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**dam.** A structure across a watercourse that impounds water; may be natural or artificial<sup>[16]</sup>.

**damping.** The process of gradually reducing amplitude of a periodic event such as acoustic oscillations in velocity logging<sup>[16]</sup>.

**dar geçit.** See aisle.

**Darcian velocity; seepage velocity.** See specific discharge.

**Darcy's law.** An empirical law given as

$$Q = -KA \frac{dh}{dL}$$

which states that the average volumetric discharge of flow through a porous medium is directly proportional to the hydraulic gradient assuming that the flow is laminar and inertia can be neglected. Note:  $Q$ =discharge,  $K$ =hydraulic conductivity,  $A$ =cross-sectional area,  $dh/dL$ =gradient, and a minus sign is attached as a convention to indicate that flow occurs in the direction of decreasing head<sup>[5]</sup>.

**Darcy unit.** A practical unit for the measure of intrinsic permeability<sup>[16]</sup>.

**Darcy-Weisbach equation.** An empirical equation given as

$$Q = -A \sqrt{\frac{8Rg}{f} \frac{dh}{dL}}$$

which states that in contrast to laminar flow, the average volumetric discharge of flow is directly proportional to the square root of the driving force and that the friction loss is equal to the hydraulic head<sup>[5]</sup>. Note:  $Q$ =discharge,  $A$ =cross-sectional area,  $R$ =hydraulic radius of the conduit,  $g$ =gravitational acceleration,  $f$ =some friction factor,  $dh/dL$ =gradient, and I have attached a negative sign to indicate that ground-water flow occurs in the direction of decreasing head. In most instances, a negative sign is not included because it is not possible to take the square root of a negative number.

**dark adaptation.** A change in the retina of the eye sensitizing it to dim light (the eye "becomes accustomed to the dark")<sup>[25]</sup>. Compare light adaptation.

**dark zone.** The part of a cave which daylight does not reach<sup>[25]</sup>.

**dating of cave sediments.** Determination of the age of development of caves is normally impossible. Only the sediments they contain can be dated, and these must necessarily be younger than the containing passage. Geomorphological correlations may allow more accurate dating of the cave erosion. The most useful dating method in current use is based upon a knowledge of the rates of decay of radioactive isotopes of uranium to thorium in stalagmites. This technique allows measurement of ages in material up to 350,000 years old. Dating of stalagmites has confirmed that many cave ages lie beyond this range. Electron spin resonance (ESR) measures the cumulative effects of radiation that are partly a function of time and can give stalagmite

ages back to about 900,000 years. Palaeomagnetism may recognize events up to 2 million years old, but a sequence of palaeomagnetically dated sediments is required to allow identification of the actual ages<sup>[9]</sup>.

**datum plane.** A reference level to which topographic or water levels in wells are related<sup>[16]</sup>.

**daylight hole.** A hole in the roof of a cave, reaching the surface<sup>[10]</sup>.

**dead cave.** A dry cave in which all solution and precipitation has ceased<sup>[10]</sup>.

**dead end.** See cul-de-sac.

**dead water.** Standing, stagnant water<sup>[16]</sup>.

**debris.** 1. Any material found to have been washed into a cave from some other locality. 2. Coarse rock fragments resulting from erosion and disintegration of bedrock<sup>[16]</sup>.

**debris karren.** These are pinnacles that form in limestones with a thin sheet structure that soon fall into smaller fragments<sup>[3]</sup>. See also pinnacles.

**decalcification.** Removal by solution of the calcium carbonate constituents from a rock or sediment, leaving a residuum of noncalcareous material<sup>[9, 21]</sup>. Synonyms: (French.) *décalcification*; (German.) *Lösungsrückstand (Entkalkung)*; (Greek.) *exasvestoses*; (Italian.) *decalcificazione*; (Russian.) *dekaljifikacija*; (Spanish.) *decalcificación*; (Turkish.) *karbonatını giderme*; (Yugoslavian.) *dekalçifikacijâ*.

**Deckenkarren.** (German.) Solutional pendant features in cave ceilings<sup>[10]</sup>.

**declination.** The angle from true (or grid) north to magnetic north for a given time and place<sup>[25]</sup>.

**declogging.** The cleaning of clogged well surface or screens<sup>[16]</sup>.

**decomposers.** Living things, chiefly bacteria and fungi, that live by extracting energy from the decaying tissues of dead plants and animals. In the process, they also release simple chemical compounds stored in the dead bodies and make them available once again for use by green plants<sup>[23]</sup>.

**decoration.** Cave features due to secondary precipitation of calcite, aragonite, gypsum, and other rarer minerals.

**deep percolation.** The drainage of soil water downward by gravity below the maximum effective depth of the root zone toward storage in subsurface strata<sup>[22]</sup>.

