

Peter Bartsch has over 40 years experience in study and design management, process engineering, due diligence, consulting, operations, across extraction facilities and development projects.

Expertise in process operations, plant commissioning and optimisation, engineering design, consultant supervision, technical and study management, operating strategies, process innovations, investigations for plant improvements, scoping and feasibility studies.

Equipment selection and sizing, cost collation and analysis for flowsheet implementation resource studies and projects.

Proficient in technical and operational management at all levels of resource businesses as well as technology leadership.

Fluent in process modelling and flowsheet simulation.

Capability in Copper, Iron Ores, Uranium, Gold and Silver, Nickel and Cobalt, Lead and Zinc, Bauxite and Alumina, Graphite and Graphene, Coal, Tin, Mineral Sands, Industrial Minerals, Imputity Metals and Rare Earths.

Comminution; Crushing, screening and ore handling, FAG, SAG, rod & ball milling, scrubbing, classification, sieving, HPRC, ore breakage analysis, energy conservation and size optimisation.

Mineral beneficiation; mineral analysis, pelletization and agglomeration, gravity, heavy media and magnetic separation, flotation of sulphide, silicate and oxide ores, hydraulic and cyclonic classification, slurry characterisation and rheology, tailings management, thickening and filtration.

Pyrometallurgy; blast and TSL smelting; carbon, electric, thermic and direct reduction; sintering, roasting, drying and calcining; fire, liquation and electro-refining, feed preparation and granulation.

Hydrometallurgy; heap, dump or agitated leaching, digestion and pressure leaching, and slurry heat exchange, CIP/CIL, HPAL, thickening, filtration, neutralization, clarification, purification, solvent extraction, ion exchange & resin-in-pulp, electrowinning, metathesis, crystalization, softening, tailings and ripios management, high-density sludge and slurry handling.

Qualifications: Member AusIMM, (CP Met) & committee member of Metallurgical Society, 2016-2017

Bachelor Applied Science, Primary Metallurgy, SAIT, Adelaide, 1976

Chemical Kinetics, Monash University, Victoria

Process Simulation; JKSimmet, METSIM, SysCAD, Limn,

Marketing, Deakin University, Geelong.

Radiation Safety, ANSTO

CONSULTING METALLURGIST, ALCHEMIDES PTY. LTD, 2006 – Ongoing

ALACER GOLD, COPLER SULFIDE EXPANSION PROJECT, Process Consultant

Review of operation and performance of thickeners, (6) during ramp-up of new plant for treatment of variable ores

OZ MINERALS, CONCENTRATE TREATMENT, Process Development Consultant

Provision of metallurgical and radiological advice for definitive study and pilot program,

Framing radiation emission; advice and reports on measurement and regulatory requirements.

Collaboration on process design for novel flowsheet for treatment of contaminated copper concentrate.

Client's representative for pilot plant scope development and supervision of operations including; non-oxidative and oxidative pressure leaching, barren liquor treatment, and de-watering of process streams.

Technical liaison with engineering consultants for process design and equipment selection.

NYRSTAR Port Pirie, Principal Metallurgist

Process developments for removal of minor impurity metals from smelter waste streams;

laboratory testwork programs, pilot plant development, process engineering, and plant commissioning for selenium, cadmium and arsenic recovery.

Key responsibilities of the role included;

- Provide subject matter expertise as whole of site metallurgical consultant.
- Identify and champion improvement projects for short and long term objectives
- Manage process risks - safety, environmental and production in liaison with responsible departments
- Develop technical solutions for identified process/metallurgical problems across site and share learnings
- Mentor metallurgists and assist process knowledge acquisition for the technical and operations teams
- Provide technical expertise and leadership to the technology team
- Identify and evaluate process projects and support plant designs and commissioning

TALGA RESOURCES, Metallurgy Manager

Leading technical and process activities during novel flowsheet investigations for treatment of graphite ore for generation of marketable sub-micron graphite products. Supervision of technicians and engineers during design, procurement, installation and commissioning of unique process equipment into a staged, pilot plant development.

ARCHER EXPLORATION, Metallurgy Manager

Provision of metallurgical leadership for graphite ore testwork specification and laboratory supervision.

Development of treatment flowsheets and mass balance including comminution, flotation, classification and gravity beneficiation as well as tailings storage facility.

Scope development and coordination of engineering services for study of hydro-fluoric acid leaching of concentrate.

Participation in feasibility studies for support of regulatory approvals.

