

## Cumulative Index to Ge 101 lecture notes, 2003

---

### 1

|                   |       |
|-------------------|-------|
| <sup>14</sup> C   |       |
| decay scheme..... | 12-9  |
| in seawater.....  | 15-16 |

---

### 2

|                        |       |
|------------------------|-------|
| <sup>234</sup> Th..... | 12-3  |
| <sup>238</sup> U.....  | 12-3  |
| <sup>26</sup> Al.....  | 12-20 |

---

### 3

|                       |       |
|-----------------------|-------|
| <sup>3</sup> H        |       |
| in seawater.....      | 15-16 |
| <sup>3</sup> He       |       |
| flux from ridges..... | 16-12 |

---

### 4

|                       |       |
|-----------------------|-------|
| <sup>40</sup> Ar..... | 12-5  |
| <sup>40</sup> K.....  | 12-5  |
| <sup>4</sup> He.....  | 10-10 |

---

### 8

|                       |      |
|-----------------------|------|
| <sup>87</sup> Rb..... | 12-4 |
| <sup>87</sup> Sr..... | 12-4 |

---

### A

|                                 |              |
|---------------------------------|--------------|
| abyssal peridotite              |              |
| Nd isotopes.....                | 18-10        |
| accumulation.....               | 6-7          |
| achondrite.....                 | 10-24        |
| acid.....                       | 2-7          |
| activity                        |              |
| of radionuclide.....            | 12-8         |
| adiabatic gradient.....         | 2-20, 2-21   |
| affinity                        |              |
| and electronegativity.....      | 11-14, 11-16 |
| and immiscible liquids.....     | 11-8         |
| and ionic radius.....           | 11-18        |
| and ionization potential.....   | 11-14        |
| and periodic table.....         | 11-9         |
| Goldschmidt classification..... | 11-8, 11-9   |
| Age of the Earth.....           | 1-23         |
| Aleutian arc.....               | 18-23        |

|                                  |                 |
|----------------------------------|-----------------|
| alkali feldspar.....             | 4-83            |
| alkali-lime index.....           | 2-8             |
| alpha decay.....                 | 12-3            |
| amphibole.....                   | 4-78, 4-82      |
| andesite.....                    | 2-5, 3-17, 4-83 |
| anoxia.....                      | 15-23           |
| anticline.....                   | 5-9             |
| Appalachians.....                | 1-57            |
| Ar                               |                 |
| 3-isotope diagram.....           | 19-20           |
| and mantle structure.....        | 19-21           |
| basic facts.....                 | 19-19           |
| coupled to Ne.....               | 19-20           |
| coupled to Pb.....               | 19-22           |
| recycling?.....                  | 19-22           |
| Ar mass balance.....             | 13-24           |
| Archaean.....                    | 1-19            |
| asthenosphere.....               | 1-28            |
| Atlantic coast.....              | 1-49            |
| atmophile.....                   | 11-8            |
| atmosphere                       |                 |
| absorption bands.....            | 16-2            |
| adiabatic lapse rate.....        | 16-7            |
| and coriolis effect.....         | 16-10           |
| and degassing of interior.....   | 16-12           |
| compared to magmatic gas.....    | 16-13           |
| composition.....                 | 16-13           |
| Deuterium/Hydrogen ratio.....    | 13-37           |
| emission temperature.....        | 16-5            |
| global wind patterns.....        | 16-11           |
| H loss.....                      | 13-37           |
| heat transport.....              | 16-8, 16-9      |
| latent heat.....                 | 16-8            |
| mesosphere.....                  | 16-7            |
| origin.....                      | 13-36           |
| outgassing.....                  | 13-36           |
| outgoing radiation spectrum..... | 16-5            |
| ozone layer.....                 | 16-21           |
| pressure structure.....          | 16-6            |
| primitive.....                   | 13-36           |
| radiative balance.....           | 16-9            |
| radiative forcing.....           | 16-2, 16-3      |
| rise of oxygen.....              | 13-38           |
| scale height.....                | 16-6            |
| stratosphere.....                | 16-7            |
| temperature structure.....       | 16-7            |
| thermosphere.....                | 16-7            |
| three-dimensional structure..... | 16-11           |
| troposphere.....                 | 16-7            |
| upwelling and subsidence.....    | 16-11           |
| aufbau principle.....            | 11-10, 11-12    |

---

### B

|                               |      |
|-------------------------------|------|
| Barrovian metamorphism.....   | 7-23 |
| basalt.....                   | 4-82 |
| information about source..... | 18-5 |
| Sr isotope histograms.....    | 18-6 |

|                                    |  |  |                     |
|------------------------------------|--|--|---------------------|
| base level.....                    | 8-5, 8-6                                 | Death Valley.....                                    | 8-42                |
| and relative sea level.....        | 8-6                                      | end of subduction.....                               | 8-37                |
| and river profiles.....            | 8-7                                      | Franciscan accretionary complex.....                 | 8-33                |
| and river terraces.....            | 8-8                                      | geochronology.....                                   | 8-34                |
| basic.....                         | 2-7                                      | geologic map.....                                    | 8-24                |
| Basin and Range province.....      | 8-38                                     | Great Valley as forearc basin.....                   | 8-33                |
| topography.....                    | 8-39                                     | Laramide orogeny.....                                | 8-35                |
| batch melting.....                 | 11-22                                    | Long Valley and Bishop Tuff.....                     | 8-44                |
| equation.....                      | 11-22                                    | Nevadan orogeny.....                                 | 8-33                |
| plot.....                          | 11-23                                    | Owens Valley.....                                    | 8-40                |
| Bateman equation.....              | 12-25                                    | proterozoic rifting event.....                       | 8-27                |
| Benioff Zone.....                  | 1-39, 3-7                                | recent magmatism.....                                | 8-43                |
| beta decay.....                    | 12-4                                     | San Andreas Fault.....                               | 8-37                |
| bicarbonate ion.....               | 15-27                                    | Sierra Nevada batholith.....                         | 8-33                |
| Big Bang.....                      | 10-9                                     | slab window.....                                     | 8-38                |
| nucleosynthesis.....               | 10-10                                    | Sonoma orogeny.....                                  | 8-31                |
| biharmonic equation.....           | 2-14                                     | strike-slip faults.....                              | 8-41, 8-42          |
| binary mixing.....                 | 13-4                                     | topography.....                                      | 8-23                |
| curvature index.....               | 13-16                                    | Transverse Ranges.....                               | 8-42                |
| element-element plots.....         | 13-5, 13-6, 13-7                         | calc-alkaline rocks.....                             | 3-17                |
| element-ratio plots.....           | 13-8, 13-9, 13-10, 13-11                 | <i>Cambrian</i> .....                                | 1-21                |
| inverse element-ratio plots.....   | 13-12, 13-13                             | carbon   |                     |
| lever rule.....                    | 13-7                                     | burial of organic C.....                             | 16-16               |
| ratio-ratio plots.....             | 13-14, 13-15, 13-16, 13-17               | geochemical cycle of.....                            | 16-16               |
| test for.....                      | 13-13                                    | recent history of CO <sub>2</sub> in atmosphere..... | 16-19               |
| weighted averages.....             | 13-8                                     | carbonaceous chondrite.....                          | 10-24               |
| biomineralization.....             | 15-21                                    | carbonate compensation depth.....                    | 15-28, 15-29        |
| Biostratigraphy.....               | 1-13                                     | carbonate ion.....                                   | 15-27               |
| biotite.....                       | 4-83                                     | carbonic acid  |                     |
| Bishop Tuff.....                   | 8-44                                     | in seawater.....                                     | 15-27               |
| Black Sea.....                     | 15-23                                    | <i>Carboniferous</i> .....                           | 1-21                |
| box models                         |  | Catastrophism.....                                   | 1-23                |
| conservation equations.....        | 13-26                                    | catchment.....                                       | 6-12                |
| eigenmode decomposition.....       | 13-28, 13-29, 13-30                      | Ce/Pb.....   | 18-20, 18-22, 18-23 |
| for radiogenic Ar.....             | 13-24                                    | Cenozoic.....  | 1-20, 1-21          |
| layered mantle.....                | 13-25, 13-31, 13-32, 13-33, 13-34, 13-35 | chalcophile.....                                     | 11-8                |
| matrix formulation.....            | 13-27                                    | Chapman mechanism.....                               | 16-22               |
| motivation.....                    | 13-18                                    | Chart of the Nuclides.....                           | 10-4, 10-5          |
| reservoirs and fluxes.....         | 13-19                                    | chemical potential.....                              | 4-46                |
| residence time.....                | 13-22                                    | Chemical weathering.....                             | 9-6                 |
| steady-state.....                  | 13-20                                    | acidity of natural waters.....                       | 9-8                 |
| brittle failure                    |  | activity diagrams.....                               | 9-8                 |
| pressure dependence.....           | 7-16                                     | climate feedback.....                                | 9-11                |
| Bulk composition of the Earth..... | 10-28, 10-29, 10-30                      | formation of kaolinite.....                          | 9-8                 |
| Bulk partition coefficient.....    | 11-20                                    | of limestone.....                                    | 9-10                |
|                                    |  | rates.....   | 9-11                |
|                                    |  | Sierra Nevada example.....                           | 9-9                 |
|                                    |  | types of reactions.....                              | 9-7                 |
|                                    |  | watershed approach.....                              | 9-9                 |
|                                    |  | chondrite.....                                       | 10-25               |
|                                    |  | and volatility.....                                  | 10-26               |
|                                    |  | defined.....   | 10-24               |
|                                    |  | chondrites   |                     |
|                                    |  | age.....   | 11-7, 12-16         |
|                                    |  | CHUR.....  | 12-17               |
|                                    |  | cinder cones.....                                    | 3-22                |
|                                    |  | CIPW norm.....                                       | 2-4                 |
|                                    |  | Clayton, R. N.....                                   | 14-28               |
|                                    |  | <i>cleavage</i>                                      |                     |
|                                    |  | axial plane.....                                     | 5-27                |
|                                    |  | clinopyroxene.....                                   | 4-81, 4-82          |
|                                    |  | CO <sub>2</sub>                                      |                     |

