

Index

Page numbers in *italics* refer to Figures. Page numbers in **bold** refer to Tables.

- accessory minerals *see* U-series dating
 - Achada das Furnas 86, 86, 87, 87, 99, 100
 - Adamello batholith (Italy) 162
 - see also* Western Adamello Tonalite
 - Adams, Mount (Cascades, USA) 57, 78, 147
 - Água de Pau volcano 87, 99
 - Aleutians
 - U-series ages 147, 164
 - Alid (Eritrea) 147, 163, 164
 - alkali basalt, São Miguel 91
 - allanite dating 142, 143, 161, 164–165
 - Altiplano-Puna Magma Body (APMB) 1, 2, 58, 59, 80
 - Altiplano-Puna Volcanic Complex (APVC) 59
 - amphiboles
 - as hydrous minerals 106
 - rim composition 121
 - andalusite 43
 - Andean Arc 59
 - andesites
 - Tatun Volcanic Group
 - geochemistry 177
 - map 176
 - mineralogy 177–178, 178
 - sampling 176, 177
 - U-Th-Ra ages
 - methods of analysis 178–180
 - results **181**, 182
 - results discussed 182–186
 - Tavurvur volcano 17, 18, 19
 - 2006 eruption study
 - methods of analysis 19, 21, 23
 - results 20, 21, 22, 23
 - melt inclusions 24–26
 - major elements 26–27
 - volatiles 27–28
 - mineral compositions and textures 23–24
 - results discussed
 - fractional crystallization 27–31
 - implications for unrest 34–36
 - mafic-silicic interactions 31–34
 - pressure-temperature estimates 28
 - eruption history 19
 - map 18
 - andesitic arc eruptions
 - Colima, Volcán de
 - eruptive activity (1818–1913) 193
 - eruptive activity (1961–2010) 193
 - eruptive activity (1998–2010) 190, 191, 192, 192
 - magma geochemistry 192–193
 - magma petrology 193
 - Pb–Ra disequilibrium study 193–194
 - methods 194
 - results 194, 195
 - results discussed 194, 196
 - conduit dynamics 202–203
 - fractionation 196–199
 - magma petrology 203
 - ^{210}Pb deficits 199–201
 - ^{210}Pb excesses 201
 - SO₂ flux 201–202
 - summary 203–204
 - andesitic melts, production of 4–5
 - antecrysts 90, 161
 - defined 148
 - $^{40}\text{Ar}/^{39}\text{Ar}$ dating
 - Tatun Volcanic Group 176
 - Uturuncu lavas
 - methods 61–62, 63
 - results 67–68, **69**
 - results discussed 78–79
 - Arenal volcano 147, 199
 - assimilation, crustal 215
 - Atacama ignimbrite 162
 - Aucanquilcha volcano 75–76, 78
 - autocrysts 161
 - defined 148
 - Azores archipelago 85–86
 - São Miguel basalt fluid inclusion study
 - methods 90
 - results
 - fluid inclusion description 92–96
 - geochemistry 91–92
 - sample texture and mineralogy **88**, **89**, 90–91
 - results discussed
 - magma ponding 98–99
 - re-equilibration 96–97
 - tectonics or underplating 99–101
 - geological setting 86–87
 - map 86
 - seismic records 87
- backscattered electron (BSE) images, Tavurvur 2006
 - eruption 19, 20, 21, 32, 33
- Baker, Mount (USA) 57, 78
- basalt
 - mixing and mingling 17–18, 31
 - São Miguel fluid inclusion study 86
 - methods 90
 - results
 - fluid inclusion description 92–96
 - geochemistry 91–92
 - sample texture and mineralogy **88**, **89**, 90–91
 - results discussed
 - magma ponding 98–99
 - re-equilibration 96–97
 - tectonics or underplating 99–101
- batch of magma, defined 42
- Belford Tuff (Lesser Antilles) 165
- Biot number 11, 208, 210, **212**, 213, 213, 214, 215
- biotite
 - Fish Canyon Tuff experimental petrology 117, 118, 121
 - Uturuncu volcano, $^{40}\text{Ar}/^{39}\text{Ar}$ age 67–68

