

Third Edition

GLOSSARY OF GEOLOGY

Robert L. Bates and
Julia A. Jackson, Editors

American Geological Institute
Alexandria, Virginia
1987

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GLOSSARY OF GEOLOGY—Third Edition

Definition is that which refines
the pure essence of things from
the circumstance.

—Milton

It is not really a mark of distinction
for a geologist's writing to be so
obscure that a glossary is required
for its comprehension.

—Jules Braunstein

Preface—Third Edition

As earth scientists continue to generate new facts, concepts, and interpretations, the geological language necessarily expands and evolves. This third edition of the *Glossary of Geology* incorporates more than 1,000 new terms and definitions, and expands or brings up to date some 650 definitions from the previous edition. In addition, it includes for the first time the division of terms into syllables, with accents to aid in pronunciation. Approximately 150 references have been added to the 2,000 in the second edition.

New entries are especially numerous in the fields of carbonate sedimentology, hydrogeology, marine geology, mineralogy, ore deposits, plate tectonics, and snow and ice. Terms and definitions recommended in the North American Stratigraphic Code (1983) are included.

The authority of this edition, like that of its predecessor, rests on the expertise of geoscientists from many specialties. Their contributions make the *Glossary* an essential reference work for all in the geoscience community.

April 1987

Julia A. Jackson
Robert L. Bates

Preface—Second Edition

"If it were not for the occasional appearance of an authoritative glossary," wrote Ian Campbell in his preface to the first edition of this work, "our language . . . would rapidly degenerate into babel." He added that as the science advances and knowledge expands, we modify and improve our concepts, and with this must come modification and enlargement of our vocabulary.

The American Geological Institute had recognized the need for a glossary, and in 1957, in cooperation with the National Academy of Sciences, it published a 14,000-term *Glossary of Geology and Related Sciences*. A revision with a 4,000-term supplement, appeared in 1960. These gave rise, in 1972, to AGI's one-volume *Glossary of Geology*, containing nearly 33,000 terms.

The present volume, the 36,000-term second edition, incorporates the modifications and growth of the geoscience vocabulary since 1972. Coverage has been expanded and updated, particularly in such active fields as biostratigraphy, caves and karst, igneous petrology, paleomagnetism, remote sensing, plate tectonics, and seismic stratigraphy. Some 450 new mineral names join the 4,000 in the previous edition; more than 100 abbreviations commonly used by geoscientists make their first appearance; and the list of references includes about 400 additional entries.

We acknowledge the pioneering work of J. V. Howell, who set the course and standards of excellence for the *Glossary of Geology and Related Sciences*, and the editorial advice and counsel of Frank C. Calkins, who helped materially in the preparation of the first edition of the *Glossary of Geology*.

We hope this *Glossary* will meet the needs of the geoscience community, and will prove to be a bulwark against the babelization of the geological language.

December 1979

Julia A. Jackson
Robert L. Bates

Introduction

The terms listed in this *Glossary* have appeared in English-language publications, and reflect North American usage unless otherwise noted. Foreign-language terms are included if they have been used by writers in English. Many obsolete terms are retained, as they remain valuable for readers using the older literature. Besides giving the current or preferred meaning of a term, some definitions include information on original usage or historical development.

Alphabetization is strictly letter-by-letter. Thus *C wave* appears near the end of the *C's*, following *cuztците*.

Syllabication is given in parenthesis following the first appearance of a term. As an aid in pronunciation, the main accent is given by a heavier mark, the secondary accents (if any) by lighter ones. For a few terms, a further pronunciation guide appears in brackets. No syllabication is given for long terms from obscure language sources.

Italicized terms denote cross-references. An entry followed by a single term in italics means that the terms are synonyms and that the definition will be found under the italicized term. Terms italicized within a definition are themselves defined elsewhere in the *Glossary*.

Citations to the literature are given in many definitions. The works referred to are listed in the References Cited at the end of the book.

Multiple definitions for a term are indicated by (a), (b), (c), and so on. If there is a comment about a term that applies to all its meanings, it is given at the end of the definition after a long dash (—).

Brackets enclose tags for terms that have meanings in more than one subject. For example, head [coast], head [hydrogeol], and head [paleont] are each treated as a separate entry. Many tags, for example [coast], are self-explanatory, but many others are abbreviations, as follows:

arch—archaeology
astrogeol—astrogeology
astron—astronomy

biol—biology
bot—botany
cart—cartography
chem—chemistry
clim—climatology
cryoped—cryopedology
cryst—crystallography
drill—drilling
eco geol—economic geology
ecol—ecology
elect—electricity
eng—engineering
eng geol—engineering geology
evol—evolution
exp struc geol—experimental structural geology
geochem—geochemistry
geochron—geochronology
geog—geography
geol—geology
geomorph—geomorphology
geophys—geophysics
glac geol—glacial geology
glaciol—glaciology
grd wat—ground water
hydraul—hydraulics
ign—igneous
ign petrol—igneous petrology
intrus rocks—intrusive rocks
magnet—magnetism
mass move—mass movements
mater—materials
meta—metamorphism
meteorol—meteorology
migma—migmatites
mineral—mineralogy
mnts—mountains
oceanog—oceanography
ore dep—ore deposits
paleoclim—paleoclimatology
paleoecol—paleoecology
paleomag—paleomagnetism
paleont—paleontology

palyn—palynology
part size—particle size
pat grd—patterned ground
periglac—periglacial features
petrog—petrography
philos—philosophy
photo—photography
phys—physics
phys sci—physical science
planet—planetology
pyroclast—pyroclastics
rock mech—rock mechanics
sed—sedimentology
sed struc—sedimentary structures
seis—seismology
speleo—speleology
stat—statistics
stratig—stratigraphy
struc geol—structural geology
struc petrol—structural petrology
surv—surveying
taxon—taxonomy
tect—tectonics
topog—topography
volc—volcanism

wtr res—water resources
weath—weathering

Abbreviations of certain common terms are used in the definitions, as follows:

Abbrev:—abbreviation
adj.—adjective
Ant:—antonym
Cf:—compare (Latin *confer*)
e.g.—for example (Latin *exempli gratia*)
esp.—especially
et al.—and others (Latin *et alii*)
etc.—and so forth (Latin *et cetera*)
Etymol:—etymology
i.e.—that is (Latin *id est*)
n.—noun
Pl:—plural
q.v.—which see (Latin *quod vide*)
Pron:—pronounced
Sing:—singular
specif.—specifically
Syn:—synonym
v.—verb
var.—variant

Acknowledgments

Specialists in many fields of geoscience have volunteered their help in bringing the widely used second edition of the *Glossary* up to date by reviewing definitions, adding new terms, recommending corrections, and citing references. These persons have also evaluated material called to the editors' attention by concerned geoscientists not formally involved with the revision. The geoscience community owes special gratitude to the following persons: S. W. Bailey, Arthur L. Bloom, Richard Boardman, Francis H. Brown, Kevin C. Burke, Samuel C. Colbeck, D. M. Cruden, Roger J. Cuffey, Richard A. Davis, Jr., Richard V. Dietrich, Rhodes Fairbridge, Gerald M. Friedman, John M. Guilbert, William F. Hanna, Richard D. Harvey, Nicholas Hotton III, William J. Jones, Paul D. Lowman, Jr., George W. Moore, Matthew Nitecki, Stanley E. Norris, Donald E. Owen, Donald R. Peacor, John Pejeta, J. Keith Rigby, Robert E. Sheriff, Arthur W. Snoke, Curt Teichert, Edd Turner.

The fields covered in the *Glossary* with their reviewers for the second edition are given below. For those entries followed by more than one name, the first name is that of the chief reviewer.