## C

|                                    |                                    |
|------------------------------------|------------------------------------|
| CAI.....                           | 12-21                              |
| calc-alkaline.....                 | 2-8                                |
| California                         |                                    |
| geologic history summary.....      | 8-26                               |
| miogeocline.....                   | 8-28                               |
| California.....                    | 8-22                               |
| and valley glacier morphology..... | 8-45                               |
| Antler orogeny.....                | 8-30                               |
| as continental margin.....         | 8-25                               |
| as subduction zone.....            | 8-29, 8-30, 8-31, 8-32, 8-33, 8-34 |

|  |              |
|--|--------------|
| recent history in atmosphere.....                        | 16-19        |
| coccolithophorids.....                                   | 15-21        |
| compatible.....  | 11-20        |
| concordant.....  | 12-30        |
| concordia.....   | 12-32        |
| condensation sequence.....                               | 10-23, 10-27 |
| conservative elements.....                               | 15-20        |
| continental crust  |              |
| composition.....   | 4-83         |
| origin.....  | 11-27        |
| trace element enrichment.....                            | 11-27        |
| Continental extension.....                               | 8-38         |
| and basaltic volcanism.....                              | 8-43         |
| and normal faulting.....                                 | 8-40         |
| continental margins.....                                 | 8-25         |
| continental weathering                                   |              |
| and ocean <sup>87</sup> Sr/ <sup>86</sup> Sr record..... | 15-19        |
| continents   |              |
| origin in subduction arcs.....                           | 18-23        |
| continuum mechanics                                      |              |
| angle of internal friction.....                          | 7-20         |
| brittle failure.....                                     | 7-16         |
| brittle failure criteria.....                            | 7-20         |
| constitutive relations.....                              | 7-12         |
| continental lithosphere.....                             | 7-21         |
| creep.....   | 7-14         |
| defined.....   | 7-7          |
| deviatoric stress.....                                   | 7-9          |
| differential stress.....                                 | 7-9          |
| effective pressure.....                                  | 7-20         |
| elasticity.....  | 7-13         |
| Griffith failure criterion.....                          | 7-20         |
| Hooke's law.....   | 7-13         |
| hydrostatic stress.....                                  | 7-9          |
| mean stress.....   | 7-9          |
| Mohr circle.....   | 7-18         |
| Mohr circle in 3 dimensions.....                         | 7-19         |
| Mohr diagram.....  | 7-17         |
| Mohr failure envelope.....                               | 7-20         |
| newtonian fluid.....                                     | 7-14         |
| oceanic lithosphere.....                                 | 7-21         |
| plastic strength.....                                    | 7-15         |
| principal stress.....                                    | 7-9          |
| strain.....  | 7-10, 7-11   |
| strain rate.....   | 7-11         |
| stress.....  | 7-8          |
| stress ellipsoid.....                                    | 7-9          |
| viscosity.....   | 7-14         |
| yield stress.....  | 7-13         |
| Contour Maps.....  | 5-4          |
| Convection   |              |
| and Earth's mantle.....                                  | 1-44         |
| defined.....   | 1-43         |
| Rayleigh number.....                                     | 1-43         |
| coordination   |              |
| and ionic radius.....                                    | 11-18        |
| octahedral.....  | 11-18        |
| tetrahedral.....   | 11-18        |
| <i>Core</i>  |              |
| age.....   | 11-7         |
| and gravitational energy.....                            | 11-6         |
| chemical evidence.....                                   | 11-4         |

|                                  |                        |
|----------------------------------|------------------------|
| formation.....                   | 11-6, 11-7             |
| seismic evidence.....            | 11-3                   |
| siderophile depletion.....       | 11-4                   |
| Coriolis force.....              | 15-6, 16-10            |
| corner flow.....                 | 2-15                   |
| correlation                      |                        |
| defined.....                     | 1-3                    |
| cosmogenic nuclides.....         | 6-32                   |
| covalent bonding                 |                        |
| and affinity.....                | 11-16                  |
| craton.....                      | 7-2                    |
| <i>Cretaceous</i> .....          | 1-21                   |
| Cross Sections                   |                        |
| Balanced.....                    | 5-40, 5-41             |
| Busk method for folds.....       | 5-42                   |
| examples.....                    | 5-36, 5-37, 5-38, 5-39 |
| Kink method for folds.....       | 5-43                   |
| philosophy of.....               | 5-35                   |
| cross-cutting relationships..... | 1-6                    |
| crustal recycling.....           | 18-25, 18-26, 18-27    |
| cyanobacteria.....               | 13-38                  |

---

## D

|                              |                           |
|------------------------------|---------------------------|
| dacite.....                  | 2-5, 3-17                 |
| D'Arcy's law.....            | 2-26                      |
| Darwin, Charles.....         | 1-24                      |
| dating.....                  | <i>See</i> isotope dating |
| Davis, William Morris.....   | 6-21                      |
| Decay chains.....            | 12-24                     |
| deep water formation.....    | 15-10                     |
| deep-sea sediments.....      | 15-30                     |
| degassing.....               | 16-12                     |
| dehydration melting.....     | 3-12                      |
| density filtering.....       | 3-19                      |
| denudation.....              | 6-7                       |
| depleted mantle              |                           |
| mass balance.....            | 18-13, 18-14              |
| depth of compensation.....   | 6-8                       |
| derivatives                  |                           |
| partial vs. total.....       | 4-47                      |
| deuterium.....               | 10-12                     |
| <i>Devonian</i> .....        | 1-21                      |
| diagenesis.....              | 9-22                      |
| Diamond Head, Oahu.....      | 2-51                      |
| diatoms.....                 | 15-21                     |
| differentiation.....         | 4-84, 13-2                |
| and trace elements.....      | 11-29                     |
| crust vs. mantle.....        | 11-29                     |
| summary.....                 | 11-2                      |
| diffusion.....               | 18-9                      |
| diorite.....                 | 2-5, 4-83                 |
| discordant.....              | 12-30                     |
| distributed deformation..... | 7-6                       |
| divide.....                  | 6-12                      |
| DMM.....                     | 18-16, 18-24              |
| drainage.....                | 6-12                      |
| dunite.....                  | 2-6, 2-13                 |
| Dupal anomaly.....           | 18-18                     |

