International Association of Geomorphologists

Association Internationale des Géomorphologues

ALPHABETICAL GLOSSARY OF GEOMORPHOLOGY

Version 1.0

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Abime A vertical shaft in karstic (limestone) areas

Ablation The wasting and removal of material from a rock surface by weathering and erosion, or more specifically from a glacier surface by melting, erosion or calving

Ablation till Glacial debris deposited when a glacier melts away

Abrasion The mechanical wearing down, scraping, or grinding away of a rock surface by friction, ensuing from collision between particles during their transport in wind, ice, running water, waves or gravity. It is sometimes termed corrosion

Abrasion notch An elongated cliff-base hollow (typically 1-2 m high and up to 3m recessed) cut out by abrasion, usually where breaking waves are armed with rock fragments

Abrasion platform A smooth, seaward-sloping surface formed by abrasion, extending across a rocky shore and often continuing below low tide level as a broad, very gently sloping surface (plain of marine erosion) formed by long-continued abrasion

Abrasion ramp A smooth, seaward-sloping segment formed by abrasion on a rocky shore, usually a few meters wide, close to the cliff base

Abyss Either a deep part of the ocean or a ravine or deep gorge

Abyssal hill A small hill that rises from the floor of an abyssal plain. They are the most abundant geomorphic structures on the planet Earth, covering more than 30% of the ocean floors

Abyssal plain An underwater plain on the deep ocean floor, usually found at depths between 3000 and 6000 m. Lying generally between the foot of a continental rise and a mid-ocean ridge

Accelerated erosion Erosion that occurs at a faster rate in an area than is usual or natural, largely as a result of various human activities such as land cover removal, urbanization, etc.

Accordant drainage A drainage system whose pattern correlates to the structure and relief of the landscape over which it flows

Accordant junctions, law of The law which states that tributary rivers join major rivers at the same level, that is that there is usually no sudden drop

Accordant summit The phenomenon of hill crests and mountain peaks in a region being within a similar plane (horizontal or inclined) suggesting that they are remnants of a former plain, plateau or erosion surface

Accretion The gradual enlargement of an area of land through the natural accumulation of sediment, washed up from a river, lake or sea. Accretion also refers to the theory that continents have increased their surface area during geological history by the addition of marine sediments at their boundaries via tectonic collision with other oceanic or continental plates

Accumulation area The portion of a glacier above the firn line, where the accumulation exceeds ablation

Active channel A channel of an alluvial stream subject to change by prevailing discharges

Active layer Ground above permafrost which thaws in summer and refreezes again in winter

Active margin A continental margin that approximately coincides with a plate boundary and which is characterised by active tectonic, volcanic and seismic processes

Active volcano A volcano known to have erupted in recent times, or which is likely to erupt. Examples include Mt. St Helens, USA, and Etna, Sicily

Actualism A concept based on the premise that present causes of environmental change are sufficient to explain events of the past. Causes of changes in the past differ not in kind, but often in energy, from those now in operation

Adhesion and Adhesion ripple Refers to the adhering of wind-blown sand to a wet or damp surface. Adhesion is most common in damp or wet interdunes between active dunes, but also occurs on sand sheets, beaches, riverbanks and damp portions of dunes

Aeolation The moulding of desert landscapes by the erosional action of wind

Aeolian bounding surface An erosion surface which truncates strata within wind deposited sediments

Aeolian geomorphology The study of the effect of the wind on earth surface processes and landforms

Aeolian sand sheet An extensive area of wind-deposited sand which has only rare slip-faced bedforms

Aeolianite A cemented carbonate-rich dune sandstone that has formed as a result of the processes of entrainment, transportation and deposition by wind. This rock type has

various names including eolianite (U.S.), miliolite (India and the Middle East), dunerock (South Africa), and kurkar (Israel)

Aggradation The raising of a land surface by deposition (vertical accretion) of sediment, as on a beach, dune, mudflat, marsh, coastal plain or delta

Aggresivity A measure of the capacity of water to dissolve calcium carbonate, which depends on the amount of carbon dioxide and any organic acids in the water

Aiguille A sharply pointed rock outcrop or peak, very often produced by intense frost action in mountainous regions, such as the Alps

Aklé A network of sand dunes comprising overlapping transverse dune ridges that totally enclose the interdune areas. This produces a pattern that sometimes appears to have the form of fish scales

Alas Substantial circular and oval thermokarst depressions with steep sides and flat floors, sometimes occupied with lakes. Coalescence processes amongst individual alas depressions can lead to the development of alas valleys

Alcove An arcuate, steep-sided cavity on the side of a rock outcrop which has been produced by such processes as spring sapping

Alcrete An aluminium-rich duricrust resulting from the accumulation of aluminium sesquioxides within a weathering profile. Also called bauxite

Algal mat A carpet of blue-green algae (cyanophytes) that stabilizes intertidal sediments and precipitates carbonates on the sheltered shores of hypersaline areas

Algal rampart, Algal reef A structure typically 10-20 m, occasionally up to 100 m wide, formed in shore and nearshore waters by the growth of calcareous algae (notably *Lithothamnium, Lithophyllum, or Porolithon* spp.)

Algal ridge A structure built by calcareous algae on the surface of a reef or shore platform

Algal rim A ridge built on the more exposed (seaward) margins of coral reefs or shore platforms by encrusting calcareous algae, such as *Lithothamnium* or *Porolithon*; they are usually no more than 20 centimeters high. Networks of ridges constructed by algae may enclose shallow pools on coral reef flats and shore platforms

Aligned drainage. A parallelism of drainage lines that can be produced by structural controls or by wind erosion

Allogenic stream A stream which derives its discharge from outside the local area, particulay in areas where local conditions do not generate much streamflow (as, for example, in deserts or karstic regions)

Allometric growth A condition in which a change in size of the whole is accompanied by scale-related changes in the proportions of aspects of the object under study

Alluvium An unconsolidated, stratified deposit laid down by running water

Alluvial channel A river channel that is cut in alluvium

Alluvial cone A type of alluvial fan, but one where the slope angles are steeper, and which has been deposited by a short-lived torrent emerging at a mountain front or valley side

Alluvial fans Depositional landforms created where steep high-power channels enter a zone of reduced stream power. Typically they range in scale from axial lengths of 10s of m to 10s of km. They are usually cone-shaped forms with surface slopes radiating away from an apex, located at the point where the feeder channel enters the fan. Alluvial fans are subaerial features. However, if they extend into water they are known as ***fan-deltas***

Alluvium The term used for the sediments that are deposited by flowing water in river valleys and deltas

Alpine Glacier Small glacier that occupies a U-shaped valley on a mountain. Also called a *mountain glacier*

Alpine orogeny A mountain building period during the tertiary that produced the Alpine-Himalayan belt of mountains

Altimetric frequency curve A frequency curve constructed by dividing an area into squares, determining the maximum altitude in each square and plotting the frequency of these determinations

Altiplanation A form of earth movement in cold regions that produces terraces and flat summits that consist of accumulations of loose rock

Alveoles Honeycomb weathering features that take the form of small hollows in rock surfaces

Amphitheatre Curved valley head of non-glacial origin often attributed to erosion under arid climates, but also widespread in humid areas. They occur mainly where a valley extends headward through gently inclined sedimentary rocks or through dissected volcanic domes. Unless angular morphology is maintained by strong rectangular fracturing, curved planimetry develops as a strong caprock is undercut either by seepage or by mass failure

Anabranching river A system of multiple channels characterised by vegetated or otherwise stable alluvial islands that divide flows at discharges up to bankfull. The islands may be developed from within-channel deposition, excised by channel avulsion from extant floodplain, or formed by prograding distributary-channel accretion on splays or deltas

Anastomosing river A type of anabranching river associated with low energy and fine grained material

Angle of repose The angle at which a slope formed of loose, cohesionless sediment retains stability

Annular drainage A circular or ring-like drainage pattern that is produced when streams and rivers drain a dissected dome or basin

Antecedent drainage A drainage system which has maintained its general direction across and area of localized uplift

Antecedent platform theory The theory that coral reefs and atolls formed by upward growth following colonization of submarine banks built up to a suitable depth by uplift or accretion

Anteconsequent stream A stream which flows consequent on an early uplift but antecedent to later stages of the same tectonic uplift

Anthropogeomorphology The study of the human role in creating landforms and modifying the operation of geomorphological processes such as weathering, erosion, transport and deposition

Antidune A symmetrical fluvial bedform produced by near-critical flows, forming in broad shallow channels, and comparable to a sand dune. They migrate upstream as sediment is lost from their downstream side more rapidly than it is deposited, though they can also move downstream or remain stationary

Applied geomorphology The application of geomorphology to the solution of miscellaneous problems, especially to the development of resources and the diminution of hazards, to planning, conservation and specific engineering or environmental issues. It incorporates what is sometimes called ‘engineering geomorphology’

Arch, Natural Feature formed when weathering, together with mass collapse, and in arid areas with wind erosion, creates a tunnel through a slab of rock. They can thus be distinguished from natural bridges which are formed by fluvial or marine erosion

Archipelago Sea or lake containing numerous islands or a chain or cluster of islands

Arête A landform composed of a fretted, steep-sided ridge that separates valley or cirque glaciers. Arêtes are the result of glacial undercutting – basal sapping – of rock slopes. They are common whenever mountains and peaks rise above glaciers, as in the case with nunataks

Armoured mud balls Roughly spherical lumps of cohesive sediment which generally have a diameter of a few centimetres. They are also called mud balls, mud pebbles, pudding balls, till balls and clay balls

Armouring The process whereby a clastic deposit develops a surface layer that is coarser than the substrate. It is most commonly associated with warm deserts and gravel-bed rivers

Arroyo Incised valley bottom, particularly in the western U.S. The arroyos can be cut as deeply as 20m, be over 50m wide and tens or even hundreds of kilometres long

Artificial beach A beach emplaced by human action, as where sand brought from the land, or alongshore or offshore sources is dumped on the shore, strictly where there was no natural beach, but the term is often used where a natural beach depleted by erosion is restored or renourished

Ash flow A concentrated dispersion of hot, solid, juvenile volcanic fragments in gas which moves as a gravity-controlled flow. Also called a pyroclastic flow

Aspect The orientation of the face of a slope

Astrobleme An ancient erosional scar, usually circular in outline, that forms on the Earth's surface through the impact of a cosmic body

Asymmetric valley A valley in which one side slope is steeper than the other. This can result in some cases from different processes acting with different intensity according to aspect

A-Tent A weathering form produced by the uplift of rock sheets to produce a form that is reminiscent of a bivouac tent

Atlantic coastline A coastline where the trend of the mountain ranges is at right angles or oblique to the coastline

Atoll A ring-shaped coral reef structure (ranging from less than a kilometer to over 100 km in diameter), partly or wholly enclosing a lagoon (typically 30 to 100 m deep and several km wide); the outer (seaward) slopes plunge steeply to the deep ocean floor (oceanic atoll) or to the continental shelf (shelf atoll)

Attrition The wearing down of rock fragments by friction when they are mobilized and thrown against a rock surface, or ground against other rock fragments by wind action, waves or currents

Aulacogen A continental rifting system in which seafloor spreading proceeded for a while and then ceased. Often called an aborted pull-apart

Autocthonous Denoting any feature which is not transported, i.e. is *in situ*

Autogenic stream A stream whose flow is sustained by a continuously positive water balance along its course

Avalanche boulder tongue Avalanche boulder tongues are distinctive accumulations of coarse debris resulting from the long continued, downslope transport of debris by snow avalanches

Avalanche A volume of snow, ice, soil, rock debris (or a mixture of all of them) that moves rapidly down a slope by gravity. The term is normally applied to the sudden movement of snow and ice in mountainous regions, but it is also applied to the sudden movement of rock debris and other sediment (a ***debris avalanche***)

Avalanche tarn Small water-filled depression produced by repeated avalanche impacts

Aven A vertical passage or shaft which connects a cave with the surface or overlying chambers and passages

Avulsion The separation of an area of land when a river or estuary channel suddenly changes its course, usually during floods, or when a meander is breached

Back arc basin Submarine basin that forms behind an island arc. Such basins are typically found along the western margin of the Pacific Ocean near the convergence of two tectonic plates. A back-arc basin is formed by the process of back-arc spreading, which begins when one tectonic plate subducts under (underthrusts) another

Backshore The area of a beach extending from the limit of high water foam lines to dunes or extreme inland limit of the beach. It is only affected by waves during exceptional high tides or severe storms

Backswamp The section of a floodplain where deposits of fine silts and clays settle after a flood. They usually lie behind a stream's natural levees

Backwall The curved, steep head wall of a landslip scar or a glacial cirque

Backwash Also known as 'swash', the backwards flow of water on a beach

Backwearing or backwasting A process of lateral recession of slopes in which there is no loss of steepness

Badlands Deeply dissected erosional landscapes formed in soft rock terrain, commonly but not exclusively in semi-arid regions. Badland processes are dominated by overland-flow erosion. Badlands usually have a high drainage density of rill and gully systems, and at most support sparse vegetation

Bajada The broad zone of coalesced or compound alluvial fans that form a more or less continuous piedmont alluvial apron lying between the mountain front and the basin floor in areas like the semi-arid south western United States

Bank erosion The detachment and entrainment of bank material as grains, aggregates or blocks by fluvial, subaerial or geotechnical processes

Bankfull discharge A hydrologic term, is the flow rate when the stage (height) of a stream is coincident with the uppermost level of the banks -- the water level at channel capacity, or bankfull stage

Bank storage The process by which water, during periods of above-normal streamflow, infiltrates into and saturates bank sediment

Bar An elongated bank, ridge or mound of sediment (sand or gravel) a few meters wide, deposited and shaped by waves and currents, and submerged at least at high tide (i.e. can be partly or wholly exposed at low tide). Bars commonly form off beaches, but also occur off river mouths and lagoon entrances. A break-point bar is a concentration of sediment formed by breaking waves where material that is being carried shoreward meets that withdrawn from the beach by backwash. Longshore bars are formed parallel to a beach, and at least partly exposed at low tide, while oblique bars run at an angle to the beach, and transverse bars at right-angles to it. Bars may also occur in cuspate, lunate, looped, crescentic, reticulate, or chevron patterns

Barbed drainage A pattern of drainage on which the confluence of the tributary streams with the main river is characterized by a discordant junction, as if the tributaries intend to flow upstream and not downstream

Barchan An active crescentic-shaped dune, developing in areas of unidirectional winds and limited sand supply

Barchanoid ridge A type of transverse sand dune that has the appearance of a series of linked barchans dunes, perpendicular to the resultant sand transport direction

Barranco Deep, rectanglular to steep-sided trapezoid-shaped ravine or arroyo in partially consolidated bottomland alluvium

Barrier (Coastal barrier) An elongated ridge of deposited sediment (sand, pebbles, occasionally boulders) that has been built up by wave action above high tide level along the coast or across an embayment (bay barrier). It differs from a bar, which is submerged at least at high tide. Typically a barrier is backed by a lagoon or swamp that separates it from the mainland or from earlier barriers, but this is not essential: some barriers abut older land surfaces. A barrier may be from a few m to more than a km wide and up to 100 km long, attached to the mainland at one end (see Barrier spit) or both ends, or interrupted by tidal inlets (see Barrier island)

Barrier beach A single, narrow (usually < 200 m wide) elongated ridge built parallel to the coast, without surmounting dunes

Barrier island A barrier segment bordered by transverse gaps (tidal inlets, lagoon entrances, river outlets) which may be migratory and subject to closure. Barrier islands are typically 0.5 to 5.0 km wide, 1 to 100 km long and 6 to 100 m high

Barrier lagoon A lagoon extending roughly parallel to the coastline, behind a barrier or reef. See Coastal lagoon

Barrier reef An elongated, narrow coral reef built up offshore and parallel to the coast, from which it is separated by a broad lagoon (which may be several kilometers wide), typically with extensive areas too deep for coral growth

Barrier rollover the landward migration of a barrier that is accomplished primarily through the process of storm overwash

Barrier spit A barrier attached at one end to the mainland, with or without recurves, and backed by a bay, lagoon or marshland (swamp)

Basal ice A relatively thin layer of debris-rich ice present at the base of a glacier which is produced at and interacts with the glacier bed

Basal sapping Undercutting at the base of a slope by groundwater seepage, weathering, etc.

