

Index

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

- a'ā lava 186–187
- Aegir Ridge 12, 13
 - rifting 14, 15, 22
- African Plume *see* Large Low Shear Velocity Province
- Alligin Field, discovery 2, 60, 61
- Amos Field, discovery 2, **60**, 61
- amplitude anomalies 63, 64, 65, 70, 74
 - Assynt prospect 64, 73, 74–77
 - Glenlivet Field 63, 64, 65
 - North Fleet prospect 75, 76, 77–78
 - Schiehallion Field 65
 - Tormore Field 65
 - Tornado Field 64
- apatite fission track analysis 23
- Arkle Field, discovery **60**, 61
- Assynt prospect, amplitude anomalies 64, 73, 74–77
- AVO analysis 65, 69–70, 73–74
 - Foinaven Field 71, 72
 - Glenlivet Field 63, 64, 65, 135, 136
 - Laggan Field 65, 73, 107, 108
 - North Fleet prospect 76, 77–78
 - Schiehallion Field 65
 - Tornado Field 64
- Baffin Bay spreading ridge 14
- Balder Formation 34, 44, 61, 65
- basalt
 - Aegir Ridge 13
 - GIFR 16
 - Palaeocene, micro-imaging 173–190
 - Palaeocene-Eocene 20–21
 - Palaeogene 3, 5
 - sub-basalt imaging 163–170
 - 'sub-basalt problem' 173, 193*see also* Mid-Ocean Ridge Basalts
- basement
 - as exploration play 81–103, 84
 - Lewisian, Rona Ridge 82, 85–103*see also* Lancaster Prospect
- Bedlington Field, discovery 60, 61
- Beimisvørð Formation 173
- Benbecula discovery 3
- Bering land bridge 17
- biogeography *see* migration
- Bouguer anomaly, Vøring Spur 17
- breccia, FMI 181, 187–188
- broadband seismic data 169–170
- Brown Field and Southern North Sea Allowance 6
- Bunnehaven Field
 - discovery 2, 60, 61, 63
 - reservoir properties 63
- calcite nodules, Laggan Field 107, 116–117
- Cambo Field 2, 146
 - commercial challenges 5
 - discovery 3, 60, 61, 63
 - exploration 146–147, 148
 - four-way dip closure 145–162
 - pre-drill evaluation 147–149, 150, 159
 - reservoir properties 65
 - seal integrity 148–149, 157
 - stratigraphy 147
 - Well 204/10-1 149–151, 152, 159
 - Well 204/10-2 (Lindisfarne) 151–155, 156, 159
 - Well 204/10a-3 155–160
 - Well 204/10a-4,4Z 159, 160–161
- Cambo High, hydrocarbon potential 148–162
- Cambo Sandstone Member 145
 - potential reservoir 148, 149, 150, 152
- cherry, cornelian, migration 17
- chlorite
 - Laggan Field 62, 66, 116, 117
 - Tormore Field 64
- Clair Field
 - basement reservoir 82
 - discovery 2, 3
- Colsay Sandstone Member 21, 61, 63, 65, 145
 - hydrocarbons 147, 174
- commercial challenges 5, 6
- continent-ocean boundary 13, 14, 15
- controlled source electromagnetic survey (CSEM) 3, 70
- core analysis
 - FMI 178–183
 - sidewall 183
- Cornus, migration 17
- Corona Basin 167
- Corona Ridge 21, 34, 163, 167
 - hydrocarbon discovery 59, **60**, 63
- creaming curves, UKCS 3, 4
- Cuillin Field, discovery **60**, 61
- DHI (direct hydrocarbon indicator) anomalies 70
- diapirism, mud/shale 51–52
- discoveries, WoS 2, 3
- ditch cutting analysis
 - LIPs 193–205
 - end-member classification 197–200
 - facies classification 196–197
 - generation 195
 - idealized volcanic stratigraphy 201–204
 - sample preparation 195
 - simple log output 200–201
- drilling, basement reservoir, Lancaster Prospect 92–94
- dual rift model 21–22
 - sediment provenance studies 23–24
- dykes
 - age 34, 35, 36–37
 - emplacement 35–37, 39, 45
- East Faroe High 167
- East Rockall Wedge, zircon U-Pb analysis 212, 215
- East Solan Basin 90–91
- Edradour discovery 2, 3

- Eocene
 Atlantic margin development 18–19, 21
 inversion 23
see also Palaeocene-Eocene
- European Union, response to Macondo oil spill 5
