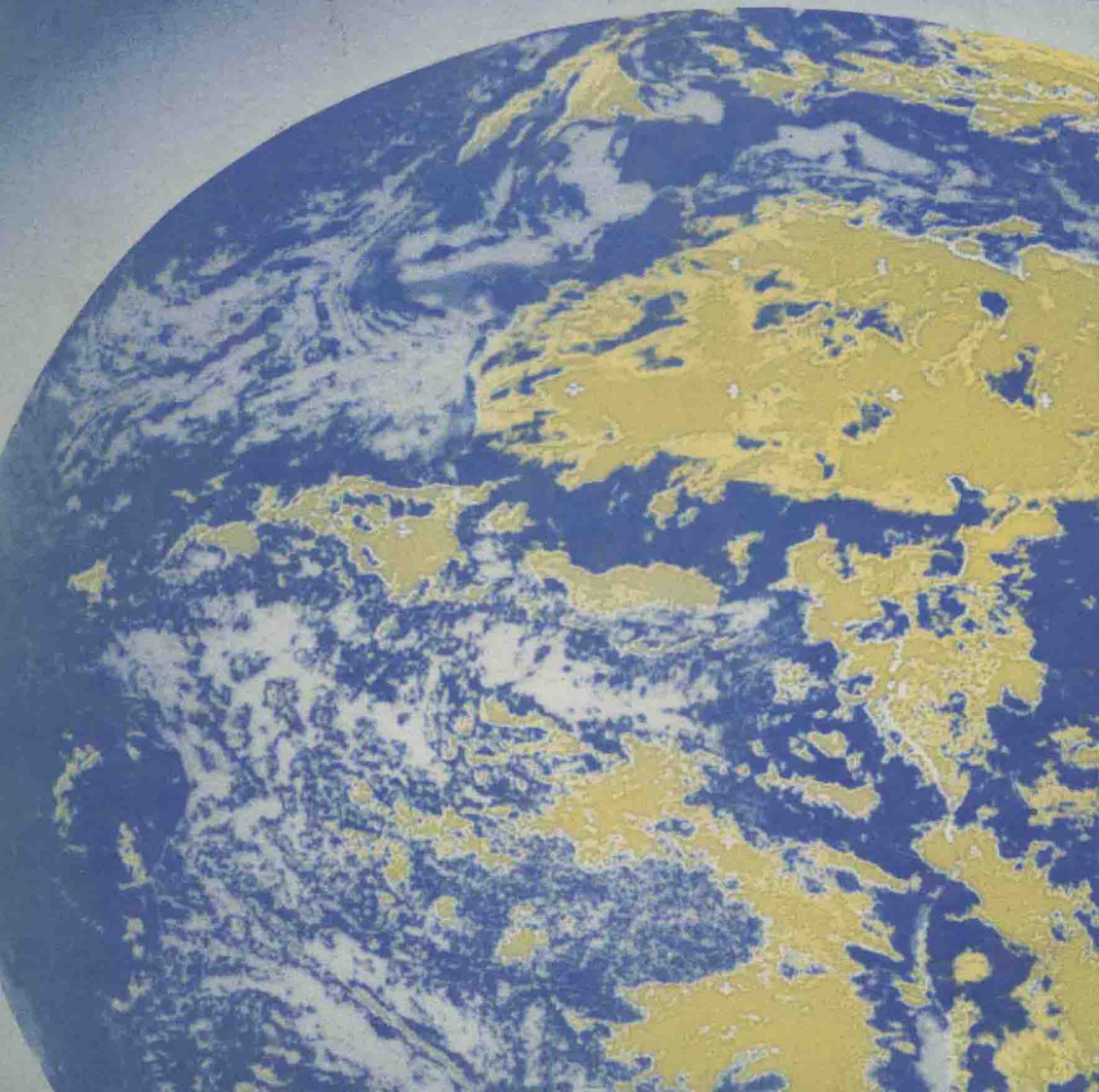


# A Modern Dictionary of Geography

John Small and Michael Witherick



# A Modern Dictionary of Geography

**John Small**

Professor of Physical Geography, University of Southampton  
and

**Michael Witherick**

Lecturer in Human Geography, University of Southampton



**Edward Arnold**

© John Small and Michael Witherick 1986

First published in Great Britain 1986 by  
Edward Arnold (Publishers) Ltd, 41 Bedford Square, London WC1B 3DQ

Edward Arnold (Australia) Pty Ltd, 80 Waverley Road, Caulfield East, Victoria 3145,  
Australia

Edward Arnold, 3 East Read Street, Baltimore, Maryland 21202, USA

**British Library Cataloguing in Publication Data**

Small, R.J.

A modern dictionary of geography.

I. Geography—Dictionaries

I. Title II. Witherick, M.E.

910'.3'21 G63

ISBN 0-7131-6435-2

ISBN 0-7131-6434-4 Pbk

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, photocopying, recording, or otherwise, without the prior permission of Edward Arnold (Publishers) Ltd.

This book is published in two editions. The paperback edition is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form of binding or cover other than that in which it is published and without a similar condition including this condition being imposed upon any subsequent purchaser.

Text set in 8/9pt Times Compugraphic

by Colset Pte. Ltd., Singapore

Printed and bound by Richard Clay (The Chaucer Press) Ltd, Bungay, Suffolk

## Acknowledgements

The authors wish to acknowledge the invaluable assistance received from Alan Burn and his staff in the Cartographic Unit, University of Southampton, in the preparation of the illustrations, and from colleagues in the Department of Geography at Southampton for constructive comments on individual entries.

The publishers would like to thank the following for permission to include copyright material:

Dr Abler for figures from Abler, Adams and Gould: *Spatial Organisation*; George Allen & Unwin for 2 figures from Whyne-Hammond: *Elements of Human Geography*; The American Academy of Political and Social Science for a figure from Harris and Ullman: *The Nature of Cities*; B J L Berry for Berry and Horton: *Geographic Perspectives in Urban Systems*; Cambridge University Press for data from tables from Lindley & Miller: *Cambridge Elementary Statistical Tables* and Longman Group Limited for a figure from Gregory: *The Statistical Methods and the Geographer* compiled from CUP's data; William Collins for a figure from Riley: *Industrial Geography*; Doncaster Metropolitan Borough Council, Mrs Urquhart, Gould and White for a map from Gould and White: *Mental Maps*; Gower Publishing Company Limited for a figure from Hall and Hay: *Growth Centres in the European Urban Systems*; Harper & Row Inc for figures from Lloyd and Dicken: *Location in Space*, Haggett: *Geography: a Modern Synthesis* and Huggett & Meyer: *Industry*; Heinemann Educational Books for a figure from Theakstone & Harrison: *The Modern Dictionary of Geography*; Gustav Fischer Verlag for a figure from Lösch: *The Economics of Location*; Methuen & Co for a figure from Chorley & Haggett: *Models in Geography*; Pergamon Press Ltd for a figure from Hall: *Von Thünen's 'Isolated State'*; Macmillan Accounts and Administration Ltd, London and Basingstoke for a table from Toyne & Newby: *Techniques in Human Geography*; MIT Press for a figure from Friedmann: *Regional Development Policy: a Case Study of Venezuela*; Oxford University Press for a figure from Bradford & Kent: *Human Geography* © OUP 1977; Professor Pred and the University of Lund for a figure from Pred: *Behaviour and Location*; Routledge & Kegan Paul for a figure from Mann: *An Approach to Urban Sociology*; TrainLines of Britain for a map; Universe Books for a figure from Meadows, Meadows, Randers and Behrens: *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. A Potomac Associates book published by Universe Books, NY 1972. Graphics by Potomac Associates; The University of Chicago Press for figure from Park and McKenzie: *The City* and University Tutorial Press Ltd for a figure from Tidswell: *Pattern and Process in Human Geography*.

