

## GLOSSARY

### A

**aa** jagged chunks of lava formed by rapid cooling on the surface of a lava flow (120)

**abrasion** mechanical weathering in which rocks collide and scrape against each other, wearing away the exposed surfaces (221)

**absolute age** actual age of an object (327)

**absolute magnitude** brightness of a star as it would appear if located 32.6 light-years from the Earth (553)

**abyssal plain** extremely level area of the deep ocean basin where the depth is often greater than 4 km (396)

**abyssal zone** benthic environment that extends from beneath the bathyal zone to a depth of 6,000 m (416)

**adiabatic** describing a change in temperature resulting from the cooling of rising air and the warming of sinking air (484)

**advection fog** condensation of water vapor that results from the cooling of warm, moist air as it moves across a cold surface (488)

**advective cooling** decrease in the temperature of a mass of air that results as it moves over a cold surface (486)

**aftershock** tremor that follows and is smaller than a major earthquake (99)

**air mass** large body of air with uniform temperature and moisture content (499)

**albedo** percent of solar radiation reflected by a surface (466)

**alloy** solid solution of two or more metals (151)

**alluvial fan** fan-shaped deposit of sediments at the base of a slope on land (252)

**amber** hardened tree sap in which fossils may be preserved (335)

**anemometer** instrument used to measure wind speed (509)

**angular unconformity** boundary between horizontal and tilted layers of rock (325)

**anthracite** hardest form of coal (199)

**anticline** upcurved fold in rock layers in which the oldest layer is the center of the fold (85)

**anticyclone** storm that spirals outward from a high-pressure center (505)

**GLOSSARY**

- aphelion** point in the orbit of a planet at which the planet is farthest from the Sun (29)
- apogee** point in the orbit of a satellite at which the satellite is farthest from the Earth (621)
- apparent magnitude** brightness of a star as it appears from the Earth (552)
- aquaculture** farming of the ocean (420)
- aquifer** body of rock that can store much water and from which water flows freely (261)
- arête** sharp, jagged ridge formed between cirques (282)
- artesian formation** sloping layer of permeable rock sandwiched between two layers of impermeable rock and exposed at the surface (267)
- artesian spring** natural flow of water to the Earth's surface from an artesian formation (267)
- artesian well** hole dug through the cap rock of an artesian formation through which water flows freely, with no pumping necessary (267)
- asteroid** fragment of rock that orbits the Sun (606)
- asteroid belt** the region between the orbits of Mars and Jupiter in which most asteroids are found (606)
- asthenosphere** zone of mantle beneath the lithosphere that consists of slowly flowing solid rock (72)
- astronomical unit** average distance between the Earth and the Sun, approximately 149.5 million km (592)
- astronomy** study of the universe beyond the Earth (6)
- atmosphere** thick blanket of gases surrounding the Earth (7)
- atmospheric pressure** ratio of the force of the air to the area of the surface on which it presses (457)
- atoll** nearly circular coral reef surrounding a shallow lagoon (311)
- atom** smallest unit of an element (140)
- atomic number** number of protons in the nucleus of an atom (141)
- aurora** sheets of colored light produced by a magnetic storm in the Earth's upper atmosphere (579)
- autumnal equinox** beginning of the fall season (31)
- axis** imaginary straight line running through the Earth from pole to pole (23)

**GLOSSARY****B**

**background radiation** low levels of energy evenly distributed throughout the universe (16)

**barometer** instrument that measures atmospheric pressure (458)

**barred spiral galaxy** type of spiral galaxy with a bar of stars that runs through its center (563)

**barrier island** long, narrow ridge of sand that lies parallel to the shore (310)

**barrier reef** type of coral reef that surrounds the remnant of a partially submerged volcanic island (311)

**basal slip** movement of a glacier caused by the melting of ice in contact with the ground (279)

**batholith** intrusive formations with at least a surface exposure of 100 square kilometers and reaching a depth of thousands of meters (180)

**bathyal zone** benthic environment that begins at the end of the continental shelf and extends to a depth of 4,000 m (415)

**bathyscaph** self-propelled, free-moving submersible used for deep-ocean research (391)

**bathysphere** spherical submersible that remains attached to a research ship for communications and support (390)

**beach** deposit of rock fragments along an ocean shore or a lakefront (304)

**bedding plane** boundary between two sedimentary rock layers (324)

**benthic environment** major division of ocean environment that includes the five bottom zones: intertidal, sublittoral, bathyal, abyssal, and hadal (415)

**benthos** organisms that live on the ocean floor (415)

**berm** raised midsection of a beach, the part above which is usually used for recreation (305)

**big bang theory** theory that all matter and energy in the universe was compressed into an extremely small volume that suddenly, billions of years ago, began expanding in all directions (17)

**bimetal thermometer** instrument used to measure temperature, consisting of a bar made of two strips of different metals that curves when heated and straightens when cooled (509)

**binary star** pair of stars that revolve around each other (564)

**biodegradable** able to be broken down into component parts by microorganisms (8)

## GLOSSARY

**biosphere** ecosystem encompassing all the life on Earth and the physical environment that supports it (7)

**bituminous coal** soft coal (199)

**black hole** hole in space with a gravity so great that not even light can escape, formed by the collapse of a very large supernova (560)

**bora** cold northern wind that blows down the mountains of Greece and the Balkan nations toward the Adriatic Sea (528)

**breaker** foamy mass of water that washes onto the shore (436)

**breccia** elastic sedimentary rock composed of angular fragments cemented together by minerals (182)

**Bright Angel Shale** rock layer of the Grand Canyon deposited during the Cambrian Period (374)

**butte** elevated, narrow, flat-topped area (237)

### C

**calcareous ooze** type of ooze that is mostly calcium carbonate (401)

**caldera** large basin-shaped depression formed when an explosion destroys the upper part of a volcanic cone or when the magma chamber below a volcano is emptied during an eruption (124)

**calendar** system used to measure the passage of time (627)

**Canadian Shield** exposed portion of the craton around which North America has been built up (370)

**cap rock** top layer of impermeable rock in an artesian formation (267)

**capillary fringe** region of soil just above the water table that receives moisture from the zone of saturation by capillary action (263)

**carbonation** chemical weathering process in which minerals react with carbonic acid (222)

**carbonization** process in which plant materials are changed into carbon (198)

**cartography** science of map making (46)

**cementation** process in which dissolved minerals left by water passing through sediments bind the sediments together (182)

**Cenozoic Era** the most recent geologic era, beginning 65 million years ago; the Age of Mammals (346)

**channel** path that a stream follows (247)

## GLOSSARY

**chemical bond** force that holds together the atoms that make up a compound (148)

**chemical formula** symbols indicating the elements a compound contains and the relative number of each element (150)

**chemical property** characteristic that describes how a substance interacts with other substances to produce different kinds of matter (139)

**chemical sedimentary rock** rock formed from minerals that precipitate from water (182)

**chemical weathering** process in which rock is broken down as a result of chemical reactions (219)

**chinook** warm, dry wind that flows down the eastern slope of the Rocky Mountains (528)

**chromosphere** thin layer of the Sun's atmosphere that lies above the photosphere and glows with a reddish light; color sphere (575)

**cinder cone** steep-sloped deposit of solid fragments ejected from a volcano (122)

**circumpolar** describing any star that is always visible in the night sky and, from the Northern Hemisphere, can be seen circling Polaris (549)