Archaeology Daniel F. Merriam; John A. Gifford, George R. Rapp, Jr.

Astrogeology Paul D. Lowman, Jr.

Cartography surveying Douglas M. Kinney; William H. Chapman, William J. Jones, Richard D. Kidwell, John B. Rowland, Stanley H. Schroeder, Dale F. Stevens

Climatology, paleoclimatology Rhodes W. Fairbridge; William L. Donn, George J. Kukla

Coal geology Jack A. Simon; Richard D. Harvey

Economic geology, mining geology John M. Guilbert; Robert L. Frantz, Daniel A. Freiberg, Philip M. Giudice, Hans-Friedrich Krausse, George F. Sanders, Jr., Robert W. Schafer, Ty Schuiling, Walter S. White, William V. Yarter

Engineering geology Edward J. Cording; Harold C. Ganow

Environmental geology John C. Frye; Robert E. Bergstrom, Keros Cartwright, Donald O. Doehring, Paul B. DuMontelle, Leon R. Follmer, Robert A. Griffin, John P. Kempton, David E. Lindorff, Ronald W. Tank

Forensic geology Daniel F. Merriam; Raymond C. Murray

General geology Rhodes W. Fairbridge; Hanna Bremer

Geochemistry John Hower; Isidore Adler, Daniel E. Appelman, Alan M. Gaines, Gordon L. Nord, Jr.

Geochronology Frances H. Brown; John R. Bowman

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Glaciers, snow, permafrost Robert F. Back, Jerry Brown, Anthony L. Gow, Joseph H. Hartshorn, Malcolm Mellor, Johannes Weertman, Wilford Weeks

History of geology Daniel F. Merriam; Cecil J. Schneer

Hydrology, hydrogeology Philip E. LaMoreaux; Charles Hains, Charles E. Herdendorf, Doyle B. Knowles, William J. Powell

Igneous and metamorphic petrology Richard V. Dietrich; Daniel S. Barker, Donald M. Burt, Bernard W. Evans, Grant H. Heiken, Richard A. Heimlich, Jean-Claude C. Mercier, Charles P. Thornton

Mathematical geology Daniel F. Merriam

Military geology Daniel F. Merriam; Arthur D. Howard

Mineralogy, crystallography Donald R. Peacor; Charles W. Burnham, Franklin F. Foit, Jr., R. Gaal

Oceanography, marine geology Orrin H. Pilkey, Jr.; Roger W. Baier, William J. Cleary, Larry J. Doyle, Robert M. Goll, George W. Lynts, William J. Neal

Paleobotany, palynology James M. Schopf; Arthur Cronquist, Robert M. Kosanke

Paleontologic names, taxonomy James M. Schopf; Stig M. Bergström, James W. Collinson, Nicholas Hotton III, Leslie F. Marcus

Paleontologic morphology Donald B. Macurda; Nicholas Hotton III, Roger Batten, Bruce Bell, William Berry, Richard Boardman, Alan Cheetham, Donald Baird, Al Fagerstrom, Carol Faul, R. M. Feldmann, Cris Hughes, Robert Jull, Robert V. Kesling, N. Gary Lane, Matthew Nitecki, John Pojeta, J. Keith Ribby, Albert Rowell, Charles Smith, James Sprinkle, Curt Teichert

Paleontology, paleoecology Roger J. Cuffey; Niles Eldredge

Petroleum geology and technology Jules Braunstein; James A. Hartman, Robert E. Sheriff; Al Singleton

Photogeology Daniel F. Merriam; Alden Colvocoresses, Robert G. Reeves

Sedimentary petrology Walter D. Keller; Harvey Blatt, Frank G. Ethridge, Robert L. Folk, Gerard V. Middleton, Robert F. Schmalz

Soils, weathering M. E. Harward; J. H. Huddleston, G. F. Kling

Stratigraphy Hollis D. Hedberg; William A. Berggren, William A. Cobban, James A. Helwig, Grant Steele

Structural geology, tectonics Winthrop D. Means; Clark B. Burchfiel, Kevin C. Burke, B. E. Hobbs, A. M. Celal Sengör, Edgar W. Spencer, P. F. Williams

Many geoscientists, not formally involved with this revision, have taken the time to send in corrections to the 1972 edition, call attention to new terms and definitions, and provide citations to the literature. Much of this material has filled gaps and has added appreciably to the completeness of the book.



A

aa (a'-a [ah'-ah])—A Hawaiian term for lava flows typified by a rough, jagged, spinose, clinkery surface. Cf: *pahoehoe*; *block lava*. Obs. syn: *aphrolith*.

Aalenian (Aa-le'-ni-an) Stage in Great Britain: lowermost Middle Jurassic or uppermost Lower Jurassic (above Yeovilian, below Bajocian).

AAR *accumulation-area ratio*.

a* axis That axis of a reciprocal crystal lattice which is perpendicular to (100). Cf: *b* axis*; *c* axis*.

a axis [cryst] One of the crystallographic axes used as reference in crystal description. It is the axis that is oriented horizontally, front-to-back. In an orthorhombic or triclinic crystal, it is usually the *brachy-axis*. In monoclinic crystals, it is the *clinoaxis*. The letter *a* usually appears in italics. Cf: *b axis*; *c axis*.

a axis [struc petrol] One of three orthogonal reference axes, *a*, *b*, and *c*, that are used in two distinct ways. (a) To help describe the geometry of a fabric possessing monoclinic symmetry. The unique symmetry plane is labelled the *a-c* plane, and *a* lies at the intersection of this plane with a prominent fabric surface. (b) In a kinematic sense, to describe a *deformation plan* that possesses monoclinic symmetry, such as progressive simple shear. In this case the *a* axis again lies in the unique plane of symmetry but parallel to the movement plane. It is the direction of maximum displacement and is commonly referred to as the direction of tectonic transport. In a progressive simple shear the *a* axis is the direction of shear. See also: *b axis*; *c axis*. Syn: *a direction*.

abactinal (ab-ac'-ti-nal) Referring to the *aboral* aspect; e.g. pertaining to the upper side of the test of an echinoid or to the side of a crinoid theca or plate opposite the oral surface. Ant: *actinal*.

abandoned channel (a-ban'-doned) (a) A drainage channel along which runoff no longer occurs, as on an alluvial fan. (b) *oxbow*.

abandoned cliff A sea cliff that is no longer undergoing wave attack, as a result of a relative drop of sea level or progradation at the cliff base.

abandoned meander *cutoff meander*.

abapertural (ab-ap-er'-tur-al) Away from the aperture of a gastropod, nautilus, or tentaculite shell. Ant: *adapertural*.

abapical (ab-ap'-i-cal) Away from the apex of a gastropod shell and toward the base, along the axis of spiral or slightly oblique to it.

abathochroal eye (ab-ath'-o-chro'-al) A trilobite eye superficially similar to a *schizochroal eye* but possessing no scleral projections.

abaxial (ab-ax'-i-al) Directed or facing away from, or situated on the outside of, the axis or center of the axis, as of an organ, plant, or invertebrate; dorsal or anterior. AL: -, said of the abaxial side. Ant: *adaxial*.

Abbe refractometer An instrument used for determining the refractive index of liquids, minerals, and gemstones. Its operation is based on measurement of the *critical angle*.

abbreviation (ab-bre'-vi-a'-tion) Loss of the final ontogenetic stages during the course of evolution.

ABC soil A soil with a distinctly developed profile, including A, B, and C horizons.

