the University of Utah, and several other universities. The goal is to better understand the weathering processes that affect mine rock piles to mitigate possible hazards. She has published over one hundred and fifty articles on the metallic mineral resources of New Mexico, including her best-selling map of the gold and silver deposits of New Mexico. Ginger is an energetic researcher in the field of alkaline magmatism, carbonatites, anorthositic, and A-type granites. In 2004 Ginger received an Appreciation Award from the New Mexico Mining Association for her participation at their sixty-fifth annual meeting and the Team of Excellence Award from the Utah Engineering Experiment Station for her contributions to the Molycorp project. She also was elected chairman of the steering committee for the Acid Drainage Technology Initiative group, which conducts research and disseminates technologies on acid drainage. She holds B.S. and M.S. degrees in geology from New Mexico Institute of Mining and Technology and received her Ph.D. in geoscience from the University of Texas at El Paso.

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Mary Ann Menetrey has worked for the Environment Department since 1991 and has held her current position since 2000. Her primary responsibilities include oversight of ground water discharge permitting, including closure plans and abatement actions, for all hard rock mining operations regulated under the New Mexico Water Quality Act and Water Quality Control Commission Regulations. She also worked six years as a project manager and soil scientist for an environmental consulting firm. Mary Ann received her B.S. degree in soil science from California Polytechnic State University and was an M.S. candidate in soil science at the University of California at Davis.

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Kirk Nordstrom joined the U.S. Geological Survey in 1980 as a project

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John Pfeil is a program manager for Mining and Minerals Division, Energy, Minerals and Natural Resources Department and is responsible for the development of several publications relating to New Mexico's extractive minerals industry. He has worked for a number of private and government organizations whose focus is the management and protection of natural resources. He attended the University of Wisconsin at Madison and graduated with degrees in both geology and history.

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Greer Price currently directs the publications program at the bureau. His experience includes seven years as a geologist working in the oil patch, ten years with the National Park Service, and four years as managing editor at Grand Canyon Association. He has served on the board of the *Publishers Association of the West* and is currently on the board of the *New Mexico Geological Society Foundation*. His focus for many years has been on the interpretation of geology for the general public. His career has involved teaching, writing, and field work throughout North America. He is the author of *An Introduction to Grand Canyon Geology*. He holds a B.A. and an M.A. in geology from Washington University in St. Louis.

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Andrew Robertson has thirty-five years of experience in geotechnical engineering applied to mines. He was a founding partner in 1974 of the international firm of mining and geotechnical engineers, SRK Consultants, and was responsible for the development of their U.S. and Canadian practices. He formed Robertson GeoConsultants Inc. in 1995 and provides an international consulting practice in mining geotechnics, mine waste management, stability and environmental liability assessments for mines, risk management, closure planning and decision analyses for mines. He serves on a number of independent geotechnical review boards for major tailings dams and large risk mining geotechnical structures internationally and has served as a technical advisor to a number of U.S. states and government agencies internationally on these matters. He has written over seventy five technical papers on these topics. He has a B.S. in civil engineering, a Ph.D. in rock mechanics.

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Peter Scholle has had a rich and diverse career in geology: nine years with the U.S. Geological Survey, four years directly employed by oil companies (plus many additional years of petroleum consulting), seventeen years of teaching at two universities, and now a career in state government at the New Mexico Bureau of Geology and Mineral Resources. His main areas of specialization are carbonate sedimentology and diagenesis as well as exploration for hydrocarbons in carbonate rocks throughout the world. He has worked on projects in nearly twenty countries, with major recent efforts in Greenland, New Zealand, Greece, Qatar, and the Danish and Norwegian areas of the North Sea. A major focus of his studies dealt with understanding the problems of deposition and diagenesis of chalks, a unique group of carbonate rocks that took on great interest after giant oil and gas discoveries in the North Sea. His career has also concentrated on synthesis of sedimentologic knowledge with the publication of several books on carbonate and clastic depositional models and petrographic fabrics. He and his wife have published many CD-ROMs for geology, oceanography, and environmental science instructors, and they currently are developing computer-based instructional modules and expert systems in carbonate petrography. He has been president of Society for Sedimentary Geology and currently is treasurer of the American Geological Institute and president-elect of the Association of American State Geologists. Peter Scholle received a B.S. in geology from Yale University and continued his studies at the University of Munich on Fulbright/DAAD Fellowships and at the University of Texas at