- Bishop Tuff (USA) 2, 150
 U-series age 145, 150–152
- Bolivia
 Altiplano-Puna Magma Body (APMB) 1, 2, 58, 59, 80
 Altiplano-Puna Volcanic Complex (APVC) 59
 Uturuncu volcano 57–58
 digital elevation model 60
 erupted volume estimate 65–67
 geochronology study
 methods 61–62, 63–64
 results
 dating eruptions 67–71, 68, **69**
 geochemistry and petrology 71–73, 72, 73
 mineral composition 73–74
 results discussed
 eruptive flux 78–79
 magma processes 74–78
 summary 79–80
 geological setting 59–60
 map 58
- Bowen, Norman Levi 1, 2
 buoyancy of magma 76, 79
 neutral 85
- $\delta^{14}\text{C}$ dating 165, 176
 caldera system, unrest 17
 Campi Flegrei (Phlegraean Fields, Italy) 17, 132, 137, 147
 Cape Ann Granite 107, 108
 Carnegie Institution, Washington 1
 Cascades volcanoes 141, 146, 147
 Ceboruco-San Pedro 57
 Central Plateau Member Rhyolites 158–159
 Central Volcanic Zone (Andes) 59
 Cerro Galán (Argentina) 162
 Cerro Uturuncu *see* Uturuncu volcano
 Changbaishan volcano (China) 161
 Chebyshev collocation method 21, 211
 Cising, Mount 176, 176, **177**
 effusive eruption lavas
 sample mineralogy 177, 178
 U-Th-Ra ages
 methods of analysis 178–180
 results **181**, 182
 results discussed 182–186
- clinopyroxene
 Fish Canyon Tuff experimental petrology 117, 118
 São Miguel basalts 90, 91, 92, 96–97
 Tavorvur 2006 eruption 20, 21, 23–24, 25, 26, 28, 31
- clinopyroxenite, São Miguel 91
- CO_2 in magma
 São Miguel basalt fluid inclusion study 86
 methods 90
 results
 fluid inclusion description 92–96
 geochemistry 91–92
 sample texture and mineralogy **88**, **89**, 90–91
 results discussed
 magma ponding 98–99
 re-equilibration 96–97
 tectonics or underplating 99–101
 Tavorvur 2006 eruption 28
 Uturuncu 79
- Colima, Volcán de
 eruptive activity (1818–1913) 193
 eruptive activity (1961–2010) 193
 eruptive activity (1998–2010) 190, 191, 192, 192
 magma geochemistry 192–193
 magma petrology 193
 Pb–Ra disequilibrium study 193–194
 methods 194
 results 194, 195
 results discussed 194, 196
 conduit dynamics 202–203
 fractionation 196–199
 magma petrology 203
 ^{210}Pb deficits 199–201
 ^{210}Pb excesses 201
 SO_2 flux 201–202
 summary 203–204
- composition gap 5, 6
 conduction, role of 11
 Biot number 208
 contact aureole, use in magmatic system study 41
 Western Adamello Tonalite 42–43, 42
 methods of analysis 43
 fieldwork 43
 phase petrology 43–45
 XRF 43
 results
 thermal model 45–49
 XRF **52**
 results discussed 49–51, 53–54
- convection, role of 11
 Bio number 208
 magma interaction 134–136
- convective overturn 76
- cooling, melt composition and 2, 3
- Coso volcanic field (California), U-series ages
 146, 161
- Cotopaxi (Ecuador), U-series ages 147, 161–162
- Crater Lake lavas 161, 163, 164
- crust-magma interaction 207
- crystallization of magma 1
 stages of 165–166
- cumulates, and ^{210}Pb deficits 198
- dacites
 Fish Canyon Tuff 107
 experimental petrology
 methods 109–110
 results 110–111, **112–114**, **115**, 116, 117,
 118, 119
 results discussed 119–128
 U-series age 145, 162
 mixing and mingling 17–18, 31
 Uturuncu volcano 57–58
 digital elevation model 60
 erupted volume estimate 65–67
 geochronology study
 methods 61–62, 63–64
 results
 dating eruptions 67–71, 68, **69**
 geochemistry and petrology 71–73, 72, 73
 mineral composition 73–74
 results discussed
 eruptive flux 78–79
 magma processes 74–78
 summary 79–80

