

MIKE TURNER
MINING/GEOTECHNICAL ENGINEER
Turner Mining and Geotechnical Pty Ltd
P O Box 611
Wembley
WA 6913
Australia

Date of Birth: 5 January 1958

Nationality: British/Australian

Telephone: 61-400 498 438 (mobile)

Email: mhturner@hotmail.com

EXPERTISE

- Production, planning and geotechnical experience in a wide variety of deposits, with a wide range of mining methods and ranging from Scoping Studies to Bankable Feasibility Studies to Due Diligence Studies, Geotechnical Review Boards and operating mines
- Technical and managerial experience and expertise in slope stability analyses for hard and soft rock open pits and tailings dams
- Extensive experience with geotechnical data collection and data analysis.
- Technical expertise in underground rock mechanics for shallow to very deep mines, using numerical modelling techniques and empirical methods
- Ground support design for all rock conditions, including high stress, bursting and high deformation environments
- Design, installation, operation, and analysis of results from portable and full scale mine based seismic and other monitoring systems
- Experience in all aspects of mining services, including ventilation, survey, geology etc.
- Good computing skills, including spreadsheet, database, graphics, contouring, geotechnical numerical modelling and seismic processing and analysis software
- Experience and success training and mentoring junior and senior geotechnical engineers.

EDUCATION

United World College of South East Asia

‘O’ and ‘A’ Levels

UK Government Scholarship, 1976

Imperial College, London (1976-1979)

BSc (Eng) (Honours) (Mining)

Associate of Royal School of Mines (ARSM)

Mining Association Educational Trust Scholarship, 1976-1979

Imperial College Scholarship, 1977-1979

Imperial College, London (1983-1984)

MSc (Mineral Production Management)

Diploma of Imperial College (DIC)

James Capel Scholarship, 1983-1984

South Africa

Mine Manager’s Certificate of Competency (Metalliferous)

MDP (UNISA)

Chamber of Mines, South Africa

Rock Mechanics Certificate (Metalliferous) (No. 192)

PROFESSIONAL MEMBERSHIPS

Fellow, The Australasian Institute of Mining and Metallurgy (FAusIMM(CP))

Registered Professional Engineer of Queensland (RPEQ)

Member, International Society of Rock Mechanics

Member, Australian Geomechanics Society

EMPLOYMENT

From October 2005

Turner Mining and Geotechnical Pty Ltd.

From 1997 to October 2005

Principal Geotechnical Engineer - AMC Consultants Pty Ltd.

From 1993 to 1997

Geotechnical Engineering Superintendent (Underground) - Ashanti Goldfields Company Limited.

From 1989 to 1993

Rand Mines (Mining and Services) Ltd - Geotechnical Engineer.

From 1984 to 1989

Shift Boss to production Mine Overseer to Rock Mechanics Overseer - East Rand Proprietary Mines Ltd. South Africa.

1983 (4 months)

Deputy Quarry Manager (to finance MSc) - Blue Circle Cement PLC, Weardale, England.

From 1979-1983

Technical Assistant and Production Mine Overseer - Rio Tinto Zimbabwe.

1978 (3 months)

Vacation employment - Weipa Bauxite Mine, Queensland, Australia.

1977 (3 months)

Vacation employment - Ladywash Fluorite Mine, Derbyshire, England.

EXPERIENCE

Turner Mining and Geotechnical Pty Ltd - *From October 2005*

AIC Mines – Eloise Copper Mine geotechnical operating, design advice and mentoring of geotechnical engineer

AIC Mines – Jericho Copper Mine geotechnical study and design advice

Alacer Gold – Review of early stage seismicity and seismic system design.

Alan Dickson and Associates – Geotechnical data collection guidelines for uranium open pit project.

Albidon Limited – Geotechnical reviews, support designs, extraction sequencing and subsidence review for Munali Nickel Project.

AngloGold Ashanti – Obuasi Gold mine geotechnical reviews and mentoring.

