

Index

Page numbers in *italic* refer to figures. Page numbers in **bold** signify entries in tables.

- Adamant Pluton *542*
- Adams–North Thompson Fault *560*
- Altyn Tagh fault *40, 356*
- Ama Dablam *363*
- Appalachian Inner Piedmont *517–518, 535*
 - attributes *520–527*
 - cross-sections *532*
 - dominant foliation *522*
 - geological map *529*
 - mineral stretching lineation *527, 528*
 - Neocadian metamorphic isograd map *530*
 - stromatic migmatite *525*
 - structure *523*
 - tectonothermal time line *531*
 - channel flow *527–535*
 - flow model *526*
 - tectonic setting *518–520, 519*
- Astor River *208*
- Bangong suture *356*
- Bangong–Nuijiang suture *40, 356*
 - lithospheric electrical conductivity *50*
 - seismic anisotropy *52*
 - seismic reflectivity *54*
- Bhutan
 - geological cross-section *429*
 - geological map *416, 426, 428*
 - geological setting *426–427*
 - normal-sense shear zones *425–426, 439–441*
 - cathodoluminescence (CL) images *435*
 - geometry and kinematics *427–429, 431, 434, 441*
 - Tera-Wasserburg diagrams *439*
 - U–Pb geochronology *433–436, 437–438*
 - pulsed channel flow *415–417, 420–421*
 - data *418–420, 419, 420*
 - T–t paths *417*
- Bonington pluton *566, 570*
- Canadian Cordillera *543, 555–556, 561–567, 562, 582–583, 589–561, 607*
 - channel flow model applied to Ominecca Belt *593*
 - Domain 1 – structures and metamorphism *594–560*
 - Domain 1 – timing of deformation *600–601*
 - Domain 2 – structures and metamorphism *601–602*
 - Domain 2 – timing of deformation *602*
 - Domain 3 – structures and metamorphism *602–603*
 - Domain 3 – timing of deformation *603–604*
 - Domain 4 *604*
 - general statements *593–595*
 - overview **597–598**
 - tectonic interpretations *596*
 - coherent thrust sheet architecture *569–572*
 - comparison with High Himalaya *555*
 - continuity of mid-crustal ductile zone *552–553*
 - Cretaceous mid-crustal ductile zone *545–546*
 - Big Bend area *546–549*
 - Big Bend area deformation and exhumation *549–552, 550*
 - ductile zone west of Monashee Complex *552*
 - cross-sections *547, 551, 563, 567, 571*
 - detachment flow *564–565*
 - geological background *591–593*
 - geological model *606*
 - geological setting *543–545, 544*
 - gneiss dome formation *554–555*
 - granitoid migration *604–605*
 - consistency with other models *605–606*
 - origin of Cretaceous granitoids *605*
 - origin of Middle–Late Jurassic granitoids *605*
 - origin of Palaeocene–Eocene granitoids *605*
 - Gwillim Creek shear zone *573–574*
 - geometry and depth *575–578*
 - large displacement and link to Rocky Mountain thrust fault systems *578–580*
 - northward continuation *580–581*
 - time constraints *574–575*
 - U–Pb data **576, 577, 578, 583–584**
 - interpretation of Cretaceous mid-crustal ductile zone *553*
 - support for channel flow model *553*
 - shortening in the Ominecca Belt *606–607*
 - suprastructure–infrastructure association *568–569*
 - tectonic evolution *568*
 - tectonic map *590*
 - tectonic model *554*
 - Valhalla Complex
 - origin *560*
 - reconciliation of crystalline thrust sheet model *581–582*
 - upper margin *572–573*
- Cariboo Mountains *590*
 - deformation, metamorphism and age constraints **599**
- Carolina superterrane *519, 533, 534*
- Cat Square terrane *519, 520*
 - cross-section *532*
- Champion Lakes Fault *566*
- Changtse *363*
 - channel flow *25–26, 33–34*
 - see also* pulsed channel flow
 - challenges and unresolved issues *14–15*
 - ductile extrusion *207–208*
 - channel flow in mid- and upper crust *204*
 - ductile flow in lower crust *204*
 - field characteristics *205–206*
 - requisite conditions *205*
 - thermal–mechanical models *204*
 - thermal–mechanical models, implications for *204–205*
 - dynamics *2–4*
 - exhumation *6*
 - extrusion *4–6, 5*

