

Glossary

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A

Abukuma-type metamorphism*: Low-pressure regional metamorphism, typically occurring in the magmatic belt above subduction zones.

Acidic: → *Magma* and → *magmatic rock* with more than 65 weight-% SiO₂.

Active continental margin: Continental margin with a → *subduction zone* dipping beneath. Represents a destructive → *plate boundary*. See also → *passive continental margin*.

Alkali feldspar: Mineral, potassium-sodium → *feldspar*.

Alkaline: Term for magma or magmatic rock rich in alkalis (Na₂O, K₂O) with reference to the content on silica (SiO₂) or alumina (Al₂O₃).

Alkaline basalt: Basalt with high content of alkalis (Na, K) and lower content of silica as compared to → *tholeiitic basalt*. Derived from mantle → *peridotite* with low degree of partial melting (<10 %), typically occurring in → *graben structures* and above → *hot spots*.

Amphibole: Mineral group similar to *pyroxene* but containing hydroxyl ions. An important member of this mineral group is hornblende.

Amphibolite: Rock derived from basalt or gabbro by regional metamorphism; main mineral constituents are amphibole and plagioclase.

Amphibolite facies*: Medium- to high-grade regional metamorphism.

Anatexis*: Melting of rocks in continental crust during high-grade regional metamorphism.

Andesite*: Volcanic rock, typically formed above subduction zones.

Anhydrite: Mineral, calcium sulfate; *cf* → *gypsum*.

Aragonite: Mineral, calcium carbonate of same chemical composition as → *calcite* but crystallizing in a different crystal system. Occurring in shells of certain organisms and in high-pressure metamorphic rocks.

Arkose: → *Sandstone* containing a considerable amount of feldspar (>20–25%) besides quartz.

Assimilation: Incorporation of wall rocks into a magma chamber by melting.

Asthenosphere: Shell of the upper mantle directly below the base of the → *lithosphere*, mostly in depths between 100 and 250 km. Contains low amounts of melt.

Aulacogen: Failed → *graben structure* filled with extremely thick sediments.

B

Barrow-type metamorphism*: Medium-pressure regional metamorphism, typically occurring in collision zones of continents (see → *continent-continent collision*).

Barite: Mineral of high density, barium sulfate.

Basalt*: Volcanic rock, very common at the ocean floor and in → *flood basalts*. Basaltic magma evolves by partial melting of → *peridotite* in the → *mantle*.

Basement: Metamorphic and igneous base on which a younger sedimentary cover sequence

was deposited; e.g., in the Alps the Variscan basement of the Alpine sequences.

Basic: → *Magma* and → *magmatic rock* with 45–53 weight-% SiO_2 .

Batholith: Large body of → *plutonic rock* mainly composed of → *granodiorite* and → *granite*, typically occurring in the → *magmatic belt* above → *subduction zones* or in collision zones of continents (see → *continent-continent collision*).

Benioff zone: Seismically active zone at convergent plate boundaries which obliquely plunges down to a maximum depth of 700 km indicating a → *subduction zone*.

Blueschist: High-pressure metamorphic rock formed in → *blueschist facies*. Contains → *glauco-phane*.

Blueschist facies*: Lower grade of → *high-pressure metamorphism*; cf → *eclogite facies*.

Breccia: Rock mainly composed of angular rock fragments. May evolve tectonically (fault breccia) or by sedimentary processes.

Brittle: Rigid behavior of rock with fracturing during deformation (as opposed to → *ductile*).

C

Calc-alkaline: Magmas and magmatic rocks mainly formed above *subduction zones* and in collisional belts.

Calc-alkaline basalt: → *Basalt* with substantial contents of calcium, alkalis, and aluminum. Typically formed above → *subduction zones*. Typically a → *high-alumina basalt*.

Calcite: Mineral, calcium carbonate. Main constituent of limestone and chalk, formed primarily by organic processes in shallow, warm seas.

Calcite compensation depth: Oceanic boundary layer below which no calcitic sediments are deposited because calcite dissolution is higher than calcite supply.

Carbonatite: Magmatic rock mainly composed of → *calcite* or → *dolomite*.

CCD: see → *calcite compensation depth*.

Chlorite: Greenish mineral similar to mica, typical of low-grade metamorphism.

Chromite: Mineral of the → *spinel* group, chrome ore.

Clastic sediment: Sediment formed by transportation and deposition of mineral and rock fragments.

Claystone: → *Clastic sedimentary rock* composed of quartz and clay minerals with grain-sizes below 0.06 mm or, → *sensu stricto*, below 0.004 mm; cf → *siltstone*.

Clinopyroxene: see → *pyroxene*.

Coccolithophorids: Carbonate-secreting algae.

Coësite: High-pressure modification of → *quartz*.

Collision: forceful interaction between plates, e.g., → *continent-continent collision*.

Concordant: Strata that show parallel bedding without break in sedimentation or contain interlayered rocks (e.g., → *sills*) that are parallel to bedding; cf → *discordant*.

Conglomerate: Sedimentary rock mainly composed of grains larger than sand-size, usually pebbles and cobbles.

Conjugate faults: Connected system of two differently oriented *fault* sets that form during the same tectonic event. Their sense of movement is interconnected.

Conservative plate boundary: see *plate boundary*.

Constructive plate boundary: see *plate boundary*.

Contact metamorphism*: Metamorphism in the thermal aureole of *intrusions*.

Continent-continent collision: Collision of continental parts of plates as a consequence of subduction of intervening oceanic parts of plates. Leads to *orogeny*.

Continental crust: Outermost shell of the solid Earth, ca. 35 km thick on average and forming the continents and shelf areas. Average composition is andesitic with about 60 % SiO_2 . Beneath mountain ranges thickness increases up to ca. 70 km.

Continental margin: edge of continental crust, usually bordered by slope-rise; two broad types,

→ *active continental margin* and → *passive continental margin*.

Core: Innermost zone of the Earth below ca. 2900 km depth, mainly composed of iron and nickel. The outer core is liquid, the inner core (below ca. 5100 km) is solid.

Craton: Old, cooled and therefore relatively stiff parts of continents. Most cratons underlain by Precambrian → *basement*.

Crust: see → *continental crust*, → *oceanic crust*.

Curie temperature: Temperature below which a mineral acquires and preserves magnetic properties (after Pierre Curie). 680 °C for hematite, 580 °C for magnetite.

D

D"-layer: Lowermost layer of the Earth's mantle, thickness between 100 and 500 km (mostly 200–250 km). Believed to be area where most mantle plumes originate.

Dacite*: Volcanic rock of → *acidic*/ → *intermediate* composition, typically formed above → *subduction zones*.

Deep earthquake: Earthquake with focus between 350 and 700 km depth.

Deep sea trench: Depression at the margins of oceans with water depths up to 11 km. Indicates a convergent → *plate boundary* where a subducting plate plunges down into the mantle.

Depleted mantle: Mantle impoverished in → *incompatible elements* during partial melting and extraction of basaltic melts.

Destructive plate boundary: see → *plate boundary*.

Devitrification: Growth of fine minerals from a precursor of volcanic glass.

Diagenesis*: Compaction and alteration of sediments at temperatures below 200 °C (grades into lowest ranks of → *metamorphism*).

Diamond: High-pressure modification of graphite, formed in the Earth's mantle and in → *subduction zones* at depths of more than 100 km as well as by meteorite impacts.

Diapir: Rising, mostly tube-shaped rock body of highly variable diameter. The ascent is a result of density inversion, e. g., → *salt* beneath limestone, → *serpentinite* beneath oceanic crust, hot → *peridotite* in the mantle beneath cooler peridotite (→ *hot spot*). The rising rock material must be easily deformable; the ability of deformation is mainly dependent on the temperature.

Diatoms: Siliceous algae capable of forming major sedimentary rock sequences rich in chert. Although algae live and die in shallow water, they usually accumulate in deep-water deposits.

Differentiation: Modification of the composition of a magma by → *assimilation* of wall rock or crystallization and separation of minerals (e. g., by gravity). Basic rocks typically differentiate to more acidic rocks.

Dike: Magmatic tabular, → *discordant* rock body forming a mostly subvertical sheet, typically several decimeters or meters thick. Commonly a feeder channel under a volcanic edifice. See also → *sill*.

Diopside: a pyroxene (clinopyroxene) mineral enriched in magnesium and calcium.

Diorite*: *Intermediate* composition plutonic rock typically formed in the magmatic belt above *subduction zones*. Equivalent to *andesite*.

Discordant: Strata or rocks that are non-parallel or cross cutting; cf → *concordant*, → *unconformity*.

Dolerite: Subvolcanic basaltic rock occurring in → *dikes* and → *sills*. Intermediate in texture between basalt and gabbro.