IRON ROAD LIMITED, Study Manager

Management of Client's Study team for development of large-scale, magnetite iron ore project, including oversight of Mining, Ore Treatment, Rail and Port, Utilities and Project Services

Responsibilities included management of feasibility engineering, design, risk identification and mitigation, and investigations across multiple service providers for multi-billion dollar facilities in South Australia.

Control of expenditure approximately \$36m over 2 years; encompassed multiple providers of Consulting and Engineering services for class 2 estimates, (capex and opex), covering complete scope of facilities;

Mining, milling, magnetic separation, gravity beneficiation, stockyards, railway, port, water supply.

INTERNATIONAL ATOMIC ENERGY AGENCY, Uranium Production Specialist

Technical assignment based at Vienna in Nuclear Fuel Cycle Department

Coordination of international technical seminar on Low Grade Uranium

Provision of assistance or advice to member states across uranium production cycle.

Expert mission to advance uranium production from phosphoric acid for Jordan Atomic Energy Commission.

Prepared and delivered training course on uranium production for government regulators in Mongolia.

RUNGE AUSTRALIA, Metallurgical Consultant

Technical review and operating cost validation for expansion of Langer Heinrich uranium facilities

Technical due diligence and preparation of cost models for calcrete uranium project

Review of in-situ leaching, metallurgical recovery and project costs for undisclosed uranium study.

MITSUI & Co URANIUM AUSTRALIA, Manager Technology and Projects

Technical advice and oversight for Honeymoon uranium in-situ leach project.

Business development for targeting uranium assets in Asia-Pacific region.

Ion-exchange investigations for uranium recovery from saline liquors.

Technical review of metallurgical projects; Elkon uranium project, Goro nickel project.

OK TEDI MINING LIMITED, Metallurgical Advice;

Review of pyrite flotation processes and technology including literature search

ENERGY RESOURCES AUSTRALIA, Ranger Expansion Project, Heap Leach Pre-feasibility Study;

Independent process review of testwork and design, solution handling and solvent extraction.

ENERGY RESOURCES AUSTRALIA, Project based technical assistance and advice.

Review of laterite feasibility study and design basis, and
Redesign/retrofit of water treatment and facilities; process development, design review and HAZOP.
Calciner replacement study process and equipment review.
Sludge, ammonia and brine disposal options review.
Review of water treatment commissioning documentation

RIO TINTO MINERA PERU, Chief Technologist

Technical management for pre-feasibility study of La Granja copper heap leach project.
Supervised development of novel heap leach technology and associated testwork program.
Management of investigations for process and development options,
Responsibility for geological and geo-metallurgical activities
Participation in risk reviews, options analysis and value engineering initiatives.

BHP Billiton, Olympic Dam Projects, Principal Metallurgist

Metallurgical support of optimization, capital and reliability projects including; scope, testwork management and process definition, equipment specification and client interface.

- Tails leach tanks upgrade including ventilation system design and engineering
- Concentrate treatment facilities upgrade; process definition and design review
- Milled ore scats screen study and process design
- Water circuit modelling across metallurgical and tailings facilities
- Water conservation through paste thickening and liquor recycle
- Trouble shooting process stability for uranium solvent extraction
- Re-scoping options for tailings deslime circuit upgrade
- Planning for USX performance verification
- Tailings liquor management and uranium recovery modelling
- Milling Circuit and selective flotation options review

HERON RESOURCES, Metallurgical Consultant

Technical advice and assistance on various requests.
Nickel Laterite Heap Leach, testwork supervision and studies review.
Metallurgical consulting for Jump-Up Dam development.
Kalgoorlie Nickel Project review of metallurgical flowsheet options

SXR URANIUM ONE, Honeymoon Uranium Project, Independent Technical Consultant

Process deliverables revision, supervision of SX study, (pulse columns Vs mixer settlers)
Testwork review, liaison with equipment vendors and plant design review.

NATIONAL MINING COMPANY, Oman, (now Mawarid Mining), Independent Technical Consultant

Metallurgical advice and plant design services
Lasail copper concentrator upgrade process review,
Expansion feasibility study review, precious metals department analysis,
Technical supervision during plant commissioning of refurbished facilities.
Improvements to flotation circuit and pyrite re-flotation

AUSENCO for EQUINOX RESOURCES, Lumwana Uranium Project, Independent Technical Consultant

Process design, testwork and flowsheet review/comparison, testwork planning.
Metallurgical consulting for uranium rich, copper ore stream for yellowcake production.
Cost estimate for SX pulse column facility.

