The Encyclopaedic Dictionary of Physical Geography

Edited by
Andrew Goudie

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Preface

The preparation of a dictionary of this complexity has involved many people, and all deserve thanks for the efficiency with which they have prepared their material on time and in the format required. We have been fortunate in having as a model our companion volume, *The dictionary of human geography*, which was so expertly edited by R. J. Johnston and his team. I would like to express particular thanks to Janet Godden for having taken over so much of the organizational burden, and to Andrew Watson for being willing to prepare many of the short entries.

ASG

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Editors' Introduction

The prime virtue of our companion volume, *The dictionary of human geography*, was that it provided digestible short discussions on many of the new, and often complex, concepts that have arisen in that field in the last few decades. We have emulated this approach so far as we can, but because of the large array of technical terms with which the physical geographer has to contend we have also tried to provide a comprehensive range of short definitions of these terms to complement our conceptual reviews.

We have designed this dictionary for professional geographers and for earth, environmental and life scientists who work on the boundaries of our discipline. It is also intended for use by tertiary-level students, and secondary school teachers, all of whom need up-to-date definitions of words and terms in current usage. Furthermore, we hope that it will provide comprehensive but select guidance to the literature.

As in the companion volume, two systems are used to facilitate navigation through our complex sea of entries. The first is *cross-referencing*. Within an entry, certain other entries are referred to in capital letters. Reading of these entries will expand the understanding of the term originally referred to and will also place it in a broader context. Secondly, there is an *index*, from which the reader will be able to find other entries in which a term is used and thereby obtain a wider sense of its usage. Most entries are followed by references or by suggestions for further reading as appropriate. References which are also suitable for use as further reading are indicated with a dagger.

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Abbreviations in Physical Geography

One of the horrors of the second half of the twentieth century has been the proliferation of abbreviations and acronyms. In physical geography a prime cause of this has been the growth of world organizations, such as the United Nations, and the tendency for much research to be carried out by multi-disciplinary and multi-institutional research teams. It is a matter for regret that so many books and papers fail to record the full meaning of abbreviations used. We have therefore listed below the abbreviations most frequently encountered in the current literature of physical geography. Abbreviations to periodicals can be found in the *World list of scientific periodicals*, while those to organizations can be found in Buttress's *World guide to abbreviation of organizations* (London: Leonard Hill, 5th edn, 1974).

AAR	Accumulation Area Ratio
AAAS	American Association for the Advancement of Science
AAS	Atomic Absorption Spectrophotometer
AE	Actual evapotranspiration
AEM	Auger electron microscopy *see* also SAM/SAEM
AES	Auger electron spectroscopy
AGFG	American Geomorphology Field Group
AAG	Association of American Geographers
AMQUA	American Quaternary Association
AMRA	American Water Resources Association
AMRT	Apparent mean resident time
APT	Automatic picture transmission
ARMA	Autoregressive-moving average
ASAE	American Society of Agricultural Engineers
ASCA	Agricultural Stabilization and Conservation Service
ASCE	American Society of Civil Engineering
ASTM	American Society for Testing Materials
ASV	Anode-stripping voltometry
ATS	Applications technology satellite
AVHRR	Advanced very high resolution radiometer
BAS	British Antarctic Survey
BE	Backscattered electrons
BES	British Ecological Society
BESI	Backscattered electron scanning images
BGRG	British Geomorpohological Research Group