---

## E

|                                    |                            |
|------------------------------------|----------------------------|
| Earth                              |                            |
| Bulk composition .....             | 10-28, 10-29, 10-30, 10-31 |
| core.....                          | 11-6                       |
| differentiation .....              | 11-2                       |
| eccentricity .....                 | 14-23                      |
| effusive eruption .....            | 3-22                       |
| Ekman pumping.....                 | 15-7                       |
| El Niño .....                      | 15-13                      |
| electron                           |                            |
| energy levels.....                 | 11-12                      |
| electronegativity.....             | 11-14                      |
| elements                           |                            |
| origin.....                        | 10-8                       |
| solar abundance.....               | 10-6, 10-7                 |
| elevation .....                    | 6-6                        |
| EMI.....                           | 18-16, 18-27               |
| EMII .....                         | 18-16, 18-25               |
| Emiliani, Cesare.....              | 14-21                      |
| end members .....                  | 13-3                       |
| ENSO .....                         | 15-13                      |
| <i>Eocene</i> .....                | 1-22                       |
| Eons.....                          | 1-19                       |
| epidote.....                       | 4-79                       |
| <i>Epochs</i> .....                | 1-22                       |
| epsilon-Nd.....                    | 12-17                      |
| equilibrium                        |                            |
| metastable .....                   | 4-40                       |
| stable.....                        | 4-40                       |
| thermodynamic.....                 | 4-40                       |
| Eras.....                          | 1-20                       |
| erosion                            |                            |
| mechanisms .....                   | 9-17                       |
| particle entrainment diagram ..... | 9-18                       |
| erosion rates .....                | 6-25                       |
| eutectic .....                     | 4-69                       |
| explosive eruption.....            | 3-22                       |
| extinct nuclides .....             | 12-20                      |

---

## F

|                                    |      |
|------------------------------------|------|
| Fabric                             |      |
| and map-scale structure.....       | 5-26 |
| defined .....                      | 5-25 |
| foliation vs. lineation.....       | 5-26 |
| importance of.....                 | 5-25 |
| lattice preferred orientation..... | 5-29 |
| shape preferred orientation .....  | 5-30 |
| Farallon plate.....                | 8-37 |
| Faults                             |      |
| defined .....                      | 5-12 |
| foot wall.....                     | 5-12 |
| hanging wall .....                 | 5-12 |
| normal .....                       | 5-12 |
| oblique .....                      | 5-12 |
| reverse.....                       | 5-12 |
| right and left lateral .....       | 5-12 |
| strike-slip .....                  | 5-19 |
| strike-slip vs. dip-slip.....      | 5-12 |

|                                     |            |
|-------------------------------------|------------|
| thrust.....                         | 5-12       |
| vs. joints .....                    | 5-12       |
| Fe <sub>8</sub> 2-34, 2-36 .....    | 4-81, 4-82 |
| feldspar.....                       | 2-7        |
| felsic .....                        | 12-6       |
| fission tracks.....                 | 2-43       |
| Flood basalts .....                 | 2-41       |
| and hotspot tracks .....            | 2-43       |
| eruption rate .....                 | 2-44       |
| melting model .....                 | 2-43       |
| petrology and geochemistry .....    | 2-43       |
| volume.....                         | 1-55       |
| flysch.....                         | 5-6        |
| Folds                               |            |
| angular.....                        | 5-9        |
| anticline .....                     | 5-9        |
| antiform .....                      | 5-8        |
| axial plane .....                   | 5-10       |
| basin.....                          | 5-42       |
| Busk method for extrapolation.....  | 5-6        |
| curved .....                        | 5-5        |
| cylindrical.....                    | 5-10       |
| dome .....                          | 5-8        |
| fold axis .....                     | 5-6        |
| Gaussian curvature.....             | 5-8        |
| hinge .....                         | 5-8        |
| inflection.....                     | 5-43       |
| Kink method for extrapolation ..... | 5-8        |
| limb.....                           | 5-11       |
| mechanisms .....                    | 5-9        |
| overtaken.....                      | 5-6        |
| parallel.....                       | 5-9        |
| recumbent .....                     | 5-6        |
| similar .....                       | 5-9        |
| syncline.....                       | 5-9        |
| synform.....                        | 15-21      |
| foraminifera .....                  | 1-13       |
| Fossil, defined.....                | 6-13       |
| fractal geometry.....               | 2-31       |
| fractional crystallization.....     | 2-33       |
| correction for.....                 | 11-24      |
| definition .....                    | 11-24      |
| equations for trace elements .....  | 11-24      |
| plot .....                          | 11-25      |
| fractional melting                  |            |
| equations.....                      | 11-26      |

---

## G

|                                    |                           |
|------------------------------------|---------------------------|
| gabbro .....                       | 2-6, 4-82                 |
| layered .....                      | 2-12                      |
| garnet.....                        | 4-81                      |
| geobarometry .....                 | 7-27                      |
| geochemistry                       |                           |
| standard model .....               | 18-4                      |
| geochronology .....                | <i>See</i> isotope dating |
| defined.....                       | 1-3                       |
| geodynamics                        |                           |
| inferences from geochemistry ..... | 18-3                      |
| lava lamp model.....               | 18-4                      |

|   |              |
|---|--------------|
| layered vs. whole mantle convection.....    | 18-4         |
| mantle model cartoons .....                 | 18-4         |
| Geologic timescale.....                     | 1-18         |
| geomorphology                               |              |
| and climate.....                            | 6-22         |
| and observation.....                        | 6-3          |
| and tectonics.....                          | 6-28         |
| and the rock cycle.....                     | 6-4          |
| defined .....                               | 6-2          |
| feedbacks .....                             | 6-20         |
| importance of.....                          | 6-5          |
| measuring rates.....                        | 6-32         |
| process geomorphology .....                 | 6-14         |
| surface exposure dating.....                | 6-32         |
| valley glaciers.....                        | 8-45         |
| geostrophic equation.....                   | 15-6         |
| geothermometry .....                        | 7-27, 14-15  |
| Gibbs free energy                           |              |
| and chemical potential .....                | 4-58         |
| derivatives.....                            | 4-58         |
| global trend .....                          | 2-36         |
| global warming .....                        | 16-17, 16-18 |
| and carbon sinks .....                      | 16-20        |
| Goldschmidt, V.M.                           |              |
| geochemical classification of elements..... | 11-8         |
| rules for substitution.....                 | 11-19        |
| GPS.....                                    | 1-42         |
| Graben .....                                | 5-14, 8-40   |
| granite.....                                | 2-5, 4-83    |
| granodiorite .....                          | 2-5          |
| greenhouse effect .....                     | 16-4         |
| global radiative forcing estimates.....     | 16-19        |
| historical temperature records.....         | 16-17        |
| millennial history in atmosphere .....      | 16-18        |
| Grenville belt.....                         | 7-5          |
| groundmass .....                            | 2-2          |
| Gulf of Mexico.....                         | 15-23        |

---

## H

|  |             |
|--|-------------|
| Hadean.....                                    | 1-19        |
| Hadley circulation.....                        | 16-10       |
| Hart, S.R.....                                 | 18-7        |
| harzburgite.....                               | 2-6, 2-13   |
| Hawaii   |             |
| topography .....                               | 2-49        |
| He 19-4  |             |
| and degassing of mantle.....                   | 19-8        |
| and heat flow .....                            | 19-10       |
| and isotopic endmembers.....                   | 19-11       |
| and mantle structure .....                     | 19-11       |
| and undegassed reservoir .....                 | 19-9        |
| coupled to Ne.....                             | 19-18       |
| isotope ratio in basalts.....                  | 19-6, 19-7  |
| possible high- <sup>3</sup> He components..... | 19-12       |
| Heart Mountain fault.....                      | 5-16        |
| heat .....                                     | 4-41        |
| heat flow.....                                 | 1-25, 19-10 |
| Hess Deep.....                                 | 1-47        |
| hillslope evolution.....                       | 6-16        |

|                               |              |
|-------------------------------|--------------|
| Himalaya.....                 | 1-56         |
| HIMU.....                     | 18-16, 18-26 |
| Hofmann and White model ..... | 18-12        |
| Hofmann, A.W. ....            | 18-7         |
| <i>Holocene</i> .....         | 1-22         |
| hornblende .....              | 4-82         |
| Hotspots .....                | 1-34         |
| and flood basalts .....       | 2-41         |
| and geoid .....               | 2-39         |
| and plumes .....              | 2-40         |
| chains.....                   | 2-37         |
| defined.....                  | 2-38         |
| HO <sub>x</sub> family .....  | 16-25        |
| Hutton, James.....            | 1-24         |
| hydrologic cycle              |              |
| and stable isotopes .....     | 14-18        |
| Hydrothermal alteration       |              |
| and oxygen isotopes.....      | 3-5          |
| of ocean crust .....          | 3-5          |
| hydrothermal vents.....       | 3-2          |
| water chemistry .....         | 3-4          |
| hydrous melting .....         | 3-12         |