**deflocculation.** The breakup of flocs of gel structures by use of a thinner<sup>[6]</sup>.

**deformation.** Changing of form, volume, and relative position of rock masses<sup>[16]</sup>.

**degradation.** 1. Geological action of wearing down a surface<sup>[16]</sup>. 2. the process of degrading water quality in an aquifer by the addition of contaminants, either naturally or artificially. 3. The process by which various chemicals are altered to form new chemicals; breakdown.

**degree of cementation.** The degree to which a rock has been solidified due to cementation<sup>[16]</sup>.

**degree of karstification.** The ratio of the volume of openings to the total volume of a soluble massif, expressed as a percentage. It is the sum of the activity indices from the initiation of karstification, and so is normally applied only to carbonate rocks with little or no primary porosity<sup>[20]</sup>. Related to corrosion and solution. Synonyms: (French.) *taux de karstification*; (German.) *Ausmaß (Grad) der Verkarstung*; (Greek.) *vathmos karstikiiseos*; (Italian.) *grado di carsificazione*; (Spanish.) *grado de karstificación*; (Turkish.) *karstlaşma derecesi*; (Yugoslavian.) *stupanj krškog procesa, stopnja zakrasevanja, stepen karstifikacijé*.

**degree of saturation.** See percent saturation.

**delay.** The lapse time between signal emission and signal reception in seismic logging<sup>[16]</sup>.

**delta.** A triangular deposit of sediments at the inflow of a river into an ocean or lake<sup>[16]</sup>.

**demand.** The rate of draft from an aquifer or reservoir to meet a certain demand<sup>[16]</sup>.

**demineralization.** The removal of mineral matter from water<sup>[16]</sup>.

**dendritic.** Tree-like pattern<sup>[16]</sup>.

**dendritic drainage pattern.** A drainage pattern in which the streams branch

randomly in all directions and at almost any angle, resembling in plan the branching habit of certain trees. It is produced where a consequent stream receives several tributaries which in turn are fed by smaller tributaries. It is an indicative of insequent streams flowing across horizontal and homogeneous strata or complex crystalline rocks offering uniform resistance to erosion. This pattern may form on top of the land surface or below the land surface in karst aquifers with anastomoses forming the smaller tributaries.

**density.** The mass of water per unit volume, usually stated in grams per cubic centimeter ( $\text{gm}/\text{cm}^3$ ), but may also be measured in pounds per gallon ( $\text{lb}/\text{gal}$ ), pounds per cubic foot ( $\text{lb}/\text{ft}^3$ ), and kilograms per cubic meter ( $\text{kg}/\text{m}^3$ ). Density of fresh water is taken to be 1.0.

**density current.** A gravity-induced flow of one current through, over, or under another, owing to density differences. Factors affecting density differences include temperature, salinity, and concentration of suspended particles.

**denudation.** The wearing away of overlying loose rock to top of bedrock<sup>[16]</sup>.

**denuded karst.** Subsoil karst or interstratal karst which has been exposed by erosion of its cover<sup>[17]</sup>. See also exposed karst; interstratal karst; subsoil karst. Synonyms: (French.) *karst dénudé*; (German.) *nackter Karst, oberflächlicher Karst*; (Greek.) *apogymnomenon karst*; (Italian.) *carso denudato, carso nudo*; (Russian.) *golij karst, otkritij karst*; (Spanish.) *karst denudado*; (Turkish.)

*belirgin karst; (Yugoslavian.) ogoljeli k̄rs (krās), goli k̄rs(krās), razkriti kras.*

**depletion.** The withdrawal of water at a greater rate than replenishment<sup>[16]</sup>.

**deposition factor.** The factor that describes the settling of suspended solids within pore space<sup>[16]</sup>.

**depression.** A small hollow in a surface<sup>[16]</sup>.

**depression spring.** See spring, depression.

**depth gage.** 1. Any device used to measure depths such as water level in wells<sup>[16]</sup>. 2. Specific gage for measuring river stage<sup>[16]</sup>.

**depth of penetration.** In electrical resistivity surveys, it is the depth to which an electrical field penetrates into the subsurface as a function of electrode spacing<sup>[16]</sup>.

**desalinization.** The process of salt removal<sup>[16]</sup>.

**desander.** A device used to separate sand from well water<sup>[16]</sup>.

**descender.** A mechanical device for descending ropes<sup>[25]</sup>.

**desert.** 1. Region where precipitation is less than 10 inches per year. 2. Region where the net moisture inflow is too small to support vegetation<sup>[16]</sup>.

**desiccation.** The removal of moisture by evaporation or drying<sup>[16]</sup>.

**desiccation crack.** A crack formed in soil as a result of shrinkage to a drying volume<sup>[16]</sup>.

**desorption.** The reverse process of sorption<sup>[22]</sup>. See also sorption.

**detritus.** Loose material originating from disintegrated and weathered rock<sup>[16]</sup>.

**developed section.** The result of straightening out a section composed of several parts with differing directions into one common plane. Usually the plane is vertical and the length of the section equals the plan lengths of the passages and chambers comprising<sup>[25]</sup>.