**cirque** bowl-shaped depression produced by a valley glacier (282)

**cirrus cloud** feathery cloud composed of ice crystals that has the highest altitude of any cloud in the sky (486)

**clastic sedimentary rock** rock made up of fragments from pre-existing rocks (182)

**cleavage** splitting of a mineral along smooth, flat surfaces (164)

**climate** general weather conditions over many years (455)

**cloud seeding** addition of freezing nuclei to supercooled clouds in an attempt to induce or increase precipitation (492)

**coalescence** combination of different-sized cloud droplets to form larger droplets (491)

**Coconino Sandstone** rock layer of the Grand Canyon deposited during the Permian Period (375)

**cold front** boundary formed where a cold air mass overtakes and lifts a warm air mass (502)

**coma** spherical cloud of gas and dust that surrounds the nucleus of a comet (607)

**GLOSSARY**

**comet** body of rock, dust, methane, ammonia, and ice that revolves around the Sun in a long, elliptical orbit (607)

**compaction** process in which air and water are squeezed out of sediments, resulting in the formation of sedimentary rock (182)

**composite volcano** also called *stratovolcano*, steep-sloped volcanic deposit with alternating layers of hardened lava flows and pyroclastic materials (123)

**compound** a substance that results when the atoms of two or more elements are chemically combined (147)

**compression** stress that squeezes crustal rocks together (84)

**concretion** nodule of rock with a different composition from that of the main rock body (186)

**condensation** process by which water vapor changes to liquid water (244)

**condensation nuclei** solid particles in the atmosphere, such as ice and dust, that provide the surfaces on which water vapor condenses (484)

**conduction** type of energy transfer in which vibrating molecules pass heat along to other vibrating molecules by direct contact (468)

**cone of depression** lowered area of a water table produced by pumping water from a well (266)

**conglomerate** sedimentary rock composed of rounded gravel or pebbles cemented together by minerals (182)

**conic projection** map projection in which the meridians converge at the poles; the parallels appear as equally spaced, concentric curves (47)

**constellation** pattern of stars (561)

**contact metamorphism** change in the structure and mineral composition of rock surrounding an igneous intrusion (187)

**continental crust** material that makes up landmasses (72)

**continental drift** hypothesis stating that the continents once formed a single landmass, broke up, and drifted to their present locations (67)

**continental ice sheet** mass of ice that covers large land areas (278)

**continental margin** shallower portion of the ocean floor that is made of continental crust and a thick wedge of sediment (393)

**continental polar** describing a cold, dry air mass that forms over land in polar regions (500)

**continental rise** accumulation of sediments at the base of a continental slope (395)

## GLOSSARY

- continental shelf** edge of a continent covered by shallow ocean water (393)
- continental slope** steep incline at the edge of a continental shelf (394)
- continental tropical** describing a warm, dry air mass that forms over land in tropical regions (500)
- contour interval** difference in elevation between one contour line and the next (51)
- contour line** line on a map connecting points with the same elevation (50)
- convection** transfer of heat through the movement of heated material (74)
- convection cell** looping pattern of flowing air (470)
- convection current** movement in a fluid caused by uneven heating (74)
- convective cooling** decrease in the temperature of a mass of air that results as the air rises and expands (484)
- convective zone** region around the Sun's radiative zone in which moving gases transfer energy (574)
- convergent boundary** border formed by the collision of two lithospheric plates (73)
- coprolite** fossilized waste material from an animal (337)
- coral reef** ridgelike coastal feature made of millions of coral skeletons (311)
- core** center of a planetary body, such as the Earth (24)
- core sample** cylindrical sample of sediments from the deep-ocean floor (399)
- Coriolis effect** deflection of wind and ocean currents caused by the Earth's rotation (428)
- corona** outermost layer of the Sun's atmosphere; crown (575)
- covalent bond** bond based on the attraction between atoms that share electrons (150)
- covalent compound** compound formed from atoms that share electrons (150)
- crater** funnel-shaped pit at the top of a volcanic cone (124); bowl-shaped depression on the surface of a planetary body (616)
- craton** large area of Precambrian rocks found on all continents (366)
- creep** slow downhill movement of weathered rock material (236)
- crest** highest point of a wave (433)

## GLOSSARY

**crevasse** large crack that forms on the surface of a glacier (280)

**crude oil** unrefined petroleum (200)

**crust** outermost zone of the solid Earth (24)

**crystal** natural solid substance that has a definite internal pattern (159)

**cumulus cloud** thick, billowy cloud that forms above stratus clouds and below cirrus clouds (486)

**current** steady movement in one direction, such as that of water in the ocean (427)

### D

**day** time required for the Earth to make one rotation on its axis, about 24 hours (627)

**daylight saving time** system in which clocks are set one hour ahead of standard time from April to October (34)

**deep current** streamlike movement of water beneath the surface of the ocean (427)

**deep ocean basin** part of the ocean floor made of oceanic crust and a thin sediment layer (393)

**deflation** most common form of wind erosion in which fine, dry soil particles are blown away (298)

**deflation hollow** shallow depression left after the wind has eroded a layer of exposed soil (298)

**deformation** bending, tilting, and breaking of the Earth's crust (83)

**delta** fan-shaped deposit of sediments at the mouth of a stream (252)

**density** ratio of the mass of a substance to its volume, expressed as  $\text{g/cm}^3$  (167)

**depression contour** contour line with short, straight lines drawn along the inside of the loop pointing toward its center that indicates a depression (55)

**desalination** process of removing salt from ocean water (246)

**desert pavement** surface of closely packed small rocks left after the top layer of soil has been removed by deflation (298)

**dew** type of condensation formed when air that is in contact with a cool surface loses heat until it reaches saturation (483)

**dew point** temperature to which air must be cooled to become saturated (483)

## GLOSSARY

**diatomic** consisting of two atoms (147)

**dike** igneous intrusion that cuts across rock layers (181)

**discharge** volume of water moved by a stream within a given time (249)

**disconformity** boundary between layers of rock that have not been deposited continuously (325)

**distillation** process in which ocean water is heated until it evaporates in order to separate fresh water from dissolved salts (417)

**divergent boundary** boundary formed by two lithospheric plates that are moving apart (73)

**divide** elevated region that separates two watersheds (247)

**doldrums** narrow zone of low air pressure at the equator characterized by weak and undependable winds (471)

**dome mountain** landform created when molten rock pushes up rock layers on the Earth's surface and the layers then are worn away in places, leaving separate high peaks (93)

**Doppler effect** apparent shift in the wavelength of energy, such as a sound wave or a light wave, emitted by a source moving away from or toward an observer (15)

**double refraction** property exhibited by transparent minerals that produce a double image of any object viewed through them (168)

