

# Index

Page numbers in *italics* refer to Figures and Tables

- Aci San Antonio 182
- Acicatena 182–3
- Aciplatani 183–4
- Aeolian Islands
  - Alicudi 12
    - see also* Stromboli
- Alaska 1, 3, 11, 12, 17
- Alba Patera 319–20, 334, 335, 336, 339
- Albor Tholus 323, 324–5 334, 335, 336, 339
- Alicudi 12
- Alpha Regio 352, 358
- Amphitrites Patera 327–9, 334, 337
- analogue modelling
  - landslides 302–4
- Andean volcanoes 1
- Antarctica *see* Deception Island
- Apollinaris Patera 325–6, 334, 335, 336, 337, 338
- Arsia Mons 36, 37, 316–18, 334, 335, 336, 337, 338, 339
- Arsia-type caldera 335–6
- Ascraeus Mons 37, 38, 319, 334, 335, 336, 337, 338, 339, 341
- aseismic creep 179–80
  - Etna study
    - measurement sites 181–6
    - significance of results 186–90
- Atla Regio 353, 356, 357, 364, 369
- Augustine Island (Alaska) 1, 3, 11, 12, 17
- Avalancha del Zarzo 366, 368
- Ayacata Formation 86, 87
  
- Bandai-type collapse 77–8
- basalt
  - influence on stability 48–9
  - shield volcano landslides 295
- Basaltic Shield Formation (BSF) 255
- basement
  - deformation behaviour
    - numerical modelling 105–9
    - quantification 102–3
  - Mount Etna 200–3
- Basilicata mass flow studies 237–9
  - emplacement 241–5
  - lithology 239–40
  - summary 245–6
- Bezymianny-type collapse 77, 78, 340
- Biblis Patera 323, 334, 336, 339
- Blackhawk landslide 366, 368
- Bracciano Depression
  - setting 225–6
  - structure 230–3
  - volcanic sequence 227–30
- Bransfield Strait *see* Deception Island
- Brito Formation 97
  
- calderas
  - Deception Island
    - origin 263
    - setting 253–14
    - dating 250–4
- martian
  - classification 333–6
  - deformation 336–7
  - flank structures 337–9
  - gravitational collapse 340–3
  - regional studies
    - Elysium 323–7
    - Hellas 327–30
    - Syrtis Major 330–2
    - Tharsis 313–23
  - rift zones 339–40
  - sizes 332–3
  - morphology classification 308
  - problems of interpretation 308–10
  - related slides 276–7
- California 83
- Campi Flegri 83, 263
- Canarian Archipelago (Canary Islands) 1, 5, 8, 12
  - mass wasting 128
  - rift features 125–8
    - geometry 129
    - stresses in 128–9
  - setting 125
  - slides 281
  - volcanic activity 125
  - volcanic hazard assessment 131–4
  - see also* El Hierro; Fuerteventura; Gran Canaria; La Gomera; La Palma; Lanzarote; Tenerife
- Caribbean
  - tsunami hazard 115
  - quantification 120–2
- Cascades Range *see* Mount Adams; Mount Rainier; Mount St Helens
- Casita 99
- Cavoni 55, 60
- Ceraunius Tholus 321–2, 334, 335, 336, 339, 343
- Chilean volcanoes
  - Hudson 245
  - Socompa 7, 8, 77, 78
- clastic dykes, effect on pore pressure of 83–5
- cohesive strength (s), relation to collapse 79
- Colima (Mexico), Nevado di 3–4, 7–8, 16
- collapse
  - classification 77–8
  - physical parameters influencing 78–80
- collapse calderas 2
- Colli Albani Volcanic District 225
- Colombia 17
- Concepción (Nicaragua) 10, 86, 96, 98, 100–1, 103
- Copernicus crater 30
- Crocefisso–Nizzeti 182
- Cumbre Vieja ridge 5, 15
  
