

# Index

Page numbers in *italics* refer to Figures. Page numbers in **bold** refer to Tables.

- abiotic deposition 142
- Abqaiq field
  - Arab-C reservoir 179
  - Arab-Hith formation 159–160, *161*
  - depositional geometry 98, 99–101, *100*
  - Ulayyah sequence 149
- Abu Dhabi
  - Arab-C reservoir 179
  - Arab-D anhydrite 174
  - Arab-D reservoir 172–173, 173
  - basin infill 163
  - biomarkers 201
  - biostratigraphy 71, 73, 74, 75
  - carbonate–evaporite facies 161
  - correlations to Saudi Arabia 52–53, 106–107
  - depositional geometry
    - offshore 107
    - onshore 104–107
  - depositional sequences *84*
  - Hanifa formation 64
  - Hanifa sequences 149–150
  - Hith formations 179
  - interpretations of the eastern margin of the Arabian Intrashelf Basin 116, *117*, 120
  - lithostratigraphic intervals 53
  - net source rock isopach 131–132, *133*
  - sequence stratigraphy 86–87
  - source rock facies 60, *61*
  - source rock interval 60, 64, 66
  - Sr/Sr dating 78–79, 80
  - summary cross-section *115*
  - well log cross-section *162*
- Abu Hadriya field 14
- accommodation space
  - Arab-C to Arab-A carbonate–evaporite sequences 176
  - Arab-D anhydrite 174–175, 199
  - summary cross-section 116
  - Tuwaiq Mountain 130
  - water depths 144
- age dating
  - Abu Dhabi onshore depositional geometry 105–106
  - Arabian Intrashelf Basin 6–7
  - biostratigraphy 67–75, 127–128
  - geological time and the depositional sequences 202–203
  - lithostratigraphic nomenclature 38
  - main premises and new interpretations 7
  - source rock interval 71–75
  - Sr/Sr data for the Arabian Intershell Basin 75–78
  - Sr/Sr dating as a dating tool 37, 202
- aggradation of the intrashelf basin rim 175
- alkaline waters 142, 200–201
- Amar collision 21
- ammonite dating 73
- ammonite zones 67
- anhydrite
  - Arab-C reservoir 88, 177–179
  - Arab-D reservoir 167
  - Arab-Hith formation 199
  - Hanifa sequences 151–152
  - Hith formations 88, 179
  - late-stage infill of the basin 191–192
  - platform deposition and filling of
    - accommodation space 176
    - subaqueous 116
  - anhydrite interval
    - Arab-D 65, 99, 173–175, 199
    - depositional geometry 106
    - Hanifa formation 63, 64
  - anhydrite seals 65, 188–189, *192*, 199
  - anhydrite sequence phase 180, 183, 203
  - anticlinal nose 192
  - anticlinal trends 21, 33
  - Ara salt 21
  - Arab-A facies 66
  - Arab-A interval 75, 179
  - Arab-A sequence 175–176, *176*, 181
  - Arab-B interval 179
  - Arab-C facies 66
  - Arab-C intervals 75
  - Arab-C reservoir 88, 177–179
  - Arab-C sequence 10, 175–176, *176*, 181
  - Arab-D
    - anhydrite interval 173–175
    - depositional and reservoir models and local settings 166–173
    - Jubaila–Arab-D interval 165–166
    - and Jubaila deposition 161–165
  - Arab-D anhydrite 173–175
  - accommodation space 174–175, 199
  - core 65
  - Kurayn field to North Ghawar field 99
  - platform deposition and filling of
    - accommodation space 176
    - setting 65
  - Arab-D dolomite 78
  - Arab-D intervals 74–75, 120–121
  - Arab-D member 88, 162–163
  - Arab-D reservoir
    - Abqaiq field 160
    - basin deposition 116
    - carbonate deposition *164*
    - depositional and reservoir models and local settings 167–173, *168*
    - exploration research 187
    - Ghawar field 64–66
    - interpretations of the eastern margin of the Arabian Intrashelf Basin 116
    - late-stage infill of the basin 191–192
    - oil source 53
    - post-Arab-D reservoir deposition 179–183
  - Arab-D sequence
    - basin geometry 198–199
    - depositional geometry
      - Abu Dhabi offshore *107*, *107*
      - offshore northern Bahrain to the Qatif area 101–102
      - Saudi Arabia Jurassic outcrop 97
      - exploration research 187
      - general setting 9
      - geological time 203
      - interpretations of the top 166
      - sequence stratigraphy 87–88
      - stratigraphic terms *160*
      - stratigraphy review 87–88
- Arab formations
  - basin deposition 116
  - collapse of the shelf margin and deposition of the Asab–Rayda sequences 118
  - depositional geometry
    - offshore northern Bahrain to the Qatif area 101–102
    - outcrop belt 97
  - exploration research 187
  - interpretations of the eastern margin of the Arabian Intrashelf Basin 120–121
  - juxtaposition of the Arab–Hith shoal facies 121
  - nomenclature 38
  - post-Arab-D reservoir deposition 179–183
  - stratigraphic terms 159–161, *160*
- Arab–Hith formation