ABC system A method of correcting seismic data for the effect of irregular thickness of the surficial *low-velocity layer*. It is based on reciprocal placement of shot holes and seismometers.

abdomen (ab'-do-men) (a) The posterior and often elongated region of the body of an arthropod, behind the thorax or cephalothorax; e.g. the tagma following the thorax of a crustacean, including the telson, and consisting of seven or fewer segments; or the complete, usually unsegmented part of the body of an arachnid or merostome, following the cephalothorax. Cf: *opisthosoma*; *pygidium*. (b) The third joint of the shell of a nasselline radiolarian.—Pl: *abdomens* or *abdomina*. Adj: *abdominal*.

abelsonite (a'-bel-son-ite') A triclinic mineral: $C_{32}H_{36}N_4Ni$ (nickel

porphyrin).

aber The mouth of a river, or the confluence of two rivers. Etymol: Celtic.

abernathyite (ab-er-nath'-y-ite) A mineral: $K(UO_2)(AsO_4) \cdot 4H_2O$.

aberration (ab-er-ra'-tion) Any disturbance of the rays of a pencil of light such that they cannot be brought to a sharp focus or form a clear image.

AB interray Right anterior interray in echinoderms situated between A ray and B ray and clockwise of A ray when the echinoderm is viewed from the adoral side; equal to interambulacrum 3 of the Lovenian system.

abiogenesis (a-bi'-o-gen'-e-sis) The development of living organisms from lifeless matter. Cf: *biogenesis*.

abioglyph (a-bi'-o-glyph) A hieroglyph of inorganic origin (Vassoevich, 1953, p.38). Cf: *bioglyph*.

ablation [geomorph] (ab-la'-tion) Separation and removal of rock material, and formation of residual deposits, esp. by wind action or the washing away of loose and soluble materials. Most writers prefer to restrict the term to wasting of glaciers by melting and evaporation.

ablation [glaciol] (a) All processes by which snow and ice are lost from a glacier, floating ice, or snow cover. These processes include melting, evaporation (sublimation), wind erosion, and calving. Sometimes calving is excluded, or ablation may be restricted to surface phenomena. Cf: *accumulation [glaciol]*. (b) The amount of snow or ice removed by the process of ablation.—Syn: *wastage [glaciol]*.

ablation [meteorite] Removal of molten surface layers of meteorites and tektites by direct vaporization during flight through the atmosphere.

ablation area The part of a glacier or snowfield in which, over a year's time, ablation exceeds accumulation; the region below the *equilibrium line*. Cf: *accumulation area*. Syn: *zone of ablation*.

ablation breccia *solution breccia*.

ablation cave A *glacier cave*, a few meters in height and width, formed near a glacier terminus by circulating warm air, generally where a meltwater stream flows from beneath the ice.

ablation debris Rock material of all sizes, from blocks to clay, as isolated fragments or discontinuous piles on the glacier surface; not continuous enough to form *ablation moraine*. The term is also used for that material comprising ablation moraines.

ablation form A feature formed on a surface of snow, firn, or ice by melting or evaporation; e.g. *nieve penitente* or *ice pyramid*.

ablation funnel A closed depression, similar to a solution channel, formed by solution processes or by removal of particulate material by circulating ground water.

ablation gradient The change in ablation with altitude on a glacier, usually expressed as millimeters of water equivalent per meter of altitude. Also used incorrectly to specify change of net balance with altitude up to the equilibrium line. Cf: *activity index*.

ablation moraine An uneven pile or continuous layer of *ablation till* or *ablation debris*, either overlying ice in the ablation area or resting on ground moraine derived from the same glacier.

ablation rate The amount of ice or snow loss per unit time from a glacier, floating ice, or snow cover. Usually expressed in millimeters of water equivalent per hour or day.

ablation season *summer season*.

ablation till Loosely consolidated rock debris, formerly in or on a glacier, that accumulated in place as the surface ice was removed by ablation.

ablato-graph (ab-lat'-o-graph) An instrument that measures the distance through which the surface of snow, ice, or firn changes, because of *ablation* and *regelation* during a given period.

ablykite (ab'-lyk-ite) A clay-mineral material consisting of an

aluminosilicate of magnesium, calcium, and potassium. It resembles halloysite in its dehydration characteristics but differs from it in its thermal and X-ray diffraction properties. Syn: *ablikite*.

Abney level A hand level consisting of a short telescope, a movable bubble tube, and a graduated vertical arc to which a bubble is attached, and used to measure vertical angles. Named after William de Wiveleslie Abney (1843-1920), English physicist.

abnormal (ab-nor-mal) Said of an antyclinorium in which the axial surfaces of the subsidiary folds converge upwards; said of a synclinorium in which the axial surfaces of the subsidiary folds converge downwards. Cf. *normal* [fold].

aboral (ab-o'-ral) (a) Located opposite to or directed away from the mouth of an invertebrate; esp. applied to the *abactinal* surface (or to the structures on it) opposite that bearing the mouth and proximal ends of the ambulacral grooves of an echinoderm, or to the part of an echinoderm theca or plate directed away from the mouth (directed downward in an edrioasteroid). Cf. *adoral*. (b) Toward the underside of a conodont element; e.g. "aboral edge", "aboral groove", or "aboral attachment scar".—Ant. *oral*

aboral margin The trace of the aboral side of a conodont element in lateral view. The term has also been used for the aboral side itself.

aboral pole (a) The end of a flask-shaped chitinozoan that includes the chamber of the body and the base. Cf. *oral pole*. (b) The point of intersection of the oral-aboral axis with the aboral surface of the theca of echinoderms; it marks the center of the aboral surface.

aboral side The underside of a conodont element to which the basal plate is attached or onto which the basal cavity or attachment scar opens. Cf. *oral side*.

aboral surface Morphologically related unit of an edrioasteroid theca distal to the oral surface plates; commonly forms only part of the lower side of the individual.

aboriginal (ab-o-rig'i-nal) Said of the original race, fauna, or flora of a particular area, as distinguished from later immigrant or imported forms. Noun. *aborigine*.

abrasion (ab-ra-sion) The mechanical wearing, grinding, scraping, or rubbing away or down of rock surface by friction and impact, in which the solid rock particles transported by wind, ice, waves, running water, or gravity are the tools of abrasion. The term *corrasion* is essentially synonymous. Also, an abraded place or the effect of abrading such as the abrasion left by glacial action. Verb: *abrade*. Cf. *attrition*.

abrasion pH A term proposed by Stevens & Carron (1948) to designate the characteristic pH achieved by a suspension of a pulverized mineral in water, resulting from a complex of hydrolysis and dissolution reactions.

abrasion platform An extensive, gently seaward-sloping intertidal surface produced by long-continued wave erosions. Term introduced by D. W. Johnson (1916, p. 444), see also Bradley & Griggs (1976). Cf. *erosion platform*. See also *wave-cut platform*, *plain of marine erosion*.

abrasion shoreline *retrograding shoreline*

abrasion tableland A broad, elevated region in which the outcrops of various rocks have been reduced to nearly the same level by denuding agents (Stamp, 1961 p. 2).

abrasive [geomorph] (ab-ra-'sive) n. A rock fragment, mineral particle or sand grain used by natural agents in abrading rock material or land surfaces.—adj. Possessing the characteristics of a tool of grinding or mechanical wear

abrasiv [mater] Any natural or artificial substance suitable for grinding, polishing, cutting, or scouring. Natural abrasives include diamond, emery, garnet, silica sand, diatomite, and pumice; manufactured abrasives include esp. silicon carbide, fused alumina, and boron nitride

abrolhos A term used in Brazil for a mushroom-shaped barrier reef spreading widely near the surface. Etymol: Portuguese, "breakers pointed rock"