## Abbreviations

cf	see, for purposes of comparison
cm	centimetre
ct	see, for purposes of contrast
E	east
e.g.	for example
[f]	see figure attached
[f <sup>TERM</sup> ]	see figure attached to term cited
I	island, isle in proper name
i.e.	that is
km	kilometre
km <sup>2</sup>	square kilometre
m	metre
mm	millimetre
N	north
NE	northeast
NW	northwest
R	river
S	south
s	second
SE	southeast
SW	southwest
SI	Système International (d'Unites)
W	west
UK	United Kingdom
USA	United States of America

## Introduction

In compiling this Dictionary we have been guided by a number of principles. Of these, the overriding was to produce a book that would meet the needs *primarily* of pupils in advanced courses at secondary schools and colleges, of their equivalents in overseas countries, together with those of first-year undergraduates at universities and other institutions of higher education.

The most difficult decision concerned the actual choice of terms for definition. Given the nature of geography as a discipline, and the fact that it interfaces with a range of other subjects, it is manifestly impossible to select a vocabulary that is in any way *exclusive* to geography. Inevitably, therefore, terms that are more properly geological, economic, sociological, statistical and so on, have been included, though a conscious effort has been made to avoid ‘opening the flood-gates’, and to employ terms that are *widely* used by geographers at the level specified. More controversial still was the identification of the terms deemed to be relevant to A-level and undergraduate geographers. Quite clearly, it is impossible to compile a definitive list that would be acceptable to everyone. What we have done, as A-level examiners and university teachers of many years standing, is to choose terms that – in our experience – are currently in use by advanced level candidates (both from home and overseas centres) and that we would expect to be understood by first-year undergraduates. We have also consulted current A-level syllabuses and question papers from all the British GCE Boards, have referred to the indices of textbooks that are primarily intended for A-level students and first-year undergraduates, as well as sounding out the views of practising teachers of geography.

Although we have tried to be objective in our selection of terms, it is perhaps inevitable that our own particular interests and enthusiasms have had some influence on the final list of terms. Some of these will doubtless be regarded as ‘superfluous’, ‘too advanced’, ‘too elementary’; important omissions will also be identified. All that we can say is that this is *our choice*, made in good faith *at this time*. As the discipline of geography changes and develops, so undoubtedly we shall need to modify the selection for future editions. Indeed, we would like to extend an invitation to our readers to join with us in this challenge of extending, updating and refining the Dictionary. Where you consider terms have been wrongly defined, poorly conveyed, undervalued in terms of space, overdone, or are absent without justification, please write to us via the publishers, Edward Arnold.

Our main hope, however, is that the Dictionary as it presently stands will provide a comprehensive guide to, and in many instances, an *explanation* of the principles, concepts and terminology of modern school geography. We have deliberately aimed to produce a balance between ‘physical’ and ‘human’ definitions. In some previous dictionaries of geography there has arguably been a bias towards the former, reflecting the widespread use of ‘technical’ or scientific terminology in branches of the subject such as geomorphology, meteorology and hydrology. However, it is in our opinion necessary to bring out the increasing use, particularly during the past two decades, of specialized terminology on the human side of geography.

We have *not* attempted to define common commodities (which are adequately covered in ‘standard’ dictionaries); we have not elected to include esoteric, unusual or even bizarre terms (this Dictionary is not to be regarded as a jargonist’s charter!); and we have aimed to include ‘local’ terms (for example, hacienda) only where they are also used, and known about, outside the country of origin. In some instances we have included examples, where these were felt to illuminate further the definition and explanation of particular terms. In other instances, our view is that readers should be capable of deriving appropriate examples, both from their own first-hand experience and the reading of currently available textbooks. Ultimately, it is our hope that the Dictionary will go beyond the provision of rather ‘bare’, academically correct definitions, and will provide material that is interesting to read, that can be incorporated by students in essay work, and that can be used to assist revision work in preparation for examinations.

Finally, a few additional points – which will assist readers in their use of the Dictionary – need to be stressed.

- 1 A cross-referencing system is employed and is signalled when, either within or at the end of a particular entry, another term is given in small capital letters. For such terms, a full definition is included elsewhere in the Dictionary. Consultation of these entries will then amplify, and aid the understanding of, the original entry.
- 2 Where a term is given in italics, it means that there is no separate entry. This device is mainly used in three different circumstances: (i) where the meaning of the term is apparent from the content of the entry in which it is contained; (ii) where the meaning is explained as part of a more comprehensive entry, and (iii) where the meaning is essentially synonymous. Nonetheless, many of these italicized terms are recorded in the alphabetical listing of the Dictionary along with the identity of their ‘host’ entry.
- 3 In a relatively small number of entries, the names of significant contributors are included, together with a date in parentheses that refers to a relevant publication. The intention of the latter is to do no more than provide a temporal context. Full referencing of authorities and publications was, however, deemed inappropriate, on the grounds that most users of the Dictionary will not have ready access to specialized libraries containing a wide range of geographical literature, and in particular the scientific publications and journals in which the results of most geographical research first appear.
- 4 The Dictionary contains over 125 illustrations. Where a definition has an accompanying map or diagram, the abbreviation [*f*] is given at the end of the entry. Where we think an entry might usefully be illustrated by reference to a figure associated with another definition, the location of that map or diagram is indicated by [*f*TERM].
- 5 We have been deliberately selective about the inclusion of references to governmental bodies and international organizations, and have included only those which, in our opinion, are relevant to mainstream geographical study at this level.
- 6 SI units are used throughout the Dictionary, though a full definition of these is not included on the grounds of length and complexity of the necessary tables.

**ablation** The process by which solid ice and snow are lost from a glacier. Ablation includes (i) surface, internal and basal melting (of which the first is by far the most important), (ii) sublimation, which is the direct transfer of water from the solid to the gaseous state, and (iii) CALVING of icebergs of smaller ice blocks where the ICE SHEET or glacier enters the sea or a lake.

**ablation zone** That part of a glacier or ice sheet lying below the EQUILIBRIUM LINE, where the ice-surface is lowered by melting during the summer. The amount of ABLATION increases downglacier from the firn line (where net ablation is nil) to as much as 5-10 m near the snout; this is known as the *ablation gradient*. At the glacier snout annual ablation may equal forward glacier motion, giving a stationary front. Ablation processes include not only surface melting (though this is overwhelmingly dominant), but also sublimation, evaporation, and basal melting due to sliding friction and the escape of geothermal heat. [f.MASS BALANCE]

**aborigines** See AUSTRALOID.

**abrasion** The processes by which solid rock is eroded by rock fragments transported by running water, glacier ice, wind and breaking waves. Characteristic products of abrasion are: POT-HOLES in river beds (formed by eddying water and concentrations of pebbles); smoothed, striated and polished surfaces (formed by debris frozen into the glacier sole, or trapped between the ice and BEDROCK); basally eroded rock formations (due to abrasion by SAND particles transported just above ground level by the wind); and WAVE-CUT PLATFORMS (the product mainly of the impact of rock particles contained within turbulent sea-water and the swash of breaking waves). Abrasion is most effective when the impact of the particles on bedrock is vigorous, and the particles themselves are coarse, hard and angular.

