Index

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

aggrading neomorphism 48 albite and albitization 9 authigenic 272-273, 277-278 cement 11 Algeria see Illizi Basin alkali elements, quartz cement study 378-379, 382-384, 384 aluminium, quartz cement study 377-378, 378, 379-382, 379.384 Amenas-Bourarhat Sud study area see Hirnantian glaciation sandstones analytical techniques, summary of 13-15 see also named methods anhydrite 10, 11, 13, 274-275 Anschutz Ranch East Field (USA) 161 apatite cement 12 aragonite 4, 5 dissolution 47-48 in eodiagenesis 5 Arbuckle Group geological setting 285-287 methods of analysis 283-284 results BSEM 291-292 fluid inclusion 292-300 paragenesis 287-288 early 288 late 288-291 Sr isotopes 306-309 stable isotopes 300-306 results discussed fluid flow conduits 309-310 hydrologic models 311-315 hydrothermal event timing 315 hydrothermal fluids 310-311 migration events 311 stratigraphy 285 summary 315-316 Arroyo Grande Field (USA) 161 ATR-FTIR (attenuated total reflectance Fourier transform infrared) spectroscopy Qishn Formation 109, 111 Austria see Vienna Basin authigenic minerals quartz 373-374 Vedder Formation anhydrite 274-275 barite 274 carbonate 271-272, 277 clay minerals 271, 277 feldspar 272-274, 277-278 glauconite 269, 277 phosphate 269-271, 277 pseudomatrix 274 pyrite 271, 277 quartz 274, 278 rutile 274

backscattered electron (BSE) imaging Niger Delta Tertiary sands 249 Pannonian Basin study 407 back-scattered electron microscopy (BSEM) 15 Arbuckle Group 283, 291-292 barite 10, 11, 274-275 baroque dolomite see under dolomite Barra Velha Formation Mg-rich clay mineral growth chemical controls 36-38 diagenetic controls 39-41 environment of formation 33-34 sedimentological controls 38-39 structural controls 34-36 summary of behaviours 41-43 basin modelling 249-250 Niger Delta Tertiary 250-252 Bassein Limestone depositional environment 70 facies 71 geological setting 68-70 methods of analysis 72-73 results matrix porosity and stylolite density 74-76 pore system 73-74 results discussed diagenetic phases 76-77, 77 dissolution mechanism 79-83 porosity generation 77-79 stratigraphy 69-70, 69 tritiated water tracer test 70, 72 Belgium, Hallembaye chalk study methods effluent ion chromatography 220, 221 FEG-SEM 222 flooding 218-220 porosity 224-226 pycnometry 222 sample selection 218 whole-rock geochemistry 222-224 XRD 222 results effluent ion chromatography 227 FEG-SEM 227-228, 227, 228 porosity 226 whole-rock geochemistry 228-229, 231 XRD 228, 229, 230 results discussed 229-230, 232-233 summary 233 berthierine, eogenetic 6, 7, 9 bicarbonate concentration role in alteration 8 biofilms 8 bioturbation 8 Bombay Basin, Bassein Limestones study depositional environment 70 facies 71 geological setting 68-70

Bombay Basin, Bassein Limestones study (Continued) methods of analysis 72-73 results matrix porosity and stylolite density 74-76 pore system 73-74 results discussed diagenetic phases 76-77, 77 dissolution mechanism 79-83 porosity generation 77-79 stratigraphy 69-70, 69 tritiated water tracer test 70, 72 boron, quartz cement study 378, 384 Borrowdale Volcanic Group 125 Brazil Barra Velha Formation Mg-rich clay mineral growth chemical controls 36-38 diagenetic controls 39-41 environment of formation 33-34 sedimentological controls 38-39 structural controls 34-36 summary of behaviours 41-43 Campos Basin 261, 262 Santos Basin 321 Bridport Sandstone 6 BSE (backscattered electron) imaging Niger Delta Tertiary sands 249 Pannonian Basin study 407 BSEM (back-scattered electron microscopy) 15 Arbuckle Group 283, 291-292 burial corrosion, defined 67 burial depth estimation see clumped isotope thermometry burial diagenesis see mesodiagenesis burial history modelling **Oishn Formation** methods of analysis 109-111 results 111-114 results discussed 114-119 setting 108-109 summary 119-120 Skagerrak Formation 332-333 reservoir implications 338 C isotope analysis 15 Arbuckle Group 284 baroque dolomite 300-303 calcite cement 303-306 Kharaib Formation 50, 55-56 calcite authigenic 271 high magnesium 4, 5 in eodiagenesis 5 in late diagenesis 291, 298-300, 303-306, 308-309, 315, 316 calcrete 8 Campos Basin (Brazil) 261, 262 carbon dioxide storage, factors affecting 405 Hungarian Plain study geological setting 406-407 methods of analysis **FTIR 408** kinetic model application 408-409 petrography 407