---

## I

|  |              |
|--|--------------|
| ice core records.....                            | 14-26        |
| igneous rocks                                    |              |
| classification.....                              | 2-2, 2-5     |
| mineralogy and composition .....                 | 4-80         |
| Streckeisen classification.....                  | 2-5          |
| summary diagram.....                             | 4-80         |
| incompatible .....                               | 11-20        |
| intermediate .....                               | 2-7          |
| ionic bonding                                    |              |
| and affinity .....                               | 11-16        |
| ionic charge.....                                | 11-15        |
| ionic radius                                     |              |
| and affinity .....                               | 11-18        |
| and coordination.....                            | 11-18        |
| graph.....                                       | 11-17        |
| vs. ionic charge .....                           | 11-17        |
| ionization potential .....                       | 11-14        |
| iron meteorites .....                            | 10-24        |
| island arcs                                      |              |
| compositional evolution .....                    | 3-18, 3-19   |
| differentiation.....                             | 3-19         |
| rock compositions .....                          | 3-17         |
| isochron.....                                    | 12-14        |
| isograds .....                                   | 7-24         |
| isostasy.....                                    | 6-8          |
| Airy.....  | 6-9          |
| and oceanic crust.....                           | 2-35         |
| Pratt.....                                       | 6-9          |
| isotope dating                                   |              |
| <sup>147</sup> Sm- <sup>143</sup> Nd.....        | 12-17        |
| <sup>14</sup> C method.....                      | 12-9         |
| <sup>207</sup> Pb- <sup>206</sup> Pb method..... | 12-30        |
| <sup>40</sup> Ar- <sup>39</sup> Ar .....         | 12-12, 12-13 |
| <sup>40</sup> K- <sup>40</sup> Ar.....           | 12-12, 12-13 |
| <sup>87</sup> Rb- <sup>87</sup> Sr.....          | 12-15, 12-16 |

|                                    |             |
|------------------------------------|-------------|
| age of earth .....                 | 12-31       |
| concordia method .....             | 12-32       |
| concordia method and Pb loss ..... | 12-33       |
| extinct nuclides .....             | 12-20       |
| isochron method .....              | 12-14       |
| Pb evolution curve .....           | 12-31       |
| Pb isotopes .....                  | 12-29       |
| Isotope geochemistry               |             |
| enriched and depleted .....        | 12-19       |
| isotopic equilibrium .....         | 18-7, 18-10 |
| and diffusion .....                | 18-9        |

---

## **J**

|                       |      |
|-----------------------|------|
| Joins                 |      |
| defined .....         | 5-32 |
| Joint sets .....      | 5-32 |
| joint system .....    | 5-33 |
| <i>Jurassic</i> ..... | 1-21 |

---

## **K**

|                    |      |
|--------------------|------|
| Kelvin, Lord ..... | 1-25 |
| Kilauea .....      | 2-47 |

---

## **L**

|                                      |       |
|--------------------------------------|-------|
| lahar .....                          | 3-26  |
| lakes                                |       |
| salinity, temperature, density ..... | 15-3  |
| Legendre transform .....             | 4-51  |
| lever rule .....                     | 4-68  |
| lherzolite .....                     | 2-6   |
| liquidus .....                       | 4-67  |
| lithification .....                  | 9-22  |
| lithophile .....                     | 11-8  |
| and electronegativity .....          | 11-16 |
| lithosphere .....                    | 1-28  |
| continental .....                    | 7-22  |
| oceanic .....                        | 7-22  |
| strength .....                       | 7-22  |
| Lithostratigraphy .....              | 1-6   |
| diachronous .....                    | 1-12  |
| isochronous .....                    | 1-12  |
| Loihi seamount .....                 | 2-46  |
| Long Valley Caldera .....            | 8-44  |
| Lu/Hf .....                          | 18-19 |
| Lyell, Charles .....                 | 1-24  |

---

## **M**

|                                   |           |
|-----------------------------------|-----------|
| mafic .....                       | 2-7, 4-82 |
| mafic rocks                       |           |
| classification .....              | 2-6       |
| magnetic polarity timescale ..... | 8-20      |

|                                      |             |
|--------------------------------------|-------------|
| mantle                               |             |
| heterogeneity and latitude .....     | 18-18       |
| internal components .....            | 18-17       |
| isotopic endmembers .....            | 18-17       |
| mantle array .....                   | 18-11       |
| mantle heterogeneity .....           | 18-8        |
| mantle layering .....                | 13-24       |
| Mantle plumes .....                  | 2-40        |
| mantle structure                     |             |
| basic models .....                   | 18-12       |
| mantle wedge .....                   | 3-8         |
| and wet melting .....                | 3-12        |
| fluid transport .....                | 3-15        |
| melting environment .....            | 3-13        |
| transport rates .....                | 3-16        |
| Maps                                 |             |
| geological .....                     | 5-2, 5-3    |
| topographic .....                    | 5-4         |
| marine terraces .....                | 6-30, 14-22 |
| Mauna Kea .....                      | 2-50        |
| mean life .....                      | 12-8        |
| Melt Migration .....                 | 2-26        |
| and dunite .....                     | 2-30        |
| and fractional melting .....         | 2-28        |
| and peridotite chemistry .....       | 2-28        |
| and seismology .....                 | 2-28        |
| D'Arcy's law .....                   | 2-26        |
| magma solitons .....                 | 2-29        |
| mechanisms for fast extraction ..... | 2-29        |
| permeability .....                   | 2-26        |
| porosity waves .....                 | 2-29        |
| porous flow .....                    | 2-26        |
| rates .....                          | 2-27        |
| reactive infiltration .....          | 2-30        |
| melting                              |             |
| adiabatic .....                      | 2-20        |
| and density changes .....            | 2-18        |
| and isotopic equilibrium .....       | 18-7        |
| isentropic .....                     | 2-20        |
| productivity .....                   | 2-25        |
| Mendocino triple junction .....      | 8-37        |
| Mesozoic .....                       | 1-20, 1-21  |
| metallic bonding                     |             |
| and affinity .....                   | 11-16       |
| metaluminous .....                   | 2-7         |
| metamorphic facies .....             | 7-24, 7-26  |
| metamorphic facies diagram .....     | 3-10        |
| metamorphic field gradient .....     | 7-23        |
| metamorphic grade .....              | 7-23        |
| metamorphic zones .....              | 7-24        |
| metamorphism .....                   | 7-23        |
| basaltic rocks .....                 | 7-25        |
| decarbonation .....                  | 7-28        |
| dehydration .....                    | 7-28        |
| dehydration reactions .....          | 3-11        |
| garnet-biotite thermometer .....     | 7-30, 7-31  |
| in subduction zones .....            | 3-11        |
| pelitic rocks .....                  | 7-25        |
| P-T paths .....                      | 7-27        |
| meteoric water line .....            | 14-20       |
| meteoric waters                      |             |
| isotopic composition .....           | 14-19       |

