

# CONTENTS

Introduction ix

## 1 Basics 1

- 1.1 Terminology 1
- 1.2 Basic Log Types 3
- 1.3 Logging Contracts 9
- 1.4 Preparing a Logging Programme 11
- 1.5 Operational Decisions 14
- 1.6 Coring 16
- 1.7 Wellsite Mud Logging 21
- 1.8 Testing/Production Issues 24

## 2 Quicklook Log Interpretation 29

- 2.1 Basic Quality Control 29
- 2.2 Identifying the Reservoir 30
- 2.3 Identifying the Fluid Type and Contacts 32
- 2.4 Calculating the Porosity 34
- 2.5 Calculating Hydrocarbon Saturation 37
- 2.6 Presenting the Results 40
- 2.7 Pressure/Sampling 42
- 2.8 Permeability Determination 45

## 3 Full Interpretation 49

- 3.1 Net Sand Definition 49
- 3.2 Porosity Calculation 51
- 3.3 Archie Saturation 53
- 3.4 Permeability 54

## 4 Saturation/Height Analysis 59

- 4.1 Core Capillary Pressure Analysis 60
- 4.2 Log-Derived Functions 64

- 5 Advanced Log Interpretation Techniques 67**
  - 5.1 Shaly Sand Analysis 67
  - 5.2 Carbonates 73
  - 5.3 Multi-Mineral/Statistical Models 74
  - 5.4 NMR Logging 76
  - 5.5 Fuzzy Logic 85
  - 5.6 Thin Beds 87
  - 5.7 Thermal Decay Neutron Interpretation 93
  - 5.8 Error Analyses 96
  - 5.9 Borehole Corrections 101
  
- 6 Integration with Seismic 103**
  - 6.1 Synthetic Seismograms 103
  - 6.2 Fluid Replacement Modelling 108
  - 6.3 Acoustic/Elastic Impedance Modelling 110
  
- 7 Rock Mechanics Issues 115**
  
- 8 Value Of Information 119**
  
- 9 Equity Determinations 125**
  - 9.1 Basis for Equity Determination 126
  - 9.2 Procedures/Timing for Equity Determination 127
  - 9.3 The Role of the Petrophysicist 129
  
- 10 Production Geology Issues 137**
  - 10.1 Understanding Geological Maps 140
  - 10.2 Basic Geological Concepts 147
  
- 11 Reservoir Engineering Issues 155**
  - 11.1 Behavior of Gases 155
  - 11.2 Behavior of Oil/Wet Gas Reservoirs 159
  - 11.3 Material Balance 162
  - 11.4 Darcy's Law 163
  - 11.5 Well Testing 166
  
- 12 Homing-in Techniques 171**
  - 12.1 Magnetostatic Homing-in 171
  - 12.2 Electromagnetic Homing-in 185
  
- 13 Well Deviation, Surveying, and Geosteering 193**
  - 13.1 Well Deviation 193
  - 13.2 Surveying 195

- 13.3 Geosteering 197
- 13.4 Horizontal Wells Drilled above a Contact 203
- 13.5 Estimating the Productivity Index for Long Horizontal Wells 205

**Appendix 1 Test Well 1 Data Sheet 207**

**Appendix 2 Additional Data for Full Evaluation 215**

**Appendix 3 Solutions to Exercises 218**

**Appendix 4 Additional Mathematics Theory 251**

**Appendix 5 Abbreviations and Acronyms 264**

**Appendix 6 Useful Conversion Units and Constants 268**

**Appendix 7 Contractor Tool Mnemonics 271**

**Bibliography 309**

**About the Author 313**

**Acknowledgments 314**

**Index 315**