- geological setting 59–60
 - map 58
- decompression and ascent 3
- deformation in ground, role in volcanic unrest 17
- degassing
 - role in Pb–Ra disequilibria 11, 189, 190
 - conduit dynamics 202–203
 - magma petrology 203
 - ^{210}Pb deficits 199–200
 - role of water 106
 - Tavurvur 2006 eruption 36
- Delauney triangulation 65, 65
- density of magma 11
 - role of density contrasts 134
- differentiation of magma 1, 76
- digital elevation models 60, 65, 86
- dykes, role of 11, 85, 138

- Earthquake Flat eruptions (New Zealand) 165
- effusive eruptions 190, 192
- El Hoyazo (Spain) 208, 209
 - see* Neogene Volcanic Province (Spain) xenolith study
- Elba pluton 162
- enthalpy, role of
 - Fish Canyon Tuff experimental petrology 122, 124–125
 - see also* heat
- Erebus (Antarctica), U-series ages 147, 166
- eruption triggers 134
- Eritrea, Alid 147, 163
- eutectic crystallization 2, 8, 8
- exsolution of volatiles 3, 11, 189

- Fish Canyon Tuff (FCT) 107
 - experimental petrology
 - methods 109–110
 - results 110–111, **112–114**, **115**, 116, 117, 118, 119
 - results discussed 119–128
 - U-series age 145, 162
- fissure eruptions 85, 86, 87
- fluid dynamics
 - shallow magma chamber modelling
 - methods 132–134
 - results 134–136
 - results discussed 136–138
- fluid-inclusion microthermometry 85–86
 - methods 90
 - results
 - descriptions 92–96
 - geochemistry 91–92
 - sample texture and mineralogy **88**, **89**, 90–91
 - results discussed
 - magma ponding 98–99
 - re-equilibration 96–97
 - tectonics or underplating 99–101
- flux
 - magma *see* magma supply rate
 - SO_2 *see* SO_2 flux
- fractional crystallization 2, 85
 - impact on Pb–Ra disequilibrium 196
 - Tavurvur 2006 eruption 28–31, 34–36

- fumaroles, chemistry 175, 190
- Furnas volcano 87

- gabbro, São Miguel 91
- gas bubbles, impact of 11
- gas release 189
- geochemistry
 - Fish Canyon Tuff experimental petrology 111, **112–114**, **115**, 117, 118–121, 120
 - São Miguel basalts 91–92
 - Tatun Volcanic Group 177, 177
 - Uturuncu lavas 59, 71–73, 72, 73
 - zircon trace elements 155, 156, 159, 162
- geochronology *see* $^{40}\text{Ar}/^{39}\text{Ar}$ dating; K–Ar dating; U-series dating
- geometry of magma chambers, role of 134, 135
- Geophysical Laboratory, Washington 1
- geothermal gradient 175
- Germany, Laacher See volcano 147, 160
- Givens, Mount 78
- glaciation, effect on magmatic systems 57
- Glass Mountain rhyolite 150, 151
- glass (residual)
 - Fish Canyon Tuff experimental petrology 118–119, 119, 120, 121
 - Tavurvur 2006 eruption 26–28
- granitic magma
 - melting behaviour 107, 108
 - role of water 106
- Grashof number 210
- ground deformation, role in volcanic unrest 17