Absaroka sequence (Ab-sa-ro-ka) An informal lithostratigraphic unit in the North American craton that overlies an unconformity on Mississippi strata of the Kaskaskia sequence and underlies an unconformity overlain by Middle Jurassic or higher strata of the Zuni sequence (Sloss 1963)

absarokite (ab-sa-ro-'te) A basaltic rock composed of phenocrysts of olivine and clinopyroxene in a groundmass of labradorite with alkali feldspar rims, olivine, and some leucite. Absarokite grades into *shoshonite* with a decrease in the olivine content and with the presence of some dark-colored glass and into *banakite* with a decrease in the olivine and augite. It was named by Iddings

in 1895 from the Absaroka Range, Wyoming.

abscission (ab-'cis-'sion) Separation of plant parts, e.g. of a leaf from its stem, usually by cell-wall dissolution along a certain layer (*abscission layer*).

abscission layer The zone of cells, e.g. at the base of a petiole, along which separation of plant parts occurs. Syn: *separation layer*.

absite A thorian variety of brannerite.

absolute abundance (ab-'so-lute) The exact number of individuals of a taxon in a certain area or volume. See also: *abundance* [ecol]; *relative abundance*.

absolute age The *geologic age* of a fossil organism, rock, or geologic feature or event given in units of time, usually years. Commonly used as a syn. of *isotopic age* or *radiometric age*, but may also refer to ages obtained from tree rings, varves, etc. Term is now in disfavor as it implies a certainty or exactness that may not be possible by present dating methods, i.e. two absolute ages for the same pluton may disagree by hundreds of millions of years. Cf. *relative age*. Syn. *actual age*.

absolute age determination Calculation of *absolute age* usually but not always on the basis of radioactive isotopes. The ratio of decay products to parent products in the sample is calibrated to a certain number of years as in the *age equation*.

absolute chronology *Geochronology* in which the time-order is based on *absolute age*, usually measured in years by radiometric dating, rather than on superposition and/or fossil content as in *relative chronology*.

absolute date The date of an event usually expressed in years (*absolute age*) and related to a specific time scale.

absolute-gravity instrument A device for measuring the true value of gravity at a point. This type of measurement is much more difficult than relative determinations because all the physical influences must be evaluated with extreme accuracy. The measurements are accomplished by various forms of reversible pendulums or by timing the motion of a body in free fall. Cf. *relative-gravity instrument*.

absolute humidity The content of water vapor in air, expressed as the mass of water per unit volume of air. Cf. *relative humidity*.

absolute permeability The ability of a rock to conduct a fluid, e.g. gas, at 100% saturation with that fluid. See also: *effective permeability*, *relative permeability*.

absolute pollen frequency An estimate of the actual amount of pollen deposited per unit area in a given length of time, achieved by correcting the amount of pollen per gram of sediment by factors based on rate of sedimentation. Abbrev. APF.

absolute time *Geologic time* measured in years; specific time as determined by radioactive decay of elements. Jeletzky (1956 p. 681) proposed that the term be abandoned because its usage, based on criteria peculiar to the Earth and having the present part of geologic history as its starting point, is "incorrect and highly misleading". Cf. *relative time*, *mineral time*, *physical time*.

absolute viscosity *viscosity coefficient*.

Absonderung A term, now obsolete, applied by Leonhard in 1823 to the parting in igneous rocks that divides them into more or less regular bodies. The parting results from fractures that developed as a cooling phenomenon (Johannsen, 1939 p.163). Etymol. German, "separation, division".

absorbed water (ab-sorbed) (a) Water retained mechanically within a soil mass and having properties similar to those of ordinary water at the same temperature and pressure. (b) Water entering the lithosphere by any means. Cf. *adsorbed water*.

absorbing well (ab-sorb-'ing) *drainage well*.

absorptance (ab-sorp-'tance) The ratio of the energy absorbed by a material to that incident upon it. Syn. *absorption coefficient*.

absorption (ab-so-'p-'tion) Taking up, assimilation, or incorporation, e.g. of liquids in solids or of gases in liquids. Cf. *adsorption*. Syn. *occlusion*.

absorption [grd wat] The entrance of surface water into the lithosphere by any method. Verb: *to absorb*. Cf. *adsorption*.

absorption [optics] The reduction of light intensity in transmission through an absorbing substance or in reflection from a surface. In crystals the absorption may vary with the wavelength or vibration direction of the transmitted light.

absorption [phys] Any mechanism by which energy, e.g. electromagnetic or seismic, is converted into heat.

absorption band The wavelength interval at which electromagnetic radiation is absorbed by the atmosphere or by other media, e.g. an atmospheric absorption band at 5 to 8 μm . caused by water

vapor that absorbs thermal infrared radiation of those wavelengths. Cf: *absorption spectrum*; *absorption line*.

absorption coefficient *absorbance*.

absorption edge The wavelength at which there is an abrupt change in the intensity of an *absorption spectrum*. The term is usually applied to X ray spectra.

absorption line Any of the dark lines in the *absorption spectrum* of a substance due to certain wavelengths in the spectrum being selectively absorbed on passing through a medium. Cf: *absorption band*.

absorption loss Water lost through absorption by rock and soil during the initial filling of a reservoir.

absorption spectroscopy The observation of an *absorption spectrum* and all processes of recording and measuring that go with it.

absorption spectrum The array of absorption bands or lines seen when a continuous spectrum is transmitted through a selectively absorbing medium. Cf: *atomic absorption spectrum*.

absorptivity (ab-sorp-tiv'ity) The ability of a material to absorb energy incident upon it.

abstraction [streams] (ab-strac'tion) The merging of two or more subparallel streams into a single stream course, as a result of competition between adjacent consequent gullies and ravines, as by the deepening and widening of one channel so that it absorbs a shallower and smaller one nearby; the simplest type of *capture*. It usually occurs at the upper end of a drainage line. Syn: *stream abstraction*.

abstraction [water] That part of precipitation that does not become direct runoff (e.g. interception, evaporation, transpiration, depression storage, infiltration). Cf: *precipitation excess*; *rainfall excess*.

abtragung The part of degradation not resulting directly from stream erosion, i.e. preparation and reduction of rock debris by weathering and transportation of waste (Von Engel, 1942, p. 265). Etymol: German *Abtragung*, "degradation; denudation".

abukumalite (ab-u-ku-ma lite) *britholite*-(Y).

Abukuma-type facies series (Ab-u-ku'-ma) Rocks produced in a type of dynamothermal regional metamorphism named after the Central Abukuma plateau of Japan, and characterized by the index minerals (in order of increasing metamorphic grade) biotite - andalusite - cordierite - sillimanite, representing the greenschist and amphibolite or hornblende-hornfels facies. Pressures are rather low, approaching those in contact metamorphism, i.e. 2500-3500 bars (Hietanen, 1967, p.182). Cf: *Buchan-type facies series*.

abundance [ecol] (a-bun'-dance) In ecology, the number of individuals of a particular taxon in a certain area or volume of sediment. See also: *absolute abundance*; *relative abundance*.

abundance [geochem] The mean concentration of an element in a geochemical reservoir, e.g. the abundance of Ni in meteorites, or the crustal abundance of oxygen. Also used for relative average content, e.g. the order of abundance of elements in the Earth's crust is O, Si, Al, Fe, Ca, etc.; the estimated cosmic abundance of Li in atoms per 10,000 atoms of Si is 1.0 (Suess & Urey, 1956).

abundance zone A *biozone* characterized by quantitatively distinct maxima of relative abundance of one or more taxa (NACSN, 1983, Art. 52). It is essentially the same as *acme zone*, q.v.

abundant (a-bun'-dant) In the description of coal constituents, 30-60% of a particular constituent occurring in the coal (ICCP, 1963). Cf: *rare*; *common*; *very common*; *dominant*.

abyss [geomorph] (a byss') *chasm*.

abyss [oceanog] *deep [oceanog]*.