  - Abqaiq field cross-sections 159–161, *160*, *161*
  - anhydrites 199
  - Arab-C to Arab-A carbonate–evaporite sequences 176
  - evaporite belts 202
  - geological time 203
  - lack of synchronicity of the Arab–Hith carbonate–evaporite sequences 183
  - schematic cross-section *172*
- Arabian Gulf 143, 193–194
- Arabian Intrashelf Basin
  - age dating overview 6–7
  - definition 197
  - eastern margin 116–121, 199
  - exploration history 13–15
  - exploration research overview 187–194
  - field names and fields 4, 5
  - general setting 1–2, 3
  - Google Earth image 1, 2
  - Gotnia–Mesopotamian Basin communication 128–129, 201
  - Late Bathonian–Oxfordian development and evolution 121–123
  - Late Jurassic eastern margin 116–121
  - main premises and new interpretations 7–8
  - plate tectonic setting 10–13
  - previous studies in this region 2–5
  - reserves 16
  - as single intrashelf basin 113, 152
  - source rock interval 131–139
  - stratigraphy overview
    - and ages 1–2

- Arabian Intraself Basin (*Continued*)  
 biostratigraphy 37  
 intervals and sequences 8–10  
 previous studies in this region 2  
 stratigraphic nomenclature 5–7, 6  
 structural development 21, 33–34  
 Dhurma tectonically controlled intrashelf basin 23  
 isostasy 31–32  
 Permian–early Triassic 22  
 pre–mid-Jurassic 22–23  
 pre-Permian 21–22  
 present day 33  
 Qatar Arch 24–27  
 Rimthan Arch 27–29, 30  
 tectonics 21, 23–30  
 unconformities 32–33  
 summary cross-section 113–116, 114  
 Tethys Ocean communication 78–81, 128, 153  
 Tuwaiq sequence  
 features of the setting 128–130  
 proposed modification 123–128
- Arabian orbital stratigraphy hypothesis 88  
 Arabian Shield 116  
 aridity 202  
 Arkell ammonite dating 73  
 Asab formation 66, 75, 118, 183  
 Asab Oolite 121, 199  
 Atash Callovian 69  
 Atash–Fadhili–Uwainat interval 80, 121, 122  
 Atash member 85, 95, 123  
 Atash platform 86
- Bahrain  
 biostratigraphy 73, 74, 75  
 depositional geometry 101–102, 103  
 exploration history 13–15  
 Hanifa formation 63  
 lithostratigraphic nomenclature 38  
 sequence stratigraphy 86  
 source rock facies 59–60  
 source rock interval 59–60, 63, 65–66  
 source rock isopach 104, 104  
 water depths 144
- Bajocian 10  
 Balum sequence 83  
 basin infill 163  
 basin rim exposure 86, 128  
 basinal biofacies 57  
 Bathonian  
 Late Bathonian–Oxfordian development and evolution 121–123  
 palaeolatitudes 10  
 Sr/Sr dating 80
- benthic cyanobacterial cells, 145  
 benthic forams 68, 69–71, 74–75, 142  
 Berri field  
 basin rim 126  
 depositional geometry 98–99  
 Hadriya reservoir 52  
 Hanifa reservoir 62, 62–63, 138  
 Ulayyah sequence 62–63, 149
- biofacies  
 chart 69  
 source rock interval 57, 63, 139  
 water depths 130
- biomarkers 201  
 biostratigraphy  
 age dating 67–75, 127–128  
 episodic variation 141–142  
 interpretations of the eastern margin of the Arabian Intraself Basin 117–118, 119  
 Jurassic in Oman 108  
 known age ranges of fossils 80–81  
 reconciling biostratigraphic differences 127–128  
 Sr/Sr dating 80
- bitumen 58  
*Bositra buchi* 47–48, 52, 57  
 broad evaporite and carbonate platform 175  
 bulk-rock samples 77  
 Butabul-1 well 109
- CaCO<sub>3</sub> nucleation 145  
 calcarenite 4  
 calcarenitic limestone 4  
 Callovian  
 biostratigraphy 73  
 Dhurma formation 69–70  
 extinction event 71, 72, 140  
 geological time 202  
 interpretations of the eastern margin of the Arabian Intraself Basin 118, 120  
 interpretations of the sequence stratigraphic framework 197  
 Late Bathonian–Oxfordian development and evolution 121  
 Lower Hanifa source rock 198  
 lowstand (LST) model 139, 140–141, 142, 143  
 sequence stratigraphy 85  
 Sr/Sr dating 79, 79, 80  
 transgression 197
- Callovian–Oxfordian transition 86  
 global anomalous events 139–142  
 global model for 142–145  
 carbon dioxide concentration  
 climate change implications 203  
 cyanobacteria 144–145  
 global model for the Late Callovian–Early Oxfordian 142, 143
- carbonate deposition 191–192, 192  
 carbonate–evaporite facies 161  
 carbonate–evaporite sequences 175–176  
 carbonate intrashelf basins 7  
 carbonate laminite 55, 131  
 carbonate platform 175  
 carbonate production 136, 142  
 carbonate seals 189  
 carbonate sequence phase 180–181, 183, 203  
 carbonate source rock 194
- Carboniferous 21  
 chronostratigraphy 81, 83  
 climate change implications 203  
 clinoformal ramp cycles 121–123, 146  
 clinofolds 130  
 coccoliths 141  