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Shannon Shaw has worked with Robertson GeoConsultants for more than eight years providing consulting services to the mining industry internationally in fields related to material characterization, acid rock drainage, mine waste management, closure planning, and multi-stakeholder facilitation for options evaluations and risk assessments. She has served as project manager and third party reviewer for many projects and has written a number of technical papers and presentations. She has a B.S. in geological and chemical sciences, and an M.S. in geological sciences with a specialization in sulfide oxidation.

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Brian Shields is executive director of Amigos Bravos and Friends of the Wild River, a statewide river advocacy organization with offices in Taos and Albuquerque, New Mexico, which he helped form and has led for over seventeen years. For the past sixteen years Brian has been instrumental in creating a community-based "river's movement" along the Rio Grande and in the communities of northern New Mexico. Brian is involved in a number of community collaborative efforts including citizen monitoring, river restoration, water protection, and policy development. Those efforts include working with land-based indigenous communities, irrigators, environmentalists, ranchers, social and environmental justice organizations, and government agencies to restore clean water, natural flows and native fisheries. Brian has taken a leadership role in establishing various community-based groups and organizations including the Rio Grande/Rio Bravo Basin Coalition, Rio Grande Alliance, Alliance for the Rio Grande Heritage, Rio Chama Coalition, Rio Pueblo/Rio Embudo Watershed Protection Coalition, Reviva el Rio Costilla, Red River Watershed Association, the New Mexico Mining Act Network, the Mining Impacts Communications Alliance, New Mexicans for Sustainable Energy and Effective Stewardship, and the Coalition for the Valle Vidal.