- channel flow (*Continued*)
 dynamics (*Continued*)
 kinematic relationship between channel flow and extrusion 5
 viscous channel flow 4
 flow relationships 27–33, 28
 aggregate strength versus melt fraction 32
 velocity profiles 30
 GHS models 165–166, 179–180
 crustal-scale model results 166–174, 170–173
 design 166, 167, 168, 169
 requirements and characteristics of channel flow 6–7
 channel thickness and late-stage modifications 14
 coeval channel-bounding structures 8
 discontinuity of protoliths across channel 12–13
 internal deformation within channel 8–12
 kinematic inversions 8
 lateral versus vertical transport of material 12
 metamorphic characteristics 12
 plateau formation 7
 timing of melting and shortening structures 13
 viscosity 7
 Tibet
 flow modes 41–43, 41
 channel flow folds (CFFs) 593–595
 Channel Flow–Extrusion hypothesis for Himalayan–Tibetan orogen 71, 72, 83
 evolution of ideas
 1 – partially molten crust beneath Tibet 71–73
 2 – lateral flow of Tibetan fluid layer 73–74
 3 – eastern growth of Tibetan Plateau 74–75, 74
 4 – Miocene slip on Himalayan thrust faults coeval with normal faults 75–77, 76
 5 – Greater Himalayan channel roots northward 77
 6 – monsoon erosion and channel extrusion linked 77–78
 Phase I – steady state configuration during Early–Middle Miocene 78–79
 Phase II – second emergent channel established during Middle Miocene–Early Pliocene 79–81, 80
 Phase III – intensive extrusion at Himalayan front from Late Pliocene–Recent 81–82
 testing the hypothesis 82
 applicability to other orogenic systems 83
 theoretical studies 82–83
 channel injection (CI) model of continental plateau growth 161–162
 model comparison 148
 theory 149–150, 149
 model CI-1 – transition zone with uniform-property channel 150–151, 151
 model CI-2 – constant thickness, variable viscosity channel 151–153, 152
 model CI-3 – temperature-dependent channel properties 153, 154, 155
 thermal and rheological consistency 153
 criteria for rheological consistency 157–158, 157, 158
 criteria for thermal and mechanical models 154–156, 156
 upper crust 159
 stability 159–161
 viscous thickening model 159
 channel-bounding structures 8
 Chekha Formation 416, 418, 426, 428
 China Creek Dome 566
 U–Pb data 576, 577, 578, 583–584
 Chomolhari 428
 Clachnacudainn Complex 590
 deformation, metamorphism and age constraints 599
 College Creek pluton 570
 Columbia River fault 544, 546, 548, 551, 562, 566, 590
 continental plateau growth 147–149
 channel injection (CI) modelling 161–162
 theory 149–153, 149
 thermal and rheological consistency 153–158
 upper crust, behaviour of 159–161
 possible models 148
 thermal model 162–164
 continuum mechanics model for dilatancy effects
 dilatant plane strain 186–188
 isochoric plane strain 185–186, 185, 187
 Couette flow 27–33, 28, 41
 deformation sequence 32
 velocity profiles 30
 Cowrock terrane 519
 crustal extension
 Nanga Parbat–Haramosh Massif 208–210, 208
 numerical modelling 202, 202
 Wing Pond Shear Zone (WPSZ), New Foundland 210–214, 211, 212, 213
 crustal flow
 flow modes in hot orogens 91–93, 137–138
 classification according to temperature–magnitude plots 92
 crustal-scale model results 99–126
 effect of thermal relaxation and incubation time on crustal flow 135–136
 flow modes in temperature–magnitude space 134–135
 infrastructure and superstructure 136–137
 numerical calculation of crustal- and upper-mantle-scale flows 93–99
 upper-mantle-scale model results 126–134
 Tibet
 flow modes 41–43, 41
 inferred channel flow 59
 lateral strain variations, vertical strain and strength profiles 39–41
 crustal-scale (CS) modelling 93
 density structure and isostatic compensation 98–99
 design
 advantages and limitations 138
 complexity and tuning 138–139
 Himalayan–Tibetan (HT) models 140–141
 model–data comparisons 142–143
 philosophy of numerical approach 138
 scaling of laboratory power-law creep flow laws 139–140
 testing basal boundary conditions 139
 mechanical models 96–98
 melt-weakening 98
 parameters 95–96, 99