 continental margin evaporites 202  
 copepods 136  
 Coriolis force 12
- Cretaceous  
 Hanifa sequences 151  
 Jurassic–Cretaceous boundary 183–184  
 Sulaiy–Habshan formation 183
- Cretaceous Bab basin 187  
 Cretaceous beds 118  
 cyanobacteria 56, 143, 144–145, 201, 203
- Dahl Hith 66–67, 179  
 Dammam dome 14  
 Dammam well-7, 38  
 dating *see* age dating; stratigraphy  
 deposition  
 Arabian Intraself Basin 10  
 evaporite 12–13  
 hurricanes 12
- depositional facies  
 Arab-D reservoir 166–173, 167, 168  
 Atash-Lower Fadhili-Uwainat 80  
 fossils 80  
 Hanifa formation 146  
 terminology 47, 48
- depositional geometry 95  
 Abqaiq field to Jaham area 99–101  
 Abu Dhabi offshore 107  
 Abu Dhabi onshore 104–107  
 Bahrain source rock isopach 104  
 basin infill 163  
 Hanifa sequences 145  
 interpretations of the eastern margin of the Arabian Intraself Basin 116–121  
 Jurassic in Oman 108–109  
 Kurayn field to North Ghawar field 98–99  
 lowstand (LST) model 141  
 offshore northern Bahrain to the Qatif area 101–102  
 Qatar 102–104  
 rim and basin centre 152–153  
 Rimthan Arch margins 97–98  
 Saudi Arabia Jurassic outcrop 95–97  
 source rock interval 138–139
- depositional gradients 116, 126–127, 138  
 depositional sequences 81–82, 84, 88, 123–128
- Dhibi sequence 83  
 Dhurma Atash sequence  
 as broad platform 197  
 deposition 152  
 development 113, 121  
 development of the intrashelf basin 8  
 exploration research 187  
 schematic cross-section 122  
 Tuwaiq proposed modification 123, 124  
 Tuwaiq sequence 124, 128
- Dhurma formation  
 age dating 70  
 biostratigraphy 67, 69–70  
 depositional geometry  
 Jurassic in Oman 108, 108–109  
 Rimthan Arch margins 97, 97  
 Saudi Arabia Jurassic outcrop 95
- erosion of 28  
 exploration research 187  
 Late Bathonian–Oxfordian development and evolution 121–123, 122  
 lithostratigraphy 40, 44–45  
 Marrat–Dhurma sediment load 31, 31  
 mid-Jurassic Dhurma sequences 83–85  
 stratigraphic interval 1  
 subsidence 197  
 thickening 130
- Dhurma Hisyan Member 70, 124  
 Dhurma tectonically controlled intrashelf basin 23  
 Dhurma Uwainat 108, 116  
 diagenesis Sr/Sr dating 77  
 diffusion through seals 189  
 distal outer ramp biofacies 57

- dolomitization  
 early structural growth 170, 171  
 regional trends 164  
 Rimtham Arch 49–50, 50, 164  
 sediment types 48–50, 49
- down-ramp grainstone belts 199–200
- down-ramp shoal belts 190–191
- Dukhan field 26, 102
- Dukhan log 104
- eastern margin Arabian Intraself Basin 116–121, 199
- eastern palaeohigh 121
- end-Calloviaian 7, 9, 37, 198, 200
- end-Calloviaian extinction event 71, 72, 140
- energy levels 105, 128, 141, 201
- equator Intertropical Convergence Zone 202
- erosional truncation 108–109
- eustasy  
 anhydrite deposition 175  
 possible global type section for Jurassic eustasy 199, 200  
 Tuwaiq Mountain 129–130
- evaporite belts 202
- evaporite deposition 12–13, 191–192, 192
- eventite model 170
- exploration research  
 conclusions of this Memoir 197–203  
 current state of 187, 194  
 exploration history of the Arabian Intraself Basin 13–15  
 future exploration 189  
 geological questions needing more answers and definitions 199–203  
 Jurassic Arabian Intraself Basin hydrocarbon system 187–189  
 late-stage infill of the basin 191–192  
 other plays not covered in this Memoir 187  
 possible fault and stratigraphic traps in the Arabian Gulf area 193–194  
 possible syndepositional stratigraphic traps and late Jurassic unconformity traps 189–191  
 traps formed by later structural development 192–193  
 unconventional play in the source rock facies 194  
 value of Arabian Intraself Basin area 197, 203
- extinction event  
 end-Calloviaian 71, 72, 140  
 Tithonian 183–184
- facies maps 2
- facies terminology 47
- facies variation 165
- Fadhili field 73
- fault-related traps 192–193
- flooding events 123–124, 183–184
- forams  
 alkaline waters 142  
 biostratigraphy 67–75, 68  
 extinction event 140  
 interpretations of the eastern margin of the Arabian Intraself Basin 118  
 lowstand (LST) model 141  
 source rock interval 56, 63, 66
- fossils  
 biostratigraphy 67–75  
 episodic variation 141–142
- Hanifa sequences 153  
 known age ranges 80–81  
 lowstand (LST) model 144  
 pelagic megafossils 139  
 petrographic characteristics 56–57  
 Tuwaiq sequence 11
- France 140
- future exploration 189
- Galloway sequences 81, 148
- gas fields 4, 5, 187
- gas reserves 16