- Hawaii, U-series ages 147, 164
- $^3\text{He}/^4\text{He}$ isotope ratios 164, 165, 175
- heat (enthalpy) of system 9
- heat loss, impact of 2
- heat transfer, for wall rock 210
- Hf isotope ratio 159, 162
- Hood, Mount (Cascades, USA) 147
- hornfels, Adamello contact aureole 43
- host rock *see* xenolith study
- Hualalai (Hawaii) 164
- Huangzuei, Mount 176, 176, **177**
 - effusive eruption lavas
 - sample mineralogy 177, 178
 - U–Th–Ra ages
 - methods of analysis 178–180
 - results **181**, 182
 - results discussed 182–186
- Huckleberry Ridge Tuff 158
- hydrous minerals, role of 106

- ignimbrite 105
 - Uturuncu 59, 60
- illite crystallinity 43
- intrusion, thermal evolution of 207
- ion microprobe analysis 142–143, 143
- Italy *see* Adamello batholith; Campi Flegrei; Western Adamello Tonalite

- K–Ar dating 176
- Katmai 57, 147
- Kilgore Tuff, U-series age 162
- Kizimen 78

- Kombiu 18, 19
 basalt sampling and analysis 21, 22, 23, 24, 27, 27, 28, 29, 30
- Kos Plateau Tuff 161, 163
- La Pacana (Chile) 145, 162
- La/Y ratios 177
- Laacher See volcano 147, 160, 163
- Las Tres Virgenes (Mexico) 165
- latent heat of crystallization, impact of 2, 3
- Lava Creek Tuff 158
- Lesser Antilles, U-series ages 146, 147, 165
- liquid line of descent (LLD) 29, 30
- Llullaillaco 78
- Long Valley caldera system (California) 17
 U-series ages 146, 150–153, 167
- Lozio shales
 Western Adamello Tonalite contact aureole study
 methods 43
 fieldwork 43
 phase petrology 43–45
 XRF 43
 results
 thermal model 45–49
 XRF 52
 results discussed 49–51, 53–54
 geological setting 42–43
 map 42
- Mar Menor (Spain) 208, 209
see Neogene Volcanic Province (Spain)
 xenolith study
- magma storage and evolution
 evidence from fluid inclusions
 Long Valley case study 150–153
 Taupo Volcanic Zone case study
 153–158
 Yellowstone caldera system case study
 158–161
see also São Miguel
- magma supply rate (flux) 2, 3, 5
 eruptive flux 78–79
 modelling *see* Western Adamello Tonalite
 timescale *see* Uturuncu
- magmas, interaction of 131, 141
 mathematical modelling
 methods 132–134
 results 134–136
 results discussed 136–138
- magmatic system, pictorial representation 4
- magnetite, São Miguel basalts 90
- major elements *see* geochemistry
- Mangakino caldera centre 157
 U-series ages 146
- mantle melting effects 196, 198
- mathematical modelling
 magma system
 method 132–134
 results 134–136
 results discussed 136–138
- Mauna Kea (Hawaii) 164
- Mazama, Mount (USA) 57, 78
- Mazarrón (Spain) 208, 209
see Neogene Volcanic Province (Spain) xenolith study
- megacryst, defined 148
- melt thermometer, two pyroxene-plagioclase 193
- Mesa Falls Tuff 158
- metamorphic aureole *see* contact aureole
- methane (CH₄), fluid inclusions 93
- Mexico *see* Colima, Volcán de
- microthermometry *see* fluid-inclusion
 microthermometry
- migmatite 43
- mingling
 defined 131
 factors favouring 134–136
- mingling and mixing 4, 5
 Tavorvur 2006 eruption 31, 34–36
- mixing
 defined 131
 factors favouring 134
 Uturuncu magmas 76–78
- Moho Transition Zone 86, 98, 100
- monotonous intermediates
 defined 105
see also Fish Canyon Tuff
- Montserrat 57
- mugearite, São Miguel 91
- mush 1, 2
 role in magma reservoir 76, 161, 167
- Nazca Plate 59
- eNd 60, 77
- Neogene Volcanic Province (Spain)
 xenolith study
 behaviour
 equations governing 209–210
 numerical modelling
 method 210–212
 results 213–214
 results discussed 214–215
 description 208–209
 introduction 207
 role of Biot number 208
- New Britain *see* Rabaul caldera
- New Zealand
 Okataina Volcanic Centre 141, 146, 147, 153–158,
 163, 164
 Ruapeho 78
 Taupo Volcanic Centre 153–158
 Taupo Volcanic Zone 2, 146, 153, 157, 160
- Ni/V ratio 196
- nitrogen (N₂), fluid inclusions 93
- δ¹⁸O 60, 158, 162
- Okataina Volcanic Centre (New Zealand) 141, 146, 147,
 153–158, 163, 164
- Okinawa Trough 175
- olivine
 Kombiu basalts 23, 24, 25, 26
 São Miguel basalts 90, 94, 96, 98, 99
- Ollagüe 78
- orthopyroxene 21, 24, 24, 25–26, 28
- oscillatory zoning, plagioclase 193
- Ostwald ripening 31
- overpressure 36, 189
- overturning magma 134
- oxygen fugacity, Uturuncu lavas 74