- results 99–116
 - model LHO-1 – homogeneous channel flow 100–107, 116, 137
 - model LHO-2 – heterogeneous channel flow 108–115, 116–117, 137
 - model LHO-3 – hot fold nappes 117–126, 118–125, 137
 - topographic evolution in LHO models 126, 127
 - surface processes 99
 - thermal model 99
 - velocity boundary conditions and reference frames 93, 94
- Cusson Creek 590
- Darondi River 245
- detachment flow folds (DFFs) 593–595
- dilatancy effects on extrusion 183–184, 195–196
 - considerations 193
 - kinematic vorticity changes 195
 - slab stretching and thinning 195
 - volume change 193–195, 194
 - continuum mechanics model
 - dilatant plane strain 186–188
 - isochoric plane strain 185–186, 185, 187
 - homogeneous deformation
 - constant thickness 190–192, 191
 - finite 188–190, 189
 - modelling approach 184–185
 - progressive deformation
 - constant thickness 192–193, 192
- dilatant plane strain 186–188
- Dinarides 498
- drag folds 229–231, 230
- Drucker–Prager yield criterion 96
- ductile extrusion 26–27, 201, 497, 513–514
 - channel flow 207–208
 - channel flow in mid- and upper crust 204
 - ductile flow in lower crust 204
 - field characteristics 205–206
 - requisite conditions 205
 - thermal–mechanical models 204
 - thermal–mechanical models, implications for 204–205
 - orogenic thickening and crustal extrusion 201–202, 203–204, 203, 214
 - evidence from central and eastern Himalayas 203
 - numerical modelling 202, 202
- dynamics of channel flow 2
- East Rongbuk glacier 369, 395
- Everest, Mount 373–374
 - crustal structure 361–364, 362–363, 395–397, 396
 - geological background 383–385, 384
 - geological map 395
 - regional setting 355–357, 356
 - Greater Himalayan sequence (GHS) 357–359, 358, 360
 - restoration 364–366, 365, 371–373, 372, 373
 - timescales of metamorphism, melting and channel flow 370–371, 370
- exhumation 6
- External Greater Himalayan klippen 257–259, 259
- extrusion 4–6
 - see also* ductile extrusion
 - extrusive flow 225–227, 226
 - kinematic relationship between channel flow and extrusion 5
- flow partitioning in the Himalaya 379–381, 403–409
 - channel flow models 381
 - distribution of flow regimes 402–403
 - extrusion models 381–382, 381
 - kinematic models 382–383
 - thermal–mechanical models 383
 - geological background of Everest transect 383–385, 384
 - geological map 380
 - lithological, structural and temporal controls 401–402
 - petrography
 - Everest summit–Kangshung Valley 395–397
 - Main Central Thrust (MCT) 397–399, 398, 399
 - Rongbuk valley transects 389–395, 391
 - tectonic setting 381
 - vorticity analysis 386, 388, 390, 393, 394
 - Everest transect 401
 - rigid grain data plots 385–389, 387, 404–408
 - techniques 385
- Foreland Belt 544, 548
- Frenchman Cap Dome 544, 551, 562, 590
- Gangdese batholith 360
- Gaza Dzong 428
- Ghat 362, 365
- Gilgit River 208
- Grandfather Mountain window 519
- Greater Himalayan sequence (GHS) 2, 25, 357–359, 373–374
 - buckling at Nar valley, central Nepal 269–270
 - exposed deformation features 285
 - geology 272–274
 - implications for cooling rate 285–287, 286
 - implications for southward extrusion 287–289, 288
 - structural constraints 274–279
 - timing constraints 279–285
- channel flow models 165–166, 179–180, 359–361
 - crustal-scale model results 166–174, 170–173
 - design 166, 167, 168, 169
- channel thickness and late-stage modifications 14
- channel-bounding structures 8, 9
- crustal extrusion 203
- distribution of flow regimes 402–403
- exhumation 6
- geological map 358
- INDEPTH profile 361
- leucosome and leucogranite bodies 13
- metamorphic characteristics 12
- pressure–temperature diagram 417
- protoliths 12–13
- provenance 174–176, 175, 177, 178
 - NHG domes and leucogranites 176–179
- restoration 364–366, 365, 371–373, 372, 373
 - timescales of metamorphism, melting and channel flow 370–371, 370