- Geological Time Scale (GTS), 37, 75–81, 76, 77, 78, 79, 81, 203
- geological time and the depositional sequences 202–203
- Ghasha field 161
- Ghawar field 1, 53, 64–65  
 Arab-D anhydrite 175  
 depositional geometry 98, 98–99  
 layer cake model 166  
 reservoir deposition 165, 166–173, 167, 169, 169  
 Sr/Sr dating 78
- glacial lowstand model 131, 140, 142–145, 200–201
- global context  
 Callovian–Oxfordian transition  
 anomalous events 139–142  
 Callovian–Oxfordian transition model 142–145  
 Jurassic eustasy 199, 200  
 lack of synchronicity of the Arab–Hith carbonate–evaporite sequences 183  
 sea-level fluctuations 113  
 Sr/Sr dating curve 37, 75–81  
 value of Arabian Intraself Basin area 197, 203
- Gotnia Basin  
 age dating 70  
 Dhurma formation 44, 45  
 evidence for a connecting channel 50, 163–164  
 Kimmeridgian deposition 164–165  
 Kuwait 139  
 Rimtham Arch 27, 28
- Gotnia-Mesopotamian Basin 1  
 communication with the Arabian Intraself Basin 128–129, 201
- evaporite belts 202
- evaporite deposition 12–13
- stratigraphy 6
- grainstone  
 Arab-D reservoir 171, 173  
 dolomitization 48, 49  
 porosity 51  
 terminology 4  
 tidal or rip-tide grainstone deltas 189–190
- grainstone belts 199–200
- grainstone tongues 189
- gypsum deposition 191–192
- Hadriya reservoir  
 depositional geometry  
 Abqaiq field to Jaham area 100  
 Abu Dhabi onshore 105  
 Jurassic in Oman 109  
 Kurayn field to North Ghawar field 98–99  
 offshore northern Bahrain to the Qatif area 101–102  
 Qatar area 102
- lithostratigraphic intervals 45, 46, 52, 53
- sea-level fluctuations 140
- shallow water facies 126
- source rock 72
- source rock interval 62, 62, 63
- Hanifa anhydrites 151–152
- Hanifa formation  
 depositional geometry 100–101, 101, 104  
 Abu Dhabi offshore 107  
 Abu Dhabi onshore 105, 106, 107  
 Jurassic in Oman 109  
 Qatar area 102, 103
- interpretations of the eastern margin of the Arabian Intraself Basin 120
- Jurassic cross section 96
- lithostratigraphy 37
- seismic amplitude image 191
- source rock 72
- source rock interval 60–64
- water depths 130
- wireline logs 4
- Hanifa Hawtah 62–63, 86, 87, 96, 99, 104, 151
- Hanifa outcrop cross-section 150
- Hanifa reservoir  
 biostratigraphy 73  
 depositional geometry 105  
 lithostratigraphic units 53
- Hanifa sequences 9  
 above the Lower Hanifa Source Rock LST 145–152  
 definition 146–148  
 depositional geometry 96, 99, 100, 109  
 exploration research 187  
 fossils 153  
 geological time 202–203  
 Late Bathonian–Oxfordian development and evolution 121  
 Late Jurassic Tethys 30  
 lithostratigraphic source rock interval 145  
 lithostratigraphy and depositional characteristics 87  
 post-Hanifa Tethys margin 121  
 Qatar Arch 26  
 source rock interval 62, 87, 134, 138–139, 145–152, 153  
 summary cross-section 114
- Hanifa shelf 100
- Hanifa Ulayyah sequence 87
- Haq curve 199
- Hawtah member 62–63, 86, 87, 96, 99, 104, 151
- Hawtah sequence 146–148
- Hercynian orogeny 21
- highstand systems tract (HST)  
 Arab-D anhydrite 175  
 Arab-D reservoir 168  
 Hadriya reservoir 52  
 Hanifa sequences 149  
 highstand vs. lowstand model 135–136  
 ‘post-Hanifa wedge’, 152
- Hisyan member 85, 123–124
- Hith Anhydrite formation  
 depositional geometry 97  
 description of 66–67  
 exploration research 187  
 stratigraphic interval 1
- Hith Anhydrite sequence 88

- Hith formations  
 anhydrites and evaporites 179  
 Arab–Hith formation 159–161, 160, 161, 172  
 basin deposition 116  
 biostratigraphy 75  
 carbonate–evaporite sequence 10  
 collapse of the shelf margin and deposition of the Asab–Rayda sequences 118  
 depositional geometry 97  
 juxtaposition of the Arab–Hith shoal facies 121  
 outcrop type section 181  
 post–Arab–D reservoir deposition 179–183  
 Sr/Sr dating 80  
 stratigraphic terms 159–161, 160  
 structural development 27–28  
 tripartite subdivision 179–180, 180
- Hith sequence 181–183  
 Hormuz salt 21, 23  
 hurricanes 12, 14  
 hydrocarbon system exploration research 187–189  
 hypersalinity 143–144
- India 140  
 Intertropical Convergence Zone (ITCZ), 13, 198, 202  
 intra-Hith events 182  
 intrashelf basin centre thicknesses 127  
 intrashelf basin definition 1, 7, 197  
 intrashelf basin rim 4–5  
 intrashelf basin rim thicknesses 127  
 Iran 117–118, 118  
 Iraq Petroleum Company (IPC), 15  
 isopach maps  
 Arab–C reservoir 177–178, 178  
 Qatif field Arab–D 171  
 source rock interval 131–132, 133  
 structural development of the Arabian Intrashelf Basin 26–27