AngloGold Ashanti – Sunrise Dam underground geotechnical studies and design guidelines.

Anvil Mining - Dikulushi Mine open pit stability and underground mining studies.
Geotechnical training course for geologists. Kinsevere and Mutoshi open pit stability studies.

Apex Gold – Support and ground conditions review, Wiluna. Mentoring of geotechnical engineer.

Apex Mining – Open pit and underground geotechnical reviews of Maco Gold Mine.

Argyle Diamonds – Major excavation support design and monthly on-site geotechnical coverage and mentoring of geotechnical engineers (Oct 2007 to Feb 2009).

AusIndustry – Mining and geotechnical input for technical reviews.

Ballarat Goldfields – Regular geotechnical reviews.

Barmingo – Geotechnical and mining method reviews, Eloise Copper Mine.

Barrick Gold – North Mara Gold Mine open pit stability study.

Barrick Gold – Pueblo Viejo open pit geotechnical review.

Barrick Gold - Bulyanhulu Mine seismic system design and installation.

Beaconsfield Gold Mine - Geotechnical reviews, support designs and investigation into seismicity.

BHP Billiton – Geotechnical assessment of Cliffs decline.

Billabong Gold – Various open pit geotechnical studies.

Bisha Mining Share Company – Analysis of Bisha Mine slope failure and generation of modified slope design guidelines for pit cut-back.

Boliden – Technical advice and slope stability assessment, Kevitsa Mine.

Campbell Geotechnical – Peer review of Bald Hill underground geotechnical study.

Capricorn Copper – Underground assessment for re-opening, SLC evaluation, raisebore stability assessments and airblast assessment.

Cassidy Gold – Geotechnical and design advice for boxcut, portal and underground at Kouroussa Mine, Guinea.

Citadel – Review of Jabal Sayid decline conditions and support designs. Analysis of diamond drill logging data for raisebore stability.

Consolidated Tin Mines – Mt Garnet and Dry River South underground technical studies and reviews.

DatGeo (Sdn. Bhd) – Chaah iron ore open pit and underground mine review and mine design guidelines.

Dioro – Peer review of Frog’s Leg slope stability assessment.

Discovery Metals limited – Geotechnical core logging training, geotechnical open pit reviews and underground design guidelines for Boseto Project.

DLA Piper – Geotechnical study of rockfall for legal case.

Egan Street Resources – Rothsay Gold Mine geotechnical sections of pre-feasibility and feasibility studies.

Evolution Mining - Kundana, EKJV and Mungari Geotechnical Review Board.

Evolution Mining - Ernest Henry ground support review.

First Quantum Minerals – Geotechnical reviews and slope designs for Guelb Moghrein, Kevitsa and Enterprise Mines, including formal core logging training.

FMR Investments – Burbanks North open pit stability and Burbanks underground due diligence study. Burbanks portal and support designs and operation advice.

FMR Investments – Eloise Copper Mine geotechnical and mining method reviews. Support, mine design, extraction sequencing and seismic input. Training of geologists for basic seismology, and geotechnical observational techniques.

FMR Investments –Gordon Sirdar open pit stability, waste dump stability and underground stope and support designs

FMR Investments – Greenfields open pit and treatment plant stability.

FMR Investments – Penny’s Find, Hawkins Find, Yunndaga and Silver Star open pit stability and underground due diligence studies and stability reviews.

Golden Star Resources – Extraction sequence and mining method guidelines for Prestea gold mine.

Gondwana Resources Limited – Waste dump stability review for Buffalo Open Pit.

Herald Resources - Geotechnical input for BFS and design stage of Anjing Hitam and Lae Jehe underground lead-zinc deposits, Sumatra.

Independence Group – Geotechnical portion of various project evaluations.

Ironbark – Portal support design and underground design review, Citronen project.

KBL Mining – Slope stability analyses, Pearse open pit.

Lithium Australia – Slope stability analyses, Sinclair lepidolite open pit.

Lumley General – Investigation of recovery potential for failed raisebore equipment.

