

牛津英语百科分类词典系列

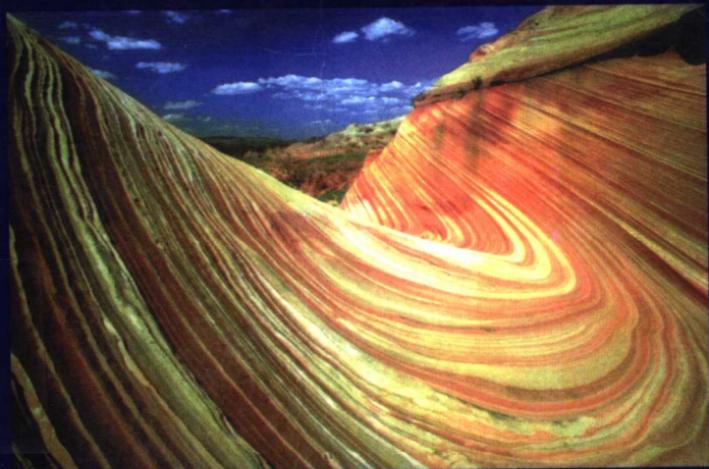


Oxford

DICTIONARY OF

EARTH SCIENCES

牛津地球科学词典



上海外语教育出版社
SHANGHAI FOREIGN LANGUAGE EDUCATION PRESS



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Oxford Dictionary of

Earth Sciences

牛津地球科学词典

Edited by

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and MICHAEL ALLBY



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出版说明

随着改革开放的不断深入以及国际交流的日趋广泛,外语学习已经不仅仅局限于语言技能的培养。通过英语获取专业知识、提高专业水平、跟踪学科的最新发展已经成为时代的要求。因此,目前国内急需一批用英语编纂的专业词典。

牛津英语百科分类词典系列是由牛津大学出版社组织编纂的一套工具书。该系列涉及语言学、文学、文化、艺术、社会学、数学、物理学、化学、生物学、医学、食品与营养、计算机等社会科学和自然科学门类近百种,均由造诣很深、经验丰富的专家撰写。作为第一批,我们从中精选了52本,以满足国内读者的需要。词典用浅显的英语,精确地解释了常用的专业词汇,充分体现了牛津大学出版社在出版工具书方面严谨的传统。

该系列词典可作为大专院校各专业的学生以及专业技术人员学习专业知识、提高专业英语能力的参考书。

本社编辑部

From the Preface to the First Edition

Setting intellectual boundaries that would serve to define 'geology' has never been simple. As long ago as 1830, in his *Principles of Geology*, Charles Lyell expressed the view that geologists should be well versed in chemistry, natural philosophy, mineralogy, zoology, comparative anatomy, and botany. For at least a century and a half those who would study the structure and composition of the Earth have had to familiarize themselves with a wide range of scientific disciplines.

Strictly speaking, the word 'geology' describes all studies of the Earth. Traditionally, however, 'geology' has come to mean the study of rocks.

T. C. Chamberlin used the name 'Earth sciences' to embrace astronomy, cosmogony, and cosmology as well as the traditional disciplines, and Alfred Wegener (originally a meteorologist) also used it, but it was not until the 1960s that it began to gain a wider currency. Within ten years it was widely accepted, used sometimes in the singular, nowadays commonly in the plural. When, in the late summer of 1985, our friends at the Oxford University Press invited us to compile a dictionary of terms used in the topics directly related to studies of the Earth, it was clear that it should be a dictionary of 'Earth sciences'.

We had to begin by defining the term for our own purpose. We examined the way it was used by other authors, assembled a kind of consensus, and determined that our dictionary should include terms from climatology, meteorology, economic geology, engineering geology, geochemistry, geochronology, geomorphology, geophysics, hydrology, mineralogy, oceanography, palaeoclimatology, palaeoecology, palaeogeography, palaeontology, pedology, petrology, the philosophy and history of the Earth sciences including brief biographical notes of important figures, planetary geology, sedimentology, stratigraphy, structural geology, tectonics, and volcanology.

The task of a dictionary is descriptive, not prescriptive. It records words and expressions that are in current use and explains the meanings attached to them, but it does not impose those meanings or seek to dictate what a correct usage should be. As recorders, we express no opinions.

We would emphasize that the book is meant to be used as a dictionary. In no sense is it intended to be a textbook in its own right.