thermal study 407-408 XRD 407 results kinetic modelling 412-413 laboratory 410-412 petrography 410 results discussed 413-416 summary 416 carbonate authigenic 271-272 depositional environment 4-5 diagenesis effect of petroleum on 19-21 eodiagenesis 3, 6-7, 8-9mesodiagenesis 3, 9-11 structural diagenesis 12 telodiagenesis 3, 13 reservoir quality controls 3 Barra Vehla Formation chemical controls 36-38 diagenetic controls 39-41 environment of formation 33-34 sedimentological controls 38-39 structural controls 34-36 summary of behaviours 41-43 Bassein Limestone depositional environment 70 facies 71 geological setting 68-70 methods of analysis 72-73 results matrix porosity and stylolite density 74-76 pore system 73-74 results discussed diagenetic phases 76-77, 77 dissolution mechanism 79-83 porosity generation 77-79 stratigraphy 69-70, 69 tritiated water tracer test 70, 72 Kharaib Formation geological setting 48-50 microporosity study methods of analysis 50, 52 reservoir quality 62 results BSE 54 fluid inclusion microthermometry 56 optical microscopy 51, 52, 55 petrography 52-55 SEM 51. 53 stable isotopes 55-56 results discussed calcite formation temperature 60-61 macropores 61-62 micritization 56-59 micro-overgrowth 59-60 summary 63 Mishrif Formation composition 86, 87 geological setting 85 methods of analysis 88 results capillary pressure curves 94-95, 95 diagenetic framework 94

facies 88-89 microbial 92-93 rudist 89, 90, 91, 92 rock types 95, 97 non-reservoir 98, 99 reservoir 96, 97, 99 results discussed role of cyclicity in reservoir quality 99-103 summary 103 Raytown Limestone geological setting 178-179, 179 methods of analysis 180-181, 183 results diagenesis early 189-193 late 193-199 lithofacies 183, 183, 185 stratigraphy 183-188 results discussed origin of cements 199-203 porosity evolution 203-209 summary 209-210 carbonate clumped isotope thermometry 107-108 **Oishn** Formation method 109-111 results 112, 113, 114, 117 results discussed 114-116 burial history 119 palaeo-environmental significance 116, 118 summary 119-120 cataclastic deformation bands 141, 161 Rotliegend sandstone study 143 methods of analysis permeability 143-144 petrography 144 well logs 143 results permeability 149-152 petrography 144-145, 146, 148, 149 well logs 145, 147, 149 results discussed permeability 155-157 petrography 152, 154 well logs 154-155 summary 157 cathodoluminescence (CL) 15 Arbuckle Group 283 Niger Delta Tertiary sands 249 Qishn Formation 109, 111, 114 Ravtown Limestone 181 Rotliegend sandstone 144, 145 Sherwood Sandstone Group 163, 167, 167 Vedder Formation 268 cement and cementing minerals 6-8, 11-12 calcite authigenic 271 high magnesium 4, 5 in eodiagenesis 5 in late diagenesis 291, 298-300, 303-306, 308-309, 315, 316 carbonate 11 clav 11 dolomite authigenic 271-272

baroque 289-290, 300-303, 396-308, 315, 316 eogenetic 6 mesogenetic 198, 199, 203 quartz 11, 274, 278, 329, 373-374 inhibition 355-359, 360-363, 366 sulphate 11 cementation bands 161 cementation events Arbuckle Group baroque dolomite 289-290, 300-303, 315.316 calcite 291, 303-306, 315, 316 megaquartz 289 Hirnantian glaciation sandstones 353-359 Raytown Limestone 189, 193, 194-195 origins of 200-203 cementation modelling Niger Delta Tertiary sands 250-252, 261 cementation porosity loss (CEPL) 332 Central Graben (North Sea) 321, 322, 323 Skagerrak Formation geological setting 322 methods of analysis 325 results burial history model 332-333 compaction 327-328 diagenesis 328-329 cement volume 332 chlorite coatings 329-331 K-feldspar alteration 331 quartz cements 329 intergranular and cement volume 332 overpressure-depth correction 333-334 petrography grain size 325-327 porosity distribution 325-327 results discussed 334-338 stratigraphy 322-325, 324 summary 338 Central Kansas Uplift (USA) 178, 180 impact on Raytown Limestone 203-209 chalcedony 198 chalk porosity and compaction study at Hallembaye methods effluent ion chromatography 220, 221 FEG-SEM 222 flooding 218-220 porosity 224-226 pycnometry 222 sample selection 218 whole-rock geochemistry 222-224 XRD 222 results effluent ion chromatography 227 FEG-SEM 227-228, 227, 228 porosity 226 whole-rock geochemistry 228-229, 231 XRD 228, 229, 230 results discussed 229-230, 232-233 summary 233 strength factors 217 Chaunoy Formation 10 chemical compaction (pressure solution) 18