**absolute humidity** The amount of water vapour contained within a unit volume of air, commonly expressed in grammes per cubic metre ( $\text{g m}^{-3}$ ). Cold air can contain less vapour than warm air. For example, air at  $-18^\circ\text{C}$  is saturated by  $1\text{g}$  of water vapour per  $\text{m}^{-3}$ ; at  $-7^\circ\text{C}$  by  $3\text{g m}^{-3}$ ; at  $4^\circ\text{C}$  by  $7\text{g m}^{-3}$ ; at  $15^\circ\text{C}$  by  $14\text{g m}^{-3}$ ; and at  $27^\circ\text{C}$  by  $25\text{g m}^{-3}$ . It follows that absolute humidity is highest near the Equator, and least over Antarctica and the central Asian land-mass in winter. See RELATIVE HUMIDITY, SPECIFIC HUMIDITY.

**absolute instability** The condition of the ATMOSPHERE in which the ENVIRONMENTAL LAPSE-RATE exceeds the DRY ADIABATIC LAPSE-RATE. If air pockets begin to rise, as a result of initial heating and convection, they will lose heat adiabatically owing to expansion but remain warmer than the surrounding air; they will therefore continue to rise to great heights.

See CONDITIONAL INSTABILITY.

**absolute stability** The condition of the ATMOSPHERE in which the ENVIRONMENTAL LAPSE-RATE is less than the SATURATED ADIABATIC LAPSE-RATE. If air pockets (even if very moist and subject to CONDENSATION upon cooling) are forced to rise, they will lose heat adiabatically at a rate such that they will be cooler than the surrounding air. Thus if upward movement (for example, that caused by a FRONT or a mountain range) is terminated, the air pocket will again sink to lower levels. In the absence of such forced ascent there will be no upward movement of air pockets in the first instance, since they would immediately become cooler and heavier than the surrounding air.

**abstraction** The process by which a stream, by the lateral extension of its valley, 'takes over' the CATCHMENTS of neighbouring streams, thus leading to an overall reduction in the number of streams. The process tends to be self-reinforcing. Once a stream has abstracted adjacent streams its catchment, and thus discharge, will be increased, and its power to erode laterally and abstract other streams will be enhanced further. The term *underground abstraction* is used for the process whereby, in PERMEABLE rocks such as LIMESTONE, a deeply incised stream can gain water from beneath the catchment of a less incised stream; the resultant fall in the WATER TABLE may cause the less powerful stream to become dry.

**abyssal** A term applied to the deepest parts of the ocean floor (mainly between 2200 and 5500m), on which fine-textured deposits (*ooze*) of calcareous or siliceous composition have accumulated to considerable thicknesses over long periods of geological time.

**accelerated erosion** An increase in the rate of 'natural' erosive processes (such as RAINWASH or rainsplash) owing to the activities of man (for example, in the clearing of vegetation, building construction, ploughing of fields, and OVERGRAZING by domestic animals). The occurrence of accelerated erosion is shown by such obvious features as gullies on hill-slopes in areas subject to SOIL EROSION and the rapid erosion of previously stable stream banks (induced, for example, by increased stream RUN-OFF due to URBANIZATION). It is also associated with significant increases in the LOADS of streams (see SEDIMENT YIELD); for instance, the suspended sediment carried by tropical streams can be increased by several orders of magnitude following clearance of forest for house-building or AGRICULTURE.

**accessibility** The ease with which a location may be reached from other locations. As defined in terms of transport, accessibility is that relative quality possessed by a place (usually a SETTLEMENT) as a result of its particular location within a TRANSPORT NETWORK: i.e. the more



## 2 Accordant drainage

routes converging on a settlement, the greater its NODALITY and therefore its accessibility (see also NETWORK). In an economic sense, accessibility refers rather more to the ease of movement and communication between activities. As such, it is fundamental to the economic objective of seeking to minimize the costs of distance and contact, in that the greater the accessibility, the less these costs. The term is also used in a social context in the sense of the degree to which different social groups are able to obtain goods and services (for example, the poor have much less accessibility to good housing and luxury goods than the rich) (see DEPRIVATION).

**accordant drainage** A drainage pattern in which the streams are mainly guided by the underlying geological structure; for example, some streams will follow the DIP of the rocks, others will develop along lines of geological weakness (such as soft rock outcrops and FAULT-lines), and none will cut across structural features such as anticlinal folds. See ADJUSTMENT TO STRUCTURE.

**accordant summits** A series of hilltops and PLATEAU summits rising to approximately the same height. See UPLAND PLAIN.

**accumulated temperature** See GROWING SEASON.

**accumulation zone** That part of a glacier or ICE-SHEET lying above the EQUILIBRIUM LINE, on which the dominant process is the addition of snow and ice (*alimention*). Winter snowfall is the most important component of accumulation; the snow which is not removed by ABLATION during the following summer remains as net accumulation, and is gradually transformed by compaction and recrystallization into glacier ice. The accumulation zone thus comprises a layered structure, with a series of accumulation layers separated by ablation surfaces; this structure is, however, deformed downglacier by flow and fracturing of the mobile ice.

[f MASS BALANCE]

**acid lava** Volcanic LAVA which is rich in silica, has a high melting point, and flows slowly owing to its high viscosity. Acid lava forms steep-sided, dome-like volcanoes (for example, the Puy de Dome in France, and Mount Lassen, California, USA).

**acid rain** Rain contaminated by chemicals (notably sulphur dioxide, producing dilute sulphuric acid) which have been released from industrial chimneys, and in particular from coal-burning power stations. It is increasingly believed that acid rain is responsible for the 'acidification' of rivers and lakes in uplands, the widespread destruction of fish and other wildlife, and the serious degeneration of coniferous forest in many parts of Europe (such as southern Scandinavia, which may have been seriously affected by rains contaminated over Britain). Acid rain is now widely regarded as a

serious environmental hazard, and campaigns to curtail the emission of sulphur dioxide are being mounted.

**acid rock** A type of IGNEOUS ROCK, either extrusive or intrusive, which contains over 10% of quartz or other minerals rich in silica. The most important intrusive acid rock is GRANITE.

**acid soil** See PH VALUE.

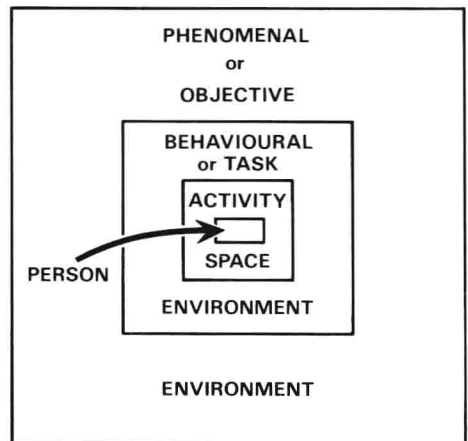
**acidification** See PH VALUE.

**action space** See BEHAVIOURAL ENVIRONMENT.

**active layer** In PERIGLACIAL conditions, where PERMAFROST exists, only the upper layer of ground thaws in summer; this upper layer, which is affected by summer thawing and winter freezing, is the active layer. Its lower limit is the permafrost table, which causes the active layer to be poorly drained. At its maximum the active layer may reach a depth of 3–6 m, depending on summer temperatures, the duration of the thaw season, soil composition (GRAVELS favour deeper thawing than peaty soils because of higher conductivity), SOIL MOISTURE content and density of the plant cover. Within the active layer processes such as SOLIFLUCTION and FROST HEAVE can be highly effective.

