

# Index

Page numbers in *italic*, e.g. 173, refer to figures. Page numbers in **bold**, e.g. **241**, signify entries in tables.

- Adamello pluton 172, 173
- Adelaide Geosyncline 105
- Aegean Sea 360
- aluminium
  - dynamic recrystallization 6, 6
- amphiboles
  - chemical analyses **241**
  - deformation mechanisms **240**
  - lattice parameters **247**
  - pole figures 248, **248**, 249
- amphibolites
  - Windy Pass thrust area 219, 236
    - development mechanisms 232–235
    - pole figures 226–228, 227, 228, 229, 230
    - geological setting and structural analysis 219–221, 220
    - methodical aspects of QTA 232, **234**
    - mylonites 221–222, 222, **222**
    - quantitative texture analysis (QTA) 224
    - sample textures 229–232, 233
    - neutron diffraction 224–226, 225
- anhydrite, weakening 11
- annealing 191
- Arkaroola Creek 106
  
- Balmuccia ultramafic body 388, 389, 390, 391, 399–400, 399
- Bechun Glacier 373
- Belle Ile 86, 94
- Bergell pluton 173
- Bhutan
  - High Himalayan Crystalline (HHC) wedge 372–373, 372, 382, 383–384
- Black Hills quartzite 192, 193
- Brittle–ductile models 355–357, 356
  - lithosphere extension 357
    - necking and narrow rifts 357–359, 358, 359
    - spreading and wide rifts/core complexes 359–360, 360, 361
  - lithosphere thrusting 362–365, 363, 364
  - uses and limitations 357
- bulging recrystallization (BLG) 7, 171
  - Tonale fault zone 173
  - grain size determination 175, **175**
  - grain size variation 176, 177
- calcite
  - softening 11
  - wet compaction 29–30, 37
    - deformation mechanisms 34
    - effect of magnesium 3, 33, 33, 34, 37
    - experimental method 30–33, 31
    - experimental results 33
    - intergranular pressure solution (IPS/PS) model 34–37
  - calcite, creep 293, 304–305
    - activation energy 297–300, **299**
    - alternative steady state flow laws for dislocation creep 301–303
    - creep laws
      - mechanical testing 294–295
      - state variable approach 294
      - steady-state constitutive laws 293–294
    - data and results 295, 295
    - grain-size dependence of dislocation creep 300–301, 300
    - internal state or structure 304
    - internal stress and grain size 303–304
  - calcite, strength 309, 325
    - strength and paleostress estimates
      - comparison of palaeostresses and extrapolated flow laws 315–317
      - paleostress estimates and extrapolated strengths 319, 320
      - palaeostresses 313–315, 314
      - Sesia zone 317–319, 318
      - Strength extrapolated from experimental flow laws 315, **316**, 317
    - field study results **310–311**
    - inversion using simple theoretical flow laws 322–324, 324
    - recrystallization weakening 324–325
    - recrystallized grain size 312
    - recrystallized grain size variations 319–321, 323
    - shear zones and dynamic recrystallization 309–313, 313
- Carrara marble 326, 331–332, 350–351
  - chemical analysis **333**
    - deformation and microstructure characteristics **334**
  - deformation mechanisms 345–346
  - evolution of dynamically recrystallizing microstructure 348–349
  - evolution of flow stress with strain 346–348, 348
  - experimental procedure page numbering 333–335, 343–344
    - experimental results
      - grain size distributions 339, 340, 341, 342
      - mechanical data **334**, 335–336, 336
      - qualitative microstructural observations 336–338, 337
      - quantitative microstructural results 339–345
      - statistical descriptors 343, 344
    - geodynamic implications 350
- Cascades Crystalline Core 219, 220
- channelized fluid flow 4–5
- Chiwaukum Schists 220, 220, 221, **222**
- clay
  - effect on pressure solution in sandstones 3–4, 41–42, 52, 57–59, 58

- clay (*cont.*)
- clay-enhanced contact diffusion 48–50, 49, 50, 51