chemical index of alteration (CIA) 398 chert, eogenetic 7 Cheshire Basin see Thurstaston (Wirral) chlorite and chloritization 9 authigenic 271, 278 cement and grain coatings 11 Skagerrak Formation 329-331, 336-337 modelling 421, 427-429, 436-437 CL see cathodoluminescence Clair Field (UK) 161 clay minerals authigenic 271, 277 cement 11 Hirnantian glaciation sandstones 353-355 feldspar alteration 123 Ravenglass Estuary 136 grain coatings 329-331, 336-337, 338 Mg-rich chemical controls 36-38 diagenetic controls 39-41 environment of formation 33-34 sedimentological controls 38-39 structural controls 34-36 summary of behaviours 41-43 Vienna Basin study methods 392-393 results mudstones 394-395, 396 sandstones 393-394, 396 results discussed 399-401 see also chlorite; illite; kaolinite clumped isotope thermometry 107-108 **Oishn Formation** method 109-111 results 112, 113, 114, 117 results discussed 114-116 burial history 119 palaeo-environmental significance 116, 118 summary 119-120 CO₂ storage Hungarian Plain study geological setting 406-407 methods of analysis **FTIR 408** kinetic model application 408-409 petrography 407 thermal study 407-408 XRD 407 results kinetic modelling 412-413 laboratory 410-412 petrography 410 results discussed 413-416 summary 416 compaction porosity loss 12-13, 321 Raytown Limestone 189, 193 Vedder Formation 268-269, 278 compaction bands 141, 161 compaction porosity loss (COPL) 332 concretions 6, 6 Congo see Lower Congo Basin conodont alteration colour 107 contact index (CI) 267-268, 268-269

core analysis, Hirnantian glaciation sandstones 346-347 cyclothemic strata, Kansas 178-179, 181 dawsonite development of 405-406 role in CO₂ sequestration methods of analysis 407-409 results kinetic model 412-413 laboratory 410-412 petrography 410 results discussed 413-416 summary 416 decompaction joints 13 dedolomitization 13 deformation bands 12-13 cataclastic see Rotliegend sandstone study classification 141, 161 dilational 141 role of 161 Thurstaston (Wirral) study methods field descriptions 163, 164, 165 microstructures 163-165 results field data 165-166 microstructures 167-169 results discussed relation to faults 169-170 relation to reservoir properties 171-173 relation to rock properties 170-171 summary 173 depositional environment, impact on reservoir 4-5 depth of burial interpretation using clumped isotopes 119 role in eodiagenesis 5 role in mesodiagenesis 9 diagenesis controls on Mg-silicate formation 39-41 experimental simulation 16 forward modelling 16-17 Mishrif Formation 94 modelling see reactive transport modelling Niger Delta Tertiary sands 254 Raytown Limestone 188-189 early stage 189-193 late stage 193-199 role in microporosity development 47-48 role of petroleum emplacement in 19-21 Skagerrak Formation 328-329 chlorite cement 329-331 development 334-336 K-feldspar alteration 331 quartz cement 329 see also eodiagenesis; mesodiagenesis, telodiagenesis diatoms 8 dilation bands 141, 161 dilational deformation bands 141 disaggregation bands 161 dissolution Arbuckle Group 288-289 Bassein Limestone, 79-83 eogenetic v. mesogenetic 67, 77

Raytown Limestone 189, 193, 198 Vedder Formation 278-279 dolocrete 8 dolomite authigenic 271-272 baroque (saddle) 289-290, 300-303, 396-308, 315, 316 eogenetic 6 mesogenetic 198, 199, 203 dolomitization modelling 235 role in eodiagenesis 9 role in mesodiagenesis 21 Toca Formation methods 237-238 results 238-240 results discussed 242-243 summary 243 EDS (energy-dispersive X-ray spectrometry) 15, 126, 268 Ekofisk field (North Sea) 217, 218 ELAN (petrophysical element analysis) 249-250 electron microprobe analysis, quartz cement study, method 376 energy-dispersive X-ray spectrometry (EDS) 15, 126, 268 eodiagenesis 3, 4, 5-9 dissolution effects 67 dolomitization 9 effect of depth 5 minerals 6-8 role of animals 8 role of microbial activity 8-9 role of water 8 Eskdale Granite 125 estuaries as sediment traps 123-124 Ravenglass Estuary geological setting 124-125, 124 methods of analysis core sampling 125 **QEMSCAN 126 SEM 126** XRD 126 results core stratigraphy 126-127, 127 QEMSCAN 130-131, 131, 132, 133 SEM 127-129 XRD 129-130, 129 results discussed 133 clay minerals 136 Fe-minerals 134-135 feldspar populations 134 mineralogy 133-134 provenance 134 summary 136-137 faults, control on system openness 20 Fe-minerals, Ravenglass Estuary 134-135 FEG-SEM (field emission gun scanning electron microscopy) chalk study 222, 227-228, 227, 228 feldspar alteration 123 authigenic 272-274 cement 11, 12 Ravenglass Estuary alteration studies 134