- exploration
 basement reservoirs 81–103
 commercial challenges 5, 6
 political challenges 5–7
 technical challenges 3, 6
 large igneous provinces 193
- WoS
 history 1, 3, 59–64
 post-drill analysis 70–78
 pre-drill evaluation, Cambo Field 147–149
- Faroe Conduit 23
- Faroe Islands, LIP facies classification 196
- Faroe-Shetland Basin 11–26, 12
 geological setting 34, 35–37
 Geostreamer 3D seismic imaging 147
 hot fluid flow 23
 igneous intrusions 33–55
 sediment provenance studies 23–24
 stratigraphy 34
 sub-basalt imaging 163–170
 volcanic margin rocks, Rosebank prospect 174–190
see also Rosebank Field
- Faroës-Kangerlussauq lineaments 18, 19
- Fault Zones 89–90
 Lancaster Field 95–96, 98–99, 100, 101
- faults
 Glenlivet Field 133
 Lewisian Basement 85
 conceptual model 88–90, 99
 Lancaster Field 86–87, 95–96, 100, 101, 102
- field allowances 5, 6
- Flett Formation
 broadband processing 168, 170
 hydrocarbon discovery 61, 63
- Flett Ridge 34, 167
- Flett Sub-basin 34, 131, 167
 hydrocarbon discovery 59, 60, 63, 70
 hydrothermal vents 52
 post-drill analysis 70, 77
 seal presence 67, 68
 seismic data 36, 37, 38, 44
 sill emplacement 44, 47, 50
 and Vailla turbidite deposition 45, 51, 53–54
 source rocks 69
 trap model 64–65
- fluid flow
 in fracture networks 85, 87
 hot, Faroe-Shetland Basin 23
- Foinaven Field
 discovery 2, 3, 60, 61, 62–63
 post-drill analysis 70, 71, 72, 74
 reservoir properties 62, 63, 65, 66
 seal presence 68
 source rocks 69
- formation micro-imaging (FMI)
 volcanic rock 174–190
 core analysis and analogues 178–179, 183
 down-hole well analysis 174
- field-based acquisition 183–185
 interpreting joint and fracture systems 190
 lithofacies identification 180–182, 186–189
 lithological separation 190
 methods of calibration 176–185
 sidewall core analysis 183
- Foula Sub-basin 60, 167
 kitchen area 83, 85, 90, 91, 92
- four-way dip closures, White Zone, Cambo High 145–162
- fracture networks
 fluid flow 85, 87, 88, 90
 FMI 181, 187, 190
 Lancaster Prospect 88–90, 100
 Lewisian Basement 85–86
see also faults; joints; shear fractures;
 sheet fractures
- Front-End Engineering Design (FEED), Rosebank prospect 6, 8
- Fugloy Ridge 163, 167
- FUKA (Frigg UK Association) Pipeline 123, 124
- geoid anomaly, North Atlantic Ocean 25–26
- George Bligh High 210
 zircon U-Pb analysis 214, 216, 217, 218, 219, 221
- Geostreamer 3D seismic imaging 147
- Glenlivet Field 131–143, 132
 AVO 135, 136
 conceptual model 143
 depositional model 137–141
 lower zone 138–139, 141
 middle zone 139–141, 142
 upper zone 141, 142
 discovery 2, 3, 60, 61, 131
 porosity/permeability 131
 reservoir properties 63, 64, 65, 131, 134–137
 reservoir thickness 134
 seismic interpretation 134–137
 shale 131
 structural and deposition evolution 133–134
 Vailla turbidites 131
 zone boundaries 141, 143
- Great Britain, Atlantic margin development 18–19
- Greenland, Palaeocene-Eocene succession 19–21
- Greenland-Faroes Ridge 11
- Greenland-Iceland-Faroe Ridge 11, 12, 13
 composition 16
 developmental model 17–18
- Gross Rock Volume, Lancaster prospect 89, 90, 101
- Hatton Basin 19, 20
- Hatton High 19
 folding 23
 zircon U-Pb analysis 220
- Hebridean margin, zircon U-Pb analysis 212, 213, 214, 216–218, 220
- Hildasay Sandstone Member 61, 63, 65, 145
 hydrocarbon 147, 150, 152, 154–158, 160–161
- Huab outliers, Namibia, FMI 183–184
- hydrocarbons
 exploration WoS
