

Index

Page numbers in *italic*, e.g. 70, refer to figures. Page numbers in **bold**, e.g. 6, signify entries in tables.

- admittance 16–17
- Albatross field 414
 - initial reservoir pressure 478
- Alligin field 415
- Altmark–Brandenburg Basin 70
- Andøya Slide 147
- Anton Dohrn Seamount 314
- apatite fission-track (AFT) analysis 5–7, **6**
 - Cenozoic uplift and denudation of southern Norway 222
 - factors affecting accuracy and precision of timing estimates 341–343, 342
 - Paleocene initiation of Cenozoic uplift in Norway 60–61
 - quantifying Atlantic exhumation 331–332
 - analytical problems 337, 338–339
 - approaches based on heat flow 334
 - availability of palaeotemperature constraints over a range of depths 339
 - basic assumptions 332–333, 332
 - calibration of system response 335
 - depth resolution versus thermal resolution 344
 - Early Tertiary palaeo-thermal effects in NW England 344–346, 345
 - factors affecting the accuracy of the magnitude of exhumation 332–339
 - factors affecting the precision of the magnitude of exhumation 339–340
 - heating rates 334–335
 - identifying the appropriate unconformity 335
 - inappropriate system kinetics 335–336
 - integration of results from different methods 337–338
 - latest results 344–349
 - limitations of this technique 343–344
 - Mesozoic palaeothermal episodes in Ireland and Central Irish Sea Basin 347–349
 - nature of palaeotemperature constraints 339–340
 - new results from Central England 346–347
 - non-linear palaeogeothermal gradients 333–334, 333
 - onset versus duration of cooling or exhumation 344
 - palaeo-surface temperature 334
 - reburial 344
 - thermal history resolution 343–344
 - timing of exhumation 340–341, 340, 347
- Scandinavian denudation
 - age and track length statistics 120
 - annealing 119–120
 - inverse modelling 120–121
 - procedure 120
- thermal and denudational history of Ireland 377–380, **378–379, 382–383, 384–386**
 - analytical details 380
 - contouring method 387
 - evaluation of geothermal gradient 387–388
 - modelling procedures 380–387
 - sampling 380
- thermotectonic development of southern Sweden 177–180
 - dating method 172
 - forward modelling 172–176
 - geological and geomorphological modelling constraints 176
 - modelled thermal histories 174–175
 - modelling results **173**, 176–177
 - timing of Norwegian denudation 28–31, 33
- Ardmore field 421
- Armorican Block 86, 87
- Askeladden field 414
 - initial reservoir pressure 478
- Asland field 419
- Assynt 276, 277
- Åsta Graben 237
- Atlantic, North *see* North Atlantic
- Ätnajäkka fluvial valley 159, 160
- Ballycotton field 421, 477
- Baltic Shield 68, 69
- Barents Sea 118, 403, 412–416, 414, 423, 474
 - cap-rocks 476
- Barra, Isle of 276, 277
- Barra Fan 314, 315, 317, 318
- Beatrice field 418
- Ben Wyvis 273
- Bennachie 273
- Bill Bailey's Bank 314
- Binney field 419
- Bivrost Fault Zone 147
- Bjarmeland Platform 414
- Bjorn Drift 314
- Bjørnøya Basin 414
- Blake field 418
- Bothnia, Gulf of 118
- Bristol Channel 86, 372
- Britain
 - bathymetric setting of Atlantic margin 314
 - Cenozoic denudation 18–19, 19
 - mass balance calculations 19–21, 20, 21
 - mass balance results 21–22
 - correlation with Alpine tectonics 95–98, 97
 - Early Tertiary palaeo-thermal effects in NW England 344–346, 345
 - Late Neogene development of Atlantic margin 313–314, 327
 - airgun profiles 321, 318, 319, 320
 - basal unconformity 316–322
 - deep-water sedimentary response 324–325
 - mechanics of change 326–327
 - prograding wedges 322–324
 - setting 314–316
 - stratigraphy and sedimentation 315, 316–326, 317
 - summary event stratigraphy 325–326, 325
 - timing of change 326
 - Mesozoic sedimentary basin evolution 86–88, 86
 - new results from Central England 346–347
 - post-Variscan tectonic events 87
 - southern, Cenozoic inversion and uplift 85–86, 88
 - fault inversion 88–89

Britain *continued*

- inversion by bulk deformation and uplift 90
- Variscan Thrust Front 89, 90
- Tertiary landscape evolution 98–99
- Variscan structural framework 87
- Weald Basin inversion 90–91, 92
 - forward model 94–95, 94, 95, 96
 - model 91–93, 93
- Brona Basin 403, 474
- Brygge Formation 141, 141, 142, 143
- Buchan 276, 277
- Buchan field 418
- Cairngorms range 276
- Caithness 273, 276
- Caithness Ridge 418
- Calder field 419
- Cape Wrath 276
- Captain field 418
- Cardigan Bay Basin 372, 474
- Celtic Sea Basin
 - cap-rocks 476
 - Kinsale Head gas field 477
- Cenozoic denudation of Britain and Ireland 18–19, 19
 - mass balance calculations 19–21, 20, 21, 21–22
- Cenozoic evolution of the Faroe Platform 291, 308–309