|                              |                            |
|------------------------------|----------------------------|
| Meteorites                   |                            |
| chondrites.....              | 10-25                      |
| classification.....          | 10-24                      |
| Mg-Fe partitioning.....      | 4-84                       |
| MgO-SiO <sub>2</sub> system  |                            |
| phase diagram.....           | 4-85                       |
| mica.....                    | 4-77, 4-83                 |
| mid-ocean ridge              |                            |
| fluid dynamic treatment..... | 2-14                       |
| melting regime.....          | 2-22, 2-23, 2-24           |
| mid-ocean ridge basalt       |                            |
| trace elements.....          | 11-28, 11-29               |
| mid-ocean ridges             |                            |
| active flow.....             | 2-18                       |
| axial depth.....             | 2-36                       |
| magma chambers.....          | 2-32                       |
| viscosity variations.....    | 2-17                       |
| Milankovitch cycles.....     | 14-21, 14-23, 14-24, 14-25 |
| Minerals                     |                            |
| and ions.....                | 4-74                       |
| chain silicates.....         | 4-78                       |
| classification.....          | 4-75                       |
| defined.....                 | 4-73                       |
| dimer silicates.....         | 4-79                       |
| framework silicates.....     | 4-76                       |
| isolated silicates.....      | 4-79                       |
| layer silicates.....         | 4-77                       |
| naming of minerals.....      | 4-73                       |
| <i>Miocene</i> .....         | 1-22                       |
| <i>Mississippian</i> .....   | 1-21                       |
| mixing.....                  | 13-2                       |
| binary.....                  | 13-4                       |
| mobile belts.....            | 7-3                        |
| molasse.....                 | 1-55                       |
| Moon                         |                            |
| Fe depletion.....            | 11-5                       |
| giant impact hypothesis..... | 11-5                       |
| origin.....                  | 11-5                       |
| moraines.....                | 8-45                       |
| MORB.....                    | 2-24                       |
| and mantle temperature.....  | 2-36                       |
| global trend.....            | 2-34                       |
| primary.....                 | 2-33                       |
| muscovite.....               | 4-83                       |

## N

|                              |              |
|------------------------------|--------------|
| Na <sub>g</sub> .....        | 2-34         |
| Na <sub>g</sub> .....        | 2-36         |
| Nb/U.....                    | 18-20        |
| Nd isotope                   |              |
| evolution of reservoirs..... | 18-11        |
| Nd isotopes                  |              |
| in MORB and peridotite.....  | 18-10        |
| mass balance.....            | 18-13, 18-14 |
| Ne                           |              |
| 3-isotope diagram.....       | 19-14        |
| basic facts.....             | 19-13        |
| coupled to He.....           | 19-18        |
| Loihi line.....              | 19-17        |

|  |                     |
|--|---------------------|
| mass fractionation line.....               | 19-15               |
| MORB line.....                             | 19-16               |
| OIB data.....                              | 19-17               |
| solar and atmosphere compositions.....     | 19-15               |
| <i>Neogene</i> .....                       | 1-21, 1-22          |
| Neptunism.....                             | 1-23                |
| neutrino.....                              | 10-10               |
| <i>neutron capture cross-section</i> ..... | 10-19               |
| nitrogen                                   |                     |
| geochemical cycle of.....                  | 16-14, 16-15        |
| nitrogen fixation.....                     | 15-24               |
| noble gases                                |                     |
| and mantle structure, summary.....         | 19-32               |
| Ar basic facts.....                        | 19-19               |
| atmospheric composition.....               | 19-3                |
| atmospheric contamination.....             | 19-5                |
| He basic facts.....                        | 19-4                |
| Ne basic facts.....                        | 19-13               |
| summary table.....                         | 19-2                |
| Xe basic facts.....                        | 19-24               |
| norm.....                                  | 2-4                 |
| Normal Faults                              |                     |
| and metamorphic core complexes.....        | 5-18                |
| detachment.....                            | 5-14                |
| footwall rebound.....                      | 5-18                |
| horst and graben.....                      | 5-14                |
| listric.....                               | 5-14                |
| NO <sub>x</sub> family.....                | 16-26               |
| nucleosynthesis.....                       | 10-8                |
| alpha nuclides.....                        | 10-13               |
| big bang.....                              | 10-10               |
| Carbon burning.....                        | 10-13               |
| Helium burning.....                        | 10-13, 10-15        |
| hydrogen burning.....                      | 10-12               |
| neutron capture.....                       | 10-19, 10-20        |
| nuclear binding energy.....                | 10-16               |
| nuclear statistical equilibrium.....       | 10-17               |
| photodisintegration rearrangement.....     | 10-18               |
| PPI Chain.....                             | 10-12               |
| reaction rate.....                         | 10-11               |
| red giant stars.....                       | 10-15               |
| r-process.....                             | 10-20               |
| Silicon burning.....                       | 10-13               |
| s-process.....                             | 10-20               |
| stellar.....                               | 10-11, 10-12, 10-13 |
| β-decay.....                               | 10-20               |
| nucleus                                    |                     |
| binding energy.....                        | 10-16               |
| mass defect.....                           | 10-16               |
| nuée ardente.....                          | 3-25                |
| nutrient elements.....                     | 15-20, 15-24        |
| and oxygen.....                            | 15-22               |
| as tracers of upwelling.....               | 15-25               |
| vertical profile of.....                   | 15-22               |

## O

|                        |       |
|------------------------|-------|
| obliquity.....         | 14-23 |
| ocean                  |       |
| anoxic conditions..... | 15-23 |

|   |                            |
|---|----------------------------|
| classification of elements.....           | 15-20                      |
| distribution of carbonate sediment.....   | 15-29                      |
| distribution of siliceous sediment.....   | 15-26                      |
| Fe fertilization.....                     | 15-24                      |
| heat transport.....                       | 16-8                       |
| inorganic carbon chemistry.....           | 15-27                      |
| inputs and outputs.....                   | 15-18                      |
| limiting nutrients.....                   | 15-24                      |
| mixed layer.....                          | 15-2                       |
| photic zone.....                          | 15-2                       |
| photosynthesis and respiration.....       | 15-22                      |
| salinity, temperature, density.....       | 15-3                       |
| sediment distributions.....               | 15-30                      |
| thermocline.....                          | 15-2                       |
| upwelling and nutrients.....              | 15-25                      |
| vertical structure.....                   | 15-2                       |
| ocean dynamics.....                       | 15-6                       |
| age of water masses.....                  | 15-15                      |
| and climate change.....                   | 15-12                      |
| coastal upwelling.....                    | 15-8, 15-9                 |
| deep circulation.....                     | 15-10                      |
| Ekman spiral.....                         | 15-7                       |
| El Niño.....                              | 15-13                      |
| equatorial upwelling.....                 | 15-9                       |
| high latitude upwelling.....              | 15-9                       |
| subtropical gyres.....                    | 15-9                       |
| thermohaline circulation.....             | 15-11                      |
| wind forcing.....                         | 15-9                       |
| Ocean island basalt                       |                            |
| vs. MORB.....                             | 2-52                       |
| Ocean Island Basalts                      |                            |
| He and Sr isotopes.....                   | 13-17                      |
| Ocean Island Volcanoes.....               | 2-45. See Shield Volcanoes |
| oceanic crust                             |                            |
| and fractional crystallization.....       | 2-31                       |
| composition.....                          | 4-82                       |
| lower.....                                | 2-31                       |
| seismic structure.....                    | 2-9                        |
| thickness.....                            | 2-35                       |
| <i>Oligocene</i> .....                    | 1-22                       |
| olivine.....                              | 4-79, 4-81                 |
| phase diagram.....                        | 4-84                       |
| Oman ophiolite.....                       | 1-48, 2-13                 |
| Ontong-Java plateau.....                  | 2-44                       |
| <i>ophiolite</i> .....                    | 1-46                       |
| orbitals.....                             | 11-11, 11-12               |
| filling sequence.....                     | 11-12                      |
| <i>Ordovician</i> .....                   | 1-21                       |
| original horizontality, principle of..... | 1-6                        |
| orogenic foredeep.....                    | 7-3                        |
| orogeny                                   |                            |
| defined.....                              | 1-55                       |
| orthopyroxene.....                        | 4-81, 4-82                 |
| outgoing radiation.....                   | 16-5                       |
| O <sub>x</sub> family.....                | 16-22                      |
| oxygen                                    |                            |
| and burial of organic C.....              | 16-16                      |
| as tracer of changes in carbon cycle..... | 16-20                      |
| geochemical cycle of.....                 | 16-16                      |
| ozone.....                                | 16-21                      |
| and oxygen isotopes.....                  | 14-29                      |
| and polar stratospheric clouds.....       | 16-31                      |

|                                       |                     |
|---------------------------------------|---------------------|
| Antarctic ozone hole.....             | 16-29, 16-30, 16-31 |
| catalytic loss cycles.....            | 16-25               |
| Chapman cycle.....                    | 16-22               |
| Chapman cycle steady solution.....    | 16-23               |
| destruction by nitrogen radicals..... | 16-27               |
| in troposphere.....                   | 16-32               |
| sources and sinks.....                | 16-28               |
| vertical structure.....               | 16-24               |