- Greater Himalayan sequence (*Continued*)
 Slab core 399–400, 400
 transport of materials 12
 viscosity 6
- Gwillim Creek shear zone 562, 566, 572, 573–574, 590
 geometry and depth 575–578
 U–Pb data 572, 577, 578, 583–584
 large displacement and link to Rocky Mountain thrust fault systems 578–580
 northward continuation 580–581
 time constraints 574–575
- Harramosh, Mount 208
- Helenides, External 497
 comparison with other ductile extrusion zones 513–514
 geotectonic framework 498–499, 498
 Phyllite-Quartzite (PQ) unit 498–499, 498
 deformation temperatures 504–506
 displacement and extrusion rate 510–513, 512
 finite strain analysis 506
 finite strain symmetry 504
 interpretation and synthesis 509–510
 kinematic vorticity analysis 508–509, 509
 major fabric elements 499–500
 patterns and shear sense 502–503
 quartz *c*-axis fabrics 500–506
 sampling 500, 501
 stable-orientation analysis 508
 thinning and dip-parallel elongation 510, 511
 vorticity analysis 506–508, 507
- Plattenkalk (PLK) unit 498–499
- Hermit's Gorge 363, 368, 386, 391, 394–395, 406
- Herzssprung–Russell diagram for classification of stars, used as template for orogen classification 92
- heterogeneous deformation 497
- High Himalayan leucogranites (HLL) 294, 296
 final stage of building 302–303
 petrogenesis 294–297, 295
 thermal evolution 309–312, 310, 311
 geological constraints 312–313
 implications for Miocene denudation of Himalaya 323–324
 numerical model 313–315, 313
 numerical model results 315–323
- Himalayan orogen 3
see also Tethyan Himalaya
 flow partitioning 379–381, 403–409
 channel flow models 381
 distribution of flow regimes 402–403
 extrusion models 381–383, 381
 geological background of Everest transect 383–385, 384
 Greater Himalayan Slab 399–400, 400
 lithological, structural and temporal controls 401–402
 petrography 389–399
 vorticity analysis 385–389, 386, 387, 388, 390, 393, 394, 401, 404–408
 geological map 380
 interpreted ages of motion 9, 10–11
 magmatic processes 293–294, 304–305
 compaction 298–300
 final stage of HHL building 302–303
 geological setting 294–297, 295, 296
 melt extraction 297–301
 melt extraction, consequences for crustal flow 304
 shearing 300–301
 timescales of magma cooling 303–304
 regional setting 447
 regional tectonic map 446
 tectonic setting 381
- Himalaya–Tibetan plateau system 2, 14–15, 25
 accretion/rapid denudation models
 focused denudation-induced channel flow 246–247
 focused denudation-induced channel flow, limitations 247
 thrust ramp models 246
 uniqueness of predictions 248
 unresolved features 247–248
 channel flow 256–257
- Channel Flow–Extrusion hypothesis 71, 72, 83
 evolution of ideas 71–78
 Phase I – steady state configuration during Early–Middle Miocene 78–79
 Phase II – second emergent channel established during Middle Miocene–Early Pliocene 79–81
 Phase II – second emergent channel established during Middle Miocene–Early Pliocene 80
 Phase III – intensive extrusion at Himalayan front from Late Pliocene–Recent 81–82
 testing the hypothesis 82–83
 deformed migmatites 26
 geological setting
 background 237–238, 239
 inverted metamorphism 238–240
 paired leucogranite belts 240
 Tibetan rifts 240–241
- Himalaya extruded from beneath Tibet theory 237, 248–249
 timing 259–261, 261
- shallow Tibetan anatexis model
 INDEPTH survey 241
 supporting evidence 241–242, 242
 Zhao and Morgan hypothesis 241
- shallow Tibetan anatexis model,
 critique of 246
 consistency with $^3\text{He}/^4\text{He}$ data 243–244
 consistency with absence of Gangdese zircons 244–245
 consistency with cold southern Tibetan Moho 243
 consistency with geology and geochemistry of Yangbajain rift 244
 crustal thickening explanation 244
 nature of 'bright spots' 243
 representativeness of Yadong–Gulu rift 242–243
 stratigraphy 245–246, 245
- homogeneous deformation
 constant thickness 190–192, 191
 finite 188–190, 189