 - denudation depth 308
 - mass balance 306–308
 - denudation estimates 306
 - sediment yield estimates 307
 - structural elements and regional setting 291–294, 292
 - distribution of Paleocene basalt 297, 298
 - seismic sections 293, 295, 303, 305
 - seismic units 294
 - stratigraphic correlation 294–298, 296
 - structural evolution 307
 - tectonics, denudation and deposition
 - Early and Mid-Miocene time 304–305
 - Eocene deposition 303–304
 - Eocene–Recent denudation of Paleocene plateau basalts 299–303, 300, 301, 302
 - Late Miocene–Early Pliocene time 305
 - Late Pliocene time 305–306
 - Oligocene time 304
 - Paleocene time 298–299, 299
 - Pleistocene time 306
- Cenozoic evolution of the North Sea 229–230, 235–236, 244, 263
 - correlation with global climate and sea level 221
 - correlation with regional tectonic events 219–221
 - database 216
 - depocentres 215
 - Eocene time 248–250, 249
 - Miocene time 254–258, 255
 - Neogene incised valleys 256
 - Oligocene time 250–251, 252, 254
 - palaeogeographical development 216–219, 218
 - palaeo-water depth 240–243, 240, 241, 245, 249, 257
 - Paleocene time 244–248, 245, 246
 - Plio-Pleistocene time 257, 258–259, 258, 260
 - possible vertical movement mechanisms 259–261
 - intra-plate stress 262
 - Late Paleocene–Early Eocene vertical movements 261
 - Oligocene–Miocene domal uplift of southern Norway 262
 - Plio-Pleistocene glacial erosion and uplift 262
 - regional profiles 239
 - regional setting in Early Oligocene time 253
 - regional setting in Late Paleocene–earliest Eocene time 247
 - regional setting in mid-Miocene time 255
 - seismic lines 246, 252, 258,
 - seismic mapping 236–240, 238
 - stratigraphy 213, 238
 - structural map 237
 - study area 236
 - tectonic modelling and subsidence analysis 242, 243–244, 244
- Cenozoic uplift of North Atlantic 2, 22
 - Paleocene initiation 45–46, 60, 63–64
 - active mechanisms of surface uplift 54–60
 - Bouguer gravity map 46
 - chalk overburial 53
 - changing in-plane stress 54–57, 55, 56
 - climate and eustasy 46–47
 - gravity 63
 - heat flow 63
 - isostatic adjustments caused by erosion of existing topography 48, 49–51, 49, 50
 - isostatic and erosional response to sea-level fall 51–54, 51, 52
 - lithospheric delamination 58–60, 58, 59, 62
 - magmatic underplating 57–58, 57
 - mechanism of surface uplift 61–63
 - passive mechanisms of surface uplift 49–54
 - pre-Quaternary geological map 54
 - sediment structure and fission tracks 60–61
 - tectonics 47–49
 - thermal and topographic response of lithosphere 57, 58, 59, 62
 - Paleocene permanent uplift 22–23
 - Paleocene–Eocene dynamic support 23
 - Oligocene–Recent dynamic support 23–24
 - timing and mechanisms 27–28, 40
 - denudation of the eastern Atlantic margin 28–31
 - Neogene uplift of Norway 31–35
 - proposed mechanisms 28
- Central Channel High 86, 89
- Central English Channel 86, 86, 88
- Central Graben, North Sea 68–69, 68, 69, 70
- Central Graben Dome, North Sea 67–68, 68, 70, 74
 - Mesozoic structure and evolution 75
- chemical denudation, definition 4
- Cheshire Basin 419
- Clair field 415, 416–417
- Claymore field 418
- Clyde field 419
- coherence analysis 35, 35
- Coll, Isle of 276, 277
- compaction analysis 6
- Cornubian Massif 87, 87
- Corona Basin 415
- Corona Ridge 292
- Corrib field 420
 - capillary seal capacity 463
 - initial reservoir pressure 478
 - underfilled traps 478
- cosmogenic nuclide 6
- cosmogenic nuclide studies
 - erosion of glaciated passive margins 155, 162–164, 163
 - complex exposure and shielding histories 157–158
 - erosion depths 157

- surface exposure dating and erosion rates 155–156
 - surface exposure dating and erosion rates 156, 157
- Cowal peninsula 273, 276, 277
- Cromarty field 418
- Crossans field 419
- crustal uplift, definition 4
- Cullins 276
- Dalradian belt 277
- Danish Basin 73, 185
- Danish Megablock 67–68, 68, 69, 71
 - Jurassic–Cenozoic rotation 70
- Darwen field 419
- Darwin volcanic centre 292
- Deemster Basin 419
- Deemster Platform 419
- Dellen meteorite impact 104
- Denmark
 - Late Cenozoic erosion
 - comparison with other studies 198
 - estimates of missing section 193–195, 195
 - magnitude 196, 195–197, 197
 - timing of maximum burial and subsequent erosion 197–198
- denudation, definition 4–5
- Donegal Basin 372, 403
- Donegal Fan 314, 317
- Douglas field 419
- Dragon field 421
- drill stem tests (DSTs) 479
- Dutch Bank Basin 418
- East Faroe Graben 415
- East Faroe High 292
- East Faroes wedge 314, 315, 317
- East Irish Basin 372
- East Irish Sea Basin 417–422, 419, 423, 474
 - cap-rocks 476
- East Midlands Shelf 76