  - clay-enhanced dissolution kinetics 50, 51, 52, 53
  - compaction of sediments 57
  - contact diffusion-limited compaction 52–57
  - dissolution-limited compaction 57
  - model 42–46
  - numerical models and boundary conditions 46, 46
  - precipitation-limited compaction 57
  - precipitation-limiting processes 52, 54, 55, 56
  - rate-limiting processes 47–48
  - simulation results 48–52
- Coble creep 322–324, 325
- computer-integrated polarization (CIP) microscopy 5
- continental lithosphere deformation 355, 365
- kinematic localization in ductile layers 368
  - lithosphere extension 357
    - necking and narrow rifts 357–359, 358, 359
    - spreading and wide rifts/core complexes 359–360, 360, 361
  - lithosphere thrusting 360–361
    - brittle–ductile models 363–365, 363, 364
    - sandbox-type models 361–362, 362, 363
  - mantle rheology 365–367
  - modelling principles and techniques 355
    - brittle–ductile models 355–357, 356
    - brittle–ductile models, uses and limitations 357
    - scaling 355
    - strain localization and brittle–ductile coupling 367
  - crack-seal theory 103–104
  - crystallographic preferred orientations (CPOs) 191, 200, 201, 202, 203, 210–211, 214–216
    - omphacite 257–258
- deformation
- effect of fluids 1–2
    - channelized and pervasive fluid flow 4–5
    - dissolution–precipitation creep 2–4
    - outstanding problems and future goals 16–17
    - pressure-solution creep 2, 2
    - water-bearing grain boundaries 4, 4
- deformation mechanisms
- amphiboles **240**
  - calcite
    - wet compaction 29–30, 34, 37
  - Carrara marble 345–346
  - crust and lithosphere tectonics 14
    - olivine deformation mechanism map 15
    - softening and localization 14–15
  - crust and upper mantle minerals 10
    - flow laws 10–11
    - lower crust 12–13
  - Himalaya, fault-accommodated strain 383–384
  - olivine 11, 12, 15
  - outstanding problems and future goals 16
    - fluids and grain boundaries 16–17
    - geodynamic modelling 18
      - high-strain flow laws 18
      - microstructure development 17–18, 17
  - quartz 183–186, 184
- diffusion control creep equation 34
- Diorito-Kinzigitica Zone 241, 242
- dissolution control creep equation 34
- dissolution–precipitation creep 2–4
- outstanding problems and future goals 16
- Druk Chung Glacier 373
- dynamic recrystallization of quartz 171–172, 186
- constraints on deformation along Tonale fault zone 182
  - correlation between nature and experiment 174–177
    - deformation mechanism 183–186, 184
  - evaluation of paleopiezometers 183
  - geological setting 172
  - grain size determination 172–174
    - autocorrelation function (ACF) 174
    - line-intercept method 174, 175, **175**
  - recrystallized grain size 182–183
  - stress and strain rate calculations 178, 179, 180
    - flow law coefficients **181**
    - flow stress data 181
    - paleopiezometry 178–180
    - strain rate estimation 180–182
- dynamic recrystallization, ELLE simulation 167
- Eastern Tonale fault zone 172, 173
- Eclogitic Micaschists Complex (EMC) 241, 242
- electron back scattered diffraction (EBSD) analysis 5
- boundary misorientations 7, 8
- ELLE simulation 140, 141, 142, 143, 155–156, 156, 167–168
- comparison with experimental data 163–165
  - comparison with natural examples 165–166
  - deformation maps 166
  - dynamic recrystallization 167
  - extrapolation to natural conditions 166–167
  - general description 150, 150
  - grain boundary migration 154–155, 161
  - grain boundary mobility 166
    - one index heading ‘microstructures’
  - mean grain size 161
  - microstructure groupings **160**
  - observations and interpretation 156–159, 157, 158
  - recrystallization by nucleation 153–154, 154, 159
  - recrystallization by rotation 154, 159
  - recrystallized grain size 166