abyssal [intrus rocks] (a-bys'-sal) Pertaining to an igneous intrusion that occurs at considerable depth, or to the resulting rock; *plutonic*. Cf: *hypabyssal*.

abyssal [lake] Pertaining to the zones of greatest depth in a lake at which the water is "stagnant" or has a uniform temperature.

abyssal [oceanog] Pertaining to the ocean environment or *depth zone* of 500 fathoms or deeper; also, pertaining to the organisms of that environment.

abyssal benthic Pertaining to the benthos of the abyssal zone of the ocean. Syn: *abyssobenthic*.

abyssal cone A type of *submarine fan*.

abyssal deposit *pelagic deposit*.

abyssal fan *submarine fan*.

abyssal gap A passage that connects two abyssal plains of different levels, through which clastic sediments are transported. Syn: *gap [marine geol]*.

abyssal hill A common low-relief feature of the ocean floor, usually found seaward of abyssal plains and in basins isolated by ridges, rises, or trenches. Abyssal hills range up to several hundred meters in height and several kilometers in diameter. About 85% of the Pacific Ocean floor and 50% of the Atlantic Ocean floor are covered by abyssal hills.

abyssal injection The rising of plutonic magma through deep-seated contraction fissures.

abyssal pelagic Pertaining to the open-ocean or pelagic environment at abyssal depths. Syn: *abyssopelagic*.

abyssal plain A flat region of the ocean floor, usually at the base of a continental rise, whose slope is less than 1:1000. It is formed by the deposition of turbidity-current and pelagic sediments that obscure the preexisting topography.

abyssal theory A theory of mineral-deposit formation involving the separation and sinking of minerals below a silicate shell during the cooling of the Earth from a liquid stage, followed by their transport to and deposition in the crust as it was fractured (Shand, 1947, p.204). Modern thought has completely negated such theories.

abyssal tholeiite *oceanic tholeiite*.

abyssobenthic (a-byss'-o-ben'thic) *abyssal benthic*.

abyssolith (a-byss'-o-lith) *batholith*.

abyssopelagic (a-byss'-o-pe-lag'-ic) *abyssal pelagic*.

acacialite (a-ca'-di-a-lite') A flesh-red variety of chabazite, found in Nova Scotia.

Acadian (A-ca'-di-an) North American provincial series: Middle Cambrian (above Georgian, below Potsdamian). Obsolete syn. of *Alberian*.

Acadian orogeny A Middle Paleozoic deformation, especially in the northern Appalachians; it is named for Acadia, the old French name for the Canadian Maritime Provinces. In Gaspé and adjacent areas the climax of the orogeny can be dated by limiting strata as early in the Late Devonian, but deformational, plutonic, and metamorphic events were prolonged over a more extended period; the last two have been dated radiometrically as between 330 and 360 m.y. ago. The Acadian had best be regarded, not as a single orogenic episode, but as an orogenic era in the sense of Stille. Cf: *Antler orogeny*.

acantharian (ac-an-tha'-ri-an) Any radiolarian belonging to the suborder Acantharina, characterized by a centrogenous skeleton composed of strontium sulfate and a central capsule enclosed by a thin simple membrane.

acanthine septum (a-can'-thine) A corallite septum composed of a vertical or steeply inclined series of *trabeculae* and commonly marked by spinose projections along the axially directed margin of the septum.

acanthite (a-can'-thite) A monoclinic mineral: Ag₂S. It is dimorphous with argentite and constitutes an ore of silver.

Acanthodii (Ac-an-tho'-di-i) A subclass of the Osteichthyes characterized by fixed paired fins supported anteriorly by spines; more than two pairs are usually present. It includes the oldest recorded gnathostomes (Upper Silurian). Stratigraphic range, Upper Silurian to Lower Permian.

acanthopore (a-can'-tho-pore) A small rodlike skeletal structure, originally believed to be hollow, consisting of a solid core surrounded by a sheath of cone-in-cone laminae lying within zoecial walls or extrazoidal skeleton in stenolaemata bryozoans. Acanthopores form spinelike projections at the colony surface.

acanthostyle (a-can'-tho-style) A monaxonic sponge spicule (*style*) covered with short or tiny spines over most of its surface.

acanthus (a-can'-thus) A secondary deposit in the chamber floor of certain foraminifers (such as *Endothyra*), sharply pointed but not curved toward the anterior (TIP, 1964, pt.C, p.58). Pl: *acanthi*.

acarid (ac'-a-rid) Any arachnid belonging to the order Acarida, characterized by the absence of abdominal segmentation but with subdivision of the body into a proterosoma and hysterosoma. Their stratigraphic range is Devonian to present.

acaustobiolith (a-caust'-o-bi'-o-lith) A noncombustible organic rock, or a rock formed by the organic accumulation of purely mineral matter (Grabau, 1924, p. 280). Cf: *caustobiolith*.

acaustophytolith (a-caust'-o-phy'-to-lith) An *acaustobiolith* formed by plant activity; e.g., a pelagic ooze containing diatoms, and a nullipore reef or limestone.

accelerated development (ac-cel'-er-at'-ed) The production of a landscape where the rate of uplift is more rapid than the rate of downward erosion or where valley deepening exceeds valley widening, characterized by an increase of the relative relief and the

formation of convex slopes. Cf: *declining development*; *uniform development*. Syn: *waxing development*; *ascending development*.

accelerated erosion Erosion occurring in a given region at a greater rate than *normal erosion*, usually brought about by the influence of man's activities in disturbing or destroying the natural cover, thus sharply reducing resistance of the land surface and rate of infiltration. It may result from deforestation, improper cultivation of soil, dry-farming, overgrazing of rangelands, burning and clearance of natural vegetation, excavation for buildings and highways, urbanization of drainage areas, strip mining, or copper smelting; and by nonhuman influences, such as lightning or rodent invasion.

acceleration (ac-cel'-er-a'-tion) (a) During evolution, the appearance of modifications earlier and earlier in the life cycle of successive generations; adult characters of the ancestor appear earlier in immature stages of the descendants (*tachygenesis*), sometimes to the point that certain steps are omitted (*brachygenesis*). (b) In Paleozoic corals, the addition of more secondary septa in one pair of quadrants than in the other pair.

acceleration due to gravity The acceleration of a freely falling body in a vacuum as a result of gravitational attraction. Although its true value varies with altitude, latitude, and the nature of the underlying rocks, the standard value of 980.665 cm/sec² has been adopted by the International Committee on Weights and Measures.

accelerometer (ac-cel'-er-om'-e-ter) A seismometer whose response is linearly proportional to the acceleration of the earth materials with which it is in contact.

accented contour (ac'-cent-ed) *index contour*.

accessory [mineral] (ac-ces'-so-ry) *accessory mineral*.

accessory [paleont] adj. Said of a secondary or minor element of an ammonoid suture; e.g. "accessory lobe" or "accessory saddle". Cf: *auxiliary*. —n. Such a lobe or saddle.

accessory [pyroclast] Said of pyroclastics that are formed from fragments of the volcanic cone or earlier lavas; it is part of a classification of volcanic ejecta based on mode of origin, and is equivalent to *resurgent ejecta*. Cf: *essential*; *accidental*. See also: *cognate [pyroclast]*.

accessory aperture An opening in the test of a planktonic foraminifer that does not lead directly into a primary chamber but extends beneath or through accessory structures (such as bullae and tegilla); e.g. a *labial aperture*, an *infralaminar accessory aperture*, and an *intralaminar accessory aperture*.

accessory archeopyle suture An *archeopyle suture* that consists of a short cleft in the wall adjacent to the principal suture, or that may be more fully developed on the operculum of the dinoflagellate cyst, dividing that structure into two or more separate pieces.