GREENLAND MINERALS & ENERGY, Kvanefjeld Project, Process Development Consultant

Testwork planning and coordination for complex rare earth and uranium ore.
Novel leach process investigation and flotation reagent experimentation
Complete flowsheet development including testing at laboratory scale

TORO ENERGY; Metallurgical consulting and advice

Lake Way & Centipede pre-feasibility process risk review.
Napperby heap leach testwork review, planning and coordination.
Confidential process due diligence for Australian uranium project.

CONSOLIDATED MINERALS, Technical marketing proposal for improved margins of mine products

ARGOSY MINERALS; Musongati nickel laterite project;

Formulation of preliminary project scope, process development planning and metallurgical advice.

2004 - 2006

AKER KVAERNER, (now JACOBS), Chief Process Engineer, Metals, WA

Supervision and coordination of process group for metal and mineral studies and projects.

Developed metals process group and supported business development activities in Australasia

- SXR Uranium One, Honeymoon Uranium Project, Lead Process Engineer for feasibility study including Ontario Securities Commission NI 43-101 documentation.
- Heron Resources, Kalgoorlie Nickel Project process consulting.
- Hamersley Iron Brownfield Mine Expansion process review and optimization of design deliverables
- BHPB nickel laterite process technologies; 5 flowsheets included modelling capex & opex.
- Newmont & Anglo Gold, Boddington Mine Expansion proposal engineer
- Process risk review for European Nickel laterite heap leach project
- Baffinland Mary River iron ore project process audit and NI 43-101 process documentation
- Operating cost estimates for Albion and Biox refractory gold process facilities
- Gladstone Pacific Nickel Marlborough Project, beneficiation process design
- Minara Resources, Nickel ore scats heap leach study planning and budget preparation
- Review of bauxite scrubbing and slurry handling designs for Comalco's Weipa operations

2002 – 2004

SINCLAIR KNIGHT MERZ, (now JACOBS), Mineral Process Leader

Established and managed minerals process group, (8 staff & 6 contractors). Study management, process design, engineering services, business development and proposal preparation.

- PFS Manager for Hamersley Iron's Tom Price and Marandoo brown-field expansion study
- Managed scoping study for Heron Resources, Kalgoorlie Nickel Project
- Commissioning WMC's re-built uranium solvent extraction plant at Olympic Dam
- Smelter improvement proposal for WMC Kalgoorlie Nickel Smelter
- PFS review of Allegiance Mining, Avebury Nickel processing facilities
- ERA's Ranger Mine; scope development including, process review and cost study of process water treatment plant for environmental discharges.
- Process and cost review of laterite project improvements for Anaconda Nickel

Process lead and value improvement activities for INCO's Goro Nickel project

- Technical and economic evaluation of 30+ process and equipment options
- Review and revision of refinery process design basis and testwork review
- Redesign of SX & IX area including equipment selection and sizing
- Review of tailings disposal water balance including high density thickening
- Contribution to commissioning plans for metal refinery

Process and plant improvement studies and engineering for Iluka Resources Limited.

- Tails Circuit addition and spiral upgrade
- Char magnet upgrade and sand trap design
- HCl Leaching of synthetic rutile
- Coal benefit modeling
- Preparation of process guarantees contract.
- Ore handling and wet scrubber 'mining' unit design audit

1998 – 2002

HATCH KAISER, *Principal Metallurgist and Client Services Manager - Minerals*

Technical and metallurgical development in projects and studies:

- Process review of Comalco Alumina Refinery design.
- St Ives Gold Mine toll treatment of gold ore contract
- Process design of refinery systems for Moneo Nickel Project.
- Lead metallurgist for Mt Margaret Nickel Project; feasibility study including options studies, process design and testwork review
- Lead Process Engineer for WMC Olympic Dam solvent extraction enhancement project.
- Management of pulse column and solvent regeneration testwork for WMC ODO.
- Testing of RIP technology for recovery of nickel at QNI's Yabulu refinery.
- Review of solvent extraction designs for QNI's Yabulu Expansion Project.
- Process options studies at QNI's Yabulu optimization project; roasting, leaching, purification and refining.

Ravensthorpe Nickel laterite feasibility study.

- Process review of chemistry, flow sheets and equipment.
- Participation in beneficiation studies and designs
- Review of cost estimates and preparation of study report

Study and Process Management.

- Process review and scoping study for cyanide destruction at Comalco BSL
- Mt Todd comminution options study.
- Simulation of magnesium production facility for SAMAG.
- Indirect heat exchanger testwork and designs for slurries for Anaconda Nickel.
- Pre-feasibility study for vanadium oxide plant.
- Pre-feasibility study for green-field alumina production facility
- Scoping study for Lake Maitland Project; yellow cake production from uranium bearing calccrete ores; including pressure leach and resin in pulp recovery.
- Feasibility engineering and cost estimates for AMC's flame retardant study.