- Illecillewaet Synclinorium 590
 Indus River 208
 Indus–Tsangpo Suture Zone (ITSZ) 445
 Indus–Yarlung suture 40
 seismic reflectivity 54
 infrastructure zones 221–222, 222, 232–233
 drag folds 229–231, 230
 kinematic vorticity number and strain
 compatibility 224–225, 228–229
 distributed pure shear 228
 extrusive flow 225–227, 226, 227
 volume loss 227–228
 model characterisation and kinematics 222–223
 channel flow 223
 objectives 223–224, 224
 transport flow 223
 strain localization 232
 tectonic models 231
 isochoric plane strain 185–186, 185, 187
- Jiali fault 40, 240, 356
 Jinsha River suture 40, 356
 lithospheric electrical conductivity 50
 Joss Mountain 588
- Kahtang thrust 416, 419–420, 426, 428
 Kailas, Mount 356
 Kampa Dome 446
 Kangmar Dome 40, 446, 473
 geological map 473
 stereographic plot 478
 Kangmar Thrust 360
 Kangshung Valley 395
 Karakax fault 40
 Karakoram Fault 356
 Karakoram Range 208
 Karakoram–Jiali fault system
 seismic anisotropy 52
 Karikhola 362
 Khang Bum 428, 429
 Khumbu glacier 395
 Khumbu Thrust 363, 365
 kinematic inversions 8
 kinematic vorticity 195, 224–225, 228–229
 distributed pure shear 228
 extrusive flow 225–227, 226, 227
 volume loss 227–228
 Kinnaird pluton 570
 Kohistan 208
 Kootenay Arc 562, 563, 590
 Kootenay River 566
 Kun Lun suture 356
 Kunlun fault 40, 356
 lithospheric electrical conductivity 50
 Kunlun Shan
 lithospheric electrical conductivity 50
 Kushma Formation 263
- Ladakh 208
 Ladybird granite 566, 570, 571, 572–573
 Laya 428
 Lesser Himalayan sequence (LHS)
 pressure–temperature diagram 417
 provenance 174–176, 175, 177
 structure 261–263, 263
 Lewis Thrust 562, 563
 Lhasa Terrane 40
 channel flow 59
 lithospheric electrical conductivity 50
 seismic reflectivity 54
 strength–depth profiles 57
 surface-wave velocity models 47
 Lhotse detachment 363, 365, 367, 392, 395
 Lingshi Dzong 428
 Lobuche 362
 Lukla 362, 365
 Lumpola Valley
 seismic anisotropy 52
 Lunpola Basin 356
- Mabja Dome, Tibet 445–447, 465
 apatite fission track analysis 455
 ⁴⁰Ar/³⁹Ar thermochronology 451–456, 455,
 456, 457–458, 460
 cathodoluminescence (CL) images 454
 cross-section 449
 formation 461–464, 462
 geological map 448
 geology
 metamorphic history 450–451
 rock units 447–450
 structural history 450
 Miocene crustal flow 464–465
 regional tectonic map 446
 significance of results 456–461, 459, 461
 U–Pb geochronology 451, 452, 453–454
 Mackie pluton 571
 Main Boundary Thrust (MBT) 40, 360
 Main Central Thrust (MCT) 2, 25, 40, 362, 365
 channel-bounding structures 8, 9, 10–11
 crustal structure 397–399, 398, 399
 exhumation 6
 transport of materials 12
 Main Himalayan Thrust (MHT) 360
 Malashan Dome, Tibet 446, 471–473, 493
 contradictory interpretations 491–492
 general features 491
 geological map 474, 477
 granite bodies 481
 bulk chemistry 485, 487, 488
 Cuocu and Paika granites 485–490, 489, 490
 origins 490–491
 similarity to Kangmar granite 482–485, 484, 486
 implications for channel flow models 492–493
 metasedimentary schists
 D₂ deformation kinematics 476–478, 479, 480
 D₂ structure orientation 476
 deformation stages 473–476, 475
 metamorphic zonation 473
 sedimentary age 478–481, 482
 stereographic plot 478
 tectonic map 472
 Malton Complex
 deformation, metamorphism and age
 constraints 597
 Malton gneiss 590
 Marsyandi River 245, 271