**development.** The act of repairing damage to the formation caused by drilling procedures and increasing the porosity and permeability of the materials surrounding the intake portion of the well<sup>[6]</sup>.

**deviation.** 1. Deflection of a recording from a base line (e.g., the deviation from vertical of a borehole)<sup>[16]</sup>. 2. Usually a sling of rope or tape attached to a natural anchor at one end and clipped to the rope with a karabiner at the other. Used to avoid rub points on pitches<sup>[25]</sup>. Synonym: redirection.

**dew-point.** The point at which dew formation starts for given temperature and humidity conditions<sup>[16]</sup>.

**D-horizon.** The zone of bedrock in a soil horizon<sup>[16]</sup>.

**diagenesis.** Post depositional physical and chemical changes in sediment<sup>[16]</sup>.

**diatomaceous earth.** A light-colored, soft, siliceous earth composed of the shells of diatoms, a form of algae. Some deposits are of lake origin but the largest are marine<sup>[6]</sup>.

**differential water capacity.** The absolute value of the rate of change of water content with soil water pressure. The water capacity at a given water content will depend on the particular desorption or adsorption curve employed. Distinction should be made between volumetric and specific water capacity<sup>[22]</sup>.

**diffuse circulation; diffuse flow.**

Circulation of ground water in karst aquifers (or other aquifers) under conditions in which all, or almost all, openings (primary and secondary) in the karstified rock intercommunicate and are full of water but have not been selectively enlarged in specific zones by dissolution, and so thus no concentration of ground water occurs in restricted conduits<sup>[9, 21]</sup>. The ground-water flow is generally slow-moving, may be laminar, and have a uniform discharge and slow response to storms. It is being replaced by the term, *slow flow*, because significant confusion regarding its usage especially when thought of as in terms of porous-media flow. Synonyms: (French.) *circulation diffuse*; (German.) *Diffuse Grundwasserbewegung*; (Greek.) *thiacheomenon ydhor*; (Italian.) *circolazione carsica diffusa*; (Spanish.) *circulación saturada difusa*; (Turkish.) *yaygın dolaşım*; (Yugoslavian.) *difuzno tečenje*.

**diffusion.** Process whereby ionic or molecular constituents move under the

influence of their kinetic activity in the direction of their concentration gradient<sup>[22]</sup>.

**diffusion coefficient.** See molecular diffusion, coefficient.

**diffusion, convective.** See mechanical dispersion, coefficient.

**diffusivity, soil water.** The hydraulic conductivity divided by the differential water capacity (care being taken to be consistent with units), or the flux of water per unit gradient of moisture content in the absence of other force fields<sup>[22]</sup>.

**diffusivity, hydraulic.** The ratio of transmissivity divided by the storage coefficient or the hydraulic conductivity divided by the specific storage<sup>[22]</sup>.

**dig.** An excavation made to discover or extend a cave or to uncover artefacts or animal bones<sup>[25]</sup>.

**dike.** 1. A wall or embankment protecting lowlands from being flooded<sup>[16]</sup>. 2. A subsurface sheet-like igneous intrusion into bedrock fractures<sup>[16]</sup>.

**Dinaric Karst.** The extensive expanse of karst landscape stretching from Italy, across the whole of southern Slovenia and Croatia, into parts of south-west Bosnia and across Montenegro, ultimately extending into Albania and Greece<sup>[9]</sup>.

**dip.** 1. The angle between an inclined bedding plane in a rock sequence and the horizontal. The dip value includes an inclination and a direction and the two components are generally quoted in this

order and in the format  $10^\circ$  ENE or  $10^\circ$  towards  $025^\circ$  magnetic (etc.). The dip direction is down the slope. True dip is the maximum dip value of a given bedding plane; other, lesser values, obliquely down the same bedding plane, referred to as apparent dips. The direction at right-angles to the true dip, where the dip value is zero, is known as the strike<sup>[9]</sup>. 2. Maximum plunge of sloping planar features (e.g bedding, fractures) within a geological formation measured perpendicularly to the strike of the features. See also strike; hade.

**dipmeter survey.** A geophysical borehole logging method where the dip of the penetrated strata is measured<sup>[16]</sup>.

**diphenyl brilliant flavine 7GFF, direct yellow 96.** A yellowish dye initially developed to color tennis balls and subsequently shown to be useful in environmental tracing studies. Dye type: *Stilbene*. See also fluorescent dyes.

**discharge.** The volumetric flow of water through a given cross section<sup>[16]</sup>.

**discharge area.** An area in which ground water is discharged to the land surface, surface water, or atmosphere<sup>[22]</sup>.