Preface to the Second Edition

Work on the first edition of *The Concise Oxford Dictionary of Earth Sciences* was completed in the summer of 1988, and the book was published in 1990. Many changes and advances have occurred during the years that have passed since the initial compilation and we are glad to have been given the opportunity to take account of them in a second edition.

The revision has been extremely thorough. Every entry from the first edition has been scrutinized and many have been amended to bring them up to date. A

few entries have been removed as no longer relevant, but many new definitions have been added.

It is in the nature of dictionaries to grow longer with each revision and we do not apologize for the fact that ours conforms to this rule. Such growth is unavoidable, because the language itself is growing. The introduction of a new word or expression does not mean an earlier term has been discarded, as it were to make room for it. Old words survive and while they remain in use we are bound to define them.

Most of the additions have been generated by advances in planetary exploration and the search to identify new reserves of petroleum and natural gas. Planetary exploration has discovered many new satellites and smaller bodies within the solar system and has revealed previously unknown details about the more familiar planetary satellites. This has required us to augment the number of entries devoted to the solar system. Simply listing satellites and explaining the meaning of 'asteroid' and 'comet' is no longer adequate. Satellites have qualities that may now be summarized, and at least some of the minor bodies have names and known dimensions. In pursuing this exploration, new space vehicles have carried new instruments. We have provided some details about the more important space missions, including some that are still in the planning stage, and have defined some of the devices and techniques used.

Space exploration has an immediate influence on the Earth sciences through the use of satellites for observation. We have listed some of the more important satellites and remote-sensing techniques.

Advances in the methods used in petroleum exploration have led to rapid developments in the relatively new discipline of sequence stratigraphy, which has acquired a vocabulary of its own. It has also focused considerable attention on the study of trace fossils and the branch of taxonomy devoted to them. We have defined the terms most widely used in both sequence stratigraphy and ichnology.

Those may have been the main source areas for new terms requiring definition, but they are not the only ones. The discovery of communities of living organisms that thrive in extreme environments, such as those adjacent to hydrothermal vents, has led to important revisions in the scientific classification of organisms in general, with implications for evolutionary science that have influenced palaeontological ideas. These, too, we have aimed to accommodate.

We have retained the system of cross-referencing used in the first edition, but have made two innovations. We have consigned to appendices material that is best displayed in tables, such as time-scales. This makes the information they contain easier to find and use than it was when they appeared in the main body of the text. We have also added a small number of illustrations. Generally, a dictionary is about words and their uses and should use words to explain the meaning of words. There are occasions, however, when a simple diagram can usefully illustrate essentially visual ideas.

The first edition was compiled with the help of many contributors and advisers. The value of their hard work endures, and we fully acknowledge it, for without it there would have been no dictionary to revise. In preparing the first edition we were greatly helped by Professor Hubert Lamb. His contribution remains, but sadly he died in 1997. He was always friendly and unstinting in the trouble he took on our behalf. He is much missed.

In preparing the new edition we have been assisted by Dr Robin Allaby. His contribution has greatly strengthened the revision and we are very grateful for his help.

We also wish to thank Professor D. H. Tarling and Dr C. D. Gribble. They each scrutinized a long list of entries, revising them where necessary.

Finally, we thank Nigel May, the science librarian at the library of the University of Plymouth, for allowing us to make use of the library facilities.

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牛津植物学词典 *Oxford Dictionary of Plant Sciences*

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A

aa See LAVA.

AABW See ANTARCTIC BOTTOM WATER.

AAC See ANTARCTIC CONVERGENCE.

Aalenian A *stage in the European Middle *Jurassic (178–173.5 Ma, Harland et al., 1989). See also DOGGER.

AAV See AGGREGATE TESTS.

Ab See ALKALI FELDSPAR.

abapical A directional term meaning away from the shell *apex.

abaptation The process by which an organism is fitted to its environment as a consequence of the characters it inherits, which have been filtered by *natural selection in previous environments. Because present environments seldom differ greatly from recent past environments, adaptive fitness can resemble *adaptation. In this sense, however, adaptation appears to imply advance planning, or design, which is misleading.

abandoned channel A former stream channel through which water no longer flows (e.g. a *cut-off).

abandonment facies association A *facies association formed under conditions of rising sea level, when *clastic deposition has ceased and sediment is deposited very slowly.