- debris aprons
  - Venus
    - morphology 353–9
    - morphometry 359–61
- debris avalanches
  - defined, 7
  - Hawaiian Islands 295
  - Réunion 298–302

- Deception Island  
 plate tectonic character 254, 255  
 seismological study  
 method 257  
 results 257–62  
 results discussed 262–4  
 setting 253–4, 255  
 stratigraphy 254–6  
 structure 257
- decompression 361
- deformation  
 basement 95–6  
 numerical modelling 105–9  
 quantification 102–3  
 relation to pore pressure 85–8
- degassing, effect on pore pressure of 82–3
- digital evaluation modelling (DEM) 299
- digital terrain modelling  
 methods 296–7  
 results 297–302
- dyke injection  
 contribution to flank failure 47–50  
 lunar 27  
 relation to pore fluid pressure 46–7  
 relation to rifting 8–10, 129
- dyke swarms 8–10
- earthquakes (seismic), effect on flank failure 50–1
- El Chonco 99
- El Coyal Group 97
- El Hierro 5, 8, 125, 126, 127, 131, 132, 133
- Elysium Mons 323, 326, 334, 335, 336, 339
- Elysium region 16, 323–7
- eruptions  
 prediction of 113–14  
 triggering 113
- Esan Skyzawa-yama 267, 268, 278
- Etna *see* Mount Etna
- fabric, role in failure 7–8
- fault creep 179–80  
 Etna study  
 measurement sites 181–6  
 significance of results 186–90
- fault systems  
 Mount Etna 194–9  
 Roccamonfina 219–20
- faulting, relation to pore pressure of 85–8
- flank failure geometry 47–8  
 relation to mechanical pore fluid pressure 48–50  
 relation to thermal pore fluid pressure 50
- forecasting of eruptions 18–19
- friction, effective coefficient of ( $\mu$ ), relation to collapse 79–80
- Fuerteventura 125, 126, 127, 133
- Galápagos Islands  
 shield volcano 338, 339  
 submarine slides 12
- Geisha seamounts 339
- geochemistry, Hawaiian Island turbidites 285–8
- geomorphology, Roccamonfina 216–19
- glass, volcanic 286
- Gomera 125, 126, 127, 133
- Gough Island 128
- grading in mass flows 242
- Gran Canaria 125, 126, 127, 133
- gravitational collapse  
 earth volcanoes 340–1  
 martian volcanoes 341–3
- gravitational sliding and thrusting 11, 169
- gravity anomaly, Bracciano 231
- ground movement  
 application of inverse rate method  
 method 111–12  
 study of Etna 112–13  
 use in eruption prediction 113–14
- Guinevere Platinia 354
- Hadriaca Patera 329, 334, 335, 336
- Harimkotan 17
- Hawaiian Islands 1, 4, 10, 11, 12  
 flank collapse 341  
 landslides 281, 283, 295  
 rift zones 339–40  
 setting 281–2  
 shield volcano structure 309, 339  
 submarine slides 128, 368  
 turbidites  
 correlation 290–2  
 geochemistry 285–8  
 origins 288–90  
 petrography 285  
 role in deep sea sedimentation 292  
 stratigraphy 283–5  
 volcanic sand study 290  
*see also* Kilauea; Mauna Loa
- Hawaiian Ridge 13, 14, 39–40
- Hawaiian rifts 129
- hazard assessment for instability 16–18  
 Canary Islands 131–4
- Hecates Tholus 323, 326–7, 334, 335, 336, 339
- Hekla 338, 339
- Helen Planitia 353, 359
- Hellas region 327–30
- Hokkaido volcanoes 276–70  
 caldera formation 276–7  
 hydrologic mass flows  
 Tokachidake 274–6  
 Usu 270–4
- Hudson, Volcan 245
- hydrogeology, Mount Etna 199–200
- hydrologic mass flows  
 Tokachidake 274–6  
 Usu 270–4
- Iceland 338, 339
- Iizuna volcano 95
- instability, coastal  
 causes 2–3  
 defined 1  
 development 3–4  
 frequency of occurrence 2  
 rifting 8–10  
 role of water 5  
 triggering mechanisms 4–5