---

## P

|  |                            |
|--|----------------------------|
| <i>Paleocene</i> .....   | 1-22                       |
| paleoclimate   |                            |
| Heinrich events.....   | 14-27                      |
| ice core records.....  | 14-26                      |
| Milankovitch cycles.....   | 14-21, 14-23, 14-24, 14-25 |
| non-linearity.....   | 14-25                      |
| sea-level record.....  | 14-22                      |
| sediment core record.....  | 14-21                      |
| stability of Holocene.....   | 14-27                      |
| <i>Paleogene</i> .....   | 1-21, 1-22                 |
| paleomagnetism.....  | 8-17                       |
| and continental drift.....   | 8-21                       |
| apparent polar wander.....   | 8-21                       |
| chemical remanent magnetism.....   | 8-18                       |
| curie point.....   | 8-17                       |
| depositional remanent magnetism.....                                     | 8-18                       |
| magnetic polarity.....   | 8-20                       |
| paleointensity.....  | 8-20                       |
| paleolatitude.....   | 8-21                       |
| thermal remanent magnetism.....  | 8-17                       |
| virtual magnetic dipole.....   | 8-19                       |
| Paleozoic.....   | 1-20, 1-21                 |
| <i>Pangaea</i> .....   | 1-35                       |
| Parana-Etendeka flood basalt.....  | 2-42                       |
| Partition coefficient.....   | 11-20                      |
| and continental crust.....   | 11-27                      |
| partition coefficient  |                            |
| and ionic radius.....  | 11-21                      |
| systematics.....   | 11-21                      |
| Passive margin.....  | 1-49, 7-3                  |
| Patterson, C. C.....   | 12-31                      |
| Pauli exclusion principle.....   | 11-10                      |
| Pb isotopes.....   | 18-23, 18-30               |
| <i>Pennsylvanian</i> .....   | 1-21                       |
| peralkaline.....   | 2-7                        |
| peraluminous.....  | 2-7                        |
| peridotite.....  | 4-81                       |
| peridotite solidus.....  | 2-21                       |
| periodic table.....  | 11-10, 11-13               |
| and orbital filling.....   | 11-13                      |
| and quantum mechanics.....   | 11-10                      |
| and valence.....   | 11-15                      |
| <i>Periods</i> .....   | 1-21                       |
| peritectic.....  | 4-85                       |
| <i>Permian</i> .....   | 1-21                       |
| Phanerozoic.....   | 1-19, 1-20                 |
| Phase diagrams.....  | 4-59                       |
| lever rule.....  | 4-68                       |
| Mg <sub>2</sub> SiO <sub>4</sub> -Fe <sub>2</sub> SiO <sub>4</sub> ..... | 4-84                       |

|                                      |                  |
|--------------------------------------|------------------|
| MgO-SiO <sub>2</sub> .....           | 4-85             |
| Phase rule .....                     | 4-72             |
| phenocryst .....                     | 2-2              |
| phonolite.....                       | 3-17             |
| phreatomagmatic eruption.....        | 3-25             |
| physical weathering                  |                  |
| feedback with chemical.....          | 9-13             |
| mechanisms .....                     | 9-12             |
| pillow basalt .....                  | 2-10             |
| plagioclase.....                     | 4-81, 4-82       |
| Planets                              |                  |
| density.....                         | 10-22            |
| size .....                           | 10-22            |
| Plate boundaries                     |                  |
| classification.....                  | 1-30             |
| continental rift .....               | 1-31             |
| convergent .....                     | 1-32             |
| Divergent .....                      | 1-31             |
| mid-ocean ridge.....                 | 1-31             |
| subduction.....                      | 1-32             |
| transform.....                       | 1-33             |
| Plate Tectonics                      |                  |
| and age of seafloor .....            | 1-40             |
| and continental arc subduction ..... | 1-53             |
| and continental collisions.....      | 1-55             |
| and geodetic measurements .....      | 1-42             |
| and island arc subduction.....       | 1-51             |
| and magnetic lineations.....         | 1-41             |
| and oceanic crust .....              | 1-45             |
| and seismicity.....                  | 1-39             |
| and strain concentration .....       | 7-22             |
| and volcanism.....                   | 1-38             |
| defined .....                        | 1-28             |
| evidence for .....                   | 1-35             |
| postulates .....                     | 1-28             |
| platform .....                       | 7-2              |
| <i>Pleistocene</i> .....             | 1-22             |
| plinian eruption.....                | 3-25             |
| <i>Pliocene</i> .....                | 1-22             |
| plume-ridge interaction.....         | 18-24            |
| plutonic rock .....                  | 2-2              |
| plutonium .....                      | 12-6             |
| polar stratospheric clouds.....      | 16-31            |
| popping rock .....                   | 19-16            |
| potential temperature .....          | 2-21, 2-36       |
| in seawater .....                    | 15-4             |
| practical salinity units.....        | 15-4             |
| pre-Cambrian .....                   | 1-19             |
| precession .....                     | 14-23            |
| precipitation                        |                  |
| isotopic composition .....           | 14-19            |
| pressure.....                        | 4-41             |
| primitive mantle.....                | 18-20            |
| relative to chondrites.....          | 11-4             |
| Proterozoic .....                    | 1-19             |
| pycnocline .....                     | 15-2             |
| pyroxene.....                        | 4-78, 4-81, 4-82 |

---

## Q

|                           |              |
|---------------------------|--------------|
| quantum mechanics         |              |
| and stable isotopes ..... | 14-7         |
| quantum numbers .....     | 11-10, 11-11 |
| <i>Quaternary</i> .....   | 1-21, 1-22   |

---

## R

|                                |                 |
|--------------------------------|-----------------|
| radiative balance.....         | 16-3            |
| radiative spectra.....         | 16-2            |
| radical species.....           | 16-25           |
| radioactivity                  |                 |
| activity.....                  | 12-8            |
| and parent-daughter ratio..... | 12-10           |
| daughter, defined.....         | 12-2            |
| decay constant, defined.....   | 12-7            |
| electron capture.....          | 12-5            |
| equation .....                 | 12-7            |
| fundamental law.....           | 12-7            |
| half life .....                | 12-8            |
| induced fission .....          | 12-6            |
| isochron method.....           | 12-14           |
| mean life.....                 | 12-8            |
| modes of decay.....            | 12-2            |
| parent, defined.....           | 12-2            |
| positron emission .....        | 12-5            |
| spontaneous fission.....       | 12-6            |
| $\alpha$ -decay.....           | 12-3            |
| $\beta$ -decay .....           | 12-4            |
| radiogenic isotopes            |                 |
| mantle components .....        | 18-17           |
| radiolaria .....               | 15-21           |
| Rare earth elements .....      | 12-18           |
| Redfield ratios.....           | 15-24           |
| regional metamorphism.....     | 7-23            |
| regression                     |                 |
| defined.....                   | 8-9             |
| relief .....                   | 6-6             |
| residence time.....            | 13-22           |
| elements in seawater .....     | 13-23           |
| stopwatch example.....         | 13-21           |
| rhyolite .....                 | 2-5, 3-17, 4-83 |
| Rio Grande Rift .....          | 8-38            |
| river profiles.....            | 8-7             |
| knickpoints .....              | 8-8             |
| river terraces .....           | 6-31            |
| Rivera triple junction.....    | 8-37            |
| rock cycle.....                | 9-2             |