Abbé refractometer See REFRACTOMETER.

abiogenesis Development of living organisms from non-living matter; as in the supposed origin of life on Earth, or in the concept of spontaneous generation, which was once held to account for the origin of life but which modern understanding of evolutionary processes (see EVOLUTION) has rendered outdated.

abiotic Non-living; devoid of life. Compare BIOTIC.

ablation 1. Removal of snow and ice by melting and by direct alteration from the solid to the gaseous phase (sublimation). The rate of loss is controlled chiefly by air temperature, wind velocity, *humidity, rainfall, and *solar radiation. Ablation on

snowfields is also influenced by aspect, depth of snow, and the nature of the underlying surface. Ablation *till is the glacial debris that may be released. The ablation zone of a glacier is that area in which losses, including *calving, exceed additions. **2.** Removal of *rock material, especially by wind action.

ablation till See ABLATION 1; and TILL.

ablation zone See ABLATION.

aboral Away from the mouth; on the opposite side of the body from the mouth.

abrasion (corrasion) The erosive (see EROSION) action that occurs when *rock particles of varying size are dragged over or hurled against a surface. Some common agents of abrasion are the *bed load of streams, rock debris embedded in the bases of *glaciers, and *sand and *shingle transported by wind or waves.

absolute age (true age) The age of a geologic phenomenon measured in present Earth years, rather than its age relative to other geologic phenomena (compare RELATIVE AGE). The term 'absolute age' has been considered rather misleading, as the means for measuring ages (*radiometric dating, *dendrochronology, *varve analysis) are subject to experimental error and the dates obtained are not precise. The alternative term 'apparent age' has been suggested. See also DATING METHODS; and GEOCHRONOLOGY.

absolute humidity See HUMIDITY.

absolute plate motion The motion of a lithospheric *plate (see LITHOSPHERE) with respect to a fixed frame of reference. Various frames of reference have been used, including those defined by *hot spots, no net torque of all the plates, and palaeomagnetic (see PALAEO-MAGNETISM) Euler poles (see POLE OF ROTATION).

absolute pollen frequency (APF) *Pollen data from sediments, expressed in terms of the absolute numbers for each *species, *genus, or *family, per unit volume of sediment and, where deposition rates are known, per unit time. In certain circumstances this approach gives clearer

information than does the traditional way of expressing pollen data as *relative pollen frequencies (RPF). APFs are particularly useful in site comparisons in which one or more high pollen producers vary. For example, when trees first appear in the regional pollen rain their prolific pollen may, in an RPF method, give the impression of declining herbaceous species, whereas examination by an APF method will show constant values for herb species.

absolute porosity See POROSITY.

absolute temperature Temperature measured using the *Kelvin scale.

absolute vorticity See VORTICITY.

absolute zero See KELVIN SCALE.

absorptance The ability of a material to absorb *electromagnetic radiation of a specified wavelength. See also ABSORPTANCE BAND.

absorptance band The range of wavelengths of *electromagnetic radiation which are absorbed by a material. See also ABSORPTANCE.

absorption The amount of seismic energy lost during transmission, by conversion to heat. The absorption coefficient is the fractional loss of energy over a distance of one *wavelength; hence higher-*frequency signals are attenuated more readily than those of lower frequencies over the same path. Typical values for *rocks range from 0.25 to 0.75 dB per wavelength.

abstraction (extraction) The artificial removal of water from a well, *reservoir, or river.

Abukama-type metamorphism The *recrystallization of *rocks under a high *geothermal gradient so that at any given temperature the pressure is relatively low. The term originally referred to a belt of *metamorphic rocks stretching southwestwards from the Abakuma Plateau in Japan, and characterized by the development of *andalusite and *sillimanite in rocks that were originally *shales (*pelites). This belt lies parallel to, and on the continental side of, a high-pressure metamorphic belt.

abundance zone See ACME ZONE.