- intrusive bodies
  - effect on Etna stability 204
  - see also dyke injection
- inverse rate method 111–12
  - application to Etna 112–13
  - use in eruption prediction 113–14
- Irumukeppu-yama 268, 269
- Ischia
  - evolution 249
  - uplift estimates
    - methods of analysis 249–51
    - results discussed 251
- Japan 1, 95
  - Esan Skyzawa-yama 267, 268, 278
  - Hokkaido 276–70
    - caldera formation 276–7
    - hydrologic mass flows 270–6
  - Irumukeppu-yama 268, 269
  - Komagatake 267, 268, 278
  - Matsushiro 83
  - Minami-dake 268, 270, 278
  - Niseko 268, 278
  - Onnebetsu-dake 268, 269–70, 278
  - Oshima Ohshima 267, 268, 278
  - Shikaribetsu 268–9
  - Shiribetsu-dake 268, 278
  - Tokachidake 268, 269, 278, 274–6
  - Unzen 7, 17
  - Usu 83, 267, 268, 278, 270–4
  - Yake-dake 83
- Java 95
- Jovus Tholus 323, 334, 335, 336, 339
- Kamchatka 1, 10
- Kick 'em Jenny 17
  - setting 115–17
  - tsunamigenic potential 122–3
- Kilauea 11, 12, 14, 282, 290
  - caldera 309
- Klyuchevshoi 10
- Komagatake 267, 268, 278
- Kurile Islands 1, 17
- La Palma 5, 8, 15, 125, 126, 127, 131, 132, 133
- La Pelona 99
- lahar, defined 7
- Lahar Facies 237–8
  - distribution 238
  - stratigraphy 239
  - transport mechanisms 241–5
- landslides
  - Canary Islands 128, 131
  - Hawaiian Islands 281, 283, 295
  - Réunion 297
    - debris avalanches 298–302
    - modelling 302–4
    - see also slope failure
- Lanzarote 125, 126, 127, 133
- laser altimetry
  - airborne method 139–40
  - application in morphometry 146–8
  - general method 138–9
  - use in volcano monitoring
    - Mount Adams 145–6
    - Mount Rainier 145–6
    - Mount St Helens 140–4
- Lassen Peak (California) 365
- Latian Volcanic Province 225
- Lesser Antilles
  - setting 115–17
  - tsunamigenic potential 17, 122–3
- Loma de la Asperaza 366, 368
- Loma La Teta 99
- Loma Redonda landslide 366, 368
- Long Valley 263
- Maderas (Nicaragua) 10, 96, 98, 101, 103
- magma chamber collapse 308
- maria, lunar 28
- Marion Island 128
- Marquesas 12, 281
- Mars 1, 15–16
  - calderas
    - characters 310–13
    - classification 333–6
    - deformation 336–7
    - flank structures 337–9
    - gravitational collapse 340–3
    - regional studies
      - Elysium 16, 323–7
      - Hellas 327–30
      - Syrtis Major 330–2
      - Tharsis 16, 35, 313–23
    - rift zones 339–40
    - sizes 332–3
  - igneous processes 34–5
  - volcano structures 33–4, 35–9
- Martinique 1, 12
- Mascalucia fault system 195
- mass flow deposits of Monte Vulture 237–9
  - emplacement 241–5
  - lithology 239–40
  - summary 245–6
- mass movement
  - defined 267
  - factors affecting 267
  - Hokkaido examples 267–70
    - caldera formation 276–7
    - Tokachidake 274–6
    - Usu 270–4
- mass transport 5–6
- mathematical modelling, basement deformation 105–9
- Matsushiro 83
- Mauna Loa 12, 15, 282
  - debris avalanche 45
- Meroe Patera 330, 332, 334, 337
- Mexico 3–4, 7–8, 16
- Minami-dake 268, 270, 278
- modelling
  - analogue modelling of landslides 302–4
  - digital evaluation modelling (DEM) 299
  - digital terrain modelling
    - methods 296–7
    - results 297–302