- Masang Kang 428, 429
Mica Creek 590
Milton Belt 519
Monashee Complex 544, 546, 548, 551, 562, 590
 deformation, metamorphism and
 age constraints 597
Monashee Décollement 551
Namche 362, 365
Namche Barwar 40
Nanga Parbat, Mount 40, 208
Nanga Parbat–Haramosh Massif
 crustal extrusion 208–210, 208
Nar valley, central Nepal 269–270, 289
 exposed deformation features 285
 geology
 GHS 272–274
 Tethyan sedimentary sequence 274
 structural constraints 274
 crustal-scale buckling 277–278
 Phu detachment 275–276
 structural evolution 278–279
 structural level-1 274, 276
 structural level-2 275, 276
 structural level-3 277
 timing constraints
 $^{40}\text{Ar}/^{39}\text{Ar}$ thermochronology 279–282, 282
 biotite $^{40}\text{Ar}/^{39}\text{Ar}$ ages 284–285
 hornblende $^{40}\text{Ar}/^{39}\text{Ar}$ ages 282, 283
 muscovite $^{40}\text{Ar}/^{39}\text{Ar}$ ages 282–284
 U–Pb geochronology 279, 280, 281
Nelson batholith 566
Nepal 269–270
 geology of north-central region 270–272, 271
Newton window 519
normal-sense shear zones 439–441
 geometry and kinematics 427–429
 vorticity analysis 431–433, 434, 441
north Himalayan gneiss (NHG) domes 176–179, 360
Northern Rongbuk valley 386, 391, 392, 404, 405
Nuptse 363
Nyainqentanghla (NQTL) massif 240
Nyalam detachment, southern Tibet 351–352
 analytical methods 334–335
 $^{40}\text{Ar}/^{39}\text{Ar}$ thermochronology
 calculated cooling rates and tectonic
 interpretations 345–348
 fault footwall 340–342, 341–342, 349
 fault surface 335–340, 336–337, 343–346,
 347–348, 349
 south-central GHS 342–345, 349
 geological setting and structural
 framework 330, 331
 deformational features 329
 deformational features in footwall 329–331
Nyalam detachment, southern Tibet
 geological setting and structural framework
 tectonic setting 329
 mechanical model 350–351, 351
 sampling characteristics and distribution 331
 detachment fault footwall 331–333, 333–334
 detachment fault surface 331, 332, 333–334
 south-central GMS 334
 timing of detachment 348–350
Oknagan Fault System 544, 551
Oknagan–Eagle River Fault 590
Ominecca Belt 544, 607
 channel flow model 593
 Domain 1 – structures and metamorphism
 595–600
 Domain 1 – timing of deformation 600–601
 Domain 2 – structures and metamorphism
 601–602
 Domain 2 – timing of deformation 602
 Domain 3 – structures and metamorphism
 602–603
 Domain 3 – timing of deformation
 603–604
 Domain 4 604
 general statements 593–595
 overview 597–599
 tectonic interpretations 592
 geological model 606
 granitoid migration 604–605
 consistency with other models 605–606
 origin of Cretaceous granitoids 605
 origin of Middle–Late Jurassic
 granitoids 605
 origin of Palaeocene–Eocene granitoids 605
 shortening 606–607
Paiku Lake 474, 477
Parmon Window 498, 501, 502
 micrographs 505
 quartz *c*-axis fragments 504
 vorticity analysis 507
 kinematic vorticity analysis 509
Paro 428
Passmore Dome 562, 570
Peloponese 498
Phaplu augen gneiss 365
Pheriche 362
Phu detachment 271, 273, 275–276, 277
Pine Mountain window 519
Pinnacles Area 590
 deformation, metamorphism and age
 constraints 598
plateau formation 7
Poiseuille flow 27–33, 28, 41
 velocity profiles 30
Porcupine Creek Anticlinorium 590
progressive deformation
 constant thickness 192–193, 192
Puga 40
pulsed channel flow 415–417, 420–421
 Bhutan data 418–420, 420
Pumori 362
Punaka 428
Purcell Anticlinorium 562, 563, 590
Purcell Thrust 542, 544, 588
Purcell Thrust Fault 551
Qaidam Basin 40, 356
Qaidam Border fault 40
Qiangtang Terrane 40, 240
 channel flow 59
 lithospheric electrical conductivity 50