Basal sliding The sliding movement of a glacier over its rock-floor, resulting from the gradient of the slope and the weight of the ice

Basal surface of weathering A line of variable depth beneath the land surface which marks the lower limit of active weathering and which marks the change from sound rock (beneath) to weathered rock or regolith (above)

Basal till Till carried at or deposited from the under surface of a glacier

Base flow Sustained, low, or fair-weather flow of a stream, often largely derived from groundwater flow

Base level The concept that there is an effective lower limit to erosional processes. There are four types: Grand base level or ‘ultimate base level’ which is the plane surface forming the extension of the sea under the lands; temporary or structural base

level, whereby there is a limit to downward erosion of an ephemeral character imposed headwards of a resistant outcrop; base-levelled surface, which is an ultimate or penultimate topographic surface; and local base level, as for example in areas of interior drainage under an arid cycle of erosion

Basin-and-range terrain A type of geological structure comprising large fault blocks (ranges) separated by down-faulted blocks (basins)

Batholith A large and deep-seated mass of igneous rock, usually with a surface exposure greater than 100 km^2

Bauxite An impure aluminium hydroxide associated with the clay deposits of weathering zones, especially in tropical limestone regions

Bay A general term for a wide (typically > 1 km) coastal re-entrant between two headlands, its seaward boundary generally wider than the extent of landward penetration

Bayou An area of sluggish water which forms a backwater beside the main channel of a river

Beach A wave deposited accumulation of sediment located between modal wave base and the upper swash limit

Beach berm An ephemeral flat or landward-sloping step or terrace built on a beach face by swash action. On shingle beaches there may be several such berms, resulting from successive episodes of swash action at successively lower tidal levels

Beach cusp Crescentic concave-seaward regularly spaced features occurring along the shoreline. The term has been used for features with spacing ranging from 10 cm to many hundreds of m

Beach nourishment The act of placing sediment (termed fill) on a beach by artificial means using sources outside the nourished area

Beachrock A consolidated deposit that results from lithification by calcium carbonate of sediment in the intertidal and spray zones of mainly tropical coasts

Beach ridge Azonal accumulation form created on the shores of seas and lakes. They are usually sub-parallel ridges of sand, gravel or pebble, as well as detritus of shell situated in the foreshore zone, which is the boundary of low and high water's range

Beaded drainage A series of small pools connected by streams that results from the thawing of ground ice

Bedform The transport of sand or gravel as bedload creates on the bed a variety of features called bedforms, the size, form and relative orientation of which depend through complex interactions on the density, shape and coarseness of the sediment particles, and on the strength, uniformity and steadiness of the current. They are known from rivers, tidal systems (especially estuaries) and the deep sea, and are most widely familiar from sand deserts (dunes, ripples, etc.)

Bedload Sediment that is transported in a stream by rolling, sliding or skipping along the bed or very close to it

Belt of no erosion The uppermost hilltop zone of a slope in which the gradient is insufficient to generate erosion in the form of hillwash

Bergschrund Deep, transverse or extensional crevasses that occur at the heads of valley or cirque glaciers

Berm A nearly horizontal or gently landward sloping ridge at the crest of a beach

Bifurcation ratio The relationship between the number of streams of one order and the number of the next higher order

Billabong Blind or discontinuous anabranches of complex channel systems

Bioconstruction Formed by organisms (e.g. algae, corals, vegetation) that trap sediment, including the products of their own decay (e.g. shells, peat)

Bioengineering The use of any form of vegetation as an engineering material as, for example, in soil conservation or river bank erosion control

Bioerosion Removal of rock material by the physical and chemical processes associated with the activities and metabolism of plants and animals that inhabit the shore, especially on limestone coasts

Biogemorphology An umbrella term to describe studies which focus on the linkages between ecology and geomorphology. Three common themes within present-day biogeomorphological research are the effects of organisms on geomorphic processes, the contribution made by organic processes to the development of landforms, and the impact of geomorphological processes on ecological community development

Bioherm A mound, bank or reef built by sedentary organisms, such as corals, algae, foraminifera, molluscs or gastropods, or a reef built in the nearshore zone by oysters, mussels, gastropods (e.g. vermetid reefs) or worms (e.g. serpulid reefs)

Biokarst Karst landforms created, or influenced to a significant degree, by biological processes. Biokarst features can be erosional or depositional, or involve a combination of the two processes, and are commonly found on exposed limestone surfaces in a range of environmental settings

Bioprotection The concept that some animals and plants protect the surfaces they colonise from weathering and erosion. Plant roots bind soils, lichens umbrella buildings from insolation, moisture and pollutants

Biostasie (Biostasy) A period of soil formation and land stability

Biostrome A sheet-like mass of purely organic material derived from organisms *in situ, in* contrast to the dome-shaped form of a bioherm

Bioturbation The physical rearrangement of sediments by churning, stirring or disruption through biophysical processes

Biscuit-board relief Topography which is characterized by a rolling upland or plateau into which glacial cirques have taken out large bites but where the cirques have yet to coalesce

Blanket bog An area of waterlogged ground, often composed of peat that develops under high rainfall conditions and forms extensive low-relief areas

Blind valley A valley formed by fluvial processes that terminates downstream against a steep and sometimes precipitous slope at the foot of which the stream that carved the valley disappears underground into a cave system. The headwaters are usually on relatively impervious rocks such as sandstones or granites and the surface stream disappears underground when it crosses a lithological contact onto a karstic rock such as limestone

Block field/block stream The term blockfield (or block field) is used to describe an extensive cover of coarse rubble on flat or gently-sloping terrain, with an absence of fine material at the ground surface. The German term felsenmeer ('stone sea') is sometimes used to describe the same phenomenon. Three types of blockfield are recognised: autochthonous blockfields, formed in situ by weathering of the underlying bedrock; para-autochthonous blockfields, in which boulders produced by weathering of bedrock have undergone downslope mass movement over low gradients; and allochthonous blockfields derived from glacial deposits by upfreezing of boulders and washing out of fine sediments

Block slide A slide of coherent bedrock on a gently sloping discontinuity

Blow hole Fountains of spray are emitted through blowholes during storms and high tidal periods when large breakers surge into tunnel-like caves connected to the surface

Blowout A small saucer-shaped hollow or trough excavated in vegetated dunes by wind action, with an advancing nose of sand spilling downwind

Blue hole Submarine, circular, steep-sided holes which occur in coral reefs

Bog Any nutrient poor, acidic peatland community

Bog burst The sudden disruption of a bog so that there is a release of water and peat which may then flow over a considerable distance

Bogaz A narrow, deep ravine in a karst area produced by limestone solution along bedding lanes, joints and fissures

Boinka Groundwater fed irregular saline lake area

Bolson Derived from the Spanish word for ‘purse’, bolsons are depressions with centripetal drainage that are surrounded by hills and mountains. At their centre there is normally a saline playa or pan, but if the low-lying area is drained by an ephemeral stream the basin may then be termed a ‘semi-bolson’. Bolsons are a feature of semi-arid basin-and-range terrain and may contain such landform-types as pediments, alluvial fans and bajadas

Bombardment The striking of the Earth by bodies such as asteroids, comets and meteoroids (bolides). Impacts can create landforms including craters (astroblemes),

generate tsunamis, set off volcanic activity, send dust into the atmosphere and may be implicated in mass extinctions, such as that at the end of the Cretaceous

Bornhardt Dome-shaped, steep-sided hills, usually built of massive igneous rocks such as granite or rhyolite, with bare convex slopes covered with very little talus and flattened summit surface. Bornhardts form due to differential weathering and erosion, in the course of which the surrounding less massive rock is eroded away leaving massive, sparsely jointed compartment

Boss A small batholith or any dome-shaped intrusion of igneous rock especially one exposed at the surface through erosion of less resistant host rocks

Bottomland That part of an alluvial valley formed of and underlain by alluvium that has been transported by and deposited by the stream flowing through the valley reach

Boulder clay An unstratified mass of glacially deposited material that contains both coarse and fine material. Much of it is ground moraine and is often called till

Boulder field Blockfield or felsenmeer

Boulder-controlled slope A slope whose angle is controlled by the angle of repose of the boulders which have been produced by weathering but remain on the slope

Boulder train A stream of boulders generated from an identifiable bedrock source and carried laterally in a more or less straight line by a glacier or ice sheet

Boundary layer A boundary layer can be defined as that part of the flow markedly affected by the presence of the boundary. Here, a flow refers to the motion of almost any kind of Newtonian fluid. Most flows of geomorphic interest, such as flowing water in a river or blowing wind over a sand dune, are considered boundary layers because much of the flow is strongly affected by the boundary

Bounding surfaces Represent discontinuities in sedimentation

Bourne A temporary stream that flows in a normally dry chalk valley

Bowen's reaction series A series of minerals which crystallise from molten rock of a specific mineral composition, wherein any mineral formed early in the chain will later react with the melt, forming a new mineral further down the series; the minerals formed under decreasing temperatures of crystallization are more stable in the weathering environment

Box valley A box valley has a broad flat floor, bounded by steep slopes which form a sharp piedmont angle

Braid bar Or mid-channel bar, a landform composed of sand and gravel in a river that begins to form when the discharge is low and the river is forced to take the route of less resistance by means of flowing in locations of lowest elevation. Over time, the river begins to erode the outer edges of the bar, causing it to become a higher elevation than the surrounding areas. The water level decreases even more as the river laterally erodes the less cohesive bank material resulting in a widening of the river and a further exposure of the braid bar. As the discharge increases, material may deposit about the braid bar since it is an area in the river of low velocity due to its increased elevation in

relation to surrounding areas. During times of extremely high flow, the bars may become covered; only to resurface when the flow decreases

Braid plain Extensive region of gently sloping terrain composed of inter-lapping alluvial fans resulting from the sediment discharge of glacial meltwater streams

Braided river A river that has a wide, relatively horizontal channel bed over which water during low flows forms an interlacing pattern of small sub-channels that split and then coalesce downstream

Breached anticline An anticline where erosion has been concentrated along the fold axis to result in an elongated valley bounded by inward facing escarpments

Breakout flood Sudden release of impounded water from lakes in volcanic regions

Break-point bar A bar built in the zone where waves break, deposition occurring where shoreward drifting beneath incoming waves meets seaward drifting by backwash, leaving a parallel trough to landward

Bridge, natural (see Natural bridge)

Brousse tigrée (tiger bush) A striking form of patterned ground composed of alternating bands of vegetation and bare ground aligned at the contour. From the air, these bands or arcs form a distinctive pattern similar to the pelt of a tiger

Bruun rule A belief that with a rise in sea level, the profile of a beach and its nearshore zone would move landward and upward, and that the quantity of sediment eroded from the upper part of the profile would be transported seaward to build up the adjacent seafloor by an amount equivalent to the sea level rise

Bubnoff unit Unit providing a useful means to quantify the rate of operation of diverse geomorphological processes as a rate of ground loss (perpendicular to the surface) or slope retreat. A unit equals 1 mm per 1000 years, equivalent to 1 m^3 km^{-2} a^{-1}

Bulge, valley (see Valley bulge)

Buried karst A karst surface that is buried by later rocks

Buried valley The bedrock expression of a valley buried by more recent deposits. These features are surprisingly common but are not well known as they have no surface expression. They are usually identified following borehole information or other sub-surface investigations employing geophysical techniques

Butte A small steep-sided and flat-topped hill, built of flat lying soft rocks capped by a more resistant layer of sedimentary rock, lava flow or duricrust, surrounded by a plain. Butte is smaller than mesa and may be considered as a more advanced stage of mesa degradation. Together with mesas, buttes are outliers that occur in front of cuestas and plateau margins, indicative of long-term scarp retreat

Butte-témoin An outlier

Bysmalith A plutonic plug or mass of igneous rock which has been forced up into the overlying rocks causing them to dome up and fracture

Cala, Calanque A deep steep-sided marine inlet on a limestone coast: calas are found in the Balearic Islands and calanques on the coast of Provence, France. They may be drowned valleys that were incised during low sea-level stages into carbonate landforms

Calcrete A type of near-surface duricrust, predominantly composed of calcium carbonate, which occurs in a range of forms from powdery through to nodular and highly indurated

Caldera A large crater or depression resulting from a powerful volcanic explosion or the collapse of the central part of a volcano

Caliche A crust of sodium nitrate, though also used as a synonym for calcrete

Calving The breaking away of a mass of ice from a floating glacier or ice shelf to form icebergs or brash ice

Cambering The result of the warping and sagging of rock strata which overlay plastic clays, causing the flow of the overlying rocks towards adjacent valleys

Canyon A deeply incised, steep-sided river valley

Capacity The ability of a stream to move its sediment load. Generally, it varies according to the third power of stream velocity

Cap-rock A resistant layer of rock that protects underlying weaker rocks and gives rise to such features as escarpments, mesas and buttes

Cape A large, often rounded coastal protrusion, located where the coastline intersects a range of mountains, hills, or a plateau, usually where a drainage divide reaches the coast. However, some capes are low-lying, e.g. Cape Canaveral (Kennedy) and others on the American Atlantic coast

Capture, river The capture of one drainage system by another system during the course of drainage pattern evolution, as a result of greater erosion by one stream which then heads back

Carbonation A chemical weathering process in which carbonate rocks are attacked by rainwater containing dissolved carbon dioxide and therefore acting as a weak carbonic acid

Carse A flat area of alluvium that lies adjacent to an estuary

Case hardening The formation of a hard, resilient crust on the surfaces of boulders and rock outcrops through the filling of voids with natural cement composed very often of iron and manganese oxides, silica and calcium carbonate. Beneath the hard surface the rock may be weakened, so that if the crust is breached, cavernous weathering and tafoni formation may occur

Castle kopje A small inselberg in which the joint pattern of the rock has influenced the shape of the summit, giving a castellated appearance

Cataclasis The process of rock deformation accomplished by the fracture and rotation of mineral grains, as in the production of a crush breccia

Cataclinal Pertaining to a stream or river which trends in the same direction as the dip of the rocks over which it flows

Cataract A series of stepped waterfalls across a stream channel

Catastrophism A concept that landforms are the result of sudden catastrophic events rather than slow processes

Catchment The area drained by a river and defined by the surrounding watershed

Catena A sequence of soils that changes in response to their positions on a slope owing to variations in weathering, transportational processes and soil moisture conditions on the slope

Causse A French term synonymous with karst

Cave or cavern A subsurface macro opening or chamber or series of chambers, resulting very often from the solution of carbonate rocks

Cavernous weathering A process which causes the hollowing-out of rock outcrops and boulders on vertical and near-vertical faces

Cavitation A process of fluvial erosion commonly occurring at waterfalls and rapids, but also in sub-glacial streams, where bubbles of air within the water implode, sending out shock waves that can exert considerable stresses

Cay A small low-lying depositional island of coralline sand or gravel (shingle cay) built up just above high tide level by wave action on a reef flat, usually towards the lee side. In the Caribbean a cay is termed a key

Celerity In a river, the square root of the product of the acceleration due to gravity and the mean depth of the river flow

Cenote A distinctive type of doline or sinkhole, formed by the dissolution of limestone or other soluble rocks in subdued karst plains. The typical Yucatan cenote is a near-circular, water-filled shaft with vertical or overhanging walls extending up to 100m downward from the ground surface

Centripetal drainage A pattern of streams converging on a central lowland from surrounding highlands

Channel The bed and banks that confine the surface flow of a stream

Channel capacity The size of the river channel cross-section to bankfull stage, usually expressed as the cross-sectional area in square metres

Channel resistance Sources of resistance, such as roughness, which oppose downstream motion and result in energy loss

Channel storage The volume of water that can be stored along a river channel because of the variations in channel morphology

Channelization Straightening or deepening of a natural channel by artificial cut-offs, grading, flow-control measures, or diversion of flow into a man-made channel