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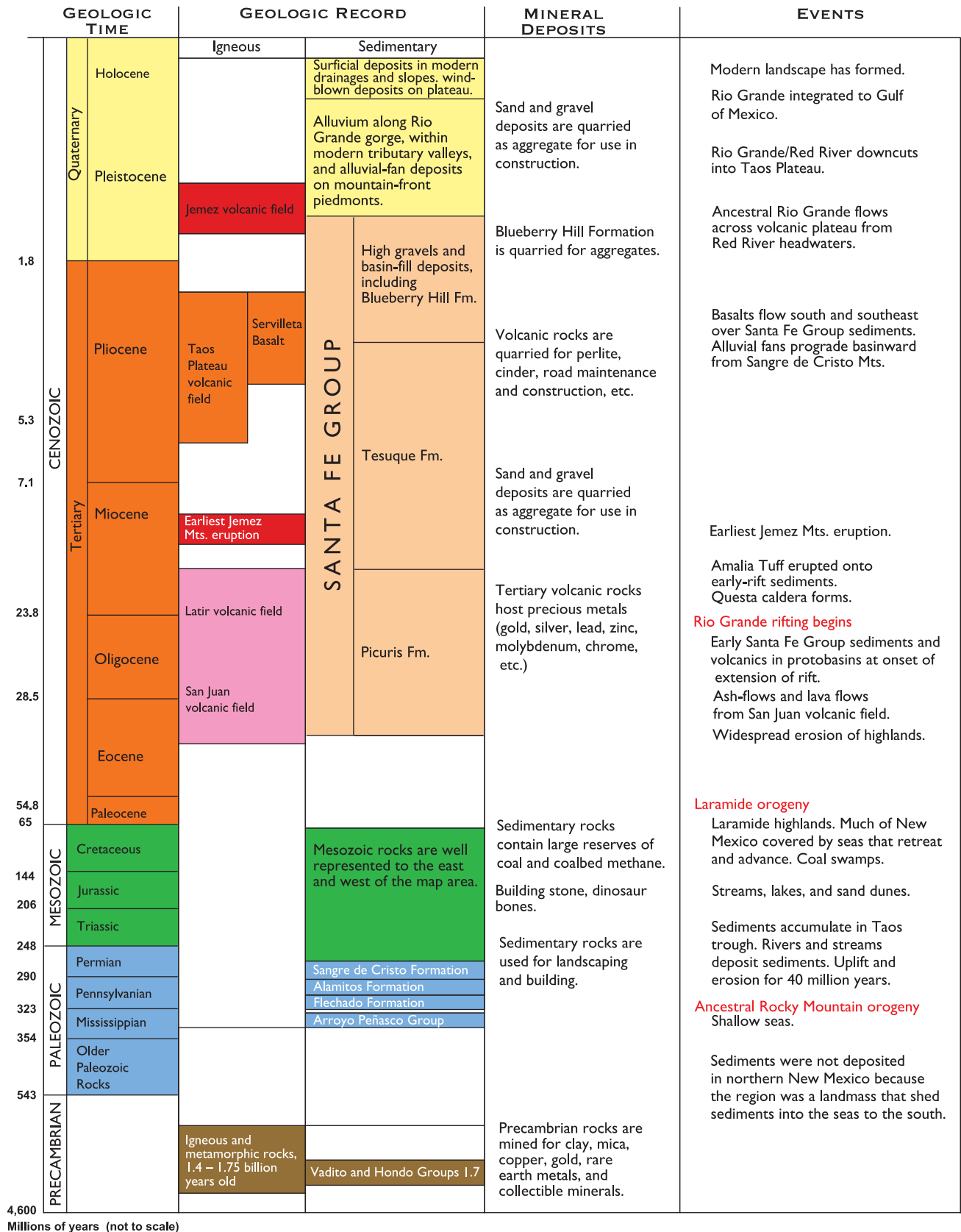
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ACRONYMS

AAS	alternative abatement standards
AMD	acid mine drainage
AML	abandoned mine lands
ARD	acid rock drainage
BBER	Bureau of Business and Economic Research
BLM	U.S. Bureau of Land Management
BMP	best management practice
CERCLA	Superfund
DEQ	Montana Department of Environmental Quality
EMB	Environmental Management Bureau (Montana DEQ)
EPA	U.S. Environmental Protection Agency
FDIC	Federal Deposit Insurance Corporation
FMEA	Failure Modes and Effects Analysis computer model
HRI	Hydro Resources, Inc.
ICMM	International Council on Mining and Metals
ISL	in situ leaching
ITP	Industrial Technologies Program (U.S. Department of Energy)
LA	load allocation
LES	Louisiana Energy Services
MAA	Multiple Accounts Analysis computer model
MIW	mining influenced waters or mine impacted waters
MMD	Mining and Minerals Division (New Mexico Energy, Minerals and Natural Resources Department)
MMSD	Mining Mineral and Sustainable Development project
MPC	Montana Power Company
MSHA	Mine Safety and Health Administration
NAMLRP	Navajo Abandoned Mine Lands Reclamation Program
NAS	National Academy of Sciences
NEPA	National Environmental Protection Act
NGO	non-government organization
NPDES	National Pollutant Discharge Elimination System
OSM	Office of Surface Mining
RAMS	Restoration of Abandoned Mine Sites (U.S. Army Corp of Engineers)
R&D	research and development
RFP	request for proposals
SARM	sustainable aggregate resource management
SMCRA	Surface Mining Control and Reclamation Act
SXEW	solvent extraction/electrowinning
TDS	total dissolved solids
TMDL	total maximum daily load
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WLA	wasteload allocation
WQCC	Water Quality Control Commission



Millions of years (not to scale)