Dolomite: Mineral, calcium-magnesium carbonate. Also sedimentary rock mainly composed of the mineral dolomite; cf → *limestone*.

Ductile: Plastic behavior of rock without fracturing during deformation (as opposed to → *brittle*).

Dunite*: Kind of → *peridotite* formed in the uppermost mantle directly below the oceanic crust.

E

Eclogite: Rock formed by → *high-pressure metamorphism* in → *subduction zones*, mostly from rocks of the → *oceanic crust*.

Eclogite facies*: Higher grade of → *high-pressure metamorphism*; cf → *blueschist facies*.

Ensialic island arc: → *Island arc* with basement of → *continental crust*.

Ensimatic island arc: → *Island arc* with basement of → *oceanic crust*.

Enstatite: Mineral, magnesium → *pyroxene* (orthopyroxene).

Earth's core: see → *core*.

Earth's crust: see → *crust*.

Earth's mantle: see → *mantle*.

F

Facies: Sum of rock characteristics as compared to other facies. Sedimentary facies are acquired in sediment according to place and conditions of formation (e.g., marine facies, deep-water facies, sandy facies). Metamorphic facies reflect the pressure and temperature conditions during metamorphism.

Fault: Displacement of two blocks along a fracture. Normal fault: Inclined fault plane with the hanging-wall block (block above the fault plane) moving downwards relative to the footwall block (expression of horizontal extension, e.g., during formation of a graben). Reverse fault: Hanging-wall block moving upwards relative to the footwall block (expression of horizontal compression). Thrust fault: reverse fault with a shallow-dipping fault plane (expression of strong horizontal contraction, formation of → *nappes*). Strike-slip fault: Horizontal movement of two blocks past each other along a steep-dipping fault; may be dextral (right-lateral; clockwise ball-bearing effect) or sinistral (left-lateral; anticlockwise ball-bearing effect).

Feldspar: Most common aluminum-rich mineral in the Earth's → *crust*. → *Plagioclase* (Na-Ca feldspar) and → *alkali feldspar* (K-Na feldspar) represent two different mineral groups.

Fenster: see → *teconic window*.

Flood basalt: Thick, widespread sheets of flat-lying → *basalts* formed above a → *hot spot*. Horizontal layers of lava and vertical fissures cause a staircase-like morphology, therefore also termed trap basalt (*trappa*, Swedish stairs). May cover areas more than 1,000,000 km².

Flower structure: Subvertical fault fanning upwards towards the surface.

Fluid, fluid phase: Highly mobile gas or liquid phase in a rock, circulating along grain boundaries and fissures or by volume diffusion. Mostly "water" as hydroxyl (OH⁻) ions, or CO₂. Serves as transport medium of elements during metamorphism. Decreases the melting temperature of rocks substantially.

Fluviatile sediments: → *Terrestrial* through a boundary layer, e.g., the Earth's surface. Measured in milliwatt per square meter (mW/m²)

H

Hematite: Mineral, iron oxide (Fe₂O₃) with iron in trivalent state. Common state of iron at Earth's surface since presence of oxygen in atmosphere (ca. 2000 Ma).

High-alumina basalt: → *Calc-alkaline basalt* rich in aluminum (Al₂O₃ >16 weight-%), occurs above → *subduction zones*.

High-pressure metamorphism*: Metamorphism typical of → *subduction zones*.

Hornblende: Mineral of the → *amphibole* group.

Hornfels: Rock formed at conditions of high-grade → *contact metamorphism*.

Horst: Elevated block between two → *grabens*. Horst-graben structure typical of rift zones and dominate American Basin and Range Province.

Hot spot: Place in the Earth's → *crust* under which a mantle → *diapir* rises. Characterized by volcanism (e.g., Hawaii).

Hyaloclastite: Broken → *volcanic glass* in the spandrels (between bulges) of pillow lavas.

Hydrothermal activity: Hot water and steam circulating in cracks and pores of rocks.

I

I-type (“igneous”) granite: Granitic rock evolved from more → *basic* magmatic rocks by → *differentiation*, typically occurring above → *subduction zones* (compare → *S-type granite*).

Illite: A clay mineral, similar to white mica and derived by weathering of feldspars. Typical clay in many marine sedimentary rocks; *cf* → *kaolinite*.

Incompatible elements: Chemical elements (e.g., alkalis) incompatible with mantle rocks, i. e., they cannot be integrated in the main mineral phases of mantle → *peridotite*. During partial melting they preferably enter the melt. Also termed “lithophile elements”.

Indenter: Stiff crustal block that is pushed into deformable crust (e.g., Indian indenter in the Himalayas, South-Alpine indenter in the Alps).

Intermediate: → *Magma* and → *magmatic rock* with 53–65 weight-% SiO_2 .

Intermediate earthquake: Earthquake with focus between 70 and 400 km depth.

Intraplate magmatism, Intraplate volcanism: Magmatism (volcanism) in the interior of plates above → *hot spots* or along → *graben structures*.

Intrusion: → *Magma* penetrating older rocks and crystallizing at depth.

Island arc: Arcuate chain of islands with active volcanoes above → *subduction zones*.

Isostasy: Buoyancy equilibrium of crustal blocks of different thickness and density.

K

Kaolinite: A clay mineral derived from weathering of feldspars. Typical clay in many continental sedimentary rocks; *cf* → *illite*.

Komatiite: Peridotitic or basaltic volcanic rock formed by high percentage of partial melting of → *peridotite*; rich in magnesium (MgO >18 weight-%).

Kyanite: Mineral, aluminum silicate typical of → *Barrow-type* and → *high-pressure metamorphism*.

L

Lava: Liquid form of rock (→ *magma*) extruded onto surface of Earth. Magma releases dissolved gas when approaching the surface, because of pressure release. The gas may remain enclosed as bubbles in the solidifying lava.

Leucite: Mineral similar to potassium feldspar but undersaturated in SiO_2 .

Lherzolite*: Kind of → *peridotite* widely distributed in the upper mantle.

Limestone: Sedimentary rock mainly composed of → *calcite* and mainly formed in the shelf areas and the open ocean above the → *calcite compensation depth* by the accumulation of shells and skeletal particles of organisms.

Listric fault: Curved → *fault*, subvertical near the surface and becoming flatter at depth. Causes tilting of the hanging-wall block (block above the fault).

Lithophile elements: See → *incompatible elements*.

Lithosphere: Outer solid layer of rocks that form the plates. Layer includes the → *crust* (continental or oceanic) and the → *lithospheric mantle*. Thicknesses typically range between 70 and 150 km but swell to more than 200 km beneath mountain ranges.

Lithospheric mantle: Uppermost rigid part of the Earth’s → *mantle* that belongs to the → *lithosphere*. Together with the → *crust* it forms the lithospheric → *plates*.

Lysocline: Boundary layer in the sea water below which the dissolution (e.g., of → *calcite*) increases substantially. For calcite mostly 1500–2000 m above the → *calcite compensation depth*.

M

Magma: Molten rock, generally composed of melt, dissolved gas, and crystallized minerals.

Magmatic arc, ~belt: Magmatic (volcanic) zone above a → *subduction zone*.

Magmatic (volcanic) front: Line of abrupt onset of magmatism above a → *subduction zone*.