Chatter marks A series of small, closely spaced, crescentic grooves or scars formed in bedrock by rocks frozen in basal ice as they move along and chip the glacier's bed. The horns of the crescent generally point down glacier

Chelation The chemical removal of metallic irons in a rock or mineral by biological weathering

Cheluviation The result of water containing organic extracts combining with soil cations to form a chelate. This solution then moves downward through the soil profile by eluviation, thereby transferring aluminium and iron sesquioxides into lower horizons

Chemical denudation Denudation that results from the removal of dissolved material. Most frequently chemical denudation is calculated from the solute loads of rivers draining large catchments

Chemical weathering The decomposition of rock minerals in situ by chemical reactions

Chenier ridge A long, low-lying narrow strip of sand, often shelly and typically up to 3 meters high and 40 to 400 meters wide, deposited in the form of wave-built beach ridge on a swampy (peat and clay), deltaic or alluvial coastal plain by wave action. Many cheniers contain shelly sand and gravel

Chevron A linear pattern of small, V-shaped ridges formed by the dragging of an object over the surface of a viscous mud. The V-shapes close in the down-current direction, enabling the marks to be used as palaeocurrent indicators

Chézy coefficient/equation An empirical formula relating stream velocity to the controlling variables of hydraulic radius and channel slope

Chine A deep and narrow ravine cut into soft rock on a cliffed coast by a stream descending steeply to the shore, often over waterfalls

Chott A seasonal lake, often very saline, especially in the context of tectonically formed basins in North Africa

Chronosequence A time sequence of landforms constructed by using sites of different ages

Chute A narrow channel with a swift current, applied to rivers, the straits between the mainland and islands, and to furrows produced by avalanches on hill slopes

Cinder cone A volcanic cone composed of small fragments of solidified lava formed during explosive eruptions

Cirque (corrie/cwm) A bowl-shaped depression formed by glacial erosion of bedrock

Clay dune A dune, often a lunette, formed of clay sized particles or clay aggregates

Clay-with-flints An admixture of clay and gravel, predominantly flint, occurring in the chalk uplands of southern England, and probably the insoluble residue left after chalk solution and/or the reworking of Tertiary deposits

Clay pan A small dryland depression with a baked surface of clay

Clast Grain of sediment, silt, sand, gravel, etc., especially as a constituent fragment of a clastic rock formation, as distinguished from a chemical or biogenic component of such a formation

Clear water erosion The erosion caused by rivers whose sediment load has been removed or reduced by the construction of a dam and reservoir. With a reduced sediment load, incision tends to occur rather than aggradation

Cliff A rocky near vertical slope

Cliff, marine A steep (usually > 40°, often vertical and sometimes overhanging) coastal slope cut into (and thus exposing) rock formations, produced by basal marine erosion (undercutting), but occasionally by faulting or earlier fluvial or glacial erosion

Cliff-top dunes Usually found where sand blown from a beach moved up and over a cliff, but the link between the beach and the dune has been removed by erosion, exposing the cliff; occasionally the dunes have arrived from inland

Climatic geomorphology The interpretation of land form assemblages and regions in terms of the climatic zones in which they occur

Climato-genetic geomorphology An attempt to explain landforms and different relief generations in terms of fossil as well as contemporary climatic influences

Climbing dune Topographic dune that occurs to the windward side of a hill and move up the hillside

Clint and grike An upstanding block of limestone (clint) bounded by fissures (grikes)

Clitter Accumulations of large granite boulders as a blockstream on hill slopes below tors

Cluse A steep sided valley which cuts through a mountain ridge

Cockpit karst Scenery produced by limestone solution resulting in a hummocky terrain of conical residual hills surrounded by depressions

Col A well-defined depression (pass, saddle or wind-gap)

Cold-based glacier A glacier whose base is at a temperature much below 0°C and frozen to the bedrock, resulting in slow movement and limited erosion

Collision coast A coastline coinciding with the convergence of two lithospheric plates

Colluvium An unconsolidated mass of rock debris and weathered material that has accumulated at the base of a cliff or slope and deposited by surface wash and various mass movement processes

Combe (Coombe) A small valley

Comminution The process of reducing a mass to smaller particles by impact or abrasion by water, wind or ice

Competence The ability of a current of water or wind to transport sediment of a particular particle size

Complex dune A dune which is a combination of two or more dune types

Complex response The variety of linked changes which may occur in a drainage basin in response to the single passage of a geomorphological threshold

Composite cone A volcanic cone showing a crude stratification owing to the alternate deposition of layers of ash, cinders and lava

Compound dune A large dune on which smaller dunes of similar type and slip-face orientation are superimposed

Compressing flow A type of glacier flow in which there is a decrease of velocity in a down-glacier direction

Conchoidal fracture A fracture in a rock or mineral which is shaped like a shell

Concordant coast A coastline in which the natural grain of the country, represented by ridges and valleys runs parallel to the coast

Concordant drainage drainage that is concordant to geological structures

Cone A mass in which the base is a circle and the summit a point, as with many volcanoes

Cone karst A type of karst dominated by residual hills. The fencong of China

Congelifluction The movement of rock and earth, usually down hillslopes, as a result of freezing and thawing of ice

Congelifraction Freeze-thaw weathering

Congeliturbation Frost churning in the active layer

Consequent stream A stream whose course follows, or is ‘consequent upon’ the original slope of the land surface

Constant slope The straight part of a hillside surface lying below the free face, and having an inclination determined by the angle of repose of the talus material forming it

Constructive waterfall A waterfalls produced by the precipitation of curtains of tufa

Constructive wave A type of wave the effect of which is to build up a beach profile

Continental drift The hypothesis that continental land-masses have undergone changes in position as a result of seafloor spreading

Continental flood basalts The result of a giant volcanic eruption or series of eruptions that coats large stretches of land or the ocean floor with basalt lava. Flood basalts have occurred on continental scales (large igneous provinces) in prehistory

Continental margin A zone which combines both the continental shelf and the continental slope as is distinct from the deep-sea floor

Continental rise The gently inclined slope which leads up from the deep-sea floor to the foot of the continental slope

Continental shelf The submerged gently sloping margins of a continent bonded on the ocean side by a continental slope

Continental shield An ancient, stable, low-relief interior of a continent

Continental slope A slope between a continental shelf and the adjoining abyssal floor

Continuous permafrost zone A region in which permafrost occurs everywhere in the ground except beneath large bodies of water or ice

Contributing area The portion of a catchment which is, or appears to be, providing water for storm runoff

Convergent boundary In plate tectonics, a convergent boundary, also known as a destructive plate boundary (because of subduction), is an actively deforming region where two (or more) tectonic plates or fragments of the lithosphere move toward one another and collide. As a result of pressure, friction, and plate material melting in the mantle, earthquakes and volcanoes are common near convergent boundaries. When two plates move towards one another, they form either a subduction zone or a continental collision

Convex slope A slope element with a progressively increasing steepness in a downslope direction

Convolution a wavy pattern in sediment caused by frost churning and periglacial action

Coombe A short, steep-sided valley

Coombe rock A structureless mass of unstratified rubble produced by frost weathering and solifluction under past periglacial conditions

Coquina A carbonate rock which consists largely or wholly of mechanically sorted, weakly to moderately cemented fossil debris (especially that of shells) in which the interstices are not necessarily filled with a matrix of other material

Coral algal reef A marine structure containing colonies of scleractinian corals

Corestone A spheroidal boulder of relatively unweathered rock surrounded by saprolite and formed by sub-surface weathering of a joint block

Corniche An organic protrusion growing out from steep rock surfaces at about sea level and providing a narrow pavement at the foot of sea cliffs. Calcareous algae are a major component, along with serpulids and vermetids

Corrasion The mechanical erosion of rock surfaces by the impact of moving debris

Corridor karst A type of karst characterized by long, narrow chasms enlarged by the action of water and into which surface runoff or stream may flow; they may be located along a fault plane, fissure, joint or between two beds

Corrie A glacial cirque

Corrosion The chemical erosion of rock surfaces by water

Corrosion plain A product of the end stages of karst denudation when the surface is lowered so that residual hills disappear and only a plain is left

Cosmogenic dating A technique based on the fact that Earth is constantly being bombarded by cosmic rays. These induce nuclear reactions within the upper few m of the Earth's surface, producing cosmogenic nuclides. With the development of advanced spectrometric techniques it became possible from the 1980s onwards to measure the concentrations of these nuclides. This enables dating of surfaces to be undertaken as their nuclide concentrations are interpreted as reflecting the time elapsed since the surface was first exposed. The range of dates that can be obtained can extend over several thousands to several millions of years

Coulée A flow of volcanic lava which has cooled and solidified

Couloir A deep gorge or ravine on the side of a mountain

Covered karst A limestone terrain in which the characteristic karstic forms are buried beneath a cover of superficial material

Coversand Aeolian sand sheets of cold climate origin

Crab-hole A small abrupt depression in the ground surface which occurs in sediments that are prone to vertical cracking and horizontal piping

Crag-and-tail A glacial landform developed where a glacier or ice sheet overrides a mass of hard rock (the crag), which protects softer rock in its lee, thus forming a tapered, gently sloping ridge (the tail)

Crater A rounded depression formed at the summit of a volcano or by the impact of a meteorite

Craton A continental area that has experienced little internal deformation since the Precambrian. They form the core of ancient shield areas

Creep The gradual downslope movement of material on hillsides or of glacier ice under the influence of gravity

Crevasse A deep fissure in the surface of a glacier resulting from tensional forces

Crevasse-splay A fan-shaped system of distributive and anastomosing channels developed on the side of a levee

Crust, biological Organic crusts (also called microphytic, microbiotic, cryptogamic, cyanobacterial crusts) that occur particularly in and on the surfaces of desert soils and sediments. They are composed of mosses, algae and lichens

Crust, rainbeat Crusts that develop when physico-chemical changes occur at the interface between the air and the soil during and after rainfall events. These rain-beat crusts develop in dry regions because a protective plant canopy is seldom present to intercept the impact of falling raindrops. Direct raindrop impact on such unprotected surfaces causes speedy disruption of soil aggregates, compaction of the surface, slaking and the filling of cracks and pores by wash-in of sediment

Cryoclasty The breaking up of rock by frost action

Cryoconite hole A water-filled cylindrical melt-hole on glacial ice surface

Cryogenic weathering The combination of weathering processes, both physical and chemical that operate in cold environments

Cryoplanation The flattening and lowering of a landscape by processes related to the action of frost

Cryosphere Those portions of Earth's surface where water is in a solid form (i.e. ice)

Cryostatic pressure The elevated water potential in saturated, coarse-grained sediments caused by freezing in a closed system

Cryoturbation The process whereby soils and rock are churned up by frost processes to produce convolutions or involutions

Cryptovolcano A small roughly circular area of greatly disturbed strata and sediments which though suggestive of volcanic activity does not contain any true volcanic materials

Cuesta An asymmetrical upland feature usually associated with gently dipping rocks and comprising a steep scarp slope (or escarpment) and a longer, gentler dip slope

Cuirass An indurated soil crust, such as a hard laterite, which mantles the land surface and provides a protective covering

Cultural geomorphology The scientific study of human engagement with geomorphological landscapes and of cultural reactions to and perceptions of landscape, and how these should be considered by geomorphologists, especially in terms of improving environmental management and landscape conservation

Cuspate bar A triangular depositional bank of sand or shingle, submerged, at least at high tide, extending out from the coast with straight or concave shores that meet in a seaward point, and enclosing a depression occupied by a lagoon at low tide

Cuspate barrier Similar to a cuspate bar, except that it has been built above high tide level

Cuspate foreland A triangular depositional area of sand or shingle with straight or concave shores extending out to a seaward point, with multiple beach ridges marking

stages in progradation on one or both flanks. Cuspate forelands may migrate by erosion of one flank and the drifting of beach material to accrete on the other

Cusp, beach Regular successions of half-saucer (crescentic) depressions opening seaward between cuspate points in the swash zone on the upper beach face, the points being of coarser material (shingle or coarse sand) than the intervening hollows. Also known as swash cusps

Cuspate spit A triangular spit that projects from the coast with straight or concave shores extending out to a seaward point. Often formed in the lee of an islet, stack, reef or shoal, or on the shores of a bay or lagoon as the result of convergent wave refraction. Formerly known as a cuspate bar, but this term is not applicable to a feature built above high tide level

Cut-off A neck between adjacent meanders that has been cut off by erosion

Cwm A corrie or cirque

Cycle of erosion The sequence of denudational processes and forms which, in theory, exist between the initial uplift of a block of land and its reduction to a gently undulating surface or peneplain close to base level

Cyclic time A period of time in which events happen in an orderly way

Cymatogeny The warping of the Earth's crust over horizontal distances of tens to hundreds of kilometres with minimal rock deformation producing vertical movements of up to thousands of metres

Dalmatian coast A coastline characterized by chains of islands running parallel to the mainland, deep bays and steep shorelines, being the product of subsidence of an area of land with mountain ridges running parallel to the coast

Daly level Levels on coral reefs caused by erosion at times in the Pleistocene when temperatures and sea levels were lower

Dambo A shallow valley or depression which, though seasonally waterlogged, frequently contains no channel. The flanking slopes are gentle and they are associated with land surfaces of very low relief

Danxia landform A kind of landform consisting of terrestrial red beds and featured by steep scarps

Daya A shallow depression found primarily in areas underlain by limestone bedrock or calcrete as a result of solution

De Geer Moraine A glacial landform consisting of swarms of small ridges oriented perpendicular to the ice flow direction. They are believed to form either marginally to an ice body by a glacier pushing at the grounding line or sub-glacially by material being squeezed up into basal crevasses

Dead-ice topography Stagnant ice topography

Debâcle The breaking up of ice in rivers in the spring

Debris avalanche A sudden downslope gravitational movement of debris due to saturation by heavy rain

Debris cone A fan-shaped deposit of debris at the point where a mountain torrent debouches onto a valley floor

Debris flow A mixture of fine material (sand, silt and clay), coarse material (gravel and boulders), with a variable quantity of water, that forms a muddy slurry which moves downslope

Debris slide A failure of unconsolidated material which breaks up into smaller parts as the slide advances downslope. The material involved is mostly colluvium and weathered material of fractured rocks masses (i.e. flysch formations, shales, and slates). The failure surface usually develops at the contact between the regolith cover and the bedrock, and is roughly parallel to the ground surface

Decollement A feature resulting from the detachment of strata from underlying beds during folding, with the result that the upper strata slip forward

Deep weathering The production of regolith or saprolite by prolonged and/or intense chemical weathering

Deflation The entrainment and transport of fine sediment from a source deposit by the action of wind

Deformable beds When glaciers move over an unconsolidated bed, it has been shown by numerous workers that there is a coupling between the glacier and the underlying bed. This leads to an increase in the velocity and/or decrease in the slope angle of the glacier, and the deformation of the sediments below

Deglaciation and deglacierization The reduction in size of a glacier or ice sheet resulting from a negative mass balance leading to the exposure of the previously ice-covered surface

Degradation The wearing down of the and surface by denudational processes

Dell A small well-wooded stream or river valley

Delta A depositional landform produced by sedimentation at and around the mouth of a river

Demoiselle A pillar of earth or other unconsolidated material that is protected from erosion by a capping boulder

Dendritic drainage A type of drainage pattern with a tree-like form

Dendrochronology The study of annual tree rings, based on the measurement of variations in the ring widths caused by variations in climate and the environment at the time of ring formation

Dendrogeomorphology The use of tree rings to establish the dating of geomorphological phenomena

Density current A descending body of air or water with a high suspended load (e.g. a turbidity current, a dust storm, clouds of falling volcanic ash, etc.)

