Index

Page numbers in **bold** indicate references to the main entry. Please refer to the thematic list for individual entries on major topics (coastal and marine, fluvial, glacial etc.).

'a'ā lava 611–12
a/s index 187
ablation-dominated medial moraines 1027
ablation zone 456
abrasion **1**, 9, 271, 332–3, 870
abrasion ramps **1**
absolute accumulations 298
absolute dating methods 221–4
absolute hypsometric curve 542
abstraction 860
Abu Dhabi sabkha 890, 891
accelerated erosion 336
accelerated sedimentation 940
accelerator mass spectrometry (AMS) 194
accretion **1**, 382–3
accretion rips 855
accretionary wedge 575
accumulation area ratio (AAR) 323
accumulation zone 456
acoustical sands **960–1**
active channel width 780
active dunefields/sand seas 905
active faults **1–3**, 715, 941–2
active folding 943
active layer **3**, 534
active margins **3–5**, 183–4, 201, 338, 701, 731, 793–6
active soil conservation 971–2
active tectonics **714–15**
active transformation 679
active volcanoes 1093
actualism **5**, 120–1
actualistic directional catastrophism 121
adhesion **5**
adhesion ripples 860
adhesion warts 860
advancing coasts 167
advection 618
aeolation **5–6**
aeolian dunes 97, **285–91**, 295
aeolian geomorphology **6–8**, 249, 250–1, 429
aeolian processes **8–11**, 828, 978
  extraterrestrial geomorphology 356
  glaciaeolian processes **444–5**
  loess 7, 11, 303, **626–8**, 762
  nivęo-aeolian processes **720–1**
  sediment transport and beach–dune interaction **69–70**
aeolianite **11–12**
aerial photography 844
aerosol index (AI) 302
Agassiz, Louis 121, 432
aggradation **12–13**
  aggradational fans 16, 17, 18
  punctuated **817–18**
aggregates 329–30
agriculture 526
  desertification 256–7
  precision agriculture 488
  soil conservation 973–4
  tillage erosion 975–6, 978
Ahnert, Frank 421
aiguilles 417
airport sites 1087
alases **13**, 1049–50
alcoves (apses) 31
alcrete 300
Aleutian Arc 575, 576
algae 1109, 1110
  boring **90–1**
algal reefs 835
aligned drainage **13–14**
allochthonous blockfields 88
allochthonous saltmarsh systems 899
allogenic recharge 588
allometry **14–15**
alluvial channels 19–20, 21–2, 133–9
alluvial fans **15–19**, 20, 362, 873, 1051, 1084

alluvial meanders 1090
see also meandering
alluvium 19–21, 978
altiplanation *see* cryoplanation
aluminium hydroxide, hydrated 535
alveoli 128
Amazon basin 146
Amazon Delta 863, 865
American fall line 362
amphitheatres 21
anabranching rivers 21–5, 99, 137, 138
anaclinal slopes 120
anastomosing rivers 21–5, 99, 137, 138, 655
ancestral channels 745, 752–3, 809–10
Andes 4
animals 1122–3
annual frost creep 984–5
antecedent moisture content 738–9
antecedent rivers 280, 398
anthropogeomorphology 25–7
anti-dip streams 399, 400
anticlines 398, 399, 400, 401
salt anticlines 893
antidunes 19, 27–8, 77, 995
antithetic faults 362
apatite 372–3, 1083–4
apparent polar wander (APW) path 1117
applied geomorphology 28–31, 390
loess 628
mountains 702
periglacial 775–6
roles of applied geomorphologist 29–30
applied stress model 632
apposition beaches 951
apron pediments 769
aquicludes 497
aquifers 497
aquitards 497
aragonite 74
speleothems 990–1
arches, natural 31
arcs, island 575–7, 794–5
area-slope relationship 698
area vulnerability 319–20
arenization 815
arêtes 31, 156, 447
argon-argon dating 223
armchair cirques 154, 155, 157
armour, fluvial 389–90
armoured mud balls 31–2
armouring 32, 79, 494–5
Arnhemland Escarpment 339–40
arroyos 26, 32–4, 481, 503
artesian springs 994
artificial canals 937
artificial coastlines 168
artificial embankments 386
artificial reefs 834–5
ash fall deposits 1094
ash-flow tuffs (ignimbrites) 818, 820, 1094
aspect 34–6, 38–9, 437
aspect ratio
channels 100, 101, 656
pyroclastic flow deposits 819
astroblemes 36–8
asymmetric folds 398, 399
asymmetric valleys 35–6, 38–9
asymmetry factor (AF) 1036
at-a-station hydraulic geometry 536, 537
Atlantic coasts 165–6
atolls 39–41, 189, 506
microatolls 670–1
attractors 142, 176, 722
strange attractors 142, 322
attribute (descriptor) data 441
attrition 332, 333
aulacogens 850
autochthonous blockfields 87–8
autochthonous saltmarsh systems 899
autogenic recharge 588
avalanche boulder tongues 41, 42, 43
avalanches
avalanche paths 41, 42
rock avalanches 155–6, 645, 652, 1009
snow avalanches 41–4
averaging time 193–4
avulsion 20, 44

backarc basins 575, 576
backshore 63
bacteria 253, 1109, 1110
badlands 45–8, 513
Bagnold, Ralph Alger 249, 307
Bagnold equation 979–80
bajadas 17, 48
ballistic ripples 860
bank-attached compound bars 57–8
bank erosion 48–52
bank protection 140, 385
bankfull discharge 52–4, 743, 744
bankfull stage 52
bar-built estuaries 342
barchans 58–9, 296, 297
barnacles, boring 91
Barreiras Formation 232
barrier islands 59–62, 953, 954
barrier reefs 189
barriers 59–62, 994
overwashing 739–40
Barringer Crater (Meteor Crater) 197
bars
coastal 54–6, 60, 63, 953, 954, 1107
point bars 57, 800–1
river 19, 53, 56–8, 99, 800–1
river confluences and junctions 182
basal ice 547

basal tafoni 128
base flow 821
base level 62
river capture 860–1
baselevel poljes 591, 592
basin length 697
beach cusps 64, 67–8, 176
beach nourishment 71–2
beach ridges 72–3, 827
chenier ridges 153, 951–4
overwashing 61, 739–40
beach rock 73–4, 131
beaches 62–7
beach–dune interaction 68–71
Bruun Rule 27, 103–6, 483, 1061
equilibrium shoreline 324–5
estuaries 343–4
log spiral beaches 628–9
mobility 69
raised beaches 827–9
rip currents 55, 64–5, 208–10, 855–7
sediment budgets 930
sediment transport 74–6
types of 63–7
width 69
bears 1122
beavers 1122–3
bed return flow 66
bed shear stress 1105
bedforms 76–9
antidunes 27–8
gravel-bed rivers 495
sand-bed rivers 901
scablands 913
subglacial 473–4
weathering-limited and transport-limited 1114
bedload 74, 79–81, 271, 901, 934, 1029
alluvial channels 138
fluvial erosion quantification 390–1
longshore drift 630–1
mobile beds 685–6
bedrock channels 81–2, 116
anabranching 22
rapids 829–30
valley meanders 1077, 1078, 1090
bedrock core bars 58
bedrock erosion marks (s-forms) 460–2
beheaded valleys 83
bends 363
bergschrunds 83, 155, 457
Bertalanffy, Ludwig von 1031
beryllium 554
Beschel, Roland 618–19
bicarbonate 148
bifurcation ratio 371, 531
bifurcation theory 120
biodiversity 418
bioerosion 84, 727
biofilms 84, 86, 728
biogeomorphology 83–6
bioherms 835
biokarst 86–7, 587, 729
biological (organic) weathering 659, 727–30, 1108, 1109, 1110
bioprotection 728
biostromes 835
biota 134
biotic diversity 862
bivalves, boring 91
black-box (statistical) models 170, 687
black smokers 926, 1093
Blackhawk landslide, California 389
blanket mires 682–3
bleaching, coral 190, 312, 482
blind valleys 87, 590
blisters, icing 560
block-and-ash flow deposits 818
block slides 646–7
blockfields 87–9
blocks 1094
ploughing blocks and boulders 796–7
blockstreams 87–9
blowholes 89
blowouts 292–3
blue holes 89, 132–3
Blue Ridge Escarpment 339
bogs 682–3, 683–4
see also mires
boilers (cup reefs) 1091–2
Bølling-Allerød interstadial 554
bolsons 89–90
bombs 1094
Bond cycles 554
border poljes 591, 592
bores
flash flood 377–8
surf 1104
boring organisms 90–2
bornhardts 92–3, 564, 1064
boulder inselbergs 564
boulder pavements 93–4
boulder tongues, avalanche 41, 42, 43
boulders, ploughing blocks and 796–7
boundary conditions 661
boundary layers 74, 94–7
boundary layer stresses 1105
boundary Reynolds number 95
bounding surfaces 97
Bowen's reaction series 97–8, 485
box valleys 98
braided rivers 19–20, 22, 23, 98–101, 137, 902
breached anticlines 398
breakers, types of 1104
Bretz, J.H. 122, 913
bridges, natural 31, 708
brousse tigrée 102–3, 766

Bruun Rule 27, **103–6**, 483, 1061
Bubnoff unit **106**, 832, 935
Buckingham Pi Theorem 653
Buckland, William 121, 431
buckling 361
Büdel, Julius 163, 420, 433, 694
bulging, valley **115–16**
buried etchplain 345
buried gorges 487
buried karst 754
buried palaeosols 983
buried valleys **106**
Burnet, Thomas 430
bursting process 96
Butler, B.E. 808–9
buttes **106–7**, 116

calanques **108**
calcite 74, 109, 240
  speleothems 510, 990–1
calcium carbonate 73, 108, 109, **110**
  tufas and travertines **1071–3**
calcrete **108–11**, 298, 299, 300
  see also caliche
calderas **111–13**, 197, 1096
caliche **113–14**
  see also calcrete
calving glaciers **114–15**, 233, 784
cambering **115–16**
cannibalization 993
canyons **116**
  submarine 1017, 1019–20
capable faults **1–3**
capacity load 934
caprocks **116–18**
  caprock waterfalls **1100**
capture, river **860–1**, 1040
carbon dioxide 264, 478
carbonates, dissolution of 264–5
carbonation **1110**
carbonic acid 264–5
Caribbean Arc 575, 576
Carpenter, Nathanael 430
Cascade Ranges 4
case hardening **118–19**, 129, 589, 908
castellated inselbergs 564
casts, ice wedge 559
cataclasis **119**
cataclinal slopes **119–20**
catastrophism **120–2**, 709, 1080
catchment experiments 353
catchments *see* drainage basins
catenas **122–4**, 982
cauldron subsidence 855
causal linkages 424
cave pearls 991
cavernous weathering **128–30**
  honeycomb weathering 128, 530
  tafoni 119, **128–9**, 1034–5
caves **124–8**, 1023
  gypsum 510, 511
  karst 124–7, 588–91
  speleothems 510, 511, 589, **990–2**
cavitation **130**, 331
cays **130–2**
cellular models 724, 944
cementation 625–6
cenotes **132–3**, 269, 591
Changjiang (Yangtze) Delta 863, 864
channel networks
  channel network evolution model 275
  channel network width function 698
  drainage basins **272–7**
  drainage density **277–9**
  drainage pattern **279–81**
channel segments *see* anabranching rivers
Channeled Scabland 664, 744, 751, 913–14
channelization **139–42**, 1085, 1086
channels
  alluvial 19–20, 21–2, 133–9
  aspect ratio 100, 101, 656
  bankfull discharge 52–4, 743, 744
  bedrock *see* bedrock channels
  channel patterns 137–8, 400, **401**, 781
  confluences 99, **180–3**, 613
  cut-and-fill **212–13**
  dynamic equilibrium 134
  extraterrestrial geomorphology 356–7
  fluviogeomorphology **392–8**
  GIS and studies of 443
  gradients **133–4**
  heads 186, 513–14
  headward erosion **513–15**, 861
  hillslope-channel coupling **515–16**, 608
  hydraulic geometry *see* hydraulic geometry
  impact of dams 218–19, 781
  palaeochannels *see* palaeochannels
  pools and riffles 212, **801–3**
  roughness of channel bed **884**
  stability in forested watersheds 402–4
  stream power 82, **1002–4**
  supraglacial 1026–7
  uniclinal shifting **1079–80**
  yazoos **1121**
chaos and chaos theory 100–1, **142–3**, 176, 722
characteristic forms 964
characteristic time (landform lifetime) 838, 839
Charpentier, Jean de 432
check dams 385
chelation **143–4**, 150–1, 1110
cheluviation **143–4**
chemical denudation **144–8**, 240–1, 243
  see also chemical weathering
chemical deposits 510
chemical weathering 144, **148–53**, **1109–10**
  cavernous weathering 128–9
  climate change and **1112–13**
  Goldich weathering series **485–6**
  processes **148–51**
  products 151
  salt and 895–7
  solute load and rating curve **988–90**
  weathering rinds **853–5**
  see also under individual processes
chemical weathering indices **1110–11**
chenier ridges (cheniers) **153**, 951–4
chevron crevasses 458
Chézy equation 884
chickenwire structure 888, 889
Chicxulub structure 37
Chinese loess plateau 7
Chorley, Richard J. 433, 1031, 1032
chronofunctions **154**
chronosequences **153–4**, 1043
Chuja Valley 744
chute channels 57–8, 667
chute cutoffs 740
cinder (scoria) cones 1095–6
cirque glaciers 454, 455
cirques, glacial **154–8**, 447
clasts 259
clay-with-flint **159**
clays
  overconsolidated **735–6**
  quickclays **821–2**
  subsidence 1021–3
clearcutting 403
clearwater releases 218
cliffs
  coastal **159–62**, 1106
  recession 161–2
  sandstone 906–7
climate 713
  chemical denudation 146–7
  coastal classification based on 166
  El Niño effects **311–14**, 348
  and erosion 334–5
  erosion, tectonic processes and 841–2
  global climate change *see* global warming
  gypsum karst 510
  hillslope processes 526
  influences on drainage basins 275–6
  inselbergs and 566
  megafloods and climate change 465
  orbitally forced climate change 551–4
  palaeoclimate **746–8**
  weathering and climate change **1112–13**
climatic geomorphology **162–4**, 334, 492, 694, 843, 1063–4
climato-genetic geomorphology **164–5**, 696
  climato-genetic model of geomorphic evolution 420
  relief generations **842–3**
climato-morphogenetic regions 694
climax avalanches 42
climbing dunes 286, 288
clints 579, 589, 621–2
clitter 1055
closed systems 1031, 1032
coarse sediment transport studies 1057, 1058
coarse woody debris (CWD) 395
Coast Ranges 4
coastal barriers **59–62**, 739–40, 994
coastal bars **54–6**, 60, 63, 953, 954, 1107
coastal cliffs **159–62**, 1106
coastal dunes 171, **291–5**, 295, 344
coastal geomorphology **168–72**, 429, 632
coastal lagoons **597**
coastal management 170–2
  integrated **567–70**
coastal notches 725, 1092, 1106
coastal plains 763, 764
coastal ramps **829**
coastal sabkhas 887–90, 891
coastlines and coasts
  Bruun Rule 27, **103–6**, 483, 1061
  classification **165–8**, 169
  coastal processes **166**, 169
  equilibrium shoreline **324–5**
  estuary shoreline environments 343–4
  fjords 342, **374–6**, 447, 1017
  geomorphological response to waves 1106–7
  global warming 482–4
  managed retreat **638–9**
  muddy coasts **704–6**
  rias 847
  sediment cells **931–2**
  shingle coasts **950–6**
  shoreline reconstructions **924**
  skerries **962**
  see also beaches
cohesion **172–3**, 330
  cohesive banks 49
  cohesive coasts 1106
collapse dolines 267, 268, 269–70, 590
collapsing soils 1024
collisions, crustal 794–5
colluvium **173**, 977–8, 1035
Columbia River 23–4
columns 991
comminution **173**
Commonwealth Scientific and Industrial Research Organisation (CSIRO) 602–3
compaction of soil **174–5**, 973–4
comparative planetary geomorphology 478–9
complex craters 197
complex etchplains 345
complex mass movements 645, 652