ABW See ARCTIC BOTTOM WATER.

abyssal hills Relatively small topographic features of a dominantly flat, deep-ocean

floor, commonly 50–250 m in height and a few kilometres in width. They are most typical of the *Pacific Ocean floor at depths of 3000–6000 m.

abyssal plain Smooth, almost level area of the deep-ocean floor in which the gradient is likely to be as low as 1 : 10 000. The covering sediments are usually thin deposits of a *pelagic ooze or *distal *turbidite.

abyssal storm (benthic storm) A large pulse of energy, possibly transferred from the surface, that accelerates *contour currents on the ocean floor to about 40 cm/s, raising large amounts of fine sediment.

abyssal zone Zone of greatest ocean depth, i.e. below a depth of 2000 m. This zone lies seaward of, and deeper than, the *bathyal zone, and covers approximately 75% of the total ocean floor. It is the most extensive Earth environment, cold, dark, with slow-moving currents (less than a few centimetres per second), supporting *fauna that typically are black or grey, delicately structured, and not streamlined.

Acadian orogeny A phase of mountain building affecting an area from the northern Appalachians in what is now New York State to the Bay of Fundy in maritime Canada (the name refers to the colony of Acadie in that region of French Canada). It occurred in the *Devonian about 380 Ma ago, although the precise date and duration are uncertain, and was most intense east of the Taconic area (see TACONIC OROGENY). It was caused by the westward movement of the Avalon *terrane. See APPALACHIAN OROGENIC BELT.

Acado-Baltic Province See ATLANTIC PROVINCE.

acanthodians See ACANTHODII.

Acanthodii (acanthodians) Class of primitive, fossil fish, characterized by the presence of a true bony skeleton (see BONE), a *heterocercal tail *fin, a persistent *notochord, *ganoid scales, and stout spines in front of the fins. The acanthodians lived from the *Silurian to the *Permian Period and may be related to ancestors of the more modern bony fish.

Acanthograptidae See DENDROIDEA.

Acanthostega See ICHTHYOSTEGA.

acceleration *Evolution that occurs by increasing the rate of ontogenetic (see ONTOGENY) development, so that further stages

can be added before growth is completed. This form of *heterochrony was proposed by E. H. Haeckel as one of the principal modes of evolution.

acceleration, gravitational See GRAVITATIONAL ACCELERATION.

accelerometer A device whose output is directly proportional to acceleration. Accelerometers are used in the measurement of the motion of a ship, helicopter, or aircraft during *gravity surveys. A *seismometer or moving-coil *geophone can also function as an accelerometer.

accessory, lithic See LITHIC FRAGMENT.

accessory mineral A *mineral *phase within a rock whose presence does not affect the root name of the rock. For instance, the root name 'granite' is defined by the presence of *quartz, *alkali feldspar, and *mica. These are the '*essential minerals'. The presence of the mineral *sphene does not affect the root name and hence would be an example of an accessory mineral. *Apatite and *zircon are also common accessory minerals.

accessory plate (sensitive tint) In optical microscopy, a plate used to determine the optical properties of *minerals. *Quartz, *mica, and *gypsum are the common minerals used to determine the slow and fast *vibration directions that relate to the two *refractive indices of an *anisotropic mineral. The terms 'length-fast' and 'length-slow' may then be assigned to a given mineral for identification purposes. A wedge of quartz (quartz wedge) is used to determine the order of *interference colour exhibited by a mineral.

accidental lithic See LITHIC FRAGMENT.

accommodation space The space in which sediment may accumulate.

accordion fold See CHEVRON FOLD.

accretion 1. Process by which an inorganic body grows in size by the addition of new particles to its exterior. It is the mechanism by which primitive planetary bodies are believed to form as a result of the accumulation of minute, cold, homogeneous particles (homogeneous accretion). An alternative hypothesis is that iron-rich cores accumulated first and were later surrounded by silicate material (heterogeneous accretion). Homogeneous accretion yields a planet that initially has the same

composition from centre to surface; heterogeneous accretion yields a planet that has a layered structure from the start. **2.** The accumulation of sediments from any cause, representing an excess of deposition over *erosion. **3.** The addition of continental material to a pre-existing continent, usually at its edge. The use of 'accretion' in this sense has evolved from theories of *nucleation to newer theories of the horizontal addition of *allochthonous *terraces of initially coherent bodies of continental *rock, usually more than 100 km² in area, which can collide, rotate, and fragment as they become sutured to a continent.

accretional heating The heating of bodies orbiting a star due to bombardment by smaller objects, the kinetic energy of the impacting body ($\frac{1}{2}mv^2$, where *m* is mass and *v* velocity) being released mainly as heat.