 history 1, 3, 59–64
 post-drill analysis 70–78
 pre-drill analysis 147–149

- reservoirs
 - basement 81–103
 - presence 65
 - quality 65–67
 - Vaila turbidites 52–53
- seals 67–68
- source rocks 68–69
- trap models 64–65
- hydrothermal alteration, Rona Ridge basement 86, 87
- hydrothermal vents 52
- Iceland
 - age and role 24–25, 26
 - mantle plume 11, 17, 24
- igneous intrusions
 - and turbidite deposition 33–55
 - see also* dykes; sills
- Igertiva basalts 21
- inflation anticlines 38–44, 45, 50
- infrastructure 2, 8
 - commercial considerations 5, 6
- Inner Fault Zone 89–90
- integrated asset model
 - WoS 126–129
 - additional field tie-in case study 127, 129
 - software 127–129
 - subsea gas compression case study 128, 129
- inversion, North Atlantic province 23
- inversion anticlines 50–51
- Jan Mayen Fracture Zone 12, 13, 14
 - Bouguer anomaly 17
 - developmental model 17, 18
- Jan Mayen micro-continent 14–15, 16
- joints
 - FMI 181, 187, 190
 - regional, Lewisian Basement 85
- Judd Sub-basin
 - hydrocarbon discovery 59, 60, 62–63, 65, 70
 - post-drill analysis 70, 74
 - reservoir properties 65, 67
 - seal presence 67
 - source rocks 69
- Kangerlussauq 12, 14, 20, 21
 - sediment provenance 23
- Kangerlussauq lineament 18, 19
- Kettle Tuff 34, 44, 49
 - seal presence 52, 53, 63, 67, 70
- Kimmeridge Clay Formation 69, 85, 148
- Kolbeinsey Ridge 12
 - rifting 14, 15, 24
- Labrador Sea extinct Ridge 12, 14
- Lagavulin prospect 5
- Laggan gas condensate field 108
 - 3D geological modelling 107–121
 - channel feature 113, 115
 - damage zones 111
 - discovery 2, 3, 60, 61, 62, 63, 107
 - facies modelling 117
 - fault extensions 110, 111
 - lineaments 110, 111
 - petrophysical modelling 117–120
 - 3D 119–120
 - connate water saturation correction 118–119
 - depth correction 117
 - Klinkenberg correction 118
 - permeability and petrophysical logs 119
 - porosity/permeability 107, 109, 110, 116, 117, 120
 - post-drill analysis 70, 72, 73, 74
 - reservoir modelling 111–113, 114
 - reservoir properties 62, 65, 66, 107, 109, 116–117
 - heterogeneities 116–117
 - quality 107
 - thickness 107, 112, 113, 114, 115–116
 - sedimentological model 113, 115
 - seismic data 107–108, 109, 110, 111, 113
 - seismic faults 108
 - structural elements 108, 110–111
 - structural model building 111, 113
 - base reservoir construction 112, 113, 114
 - fault modelling 111
 - top reservoir construction 111, 113
 - water saturation modelling 120
 - well test matching 120
- Laggan-Tormore gas condensate development 3
 - Eclipse models 123, 125, 126, 128
 - HYSYS models 125, 126, 128
 - integrated modelling 123–129
 - reservoir modelling 123, 125, 126
 - Resolve software 128–129
 - WoS integrated asset model 126–129
- Laggan-Tormore pipeline 5, 8, 123, 124
- Lamba Formation 34, 44, 64
- Lancaster Prospect 2, 3, 81, 82, 83, 84
 - appraisal wells 102
 - establishing resource potential 99–103
 - exploration well planning 86–93
 - funding 84
 - operational plan 93–99
 - drill stem tests 93, 95–96, 97
 - petroleum system 85–86
 - drilling 92–94
 - fracture network 85–86, 88
 - conceptual model 88–90, 99
 - oil-down-to 90, 100, 101
 - porosity/permeability 86, 88, 90, 100, 101
 - source rock 85
 - source and type of oil 91
 - tectonic history and charge 91, 93
 - trap and seal 85
 - stress fields 87–88
- land bridges 17, 22
- large igneous provinces
 - ditch cutting analysis 193–205
 - idealized volcanic stratigraphy 201–204
