Curriculum Vitae

Andrew Bamber – Managing Director (UK), Principal Consultant

Profession: Mining and Metallurgical Engineer
Education: BSc Hons. (Mech. Eng) University of Cape Town
MASc (Mineral Process Engineering) University of British Columbia
PhD (Mining Engineering) University of British Columbia
Engineer's Certificate of Competency (Mines and Works, 1995)
Registrations/Affiliations
Registered Professional Engineer APEGBC
Registered Professional Engineer ECSA
Member Canadian Institute of Mining and Metallurgy
Member Society of Mining Engineers (USA)

Specializations:

- Mining and mineral process engineering
- Project and Engineering Management
- Mine-mill optimization
- Economic assessment of mining and mineral processing projects and operations
- Pre-concentration, sensors and sensor-based sorting
- Innovation, technology development, demonstration and commercialization

Expertise:
Andrew is a qualified Professional Engineer with over 25 years' experience in mining and minerals processing in Southern Africa, the Americas, Australia and Asia. His involvement has ranged as an engineer at operations, through to development and detailed design of process solutions in a range of commodities including nickel, copper, chrome, gold and platinum. He has extensive experience in process and process equipment design, plant design, cost estimation and project economics as well as project, construction and operations management. Andrew has had extensive involvement in mining both at the consulting and R&D level, with specializations in the development and commercialization of innovative mining and process technologies. He has worked as a Consulting Engineer on prefeasibility and feasibility studies across several commodities and has contributed as lead engineer or project manager in the completion of major capital projects on time and under budget. In 2009 he founded MineSense Technologies, a Vancouver-based mining technology company focused on the delivery of sensor-based grade control and bulk sorting solutions to the industry. Andrew joined join Bara Consulting as Principal, Americas in 2017.

EMPLOYMENT

2017- **Principal and Managing Director, Bara Consulting (Americas)–** Bara Consulting is an engineering consultancy focused on serving the mining industry globally. With offices in the UK, the RSA and Canada, the company offers multidisciplinary professional services in mining, mineral processing, infrastructure and tailings, typically at prefeasibility or feasibility study stage. As Principal, Americas I am focused on business and corporate development, delivering value-engineering services to clients in the fields of mine engineering, process engineering, and mine-mill optimization including bulk sorting and other innovations.

2009 - 2016 **Founder**, **CEO and CTO, MineSense Technologies Ltd –** at MineSense Technologies I was principally responsible for the development and commercialization of sensor-based ore control and sorting systems for base- and precious metals mines. As CTO I was responsible for the development of ShovelSense™ and BeltSense™, unique shovel- and belt-based bulk ore sensing and sorting systems, as well as ongoing work in the characterization of ores and orebodies for sorting. As CEO, reporting to the Board, my focus was technology, business and corporate development, as well as capital-raising, generating circa $20M in both dilutive and non-dilutive funds for the development, marketing and commercialization of the technology.

2006-2012 **Process Consultant**, **Golder Associates Global Mining Group.** From 2006 I was a senior metallurgical consultant and Qualified Person for Golder Associates Global Mining Group, consulting on NI-43-101 technical reports, preliminary assessments and pre-feasibility studies, as well as due diligence studies and mine audits in *inter alia* copper, nickel, tungsten, lead-zinc, gold and precious metals projects globally.

2005-2010 **Principal Consultant**, **BC Mining Research Ltd.** As principal consultant for BC Mining Research Ltd, I was responsible for research relating to metallurgical process and process technology development, including novel pre-concentration and waste disposal systems for Placer Dome, Barrick, Vale and Xstrata, as well as process consulting in comminution (SAG mills, high pressure grinding rolls and high speed stirred mills)

and beneficiation (sensor-based sorting, gravity concentration, flotation and leaching).

2003-2008 **Research Associate, University of British Columbia** (Mining Engineering Dept.). During this period the focus of my research was on the development, testing and evaluation of underground ore pre-concentration and solid waste disposal systems for companies such as INCO, Xstrata and Placer Dome. Completed MASc in 2005 and Ph.D. in 2008

2001-2003 **Senior Project Engineer, Dowding Reynard & Associates.** Lead Engineer/Project Manager for Feasibility, Design and Construction of US$35M Mimosa Platinum Phase III expansion (Zimbabwe), responsible for a project team of 40 and a construction team of 500. Scope of delivery included 4100 tpd Ni-Cu-PGE process plant, 88kV HT powerline and substation, 20km access road, water and tailings infrastructure. Additional responsibilities included support for feasibility studies in nickel, copper, platinum and chrome.

