

Field Geologists' Manual – Fifth Edition

Contents

1. Ethics

1.1. PREAMBLE	1
1.2. CODE OF ETHICS	1
1.3. CODE FOR CONSULTANTS	3

2. Health, Safety and Environment

2.1. OCCUPATIONAL HEALTH AND SAFETY	7
2.2. COMMUNITY AND ENVIRONMENT	15

3. Mineral and Rock Information

3.1. MINERAL INDEX.....	21
3.2. LIST OF COMMON MINERALS IN ORDER OF DENSITY	43
3.3. DESCRIPTION OF HEAVY LIQUIDS	47
3.4. CLASSIFICATION OF PLUTONIC ROCKS – IUGS FIELD SYSTEM	49
3.5. CLASSIFICATION OF VOLCANIC ROCKS – IUGS SYSTEM	50
3.6. BROAD CLASSIFICATION OF IGNEOUS ROCKS BY COLOUR AND GRAIN SIZE	50
3.7. CLASSIFICATION OF PYROCLASTIC ROCKS – IUGS SYSTEM.....	51
3.8. DIAMOND INDICATOR MINERALS (DIMs)	52
3.9. METAMORPHIC FACIES DIAGRAM	56
3.10. SUMMARY OF METAMORPHIC ROCKS	57
3.11. CLASSIFICATION OF ALTERATION, VEINS AND BRECCIA IN ORE SYSTEMS	59
3.12. CLASSIFICATION OF ARENITES AND TERRIGENOUS SEDIMENTS.....	65
3.13. CLASSIFICATION OF CARBONATE SEDIMENTS	67
3.14. ROUNDNESS AND SPHERICITY, RELATIVE RESISTANCE TO ABRASIVE ROUNDING, AND PARTICLE SIZE TERMINOLOGY FOR SEDIMENTARY AND PYROCLASTIC PARTICLES	68
3.15. BEDDING THICKNESS TERMINOLOGY	69
3.16. A GENETIC CLASSIFICATION OF SEDIMENTARY STRUCTURES.....	70
3.17. DIAGRAMS REPRESENTING VARIOUS PERCENTAGES OF GRAINS	71
3.18. REGOLITH TERMINOLOGY	71

4. Geochemistry

4.1. PERIODIC TABLE OF THE ELEMENTS.....	75
4.2. ALPHABETICAL LIST OF NATURAL ELEMENTS AND COMMON VALUES.....	76
4.3. CONVERSION FACTORS, ELEMENTS TO COMPOUNDS	78

4.4.	AVERAGE ABUNDANCES OF SELECTED MINOR ELEMENTS	79
4.5.	RANGE OF ABUNDANCE OF TRACE ELEMENTS IN SOILS	81
4.6.	GEOCHEMICAL SIGNATURE OF MINERAL DEPOSIT TYPES.....	81
4.7.	GENERAL NOTES FOR GEOCHEMICAL SAMPLING.....	83

5. Geological Mapping

5.1.	INDEX TO NEW ZEALAND, AUSTRALIA AND PAPUA NEW GUINEA 1:250 000 SCALE MAPS SHOWING MAGNETIC DECLINATION.....	91
5.2.	GEOLOGICAL TIME SCALE	97
5.3.	STANDARD MAPPING SYMBOLS – GEOSCIENCE AUSTRALIA SYSTEM	109
5.4.	AUSTRALIA STANDARD COLOUR SCHEME AND STRATIGRAPHIC SYMBOLS FOR GEOLOGICAL MAPS	170
5.5.	GEOLOGICAL MAP PROJECTIONS	170
5.6.	ABRIDGED GUIDE TO LITHOSTRATIGRAPHIC NOMENCLATURE IN AUSTRALIA	179
5.7.	CHECK LISTS FOR RECORDING OUTCROP INFORMATION.....	189
5.8.	CLASSIFICATION OF FAULTS.....	191
5.9.	CLASSIFICATION OF FOLDS BY DIP ISOGONS AND BY HINGE SURFACE	192
5.10.	GRAPH SHOWING ANGLE OF TRUE DIP OR SLOPE, VERTICAL EXAGGERATION, AND EXAGGERATED DIP	194
5.11.	NOMOGRAM FOR ESTIMATING AREA	195
5.12.	NOMOGRAM FOR ESTIMATING TRUE WIDTH	196