Masan – Underground geotechnical study for Nui Phao tungsten mine, Vietnam.

Mawson West – Slope guidelines and underground assessments for Dikulushi Mine and open pit design guidelines and operational advice for Kapulo open pit.

MetalsX – Underground design guidelines for a selection of mines.

Mineral Hill – Evaluation of Mineral Hill decline stability and rehabilitation requirements.

Mincor Resources – Geotechnical reviews of Mariners, Miitel, Redross, Wannaway and Carnilya Hill mines. Mentoring of on-site geotechnical engineers.

Mining Plus – Geotechnical design guidelines and due diligence studies for various underground and open pit projects.

MMG – Geotechnical review and slope designs for Kinsevere Mine.

Moho Resources – Geotechnical drilling guidelines for the East Sampson Dam project

Newmarket Gold – Underground geotechnical study at Cosmo Gold Mine.

Newmont – Geotechnical study for fatality investigation.

Norilsk Nickel – Underground geotechnical studies.

Olympus Pacific – Geotechnical reviews of Phuoc Son and Bong Mieu Gold Mines.

Otter-Juan, Coronet, McCloy and McMahon Mines - Regular geotechnical reviews, assistance and mentoring of geotechnical engineers.

Oz Minerals – Geotechnical portion of underground feasibility study for Carrapateena sub-level cave operation.

Poseidon Nickel Limited – Geotechnical evaluation of Mt Windarra 550 decline.

Panoramic Resources Limited – Design and installation of seismic system for Savannah Mine and review of seismicity and modelling.

Pioneer Resources – Mine design guidelines for open pit and underground mining of Sinclair Caesium deposit.

PT Dairi Prima Mineral - Geotechnical input for design stage of Anjing Hitam and Lae Jehe underground lead-zinc deposits, Sumatra. Core logging training for geologists. On-site progress review.

PT Natarang Mining – Open pit and underground geotechnical evaluations for Way Linggo and Talang Santo mines.

PTT Asia Pacific Mining – Sakoa open pit coal mine slope design guidelines.

Rio Tinto – Geotechnical Review Board reviewing the Jadar Project, Serbia.

Rock Team – Geotechnical assessment for re-opening Maggie Hays Nickel Mine.

Rox Resources – Geotechnical section of PFS and FS for Youanmi Mine.

RSG Global – Geotechnical component of Technical Audit for banks.

RSV – Geotechnical component of boxcut and portal designs.

Sandfire Resources – Open pit geotechnical peer review, underground design guidelines, raisebore stability assessment and assistance with due diligence studies.

Seismic sensors – Manufacture of high sensitivity sensors for small-scale seismic systems.

South32 – Seismic analysis for Cannington.

Southern Cross Gold – Geotechnical core logging training and slope design guidelines for various open pits.

SRK – Geotechnical study of Prestea underground mine for Golden Star Resources including detailed shaft rehabilitation investigation. Assistance with geotechnical review of large underground gold mine in Africa.

Straits Resources – Open pit and underground geotechnical studies, Mt Muro Gold Mine. Sebuku coal mine wall stabilisation review.

Tennant Consolidated – Geotechnical core logging and stability advice for Chariot and Mauretania Mines. Stability assessment and mine design guidelines for Chariot. Design reviews for Rising Sun, Black Snake and Malbec West open pit mines.

Trafigura Limited – Technical studies for underground and open pit copper mines in DRC.

Ventnor Resources – Preliminary slope designs for Green Dragon and Thaduna.

Venture Minerals – Geotechnical component of pre-feasibility and feasibility studies for open pit and underground mining at Mt Lindsay and open pit at Livingstone.

Westgold – Support design and review for Big Bell sub-level cave.

Woulfe Mining Corp – Geotechnical core logging and mapping training, geotechnical review and design guidelines for Sangdong Mine.

Principal Geotechnical Engineer - AMC Consultants Pty Ltd - 1997 to October 2005

Lonmin Platinum –Geotechnical input for mining methods and stability study.