  - results 156–163
  - routines and parameters 150–155, **151, 152, 155**
- exhumation of subcontinental mantle, strain
- localization 387–388, 403–404
  - geological setting 388–391
  - lithospheric extensional faulting and weakening 401–403, 401
  - micromechanics of strain localization 399–401, 399
  - microstructures and mineral assemblages
    - high temperature 393–395, 394, 395, 396

- low temperature 395–396, 397
- pressure–temperature conditions of type 1 shear zones 396–398, 397
- structural geology of the shear zones 391–393, 391, 392
- ting, effect of fluids 2
- spar, rheology 13
- ero ultramafic body 389
- nish Cap 358
- is
  - ffect on deformation 1–2
    - channelized and pervasive fluid flow 4–5
    - dissolution–precipitation creep 2–4
    - outstanding problems and future goals 16–17
    - pressure–solution creep 2, 2
    - water-bearing grain boundaries 4, 4
  - ffect on faulting 2
  - ffect on tectonics 5
- trains in a crustal-scale décollement 85, 98–99
  - deformation 87, 88–90, 89, 90
  - deformation processes 95–98
  - geochemistry 90–95, 91, 91, 92, 93, 94, 95
  - geological setting 85–86, 86
  - petrography 86–88
- sturing and reaction weakening 387–388, 403–404
- geological setting 388–391
- ithospheric extensional faulting and weakening
  - 401–403, 401
- micromechanics of strain localization 399–401, 399
- microstructures and mineral assemblages
  - high temperature 393–395, 394, 395, 396
  - low temperature 395–396, 397
- ressure–temperature conditions of type 1 shear zones 396–398, 397
- structural geology of the shear zones 391–393, 391, 392
- rdicarie Line 172, 173
- ucophanite in the Sesia-Lanzo Zone 239–241, 249–250
- hemical analyses 241
- geological setting and sample description 241–243, 242, 243
- attice parameters 247
- mineral chemistry and quantitative diffraction analyses 243–244
- eutron diffraction 246–247, 247
- ole figures 248, 248, 249
- esults 248–249
- exture measurements 244–247
- X-ray diffraction 244–246, 245, 246
- ieiss Minuti Complex (GMC) 241, 242
- ban spur 358
- in boundaries
  - migration recrystallization 7
  - misorientations 7–9, 8
  - models 74
  - island–channel grain boundary model 4–5, 4, 69, 74–75, 81
  - island–crack model 4, 4, 67, 75, 81
  - relationship between the models 75
  - thin film model 4, 4, 63, 74, 74
- outstanding problems and future goals 16–17
- water 1–2, 2
  - structure and properties 4, 4
- grain boundary migration 154–155, 161
- grain boundary migration recrystallization (GBM) 171
  - Tonale fault zone 173
    - grain size determination 175, 175, 176
- grain boundary mobility 166
- grain size 7–9, 8
- grain-size-sensitive (GSS) laws 315, 317, 319
- Grinfield-type instabilities 76, 81
- Groix 86
- halite–clay mixtures 2
- Hall–Petch relation 301
- Himalaya, fault-accommodated strain 371, 384
  - background 371–373, 372
  - Eastern Lunana 373–375, 373, 374–375
  - fault analysis 375–377, 376
    - palaeostress and palaeostrain calculation 377, 378–379
  - interpretation of results 381–383, 382
- Ingalls Complex 219–220, 220, 222
- intergranular pressure solution (IPS/PS) 29–30, 34, 41–42, 42, 73–74, 79–81
  - compaction creep of wet calcite 34–37
  - compaction creep in quartz–muscovite mixtures 61–62
  - creep equations 34
  - grain boundary models 74
    - island–channel grain boundary model 4–5, 4, 69, 74–75, 81
    - island–crack model 4, 4, 67, 75, 81
    - relationship between the models 75
    - thin film model 4, 4, 63, 74, 74
- modelling effects of clay on sandstone pressure solution 42–46, 52, 57–59, 58
  - clay-enhanced contact diffusion 48–50, 49, 50, 51
  - clay-enhanced dissolution kinetics 50, 51, 52, 53
  - compaction of sediments 57
  - contact diffusion-limited compaction 52–57
  - dissolution-limited compaction 57