**drift** weak, slow-moving ocean current (429)

**drumlin** long, low, tear-shaped mound of till (285)

**dune** mound of windblown sand (299)

## E

**earth science** study of the Earth and the universe around it (3)

**earth-grazer** asteroid that orbits the Sun in an elongated ellipse that may pass close to the Earth and Sun (607)

**earthquake** vibration of the Earth's crust (99)

**earthshine** sunlight reflected off the surface of the Earth (626)

**eclipse** passing of one planetary body through the shadow of another (623)

**ecology** study of the complex relationships between living things and their environment (7)

## GLOSSARY

- ecosystem** community of organisms and the environment they inhabit (7)
- elastic rebound theory** theory that rocks that are strained past a certain point will fracture and spring back to their original shape (99)
- electrical thermometer** instrument used to measure temperature based on the increased flow of electricity through certain materials when the materials are heated (509)
- electromagnetic spectrum** complete range of wavelengths of radiation (463)
- electron** subatomic particle with a negative electrical charge (141)
- electron cloud** region of space around the nucleus of an atom in which electrons may be found (141)
- element** substance that has a characteristic set of physical and chemical properties (15)
- elevation** height above sea level (50)
- ellipse** oval whose shape is determined by two points within the figure (592)
- elliptical galaxy** type of galaxy with a very bright center that contains little dust and gas and is spherical to disklike in shape (563)
- emergent coastline** coast along which sea level falls or the land rises (310)
- energy level** arrangement of electrons within the electron cloud of an atom (147)
- epicenter** point on the Earth's surface directly above the focus of an earthquake (99)
- epicycle** small circular motion of the planets within their orbits proposed as an explanation for retrograde motion (591)
- epoch** subdivision of a geologic period (346)
- era** largest unit of geologic time (346)
- erosion** process by which the products of weathering are transported (231)
- erratic** large boulder transported and deposited by a glacier (284)
- esker** long, winding ridge of gravel and coarse sand deposited by a glacier (286)
- estuary** wide, shallow bay formed where ocean water submerges the mouth of a river and where salt water and fresh water mix (309)
- evaporites** sedimentary rocks formed from minerals left after water evaporates (183)

**GLOSSARY**

**evapotranspiration** process by which water enters the atmosphere; evaporation and transpiration combined (243)

**evolution** change of living things over time (334)

**exfoliation** process in which sheets of rock peel or flake as a result of weathering (219)

**exosphere** layer of the atmosphere above the ionosphere that merges with interplanetary space (461)

**experimentation** process by which a scientific procedure is carried out according to certain guidelines (12)

**extrusive igneous rocks** rocks formed from molten lava that hardens on the Earth's surface (178)

**F**

**fault** break in rock along which rocks on either side of the break move (86)

**fault plane** surface of a fault along which movement of rocks occurs (86)

**fault zone** group of interconnected faults (101)

**fault-block mountain** mountain formed where faulting breaks the Earth's crust into large blocks that become tilted, causing some blocks to drop down relative to other blocks (92)

**felsic lava** silica-rich lava (120)

**fetch** distance that wind can blow across open water (435)

**fiord** narrow, deep, steep-walled bay formed by flooding of a glacial valley due to a rise in sea level (310)

**fireball** brilliant flash of light produced by a meteor that vaporizes quickly (608)

**firn** grainy ice in a glacier that has been partially melted and refrozen (277)

**fissure** crack in a rock surface through which lava flows (119)

**floodplain** part of the valley floor that may be covered with water during a flood (253)

**fluorescence** ability to glow under ultraviolet light (168)

**focus** area along a fault at which slippage first occurs, initiating an earthquake (99); *also* one of two points within an ellipse that determines the shape of the figure (592)

**foehn** warm, dry wind that flows down the slopes of the Alps (528)

## GLOSSARY

**folded mountain** landform created when tectonic movements bend and uplift rock layers (90)

**folding** permanent deformation or bending of a rock under stress (85)

**foliated** describing a metamorphic rock with parallel bands (187)

**footwall** in a nonvertical fault, the rock below the fault plane (86)

**fossil** trace or remains of a plant or an animal in sedimentary rock (186)

**fossil fuel** fuel formed from the remains of living organisms, such as coal, petroleum, and natural gas (198)

**fracture** break in rock along which there is no movement (86)

**fracture zone** faults running perpendicular to a mid-ocean ridge (398)

**freezing nuclei** condensation nuclei with a crystalline structure like that of ice (491)

**fringing reef** type of coral reef that forms around a volcanic island (311)

**front** boundary between air masses of different densities (502)

**frost** ice crystals formed when the dew point is below 0°C and water vapor directly enters the solid state (483)

**full moon** phase of the moon during which the entire half of the moon facing the Earth is visible (626)

## G

**galaxy** large-scale group of stars (562)

**Galilean moon** any one of the four largest satellites of Jupiter, which were first seen by Galileo (631)

**gas** physical form of matter that does not have a definite volume or shape (145)

**gastrolith** fossilized stone found within the digestive system of a dinosaur or other reptile (337)

**gemstone** nonmetallic mineral that is brilliant and colorful when cut (196)

**geocentric** Earth-centered (591)

**geologic column** arrangement of rock layers based on the ages of the rocks (345)

**geology** study of the origin, history, and structure of the solid Earth and the processes that shape it (4)

## GLOSSARY

**geomagnetic pole** point on the Earth's surface above a pole of the Earth's imaginary internal magnet (45)

**geosphere** the solid Earth (7)

**geosynchronous orbit** orbit directly above the Earth's equator and moving in the direction of the Earth's rotation (35)

**geothermal energy** energy contained in and available from water heated by magma or gases within the Earth (205)

**geyser** hot spring that erupts periodically (268)

**giant** very large, cool, bright star (554)

**glacial drift** sediments deposited by a glacier (285)

**glacier** mass of moving ice (277)

**glaze ice** thick layer of sheet ice formed when rain freezes as it contacts a surface (489)

**globular cluster** spherically shaped group of hundreds of stars located around the core of the Milky Way Galaxy (564)

**gnomonic projection** map projection in which the parallels appear as unevenly spaced, concentric circles, the meridians appear as straight lines radiating from a central point, and all other great circles appear as straight lines (47)

**Gondwanaland** southern landmass that broke away from Pangaea and later formed South America, Africa, India, Australia, and Antarctica (367)

**graben** long, narrow valley formed by faulting and downward slippage of a crustal block (92)

**gradient** change in elevation over a distance (249)

**gravity** force of attraction between all matter in the universe (27)

**great circle** any circle that divides the globe in half (44)

**greenhouse effect** process by which the atmosphere traps infrared rays over the Earth's surface (467)

**Gregorian calendar** revision of the Julian calendar by Pope Gregory XIII; currently used in most of the world (628)

**ground moraine** unsorted material left beneath a glacier when the ice melts (285)

**groundwater** water that soaks deep into soil and rock (243)

**GLOSSARY**

**Gulf Stream** swift, warm Atlantic current that flows from the Gulf of Mexico, around Florida, and up the east coast of North America (428)

**guyot** flat-topped, submerged seamount (398)

**gyre** huge circle of moving ocean water formed as a result of the wind belts and the Coriolis effect (428)

**H**

**hadal zone** benthic environment of the ocean deeper than 6,000 m (416)

**hail** type of precipitation in the form of lumps of ice (490)

**hair hygrometer** instrument used to measure relative humidity, based on the fact that human hair stretches as humidity increases (482)

**half-life** time required for half the mass of a radioactive element to decay into its daughter elements (330)

**hanging valley** small abandoned glacial valley suspended on a mountain above the main glacial valley (283)

**hanging wall** in a nonvertical fault, the rock above the fault plane (86)

**hard water** water that contains relatively large amounts of dissolved minerals (269)

**hardness** measure of the ability of a mineral to resist scratching (165)

**headland** change-resistant projection of rock out from shore into the water (303)

**headward erosion** lengthening and branching of a stream (247)

**headwaters** beginning of a stream (249)

**heliocentric** Sun-centered (591)

**Hermit Shale** rock layer of the Grand Canyon deposited during the Permian Period (375)

**horizon** layer of a soil profile (228)

**horn** sharp, pyramid-like peak formed where several arêtes join (282)

**horse latitudes** subtropical high-pressure belt of air, around 30° latitude (471)

**hot spot** area of volcanism within a lithospheric plate (119)

**hot spring** hot groundwater that rises to the surface before cooling (267)

**GLOSSARY**

**H-R diagram** Hertzsprung-Russell diagram; graph showing the relationship of the surface temperature and absolute magnitude of a star (553)