Abosso Goldfields - geotechnical data analysis for underground prefeasibility study.

Valencia Ventures Inc – open pit stability study, Mt Bundy gold mine.

Barrick Gold, Bulyanhulu Gold Mine – life of mine geotechnical study.

Barrick Gold, Plutonic Gold Mine - geotechnical review.

Barrick Gold, Lawlers Gold Mine - seismic review, data analysis and interpretation.

Anvil Mining NL - slope stability and underground design studies for Dikulushi Copper Mine, DRC.

Beck Mining – Peer review of modelling project.

Lightning Nickel, Victor South and Longshaft - seismic system installation, data analysis and interpretation.

Beaconsfield Gold Mine - seismic system installation, data analysis and interpretation. Geotechnical reviews and study of F21 area.

Aditya Birla, Nifty Copper Mine - geotechnical studies for decline, portal, ventilation rise, pit stability and underground crusher.

Otter-Juan and Coronet - review of geotechnical risk aspects for potential purchase of mine. On-site geotechnical coverage during re-opening and production stages, including compilation of Ground Control Management Plan and support standards. Ongoing geotechnical assistance and advice. Stability assessment as part of due diligence for external underground gold resources. Review of seismic activity and expected change in conditions with depth.

Coronet Nickel Mine - seismic data analysis and interpretation.

WMC Resources, Olympic Dam Mine - airblast risk assessment.

WMC Resources, Leinster Nickel Operations - mining method study for Perseverance Deeps.

WMC Resources - peer review of planning and slope stability for Harmony open pit.

Herald Resources - geotechnical portion of bankable feasibility study into Dairi project, Sumatra.

WMC Resources - peer review of planning for Mt Keith Stage F.

Newcrest Mining Limited, Telfer Gold Mine - investigation into stability of proposed raisebored hoisting shaft. Geotechnical study into Western Flank orebodies to provide stope design and support guidelines.

WMC Resources, Leinster Nickel Operations - geotechnical study into under hand cut and fill mining.

Peak Gold Mine - review of seismicity including analysis and interpretation.

Geita Gold Mining Limited - geotechnical sections of BFS and prefeasibility study for underground room and pillar mining.

Argyle Diamonds - geotechnical and contract advice for trial caving access development.

BankWest, Commonwealth Bank of Australia and Rothschilds Australia - geotechnical component of due diligence studies and confidential risk evaluations for investment projects.

Western Areas NL - geotechnical study for New Morning, Daybreak and Flying Fox nickel projects.

Rio Tinto - geotechnical study for open stoping at Northparkes.

Ararat Gold Recovery Company (Armenia) - geotechnical review and mine design guidelines for Meghradzor and Zod Mines.

Platinum Australia - training for geotechnical core logging and geotechnical assessment for Panton Sill.

Harmony Gold - seismic risk analysis and review of designs and support systems for Big Bell.

Harmony Gold Mt Marion - geotechnical and caving assessment for conversion of mining method from open stoping to sub-level caving.

Harmony Gold Hill 50 - seismic data processing for microseismic system.

Placer (Granny Smith) - training for geotechnical core logging and geotechnical assessment for Wallaby underground scoping study.

WMC Resources - geotechnical assessment for Kim orebody.

Outokumpu - geotechnical assessment for Sulphur Springs underground bankable feasibility and prefeasibility studies.

Outokumpu - ground control management plan and analysis of seismic data for Black Swan Nickel Mine.

Emperor Gold Mine - underground geotechnical review of operations including support systems, design and planning. Also conducted training for geotechnical core logging and mapping.

Helix Resources - training for geotechnical core logging at Munni Munni project.
Assessment of geotechnical data for project.

Miitel Nickel Project - due diligence investigation of the underground mining potential for NM Rothschild (Australia) & Sons Limited as part of bank financing requirements.

Miitel, Lanfranchi, Longshaft, Victor and Wannaway Mines - geotechnical studies for purchasers of mines (from WMC), including data evaluation, stope design and scheduling, and support and reinforcement design.