- East Orkney Basin 418
- East Rockall wedge 314, 315
- East Shetland Basin 237
- East Shetland Platform 237
- Egersund Basin 403, 474
- Egret field 478
- Elgin 273
- erosion, definition 4
- erosion of glaciated passive margins 153–155, 154
 - cosmogenic nuclide studies 155, 162–164, 163
 - complex exposure and shielding histories 157–158
 - erosion depths 157
 - surface exposure dating and erosion rates 155–156, 156, 157
 - landscape surface reconstruction in northern Sweden 158
 - fluvial inclusion during interglacial periods 158–161, 159
 - glacial erosion by selective linear erosion 161
 - localized subglacial modification of preglacial upland surfaces 161–162
 - lowering of preglacial upland surfaces by nonglacial processes 162
 - preglacial fluvial drainage system 158
 - uneven sediment production 164–165
- Erris Basin 403
- Erris Ridge 420
- Erris Trough 372, 474
- Eubonia Basin 419
- exhumation, definition 3–4, 5, 210–212
- exhumation of the North Atlantic margin 1–3, 348, 349
 - basins 403
 - mechanisms
 - accelerated burial before uplift 350
 - comparisons with other regions 350–351
 - regional events in NW Europe 349–350
 - repeated cycles of burial and exhumation 350
 - overview 5, 10
 - continental margin record 7–9
 - mechanisms 7, 8
 - petroleum exploration 9–10
 - techniques 5–7, 6
 - quantification using apatite fission-track analysis and vitrinite reflectance data 331
 - analytical problems 337, 338–339
 - approaches based on heat flow 334
 - availability of palaeotemperature constraints over a range of depths 339
 - basic assumptions 332–333, 332
 - calibration of system response 335
 - depth resolution versus thermal resolution 344
 - Early Tertiary palaeo-thermal effects in NW England 344–346, 345
 - factors affecting accuracy and precision of AFT timing estimates 341–343, 342
 - factors affecting the accuracy of the magnitude of exhumation 332–339
 - factors affecting the precision of the magnitude of exhumation 339–340
 - heating rates 334–335
 - identifying the appropriate unconformity 335
 - inappropriate system kinetics 335–336, 336, 337
 - integration of results from different methods 337–338
 - latest results 344–349
 - limitations of these techniques 343–344
 - Mesozoic palaeothermal episodes in Ireland and Central Irish Sea Basin 347–349
 - nature of palaeotemperature constraints 339–340
 - new results from Central England 346–347
 - non-linear palaeogeothermal gradients 333–334, 333
 - onset versus duration of cooling or exhumation 344
 - palaeo-surface temperature 334
 - reburial 344
 - thermal history resolution 343–344
 - timing from AFT data 340–341, 340, 347
- Faroe Bank 314
- Faroe Bank Knoll 292
- Faroe Islands 293, 314
- Faroe Platform, Cenozoic evolution 291, 308–309
 - denudation depth 308
 - mass balance 306–308
 - denudation estimates 306
 - sediment yield estimates 307
 - structural elements and regional setting 291–294, 292
 - distribution of Paleocene basalt 297, 298
 - seismic sections 293, 295, 303, 305
 - seismic units 294
 - stratigraphic correlation 294–298, 296
 - structural evolution 307
 - tectonics, denudation and deposition

- Faroe Platform, Cenozoic evolution *continued*
 Early and Mid-Miocene time 304–305
 Eocene deposition 303–304
 Eocene–Recent denudation of Paleocene plateau
 basalts 299–303, 300, 301, 302
 Late Miocene–Early Pliocene time 305
 Late Pliocene time 305–306
 Oligocene time 304
 Paleocene time 298–299, 299
 Pleistocene time 306
- Faroe Shelf 314, 403
- Faroe–Shetland Basin 415
- Faroe–Shetland Channel 293, 314, 315
- Faroe–Shetland Escarpment Slide 146
- Farsund Basin 70, 403, 474
- Fastnet Basin 372
- Fastnet High 421
- Feni Ridge 314, 317
- Fennoscandian Border Zone 170
- Fennoscandian High 70
- Finnmark Platform 414
- Flett Basin 292, 415
- Flett Ridge 292, 415
- flexural rigidity 34–35
- Foinaven Basin 292, 293, 295, 415
- Foinaven field 415
- formation integrity tests (FITs) 476, 479
- Formby field 419
- Fornby Point Fault 419
- Foula sub-basin 415
- Friesland Dome 68, 69, 70, 71
- Frøya Basin 403
- Fugloy Basin 292, 293, 295, 303
- Gaick 277
- Gardar Drift 314
- gas reserves and resources 401–402
 Barents Sea 414, 416
 dissolved in Earth's crust 449–450
 East Irish Sea Basin 417–422, 419
 effects of exhumation 412, 413
 Inner Moray Firth Basin 417, 418
 North Celtic Sea Basin 421, 424
 release from groundwater 450–452
 efficiency 452–453
 resource estimation 409–412
 risk analysis 402–409, 404
 Slyne–Erris Basin 420, 422–424
 solubility in water 447–448, 448, 449
 West Shetland Basin 415, 416–417
- Geikie Escarpment 320
- geomorphological analysis 6