**humid continental climate** middle-latitude climate occurring between 35° and 50° north latitude, with warm, humid summers and cold winters (534)

**humid subtropical climate** very wet middle-latitude climate that occurs in southeastern coastal areas between 30° and 40° north and south latitude, with warm, humid summers and generally mild winters (534)

**humidity** amount of water vapor in the atmosphere (480)

**humus** dark, organic material formed from the decayed remains of plants and animals (227)

**hurricane** severe storm that develops over tropical oceans, with strong winds of over 120 km/h that spiral in toward the intensely low-pressure storm center (505)

**hydrocarbon** compound made up of atoms of carbon and hydrogen (198)

**hydroelectric energy** energy produced by running water (206)

**hydrolysis** chemical reaction between water and another substance (221)

**hydrosphere** all the Earth's water (7)

**hypothesis** possible explanation of a problem that is based on facts (11)

**I**

**ice age** long period of climatic cooling during which ice sheets cover large areas of the Earth's surface (289)

**ice wedging** mechanical weathering caused by the freezing and thawing of water that seeps into cracks in rocks (219)

**igneous rock** rock formed from cooled and hardened magma (175)

**impermeable** rock or sediment through which water cannot flow (263)

**index contour** every fifth contour line on a topographic map that is printed bolder for reference (53)

**index fossil** guide fossil; fossil found in the rock layers of only one geologic age and is used to establish the absolute age of the rock layers (338)

**inertia** tendency of a moving body to remain in motion or a stationary body to remain at rest until an outside force acts on it (593)

**inorganic** not made up of living organisms or the remains of living organisms (157)

## GLOSSARY

**intensity** amount of damage caused by an earthquake (104)

**internal plastic flow** slow movement of a glacier in which ice crystals slip over each other (279)

**International Date Line** line running from north to south through the Pacific Ocean where the date changes from one day to the next (34)

**intertidal zone** benthic environment that lies between the low-tide and high-tide lines (415)

**intrusive igneous rocks** rocks formed from the cooling of magma beneath the Earth's surface (178)

**invertebrate** animal without a backbone (349)

**ion** atom or group of atoms that carries an electrical charge (149)

**ionic bond** bond in which electrons are transferred from one atom to another (148)

**ionic compound** compound formed through the transfer of electrons (148)

**ionosphere** lower region of the thermosphere, at an altitude of 80 to 550 km (461)

**iron meteorite** type of meteorite made of iron, with a characteristic metallic appearance (609)

**irregular galaxy** type of galaxy with no identifiable shape and an uneven distribution of stars within it (563)

**island arc** chain of volcanic islands formed along an ocean trench (74)

**isobar** line drawn on a weather map connecting points of equal atmospheric pressure (513)

**isostasy** balancing of the forces pressing up and down on the Earth's crust (83)

**isostatic adjustment** up-and-down movements of the Earth's crust to reach isostasy (83)

**isotope** atom of an element that has the same atomic number but different atomic mass than another atom of that element (145)

## J

**jet streams** bands of high-speed, high-altitude westerly winds (472)

**Jovian planet** any one of the first four outer planets—Jupiter, Saturn, Uranus, or Neptune—with properties similar to those of Jupiter (598)

## GLOSSARY

**Julian calendar** calendar devised by Julius Caesar's astronomers consisting of 12 months; 11 with 30 or 31 days, one with 28 days, and an extra day added every four years (628)

### K

**Kaibab Limestone** rock layer of the Grand Canyon deposited during the Permian Period (375)

**karst topography** region where the effects of chemical weathering due to groundwater, such as sinkholes and caverns, are clearly visible (271)

**kettle** depression in a glacial outwash plain (286)

### L

**laccolith** flat-bottomed intrusion that pushes overlying rock layers into an arc (181)

**lagoon** narrow region of shallow water between a barrier island and the shore (310)

**landform** physical feature of the Earth's surface (236)

**landslide** sudden movement of loose rock and soil down a slope (233)

**lapilli** pyroclastic particles between 2 mm and 64 mm in diameter (121)

**latent heat** energy stored in molecules (480)

**lateral moraine** unsorted material deposited along the sides of a valley glacier (285)

**laterite** thick infertile soils produced in tropical climates (229)

**latitude** angular distance north or south of the equator (43)

**Laurasia** northern landmass that broke away from Pangaea and later formed North America and Eurasia (367)

**lava** magma that reaches the Earth's surface (117)

**lava plateau** raised, flat-topped area made of layers of hardened lava (181)

**law of crosscutting relationships** principle that a fault or intrusion is always younger than the rock layers it cuts through (326)

**law of gravitation** principle that the force of attraction between two objects depends on the masses and the distance between the objects (28)

## GLOSSARY

**law of superposition** principle that a sedimentary rock layer is older than the layers above it and younger than the layers below it (324)

**leaching** process in which water carries dissolved minerals to lower layers of rock (221)

**leap year** year with an extra day in it, occurring every four years (628)

**legend** list of map symbols and their meanings (48)

**light-year** distance that light travels in one year, about 9.5 trillion km (550)

**lignite** brown coal (199)

**liquid** physical form of matter with a definite volume but no definite shape (145)

**lithosphere** thin outer shell of the Earth consisting of the crust and the rigid upper mantle (72)

**lode** deposit formed by thick mineral veins (195)

**loess** thick, yellowish deposit of windblown dust (301)

**longitude** angular distance east or west of the prime meridian (44)

**long-period comet** comet with a period of several thousand or million years (608)

**lunar eclipse** passing of the Earth between the moon and the Sun during which the Earth's shadow crosses the lighted half of the moon (624)

**luster** light reflected from the surface of a mineral (164)

## M

**mafic lava** dark-colored lava rich in magnesium and iron (120)

**magma** liquid rock produced deep inside the Earth (117)

**magnetic declination** angle between the direction of the Earth's geographic pole and the direction in which a compass needle points (45)

**magnetosphere** a region of space that is affected by the Earth's magnetic field (26)

**magnitude** a measure of the energy released by an earthquake; described as the amount of ground motion (104)

**main-sequence star** star with characteristics that place it within a band running through the middle of the H-R diagram (554)

**mantle** zone of rock below the Earth's crust (24)

**GLOSSARY**

**map projection** flat map that represents a three-dimensional curved surface (46)

**maria** (sing: mare) dark areas of smooth, dry, solidified lava on the moon that reflect little light (616)

**marine west-coast climate** wet middle-latitude climate that occurs in western coastal areas located between 40° and 60° latitude, with relatively cool summers and mild winters (533)