Merlin Diamonds - geotechnical assessment for underground trial mining project.

Normandy Mining - investigation into crown pillar failure at the Discovery section of Bronzewing Mine, including adjustments to support system and extraction sequence. Installation of seismic system and analysis of seismic data for Central section. Support system review for McClure Mine, and geotechnical study for Cockburn Mine. Review of geotechnical department at Bronzewing and development of a training course for underground awareness.

Pasminco - installation of microseismic system at Elura Mine to monitor seismicity in and around large stope and neighbouring pillars. Detailed geotechnical assessment for Dugald River Mine.

New Hampton - investigation into seismic activity at the Big Bell Mine, including installation of seismic system, analysis of seismic data, review and adjustments to support system, and numerical modelling. Review of designs and support systems.

WMC Resources - development of geotechnical training and awareness programmes for Head Office, senior management and operators. Also undertook adjustments to Inrushes and Subsidence standards to include airblast hazard management.

WMC Resources, Kambalda Nickel Mines - control of Longshaft and Victor geotechnical aspects (high stress, seismically active mines). Also reviewed Longshaft working areas to assess relative seismic risk for support system design and extraction sequencing.

Ashanti Goldfields Zimbabwe - geotechnical audit and training at Freda-Rebecca Mine.

WMC Resources, Leinster Nickel Operation - life of mine geotechnical study for disseminated orebody sub-level caving and massive orebody mining, down to 1,100m below surface. Geotechnical review of designs for Progress Orebody.

WMC Resources, Leinster Nickel Operation - control of LNO Geotechnical Engineering Department, covering all geotechnical aspects of Perseverance and Rocky's Reward mines (large sub-level cave in poor ground with high stresses, and steep massive nickel deposit respectively).

Central Norseman Gold Corporation - investigation into proposed Bullen West raisebored ventilation shaft and OK Mine pillar extraction study.

WMC Resources, Kambalda Nickel Mines - rock mass classification investigations, mining method assessments, support system designs, and compilation of geotechnical databases and procedures for fall of ground control.

Sons of Gwalia, Sons of Gwalia Mine - geotechnical assessment of underground mining - Notice of Intent to mine etc. and input into Gwalia Deeps Study.

From 1993 to 1997

Geotechnical Engineering Superintendent (Underground) - Ashanti Goldfields Company Limited -

This work included the introduction of efficient ground control systems, analytical planning and project work and the supervision and training of Section Geotechnical Engineers, covering the underground sections and the Obuasi Tailings dams. The mining methods employed at Obuasi included sub-level caving, open stoping, bench stoping, cut and fill and square set stoping.

Instrumentation projects included extensometers, seismic monitoring, precise levelling, closure meters and stress measurement programs.

Project work included a detailed assessment of the Eaton Turner Shaft pillar, assessment of mining methods and stope design for the Kalana gold mine in Mali, pillar/stope dimensions for the Kimin mine in Zaire and Freda/Rebecca in Zimbabwe; open pit stability analyses for the Sansu open pit; and open pit drainage for the Ayanfuri mine. Other major ongoing project work involved the assessment of mining methods (open stoping, cut and fill and sub-level caving) using empirical and numerical methods and stope scheduling for the large trackless orebody blocks at Obuasi.

The regular use of shotcrete as a support element was introduced to the Obuasi operation for poor ground and high stress conditions.

From 1989 to 1993

Rand Mines (Mining and Services) Ltd - Geotechnical Engineer

Responsible for all group chrome mines (Millsell, Winterveld, Elandsdrift, Buffelsfontein), platinum mines (Crocodile River, Kennedy's Vale), other small mines (Vlakfontein Nickel, Vansa Vanadium), gold mines without Rock Mechanics managers (Durban Roodepoort Deep, East Rand Proprietary Mines, Harmony, Blyvooruitzicht and Barbrook) and Pretoria Portland Cement open pits.