  - numerical models and boundary conditions 46, 46
    - precipitation-limited compaction 57
    - precipitation-limiting processes 52, 54, 55, 56
    - rate-limiting processes 47–48
    - simulation results 48–52
- modelling wet calcite compaction 34–37
- morphology of elastically strained surfaces 75–77, 76
- thermodynamics 41

- Ivrea–Verbano Zone 388–391, 389
- Les Sables d'Olonne 86
- liquid percolation threshold (LPT) 276, 277
- Loire, River 86
- lower crust  
rheology and deformation mechanisms 12–13  
seismic reflectors 13
- Lugge Glacier and Lake 373
- magma, rheology of 275–276, 288  
behaviour loops 283  
negative feedback loops in magma crystallization 284–285, 284  
positive feedback loops in melting 283–284, 283, 284  
differences between melting and crystallizing 285–286, 285  
geological relevance  
equilibrium versus disequilibrium compositions 286–287, 287  
fabrics in imbricated magma intrusions 287–288, 288  
magma extraction 286
- matter and stress transfer thresholds 276  
liquid versus rigid percolation thresholds 276, 277  
melt escape and particle locking thresholds 276–277, 277
- non-linear melting and crystallization rates  
crystallization of magmas 278, 279  
melting in source rocks 277–278, 277, 278
- partially molten rock (PMR) 280  
crystallizing magma 282–283  
melt rheology 280–281  
melting migmatites 281–282  
sub-melting conditions 280, 280
- strain partitioning 278  
magma crystallization 279  
partial melting 278–279
- magnesium, effect on calcite compaction 3
- Mars, Mount 241, 242
- melt escape threshold (MET) 276–277, 277
- Merano 173
- metals, dynamic recrystallization 6
- mica 62
- microstructures and textures 5  
amphibolites from the Windy Pass thrust 219, 236  
data acquisition and quantitative texture analysis (QTA) 224  
development mechanisms 232–235  
pole figures 226–228, 227, 228, 229, 230  
geological setting and structural analysis 219–221, 220  
methodical aspects of QTA 232, 234  
mylonites 221–222, 222, 222  
sample textures 229–232, 233  
neutron diffraction 224–226, 225  
boundary misorientations 7–9, 8  
computer simulation 10  
crystallographic textures 9–10  
dynamic recrystallization 5–7, 6  
terminology 6  
evolution towards high strain 11–12, 12  
glaucophanite from the Sesia-Lanzo Zone 239–241, 249–250  
geological setting and sample description 241–243, 243  
lattice parameters 247  
mineral chemistry and quantitative diffraction analyses 243–244  
neutron diffraction 246–247, 247  
pole figures 248, 248, 249  
results 248–249  
texture measurements 244–247  
X-ray diffraction 244–246, 245, 246  
metamorphic rocks from subduction zones 258–259, 260  
outstanding problems and future goals 17–18, 17  
microstructures, numerical simulation 137, 142–144, 143, 149–150  
crystal growth 140–141, 142  
deformation of one-phase systems 140, 141  
deformation of two-phase systems 140  
ELLE model 140, 141, 142, 143, 155–156, 156, 167–168  
comparison with experimental data 163–165  
comparison with natural examples 165–166  
deformation maps 166  
dynamic recrystallization 167  
extrapolation to natural conditions 166–167  
general description 150, 150  
grain boundary migration 154–155, 161  
grain boundary mobility 166  
one index heading 'microstructures'  
mean grain size 161  
microstructure groupings 160  
observations and interpretation 156–159, 157, 158  
recrystallization by nucleation 153–154, 154, 159  
recrystallization by rotation 154, 159  
recrystallized grain size 166  
results 156–163  
routines and parameters 150–155, 151, 152, 155  
grain boundary topology and geometry 139–140  
texture development 137–139, 138, 139
- modelling  
continental lithosphere deformation 355  
brittle–ductile models 355–357, 356  
brittle–ductile models, uses and limitations 357  