- Magmatic rock:** Rock formed by cooling from a melt (see → *magma*).
- Magnesio-wuestite:** Mineral, magnesium oxide (MgO) that prevails in the lower → *mantle* together with → *perovskite*.
- Magnetite:** Mineral, iron oxide (Fe₃O₄) with iron in both bivalent and trivalent state.
- Mantle:** Shell of the Earth between crust and → *core*. The boundary between upper and lower mantle is at a depth of ca. 660 km.
- Marine sediment:** Sediment deposited in the ocean realm. Includes shallow-water deposits of the shelf (on → *continental crust*) and abyssal deposits of the deep ocean (on → *oceanic crust*).
- Mélange:** Mixture of different rocks formed by sedimentary and/or tectonic processes. Characterized by a block-in-matrix structure: more rigid rock types form blocks in a matrix of softer and strongly deformed rock. The blocks range from meters to kilometers in size. Typically form in trenches and some foredeeps.
- Metamorphic core complex:** See → *metamorphic dome*.
- Metamorphic dome:** Dome-shaped bulge of highly metamorphosed rocks formed by substantial crustal extension. Synonym: Metamorphic core complex.
- Metamorphism*:** Transformation of rocks, typically (except → *contact* and → *ocean-floor metamorphism*) achieved by burial to greater depths which causes an increase in pressure and temperature. The mineral association (→ *paragenesis*) is adapted to the changing pressure and temperature conditions because minerals and parageneses have different fields of stability. The presence of a → *fluid phase* plays an important role because it transports ions and thus enables mineral reactions.
- Mid-ocean(ic) ridge:** Elongate ridges in the oceans where new oceanic → *lithosphere* is formed. Constructive plate → *boundary*.
- Migmatite:** “Mixed” rock – highly metamorphosed schists or gneisses that were partly melted (see → *anatexis*). The melt phase, typically of granitic composition, solidified within the gneisses and schists thus giving the mixed appearance to the rock.
- Moho:** Common acronym of Mohorovičić discontinuity. Boundary layer between → *crust* and → *mantle*.
- Molasse:** Sequence of → *marine* and → *terrestrial* sediments deposited in the foredeep of a rising mountain range. Largely composed of the erosional detritus of the mountain range. Usually syn- to post-orogenic.
- Montmorillonite:** A clay mineral of the → *smectite* group. A typical weathering product of volcanic ashes.
- Mudstone, mudrock:** general sedimentary rock term for any combination of silt and clay; usually lacks parting or fissility; cf → *shale*, → *siltstone*.
- Mylonite:** Strongly deformed rock in a shear zone and recrystallized to a fine-grained mineral association. Deformation occurs in a *ductile* manner.
- N**
- Nappe:** Tectonic unit thrust upon another unit at km-scale. Result of strong horizontal shortening during orogenesis (see → *fault*).
- Nepheline:** Mineral similar to sodium feldspar but undersaturated in silica (SiO₂).
- Normal fault:** see → *fault*.
- O**
- Obduction:** Thrusting of an → *ophiolite* and/or associated accretionary prism and/or accreted terrane over a continental margin or island arc. Opposite to → *subduction*.
- Ocean-floor metamorphism:** → *Metamorphism* in the area of mid-ocean ridges that transforms the mineral assemblages of the still hot rocks of the → *oceanic crust* by circulating waters and aqueous → *fluids*.
- Oceanic crust:** Outermost shell of the solid Earth forming the ocean floors. Average thickness 6–8 km. The composition of the oceanic crust is basaltic (ca. 50 % SiO₂).
- Oceanic plateau:** Submarine plateaus with thickened → *oceanic crust* standing above the abyssal plains.

Olivine: Mineral, magnesium(-iron) silicate, undersaturated in silica (SiO_2). Most important constituent of \rightarrow *peridotite* in the \rightarrow *mantle* to a depth of ca. 400 km.

Omphacite: Mineral, sodium \rightarrow *pyroxene*, as a high-pressure mineral and important constituent of \rightarrow *eclogite*.

Ophiolite: Rock association of the oceanic \rightarrow *lithosphere*, directly accessible due to tectonic processes (\rightarrow *obduction* or scrape-off during \rightarrow *subduction*). Belts of ophiolites mark \rightarrow *suture zones* in orogens.

Orogen: Mountain range formed by \rightarrow *orogenesis*.

Orogenesis, orogeny: Mountain building process, initiated by the collision of continents or island arcs and characterized by crustal thickening, \rightarrow *nappe* formation, rock deformation, \rightarrow *metamorphism* and \rightarrow *anatexis*.

Orthopyroxene: See \rightarrow *pyroxene*.

P

Paired metamorphic belt: Parallel arrangement of a \rightarrow *high-pressure metamorphic belt* and an \rightarrow *Abukuma-type metamorphic belt*. Indicates former subduction activity.

Pangaea: Supercontinent in the Late Paleozoic and Early Mesozoic (ca. 300–175 Ma).

Panthalassa: Giant ocean opposing \rightarrow *Pangaea*.

Paragenesis: Metamorphic mineral association depending on the chemical composition of the rock as well as the pressure and temperature during \rightarrow *metamorphism*. Used to estimate the pressure-temperature conditions during metamorphism.

Passive continental margin: Continental margin with the \rightarrow *continental crust* connected to the adjacent \rightarrow *oceanic crust*. Does not represent a \rightarrow *plate boundary*. See also \rightarrow *active continental margin*.

Pelagic sediment: Sediment formed in the open ocean (outer shelf, deep sea) and only slightly influenced by terrigenous input (*cf.* \rightarrow *terrigenous sediment*).

Peridotite*: Rock forming the Earth's \rightarrow *mantle*, mainly composed of \rightarrow *olivine* and \rightarrow *pyroxene*.

Perovskite: Mineral group, most frequent as Mg-Si spinel (MgSiO_3) in the lower \rightarrow *mantle* (between a depth of ca. 660 and 2900 km).

Phonolite*: \rightarrow *Alkaline* volcanic rock occurring in \rightarrow *graben structures*.

Phreatic, phreatomagmatic: Characterization of explosive volcanic events as a consequence of access of surface waters into the magma chamber and the subsequently developing gas pressure.

Pillow lava: Basaltic lava with pillow-like structures formed during subaquatic extrusion.

Plagioclase: Sodium-calcium \rightarrow *feldspar*.

Plagiogranite*: \rightarrow *Plutonic rock* rich in \rightarrow *plagioclase*, typically occurring in sections of \rightarrow *oceanic crust*. Similar to \rightarrow *tonalite*.

Plate: Part of the rigid outer shell of the solid Earth, consisting of \rightarrow *crust* (oceanic, continental) and \rightarrow *lithospheric mantle*. The Earth is divided into approximately a dozen plates, each with individual movements.

Plate boundary: Constructive (divergent) plate boundary: Plate boundary along which new oceanic \rightarrow *lithosphere* is formed (\rightarrow *mid-ocean ridge*). Destructive (convergent) plate boundary: Plate boundary along which one plate subducts beneath the other (\rightarrow *subduction zone*). Conservative plate boundary: Plate boundary along which plates slide past each other (\rightarrow *transform fault*).

Pluton: Body of \rightarrow *plutonic rocks* solidified from a \rightarrow *magma* chamber.

Plutonic rock: \rightarrow *Magmatic rock* that solidified at depth; usually coarse-grained due to slow cooling.

Pyrite: Mineral, iron sulfide.

Pyrope: Mineral of the \rightarrow *garnet* group formed during \rightarrow *high-pressure metamorphism*; constituent of \rightarrow *eclogite*.

Pyroxene: Mineral, magnesium(-iron) silicate (e.g., the orthopyroxene enstatite), similar to \rightarrow *olivine* but saturated in silica. Diopside and augite (clinopyroxenes) contain relevant amounts of

calcium. Important constituent of → *peridotite*, → *gabbro*, and → *basalt*.

Q

Quartz: SiO₂, common mineral in continental crust. Important constituent of most → *sandstones*.

Quartzite: Metamorphic rock derived from → *sandstone*, mainly composed of → *quartz*.

R

Radiolarian: Protozoan with siliceous shell.

Radiolarite: Rock derived from the remains of → *radiolarians*, typically composed of very fine-grained quartz. Common in deep-sea deposits; commonly associated with arc terranes.

Radiometric age determination: Dating of minerals and rocks using the decay of radioactive isotopes (e. g., uranium-lead method).

Regional metamorphism*: → *Metamorphism* affecting large crustal bodies in the → *magmatic belt* above → *subduction zones* and during mountain building processes. Subdivided into → *Abukuma-type* and → *Barrow-type metamorphism*.

Regression: Seaward shift of the coastline due to sea-level drop, sediment influx, or uplift of the shelf area. Opposite to → *transgression*.

Rhyolite*: Volcanic rock rich in silica (SiO₂). Equivalent to → *granite*.

Rift: Graben structure (see → *graben*).

S

S-type granite: Granitic rock formed by → *anatexis* of → *continental crust*, commonly through melting of sediments ("S") (compare → *S-type granite*).

Salt: Sedimentary rock formed by evaporation of saline water. Strong indicator of paleoaridity.

Sandstone: → *Clastic* sedimentary rock originating from sand (grain size 0.06–2 mm). → *Quartz* is typically the predominating constituent.

Sapropel: → *Claystone* or → *siltstone* rich in organic (bituminous) matter. Lack of oxygen in the sediment or in the water body directly above

prevents decomposition of organic matter. Petroleum source rocks (black shales) evolve from sapropel by → *diagenesis*.

Sea-floor spreading: Spreading of newly formed ocean floor (oceanic → *lithosphere*) at the → *mid-ocean ridge*.

Seamount: Submarine volcano, frequently arranged in chains that formed above → *hot spots*.

Serpentine: Metamorphic mineral transformed from → *olivine* or orthopyroxene (see → *pyroxene*) by absorption of water.

Serpentinite: Metamorphic rock mainly composed of → *serpentine*.

Shale: Sedimentary rock composed of silt and clay that displays parting or fissility. Typical of low-energy sedimentary environments; cf → *mudstone*, *siltstone*.

Shallow earthquake: Earthquake with focus in depths of less than 100 km.

Shoshonite: → *Basalt* with high potassium content.

Shield: Stable continental crust that consolidated in the Precambrian.

Sial: Acronym (silicium and aluminum) coined by Wegener to characterize → *continental crust*.