This work included:

- The design of room and pillar, breast, shrinkage and longwall mining systems, including solid (conventional and squat) and yield pillar designs.
- The design of internal stope support systems, including liaising with producers for new designs/packaging requirements.
- The design of development support systems.
- Sequencing of mining to maximise extraction and reduce poor ground and rockburst hazards.
- Co-ordinating shaft sinkers and consultants for open pit, shaft portal, shaft collar, shaft and large excavation design, excavation and support.
- The design of mining systems for the extraction of a number of shaft pillars in operating shafts that were completed and successfully implemented. Major shafts pillars included the ERPM Far East Sub-Vertical Shaft and the Durban Roodepoort Deep Number 5 shaft.
- Submission of requests for undermining surface structures.
- Use of various seismic systems to assess the damage risk from geological features, blasting and mining geometries. The design and management of a stress measurement project at a major platinum mine was also undertaken.

An additional function undertaken during this period was an examiner for the Chamber of Mines Rock Mechanics Certificate.

PUBLICATIONS

- Turner MH, 1997. *Shaft Pillar Extraction at Ashanti Goldfields*, Southern African Rock Engineering Symposium (SARES), Johannesburg, South Africa, September.
- Turner MH, 1998. *Excavation Support Analysis*, Australian Centre for Geomechanics - Short course in Excavation Engineering for Underground Mines, October.
- Turner MH, 1999. *Overview of Design and Planning Strategies*, Australian Centre for Geomechanics - Workshop on Mining in High Stress and Seismically Active Conditions, April.
- Turner MH, 2000. *Shrinkage Mining*, Australian Centre for Geomechanics - Short course in Underground Mining Methods, Perth, Western Australia, May.
- Turner MH and Player J, 2000. *Seismicity at Big Bell Mine*, Massmin 2000 Conference, Australasian Institute of Mining and Metallurgy, October.
- Struthers MA, Turner MH, McNabb K and Jenkins PA, 2000. *Rock Mechanics Design and Practice for Squeezing Ground and High Stress Conditions at Perseverance Mine*, Massmin 2000 Conference, Australasian Institute of Mining and Metallurgy, October.
- Turner MH, 2002. *Seismically Active Mines - to Buy or Not to Buy*, Operators Conference, Australasian Institute of Mining and Metallurgy, Townsville, July.
- Turner MH and Beck DA, 2002. *Monitoring the Onset of Seismicity*, Deep and High Stress Mining, Australian Centre for Geomechanics Seminar, Perth, November.
- Turner MH, Teasdale P and Green T, 2004. *A step back in time to hand-held mining for profitability*. Second International Symposium on Mining Techniques of Narrow-Vein Deposits, Val d'Or, Quebec, Canada, October.
- Turner MH and Green T, 2005. *Threadbar bolts in a seismically active, high-stress, high-yield environment - Otter Juan Mine, Kambalda*. Sixth International Symposium on Rockbursts and Seismicity in Mines, Perth, Australia, March.
- Turner MH, 2005. *Management of Seismicity using Portable Seismic Systems*, Australian Centre for Geomechanics – Course on Advanced Geomechanics in Underground Mines, August.
- Turner MH and Green T, 2007. *Inflatable Rockbolts at Otter-Juan Mine, Kambalda*. Fourth International Seminar on Deep and High Stress Mining, Perth, Australia, November.
- Turner MH and Li C, 2009. *The D-Bolt – A New Energy Absorbing Rock Bolt*. Section 19, Advanced Ground Support in Underground Mining - Australian Centre for Geomechanics Seminar, Perth, Australia, 11-13 November.
- Turner MH, 2013. *Converting to sub-level caving at over 1000 mbs – seismicity at Eloise Copper Mine*. Eighth International Symposium on Rockbursts and Seismicity in Mines, Saint-Petersburg - Moscow, Russia, September.
- Turner MH, 2015. *Seismicity at Eloise Copper Mine*. East Australian Ground Control Group Stress and Seismicity Workshop, Launceston, 18th and 19th March.