Preface

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Biographical notes: Ravi K. Jain was a Professor and the Dean at the School of Engineering and Computer Science, University of the Pacific, Stockton, California from 2000 to 2013. Prior to this appointment, he has held research, faculty, and administrative positions at the University of Illinois (Urbana-Champaign), Massachusetts Institute of Technology (MIT), and the University of Cincinnati. He was elected member of the European Academy of Sciences and American Academy of Environmental Engineers. He has been a Littauer Fellow at the Harvard University and Fellow of Churchill College, Cambridge University, UK.

Jeremy K. Domen has a broad range of experience in research related to water quality, hydraulic fracturing, mining and mineral processing, environmental impact analysis, and engineering innovation. He has published multiple peer-reviewed papers and technical reports and has presented research work at various technical conferences. He has held research appointments at the Lawrence Berkeley National Laboratory in Berkeley, California, as well as at the School of Engineering and Computer Science at the University of the Pacific, Stockton, California. He received his BS in Bioengineering and MS in Engineering Science from the University of the Pacific, School of Engineering and Computer Science.

The importance of mining and mineral extraction is best characterised by the National Academy of Engineering (NAE) (2010), where it was stated that the history of human civilisation is often characterised by periods such as the Stone Age, Bronze Age, Industrial Revolution, and Information Age. As can be seen, a common thread among all these epochs is the extraction, processing, and use of materials from the Earth (NAE, 2010).

Mining and mineral processing activities contribute significantly to the economic activities of industrialised and industrialising nations. These activities are necessary for economic development and job creation. There are, however, serious environmental impacts from these activities. This special issue focuses on the environmental implications, pollution prevention, and sustainability related to mining and mineral processing.

Topics covered in this special issue include:

- the importance of mining and mineral processing to a nation and to society
- environmental impacts of mining and mineral processing

- waste treatment technologies
- secondary waste disposal issues and heavy metal accumulation
- leachate control from mining wastes
- mining backfill technologies, materials, costs, and long term implications
- mining site subsidence, environmental and economic impacts, and related control methods
- mitigation measures and control technologies for dust dispersion and erosion control
- mine safety and environmental pollution nexus.

The United Nations World Commission on Environment and Development (1987) defines sustainable development as "meet[ing] the needs of the present generation without compromising the ability of the future generation to meet their needs". Sustainable development can also be viewed as a process that "involves the economic, social, cultural and environmental dimensions of human existence" (United Nations, 2002). Another related concept developed by John Elkington in 1994 suggests an appropriate balance is needed between economic prosperity, environmental quality, and social justice.

As the world moves toward more sustainable practices, the mining and mineral processing industry will be profoundly impacted. Mining provides the raw materials found in virtually every product and service throughout the world. However, the long project life cycles for mining operations mean that companies are accustomed to long-term plans and operations and should be able to implement appropriate sustainable development practices.

To effectively address environmental challenges, current mining trends need to be taken into consideration. With few exceptions, global production of mineral products has significantly increased in recent years (Table 1). This has led not only to the processing of larger volumes of materials, but also to the greater chance of negative environmental impacts. Trends in the mining industry can be used to predict which technologies are becoming cost-effective and where mining growth is expected in the future.

Population growth and urbanisation are important factors that have increased, and will continue to increase, the demand for mineral commodities and in turn drive mining activities. According to the International Council on Mining & Metals et al. (2014), the increase in urbanisation and population in Asia is one of the driving forces in the recent increase in demand for mineral resources. As economies in Asian countries flourish, mining and mineral processing activities are likely to increase in response.

Contributors to this special issue include academicians, engineers, and scientists with exceptional research and professional practice experience. Important topics relevant to the special issue are covered creatively and comprehensively. Thus, this special issue can serve as an excellent text and reference document for professionals and students interested in mining, mineral processing and related environmental implications.

Table 1 Global production for select mineral commodities in 2010 and 2014

Mineral/product	*2010 production*	*2014 production*	*Mineral/product*	*2010 production*	*2014 production*
Aluminium	40.8 Mt	49.3 Mt	Lead	4.14 Mt	5.46 Mt
Antimony	0.167 Mt	0.160 Mt	Lime	311 Mt	350 Mt
Arsenic	52,800 t	46,000 t	Magnesium compounds	5.76 Mt	6.97 Mt
Asbestos	2.01 Mt	1.98 Mt	Manganese	13.9 Mt	18 Mt
Barite	7.85 Mt	9.26 Mt	Mercury	2,250 t	1,870 t
Bauxite and alumina	209 Mt	234 Mt	Mica	1.07 Mt	1.13 Mt
Bentonite	10.6 Mt	12.2 Mt	Molybdenum	0.242 Mt	0.266 Mt
Beryllium	205 t	270 t	Nickel	1.59 Mt	2.4 Mt
Boron	4.08 Mt	3.72 Mt	Peat	23.4 Mt	27.7 Mt
Bromine	0.45 Mt	0.411 Mt	Perlite	1.67 Mt	2.09 Mt
Cadmium	21,100 t	22,200 t	Phosphate rock	181 Mt	220 Mt
Cement	3,310 Mt	4,180 Mt	Platinum group metals	192,000 kg	161,000 kg
Chromium	23.7 Mt	29 Mt	Potash	33.7 Mt	35 Mt
Cobalt	89,500 t	0.122 Mt	Salt	280 Mt	269 Mt
Copper	15.9 Mt	18.7 Mt	Sand and gravel (industrial)	121 Mt	165 Mt
Feldspar	20.6 Mt	21.5 Mt	Silver	23,100 t	26,100 t
Fluorspar	6.01 Mt	6.85 Mt	Sulphur	68.1 Mt	72.4 Mt
Fuller's earth	3.29 Mt	3 Mt	Tin	0.265 Mt	0.296 Mt
Gold	2,560 t	2,860 t	Titanium	0.137 Mt	0.192 Mt
Graphite	0.925 Mt	1.17 Mt	Tungsten	68,800 t	82,400 t
Gypsum	147 Mt	246 Mt	Vanadium	57,600 t	78,000 t
Iron ore	2,590 Mt	3,220 Mt	Vermiculite	0.536 Mt	0.4 Mt
Kaolinite	33.1 Mt	41 Mt	Zinc	12 Mt	13.3 Mt

Note: Values are in metric tons (t).

Source: US Geological Survey (USGS, 2012, 2015)

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