fenestral pores, Raytown Limestone 189-190, 189, 192 field emission gun scanning electron microscopy (FEG-SEM) chalk study 222, 227-228, 227, 228 Fiexianguan Formation 10 fission track-infrared spectroscopy see FT-IR fluid composition, role in eodiagenesis 5 fluid inclusion analysis 14, 15 Arbuckle Group 283, 292-293 baroque dolomite 294-298 calcite cement 298-300 megaquartz 293-294 Bassein Limestone 73 Hirnantian glaciation sandstones 347, 370 Kharaib Formation 50, 56 Raytown Limestone 199-200 fluid overpressure 321 fracture porosity 13 fractures control on system openness 20 detrital grain 269 fracturing, Arbuckle Group 288 FT-IR spectroscopy Bassein Limestone 73 Pannonian Basin study 408, 412 Qishn Formation 109, 111 quartz cement study, method 377 galena Arbuckle Group 290 cement 12 ganister formation 8 Gaza Formation (Tarbert Ness) 20 gel formation, Mg-silicates 38-39 geochemistry and geochemical analysis 14, 15 chalk 222-224, 228-229, 231 see also trace element analysis germanium, quartz cement study 378, 379, 384, 384 Germany see North German Basin glauconite authigenic 269, 274, 277 eogenetic 6, 7, 9 grain coatings 6, 7, 11, 260 chlorite 329-330, 336-337, 338 illite 271, 277 grainstones, Mishrif Formation 96, 97 Greenley field (USA) geological setting 267 location 266 reservoir quality studies methods of analysis petrography 267-268 sampling 267 results authigenic minerals 269-275 compaction 268-269 detrital minerals 268 fractures 269 mass balance 276-277 porosity 275 results discussed 277 authigenic minerals 277-278 compaction 278 dissolution 278-279

Greenley field (USA) (Continued) mass balance calculations 279 porosity 279 summary 280 gypcrete 8 gypsum, eogenetic 6 H isotope analysis 15 halite, cement 11, 12 Hallembaye (Belgium) chalk study methods effluent ion chromatography 220, 221 FEG-SEM 222 flooding 218-220 porosity 224-226 pycnometry 222 sample selection 218 whole-rock geochemistry 222-224 XRD 222 results effluent ion chromatography 227 FEG-SEM 227-228, 227, 228 porosity 226 whole-rock geochemistry 228-229, 231 XRD 228, 229, 230 results discussed 229-230, 232-233 summary 233 Haushi Group, quartz cement study 375, 376 Haushi-Huqf High (Oman) 109 see also Qishn Formation heavy mineral analysis 15 Ravenglass Estuary 134 helium porosity, Mishrif Formation 88 Heron field (UK) 323, 326, 329, 332, 333, 334, 336-337 high-magnesium calcite 4, 5 Hirnantian glaciation sandstones methods of analysis 346-347 facies scheme 345 results diagenetic factors 353 clay minerals 353, 355, 357, 358 quartz cements 366-369 facies associations 348-349 grain size and sorting 353, 354 mineralogy 352-353, 352 pore evolution 359-360 porosity v. permeability crossplots 350, 351.352 results discussed quartz cementation 360-363 hydrocarbon inhibition of 363, 366 silica budgets 366-367 setting 343, 344, 345 stratigraphy 344 summary 367-370 Hungarian Plain, CO2 storage study 405 geological setting 406-407 methods of analysis **FTIR 408** kinetic model application 408-409 petrography 407 thermal study 407-408 XRD 407

results kinetic modelling 412-413 laboratory 410-412 petrography 410 results discussed 413-416 summary 416 hydrocarbon charge, effect on cementation 261 hydrothermal systems, USA 286-287 ichnology 15 ICP-MS (inductively coupled plasma mass spectrometry) 376 illite and illitization 9, 389, 390 cement 11 coatings 271, 277 modelling 421, 430-435, 437-438 Vienna Basin study methods 392-393 results 393-395 results discussed 399-401 Illizi Basin (Algeria) glacial sandstones study facies scheme 345 geological setting 343, 344, 345 methods of analysis 346-347 results diagenetic factors 353 clay minerals 353, 355, 357, 358 quartz cements 366-369 facies associations 348-349 grain size and sorting 353, 354 mineralogy 352-353, 352 pore evolution 359-360, 364 porosity v. permeability crossplots 350, 351, 352 thermal history 366 results discussed quartz cementation 360-363 hydrocarbon inhibition of 363, 365, 366 silica budgets 366-367, 368, 369 stratigraphy 344 summary 367-370 ilmenite, cement 12 India, Bassein Limestones study depositional environment 70 facies 71 geological setting 68-70 methods of analysis 72-73 results matrix porosity and stylolite density 74-76 pore system 73-74 results discussed diagenetic phases 76-77, 77 dissolution mechanism 79-83 porosity generation 77-79 stratigraphy 69-70, 69 tritiated water tracer test 70, 72 inductively coupled plasma mass spectrometry (ICP-MS) 376 Indus Basin (Pakistan) 321 infiltration 8 Iola Limestone Formation 178, 179, 181 Iraq, Mishrif Formation composition 86, 87 geological setting 85 methods of analysis 88

446

results capillary pressure curves 94-95, 95 diagenetic framework 94 facies 88-89 microbial 92-93 rudist 89, 90, 91, 92 rock types 95, 97 non-reservoir 98, 99 reservoir 96, 97, 99 results discussed role of cyclicity in reservoir quality 99-103 summary 103 iron Fe-minerals 134-135 ferric-ferrous reduction 9 isotope analysis ⁸⁷Sr/⁸⁶Sr analysis 15 Arbuckle Group 284 results baroque dolomite 306-308 calcite cement 308-309 Kharaib Formation 50, 56 stable isotopes 15 Arbuckle Group methods 283-284 results 300 baroque dolomite 300-303 calcite cement 303-306 Kharaib Formation methods 50 results 55-56 Raytown Limestone 183, 200 Judy field (UK) 323, 326, 327, 329, 331, 332, 336, 337 K-feldspar authigenic 273-274, 278 Skagerrak Formation 331 Kansas Cyclothem 181 Kansas (USA) Central Kansas Uplift 284 see also Arbuckle Group kaolinite and kaolinitization authigenic 271, 279, 389 eogenetic 6 modelling 421, 424-427, 436 Vienna Basin study 396 karstification reactions 8 kerolite 34. 35 Keuper Sandstone (Paris Basin), quartz cement study 375, 376 Kharaib Formation geological setting 48-50 microporosity study methods of analysis 50, 52 results BSE 54 fluid inclusion microthermometry 56 optical microscopy 51, 52, 55 petrography 52-55 SEM 51. 53 stable isotopes 55-56 results discussed calcite formation temperature 60-61