complex response 175–6, 178, 219, 470
complexity 100–1, 176–8, 405, 418, 437, 722
composite coastal classifications 167–8
composite cones 1096
composite (multi-event) scarps 363
compound allometry 14
compound bars 57
computational fluid dynamics (CFD) 179–80, 388
computational methods 434
  see also digital elevation models; geographic information systems
concave slopes 518
concavity index 81
conceptual models 686–7, 964, 967
conchoidal fractures 180
concrete 896
conditioners, soil 974
cone karst 591
cone sheets 855
confined aquifers 497
confined braiding 99
confluences 99, 180–3, 613
consequent streams 279–80
conservation laws 660
constitutive equations 660–1
constructed rasas 830
constructional deformation 473
constructive and destructive action 429–30
continental–continental crustal collisions 731, 795
continental drift 792–3
continental–oceanic crustal collisions 794–5
continental shelves 183–5
continental slopes 1018
Continental Terminal 232
continuity of mass equation 688
continuous creep 974–5, 977
continuum mechanics 659–62
contour farming 973
contributing areas 185–8, 697
controlled colluviation 973
controlled moraines 557
convex slopes 518, 976
cooling joints 579
Coon Creek watershed 928
Coon Creek wildfire 368–9
coral reefs 188–90, 476, 482–3
  atolls 39–41, 189, 506
  cays 130–2
  fringing reefs 189, 410–12
corals 670–1
core softening 118, 119
corestones 579
Coriolis force 613
corniches 191
corries *see* cirques, glacial
corrosion 191–2, 332, 333
corrosion plains 592
cosmogenic dating 192–4, 221
coulees 195, 611
Coulomb, Charles A. de 359, 661
covered pediments 769
covered runways (sheetings) 1038
coversands 195–6
cracks and polygons, desiccation 257–8, 766
crater lakes 1093
craters 111, 196–9, 355
cratons 199–200
creeks, tidal 1052
creep 10, 226
  soil creep 635, 974–7
  talus creep 916
crescentic (sinuous) bars 54–6
crescentic dunes 286, 287, 296, 297
crevasse-fill ridges 463, 464
crevasse splays 20
crevasses 457–8
critical packing porosity 822
critical power 1003
crop residue management systems 974
cross-barrier beaches 61
cross profiles, valley 200–1
cross-shore sediment transport 75
crossdating 238–9
crust
  crustal deformations 201–3
  cymatogeny 215–16, 420
  generation and seafloor spreading 925–7
  neotectonics 713–18
  see also plate tectonics
crusting of soil 203–4
cryogenic weathering 413
cryopediments 204
cryoplanation 204–5, 719, 775, 789
cryosphere 546
cryostatic pressure 205, 416
cryoturbation 412
cryptodomes 611
cryptokarst 205
cryptovolcanic (cryptoexplosion) structures 36
cryptovolcanoes 205–6
crystallization 626, 894–5
cuestas 116, 206–7, 399, 400, 1008
Culmann formula for planar failure 50
cultivation *see* agriculture
cultural eutrophication 601
culverts 140
cumulative area distribution function 698
cup reefs (boilers) 1091–2
current ripples 859
currents 207–11
  rip currents 55, 64–5, 208–10, 855–7
  tidal currents 210, 1103
curvature 437, 517, 518, 976
cuspate forelands 211–12, 954

cusps, beach 64, 67–8, 176
cut-and-fill 212–13
cutoffs, meander 20, 740
Cuvier, Georges 120, 121
cycle of erosion (geographical cycle) 213–14, 328, 333, 392, 402, 420, 476, 539, 653, 687, 837, 982
  and denudation chronology 245
  development of geomorphology 432–3
  slope evolution 963–4
  time 215
cyclic time 214–15, 309, 689
cyclones 313, 482
cyclothems (cyclic sediments) 920, 921, 922
cymatogeny 215–16, 420

daily water discharge 780
dambos 220
damburst floods 379
dams 217–20, 385, 781
  glacier dams and ice dams 555
  landslide dams 607, 608–9
Dansgaard-Oeschger events 234, 554
Darcy-Weisbach equation 738, 884
Darwin, Charles 39–40, 84, 189, 328, 476, 831
Darwin Point 506–7
dating methods 12, 221–4, 434, 838
  cosmogenic 192–4
  lichenometry 618–20
  luminescence dating 7, 223
  sea level changes 920–1
  (U-Th)/He analysis 372–3, 1083–4
Davis, William Morris 162, 250, 306, 489, 686–7, 781, 861, 967
  cycle of erosion 213–14, 215, 245, 328, 333, 392, 402, 420, 432–3, 476, 539, 653, 837, 963–4, 982
  drainage networks 279
  escarpments 338
dayas 224
daylighting 1004
De Geer moraines 463, 692
dead-ice tectonics 472
dead-ice topography *see* ice stagnation topography
Death Valley 851–2
debris
  angle of repose 846
  mass movements 645, 647–8, 649–50, 650–1
  scree 882, 915–17
  supraglacial 1027
debris fans 160
debris flows 15, 225, 650–1, 1051, 1114
  fluidization 388–9
debris slides 360, 647–8
debris spreading 649–50
debris tails 42, 43
debris torrents 225–6
decollements 226
deductive inference 751
deep-sea bedforms 78
deep-seated gravitational slope deformations (DGSDs) 226–8
deep-time problem 690
deep weathering 228–33, 346–7, 1111–12
deflation 9, 233, 332
deforestation 257
deformable wedge deformation 471, 472
deformation structures 473, 474
deformation till 473
deglaciation 233–7
dells 237–8, 522
delta kames 453, 464
delta moraines 453
deltas
  glacideltaic (glaciodeltaic) processes and forms 452–4, 466
  inland deltas 563
  river deltas 20, 563, 862–6, 1017
  tidal deltas 1052–4
demoiselles 238
dendrochronology 238–9
dendrogeomorphology 84, 239–40
denivation 720
density-induced currents 211
denudation 240–4, 331, 478, 1082
  chemical 144–8, 240–1, 243
  data on denudation rates 477
  denudational mountain forms 701
  fission track analysis 372–4
  Richter denudation slopes 847–8, 881
  (U-Th)/He analysis 1083
  see also erosion
denudation chronology 215, 244–8, 476
denudational escarpments 337–8
denudational unloading 1082
depletion zone (failure zone) 605–6, 607
depth-integrating samplers 1029
deposition 430, 478, 749
  aeolian 11
  alluvium 19
  dust 302–3
  glacial 106, 445–7
  grounding-line depositional systems 467–8
  meltwater 462–5
  river deltas 864–5
  snow avalanches 42–3
  subglacial depositional landforms 1013–14
  urban depositional landforms 1087
depositional terraces 1039, 1040, 1041
depression storage 737
depth sounding 213
depth of zero amplitude 777
derivative maps 1045–6
Descartes, René 121
desert geomorphology 248–51

desert loess 626–7
desert margins 481–2
desert rose 507, 508
desert varnish 251–4, 870–1, 872
desertification 254–7
  rocky 883–4
desiccation 625
  cracks and polygons 257–8, 766
design floods 140
Desmarest, Nicolas 431
destructive and constructive action 429–30
detachment faults 926
deterministic models 170, 688
dew ponds 258
diagenesis 258, 625
diamagnetic materials 676
diamictite 259
diapirs 259
  salt related 893
diastrophism 259–60
diatremes 197, 260
Diego Garcia Atoll 40
differential GPS (DGPS) 488
diffusion 618
diffusive processes 975–6
diffusivity 525–6
digital elevation models (DEMs) 48, 143, 260–3, 435, 697, 845, 1036
  GIS and 441–2
  hillslope form analysis 519–20
diluvialism 263, 431
dimensionless fall velocity 64
dimictic lakes 601
dip-slip faults 202, 362
dip streams 399, 400
direct action avalanches 41–2
directionalism 120–1
discharge reconstruction 743–6
discontinous permafrost 777–8
dispersion 938
dissectional fans 16, 17, 18
dissipative beaches 65–6, 68–9, 70, 324
dissipative systems 120, 690, 722
dissolution 263–5, 460, 587, 815–16, 1110
  see also chemical erosion; corrosion
distance area diagram 698
diurnal frost creep 984–5
divergent erosion 265–6
diversion canals 386
diversion channels 140, 386
DOCPROBE model 50
dolines 266–70, 589–91, 1023, 1025
dome-collapse avalanche deposits 818
domed inselbergs 564, 565
domes 850, 1008
  ice 454, 547–8
  lava 611
  mantle plumes and 641, 642
  pediment domes 769
  sandstone 907
dominant discharge 134–7
dongas 270–1
downstream fining 271–2, 901
downstream hydraulic geometry 536, 537–8
draas (megadunes) 272
drainage
  aligned 13–14
  folds and 398–400
  rift valleys and rifting 851
drainage area 697
drainage basins 272–7, 279, 281, 540
  asymmetry factor 1036
  contributing areas 185–8, 697
  corrosion rates 192
  development and evolution 274–5
  evolution models 421–2
  geologic and climatic influences 275–6
  morphometric properties 696–8
  organization 273–4
  relief and 840–1
  sediment budgets 927, 928–30
  watersheds 1101
drainage density 274, 277–9, 533, 698, 1001
  slope evolution 967–8
drainage networks 273–6, 279, 394
  Horton's Laws 274, 531–4, 613–14, 1001
drainage patterns 279–81
drained failures 361
Drakensberg Escarpment-Natal Coast area 246, 247
drapes 259, 281–2
dredging 141
drift-aligned beaches 325
drift ice deposits 545
drip simulation systems 826
dripstones 991
dropout dolines 268, 269, 270, 1023
drowned atolls 506
drowned coral reefs 188
drowned river valley estuaries 342
drumlins 282–4, 461, 462, 463, 474
dry ravel 369
dry sand flows 651–2
dry sapping 499
dry snow avalanches 42
dry-snow line 456
dry valleys 284–5
Du Toit, Alexander 793
dump (meltout) moraines 693
dune memory 296
dune mobility 295–7
dunefields 285, 902–5
  transgressive 294
dunes
  aeolian 97, 285–91, 295
  barchans 58–9, 296, 297

  beach–dune interaction 68–71
  beach nourishment 72
  bedform 19, 76, 77
  coastal 171, 291–5, 295, 344
  draas 272
  fluvial 295
  interdune areas 570–2
  snow 297
  variety in sand seas 904
Dungeness-type cuspate forelands 212
duricrusts 298–301, 836, 1111–12
  calcrete 108–11, 298, 299, 300
  ferricrete 298, 299, 300, 365–7
  gypcrete 507–9
  silcrete 298, 299, 300, 959–60
Dust Bowl 972
dust storms 301–4
dye tracing 304–5
dyke (dike) swarms 305
dynamic allometry 14
dynamic equilibrium 134, 305–7, 326, 963, 964, 979, 1005
dynamic geomorphology 307–10