- George Bligh Bank 314, 315
- Glelprie Fault Zone 147
- Godred Croven Basin 419
- Goliath field 414
- Göteborg 170
- Grampian Highlands Massif 418
- Great Glen 273
- Great Glen Fault 274, 276
- grus 108
- Halibut Horst 273, 418
- Halibut Shelf 418
- Haltenbanken 140
- Hamilton field 419
- Hammerfest Basin 403, 414
- Hampshire–Dieppe Basin 86, 88–89
- Hanö Bay 73, 73
- Harlingen gas field 465
- Harris, Isle of 273, 276, 277
- Harstad Basin 414
- Hatton Bank 314, 403
- Hatton Drift 314
- Hatton Rockall Basin 314
- Hebridean Basins 403, 474
- Hebrides Shelf 314, 317
- Hebrides Terrace Seamount 314
- Helmsdale Fault 276
- Helsingborg 170
- Helvick field 421
- Heron field 478
- Highland Boundary Fault 274, 276
- Horda Platform 237, 403, 423
- hydrocarbon systems in exhumed basins 401–402,
 424–425, 443
 abnormal pore pressures 472–475
 commercial implications 431
 depressurization 457–459, 479–480
 abnormal formation pressures 458
 capillary leakage 459–462, 460
 capillary seal capacity 463
 dilatant shear fractures 464
 hydraulic leakage 461, 462–465
 molecular transport 461, 465
 tectonic breaching 459, 460
 top-seal leakage mechanisms 459–465
- diagenesis 433
 diagenetic sequence 440
 near-surface fluids 435–436
- empirical observations 475–479
 formation pressures 479
 initial reservoir pressures 478
 regional cap-rocks 476
 underfilled traps 478
- examples from NW European margin 412, 423
 Barents Sea, western 412–416, 414, 423
 East Irish Sea Basin 417–422, 419, 423
 Horda Platform 423
 Inner Moray Firth Basin 417, 418, 423
 North Celtic Sea Basin 421, 423, 424
 North Sea Basin 423
 Slyne–Erris Basins 420, 422–424, 423
 West Shetland Basin 415, 416–417, 423
- exhumation processes 433, 469–470
 changing hydrodynamic regime 470–472, 471
 chemical processes 435
 physical processes 434
 stress 470, 473
- fracturing 440–441
 porosity and permeability 441
- key characteristics 412, 413
- natural gas 447, 453
 dissolved gas in crust 449–450
 efficiency of gas release 452–453
 formation pressures 479
 hydrodynamic effects 451–452, 470–472, 471
 hydrostatic effects 450–451
 initial reservoir pressures 478
 solubility of gas in water 447–449, 448
 underfilled traps 478
 uplift-related gas release 450–452, 451

- oil-bearing reservoirs 441–443
 - fluid-fill history 442
- physical properties of cap-rocks 465–466
 - lithology, porosity and permeability 466
 - porosity–depth behaviour 468
 - strength, ductility and brittleness 467–469, 467
- porosity trends 436–437
 - causes of porosity change 436
 - clay distribution 439
 - effect of erosion on pore pressure evolution 438
 - effective stress 437
 - erosion rate 437
 - percentage oil residue 439
 - secondary porosity and sandstone framework stability 437–439
- prospect resource estimation 409–410, 409
 - formation volume factor 411
 - gross rock volume 410
 - net-to-gross ratio, porosity and hydrocarbon saturation 410–411
 - recovery factor 411–412
- prospect risk analysis 402–405, 404
 - probability of oil versus gas 406–407
 - probability of reservoir 405
 - probability of source and charge 405–406
 - probability of trap and seal 407–409
- Iceland Basin 314, 317
- Iceland (mantle) Plume 7, 13–14, 27, 58
 - influence in the Faroe–Shetland area 294, 309
 - influence in the Irish Sea basin area 356
 - North Sea basin subsidence 261, 263
 - Paleocene uplift of British Isles 309
 - present-day dynamic support 14–15
 - estimates from bathymetry 15–16
 - estimates from gravity 16–18, 17
 - role in Cenozoic surface uplift 61–63, 62, 212, 214
- Iceland–Faroe Rise 314
- Indefatigable field 478
- Inner Moray Firth Basin 403, 417, 418, 423
 - cap-rocks 476
- inversion, definition 5
- Ireland 372
 - Cenozoic denudation 18–19, 19
 - mass balance calculations 19–21, 20, 21
 - mass balance results 21–22
 - denudation since Triassic time 388–389, 393
 - Triassic time 388
 - Jurassic time 389–390, 389
 - Cretaceous time 390–391, 390
 - Paleocene–Eocene time 391, 391
 - Oligocene–mid-Miocene time 391–392, 392
 - Mesozoic palaeothermal episodes 347–349
 - post-Variscan thermal and denudation history 371–373, 396
 - eastern and northern offshore flanks 377
 - Irish landmass 373–375, 373, 374
 - palaeothermal and thermochronological data 377–388, 378–379, 382–383, 384–386
 - southern offshore flank 375–376
 - western offshore flank 376–377
 - total denudational efflux of Irish landmass 392–396, 394, 395
- Irish Platform 420
- Irish Sea Basin 403
 - Mesozoic palaeothermal episodes 347–349
 - regional setting and stratigraphy 356–357
- sonic velocity analysis of Tertiary denudation 355–356, 365–368, 365, 366