BGS	British Geological Survey
BHS	British Hydrological Society
BLE	Bombardment-induced light emission
BOD	Biochemical oxygen demand
BS	British standard
BSE	*See* BE
BSI	Backscattered electron imaging
CAS	Committee on Atmospheric Sciences
CAZRI	Central Arid Zone Research Institute, India
CBR	California bearing ratio
CCN	Cloud condensation nucleus
CCT	Computer compatible tape
CERC	Coastal Engineering Research Station Washington
CL	Cathodoluminescence
CLIMAP	Climate long-range interpretation and prediction project
CNRS	Centre Nationale de la Recherche Scientifique
COLE	Coefficient of linear extensibility
COSPAR	Committee on Space Research (of ICSU)
COWAR	Committee on Water Research (of ICSU)
CPD	Critical point drying
CRREL	(US Arms) Cold regions Research and Engineering Laboratory, Hanover (New Hampshire)
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
CSSA	Crop science society of America
CTEM	Conventional transmission electron microscopy
CZCS	Coastal zone colour scanner
DALR	Dry adiabatic lapse rate
DCP	Data collection platform
DCS	Data collection service
DDT	Dichloro-diphenyl-trichloroethane
DSC	Differential scanning colourimetry
DTA	Differential thermal analysis
DTG	Differential thermo-gravimetry
ECP	Electron channelling patterns
EDAX	*See* EDXRA
EDS	Energy-dispertive spectroscopy = EDXRA
EDX	*See* EDXRA
EDXRA	Energy dispersive X-ray analysis
EELS	Electron energy-loss spectrometry
EIA	Environmental impact assessment
EIS	Environmental impact statement
ELA	Equilibrium Line Altitude
ELR	Environmental lapse rate
ELS	*See* EELS
EMA	Electron microprobe analysis = EPMA
EMP	Electron microprobe analysis, i.e. EDXRA (EDX) and WDXRA (WDX)

EPA	(USA) Environmental Protection Agency
EPMA	Electron probe microanalysis
EROS	Earth Resources Observation Service
ERS	Earth resources satellite
ERTS	Earth resources technology satellite
ESA	European-Space Agency
ESCA	Electron spectroscopy for chemical analysis
ESMR	Electrically scanning microwave radiometer
ESR	Electron spin resonance (spectroscopy)
FAO	Food and Agriculture Organization of the United Nations
FDA	(USA) Food and Drug Administration
FGGE	First GARP Global experiment
GARP	Global Atmospheric Research Programme
GATE	GARP Atlantic tropical experiment
GCM	Geneal circulation model
GEMS	Global environmental monitoring system
GHOST	Global horizontal sounding technique
GLU	Grazing livestock unit
GMS	Geostationary Meteorogolical Satellite
GOES	Geostationary Operational Environmental Satellite
GSA	Geological Society of America
HCMM	Heat capacity mapping mission
HEIS	High energy ion scattering = RBS
HOMS	Hydrological Operational Multipurpose Subprogramme (of WMO)
HREM	High resolution electron microscopy
HRIR	High resolution infra-red radiometer
HRS	Hydraulics Research Station
HVEM	High voltage electron microscopy
IAEA	International Atomic Energy Agency
IAEG	International Association of Engineering Geology
IAH	International Association of Hydrogeologists
IAHR	International Association of Hydraulic Research
IAHS	International Association of Hydrological Sciences
IAMAP	International Association of Meteorology and Atmospheric Physics
IAPSO	International Association of Physical Sciences of the Oceans
IASH	International Association for Scientific Hydrology
IBG	Institute of British Geographers
IBP	International Biological Programme
ICCE	International Commission on Continental Erosion (of IAHS)
ICE	Institution of Civil Engineers (London)
ICES	International Council for Exploration of the Sea
ICP	Inductively coupled plasma (spectrometry)
ICSI	International Commission on Snow and Ice (of IAHS)
ICSU	International Council of Scientific Unions
IGCP	International geological correlation programme
IGS	Institute of Geological Sciences
IGS	International Glaciological Society
IGU	International Geographical Union