**discharge, evaporation.** The direct discharge of ground water to the atmosphere by evaporation<sup>[16]</sup>.

**discharge, hydraulic.** The discharge of ground water through springs or wells<sup>[16]</sup>.

**discharge, maximum.** The maximum discharge of a river or spring during high flow conditions<sup>[16]</sup>.

**discharge, natural.** The discharge of water into surface water bodies or springflow<sup>[16]</sup>.

**discharge hydrograph.** A graph showing the discharge of water as a function of time<sup>[16]</sup>.

**discharge pipe.** A pipe through which a pump discharges<sup>[16]</sup>.

**discharge pressure.** The pressure at which a certain discharge takes place<sup>[16]</sup>.

**discharge velocity.** The rate of discharge of water through a porous medium per unit of total area perpendicular to the direction of flow.

**disconformity.** A geological unconformity between parallel beds, often with some series missing<sup>[16]</sup>.

**discontinuity.** 1. A point where a mathematical function becomes nondefined<sup>[16]</sup>. 2. An unconformity in which the bedding planes above and below the break are basically parallel, indicating a significant hiatus in the orderly sequence of sedimentary rocks. 3. A surface at which seismic-wave velocities abruptly change.

**discontinuity surface.** Any surface across which some property for a rock mass is discontinuous. This includes fracture surfaces, weakness planes, and bedding planes but the term should not be restricted only to mechanical continuity.

**dispersion.** The spreading and mixing of chemical constituents in ground water caused by diffusion and mixing due to

microscopic variations in velocities within and between pores<sup>[6]</sup>.

**dispersion coefficient.** 1. A measure of the spreading of a flowing substance due to the nature of the porous medium, with its interconnected channels distributed at random in all directions<sup>[22]</sup>. 2. The sum of the coefficients of mechanical dispersion and molecular diffusion in a porous medium<sup>[22]</sup>.

**dispersion, longitudinal.** Process whereby some of the water molecules and solute molecules travel more rapidly than the average linear velocity and some travel more slowly which results in spreading of the solute in the direction of the bulk flow<sup>[22]</sup>.

**dispersion, mechanical.** See mechanical dispersion.

**dispersion, transverse.** Spreading of the solute in directions perpendicular to the bulk flow<sup>[22]</sup>.

**dispersion zone.** A zone of intermixing in miscible flow or in sea water encroachment. See also transition zone<sup>[16]</sup>.

**dispersivity.** A geometric property of a porous medium which determines the dispersion characteristics of the medium by relating the components of pore velocity to the dispersion coefficient<sup>[22]</sup>.

**displacement.** 1. The process of replacing one fluid in a porous medium by another<sup>[16]</sup>. 2. A change in position of a material point. See also miscible displacement.

**disposal well.** A well used for the disposal of waste into a subsurface stratum. See also injection well<sup>[22]</sup>.

**dissociation.** A chemical process that causes a molecule to split into simpler groups of atoms, or ions. For example, the water molecule ( $H_2O$ ) breaks down spontaneously into  $H^+$  and  $OH^-$  ions<sup>[6]</sup>.

**dissolution.** See solution.

**dissolution of limestone.** The solubility of calcite (and hence of limestone) in pure water is very low, but is vastly increased in the presence of carbon dioxide. This gas, dissolved in the water to produce carbonic acid, permits dissociation of calcium carbonate, and dissolution rates and loads are therefore directly related to carbon dioxide content. This accounts for the importance to limestone dissolution of plant growth; soil water contains greatly more carbon dioxide than stream waters. Further dissolution occurs due to mixing of saturated waters of different carbon dioxide content (see *Mischungskorrosion*), because of a non-linear relationship between carbonate saturation and carbon dioxide content. This process is of major significance to continued dissolution within the phreas. Cold water can dissolve more carbon dioxide but, with respect to cave development, this climatic factor is overwhelmed by the higher organic activity producing more carbon dioxide in warmer environments. Loss of carbon dioxide, by diffusion into open air, causes water to precipitate calcite as speleothems. Limestone dissolution may also be achieved by organic acids or by strong acids, particularly sulphuric acid,

though such effects are normally far less than that of carbon dioxide. Strong acid dissolution is probably involved in the inception of most underground drainage. Dissolution by sulphuric acid formed by oxidation of sulfide minerals or gases may be a major cave-forming process in some regions, and was largely responsible for the enlargement of Carlsbad Caverns and Lechuguilla Cave, New Mexico<sup>[9]</sup>.

**dissolution zone.** A laterally extensive zone where extensive dissolution of bedrock has occurred.

**distortion.** A change in shape of a solid body.

**distribution coefficient.** The quantity of the solute, chemical, or radionuclide sorbed by the solid per unit weight of solid divided by the quantity dissolved in the water per unit volume of water<sup>[22]</sup>.

**distribution, frequency.** Distribution of the number of occurrences of a variate.

**disturbance.** In geology, any change of the original position of rocks by folding<sup>[16]</sup>.

**disturbed sample.** A sample disturbed with respect to its original mode of packing and sedimentation (e.g., a drill core)<sup>[16]</sup>.