---

## S

|                          |            |
|--------------------------|------------|
| salinity.....            | 15-4, 15-5 |
| scavenged elements ..... | 15-20      |
| Schilling effect.....    | 18-24      |
| sea level                |            |
| and glaciation .....     | 8-16       |
| and plate tectonics..... | 8-16       |

|  |                        |
|--|------------------------|
| and transgression/regression.....              | 8-9, 8-10              |
| causes of change.....                          | 8-16                   |
| relative and eustatic.....                     | 8-9                    |
| sea-breeze circulation.....                    | 16-10                  |
| sea-level record.....                          | 14-22                  |
| seawater                                       |                        |
| <sup>14</sup> C.....                           | 15-15, 15-16           |
| <sup>3</sup> H.....                            | 15-16                  |
| <sup>87</sup> Sr/ <sup>86</sup> Sr record..... | 15-19                  |
| age of water masses.....                       | 15-15, 15-17           |
| carbon isotopes.....                           | 15-28                  |
| carbonate saturation.....                      | 15-28                  |
| classification of elements.....                | 15-20                  |
| conservative properties.....                   | 15-4                   |
| inorganic carbon chemistry.....                | 15-27                  |
| inputs and outputs.....                        | 15-18                  |
| latitude structure.....                        | 15-5                   |
| pH.....  | 15-28                  |
| salinity, evaporation, and precipitation.....  | 15-5                   |
| salinity, temperature, density.....            | 15-3                   |
| stable stratification.....                     | 15-4                   |
| surface density.....                           | 15-5                   |
| total inorganic carbon.....                    | 15-28                  |
| vertical structure.....                        | 15-4                   |
| Secular equilibrium.....                       | 12-26                  |
| sediment transport                             |                        |
| mineral sorting.....                           | 9-19                   |
| shape sorting.....                             | 9-19                   |
| size sorting.....                              | 9-18                   |
| sedimentary basins.....                        | 7-2                    |
| sedimentary environments.....                  | 9-31                   |
| alluvial fans.....                             | 9-32                   |
| and lateral continuity.....                    | 9-42                   |
| beach-barrier system.....                      | 9-41, 9-42             |
| deep sea.....                                  | 9-45                   |
| deltas.....                                    | 9-38, 9-39, 9-40       |
| desert.....                                    | 9-35                   |
| estuaries.....                                 | 9-43                   |
| fluvial.....                                   | 9-32                   |
| glacial and peri-glacial.....                  | 9-37                   |
| lakes.....                                     | 9-36                   |
| marginal marine.....                           | 9-38                   |
| marine.....                                    | 9-44                   |
| meandering rivers.....                         | 9-34                   |
| neritic.....                                   | 9-44                   |
| rivers.....                                    | 9-33                   |
| shallow marine.....                            | 9-44                   |
| terrestrial.....                               | 9-32                   |
| tidal flats.....                               | 9-43                   |
| sedimentary rock                               |                        |
| volume and area.....                           | 9-4                    |
| sedimentary rocks                              |                        |
| and depositional environment.....              | 9-20                   |
| chemical rock names.....                       | 9-24                   |
| classification.....                            | 9-21                   |
| clastic rock names.....                        | 9-23                   |
| clastic vs. chemical.....                      | 9-21                   |
| diagenesis and lithification.....              | 9-22                   |
| sedimentary structure                          |                        |
| bedding.....                                   | 9-25                   |
| carbonates and fossils.....                    | 9-30                   |
| cross bedding.....                             | 9-26                   |
| graded bedding.....                            | 9-29                   |
| mudcracks.....                                 | 9-27                   |
| ripples.....                                   | 9-26                   |
| soft-sediment deformation.....                 | 9-28                   |
| trace fossils.....                             | 9-28                   |
| sedimentation.....                             | 9-20                   |
| <i>seismology</i>                              |                        |
| and Earth structure.....                       | 11-3                   |
| sequence.....                                  | 8-5                    |
| sequence stratigraphy                          |                        |
| and transgression/regression.....              | 8-13                   |
| second and third order cycles.....             | 8-15                   |
| Stoss cycles.....                              | 8-14                   |
| sheeted dikes.....                             | 2-11                   |
| shield.....                                    | 7-2                    |
| shield volcano.....                            | 3-21                   |
| Shield Volcanoes.....                          | 2-45                   |
| evolution of.....                              | 2-45                   |
| main shield-building stage.....                | 2-47                   |
| post-erosional stage.....                      | 2-51                   |
| post-shield stage.....                         | 2-50                   |
| pre-shield stage.....                          | 2-46                   |
| sector collapse.....                           | 2-47                   |
| summit caldera.....                            | 2-47                   |
| short-lived radioactivity.....                 | 12-20                  |
| siderophile.....                               | 11-4, 11-8             |
| <i>Silurian</i> .....                          | 1-21                   |
| slab.....                                      | 3-8                    |
| <i>Slickensides</i> .....                      | 5-27                   |
| slope.....                                     | 6-6                    |
| Sm/Nd.....                                     | 18-19                  |
| smog.....                                      | 16-32                  |
| soil formation.....                            | 9-15                   |
| and aridity.....                               | 9-16                   |
| types of soil profiles.....                    | 9-16                   |
| solar abundance                                |                        |
| and nuclear equilibrium.....                   | 10-18                  |
| elements.....                                  | 10-6                   |
| nuclides.....                                  | 10-14                  |
| Solar Nebula.....                              | 10-21                  |
| Solid solution.....                            | 4-65                   |
| solidus.....                                   | 4-67                   |
| solidus depression.....                        | 3-12                   |
| Spidergram.....                                | 12-18, 18-22           |
| spinel.....                                    | 4-81                   |
| Sr isotope                                     |                        |
| evolution of reservoirs.....                   | 18-11                  |
| Sr isotopes                                    |                        |
| in oceanic basalts.....                        | 18-6                   |
| Sr-Nd isotope correlation.....                 | 18-11, 18-15           |
| Sr-Nd-Pb space.....                            | 18-16, 18-17           |
| stable isotope fractionation                   |                        |
| and hydrothermal alteration.....               | 14-13, 14-14           |
| definition.....                                | 14-5                   |
| equilibrium.....                               | 14-6, 14-7, 14-8, 14-9 |
| gaseous diffusion.....                         | 14-11                  |
| kinetic.....                                   | 14-11                  |
| mass-independent.....                          | 14-28, 14-29           |
| mechanisms.....                                | 14-5                   |
| temperature dependence.....                    | 14-10                  |
| stable isotope thermometry                     |                        |
| calcite sediment cores.....                    | 14-17                  |

|   |              |
|---|--------------|
| Epstein calibration.....                | 14-16        |
| in ice cores.....                       | 14-26        |
| mineral pairs.....                      | 14-15        |
| mineral-water.....                      | 14-16        |
| temperature and ice volume effects..... | 14-17        |
| stable isotopes                         |              |
| and hydrologic cycle.....               | 14-18        |
| delta notation.....                     | 14-4         |
| elements of interest.....               | 14-2, 14-3   |
| fractionation.....                      | 14-5         |
| Rayleigh fractionation.....             | 14-12        |
| standards.....                          | 14-4         |
| terrestrial fractionation line.....     | 14-28        |
| three isotope plot.....                 | 14-28        |
| standard model.....                     | 18-12, 18-15 |
| Stefan-Boltzmann law.....               | 16-3         |
| Steno, Nicolaus.....                    | 1-6          |
| stirring.....                           | 18-8, 18-9   |
| stony-iron meteorites.....              | 10-24        |
| stratigraphy                            |              |
| and astronomical cycles.....            | 1-16         |
| and cyclicity.....                      | 8-2          |
| and hierarchy.....                      | 8-2          |
| and unconformity.....                   | 8-3          |
| and uniformitarianism.....              | 8-2          |
| base level.....                         | 8-5, 8-6     |
| chemical.....                           | 1-15         |
| defined.....                            | 1-3          |
| isotopic.....                           | 1-15         |
| lateral succession.....                 | 8-3          |
| magnetic.....                           | 1-14         |
| principle of lateral continuity.....    | 8-11         |
| sequence stratigraphy.....              | 8-5          |
| types.....                              | 1-5          |
| vertical succession.....                | 8-3          |
| stratosphere                            |              |
| ozone layer.....                        | 16-21        |
| role of nitrogen radicals.....          | 16-26        |
| stratovolcano.....                      | 3-20         |
| stream function.....                    | 2-14         |
| stress                                  |              |
| defined.....                            | 7-8          |
| normal.....                             | 7-8          |
| shear.....                              | 7-8          |
| tensor.....                             | 7-8          |
| Strike-slip faults.....                 | 8-41, 8-42   |
| conjugate.....                          | 5-21         |
| en échelon.....                         | 5-20         |
| restraining and releasing bends.....    | 5-19         |
| tear faults.....                        | 5-21         |
| subaluminous.....                       | 2-7          |
| subduction                              |              |
| and amphibole dehydration.....          | 3-15         |
| chemical components.....                | 3-9          |
| cross sections.....                     | 3-7          |
| flat slab events.....                   | 8-36         |
| in the Archean.....                     | 3-14         |
| map.....                                | 3-6          |
| melting region.....                     | 3-14         |
| polarity reversal.....                  | 8-31         |
| slap dip and volcanism.....             | 8-36         |
| thermal models.....                     | 3-8          |