**activity rate** The proportion of the population in the working age-group (usually 15–64 years for men; 15–59 years for women) who are registered as employed or who are unemployed but seeking work.

**activity space** A concept of BEHAVIOURAL GEOGRAPHY referring to those places, people and organizations with which an individual has direct contact as a result of day-to-day activities, such as going to work, shopping, seeking entertainment. It is the circulation space within which a person moves for these and other specific purposes and so forms part of the BEHAVIOURAL ENVIRONMENT. [f]



The nested relationships between environments.

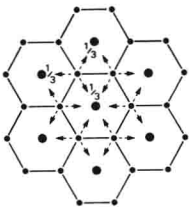
**adiabatic** Refers to the change of temperature in a gas (such as those comprising air) which experiences compression (leading to heating) and expansion (leading to cooling), without exchange of heat from outside. In the earth's ATMOSPHERE rising and descending air pockets, and on a large scale air masses, will be affected by adiabatic changes. See DRY ADIABATIC and SATURATED ADIABATIC LAPSE-RATES.

**adjustment to structure** The process by which, over a lengthy period of time, streams adjust their courses to take advantage of lines of geological weakness, usually by HEADWARD EROSION. See also DISCORDANT drainage.

[f SHATTER BELT]

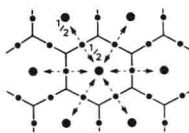
**administrative principle** One of three *principles* underlying Christaller's CENTRAL-PLACE THEORY and governing the spatial arrangement of central places relative to their market areas (see HINTERLAND). The administrative principle applies where advanced systems of centralized administration have developed and where six centres of a given order fall entirely within the hexagonal hinterland of a higher-order central place. This arrangement, having a K-VALUE of 7, ensures that there is no shared allegiance, and thus avoids the unsatisfactory situation of one settlement being located within the administrative area of more than one higher-order central place. Cf MARKET PRINCIPLE, TRAFFIC PRINCIPLE. [f]

A) MARKET PRINCIPLE (K-value : 3)



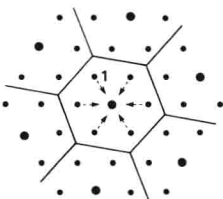
- Higher-order centre
- Lower-order centre

B) TRAFFIC PRINCIPLE (K-value : 4)



- - - Direction and proportion of custom from lower- to higher-order centres

C) ADMINISTRATIVE PRINCIPLE (K-value : 7)



The three principles of central-place theory.

**advanced countries** STATES with high levels of income per head and high standards of living, e.g. countries of W Europe, Japan, USA and Canada. See also DEVELOPED WORLD.

**advection fog** FOG developed in air which is moving in a horizontal direction (cf CONVECTION). The air, which is initially warm and moist, is cooled to dewpoint as it passes over a cold land or sea surface. Advection fog forms in mid-latitudes in winter, for example, when tropical maritime air crosses a land-mass previously cooled under anticyclonic conditions, and in spring and early summer, when very warm tropical air is cooled by contact with a relatively cold sea surface, giving *sea fog*. It is also particularly common at the convergence of warm and cold ocean currents (for example, the Grand Banks of Newfoundland, Canada, where warm air from above the Gulf Stream drifts over the Labrador Current, and is cooled to give up to 100 days of fog each year).

**aeolian** A term applied to the action of wind, especially in a geomorphological sense, for example, *aeolian erosion* and *aeolian deposition*.

**aerial photograph** The term normally refers to a photograph, vertical or oblique, taken from an aircraft, but might also include the images recorded from an orbiting satellite (see REMOTE SENSING). Amongst other things, aerial photographs may be used for mapping (see PHOTOGRAMMETRY) and for general study of landforms and landscape change. Aerial photographs are taken in strips (*sorties*) of overlapping prints, and used to make a *mosaic* (in USA, a *print lay-down*). The scale of an aerial photograph is the relation between the height of the aircraft and the focal length of the camera lens; e.g. with a 100 cm camera at a height of 10000 m, the scale would be 1/10000.

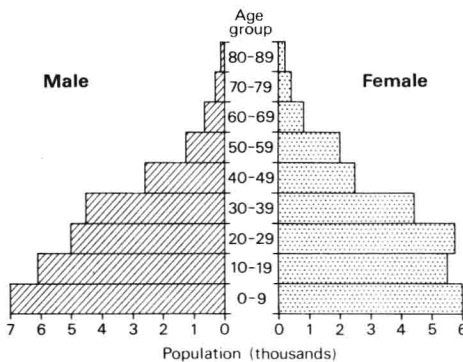
**affluent society** A term used to describe those advanced industrial nations which have benefited from long periods of continuous economic growth and in which the general level of prosperity allows the population at large to enjoy a good QUALITY OF LIFE and a high level of WELL-BEING (see also WELFARE). Most people are able to purchase a wide range of goods and services over and above their basic subsistence needs. Within the affluent society there is typically much emphasis on MATERIALISM and SELF-ACTUALIZATION.

**afforestation** The deliberate planting of trees, usually where none grew previously or recently, as by the Forestry Commission on the heathlands and moorlands of Britain. Where the planting takes place on areas of cleared woodland, then it would be more appropriate to refer to it as *reafforestation*. Formerly, the term afforestation was used to denote (i) the placing of an area in England under forest law as a royal hunting-ground (e.g. the creation of the New

#### 4 Age-sex pyramid

Forest, by William the Conqueror), and (ii) the clearing of land of sheep and cattle by landed gentry to create deer-forests (as in the Scottish Highlands during the 19th century).

**age-sex pyramid** A frequency distribution or HISTOGRAM of the population of a specific area, constructed in 1-, 5- or 10-year age groups, with males on one side, females on the other. This usually takes the form of a pyramid, with the base representing the youngest group, the apex the oldest. The horizontal bars are drawn proportional in length to either the percentage of the population or the actual number in each age group. [f]



An age-sex pyramid.

**agglomeration** In the economic landscape, agglomeration refers to the clustering of activities and people at nodal points (e.g. towns and cities). This clustering is prompted by CENTRIPETAL FORCES in spatial organization and by the need to achieve AGGLOMERATION ECONOMIES. See also CENTRALIZATION, POLARIZATION.

**agglomeration economies** The potential savings to be made by a firm as a result of locating within an AGGLOMERATION. These savings occur (i) because the firm is able to share with others in the agglomeration, rather than bear alone, the full costs of such items as PUBLIC UTILITIES and specialist services (e.g. legal advisers, financiers, advertising agencies, etc.); (ii) because agglomeration means that distances, and therefore transport costs, are minimized by those firms between which there is some form of LINKAGE, and (iii) because of COMMUNICATIONS ECONOMIES. The scale of potential savings may be thought of as being directly proportional to the scale of agglomeration. These economies of agglomeration may also be referred to as EXTERNAL ECONOMIES. See also LOCALIZATION ECONOMIES.

**aggradation** A term used loosely to describe the building-up of SEDIMENTS by rivers and wave action, hence, an *aggraded river valley*, and *aggraded beach profile*. More strictly, the

term refers to DEPOSITION carried out to restore or maintain the condition of GRADE. For example, an influx of sediment may cause a stream to become overloaded; it will therefore deposit sediment and steepen its course (*aggrade*), thus increasing its energy and capacity to transport the increased LOAD.