macropores 61-62 micritization 56-59 micro-overgrowth 59-60 reservoir quality 62 summary 63 kinetic modelling Pannonian Basin study methods 408-409 results 412-413 Kreyenhagen Formation geological setting 267 methods of analysis petrography 267-268 sampling 267 results authigenic minerals 269-275 compaction 268-269 detrital minerals 268 fractures 269 mass balance 276-277 porosity 275 results discussed 277 authigenic minerals 277-278 compaction 278 dissolution 278-279 mass balance calculations 279 porosity 279 summary 280 LA-ICP-MS (laser ablation-inductively coupled plasma-mass spectrometry) 376-377 lake systems and lacustrine sediments 33 hydrothermal dolomitization modelling geological setting 236-237 methods 237-238 results 238-240 results discussed 242-243 summary 243 Mg-rich clays in carbonates chemical controls 36-38 diagenetic controls 39-41 environment of formation 33-34 sedimentological controls 38-39 structural controls 34-36 summary of behaviours 41-43 laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) 376-377 laumontite cement 279 Liège (Belgium) see Hallembaye lithium, quartz cement study 378-379 Lower Congo Basin 261, 262 Macaronichnus 8 macroporosity, Hirnantian glaciation sandstones 347 magnesium-rich clay mineral growth Barra Velha Formation chemical controls 36-38 diagenetic controls 39-41 environment of formation 33-34 sedimentological controls 38-39 structural controls 34-36 summary of behaviours 41-43 Marlim Complex 262

mass balance calculations 276-277, 279

mechanical infiltration 8 mercury injection capillary pressure (MICP) Mishrif Formation 88, 94-95, 95 mercury porosimetry Bassein Limestone 73, 75 mesodiagenesis 3, 4, 9-13 dissolution effects 67 Mesopotamian Basin 86 Mishrif Formation composition 86, 87 geological setting 85 methods of analysis 88 results capillary pressure curves 94-95, 95 diagenetic framework 94 facies 88-89 microbial 92-93 rudist 89, 90, 91, 92 rock types 95, 97 non-reservoir 98, 99 reservoir 96, 97, 99 results discussed role of cyclicity in reservoir quality 99-103 summary 103 meteoric water, role in eodiagenesis 5, 8 Mexico, Gulf of 321 Mg-rich clay minerals see under clay minerals micritization 48 Raytown Limestone 189, 192 microbes, role in eodiagenesis 8-9 microporosity 47-48 Hirnantian glaciation sandstones 347 Kharaib Formation 48-50 methods of analysis 50, 52 results BSE 54 fluid inclusion microthermometry 56 optical microscopy 51, 52, 55 petrography 52-55 SEM 51, 53 stable isotopes 55-56 results discussed calcite formation temperature 60-61 macropores 61-62 micritization 56-59 micro-overgrowth 59-60 reservoir quality 62 summary 63 microthermometry Arbuckle Group baroque dolomite 296 calcite cement 299 megaquartz 293-294 Mihályi-Répcelak (Hungary), CO2 storage study 405 geological setting 406-407 methods of analysis **FTIR 408** kinetic model application 408-409 petrography 407 thermal study 407-408 XRD 407 results kinetic modelling 412-413 laboratory 410-412

petrography 410 results discussed 413-416 summary 416 mineralogical analysis 14, 15 Niger Delta Tertiary sands detrital 252, 254 diagenetic 254 Mishrif Formation composition 86, 87 geological setting 85 methods of analysis 88 results capillary pressure curves 94-95, 95 diagenetic framework 94 facies 88-89 microbial 92-93 rudist 89, 90, 91, 92 rock types 95, 97 non-reservoir 98, 99 reservoir 96, 97, 99 results discussed role of cyclicity in reservoir quality 99-103 summary 103 modelling burial history Qishn Formation geological setting 108-109 methods of analysis 109-111 results 111-114 results discussed 114-119 summary 119-120 Skagerrak Formation 332-333 reservoir implications 338 cementation Niger Delta Tertiary sands 250-252, 261 hydrologic 311-315 see also reactive (reaction) transport modelling Mukta field, Bassein Limestones study depositional environment 70 facies 71 geological setting 68-70 methods of analysis 72-73 results matrix porosity and stylolite density 74-76 pore system 73-74 results discussed diagenetic phases 76-77, 77 dissolution mechanism 79-83 porosity generation 77-79 stratigraphy 69-70, 69 tritiated water tracer test 70, 72 Mumbai, offshore see Mukta field also Panna field neomorphism, Raytown Limestone 189, 196 Niger Delta geological setting 245-247, 246 lithostratigraphy 248, 257 tectonics and structure 247-248, 249 reservoir quality assessment methods of analysis basin modelling 249-250 cementation modelling 250-252 petrography 248-249 petrophysics 249