- modelling (*continued*)  
 mathematical modelling  
 basement deformation 105–9  
 stress modelling  
 parameters 67–9  
 results 70–3  
 summary 73–4  
 Mokosha Mons 352, 353, 355  
 Mombacho 1, 96, 98, 99–100, 103  
 Monte Vulture  
 mass flow deposits 238–9  
 emplacement 241–5  
 lithology 239–40  
 summary 245–6  
 setting 237–8  
 Moon 15  
 igneous processes 26–7  
 lack of calderas 310  
 maria 28  
 seismicity 30  
 volcano structures 26  
 morphometric analysis 146–8  
 Mount Adams 145–6  
 Mount Etna 4, 8, 12, 15, 169–70  
 eruption prediction 113–14  
 eruption triggering 113  
 explosion-quake monitoring  
 methods 373–4  
 results 374–5  
 spectral analysis 375–9  
 fault creep study  
 measurement sites 181–6  
 significance of results 186–90  
 flank collapse 111, 341  
 instability factors 204–6  
 basement 200–3  
 fault systems  
 Mascalcucia 195  
 Pernicana 194  
 Ragalna 195–9  
 Trecastagni 195  
 gravitational 153–4, 169  
 Holocene uplift 203  
 hydrogeology 199–200  
 intrusive bodies 204  
 magma emplacement 156  
 regional uplift 156, 165–6  
 sea-level change 156–7  
 seismicity 199  
 tectonic 154–6  
 seismicity study 170–1  
 methods 171  
 results 171–4  
 significance of results 174–6  
 vertical ground deformation 111–12  
 Mount Rainier  
 laser altimetry 145–6  
 morphometric analysis 148  
 Mount St Helens 1, 6, 16  
 collapse classification 77  
 flank collapse 340  
 lahars 7, 8  
 laser altimetry 140–4  
 Mount Shasta 7, 8  
 Moyotepe 99  
 Navka Platina 352, 354, 362, 364, 368  
 nested calderas 308  
 neutral buoyancy zone (NBZ)  
 Moon 27, 28–9  
 Venus 30–2  
 Nevado del Ruiz 17  
 Nevado di Colima 3–4, 7–8, 16  
 Nicaragua *see* Concepción; Maderas; Mombacho  
 Nicaragua  
 basement geology 97  
 volcano construction 97–9  
 volcano deformation  
 numerical modelling 105–9  
 quantification 102–3  
 volcano description  
 Concepción 10, 86, 96, 98, 100–1, 103  
 Maderas 10, 96, 98, 101, 103  
 Mombacho 1, 96, 98, 99–100, 103  
 San Cristobal 96, 98, 99, 103  
 Nigorikawa Caldera 268, 276  
 Nili Patera 330, 331–2, 334, 337  
 Niobe Platina 356, 364, 368  
 Niseko 268, 278  
 Nyiragongo 338, 339  
 Oahu 282  
 oceanic islands, landslides 295  
 olivine geochemistry 286–8  
 Olympus Mons 15, 33–4, 36–7  
 caldera 309, 311, 312, 313–16, 334, 335, 336–7, 339  
 gravitational collapse 341, 342  
 morphometry 148, 150  
 Olympus-type caldera 335  
 Onnebetsu-dake 268, 269–70, 278  
 Oshima Ohshima 267, 268, 278  
 overpressurization 27  
 palaeomagnetism 283–4  
 palaeoshoreline change  
 implications for volcano instability 165–6  
 methods of study 157  
 regional studies in Sicily 158–65  
 Pavonis Mons 37, 38, 318–19, 334, 335, 336, 337, 338, 339  
 Peneus Patera 329, 334, 336  
 Pernicana fault system 194  
 petrography, Hawaiian Island turbidites 285  
 Phoebe Regio 352, 355  
 Piton de la Fournaise 1, 8, 14, 15, 295–6  
 flank collapse 341  
 landslide analogue modelling 302–4  
 methods 296–7  
 results 297–302  
 results discussed 304–5  
 rift zones 339  
 Piton des Neiges 12, 295  
 Piton du Carbet 12  
 plutonic complexes *see* intrusive bodies