Earth cliffs 159
Earth pinnacles 876
Earth Summit 568, 569
earthquakes 794, 795, 796
  reservoir-induced 217
  seismotectonic geomorphology 941–3
  tsunamis caused by 1070
East African Rift 849, 850, 851
ebb-tidal deltas 1052–3
echinoderms, boring 91
Echinometra lucunter 91
ecology 395
  biogeomorphology 83–6
  foredune ecology 70
effective events 405
effective stress 174, 311, 359–60
effusive eruptions 609, 1094
  see also lava
El Niño effects 311–14, 348
elbow of capture 861
electromagnetic spectrum 845
electron spin resonance (ESR) dating 224
element (factual) maps 1045–6
'elephant skin' 908
elevation surface 697
Elm rockslide, Switzerland 389
eluviation 143, 314–15
eluvium 314–15
embankments (levees) 20, 140, 383, 617–18
embayment beach-ridge plains 951
emerged fringing reefs 411–12
emergence, coasts formed by 166
emergent complexity 722
Empingham Reservoir 115–16
end moraines 464–5, 693
end of summer snowline (EOSS) 323
endogenic and exogenic forces 429
endokarst 315–16
endolithic algae 90–1
endoreic drainage patterns 279
energetics model 75, 631–2
energy dispersive spectrometry (EDS) 914
energy dissipation 1104
engineering 85
  channelization 139–42, 1085, 1086
engineering geomorphology 28, 316–18
englacial meltwater channels 666
enhancement 867
entrainment 329
  aeolian 9–10
  fluid entrainment processes 49
  principle of selective entrainment 562
  threshold 897–8
  see also initiation of motion
entrenched meanders 1090
environmental change 1042–3
  global warming *see* global warming
environmental geomorphology 318–20
environmentally driven directional catastrophism 121
environmentally driven steady-state catastrophism 121
eogenetic coastal caves 124–6
epeirogeny 320
epigenetic ice wedges 558
epikarst (subcutaneous zone) 205, 320–1, 589, 1010
epilimnion 600
episodic stratigraphic accumulation hypothesis 817–18
episodicity 635
equality of action 325–6
equifinality 321–3, 690
equilibrium
  dynamic 134, 305–7, 326, 963, 964, 979, 1005
  equilibrium line altitude (ELA) 323, 643
  equilibrium line of glaciers 323, 456
  equilibrium profile 1106–7
  punctuated 710
  thermodynamic 722
equilibrium shoreline 324–5
equilibrium slopes 325–7
ergodic hypothesis 275, 327–9
ergs 285, 902
  see also dunefields; sand seas
erodibility 329–31, 824, 980–1

erosion 331–6, 430
agents and processes 331–3
bank erosion 48–52
beach–dune interaction 70
bioerosion 84, 727
cavitation 130, 331
climate, tectonics and 841–2
cycle of *see* cycle of erosion
desertification 255
divergent 265–6
equilibria between hillslope erosion and sediment yield 832–3
factors 333–6
fine sediment tracing studies 1058–9
fluvial *see* fluvial erosion
fluviothermal 1050
glacial 155–6, 200–1, 447–8, 789–90
and gullies 503–5
headward erosion 513–15, 861
measurement using erosion rate studies 193–4
meltwater 460–2
micro-erosion meter 192, 669–70, 957
orogenesis 732–3
palaeostage indicators 749
peat 766–8
raindrop impact, splash and wash 823–6
and sedimentation 939–41
seepage erosion 498
sheet erosion 947–9, 977
snow avalanches 42–3
soil *see* soil erosion
subglacial erosional landforms 1011–13
tunnel erosion 786, 1073–4
volcanoes 1096
waterfalls 1100
by waves 1106
erosion front 1061
erosion pins 48, 980
erosion productivity impact calculator (EPIC) 979
erosion rips 855
erosional terraces 1039, 1040–2
erosional unloading 1082
erosivity 336, 980–1, 1081
erratics 337
eruption styles 1094–5
escarpments *see* scarps
eskers 340–1, 464, 667
established foredunes 292
estavelles 994
estuaries 77, 341–4
etching 345–7, 499
etchplains 231, 345–7, 789, 842–3, 1064, 1065
etchplanation 345–7, 789
ettringite 896
Eulerian streaming 207
EUROSEM (European soil loss erosion model) 979, 1082
eustasy 246, 347–9, 917, 922–3
evaporites
salt karst 892
salt related landforms 893–4
event flow (quick flow) 821
event time models 689
events 635
formative 404–5
evorsion 333, 349
excavational deformation 473
excentrics 991
excess strength 969
exfoliation 349, 657, 1109
see also sheeting; spheroidal weathering
exhumed landforms 349–50
exhumed etchplain 345
exhumed palaeosols 983
exogenic and endogenic forces 429
exoreic drainage patterns 279
expansion 657–9, 895
material in voids 658–9
rocks and minerals 657
expansive soil 350–1
experimental geomorphology 275, 351–3
experimental (hardware) models 687
explosive eruptions 609, 1094
see also pyroclastic flow deposits
exsurgences 994
externalism 120–1
extracellular polymeric substances (EPS) 705
extraction, landforms of 1085–7
extraterrestrial geomorphology 353–8, 477
extrinsic thresholds 134, 1051

fabric analysis 359
factor of safety 359–60, 361, 668, 969
failure 360–1, 906–7
failure zone (depletion zone) 605–6, 607
fall line 361–2
fall sorting 916
falling dunes 286, 288
falls 644–5
rockfalls 155–6, 882, 915–16
fan boulder tongues 41, 42, 43
fan deltas 20
fanglomerates 362
fanhead trenches 16, 17, 18
fans 61
alluvial 15–19, 20, 362, 873, 1051, 1084
debris 160
megafans 662
outwash fans 464–5
fast-responding landforms 605
fault-line scarps 363
fault scarps 362–4, 942

faults 362–4
active 1–3, 715, 941–2
beheaded valleys 83
capable 1–3
crustal deformation 201–2
detachment faults 926
seismotectonic geomorphology 941–3
transcurrent 363, 795
transform 363, 795–6
fech-fech 364
feldspar 97, 98
Fennoscandian Shield 561
fens 683–4
ferrallitization 364–5
ferricrete 298, 299, 300, 365–7
ferromagnetic materials 676
fetch 69
field mapping 427–8
fill-cut (fill-strath) terraces 1041–2
fillways 386
filtering weirs 385
fine sediment transport studies 1057, 1058, 1058–9
fining, downstream 271–2, 901
fire 367–70
fire–flood sequence 370
firn 456, 547
first-order streams 274, 370–2
first-order stress provinces 715
fission track analysis (FTA) 223, 372–4
fissure eruptions 1095
fissure-weirs 385
fjards 447
fjords 342, 374–6, 447, 1017
flaking *see* spalling
flank margin caves 124–6
flash floods 376–8
flat irons 378
Flint's law 81
flocculation 704
flood attenuation basins 385–6
flood power 1003
flood-tidal deltas 1052–3
floodouts 380–1
floodplains 20, 52, 53, 381, 381–4, 394, 858
floods 378–80
control of 140, 141, 379, 385–6
dams and 217–18
fire-flood sequence 370
flash floods 376–8
flood-frequency analysis 750
megafloods and climate change 465
outburst floods 460, 555, 666, 734–5, 744–5
palaeofloods 396, 540, 748–50
flow direction field 697
flow regulation systems 384–7
flow resistance 884
flow separation 94, 95, 181, 182
flow slides 652
flow stagnation 180, 181
flow strength 76, 77
flow-till 445
flow velocity 134–7
flow visualization 387–8
flows
debris *see* debris flows
hyperconcentrated 369, 542
mass movement 645, 650–2
flowstone sheets 991
fluid dynamics/mechanics 660–1
blowouts 293
boundary layers *see* boundary layers
CFD 179–80, 388
confluences 180–2
Reynolds number 100, 847, 1051
fluid entrainment processes 49
fluid threshold 9–10
fluid upwelling 181, 182
fluidization 388–9
fluorescent dyes 304
flutings 462
fluvial armour 389–90
fluvial dunes 295
fluvial erosion 200–1
quantification 390–2
fluvial geomorphology 392–8, 407, 429
fluvial palaeohydrology 752–3
fluvial processes, extraterrestrial 356–7
fluvial relief 840
fluvial systems
components of 394–5
fire and 369
maximum flow efficiency 136, 617, 654–5
fluvialism 431
fluviokarst 587
fluviothermal erosion 1050
fold-limb (monoclinal) scarps 363
folds and folding 202–3, 398–401, 574
active folding 943
foliation structures 458
Forbes bands 458
force, and resistance 401
foredune plains 292
foredunes 69–70, 286, 291–2
foreland only deformation 472
forest geomorphology 401–4
forests, submerged 1021
form drag 9
formative events 404–5
forward modelling 451, 689
four state model 127
fractals 100, 177, 274, 405–8
fractal dimension (D) 406
fractures
conchoidal 180
fracture-guided network caves 126

fragipans 408
free braiding 99
freeze–thaw cycles 83, 408–10, 413
  solifluction 984–7
freezing
  duration 409–10
  rates of 410
frequency
  magnitude-frequency concept 635–8, 710
  stream frequency 533
fringing (pocket) beaches 951, 952
fringing reefs 189, 410–12
frontal moraines 693
frost 412–15
frost creep 797
  solifluction 984–7
frost heave 415–16, 797
frost weathering 412–15, 658, 879, 1109
frost wedging 412
Froude number 27, 1051
fumaroles 1093
functional mountain geomorphology 701–2
fungi, boring 91
funnel calderas 111
funnel-shaped valley heads 522, 523