- isostasy 31–32, 129–130  
 isotopic signatures 13
- Jafurah area core 57  
 Jafurah core 194  
 Jaham depositional geometry 99–101  
 Jarief formation 118  
 Jubaila  
 and Arab–D deposition 161–165  
 basin deposition 116  
 basin geometry 198–199  
 biostratigraphy 67, 74  
 depositional geometry  
 Jurassic in Oman 108, 109  
 Kurayn field to North Ghawar field 99  
 Rimtham Arch margins 98  
 Saudi Arabia Jurassic outcrop 97  
 depositional setting 138–139, 170  
 exploration research 187  
 general setting 9  
 geological time 203  
 interpretations of the eastern margin of the Arabian Intrashelf Basin 120–121  
 Jubaila–Arab–D interval 165–166  
 sequence stratigraphy 87–88  
 source rock interval 53, 64–66  
 stratigraphic terms 159
- Jubaila–Arab–D interval 64, 74–75, 99, 120–121, 138  
 Jubaila transgression 162  
 Jurassic Arabian Intrashelf Basin 1  
 Jurassic–Cretaceous boundary 183–184  
 Jurassic glacial lowstands 140, 142–145, 200–201  
 Jurassic minimum Sr/Sr curve 75  
 Jurassic outcrop reference section 38, 41  
 Jurassic period  
 lithostratigraphy 37  
 main premises and new interpretations 7–8  
 Saudi Arabia outcrop reference section 38, 41  
 sequence stratigraphy 81–88  
 structural development of the Arabian Intrashelf Basin 22–23, 24–26, 26–27, 30
- karst valley interpretation 125  
 karstic features 199  
 kerogen 57  
 Khuff gas 25  
 Khurais field 63, 121–123, 169–170  
 Kimmeridgian  
 basin geometry 199  
 biostratigraphy 67, 71, 74  
 depositional geometry  
 Abu Dhabi onshore 105–106  
 Jurassic in Oman 109  
 eastern palaeohigh 121  
 geological time 203  
 Gotnia Basin deposition 164–165  
 interpretations of the eastern margin of the Arabian Intrashelf Basin 118, 120–121  
 Sr/Sr dating 79, 79, 80  
 uplift 10
- Kimmeridgian–Tithonian 27  
 Kurayn field 98, 98–99  
 Kuwait 71, 139
- land barrier  
 eastern margin of the Arabian Intrashelf Basin 120  
 Late Jurassic Tethys 9–10, 30, 165, 183, 199  
 timing of development 199
- Late Bathonian–Oxfordian development and evolution 121–123
- Late Jurassic  
 eastern margin 116–121  
 Tethyan margin land barrier 9–10, 30, 165, 183, 199  
 tidal ranges 189
- lateral faulting 193  
 layer cake model 166  
 Lebanon 140  
 lime mud 37, 48  
 lime mudstone laminae 55–56  
 lithofacies 44–45, 57  
 lithostratigraphic nomenclature 5–6, 6, 37, 38–40, 39–40  
 lithostratigraphic units 51–53  
 lithostratigraphy  
 Arabian Intrashelf Basin overview 40–45  
 interpretations of the eastern margin of the Arabian Intrashelf Basin 119  
 sequence stratigraphy correlations 82  
 source rock interval 145
- low-gradient clinoforms 130  
 Lower Fadhili–Uwainat reservoir 44, 121–123, 122  
 Lower Hanifa source rock 153, 187–188, 188, 198
- lowstand (LST) model  
 Arab–D reservoir 168  
 highstand vs. lowstand comparison 135–136, 136  
 Jurassic glacials 142–145, 200–201  
 lithostratigraphic timeframes 145  
 Lower Hanifa source rock 145–146  
 model overview 142–145, 198  
 proposed explanations 140–142  
 sea-level fluctuations 199  
 source rock deposition 137, 139  
 Tuwaiq Mountain 135
- Lurestan Basin 1
- Manifa member 67  
 Manifa reservoir  
 biostratigraphy 75  
 flooding event 183–184  
 Hith formations 179–180
- Manifa–Sulayy sequence 88  
 Marrat–Dhurma sediment load 31, 31  
 Marrat formation  
 depositional geometry  
 Saudi Arabia Jurassic outcrop 95  
 earliest Jurassic Marrat sequence 82–83  
 lithostratigraphy 37, 40–44  
 structural development 23, 26, 29, 31
- maturation source rock interval 133  
*see also* thermal maturity
- maximum flooding surface (MFS)  
 horizons  
 interpretations of the sequence stratigraphic framework 197  
 Jubaila–Arab–D sequences 165–166  
 lithostratigraphy 38, 39  
 Saudi Arabia Jurassic outcrop 95  
 sequence stratigraphy 84, 85
- megafossils 139  
 Mender Glauconite formation 66, 75, 104, 183  
*Meyendorffina bathonica* 68, 127–128  
 microbial calcification 143, 145  
 microbial deposition 142  
 microbial origin source rock interval 144–145  
 microbial processes 145, 201  
 microfossils  
 age dating 7, 69  
 lowstand (LST) model 141  
 micropeloidal micrograinstone 55–56, 56, 57, 131, 201
- Middle East oil reserves 16  
 migration source rock interval 133  
 Minjur formation 26, 29
- Najd rift phase 21  
 Najmah formation 71  
 Neotethys Ocean 2  
 net source rock isopach 131–132, 132, 133  
 normal faulting 193
- oil fields 4, 5, 14–15, 187  
 oil reserves 16
- Oman  
 biostratigraphy 71, 73, 74, 75  