scaling 355  
crust and lithosphere tectonics 15–16  
geodynamic models and localization 18  
grain boundary models 74  
island–channel grain boundary model 4–5, 4, 69, 74–75, 81

- island–crack model 4, 4, 67, 75, 81
- relationship between the models 75
- thin film model 4, 4, 63, 74, 74
- IPS model for effect of clay on sandstone pressure solution 42–46, 52, 57–59, 58
  - clay-enhanced contact diffusion 48–50, 49, 50, 51
  - clay-enhanced dissolution kinetics 50, 51, 52, 53
  - compaction of sediments 57
  - contact diffusion-limited compaction 52–57
  - dissolution-limited compaction 57
  - numerical models and boundary conditions 46, 46
  - precipitation-limited compaction 57
  - precipitation-limiting processes 52, 54, 55, 56
  - rate-limiting processes 47–48
  - simulation results 48–52
- IPS model for wet calcite compaction 34–37
- lithosphere extension 357
  - necking and narrow rifts 357–359, 358, 359
  - spreading and wide rifts/core complexes 359–360, 360, 361
- lithosphere thrusting 360–361
  - brittle–ductile models 363–365, 363, 364
  - sandbox-type models 361–362, 362, 363
- microstructures 137, 142–144, 143
  - crystal growth 140–141, 142
  - deformation of one-phase systems 140, 141
  - deformation of two-phase systems 140
  - development 10
  - grain boundary topology and geometry 139–140
  - texture development 137–139, 138, 139
- pressure–solution creep 3
- rheology of partially molten rock 280–285, 280
  - model parameters 280
- microstructures using ELLE simulation 155–156, 156, 167–168
  - comparison with experimental data 163–165
  - comparison with natural examples 165–166
  - deformation maps 166
  - dynamic recrystallization 167
  - extrapolation to natural conditions 166–167
  - general description 150, 150
  - grain boundary migration 154–155, 161
  - grain boundary mobility 166
    - one index heading ‘microstructures’
  - mean grain size 161
  - microstructure groupings 160
  - observations and interpretation 156–159, 157, 158
  - recrystallization by nucleation 153–154, 154, 159
  - recrystallization by rotation 154, 159
  - recrystallized grain size 166
  - results 156–163
  - routines and parameters 150–155, 151, 152, 155
- Mombarone, Mount 241, 242
- Mucrone, Mount 241, 242
- muscovite 62, 63
  - chemical composition 67–68, 67
  - effect on pressure solution 62, 68–70
    - experimental method 64–65,
    - experimental results 65–68, 65
    - mechanical data 65–67, 66
    - microstructure 67–68, 68
- Nantes 86
- neutron diffraction analysis 9
- non-linear feedback in the rheology of phase change 275–276, 288
  - behaviour loops 283
    - negative feedback loops in magma crystallization 284–285, 284
    - positive feedback loops in melting 283–284, 283, 284
  - differences between melting and crystallizing 285–286, 285
  - geological relevance
    - equilibrium versus disequilibrium compositions 286–287, 287
    - fabrics in imbricated magma intrusions 287–288, 288
    - magma extraction 286
  - matter and stress transfer thresholds 276
    - liquid versus rigid percolation thresholds 276, 277
    - melt escape and particle locking thresholds 276–277, 277
  - melting and crystallization rates
    - crystallization of magmas 278, 279
    - melting in source rocks 277–278, 277, 278
  - partially molten rock (PMR) 280
    - crystallizing magma 282–283
    - melt rheology 280–281
    - melting migmatites 281–282
    - sub-melting conditions 280, 280
  - strain partitioning 278
    - magma crystallization 279
    - partial melting 278–279
- olivine
  - deformation 11, 12
  - deformation mechanism map 15
- omphacite 257–258
- Oppaminda Creek (Australia) 105, 106, 107
- paleopiezometry 178–180
  - evaluation 183
- PARIS factor 207, 209, 213
- particle locking threshold (PLT) 277, 279