accessory comb The line of large cilia within the preoral cavity in a tintinnid.

accessory element trace element.

accessory mineral A mineral whose presence in a rock is not essential to the proper classification of the rock. Accessory minerals generally occur in minor amounts; in sedimentary rocks, they are mostly *heavy minerals*. Cf: *essential mineral*. Syn: *accessory [mineral]*.

accessory muscle (a) A convenient noncommittal term for any muscle of a bivalve mollusk (other than an adductor muscle or a muscle withdrawing marginal parts of the mantle) of uncertain origin and having a scar of attachment to the shell. (b) One of a pair of diductor muscles branching posteriorly and ventrally from the main diductor muscles of a brachiopod and inserted in the pedicle valve posterior to the adductor bases (TIP, 1965, pt.H, p.139).

accessory spore A spore present in a rock only in very small quantities. Accessory spores may contain types with a restricted range and they have been used for correlation and for zoning (as of coal measures).

accident (ac'-ci-dent) (a) A departure from the normal cycle of erosion, caused by events that occur "arbitrarily as to place and time", such as climatic changes and volcanic eruptions (Davis, 1894). Cf: *interruption*. (b) An event, such as drowning, rejuvenation, ponding, or capture, that interferes with or entirely puts an end to, the normal development of a river system (Scott, 1922, p. 188). (c) An irregular feature in, or an undulation of, a land surface.

accidental (ac-ci-den'-tal) Said of pyroclastics that are formed from fragments of nonvolcanic rocks or from volcanic rocks not related to the erupting volcano; it is part of a classification of

volcanic ejecta based on mode of origin, and is equivalent to *allothigenous* ejecta. Cf: *cognate*; *accessory*; *essential*. Syn: *noncognate*.

accidental error An unpredictable error that occurs without regard to any known mathematical or physical law or pattern and whose occurrence is due to chance only; e.g. an error ascribed to uncontrollable changes of external conditions. Syn: *random error*.

accidental inclusion xenolith.

accidental relief Rugged and irregular relief; probably a literal translation of the common French term *relief accidenté* (Stamp, 1961, p. 4).

acclimation (ac-cli-ma'-tion) *acclimatization*.

acclimatization (ac-cli'-ma-ti'-za'-tion) Physiologic adjustment by an organism to a change in its immediate environment. Syn: *acclimation*.

acclinal (ac-cli'-nal) A syn. of *cataclinal*. Term used by Powell (1873, p. 463). Not to be confused with *acinal*.

acclivity (ac-cliv'-i-ty) A slope that ascends from a point of reference. Ant: *declivity*.

accordance of summit levels (ac-cord'-ance) *summit concordance*.

accordant (ac-cord'-ant) Said of topographic features that have the same or nearly the same elevation; e.g. an *accordant* valley whose stream enters the main stream at the same elevation as that of the main stream. Ant: *discordant*.

accordant drainage Drainage that has developed in a systematic relationship with, and consequent upon, the present geologic structure. Ant: *discordant drainage*. Syn: *concordant drainage*.

accordant fold One of several folds having similar orientation.

accordant junction The joining of two streams or two valleys whose surfaces are at the same level at the place of junction. See also: *Playfair's law*. Ant: *discordant junction*. Syn: *concordant junction*.

accordant summit level A hypothetical level or gently sloping surface that regionally intersects hilltops or mountain summits. Accordant summit levels in a region of high topographic relief suggest that the summits are remnants of an erosion plain formed in a previous erosion cycle. See also: *summit concordance*; *even-crested ridge*. Syn: *concordant summit level*.

accordant summits Hilltops or mountain peaks that regionally reach the same hypothetical level or gently sloping surface. The term cannot be used in the singular.

accordion fold (ac-cor'-di-on) An old term, formerly used with genetic significance; now sometimes used as a syn. of *kink fold*. See also: *zigzag fold*; *chevron fold*. Syn: *angular fold*; *concertina fold*.

accreting plate boundary (ac-cret'-ing) A boundary between two plates that are moving apart, with new oceanic-type lithosphere being created at the seam (Dennis & Atwater, 1974, p. 1033). See also: *mid-oceanic ridge*. Syn: *divergent plate boundary*.

accretion [planet] (ac-cre'-tion) The process whereby small particles and gases in the solar nebula came together to form larger bodies, eventually of planetary size.

accretion [sed] (a) The gradual or imperceptible increase or extension of land by natural forces acting over a long period of time, as on a beach by the washing-up of sand from the sea or on a flood plain by the accumulation of sediment deposited by a stream. Legally, the added land belongs to the owner of the land to which it is added. Cf: *avulsion*; *reliction*. See also: *lateral accretion*; *vertical accretion*. Syn: *aggradation*; *alluvion*. (b) The land so added or resulting from accretion. (c) *continental accretion*.

accretion [sed struc] (a) The process by which an inorganic body increases in size by the external addition of fresh particles, as by adhesion. (b) A *concretion*; specif. one that grows from the center outward in a regular manner by successive additions of material (Todd, 1903). (c) Deposition of eolian sand on a continuous sand surface because of a decrease in wind intensity or an increase in surface roughness (Bagnold, 1941, p. 127).

accretion [stream] The filling-up of a stream bed, due to such factors as silting or wave action. Cf: *degradation [stream]*.

accretion [struc geol] The addition of island-arc or microcontinental material to a continent by convergent and transform motion, i.e. by collision and welding or suturing. Locally, very large volumes of material, containing slivers of ophiolite, are added by accretion, e.g. the Barbados wedge complex. Cf: *continental accretion*. Syn: *tectonic accretion*.

accretionary (ac-cre'-tion-a'-ry) Tending to increase by external addition or accumulation; esp. said of a secondary sedimentary structure produced by overgrowth upon a preexisting nucleus,

such as a rounded form that originated through rolling, or said of a limestone formed in place by slow accumulation of organic remains.

accretionary lapilli More or less spherical masses, mostly between 1 mm and 1 cm in diameter, of cemented ash; the cementation is often weak. Formed by accretion of particles around wet nuclei, e.g. raindrops falling through a cloud of ash (Macdonald, 1972, p. 133). Syn. for individual mass: *pisolite* [volc]; *tuff ball*.

accretionary lava ball A rounded mass, ranging in diameter from a few centimeters to several meters, formed on the surface of a lava flow such as aa, or on cinder-cone slopes, by the molding of viscous lava around a core of already solidified lava.

accretionary terrane An allochthonous mass of continental or oceanic material added to the margin of a craton by collision and welding. As most terranes are considered to have such a history, the term may be considered redundant. Syn: *accreted terrane*.

accretion ridge A beach ridge located inland from the modern beach, representing an ancient beach deposit and showing that the coast has been built out seaward (Fink, 1959, p. 111). It is often accentuated by the development of dunes.

accretion ripple mark An asymmetric ripple mark having a gentle and curved lee slope, with a maximum angle of dip less than the angle of repose, and composed of cross-strata without conspicuous sorting of particles (Imbrie & Buchanan, 1965, p.151 & 153). Cf. *avalanche ripple mark*.

accretion till *basal till*.

accretion topography A landscape built by accumulation of sediment.

accretion vein A type of vein in which the mineral deposit has been formed by repetition of channelway filling and reopening of the fractures.

accumulated discrepancy (ac-cu'-mu-lat'-ed) The sum of the separate discrepancies that occur in the various steps of making a survey or of the computation of a survey.

accumulation (ac-cu'-mu-la'-tion) (a) All processes that add snow or ice to a glacier, floating ice, or snow cover, including snowfall, condensation, avalanching, snow transport by wind, and freezing of liquid water. Syn: *nourishment* [glaciol]; *alimentation*. Cf. *ablation* [glaciol]. (b) The amount of snow and other solid precipitation added to a glacier or snowfield by the processes of accumulation.