6. Mining and Economic Geology

6.1.	FIELD CHEMICAL TESTS FOR COMMON ELEMENTS AND MINERAL CLASSES	197
6.2.	COMMERCIAL ORES.....	204
6.3.	TYPICAL STAGES AND METHODS IN MINERAL EXPLORATION	230
6.4.	BACKGROUND DATA FOR A MINE EVALUATION	231

7. Engineering Geology

7.1.	FIELD GEOTECHNICAL TESTING METHODS	233
7.2.	LABORATORY GEOTECHNICAL TESTING METHODS	234
7.3.	STATIC MECHANICAL PROPERTIES OF UNWEATHERED ROCKS	235
7.4.	PHYSICAL PROPERTIES FOR UNWEATHERED ROCKS.....	236
7.5.	RECOMMENDED ORDER OF DESCRIPTION OF ROCK PROPERTIES.....	238
7.6.	ROCK WEATHERING CLASSIFICATION.....	238
7.7.	ROCK STRENGTH CLASSES	239
7.8.	BULKING FACTORS FOR EXPANSION OF COMMON ROCK MATERIALS	239

7.9. DISCONTINUITY SPACING	240
7.10. APERTURE OF DISCONTINUITY SURFACES.....	240
7.11. COMMON DEFECTS IN ROCK MASS.....	241
7.12. CLASSIFICATION OF LANDSLIDES	244
7.13. ORDER OF DESCRIPTION OF SOILS.....	249
7.14. DESCRIPTION, IDENTIFICATION AND CLASSIFICATION OF SOILS	250
7.15. CALCAREOUS SEDIMENTARY ROCK NOMENCLATURE.....	252
7.16. CONSISTENCY OF SOILS	253
7.17. SOIL MOISTURE CONTENT	254
7.18. DYNAMIC PENETRATION TEST.....	254
7.19. HYDRAULIC CONDUCTIVITY (PERMEABILITY).....	257
7.20. SUMMARY OF THE ARITHMETIC MEAN OF HYDRAULIC PROPERTIES FOR ALL ROCK TYPES	258

8. Hydrogeology

8.1. THE INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS.....	261
8.2. AUSTRALASIAN HYDROGEOLOGY AUTHORITIES	261
8.3. APPROXIMATE WATER SUPPLY REQUIREMENTS FOR HOMES AND FARMS	263
8.4. INDMILL PUMPING CAPACITY	264
8.5. VOLUMES CORRESPONDING TO STANDARD PIPE SIZES.....	264
8.6. GRAPH SHOWING FLOW FROM VARIOUS DIAMETER PIPES	265
8.7. FACTORS FOR CALCULATING VOLUME OF PARTIALLY FILLED HORIZONTAL CIRCULAR TANKS.....	266
8.8. CONVERSION FACTORS FOR UNITS OF PRESSURE.....	266
8.9. CONVERSION FACTORS FOR PUMPING TEST UNITS	267
8.10. CIRCULAR ORIFICE METER DISCHARGE TABLE	269
8.11. RECTANGULAR AND V-NOTCH WEIR BOARD DISCHARGE TABLE.....	270
8.12. PRESSURE CORRESPONDING TO HEAD OF WATER.....	271
8.13. RECOMMENDED WELL DIAMETERS FOR VARIOUS PUMPING RATES	271
8.14. APPROXIMATE AIRLIFT CAPACITIES FOR AIRLIFT PUMPING	272
8.15. NOTES ON WATER SAMPLING.....	272
8.16. GUIDELINES FOR CHARACTERISTICS OF DRINKING WATER.....	277
8.17. RECOMMENDED STOCK WATER QUALITY	278
8.18. RECOMMENDED IRRIGATION WATER QUALITY	280

9. Geophysics

9.1.	PHYSICAL PROPERTIES AND CONVERSION FACTORS.....	283
9.2.	GRAVITY SURVEYING METHODS AND TABLES.....	285
9.3.	MAGNETIC SURVEY METHODS AND TABLES	288
9.4.	ELECTROMAGNETIC, RESISTIVITY AND INDUCED POLARISATION SURVEY METHODS AND TABLES	290
9.5.	RADIOMETRIC SURVEYS AND TABLES	296
9.6.	SEISMIC SURVEY METHODS AND DATA.....	300
9.7.	DOWNHOLE SURVEY METHODS.....	300
9.8.	AIRBORNE SURVEY METHODS	300
9.9.	EARTHQUAKE MAGNITUDE AND INTENSITY	301