- Péclet number 287
- Peio line 173
- permeability anisotropy 120, 134
  - development 127–130
  - experimental procedure 120–122
  - experimental results
    - influence of loading path 125–127, 131
    - mechanical data 124–125, 124

- permeability anisotropy (*cont.*)  
 permeability data 125, **126–127**, 128, 129  
 loading configurations 122–124, 123
- pH at zero charge 61–62
- phengite-rich bands 88, 88
- phyllosilicates 61–63, 69–70
- Pogallo Shear Zone (PSZ) 401–402, 401
- Potts model 139, 139, 140, 144
- power-law creep equation applied to calcite rocks  
 293, 304–305  
 activation energy 297–300, **299**  
 alternative steady-state flow laws for dislocation  
 creep 301–303  
 creep  
 mechanical testing of calcite rocks 294–295  
 state variable approach 294  
 steady-state constitutive laws 293–294  
 data and results 295, 295  
 grain-size dependence of dislocation creep  
 300–301, 300  
 internal state or structure 304  
 internal stress and grain size 303–304
- precipitation control creep equation 34
- Premosello ultramafic body 389
- pressure solution *see* intergranular pressure solution  
 (IPS/PS)
- pressure-solution creep 2, 2  
 effect of clay 3–4, 41–42  
 effect of magnesium 3
- Pyrenees 364
- quantitative texture analysis (QTA) 224  
 glaucophanite, deformed 239–241, 244, 249–250  
 geological setting 241–243, 243  
 lattice parameters **247**  
 neutron diffraction 246–247, 247  
 pole figures 248, **248**, 249  
 results 248–249  
 X-ray diffraction 244–246, 245, **246**  
 methodical aspects 232, **234**
- quartz, dynamic recrystallization 171–172, 186  
 constraints on deformation along Tonale fault zone  
 182  
 correlation between nature and experiment  
 174–177  
 deformation mechanism 183–186, 184  
 evaluation of paleopiezometers 183  
 geological setting 172  
 grain size determination 172–174  
 autocorrelation function (ACF) 174  
 line-intercept method 174, 175, **175**  
 recrystallized grain size 182–183  
 stress and strain rate calculations 178, 179, 180  
 flow law coefficients **181**  
 flow stress data 181  
 paleopiezometry 178–180  
 strain rate estimation 180–182
- quartzites, experimental deformation 191–192, 217  
 crystallographic preferred orientations (CPOs) 191,  
 200, 201, 202, 203, 210–211, 214  
 experiments 192–195, 193, **194**, 195  
 grain shape 213–214  
 grain size 211–213  
 grain size distributions 198, 199, 200  
 image analysis 195–201, 196, 197  
 implications for natural deformation 216–217  
 results  
 annealed samples 206  
 deformed samples and creep regimes 201–206,  
 204, 205  
 grain boundary character 209–210, 210  
 grain shape analysis 208  
 grain size distribution 206–209, **207**  
 misorientation density 211
- quartz–muscovite mixtures  
 compaction creep 61–62, 68–70  
 experimental method 64–65  
 experimental results 65–68, **65**  
 mechanical data 65–67, 66  
 microstructure 67–68, 68
- Quiberon 86
- Raphstreng Glacier and Lake 373
- recrystallization 5–7, 6  
 outstanding problems and future goals 17–18, 17  
 terminology 6
- recrystallization by rotation 154, 159
- recrystallization by nucleation 153–154, 154, 159
- rheological critical melt percentage (RCMP) 14, 276,  
 277
- rheology  
 crust and lithosphere tectonics 14  
 olivine deformation mechanism map 15  
 softening and localization 14–15  
 crust and upper mantle minerals 10  
 effect of melts 13–14  
 evolution towards high strain 11–12, 12  
 flow laws 10–11  
 lower crust 12–13
- magma 275–276, 288  
 behaviour loops 283–286, 283, 284, 285  
 differences between melting and crystallizing  
 285–286  
 geological relevance 286–288, 287, 288  
 matter and stress transfer thresholds 276–277, 277  
 non-linear melting and crystallization rates  
 277–278, 277, 278, 279  