Ganges-Brahmaputra Delta 863
gas hydrate dissociation 1016, 1018
Geikie, Archibald 831
gelifluction 797, 984
gelivation *see* frost weathering
gendarmes 156, 417
general circulation models (GCMs) 482
general geomorphometry 435–7
general systems theory (GST) 1031
generations, relief 164–5, 561, 842–3
geocryology 416, 417, 775
geodiversity 417–18, 440
geoecology 84
geographic information systems (GIS) 441–4, 519–20, 521, 604
geographical cycle *see* cycle of erosion
geoindicators 418–20
geology
  coastal classification 167
  geological properties 875
  influences on drainage basins 275–6
geomagnetic reversal chronology 920–2
geomorphic evolution 420–2
geomorphic markers 1037
geomorphic surfaces 983
geomorphic thresholds 134, 379, 635, 1051–2
geomorphic transport laws 688–9
geomorphological hazards 29, 30, 423–7
  caldera-forming eruptions 113
  dust storms 303
  environmental geomorphology 318–20
  fire 369–70
  hazard mitigation strategies 425–6
  hazard paradigms 424
  landslide dams 608
  submarine landslides 1018–19
geomorphological laws 612–14
geomorphological mapping 427–8, 488–9, 1084
  engineering geomorphological mapping 316–18
geomorphological resources 318–19
geomorphology 428–35, 540
  definition and scope 428–9
  early historical development 430–2
  future directions 434
  major themes and concepts 429–30
  phases in the twentieth century 432–4
geomorphometry 435–9, 696
geophysical relief 840
geos 579
geosites 440
geotextiles 973
Gerlach troughs 980
geysers 994, 1093
gibbsite 151, 726
Gilbert deltas 453
Gilbert, Grove Karl 250, 307, 392, 432, 613, 653, 687
  craters 354
  equality of action 325–6
  grade 306, 489
  law of unequal slopes 1079
  river capture 860
  slope evolution 963
  weathering-limited and transport-limited 1114
gilgai 351, 440–1, 765–6
glaciaeolian (glacioaeolian) processes and forms 444–5
glacial cirques 154–8, 447
glacial deposition 106, 445–7
glacial diffluence 447
glacial erosion 155–6, 200–1, 447–8, 789–90
glacial isostasy 448–51
  glacial isostatic adjustment (GIA) 716–17
glacial landforms, extraterrestrial 357–8
glacial meltwater 666
glacial and periglacial geomorphology 429
glacial plucking 331–2, 447, 870, 1106
glacial protectionism 451–2
glacial sedimentation 939
glacial theory 432, 452
glacial trimlines 1062–3
glacial unloading 1082
glacideltaic (glaciodeltaic) processes and forms 452–4, 466
glacier dams 555
glacier karst 557
glaciers 454–9
  calving 114–15, 233, 784
  deglaciation 233–7
  equilibrium line 323, 456
  flow 457–9
  glacier model of rock glacier origins 878
  global warming 481
  ice 546–7
  mass balance of 455–7, 643–4
  moraines 236, 445, 464–5, 472, 691–4, 1027
  moulins 548, 666, 699–700
  proglacial landforms 462–3, 465, 810–13
  regelation 835
  salt glaciers 893–4
  sichelwannen 959
  surging 1028–9
  systematics 454–5
glacifluvial (glaciofluvial) processes and forms 459–65
glacilacustrine (glaciolacustrine) processes and forms 465–7
glacimarine (glaciomarine) processes and forms 467–8
glacio-hydro-isostasy 917, 922–3
glacipressure (glaciopressure) 469
glacis d'érosion 469–70, 769
glacitectonic cavities 470–1
glacitectonics (glaciotectonics) 471–4
glint 475
global assessment of land degradation caused by soil degradation (GLASOD) 256
global geomorphology 475–9
  historical context 475–6
  key issues 477–9
  renewed interest 476–7
Global Positioning System (GPS) 487–9
Global Terrestrial Network for Glaciers 644
global warming 26–7, 28, 423–4, 478, 479–85
  chemical denudation and 147
  and coastal populations 172
  geomorphological consequences 479, 480
  weathering and 1112–13
Goldich weathering series 485–6
Gondwanaland 549, 793, 1117
gorges 116, 486–7, 503
graben 362, 531, 849
grade, concept of 306, 489–90
graded time 309, 489, 490
gradient
  channel 133–4
  slope 436–7, 517–18
gradualism *see* uniformitarianism
grain Reynolds number 96
granite geomorphology 490–3
granular disintegration 493–4
gravel-bed rivers 23, 494–6, 901
gravel-dominated barriers (GDBs) 60
gravitational stresses 307
gravity waves 1103–4
gray whales 1123
Great Barrier Reef Marine Park 172
Great Escarpments 338, 763, 764
grèzes litées 496–7
grid DEMs 260, 261, 262
grikes 579, 589, 621–2
groizes litées 496
ground ice 778–9
ground penetrating radar (GPR) 7, 846
ground water 497–500
  as a geomorphological agent 497–9
  groundwater calcretes 109, 110
  overdraft 499–500
  processes 497
  seepage and rock mass strength 880
grounding-line systems 465, 467–8
groundsurfaces 809
groynes 140–1, 170–1, 385, 500–1
grus 229, 493, 501–3
Guettard, Jean Étienne 431
gullies 46, 47, 369, 503–6, 767, 786, 977, 1051
gulls 115, 579
gutters 1092
guyots 506–7
gypcrete 507–9
gypsum 507–8
  speleothems 990, 992
  sulphation 1025–6
gypsum karst 507, 509–11

Haboob 302
Hack's Law 614
haldenhangs 512
half-grabens 362, 531
halocline caves 126
halophytic vegetation 898–9
haloturbation (salt heave) 892–3
hamadas 512–13
hanging valleys 279, 447–8, 513
hardware (experimental) models 687
Hawaiian calderas 111–12
hazards, geomorphological *see* geomorphological hazards
headward erosion 513–15, 861
heavy metals 678–80
hedgerows 972
Heinrich Events 550, 554
helical flow 181–2
helictites 991
Hell, Grand Cayman Island 86
hermatypic corals 188
Hiatella arctica 90, 91
high-alpine cirques 155, 157
high-energy window 515
hillslope-channel coupling 515–16, 608
hillslope geomorphology 429
hillslope hollows 521–4
hillslope processes 514, 516, 524–7
hillslope profiles 519, 520
hillslope relief 840, 841

hillslopes 516–21
  catena concept 123, 982
  equilibria between hillslope erosion and sediment yield 832–3
  equilibrium slopes 325–7
  extraterrestrial geomorphology 356
  hillslope units 516–19
  measurement and analysis 519–20
  profiles and toposequences 519
  Richter denudation slopes 847–8
hinge faults 363
historical mountain geomorphology 701
historical phase of geomorphology 432–3
historical records/evidence 748, 919–20
Hjulström curve 721, 939
Hjulström deltas 452–3
hogbacks 116, 399, 400, 527, 1008
Holocene geomorphology 527–30
holokarst 586
homoclinal shifting 399, 400
homolithic scarps 117
Honduras Depression 4
honeycomb weathering 128, 530
hoodoos 531, 768
Hooke, Robert 354
hornitos 612
horns 447
horsts 362, 531
Horton, R.E. 433
  Horton's Laws 274, 531–4, 613–14, 1001
  Horton's stream ordering scheme 370, 531, 532, 1001
Hortonian overland flow 45–6, 185, 737–8, 885, 971
hot springs 1093
Huanghe (Yellow River) Delta 863, 864
human activity/impact 940
  agriculture *see* agriculture
  anthropogeomorphology 25–7
  and atolls 40–1
  coral reefs 189–90
  desertification 256–7
  and dust storms 303
  and erosion 335
  fringing reefs 412
  geomorphological resources 319
  and gullies 503–4
  Holocene geomorphology 528–9
  micromorphology 672–3
  military geomorphology 674–5
  mining impacts on rivers 678–80
hummocks 462, 463, 534, 556–7
hummocky moraines 692–3
hums 591–2
hurricanes 313, 482
Hutton, James 431, 613, 1080
Huxley, T.H. 781
hydration 149–50, 534–5, 541, 895, 1109, 1110
hydraulic action 331–2
hydraulic geometry 386, 535–9, 901–2
  alluvial channels 134–7
  interpretation 536–8
  limitations 538
  maximum flow efficiency 136, 617, 654–5
hydraulic head 803–4
hydraulic pingos 783
hydraulic provinces 1104
hydraulic sorting 80
hydrochemistry 683–4
hydrocompaction 175, 539
hydrogen sulphide caves 126
hydro-laccoliths 539
hydrological geomorphology 539–41
hydrology
  forested watersheds 402–4
  hydrologic pathway 989
  mires 681
  palaeohydrology 394–5, 540, 750–4
hydrolysis 148–9, 535, 541, 741, 1110, 1112
hydromulching 973
hydrophobic (water repelling) soil 369, 541–2
hydrostatic pingos 783
hydrovolcanic eruptions 1095
hyperconcentrated flows 369, 542
hyperpycnal plumes 864, 866–7, 1075
hypogene caves 124, 125, 126
hypogene palaeokarst 755
hypolimnion 600
hypopycnal plumes 866
hypsometric analysis 542–3
hypsometric curve 436, 542–3, 698, 1036
hypsometric integral 435–6, 543, 1036

ice 544–9
  classification of ground ice 778–9
ice ages 549–54
ice caps 454, 555
ice caves 548
ice cliffs 160
ice-contact landforms 462–5
ice-cored moraines 236
ice dams 555
ice-distal glacimarine systems 468
ice domes 454, 547–8
ice jams 548
ice-marginal valleys/streamways (urstromtäler) 1088
ice-proximal glacimarine systems 468
ice-push 828
ice rafting 468
ice shafts (moulins) 548, 666, 699–700
ice sheets 88, 114, 454, 547–8, 555–6
  glacial isostasy 448–51
  global warming 481
  growth 549–50
  proglacial ice sheet systems 810–12

ice shelves 454
ice stagnation topography 556–7
ice stream interaction medial moraines 1027
ice streams 454, 548, 556, 557–8
ice wedges 558–9
icebergs 114, 454, 559
icings 559–60
igneous rocks 1008
  Bowen's Reaction Series 97–8, 485
ignimbrites 818, 820, 1094
illuviation 560
illuvium 314
imaging 664
  lineations 623–4
imbricate parabolic dunes 293
imbrication 560
impact structures 1070
  astroblemes 36–8
  craters 196, 197–9, 355
impact threshold 9–10
in situ process studies 473
inactive (passive) fans 16, 17
inactive-particle, short-range bond theory 822
incipient foredunes 291–2
incision 1039–40
  rates 82
indicator deposits 920
indicator erratics 337
inductive inference 751
inertial currents 211
inference, palaeohydrological 751–2
infiltration 982
  rate 737–8
infiltration-excess (Hortonian) overland flow 45–6, 185, 737–8, 885, 971
infragravity waves 1103–4
inheritance 430, 560–2
  coastal 170, 958
initial coasts 166–7
initial conditions 661
initiation of motion 9–10, 562–3, 685
  see also sediment transport
inland deltas 563
inland sabkhas 887, 888, 890
inner-driven directional catastrophism 121
inner moraines 692
inorganic (rain-beat) crusts 203
inselbergs 93, 265–6, 564–6
insequent streams 281
insolation forcing 748
insolation weathering 566–7, 657, 1108
instability models 857
integrated coastal management (ICM) 567–70
Inter-Andean Depression 4
interdune areas 570–2
interdune surfaces 97
interfluves 572–3
interformational casts 559
interglacials 549–54
interlobate moraines 465
intermediate beaches 64–5, 68–9, 70
intermediate floodouts 380, 381
intermontane basins 573–4
internalism 120–1
interrill flow 737
  see also sheet flow
interstadials 549–54
interstratal karst 586, 754, 755
intertidal boulder pavements 93
intraformational casts 559
intrastatal karst 754, 755
intrinsic changes 722–3
intrinsic thresholds 134, 1051–2
intrusive ice 778–9
Inuvik 776
inverse-conical kettles 594
inverse modelling 451
inverted relief 117, 299–300, 574
ion-exchange reactions 150, 1110
ion mobility 150
iridium anomaly 37
iron 896, 1067
iron films 870–1, 872
iron hydroxides 535
iron oxides 741, 834
irrigation systems 256
island arcs 575–7, 794–5
island-forming rivers 22–3
islands
  barrier islands 59–62, 953, 954
  motu 39, 40, 130, 131
  river bars 57
  volcanic 1018
isolated systems 1031
isometry 14
isostasy 478, 577–8, 732
  glacial 448–51, 716–17
  isostatic rebound 710
Isothermal Plateau Fission Track Dating (ITPFT) 223

Jahn, Alfred 1114
jams 609
  ice jams 548
Johnston Atoll 39
jointing 579–80
  case hardening 118–19
  inselbergs 564
  lineations 623–4
  rock mass strength 879, 880
  sheeting joints 93
  structural landforms 1007–8
  tors 1055
jökulhlaups *see* outburst floods

junctions
river 99, 180–3, 613
triple 796
Jupiter 355

K-T impact 1070
Kaali impacts 198
kame complexes 582
kame and kettle topography 582
kame terraces 464, 581–2
kamenitzas 584–5
kames 464, 581–2
Kansai airport 1087
kaolin 582
kaolinite 151
kaolinization 582–3
Kármán-Prandtl law of the wall 96
karren 583–5, 589
limestone pavements 589, 621–3
karst 264, 497, 586–94
biokarst 86–7, 587, 729
caves 124–7, 588–91
cenotes 132–3, 269, 591
chemical processes 587
dolines 266–70, 589–91, 1023, 1025
endokarst 315–16
gypsum karst 507, 509–11
landscape development 587–93
modelling karst evolution 593–4
palaeokarst 754–5
poljes 591, 592, 801
pseudokarst 786, 814–16
relict karst 754–5
rocky desertification 883–4
salt (evaporite) karst 892
springs 994
subsidence 1023
syngenetic 589, 1030–1
turloughs 1075–6
volcanic 1092
karst geomorphology 429
karst windows 590
Kennedy, B.A. 1031
kettle holes 594–5
kettles 594–5
King, Lester 420, 964, 967
Kirkby, M.J. 421, 1114
'klimatische Geomorphologie' 164, 843
kluftkarren 584, 585
knickpoints (nickpoints) 134, 595–6

la Beche, Henry Thomas de 431
laccoliths 1008
lacustrine palaeohydrology 753
lagoons, coastal 597
lahars 225, 597–9, 650, 651
Lake Eyre Basin 745, 746
lakes 599–602, 851
crater lakes 1093
deglaciation 236–7
extraterrestrial geomorphology 357
glacial 465–7
ice-dammed 555
lava 610–11
levels and El Niño events 312
oriented 730, 1049
paternoster 765
pluvial 797–800
sand seas and dunefields 904–5
supraglacial 1027
thermokarst 1049
Lamarck, Jean-Baptiste 431
laminar flow 94–5
land facets 602
land raise mounds 1087
land surface evaluation *see* terrain evaluation
land systems 602–4
land units 602, 603
landfill 1087
landform mapping 443
see also geomorphological mapping; terrain evaluation
landform material science 873–4
landform measurement 442–3
landscape evolution
chemical weathering and 151–2
denudation chronology 244–8
geomorphic evolution 420–2
GIS and 443–4
landscape morphology 982
landscape sensitivity 604–5, 838
landslide dams 607, 608–9
landslides 226, 360, 361, 605–8, 644, 786
submarine 1014–19, 1070
volcanic 1096
Langbein and Schumm model 978
lapilli 1094
large woody debris (LWD) 609
lateral accretion 382
lateral bars 57
lateral blasts 1095
lateral erosion 861
lateral mixing 208
lateral moraines 692, 693, 1027
lateral spreading 227, 645, 648–50
lateral transfer models 298–9
laterite 230, 231, 365–7, 1067
Laurasia 793, 1117
lava 836, 1094
domes 611
flows 610–11
lakes 610–11
landforms 609–12
plateaux 611
surface textures of lava flows 611–12
tubes 124, 612