Due diligence process plant review of various projects for primary copper smelter, vanadium pentoxide production, and various alumina and magnesium studies.

Management of business development activities including proposal preparation and client liaison across Australian mineral resources sector.

1995 – 1998

BATEMAN AUSTRALIA, (now Tenova Projects), *Senior Metallurgist / Acting Process Manager*

Process management and supervision for the following projects:

Port Pirie lead refinery; renewal of facility, review of process operations and facility design

Bulong Stage 2 pre-feasibility study, nickel recovery flowsheet, process design and facility costing

Marlborough Nickel feasibility study process design, and leading testwork planning, co-ordination and interpretation.

Due diligence process review for EZINEX zinc process.

Qsmelt custom copper smelter study including process design and cost estimates.

Gunpowder Copper feasibility study for Aberfoyle Resources including development of process mass balances and management of pilot plant.

Gunpowder cobalt recovery process design including solvent extraction and ion exchange.

Argyle Diamond Mine, development of process simulation for crusher, HM beneficiation and screen operations including plant surveys of all process operations to support process model development.

Process design for Argyle Diamond's upgrade study including secondary HPGR.

Bulong Nickel feasibility capital and operating cost estimation, and metallurgical review.

Pre-feasibility study cost estimate of gold project for RGC Exploration.

Olympic Dam Expansion pilot testwork and process design of uranium SX facility,.

Modeling of waste and water circuits for Tiwest's synthetic rutile operations.

Commissioning at Mt Todd, NT. and Henty Gold Mine, Tasmania.

Mt Todd copper concentrate flotation and filtration improvement study

Review of scrubbing and wet screening operations of high clay gold ores for Higginsville Operation of Resolute Limited.

1994 – 1995

DAVY JOHN BROWN, (now JACOBS), Principal Metallurgist

Preparation of definitive testwork, process design and feasibility study plan to develop Mt Weld rare earth project for Ashton Mining

Supervision of cost estimates preparation for lateritic nickel projects.

Directed plant surveys to establish water balance for Tiwest's synthetic rutile plant at Muchea.

Chinese gold project; Milling, flotation, CIP testwork review and study compilation.

Lead metallurgist for cobalt refinery feasibility study at QNI, including mass balances and equipment specification for three stage, solvent extraction, ion exchange and ammonia stripping.

Review of Uley graphite process criteria and flowsheet

Support for mineral and metallurgical project proposals.

1992 – 1994

CRA ATD, (now Rio Tinto Technology and Innovation), Senior Project Metallurgist

Leading process modelling studies for CRA's business units.

Leading studies in product quality initiative for Hamersley Iron including:

- coordination of mine to port process simulator development and implementation,
- automation of product value calculations
- world wide survey of screening performance measures
- audit of ore screening operations at Hamersley Iron
- screening and crusher model development
- methodology for optimizing product value for multi mine operation
- investigation of screening control systems to maximize lump production.

Technical awareness and best practice benchmarks in process modelling and simulation.

Review and update of process models for Hi-Smelt iron-making.

Process design for high temperature diamond cleaning process.

Provide metallurgical review of studies and projects covering iron ore, nickel, uranium, gold, and diamond operations across Australian operations.

1990 – 1992

AGIP AUSTRALIA, RADIO HILL PROJECT, Metallurgical Superintendent

Client technical representative during flowsheet development, through plant design and implementation.

Project tender review and contractor selection for process facilities.

Recruitment of personnel and establishment of plant maintenance systems during construction.

Plant commissioning and operation of the 150,000 tpa concentrator and 50,000 tpa smelter.

Operation of process facilities including column flotation, Isasmelt furnace and utilities.

Responsibilities covered safety, environmental, maintenance, analytical and metallurgical functions.

1989 – 1990

ELDERS Resources, Yilgarn Operations, (now Sons of Gwalia), Metallurgical Superintendent

Management of 40 professional staff, consultants and contractors.

Operation of Marvel Loch (1.2Mtpa) and Southern Cross (0.5 Mtpa) treatment plants, processing weathered, primary, high sulphur and oxygen avid ores.

Operation of Exhibition heap leach and development and operation of 50,000 t trial dump leach.

Supervision of toll treatment campaigns for various ores.

Process development through plant and laboratory testwork, modelling and simulation.

Throughput improvement during treatment of high work index and high clay ore types

Preparation of operating budgets and systems including justification of capital projects.

Development and compilation of occupational health, safety programs and operating procedures.