**agricultural geography** The study of variations from place to place in the pattern of AGRICULTURE. It is concerned with the description and explanation of those variations. In terms of description, LAND USE is the most conspicuous element in the pattern, whilst explanation requires reference to such factors as the BEHAVIOURAL ENVIRONMENT of farmers' decision making, ECONOMIC RENT, GOVERNMENT INTERVENTION, LAND TENURE, etc.

**agriculture** Used in the wide sense to include the growing of crops and the rearing of livestock; the whole science and practice of farming. However, some restrict the term to the growing of crops alone.

**agro-town** A compact and densely populated type of SETTLEMENT found in parts of Mediterranean Europe and the USSR. Although the majority of the working population is engaged in AGRICULTURE, the size of such settlements (often over 20000 people) is such as to warrant the term TOWN. Generally speaking, these settlements do not form part of a more extensive URBAN system; rather they tend to be independent and self-sufficient.

**A-horizon** The uppermost layer in a well developed or mature SOIL PROFILE, characterized by advanced WEATHERING of contained minerals, a relatively large HUMUS content, especially close to or at the soil surface, and loss of bases by downward LEACHING and ELUVIATION. The A-horizon may be subdivided as follows. The O1, or *litter horizon*, comprising loose leaves, twigs and dead grasses as yet little decomposed; the O2, or *fermentation horizon*, comprising partly decomposed organic matter; the A, or *humus horizon*, dark in colour owing to the high content of fully decomposed humus; and the E, or *eluvial horizon*, light in colour owing to the loss of CLAY particles, iron and aluminium by leaching and eluviation.

**aid** Assistance given by the more wealthy nations to the THIRD WORLD mainly to encourage DEVELOPMENT and to help overcome the obstacles to it. Aid can take a variety of forms, from the transfer of capital, technology and expertise to the granting of loans and educational scholarships, from assistance with military defence to the setting up of training programmes. Aid may either be arranged directly between two countries (e.g. as from the UK to some of its former colonies) or be channelled through special agencies (e.g. International Relief Agencies, International Monetary Fund, United Nations Food and Agricultural Organization,

UNESCO, etc.) which redistribute aid received from a number of contributing countries. In the former instance, aid is usually given with 'strings attached' (e.g. interest repayments, the supply of primary goods at preferential rates, etc.) and in this way the donor country frequently is able to extend its economic and strategic influence, as well as increase the general level of dependence of the receiving country (see NEOCOLONIALISM). Aid programmes have not always achieved what was originally intended, often because of inadequate coordination. For example, whilst medical aid may have been very effective in terms of reducing levels of mortality, food production programmes often have been unable to keep pace with the resulting increase in population. See also BRANDT COMMISSION.

**air mass** A large and essentially homogeneous mass of air, many thousands of km<sup>2</sup> in area, characterized by more or less uniform temperature and humidity. Air masses originate in *source-regions* (normally large ANTICYCLONES), where they are able to derive their principal characteristics from the underlying land or sea surface. Subsequently, the air masses migrate over large distances, as components of the earth's atmospheric circulation; in the process temperature and humidity will be gradually modified, and initial conditions of atmospheric stability and instability (and associated weather phenomena) considerably altered. Air masses may be broadly classified into four types: cold and dry (*polar continental*), cold and moist (*polar maritime*), warm and dry (*tropical continental*) and warm and moist (*tropical maritime*).

**alas** A large THERMOKARST depression, with steep bounding walls and a flat floor, sometimes occupied by a shallow lake. Alases are well developed in Siberia, where they are up to 40 m deep and 15 km in diameter, and result from the localized melting of the PERMAFROST following destruction of the forest cover. ICE WEDGES melt to give narrow linear depressions and hummocky terrain, with mounds that eventually collapse to create a larger depression with meltwater lakes. Alases grow laterally, and may merge to give *alas valleys*. In Siberia alases, formed during the POST-GLACIAL period, occupy up to half the surface area in some regions.

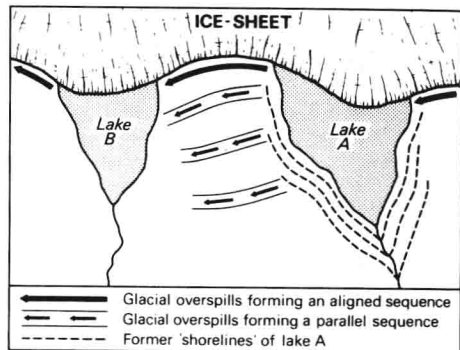
**albedo** The proportion of the total solar radiation which is reflected by the earth's surface, expressed as a decimal or percentage. The earth's mean albedo is 0.4 (40%), but the actual albedo from place to place varies greatly, depending on the precise nature of the surface (ice, snow, different types of vegetation, SOILS of differing hues, urban areas, etc.). The albedo for fresh clean snow exceeds 0.8, but is much reduced for coarsely crystalline glacier ice (0.5). For grassland albedo ranges between 0.3 and

0.2, and for a dark peaty soil is less than 0.1.

**algorithm** A step-by-step procedure as used in computation (e.g. linear programming) or in problem-solving exercises that require the formulation of a desirable or optimal solution (e.g. selecting the sites for a series of NEW TOWNS).

**alienation** The feeling of powerlessness, frustration and dissatisfaction particularly experienced by the poorer and less competitive members of the AFFLUENT SOCIETY. A reaction to the 'revolution of rising expectations' of ADVANCED COUNTRIES where advertising, fashion, the wish to emulate others, and even governments, artificially create demands for an ever-increasing range of goods and services (mainly of a non-essential nature).

**aligned sequence** A series of glacial overspill CHANNELS, successively crossing the divides between river valleys and showing a distinct alignment. It has been assumed in the past that the channels were developed along, or close to, a former ICE-SHEET margin, which dammed the PROGLACIAL streams to give a series of lakes, nourished by glacial meltwater, on the site of pre-existing valleys. The channels were eroded as the lakes overspilled from one to another. However, it is now believed that many such channels have been developed by SUBGLACIAL streams, flowing under considerable hydrostatic pressure and capable even of eroding uphill, without the formation of proglacial lakes. See also PARALLEL SEQUENCE. [f]



Aligned sequence and parallel sequence of glacial drainage channels.

**alimentation** See ACCUMULATION ZONE.

**alluvial fan** A fan-shaped mass of ALLUVIUM (SAND, GRAVEL, COBBLES and sometimes BOULDERS) formed where a rapidly flowing stream leaves a steep and narrow valley and enters a lowland or broad valley. At such points a reduction in gradient, and thus stream velocity, occurs, causing overloading and DEPOSITION. Alluvial fans form in many different sites, e.g.

where a small tributary valley joins a major glacial trough, as in the Rhone valley, Switzerland; where a stream incised into a FAULT SCARP flows into the scarp-foot zone; and where a desert stream passes through the MOUNTAIN FRONT to the PIEDMONT ZONE.

**alluvium** The SEDIMENTS laid down by streams. Alluvium is unconsolidated material forming features such as ALLUVIAL FANS, FLOOD PLAINS, RIVER TERRACES and DELTAS. The most common constituents are CLAY and SILT (from the SUSPENDED SEDIMENT LOAD of the stream) and SAND and GRAVEL (from the BED LOAD of the stream).