Denudation The wearing away of the landscape by processes of weathering, erosion and mass movement

Denudation chronology The timing of erosional events as revealed by erosion surfaces

Deranged drainage A disordered and somewhat chaotic drainage pattern characterized by numerous short streams and basins of internal drainage

Desert pavement Often called stone pavement, it is a stony surface, often found in deserts, where coarse particles form a surface layer underlain by material that is a mixture of coarse and fine sediments. It may be formed by deflation of fine materials, their removal by sheet floods, or by upward movement of clasts by heaving processes or downward movement of silts from above

Desert varnish A thin, shiny, dark patina, generally rich in iron and/or manganese, that develops on rock surfaces

Desertification The spread of desert conditions into areas that were previously not desert as a result of human activities and/or climate change

Desiccation cracks and polygons Features produced by wetting (swelling) and drying (shrinking)

Desquammation Onion skin weathering. The disintegration of rocks by peeling off the surface layers

Destructive wave A type of wave that erodes or combes down a beach

Detachment The process of separation of transportable particles from a soil or soft-rock layer, usually by running water, raindrop impact or wind

Dew-pond An artificial small hollow in southern England used for storing water

Diagenesis Post-depositional changes which have altered a sediment, particularly cementation and compaction

Diapir An anticlinal fold which has resulted from the upward movement of mobile rocks, such as halite, lying beneath more competent strata

Diastrophism Tectonic processes which produce dramatic changes in the shape of the Earth's surface, such as orogeny, faulting or folding

Diatreme Vents and pipes which have been forced through sedimentary strata by the forces of underlying volcanism (e.g. a kimberlite pipe)

Differential erosion The selective erosion of rocks of widely varying resistance or along lines of weakness, such as joints and faults

Diffluence, glacial The breaching of watersheds by distributary ice flows from a valley glacier

Digital elevation model (DEM) a numerical description of the ground surface

Digital terrain model (DTM) A method of transforming elevation data into a contoured surface of a three-dimensional display

Dilatation or dilation The process whereby rock joints are developed by the spontaneous expansion of rock masses when confining pressure is reduced as a result of erosion

Diluvium Material deposited by Noah's flood

Diluvialism The belief in the role of Noah's flood in shaping the landscape

Dipslope The more gentle slope of a cuesta; the slope of the land surface that approximates the dip of the underlying sedimentary rocks

Directional Index the ratio between the resultant drift (or sand transport) potential (RDP) and the total drift potential from all directions (DP)

Dirt band A band of dirty or discoloured ice in a glacier composed of dust, soot and debris. It is indicative of a season of ablation

Dirt cone A conical or elongated mound of ice, covered by a layer of debris developed in the ablation zone of a glacier

Dirt cracking Weathering produced because if a rock contains some cracks, dirt (e.g. windblown silt) would accumulate in them. If differential thermal expansion between the core and outside of the rock mass caused the cracks to alternately open and close, then when the crack opens dirt particles penetrate more deeply into the crevices. The particles then prevent the crack from closing to its former position, and so put the rock under strain. In addition, the dirt particles themselves would be affected by expansion and contraction, possibly in response to changes in moisture

Disarticulation The process through which large blocks of ice, sometimes greater than 0.5 miles in width, detach from the thinning and retreating terminus of a glacier that ends in a body of water. Disarticulation occurs as the terminus thins to where its buoyancy no longer permits it to remain in contact with its bed. As the glacier begins to float free and rises off the bottom it rapidly comes apart along old fracture scars and crevasses

Discontinuous permafrost zone A region in which frozen ground occurs but us not laterally continuous

Discordant drainage Drainage that is discordant to or cuts across the structural gain of an area

Discordant junction A type of river confluence with a difference in elevation between the trunk stream and the tributary stream

Dissipative beach A beach where wave energy is greatly diminished as spilling breakers move in through shallow nearshore water

Dissolved load That part of the stream load that is carried in solution

Dissolution The process whereby a rock, or parts of a rock, combine with water to form a solution

Distributary One of a number of channels formed in a delta region where the river branches downstream

Divergent erosion A feature of tropical inselbergs, where surface runoff from the rock dome is fast and so there is little moisture for further weathering of the rock surface, whereas, by contrast, in the surrounding zone the water can percolate into the soil and so guarantees continued weathering of the rock there

Doline An enclosed depression found in karst landscapes. They are typically sub-circular in plan, tens to hundreds of in depth. They may have vertical or gentle sides and they range from being saucer shaped to conical or even cylindrical). They occur in carbonate rocks, evaporites and even in siliceous rocks such as quartzites. Some are the result of concentrated dissolution, some result from collapse into underlying cavities and some are the result of subsidence or suffusion of overlying materials into the underlying bedrock

Dolocrete A form of calcrete in which magnesium carbonate is a major component, and which probably forms as a groundwater precipitate near the water table of a brackish water body

Dome dune A low, circular or oval mound formed where dune height is inhibited by unobstructed strong winds

Domepit A combined name for vertical karst cavities of which the arched tops are called domes and the deep bottoms are called pits

Dominant discharge The discharge to which the average form of river channels is related

Dominant wave The most powerful wave capable of moving the greatest quantities and largest sizes of beach material

Donga The term used in southern Africa to describe a gully or badland area caused by severe erosion, or the term used in Australia for a shallow closed depression on the Nullarbor Plain

Dormant volcano A volcano which, though not currently or perhaps even recently active, is not extinct since it is likely to erupt in the future

Double planation The development of two erosion surfaces, one below the surface produced by weathering, the other at the surface produced by wind and water erosion. It can contribute to the production of an etchplain

Down-warping A slight downward deformation of the Earth's crust caused by sagging under the weight of an overlying burden as when the crust is depressed by deltaic sedimentation

Draa The largest category of desert bedform or dune

Drainage basin An area of land surface, upslope from a specific channel site to topographic divides separating the basin from adjacent drainage basins, over which water that results from inputs of precipitation moves and converges through a system of channels o and past the specified channel site

Drainage density The ratio of the combined stream lengths of a drainage basin to the basin area

Drainage Pattern The spatial arrangement of drainage channels

Drapes (silt and mud) A thin deposit of water-lain silt or mud coating a pre-existing morphological feature that can form in both tidal and fluvial environments

Dreikanter A shaped pebble found on the surface in desert regions and periglacial areas with three distinct facets on its upper surface as a result of wind abrasion

Drift ice Any type of floating ice that has drifted from its point of origin and broken into pieces small enough for a ship to sail through

Drift potential The potential sand transport due to aeolian processes in a particular wind environment

Dripstone Any accumulation of water-soluble salts on the roofs, walls and floors of caves. A general term for stalactites and stalagmites

Dropstones Isolated fragments of rock found within finer-grained water-deposited sedimentary rocks. They range in size from small pebbles to boulders. The critical distinguishing feature is that there is evidence that they were not transported by normal water currents, but rather dropped in vertically through the water column from icebergs, volcanoes, or floating plant material

Drowned valley A ria

Drumlin An elongated and streamlined mound of glacial till deposited and shaped beneath an ice sheet

Dry ravel A general term that describes the rolling, bouncing, and sliding of individual particles down a slope and is a dominant hillslope sediment transport process in steep arid and semiarid landscapes

Dry sand flow A mass movement type in which a large mass of dry material falls from or over a steep slope and fluidizes on impact

Dry valley A valley formerly occupied by a permanent stream but which is now, except under extreme flow conditions, dry

DuBoys equation The bedload transport weight per unit width of channel per unit time expressed as a function of the mean bed shear stress in excess of the threshold shear stress required to initiate particle motion

Dune A ridge or hill of sand deposited by the wind

Dunerock Aeolianite

Dune slack Flat-bottomed, hollow zone within a sand-dune system. It may result from erosion or blow-out of the dune system, and the flat base level is therefore close to or at the permanent water-table level

Duricrust a hard crust or nodular layer formed at or near the land surface by weathering processes (e.g. ferricrete, calcrete, silcrete)

Duripan An indurated and cemented silica-rich accumulation within the soil zone or zone of weathering

Dust devil A strong, well-formed, and relatively long-lived whirlwind, which stirs up dust and ranges from small (half a meter wide and a few m tall) to large (more than 10 m wide and more than 1000 m tall). The primary vertical motion is upward

Dust haze A suspension in the air of dust or small sand particles in the atmosphere, reducing visibility. The dust may be raised from the ground prior to the time of observation by the deflation activity of a dust storm

Dust storm An event in which visibility is reduced to less than 1 km as a result of particles being entrained by wind

Dynamic equilibrium A concept which describes a situation of relatively restricted fluctuations about a mean value, together with non-stationarity of that mean

Earth hummock A form of patterned ground characterized by rounded hummocks which produce an irregular net pattern over the land surface

Earth pillar A sharply pointed pinnacle of debris produced by intense erosion of susceptible materials

Earthflow A rapid movement of loose material downslope when saturated with water

Earth system science The study of the Earth System, with an emphasis on observing, understanding and predicting global environmental changes involving interactions between land, atmosphere, water, ice, biosphere, societies, technologies and economies. The Earth system is the unified set of physical, chemical, biological and social components and interactions that together determine the state and dynamics of Planet Earth, including its biota and its human occupants

Ebb-flood deltas (see Tidal deltas)

Echo dune A topographic dune that is detached from the obstacle that induces its formation, due to the development of a reverse flow eddy that sweeps the area adjacent to the obstacle clear of sand

Edge waves Standing oscillations that develop at right angles to the coastline as the result of resonance between waves approaching the shore and waves reflected from it

Effective stress The difference between total stress and pore pressure in a material, responsible for mobilizing internal friction

Effusive eruption A volcanic eruption where low-viscosity basaltic magma is released. This type of eruption is not explosive and tends to form shield volcanoes

Elbow of capture An abrupt turn in the course of a river attributable to stream piracy

Eluvium and eluviation The process of producing material (eluvium) by the washing down of soil constituents through a profile by leaching and/or mechanical downwash of clays, humus, etc.

End moraine A terminal moraine marking the limits of a glacial advance

Endogenic Processes arising from within the Earth

Endokarst Consists of the main part of karstic relief and contains both carbonate rocks and this includes cave systems (shafts, cavern etc.)

Endoreic drainage A catchment with no hydrological connection with the marine environment

Endrumpf A land surface that has been reduced to a flat plain or gently undulating landscape by erosive processes

Engineering geomorphology The application of geomorphic theory and techniques to solve earth-related engineering problems. It is one type of applied geomorphology and is very important for understanding and mitigating geomorphological hazards, including those triggered by human activities

Englacial Contained within a glacier or ice sheet

Entrainment The process by flowing water or air of mobilizing sediment by picking up particles and transporting them

Entrenched meander A meander that has become incised into its valley floor

Epeirogenic movement Upward or downward tectonic movements of large (continental) land masses

Ephemeral stream A stream or reach of a stream that does not flow for parts of the year

Epikarst The uppermost highly weathered layer of karst bedrock beneath the soil – the subcutaneous zone

Epiphreatic In a cave system, the ***epiphreatic zone*** or the ***floodwater zone*** is the zone between vadose zone above it and phreatic zone beneath it

Equifinality The belief that the generation of a particular landform can be produced by a number of alternative mechanisms

Equilibrium line The boundary between the accumulation and ablations zones of a glacier

Equilibrium shoreline A hypothetical dynamic state in which the geometry of a beach reflects a balance between materials, processes and energy levels (climate)

Equilibrium slope A slope characterized by an equilibrium of forces that compensate each other. It exists if the amount of material that is removed from an areal unit of the surface per time unit is equal to the amount of material that is supplied to this areal unit during the same time

Erg A large area of sand dunes

Ergodic hypothesis The suggestion that sampling in space can be equivalent to sampling through time

Erodibility An expression of the susceptibility of a surface to erosional processes

Erosion The sculpturing action of geomorphological agents (e.g. glaciers, rivers, waves, wind) involving the transport of material

Erosion surface A more or less flat plain created by erosion. A planation surface

Erosional isostasy The uplift of a landmass as a result of erosion removing a mass of rock

Erosivity An expression of the susceptibility of the rainfall to detach particles from a soil surface and to initiate erosion

Erratic A rock that lies on contrasting bedrock because of long-distance transport from its origin, usually by glaciers

Escarpment A steep slope or cliff at the margins of an upland (e.g. a plateau edge or a cuesta)

Esker A sinuous, winding ridge of material laid down in a meandering subglacial stream

Estuary The seaward end of a river, opening towards the sea, typically through a funnel-shaped inlet, and usually subject to tidal movements and incursions of salt water from the sea

Etchplain An erosional plain where crystalline rocks are deeply weathered and where the saprolite is removed by erosion during uplift and dissection

Eustasy/Eustatic movements World-wide movements of sea level resulting from changes in the volume of water in the ocean basins. Such changes have occurred as the result of the waxing and waning of the Earth. s glaciers, ice sheets and snowfields (glacio-eustatic movements), but similar changes have taken place as the result of modification of the shape and capacity of the ocean basins by deposition of sediment (sedimento-eustatic movements), submarine vulcanicity (volcanic-eustatic movements) or tectonic deformation (tectono-eustatic movements). There are also steric changes due to expansion or contraction of the oceans with rising or falling temperatures

Evaporite A water-soluble mineral or rock composed of minerals that has been precipitated from saline water as a result of evaporation, especially in sabkhas or salt lakes

Evorsion The erosion of rock or sediment in a river bed through the action of eddies and vortices

Exfoliation The peeling away of layers or sheets of rock from an exposed rock surface

Exhumation The uncovering of surfaces beneath regolith or younger geological materials

Exogenic Factors and processes in landform development arising from outside the Earth (c.f. endogenetic), such as climate

Expansive soil A soil whose volume can be increased substantially as it becomes wet, and which shrinks as it dries out

Exsudation A type of salt weathering by which rock surfaces are scaled off, owing to the growth of salt crystals from water raised by capillary action (the wick effect)

Extending flow A type of glacier flow in which there is stretching and thinning of glacial ice, often in response to an increased bedrock gradient and subsequent increase in glacial velocity

Extrusion flow A type of glacier flow in which the lower layers of a glacier are supposedly squeezed out by the weight of the overlying ice and move faster than it

Exudation basin A depression that occurs at the head of glaciers emanating from Greenland's ice cap

Eyot An islet in a river or lake

Fabric analysis The measurement of one or more parameters of the three dimensional disposition of elongated rock fragments in sediments

Factor of safety In the context of slope stability, the ratio of resistance (shear strength) to force (shear stress)

Fairy circle A type of intriguing, but little understood, vegetation pattern, that has been likened to an ostrich skin. These occur in their thousands in the pro-Namib in Namibia in areas with sandy soils and where the mean annual rainfall is 50-150 mm. They consist of bare areas c 2 to 12 m in diameter surrounded by perennial grasses such as *Stipagrostis*

Fall The free movement of material from steep slopes

Falling dune A topographic dune that has developed on the lee side of an obstacle, as airflow and sand transport is disrupted by the barrier

Fall-line A line or zone marking the tract where a series of almost parallel rivers descend from an upstanding area on to a lowland by means of waterfalls

Fan delta An alluvial fan that extends into a body of water

Fanglomerate Indurated alluvial fan gravel

Fault A fracture in a rock induced by either tensional or compressive forces, in which there is a displacement along a fault line

Fault scarp A steep slope coinciding with the line of a fault

Feeder beach A beach that is artificially widened and nourishes downdrift beaches by natural littoral currents or forces

Felsenmeer A blockfield

Fen An area of wooded, swampy land

Fencong A Chinese term for cone karst

Fenglin A Chinese term for tower karst

Feral relief The landscape occurring in areas where the sides of a main valley are dissected by insequent streams as a result of raid runoff with intense dissection

Ferrallitization A combination of intense weathering and efficient removal of the more soluble weathering products under warm, wet conditions

Ferricrete A type of duricrust consisting of an iron-pan or near-surface zone of iron sesquioxide cementation

Fetch The distance of open water over which wind blows to generate waves

Fiard A coastal inlet produced by the drowning of an undulating landscape of shallow valleys and low interfluves

Finger lake An elongated lake occupying a formerly glaciated valley or trough

Firn Snow that has lain a year without melting. The balance of the winter snowfall on the accumulation zone of a glacier after the removal of the uppermost layers by summer ablation

Firn line The equilibrium line on a glacier that represents the boundary between the accumulation and ablation zones

Fissure eruption A linear volcanic eruption in which lava emerges in large quantities and with little explosive activity along lines of crustal weakness (e.g. faults, fractures, joins)