IGY	International geophysical year
IHD	International Hydrological Decade
IHP	International Hydrological Programme (of UNESCO)
IITA	International Institute of Tropical Agriculture
IMMA	Ion microprobe mass analysis
INQUA	International Quaternary Association
IOC	Intergovernmental Oceanographic Commission
IOH	Institute of Hydrology
IPS	International Peat Society
IRA	Infra-red spectrometry
ISRM	International Society for Rock Mechanics
ISS	Ion scattering spectrometry = LEIS
ISSMFE	International Society of Soil Mechanics and Foundation Engineering
ITC	International Institute for Aerial Surveys and Earth Sciences (Dutch)
ITCB	Inter-tropical cloud band
ITCZ	Inter-tropical convergence zone
ITE	Institute of Terrestrial Ecology
IUCN	International Union for the Conservation of Nature and Natural Resources
IUFRO	International Union of Forest Research Organizations
IUGG	International Union of Geodesy and Geophysics
IUH	Instantaneous unit hydrograph
LAI	Leaf area index
LAMMA	Laser microprobe mass analysis = LMP
LEIS	Low energy ion scattering = ISS
LMP	Laser microprobe analysis = LAMMA
LOES	Laser optical emission spectrometry
LRDC	Land resources development centre
LTA	Low temperature ashing
MAB	Man and the biosphere programme (UNESCO)
MCA	Multi-channel analyser
MFD	Multi-function detector
MOS	Marine observation satellite
MRIR	Medium resolution infra-red radiometer
MSS	Multispectral scanning system
MSU	Microwave sounding unit
NAS	(USA) National Academy of Sciences
NASA	National Aeronautics and Space Administration (United States)
NCAR	(USA) National Center for Atmospheric Research
NCC	(UK) Nature Conservancy Council
NEPA	(UK) National Environmental Policy Act, 1970
NERC	(UK) Natural Environmental Research Council
NMR	Nuclear magnetic resonance (spectroscopy)
NNR	(UK) National Nature Reserve
NOAA	National oceanic and atmospheric administration (United States)
NPP	Net primary productivity
NRC	National Research Council (Canada)
NSF	(USA) National Science Foundation

NWP	Numerical weather prediction
NZARP	New Zealand Antarctic Research Programme
NZGS	New Zealand Geological Society
OES	Optical emission spectrometry
OHP	Operational Hydrology Programme (of WMO)
OM	Optical microscopy
ORSTOM	Office de la Recherche Scientific et Technique Outre-Mer
OTM	Optical transmission microscopy
P-E	Precipitation-effectiveness
PBL	Planetry boundary layer
PCSP	Polar Continental Shelf Project (Ottawa)
PDSI	Palmer drought severity index
PE	Potential evapotranspiration
PIXE	Particle induced X-ray emission
pixel	picture element
ppm	parts per million
PVC	Potential volume change
PWP	Pore water pressure
QBO	Quasi-biennial oscillation
QRA	(UK) Quaternary Research Association
RADAR	Radio detection and ranging
RBS	Rutherford backscattering spectrometry = HEIS
RBV	Return beam vidicon camera system
RES	Radio-echo sounding
RISP	Ross Ice Shelf Project
RMS	Rock mass strength
RSG	Royal Geographical Society
RY	Recurrence surface (Swedish: *rekurrensytor*)
SAEM	Scanning auger (electron) microscopy
SALR	Saturated adiabatic lapse rate
SAM	Scanning auger microprobe
SAR	Synthetic aperture radar
SCAR	Scientific Committee on Antarctic Research
SCOPE	Scientific Committee on Problems of the Environment of the ISCU
SCP	Single cell protein
SCS	Soil conservation service
SCSA	Soil Conservation Society of America
SE	Secondary electrons
SEI	Secondary electron images
SEM	Scanning electron microscopy
SEM	Scanning electron microscope
SI	System International d'Unités
SIMS	Secondary ion mass spectrometry
SIPRE	(former name of CRREL)
SIRS	Satellite infra-red spectrometer
SLAM	Scanning laser acoustic microscope
SLAR	Sideways-looking airborne radar
SMD	Soil moisture deficit