- Papua New Guinea *see* Rabaul caldera
 Parinacota 57, 147
 Pb–Ra disequilibrium study, Colima volcano 11,
 189–190, 193–194
 methods 194
 results 194, 195
 results discussed 194, 196
 conduit dynamics 202–203
 fractionation 196–199
 magma petrology 203
²¹⁰Pb deficits 199–201
²¹⁰Pb excesses 201
 SO₂ flux 201–202
 Péclet number 210
 phase equilibria 2
 phase petrology modelling
 Adamello contact aureole
 methods 43–45
 results 45–49
 results discussed 49–54
 phenocryst, defined 148
 Phlegraean Fields (Campi Flegrei, Italy) magmatic
 system 17, 132, 137, 147
 phonolite **133**, **1334**
 plagioclase
 Fish Canyon Tuff experimental petrology 117, 118, 121
 Pb–Ra disequilibrium 190, 196
 São Miguel basalts 90, 91
 Sr content 193
 Taurvur 2006 eruption 20, 21, 23, 25, 26, 31, 32–34,
 32, 33
 Plinian eruptions 190
 plutonic blocks, erupted, zircon dating 163–164
 plutons, assembly timescale 41, 162–164
 ponding of magma 101–102
 pressure estimates
 Fish Canyon Tuff 121
 Taurvur 2006 eruption 28, 29
 pulse of magma, defined 42
 Puyehue-Cordon Caulle 147
 Quizapu 147
²²⁶Ra
 in magnetite dating 176
 Tatun Volcanic Group
 methods of analysis 180
 results **181**, 182
 results discussed 182–186
see also Pb–Ra disequilibrium study
 Rabalanakaia 18, 19
 Rabaul caldera 17, 18, 19
 2006 eruption study
 methods of analysis 19, 21, 23
 results 20, 21, 22, 23
 melt inclusions 24–26
 major elements 26–27
 volatiles 27–28
 mineral compositions and textures 23–24
 results discussed
 fractional crystallization 27–31
 implications for unrest 34–36
 mafic-silicic interactions 31–34
 pressure-temperature estimates 28
 rare earth elements (REE) 177
 Rayleigh number 211, **212**
 Rayleigh-Taylor instability 134, 137
 Redoubt volcano (Alaska) 164
 Região dos Picos 86, 86, 87, 87, 99, 100
 residual melt, composition and evolution of 5–9
 Reynolds number 210, **212**
²²²Rn and degassing 189, 190, 194, 198, 199, 201, 202
 Ruapehu (New Zealand) 78
 Ryukyu Arc 175
 S/Cl in fumarole gases 190
 São Miguel 86
 basalt fluid inclusion study
 methods 90
 results
 fluid inclusion description 92–96
 geochemistry 91–92
 sample texture and mineralogy **88**, **89**, 90–91
 results discussed
 magma ponding 98–99
 re-equilibration 96–97
 tectonics or underplating 99–101
 geological setting 86–87
 map 86
 seismic records 87
 St Helens, Mount, U-series ages 146, 147, 160, 161
 Sakurajima volcano 199
 Salton Buttes (California), U-series ages 146,
 161, 163, 165
 San Juan Mountains 107
 sanidine, Fish Canyon Tuff experimental
 petrology 117, 118
 Santorini 17, 57
 secondary ion mass spectrometry (SIMS) 21, 23
 seismic activity, role in volcanic unrest 17
 Sete Cidades volcano 87, 99
 settling (sinking) of crystals 1
 Shamao, Mount 176, 176, **177**
 effusive eruption lavas
 sample mineralogy 177, 178
 U-Th-Ra ages
 methods of analysis 178–180
 results **181**, 182
 results discussed 182–186
 Shasta, Mount (Cascades, USA) 147
 shoshonite **133**, **134**
 silica content, impact of 2
 sinking (settling) of crystals 1
 SO₂, fluid inclusions 93
 SO₂ flux 190, 192
 Colima, Volcán de 200, 201–202
 Taurvur 2006 eruption 27–28, 36
 Solfatara Plateau flow 159
 Soufriere (St Lucia) 163, 164
 South Sister (Cascades, USA) 146, 147, 160, 161
 Spain, Neogene Volcanic Province 207, 208
 xenolith study
 behaviour
 equations governing 209–210
 numerical modelling
 method 210–212
 results 213–214
 results discussed 214–215