**divide.** 1. A line connecting the highest topographic elevations or ground-water crests that separate one drainage basin from another<sup>[16]</sup>. 2. A ridge in the water table or potentiometric surface from which the ground water represented by that surface moves away in both directions. Water in other aquifers above or below, and even in the lower part of

the same aquifer, may have a potentiometric surface lacking the ridge, and so may flow past the divide. See also ground-water divide; water-table divide. Synonyms: ground-water divide; ground-water ridge; water-table divide. 3. (a) The line of separation, or the ridge, summit, or narrow tract of high ground, marking the boundary between two adjacent drainage basins or dividing the surface waters that flow naturally in one direction from those that flow in the opposite direction; the line forming the rim of or enclosing a drainage basin; a line across which no water flows. 3. (b) A tract of relatively high ground between two streams; a line that follows the summit of an interfluvium<sup>[1]</sup>. See also drainage divide.

**DNAPL.** Abbreviation for *dense nonaqueous phase liquid*. Liquids falling into this category have specific gravities greater than water (the specific gravity for water is usually taken to be one), are relatively immiscible with water, and tend to migrate downwards through the vadose and phreatic zones in a relatively unimpeded manner. See also LNAPL; immiscible; NAPL.

**dog-tooth crystal; dog-tooth spar.** A variety of calcite in the form of sharp-pointed crystals<sup>[10]</sup>.

**doline; sinkhole.** A basin- or funnel-shaped hollow in limestone, ranging in diameter from a few meters up to a kilometer and in depth from a few to several hundred meters. Some dolines are gentle grassy hollows; others are rocky cliff-bounded basins. A distinction may be made by direct solution of the limestone surface zone, (solution dolines), and those formed



by collapse over a cave, (collapse dolines), but it is generally not possible to establish the origin of individual examples<sup>[10]</sup>. Solutional enlargement is either circular in plan, if there is one dominant vertical joint, or otherwise irregular if there are several and can achieve dimensions of up to 1,000 meters in diameter and 100 meters deep. Where a karst bedrock is covered by superficial deposits, solutional enlargement permits the latter to subside into vertical fissures, creating *subsidence cones* or *alluvial dolines*, whose slopes are unstable because of the unconsolidated nature of the surface material. The bedrock remains covered in the first instance. Dolines are also formed by the large-scale subsidence caused by cave roof-collapse of near-surface caverns; in this instance, the *collapse doline*, the sides are cliff-like and the floor composed of the irregular blocks from the fragmented roof. Cave roof-collapse is considered a relatively rare phenomenon. Closed depressions receiving a stream are known as swallow holes or stream sinks. A doline which is largely dependent upon snow for solution-enlargement is known as a *kotlici* or *Schneedoline*<sup>[19]</sup>. In America most dolines are referred to as sinks or sinkholes. See also jama; pit; ponor; sink, sinkhole; stream sink; swallet; swallow hole; sumidero. Synonyms: (French.) *doline*; (German.) *Dolinen*, *Karsttrichter*; (Greek.) *tholene*; (Italian.) *dolina*, *pozzo naturale*; (Russian.) *karstovaja voronka*, *karstovaja kotlovina*; (Spanish.) *dolina*; (Turkish.) *düden*, *kokurdan*, *huni*; (Yugoslavian.) *vrtiča*, *ponikva*, *dolac*, *do*, *duliba*, *kotlič*, *konta*.

**doline karst.** Karst dominated by closed depressions, chiefly dolines, perforating a simple surface<sup>[25]</sup>.

**doline lake.** A small karst lake occupying a doline or closed depression in limestone. The term implies that the doline is at or near the ground-water table and in hydrological continuity with it, or that the base of the doline is sealed with an impermeable layer such as clay<sup>[20]</sup>. See also sinkhole pond. Synonyms: (French.) *lac de doline*; (German.) *Dolinensee*; (Greek.) *limni dholina*; (Italian.) *lago di dolina*, *lago carsico*; (Russian.) *karstovoe ozero*; (Spanish.) *dolina laguna*, *torca laguna*; (Turkish.) *obruk gölü*; (Yugoslavian.) *krško jezero*, *kraško jezero*.

**dolomite.** 1. The pure mineral dolomite has the composition  $\text{CaMg}(\text{CO}_3)_2$  and has properties very similar to those of calcite. The rock dolomite consists mainly of the mineral dolomite, with subordinate calcite, and has properties very similar to those of limestone. The natural dissolution of dolomite is generally slower than that of limestone. Hence, dolomite karst is generally less well developed than limestone karst, though exceptions do occur in areas such as north-west Canada. Large, deep caves can form in dolomite, as in the Rand of South Africa<sup>[9]</sup>. 2. A mineral composed of calcium magnesium carbonate,  $\text{CaMg}(\text{CO}_3)_2$ . 2. Rock chiefly composed of the mineral dolomite<sup>[10]</sup>. Also called dolostone.