accretionary lapilli Pellets of *ash, ranging in size from 2 mm to 64 mm, which commonly exhibit a concentric ('onion skin') internal structure. The *lapilli are formed by the accretion of very fine ash around condensing water droplets or solid particles, particularly in steam-rich eruptive columns (see ERUPTION). Once formed they can be transported and deposited by *pyroclastic fall, *surge, or flow processes.

accretionary levée See LAVA LEVÉE.

accretionary prism See ACCRETIONARY WEDGE.

accretionary wedge (accretionary prism)

A tectonically thickened wedge of *sediment found on the landward side of some *trenches. The accretionary wedge consists of oceanic sediment scraped off the subducting *plate (see SUBDUCTION), plus sediment derived from landward and deposited in the trench. Slices of sediment are added to the wedge by *underthrusting and the trench migrates seaward, the continuation of this process producing an *inversion.

accumulated temperature Surplus or deficit of temperature with respect to a defined mean value and expressed as an accumulation over a given period, e.g. a month, season, or year. For example, a datum value of 6 °C is used as a critical temperature for sustained vegetation growth, against which accumulated surpluses or deficits may be measured.

accumulation zone That part of a *glacier where the mean annual gain of

*ice, *firn, and snow is greater than the mean annual loss. The zone consists of stratified firn and snow together with ice from frozen meltwater. Its lower boundary is the *equilibrium line.

ACF See ACF DIAGRAM; and AUTOCORRELATION.

ACF diagram A three-component, triangular graph used to show how metamorphic *mineral assemblages vary as a function of *rock composition within one *metamorphic facies. Besides SiO_2 , the five most abundant oxides found in *metamorphic rocks are Al_2O_3 , CaO , FeO , MgO , and K_2O . The three components plotted on ACF diagrams are A (Al_2O_3), C (CaO), and F ($\text{FeO} + \text{MgO}$), making the diagrams particularly useful for showing assemblage variations in metamorphosed, *basic, *igneous rocks and impure *limestones. However, each of these components has to be modified slightly to account for the presence of other, minor components in the rock. Such modification leads to: A ($\text{Al}_2\text{O}_3 - \text{Na}_2\text{O} - \text{K}_2\text{O}$); C ($\text{CaO} - [(10/3)\text{P}_2\text{O}_5] - \text{CO}_2$); and F ($\text{FeO} + \text{MgO} - \text{Fe}_2\text{O}_3 - \text{TiO}_2$). The minerals *quartz and *albite are assumed to be present in the rocks and are not shown on the diagram. *Tielines connect minerals which coexist in equilibrium and can thus define triangular areas in which three minerals are in equilibrium in the rock, lines on which two minerals are in equilibrium in the rock, and points at which one mineral is in equilibrium in the rock (in addition to the ubiquitous quartz and albite).

achnelith See PELE'S HAIR.

achondrite Rare stony *meteorite lacking *chondrules and with low nickel-iron content. It is more coarsely crystalline than a *chondrite. Basaltic achondrites resemble terrestrial *lavas.

achromatic line In the three-dimensional graph which plots quantities of the three *additive primary colours contributing to *pixels against each other, the line which runs at 45° to the axes. Pixels which plot close to this line will not be strongly coloured and may be subject to *decorrelation stretching.

acicular Pointed or needle-shaped.

acid According to the Brønsted-Lowry theory, a substance that in solution liberates hydrogen *ions or protons. The Lewis theory states that it is a substance that acts

as an electron-pair acceptor. An acid reacts with a *base to give a salt and water (neutralization), and has a *pH of less than 7.

acidophile An *extremophile (domain *Archaea) that thrives in environments where the pH is below 5.0.

acid rain Precipitation with a pH of less than about 5.0, which is the value produced when naturally occurring carbon dioxide, sulphate, and nitrogen oxides dissolve into cloud droplets. The effects of increased acidity on surface waters, soils, and vegetation are complex.

acid rock *Igneous rock containing more than about 60% *Silica (SiO_2) by weight, most of the silica being in the form of silicate minerals, but with the excess of about 10% as free *quartz. Typical acid rocks are *granites, *granodiorites, and *rhyolites. Compare BASIC ROCK; and INTERMEDIATE ROCK. See also ALKALINE ROCK.

acid soil *Soil having a *pH less than 7.0. Degrees of soil acidity are recognized. Soil is regarded as 'very acid' when the reaction is less than pH 5.0. The *USDA lists five standard ranges of soil acidity (less than pH 4.5, extremely acid; 4.5-5.0, very strongly acid; 5.1-5.5, strongly acid; 5.6-6.0, medium acid; and 6.1-6.5, slightly acid). Surface *soil horizons of acid *brown earths have a reaction of pH 5.0 or less.