- seismic reflectivity 54
 strength–depth profiles 57
 surface-wave velocity models 47
 Qomolangma detachment 363, 365, 367, 369,
 392, 395
- Ram Tso 428
 Rayleigh number 314
 Red River fault 356
 Renbu Zedong Thrust 360
 Rocky Mountain Thrust 562
 Rocky Mountain Trench 590
 Rodophu Valley 429
 Rongbuk glacier 395
 Rongbuk Monastery 386, 391, 392–394, 405, 406
 Rongbuk valley 389–395, 391
 Rundle Thrust 562
- Sauratown mountains window 519
 Scrip Nappe 590
 Selkirk allochthon 542, 590
 Selkirk Detachment Fault 546, 551
 Selkirk Fan 590
 deformation, metamorphism and age
 constraints 599
 Selkirk Fan Axis 551, 590
 Selkirk Mountains 546
 Shuswap Metamorphic Complex 590
 Sichuan Basin 40
 Siwalik hills 360
 Slocan Lake Fault 566, 590
 Smith River allochthon 519
 Songpan Ganze 356
 Songpan–Ganzi Terrane 40
 channel flow 59
 lithospheric electrical conductivity 50
 South Tibetan detachment (STD) 2, 25, 310, 351–352,
 360, 365, 367
 analytical methods 334–335
 ⁴⁰Ar/³⁹Ar thermochronology
 calculated cooling rates and tectonic
 interpretations 345–348
 fault footwall 340–342, 341–342, 349
 fault surface 335–340, 336–337, 343–346,
 347–348, 349
 south-central GHS 342–345, 349
 as passive roof fault to extruding channel 366–370
 channel-bounding structures 8, 9, 10–11
 exhumation 6
 geological constraints 312–313
 geological setting and structural framework of
 Nyalam detachment 330, 331
 deformational features 329
 deformational features in footwall 329–331
 tectonic setting 329
 implications for Miocene denudation of Himalaya
 323–324
 kinematic inversions 8
 lithospheric electrical conductivity 50
 mechanical model 350–351, 351
 numerical model 313–315, 313
 numerical model results
 geothermal gradients 319–323, 319, 320, 322
 slip and erosion rates 315–319, 315, 316, 317
 protoliths 12–13
 sampling characteristics and distribution 331
 detachment fault footwall 331–333, 333–334,
 331, 332, 333–334
 south-central GMS 334
 tectonic diagram 328
 thermochronological constraints on cooling and
 exhumation 327–329
 timescales of metamorphism, melting and channel
 flow 370–371, 370
 timing of Nyalam detachment 348–350
 transport of materials 12
 Southern Rocky Mountain Trench 546
- Tamji 428, 429
 Tarmim Basin 40, 356
 Taurides 498
 Taygetos Window 498, 500, 501
 micrographs 505
 quartz *c*-axis fragments 503
 vorticity analysis 507
 kinematic vorticity analysis 509
 Tethyan Himalaya 40
 see also Himalayan orogen
 channel flow 59
 lithospheric electrical conductivity 50
 seismic reflectivity 54
 strength–depth profiles 57
 surface-wave velocity models 47
 Theri Kang 428
 Thimphu 428, 429
 Thor Odin Dome 544, 562, 590
 thrust ramp models 246
 Thyanboche 362
 Tibet, crustal flow 62
 evaluation of existing channel-flow models
 northern/eastern Tibet 61–62
 southern Tibet 60–61
 geophysical data
 data sources 43–44
 geothermal measurements 44–45
 high conductivity zones 49–51, 50
 seismic anisotropy 51–53, 52
 seismic attenuation 48–49
 seismic reflectivity 53–55, 54
 seismic velocity 45–48, 47
 seismicity cut-off 45
 temperature measurements 55–56
 topography and gravity 44
 lateral strain variations, vertical strain and strength
 profiles 39–41
 physical properties inferred from geophysical
 observations
 vertical strength profiles 56–60, 57, 59
 Tibet
 exhumation of Greater Himalayan rock
 255–256, 256, 263–264, 289
 timing of extrusion 259–261, 261
 shallow anatexis model
 INDEPTH survey 241
 supporting evidence 241–242, 242
 Zhao and Morgan hypothesis 241
 shallow anatexis model, critique of 246
 consistency with ³He/⁴He data 243–244