**Alonso model** A model developed by Alonso in the 1960s to explain the paradox observed in many cities that poor people tend to live close to the city centre on high-value land, whilst the rich occupy cheaper land close to the city margins (see BID-RENT CURVE). The explanation is based on the assumption that the income of a household is consumed by three basic costs—(i) the cost of subsistence (food, etc.), (ii) the cost of housing, and (iii) the cost of COMMUTING (assuming that for most people their place of work is located in or near the city centre). Poor households can make a saving on these costs by opting for an inner-city residential location (so as to be close to their work), by limiting the amount of high-cost space occupied (i.e. by living at high densities), by occupying older and often substandard housing, and by accepting MULTI-FAMILY OCCUPATION of dwellings. Conversely, rich families are assumed to have large space requirements. Because they can afford higher commuting costs, they are also able to purchase large amounts of lower-value land to be found at the edge of the city.

**alp** A high-level bench or gently sloping area standing above a deep U-SHAPED VALLEY, as in the Austrian, French and Swiss Alps. Alps are sometimes interpreted as the remaining parts of preglacial valleys, left upstanding as a result of intense glacial overdeepening. However, many are mantled by glacial deposits indicating their former occupation by glaciers. Alps often provide sites for villages (for example, Murren and Wengen above the Lauterbrunnen valley in Switzerland) and temporary settlements (*ma-yens*) which are occupied during the early summer months when the lower slopes of alps are used for haymaking. The higher parts of alps (*alpages*) are used for the summer pasturing of cows and sheep, following the clearance of the winter snow cover.

**alpha index** Used to measure the CONNECTIVITY of a NETWORK and derived from the formula

$$\frac{E - V + S}{2V - 5}, \text{ where } E \text{ is the number of}$$

EDGES (links or arcs),  $V$  the number of VERTICES (*nodes*) and  $S$  the number of *sub-graphs*. This formula compares the observed CYCLOMATIC

NUMBER with the maximum possible value of the cyclomatic number for a complete graph. The index ranges in value from 0 to 1, the latter value indicating a completely connected network. Cf BETA INDEX.

**alpine glacier** A long, tongue-like glacier occupying a clearly defined mountain valley (hence the alternative term *valley glacier*). The glacier is nourished by an ACCUMULATION ZONE (or *firn basin*) which may comprise a number of coalescent CIRQUES or a high-level ice-field. The glacier may descend steeply from its source by way of an ICE FALL, or possess a relatively smooth unbroken long-profile. Alpine glaciers are usually active (cf *passive glaciers*), owing to the large winter snowfalls associated with high mountains and the resultant considerable inputs of ice, which passes quite rapidly through the glacier to the melt zone (ABLATION ZONE) at lower altitudes. Ice velocities are usually within the range 5–20 cm day<sup>-1</sup>, but may be up to 5 m day<sup>-1</sup> on steep ice falls.

**altiplanation** A PERIGLACIAL process, involving FREEZE-THAW WEATHERING and SOLIFLUCTION, which produces step-like features (*altiplanation terraces*) and flattened hill-tops. Where a slope is underlain by rock of variable resistance to frost action, selective weathering will attack the weaker strata, forming ledges on which snow banks can accumulate. Meltwater from the snow will contribute to further frost weathering and aid transport of the resultant rubble by SOLIFLUCTION. Thus the slope irregularities will become increasingly enhanced and in time extensive benches will be formed, as on the southern slopes of Cox Tor, Dartmoor.

**amenity** A feature of the ENVIRONMENT which is perceived as being pleasant and attractive. In current geographical usage, the term tends to be applied to something which has aesthetic, physiological or psychological benefit rather than direct monetary value, e.g. fine scenery, an equable climate, open space, privacy, etc.

**anabatic wind** A local breeze which blows up-slope on summer afternoons in regions of high RELIEF. The air above the mountain slope, which is heated by intense solar radiation because of the altitude, is warmed by conduction more effectively than that above the valley floor where solar heating is less powerful. This causes convective activity, leading to a light and irregular drift of air up the mountain slope. However, the effect is rarely pronounced; anabatic winds are much less clearly developed than KATABATIC WINDS.

**anabranch** See BRAIDED STREAM.

**analogue theory** A method of scientific reasoning based on the recognition of similarities (*positive analogies*) between two objects or processes, whereby understanding of one of those objects or processes is used to help explain or understand the other object or process. For

example, the idea of a magnet has been borrowed from physics to help understand certain aspects of migration (i.e. the notion of push and pull factors), whilst in industrial geography analogies have been drawn between systems of weights and pulleys and the relative pull of different location factors (see **VARIGNON FRAME**). More recently, the **GRAVITY MODEL** has been employed in a range of geographical investigations.

**analysis of variance** A statistical technique used to test whether a series of samples differs significantly with respect to some defined property. The technique compares within-sample differences with between-sample differences, with **SIGNIFICANCE TESTS** being used to measure the degree of dissimilarity. If between-sample differences are significantly greater than within-sample differences, it can then be assumed that, in terms of the defined property, the sample represents a distinctive group or **CLASS**.

**anastomosing** A term sometimes used for a stream in which numerous individual channels are continually separating and rejoining. See **BRAIDED STREAM**.

**angle of repose** The natural angle of rest of fragments of rock occupying a slope. The fragments may be derived either from **WEATHERING** of the underlying rock, or may have fallen onto the slope from a **FREE FACE** above to build up as **SCREE** below. The precise angle of repose is determined by the size and shape of the fragments. Where these are large and angular, and 'wedge' into each other, the slope will be steep (in excess of 35°); but where they are small and rounded, and inter-granular friction reduced, the slope will be more gentle. The presence or absence of water is also important. Where this occurs in large quantities, giving rise to high **PORE WATER PRESSURE**, friction is much reduced, flowage will occur, and the detritus will assume a low angle of repose.

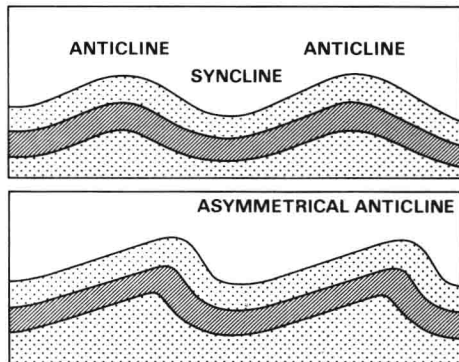
**annular drainage** A drainage pattern in which the tributary streams follow arcuate courses determined by lines of weakness in the underlying rock structure. Annular drainage is thus characteristic of dissected domes comprising alternating hard and soft rocks. The latter are etched out by **HEADWARD EROSION**, effected by tributaries of the main radial **CONSEQUENT STREAMS** developed initially on the flanks of the dome. Annular drainage is found in the Black Hills of S Dakota, which comprise a central crystalline dome (Harney Peak), around which the Cheyenne and its tributaries have formed crescentic patterns in easily eroded **SHALE** outcrops.

**anomaly** The departure of any element or feature from uniformity or from a normal state, used particularly in meteorology in connection with temperature and in oceanography in con-

nection with salinity. For example, a *temperature anomaly* is the difference in °C between the mean temperature (reduced to sea-level) for a meteorological station and the mean temperature for all stations in that latitude. The result may be either *positive* (higher than average) or *negative* (lower than average).

**antecedent drainage** A process of drainage development in which an ancient river is able to maintain its course across more youthful fold- and **FAULT**-structures as these develop. A prerequisite is that the river's capacity for downcutting must equal or exceed the rate at which the structure grows upwards across its path. Where river courses are markedly **DISCORDANT** to structure, antecedence is sometimes suspected. However, the process is often extremely difficult to prove, and can usually be discounted on various grounds. For example, the rivers cutting from north to south across the complex fold-structures of the South Wales coalfield would, if antecedent, have had to date from the Palaeozoic era, and to have endured subsequent periods of desert climate and marine inundation. However, it has been demonstrated that, in Uganda, west-flowing tributaries of the R Zaire (the present-day Kagera and Katonga) were able to maintain their courses across the developing western Rift Valley during late-Tertiary times. However, as the growth of this great structure (which involved doming as well as faulting) became more rapid during the Pleistocene period, the rivers were eventually forced to follow 'reversed' courses eastwards into the newly formed Lake Victoria.