**maritime polar** describing a cold, moist air mass that is formed over the ocean in polar areas (500)

**maritime tropical** describing a warm, moist air mass that is formed over the ocean in tropical areas (500)

**mass movement** movement of rock fragments down a slope (233)

**mass number** sum of the numbers of protons and neutrons in an atom (141)

**matter** substance that takes up space and has mass (139)

**mean sea level** point midway between the highest and lowest tide levels of the ocean (50)

**meander** wide curve in a stream channel (251)

**measurement** comparison of a property of an object or phenomenon with a standard unit (9)

**mechanical weathering** process that changes the physical form of rocks (219)

**medial moraine** ridge of unsorted glacial material along the center of a valley glacier (285)

**Mediterranean climate** middle-latitude climate that occurs in coastal areas located between 30° and 40° latitude, with dry summers and wet winters (533)

**meltwater** melted ice flowing from a glacier (285)

**Mercalli scale** scale that expresses the intensity of an earthquake with a Roman numeral and a description (104)

**Mercator projection** map projection in which the meridians appear as straight, parallel, evenly spaced lines and form a grid with the parallels, which appear as straight, parallel, and unevenly spaced lines (47)

**meridian** semicircle on the Earth that runs from pole to pole (43)

**mesa** elevated, flat-topped area smaller than a plateau (237)

**mesopause** upper boundary of the mesosphere, marked by an increase in temperature (461)

## GLOSSARY

**mesosphere** coldest layer of the atmosphere that extends upward from the stratosphere to an altitude of about 80 km (461)

**Mesozoic Era** geologic era that lasted from 248 million to 65 million years ago; the Age of Reptiles (346)

**metamorphic rock** rock formed from other rocks as a result of intense heat, pressure, or chemical processes (176)

**metamorphism** changing of one type of rock to another by heat, pressure, and chemical processes (187)

**meteor** a bright streak of light caused when a meteoroid burns up in the Earth's atmosphere (608)

**meteor shower** phenomenon caused by the burning up of large numbers of meteoroids as they enter the Earth's atmosphere (608)

**meteorite** meteoroid or part of a meteoroid left after it hits the Earth's surface (609)

**meteoroid** small bit of rock or metal moving through the solar system left by a comet or produced by a collision between asteroids (608)

**meteorology** study of the Earth's atmosphere (5)

**microquake** earthquake with a magnitude less than 2.5 on the Richter scale (104)

**Mid-Atlantic Ridge** undersea mountain range with a steep, narrow valley along its center (68)

**middle-latitude climates** climates with a maximum average temperature of 18°C in the coldest month and a minimum average temperature of 10°C in the warmest month (529)

**middle-latitude desert climate** middle-latitude climate that is very dry, with both a cold winter and a warm to very hot summer (533)

**middle-latitude steppe climate** middle-latitude climate with slightly more precipitation than a middle-latitude desert climate and a high yearly temperature range (533)

**mid-ocean ridges** system of undersea mountain ranges that wind around the Earth (68)

**Milankovitch theory** theory that small, regular changes in the Earth's orbit and in the tilt of the Earth's axis caused the ice ages (290)

**mineral** natural inorganic, crystalline solid found in the Earth's crust (157)

**mineralogist** scientist who specializes in the study of minerals (163)

## GLOSSARY

**mistral** strong, cold, northern wind that blows down the Alps toward the Mediterranean Sea (528)

**mixture** material that contains two or more substances that are not chemically combined (151)

**Moho** the Mohorovičić discontinuity, boundary between the Earth's crust and mantle (24)

**Mohs hardness scale** standard against which the hardness of a mineral is tested (165)

**molecule** smallest complete unit of a compound (147)

**monadnock** knob of rock that protrudes above a peneplain (236)

**monocline** a fold in rock layers in which both limbs remain horizontal (85)

**monsoon** seasonal wind that blows toward the land in summer, bringing heavy rains, and away from the land in the winter, bringing dry weather (527)

**month** time required for the moon to go through one set of phases as it orbits the Earth, about 29.5 days (627)

**moon** body that is smaller than a planet and orbits the planet (580)

**mountain belt** group of large mountain systems (88)

**mountain range** group of adjacent mountains with the same general shape and structure (88)

**mountain system** group of adjacent mountain ranges (88)

**Muav Limestone** rock layer of the Grand Canyon deposited during the Cambrian Period (374)

**mud** fine particles of rock combined with water (401)

**mud pot** weathered rock around a hot spring that mixes with the hot water to form liquid clay that bubbles at the surface (268)

**mudflow** rapidly moving large mass of mud (233)

**mummification** preservation of a dead organism by drying (335)

## N

**natural bridge** arch of rock formed by groundwater erosion (271)

**natural levee** raised riverbank that results when a river deposits its load at the river's edges (254)

## GLOSSARY

**neap tide** tide with minimum daily tidal range that occurs during the first and third quarters of the moon (440)

**nebula** dark cloud of gas and dust in space; first stage in the development of a star (555)

**nebular theory** theory that the Sun and the planets condensed out of a spinning cloud of gas and dust (580)

**nekton** forms of ocean life that swim, such as fish, dolphins, and squid (415)

**neritic zone** pelagic environment above the sublittoral zone filled with marine life (415)

**neutron** subatomic particle with no electrical charge (141)

**neutron star** collapsed core of a supernova consisting of a small, extremely dense ball of neutrons (559)

**new moon** phase of the moon during which the side of the moon facing the Earth is unlighted (626)

**nitrogen cycle** process in which nitrogen moves from the air to the soil to animals and back to the air (457)

**nodule** lump of minerals on the ocean floor (401)

**nonconformity** unconformity in which stratified rock rests on unstratified rock (325)

**nonfoliated** describing a metamorphic rock without parallel bands (187)

**nonrenewable resource** substance of limited supply that cannot be replaced (195)

**nonsilicate mineral** mineral that does not contain silicon (158)

**normal fault** fault in which the hanging wall moves down relative to the footwall (86)

**nova** white dwarf star that explodes as it cools, temporarily becoming thousands of times brighter (559)

**nuclear fission** splitting of the nucleus of a large atom into smaller nuclei (202)

**nuclear fusion** combination of the nuclei of small atoms to form a larger nucleus (203)

**nucleus** region in the center of an atom that contains the protons and neutrons (141)

## GLOSSARY

### O

**observation** act of using the senses to gather information (9)

**occluded front** boundary formed where a fast-moving cold air mass overtakes and lifts a warm air mass, completely cutting it off from the ground (503)

**ocean floor** continental crust and oceanic crust that lie beneath the ocean (390)

**ocean trench** deep valley in the ocean floor that forms along a subduction zone (73)

**oceanic crust** material that makes up the ocean floor (72)

**oceanic zone** pelagic environment that extends seaward beyond the continental shelf (416)

**oceanography** study of the Earth's oceans (5)

**Oort cloud** spherical cloud of dust and ice surrounding the solar system that may contain as many as a trillion comets (608)