 - curve-fitting, geological error and derivation of exhumation 357, 358, 359, 360–361, 361–364
 - methods 357–364
 - results 362, 363, 364–365, 364
 - theoretical background and mechanical control over velocity 357–361
- Irish Shelf 314
 - Jan Mayen Fault Zone 147
 - Jan Mayen Ridge 403
 - Judd High 415
- Kai Formation 141, 141, 142, 143
- Kårsatjåkka mountain block 159
- Keys Basin 419
- Keys Faults 419
- Kilfenora Horst 420
- Kinsale Head gas field 421, 475, 478
 - capillary seal capacity 463
 - initial reservoir pressure 478
 - underfilled traps 478
- Kish Bank Basin 372
- Klibreck 277
- Knoydart 276
- Labadie Bank High 421
- Laggan field 415
- Lake District Massif 419
- Lambda field 419
- leak-off tests (LOTs) 476, 479
- Leman field 478
- Lennox field 419
- Lofoten Basin 140
- Lofoten Island 119, 133
- Lomre Terrace 237
- Loppa High 414
- Lorne, Firth of 277
- Lousy Bank 314
- Lower Saxony Basin 70
- Loyal field 415
- Magnus Basin 237
- Main Porcupine Basin 372
- Malin Shelf 314
- Malin Trough 372
- Måløy Fault Blocks 237
- Mamock field 478
- mantle plume 7, 13–14, 27, 58
 - influence in the Faroe–Shetland area 294, 309
 - influence in the Irish Sea basin area 356
 - North Sea basin subsidence 261, 263
 - Paleocene uplift of British Isles 309
 - present-day dynamic support 14–15
 - estimates from bathymetry 15–16
 - estimates from gravity 16–18, 17
 - role in Cenozoic surface uplift 61–63, 62, 212, 214
- mantle upwelling 27–28
 - uplift of southern Norway 35–37
- Marulk Basin 237
 - mass balance analysis 6
 - Cenozoic denudation of Britain and Ireland 19–21, 20, 21
 - results 21–22

- mass balance analysis *continued*
- mechanical denudation, definition 4
- methane
- rates of generation 452
 - solubility in brine 448, 449
- Millom field 419
- Mizzen Basin 421
- modelling
- apatite fission track (AFT) analysis 177–180
 - AFTsolve program 120–121, 172
 - dating method 172
 - forward modelling 172–176
 - geological and geomorphological modelling constraints 176
 - modelled thermal histories 174–175
 - modelling results 173, 176–177
 - thermotectonic development of southern Sweden 172–177
 - erosion of southern Scandinavia
 - chronostratigraphic event definition 190–191
 - erosion model 191–193
 - heat-flow model 191
 - model calibration and results 192, 193, 194
 - model description 190–193
 - palaeo-surface temperatures 191, 191
 - Neogene uplift of southern Norway
 - coherence analysis 35, 35
 - estimating flexural rigidity 34–35
 - parameter values 31–35, 31
 - tectonic uplift and isostatic rebound 36
 - North Sea Basin lithosphere 78, 80–81, 81
 - new model of Cenozoic subsidence and marginal dome uplift 79
 - previous models of Mesozoic–Cenozoic evolution 78–79
 - synrift and post-rift basin evolution 78
 - North Sea tectonics and subsidence analysis 242, 243–244, 244
 - Paleocene initiation of Cenozoic uplift
 - passive margin formation 54–57, 55, 56
 - thermal and denudational history of Ireland 380–387
 - Weald Basin inversion 91–93, 93
 - forward model 94–95, 94, 95, 96
- Moine Thrust 274
- Moray Firth 277, 474
- Moray Firth Graben 68, 68, 70
- Møre Basin 140, 474
- Møre–Trøndelag Fault Complex 147
- Møre–Trøndelag Fault Zone 104, 113
- Morecambe field 419
 - initial reservoir pressure 478
- Mormond Hill 277
- Morven 276, 277
- Morvern 273, 276
- Mounth 273
- Muddus plains 108
 - compared with Norwegian Palaeic relief 109–110
- Mull, Isle of 273, 276, 277, 278
- Munken Basin 292
- Myrsilde field 414
- natural gas *see* gas reserves and resources
- Naust Formation 141, 141, 142–143, 142, 143, 145, 145, 146
- net uplift, definition 4
- Nordkapp Basin 403, 414
- Norewegian–Danish Basin 403
- North Atlantic
 - anomalous topography 15
 - Cenozoic uplift 2, 22, 27–28, 40
 - denudation of the eastern Atlantic margin 28–31
 - Neogene uplift of Norway 31–35
 - Oligocene–Recent dynamic support 23–24
 - Paleocene–Eocene dynamic support 23
 - Paleocene permanent uplift 22–23
 - proposed mechanisms 28
 - free-air gravity anomaly map 14
 - Neogene evolution of mid-Norwegian margin
 - 139–141, 147–149, 147
 - north of Storegga Slide Complex 142–143, 143, 143–147
 - stratigraphy 141–147, 141, 146
 - Paleocene initiation of Cenozoic uplift 45–46, 60, 63–64
 - active mechanisms of surface uplift 54–60
 - Bouguer gravity map 46
 - chalk overburial 53
 - changing in-plane stress 54–57, 55, 56
 - climate and eustasy 46–47
 - gravity 63
 - heat flow 63
 - isostatic adjustments caused by erosion of existing topography 48, 49–51, 49, 50
 - isostatic and erosional response to sea-level fall 51–54, 51, 52
 - lithospheric delamination 58–60, 58, 59, 62