 partially molten rock (PMR) 280–283, **280**, 281  
 strain partitioning 278–279
- mantle 365–367  
 outstanding problems and future goals 16  
 fluids and grain boundaries 16–17  
 geodynamic modelling 18  
 high-strain flow laws 18  
 microstructure development 17–18, 17  
 viscosity 280, 282

- rheology, non-linear feedback 275–276, 288  
   behaviour loops 283  
   negative feedback loops in magma crystallization 284–285, 284  
   positive feedback loops in melting 283–284, 283, 284  
 differences between melting and crystallizing 285–286, 285  
 geological relevance  
   equilibrium versus disequilibrium compositions 286–287, 287  
   fabrics in imbricated magma intrusions 287–288, 288  
   magma extraction 286  
 matter and stress transfer thresholds 276  
   liquid versus rigid percolation thresholds 276, 277  
   melt escape and particle locking thresholds 276–277, 277  
 melting and crystallization rates  
   crystallization of magmas 278, 279  
   melting in source rocks 277–278, 277, 278  
 partially molten rock (PMR) 280  
   crystallizing magma 282–283  
   melt rheology 280–281  
   melting migmatites 281–282  
   stress–strain diagram 281  
   sub-melting conditions 280, 280  
 strain partitioning 278  
   magma crystallization 279  
   partial melting 278–279  
 Rhine graben 358  
 rigid percolation threshold (RPT) 276, 277, 279  
 roughness development at solid/fluid interfaces 73–74, 79–81  
   experimental observations 78, 79, 80  
   experimental procedure 77–79, 77  
   grain boundary models 74  
     island–channel grain boundary model 4–5, 4, 69, 74–75, 81  
     island–crack model 4, 4, 67, 75, 81  
     relationship between the models 75  
     thin film model 4, 4, 63, 74, 74  
   morphology of elastically strained surfaces 75–77, 76  
  
 sandbox-type models 15–16, 361–362, 362, 363  
 sandstone  
   permeability anisotropy 134  
     development 127–130  
     evolution 132  
     experiment results 124–125, 126–127, 128, 129  
     experimental procedure 120–122  
     influence of loading path 125–127, 131  
     loading configuration 122–124, 123  
   Sesia Zone 389  
 Sesia-Lanzo Zone 242  
 Sesia-Lanzo Zone glaucophanites 239–241, 249–250  
   chemical analyses 241  
   geological setting 241–243, 243  
   lattice parameters 247  
   mineral chemistry and quantitative diffraction analyses 243–244  
   neutron diffraction 246–247, 247  
   pole figures 248, 248, 249  
   results 248–249  
   texture measurements 244–247  
   X-ray diffraction 244–246, 245, 246  
 Skagit Suite 220  
 Sondrio 173  
 South American Shear Zone (SASZ) 86  
 South Brittany Hercynian Belt 85, 98–99  
   metavolcanics 87, 88  
   phengite-rich bands 88, 88  
   syn-kinematic vein arrays 88–90, 89  
 geochemistry  
   analytical techniques 90  
   chemical analyses 91  
   composition of veins versus lithology 90, 91  
   Grant's diagrams 92  
   mass transfer associated with vein development 91–93, 92  
   oxygen isotopes 93–95, 93, 94, 95  
   geological setting 85–86, 86  
   nature and scale of mass transfer 95–96  
   petrography 86–88  
   progressive deformation model 96, 97–98, 98  
   scale of fluid transfers 96–97  
 South Tibet Detachment System (STDS) 372, 372  
 strain, effect on permeability 133–134, 133  
 stress, effect on permeability 119–120, 134  
   development of permeability anisotropy 127–130  
   experimental procedure 120–122, 121  
   experimental results  
     evolution of permeability anisotropy 132  
     mechanical data 124–125, 124  
     permeability data 125, 126–127, 128, 129  
   influence of loading path 125–127, 131  
   loading configurations  
     hybrid triaxial compression 122–124, 123  
     triaxial extension versus triaxial compression 122, 123  
 Strona–Ceneri Zone 389  