**ooze** soft organic sediment on the ocean floor (401)

**open cluster** loosely shaped group of hundreds of stars (564)

**orbit period** time required for a planet to make one revolution around the Sun (593)

**ordinary spring** natural flow of groundwater to the Earth's surface (266)

**ordinary well** hole dug below the water table that fills with groundwater (266)

**ore** deposit of minerals from which metals and nonmetals can be profitably removed (195)

**organic sedimentary rock** rock formed from the remains of organisms (182)

**outcrop** area of exposed rock (374)

**outwash plain** deposit of stratified drift in front of a glacier (286)

**oxbow lake** water remaining in an isolated meander in a floodplain (251)

**oxidation** chemical combination of metallic elements with oxygen (222)

**ozone** form of atmospheric oxygen that has three atoms per molecule (455)

**GLOSSARY****P**

**P wave** primary wave; the fastest wave generated by an earthquake and the first to be recorded by a seismograph (103)

**Pacific Ring of Fire** major earthquake zone that forms a ring around the Pacific Ocean (100)

**pack ice** floating layer of sea ice that completely covers an area of the ocean surface (410)

**pahoehoe** solidified mafic lava with a wrinkled surface (120)

**paleontologist** scientist who studies fossils (334)

**paleontology** study of fossils (334)

**Paleozoic Era** geologic era that followed Precambrian time, lasting from 540 million to 248 million years ago (346)

**Pangaea** single landmass thought to have been the origin of all continents (67)

**Panthalassa** giant ocean surrounding Pangaea (67)

**parallax** method of determining the distance from the Earth to a star based on the shift in the apparent position of the star when viewed from different angles (550)

**parallel** any circle that runs east and west around the Earth parallel to the equator (43)

**peat** brownish-black material produced by partial decomposition of plant remains (198)

**pelagic environment** major division of ocean environment that includes the two water zones: neritic and oceanic (415)

**peneplain** low, almost level surface of a mountain in its old stage (236)

**penumbra** outer part of the shadow cast by the Earth or the moon in which sunlight is only partially blocked (623)

**perched water table** secondary water table formed by a layer of impermeable rock above the main water table (264)

**perigee** point in the orbit of a satellite at which it is closest to the Earth (621)

**perihelion** point in the orbit of a planet at which it is closest to the Sun (29)

**period** subdivision of a geologic era (346)

**periodic table** system for classifying the elements (141)

**permeability** the ease with which water flows through the open spaces in a rock or sediment (262)

## GLOSSARY

**petrification** process in which organic materials are replaced by new materials (335)

**petrochemical** chemical derived from petroleum (200)

**phase** varying shape of the visible portion of the moon (626)

**phosphorescence** ability to glow during and after exposure to ultraviolet light (168)

**photosphere** innermost layer of the solar atmosphere; light sphere (574)

**physical property** characteristic that is observable in a substance without changing the chemical composition of the substance (139)

**phytoplankton** microscopic ocean plants (414)

**pillow lava** lava that flows out of fissures on the ocean floor and cools rapidly in rounded shapes (120)

**placer deposit** fragments of native metals that are concentrated in layers at the bottom of a stream bed (196)

**planet** any one of the nine major bodies that orbit the Sun (580)

**planetary nebula** expanding shell of gases shed by a dying star (558)

**planetesimal** small body of matter that formed in the outer regions of the solar nebula while the Sun was forming in its center (580)

**plankton** free-floating, microscopic ocean plants and animals (414)

**plate tectonics** theory that the lithosphere is made up of plates that float on the asthenosphere and that the plates possibly are moved by convection currents (72)

**plateau** large area of flat-topped rocks high above sea level (91)

**polar climates** climates with a maximum average monthly temperature of 10° C (529)

**polar easterlies** weak global winds located north of 65° north latitude and south of 65° south latitude that flow away from the poles (472)

**polar front** boundary at which cold polar air meets the warmer air of the middle latitudes (503)

**polar orbit** orbit that passes over the Earth's North and South poles (35)

**pollution** contamination of the environment with waste products or impurities (8)

**polyconic projection** map made by fitting together a series of conic projections of adjoining areas (48)

## GLOSSARY

**porosity** percentage of open spaces in a rock or sediment (261)

**porphyritic** describing an igneous rock composed of both large and small crystals (178)

**Precambrian time** earliest and longest geologic era, lasting from 4.6 billion to 540 million years ago (346)

**precession** slow circular motion of the Earth's axis as it turns in space that traces a circle in space every 26 thousand years (32)

**precipitation** process by which water falls from clouds to the earth as rain, snow, sleet, and hail (244)

**prime meridian** the meridian that passes through Greenwich, England, designated as 0° (44)

**principle of uniformitarianism** theory that geologic processes at work in the present were also at work in the past (323)

**prominence** cloud of glowing gases that arches high above the Sun's surface (577)

**proton** subatomic particle with a positive electrical charge (141)

**protoplanet** large body of matter that formed from the coalescence of planetesimals in the solar nebula (580)

**protostar** inside a nebula, the shrinking, spinning center region; the second stage in the development of a star (555)

**psychrometer** instrument used to measure relative humidity (480)

**pulsar** neutron star that emits two beams of radiation that sweep across space (560)

**pyroclastic material** the rock fragments ejected from a volcano (121)

### Q

**quasar** starlike object that gives off radio waves and X rays (565)

### R

**radar** device that can detect objects and weather conditions in the upper atmosphere by sending and receiving radio waves (511)

**radiation fog** condensation of water vapor that results from the cooling of air that is in contact with the ground (488)

**GLOSSARY**

- radiative zone** region surrounding the core of the Sun in which energy is transferred in the form of electromagnetic waves (574)
- rain gauge** instrument used to measure the amount of rainfall (493)
- ray** streak of displaced rock material radiating from a crater (616)
- red shift** apparent lengthening of the light waves emitted by a star moving away from the Earth (550)
- Redwall Limestone** rock layer of the Grand Canyon deposited during the Mississippian Period (374)
- refraction** bending of a light ray as it passes from one substance to another (168); *also* bending of a wave as it reaches shallow water (437)
- regional metamorphism** metamorphism that affects rocks over large areas during periods of tectonic activity (187)
- regolith** layer of weathered rock fragments covering much of the Earth's surface (227)
- rejuvenated** describing a river with a gradient that has been made steeper by a movement of the Earth's crust (251)
- relative age** age of an object compared with the ages of other objects (324)
- relative humidity** ratio of the amount of water vapor in the air to the amount of water vapor the air can hold when saturated (480)
- relief** difference in elevation between the highest and lowest points of an area (51)
- renewable resource** substance that can be replaced (195)
- retrograde motion** apparent periodic reversal in the motion of some planets as viewed from the Earth (591)
- reverse fault** fault in which the hanging wall moves up relative to the footwall (86)
- revolution** movement of a planet around the Sun (29)
- rift valley** steep, narrow valley formed as lithospheric plates separate (73)
- rille** long, deep channel that runs through the maria on the moon (616)
- rip current** swift movement of water caused by the return of water to the ocean through channels in underwater sand bars (437)
- roche moutonnée** rounded knob of rock produced by glacial erosion (283)
- rock cycle** series of processes in which rock changes from one type to another and back again (176)

## GLOSSARY

**rockfall** fall of rock from a steep cliff (233)

**rock-forming mineral** any common mineral that forms the rocks of the Earth's crust (157)

**rotation** spinning of a planet on its axis (29)

**runoff** water that flows over the land into streams and rivers (243)

### S

**S wave** secondary wave; a wave generated by an earthquake and the second to be recorded by a seismograph (103)

**salinity** number of grams of dissolved salt in 1 kg of ocean water (408)

**saltation** movement of sand by short jumps, caused by wind or water (249)

**sand bar** long ridge of sand deposited offshore (305)

**satellite** object in orbit around a body with a larger mass (35)

**saturated** describing air that contains all the water vapor it can hold at a specific temperature (480)

**scale** relationship between distance shown on a map and actual distance (49)

**scientific law** rule that correctly describes a natural phenomenon (14)

**scientific methods** organized, logical approaches to scientific research (9)

**seafloor spreading** movement of the ocean floor away from either side of a mid-ocean ridge (70)

**seamount** submerged volcanic mountains on the ocean floor that are at least 1,000 meters high (398)

**sediment** fragments that result from the breaking of rocks, minerals, and organic matter (175)

**sedimentary rock** rock formed from hardened deposits of sediment (175)

**seismic gap** zone of rock in which a fault is locked and unable to move and in which no major earthquake has occurred for a long period of time (110)