Fjord (fiord) A deeply glaciated valley in a coastal region that has been flooded following the retreat of a glacier and by subsequent sea level rise

Flandrian transgression The rise in sea level that followed the Last Glacial Maximum

Flash A depression formed by subsidence, particularly as a result of the solution of evaporite beds

Flash flood A short-lived flood characterised by a sharply rising flow

Flatiron Steep triangular cliff facets resulting from the presence of a capping of rock or indurated sediment resistant to erosion which protects the underlying more easily materials

Floating bog Any lake-fill bog or wetland with a quaking *Sphagnum* mat

Flood A period of high discharge of a river caused by high rainfall, rapid snow melt, or the breaching of a barrier. It may exceed a channel's capacity and lead to inundation of adjacent low-lying land (the flood plain)

Flood basalts (see Continental Flood Basalts)

Flood frequency curve A graph showing recurrence intervals of floods plotted as the abscissa and the magnitudes of the floods plotted as the ordinate

Floodout The part of an ephemeral desert stream system, located in the lowest reaches of the channel, where organized channel flow gives way to multiple distributary channels and ultimately to shallow non-channelized flow

Floodplain A relatively flat alluvial landform, constructed largely by the flow regime of the present river and subject to flooding

Flow A landslide in which the individual particles travel separately within a moving mass. They involve highly fractured rock, clastic debris in a fine matrix or small grain sizes. Flow in its physical sense is defined as the continuous, irreversible deformation of a material that occurs in response to applied stress. They are, therefore, characterized by internal differential movements that are distributed within the mass

Flow-duration curve A cumulative-frequency plot that shows the percentage of time that flow in a stream is likely to equal or exceed some specified value of interest

Flow visualisation This provides tools that have led to major advances in our understanding of fluid dynamics and boundary layers and allows the tracking and following of individual turbulent flow structures as they develop. Many flow visualization techniques employ foreign tracers in the flow, such as dyes, smoke and air bubbles

Flow slide A structural collapse of slope forming material with momentary fluidization and is usually referred to as a high magnitude event both in terms of velocity and destruction

Flowtill Re-sedimented material derived from flow of supraglacial debris and often associated with high-speed debris flows such as rock slides and nuée ardente

Fluid threshold shear velocity That shear velocity at which sand movement starts as a result of the shearing stresses imparted to the sand by the wind

Fluidization A geomaterial becoming a fluid and behaving like a fluid

Flute A tongue-shaped scour cut into mud by a turbulent flow of water. The tongue is deepest at the up-current end and the flute can thus be used in palaeocurrent analysis

Fluted moraine A ground moraine with a distinct lineation parallel to the direction of former ice movement

Fluvial Pertaining to rivers

Fluvioglacial A glacial river environment. Fluvio-glacial can mean sediments deposited by the glacier meltwater. Fluvio-glacial landforms differ from glacial landforms. Such fluvio-glacial landforms include outwash plains, eskers, and kames (and kame terraces)

Fluviokarst A type of landform developed in limestone areas by a combination of river action and true karst processes

Fluvio-thermal erosion Erosion by the water of rivers of river banks that are permafrosted because of the relative warmth of the river water

Fold The contortion of rock layers by pressures within the Earth's crust. Fold mountains may be formed

Foliation, glacial The layering or banding that develops in a glacier during the process of transformation of snow to glacier ice. Individual layers, called folia, are visible because of differences in crystal or grain size, alternation of clear ice and bubbly ice, or because of entrained sediment

Foot cave A cave formed at the base of a steep slope, such as a karstic tower, by lateral solution

Forbes band An ogive

Forearc The region between an oceanic trench and the associated volcanic arc. As such, forearc regions are found at convergent margins, and include any accretionary wedge and forearc basin that may be present

Forebulge A result of crustal depression by an ice body in which the deformation of the mantle creates a compensatory rise in surface level (the forebulge) at a distance from the location of the depression

Foredeep A linear, narrow crustal depression in the ocean floor on the convex side of an island arc or a coastal range of fold mountains

Foredune A coastal dune along a shore

Foreland A coastal promontory of erosional or depositional origin

Forereef A talus slope on the seaward side of a reef, which is constantly exposed to attack by waves and currents

Foreshore That part of a coast lying between the lowest low-water line and the average high-water mark

Formative event An event, of a certain frequency and magnitude, which controls the form of the land. It may be a brief episode of erosion or deposition when significant morphological changes take place

Fragipan An acidic, cemented, compact and cemented horizon between the base of the soil zone and the underlying bedrock or parent material that normally forms in a periglacial environment

Free face A steep and largely bare rock face or cliff from which weathered debris falls, slides or is washed as quickly as it is released from the bedrock surface

Freeze-thaw cycle A cycle in which temperatures fluctuate both above and below the freezing point of water

Fringing reef A platform of coral attached to a coastline and extending seawards for a distance of, typically, a few hundred m

Frost boil Also known as ***mud boil***, ***frost scar*** and ***mud circle*** is an upwelling of mud that occur through frost heave and cryoturbation in permafrost areas, such as arctic and alpine regions. They are typically 1 to 3 m in diameter with a bare soil surface, and dominantly circular, lacking a border of stones

Frost heave The upward movement of rock or soil particles as a result of the pressure generated by ice segregations within the ground

Frost weathering The complex of weathering processes, both physical and chemical, which operate either independently or in combination in cold environments, and in particular where the freezing of water in rock pores causes disintegration to occur

Froude number A dimensionless number that represents the ratio of inertial to gravitational fluid forces. It is used to assess whether flow in an open channel is critical, tranquil, or shooting. If the Froude number is less than 1, flow is said to be subcritical or slow; if Fr = 1, flow is critical; and if Fr is greater than 1, flow is fast or supercritical

Fulje A depression between barchans or barchanoid ridges

Fumarole A small volcanic vent from which steam is emitted

Gelifluction A type of solifluction occurring in periglacial environments

Gelifraction The mechanical breakup and churning of rock or soil due to repeated freezing and thawing of water within its cracks

Geliturbation The churning up of materials by frost action

Gelivation The breakdown of rocks by frost

Gendarme A pinnacle of rock which projects vertically from a ridge

Geo A narrow steep-sided inlet in a cliffed coastline

Geoconservation Geological and geomorphological conservation or Earth heritage conservation. It concerns the conservation of our non-living natural environment – our geodiversity

Geocryology The study of frozen, freezing and thawing terrain, including permafrost

Geodiversity The natural range of geological, geomorphological and soil features, assemblages, systems and processes

Geoidal eustasy Sea level change associated with changes in the shape of the geoid

Geomorphological engineering The application of the study of geomorphology to solving engineering problems

Geomorphological map Either a regional survey of terrain conditions, or a general assessment of resources and geohazards, or a survey to delineate and characterize particular landforms

Geomorphology The study of landform and the processes that form them

Geomorphometry The science of quantitative land surface analysis. It gathers various mathematical, statistical and image processing techniques that can be used to quantify morphological, hydrological, ecological and other aspects of a land surface

Geomorphosite An area of landforms that has acquired a scientific, cultural/historical, aesthetic and/or social/economic value due to human perception or exploitation

Gerlach trough A sediment trap designed to catch a sample of overland flow and the sediment it carries down a hill side

Geyser An intermittent fountain of hot water and steam produced by geothermal activity

Gibber A desert plain which is mantled in a layer of pebbles or boulders – an Australian term for a stone pavement

Gilbert-type delta A river delta which consists of a wedge-shaped body of sediment, comprising relatively thin, flat-lying, topset sediments, long, steeply dipping foresets which prograde from the river mouth, and thinner, flat-lying, bottomset or toeset deposits. These deltas are often developed in lakes, where river water and lake water are of the same density

Gilgai A class of soil surface forms, including various kinds of depressions and undulations, which are probably mostly related to the shrinking and swelling behaviour of expansive soils

Gipfelflur aA plane within which uniform summit levels occur in a mountainous region

Glacial diffluence The breaching of watersheds by distributary ice flows from a valley glacier

Glacial theory A theory developed in the nineteenth century that there had been an ice age and that glaciers could explain many landforms in areas not now glaciated

Glacial stairway The irregular long-profile of a glaciated valley resulting from the formation of alternate rock basins and rock steps

Glaciation level or limit The altitude above which mountain glaciers occur

Glacier A mass of snow and ice which, if it accumulates to a sufficient thickness, deforms under its own weight and flows

Glacier, tidewater A glacier that flows into the ocean

Glacier Mass Balance The difference between accumulation and ablation (melting and sublimation) of a glacier. Mass balance is measured by determining the amount of snow accumulated during winter, and later measuring the amount of snow and ice removed (ablated) by melting in the summer. It is the difference between these two parameters

Glacier mill A moulin

Glacier table A landform on the surface of a glacier resulting from the presence of a large boulder that protects the underlying ice from the heating effects of the Sun's rays

Glacieret A small glacier such as may develop from a snow patch

Glacideltaic (glaciodeltaic) Relating to the accumulation of a delta by the discharge of sediment-laden streams from letting glaciers into lakes or fjords

Glacierization The covering of a land area by glacier ice

Glacifluvial (Glaciofluvial) An adjective that applies to the processes, sediments and and/or produced by water flowing on, in and/or under glaciers and away from glacier snouts

Glacilacustrine (Glaciolacustrine) Relating to glacial lakes

Glacimarine (Glaciomarine) A combination of glacial and marine processes

Glacioeustasy A change in sea level due to the uptake or release of water from glaciers and polar ice

Glacio-isostasy The state of balance that the Earth's crust will attempt to achieve when loaded or unloaded by an ice sheet. Loading will cause crustal depression, whereas ice removal will lead to uplift

Glacis A French term for a gentle pediment slope cut across bedrock in drylands

Glacitectonics (Glaciotectonics) Those structures and landforms produced by deformation and dislocation of pre-existing soft bedrock and drift as a direct consequence of glacier ice movement

Glint line The escarpment of Palaeozoic rocks which borders the Scandinavian and Laurentide shields and is associated with a line of lakes

Gnamma An Australian term for a weathering pit

Goletz terrace A hillside or summit bench which is cut into bedrock in a cold area and transects lithology and structure. A cryoplanation or altiplanation terrace

Gorge A steep-sided, narrow floored valley cut into bedrock

Graben A geological structure in which a down-faulted mass lies between two parallel faults

Grade A concept of equilibrium applied to fluvial systems, which relates the gradient of a stream channel to the balance between erosion, resistance and transportation

Graded reach A length (reach) of stream channel whose gradient and cross-sectional form have become adjusted to carry just the discharge and sediment load that are normally supplied from upstream. Such a reach is said to be in equilibrium

Graded time The time period over which a landform remains in a graded condition or dynamic equilibrium exists

Gradualism The theory which holds that profound change is the cumulative product of slow but continuous processes, often contrasted with catastrophism. The theory was proposed in 1795 by James Hutton and was later incorporated into Charles Lyell's theory of uniformitarianism

Granular disintegration The breakdown by weathering processes of a rock into its constituent minerals or groups of minerals

Granule ripple Unusually large aeolian ripple composed of granule sized material i.e. 2-4 mm

Great escarpment An escarpment formed by the uplift associated with the breakup of Gondwanaland and the development of passive margins

Grey wether A local English term for a sarsen stone

Grèzes litée Stratified scree, consisting of alternating layers of angular stone and finer material occurring on hill slopes and thought to be the product of alternating frost action and solifluction under periglacial conditions

Grike (gryke) (see Clint)

Ground ice Ice that is formed within the soil, regolith or rock by intense freezing under periglacial conditions

Ground moraine Debris that having been transported at the base of a glacier or ice sheet is then left smeared on the underling bedrock

Grounding line Zone at which an ice mass entering a water body comes afloat

Growan Decomposed granite or related rock

Groyne A structure extending from the bank of a stream or on a beach in a direction transverse to the current

Grus A weathering deposit composed of disintegrated granite

Gull A fissure or crack, sometimes sediment filled, in a cliff face where joints have opened up as a result of cambering

Gully A small hollow or channel incised into sediments or unconsolidated rock by running water

Guyot A flat topped hill arising from the deep ocean floor but not breaching the sea surface. Many are volcanoes that have been planed off by marine erosion

Gypcrete A surface or sub-surface crust composed of gypsum (calcium sulphate)

Gypsum karst Landforms created by the solution of gypsum (calcium sulphate)

Hack's law An empirical relationship between the length of streams and the area of their basins. If *L* is the length of the longest stream in a basin, and *A* is the area of the basin, then Hack's law may be written as

$$L = CA^h$$

for some constant *C* where the exponent *h* is slightly less than 0.6 in most basins

Haff A coastal lagoon separated from the open sea by a sand spit formed by longshore drifting of sediments

Hagg An erosional channel which separates hummocks in a peat bog

Hairpin dune A parabolic dune

Haldenhang A degrading rock slope which underlies an accumulation of talus or scree

Half graben A lowered tilted block bounded on one side by a normal fault

Haloclasty Salt weathering of rock

Haloturbation The disturbance of soils and surficial materials by the growth of salt crystals

Hamada/hammada A stone or desert pavement

Hamra A red sandy soil which may occur on an old dune surface

Hanging valley A tributary valley that joins a main valley by means of a sharp break of slope

Hard engineering In civil engineering of shorelines, hard engineering is generally defined as controlled disruption of natural processes by using man-made structures such as seawalls, breakwaters and groynes

Head A deposit of poorly-sorted, often angular, formed at the foot of steep slopes as a result of periglacial activity

Headcut A type of knickpoint, being an interruption in a channel gradient which through processes of channel erosion moves up-channel

Headwall A steep, arcuate slope around the head of a glacial cirque or a landslide

Headward erosion Erosion in an up-valley direction

Helical or helocoidal flow Three-dimensional movement of water or air along a spiral path in the general direction of flow

Heuweltjie A topographic mound created by the burrowing activities of various organisms

Hewlettian overland flow Saturation excess overland flow

Hjulström curve A graph that shows the relationship between the size of sediment and the threshold flow velocity required to erode it, transport it and deposit it

Hogback A long ridge of rock dipping steeply on both sides that is the exposure of a rock stratum which has been tilted until the originally horizontal beds are almost vertical

Holokarst Any landscape with a fully developed range of karst features developed on a thick sequence of limestones extending below base level

Honeycomb weathering The formation of a dense series of small pits (alveoles) in a rock face

Hoodoo An unusually shaped pillar or outcrop of rock produced by erosion

Horn, glacial A pyramidal peak with three or more distinct faces steepened by glacial erosion

Horst An upstanding block of the crust that is bounded by faults and has been uplifted by tectonic processes. The down-faulted areas which bound horsts are called graben

Hortonian overland flow Water flow across the ground surface that occurs when the input of rainfall exceeds the infiltration capacity of the soil

Hotspot An area where, beneath the Earth's crust, strongly localized rising currents of magma known as plumes occur

Hum A residual hill in limestone country

Hydration A process in weathering whereby rock minerals absorb water, causing changes in volume to occur

Hydraulic conductivity A measure of the ease by which a fluid, generally water, will move through a porous medium, such as soil or rock

Hydraulic geometry The relations for a given cross section of a stream channel between hydraulic characteristics (e.g. width, depth, etc.) and river discharge

Hydraulic radius The ratio of a channel's cross sectional area to its wetted perimeter

Hydrocompcation The compaction and reduction in volume of soils and sediments that occurs when their moisture content is increased

Hydro-isostasy Vertical movements of a coast and continental shelf in response to loading and unloading of water as sea levels rise and fall

Hydrolaccolith A mound of ice formed by frost heaving of frozen underground water, resembling a laccolith in section. To some, the term hydrolaccolith is synonymous to the terms ice laccolith and pingo. However, others believe that they differ from pingos in that they are seasonal forms (whereas pingos are perennial), and differ from ice laccoliths in that they do not form within the active layer of permafrost ground. Hydrolaccoliths range in size between 1-10 m diameter, and are usually less than 2m in height

Hydrolysis A process of chemical weathering in which a reaction takes place between water and a rock mineral

Hydrophobic soil One that resists wetting by water because of the presence of organic compounds