- Spain, Neogene Volcanic Province (*Continued*)
 description 208–209
 introduction 207
 role of Biot number 208
 squeezing of residual liquid 1
 Sr, plagioclase content 193
⁸⁷Sr/⁸⁶Sr 60, 72, 77
 Sr/Y ratios, Tatun Volcanic Group 177
 storage of magma 10
 sulphides, and Pb–Ra disequilibrium 190, 196
 syenite, São Miguel 91
- Taiwan *see* Tatun Volcanic Group
 Tatara-San Pedro 57
 Tatun Volcanic Group (TVG, Taiwan)
 geochemistry 177
 map 176
 mineralogy 177–178, 178
 sampling 176, 177
 U–Th–Ra ages
 methods of analysis 178–180
 results **181**, 182
 results discussed 182–186
- Taupo Volcanic Centre (New Zealand), U-series ages
 153–158
- Taupo Volcanic Zone (New Zealand) 2
 U-series ages 146, 153, 157, 160
- Tavurvur volcano 17, 18, 19
 2006 eruption study
 methods of analysis 19, 21, 23
 results 20, 21, 22, 23
 melt inclusions 24–26
 major elements 26–27
 volatiles 27–28
 mineral compositions and textures 23–24
 results discussed
 fractional crystallization 27–31
 implications for unrest 34–36
 mafic-silicic interactions 31–34
 pressure-temperature estimates 28
 eruption history 19
 map 18
 temperature
 impact of 2, 3
 estimates
 Fish Canyon Tuff 121
 Tavurvur 2006 eruption study 28, 29
 Uturuncu lavas 73–74
 measurement with microthermometry *see* fluid
 inclusions
- Tequila 57, 78
 Terceira Rift 87
²³⁰Th–²²⁶Ra 142
- thermal evolution, magma bodies 207
 thermal ionization mass spectrometry (TIMS) 142, 150,
 152, 154, 155
 trace element analysis (TEA) 162
- thermal modelling
 for andesites 4–5
 for contact aureole
 method 43–45
 results 45–49
 results discussed 49–54
 for wall rock 210
- thermal resistance, Biot number 208
 tholeiitic index (THI) 29
 thorium isotopic compositions
 Tatun Volcanic Group
 methods of analysis 179–180
 results **181**, 182
 results discussed 182–186
- timescale of magmatic processes
 modelling
 methods 132–134
 results 134–136
 results discussed 136–138
see also U series dating
- titanite 162
- Toba Tuff, U-series ages 146, 161
- Toconao ignimbrite 162
- trace elements *see* geochemistry
- Turanguna 18, 19
- U-series dating 10, 142
 analytical techniques 142–143
 application to accessory minerals 146, 149–150
 Long Valley case study 150–153
 Taupo Volcanic Zone case study 153–158
 Yellowstone caldera system case study
 158–161
 application to bulk mineral separates 147
 research
 future topics 166–168
 past reviews 144–145, 148–149
- Tatun Volcanic Group 176–177
 methods of analysis 178–180
 results **181**, 182
 results discussed 182–186
- U–Th/He dating 164
- underplating 102
 São Miguel evidence 99–101
- Unzen (Japan) 145
- USA 2, 17
 Cascades 57, 78, 147, 160, 161
 Long Valley 150–153
 Yellowstone caldera system 158–161
see also Fish Canyon Tuff
- Uturuncu volcano 57–58
 digital elevation model 60
 erupted volume estimate 65–67
 geochronology study
 methods 61–62, 63–64
 results
 dating eruptions 67–71, 68, **69**
 geochemistry and petrology 71–73, 72, 73
 mineral composition 73–74
 results discussed
 eruptive flux 78–79
 magma processes 74–78
 summary 79–80
 geological setting 59–60
 map 58
- Veniaminof (Aleutian Islands) 164
- Vesuvius 147
- viscosity of magma 11, 105, 137
 Fish Canyon Tuff experimental petrology 122
 Western Adamello Tonalite 51, 53, 53