**seismic wave** vibration that travels through the Earth (23)

**seismograph** instrument used to detect and record seismic waves (103)

**shadow zone** location on the Earth's surface where no seismic waves or only P waves can be detected (25)

**shearing** stress that pushes rocks in opposite horizontal directions (84)

## GLOSSARY

**sheet erosion** process in which parallel layers of topsoil are stripped away, exposing the surface of the underlying subsoil or partially weathered bedrock (232)

**shield volcano** has a cone of hardened lava that forms a broad base and gentle slopes (122)

**shoreline** place where the ocean and the land meet (302)

**short-period comet** comet with a period of up to 100 years (608)

**silicate mineral** mineral that contains atoms of silicon and oxygen (158)

**siliceous ooze** type of ooze that is mostly silicon dioxide (401)

**silicon-oxygen tetrahedron** four oxygen atoms arranged in a pyramid with one silicon atom in the center (161)

**sill** sheet of hardened magma that forms between and parallel to layers of rock (181)

**sinkhole** circular depression caused when the roof of a cavern collapses (270)

**sleet** ice pellets that form when rain falls through a layer of freezing air (489)

**slump** downhill movement of a large block of soil under the influence of gravity (234)

**smog** air pollution formed from a mixture of dust and chemicals (151)

**snowfield** almost motionless mass of permanent snow and ice (277)

**snowline** elevation above which ice and snow remain throughout the year (277)

**soft water** water that contains few dissolved minerals (269)

**soil profile** cross section of soil layers and bedrock (228)

**solar collector** device for capturing solar energy (204)

**solar eclipse** passing of the moon between the Earth and the Sun during which the shadow of the moon falls on the Earth (623)

**solar flare** sudden, violent eruption of electrically charged atomic particles from the Sun's surface (578)

**solar nebula** cloud of gas and dust that developed into the solar system (580)

**solar system** the Sun and the bodies that revolve around it (580)

**solar wind** electrically charged atomic particles that stream out into space through holes in the Sun's corona (575)

## GLOSSARY

**solar year** time required for the Earth to make one orbit around the Sun, about 365.24 days (627)

**solid** physical form of matter with a definite shape and volume (145)

**solifluction** slow downslope flow of wet, muddy topsoil over frozen or clay-rich subsoil (235)

**solution** mixture in which one substance is uniformly dispersed in another substance (151)

**sonar** acronym for sound navigation and ranging, method of mapping the ocean floor using reflected sound waves (391)

**sorting** uniformity in the size of the particles of a rock or sediment (261)

**specific heat** amount of heat needed to raise the temperature of 1g of a substance 1° C (526)

**specific humidity** actual amount of moisture in the air (483)

**spectroscope** instrument that splits white light into a band of colors (15)

**spectrum** band of the various colors of light (14)

**spiral galaxy** type of galaxy with a nucleus of bright stars and flattened arms that swirl around the nucleus (563)

**spit** long, narrow deposit of sand connected at one end to the shore (306)

**spring tide** tide with maximum daily tidal range that occurs during the new and full moons (440)

**squall line** long line of heavy thunderstorms that may occur just ahead of a fast-moving cold front (502)

**stalactite** cone-shaped calcite deposit suspended from the ceiling of a cavern (270)

**stalagmite** an upward-pointing, cone-shaped calcite deposit built up from the floor of a cavern (271)

**standard atmospheric pressure** the atmospheric pressure measured at sea level; 760 mm of mercury (459)

**standard time zone** one of 24 regions of the Earth in which noon is set as the time when the Sun is highest over the center of the region (33)

**star** body of gases that gives off a tremendous amount of radiant energy in the form of light and heat (547)

**station model** cluster of weather symbols plotted on a map indicating the weather conditions at a particular reporting station (512)

**GLOSSARY**

- stationary front** boundary formed where two air masses meet and neither is displaced (503)
- steam fog** condensation of water vapor that results when cool air moves over warm water (488)
- stock** igneous intrusion with an area less than 100 square kilometers (181)
- stony meteorite** most common type of meteorite, similar in composition to rocks found on the surface of the Earth (609)
- stony-iron meteorite** rare type of meteorite that contains both iron and stone (609)
- strain** change in shape and volume of rocks that occurs due to stress (84)
- stratification** layering of sedimentary rock (185)
- stratified drift** glacial deposit that has been sorted and layered by the action of streams or meltwater (285)
- stratopause** high-temperature zone that marks the upper boundary of the stratosphere (460)
- stratosphere** layer of the atmosphere that extends upward from the troposphere to an altitude of 50 km; contains most atmospheric ozone (460)
- stratovolcano** also called *composite volcano*, steep-sloped volcanic deposit with alternating layers of hardened lava flows and pyroclastic material (123)
- stratus cloud** cloud with a sheetlike or layered form that is the lowest cloud in the sky (486)
- streak** color of a mineral in powder form (164)
- stream load** sediments carried by a stream (249)
- stream piracy** capture of a stream in one watershed by a stream in another watershed (247)
- stress** the amount of force per unit area that is placed on a given material (84)
- strike-slip fault** fault in which the rock on either side of a fault plane slides horizontally (87)
- subarctic climate** type of polar climate that occurs in areas between 55° and 65° north latitude, with little precipitation and a large yearly temperature range (532)
- subduction zone** region where one lithospheric plate moves under another (73)
- sublimation** process in which a solid changes directly into a gas, or a gas changes directly into a solid (479)

## GLOSSARY

**sublittoral zone** shallow benthic environment that is continuously submerged and that contains the largest number of benthos (415)

**submarine canyon** deep valley in the continental slope and shelf (395)

**submergent coastline** coast along which sea level rises or the land sinks (308)

**submersible** underwater research vessel (390)

**subpolar low** belt of low air pressure at about 60° north and 60° south latitude (472)

**summer solstice** the beginning of summer (31)

**sunspot** cool, dark area of gas within the photosphere caused by powerful magnetic fields (576)

**sunspot cycle** periodic variation in the number of sunspots that occurs approximately every 11 years (577)

**Supai Group** rock layers of the Grand Canyon deposited during the Pennsylvanian Period (374)

**supercooling** process in which water droplets are induced to remain liquid at temperatures below 0° C (491)

**supergiant** extremely large, giant star (554)

**supernova** star that blows apart with a tremendous explosion (559)

**surface current** streamlike movement of water on or near the surface of the ocean (427)

**surface wave** the slowest moving seismic wave generated by an earthquake and the last to be recorded by a seismograph (103)

**swell** one of a group of long, rolling waves that are all the same size (434)

**syncline** downcurved fold in rock layers in which the youngest layer is in the center (85)

## T

**talus** pile of rock fragments that accumulates at the base of a slope (233)

**Tapeats Sandstone** rock layer of the Grand Canyon deposited during the Cambrian Period (374)

**temperature inversion** atmospheric condition in which warm air traps cooler air near the Earth's surface (462)

**GLOSSARY**

**temperature range** difference between the highest and lowest temperatures of a particular time period (523)

**tension** stress that pulls rocks apart (84)

**terminal moraine** till deposited at the leading edge of a melting glacier (286)

**terrane** piece of land with a geologic history distinct from that of the surrounding land (76)

**terrestrial planet** any one of the four planets closest to the Sun—Mercury, Venus, Earth, and Mars—with properties similar to those of the Earth (594)