acme zone (peak zone, flood zone, epibole, abundance zone) An *informal term for a body of *strata containing the maximum abundance of a particular *taxon occurring within the stratigraphic range of that taxon, and after which the *zone is named.

acoustic impedance (Z) The product of density (ρ) and the acoustic velocity (v) for a given rock mass; $Z = \rho v$. The *reflection coefficient for an interface is governed by the contrast in the acoustic impedances of the two adjacent *rock masses.

acquired characteristics Characteristics that are acquired in the lifetime of an organism, according to early evolutionary theorists such as *Lamarck. Lamarck further suggested that traits acquired in one generation in response to environmental stimuli would be inherited by the next generation. Thus over several generations a particular type of organism would become better adapted (see ADAPTATION) to its environment. The kinds of acquisition envis-

aged by Lamarck and their heritability are now discredited, although there has been a recent revival of some aspects of Lamarckism in modified form.

acritarchs A diverse, perhaps unrelated group of organisms, which are organic-walled, hollow structures, 20–150 mm in diameter, ranging from *Precambrian to *Recent times. They are found in marine strata, although some non-marine examples are reported from Recent beds. Acritarchs are used in *correlation and to distinguish on-shore from off-shore *sediments.

Acrothoracica See CIRRIPIEDIA.

acrozone See RANGE ZONE.

actinium series See DECAY SERIES.

actinolite A member of the *amphiboles, $Ca_2(Mg,Fe)_3(Si_4O_{11})_2(OH,F)_2$ with the ratio $Fe/Fe + Mg = 0.9$ to 0.5 , belonging to the *tremolite-ferroactinolite series of Ca-rich amphiboles; sp. gr. 3.0–3.4; *hardness 5–6; *monoclinic; light greenish-grey to dark green; white *streak; *vitreous *lustre; habit *acicular, often fibrous and felted; *cleavage *prismatic, good {110}; occurs widely in low- to medium-grade *schists and some *igneous rocks. The asbestiform variety is called *nephrite and such felted forms were used in the past for insulation and fire-resistant materials, but the development of asbestosis in workers has severely restricted their use.

Actinopterygii (ray-finned fish) A subclass of the *Osteichthyes (bony fish, see BONE), comprising the ray-finned fish, which include the majority of living bony fish of sea and fresh water. The *fins are composed of a membranous web of skin supported by a varying number of spines and soft rays. They appeared first during the *Devonian.

activation analysis See NEUTRON ACTIVATION ANALYSIS.

activation energy (energy of activation) The energy that must be delivered to a system in order to increase the incidence within it of reactive molecules, thus initiating a reaction.

active geophysical methods Geophysical exploration methods which require an artificial signal to be generated. For example, exploration seismology, some *electromagnetic techniques, *electrical resistivity,

*remote sensing, and *induced polarization are said to be active geophysical methods. The term is contrasted with *passive geophysical methods.

active layer Seasonally thawed surface layer between a few centimetres and about 3 m thick, lying above the permanently frozen ground in a periglacial environment. It may be subject to considerable expansion on freezing, especially if silt-sized particles dominate, with important engineering implications. See also MOLLISOLS; and PERMAFROST.

active margin (seismic margin) The margin of a continent that is also a *plate margin. The alternative term, 'Pacific-type margin', indicates the range of features (e.g. *earthquakes, andesitic (see ANDESITE) volcanic chains, offshore oceanic *trenches, and young fold mountains) which may be associated with active margins. Some authors distinguish an 'Andino-type margin', involving an oceanic and a continental plate, from a 'Japan-type margin', involving an oceanic plate and an *island arc. The term 'Mediterranean-type margin' is also in use, although to a lesser extent, to signify the coincidence of continental edges and plate margins in a *collision zone.

active methods See ACTIVE GEOPHYSICAL METHODS.

active pool The part of a *biogeochemical cycle in which the nutrient element under consideration exchanges rapidly between the biotic and abiotic components. Usually the active pool is smaller than the *reservoir pool, and it is sometimes referred to as the 'exchange' or 'cycling' pool.