laws, geomorphological 612–14
leaching 314, 614–16
leaching requirement (LR) 616
least action principle (LAP) 136, 616–17, 654
Leonardo da Vinci 430
levees 20, 140, 383, 617–18
lichenometry 618–20
lichens 618–20, 728, 1109, 1110
boring 91
Lichty, R.W. 309
LIDAR (light detection and ranging) 620
Liesegang rings 620–1
lift force 9
light compensation depth (LCD) 90
limestone
corrosion 191–2
pavements 589, 621–3
see also karst
Limit Equilibrium approach 668
limiting angles 517–18
limiting stresses 661
limnology 599
lineaments 624
linear dunes 286, 287, 288, 296–7
linear elasticity 661
lineations 623–4
lined channels 140
linked cavity networks 666–7
liquefaction 225, 624–5, 649–50, 1016
LISEM 979
listric faults 362
listric thrust folding 472
lithalsas 625, 1050
lithification 625–6
lithofacies 461, 462
lithology 333–4
Little Ice Age (LIA) 234, 529–30, 711–13
littoral cell 632
littoral (longshore) drift 75, 630–3
littoral zone 599–600
livestock production 257
lobes 986–7
local relief 840–1
location-time substitution 327–8
loess 7, 11, 303, 626–8, 762
log spiral beaches 628–9
long profiles, river 630
Long Term Ecological Reserves 403–4
long-walled parabolic dunes 293
longshore bars 54–6, 72
longshore currents 207–8, 209
longshore (littoral) drift 75, 630–3
Longuet-Higgins mass transport 207, 208
loose snow avalanches 42
Lorenz, Edward 142
Louisiana 26
low angle rock benches 881
lower-stage plane beds 76, 77
Łoziński, W. 774
luminescence dating techniques 7, 223
lunar craters 196–7, 197, 198, 199, 354, 355
lunettes 286, 288, 633–4, 759
Lyell, Charles 84, 431–2, 475–6, 1080

maars 197, 1096
macrogelivation 414
Madden-Julian oscillation 311
magma 1092, 1094
magnetic properties 676–8
magnitude-frequency concept 635–8, 710
Magnus effect 10
main channel length 697
Mammoth Cave system 588, 589
managed retreat 638–9
management
coastal 170–2, 567–70
rivers 379, 396–7, 1003
slope management 972
manganese 252–3
mangrove ranges (mangrove islands) 640
mangrove swamps 483, 484, 639–41, 898
manifestly underfit streams 1077–8
Manning equation 884
mantle plumes 641–3
mantled etchplain 345
mantled pediments 769
manures 973
mapping
engineering geomorpological mapping 316–18
geomorphological 427–8, 488–9, 1084
landform mapping 443
marginal moraines 693
marginal swell 763–4
margins
active 3–5, 183–4, 201, 338, 701, 731, 793–6
passive 184, 338, 374, 701, 762–5, 794
Mariana Deep 575
marine planation 789
Mars 254, 355, 356–8, 479, 499
craters 199, 355
palaeochannels 743, 744–5
scablands 914
marshes 344
saltmarshes 483–4, 639, 898–900
mass balance
equation for a slope 965
of glaciers 455–7, 643–4
modelling for soil 145–6
mass failures 49–50, 51, 514

mass movements 524–5, 526, 605, 644–53, 946
  coastal cliffs 160
  complex 645, 652
  debris flows *see* debris flows
  debris torrents 225–6
  deep-seated gravitational slope deformations 226–8
  extraterrestrial geomorphology 356
  failure 360–1, 906–7
  falls 644–5
  flows 645, 650–2
  landslide dams 607, 608–9
  landslides *see* landslides
  lateral spreading 227, 645, 648–50
  sackungen 227, 361, 890–2
  slides *see* slides
  soil creep 635, 974–7
  topples 361, 645
mathematical models 170, 687–90
mathematics 653–4
Matuyama/Brunhes reversal 551
maximum flow efficiency (MFE) 136, 617, 654–5
meandering 23, 101, 137–8, 655–7, 838, 902
  meander scars 740
  meander scrolls 382
  meander wavelength 743, 744
  origin of 655–6
  oxbows 382, 740
  underfit streams 744, 752, 861, 1077–9
  valley meanders 1077, 1078, 1090
mechanical erosion 460
mechanical properties 875
mechanical unloading 1082
mechanical weathering 240, 241–2, 243, 657–9
mechanics
  of geological materials 659–62
  submarine landslides 1016
medial moraines 692, 1027
Medieval Warm Period (MWP) 712
megadunes (draas) 272
megafans 662
megafloods 465
megageomorphology 662–5
mega-rips 210, 855
mekgacha 665
melt-out 445
melting point, pressure 459, 807
meltout (dump) moraines 693
Melton's Law 278, 533
meltwater 447, 666–8, 1011
  channels 460, 461, 666–8
  deposition 462–5
  erosion 460–2
  outburst floods 460, 555, 666, 734–5, 744–5
  supply and pathways 460
Mercury 355, 356
merokarst 586–7
meromictic lakes 601
mesas 116, 399, 400, 668
metalimnion 600
metals, mining impacts of 678–80
Meteor crater, Arizona 354
Method of Slices 668–9
methodological uniformitarianism 1080
microatolls 670–1
microcraters (pits) 197
micro-erosion meter (MEM) 192, 669–70, 957
microgelivation 414
micromorphology 671–4
microrills 852
microwave remote sensing 845–6
mid-channel compound bars 57
mid-ocean ridges 793–4, 850, 925–7
migration of dunes 294
Milankovitch theory 748
military geomorphology 674–5
millennial pacings 553–4
Miller, John 308
Mima mounds 675–6, 766
mineral magnetics 676–8
mineral weathering indices 1111
minerals
  expansion 657
  solubility 987–8
minerotrophic mires 683–4
mining 1086
  impacts on rivers 678–80
mires 680–5
Mississippi Delta 171, 863–4, 865
mixed load laterally active rivers 22–3
mixing
  in lakes 600–1
  mixing length 96
mobile beds 685–6
mobile coasts 167
mobile zone 909–11
mobility, dune 295–7
modelling and models 101, 686–91, 733
  coastal 169–70
  experimental geomorphology 351–3
  geomorphic evolution 420–2
  GIS and 443–4
  glacial isostasy 449–51
  hillslopes 519, 520
  karst evolution 593–4
  quantifying soil landscape models 983
  self-organized criticality 944
  shore platforms 958
Mohorovicic discontinuity (Moho) 926
Mohr-Coulomb equation 360–1
molecular stresses 307–8
momentum conservation 660
monoclines 398, 399
monomictic lakes 601
montmorillonite 151, 787

moon 356
  craters 196–7, 197, 198, 199, 354, 355
moons 354–5
moraines 236, 445, 464–5, 472, 691–4, 1027
morphoclimatic zones 694–6
morphogenetic regions 694–6
morphogenetic zones 163
morphogenic earthquakes 942
morphological analysis 420–1
morphological mapping 427
morphology
  classification of coasts 167
  mires 681–2
morphometry 435, 653
  morphometric properties 435, 696–8
morphostructures 664
morphotectonics 699
mottles 909, 912
motu 39, 40, 130, 131
moulin kames 464
moulins (ice shafts) 548, 666, 699–700
mound springs 700
mounds 42, 43
  Mima 675–6, 766
  termite 1038
mountain-front sinuosity index 1036
mountain geomorphology 701–3
mountains 842, 1008
  mountain valley systems 812–13
  orogenesis 731–4
  passive margins 763, 764
  plate tectonics 4–5, 795
mud 281–2
  armoured mud balls 31–2
mud flats 704–6
mud volcanoes 706–7
muddy coasts 704–6
mudflows (soil flows) 225, 651–2
mudlumps 707
mudslides (earthflows) 648
mulching 973
multi-concave terrains 491–2
multi-convex terrains 491–2
multi-level (multi-phase) caves 127
multiple bars 55, 56
multiple (complex) scarps 363
multi-point velocity measurement techniques 388
Murrumbidgee River 745–6, 752–3
Myall Lakes National Park 69

natural arches 31
natural bridges 31, 708
natural channel design 1005
Navier-Stokes equations 179
neap tides 1102
nebkhas 286, 288, 708
neck cutoffs 740
necks 1008
needle-ice 49, 709
needle-ice creep 984–5
negative allometry 14
neocatastrophism 121, 635, 709–11
neogeomorphology 434
Neoglaciation 711–13
neotectonics 713–18
Neptune 355
Neptunists (Wernerians) 431
Nernst equation 987
neutron spallation 192–3
Newtonian fluids 179, 525
Niagara Falls 1099, 1100
Niger Inland Delta 563
Nile Delta 171
Niue Island 188
nival meltwater 666
nivation 204, 718–20
  nivation benches (terraces) 718
  nivation hollows 718
niveo-aeolian activity 720–1
non-actualism 120–1
non-actualistic directional catastrophism 121
non-actualistic steady-state catastrophism 121
non-capacity load 934
non-linear system dynamics (NSD) 176, 401, 721–5
non-Newtonian flows 525
non-pedogenic calcrete 109, 110
non-pedogenic silcrete 959–60
normal faults 202, 362–3, 942
normally consolidated (NC) soils 174, 175
notches, coastal 725, 1092, 1106
nourishment, beach 71–2
nuées ardentes 725–6
numerical modelling 353, 477, 689, 733
nunataks 726
nutrient depletion 255, 256
nutrient status 601
Nye channels 667

oblique-slip faults 362
oceanic–continental crustal collisions 794–5
oceanic–oceanic crustal collisions 795
oceans
  extraterrestrial geomorphology 357
  ridges 793–4, 850, 925–7
  Wilson cycle 1117
ogives 458, 612
Okavango Delta 563
Older coversands 195, 196
Olympus Mons 1093
ombrogenous mires 682–3
ombrotrophic mires 683–4
open folding 472
open systems theory 307–8, 1032
optical brightening agents (OBAs) 304
optical region of electromagnetic spectrum 845

optically stimulated luminescence (OSL) 223
optimal channel networks 274
orbital chronology 920
orbital pacings 551–4
Oregon Coast Range 928
organic (biological) crusts 203
organic (biological) weathering 659, 727–30, 1108, 1109, 1110
oriented lakes 730, 1049
orogenesis 731–4
orogenic belts 1117
orthokarst 1092
Osage-type underfit streams 1077–8
oscillation (symmetrical) ripples 859–60
outburst floods (jökulhlaups) 460, 555, 666, 734–5, 744–5
outlet glaciers 454, 455
outwash fans 464–5
outwash plains 465
overbank deposition 53
overconsolidated clays 735–6
overconsolidation ratio (OCR) 174
overdeepening 331–2
overflow channels 736–7
overland flow 185, 514, 737–9, 825, 982
  Hortonian 45–6, 185, 737–8, 885, 971
  rills 369, 503, 737, 852–3
  runoff generation *see* runoff generation
  saturation-excess 185–7, 738–9, 885, 971
  slopewash 970–1
oversteepened slopes 881
overwashing 61, 739–40
oxalates 1110
oxalic acid 1110
oxbows 382, 740
oxidation 150, 740–1, 1110
oxygen isotope ratios 545, 550–4, 923–4
oyster reefs 741–2