**theory** hypothesis or set of hypotheses supported by the results of experimentation and observation (14)

**theory of evolution** theory that organisms change over time and that new organisms are derived from ancestral types (347)

**theory of microplate tectonics** theory that continents are a patchwork of pieces of land that have individual geologic histories (76)

**thermocline** zone of rapid temperature change that begins just below the surface of the ocean (410)

**thermograph** instrument that measures temperature changes by recording the movement of the bar of a bimetal thermometer (509)

**thermosphere** the atmospheric layer above the mesosphere (461)

**thrust fault** type of reverse fault in which the fault plane is nearly horizontal rather than vertical (86)

**thunderstorm** storm accompanied by thunder, lightning, and strong winds (506)

**tidal bore** surge of water that rushes upstream in a river as the tide rises (443)

**tidal current** movement of water toward and away from the coast due to the rise and fall of the tides (443)

**tidal flat** muddy or sandy part of a lagoon that is visible at low tide (310)

**tidal oscillation** slow, rocking motion of ocean water that occurs as tidal bulges move around the Earth (442)

**tidal range** difference between the levels of the high and low tides at a specific location (440)

**tide** daily change in the level of the ocean surface (439)

**till** unsorted rock material deposited by a glacier (285)

**tombolo** ridge of sand that connects an island to the mainland (306)

## GLOSSARY

**topographic map** map that shows the surface features of the Earth (50)

**topography** surface features of the Earth (50)

**tornado** whirling, funnel-shaped cyclone (507)

**Toroweap Formation** rock layers of the Grand Canyon deposited during the Permian Period (375)

**trace fossil** fossil trace left by an ancient organism, such as a track, footprint, boring, or burrow (336)

**trade winds** global winds flowing toward the equator between 30° and 0° latitude (470)

**transform boundary** boundary formed where two lithospheric plates slide past each other (74)

**travertine** form of calcite that is deposited in terraces around the mouths of hot springs (268)

**trench** deep valley in the ocean floor (395)

**tributary** feeder stream that flows into a main stream (247)

**Trojan asteroid** asteroid that orbits the Sun just ahead of or behind the planet Jupiter (607)

**tropical climates** climates with a minimum average monthly temperature of 18° C (529)

**tropical desert climate** dry, warm climate that occurs in regions about 20° to 30° north and south of the equator (529)

**tropical rain forest climate** warm, humid climate that occurs within 5° to 10° on either side of the equator (529)

**tropical savanna climate** tropical climate located between tropical rain forest and tropical desert climates, producing very wet summers and very dry winters (529)

**tropopause** upper boundary of the troposphere in which the temperature remains almost constant (460)

**troposphere** atmospheric layer closest to the Earth's surface where nearly all weather occurs (460)

**trough** lowest point between two wave crests (433)

**true north** direction of the geographic North Pole (45)

**tsunami** giant ocean wave that often occurs after a major earthquake with an epicenter on the ocean floor (106)

## GLOSSARY

**tundra climate** polar climate that occurs in areas near the ocean at the latitude of the Arctic Circle, with a small yearly temperature range and very little precipitation (532)

**turbidity current** dense current that carries large amounts of sediment down the continental slopes (395)

**typhoon** hurricane that forms over the Pacific Ocean (505)

### U

**umbra** inner, cone-shaped part of the shadow cast by the Earth or the moon in which sunlight is completely blocked (623)

**unconformity** break in the geologic record created when rock layers are removed by erosion (325)

**undertow** irregular current that pulls water from a beach back to the ocean (437)

**upslope fog** condensation of water vapor that results from the lifting and adiabatic cooling of air rising up a slope of land (488)

**upwelling** process in which surface water moves farther out into the ocean and deep water moves upward to replace the surface water (414)

### V

**valley glacier** long, narrow, wedge-shaped mass of ice that usually moves through a mountain valley (278)

**variable** factor in an experiment that can be changed (12)

**varve** annual layer of sedimentary deposit on a lake bed (328)

**vein** narrow band of mineral deposits in rock (195)

**vent** opening through which molten rock flows onto the Earth's surface (117)

**ventifact** any stone smoothed by wind abrasion (298)

**vernal equinox** the beginning of spring (32)

**vertebrate** animal with a backbone (350)

**Vishnu Schist** the bottommost and oldest rock layer of the Grand Canyon (374)

**volcanic ash** pyroclastic particles between 0.25 mm and 2 mm in diameter (121)

## GLOSSARY

**volcanic block** the largest possible pyroclastic material that is formed from solid rock blasted from a volcanic fissure (122)

**volcanic bomb** large, spindle-shaped clot of lava thrown out of a volcano (122)

**volcanic dust** pyroclastic particles less than 0.25 mm in diameter (121)

**volcanic mountain** mountain formed when molten rock erupts onto the Earth's surface (92)

**volcanic neck** solidified central vent of a volcano (181)

**volcanism** any activity that includes the movement of magma toward or onto the Earth's surface (117)

**volcano** lava and pyroclastic material built up on the Earth's surface around a vent (117)

## W

**waning** describing the phase of the moon during which the size of its visible portion is decreasing (626)

**warm front** boundary formed where a warm air mass overtakes and rises over a cold air mass (502)

**water budget** gains and losses of water from a region (244)

**water cycle** continuous movement of water from the air to the Earth and back again (243)

**water gap** deep notch left where a stream erodes through a mountain as it is uplifted (249)

**water table** upper surface of the zone of saturation (263)

**watershed** land from which water runs off into a stream (247)

**waterspout** tornado that occurs over the ocean (508)

**wave** periodic up-and-down movement of water (433)

**wave cyclone** large storm that develops along cold or stationary fronts, with winds that spiral in toward a central region of low air pressure (503)

**wave height** vertical distance between the crest and the trough of a wave (433)

**wave period** time required for a complete wavelength to pass a given point (433)

## GLOSSARY

**wave-built terrace** extension of a wave-cut terrace that results from deposition of eroded material offshore (303)

**wave-cut terrace** nearly level platform of rock left beneath the water after the erosion of a sea cliff (303)

**wavelength** distance between wave crests (14)

**waxing** describing the phase of the moon during which the size of its visible portion is increasing (626)

**weather** general condition of the atmosphere at a particular time and place (455)

**weathering** change in the physical form or chemical composition of rock materials exposed at the Earth's surface (219)

**westerlies** global winds located between 40° and 60° latitude that flow from the southwest in the Northern Hemisphere and from the northwest in the Southern Hemisphere (471)

**white dwarf** small, hot, dim star (554)

**whitecap** crest of a wave that is blown off by high winds (435)

**wind gap** water-eroded notch in a mountain through which water no longer flows (249)

**wind vane** instrument used to determine the direction of the wind (509)

**winter solstice** the beginning of winter (31)

## Z

**zone of aeration** upper region of groundwater between the water table and the Earth's surface (263)

**zone of saturation** lower region of groundwater where all the pore spaces in a rock or sediment are filled with water (263)

**zooplankton** microscopic ocean animals (414)