 depositional geometry 108–109  
 exploration history 15

- Hanifa formation 64  
 Hanifa sequences 86–87, 149–150  
 interpretations of the eastern margin of the Arabian Intrashelf Basin 117, 117, 118, 119–120  
 lithostratigraphic intervals 53  
 lithostratigraphic nomenclature 38  
 source rock interval 64  
 orbital stratigraphy hypothesis 88  
 organic matter  
 biomarkers 201  
 episodic variation 141–142  
 microbial process 145, 201  
 source rock interval 57–59, 136  
 organic richness  
 Hanifa sequences 138  
 lowstand (LST) model 145  
 source rock interval 57–59, 131, 133  
 Tuwaiq sequence 127  
 Oxfordian 7 *see also* Callovian–Oxfordian transition  
 Abu Dhabi onshore 105–106  
 biostratigraphy 71–72, 74, 127–128  
 geological time 202–203  
 interpretations of the eastern margin of the Arabian Intrashelf Basin 118  
 interpretations of the sequence stratigraphic framework 197  
 Late Bathonian–Oxfordian development and evolution 121–123  
 lithostratigraphy 53  
 Lower Hanifa source rock 198  
 lowstand (LST) model 139, 142  
 normal marine conditions 198  
 source rock deposition 9  
 Sr/Sr dating 75, 78, 79, 79, 81  
 packstone terminology use 4  
 palaeoenvironmental interpretations 56  
 palaeohighs 163, 174–175  
 palaeolatitudes 10–11, 12, 153, 202  
 palaeotradewinds 10–12, 11, 13  
 Pangaea 11  
 pelagic megafossils 139  
 permeability dolomitization 48, 170, 171  
 Permian 21–22, 24, 25  
 Persian Gulf 143  
 petrographic characteristics  
 present day analogues 142–143  
 source rock interval 55–57  
 unique facies 60  
 Petroleum Development Company of Qatar (PDQ), 15  
 photomicrographs 131  
 photosynthesis 143, 144–145, 201  
 planktonic cyanobacterial cells 145  
 planktonic forams  
 lowstand (LST) model 141  
 palaeoenvironmental interpretations 56  
 plate tectonics  
 Arabian Intrashelf Basin setting 10–13  
 carbonate intrashelf basins 7  
 structural development of the Arabian Intrashelf Basin 21, 23–30  
 platform deposition 176  
 porosity  
 Dhurma formation 44  
 preservation of early-formed porosity 50–51, 51  
 ‘post-Hanifa wedge’, 106, 152, 166  
 Precambrian 21  
 progradation 99, 146  
 progradational fronts 189  
 proximal outer ramp biofacies 57  
*Pseudomaronella maxima* 118  
 Qatar  
 Arab-C reservoir 179  
 Arab-D reservoir 172  
 biostratigraphy 71, 73, 74, 75  
 depositional geometry 102–104, 103  
 exploration history 15  
 Hanifa formation 63  
 Hanifa sequences 149, 150  
 lithostratigraphic intervals 53  
 lithostratigraphic nomenclature 38  
 lowstand (LST) model 141  
 Marrat formation 41  
 net source rock isopach 131–132  
 sequence stratigraphy 86  
 source rock facies 60  
 source rock interval 60, 63, 65–66  
 source rock isopach 104  
 Sr/Sr dating 78  
 stratigraphy 6  
 water depths 144  
 wireline logs 4  
 Qatar Arch 22, 24–27, 33, 114  
 Qatar peninsula 117  
 Qatar well 52–53, 114–116, 115  
 Qatif  
 depositional geometry 101–102, 104  
 Hanifa sequences 152  
 Qatif field  
 Arab-C reservoir 177, 177–178  
 Arab-D anhydrite 174  
 Arab-D reservoir 65  
 depositional model 170, 170–172  
 Qatif well 38–40, 42, 52–53, 125–126  
 Qirdi field 121–123  
 Qusahwira well 104, 106, 106–107, 127  
 ramp modelling 47, 48  
 ramp setting 45–47  
 ramp terminology 47  
 Ras Al-Khaimah  
 Hanifa formation 64  
 interpretations of the eastern margin of the Arabian Intrashelf Basin 116  
 source rock interval 64  
 Ras Qirtas log 104  
 Rayda formation 75  
 collapse of the shelf margin and deposition of the Asab–Rayda sequences 118  
 deposition 183  
 depositional geometry 109  
 lithostratigraphy and depositional characteristics 66  
 research *see* exploration research  
 reservoir facies 192  
 rift-related subsidence 130  
 rim to basin transition 127  
 Rimthan Arch  
 aggradation of the intrashelf basin rim 175  
 depositional geometry 97, 97–98  
 dolomitization 49–50, 50, 164  
 general setting 1–2  
 Gotnia–Mesopotamian Basin 128–129  
 structural development 27–29, 30  
 wireline logs 4  
 rip-tide grainstone deltas 189–190  
 Rub’ al-Khali region 1, 26  
*Saccoma* interval 118  
 salinity 142–144  
 salt movement 21, 28  
 Saudi Arabia  
 Arab-C reservoir 177, 179  
 Arab–Hith formation 159  
 biostratigraphy 67, 70, 72, 73–75  
 correlations to Abu Dhabi 52–53, 106–107  
 exploration history 13–15  
 lithostratigraphic nomenclature 38  
 lithostratigraphic units 51–53  
 lithostratigraphy 37  
 lowstand (LST) model 141  