- pore-fluid pressure 4, 5  
 as fraction of lithostatic load ( $\lambda$ ) 80–1  
 aquathermal effects 81–2  
 clastic dykes effects 83–5  
 deformation effects 85–8  
 degassing effects 82–3  
 monitoring and predicting 89–90  
 relation to collapse 80  
 relation to dyking  
 mechanical 46–7, 48–50  
 thermal 47, 50  
 sustaining high values 88–9
- Pozzillo Soprano 184  
 Prince Edward Island 128  
 Provenzana-Pernicana fault system 185  
 Puu Oo eruption 290
- Rabaul 263  
 radiocarbon dating 250  
 radiolaria and turbidite ages 284  
 Ragalna fault system 195–9  
 Réunion 128, 281, 339  
 Piton de la Fournaise 1, 8, 14, 15, 295–6  
 flank collapse 341  
 landslide analogue modelling 302–4  
 methods 296–7  
 results 297–302  
 results discussed 304–5  
 rift zones 339  
 Piton des Neiges 12, 295
- rift features  
 Canary Islands 125–8  
 genesis of 128–9  
 Hawaii 129
- rift zones  
 earth volcanoes 339, 340  
 martian volcanoes 339, 340  
 role in failure 8–10
- Rivas Formation 97
- Roccamonfina  
 geomorphology 216–19  
 history of research 209–10  
 setting 210  
 stratigraphy 210–16  
 structure 219–20  
 summary 220–3
- Roque Nublo Group 83, 86
- Sabatini Volcanic District (SVD) *see* Bracciano  
 Depression
- Salton Sea volcanic field 83  
 San Cristobal 96, 98, 99, 103  
 San Giovanni Bosco-Guardia 184  
 San Leonardello 184–5  
 Santa Agata li Battiatì 181  
 Santa Tecla fault 184  
 Sapas Mons 32, 33, 355, 362  
 Sciarra del Fuoco 55, 57, 60  
 Scillichenti 184
- sea-level change  
 implications for volcano instability 165–6  
 methods of study 157  
 regional studies in Sicily 158–65
- seismic activity  
 Etna study  
 methods 171  
 results 171–4  
 results discussed 174–6  
 seismic sections 232, 233
- seismicity  
 explosion-quakes  
 methods of monitoring 373–4  
 results 374–5  
 spectral analysis 375–9  
 discussed 379–80
- Moon 30  
 Mount Etna 199
- seismological study  
 Deception Island  
 method 257  
 results 257–62  
 results discussed 262–4
- Severgina 17  
 shield volcanoes 2, 15  
 Shikaribetsu 268–9  
 Shiribetsu-dake 268, 278
- shoreline studies 250  
*see also* palaeoshoreline change
- Sicily  
 palaeoshoreline study 157–8  
 north coast 163–5  
 south-east coast 158–9  
 volcanic coast 159–63  
 shoreline uplift and volcano instability 165–6  
*see also* Mount Etna
- Sif Mons morphometry 148, 150  
 Silver Reef landslide 366, 368
- Skjaldbreidur shield  
 laser altimetry 145, 146  
 morphometry 147, 148, 150
- slope failure  
 geomorphic processes causing  
 Earth 361, 365, 366–8  
 Venus 361–4, 365, 368–9
- slump, defined 15
- slumping  
 Hawaiian Islands 295  
 Mount St Helens 143–4
- Socompa 7, 8  
 collapse classification 77, 78
- spectral analysis  
 Strombolian explosion-quakes  
 February crisis 375–7  
 May crisis 377–8  
 October crisis 378–9
- Stazzo 184
- stratigraphy  
 Bracciano 228  
 Hawaiian Island turbidites 283–5  
 Roccamonfina 214, 216  
 Stromboli 56–7
- stratovolcanoes 2
- stress fields, relation to volcanic structure 338–9,  
 341
- stress modelling  
 history of research 65–6