**dolomitic limestone.** A limestone containing a significant proportion of the mineral dolomite but in which calcite is more abundant (e.g. 10–45% dolomite,

90–55% calcite). Many dolomitic limestones originate as calcite limestone that is subsequently affected by magnesium-rich water that replaces part of the calcite with dolomite<sup>[9]</sup>.

**dolomitic flour (sand).** A loose mealy rock or residuum, produced by the disintegration of dolomitic limestones under the processes of karstification<sup>[20]</sup>. Synonyms: (French.) *sable dolomitique*; (German.) *Dolomitsand, Dolomitasche*; (Greek.) *dholomitikon alevron*; (Spanish.) *arena dolomítica*; (Turkish.) *dolomit kumu*; (Yugoslavian.) *dolomitni pijesak, d. pesak, d. pesek*.

**dolomitization.** The process whereby limestone becomes dolomite by the substitution of magnesium carbonate for part of the original calcium carbonate<sup>[10]</sup>.

**domain.** A biological region of the earth's crust<sup>[25]</sup>.

**dome.** 1. A high shaft in a room or passage formed by solution<sup>[13]</sup>. 2. A large hemispheroidal hollow in the roof of a cave, formed by the breakdown and/or salt weathering, generally in mechanically weak rocks, which prevents bedding and joints dominating the form<sup>[25]</sup>. See also dome pit.

**dome pit.** 1. American term defined by Davis (1930) 'Mammoth Cave possesses several extraordinary vertical cavities of which the arched tops are called domes and the deep bottoms are called pits. The combined name, dome pits, is here used for them'. 2. A deep shaft in a cave, intersected by a passage at or near its mid-section<sup>[20]</sup>. See aven. Synonyms:

(French.) *évorsion, marmite inversée*; (German.) *Deckenkolk*; (Greek.) *vathís lákkos me thólon*; (Italian.) *marmitta inversa*; (Spanish.) *marmita inversa*; (Turkish.) *kemerli obruk*.

**donga.** In the Nullarbor Plain, Australia, a shallow, closed depression, several meters deep and hundreds of meters across, with a flat clay-loam floor and very gentle slopes<sup>[25]</sup>.

**double brake bars.** A rappel device used by cavers that consists of two carabiners with a brake bar on each and connected together with another carabiner or a metal ring<sup>[13]</sup>.

**downwarping.** A down bending of stratum to form a depression or syncline<sup>[16]</sup>.

**drag.** The resistance force of flowing fluid on a solid boundary<sup>[16]</sup>.

**drainage area.** A horizontal projection of an area drained by a particular river system<sup>[16]</sup>.

**drainage basin.** The land area from which surface runoff drains into a stream channel or system of stream channels, or to a lake, reservoir, or other body of water<sup>[6]</sup>. In a karst setting, subsurface drainage (internal drainage) may have boundaries defined on the basis of comprehensive ground-water tracing studies. See also ground-water basin.

**drainage density.** A ratio of total channel segments lengths cumulated for all orders to basin area<sup>[16]</sup>.

**drainage ditch.** A small channel through which surface water can drain<sup>[16]</sup>.

**drainage divide.** The rim of a drainage basin<sup>[16]</sup>. See also divide; ground-water divide; water-table divide.

**drainage network.** A system of streams and rivers draining a given basin<sup>[16]</sup>.

**drainage pattern.** A geometric arrangement of stream segments in a drainage system<sup>[16]</sup>.

**drainage ratio.** A ratio of runoff to precipitation<sup>[16]</sup>.

**drainage system.** A network of streams and tributaries<sup>[16]</sup>.

**drainage well.** 1. A well installed to drain surface water, storm water, or treated waste water into underground strata<sup>[22]</sup>. 2. A water well constructed to remove subsurface water or to reduce a hydrogeologic unit's potentiometric surface<sup>[22]</sup>.

**drain tile; french drain.** A porous pipe used for collection of excess ground water<sup>[16]</sup>.

**drapery.** A thin sheet of dripstone, equivalent to curtain<sup>[10]</sup>. See also bacon; blanket; curtain.

**draw.** A natural depression or small valley<sup>[16]</sup>.

**drawdown.** 1. The vertical distance the water elevation is lowered or the reduction of the pressure head due to the removal of water<sup>[22]</sup>. 2. The decline in

potentiometric surface at a point caused by the withdrawal of water from a hydrogeologic unit<sup>[22]</sup>.

**drawdown curve.** A plot of drawdown with radial distance from a well<sup>[16]</sup>.

**driphole.** 1. Hole in rock or clay produced by fast-dripping water. 2. Hollow space surrounded by precipitated material, such as the bottom of a stalactite<sup>[10]</sup>.