 Marrat formation 40–41  
 net source rock isopach 132  
 sequence stratigraphy 87, 88  
 source rock interval 53–55, 54  
 structural development 30  
 wireline logs 3–4  
 Saudi Arabia outcrop reference section 38, 41  
 Saudi Arabia outcrops 2  
 age dating 6–7  
 comparison to Abu Dhabi intrashelf basin rim facies 106–107  
 depositional geometry 95–97  
 Jurassic cross section 96  
 summary cross-section 113–116, 114  
 thickening 130  
 sea-level fluctuations  
 anhydrite deposition 175  
 comparison with the global sea-level curve and determination of the magnitude of sea-level fluctuations 199, 200  
 deposition 153  
 global context 113  
 global drop 140  
 highstand vs. lowstand model 135–136, 136  
 lowstand (LST) model 140–142  
 Mid- and Late Jurassic tidal ranges 189  
 Tuwaiq Mountain 129–130  
 sediment load 31, 130  
 sedimentary structures 56–57  
 sedimentation rate 128  
 seismic amplitude image 191  
 sequence boundaries 202  
 sequence stratigraphy  
 Arabian Intrashelf Basin overview 37–38, 81–88  
 geological time and the depositional sequences 202–203  
 interpretations of the sequence stratigraphic framework 197, 198  
 Jurassic eustasy 199  
 lithostratigraphy correlations 82  
 Shagra Group 38  
 shale  
 Dhurma 44, 85  
 source rock interval 131  
 upper Hanifa 87  
 shallow water facies 126–127, 130  
 shallow water production crisis 139  
 shelf terminology 47  
 shelly layers 138  
 Shilaif intrashelf basin 187  
 source rock debris flow 138  
 source rock deposition 9, 21–22, 86–87, 130, 133, 137, 139, 144

- source rock facies 135  
 depositional geometry 99  
 microbial process 201  
 unconventional play 194
- source rock interval  
 Abu Dhabi 60, 64  
 age of 71–75  
 Arab-C to Arab-A members 66  
 Arabian Intraself Basin development 131–139  
 Asab Mender Glauconite and Rayda formations 66  
 Bahrain 59–60, 63  
 biostratigraphy 67–75  
 depositional setting 138–139  
 descriptions 57  
 Hanifa formation 60–64  
 Hanifa sequences 62, 87, 134, 138–139, 145–152  
 Hith Anhydrite formation 66–67  
 Jubaila and Arab-D reservoir and anhydrite 53, 64–66  
 lithostratigraphic timeframes 145  
 Lower Hanifa Source Rock interval 153, 187–188  
 microbial origin 144–145  
 Oman 64  
 organic matter and organic richness 57–59, 136  
 petrographic characteristics 55–57  
 petrographically unique facies 60  
 Qatar 60, 63  
 Ras Al-Khaimah 64  
 Saudi Arabia 53–55, 54  
 summary cross-section 114–116
- source rock isopach 104, 104  
 source rock stratigraphy 99–100  
<sup>87</sup>Sr/<sup>86</sup>Sr dating  
 as an age dating and correlation tool 37, 75–81, 202  
 anomalous values 81  
 calibration data 75–76  
 effect of isolation from the Tethys Ocean 78–81  
 Ghawar Arab-D dolomite values 78  
 interpretations 81  
 isolation from Arabian Intraself Basin 78–81  
 review of data for the Arabian Interself Basin 75–78  
 sampling issues 7  
 unconformities and chronostratigraphy 81
- storm flows 189
- stratigraphic nomenclature 5–7, 6, 55
- stratigraphy  
 Abqaiq field to Jaham area 99–100  
 age dating 6–7  
 Arabian Intraself Basin and ages 1–2  
 biostratigraphy 37, 67–75  
 effect of isolation from the Tethys Ocean 78–81  
 factors important in understanding 45–51  
 intervals and sequences 8–10  
 lithostratigraphic units 51–53  
 lithostratigraphy of 40–45  
 main source rock interval 53–67  
 sequence stratigraphy 37–38, 81–88  
 Sr/Sr dating 37, 75–81  
 stratigraphic intervals 88–89  
 stratigraphic nomenclature 5–7, 6, 55  
 structural development 27–28
- Arabian orbital stratigraphy  
 hypothesis 88
- future exploration 189
- geological time and the depositional sequences 202–203
- interpretations of the sequence stratigraphic framework 197, **198**
- lithostratigraphic nomenclature 37, 38–40
- main premises and new interpretations 7
- possible fault and stratigraphic traps 193–194
- possible syndepositional stratigraphic traps 189–191
- Tuwaik sequence deposition 125–126
- well log cross-sections 159
- structural development *see under* Arabian Intraself Basin
- structural tilt 175
- subaqueous anhydrite 116
- subaqueous gypsum 116
- subsidence 9  
 Dhurma formation 197  
 rift-related 130  
 Saudi Arabia Jurassic outcrop 95  
 summary cross-section 116  
 Tethyan shelf 32  
 Tuwaik Mountain 129–130  
 Tuwaik sequence 123
- subsurface biostratigraphy 67–69
- Sulayy formation 179, 181, 183, 183–184
- Sulayy–Habshan formation 183
- Sulayy interval 88
- synclinal low 130
- syndepositional stratigraphic traps 189–191, 190