Siliceous sediment: Sediment composed of siliceous shells of organisms (→ *radiolaria* or → *diatoms*). The original opal is transformed into → *quartz* during → *diagenesis* of the sediment.

Sill: Tabular, → *concordant* magmatic rock body that forms a subhorizontal sheet, typically several decimeters or meters thick. Often deflected feeder channel under a volcanic edifice. See also → *dike*.

Siltstone: Sedimentary rock with grain size between 0.004 and 0.06 mm. Main constituent is quartz; cf → *shale*, *mudstone*.

Sima: Acronym (silicium and magnesium) coined by Wegener to characterize → *oceanic crust* and mantle.

Skarn: Carbonatic rock transformed by → *contact metamorphism*.

Slab breakoff: Breakaway of the subducted oceanic part of a lithospheric plate after → *continent-continent collision*. Causes isostatic (see → *isostasy*)

uplift of a mountain range in consequence of the loss of the counterweight.

Smectite: A group of clay minerals typically formed from weathering of volcanic ash.

Spinel: Mineral group comprising magnetite (Fe^{+2} - Fe^{+3} spinel), chromite (Fe^{+2} - Cr^{+3} spinel), Mg-Si spinel and others (occurs as Mg-Si spinel in the deeper upper \rightarrow *mantle* between 400 and 660 km depth).

Stishovite: Highest-pressure modification of \rightarrow *quartz*.

Stratovolcano: Volcano with steep slopes (up to 40° inclination) and alternating layers of lava and volcanic ash.

Strike-slip fault: See \rightarrow *fault*.

Subduction, subduction zone: Sinking of mostly oceanic parts of lithospheric plates into the depth of the upper \rightarrow *mantle* at convergent \rightarrow *plate boundaries*.

Suture, suture zone: Elongate belt along which two colliding continents were welded together during \rightarrow *continent-continent collision*, typically characterized by tectonized remnants of oceanic lithosphere (see \rightarrow *ophiolites*) squeezed in between (“ophiolitic suture”).

Syntaxis: Region where large tectonic structures with different regional trend converge, mostly caused by the indentation of the spur of an \rightarrow *indenter*.

T

Tectonics: Study of large-scale structures of the lithosphere, stress acting on rock bodies and their reaction by movement and deformation (strain). Deformation can be \rightarrow *ductile* or \rightarrow *brittle* and acts in all dimensions from sub-microscopic scale to plate scale (plate tectonics).

Terrane: Far-traveled crustal block accreted to a continent. Due to its remote origin, the terrane shows a different geological evolution compared to adjacent parts of the continent.

Terrestrial sediment: Sediment deposited on land – in continental settings (e.g., river or lake deposits); cf \rightarrow *terrigenous sediment*.

Terrigenous sediment: \rightarrow *Clastic* sediment deposited in the ocean but composed of fragments derived from a continent or island and generally transported into the ocean by rivers or wind.

Tholeiite, tholeiitic basalt: \rightarrow *Basalt* poor in potassium but slightly richer in silica (SiO_2) than \rightarrow *alkaline basalt*. Mostly formed at \rightarrow *mid-ocean ridges* and above highly productive \rightarrow *hot spots*. Tholeiites indicate a relatively high percentage (15–25 %) of partial melting of the peridotitic source rock in the upper \rightarrow *mantle*.

Thrust: See \rightarrow *fault*.

Tilted block: Block above a \rightarrow *listric fault* tilted by normal displacement along the fault.

Tonalite *: \rightarrow *Plutonic rock* rich in \rightarrow *plagioclase*, typically occurring in subduction-related magmatic belts and continental crust. Similar to \rightarrow *plagiogranite*.

Trachyte *: Intermediate volcanic rock that commonly occurs in \rightarrow *graben structures*.

Transform fault: Strike-slip \rightarrow *fault* cutting through oceanic and continental \rightarrow *lithosphere* and connecting segments of \rightarrow *mid-ocean ridges* or \rightarrow *subduction zones*. Conservative \rightarrow *plate boundary*.

Transgression: Continentward shift of the coastline due to sea-level rise, erosion, or subsidence of the coastal area. Opposite to \rightarrow *regression*.

Trap basalt: See \rightarrow *flood basalt*.

Trondhemite: Magmatic rock similar to \rightarrow *plagiogranite* but containing \rightarrow *plagioclase* richer in sodium.

Turbidity current: Suspension of sediment in water that glides down a subaquatic (mostly submarine) slope. Common at continental margins. The deposited layer typically shows \rightarrow *graded bedding*.

Tuff: Volcanic ashes solidified to rocks.

Turbidite: Deposit from a \rightarrow *turbidity current*, characterized by \rightarrow *graded bedding*. Common in deep water adjacent to uplifted regions.

U

Ultrabasic: *Magma* and *magmatic rock* with less than 45 weight-% SiO_2 .

Ultrahigh-pressure metamorphism*: → *Metamorphism* in → *subduction zones* with extremely high pressure (burial depth more than 80 km).

Unconformity: A break in deposition within a stratigraphic package in which time is missing. Three common types: disconformity – time missing in → *concordant* rocks; non-conformity – sedimentary deposits on crystalline rocks; angular unconformity – angle (→ *discordance*) between rock layers.

V

Viscosity: Resistance of a liquid to flow. Generally, → *acidic* magmas and those with lower amounts of dissolved → *fluids* have higher viscosities.

Volcanic arc, volcanic belt: See → *magmatic arc*.

Volcanic front: See → *magmatic front*.

Volcanic glass: Non-crystallized rock material formed from a melt by fast chilling (typically in contact with water). The atoms are not arranged in a crystal lattice but rather have an arrangement similar to liquids.

Volcanic rock: → *Magmatic rock* (→ *lava* or → *tuff*) formed at the Earth's surface (subaerial or submarine).

W

Wadati-Benioff zone: See → *Benioff zone*.

Wilson cycle: Tectonic cycle that operates at the scale of 10^8 years. After break-up of a continent an ocean is formed and then subducted. The cycle ends with the complete consumption of the oceanic realm, → *continent-continent collision* and mountain building.

Window (or fenster): In a (tectonic) window a lower tectonic unit which was overthrust by a higher tectonic unit (→ *nappe*) becomes visible when the stack of nappes forms a bulge and the higher unit becomes partly eroded. The higher unit forms a frame around the exposed lower unit (the window).

Z

Zeolite: Mineral group that forms at low temperatures (*diagenesis* and very low-grade *metamorphism*).

Zeolite facies*: Very low-grade → *regional metamorphism*.

Zircon: Mineral, zirconium silicate. A tough mineral that resists weathering and is valuable in → *radiometric age determination* and → *terrane analysis*.