P-shears 848
Pacific coasts 165–6
Padre Island 61
pāhoehoe lava 612
paired river terraces 1041, 1042
palaeochannels 743–6, 749
  prior streams 745, 752–3, 808–10
palaeoclimate 746–8
palaeofloods 396, 540, 748–50
palaeohydrology 395–6, 540, 750–4
palaeokarst 754–5
palaeolimnology 601–2
palaeonunataks 726
palaeoperiglacial activity 773–4
palaeoseismology 941
palaeosols 12, 154, 673–4, 755–6, 983
pali ridges 756
Palissy, Bernard 430
pallid zone 909, 912
palsas 625, 756–8, 1050
Pangaea 792, 793, 1117
pans 507, 758–9
para-autochthonous blockfields 87–8
parabolic dunes 286, 287, 293–4
Paracentrotus lividus 91
paraglacial processes and landforms 759–62
parakarst 1092
paralic environments 762
paramagnetic materials 676
parna 627, 762
partial annealing zone (PAZ) 373
partial area storm runoff 185–6
partial retention zone (PRZ) 1083
partly stripped etchplain 345
passive dispersal 679
passive margins 184, 338, 374, 701, 762–5, 794
passive soil conservation 971–2
paternoster lakes 765
patterned ground 415, 765–6
  brousse tigrée 102–3, 766
pavements
  limestone 589, 621–3
  stone 6, 998–9
peat
  erosion 766–8
  palsas 625, 756–8, 1050
  subsidence 1023
pedestal rocks 768
pediments 768–71, 871–3, 964
  glacis d'érosion 469–70, 769
pediplains 768, 771, 789
pedogenic calcrete 109, 110
pedogenic silcrete 960
pelagic zone 599–600
peléean eruptions 1095
Penck, Walther 214, 420–1, 433, 476, 512, 964, 967, 982
peneplains 214, 245, 768, 771–2, 788–9
percentage hypsometric curve 542–3
periglacial geomorphology 772–6
periglacial landforms, extraterrestrial 357–8
periglacial planation 789
periglacial theory of tors 1055–6
permafrost 409, 548, 777–9, 1084
  active layer 3
  cambering and valley bulging 115–16
  global warming 479–81
  ice wedges 558–9
  lithalsas 625, 1050
  palsas 625, 756–8, 1050
  periglacial geomorphology 773–6
  permafrost model of rock glaciers 878
  pingos 13, 415, 539, 779, 782–4, 1050
  thermokarst 779, 1049–51
permeable pile groynes 500
persistent landscapes 561
Phillips, John 431
photo-electronic erosion pin (PEEP) system 48, 49
photogeology 844
photography 844
phreatic eruptions 1095
phreatomagmatic eruptions 1095
phyllosilicates 151
physical denudation (mechanical weathering) 240, 241–2, 243, 657–9
physical integrity of rivers 779–81
physical models, of coasts 169–70
physical properties 875
physical weathering 152, 1108–9
  see also under individual processes
physiography 781–2
phytogeomorphology 84
phytokarst 86, 90
piecemeal calderas 111
piedmont glaciers 454, 455
piedmont scarps 363
piedmont zone 768
Pierre Shale 14
piezometry 782
piggy-back basins 816–17
pillars 876
pillow lavas 612
pingos 13, 415, 539, 779, 782–4, 1050
pinnacles 876
pinning points 784
pipes 784–8
  diatremes 260
piping 46, 514, 784–8, 1074
pit craters 197
pit traps 80
pits 42, 43
  landforms of extraction 1085–6
  weathering pits 1115–16
pivot (scissor) faults 363
plains 437
planation surfaces 788–92
plane beds 19, 76, 77
planets 477
  comparative planetary geomorphology 478–9
  extraterrestrial geomorphology 353–8, 477
plasticity index (PI) 350
plate tectonics 476–7, 702, 715, 792–6, 850, 925
  active margins 3–5, 183–4, 201, 338, 701, 731, 793–6
  coastal classification 166, 169
  extraterrestrial geomorphology 356
  importance of the theory 796
  island arcs 576–7
  orogenesis 731–4
  passive margins 184, 338, 374, 701, 762–5, 794
  rift zones and ridges 793–4
  subduction zones 794–5
  tectonic activity indices 1036–7
  transform faults and triple junctions 795–6
plateaux 763
platforms 200
  shore *see* shore platforms
playas 499, 887
Playfair, John 431
Playfair's Law 279, 613
plinian eruptions 1095
plinths 1092
ploughing blocks and boulders 796–7
plucking (quarrying) 331–2, 447, 870, 1106
plug-like flow 985, 986
plumes
  mantle 641–3
  river plumes 864, 866–7
plunge pools 1100
plunging breakers 1104
Plutonists (Vulcanists) 431
plutonium 928
pluvial lakes 797–800
pocket (fringing) beaches 951, 952
pocket valleys (reculées) 994–5
point bars 57, 800–1
point-samplers 1029
polar glaciers 455, 459
poljes 591, 592, 801
polygenesis 430
polygonal karst 267–9, 589
polygons, desiccation cracks and 257–8, 766
polythermal glaciers 643
ponors 588, 801
pools
  pools and riffles 212, 801–3
  step-pool systems 403, 995–6
pore ice 778
pore size distribution (porosimetry) 413
pore-water pressure 803–5
Porites microatolls 670, 671
porosity 124, 125
  critical packing porosity 822
positive allometry 14
postglacial transgression 805–7
pot-holes 588, 807, 883
potassium-argon dating 222–3
potentially active faults 2
Powell, John Wesley 432
power laws 406, 407
power, stream 82, 1002–4
Prandtl, Ludwig 94, 96
precipitation ridges 294
precision agriculture 488
preparation (weakening) processes 49
pressure
  cryostatic 205, 416
  glacipressure (glaciopressure) 469
  pore-water pressure 803–5
pressure melting point 459, 807

pressure release 375, 447, 657, 807–8
pressure springs 994
Pretoria Salt Pan crater 206
primary rockfalls 882
principles of Earth surface systems 177–8
prior streams 745, 752–3, 808–10
process geomorphology 308–9
process mechanics 395
process models 687–9
processes
  internal and external 478
  morphogenetic regions 694–6
  rates of operation 830–4
proglacial glacitectonic deformation 471, 472
proglacial landforms 462–3, 465, 810–13
progradational fans 16, 17, 18
propagation of waves 1104
protalus lobes 877, 878, 879
protalus ramparts 813–14, 879
Proto-Soar valley 106
proxy records 747
pseudocraters (rootless cones) 197
pseudokarst 786, 814–16
pseudokarst sensu lato 1092
pseudokarst sensu stricto 1092
pseudomorphs (casts) 559
pull-apart basins 363, 816–17
pumice 1094
punctuated aggradation 817–18
punctuated equilibrium 710
push moraines 472, 693
pyroclastic flow deposits 609, 818–20, 876, 1094

quantitative flow visualization 388
quantitative phase of geomorphology 433
quarries 1085–6
quarrying (plucking) 331–2, 447, 870, 1106
quartz 97, 98
Quasi-Biennial Oscillation (QBO) 311
Quaternary palaeoclimate 748
quick flow (event flow) 821
quickclays 649, 821–2
quicksands 822
quiescent phase 1028

radial drainage 280, 281
radiation stress 1105
radiocarbon dating 221
radiogenic dating methods 223–4
radioisotopic dating methods 221–3, 1083–4
rain-impact ripples 860
rain-impacted flows 825
raindrop impact 823–6, 948
rainfall
  simulation 336, 826
  soil erosion and 978
  tropical geomorphology 1066
rainfall erosion tunnels 786
rainflow/rainwash erosion 825
raised beaches 827–9
raised mires 682–3
ramparts 42, 43
  protalus 813–14, 879
ramps
  abrasion 1
  coastal 829
  sand 902
Ramsay, Andrew Crombie 432
randklufts 83, 155
rapid quickclays 821
rapids 829–30
rasas 830
raster-based DEMs 519
rates of operation 830–4
rating curves
  sediment 936–7, 1030
  solute 144, 988–90
ravelling (suffosion) 1025
ravines 486–7, 503
reaction time 233, 838, 839
reactivation surfaces 97
reattachment, flow 94, 95
rebound, distance of 915
receding coasts 167
recessional moraines 693
reconciliation and unification phase of geomorphology 433–4
rectilinear slopes 518
recumbent folds 399
recurrent intervals (return periods) 637, 750
recurved cuspate forelands 211–12
Redhill Brook 868
redox reactions 150, 1110
reduction 150, 834, 1110
Redwood Creek 928–30
reefs 834–5
  coral *see* coral reefs
  oyster 741–2
  serpulid 946
  Vermetid 1091–2
reflected optical images 845
reflective beaches 64, 68–9, 70, 324
reforming channels 380, 381
refraction 1104
regelation 835
regime theory 134–7
regionalist phase of geomorphology 433
regolith 228–33, 835–7, 964
  regolith production models 689–90
  see also weathering profiles
regressions 1060
rehabilitation 867–8
rejuvenation 837–8
relative accumulations 298
relative dating methods 221

relative tide range (RTR) 64, 324
relaxation time 635–6, 838–40
relict karst 754–5
relict palaeosols 983
relict pingos 783
relief 840–2
  and chemical denudation 146–7
  generations 164–5, 561, 842–3
  geomorphometry 435–6
  inversion 117, 299–300, 574
  relief forming mechanisms 695
relief properties 698
relief ratio 698
remote sensing 7, 262, 427, 434, 477, 844–6, 1014
remotely operated vehicles (ROVs) 846
repose, angle of 518, 846
representative landforms 417–18
reptation 10, 79
resectioning 140
reservoirs 217–18
residence time (of stored sediment) 928–30
residual fault scarps 363
residual (ultimate) strength 847
resistance, force and 401
resolution (of data) 442
response time 233
restoration
  river 396, 867–70
  stream 1004–6
resurgences 994
resurgent calderas 112
retreat
  escarpments 339–40, 1055
  managed 638–9
retroductive (abductive) inference 751–2
retrogressive thaw slumps 1050
return flow 739
reverse faults 202, 362
revised USLE (RUSLE) 932–3, 979, 1081–2
Reynolds number 100, 847, 1051
Reynolds, Osborne 94, 95
rheology 660–1
rhomboid ripples 859
rhythmites 281, 466
rias 847
ribbed terrain 462, 463
Richter denudation slopes 847–8, 881
Richtofen, Ferdinand von 432
ridge and runnel topography 55, 56, 848
ridges 54, 848
  beach *see* beach ridges
  interfluves 572–3
  ocean 793–4, 850, 925–7
Riedel shear 848–9
Ries Kessel 36
riffles, pools and 212, 801–3
rift valleys 849–52
rift zones 793–4
rifting 849–52
rill erosion 971, 977
rillenkarren 584
rills 369, 503, 737, 852–3
rinds, weathering 853–5
ring complexes/structures 855
ring dykes 855
Ringarooma River basin 679–80
rinnenkarren 584
Rio Grande 928
rip currents (rips) 55, 64–5, 208–10, 855–7
riparian geomorphology 856–8
ripples 19, 76, 77, 859–60
risk 319–20
river bars 19, 53, 56–8, 99
  point bars 57, 800–1
river capture 860–1, 1040
river continuum 826
river deltas 20, 563, 862–6, 1017
river-dominated estuaries 343
river icings 560
river metamorphosis 395
river plumes 864, 866–7
River Restoration Centre (RRC) 868, 869
river terraces 20, 1039–43
river training works 140–1
riverbank erosion 48–52
Riverine Plain 808–10
rivers
  anabranching *see* anabranching rivers
  anastomosing *see* anastomosing rivers
  bedforms 76–7
  braided *see* braided rivers
  channelization 139–42, 1085, 1086
  channels *see* channels
  fluvial geomorphology 392–8, 407, 429
  gravel-bed 23, 494–6, 901
  incision 82, 1039–40
  long profiles 630
  management 379, 396–7, 1003
  mining impacts on 678–80
  physical integrity of 779–81
  restoration 396, 867–70
  sand-bed 22–3, 494, 900–2
  tropical geomorphology 1066
road-bank boulder tongues 41, 42, 43
roches moutonnées 448, 870
rock
  expansion of 657
  mass movement 645, 647, 648–9, 650, 652
rock avalanches (sturzstroms) 155–6, 645, 652, 1009
rock coasts 1106
rock coatings 118, 854, 870–3
  desert varnish 251–4, 870–1, 872
rock control 873–6
rock flour 447

rock flows 650
rock glaciers 876–9
rock mass strength (RMS) 38, 401, 413, 879–82
rock pediments 769
rock pillars 876
rock pinnacles 417, 876
rock (material) properties 875
rock slides 360, 647
rock spreading 648–9
rock tablets 192
rock varnish (desert varnish) 251-4, 870–1, 872
rockfalls 155–6, 882
  scree 915–16
rockpools 882–3
rocky desertification 883–4
Rogen moraines 692
rotating spray simulators 826
rotation 973
rotational slides 645, 646, 1015
roughness 495, 884
routing, sediment 937–8
ruggedness 885
rumpfflächen *see* etchplains
rundkarren 584
runnel and ridge topography 55, 56, 848
runoff generation 540, 885–6
  contributing area 185–8, 697
runoff plots 979
runout 606
rupture surface 1015

sabkhas 484, 507, 571, 887–90, 891
sackungen 227, 361, 890–2
safety, factor of 359–60, 361, 668, 969
salcrete 892
salinas 887
salinization 255
Salisbury deltas 453
salt anticlines 893
salt glaciers (namakiers) 893–4
salt heave (haloturbation) 892–3
salt karst 892
salt pillows 893
salt related landforms 893–4
salt rollers 893
salt stocks 893
salt subsidence 1024
salt walls 893
salt weathering 129, 658–9, 790, 894–7, 1109
saltation 9–10, 79, 685–6, 897–8
saltmarshes 483–4, 639, 898–900
samplers, bedload 80
sand-bed rivers 22–3, 494, 900–2
sand-dominated barriers (SDBs) 60
sand flux 10–11
sand liquefaction slides 649–50
sand ramps 902
sand ribbons 77–8
sand seas 902–5
sand sheets 286, 288
sand spits 632
sand streaks 95
sand waves 77–8
sand wedges 559
sands, singing 960–1
sandsheets 294, 905–6
  coversands 195–6
sandstone 31
sandstone geomorphology 906–8
sandurs 461, 465, 1096
sandy beaches 483
Santorini volcano, Greece 111, 112
sapping 497–9
saprock 909
saprolite 145, 228–9, 908–12, 1067
  grus 501–2
sastrugi 912
satellite imagery 434, 477, 844–5
saturation 361, 413
saturation-excess overland flow 185–7, 738–9, 885, 971
Saturn 355
Saussure, Horace Bénédict de 431, 691
scablands 122, 912–14
scale 352, 438
  breaks 438, 439
scale-invariance 722–3
scanning electron microscopy (SEM) 914–15
scarps (escarpments) 265, 266, 337–40
  fault scarps 362–4, 942
  scarp retreat theory 1055
Schmidt hammer 879, 880, 915, 1110
Schumm, S.A. 305–6, 309
scientific realism 723–4
scorched earth 675
scoria (cinder) cones 1095–6
Scotia Arc 575, 576
scour chains 213
scour lag 704–5
scours 182
scree 882, 915–17
scroll bars 57
sea level 917–25
  Bruun Rule 27, 103–6, 483, 1061
  buried valleys 106
  change and atolls 40–1
  change and cays 131–2
  eustatic change 246, 347–9, 917, 922–3
  geomorphic consequences of change 924–5
  glacial isostasy 448–51
  global warming and 172
  last glacial cycle 923
  observational evidence of change 919–22
  oxygen isotope records 923–4
  postglacial transgression 805–7
  relative sea level (RSL) rise and barriers 60–1