- tectonics *see* plate tectonics
- Tethyan margin land barrier 9–10, 30, 165, 183, 199
- Tethyan shelf  
 depositional geometry 105  
 main premises and new interpretations 7  
 subsidence 32  
 terminology 47  
 water flow and energy levels 201
- Tethys Ocean  
 Arab-D anhydrite 175  
 communication with the Arabian Intraself Basin 78–81, 128, 153  
 general setting 11  
 interpretations of the eastern margin of the Arabian Intraself Basin 116–121  
 source rock deposition 144  
 uplift 150
- thermal maturity Lower Hanifa Source Rock interval 187–188, 188
- tidal channels 189
- tidal grainstone deltas 189–190
- tidal ranges 189, 200
- tilt 9
- Tithonian  
 collapse of the shelf margin and deposition of the Asab–Rayda sequences 118  
 eastern palaeohigh 121  
 extinction event 183–184  
 geological time 203  
 lowstands 184
- palaeolatitude 10–11, 12  
 uplift 10
- topographic relief 197
- total organic carbon (TOC)  
 depositional geometry 100, 102  
 net source rock isopach 132, 133  
 source rock interval 57–58, 59, 61
- trace fossils 56–57
- transgressive systems tract (TST) model  
 Arab-D anhydrite 175  
 Arab-D reservoir 168  
 Hadriya reservoir 52  
 model overview 136  
 Ulayyah sequence 148–149
- Triassic 21, 22
- Triassic Khuff 22
- Tuwaik Mountain  
 biostratigraphy 67, 70–71  
 depositional geometry  
 Abqaiq field to Jaham area 100  
 Abu Dhabi offshore 107  
 Abu Dhabi onshore 104, 105–107, 106  
 Jurassic in Oman 108–109  
 Kurayn field to North Ghawar field 98–99  
 offshore northern Bahrain to the Qatif area 102  
 Qatar area 102  
 Rimthan Arch margins 97–98  
 Saudi Arabia Jurassic outcrop 95–96  
 development of the intrashelf basin 8–9  
 facies map 124, 124–125  
 interpretations of the eastern margin of the Arabian Intraself Basin 116, 119–120  
 isostasy 129–130  
 Jurassic cross section 96  
 land barrier 9–10  
 lithostratigraphic units 51–53  
 lithostratigraphy 37  
 lowstand (LST) model 135, 143  
 marine deposition 127  
 sea-level fluctuations 140  
 sequence stratigraphy 85–86, 87  
 source rock deposition 9  
 source rock interval 55, 60, 62, 133, 138–139  
<sup>87</sup>Sr/<sup>86</sup>Sr dating 81  
 summary cross-section 114  
 thickening 130  
 unconformities 32–33, 86  
 uplift 150  
 wireline logs 4
- Tuwaik sequence  
 basal sediments 127  
 definition 128  
 development of the intrashelf basin 8–9  
 exploration research 187  
 features of the Arabian Intraself Basin setting 128–130  
 fossil diversity 11  
 geological time 202  
 Late Bathonian–Oxfordian development and evolution 121  
 proposed modification 123–128  
 proposed modified definition 125  
 termination 125
- Ulayyah member  
 Berri field 62–63  
 depositional geometry 96  
 seismic amplitude image 191

- Ulayyah sequence  
 definition of 146, 148–149  
 depositional geometry 104  
 lithostratigraphy and depositional characteristics 87  
 progradation 99
- unconformities  
 basin rim exposure 128  
 Dhurma Atash sequence 123  
 Dhurma sequences 83, 85  
 Hanifa sequences 149, 150–151  
 Interpretations in this memoir 81, **82**  
 interpretations of the eastern margin of the Arabian Intrashelf Basin 116–121  
 Marrat sequence 83  
 onlap of anhydrites 175  
 possible Late Jurassic unconformity traps 189–191, *190*  
 structural development of the Arabian Intrashelf Basin 32–33
- Tethyan margin land barrier 30  
 Tuwaiq interval 32–33, 86
- United Arab Emirates (UAE)  
 exploration history 15  
 Hanifa sequences 149–150, *151*  
 interpretations of the eastern margin of the Arabian Intrashelf Basin 120  
 reserves 16
- Upper Dhurma formation 8, 70, 95  
 Upper Dhurma–Uwainat interval 119  
 Upper Fadhili reservoir 52, 100, 125–126  
 Upper Naokelekan 141  
 uppermost biofacies 57  
 Uwainat deposition 108, 119  
 Uwainat interval 113, 119, 121, 123
- wackestone terminology use 4  
 water circulation 10–12, *11*  
 water depths *see also* sea-level fluctuations  
 accommodation space 144
- Arab-D reservoir 167  
 end-Calloviaian 140  
 Jubaila–Arab-D interval 138  
 Tuwaiq Mountain 129–130  
 water flow 201  
 wave energies 10–12  
 well logs  
 Arab-C reservoir 178–179  
 Arab–Hith formation 159–161, *160*  
 availability 4, 45  
 lithostratigraphic nomenclature *46*  
 organic richness 58, 58–59  
 Qatif well log 38–40, *42*  
 stratigraphic terms 159  
 summary cross-section 113–114, *114, 115*
- Williston Basin North America 140  
 wireline logs 3–4  
 wrench faulting 193
- zooplankton 136