 - magmatic underplating 57–58, 57
 - mechanism of surface uplift 61–63
 - passive mechanisms of surface uplift 49–54
 - pre-Quaternary geological map 54
 - sediment structure and fission tracks 60–61
 - tectonics 47–49
 - thermal and topographic response of lithosphere 57, 58, 59, 62
 - seismic tomography 37–40
 - P-wave maps 38, 39
 - topographic and bathymetric map 3
- North Buchan Graben 418
- North Celtic Sea 86, 90
- North Celtic Sea Basin 372, 403, 421, 423, 424, 474
- North Minch 277
- North Porcupine Basin 372
- North Sea 67
 - bathymetry 210
 - Cenozoic depocentres 215
 - Cenozoic evolution 229–230, 244
 - correlation with global climate and sea level 221
 - correlation with regional tectonic events 219–221
 - database 216
 - palaeogeographical development 216–219, 218
 - Paleocene time 244–248, 245, 246
 - Cenozoic stratigraphy 213
 - central North Sea Dome 68–71
 - Danish Megablock 71
 - Jurassic–Cenozoic lithosphere models 78, 80–81, 81
 - new model of Cenozoic subsidence and marginal dome uplift 79
 - previous models of Mesozoic–Cenozoic evolution 78–79
 - synrift and post-rift basin evolution 78
- Jurassic–Cenozoic uplift–subsidence reversal 75
- Cenozoic accumulation 77

- Mesozoic structure and evolution of Central Graben
 Dome 75
 pre-Quaternary geology 76
 structure and evolution of North Sea Basin 75–77
 migration of clinoform breakpoints 216
 seismic profiles 217, 220
 South Swedish Dome 71–75
 tectonic impact on sedimentary processes 235–236,
 263
 Eocene time 248–250, 249
 intra-plate stress 262
 Late Paleocene–Early Eocene vertical movements
 261
 Miocene time 254–258, 255
 Neogene incised valleys 256
 Oligocene time 250–251, 252, 254
 Oligocene–Miocene domal uplift of southern
 Norway 262
 palaeo-water depth 240–243, 240, 241, 245, 249,
 257
 Plio-Pleistocene glacial erosion and uplift 262
 Plio-Pleistocene time 257, 258–259, 258, 260
 possible vertical movement mechanisms 259–262
 regional profiles 239
 regional setting in Early Oligocene time 253
 regional setting in Late Paleocene–earliest Eocene
 time 247
 regional setting in mid-Miocene time 255
 seismic lines 246, 252, 258
 seismic mapping 236–240, 238
 stratigraphy 238
 structural map 237
 tectonic modelling and subsidence analysis 242,
 243–244, 244
 upper crustal configuration 67–68, 68
 North Sea Basin 403, 423
 North Sea Fan 140, 314, 317
 North Westray Ridge 415
 Northern Highlands Massif 418
 Northern Scandes 103–110, 105, 112, 118
 Jurassic–Cretaceous denudation 125–132, 126–127,
 128–129, 130–131
 Tertiary denudation 132–133
 Norway 1, 28
 AFT analysis 30, 33
 Bouguer gravity anomaly map 29
 Cenozoic uplift and denudation 209–210, 229–230
 climatic and eustatic change 212–214
 constraints on magnitude 222–224
 constraints on timing 224
 definition 210–212
 differences between southern Norway and Shetland
 Platform 228–229
 hypothetical model 226–228, 227
 isostatic response to localized denudation 224–226
 isostatic uplift response 212
 study rationale 214–216
 tectonic mechanisms 212
 isostasy 34
 mean elevation 30, 32
 Neogene uplift 31–34
 calculated tectonic uplift and isostatic rebound 36
 coherence analysis 35, 35
 estimating flexural rigidity 34–35
 mechanisms 35–37
 parameter values 31
 Oligocene–Miocene domal uplift 262
 palaeic surface 108–109, 109
 compared with Swedish Muddus plains 109–110
 Paleocene initiation of Cenozoic uplift 45–46, 60,
 63–64
 active mechanisms of surface uplift 54–60
 Bouguer gravity map 46
 chalk overburial 53
 changing in-plane stress 54–57, 55, 56
 climate and eustasy 46–47
 gravity 63
 heat flow 63
 isostatic adjustments caused by erosion of existing
 topography 48, 49–51, 49, 50
 isostatic and erosional response to sea-level fall
 51–54, 51, 52
 lithospheric delamination 58–60, 58, 59, 62
 magmatic underplating 57–58, 57
 mechanism of surface uplift 61–63
 passive mechanisms of surface uplift 49–54
 pre-Quaternary geological map 54
 sediment structure and fission tracks 60–61
 tectonics 47–49
 thermal and topographic response of lithosphere 57,
 58, 59, 62
 temperature–depth plot 37
 timing of denudation 28–31
 topographic cross-sections of south Norwegian dome
 225
 topographic relief map 47
 topography, Moho and Bouguer gravity 48, 49, 50
 Nyk Slide 146
 offshore sedimentary response analysis 6
 Ogham Platform 419
 oil reserves and resources 401–402
 Barents Sea 414, 416
 East Irish Sea Basin 417–422, 419
 Inner Moray Firth Basin 417, 418
 North Celtic Sea Basin 421, 424
 resource estimation 409–412
 risk analysis 402–409, 404
 Slyne–Erris Basin 420, 422–424
 West Shetland Basin 415, 416–417