active remote sensing *Remote sensing which is based on the illumination of a scene by use of artificial radiation. An example is *radar. Compare PASSIVE REMOTE SENSING.

activity A broadly used term which refers to the rate or extent of a change associated with some substance or system. For example, it may be the tendency of a metal high in the electromotive series to replace another metal lower in the series, e.g. magnesium displacing copper from most of its compounds. It may also be used to describe the rate of decay of atoms by radioactivity.

activity coefficient (γ) The ratio of chemical activity (i.e. the effective concentration, *a*) of a component in a solution, to

the actual mole fraction (X) present in solution: ($\gamma = a/X$). Values for activities are determined experimentally in a number of ways, including measuring the ratio of the *vapour pressure (p) of a known concentration of the substance in solution to the vapour pressure (p^*) of the pure substance: $a = p/p^*$. In an ideal solution the activity coefficient = 1, and the activity of the component is equal to its mole fraction. In general, the greater the amount of dissolved material, the lower the activity coefficients of each of the species present.

Actonian A *stage of the *Ordovician in the Upper *Caradoc, underlain by the *Marshallbrookian and overlain by the *Onnian.

actual evapotranspiration (AE) The amount of water that evaporates from the surface and is transpired by plants if the total amount of water is limited. Compare POTENTIAL EVAPOTRANSPIRATION.

actualism The theory that present-day processes provide a sufficient explanation for past geomorphological phenomena, although the rate of activity of these processes may have varied. The theory was first clearly expressed in 1749 by G. L. L. *Buffon (1707-88), and was the essential principle of *uniformitarianism as presented in 1830 by C. *Lyell (1797-1875).

acuity The ability of a human to discern spatial variation in a scene.

ACV See AGGREGATE TESTS.

Adam The postulated male ancestor for all modern humans, who lived in Africa between about 100 000 and 200 000 years ago. 'Adam' is based on a change in the human Y chromosome that occurred at that time in one descendant of Adam and is now present in all human males, except for some Africans. See also MITOCHONDRIAL EVE.

adamantine Of mineral *lustre, brilliant, like a polished diamond.

adamellite A rock of granitic composition (see GRANITE) characterized by the presence of *quartz, *plagioclase feldspar, and potassium feldspar (see ALKALI FELDSPAR) accompanied by *biotite and/or *hornblende. The two feldspar types occur in approximately equal proportions, the plagioclase composition lying within the oligoclase range. The name is derived from the type locality of Adamello in the Tyrol where granites of this type were originally defined. In Britain the

best-known example occurs at Shap Fell in Cumbria.

Adams-Williamson equation Equation describing a fundamental relationship between seismic velocities (v_p and v_s), the *gravitational acceleration (g), and the adiabatic change in density ($d\rho$ within the *Earth (assuming only hydrostatic pressure) as a function of radius (dr):

$$d\rho = \frac{g\rho}{drv_p^2 - (4/3)v_s^2}$$

This equation is directly applicable to the lower *mantle and outer *core, but is invalid where the composition is variable, the pressure is not hydrostatic, or the increase in pressure is not adiabatic.

adapical A directional term: meaning towards the shell *apex.

adaptation 1. Generally, the adjustments that occur in animals in respect of their environments. The adjustments may occur by *natural selection, as individuals with favourable genetic traits breed more prolifically than those lacking these traits (genotypic adaptation), or they may involve non-genetic changes in individuals, such as physiological modification (e.g. acclimatization) or behavioural changes (phenotypic adaptation). Compare ADAPTATION. **2.** In an evolutionary sense, that which fits an organism both generally and specifically to exploit a given environmental zone.

adaptive radiation 1. A burst of evolution, with rapid divergence from a single ancestral form, resulting in the exploitation of an array of habitats. The term is applied at many *taxonomic levels, e.g. the radiation of the mammals at the base of the *Cenozoic refers to *orders, whereas the radiation of 'Darwin's finches' in the Galápagos Islands resulted in a proliferation of *species. **2.** Term used synonymously with *cladogenesis' by some authors.

adaptive zone The adaptive specialization(s) that fit the *taxon to its environment, e.g. feeding habits.

addition rule (Weiss zone law) With reference to crystallographic notation, the rule stating that the indices (see MILLER INDEXES) of two *crystal faces in the same *zone always add up to the indices of a face bevelled the edge lying between them. The rule may be used to index faces on a *stereogram, or faces at the intersection of two zones.