Tibet (*Continued*)

- Shallow anatexis model, critique of (*Continued*)
 - consistency with absence of Gangdese zircons 244–245
 - consistency with cold southern Tibetan Moho 243
 - consistency with geology and geochemistry of Yangbajain rift 244
 - crustal thickening explanation 244
 - nature of ‘bright spots’ 243
 - representativeness of Yadong–Gulu rift 242–243
 - stratigraphy 245–246, 245

Toma La 428, 429

Trail pluton 570

Tso Morari complex 40

Tugaloo terrane 519, 520

Ulug Muztagh 356

- upper-mantle-scale (UMS) modelling 93, 126–128
 - density structure and isostatic compensation 98–99
 - design
 - advantages and limitations 138
 - complexity and tuning 138–139
 - Himalayan–Tibetan (HT) models 140–141
 - model–data comparisons 142–143
 - philosophy of numerical approach 138
 - scaling of laboratory power-law creep flow laws 139–140
 - experiment description 128–129, 128
 - mechanical models 96–98
 - melt-weakening 98
 - parameters 95–96, 97–98, 99

results

- models LHO-LS1 and LHO-LS2 129–134, 130–133

thermal model 99

- velocity boundary conditions and reference frames 93–96

Valhalla Complex 562, 590

- cross-sections 563, 567

- deformation, metamorphism and age constraints 597

- geological map 566

- origin 580

- reconciliation of crystalline thrust sheet model 581–582

- upper margin 572–573

Valkyr shear zone 566, 572–573, 590

Vidler Ridge 590

viscosity 7

viscous channel flow 4

vorticity, kinematic *see* kinematic vorticity

Wagye La 428

- Wing Pond Shear Zone (WPSZ), New Foundland
 - crustal extrusion 210–214, 211, 212, 213

Xianshui-he fault 356

Yangbajain graben 40

- lithospheric electrical conductivity 50

Yarlung Tsangpo suture 360

Zanskar shear zone (ZSZ) 359