**dripline.** A line on the ground at a cave entrance formed by drips from the rock above. Useful in cave survey to define the beginning of the cave<sup>[25]</sup>.

**dripstone.** Calcium carbonate deposited from water dripping from the ceiling or wall of a cave or from the overhanging edge of a rock shelter; commonly refers to the rock in stalactites, stalagmites, and other similar speleothems; in some places composed of aragonite or gypsum<sup>[10]</sup>. Synonyms: (French.) *concrétions*; (German.) *Tropfstein, Stalagmit, Stalaktit*; (Greek.) *stalaktitis, stalagmitis*; (Italian.) *concrezione*; (Russian.) *kapel'nik*; (Spanish.) *concreción (estalagmitjca o estalactítica)*; (Turkish.) *damlataşı*; (Yugoslavian.) *sige, smugori*. See also flowstone.

**drowned karst.** Karst topography that is submerged by a change in sea level or lake level. Synonym: *karst noyé*. See also subaqueous karst.

**drowned spring.** See spring, drowned.

**drought.** A period of moisture deficiency and absence of water for plant growth<sup>[16]</sup>.

**dry cave.** A cave without a running stream<sup>[10]</sup>. See also dead cave.

**dry hole.** A hole not obtaining any production. A non-producing well<sup>[16]</sup>.

**dry valley.** 1. Valley that lacks a permanent surface stream. Dry valleys are common on carbonate rocks with good primary permeability and occur on other permeable rocks such as sandstone. Dry valleys on cavernous limestone were formed when streams flowed on the surface, either before secondary permeability and cave systems developed, or when caves were blocked by ground ice in periglacial climates. The valleys became dry when underground drains formed or were re-opened, capturing first part and then all of the surface drainage<sup>[9]</sup>. 2. A valley that lacks a surface water channel; common in the chalk of southern England<sup>[10]</sup>. 3. Elongated recesses and valleys at the bottom of which are dolines, jamas and caves. 4. A valley form of fluvial or periglacial origin in which surface drainage is intermittent or totally absent. Fossil, usually with steep scree slopes, it is variously identifiable as a product of nival processes or higher water tables subsequently lowered by allogenic valley<sup>[19]</sup>. Synonyms: (French.) *vallée sèche*; (German.) *Trockental*; (Greek.) *xera kilas*; (Italian.) *valle morta*, *valle asciutta*; (Russian.) *suhaja dolina*; (Spanish.) *valle seco*; (Turkish.) *kuru vadi*; (Yugoslavian.) *suha dolina*.

**duck; duck-under.** 1. A place where water reaches the cave roof for a short distance and can be passed by quick submergence without swimming. 2. In cave diving, a longer stretch of passage where the water

is so close to the roof that crawling or swimming beneath the water surface is needed to pass<sup>[10]</sup>.

**dug well.** A hand excavated well<sup>[16]</sup>.

**dune limestone.** (Australian.) See eolian calcarenite.

**Dupuit's assumption.** A simplifying assumption for the solution of a free surface well flow problem<sup>[16]</sup> (e.g. a water-table aquifer.) It is based on the assumption that the slope of the phreatic surface is negligibly small so that the equipotential lines are vertical and flow is essentially horizontal.

**duration curve.** A cumulative frequency curve of a continuous time series of hydrologic parameters<sup>[16]</sup>.

**Durchgangshöhle.** (German.) See through cave.

**dye gaging.** See tracer gaging.

**dye test.** Determination of direction and rate of flow of streams by marking them with dye at the infiltration area and then identifying and timing the reappearance of color at lower-lying springs, in river beds and elsewhere in a cave system<sup>[20]</sup>. Synonyms: (French.) *coloration*; (German.) *Färbung*, *Färbversuch*; (Greek.) *chrostike ichnithetesis*; (Italian.) *tracciamento con colorante*; (Russian.) *method krasjascih, indikatorov*; (Spanish.) *coloración*; (Turkish.) *boya deneyi*; (Yugoslavian.) *bojenje, barvanje*. See also tracer.

**dynamic phreas.** See phreas, dynamic.

**dynamic similarity.** A scaling procedure of model and prototype where the relationship of dynamic parameters is retained<sup>[16]</sup>.