 - simple log output 200–201
- end-member classification
 - crystalline/scoriaceous 197, 198
 - epiclastic/boles 198–200
 - volcanic glass 197–198, 199, 201
 - facies classification 196–197
- Large Low Shear Velocity Province 18
- lava flows, FMI 176, 178, 179, 182, 186–187
- Laxford Field 131, 133, 137
 - discovery 2, 3, 60, 61

- Lewisian basement reservoir
 Lancaster Prospect 82, 85–103
 conceptual model 88–90
 porosity/permeability 86, 88, 90
- Lopra Formation 173
- LOPRA-1/1a well 173
- Loyal Field 2, 8
 discovery 60, 61, 63
 seal presence 68
- Macondo 2010 oil spill, political aftermath 5, 6
- magmatism, Palaeocene 35
- magneto-chrons, North Atlantic 12, 13, 14, 15
- mantle plume
 Greenland 11–12, 17, 24
 geoid anomaly 25–26
- melting, decompressional 15–16, 17
- Mid-Ocean Ridge Basalts, Iceland 24
- migration, Thulian land bridge 16–17
- MMO drilling fluid 92, 94, 95
- Mohs Ridge 12
- monoethylene glycol (MEG) pipeline 123, 124
- Muckle Basin 34
 seismic data 37, 38, 39–43
 Vailla turbidite deposition 45, 51
 reservoir quality 50
 and sill intrusion 48, 49, 50, 53–54
- noise attenuation 165, 166, 168–169
- North Atlantic Igneous Province 11
 Cambo High 148, 154, 155
 facies classification 196
 igneous intrusions 34
 Palaeocene igneous activity 18, 174
- North Atlantic Ocean
 decompressional melting 15–16, 17
 Eocene development 18–19
 evolution 14–16
 geoid anomaly 25–26
 hot fluid flow 23
 magneto-chrons 12, 13, 14, 15
 oceanic crust 12–15, 17
 opening 11–12, 18
 plate tectonics 11, 12–16
 topography 12
 triple junction 14
- North Fleet prospect, amplitude anomalies 75, 76, 77–78
- oak pollen, migration 17
- oceanic crust, North Atlantic Ocean 12–15, 17
- offlaps 51
- Oligo-Miocene, inversion 23
- onlaps 51
- Otterburn potential reservoir 149, 150
- Outer Fault Zone 89
- overcrusting, Vøring Spur 18
- pāhoehoe lava flows, FMI 176, 178, 182, 186
- Palaeocene
 exploration WoS
 history 59–64
 post-drill analysis 70–78
 trap definition 64–65
 magmatism 35
 palaeotopography 45, 47, 48, 49, 50–51
 post-sill depositional model 53–54
 ‘T-scheme’ 145
see also palaeotopography, Palaeocene
- Palaeocene-Eocene
 dual rift model 21–22
 sediment provenance studies 23–24
 succession 19–21
- palaeotopography
 Palaeocene 45, 47, 48, 49, 50–51
 diapiric mud models 51–52
- peperite 182, 189
- pillow lava 181, 187
- Pilot Whale Anticline 51
- plate tectonics, North Atlantic 11, 12–16
- political challenges 5–7
- Porcupine Basin 19, 20
- post-drill analysis 70–78
- pre-drill analysis 147–149
- Pseudomatrix 89–90, 96
 Lancaster Prospect 95–96, 98–99, 100, 101
- reservoir modelling, Laggan-Tormore 123, 125, 126
- reservoirs
 basement 81–103, 84
 presence 65
 quality 65–67
 seals 67–68
see also hydrocarbons, reservoirs
- resistive contacts, FMI 182, 188
- Reykjanes Ridge 12, 13
 rifting 14, 15, 22, 24
- rifting
 dual rift model 21–22
 North Atlantic 13–16, 18
- Rockall Basin 19, 20
 northern 209–210
 zircon U-Pb analysis 210–221
- Rockall Granite 221
- Rockall High 210
 zircon U-Pb analysis 212–214, 215, 216, 220–221
- Rona Ridge 34, 167
 Lancaster Prospect 83, 84–85
 Lewisian Basement reservoir 81, 82, 85–103
 exploration well planning 86–93
 hydrothermal alteration 86
 petroleum system 85–86
- Rosebank Field 175
 basalt 3, 5, 173
 commercial challenges 5
 discovery 2, 3, 60, 61
 FEED project 6, 8
 formation micro-imaging
 calibration methods 176–185
 jointing and fracture systems 190