Hygric weathering Wetting and drying of rocks such as shales and marbles can cause them to disintegrate

Hyperconcentrated flow A river flow that transports an exceptionally large concentration of suspended sediments

Hypopycnal flow The flow developed at the mouth of a delta where the fresh water from the river flows as a buoyant plume over the denser salt water of the ocean. The salt water will ride under the fresh water and enter the river channel as an upstream-tapering wedge

Hypsometric curve and integral The hypsometric curve describes the distribution of elevations across an area of land. It is created by plotting the proportion of total basin height (*h*/*H* = relative height) against the proportion of total basin area (*a*/A = relative area). The total height (*H*) is the relief within the basin (the maximum elevation minus the minimum elevation). The total surface area of the basin (*A*) is the sum of the areas between each pair of adjacent contour lines. The area (*a*) is the surface area within the basin above a given line of elevation (*h*). The value of relative area *a*/*A*) always varies from 1.0 at the lowest point in the basin (where *h*/*H* = 0.0) to 0.0 at the highest point in the basin (where *h*/*H* = 1.0). The hypsometric integral (H_i) is defined as the area under the hypsometric curve. One way to calculate the integral for a given curve is as follows:

$$H_i = \frac{\text{Mean elevation} - \text{minimum elevation}}{\text{Maximum elevation} - \text{minimum elevation}}$$

A high hypsometric integral indicates a youthful topography

Ice cap An area of ice that is less extensive than an ice sheet

Ice cave A cave containing ice in karst areas within a permafrost zone

Ice dam A blockage of drainage caused by ice which leads to periodic and/or rapid fluctuations in meltwater discharge

Ice divide The boundary on an ice sheet, ice cap or glacier separating opposing flow directions of ice, analogous to a water divide

Ice dome The main form of an ice sheet or cap

Ice fall A steep section of a valley glacier at the head of a glacial trough

Ice floe A piece of floating sea or lake ice which is not attached to the land

Ice jam A blockage caused by the accumulation of pieces of river or sea ice in a narrow channel

Ice rafting The transportation of glacier sediment away from the ice margin by icebergs. Sediment transported by floating ice and deposited in the ocean is called glacial-marine sediment. Deposited in lakes, it is called glacial-lacustrine sediment

Ice sheet An extensive area of land ice

Ice shelf A floating sheet of ice attached to an embayment in the coast

Ice stream A relatively narrow zone of swiftly moving ice within an ice sheet or cap

Ice-wedge cast/pseudomorph A tapering mass of ground ice formed under periglacial or permafrost conditions, which may create a feature or cast in a deposit once the permafrost has disappeared

Icing A mass of surface ice formed during the winter in periglacial regions by successive freezing of sheets of water that may seep from the ground, from a river or from a spring

Illuviation The movement of soluble and fine-grained material downward with descending water into sites of the soil B horizon, where deposition or re-precipitation occurs

Imbrication A regular overlapping of non-spherical sedimentary particles as a result of their deposition by fluids

Impact cratering The formation of a near circular depression as a result of the impact of a meteorite

Impact threshold shear velocity The minimum shear velocity required to maintain sand in saltation

Impact threshold wind velocity The minimum wind velocity required to maintain and in saltation

In and out channel A small discontinuous channel produced by meltwater flow from a glacier onto the adjacent hillside

Incised meander A meander that is produced when a river has cut down into its bed as a result of rejuvenation

Inconsequent stream A stream not apparently related to land surface features or major geological controls, but following minor surface features without being developed into an organized pattern overall

Induration The process of hardening through cementation, desiccation, pressure or other causes, applied particularly to sedimentary materials

Infiltration The movement of water from the land surface through the air-soil interface and into the soil zone

Infiltration capacity The rate at which water derived from rain or snowmelt moves into the soil

Infiltration excess overland flow Also called Hortonian overland flow, this is runoff that occurs when the infiltration capacity of the soil is exceeded

Ingrown meander A type of incised meander with asymmetric valley sides

Inland delta A delta that does not flow into the sea but occurs in an inland location and where sedimentation takes place from channels and spreading laterally from a network of anastomosing channels as sheet flow into a flood plain

Inlier An outcrop of older rock, surrounded by younger rocks, which has been revealed by the localized removal of the younger rocks by erosion

Inselberg An island mountain. A large residual hill within an eroded plain

Insequent stream A stream in a network that has developed as a result of factors which are not determinable

Insolation weathering The cracking of a rock by alternate heating and cooling leading to thermal fatigue

Interdune The surface that occurs between dunes and over which they may travel

Interfluve An area between sites of concentrated flow, particularly stream channels

Interglacial A period of relatively warm climate separating two glacial periods

Interpluvial A period of relatively dry climate occurring between two pluvials

Interstadial A relatively short-lived period of lesser glaciation and relatively greater warmth during the course of a major glacial phase

Interrill flow The overland flow that moves as a thin layer but which is not yet organized into small channels

Interstratal karst Karst that develops along bedding planes and unconformities

Intrenched meander A type of incised meander with steep and symmetric valley sides caused by rapid rejuvenation

Inversion tectonics A process by which a normal fault is reactivated in compression or extension. Compression produces positive inversion, generating uplift, and extension produces negative inversion, resulting in subsidence and faulting

Inverted relief The condition resulting from the erosion of areas of high relief, such as anticlines, to produce low-lying area, such as valleys, which simultaneously results in

the originally low-lying synclines to become hills. Equally the deposition of resistant lag gavels, lavas or duricrusts in river valleys may cause them to be left upstanding in a subsequent phase of erosion

Involution A churned mass created by cryoturbation

Island arc A curved line of volcanic islands linked to a subduction zone and an oceanic trench

Isostasy An equilibrium between an area of the Earth's crust floating and the underlying plastic mantle, whereby areas loaded with sediment, volcanic deposits or ice subside, and areas unloaded (e.g. when an ice cover melts) rise (isostatic rebound)

Isthmus A narrow tract of land separating two bodies of water and connecting two larger bodies of land

Jökulhlaup A glacier burst – the sudden release of very large volumes of water under a glacier

Kame A mound of stratified gravels and sands formed by meltwater from a decaying glacier or ice sheet

Kame terrace A long flat ridge composed of glacio-fluvial sediment which forms along the margin of a valley glacier where the glacial ice meets the valley's slope. Sediment is deposited by laterally flowing meltwater streams

Kamenitza A weathering pit formed in limestone

Kaolinisation The change from primary rock aluminosilicate minerals through weathering and their transformation to kaolin as a residual clay mineral

Karren Furrows and other micro-forms produced by solution of a limestone surface

Karrenfield An area with a complex of different types of karren

Karst A landscape formed from the dissolution of soluble rocks such as limestone, dolomite, and gypsum. It is characterised by underground drainage systems with sinkholes, dolines, and caves. It has also been documented for weathering-resistant rocks, such as quartzite

Kavir A salt lake or playa

Kegelkarst Groups of residual, steep-sided conical-shaped hills produced by limestone solution. Cone karst or cockpit karst

Kernsprung A split boulder formed by insolation weathering

Kettle/kettle hole A circular depression, initially filled with meltwater, resulting from the gradual decay of a block of ice buried by overlying sediments

Kluftkarren Clefts, fissures or grikes. These are the major splits into limestone surfaces (see: limestone pavement) formed by widening, deepening and eventually merging of small solution features developing along linear weakness in the rock

Knickpoint An interruption or break in slope, especially along the long profile of a river

Knock-and-lochan topography Relief produced by erosion of a low-lying area of relatively resistant rock by an ice sheet, producing a landscape of low hills and depressions

Kopje A small inselberg or rocky hill

Labyrinth karst Karst characterized by a series of interconnecting linear depressions

Laccolith A concordant type of igneous intrusion formed by the injection of magma along a bedding lane and the resultant doming of the strata

Lacustrine Any feature formed or caused by the processes of a lake

Lag gravel A surface layer of gravel produced by the winnowing away of fines by wind or water

Lagoon, coastal A coastal stretch of shallow water almost cut off from the open sea by a barrier beach, spit, reef etc.

Lahar A rapid flow of mud and volcanic sediment resulting from such processes as the overflow of a crater lake and the saturation of the sediment (e.g. volcanic ash) by prolonged heavy rain

Laminar flow Flow in which the lines of flow are essentially constant and in which flow direction at all sites remains nearly unchanged through time

Land systems Sub-divisions of a region into areas having within them common physical attributes (e.g. landforms, geology, soils, vegetation, geology) which are different from those of adjacent areas

Landscape sensitivity The sensitivity of a landscape to change is the likelihood that a given change in the controls of a system will produce a sensible, recognizable and sustained response. The sensitivity is a function of the propensity for change which is measured by the size of the impulse required to initiate change

Landslide A generic term describing those downward movements of slope forming material as a result of shear failure occurring along a well-defined shear plane

Lapié A French term for karren

Lateral accretion The process by which stream bed sediments accumulate at the side of a channel as it shifts laterally

Lateral moraine A deposit of unsorted material which has accumulated along the margins of a valley glacier

Lateral spreading The lateral extension of a cohesive rock or soil mass over a deforming mass of softer underlying material

Laterite A surface accumulation caused by chemical weathering under moist, tropical conditions that is rich in iron and aluminium oxides. It typically hardens on exposure to air

Lava cave Any cave formed in volcanic rock, although in typical usage it is reserved for caves formed by volcanic processes

Lava fountain A forceful vertical expulsion of a jet of molten lava from a vent or fissure

Lava tube The commonest and most extensive kind of lava cave. They usually form in pahoehoe lava flows, though exceptions exist. As the lava is emitted from the vent area, it spreads in the path of least resistance. The outer layers of the lava harden, while the interior forms horizontal conduits that channel the advance of the flow. These conduits are the beginning stages of lava tubes that serve to insulate the heat from the lava which then provides a way for the lava flow to advance a longer distance

Lavaka A gully system in Madagascar

Leaching The washing-out of water soluble materials from soil, saprolite, or rock by the downwards or lateral movement of water

Least-work profile That profile whose gradient is just sufficient for the associated geomorphological process to occur with the minimum possible expenditure of energy (e.g. a river long profile, whose concave-up form is the shape best suited for the transfer of increasing quantities of water and sediment in accordance with the least-work principle)

Lee dune A topographic dune that forms in the less of a hill

Lee eddy hypothesis The hypothesis that the steep slip face of a barchan dune is moulded by the presence of an eddy in the lee of the dune

Lessivage The translocation of silicate clays in colloidal suspension in a soil profile without any change in their chemical composition

Levée An embankment, natural or man-made, that confines flow during high-water periods

Lichenometry A method of dating rock surfaces and boulders using the size and occurrence of lichens

Limestone pavement A horizontal or gently inclined bare limestone surface that may have been formed by glacial stripping

Lineament A large-scale linear feature on the land surface, such as a trough or ridge, that is the product of the structural geology of a region

Linear dune A dune type characterized by straightness, length (often more than 20 km), sinuous crest-line, parallelism, and regular spacing, and a high ratio of dune to interdune areas. Many linear dunes consist of a lower gently sloping plinth, often partly vegetated, and an upper crestal area where sand movement is more active. Slip faces develop on the upper part of the dune, their orientation depending on the winds of the

season. Linear dunes occur in areas of bimodal or wide unimodal wind regimes and appear to be the most widespread dune type worldwide

Liquefaction The process by which soils and sediments collapse from a sudden loss of cohesion following a loss of shearing resistance. It involves a temporary transformation of the material into a fluid mass by the sudden increase of interstitial water

Lithalsa Permafrost mounds formed by ice segregation within mineral soils that occur within the zone of discontinuous permafrost

Lithification The process whereby loose sediment may be turned into rock following cementation and compaction

Littoral cell system A system of interlinking sediment cells found adjacent to the coastline, typically involving inputs of sediment from cliff erosion or river discharge, sediment transfer (by longshore drift) and sediment deposition in sinks (e.g. beaches and bars)

Lodgement till Glacial till deposited from slowly melting ice at the base of a glacier

Loess A predominantly wind deposited material dominated by silt

Log jam An impediment to river flow because of the accumulation of woody debris across its course

Log spiral beach An asymmetrical beach between headlands, where the outline is shaped by waves arriving obliquely, and refracted round the headlands

Logan stone Any large boulder that is so balanced that it readily rocks

Long profile, river The longitudinal section through a river's course from its source to its mouth

Longitudinal dune A large, elongated dune lying parallel to the prevailing wind direction

Longshore current The flow of water along the shore or nearshore as the result of oblique waves, often augmented by wind-driven and tidal currents

Longshore (Littoral) drifting The movement of beach sediment along the shore (and nearshore) by waves arriving at an angle to the coastline (beach drifting) and by currents generated by such waves (nearshore drifting). Also known as Shore drift

Lopolith A saucer-shaped intrusion of magma usually along bedding planes and resembling a large down-warped sill

Lunette A dune that forms on the less side of a pan (desert depression)

Lynchet A man-made terrace on a hillside created by cultivation

Maar An old volcanic crater. A pond or lake in such a depression

Machair A low flat or hummocky plain of calcareous sand, generally formed on the landward side of a coastal dune, as on the coasts of Scotland and Ireland

Macrogelivation Frost weathering at a large scale acting mainly through the crack system in a rock

Macrotidal Where mean spring tide range is 4 and 6 m

Magnitude and frequency concept Big geomorphic events tend to occur infrequently in comparison with small events so the question arises as to whether frequent, on-going, low magnitude events achieve more geomorphological change over time than infrequent high magnitude events

Managed retreat A means of adapting to a rising sea level by, for example, breaching an embankment to allow salt marsh to form behind it

Mangrove swamp or Mangal A coastal swamp or marsh associated with mangrove trees in low latitudes

Manifest underfit stream A stream which meanders within a large meandering valley, the meanders being of the ingrown type

Manning equation An empirical formula relating stream velocity to controlling variables of roughness, stream gradient, channel width and channel depth

Mantle plume A convectional flow of hot rock that rises through the mantle to the base of the lithosphere and which gives rise to a hot spot on the surface

Marginal channel A channel formed by meltwater flowing along the edge of a glacier or ice sheet

Marine limit The highest position (latitude, longitude and elevation) reached by the postglacial sea at a site, the elevation being measured with respect to present sea level

Mass balance of glacier The relationship between annual accumulation of snow and ice on a glacier or ice sheet and the losses resulting from ablation

Mass movement A mass movement is the downward and outward movement of slope forming material under the influence of gravity. The process does not require a transporting medium such as water, air or ice

Mass strength A quantitative measure of the resistance to erosion and instability of an entire rock mass inclusive of its discontinuities, contained water and weathering products

Mass wasting The failure and movement by gravity of a volume of soil, alluvium, rock, etc. to a downslope site

Massive A term used to describe a rock in which there are few bedding planes, joints or other fissures

Meander A sinuous channel form with curves

Meander belt That area of an alluvial bottomland defined by lines drawn tangentially along the points of maximum horizontal extent of the various meanders in a sequence of meanders

Mechanical weathering The disintegration of rocks into fragments by mechanical or physical means (e.g. by frost, salt) without any chemical change taking place

Medial moraine A morainic ridge, developed on the surface of a valley glacier and formed by the merging of two separate ice streams, the lateral moraines of which unite to form the medial moraine

Megabarchan A giant barchan dune over 100 m in height

Megadune (draa) The largest type of aeolian bedform

Megafan A volumetrically significant depositional element of sedimentary basins adjacent to mountain belts. It is a large (10^3-10^5 km^2), fan-shaped (in plan-view) mass of clastic sediment deposited by a laterally mobile river system that emanates from the outlet point of a large mountainous drainage network'. Alternative names include megacone, inland delta, wet alluvial fan and braided stream fan

Megageomorphology Geomorphology on the scale of plate tectonics, biological evolution and macro-scale climate change

Megatidal Where mean spring tide range exceeds 6 m

Mekgacha A fossil river valley in the Kalahari created in response to higher rainfalls, or river capture, or groundwater sapping

Meltwater Water that comes from a glacier or a snow accumulation

Meltout till Till released by melting of stagnant or slowly moving debris-rich glacier ice and deposited without subsequent transport or deformation. It can be split up into sub glacial melt out till (melting of debris rich ice at the bottom of the glacier) and supraglacial melt-out till (melting of ice on the glacier surface)

Mere A lake

Merokarst (or half karst) A type of karst developed on thin sequences of limestones interbedded with other rocks, as well as upon less pure carbonate formations

Mesa A flat-topped hill formed in gently dipping or horizontally bedded rocks following stream incision and slope retreat

Mesotidal Where mean spring tide range is between 2 and 4 m

Meterorite crater A near circular depression caused by the impact of a meteorite

Microatoll A circular organic reef structure (diameter 1 to 6 m) consisting of a raised rim built by coral (usually *Porites*), algae and other organisms, surrounding a shallow depression on the shore or on a coral reef

Micro-erosion meter An instrument used to measure accurately the lowering of a rock surface by means of a micrometer placed on three legs mounted on studs drilled into the rock surface

Microgelivation Frost weathering acting in rock pores

Micromorphology The study of soils and sediments at the microscopic scale by the study of thin sections

Microtidal Where mean spring tide range is less than 2 m

Mid-ocean ridge A prominent ridge or submarine mountain chain created by sea-floor spreading and the rising of magma

Miliolite An Indian term for aeolianite

Mire A peat accumulating wetland

Misfit stream A stream that appears to be too small to have formed the valley through which it flows, possibly because of a change in climate

Mixing corrosion The increased degree of solutional corrosion which occurs when two saturated karst waters of different composition mix

Mogote A prominent limestone hill in an area of tower karst

Monadnock An isolated mountain or large hill rising prominently from a surrounding peneplain

Moraine A material or depositional landform produced on, within and beneath a glacier or ice sheet

Morphogenetic region A region in which it is claimed that certain geomorphological processes and forms result from a particular set of climatic conditions, thereby giving a distinctive landscape

Morphological map A map designed to depict surface landforms and to show breaks and changes of slope, slope gradients, etc.