saltmarshes and sea level change 899–900
  separation of eustatic, isostatic and tectonic components 922–3
  shoreline reconstructions 924
  steric effects 996–7
  transgressions 1060–1
seafloor spreading 792–3, 925–7, 1117
seamounts 506
seas, extraterrestrial 357
seasonal soil creep 975–7
second-order stress provinces 715
secondary flow 655–6
secondary rockfalls 882
sector collapses 1096
Sedgwick, Adam 431
sediment
  accretion 1
  alluvium 19–21, 978
  availability 9
  beach nourishment 71–2
  bulking 369
  colluvium 173, 977–8, 1035
  cyclothems 920, 921, 922
  dams and 218
  dynamics and hydological geomorphology 540
  entrainment *see* entrainment
  glacifluvial 462
  lakes 601–2
  palaeofloods 749
  rating curves 936–7, 1030
  snow avalanches' effect on 42, 43
  sorting 802, 954–5
  supply 8, 70, 899, 1040
  synrift sediments 851
  virtual velocity of 935
sediment budgets 402–4, 927–30, 931, 932, 935, 937
sediment cells 931–2
sediment control 972
sediment delivery ratios 932–4, 935
sediment load 390–1, 934–6
  see also bedload; suspended load
sediment routing 937–8
sediment tracing studies 676–7, 678, 1057–9
sediment transport
  alluvial channels 138
  beaches 74–6
  dust storms 302–3
  fluvial geomorphology 395
  initiation of 9–10, 562–3, 685
  longshore drift 630–3
  mechanisms 10
  mobile beds 685–6
  rills 852–3
  river deltas 864–5
  saltation 9–10, 79, 685–6, 897–8
  stream power 1002–3
  tracers and 1057, 1058, 1059
  transporting capacity 8, 964–6
  by waves 1105
sediment waves 938
sediment yields 313, 698, 934–6
  equilibria between hillslope erosion and sediment delivery ratios 832–3
  sediment delivery ratios 932–4
sedimentary coasts 1106–7
sedimentary (depositional) seals 825
sedimentation 938–41, 965
  channels 138
  floodplain sedimentation rates 383–4
  mud flats 704–5
  punctuated aggradation 817–18
  subglacial 446
  zones 939–40
seepage erosion 498
segregation ice 412, 415, 778
seismic reflection profiling 846
seismites 942
seismotectonic geomorphology 941–3
selective entrainment, principle of 562
selective linear erosion 375
self-organization 176, 177–8, 322
self-organized criticality (SOC) 177, 406–7, 722–3, 944–5
Selima SandSheet 905–6
semi-arid erosion cycle 420
semi-blind valleys 87
sensitive clays 945–6
  quickclays 649, 821–2
sensitivity, landscape 604–5, 838
sensitivity analysis 654
separation, flow 94, 95, 181, 182
sequence stratigraphy 920, 921
serpulid reefs 946
settling lag 704–5, 827
shallow gentle hollows 522, 523
shape properties 697–8
shatter cones 36
shear 946–7
  Riedel shear 848–9
shear layers 181
shear strength 330, 359–60, 360–1, 1016
shear stress 359–60, 1016
shear surfaces 946–7
shear waves 1104
sheet erosion 947–9, 977
sheet flow 666–7, 737, 947–9
sheet wash 737, 947–9, 971
sheeting 949–50, 1082, 1108–9
  see also exfoliation
sheeting joints 93
shield volcanoes 1096
shields 199–200, 950
Shields curve 96
Shields equation 562
Shields parameter 1105
shingle coasts 950–6

shoaling 1104
shore platforms 160–1, 956–9
  coastal ramps 829
  water-layer weathering 1099
shoreline *see* coastlines and coasts
Shreve stream ordering system 1001
sichelwannen 959
side scanning SONARs 846
sidewall tafoni 128
Sierra Nevada 4
silcrete 298, 299, 300, 959–60
silica glazes 870–1, 873
silicates 148, 149
silt 281–2
siltation 940
simple allometry 14
simple craters 197
simplicity, principle of 122
simulation models 170
sine-generated curve 655
singing sands 960–1
sinkholes 267
  see also dolines; swallow holes
sinuosity 781, 961–2
  mountain-front 1036
size properties 697
skeleton plotting 239
skerries 962
slab avalanches 42
slab slides (sheet slides) 647
slaking 962, 977, 1116
Slices, Method of 668–9
slickensides 963
slickrock 907
slides 645, 645–8
  rotational 645, 646, 1015
  translational 645, 646–8, 1015
slope angle 517–18, 881
slope management 972
slope-over-wall cliff profiles 160, 161
slope stability 607, 969–70
  Method of Slices 668–9
slopes
  DGSDs 226–8
  evolution 963–8
  law of unequal slopes 860–1, 1079
  see also hillslopes
slopewash 970–1
slow quickclays 821
slow-responding landforms 605
slushflows (slush avalanches) 42, 971
smectite 1022
snow avalanches 41–4
snow dunes 297
snow line 456
sodium nitrate (caliche) 113–14
soil
  alluvial channels 134
  catenas 122–4
  chemical denudation and soil profile depletion 145–6
  chronosequences 153–4, 1043
  cohesion 172–3, 330
  compaction 174–5, 973–4
  crusting of 203–4
  dispersal 787
  erodibility 329–31, 824, 980–1
  expansive 350–1
  fragipans 408
  hydrophobic 369, 541–2
  mass movements 645, 649–50, 651–2
  micromorphology 671–4
  palaeosols 12, 154, 673–4, 755–6, 983
  regolith and 836
  wind erosion of *see* wind erosion of soil
soil association 122
soil bioengineering 1005, 1006
soil conservation 971–4
  USLE 1081–2
soil creep 635, 974–7
soil erosion 336, 425, 883, 977–81
  loess 628
  rates of operation 831–2
  rills 853
  sediment delivery ratio 932–4, 935
  termites 1038–9
  universal soil loss equation 390, 932–3, 979, 1081–2
soil flows (mudflows) 651–2
soil geomorphology 981–4
soil landscape models 981–2
soil spreading 649–50
solid mechanics 660–1
solifluction 984–7
soligenous mires 682
solubility 987–8
solute load 988–90
solute rating curves 144, 988–90
solute yields 144–5
solution 332, 333, 1110
  see also dissolution
solution dolines 267–9, 589
solution pools 883
solutional erosion (corrosion) 191–2, 332, 333
sorting
  fall sorting 916
  hydraulic 80
  sediment 802, 954–5
South Downs backslopes 246
Southern Oscillation (SO) 311
spalling 990
spar linings 991
spatial autocorrelation 406
spatial data 441
spatial resolution 845
spatter 1094

specific catchment area 697
specific geomorphometry 435, 437–9
speleothems 510, 511, 589, 990–2
spheroidal weathering 657, 992, 1109
  see also exfoliation
spilling breakers 1104
spillways 736–7
spines 612
spits 59, 60, 632, 993–4
  shingle 951–4
spitzkarren 583, 584
splash (erosion) 823–6, 977
splaying crevasses 458
splintered scarps 363
Spokane Flood 744
sponges, boring 91
sporadic permafrost 777–8
spray simulation systems 826
spreading, lateral 227, 645, 648–50
spring mounds 499
spring sapping 498
  spring-sapping valley heads 522, 523
spring tides 1102
springheads 994–5
springs 994–5
stability analysis 99–100, 656
stability states 969–70
stable coasts 167
stacks 995
stadials 549–54
stalactites 991
stalagmites 991
standardization of data 832
star dunes 286, 287, 288, 297
static allometry 14
static indeterminacy 660
statistical dimensions 437, 438
statistical experimentation 352
statistical models 170, 687
steady state 120–1
  steady-state Earth 475–6
  steady-state timescales 309
steep narrow hollows 522, 523
steep-walled kettles 594
steepness index 81
Steno, Nicolaus 430
step faults 362–3
step-pool systems 403, 995–6
stepovers 363
stepped (nested) glacis d'érosion 469, 470
stepped terrains 491–2
stereopairs 845
steric effects 996–7
stochastic models 688
Stokes drift 207, 208
Stokes' law 938–9
stone-lines 997–8
stone pavements 6, 998–9
storm surges 827–8, 999–1000
Strahler, A.N. 307–8, 1031
  stream ordering scheme 370, 371, 531, 532, 1001
straight rivers 137
straightening 140, 386
strandflats 375, 1000
strange attractors 142, 322
straths (rock-cut terraces) 1041
stratigraphy
  anastomosing rivers 23–4
  loess 627
strato-volcanoes 1096
stream frequency 533
stream length-gradient (SL) index 1036
stream ordering 274, 370–2, 531–3, 697, 1001–2
stream power 82, 1002–4
stream restoration 1004–6
streamflows 313
streamlines 94
strength
  excess 969
  residual (ultimate) 847
  shear strength 330, 359–60, 360–1, 1016
  strength–stress relationships 430
strength equilibrium slopes 881
stress 660, 661
  applied stress model of longshore drift 632
  effective 174, 311, 359–60
  shear stress 359–60, 1016
  stress-strength relationships 430
  stresses generated by waves 1105
striations 1006–7
  slickensides 963
strike-slip faults 202, 362, 363, 943
strike valleys 399, 400
strip cropping 973
stripped etchplains 345
stromatolites (stromatoliths) 1007
Strombolian eruptions 1095
structural landforms 1007–9
  mountain forms 701
  poljes 591, 592
  terraces 1042
structuralism 431
structurally controlled slopes 881
sturzstroms (rock avalanches) 155–6, 645, 652, 1009
subaerial processes and forms 1009–10
  subaerial deltas 862–5
  subaerial glacial lakes 555
subaquatic proglacial systems 811, 813
subaqueous deltas 862–5
subcutaneous flow 1010
subcutaneous zone (epikarst) 205, 320–1, 589, 1010
subduction zones 794–5
subglacial bedforms 473–4

subglacial geomorphology **1010–14**
subglacial glacitectonic deformation 471–2, 472–4
subglacial lakes *555*
subglacial meltwater channels 666–7
subglacial moraines 692–3
subglacial sedimentation 446
subglacial volcanic eruptions 1096
subjacent karst 754, *755*
submarine landslides **1014–19**, 1070
submarine meandering *656*
submarine valleys **1019–20**
submarine volcanism 1096
submerged forests **1021**
submerged groynes *500–1*
submergence, coasts of *166*
subpolar glaciers 455, *459*
subsequent coasts 166–7
subsequent streams 279
subsidence 342, 475–6, 484, **1021–5**
  groundwater overdraft 499
  sea level and 922
  urban geomorphology 1086–7
subsidence dolines 267, 268, 269, 270, 1023
substantive uniformitarianism 1080
subsurface stormflow 885
subsurface water flow 982–3
Sudd *563*
Suez New City, Egypt 1046, 1047, 1048
suffosion **1025**
suffosion dolines 267, 268, 269, 270, 1023, 1025
sula **1025**
sulphates 896
sulphation 896, **1025–6**
Sumatra Arc *575*, *576*
summary maps 1045–6
super-eruptions 111, 113
superflood palaeochannels *744–5*
superimposed drainage patterns 280
superplumes 641
superposition surfaces 97
super-volcanoes 111
supraformational casts *559*
supraglacial landforms and processes **1026–7**
  supraglacial lakes *555*
  supraglacial meltwater channels 666
  supraglacial moraines 692
  supraglacial sedimentation 445
surf bores **1104**
surf ledges (trottoirs) **1069**
surf zone 63, 63–4, 1104
  currents 207–10
surface derivatives *435–7*
surface drag 9
surface exposure dating 193
surface properties 697
surface uplift 731
surges (meteorological tides) 1102
surging glaciers **1028–9**
suspended load 74, 901, *934–5*, **1029–30**
  fluvial erosion quantification 390–1
  longshore drift 630–1
  mobile beds 685–6
  sediment rating curve **936–7**
suspension 10, 332, 333
swallow holes (ponors) 588, 801
swarms, dyke **305**
swash 209, 210, 827, 1104
  cusps 64, 67–8, 176
  lamination 72
  swash-aligned beaches 325
  zone 63
symmetrical ripples (oscillations) *859–60*
synclinal subsidence 400, 401
synclines 398, 399
syngenetic caves 124
syngenetic ice wedges *558–9*
syngenetic karst 589, **1030–1**
synrift sediments 851
synthetic aperture radars (SARs) *845–6*
synthetic faults 362
systems **1031–3**
  fluvial *see* fluvial systems
  land systems **602–4**
  open systems theory 307–8, 1032
  systems phase of geomorphology 433
  whole system tracer studies 1057