accumulation area The part of a glacier or snowfield in which, over a year's time, accumulation exceeds ablation; the region above the equilibrium line. Cf. *ablation area*; *névé*. Syn: *firn field*; *accumulation zone*; *zone of accumulation* [snow].

accumulation-area ratio The ratio of accumulation area to total area of a glacier for any given year, used as a rough guide to the balance between accumulation and ablation. Abbrev: AAR.

accumulation mountain *mountain of accumulation*.

accumulation rate The amount of ice or snow gain per unit time to a glacier, floating ice, or snow cover. Usually expressed in millimeters of water equivalent per hour or day.

accumulation season *winter season*.

accumulation zone (a) *accumulation area*. (b) The area in which the bulk of the snow contributing to an avalanche was originally deposited. Syn: *zone of accumulation*.

accumulative rock (ac-cu'-mu-la'-tive) *cumulate*.

accumulator plant (ac-cu'-mu-la'-tor) In geobotanical prospecting, a tree or plant that preferentially concentrates an element.

accuracy (ac'-cu-ra-cy) The degree of conformity with a standard, or the degree of perfection attained in a measurement. Accuracy relates to the quality of a result, and is distinguished from *precision*, which relates to the quality of the operation by which the result is obtained.

AC demagnetization *alternating-field demagnetization*.

acequia (a-ce-qui'-á [ah-se-kee'-ah]) A Spanish word, of Arabic origin, for an irrigation ditch or canal.

acervuline (a-er'-vu-line) Heaped, or resembling little heaps; e.g. said of some foraminifers (such as *Acerulina*) having chambers in irregular clusters.

acetamide (ac-et-am'-ide, ac-et'-am-ide) A trigonal mineral: CH_3CONH_2 .

acetylsis (ac-e-tol'-y-sis) Any chemical reaction in which acetic acid plays a role similar to that of water in hydrolysis; e.g. a reaction used in maceration in which organic material such as peat is heated in a mixture of nine parts acetic anhydride and one part concentrated sulfuric acid. It breaks down cellulose especially vigorously.

ACF diagram A triangular diagram showing the simplified com-

positional character of metamorphic rocks and minerals by plotting the molecular quantities of the three components: $A = \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3 - (\text{Na}_2\text{O} + \text{K}_2\text{O})$; $C = \text{CaO} - 3.3\text{P}_2\text{O}_5$; and $F = \text{FeO} + \text{MgO} + \text{MnO}$. $A + C + F$ (in mols) are recalculated to 100%; the presence of excess SiO_2 is assumed. Cf. *AFM diagram*; *A'KF diagram*.

achene (a-chene') A dry one-seeded indehiscent fruit developed from a simple ovary with unfused seed coat and fruit wall. Also spelled: *akene*.

achlamydate (ach-lam'-y-date) Said of a gastropod without a mantle.

achosmitic (a-cho'-a-nit'-ic) Said of the condition in a nautiloid in which septal necks are vestigial or absent. Syn: *aneuchoanitic*.

achondrite (a-cho-n'-drite) A stony meteorite that lacks chondrules. Achondrites are commonly more coarsely crystallized than chondrites, and nickel-iron is almost completely lacking in most of them; they represent meteorites that are most like terrestrial rocks, with sizable fragments of various minerals visible to the naked eye. Adj: *achondritic*. Cf: *chondrite* [meteorite].

achroite (ach'-ro-ite) A colorless variety of tourmaline, used as a gemstone.

acicular [cryst] (a-cic'-u-lar) Said of a crystal that is needlelike in form. Cf: *fascicular*; *sagenitic*.

acicular [sed] Said of a sedimentary particle whose length is more than three times its width (Krynine, 1948, p.142). Cf: *platy*.

acicular ice Freshwater ice consisting of numerous long crystals and hollow tubes having variable form, layered arrangement, and a content of air bubbles; it forms at the bottom of an ice layer near its contact with water. Syn: *fibrous ice*; *satin ice*.

aciculate (a-cic'-u-late) Needle-shaped, or having a needlelike point; esp. said of a slender gastropod shell that tapers to a sharp point.

acid adj. (a) *silicic*. (b) *acidic*. (c) Said of a plagioclase that is sodic. **acid clay** A clay that yields hydrogen ions in a water suspension; e.g. "Japanese acid clay", a variety of fuller's earth occurring in Kambara, Japan.

acidic (a-cid'-ic) (a) A descriptive term applied to those igneous rocks that contain more than 60% SiO_2 , as contrasted with *intermediate* and *basic*. Sometimes loosely and incorrectly used as equivalent to *felsic* and to *oversaturated*, but these terms include rock types (e.g., nepheline syenite, quartz basalt) that are not generally considered acidic. This is not the chemist's usage; the term is deprecated by some because of its confusing nature. (b) Applied loosely to any igneous rock composed predominantly of light-colored minerals having a relatively low specific gravity. Cf: *felsic*. Syn: *acid*; *silicic*.

acidity coefficient (a-cid'-i-ty) *oxygen ratio*.

acidity quotient *oxygen ratio*.

acidization (ac'id-i-za'-tion) The process of forcing acid down a well into a limestone or dolomite, in order to increase permeability and porosity by dissolving a part of the rock constituents. It is also used to remove mud injected during drilling. The general objective of acidization is to increase oil productivity. Syn: *acid treatment*.

acid mine drainage Drainage with a pH of 2.0 to 4.5 from mines and mine wastes. It results from the oxidation of sulfides exposed during mining, which produces sulfuric acid and sulfate salts. The acid dissolves minerals in the rocks, further degrading the quality of the drainage water.

acid plagioclase A variety of plagioclase having a relatively high content of SiO_2 ; e.g. an Ab-rich member such as albite or oligoclase.

acid soil A soil with a pH of less than 7.0.

acid treatment *acidization*.

ac-joint A cross joint in folded sedimentary rock that is parallel to the fold axis.

acclinal (a-clin'-nal) A little-used term said of strata that have no inclination; horizontal. Not to be confused with *acclinal*.

acline A syn. of *orthocline* as used to describe the hinge teeth or shell body of a bivalve mollusk.

acline-A twin law *Manebach-Ala twin law*.

acline-B twin law A twin law for parallel twins in feldspar with twin axis *b* and composition plane (100). Cf: *x-Carlsbad twin law*.

acclinic line (a-clin'-ic) *magnetic equator*.

acme (ac'-me) That point in the phylogeny of a species, genus, or other taxon at which greatest abundance and/or variety occurs. See also: *paracme*.

acme zone A biozone consisting of "a body of strata representing the acme or maximum development — usually maximum abun-

dance or frequency of occurrence — of some species, genus; or other taxon but not its total range" (ISG, 1976, p. 59-60). It is named for the taxon whose zone of maximum development it delimits, e.g. *Didymograptus acme* zone. The corresponding geologic-time unit is *hemera*. Cf. *assemblage zone*; *ange zone*. Syn *abundance zone*; *epibole*; *flood zone*; *peak zone*.

acmite (ac'-mite) A brown or green mineral of the clinopyroxene group: $\text{NaFe}(\text{SiO}_3)_2$. It occurs in certain alkali-rich igneous rocks. Symbol: Ac. Syn: *aegirine*.

acmite-augite A mineral intermediate between augite and acmite; a variety of augite rich in sodium and ferric iron. Syn: *aegirine-augite*.

acmolith (ac'-mo-lith) *akmolith*.

acolate (a-col'-pate) Said of pollen grains without colpi. In practice, such pollen grains are sometimes difficult to distinguish from *alete* spores. Cf. *inaperturate*.