 Orcadian Basin 274
 Orkney Islands 273, 418
 Orkney–Shetland Platform 415, 418
 Oryx field 419
 Oskarshamn 170
 Outer Hebrides Islands 273
 partial annealing zone (PAZ) 119–120, 125
 Peach Slide 315, 318
 Pembroke Ridge 421
 Peterhead Ridge 418
 petroleum exploration 9–10
 Phoenix field 418
 Porcupine Abyssal Plain 314
 Porcupine Bank 314
 Porcupine Seabight 314
 prospect resource estimation 409–410, 409
 formation volume factor 411
 gross rock volume 410
 net-to-gross ratio, porosity and hydrocarbon saturation
 410–411
 recovery factor 411–412

- prospect risk analysis 402–405, 404
 probability of oil versus gas 406–407
 probability of reservoir 405
 probability of source and charge 405–406
 probability of trap and seal 407–409
 Purbeck–Wight Disturbance 86, 88, 89
- Ranger field 419
 Rannock Moor 277
 Rathlin/Ulster Basin 372
 Rayleigh–Taylor instability 58, 61, 62
 repeat formation tests (RFTs) 479
 Rhum, Isle of 273
 Ribban Basin 403
 Ringkøbing Fyn High 185
 Rockall Bank 314, 315, 403, 420
 Rockall Plateau 314, 317
 Rockall Trough 314, 315, 317, 318, 319, 320, 372, 420
 Rona Ridge 292, 415
 Rosemary Bank 314
 Ross field 418
- Sandøy Ridge 415
 Scandinavia, landforms and uplift 103, 104, 113–114,
 117–118, 134–135
 analysis of maps
 comparison between Norwegian Palaeic surface and
 Swedish Muddus plains 109–110
 grus saprolites and landforms 108
 major shape of Northern and Southern Scandes
 103–110, 105
 Palaeic surface of southern Norway 108–109, 109
 palaeosurfaces formed by etching and planation
 106–109
 plains with residual hills 108, 108
 sub-Cambrian peneplain 106–107, 106
 undulating hilly relief 107–108, 107
 zone of incised valleys 109
 analysis of profiles 110, 111
 Scandinavian domes 112
 apatite fission track (AFT) analysis
 age and track length statistics 120
 annealing 119–120
 inverse modelling 120–121
 procedure 120
 results 122–123, 123–124, 124
 geological setting 118–119
 hinge line 112–113, 113
 interpretation of AFT data and inverse modelling
 124–125
 correlation with offshore geology 134
 Jurassic–Cretaceous denudation of Northern
 Scandes 125–132, 126–127, 128–129, 130–131
 Lofoten and Vesterålen islands 133
 pattern of denudation 133–134
 post-orogenic cooling 125
 Tertiary denudation of Northern Scandes 132–133
 methods 103
 Neogene uplift induced by Southern Swedish Dome
 183–186, 198, 202–203
 burial anomaly and missing section 189–190
 chronostratigraphic event definition 190–191
 denudation surfaces 198–200, 199, 200–201
 erosion estimated from basin modelling 190–193
 erosion estimated from sonic data 186–190
 erosion model 191–193
 heat-flow model 191
 model calibration and results 192, 193, 194
 palaeo-surface temperatures 191, 191
 quantification of late Cenozoic erosion in Denmark
 193–198, 195
 sonic data 190
 timing of Cenozoic uplift 200–202
 velocity–depth trends 186–189, 186, 187, 188
 pre-Quaternary geology 184
 sampling 121
 South Swedish Dome 113, 118
 study area 119
 uplift of the Scandes 112
 Väner Basin 113
- Schiehallion field 415
 Scotland 1, 273
 Cenozoic uplift and denudation of the Highlands 1,
 281, 282–283
 denudation and landscape evolution 283–285
 denudational history 271–272, 285–286
 former cover rocks in the Highlands 279–282
 Highlands 1, 30
 Palaeozoic–present history of the Highlands 272–279
 morphotectonic units 277
 post-Devonian depths of denudation 274
 tectonics and denudation in Tertiary Igneous
 Province 278
 Tertiary uplift 276
- Senja Fault Zone 147
 Senja Ridge 414
 Seven Heads field 421
 Shetland Islands 273
 Shetland Isles 415
 Shetland Spine Fault 415
 Siljan ring meteorite impact 104
 Skagerak–Kattegat Platform 68, 68, 69, 170, 185
 Skeivi Bank 292
 Skua field 478
 Skye, Isle of 273, 276, 278
 Slyne Basin 403
 Slyne Ridge 420
 Slyne Trough 372, 474
 cap-rocks 476
 Slyne–Erris Basin 420, 422–424, 423
 Smith Bank Graben 418
 Smith Bank High 418
 Snøhvit field 414
 initial reservoir pressure 478
 underfilled traps 478
- Sogn Graben 237
 Solan Basin 415
 Solan field 415, 416
 Sole Pit fault zone 76
 Solway Basin 372
- sonic velocity analysis 6
 Irish Sea Basin 355–356, 365–368, 365, 366
 curve-fitting, geological error and derivation of
 exhumation 357, 358, 359, 360–361,
 361–364
 methods 357–364
 results 362, 363, 364–365, 364
 theoretical background and mechanical control over
 velocity 357–361
- Sorgenfrei–Tornquist Zone 185, 211
 Sørvestnaget Basin 414
 South Celtic Sea 86
 South Celtic Sea Basin 372, 421

- South Halibut Basin 418
 South Hewitt Fault 86
 South Morecambe field 478
 initial reservoir pressure 478
 South Småland Peneplain 71, 72, 106, 170, 199