 lithological separation 190
 volcanic lithofacies identification 186–189
 reservoir properties 63, 65
 stratigraphy 174, 176
- Rosemary Bank Seamount 20, 210
- rotation, regional stress field 22–23
- Rothbury sandstone potential reservoir 148, 149, 150, 151, 152

- safety, post-Macondo 5
- sand, Laggan Field 107, 109, 113, 115–116, 117
- Schiehallion Field
- discovery 2, 3, 60, 61, 63
 - redevelopment 8
 - reservoir properties 63, 65
 - seal presence 68
- seals
- Lancaster Prospect 85
 - presence and effectiveness 67–68
- sediment provenance studies, dual rift model 23–24
- shale, Laggan Field 107, 109, 116
- shear fractures, Lewisian Basement 85
- sheet fractures, Lewisian Basement 85
- Shetland Gas Plant (SGP) 123, 124
- Shetland Islands Regional Gas Export (SIRGE) pipeline 8, 123
- Shetland Platform 34
- sills
- emplacement 35–37, 45
 - age 33, 34, 35, 36–37, 45–47
 - depositional model 53–54
 - exploitation risk 52–53
 - inflation anticlines 38–44
 - inversion anticlines 50–51
 - and turbidite deposition 33
 - palaeotopography 45, 47, 48, 49
 - seismic geometries 36, 44–45
- Solan, discovery 2, 3
- source rocks 68–69
- Lancaster Prospect 85
- spectral processing, sub-basalt imaging 163–168
- spreading *see* rifting
- SRME (surface-related multiple elimination) 165, 166, 168
- Steinvør Basin 167
- Strathmore, discovery 2, 3
- stress fields, Lancaster Prospect 87–88
- sub-basalt imaging 163–170
- broadband seismic data 169–170
 - noise attenuation 168–169
 - spectral processing, low-frequency boosting 163–168
- ‘sub-basalt problem’ 173, 193
- Suilven Field
- discovery 2, 3, 60, 61, 63
 - source rocks 69
- Sullom Formation 34, 44, 48, 53
- Sullom Voe oil Terminal (SVT) 8, 123, 124
- tax, UK 2011 Budget 5–6
- technical challenges 3, 5
- Teihardina magnoliana* 17
- Thulian land bridge 17, 22
- Tobermory discovery 2, 3
- Tormore Field
- discovery 2, 3, 60, 61
 - reservoir properties 64, 65
- see also* Laggan-Tormore gas condensate development; Laggan-Tormore pipeline
- Tornado Field
- commercial challenges 5
 - discovery 2, 3, 60, 61
 - reservoir properties 64
 - seal presence 68
 - seismic amplitude anomaly 3
 - source rocks 69
- Torridon Field
- discovery 2, 60, 61
 - reservoir properties 66–67
- traps 64–65, 70
- amplitude anomalies 64, 65
 - Glenlivet Field 131, 133–134
 - Lancaster Prospect 85
- turbidites
- deposition
 - igneous intrusions 33–55
 - seismic geometries 36, 44–45
 - Glenlivet Field 131, 133–134, 137–143
 - Laggan Field 107, 109
- UK government, 2011 tax increase 5–6
- UKCS, creaming curves 3, 4
- undulose contacts, FMI 182, 188–189
- Vaila turbidite sandstone formation 34, 38, 44
- amplitude anomalies 65, 75
 - Foinaven Field 61, 62–63
 - Glenlivet Field 64, 131
 - hydrocarbon reservoirs 52–53, 61, 62, 63
 - quality 65–67
 - Laggan Field 59, 62, 66
 - Loyal Field 63
 - palaeotopographical control 40–43, 45, 48, 53–54
 - Schiehallion Field 63
 - seal presence 67, 68
 - Suilven Field 63
- Victory discovery 2, 3
- volcanic glass, end-member classification 197–198, 199, 201
- volcanic rock, FMI 174–190
- Vøring Spur 16, 17, 18
- West Lewis Basin, zircon U-Pb analysis 212
- West Shetland Basin 167
- Westray Ridge 34, 65
- Whirlwind basement discovery 81, 82
- White Zone
- four-way dip closures, Cambo High 145–162
 - seismic data 149, 150, 153, 155
- Wyville Thompson Ridge 19, 20
- zircon U-Pb analysis
- Greenland 23
 - northern Rockall Basin 210–221