Coordinated modelling and plant design for additional crushing and screening capacity.

1987 – 1989

MINPROC ENGINEERS, (now AMEC/WOOD)

Senior Project Metallurgist

Development and specification of metallurgical plant flowsheets and plant designs.

Fundamental studies for various precious metals, base metal, and industrial mineral ores for flowsheet development.

Mt. Lyell Mining, Flotation improvement including column cleaning for pyrite rich concentrate.

Feasibility studies for Australian gold and copper projects, including equipment selection for pilot and operational plants.

Metallurgical plant audits, circuit evaluation and field testwork.

Process Development:

Lead metallurgist during design and construction of Tiwest 130,000 tpa synthetic rutile.

- Liaison with clients and operating personnel during design and development.
- Coordinated design for zero liquid discharge waste handling system.

Collingwood Tin Project; flowsheet development and pilot testwork, including milling and beneficiation

Plant Management And Commissioning

Secondment to operations as Mill Superintendent / Deputy Registered Manager at Hannan's South Mine.

Commissioning metallurgist for new gold treatment plants; (Karonie & Mt. Percy), and plant upgrades including column flotation at Paddington.

1986 – 1987

NORTH KALGURLI MINES, (now KCGM), Technical Services Metallurgist

Control of the metallurgical service functions for the company's treatment plants, included responsibility for:

Operation and upgrading of the metallurgical laboratory, plant monitoring testwork, process optimization studies and ore characterization.

Supervision of testing programs for gold ore; Milling, CIP, flotation, heap leach, thickening and dewatering.

Operation of the laboratories for 3 gold production circuits.

Coordination of metallurgical research and development

Secondment for the mill and metallurgical superintendents.

Plant investigations and circuit optimization with a group of metallurgists and technicians.

Metallurgical services at Nepean Nickel concentrator and liaison with toll miller (WMC).

Responsibility for the SO₂ emission control system of roasters.

1983 – 1986

RENISON GOLDFIELDS CONSOLIDATED LIMITED, Development Metallurgist

Tin Division

Planning, initiation and supervision flowsheet development for treatment of low grade tin ore.

Laboratory testwork for mineral release and enhancement of standard assessment procedures.

Development program for flotation of cassiterite at coarse sizes.

Possible rejection of coarse gangue from rod mill products.

A major production run to examine the performance of concentrator on refractory ore types.

Prediction of effects of new technology performance by empirical mathematical models.

Mineral Sands Division

Investigations of the synthetic rutile operations.

Directing a 1/20 scale pilot leaching facility to determine the interaction of process variables.

Development of a mathematical process model for optimising kiln throughput and efficiency.

Liaison with government, academic and commercial organisations on technical processing.

Plant surveys, mass balancing and metallurgical account reconciliation.

1980 – 1983

HONEYMOON URANIUM PROJECT, CSR LIMITED, Project Metallurgist

Metallurgical studies leading to the design, construction and operation of an in-situ leaching and solvent extraction processing plant to produce high grade yellow cake.

Comparison of process technologies and costs including solvent extraction and ion exchange.

Continuous laboratory investigations of novel solvent extraction system

Supervision of ongoing metallurgical studies and radiation monitoring programs.

Operation of the pilot solvent extraction circuit for development of design criteria.

Participation in design and review of engineering deliverables for process facilities

Commissioning of the process plant and associated facilities

Made process facilities ready for care and maintenance.

Radiation Safety Officer including statutory reporting

1978 – 1980

CSIRO, DIVISION OF MINERAL ENGINEERING, Experimental Officer

Agglomeration Group

Plant and laboratory trials for the verification of mathematical models of dry grinding, balling and induration of pellets for iron ores at Savage River and Middleback Ranges.

Plant visits for data collection to pellet making facilities at Port Latta and Whyalla.

Development of a laboratory facility to produce green pellets, and study of pellet phenomenon.

Mercury porosimetry and breakage testing for assessment of pellet properties.

Analytical Group

Analysis of mineral products for metallic elements, using various instrumental techniques.

1976 – 1978

BHAS PTY LTD, PORT PIRIE, (PASMINGO/ZINIFEX/NYRSTAR), Graduate Metallurgist

Metallurgical Department

Various plant surveys and monitoring of emissions.

Sampling programs and commissioning and assessment of pollution control equipment.

Blast Furnace Department

Observation and commissioning of latest copper dressing furnace. Trials of the continuous sulphur dressing unit.

Operation of furnaces during industrial stoppages.

Research Department

Conducted studies into leaching/crystallisation process for recovery of arsenic from refinery by-products.

Established parameters for full-scale operation.