results basin thermal history model 255, 258 cementation model 258-259 mineralogy detrital 252-253 diagenetic 254 petrophysics 254-255 results discussed 259-260 cementation temperature and pressure 261 grain size and coatings 260 hydrocarbon charge 261-262 mineralogy 260 temperature 260-261 summary 262 nitrate reduction 9 nodules 6, 6 North German Basin 142-143 cataclastic deformation bands 141, 161 methods of study 143-144 results 144-152 results discussed 152-157 summary 157 North Sea, Central Graben 321, 322, 323 O isotope analysis 15, 107 Arbuckle Group 284 baroque dolomite 300-303 calcite cement 303-306 Kharaib Formation 50, 55-56 see also clumped isotope thermometry occlusion of pores 5 oil charge, effect on cementation 261 Oman 109 Qishn Formation burial history geological setting 108-109 methods of analysis 109-111 results 111-114 results discussed 114-119 summary 119-120 optical microscopy 15, 249 Ordovician see Hirnatian glaciation sandstones Ostwald ripening 48 overpressure, porosity effects 337-338 Ozark Plateau Aquifer System (OPAS; Kansas) 283, 284, 314 Arbuckle Group geological setting 285-287 stratigraphy 285 methods of analysis 283-284 results BSEM 291-292 fluid inclusions 292-300 paragenesis 287-288 early 288 late 288-291 Sr isotopes 306-309 stable isotopes 300-306 results discussed fluid flow conduits 309-310 hydrologic models 311-315 hydrothermal event timing 315 hydrothermal fluids 310-311 migration events 311 summary 315-316

packstones 96, 97, 99 Pakistan, Indus Basin 321 palaeokarst, Eocene-Oligocene 77-79 palaeothermometry see clumped isotope thermometry Panna field, Bassein Limestones study depositional environment 70 facies 71 geological setting 68-70 methods of analysis 72-73 results matrix porosity and stylolite density 74-76 pore system 73-74 results discussed diagenetic phases 76-77, 77 dissolution mechanism 79-83 porosity generation 77-79 stratigraphy 69-70, 69 tritiated water tracer test 70, 72 Pannonian Basin see CO2 storage study Paris Basin, Keuper Sandstone, quartz cement study 375, 376 permeability anisotropy 2 Rotliegend sandstone 143 methods of analysis 143-144 results 149-152 results discussed 155-157 summary 157 crossplots v. porosity glacial sandstones 96, 98, 100 Mishrif Formation 350, 351, 352 petrographic studies Arbuckle Group methods 283-284 results 289, 291, 292 baroque dolomite 294-295 calcite cement 298-299 megaquartz 293 Hirnantian glaciation sandstones 347 Kharaib Formation 52-55 Niger Delta sands 248-249 Pannonian Basin study 407, 410 Rotliegend standstone methods 144 results 144-145 results discussed 152, 154 Skagerrak Formation 325-327 Vedder Formation 267-268, 270, 271 Vienna Basin diagenesis study 392 petrophysical analysis 249-250 Niger Delta Tertiary sands 254-255 phosphate, authigenic 269-271, 277 phyllosilicate bands 141 phyllosilicate smear bands 161 pore occlusion 5 porosity 2 anomalous high 321 chalk 218 change in compaction and flooding methods 224-226 results 226 enhanced preservation in Skagerrak Formation geological setting 322 methods of analysis 325

porosity (Continued) results burial history model 332-333 compaction 327-328 diagenesis 328-329 cement volume 332 chlorite coatings 329-331 K-feldspar alteration 331 quartz cements 329 intergranular and cement volume 332 overpressure-depth correction 333-334 petrography grain size 325-327 porosity distribution 325-327 results discussed 334-338 stratigraphy 322-325, 324 summary 338 fracture-related 12-13 Hirnantian glaciation sandstones 347 impact of mesodiagenesis 10 loss by compaction and cementation 332 porosity v. permeability crossplots Mishrif Formation 96, 98, 100 Raytown Limestone 184 event (1) 189-190, 192 events (2-8) 192-193 events (9-11) 193 events (12-29) 196, 198-199 evolution 203-209 secondary 18-19, 321 Barra Velha Formation 39-41 Bassein Limestone matrix porosity and stylolite density 74-76 pore system development 73-74 porosity generation 77-79 defined 67 development in early diagenesis 39-41 Skagerrak Formation 325-326 effect of pore fluid overpressure 337-338 Vedder Formation 275, 279 see also microporosity Portland Limestone 6 potassium, quartz cement study 378-379, 384 pressure history, Niger Delta Tertiary sands 258, 261 pressure solution (chemical compaction) 18 provenance studies 15 effect on reservoir quality 123 pseudomatrix 274 pycnometry 222 pyrite 10 authigenic 271, 275, 277 cement 11 framboidal 9 stylolites 199 **OEMSCAN 15, 126** Ravenglass Estuary sediments 127-129, 130-131, 131, 132, 133 Qishn Formation burial history methods of analysis 109-111 results 111-114 results discussed 114-119 setting 108-109