Morphometry The quantitative depiction of land forms

Morphostratigraphy The subdivision of sedimentary units primarily on the basis of surface form. The identification and mapping of land surfaces, either developed upon sediment bodies or in some cases on bedrock, has been used as a means of interpreting relative chronologies in many regions. Typical examples include glacial moraines and associated landforms, dunes, fossil shorelines and river terraces

Morphotectonics The study of the interaction of tectonics and geomorphology

Moulin A sink hole or shaft in a glacier caused by melting and the flow of supraglacial water to the englacial drainage system

Mound spring A spring that flows from a small hillock composed of material deposited by the spring or by accumulation of aeolian sediment on the moist and vegetated orifice of the spring

Mountain A substantial elevation of the land surface

Mountain front The steep edge of an upland standing up above a pediment or bajada

Mountain-front sinuosity An index that reflects the balance between erosional forces that tend to cut embayments into a mountain front and the tectonic forces that tend to produce a straight front coincident with an active range-bounding fault. It is expressed as:

$$S_{mf} = L_{mf}/L_s$$

Where S_{mf} is the mountain-front sinuosity, L_{mf} is the length of the mountain front along the foot of the mountain at the pronounced break in slope, and L_s is the straight-line length of the mountain front

Mud ball (see Armoured mudball)

Mud lump A small landform caused by loading of sediment in a delta which pushes plastic clays upwards as a small diaper through overlying deltaic sand

Mud slide A form of mass movement in which masses of softened silty or very fine sandy debris slides on discrete boundary shear surfaces in relatively slow moving, lobate or elongate forms

Mud volcano A small cone formed by a volcanic vent where hot water and mud are emitted

Mudflat A relatively level unvegetated area of fine sediment on the shore, especially in sheltered inlets, estuaries or tidal lagoons. Intertidal mudflats are commonly exposed seaward or salt marshes or mangroves at low tide, and supra-tidal mudflats occur landward of salt marshes or mangroves on arid or semiarid coasts

Mudflow A form of mass movement in which saturated, fine-grained material flows down the hill

Mudslide A form of mass movement in which masses of softened silty or very fine sandy debris slides on discrete boundary shear surfaces in relatively slow moving, lobate or elongate forms

Muskeg A swamp or bog composed of accumulated bog moss

Naled A Russian word for icing or *aufeis*

Namakier A flowing mass of salt that occurs on a salt dome

Nappe A mass of rock which is thrust over other rocks by thrust faulting or a recumbent fold or both

Natural arch A feature that forms when weathering, together with mass collapse, creates a tunnel through a slab of rock

Natural bridge A natural rock exposure across a valley that has been converted into a bridge due to erosion

Nearshore The shallow water zone between the low tide line and the line where waves begin to break; a zone that migrates to and fro as the tide rises and falls

Nebkha (Nabkha) A small dune formed when windblown sand is trapped within or accumulates around a plant

Needle ice Also known as pipkrake, it is composed of a small ice crystal formed when freezing affects the topmost layer of the soil raising individual stones or soil particles above the surrounding soil surface

Nehrung A sand or shingle spit which separates a haff (lagoon) from the open sea

Neo-catastrophism The concept that over the course of geological history the environment has, at times, changed markedly and rapidly due to infrequent but high magnitude events, e.g. super-eruptions and asteroid impacts

Neoglaciation A Holocene phase of glacial advance. Multiple advances occurred of which the Little Ice Age is the latest example

Neotectonics The study of horizontal and vertical crustal movements that have occurred in the geologically recent past and which may be ongoing today

Neptunism The belief, in contrast to plutonism, that a large proportion of the Earth's rocks are precipitates that were laid down in some chaotic fluid

Ness A promontory or headland

Nevé Equivalent to firn

Nick point A break in the long profile of a river

Nival karst Alpine karst in which snow plays a role

Nivation Snow patch erosion involving freeze-thaw action, chemical weathering and solifluction

Nivation hollow A rounded hollow produced when nivation east back into a slope

Niveo-aeolian Mixed deposits of snow and aeolian sand in addition to the forms generated by them

Notch A narrow hollow excavated along the base of a cliff near high tide level by abrasion, solution or bio-erosion, often with an overhanging rock visor (protruding ledge of rock)

Nubbin A small lump of earth produced by heaving owing to the growth of needle ice

Nuée ardente A catastrophic blast of hot steam, gas and burning dust released by a violent volcanic eruption and descending the slopes of the volcano as a high velocity incandescent cloud

Nunatak A rocky peak projecting above the surface of an ice sheet

Nye channel Subglacial channel systems cut into bedrock or consolidated sediments, often with an undulating long profile and steep gradients

Obsequent stream A stream whose course runs opposite to the original slope of the land surface

Obstacle dune A sand dune that accumulates around, behind or in front of an obstacle such as a hill or a mass of vegetation

Ocean trench A hemispheric-scale long, but narrow, topographic depression of the sea floor. They are also the deepest parts of the ocean floor. Oceanic trenches are a distinctive morphological feature of convergent plate boundaries

Offshore bar A bank of sediment developed offshore on a gently sloping coastline

Ogive Alternating arcuate bands of light and dark ice that extend across the surface of some glaciers below ice falls and are the result of seasonal differences in ice colour

Onion-skin weathering The detachment of curved sheets of rock from a large boulder or rock face as a result of such processes as hydration, pressure release (unloading), and insolation

Opferkessel A weathering pit

Organic weathering The disintegration or decomposition of rock by living organisms or organic processes

Oriented lakes Lakes exhibiting a common parallel alignment in response to wind or structural alignments

Orogeny The creation of mountains, especially by folding and uplift

Orogenic eustasy Changes in worldwide sea levels brought about by changes in the volume of the ocean basins associated with orogenesis (mountain building)

Outlet glacier A type of glacier which radiates out from an ice dome

Outlier An isolated hill produced by scarp retreat

Outwash fan or plain A gently sloping area, sometimes in the shape of a fan, composed of material deposited by meltwater streams flowing from the margins of a glacier or ice sheet

Overbank flow River discharge that has escaped from a channel when its banks were overtopped

Over-consolidated clays Those that have been highly compressed by burial

Overdeepening The process whereby glaciers erode to levels below regional fluvial base level

Overflow channel A channel or spillway cut by water draining from a glacial lake

Overland flow That part of precipitation or snowmelt that moves over the land surface before becoming concentrated within a channel of a rill, gully or stream

Overwash (Washover) The washing of sediment over the crest of a beach or coastal barrier by exceptionally strong wave swash to form a depositional fan on the landward side

Ox-bow A horse-shoe shaped length of stream channel which is an almost closed meander loop. It may be occupied by an ox-bow lake

Oxidation A chemical weathering process whereby rock minerals, especially those containing iron, combine with oxygen

Oyster reef A coastal or estuarine construction composed largely of the shells of oysters

Pacific type coast A coastline that s formed where the trend of mountain ridges and valleys is parallel to the coastline as a whole

Paired spits Spits on either side of a coastal inlet, river mouth or lagoon entrance, or protruding towards each other between two islands or between the mainland and an offshore island. They have developed either by convergent longshore drifting or the breaching of a former coastal barrier

Paired terrace A river terrace whose remnants correspond in altitude

Palaeochannel A river or stream channel which no longer conveys discharge and which is no longer part of the contemporary fluvial system

Palaeoflood A flood that occurred in the past as determined by using historical, biological or geological evidence

Palaeohydrology The study of past occurrences, distributions and movements of continental waters

Palaeokarst Fossil karst consisting of features remnant from a previous period of karstification

Palaeoseismology The study of the age, frequency and size of prehistoric earthquakes

Pali ridge A sharply pointed ridge between two stream valleys on a deeply dissected volcanic dome

Pallid zone A pale weathering horizon in regolith

Palsa A conical or elongated mound, containing a lens of ice and occurring in peat bogs in a periglacial environment

Pan A closed dryland depression that may be dry, hold an ephemeral water body after rains, or which was occupied by a lake under past moister conditions

Panfan The surface produced when a hill or mountain is completely eroded so that the peripheral fans coalesce, as in the end stages of landscape evolution in an aid region

Panplain A flat or almost flat landscape that has been produced by lateral erosion by rives and lowering of divides and interfluves

Parabolic (hairpin) dune A hairpin-shaped dune in which, in contrast to barchans, the arms point away from the direction of movement

Paraglacial Non-glacial processes that are directly conditioned by glaciation that are the direct result of the former presence of ice. The term refers both to proglacial processes and to those occurring around and within the margins of a former glacier

Paralic A lagoonal environment

Parallel retreat of slopes The denudation of a landscape by lateral erosion of scarp slopes and hills which maintain their slope angle as erosion progresses

Parna An Australian term for aeolian clay deposits

Partial area contributing model A model that interprets a hydrograph in terms of the extent of a saturated area around stream and channel heads

Passive margin The margin of a continent that is not associated with the active boundary of a tectonic plate and, therefore, lies within a plate

Paterae Volcanic craters

Paternoster lake A series of lakes in a formerly glaciated valley, separated from each other by morainic deposits or rock bars but linked together by streams

Patterned ground More or less symmetrical forms, such as circles, polygons, nets and stripes that have developed at the surface. Many occur in periglacial areas, but they also occur in other zones, as is the as with brousse tigrée or fairy circles

Peat burst (see Bog burst)

Pedestal rock A small, mushroom-shaped rock pinnacle with a narrow base and stem and a large head or cap rock

Pediment A gently sloping, concave rock cut surface, with only a thin debris cover, developed by erosional processes at the base of a steep slope or mountain front

Pediplain An extensive surface of erosion created by the coalescence of pediments

Peneplain An almost featureless plain, showing little sympathy with structure and formed during the later stages of a cycle of erosion

Percoline A line of concentrated water seepage through the soil that is usually oriented downslope

Pereletok A Russian term for a layer of ground between the active layer and the underlying permafrost, which remains frozen for one or several years and then haws

Periglacial Refers to non-glacial, cold climate processes and landforms, often associated with the presence of permafrost

Peripheral forebulge A result of glacio-isostasy. The lateral displacement of mantle material from below the centre of the ice results in a compensating area of slight uplift

beyond the area that is depressed by the weight of the ice. The forebulge collapses when the ice body disappears

Permafrost Permanently frozen ground in a periglacial environment or the thermal condition in soil or rock where temperatures below 0oC persist over at least two consecutive winters and the intervening summer

Permafrost table The upper surface of permafrost

Phacolith A lens shaped igneous intrusion usually situated beneath an anticlinal fold or in the base of a syncline

Phosphate rock An indurated phosphate-rich sedimentary deposit resulting in large measure from the interaction of bird excrement and the calcium carbonate of reef sands

Photokarren A type of karren in a limestone cave that is oriented towards the light

Phreatic passage A cave passage developed in the phreatic zone – the portion of an aquifer below the water-table

Physical weathering The breakdown of rock material into smaller pieces without any change in the chemistry or mineralogy of the rock, as by frost weathering, salt weathering or insolation

Phytogeomorphology A concept that reflects the sensitive relations between landforms and vegetation

Phytokarst Features produced by the weathering and erosive action of plants and animals on limestones

Piedmont A gently sloping surface extending from the base of a mountain or mountain range

Piedmont glacier A glacier which spreads out into a piedmont lobe as it debouches into a lowland

Piezometric surface A subterranean surface marking the level to which water will rise in an aquifer

Pingo An ice-cored hill domed up by the intrusion of water that subsequently freezes under pressure (an open system pingo) or by the growth of segregated ice masses (a closed system pingo)

Pingo scar A relict periglacial feature formed by the melting of the ice core of a pingo, leaving a central surface depression with sediment ramparts

Pinnate drainage A feather-like drainage pattern containing a large number of closely spaced tributaries

Pinning point Topographic constrictions at which glaciers hat during advances or retreats

Pipe and piping Subsurface channels caused by such processes as the deflocculation of clay particles in fine-gained, highly permeable soils

Piprake Needle ice

Pit Pond A depression in an outwash plain by the melting of a block of ice floated to its depositional site by meltwater and subsequently buried by sediment. As it melts, a depression in the surface of the outwash plain develops

Planation surface The production of a gently sloping surface by erosional processes that cuts across the geological structures

Planèze A triangular or wedge-shaped landform resulting from the dissection of a volcanic cone

Plastic deformation A deformation process which proceeds elastically at low stress values and becomes viscous when a critical stress value is reached. It occurs in rock under conditions of high temperature and pressure, producing a permanent alteration of its shape but without failure or rupture

Plate tectonics A concept in geology in which the Earth's surface is seen to be formed of a series of rigid pates that move to cause the ocean basins to change in size and form, and the continents to drift apart and to collide

Plateau An upland with a near-level summit, which is often bonded by a steep margin such as an escarpment

Playa An ephemeral lake, normally in a dryland context

Playfair's law A suggestion that every river will flow in a valley proportional to the size of the river and that where rivers join their levels will be accordant

Plinian eruption An explosive volcanic eruption which is frequently so violent that the volcanic cone is destroyed

Plinthite A hardpan or soil crust, normally rich in iron

Ploughing block Individual boulders that move downslope faster than their surrounding material by processes relating to seasonal frost. Due to the differential movement, the boulder pushes up a mound against its downslope side while leaving a depression along its upslope track

Plucking A process of glacial erosion describing the removal of discrete blocks of bedrock

Plume, mantle (see Mantle plume)

Plunge pool A depression formed at the base of a waterfall as a result of the hydraulic impact of the descending water and its sediment load

Plunging cliff A steep or vertical cliff that descends into deep water inshore without any intervening shore platform, rocky shore or beach

Plutonism The concept that granites were formed by the solidification of molten material intruded into the crust from the Earth's hot interior

Pluvial lake A lake formed at a time of greater past available moisture, particularly rainfall

Pocket valley A flat, steep-sided valley enclosing a karst stream below its resurgence, It extends headwards into a limestone massif and is usually terminated by a cliff

Pockmark, submarine Crater in the seabed caused by fluids (gas and liquids) erupting and streaming through the sediments

Point bar Bed sediment, generally sand and gravel, deposited on the inside part of a meander curve by fluvial transport and sorting

Polder An area of reclaimed land produced near, at or below sea-level as a result the construction of dykes and the pumping out of water