1999 -2001 **Senior Project Engineer - Associated Manganese Mines of SA**. Client's Engineer on Feasibility, Design, Construction and Commissioning of US$30M Dwarsrivier Chrome Mine, including open pit, 3000 tpd Cr_2O_3 beneficiation plant, tailings dam, water, HT power and surface infrastructure. Additionally, I consulted on the design and construction of a novel 54MVA DC ferrochrome furnace and sinter strand at FerroAlloys in Machadodorp, designed to treat the ore from Dwarsrivier. Working within a multidisciplinary team of 6 engineers, reporting to Senior Project Manager, Ferrous Metals.

1998-1999 **Operations Manager, Nyala Minerals**. Operations Manager for novel US$10M sintered alumina facility at Nyala Minerals in Richards Bay, RSA. Upon commissioning of the Nyala Alumina plant, I was retained as the Operations Manager reporting to the Managing Director and responsible for a workforce of 39.

1996-1998 **Project Engineer, Anglovaal Mining Limited.** Project Engineer reporting to Chief Consulting Mechanical and Electrical Engineer and working with Chief Consulting Metallurgist, responsible for design, project planning, construction and commissioning of a novel US$10M sintered alumina facility at Nyala Minerals in Richards Bay.

1995-1996 **Junior Engineer, Hartebeestfontein Gold Mine.** Engineer-in-Training, reporting to Training Manager, trained in installation and maintenance of major process, material handling and HVAC plant as well as mobile mining equipment. Additional training in Administration, Utilities, Surface Gold Plant. Promoted to Underground Mechanical and Electrical Foreman in 1996.

1989-1990 **Learner Metallurgist**, **Randfontein Estates Gold Mine; Rustenburg Platinum Base Metals Refinery**. Engineer in training reporting to training manager, gaining process experience in comminution, leaching, solid/liquid separation, precipitation, smelting and refining of gold, platinum and base metals.

Major Project List

Specific projects I have been involved in my career to date include:

1997 - ZCCM: Due Diligence for privatization of Zambian Consolidated Copper Mines (with Noranda, Phelps Dodge & Avmin)
1999 - Associated Manganese Mines of South Africa: Group Enterprise Resource Planning System Study
1999 - Associated Manganese, Feralloys Chrome Division: 54MVA DC Ferrochrome Furnace Project
1999 – Associated Manganese, Feralloys Chrome Division: Dwarsrivier 1.8Mtpa Chrome Mine and Process Plant
2000 - Kroondal Platinum (Aquarius): 'K2' UG2 Platinum 200 ktpm Expansion Feasibility Study; 200ktpm Marikana Platinum Open Pit Feasibility Study
2000 – Aquarius Platinum: Mimosa Platinum Phase II Expansion
2001 - Tshikondeni Coal Mine: Due Diligence and Process Audit (for Kumba Resources, South Africa
2003 - Zimplats: Ngezi Platinum Mine 150 000 tpm Phase II Expansion Study
2002-03 – Xstrata Coal: Wits Consolidated 100000tpm production expansion
2006 – Oriel Resources: Technical Consultant, Voskhod Chrome Project, Kazakhstan/CIS
2008-12 –Goldfields Cerro Corona Gold Mine, Peru Due Diligence, Resource Audit and Process Improvement Project
2007 – UBC: Design and installation of a 50tph HPGR at the Centre for Mineral Processing, Vancouver, B.C.
2008 – Angel Mining: Feasibility Study for the Black Angel Pb-Zn Mine, Greenland
2010 – Basileus Capital: Feasibility Study for Commercialization of Minatuar® Gold Refining Process
2012 – Anfield Nickel: Design, manufacture and piloting of a 10tph XRF Sorting System for nickel laterites
2012 – Anfield Nickel: Process Consultant for 3.9 Mtpa 'Mayaniquel' ferronickel project Pre-Feasibility Study
2012 – Canadian Arrow Mines: Design, manufacture and piloting of a 10tph High Frequency EM Sorting System for Nickel-Copper Ores
2012 – Xstrata Nickel: Study for the application of pre-concentration at Xstrata Raglan and Nickel Rim South Mines including pre-sorting and comparative flotation impact study.
2013 – Almaden Minerals: QP for resource estimate and pre-feasibility study for the Ixtaca skarn-hosted epithermal Gold-Silver deposit in Mexico
2013-15 – BHP Billiton: Development and piloting of ShovelSense™ shovel based bulk sorting system for Minera Escondida