References

A

- Allègre CJ and 27 other authors (1984) Structure and evolution of the Himalaya-Tibet orogenic belt. *Nature* 307: 17–22
- Ampferer O (1906) Über das Bewegungsbild von Faltengebirgen. *Jahrbuch k k Geol Reichsanstalt* 56: 539–622
- Amstutz A (1951) Sur l'évolution des structures alpines. *Archives Sci (Genève)* 4: 323–329
- Anderson DL (1982) Hotspots, polar wander, Mesozoic convection and the geoid. *Nature* 297: 391–393
- Anderson DL, Dziewonski AM (1984) Seismic tomography. *Scientific American* 251/4: 60–68
- Anhaeusser CR (1978) The geological evolution of the primitive Earth – evidence from the Barberton Mountain Land. In: Tarling DH (ed) *Evolution of the Earth's Crust*. Academic Press, London New York San Francisco, 71–106
- Armstrong R, Wilson AH (2000) A SHRIMP U-Pb study of zircons from the layered sequence of the Great Dyke, Zimbabwe, and a granitoid anatectic dyke. *Earth Planet Sci Lett* 180: 1–12
- Auzende JM, Bideau D, Bonatti E, Cannat E, Honnorez J, Lagabrielle Y, Malavielle J, Mamaloukas-Frangoulis V, Mevel C (1989) Direct observation of a section through slow-spreading oceanic crust. *Nature* 337: 726–729
- Baker BH, Wohlenberg J (1971) Structure and evolution of the Kenya Rift Valley. *Nature* 229: 538–542
- Baker HB (1911) *The Origin of the Moon*. Free Press, Detroit
- Ballard RD, Moore JG (1977) *Photographic Atlas of the Mid-Atlantic Rift Valley*. Springer, New York, 114 pp
- Barrow G (1893) On an intrusion of muscovite-biotite gneiss in the southeastern highlands of Scotland, and its accompanying metamorphism. *Quart J Geol Soc London* 49: 330–358
- Bearth P (1959) Über Eklogite, Glaukophanschiefer und metamorphe Pillowlaven. *Schweizerische Mineralogische Petrographische Mitteilungen* 39: 267–286
- Benioff H (1954) Orogenesis and deep crustal structure: additional evidence from seismology. *Geol Soc Amer Bull* 65: 385–400
- Berger WH (1974) Deep-sea sedimentation. In: Burk CA, Drake CL (eds) *The Geology of Continental Margins*. Springer, New York-Heidelberg-Berlin, 213–241
- Bertrand MA (1884) Rapports de structure des Alpes de Glaris et du bassin houiller du Nord. *Bull Soc Géol France, 3ème Sér* 12: 318–330
- Bickle MJ (1978) Heat loss from the earth: a constraint on Archaean tectonics from the relation between geothermal gradients and the rate of plate production. *Earth Planet Sci Lett* 40: 301–315
- Bickle MJ, Nisbet EG, Martin A (1994) Achean greenstone belts are not oceanic crust. *J Geology* 102: 121–138
- Blakey RC (2003) *Global Paleogeographic Views of Earth History – Late Precambrian to Recent*. Flagstaff, World Wide Web: <http://jan.ucc.nau.edu/~rcb7/globaltext2.html>
- Blakey RC (2007) Carboniferous-Permian paleogeography of the Assembly of Pangaea. In: Wong TE (ed) *Proceedings of the XVth Int Cong Carboniferous Permian Stratigraphy Utrecht 2003*. Royal Dutch Acad Arts Sci (Amsterdam): 443–456
- Blakey RC (2008) Gondwana paleogeography from assembly to breakup – a 500 million year odyssey. In: Fielding CR, Frank TD, Isbell JL (eds) *Resolving the Late Paleozoic Ice Age in Time and Space: Geological Society of America Spec Paper* 441: 1–28
- Blundell D, Freeman R, Mueller S (1992) *A Continent Revealed. The European Geotraverse*. Cambridge University Press, Cambridge, 73 + 275 pp, 14 maps
- Bonatti E (1994) The Earth's mantle below the oceans. *Scientific American* 270/3: 26–33
- Bott MPH (1982) *The Interior of the Earth: Its Structure, Constitution and Evolution*. 2nd ed, Edward Arnold, London, 403 pp
- Boudier F, Nicolas A (1985) Harzburgite and lherzolite subtypes in ophiolitic and oceanic environments. *Earth Planet Sci Lett* 76: 84–92
- Boudier F, Ceuleneer G, Nicolas A (1988) Shear zones, thrusts and related magmatism in the Oman ophiolite: Initiation of thrusting on an oceanic ridge. *Tectonophysics* 151: 275–296
- Bowring SA, Williams IS (1999) Priscoan (4.00–4.03) orthogneisses from northwestern Canada. *Contrib Mineral Petrol* 134: 3–16
- Braun A, Marquardt G (2001) Die bewegte Geschichte des Nordatlantiks. *Spektrum der Wissenschaft* 6/2001: 50–59
- Brewer PG, Densmore CD, Munns R, Stanley RJ (1969) Hydrography of the Red Sea brines. In: Degens ET, Ross DA (eds), *Hot Brines and Recent*

B

- Heavy Metal Deposits in the Red Sea. Springer, Berlin, 138–147
- Buch LC von (1824) Über geognostische Erscheinungen im Fassathal. Von Leonard's Mineralogisches Taschenbuch 1824: 396–437
- Bullard EC, Everett JE, Smith AG (1965) The fit of the continents around the Atlantic. *Phil Trans R Soc London A258*: 41–51
- Bullen KE (1942) The ellipticities of surfaces of equal density in the Earth's interior. *Royal Soc New Zealand Transactions and Proceedings* 72: 141–143
- Burke KC, Wilson JT (1976) Hot spots on the Earth's surface. In: *Scientific American* (ed) *Continents Adrift and Continents Aground*. Freeman, San Francisco, 58–75
- C**
- Campbell BJ, Jeanthou C, Luther GW, Cary SC (2001) Growth and phylogenetic properties of novel epsilon proteobacteria enriched from *Alvinella pompejana* and deep-sea hydrothermal vents. *Appl Environ Microbiol* 67: 4566–4572
- Cann JR (1981) Ore deposits of the ocean crust. In: *Tarling DH* (ed) *Economic Geology and Geotectonics*. Blackwell, Oxford, 119–134
- Chase CG (1979) Subduction, the geoid, and lower mantle convection. *Nature* 282: 464–468
- Chen F, Todt W, Hann HP (2003) Zircon and garnet geochronology of eclogites from the Moldanubian Zone of the Black Forest, Germany. *J Geol* 111: 207–222
- Chopin C (1984) Coesite and pure pyrope in high-grade blueschists of the Western Alps: a first record and some consequences. *Contrib Mineral Petrol* 86: 107–118
- Christiansen RL, Foulger GR, Evans JR (2002) Upper-mantle origin of the Yellowstone hotspot. *Geol Soc Amer Bull* 114: 1245–1256
- Christie-Blick N, Biddle KT (1985) Deformation and basin formation along strike-slip faults. *Soc Econ Paleont Mineral Spec Publ* 37: 1–34
- Cocks CRM, Fortey RA (1982) Faunal evidence for oceanic separations in the Palaeozoic of Britain. *J Geol Soc London* 139: 465–478
- Coffin MF, Eldholm O (1993) Large igneous provinces. *Scientific American* 269/4: 42–49
- Condie KC (1973) Archaean magmatism and crustal thickening. *Geol Soc Amer Bull* 84: 2981–2992
- Condie KC (1997) Plate tectonics and crustal evolution. Butterworth-Heinemann, Oxford, 282 pp
- Condie KC, Moore JM (1977) Geochemistry of Proterozoic volcanic rocks from the Grenville Province, eastern Ontario. *Geol Ass Canada Spec Paper* 16: 149–168
- Cowan DS (1985) Structural styles in Mesozoic and Cenozoic mélanges in the western Cordillera of North America. *Geol Soc Amer Bull* 96: 451–462
- Crough ST, Morgan WJ, Hargraves RB (1980) Kimberlites: their relation to mantle hotspots. *Earth Planet Sci Lett* 50: 260–274
- Curry JR, Moore DG (1974) Sedimentary and tectonic processes in the Bengal deep-sea fan and geosyncline. In: *Burk CA, Drake CL* (eds) *The Geology of Continental Margins*. Springer, New York-Heidelberg-Berlin, 617–627
- Dana JD (1873) On some results on the Earth's contraction from cooling, including a discussion of the origin of mountains and the nature of the Earth's interior. *Am J Sci, Ser 3*, 5: 423–443
- DeMets C, Gordon R, Argus D, Stein S (1990) Current plate motions. *Geophys J Int* 101: 425–478
- DeMets C, Gordon RG, Argus DF, Stein S (1994) Effect of recent revisions to the geomagnetic reversal time scale on estimate of current plate motions. *Geophys Res Lett* 21: 2191–2194
- Descartes R (1644) *Principia philosophiae*
- Dewey JF (1972) Plate tectonics. In: *Planet Earth* (*Scientific American*), 124–135, San Francisco 1974
- Dickinson WR, Synder WS (1978) Plate tectonics of the Laramide Orogeny. *Geol Soc Amer Memoir* 151: 355–366
- Dingle RV (1980) Large allochthonous sediment masses and their role in the construction of the continental slope and rise of southwestern Africa. *Mar Geol* 37: 333–354
- Dobrzhinetskaya LF, Eide EA, Larsen RB, Sturt BA, Trønnes RG, Taylor WR, Poshukhova TV (1995) Microdiamonds in high-grade metamorphic rocks from the Western Gneiss region, Norway. *Geology* 23: 597–600
- Dogliani C, Harabaglia P, Merlini S, Mongelli F, Peccerillo A, Piromallo C (1999) Orogens and slabs vs. their direction of subduction. *Earth Sci Rev* 45: 167–208
- Drake R, Vergar M, Munizaga F, Vincente JC (1982) Geochronology of Mesozoic-Cenozoic magmatism in Central Chile, lat 31°–36°S. *Earth Sci Rev* 18: 353–363
- Drury SA (1981) The history of the Earth's crust: The Archaean eon and before. In: *Smith DG* (ed) *The Cambridge Encyclopedia of Earth Sciences*. 250–261, Cambridge University Press, Cambridge
- E**
- Einsele G (1992) *Sedimentary Basins*. Springer, Berlin-Heidelberg, 628 pp
- Einsele G, Liu B, Dürr W, Frisch W, Liu G, Luterbacher HP, Ratschbacher L, Ricken W, Wendt J, Wetzel A, Yu G, Zheng H (1994) The Xigaze forearc basin: evolution and facies architecture (Cretaceous, Tibet). *Sed Geol* 90: 1–32
- Élie de Beaumont JB (1841) *Les Vosges. Explication de la Carte Géologique de la France*, vol I, Paris