**anticline** An upfold in the rocks resulting from compressive stresses in the earth's crust. The strata **DIP** in opposite directions from the central line, or **AXIS**, of the anticline. Anticlines may be symmetrical or asymmetrical; in southern England numerous so-called Alpine folds display dips of 30–90° on their northern limbs, and dips of up to 10° on their southern limbs. Such



Anticlinal structures

asymmetry may reflect a compressive thrust from the south, but may also result from the north-south slope of the rigid basement rocks on which the folded sedimentaries rest. [f]

**anticyclone** A large area of high atmospheric pressure, usually stationary or slow moving. It is normally associated with widely spaced isobars, resulting in light and variable breezes or calm conditions. Anticyclones occur where there is convergence of air at high altitudes in the ATMOSPHERE, consequent large-scale subsidence, and slow divergence (by way of clockwise peripheral winds) near the earth's surface. Anticyclones comprise air of low relative humidity (reflecting the dryness of the air from the upper atmosphere), and low ENVIRONMENTAL LAPSE-RATES; the latter result in ABSOLUTE STABILITY or very limited INSTABILITY, so that weather conditions are usually fair. In Great Britain anticyclones produce sunny warm weather in summer, and cold and frosty weather in winter, though sometimes with FOG and STRATUS cloud giving *anticyclonic gloom*.

**anvil cloud** A very high cumulonimbus cloud, in which the topmost parts spread out at the base of the STRATOSPHERE in the direction of the high-level winds. The upper parts of cumulonimbus clouds display a fibrous texture, which is due to the presence of snowflakes and small ice-crystals. Cumulonimbus clouds result from highly unstable atmosphere conditions (see ABSOLUTE INSTABILITY), which produce rapid convectional uplift and cooling and large-scale CONDENSATION. They give rise to heavy showers of rain, hail, sleet or snow and are often associated with THUNDERSTORMS.

**anyport** A model of the development of PORT installations, formulated by Bird (1971). The model involves 6 stages, from the overflowing of the port function from its primitive nucleus to the construction of specialized quays along the waterfront between that nucleus and the open sea.

**apartheid** A policy of separate development involving planned racial segregation and spatial reorganization pursued in South Africa since 1948 in order to ensure White domination over the non-White populations (the Black Africans, Coloureds and Indians). The policy forbids the mixing of races through marriage, promotes the residential segregation of races and yet at the same time seeks to ensure the supply of non-White labour to support the White-controlled ECONOMY. In pursuit of the objective of residential segregation, African Homelands (*Bantustans*) have been established in rural areas in which Black Africans can exercise some of the political rights denied them elsewhere in the country.

**applied geography** The application of geographical knowledge, skills and techniques to world-wide problems such as ENVIRONMENTAL HAZARDS, UNDERDEVELOPMENT, REGIONAL

IMBALANCE, SOCIAL DEPRIVATION, etc. Most applied geography has been undertaken in the broad context of PLANNING.

**aquaculture** The management of water ENVIRONMENTS for the purpose of increasing the production and harvesting of organic matter (both plant and animal), as for example *fish farming* in rivers, lakes and on the continental shelf. Although large-scale aquaculture is still in the experimental stage, it is expected to make an increasingly significant contribution to world food production.

**aquiclude** A rock which is porous and thus able to hold water, but in which the pore water is so strongly held by surface tension that water movement through the rock is virtually impossible. CLAY and unjointed CHALK are aquicludes; within these rocks there may be a high content of water (up to 50% of the total volume), but this can be expelled only by the application of extreme pressure.

**aquifer** A PERMEABLE stratum, such as LIMESTONE or SANDSTONE, which is capable of holding and transmitting GROUNDWATER; the latter, when tapped by wells, is an important source of water for human use. The groundwater in an aquifer may also escape to the surface naturally, by way of springs and seepages, where the WATER TABLE intersects the earth's surface (see DIP-slope and SCARP-foot SPRINGS). The accumulation of water in an aquifer is most effective where the permeable stratum is underlain by an impermeable stratum such as CLAY, as in the eastern North Downs of Kent where the Chalk rests on Gault CLAY. The water within an aquifer percolates by way of JOINTS and BEDDING PLANES; the latter cause the water to migrate in a down-dip direction, as in the Dakota Sandstone on the flanks of the Rockies, where underground water moves eastwards in vast quantities into the Great Plains region.

**Arab League** A confederation of some 20 sovereign Arab states (e.g. Algeria, Egypt, Libya, Sudan), first established in 1945, principally for the purpose of protecting their independence and promoting their mutual interests.

**arable farming** A type of AGRICULTURE in which the emphasis is on the cultivation of plant crops (cereals, vegetables, short-ley grass and other animal feedstuffs). Cf PASTORAL FARMING.

**arch** A natural 'door' (hence Durdle Door, Dorset, England) through a projecting mass of rock. It is produced by strongly localized EROSION by waves or rivers, or WEATHERING (for examples, by concentrated solution in LIMESTONE). The most common and spectacular arches are formed where the sea, taking advantage of weaknesses afforded by JOINTS, BEDDING-PLANES or FAULTS, erodes caves on either side of a narrow promontory. These are gradually enlarged and coalesce to form a small passage which is in turn transformed into a fully

developed arch. One of the most spectacular marine arches is the Green Bridge of Wales, near Flimston, Dyfed, Wales, where a headland of Carboniferous Limestone has been penetrated by wave action. Arches can also develop where a MEANDER 'neck' is undercut from either side by a laterally eroding stream, as at the Rainbow Bridge, Utah, USA.

**arcuate delta** A river DELTA that extends into the sea of a lake in a fan shape, with the outer edge of the delta having a rounded outline, for example, the Nile delta in Egypt. Small arcuate deltas may also be developed where heavily loaded streams enter lakes. In the Swiss Alps a meltwater stream from the Mont Miné glacier has formed an arcuate delta in an adjoining lake in only 10 years.

**area-based policies** Public policies which deliberately discriminate between different areas, as for example URBAN RENEWAL programmes concentrated on INNER-CITY areas or programmes of regional AID directed at declining areas (see DEVELOPMENT AREAS).

**Area of Outstanding Natural Beauty (AONB)** Areas in England and Wales which for reasons of scenery, interest and AMENITY enjoy special protection under the terms of the National Parks and Access to the Countryside Act (1949). AONBs are generally smaller than National Parks; they are the responsibility of local planning authorities who have powers for 'the preservation and enhancement of natural beauty'. By 1986 33 AONBs (e.g. Cotswolds, South Downs, Cornish coast, etc.) have been designated, covering 14 500 km<sup>2</sup>, or a little less than 10% of the total area of England and Wales.

**areal differentiation** During the 1940s and 1950s, following the lead given by Hartshorne, this was regarded as the main objective of geographical study. It placed great stress on the study of variations from place to place in the character (e.g. RELIEF, climate, SOILS, RESOURCES, etc.) of the earth's surface, particularly the description and explanation of these variations.