 South Swedish Dome 68, 68, 69, 71–75, 72, 73, 74, 105, 106
 see also Sweden
 Neogene uplift 183–186, 198, 202–203
 burial anomaly and missing section 189–190
 chronostratigraphic event definition 190–191
 denudation surfaces 198–200, 199, 200–201
 erosion estimated from basin modelling 190–193
 erosion estimated from sonic data 186–190
 erosion model 191–193
 heat-flow model 191
 model calibration and results 192, 193, 194
 palaeo-surface temperatures 191, 191
 sonic data 190
 timing of Cenozoic uplift 200–202
 velocity–depth trends 186–189, 186, 187, 188
 Southern Gas Basin 474
 Southern North Sea Basin, cap-rocks 476
 Southern Scandes 103–110, 105, 112, 118
 Southern Scandes Dome 68, 73
 Spitsbergen 403, 474
 St George's Channel 86
 St George's Channel Basin 372, 421
 Stappen High 414
 Sticklepath Fault 86
 Stord Basin 237, 474
 Storegga Slide 140, 140
 stratigraphy 141
 Storegga Slide Complex 140, 141–142, 144, 147
 north side 142–143, 143, 146
 south side 143–147, 146
 Strathmore field 415
 Sub-Cambrian Peneplain 106–107, 106, 170
 Sulven field 415
 Sula Sgeir Fan 314, 315, 317
 surface uplift, definition 4
 Sweden
 see also South Swedish Dome
 landscape surface reconstruction 158
 fluvial inclusion during interglacial periods 158–161, 159
 glacial erosion by selective linear erosion 161
 localized subglacial modification of preglacial upland surfaces 161–162
 lowering of preglacial upland surfaces by nonglacial processes 162
 preglacial fluvial drainage system 158
 Mesozoic and Cenozoic tectonotectonic development 169, 177–180, 180–181
 Cenozoic exhumation 179–180
 dating method 172
 faults and lineaments 171–172, 171
 forward modelling 172–176
 geological and geomorphological modelling constraints 176
 large-scale Phanerozoic tectonism 180
 modelled thermal histories 174–175
 modelling of AFT data 172–177
 modelling results 173, 176–177
 palaeosurfaces 169–171
 Triassic and Jurassic exhumation 177–179, 178
 Muddus plains 108
 compared with Norwegian Palaeic relief 109–110
 slope map 108
 Tampen Slide 146
 Tampen Spur 237
 Teusajaure valley 159
 Tornquist Zone 67–68, 68, 69, 70, 76, 105
 Torridop field 415
 Traenabanken Slide 144, 146
 Traenadjupet Slide 140, 146, 147
 Triple Junction Dome 68, 68, 70, 71
 Tromsø Basin 414
 Trøndelag Platform 474
 Tynwald Basin 419
 Tynwald Fault 419
 Uer Terrace 237
 uplift, definition 4, 210–212
 Utsira High 237
 Vale of Pewsey Fault 89
 Väner Basin 113
 Vänern, Lake 170
 Vättern, Lake 170
 Vättern Graben 71, 72
 Vealevuomus glacial valley 160
 velocity–depth trends 186–190, 186, 187, 188
 baseline for Lower Jurassic marine shale 204
 baseline for Lower Triassic Bunter shale 204–205
 revised trend for North Sea Chalk 203–204
 Vestbakken volcanic province 414
 Vesterålen Island 119, 133
 Vestfjorden Basin 403
 Victory field 415
 capillary seal capacity 463
 underfilled traps 478
 Viking Graben 68, 68, 70, 237
 vitrinite reflectance (VR) 6
 quantifying Atlantic exhumation 331–332
 analytical problems 337, 338–339
 approaches based on heat flow 334
 availability of palaeotemperature constraints over a range of depths 339
 basic assumptions 332–333, 332
 calibration of system response 335
 depth resolution versus thermal resolution 344
 Early Tertiary palaeo-thermal effects in NW England 344–346, 345
 factors affecting the accuracy of the magnitude of exhumation 332–339
 factors affecting the precision of the magnitude of exhumation 339–340
 heating rates 334–335
 identifying the appropriate unconformity 335
 inappropriate system kinetics 336, 337
 integration of results from different methods 337–338
 latest results 344–349
 limitations of this technique 343–344
 Mesozoic palaeothermal episodes in Ireland and Central Irish Sea Basin 347–349
 nature of palaeotemperature constraints 339–340
 new results from Central England 346–347
 non-linear palaeogeothermal gradients 333–334, 333

- vitritine reflectance (VR) *continued*
onset versus duration of cooling or exhumation 344
palaeo-surface temperature 334
reburial 344
thermal and denudational history of Ireland
377–380
thermal history resolution 343–344
timing of exhumation 347
- Vøring Basin 140
Vøring Plateau 140
- Wardour–Portdown structure 89
Watchet–Cothelstone Fault 86, 89
Weald Basin 86, 90–91, 92, 403
forward model 94–95, 94, 95, 96
inverse model 91–93, 93
West Bank High 418
West Shetland Basin 403, 415, 423, 474
cap-rocks 476
West Shetland Platform 415
West Shetland Shelf 314, 321
West Shetland wedge 314, 315, 317
Westray Ridge 292
Westray Transfer Zone 292
Witchground Graben 237
Wyville–Thomson Ridge 314
Wyville–Thomson Ridge Complex 292