- Élie de Beaumont JB (1852) Notice sur les systèmes des montagnes. 3 vol, Paris
- England PC (1981) Metamorphic pressure estimates and sediment volumes for the Alpine orogeny: An independent control on geobarometers? *Earth Planet Sci Lett* 56: 387–397
- F**
- Faujas de Saint-Fond B (1788) Essai sur l'histoire naturelle des roches de Trapp. Rue et Hôtel Serpente, Paris, 159 pp
- Foley SF, Buhre S, Jacob DE (2003) Evolution of the Archaean crust by delamination and shallow subduction. *Nature* 421: 249–252
- Franke W (2002) Die Vereinigten Platten von Europa. Wefer G (ed) Expedition Erde, 30–35, Alfred Wegener Foundation, Berlin
- Frisch W (1979) Tectonic progradation and plate tectonic evolution of the Alps. *Tectonophysics* 60: 121–139
- Frisch W, Al Shanti A (1977) Ophiolite belts and the collision of island arcs in the Arabian Shield. *Tectonophysics* 43: 293–306
- Frisch W, Gawlick H-J (2003) The nappe structure of the central Northern Calcareous Alps and its disintegration during Miocene tectonic extrusion – a contribution to understanding the orogenic evolution of the Eastern Alps. *Int J Earth Sci (Geol Rundschau)* 92: 712–727
- Frisch W, Loesche J (1986) Plattentektonik. Wissenschaftliche Buchgesellschaft, Darmstadt, 190 pp
- Frisch W, Ménot R–P, Neubauer F, von Raumer JF (1990) Correlation and evolution of the Alpine basement. *Schweizerische Mineralogische Petrographische Mitteilungen* 70: 265–285
- Frisch W, Meschede M (2005) Plattentektonik. Kontinentverschiebung und Gebirgsbildung. Primus and Wissenschaftliche Buchgesellschaft, Darmstadt, 196 pp
- Frisch W, Neubauer F (1989) Pre-Alpine terranes and tectonic zoning in the eastern Alps. *Geol Soc Amer Spec Paper* 230: 91–100
- Frisch W, Meschede M, Sick M (1992) Origin of the Central American ophiolites: Evidence from paleomagnetic results. *Geol Soc Amer Bull*: 104: 1301–1314
- Frisch W, Dunkl I, Kuhlemann J (2000) Post-collisional orogen-parallel large-scale extension in the Eastern Alps. *Tectonophysics* 327: 239–265
- G**
- Gebauer D, Schertl HP, Brix M, Schreyer W (1997) 35 Ma old ultrahigh-pressure metamorphism and evidence for very rapid exhumation in the Dora Maira massif, Western Alps. *Lithos* 41: 5–24
- Grand SP, van der Hilst RD, Widiyantoro S (1997) Global seismic tomography: A snapshot of convection in the Earth. *GSA (Geol Soc Amer) Today* 7/4: 1–7
- Granet M, Achauer U, Wilson M (1995) Nachweis eines Mantelplumes unter Frankreichs Zentralmassiv durch seismische Sondierung. *Spektrum der Wissenschaft* 10/1995: 28–33
- Green HW (1994) Solving the paradox of deep earthquakes. *Scientific American* 271/3: 50–57
- Griffiths RW, Campbell IH (1990) Stirring and structure in mantle starting plumes. *Earth Planet Sci Lett* 99: 66–78
- H**
- Hall J (1815) On the vertical position and the convolutions of certain strata and their relation with granite. *Trans R Soc Edinburgh* 7: 79–85
- Hall R (2000) Neogene history of collision in the Halmahera region, Indonesia. *Indonesian Petrol Ass Proc, 27th Annual Convention*, 487–493
- Hann HP, Chen F, Zedler H, Frisch W, Loeschke J (2003) The Rand Granite in the southern Schwarzwald and its geodynamic significance in the Variscan belt of SW Germany. *Int J Earth Sciences* 92: 821–842
- Hatcher RD (2002) Alleghanian (Appalachian) orogeny, a product of zipper tectonics: rotational transpressive continent-continent collision and closing of ancient oceans along irregular margins. In: Martinez Catalan JR, Hatcher RD, Arenas R, Diaz Garcia F (eds) *Variscan-Appalachian Dynamics: the Building of the Late Paleozoic Basement*. *Geol Soc Amer Spec Paper* 364: 199–208
- Hauy RJ (1822) *Traité de Minéralogie*. 2nd ed, Bachelier, Paris
- Hawkins JW (1974) Geology of the Lau basin, a marginal sea behind the Tonga arc. In: Burk CA, Drake CL (eds) *The Geology of Continental Margins*, Springer, New York, 505–524
- Heaman LM, Kjarsgaard BA (2000) Timing of eastern North American kimberlite magmatism: continental extension of the Great Meteor hotspot track? *Earth Planet Sci Lett* 178: 253–268
- Heezen BC, Hollister CD (1971) *The Face of the Deep*. Oxford University Press, New York, 659 pp
- Heirtzler JR, LePichon X, Baron JG (1966) Magnetic anomalies over the Reykjanes ridge. *Deep-Sea Res* 13: 427–443
- Herzig PM, Hannington MD (2000) Input from the deep: Hot vents and cold seeps. In: Schulz HD, Zabel M (eds) *Marine Geochemistry*. Springer, Berlin-Heidelberg-New York, 397–416
- Hess HH (1946) Drowned ancient islands of the Pacific basin. *Amer J Sci* 244: 772–791
- Hoffman PF (1980) Wopmay orogen: a Wilson cycle of Early Proterozoic age in the northwest of the Canadian Shield. *Geol Assoc Canada Spec Paper* 20: 523–549
- Hoffman PF (1991) Did the breakout of Laurentia turn Gondwanaland inside-out? *Science* 252: 1409–1412
- Holmes A (1931) Radioactivity and earth movements. *Geol Soc Glasgow Trans* 18: 559–606

- Holmes A (1944) The machinery of continental drift: the search for a mechanism. In: *Principles of Physical Geology*. Nelson and Sons, London, 505–509
- Howell DG (ed) (1985) *Tectonostratigraphic Terranes of the Circum-Pacific Region*. Circum-Pacific Council for Energy and Mineral Resources (Houston), Earth Science Series 1, 581 pp
- Hutton J (1795) *Theory of the Earth with Proofs and Illustrations*. 2nd vol, Cadell, Davies and Creech, London-Edinburgh
- Hyndman RD (1996) Schwere Erdbeben nach langer seismischer Stille. *Spektrum der Wissenschaft* 10/1996: 64–72
- I**
- Illies JH (1974) Taphrogenesis: Rhinegraben, continental rift systems, and Martian rifts. In: Illies J, Fuchs K (eds), *Approaches to Taphrogenesis*. Schweizerbart, Stuttgart, 1–13
- Isacks B, Molnar P (1969) Mantle earthquake mechanisms and the sinking of the lithosphere. *Nature* 223: 1121–1124
- J**
- Jahn B, Cabry R, Monie P (2001) The oldest UHP eclogites of the World: age of UHP metamorphism, nature of protoliths and tectonic implications. *Chem Geol* 178: 143–158
- Jones DL, Cox A, Coney P, Beck M (1982) The growth of western North America. *Scientific American* 247/5: 70–84
- Jordan JL (1803) *Mineralogische, berg- und hüttenmännische Reisebemerkungen, vorzüglich in Hessen, Thüringen, am Rheine und im Sege-Altkirchner Gebiet*
- K**
- Karig DE (1971) Origin and development of marginal basins in the western Pacific. *J Geophys Res* 76: 2542–2561
- Kearey Ph, Vine FJ (1990) *Global Tectonics*. Blackwell, Oxford, 302 pp
- Kontinen A (1987) An Early Proterozoic ophiolite – the Jormua mafic-ultramafic complex, northeastern Finland. *Precambrian Res* 35: 313–341
- Kopf A (2003) Schlote, die Schlamm statt Feuer speien. *Spektrum der Wissenschaft* 1/2003: 38–47
- Kossmat F (1927) Gliederung des varistischen Gebirgsbaues. *Abhandlungen sächsisches geol Landesamt* 1: 3–40
- Kraml M, Bull A (2000) Sodaseen im Ostafrikanischen Graben – ihre Entstehung und Bedeutung. *Verein Naturforschende Gesellschaft Freiburg im Breisgau* 88/89: 85–118
- Kröner A (ed) (1981) *Precambrian plate tectonics*. Elsevier, Amsterdam, 781 pp
- Kuhlemann J, Spiegel C, Dunkl I, Frisch W (1999) A contribution to the middle Oligocene paleogeography of central Europe: New evidence from fission track ages of the southern Rhine-Graben. *Neues Jahrbuch Geol Paläont Abhandlungen* 214: 415–432
- Kusky MT, Li J-H, Tucker RD (2001) The Archean Dongwanzi ophiolite complex, North China Craton: 2.505-billion-year-old oceanic crust and mantle. *Science* 292: 1142–1145
- L**
- Lago BL, Rabinowicz M, Nicolas A (1982) Podiform chromite ore bodies: a genetic model. *J Petrol* 23, 103–125
- Larson RL (1995) The Mid-Cretaceous superplume episode. *Scientific American* 272/2: 82–86
- LePichon X (1968) Sea floor spreading and continental drift. *J Geophys Res* 73: 3661–3697
- Lister GS, Davis A (1989) The origin of metamorphic core complexes and detachment faults formed during Tertiary continental extension in the northern Colorado River region, USA. *J Struct Geol* 11: 65–94
- Lugeon M (1902) Les grandes nappes de recouvrement des Alpes du Chablais et de la Suisse. *Bull Soc Géol France*, 4^{ème} Sér, 1: 723–823
- Lyell C (1833) *Principles of Geology*. Bd 3, John Murray, London, 398 pp
- M**
- Macdonald KC, Fox PJ, Perram PJ, Eisen MF, Haymon RM, Miller SP, Carbotte SM, Cormier M-H, Shor AN (1988) A new view of the mid-ocean ridge from the behaviour of ridge-axis discontinuities. *Nature* 335: 217–225
- Makris J, Menzel H, Zimmermann J, Gouin P (1975) Gravity field and crustal structure of north Ethiopia. In: Pilger A, Rösler A (eds), *Afar Depression in Ethiopia*. Schweizerbart, Stuttgart, 135–144
- Matte P (2001) The Variscan collage and orogeny (480–290 Ma) and the tectonic definition of the Armorica microplate. *Terra nova* 13: 122–128
- McKenzie DP (1978) Some remarks on the development of sedimentary basins. *Earth Planet Sci Lett* 40: 25–32
- McKenzie DP, Parker RL (1967) The North Pacific: an example of tectonics on a sphere. *Nature* 216: 1276–1280
- McKerrow WS, Mac Niocaill C, Dewey JF (2000) The Caledonian Orogeny redefined. *J Geol Soc* 157: 1149–1154
- Meschede M (1986) A method of discriminating between different types of mid-ocean ridge basalts and continental tholeiites with the Nb-Zr-Y diagram. *Chem Geol* 56: 207–218
- Meschede M, Pelletier B (1994) Structural style of the accretionary wedge in front of the North d'Entrecasteaux Ridge (ODP Leg 134). *Proc. Ocean Drilling Progr, Sci Res*, 417–429, College Station, Texas
- Meschede M, Frisch W, Herrmann UR, Ratschbacher L (1997) Stress transmission across an active plate boundary: an example from southern Mexico. *Tectonophysics* 266: 81–100