**arête** A narrow sharp-crested ridge resulting from the headward extension of neighbouring glacial CIRQUES. As the head-walls of the cirques are attacked by glacial plucking, FREEZE-THAW WEATHERING and rock collapse, the intervening upland becomes increasingly narrow and in time takes the form of a 'knife-edged' ridge. Continual headwall recession may lead to the formation of a COL, giving a *breached arête*, across which the cirque glaciers can become joined. Arêtes are also known as *grats* (for example, the Gornergrat near Zermatt, Switzerland) and (in the USA) as *combe ridges*.

**arctic drainage** See INTERNAL DRAINAGE.

**arithmetic mean** Sometimes referred to as the *average*. It is found by summing all the values in

a set of data and dividing that total by the number of values. Cf GEOMETRIC MEAN, HARMONIC MEAN. [*f* MEDIAN]

**arithmic scale** See LOGARITHMIC SCALE.

**artesian basin** A large synclinal structure, comprising an AQUIFER (or series of aquifers) sandwiched between overlying and underlying IMPERMEABLE strata. Rainwater percolates into the ground at the margins of the basin, where the permeable rocks are exposed, and migrates down-DIP towards the AXIS of the artesian basin. The GROUNDWATER lying at depth here is under great hydrostatic pressure, and when wells are bored through the overlying impermeable stratum the groundwater will rise spontaneously to the surface. The London Basin is a good example; here the principal aquifer is the Chalk, which is sealed beneath by the Gault Clay and above by lower Eocene CLAYS, and fed by rain falling on the dip-slopes of the North Downs and the Chiltern Hills. However, much of the artesian water has been withdrawn by man, and the WATER TABLE has fallen to the extent that pumping is now necessary.

**artesian well** See ARTESIAN BASIN.

**ASEAN** An abbreviation for the *Association of South-East Asian Nations* set up in 1967 by the governments of Indonesia, Malaysia, the Philippines, Singapore and Thailand to improve regional security in a somewhat troubled quarter of the world (bearing in mind the former conflict between Indonesia and Malaysia, the Vietnam War, the Vietnamese invasion of Kampuchea, as well as the potential external threat posed by China). ASEAN is not a military alliance, but it does exert considerable diplomatic pressure in the affairs of SE Asia.

**ash** Fine powdery material emitted during a volcanic ERUPTION, and resulting from the break-up of solid LAVA. The ash is often so fine (the particles may be less than 0.25 mm in diameter) that it can be carried by the wind over vast distances. During the catastrophic Mt St Helens eruption of 18 May 1980, a violent explosion blew a large cloud of ash to a height of some 18 km; the eruption continued for 9 hours, producing further quantities of ash that fell to blanket parts of Washington, northern Idaho and western and central Montana. It is estimated that several km<sup>3</sup> of ash were expelled, and the ash cloud eventually crossed to the east coast of the USA. *Ash cones* or *ash volcanoes* are formed where the ash emitted accumulates around the vent; such cones are usually concave in profile and relatively gentle-sided.

**assembly costs** The TRANSPORT COSTS incurred by a manufacturer in bringing together his raw material requirements; sometimes referred to as *collection costs*. See also PROCUREMENT COSTS.

**assets** The property of a business, usually classified on a threefold basis: (i) *current assets* -

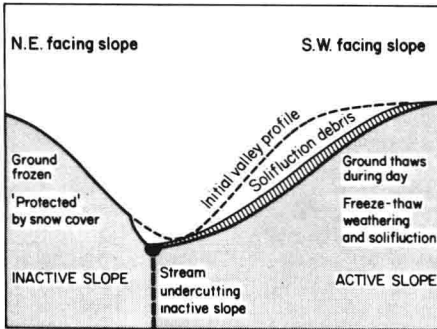


cash, stock and book debts; (ii) *fixed assets* (sometimes known as *capital equipment*) – buildings, plant and machinery, and (iii) *intangible assets* – the value of goodwill and/or patents.

**assimilation** The process by which different groups within a community (distinguished on the basis of criteria such as affluence, economic status, race, religion, etc.) intermingle and become more alike. The process particularly applies to the integration of immigrant MINORITY groups (e.g. New Commonwealth immigrants in Britain). Assimilation may take a number of different forms, such as intermarriage, adopting the values and attitudes of the community at large, contributing to the cultural life of that community or becoming proportionately represented in all the strata of the social and occupational hierarchies.

**assisted area** A term used in Britain to describe those parts of the country which benefit from various forms of government AID (see DEVELOPMENT AREA and INTERMEDIATE AREA).

**asymmetrical valley** A valley whose slopes on one side are steeper than those on the other. The formation of such a valley may be due to geological structure (for example, the DIP of the strata may cause a stream to experience UNICLINAL SHIFTING and thus to undercut and steepen the down-dip side) or to climatic influences. Many asymmetrical valleys in Britain and Europe are attributed to past PERIGLACIAL conditions, when differential exposure of the valley slopes to solar radiation and/or snow-bearing winds resulted in differential DENUDATION by frost action and SOLIFLUCTION. The *active slopes* (in many instances those facing to the southwest) were modified more rapidly than the *inactive slope* (often facing northeastwards, and remaining frozen and snow covered), resulting in asymmetry. However, the development of asymmetry is a complex process and as yet not fully understood. Many factors may be involved, including vegetation cover and the



An asymmetrical valley formed under periglacial conditions.

action of wind, not only in transporting fine SEDIMENTS from the exposed slope but in evaporating SOIL MOISTURE and thus impeding MASS MOVEMENTS. [f]

**atmosphere** The layer of gases (mainly nitrogen 78% and oxygen 21%) surrounding the earth and held in position by gravitational forces. See also STRATOSPHERE and TROPOSPHERE, which are major subdivisions of the atmosphere.

**atoll** A CORAL reef, surrounding a central lagoon, found commonly among the islands of the south Pacific (for example, in the Gilbert and Ellice Islands). It is believed that atolls have been formed above former islands (sometimes volcanoes). As these have become submerged either as a result of subsidence of the sea-floor or rises of sea-level (including that at the close of the Pleistocene period), they provided a base or 'platform' for upward coral growth. The corals have been most active on the outer walls of the reef, which has thus grown not only upwards but outwards; the inner and inactive sides of the reef mark the boundaries of the enclosed, or partially enclosed, lagoon. Such an hypothesis would explain why the coral in atolls extends to depths where light and water temperatures are now unsuitable for coral growth.

**attribute** Used in STATISTICS to denote a feature that is confined to the *nominal* scale (see NOMINAL DATA); i.e. in a classificatory sense, the feature is either present or absent. For example, a city may or may not display the following attributes: an airport, a riverside location, a population greater than one million, etc.

**attrition** The process whereby the LOAD particles of rivers, glaciers, winds and waves are reduced in size, as a result of continual impacts between individual particles. The effects of attrition in rivers (emphasized by the downstream sorting due to easy transport of the finer particles) are shown by data from the Mississippi. 38 km from the source of the river the mean diameter of particles on the river bed is 210 mm; at 120 km it is 80 mm; at 2080 km it is 0.29 mm; and at 5600 km it is 0.16 mm. This suggests that the rate of attrition is initially high, but that when the particles are reduced beyond a critical size attrition is much less effective. See COMMINATION

**Australoid** A sub-race of the human species. The Australoids probably separated from the CAUCASOIDS at an early point in human history and evolved in geographical isolation in Australia. They are now found not only in that continent (the *Aborigines*), but also in isolated parts of India, Sri Lanka and islands of SE Asia. Characteristically, they have dark skins, short stature, long heads, broad noses, dark eyes, full lips and dark wavy head hair.