acoustic basement Generally the deepest more or less continuous seismic reflector, often an "acoustic unconformity", below which seismic energy returns are extremely poor to absent.

acoustic impedance The product of seismic velocity and density. Syn: *impedance [seis]*.

acoustic log Generic term for a *well log* that displays any of several measurements of acoustic waves in rocks exposed in a borehole, e.g. compressional wave transit time over an interval (*sonic log*) or relative amplitude (*cement-bond log*).

acoustics (a-cous'-tics) The study of sound, including its production, transmission, reception, and utilization, especially in fluid media such as air or water. With reference to Earth sciences, it is especially relevant to oceanography. The term is sometimes used to include compressional waves in solids, e.g. seismic waves.

acoustic wave A longitudinal wave. In common usage it is restricted to fluids such as air, but it often includes *P-waves* in the solid Earth. Syn: *sound wave*; *sonic wave*.

acquired character (ac-quired') A character not inherited but acquired by an individual organism during its lifetime as a result of use or disuse according to its mode of life or the conditions under which it lived.

acre A unit of land area used in U.S. and England, equal to 43,560 sq ft, 4840 sq yd, 160 square rods, 10 square chains, 1/640 square mile, or 0.405 hectare. It is based on an old unit thought to be equal to the amount of land that could be plowed by a yoke of oxen in a day.

acre-foot The volume of a one-acre area (43,560 square feet) one foot thick, or 43,560 cubic feet. It is the unit commonly used in measuring volumes of water or reservoir storage space, and in measuring the volume of *reservoir rock* in an oil or gas field. See also: *acre-inch*.

acre-inch The volume of water required to cover one acre to a depth of one inch. See also: *acre-foot*.

acrepid (a-cre'-pid) Said of a *desma* (of a sponge) that lacks an axial canal, implying that it was not formed about a *crepis*.

acre-yield The average amount of oil, gas, or water recovered from 1 acre of a reservoir.

acritarch (ac'-ri-tarch') A unicellular, or apparently unicellular, resistant-walled microscopic organic body of unknown or uncertain biologic relationship and characterized by varied sculpture, some being spiny and others smooth. Many if not most acritarchs are of algal affinity, but the group is artificial. They range from Precambrian to Holocene, but are esp. abundant in Precambrian and early Paleozoic. The term was proposed by Evitt (1963, p.300-301) as "an informal, utilitarian, 'catch-all' category without status as a class, order, or other suprageneric unit" consisting of "small microfossils of unknown and probably varied biological affinities consisting of a central cavity enclosed by a wall of single or multiple layers and of chiefly organic composition". See also: *hytrichosphaerid*; *dinoflagellate*.

acrobatholithic (ac'-ro-bath'-o-lith'-ic) Said of a mineral deposit occurring in or near an exposed batholith dome; also, said of the stage of batholith erosion in which that area is exposed (Emmons, 1933). The term is little used today. Cf. *cryptobatholithic*; *embatholithic*; *endobatholithic*; *epibatholithic*; *hypobatholithic*.

acrodont (ac'-ro-dont) adj. Pertaining to vertebrate teeth fused to the occlusal margins of upper and lower jaws.

acrolamella (ac'-ro-la-mel'-la) A leaflike extension of the leasurae of megasporae. Cf. *gula*; *apical prominence*. Pl: *acrolamellae*.

acrolobe (ac'-ro-lobe) The central portion of the cephalon or pygidium of agnostid trilobites in which the axial furrows are effaced.

acron The anteriormost part of the cephalon of a crustacean, carrying the eyes and antennules.

acrotretacean ac'-ro-tre-ta'-ce-an) Any inarticulate brachiopod belonging to the superfamily Acrotretacea, characterized by a conical to subconical, rarely convex, pedicle valve.

acrozone (ac'-ro-zone) *range zone*.

actinal (ac'-ti-nal) Referring to the oral aspect; e.g. pertaining to the under or mouth side of the test of an echinoid or to the side of a crinoid theca or plate containing the mouth. Ant: *abactinal*.

actine (ac'-tine) (a) One of the individual branches of the triaena or *triole* in the *ebriidian* skeleton. (b) A star-shaped spicule, as of a sponge.

actinium series (ac'-tin'-i-um) The radioactive series beginning with uranium-235.

actinodont (ac'-tin'-o-dont) Said of the dentition of certain bivalve mollusks of early origin having hinge teeth radiating from the beak (the outer teeth being more or less elongate).

actinolite (ac'-tin'-o-lite) A bright-green or grayish-green monoclinic mineral of the amphibole group: $\text{Ca}_2(\text{Mg}, \text{Fe})_2\text{Si}_8\text{O}_{22}(\text{OH})_2$. It may contain manganese. Actinolite is a variety of *asbestos*, occurring in long, slender, needlelike crystals and also in fibrous, radiated, or columnar forms in metamorphic rocks (such as schists) and in altered igneous rocks. Symbol: Ac. Cf. *tremolite*.

actinometer (ac'-tin-om'-e-ter) Any device that measures the intensity of radiation capable of effecting photochemical changes, particularly the radiation of the Sun. Actinometers may be classified according to the quantities they measure. See also: *pyrhelic meter*; *pyranometer*; *pyrg-ometer*.

actinomorphic ac'-tin-om-or'-phic) Said of an organism or organ that is radially symmetrical or capable of division into essentially symmetrical halves by any longitudinal plane passing through the axis. Cf. *zygomorphic*.

actinopod (ac'-tin'-o-pod) Any protozoan belonging to the class Actinopoda and characterized by protoplasmic extensions radiating from the spheroidal main body. Cf. *rhizopod*.

Actinopterygii (Ac'-ti-nop'-te-ryg'-i-i) A subclass of the Osteichthyes characterized by movable paired fins supported by bony rays; ray-finned fish. Range. Lower Devonian to present.

actinosiphonate (ac'-ti-no-si'-phon-ate) Said of endosiphonular structures of a nautiloid, consisting of radially arranged longitudinal lamellae.

actinostele (ac'-tin'-o-stele) A type of *stele* consisting of alternating or radial groups of xylem and phloem within a pericycle and having a star shape in cross section.

activation [clay] (ac-ti-va'-tion) The act or process of treating clay (such as bentonite) with acid so as to improve its adsorptive properties or to enhance its bleaching action, as for use in removing colors from oils.

activation [radioactivity] The process of making a substance radioactive by bombarding it with nuclear particles. The radioactivity so produced is called *induced radioactivity*.

activation analysis A method of identifying stable isotopes of elements in a sample by irradiating the sample with neutrons, charged particles, or gamma rays to render the elements radioactive, after which the elements are identified by their characteristic radiations. Cf. *neutron activation*. Syn: *radioactivation analysis*.

activation energy The extra amount of energy which any particle or group of particles must have in order to go from one energy state into another, such as changes in phase and movement of particles in diffusion. The greater the amount of energy involved, the higher the resistance to the change, or the *potential barrier*.

active (ac'-tive) Said of a karst feature that contains moving water, or that is still being developed by the action of water.

active cave *live cave*.

active channel A channel, on an alluvial fan, in which runoff flows.

active earth pressure The minimum value of lateral *earth pressure* exerted by soil on a structure, occurring when the soil is allowed to yield sufficiently to cause its internal shearing resistance along a potential failure surface to be completely mobilized. Cf. *passive earth pressure*.

active fault A fault along which there is recurrent movement, which is usually indicated by small, periodic displacements or seismic activity. Cf. *dead fault*; *capable fault*.

active glacier (a) A glacier that has an *accumulation area*, and in which the ice is flowing. Ant: *dead glacier*. (b) A glacier that moves at a comparatively rapid rate, generally in a maritime environment at a low latitude where accumulation and ablation