 strontium isotope studies 105  
   fibrous veins 110–112, 111  
 subduction zones 255  
   metamorphic rocks 269  
     deformation record under U(HP) 257–258, 258  
     experimental constraints of flow strength 259–262, 261  
     kinetic patterns and tectonic models 267–268, 268  
     localization of deformation 262  
     microstructures and deformation mechanisms 258–259, 260  
     pressure–temperature paths 255–256, 256  
     stress in present day subduction zones 263–264  
     deformation mechanisms 264–267, 265, 266

- subduction zones (*cont.*)  
 time constraints 256–257  
 subgrain rotation recrystallization (SGR) 171  
 Tonale fault zone 173  
 grain size determination 175, **175**  
 grain size variation 176  
 subgrain rotation recrystallization 7
- Taber veins, fibrous 104
- Tapley Hill Formation 105  
 fluid flow event 115–116
- tectonics  
 continental lithosphere deformation 355, 365  
 kinematic localization in ductile layers 368  
 lithosphere extension 357–360, 358, 359, 360, 361  
 lithosphere thrusting 360–365, 362, 363, 364  
 mantle rheology 365–367  
 modelling principles and techniques 355–357, 356  
 strain localization and brittle–ductile coupling 367  
 crust and lithosphere 14  
 modelling 15–16  
 olivine deformation mechanism map 15  
 softening and localization 14–15  
 effect of fluids 5  
 exhumation of subcontinental mantle, strain  
 localization 387–388, 403–404  
 age of shear zones 398–399  
 geological setting 388–391  
 lithospheric extensional faulting and weakening 401–403, 401  
 micromechanics of strain localization 399–401, 399  
 microstructures and mineral assemblages 393–396, 394, 395, 396, 397  
 pressure–temperature conditions of type 1 shear zones 396–398, 397  
 structural geology of the shear zones 391–393, 391, 392
- metamorphic rocks in subduction zones 255, 269  
 deformation record under U(HP) 257–258, 258  
 experimental constraints of flow strength 259–262, 261  
 kinetic patterns and tectonic models 267–268, 268  
 localization of deformation 262  
 microstructures and deformation mechanisms 258–259, 260  
 pressure–temperature paths 255–256, 256  
 stress in present day subduction zones 263–264  
 suspected deformation mechanisms 264–267, 265, 266  
 time constraints 256–257  
 upper bound on flow stress 262–263  
 validity 268
- tension gash 103
- Thorthormi Glacier 373
- time-of-flight (TOF) neutron diffraction 224–226, 225
- Tonale fault zone  
 bulging recrystallization (BLG) 173  
 grain size determination 175, **175**  
 grain size variation 176, 177  
 constraints on deformation 182  
 grain boundary migration recrystallization (GBM) 173  
 grain size determination 175, **175**  
 grain size variation 176  
 subgrain rotation recrystallization (SGR) 173  
 grain size determination 175, **175**  
 grain size variation 176
- Trento 173
- ultra-high pressure (UHP) metamorphic rocks 13
- Vannes 86
- veins, fibrous 103–105, 116  
 analytical techniques 108  
 microprobe conditions **108**  
 formation and development 103, 104  
 crack-seal theory 103–104  
 sources of radiogenic Sr 114–115  
 Sr isotopes 105  
 study area and sample description 105–108, 106, 107  
 study results 113–116  
 major elements by XRF 108–110, **109**, 110  
 microprobe data 112–113, 112, 113  
 Sr isotope ratios 110–112, **111**
- Vilaine Estuary 86
- viscosity 280, 282
- Western Alps 365, 366, 367
- Windy Pass thrust 219, 236  
 geological setting and structural analysis 219–221, 220  
 microstructural analysis  
 amphibolite mylonites 221–222, 222, **222**  
 data acquisition and QTA 224  
 development mechanisms 232–235  
 pole figures 226–228, 227, 228, 229, 230  
 methodical aspects of QTA 232, **234**  
 sample textures 229–232, 233  
 neutron diffraction 224–226, 225