T-groynes *501*
T value (tolerable value) *979*
tafoni 119, 128–9, *1034–5*
taliks 778
talsand **1035**
talus *644–5*, **1035**
  creep *916*
  flat irons 378
  see also scree
taluvium **1035–6**
tectonic activity indices **1036–7**
tectonic geomorphology 429, 664, 699, **1037**
  see also plate tectonics
tectonic laminations 473, 474
tectonic processes 334
  climate, erosion and 841–2
  glacitectonics (glaciotectonics) **471–4**
  sea level 917–19, 922–3
  subsidence 1024
tectonic strain rate *715*
tectono-climatic regions 696
tektites 37
temperate glaciers *455*, *459*, 643
temporal resolution 845
tent rocks 112
tepees 766
tephra 1094

terminal fans 20, 380–1
terminal floodouts 380
terminal moraines 236, 693
termitaria **1037–9**
termites 766, **1037–9**
terrace pediments 769
terraces 986
  cryoplanation 204
  river 20, **1039–43**
terracettes **1044**
terracing 972–3
terrain evaluation 29, 427, **1044–9**
terrain slope 697
terrestrial cosmogenic nuclides (TCN) 192–4
terrestrial photogrammetric monitoring 48
Terzaghi, Karl 311, 359, 786, 822
texture properties 698
thaumasite 896
thermal diffusivity 416
thermal infrared region 845
thermocline 600
thermodynamic equilibrium 722
thermokarst 779, **1049–51**
thermoluminescence (TL) 223
thin sections 671
thorium-uranium dating 221–2
thresholds, geomorphic 134, 379, *635*, **1051–2**
throughflow 885
thrust earthquakes 942–3
thrust faults 202, 362
Tibetan Plateau *549*
tidal creeks **1052**
tidal currents 210, 1103
tidal deltas **1052–4**
tidal range 61–2, 92, 899
  relative tide range (RTR) 64, 324
  shore platform gradient and *957–8*
tidal rhythmites 281
tidal waves 1102
tide-dominated beaches 63–4, 67
tide-dominated estuaries 343
tide-modified beaches 63–4, 66–7
tides 1102–3
tidewater glaciers *454*
till 445, 467, 876
  deformation till 473
tillage *see* agriculture
tillage erosion *975–6*, 978
tilted sedimentary strata 1008
time 747
  averaging time 193–4
  characteristic time 838, 839
  cyclic **214–15**, 309, 689
  deep-time problem 690
  event time models 689
  graded 309, 489, **490**
  location-time substitution 327–8
  non-linear dynamics 722
  reaction time 233, 838, 839
  recurrent intervals 637, 750
  relaxation time 635–6, **838–40**
  temporal change and fluvial geomorphology 395–6
  see also chronofunctions; chronosequences
Titan *355*
Toba, Lake 111, 112
tombolos 632, *954*, **1054**
topogenous mires 682
topographic wetness index (TWI) 187
topographically controlled rips *855*
toposequences 122, 518, 519, 982
topples 361, *645*
torba *513*
toreva blocks **1056**
Torre, River 867
tors 321, **1054–6**
total basin relief 698
total denudation rates 242–3
tower karst 592
tracers 387, 980, **1056–60**
traction 332, 333
transcurrent faults 363, 795
transform faults 363, 795–6
transgressions **1060–1**
  postglacial transgression **805–7**
transgressive dunefields 70, 294
transient form ratio 636
translation 938
translational slides *645*, *646–8*, 1015
transmission losses 378
transport-limited systems 46, 242, 326, 831, 964, 965–7, **1114–15**
transporting capacity 8, 964–6
transverse bars *54–6*, 57, *65*
transverse crevasses 458
transverse dunes 286, 287, 296, 297
travertines **1071–3**
trees
  dendrochronology **238–9**
  dendrogeomorphology 84, **239–40**
  forest geomorphology **401–4**
  riparian geomorphology 858–9
  submerged forests **1021**
  tree falls **1061–2**
trenches
  fanhead 16, 17, 18
  oceanic *575*, *576*, 794
triangulated irregular networks (TINs) 260, 261, 441–2
tributary mouth bars 182
trimlines, glacial **1062–3**
triple junctions 796
trittkarren *584*
tropical coastlines 482–3
tropical cyclones 313, 482
tropical geomorphology 230–2, **1063–9**

trottoirs (surf ledges) 1069
true cays 130–1
'true' pediments 769
tsunamis 1018–19, **1069–71**, 1102, 1103
tufas 876, **1071–3**
tuff cones 1096
tuff rings 1096
tuffs 1094
tumuli 612
tundra 479–81
tunnel erosion 786, **1073–4**
tunnel valleys 106, 667, **1074–5**
turbidites 1075
turbidity currents **1075**
turbidity sensors 1030
turbulent boundary layers 95–6
turbulent flow 94–5
turf exfoliation **1075**
turloughs **1075–6**
Tuvalu 40
two-stage theory 1055

U-shaped valleys 200–1, 1089
ultimate (residual) strength **847**
unconfined aquifers 497
unconfined caves 124, 126–7
underconsolidation 174
undercutting
  sandstone 906–7
  waterfalls 1100
underfit streams 744, 752, 861, **1077–9**
undertows 208, 209
undrained loading **1079**
unequal slopes, law of 860–1, **1079**
uniclinal shifting **1079–80**
uniformitarianism 431–2, 475–6, 613, **1080–1**
uniformity of process 122
unique landforms **417**
unit bars 57
United States Soil Conservation Service 831–2, 972
universal soil loss equation (USLE) 390, 932–3, 979, **1081–2**
unloading **1082**, 1108–9
unpaired river terraces 1041, 1042
Upheaval Dome 206
uplift 475–6, 477–8, 1083
  equilibria between hillslope erosion and sediment yield 832–3
  sea level 922
  uplift weathering hypothesis 1113
upper-stage plane beds 76–7
uranium-thorium dating 221–2
(uranium-thorium)/helium analysis ((U-Th)/He analysis) 372–3, **1083–4**
Uranus 355
urban construction 1084–5, 1086
urban development 1084, 1085
urban geomorphology **1084–8**
urban regeneration 1087
urstromtäler **1088**
Ussher, James 430–1
uvalas 591

V-shaped valleys 200–1, 1089
valley benches 702–3
valley bulging **115–16**
valley glaciers 454, 455
valley head hillslope hollows 522, 523
valley meanders 1077, 1078, **1090**
valley side rock glaciers 877
valley trains 461, 465
valleys **1089–90**
  alas valleys 13
  asymmetric 35–6, **38–9**
  beheaded **83**
  blind 87, 590
  box **98**
  buried **106**
  cross profiles **200–1**
  dry **284–5**
  extraterrestrial geomorphology 356–7
  groundwater sapping and 498–9
  hanging 279, 447–8, 513
  interfluves **572–3**
  mekgacha **665**
  mountain valley proglacial systems 812–13
  rift valleys **849–52**
  submarine **1019–20**
  tunnel valleys 106, 667, **1074–5**
  valley floor width-to-height ratio 1037
  wadis **1098–9**
Varenius, Bernhard 430
variable source area 186
vasques **1090–1**
vegetation
  anabranching rivers 24–5
  dryland vegetation systems 255
  and dune mobility 296
  and erosion 335, 980–1
  halophytic 898–900
  hedgerows 972
  palaeofloods and 748–9
  riparian geomorphology 858
  river continuum 862
  weed cutting 141
  see also trees
vein ice 778–9
velocity-reversal hypothesis 802
Venetz, Ignace 432
Venice 1021, 1022, 1087
ventifacts **1091**
Venus 355, 356, 479
Vermetid reefs **1091–2**
vertical accretion 382–3
Vertisols 350
visors **1092**
virtual velocity of sediment 935
viscous fluid flow, linear theory of 661
volcanic craters 196, 197
volcanic fields 1096
volcanic islands 1018
volcanic karst **1092**
volcanism and volcanoes **1092–7**
  calderas **111–13**, 197, 1096
  erosional features 1096
  eruption styles 1094–5
  extraterrestrial 355–6
  geomorphological hazards research 425
  island arcs 575, 576
  lahars 225, 597–9, 650, 651
  lava *see* lava
  materials erupted 1094
  nuées ardentes **725–6**
  plate tectonics 794, 795
  pyroclastic flow deposits 609, **818–20**, 876, 1094
  rifts **850–1**
  tsunamis 1070–1
  types of volcano 1095–6
vortices (eddies) 94–5
Vredefort Dome 206
vulcanian eruptions 1095
Vulcanists (Platonists) 431

wadis **1098–9**
wandering **495**
  see also anabranching rivers; braided rivers
waning slopes 519
wash **823–6**
washover 61, 739
waste disposal 1087
water erosion prediction project (WEPP) 979, 1082
water-layer weathering **1099**
water movement
  hillslope processes 525, 526
  soil landscapes and 982–3
  tracer studies 1057
  see also overland flow; runoff generation
water repellency (hydrophobic soil) 369, **541–2**
water-storage capacity 738–9
water table 804
  lowering of 269–70
water waves 1102
  see also waves
waterfalls **1099–1101**
  knickpoints **595–6**
watershed **1101**
  management 1101
  see also drainage basins
wave base 1106
wave breaking zone 63
wave-cut notches 1106
wave-dominated beaches 63–6
wave-dominated estuaries 343
wave shoaling zone 63
wave streaming (wave drift) 207
waves 859–60, **1102–8**
  asymmetry 1104, 1105
  coastal classification 169
  geomorphological response 1106–7
  gravity wave propagation and energy dissipation 1104–5
  saltmarshes and wave climate 899
  sediment transport by 1105
  skewness 1104, 1105
  spectrum 1102–4
  stresses generated by 1105
  swash processes 209, 210, 827, 1104
  tsunamis 1018–19, **1069–71**, 1102, 1103
  wave–boundary interaction model 857
  wave–wave interaction models 857
waxing slopes 519
weathering 148, 880, 1055, **1108–12**
  cavernous *see* cavernous weathering
  chelation **143–4**, 150–1, 1110
  chemical *see* chemical weathering
  and climate change **1112–13**
  cryogenic 413
  deep **228–33**, 346–7, 1111–12
  fire and 367–9
  frost weathering **412–15**, 658, 879, 1109
  glacial trimlines **1062–3**
  Goldich weathering series **485–6**
  granite weathering mantles 491
  grus 229, 493, **501–3**
  insolation 566–7, 657, 1108
  intensity 1110–11
  mechanical 240, 241–2, 243, 657–9
  mineral magnetic analysis 676, 678
  nivation and 719
  organic 659, **727–30**, 1108, 1109, 1110
  and pediment formation 769
  processes 1108–10
  salt weathering 129, 658–9, 790, **894–7**, 1109
  sandstones 907–8
  spheroidal 657, 992, 1109
  tropical geomorphology 1064–5, 1066–7
  water-layer weathering **1099**
  wetting and drying weathering 658, 1109, **1116–17**
weathering front 229, 909, 1110, **1113**
weathering-limited systems 46, 242, 326, 831, 964, 965–7, **1114–15**
weathering pits **1115–16**
weathering profiles 615, 837, 909–12
  deep weathering 228–30, 231
weathering rinds **853–5**
wedges, ice 558–9
wedging, frost 412
weed cutting 141

Wegener, Alfred 792–3
welding 819, 820
Werner, Abraham 121, 431
Wernerians (Neptunists) 431
wet sapping 499
wet snow avalanches 42
wet-snow line 456
wet soil flows 651
wetting and drying weathering 658, 1109, **1116–17**
whales 1123
whole system tracer studies 1057
wigwams (tent rocks) 112
Wilson cycle **1117**
wind erosion assessment model (WEAM) 1118
wind erosion equation 1118
wind erosion of soil **1117–18**
  dust storms **301–4**
  processes of 9
  see also aeolation; aeolian geomorphology; aeolian processes
wind-induced currents 210–11
wind tunnels **1118–19**
wind waves 1102
  see also waves
windbreaks 972
World Coast Conference 568, 569
World Geodetic System (WGS) 488

Yangtze Delta 863, 864
Yangtze River 386
yardangs **1120–1**
yazoos **1121**
Yellow River (Huanghe) Delta 863, 864
Younger coversands 195, 196
Younger Dryas stadial 554

zero-order basins 371
zeugen 1120
Zipf's law 617
zonation
  boring organisms 91–2
  in lakes 599–600
zoogeomorphology 84, **1122–3**
zookarst 86