- Meschede M, Zweigel P, Frisch W, Völker D (1999) Mélange formation by subduction erosion: the case of the Osa mélange in southern Costa Rica. *Terra nova* 11: 141–148
- Meschede M, Schmiedl G, Weiss R, Hemleben C (2002) Benthic foraminiferal distribution and sedimentary structures suggest tectonic erosion at the Costa Rica convergent plate margin. *Terra nova* 14: 1–12.
- Miyashiro A (1973) *Metamorphism and metamorphic belts*. Allen and Unwin, London, 492 pp
- Moore GF, Billman HG, Hehanussa PE, Karig DE (1980) Sedimentology and paleobathymetry of trench-slope deposits, Nias Island, Indonesia. *J Geol* 88: 161–180
- Morelli A, Dziewonski AM (1987) Topography of the core-mantle boundary and lateral homogeneity of the liquid core. *Nature* 325: 678–683
- Morgan WJ (1968) Rises, trenches, great faults, and crustal blocks. *J Geophys Res* 73: 1959–1982
- N**
- Neumann GA, Forsyth DW (1993) The paradox of the axial profile: Isostatic compensation along the Mid-Atlantic Ridge? *J Geophys Res* 98: 17891–17910
- Nicolas A (1995) *The Mid-Oceanic Ridges. Mountains Below Sea Level*. Springer, Berlin-Heidelberg, 217 pp
- O**
- O'Connor JM, Stoffers P, Wijbrans JR, Shannon PM, Morrissey T (2000) Evidence from episodic seamount volcanism for pulsing of the Iceland plume in the past 70 Myr. *Nature* 408: 954–958
- Okomura K, Yoshioka T, Kuscu I (1993) Surface faulting on the North Anatolian Fault in these two millennia. *US Geol Survey Open-file Rep* 94–568: 143–144
- O'Neil J, Carlson RW, Francis D, Stevenson RK (2008) Neodymium-142 evidence for Hadean mafic crust. *Science* 321: 1828–1831
- P**
- Pallas PS (1777) *Observation sur la Formation des Montagnes*. St Petersburg
- Parsons B, Sclater JG (1977) An analysis of the variation of the ocean floor bathymetry and heat flow with age. *J Geophys Res* 82: 803–827
- Patriat P, Achache J (1984) India-Eurasia collision chronology has implications for crustal shortening and driving mechanism of plates. *Nature* 311: 615–621
- Pearce JA (1983) The role of sub-continental lithosphere in magma genesis at destructive plate margins. In: Hawkesworth CJ, Norry MJ (eds) *Continental Basalts and Mantle Xenoliths*, Shiva Publications, Nantwich, 230–249
- Pearce JA, Cann JR (1973) Tectonic setting of basic volcanic rocks determined using trace element analysis. *Earth Planet Sci Lett* 19: 290–300
- Pflug R (1982) *Bau und Entwicklung des Oberrheingrabens*. Wissenschaftliche Buchgesellschaft, Darmstadt, 145 pp
- Platt JP (1986) Dynamics of orogenic wedges and the uplift of high pressure metamorphic rocks. *Geol Soc Amer Bull* 97: 1037–1053
- R**
- Ratschbacher L, Riller U, Meschede M, Herrmann U, Frisch W (1991a) Second look at suspect terranes in southern Mexico. *Geology* 19: 1233–1236
- Ratschbacher L, Frisch W, Linzer H-G, Merle O (1991b) Lateral extrusion in the Eastern Alps, Part 2: Structural analysis. *Tectonics* 10: 257–271
- Reading HG (1986) *Sedimentary Environments and Facies*. 2nd ed, Blackwell, Oxford, 615 pp
- Reigber C, Gendt G (1996) Geodätische Messung der Plattentektonik. *Spektrum der Wissenschaft* 1/1996: 115–117
- Richter FM (1985) Models for the Archean thermal regime. *Earth Planet Sci Lett* 73: 350–360
- Roll A (1979) Versuch einer Volumenbilanz des Oberrheintalgrabens und seiner Schultern. *Geol Jahrbuch A* 52: 3–82
- Rolland Y (2002) From intra-oceanic convergence to post-collisional evolution: example of the India-Asia convergence in NW Himalaya, from Cretaceous to present. *Journal of the Virtual Explorer* 8: 185–208
- S**
- Saleeby JB (2003) Segmentation of the Laramide Slab – evidence from the southern Sierra Nevada region. *Geol Soc Amer Bull* 113: 655–668
- Sarnthein M, Diester-Haass L (1977) Eolian sand turbidites. *J Sed Petrol* 47: 868–890
- Saussure HB de (1796) *Voyages dans les Alpes*. Bd. 4, Fauche-Borel, Neuchâtel
- Schermer ER, Howell DG, Jones DL (1984) The origin of allochthonous terranes. *Ann Rev Earth Planet Sci* 12: 107–131
- Schidlowski M (1983) Evolution of photoautotrophy and early atmospheric oxygen. *Precambrian Res* 20: 319–335
- Schmid SM, Pfiffner OA, Froitzheim N, Schönborn G, Kissling E (1996) Geophysical-geological transect and tectonic evolution of the Swiss-Italian Alps. *Tectonics* 15: 1036–1064
- Schmincke H-U (1981) Volcanic activity away from plate margins. In: Smith DG (ed) *The Cambridge Encyclopedia of Earth Sciences*. Cambridge Univ Press, Cambridge, 201–209
- Schmincke H-U (2004) *Volcanism*. Springer, Heidelberg-Berlin, 324 pp
- Scholl DW (1974) Sedimentary sequences in the North Pacific trenches. In: Burke CA, Drake CL (eds) *The Geology of*