**dynamometer.** A device used to measure the momentum force of a stream velocity<sup>[16]</sup>.

## REFERENCES

1. Bates, R. L. and J. A. Jackson. 1980. Glossary of Geology. American Geological Institute. Falls Church, Va. 751 pp.
2. Bear, J. 1979. Hydraulics of Groundwater. McGraw-Hill Inc. New York, NY. 569 pp.
3. Bögli, A. 1980. Karst Hydrology and Physical Speleology. Springer-Verlag. Berlin, West Germany. 284 pp.
4. Daoxian, Y. 1985. New Observations on Tower Karst. Paper presented at the 1st International Conference on Geomorphology (Manchester, England). 14 pp.
5. Dreybrodt, W. 1988. Processes in Karst Systems: Physics, Chemistry, and Geology. Springer-Verlag. New York, N.Y. 288 pp.
6. Driscoll, F. G. 1986. Groundwater and Wells. Johnson Division. St. Paul, Minn. 1089 pp.
7. Ford, D. C. and P. W. Williams. 1989. Karst Geomorphology and Hydrology. Unwin Hyman Inc. Lakeland, Fla. 601 pp.
8. Jennings, J. N. 1985. Karst Geomorphology. Basil Blackwell Inc. New York, N.Y. 293 pp.
9. Lowe, D. and T. Waltham. 1995. A Dictionary of Karst and Caves: A Brief Guide to the Terminology and Concepts of Cave and Karst Science. Cave Studies Series Number 6. British Cave Research Association. London, Britain. 41 pp.
10. Monroe, W. H. (Compiler). 1970. A Glossary of Karst Terminology. Geological Survey Water-Supply Paper 1899-K. U.S. Geological Survey. U.S. Government Printing Office. Washington, D.C. 26 pp.
11. Moore, G. W. and G. N. Sullivan. 1978. Speleology: The Study of Caves. Cave Books. 2nd Edition. St. Louis, Missouri. 150 pp.
12. Mylroie, J. E. 1984. Hydrologic classification of caves and karst. Groundwater as a Geomorphic Agent. R. G. LaFleur, Editor. Allen & Unwin. Inc. Boston, Mass. pp. 157–172.
13. NSS. 1982. Glossary of caving terms used in this manual. Caving Basics. J. Hassemer, Editor. National Speleological Society. Huntsville, Ala. pp. 124–125.
14. Palmer, A. N. 1972. Dynamics of a sinking stream system: Onesquethaw Cave, New York. National Speleological Society Bulletin. 34. pp. 89–110.
15. Palmer, A. N. 1981. A Geological Guide to Mammoth Cave National Park. Zephyrus Press. Teaneck, N.J. 196 pp.
16. Pfannkuch, H. O. 1971. Elsevier's Dictionary of Hydrogeology. American Elsevier Publishing Company. Inc. New York, N.Y. 168 pp.
17. Quinlan, J. F. 1978. Types of Karst with Emphasis on Cover Beds in their Classification and Development.

- Unpublished Ph.D. Dissertation. The University of Texas at Austin. 323 pp.
18. Quinlan, J. F., P. L. Smart, G. M. Schindel, E. C. Alexander, A. J. Edwards, and A. Richard Smith. 1991. Recommended administrative/regulatory definition of karst aquifer, principles for classification of carbonate aquifers, practical evaluation of vulnerability of karst aquifers, and determination of optimum sampling frequency at springs. Hydrology. Ecology. Monitoring. and Management of Ground Water in Karst Terranes Conference (3rd. Nashville. Tenn. 1991). J. F. Quinlan and A. Stanley, Editors. National Ground Water Association. Dublin, Ohio. pp. 573–635.
  19. Sweeting, M. M. 1973. Karst Landforms. Selected Glossary. Compiled by K. Addison. Columbia University Press. New York, N.Y. 362 pp.
  20. UNESCO. 1972. Glossary and Multilingual Equivalents of Karst Terms. United Nations Educational, Scientific, and Cultural Organization. Paris, France. 72 pp.
  21. UNESCO. 1984. Guidebook to Studies of Land Subsidence due to Ground-Water withdrawal. Prepared for the International Hydrological Programme. Working Group 8.4. J. F. Poland, Editor. United Nations Education, Scientific and Cultural Organization. Paris, France. 305 pp. (plus appendices).
  22. USGS. (date ?). Federal Glossary of Selected Terms: Subsurface-Water Flow and Solute Transport. Prepared by the Subsurface-Water Glossary Working Group. Ground-Water Subcommittee. Interagency Advisory Committee on Water Data. Dept. of the Interior. U.S. Geological Survey. Office of Water Data Coordination. 38 pp.
  23. William R. Elliott, Ph.D. of the Natural History Division of the Missouri Department of Conservation. The list of definitions were obtained directly from the *Biospeleology* web site:  
  
[www.utexas.edu/depts/tnhc/.www/biospeleology](http://www.utexas.edu/depts/tnhc/.www/biospeleology)  
  
which is based on *The Life of the Cave* by Charles E. Mohr and Thomas L. Poulson (1966, McGraw-Hill) with additions from Dr. Elliott.
  24. Clark, I. and P. Fritz. 1997. Environmental Isotopes in Hydrology. Lewis Publishers, Boca Raton, Fla. p. 174.
  25. Australian Speleological Federation. 1996. Cave and Karst Terminology. The list of definitions were obtained directly from the Western Australia Speleology web site:  
  
<http://wasg.iinet.net.au/terminol.html>  
  
which contains a listing of terminology commonly used in Australia.