10. Drilling

10.1.	DETERMINATION OF TRUE WIDTH FROM OBLIQUE DRILL HOLE INTERSECTION	305
10.2.	CALCULATION OF DRILL HOLE ELEVATIONS AND COORDINATES FROM DOWNHOLE SURVEYS	307
10.3.	CHECKLISTS FOR DRILL HOLE LOGGING	308
10.4.	CORE ORIENTATION TECHNIQUES.....	308

11. Sampling, Analysis and Quality Control

11.1.	ERRORS IN SAMPLE PREPARATION AND ANALYSIS	311
11.2.	BEST ANALYTICAL METHODS FOR COMMON METALS/MINERALS/ COMPOUNDS	323
11.3.	GENERAL PREFERRED SAMPLE MASS NOMOGRAM.....	331
11.4.	GRAPHS OF PARTICLE SIZE AND PREFERRED SAMPLE MASS FOR GOLD ASSAYS.....	332

12. Reporting

12.1.	REQUIREMENTS FOR MINING COMPANY REPORTS FOR THE AUSTRALIAN SECURITIES EXCHANGE	335
12.2.	AUSTRALASIAN CODE FOR REPORTING OF EXPLORATION RESULTS, MINERAL RESOURCES AND ORE RESERVES (THE JORC CODE) 2004 EDITION.....	338

13. Geometric and Surveying Data

13.1.	MINING COORDINATE SYSTEMS – MGA94 AND LOCAL GRID SYSTEMS	363
13.2.	COORDINATE TRANSFORMATION	367
13.3.	POSITIONING EQUIPMENT AND TECHNIQUES	371
13.4.	CLASSICAL SURVEYING EQUIPMENT AND TECHNIQUES.....	374
13.5.	CLASSICAL TACHYMETRY (STADIA) SURVEYS	382

13.6. COMPASS AND TAPE TRAVERSES	383
13.7. DIP AND FAULTS PROBLEMS.....	386
13.8. AIRPHOTO SCALE NOMOGRAM AND FORMULA.....	390
13.9. USEFUL MATHEMATICAL (SURVEYING) FORMULAE	392

14. Mathematical Tables and Conversion Factors

14.1. TRIGONOMETRIC FUNCTIONS.....	399
14.2. THE INTERNATIONAL SYSTEM OF UNITS (SI).....	402
14.3. RECOMMENDED PRACTICE FOR METRIC CONVERSION	403
14.4. CONVERSION FACTORS, IMPERIAL AND INTERNATIONAL SYSTEMS	411
14.5. CONVERSION FACTORS FOR FOREIGN, RARE AND OBSOLETE WEIGHTS AND MEASURES.....	416
14.6. COMPARISON TABLE OF USA, TYLER, CANADIAN, BRITISH, FRENCH AND GERMAN STANDARD SIEVE SERIES.....	417
14.7. CONVERSION OF THE AREA OF A ONE MINUTE SQUARE TO SQUARE KILOMETRES AND SQUARE MILES	419
14.8. FRACTIONAL SCALES AND IMPERIAL SYSTEM EQUIVALENTS.....	421
14.9. FRACTIONAL SCALES AND UNIT PLAN AREAS.....	424

15. Resources, Templates and Further Reading

15.1. ADDRESSES OF AUSTRALASIAN GEOLOGICAL SURVEYS AND UNIVERSITIES WITH GEOSCIENCE DEPARTMENTS	427
15.2. SUPPLIERS OF GEOLOGICAL AND TOPOGRAPHIC MAPS AND AIR PHOTOGRAPHS	429
15.3. LIST OF ABBREVIATIONS	432
15.4. ABBREVIATIONS USED IN PETROLEUM EXPLORATION LOGS (AND INDUSTRY TERMINOLOGY)	447
15.5. RADIO ALPHABET (NATO AND AVIATION PHONETIC ALPABET).....	450
15.6. TIME OF BEGINNING AND END OF DAYLIGHT FOR THE SOUTHERN HEMISPHERE	451
15.7. SEVENTY YEAR CALENDAR.....	452
15.8. FIELD LOGGING SHEET TEMPLATE	456
15.9. ENGINEERING FIELD LOGGING SHEET TEMPLATE	457
15.10. SELECTED BIBLIOGRAPHY ON WRITING GEOLOGICAL REPORTS	458
15.11. SELECTED REFERENCES AND BIBLIOGRAPHY	458

INDEX

469