- Continental Margins. Springer, New York-Heidelberg-Berlin, 493–504
- Scholz CH, Barazangi M, Sbar ML (1971) Late Cenozoic evolution of the Great Basin, western United States, as an ensialic inter-arc basin. *Geol Soc Amer Bull* 82: 2979–2990
- Schreiner (1984) Hegau und westlicher Bodensee. *Sammlung Geol Führer vol 62, 2nd ed*, Borntraeger, Berlin-Stuttgart, 103 pp
- Schubert G, Yuen DA, Turcotte DL (1975) Role of phase transitions in a dynamic mantle. *Geophys J Royal Astr Soc* 42: 705–735
- Schwinner R (1920) Vulkanismus und Gebirgsbildung. Ein Versuch. *Zeitschrift Vulkanologie* 5: 175–230
- Scott DJ, Helmstaedt H, Bickle MJ (1992) Purtuniqu ophiolite, Cape Smith belt, northern Quebec, Canada: A reconstructed section of Early Proterozoic oceanic crust. *Geology* 20: 173–176
- Seibold E, Berger WH (1982) *The Sea Floor*. Springer, Berlin, 288 pp
- Sieh KE (1978) Prehistoric large earthquakes produced by slip on the San Andreas fault at Pallett Creek, California. *J Geophys Res* 83: 3907–3939
- Smith WHF, Sandwell DT (1997) Global seafloor topography from satellite altimetry and ship depth soundings. *Science* 277: 1957–1962
- Snider A (1859) *Le Création et ses Mystères Devoilés*. Franck and Dentu, Paris
- Stein RS, Barka AA, Dietrich JH (1997) Progressive failure on the North Anatolian fault since 1939 by earthquake stress triggering. *Geophys J Int* 128: 594–604
- Steno N (Stensen N) (1669) *De solido intra solidum naturaliter contento dissertationis prodromus*. Florence
- Stern RJ (2002) Subduction zones. *Reviews of Geophysics* 40/4: 3–1 to 3–38
- Stille H (1913) *Tektonische Evolution und Revolution in der Erdrinde*. Veit, Leipzig
- Suess E (1885–1909): *Das Antlitz der Erde*. 5 vol., Tempsky-Freytag, Vienna
- Sykes LR (1967) Mechanism of earthquakes and nature of faulting on the mid-ocean ridges. *J Geophys Res* 72: 2131–2153
- Székely B (2001) On the surface of the Eastern Alps – a DEM study. *Tübinger Geowissenschaftliche Arbeiten* 60, 157 pp
- T**
- Tait JA, Bachtadse V, Franke W, Soffel HC (1997) Geodynamic evolution of the European Variscan fold belt: palaeomagnetic and geological constraints. *Geol Rundschau* 86: 585–598
- Talwani M, LePichon X, Ewing M (1965) Crustal structure of the mid-ocean ridges. *J Geophys Res* 70: 341–352
- Tapponnier P, Peltzer G, Armijo R (1986) On the mechanics of the collision between India and Asia. *Geol Soc Amer Spec Publ* 19: 115–157
- Tarney J (1976) Geochemistry of Archaean high-grade gneisses, with implications as to the origin and evolution of the Precambrian crust. In: Windley BF (ed) *The Early History of the Earth*. Wiley-Interscience, London, 405–417
- Tarney J, Dalziel IWD, de Wit MJ (1976) Marginal basin "Rocas Verdes" complex from S Chile: a model for Archaean greenstone belt formation. In: Windley BF (ed) *The Early History of the Earth*. Wiley-Interscience, London, 131–146
- Taylor FB (1910) Bearing of the Tertiary mountain belt on the origin of the earth's plan. *Geol Soc Amer Bull* 21: 179–226
- Termier P (1904) Les nappes des Alpes orientales et la synthèse des Alpes. *Bull Soc Géol France, 4^{ème} Sér*, 3: 711–765
- Trümpy R (1980) *An Outline of the Geology of Switzerland*. Wepf and Co, Basel, 109 pp
- Turcotte DL, Emerman SH (1983) Mechanisms of active and passive rifting. *Tectonophysics* 94: 39–50
- U**
- Umhoefer PJ, Blakey RC (2006) Moderate (1600 km) northward translation of Baja British Columbia from southern California: An attempt at reconciliation of paleomagnetism and geology. In: Haggart JW, Enkin RJ, Monger JWH (eds) *Paleogeography of the North American Cordillera: Evidence For and Against Large-Scale Displacements*. *Geol Assoc Canada Spec Paper* 46: 305–327
- Uyeda S, Kanamori H (1979) Back-arc opening and the mode of subduction. *J Geophys Res* 84: 1049–1061
- Van Fossen MC, Kent DV (1992) Paleomagnetism of 122 Ma plutons in New England and the Mid-Cretaceous paleomagnetic field in North America. *J Geophys Res* 97: 19651–19661
- V**
- Vine FJ, Matthews DH (1963) Magnetic anomalies over oceanic ridges. *Nature* 199: 947–949
- Visser DJL et al. (1984) Geological map of the republics of South Africa. Dept Min Energy Affairs, South Africa
- Vogel A (1994) Die Kern-Mantel-Grenze: Schaltstelle der Geodynamik. *Spektrum der Wissenschaft* 11/1994: 64–72
- von Huene R, Scholl DW (1991) Observations at convergent margins concerning sediment subduction, subduction erosion, and the growth of continental crust. *Rev Geophys* 29: 279–316
- von Huene R, Ranero CR, Weinrebe W (2000) Quaternary convergent margin tectonics off Costa Rica, segmentation of the Cocos Plate, and Central American volcanism. *Tectonics* 19: 314–334

W

- Wadati K (1935) On the activity of deep-focus earthquakes in the Japan Islands and neighbourhoods. *Geophys Mag* 8: 305–325
- Walker RJ, Morgan JW, Horan MF (1995) Osmium-187 enrichment in some plumes: Evidence for core-mantle interaction? *Science* 269: 819–821
- Walther J (1894) *Lithogenesis der Gegenwart. Einleitung in die Geologie als Historische Wissenschaft*, vol 3, Fischer, Jena, 535–1055
- Wegener A (1912) Die Entstehung der Kontinente. *Geol Rundschau* 3: 276–292
- Wegener A (1915) Die Entstehung der Kontinente und Ozeane. Vieweg, Braunschweig, 94 pp
- Wegener A (1929) Die Entstehung der Kontinente und Ozeane. 4th ed, Vieweg, Braunschweig, 231 pp
- Wegener A (1966) *The Origin of Continents and Oceans*. Dover Publications, New York, 246 pp (translated from the fourth revised German edition by John Biram)
- Werner D, Doebl F (1974) Geothermal anomalies and consequences for diagenesis and thermal waters. In: Illies J, Fuchs K (eds), *Approaches to Taphrogenesis*. Schweizerbart, Stuttgart, 182–191
- Wernicke B (1981) Low-angle normal faults in the Basin and Range province: nappe tectonics in an extending orogen. *Nature* 291: 645–648
- White RS, McKenzie D (1995) Mantle plumes and flood basalts. *J Geophys Res* 100: 17543–17585
- Wiens DA (2001) Seismological constraints on the mechanism of deep earthquakes: Temperature dependence on deep earthquake source properties. *Phys Earth Planet Inter* 127: 145–163
- Wilde SA, Valley JW, Peck WH, Grahams CM (2001) Evidence from detrital zircons for the existence of continental crust and oceans on the Earth 4.4 Gyr ago. *Nature* 409: 175–178
- Wilson JT (1963) Evidence from islands on the spreading of the ocean floor. *Nature* 197: 536–538
- Wilson JT (1965) A new class of faults and their bearing on continental drift. *Nature* 207: 343–347
- Wilson M (1989) *Igneous Petrogenesis*. Unwin Hyman, London, 466 pp
- World Data Center for Marine Geology & Geophysics (2003): *Total Sediment Thickness of the World's Oceans & Marginal Seas*. <http://www.ngdc.noaa.gov/mgg/sedthick/sedthick.html>, Boulder
- Wyld SJ, Umhoefer PJ, Wright JE (2006) Reconstructing northern Cordilleran terranes along known Cretaceous and Cenozoic strike-slip faults: Implications for the Baja British Columbia hypothesis and other models. In: Haggart JW, Enkin RJ, Monger JWH (eds) *Paleogeography of Western North America: Evidence For and Against Large-Scale Displacements*. *Geol Assoc Canada Spec Paper* 46: 277–298

Z

- Zeitler PK, Chamberlain CP, Smith HA (1993) Synchronous anatexis, metamorphism, and rapid denudation at Nanga Parbat (Pakistan Himalaya). *Geology* 21: 347–350
- Zhao X, Antretter M, Solheit P, Inokuchi H (2002) Identifying magnetic carriers from rock magnetic characterization of Leg 183 basement core. *Proc Ocean Drilling Program Init Repts* 183, http://www-odp.tamu.edu/publications/183_IR/183ir.htm
- Ziegler PA (1990) *Geological atlas of western and central Europe*. Shell Internat Petroleum, Maatschappij, 239 pp

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- * = term explained in Glossary
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