SMMR	Scanning multifrequency microwave radiometer
SPOT	Satellite probatoire de l'observation de la terre
SPRI	Scott Polar Research Institute
SSMS	Spark source mass spectrometry
SSSA	Soil Sciene Society of America
SSSI	Site of special scientific interest
SST	Sea surface temperature
STEM	Scanning transmission electron microscope
TDCN	Topologically distinct channel network
TEELS	Transmission electron energy loss spectrometry
TEM	Transmission electron microscopy *see* also CTEM
TEM	Transmission electron microscope
TG	Thermo-gravimetry
THI	Temperature humidity index
TIROS	Television and infra-red observation satellite
TL	Thermoluminesence
TM	Thematic mapper
UCAR	University Corporation for Atmospheric Research
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNU	United Nations University (Tokyo)
USARP	United States Antarctic Research Program
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USLE	Universal soil loss equation
UVS	Ultra-violet spectrometry
WCP	World Climate Programme
WCS	World Conservation Strategy
WDC	World Data Centre
WDS	Wavelength dispersive spectroscopy = WDXRA
WDX	*See* WDXRA
WDXRA	Wavelength dispersive X-ray analysis
WHO	World Health Organization
WMO	World Meteorological Organization
WWF	World Wildlife Fund
WWW	World weather watch
XPS	X-ray photoelectron spectroscopy
XRD	X-ray diffraction
XRF	X-ray fluorescence spectrometry

Contents

A

abîme A vertical shaft in karstic limestone terrain.

abiotic The abiotic components of an ECOSYSTEM are those which are not living. These include mineral soil particles, water, atmospheric gases and inorganic salts; sometimes simple organic substances that have resulted from excretion or decomposition may be included. The term abiotic is also used for physical and chemical influences upon organisms, for example humidity, temperature, pH and salinity. An abiotic environment is one which is devoid of life. PHA

ablation The process by which snow or ice is lost from a GLACIER, floating ice or snow. Examples are melting and run-off, calving of icebergs, evaporation, sublimation and removal of snow by wind. Melting followed by refreezing at another part of a glacier is not regarded as ablation because the glacier does not lose mass. Melting is the most important process in temperate and subpolar regions and accounts for seasonal and diurnal meltwater floods. Most such ablation occurs at the glacier surface and at the snouts of glaciers in many mid-latitude areas it lowers the ice surface by the order of 10 m each year. A small amount of melting occurs within and beneath glaciers whose ice is at the pressure melting point. In the Antarctic the most important ablation process is the calving of ice shelves, though considerable losses may also occur through bottom melting of ice shelves and the removal of snow by offshore katabatic winds. DES

Reading

Paterson, W.S.B. 1981: *The physics of glaciers*. 2nd edn. Oxford: Pergamon.

abrasion The process of wearing down or wearing away by friction as by wind-borne sand or material frozen into glacial ice.

absolute age The age of an event or rock, mineral or fossil, measured in years.

absolute humidity *See* Humidity.

abundance The total number of individuals of a particular species present in an area. Various methods are used to measure the abundance of organisms but in view of the time and effort involved it is usually impractical to count all individuals within an area. Instead, population size is often estimated by collecting data from small plots (quadrats) selected by a random sampling procedure. Population size is influenced by a complex array of factors which include, for example the physical environment, weather conditions, available resources (food, nesting sites, etc.), competition both within and between species, and predation. ARH

Reading

Mueller-Dombois, D. and Ellenberg, H. 1974: *Aims and methods of vegetation ecology*. New York and London: Wiley. Chapter 6, pp. 67–92.

Watts, D. 1971: *Principles of biogeography*. New York and London: McGraw-Hill. Chapter 5, pp. 197–241.

abyss *a*. A deep part of the ocean, especially one more than about 3000 m below sea level.

b. A ravine or deep gorge.

abyssobenthic zone The bottom of a deep lake, sea or ocean inhabited by characteristic organisms.

abyssopelagic zone The portion of deep lakes, seas and oceans in which specific forms of plankton and nekton are found.

accelerated erosion *See* Soil erosion.

accessory mineral The mineral components of a rock which do not occur in sufficient quantities to merit their inclusion in the definition or classification of the rock, that is, not an essential mineral.

accommodation A term used in soil science referring to the extent to which faces of adjacent aggregates are moulds one of another. Where adjacent faces meet and

leave virtually no void (such as in the regular packing of cuboids) there is said to be good accommodation. On the other hand, a packing of spheres displays no accommodation.

accordant junctions, law of The law which states that tributary rivers join main rivers at the same level, that is there is usually no sudden drop (Playfair's Law).

