Applied Structural Geology in Exploration and Mining: A Practical Workshop

Overview

Presenter: SRK Kazakhstan
Location: SRK Kazakhstan
Technical training in structural geology developed for exploration and mining geologists

Aims

• Define the simple principles of “structural control”;  

• Demonstrate why so many ore deposits are strongly structurally controlled;  

• Describe best practices for structural data collection and analysis in mineral exploration and mining;  

• Provide sufficient information on the principal elements of structural processes to allow basic interpretations and analyses to be conducted;  

• Instill in attendees the confidence to start thinking about practical structural geology at their project and how they can use it to make a real difference!
Workshop Format

• 3 days of structural geology training
  o 2 days of classroom-based lectures and practicals (50:50)
  o 1 day based in the field, mine or core store – depending upon location

• Four technical modules each day:
  o 2 x morning sessions
  o 2 x afternoon sessions

• Module content
  o Basic topic outline
  o Starts with the basics (recap)
  o Progresses to more in-depth concepts
  o Explores practical aspects

• Exercises reinforce key practical points

• Informal learning environment – attendee participation encouraged
Summary of Workshop Modules

Day 1

Introduction: Applications of Structural Geology to Mining and Mineral Exploration

- Summary of Geological Risks to the Mining Cycle
- How Geological Knowledge Lowers Risk
- Applications of Structural Geology to:
  - Grassroots Exploration
  - Advanced Exploration
  - Feasibility Studies
  - Production
Module 1: Summary of Fundamentals

- Deformation
- Brittle and Ductile Definitions
- Stress and Strain
- Kinematics
Module 2: Stereonets - A Key Tool for Structural Geologists

• Stereonets: what are they?
• Equal Area Vs. Equal Angle
• Stereonets: why use them?
• Plotting Planes and Linear Data
• Practical Exercises
Module 3: Faults and Fault-related Structures

• What are Faults and What is Their Significance to the Mining Industry?
• Classification by Slip-sense
• Fault Zone Structure
• Fault Growth
  o Fault Propagation and Segmentation
  o Fault Linkage
• Generation of Fault Rock
• Fault Zone Heterogeneity
• Interpretation and modelling
  o 2D vs. 3D
Module 4: Shear Zones and Ductile Deformation

- Significance to the Mining Industry
- Brittle-Ductile Transition
- Homogenous vs. Heterogeneous Strain
- Simple shear vs. Pure shear
- Foliations
- Cleavage
- Lineations
- Reactivation
- Progressive Deformation
- Strain Path and Kinematics
Module 5: Folds and Related Structures

- Basic Fold Geometry
- Identification of Folds
- Orientations of Major Folds
- Intersection Lineation
- Bedding-Cleavage Relationship
- Fold Mechanisms
- Polyphase Folding
- Analysis of Multiply-folded Terrains
- Folds in Mineral Systems
- Recognition and Use of Fold Data
Module 6: Structurally-controlled Fluid Flow

- Basic concepts
- Drivers for fluid flow
- Distribution of fluids in the crust
- Fluid Transport Mechanisms at Different Levels in the Crust
- Fault Valving and the Role of Earthquakes in Fluid Redistribution
- Vein Formation and Syn-deformation Mineralisation
Module 7: Analysis of Structures in Drillholes

- How Can Oriented Data Help Us?
- Unoriented vs. Oriented Drillcore
- Drillcore Orientation Techniques
- Core Orientation and QAQC
- Common Mistakes in Core Orientation
- Approaches to Structural Core Logging
- Using Core Orientation Data
Module 8: Structural Geology Mapping, Data Collection and Observations

- Geological Maps
- Mapping Workflows
- Planning a Mapping Campaign
- Measurement of Geological Structures
- Structural Mapping
- Interpretation
- Digital Mapping
Field Day: Practice in the Real World

- Evaluation of structures at outcrop
- Field and pit mapping
- Evaluation of drillcore
- Domaining structures in drillcore
- Drillcore mapping and interpretation
SRK Course Leaders

Dr Chris Bonson

• Principal Consultant - Structural Geology, SRK UK
• Principal areas of expertise:
  o characterization and evaluation of the structural
  o geology of mineral deposits;
  o 3D modeling of structurally complex deposits;
  o quantitative analysis of fracture systems.
• Field, open-pit and underground environments.
• Experience in precious- and base-metals, coal, diamonds, hydrocarbons and industrial minerals
• Broad international experience
• European Geologist (EurGeol) and a Professional Geologist (PGeo)
Dr Paul Stenhouse

• Senior Consultant - Structural Geology, SRK UK

• Principal areas of expertise:
  
  o analysis of structural controls on mineralization at the deposit to regional scale
  
  o ore deposit delineation, characterisation and targeting
  
  o geological/structural mapping
  
  o 3D modelling of structurally complex ore deposits

• Broad international experience in a variety of commodities.
Dr Pavel Mukhin (PhD, MAIG)

- Principal Consultant, SRK (KZ)
- PhD in Structural Geology and Geotectonics
- Principal area of expertise:
  - Management of exploration projects
  - Specialising in gold, silver, copper, lead, zinc, iron and diamond exploration programmes
  - Experienced in offshore exploration for diamonds, spanning initial geophysical and geochemical surveys, to resource estimation, block modelling, and mining.
- He has worked in Russia, Uzbekistan, Kyrgyzstan, Kazakhstan, Israel, Greece, South Africa, Namibia, Congo, and Cambodia.
SRK Office Locations

>1,600 Professionals, 50 offices, 22 countries, 6 continents
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