|                                  |       |
|----------------------------------|-------|
| subsidence.....                  | 6-7   |
| substitution                     |       |
| and electronegativity.....       | 11-19 |
| and ionic charge.....            | 11-19 |
| and ionic radius.....            | 11-19 |
| Goldschmidt's rules.....         | 11-19 |
| sulfur dioxide                   |       |
| and sulfur isotopes.....         | 14-29 |
| superposition, principle of..... | 1-6   |
| syncline.....                    | 5-9   |

---

## T

|                                    |                     |
|------------------------------------|---------------------|
| temperature.....                   | 4-41                |
| <i>Tertiary</i> .....              | 1-21, 1-22          |
| Th isotopes.....                   | 18-29               |
| Th/U ratio.....                    | 18-29, 18-30, 18-31 |
| thermal radiation.....             | 10-17               |
| thermochronology.....              | 6-34                |
| thermochronometry.....             | 12-12               |
| thermocline.....                   | 15-2                |
| thermodynamics.....                | 4-37                |
| binary system.....                 | 4-62                |
| chemical potential.....            | 4-46                |
| choice of components.....          | 4-39                |
| closed system.....                 | 4-38                |
| common tangent construction.....   | 4-65                |
| component.....                     | 4-38                |
| compressibility.....               | 4-49, 4-50          |
| conservation of energy.....        | 4-43                |
| enthalpy.....                      | 4-52, 4-53          |
| entropy.....                       | 4-44                |
| environment.....                   | 4-38                |
| equilibrium.....                   | 4-40, 4-45          |
| first law.....                     | 4-43                |
| Gibbs free energy.....             | 4-56, 4-57, 4-58    |
| G-X diagram.....                   | 4-64                |
| heat capacity.....                 | 4-49, 4-50          |
| Helmholtz free energy.....         | 4-54, 4-55          |
| heterogeneous.....                 | 4-38                |
| homogeneous.....                   | 4-38                |
| internal energy.....               | 4-43                |
| isolated system.....               | 4-38                |
| minimization of energy.....        | 4-45                |
| multicomponent system.....         | 4-46                |
| one-component system.....          | 4-60, 4-61          |
| open system.....                   | 4-38, 4-46          |
| phase.....                         | 4-38                |
| phase diagrams.....                | 4-59                |
| Phase rule.....                    | 4-72                |
| reversible.....                    | 4-42                |
| second law.....                    | 4-44                |
| spontaneous.....                   | 4-42                |
| stability criteria.....            | 4-48, 4-50          |
| system.....                        | 4-38                |
| thermal expansion coefficient..... | 4-49                |
| variance.....                      | 4-72                |
| thermoluminescence.....            | 6-32                |
| Thrust faults                      |                     |
| and associated folding.....        | 5-24                |

|                                     |       |
|-------------------------------------|-------|
| duplex structure .....              | 5-23  |
| horst and graben .....              | 5-22  |
| imbrication.....                    | 5-23  |
| vergence.....                       | 5-22  |
| Timescale, geologic.....            | 1-18  |
| trace element                       |       |
| abundance.....                      | 18-5  |
| ratios.....                         | 18-5  |
| Trace elements                      |       |
| bulk partition coefficient.....     | 11-20 |
| constant ratios.....                | 18-20 |
| Henry's law.....                    | 11-20 |
| mass balance.....                   | 18-21 |
| partition coefficient.....          | 11-20 |
| ratios fractionated by melting..... | 18-19 |
| transgression                       |       |
| defined.....                        | 8-9   |
| Transpression.....                  | 8-42  |
| Transtension.....                   | 8-42  |
| <i>Triassic</i> .....               | 1-21  |
| Tristan da Cunha hotspot.....       | 2-42  |

---

## U

|                                   |              |
|-----------------------------------|--------------|
| ultrabasic .....                  | 2-7          |
| ultramafic .....                  | 2-7, 4-81    |
| ultramafic rocks                  |              |
| classification.....               | 2-6          |
| ultraviolet flux.....             | 16-21        |
| unconformity.....                 | 8-3, 8-4     |
| angular unconformity.....         | 8-4          |
| disconformity.....                | 8-4          |
| nonconformity.....                | 8-4          |
| paraconformity.....               | 8-4          |
| Uniformitarianism.....            | 1-24         |
| uplift.....                       | 6-7          |
| upper mantle                      |              |
| composition.....                  | 4-81         |
| depletion.....                    | 11-28, 11-29 |
| open system behavior.....         | 18-28        |
| residence time.....               | 18-31        |
| uranium.....                      | 12-6         |
| Uranium decay series.....         | 12-22        |
| Uranium/Lead ratio ( $\mu$ )..... | 12-31        |
| Urey ratio.....                   | 19-10        |
| U-series.....                     | 12-22        |
| and mantle melting.....           | 12-28        |
| and subduction zones.....         | 3-16         |
| disequilibria.....                | 12-27        |

---

## V

|              |       |
|--------------|-------|
| valence..... | 11-15 |
| varves.....  | 9-36  |
| Venus.....   | 13-38 |
| vibrations   |       |

|                            |            |
|----------------------------|------------|
| and stable isotopes.....   | 14-7       |
| viscosity.....             | 2-17       |
| volatility.....            | 10-21      |
| and Earth composition..... | 10-31      |
| condensation sequence..... | 10-23      |
| volcanic rock.....         | 2-2        |
| volcanology                |            |
| and lava composition.....  | 3-22       |
| and viscosity.....         | 3-22       |
| and volatile species.....  | 3-22       |
| caldera formation.....     | 3-24       |
| pyroclastic flow.....      | 3-24       |
| volcano morphology.....    | 3-20, 3-21 |
| volume.....                | 4-41       |

---

## W

|                                     |           |
|-------------------------------------|-----------|
| Wadati-Benioff Zone.....            | 1-39, 3-7 |
| Walther's Law.....                  | 8-11      |
| Walvis Ridge.....                   | 2-42      |
| Wasserburg, G. J.....               | 12-21     |
| water                               |           |
| salinity, temperature, density..... | 15-3      |
| weathering.....                     | 9-4       |
| and erosion.....                    | 9-17      |
| and soil formation.....             | 9-15      |
| chemical.....                       | 9-6       |
| chemical vs. physical.....          | 9-5       |
| physical.....                       | 9-12      |
| Wegener, Alfred.....                | 1-35      |
| Western United States.....          | 8-39      |
| Wien's displacement law.....        | 10-17     |
| work.....                           | 4-41      |
| wormogram.....                      | 18-17     |

---

## X

|                                |              |
|--------------------------------|--------------|
| Xe                             |              |
| <sup>244</sup> Pu fission..... | 19-29        |
| and atmospheric degassing..... | 19-27, 19-28 |
| and extinct nuclides.....      | 19-27        |
| and mantle structure.....      | 19-31, 19-32 |
| atmospheric composition.....   | 19-30        |
| basic facts.....               | 19-24        |
| fission yields.....            | 19-25        |
| MORB line.....                 | 19-26        |
| OIB data.....                  | 19-26        |
| recycling?.....                | 19-30        |
| well gas data.....             | 19-26        |
| Xenoliths.....                 | 2-50         |

---

## Z

|                        |      |
|------------------------|------|
| zero-point energy..... | 14-7 |
|------------------------|------|