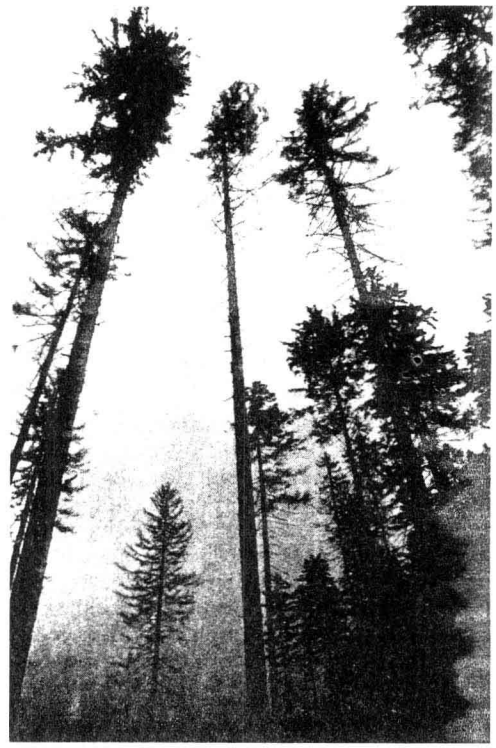
accordant summits The phenomenon of hill crests and mountain peaks in a region being within a similar plane, horizontal or inclined, attesting that they are remnants of a former plain or plateau.

accretion *a.* The gradual increase in the area of land as a result of sedimentation.
b. The process by which inorganic objects increase in size through the attachment of additional material to their surface as with the growth of hailstones.

accumulated departure The amount, which may be positive or negative, by which, over a period of time, the value of a meteorological element, such as mean annual temperature, departs from the long-term mean value.

accumulated temperature Normally the total number of days (or hours) since a given date, during which the mean temperature has been above or below a given threshold. The threshold value for agriculture is usually 6°C and accumulated mean temperatures above this value can be correlated with the growth of vegetation. For heating purposes the threshold is usually 15.5°C and accumulated mean temperatures below this value can be correlated with energy use. Generally accumulated temperature is used in agriculture and DEGREE DAYS are used in energy management. JET

acid precipitation Rain and snow with a pH of less than 5.6. The latter is the hydrogen ion concentration of natural precipitation, subject to normal concentrations and pressures of atmospheric carbon dioxide. The chemical analysis and dating of fossil ice has revealed that some two centuries ago precipitation possessed a pH that was generally in excess of 5.0. Since that time industrial urban development, particularly in northern hemisphere mid-latitudes, has resulted in the release of increasing quantities of sulphur and nitrogen oxides into the atmosphere. These emissions are caused by fossil fuel burning and sulphide ore smelting, the oxides being transformed into sulphuric and nitric acids in the atmosphere. These relatively strong acids undergo ionic separation in weakly acidic natural precipitation, with the dissociated hydrogen ions causing its pH to fall below 5.6 (Likens *et al.* 1979). The role of acid precipitation is, as yet, imperfectly understood. Probable biospheric effects include a diminution in productivity of acquatic ecosystems developed on siliceous substrates. Here acid water appears to impair fish reproductive capacity, and to reduce bacterial efficiency. In the terrestrial environment sulphur dioxide emission may be the underlying cause of tree death via increased soil acidity, leaching potential and toxicity (Pearce 1982). RLJ



Acid precipitation is one of the most serious and contentious environmental issues at the present time. Emissions of sulphate and nitrate rich pollutants from power stations, smelters, and other sources can increase the natural acidity of rainfall, with unfortunate ecological consequences, including damage to the foliage of fir trees (Albies alba) *in the Black Forest, Germany.*

Reading and References

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