summary 119-120

quartz authigenic 274, 277 cement 11 Hirnantian glaciation sandstones 355-359, 360-363, 366-369 Skagerrak Formation 328-329 radiogenic isotope analytical techniques 15 ⁸⁷Sr/⁸⁶Sr 15 Arbuckle Group 284 baroque dolomite 306-308 calcite cement 308-309 Kharaib Formation 50, 56 Raman spectroscropy 412 **Ravenglass Estuary** geological setting 124-125, 124 methods of analysis core sampling 125 **OEMSCAN 126 SEM 126** XRD 126 results core stratigraphy 126-127, 127 QEMSCAN 130-131, 131, 132, 133 SEM 127-129 XRD 129-130, 129 results discussed 133 clay minerals 136 Fe-minerals 134-135 feldspar populations 134 mineralogy 133-134 provenance 134 summary 136-137 Raytown Limestone geological setting 178-179, 179 methods of analysis 180-181, 183 results diagenesis early stage 189-193 late stage 193-199 lithofacies 183, 183, 185 stratigraphy 183-188 results discussed origin of cements 199-203 porosity evolution 203-209 summary 209-210 reactive (reaction) transport models (RTM) 16-17, 235-236, 419-420 North African Cretaceous reservoir sandstone set-up diagenetic events 421 thermodynamics and kinetics 421-424 water composition 421 simulation 424 stage (1) 424-427, 436 stage (2) 427-429, 436-437 stage (3) 430, 437-438 compaction models 431-435 flush models 430-431 summary 435-436 Toca Formation methods 237-238 results 238-240

results discussed 242-243 summary 243 recrystallization, micrite 48 reflux reactions 9 reservoir quality controls on 2, 3, 4 modern analogues 15-16 summary of factors 21-22 techniques for measuring 13-15, 13-16, 14 see also permeability also porosity rhizomoldic pores, Raytown Limestone 189-190, 189, 192 Rockenberg Formation, quartz cement study 374, 375, 376 Rotliegend sandstone, deformation bands study 143 methods of analysis permeability 143-144 petrography 144 well logs 143 results permeability 149-152 petrography 144-145, 146, 148, 149 well logs 145, 147, 149 results discussed permeability 155-157 petrography 152, 154 well logs 154-155 summary 157 rutile authigenic 274-275 cement 12 S isotope analysis 15 saddle dolomite see under dolomite St Bees Sandstone Formation 125 San Joaquin Basin (California), Greenley field geological setting 267 location 266 reservoir quality studies methods of analysis petrography 267-268 sampling 267 results authigenic minerals 269-275 compaction 268-269 detrital minerals 268 fractures 269 mass balance 276-277 porosity 275 results discussed 277 authigenic minerals 277-278 compaction 278 dissolution 278-279 mass balance calculations 279 porosity 279 stratigraphy 267 summary 280 structure 267 sandstones depositional environment 5 diagenesis eodiagenesis 5, 6-7 mesodiagenesis 9-10, 11

role of petroleum in 19-21 structural 12 reservoir quality studies 4 Miocene see Vienna Basin (Austria) Oligocene see Greenley field (USA) also Niger Delta Ordovician see Illizi Basin (Algeria) Triassic see Rotliegend also Skagerrak Formation also Thurstaston (Wirral) trace elements in authigenic quartz geological settings 374-376 methods of analysis 376-377 results 377-379 results discussed 379-385 summary 385 Santos Basin (Brazil) 321 Barra Velha Formation Mg-rich clay mineral growth chemical controls 36-38 diagenetic controls 39-41 environment of formation 33-34 sedimentological controls 38-39 structural controls 34-36 summary of behaviours 41-43 Selwicks Bay (Flamborough) 18 scanning electron microscopy (SEM) chalk 222, 227-228, 227, 228 Hirnantian glaciation sandstones 347 Niger Delta Tertiary sands 249 Sherwood Sandstone Group 163, 167 Vedder Formation 268 Vienna Basin diagenesis study 392 SEM-BSE, Vedder Formation 276 SEM-EDS 15, 126, 227-228, 268 Ravenglass Estuary sediments 127-129, 130-131, 131, 132, 133 sepiolite 34, 35 shale, porosity and uplift 13 shear bands 141, 161 Sherwood Sandstone Group, deformation band study methods field descriptions 163, 164, 165 microstructures 163-165 results field data 165-166 microstructures 167-169 results discussed relation to faults 169-170 relation to reservoir properties 171-173 relation to rock properties 170-171 summary 173 siderite, eogenetic 6, 7, 9 silica, cryptocrystalline, eogenetic 6 SIMS, quartz cement study 376 Skagerrak Formation geological setting 322 stratigraphy 322-325, 324 methods of analysis 325 results burial history model 332-333 compaction 327-328 diagenesis 328-329 cement volume 332 chlorite coatings 329-331