- volatiles
 - exsolution of 3, 11, 189
 - role of 105–106
 - Tavurvur 2006 eruption 27–28, 36
- volcanic conduit sampling *see* xenolith study
- volcanoes, renewed activity 17
- Vulcan 18, 19
- Vulcanian eruptions 190, 192, 192

- wall rock *see* xenolith study
- water in magma
 - role of 105–106, 107, 108
 - Tavurvur 2006 eruption 28
 - Uturuncu 79
 - see also* São Miguel fluid inclusion study
- water saturation, impact of 11
- websterite, São Miguel 91
- wehrlite, São Miguel 91
- Western Adamello Tonalite
 - contact aureole study
 - methods 43
 - fieldwork 43
 - phase petrology 43–45
 - XRF 43
 - results
 - thermal model 45–49
 - XRF 52
 - results discussed 49–51, 53–54
 - geological setting 42–43
 - map 42
- Western Moat 145
- Whakamaru (New Zealand) 145
- Wilson Creek Formation 165

- X-ray fluorescence (XRF)
 - Adamello contact aureole
 - methods 43
 - results 52
- xenocrysts 161
 - defined 148
- xenolith study
 - Neogene Volcanic Province (Spain)
 - behaviour
 - equations governing 209–210
 - numerical modelling
 - method 210–212
 - results 213–214
 - results discussed 214–215
 - description 208–209
 - introduction 207
 - role of Biot number 208
 - São Miguel 90, 91, 99

- Yellowstone caldera system (USA) 17, 141
 - U-series ages 145, 146, 147, 158–161, 167
- Yukon-Tanana terrane, U-series age 161

- zircon ages, U-series 10, 142, 143, 148, 149–150
 - eruptions 164–165
 - plutons and plutonic blocks 162–164
 - volcanic systems 161–162
 - Long Valley caldera system (California) 150
 - Taupo Volcanic Zone 153–158
 - Yellowstone caldera system 158–161
- zircon fission track 43
- zoned ignimbrites, defined 105