- stress modelling (*continued*)  
 Stromboli  
 model parameters 67–9  
 results 70–3  
 summary 73–4  
 Stromboli 1, 8, 12, 15, 17  
 age 60  
 dyke swarms 55  
 explosion-quake monitoring  
 methods 373–4  
 results 374–5  
 spectral analysis 375–9  
 discussed 379–80  
 geometry 57–9  
 morphology 59–60  
 stratigraphy 56–7  
 relation to collapse 60–2  
 stress modelling  
 parameters 67–9  
 results 70–3  
 summary 73–4  
 structure 66–7  
 Strombolicchio 55  
 submarine slides 12  
 Sumatra 83  
 Suoh volcanic field 83  
 synthetic aperture radar (SAR) interferometry 137,  
 141–2  
 Syrtis Major region 330–2
- Taburiente 129  
 temperature effects on pore pressure 81–2  
 Tenerife 125, 126, 127, 131, 133  
 Tharsis region 16, 35, 313–3  
 Tharsis Tholus 322–3, 334, 335, 336, 339, 343  
 thermal effects *see* temperature  
 Tinatin Planitia 352, 354  
 Tokachidake 83 268, 269, 278  
 hydrologic mass flows 274–6  
 topographic analysis by laser altimetry  
 airborne method 139–40  
 general method 138–9  
 volcano morphometry 146–8  
 volcano topography  
 Mount Adams 145–6  
 Mount Rainier 145–6  
 Mount St Helens 140–4  
 Torrente Fago 185  
 Totogalpa Formation 97  
 Trecastagni fault system 195  
 Tremestieri fault 181–2  
 Tristan da Cunha 12, 128
- tsunamis 17  
 landslide generation 117–20  
 quantification of potential 120–2  
 Canary Islands 131  
 Caribbean 122–3  
 volcanic causes 115, 118  
 turbidites 15  
 Hawaiian Islands  
 correlation 290–2  
 geochemistry 285–8  
 origins 288–90  
 petrography 285  
 role in deep sea sedimentation 292  
 stratigraphy 283–5  
 Tyrrhena Patera 329–30, 334, 335
- Ulysses Patera 323, 334, 335, 336, 339  
 Unzen (Japan) 7, 17  
 Unzen-type collapse 77–8  
 uplift  
 Mount Etna 203  
*see also* palaeoshoreline change  
 Uranius Patera 321, 334, 335, 336, 337, 339  
 Uranius Tholus 323, 334, 335, 339  
 Usu 83, 267, 268, 278  
 hydrologic mass flows 270–4
- Venus 1, 15, 16  
 caldera-like features 309, 310  
 debris aprons  
 morphology 353–9  
 morphometry 359–61  
 geomorphic processes in slope failure 361–9  
 igneous processes 30–3  
 modified domes (MD) 349  
 morphology 351–2, 365  
 morphometry 352  
 scalloped margin domes (SMD) 349  
 volcano structures 30  
 volcanic domes  
 Venus  
 modified domes (MD) 351–2, 365  
 scalloped margin domes (SMD) 349  
 volcanic spreading 11  
 volcaniclastics  
 defined 6–7  
 influence on stability 48–9  
 West African Rift 338, 339
- Yake-dake 83  
 Yellow Tuff Formation (YTF) 255, 256