Skagerrak Formation (Continued) K-feldspar alteration 331 quartz cements 329 intergranular and cement volume 332 overpressure-depth correction 333-334 petrography grain size 325-327 porosity distribution 325-327 results discussed 334-338 summary 338 smectite, eogenetic 6 illitization Vienna Basin study 389, 390 methods 392-393 results 393-395 results discussed 399-401 stevensite 34, 35 sodium, quartz cement study 378-379, 384 Solling Formation, quartz cement study 374, 375 solution bands 161-162 sphalerite Arbuckle Group 290 cement 12 87Sr/86Sr analysis 15 Arbuckle Group 284 results baroque dolomite 306-308 calcite cement 308-309 Kharaib Formation 50, 56 stable isotope analysis 15 Arbuckle Group methods 283-284 results 300 baroque dolomite 300-303 calcite cement 303-306 Kharaib Formation methods 50 results 55-56 Raytown Limestone 183, 200 stevensite 34, 35 structural diagenesis, defined 12 stylolite formation 10, 12, 18, 18 Bassein Limestone 74, 75, 76, 79 Raytown Limestone 189, 198 sulphates cement 11 dissolution 13 reduction 9 sulphuric acid, role in alteration 8 surface water, role in eodiagenesis 8 telodiagenesis 3, 4, 13 temperature history of development Niger Delta Tertiary sands 255-256, 258, 261 importance of measuring 107 role in alteration reactions 419 role in calcite micro-overgrowths 60-61 role in eodiagenesis 5 role in mesodiagenesis 9 Thamama Group 48, 50 thermogravimetry Pannonian Basin study 407-408, 410, 412

thermometry clumped isotope 107-108 Qishn Formation method 109-111 results 112, 113, 114, 117 results discussed 114-116 burial history 119 palaeo-environmental significance 116, 118 summary 119-120 fluid inclusion 15, 107 Kharaib Formation 50, 56 Thurstaston (Wirral) deformation band study methods field descriptions 163, 164, 165 microstructures 163-165 results field data 165-166 microstructures 167-169 results discussed relation to faults 169-170 relation to reservoir properties 171-173 relation to rock properties 170-171 summary 173 tight-packing index (TPI) 268, 269 Toca Formation geological setting 236-237 reaction transport modelling methods 237-238 results 238-240 results discussed 242-243 summary 243 **TOUGHREACT 420** trace element analysis 15 authigenic quartz geological settings 374-376 methods of analysis 376-377 results 377-379 results discussed 379-385 summary 385 trace fossil analysis 14-15 Triassic sandstone studies Paris Basin Keuper 375, 376 Rotliegend sandstone 143 methods of analysis permeability 143-144 petrography 144 well logs 143 results permeability 149-152 petrography 144-145, 146, 148, 149 well logs 145, 147, 149 results discussed permeability 155-157 petrography 152, 154 well logs 154-155 summary 157 Skagerrak Formation geological setting 322 stratigraphy 322-325, 324 methods of analysis 325 results burial history model 332-333 compaction 327-328

diagenesis 328-329 cement volume 332 chlorite coatings 329-331 K-feldspar alteration 331 quartz cements 329 intergranular and cement volume 332 overpressure-depth correction 333-334 petrography grain size 325-327 porosity distribution 325-327 results discussed 334-338 summary 338 Thurstaston (Wirral) deformation band study methods field descriptions 163, 164, 165 microstructures 163-165 results field data 165-166 microstructures 167-169 results discussed relation to faults 169-170 relation to reservoir properties 171-173 relation to rock properties 170-171 summary 173 tritiated water tracer test, Bassein Limestone 70.72 Turkana, Lake 39 United Arab Emirates, Kharaib Formation geological setting 48-50 microporosity study methods of analysis 50, 52 results **BSE 54** fluid inclusion microthermometry 56 optical microscopy 51, 52, 55 petrography 52-55 SEM 51, 53 stable isotopes 55-56 results discussed calcite formation temperature 60-61 macropores 61-62 micritization 56-59 micro-overgrowth 59-60 reservoir quality 62 summary 63 uplift diagenesis see telodiagenesis USA 161, 286-287 see also Arbuckle Group; Greenley field; Raytown Limestone UV epifluorescence petrography 283, 290

Vedder Formation geological setting 267 methods of analysis petrography 267-268 sampling 267 results authigenic minerals 269-275 compaction 268-269 detrital minerals 268 fractures 269 mass balance 276-277 porosity 275 results discussed 277 authigenic minerals 277-278 compaction 278 dissolution 278-279 mass balance calculations 279 porosity 279 summary 280 vertical effective stress 321 Vienna Basin (Austria) clay mineral diagenesis study methods 392-393 results mudstones chemistry 395 mineralogy 394-395 sandstones chemistry 394 mineralogy 393-394, 393, 394 results discussed effect of depth 395, 397-399 illitization process 399-401 summary 401-402 drilling history 390-391 geological setting 390, 391-392 wackestones 98, 99 weathering see telodiagenesis Witten Formation, quartz cement study 374, 375 X-ray diffraction (XRD) 15, 126 chalk 222, 228, 229, 230 Hirnantian glaciation sandstones 347, 370 Pannonian Basin study 407, 410 Ravenglass Estuary sediments 129-130 Vienna Basin diagenesis study 392, 395, 398 X-ray fluorescence (XRF) 15

Vienna Basin diagenesis study 392

zeolite, cement 11, 12