Polje A large karst depression that may sometimes be flooded with water, and which has been formed either by solution, or cavern collapse or for structural reasons

Polygonal karst An area of karst were the density of dolines is such that they dominate the landscape and are characterized by topographic divides that have a polygonal pattern

Ponor A swallow-hole as in the base of a polje

Pool and riffle A succession of one or more combinations of pools and riffles (gravel bars) along a stream channel in the downstream direction

Pore-water pressure The pressure exerted on soil and rock particles by water contained in pore spaces that forces particles apart

Portal Exit location of a melt stream at the snout or front of a glacier

Pot-hole A circular bowl cut into bedrock in the channel of a high velocity stream as a result of localized eddies which whirl large stones around at the stream bed and cause localised corrosion. The term has also been applied to vertical cave systems in karstic regions

Preglacial landform A landform created in the times before an area was glaciated

Pressure melting point The temperature at which a liquid becomes a solid at a particular pressure

Pressure release The process whereby large sheets of rock become detached from a rock mass owing to the continuing relaxation of the pressure within the mass which built up before it was exhumed by erosion

Pressure solution The dissolution of minerals at grain-to-grain contacts into an aqueous pore fluid in areas of relatively high stress and either deposition in regions of relatively low stress within the same rock or their complete removal from the rock within the fluid

Primarrumpf An upwarped dome which though still undergoing uplift is being eroded at an equal rate

Prior stream Late Quaternary palaeo-channel found in the semi-arid Riverine Plain in south eastern Australia

Proglacial The zone closely adjacent to a glacier snout or ice sheet margin

Proglacial lake Masses of water impounded at the edge of a glacier or at the edge of an ice sheet

Progradation The extension of a shoreline into the sea through sedimentation

Protalus rampart A narrow ridge of rock fragments formed by rock debris released from a free face by frost weathering siding over a snow patch which subsequently melts

Pseudokarst Landforms produced in non-carbonate rocks which are morphologically similar to those normally associated with karst

Pull-apart basin A topographic low, including sag ponds, developed by rifting along strike-slip faults

Push moraine A landform produced by the bulldozing effect of an ice sheet advancing cross glacial drift from an earlier glaciation

Puy The French term for a volcanic neck, revealed by differential erosion. The type location is the Puy de Dôme in the Massif Central

Pyroclastic flow The flow of incandescent gas, ash and rocks as a result of a violent volcanic eruption

Quickclay Water-saturated clay which has insufficient cohesion to prevent heavy objects from sinking into its surface

Quickflow The part of a stream hydrograph which lies above an arbitrary cut-off line drawn on the hydrography, representing the most rapidly responding hydrological processes and pats of the catchment

Quicksand Water-saturated sand which is semi-liquid and cannot bear the weight of heavy objects

Radial drainage A drainage pattern in which the streams radiate outwards from a central high point of a dome or volcano

Rainbeat crust A thin layer at the soil surface displaying structural changes in the arrangement of soil particles that are caused by the raindrop impact and reduce rainfall infiltration

Raindrop impact, splash and wash A term expressing the effect that individual raindrops have on erosion processes. The dislodging of soil particles that are then susceptible to entrainment by water moving downslope

Rainfall simulation The experimental and controlled delivery of water to the land surface to simulate rainfall intensity and drop-size distribution

Raised beach A beach deposit that is the product of past wave action under higher sea level conditions than exist at the present

Raised channel A channel whose form is preserved in the environment as a positive relief feature when cementation of the original channel sediments has rendered them more resistant to subsequent erosion than the surrounding landscape

Raised mire/bog A shallow dome of peat formed especially in cool, wet environments and where the topography is typically convex

Ramp, coastal Section of higher gradient at the rear of gently sloping shore platforms, or a steeply sloping rock surface (commonly at 4-10^{o}) that occupies the entire intertidal zone and which may extend to elevations that are well above high tidal level

Randkluft The gap between the backwall of a cirque and the glacial ice that fills the cirque

Rapids A stretch of rapidly flowing water associated with a steepening of the gradient along a stream course

Rating curve A term used to describe the relationship between discharge and water stage or between suspended sediment and solute transport and water discharge which can be used to estimate values of the former variable from measurements of the latter

Reef flat The widest section of a coral reef lying behind the fore reef

Resultant drift direction The direction of the resultant drift potential

Resultant drift potential A measure in vector units of the net sand moving power of the wind at a station

Reach An uninterrupted part of a stream channel between two points

Recessional moraine A morainic ridge formed at the edge of a receding glacier or ice sheet

Recurved spit A spit that ends in a landward hook or recurve

Reduction The chemical process in which oxygen is removed from a compound

Reef A rocky construction found at or near sea level formed mainly from biologically produced carbonates such as corals and algae

Reflective beach A beach where wave energy is partly reflected seaward as plunging breakers move in through relatively deep nearshore water

Refraction, wave (see wave refraction)

Reg (serir) A stony pavement in a desert area

Regelation A process of refreezing operating beneath glaciers either where basal ice at the pressure melting point is forced against a rock obstacle, thus releasing meltwater that freezes again on the sole of the glacier beyond the obstacle where pressure is reduced

Regime theory An approach to the design of river channel shape based upon theoretical and empirical assessment of the best shape for transporting a given discharge and sediment supply

Regolith An accumulation of weathered and unweathered inorganic and organic material lying above fresh bedrock

Regression A phase of relative decline of sea level exposing land that was formerly underwater

Rejuvenation A process whereby a river regains its power of down-cutting as a result of a fall in base-level or a climatic change

Relaxation time The length of time it takes a system to establish a new quasi-stable state after an external disturbance has taken place

Relict landform Features no longer active under present conditions

Relief generation An assemblage of landforms that evolved under different endogenetic forces (e.g. climate) than the present

Relief, inverted (see inverted relief)

Repose, angle of The maximum angle at which a mass of debris under given conditions will remain stable

Reptation Transitional between the creep and saltation of sand grains in aeolian transport, it occurs when the high-velocity impact of a saltating grain sets other grains moving through a low hopping process

Resequent drainage A drainage type in which after a period of development and change, streams seek their initial consequent courses

Residual strength The strength of a soil, usually clay, following failure. Large shear strains produce a reorientation of the clay mineral particles and allow a shear plane to develop. The shear strength along this plane is less than the peak strength

Retroarc basin A type of back-arc basin which is floored by continental crust. The main sediments are fluvial, deltaic, or marine, derived from the uplifted area behind the arc

Retrogressive thaw slump Spectacular thermokarst form resulting from a process initiated by thawing of ground ice. It begins by the slide of the active layer on the permafrost table, which acts as a lubricated slip plane for movement and controls the depth of the failure plane. This process produces semi-circular hollows opening downslope and usually less than 2 m high. Further thawing of permafrost produces steep slopes as much as 8 m high

Reversed drainage A drainage type in which, as a result of earth movements, rivers flow in the opposite direction to their original courses

Reversing dune A dune whose crest is subject to a change in orientation as wind conditions change

Reynolds number A numerical quantity to describe the character of flow (typically laminar or turbulent), being the ratio of inertial forces to viscous forces

Rhourd A pyramidal or star dune

Ria A long, narrow, often branching inlet formed by marine submergence of parts of a river valley that had previously been incised to a lower sea level: a drowned valley-mouth

Ribbed or Rogen moraine A landform assemblage of numerous, parallel, closely-spaced ridges consisting of glacial drift. The ridges are formed transverse to ice flow in a subglacial position and are usually found in the central portions of former ice sheets. Individual ridges are typically 10 – 30 m high, 300 – 1200 m long and 150 – 300 m wide, have a straight to arcuate planform, concave in the down-ice direction

Richter denudation slope A straight rock-slope unit with an angle of inclination which is at the maximum angle for stability of its thin talus cover

Ridge and runnel Several subdued bars and troughs running parallel or nearly parallel to the coastline and exposed at low tide on a sandy shore

Riedel shear A form of shear fracture which forms roughly perpendicular to the main direction of shear strain or movement

Riegel A step in the rock floor of a glacial valley

Riffle A depositional bar on a river channel floor

Rift valleys and rifting A large structural landform resulting from the lowering of a relatively narrow strip of rocks between parallel faults as a result of tensional or compressive forces

Rill A very small incision eroded into soil or soft rock as a response to runoff

Rillenkarren Sharp limestone ridges formed as a result of the solution of limestone rocks

Rillenstein Microsolution grooves and pitting on rock surface

Rimstone Also called *gours*, is a type of speleothem in the form of a stone dam. Rimstone is made up of calcite and other minerals that build up in cave pools

Rind, weathering A zone of chemical alteration on the outer portions of rocks involving the redistribution of elements

Ring complex A composite circular structure of igneous intrusive rocks made up of cone sheets and ring dykes

Rinnenkarren Solution runnels on limestone surfaces consisting of linear channels or furrows that show increased depth and width downslope

Riparian Relating to the banks of a stream

Rip channel A channel cut by the seaward flow of a rip current across the nearshore zone, usually through nearshore bars

Rip current A strong narrow current (up to 2 knots) flowing seaward through breakers at right angles or an oblique angle to the coastline

Ripple A general term applied to a range of normally unrelated, very small bedforms that occur in trains and record sediment mobilization and transport in various aqueous and aeolian environments

Riprap Layer or facing of rock or concrete dumped or placed to protect a structure or embankment from erosion

River capture or piracy The process by which one river cuts back and drains flow from that of another

River training Engineering works built along a stream or reach to direct or lead the flow into a prescribed channel

Roche moutonnée A projection of rock from a valley floor or valley side which has been moulded by glacial abrasion and plucking and which has a rounded and gently-sloping upglacier face (the stoss) and a steeper and more rugged downglacier face

Rock avalanche A high volume of mostly dry rock material caused by the collapse of a slope or cliff created by large falls and slides moving at high velocities and for long distances, even on a gentle slope. A sturzstrom

Rock basin A depression in solid rock often resulting from ice erosion in mountain regions and usually containing small lakes

Rock coating Thin accretion of material on rock surfaces including desert varnish, silica glaze and iron films

Rock creep Form of slow flowage in rock materials evident in the downhill bending of layers of bedded or foliated rock and in the slow downslope migration of large blocks of rock away from their parent outcrop

Rock doughnut A landform feature, sometimes found on sandstones and granites, consisting of circular raised rims surrounding a rock basin

Rock drumlin A rock hill streamlined by the passage of over-running glacier ice

Rock fall The freefall of a mass of rock from a steep slope

Rock flow Creeping flow-type, deep-seated gravitational deformations affecting homogeneous rock masses

Rock flour The fine products of glacial abrasion or of weathering processes

Rock glacier A tongue of rock waste, often a mix of ice and debris, that escapes from a cirque-like amphitheatre and undergoes very slow downhill creep

Rock mass strength A quantitative measure of the resistance of a rock mass to erosion which involves giving a rank of importance to a range of different rock parameters and summing them to come up with a total rating of strength

Rock shelter A shallow cave in a rock face such as has often been a favoured site for human occupation

Rock slide A rock slide is a translational movement of rock which occurs along a more or less planar or gently undulating surface

Rogen (ribbed) moraine) A landform assemblage consisting of numerous, parallel, closely spaced ridges of glacial drift that formed transverse to ice flow in a sub-glacial position

Rotational slip The movement of a mass of rock, ice or debris over a curved plane, in which back tilting may occur

Roughness An expression for the degree to which a stream channel is marked by irregularities, which by increasing the amount of friction cause a slowing of downstream flow

Roughness coefficient Numerical measure of the frictional resistance to flow in a river channel

Rundkarren Rounded channels or furrows developed beneath a soil cover on a limestone surface

Run out distance The distance that landslide material travels outside the source area

Run-off The amount of water leaving a drainage basin as overland flow, throughflow and groundwater flow

Ruware A low, rounded exposure of unweathered rock rising above a surrounding plain. They may be a proto-inselberg

Sabkha A low-lying very gently-sloping saline area above normal high tide level on an arid coast, subject to occasional flooding by the sea or rain water, and prolonged phases of evaporation and desiccation, resulting in hypersaline conditions

Sackung A German term describing a type of slope-sagging, gravitational lateral spreading or deep-seated gravitation in mountainous alpine landscapes

Safety, factor of (see factor of safety)

Sag pond A body of water collected in the lowest parts of a depression formed either near the head scarp of rotational landslides or between two strands of an active strike-slip fault, i.e. a pull-apart basin

Salar One of many names for a salty basin of inland drainage in a dry region

Salcrete A light-coloured surface crust of halite-cemented beach sand caused by the concentration by evaporation of swash or spray blown inshore by breaking waves

Salt dome A rounded hill produced by the upward doming f rock strata as a result of the diapiric movement of a halite bed or other evaporite deposit

Salt glacier A flow of salt (typically halite) that is created when a rising diapir in a salt dome breaches the surface. Gravity causes the salt to slowly move downslope, like ice glaciers, into adjacent valleys. Also called a namakier

Salt hydration The uptake of water of crystallisation into a salt as a result of temperature and humidity changes. It leads to a change in the volume of the salt that can contribute to salt weathering

Salt karst Landforms produced by the solution of salt (halite)

Salt marsh A flat or gently sloping vegetated wetland in the upper intertidal zone on sheltered parts of the coast (estuaries, inlets, lagoon shores). Often in the form of a depositional terrace, periodically submerged, with halophytic grasses, herbs and shrubs. They are often dissected by tidal creeks, and may contain enclosed salt pans

Salt tectonics Deformation of the Earth's crust by the flow of salts from deep-seated evaporite deposits to form salt domes, salt pillows, salt glaciers and associated structures

Salt weathering The chemical or physical weathering of rock caused by the crystallization, thermal expansion or hydration of salts in the pores of rocks and concrete

Saltation The process by which sediment, moved by wind or water, bounces along the surface of the ground or a channel

Sand-bed river An alluvial river course in which the bed material is primarily composed of sand

Sand ramp A sediment accumulation against a topographic barrier that consists of an inter-digitation of aeolian sediment and of materials derived from the slope against which the sand is trapped

Sand volcano A cone of sand formed by the ejection of sand onto a surface from a central point. The sand builds up as a cone with slopes at the sand's angle of repose. A crater is commonly seen at the summit. The cone looks like a small volcanic cone and can range in size from mm to m in diameter. The process is often associated with earthquake liquefaction and the ejection of fluidized sand that can occur in water saturated sediments during an earthquake

Sand wedge Where aeolian sediment transport is active in a periglacial area, sand or silt rather than snow and hoarfrost, may enter open thermal contraction cracks, resulting in the formation of sand-filled wedge structures

Sand Sea The largest unit of aeolian deposition; an extensive area of aeolian sand (10^2 to 10^6 km^2) that may contain sand dunes and/or sand sheets

Sandsheet An accumulation of aeolian sand with limited topographic expression

Sandstorm An event that occurs when strong winds entrain particles of sand and transport the in the atmosphere

Sandur A large glacial outwash plain that may be criss-crossed by braided streams and swept by glacial outbursts

Sapping The process of sediment removal by groundwater seepage at the base of a landform such as an escarpment or arroyo head

Saprolite Weathered or partially weathered bedrock that is in situ

Sarsen A block of silica-cemented sandstone, breccia or conglomerate found in southern England which is probably a relict silcrete of Tertiary age

Sastrugi Furrows and ridges in the surface of ice and snow accumulations resulting from the action of wind

Saturation excess overland flow A type of surface runoff occurring when the soil has become so saturated that it is unable to soak up any additional water

Scabland An erosional landscape formed by a catastrophic flood and is generally applied to the effects of jökulhlaups

Scarp The steep edge of an upland such as a plateau or cuesta

Scoria cone A simple form of small volcano formed as the result of a single eruptive episode and composed of scoria

Scree A slope accumulation of angular rock fragments resulting from the weathering of a free face

Scroll bar A river bar formed on the inside of a bend

Scroll plain Occurs where a river meanders across an area with a very low gradient. In addition to meanders, scroll plains are also characterized by many oxbow lakes

Sea level The level at which the sea stands against the coast, conventionally taken as mean sea level, the arithmetic mean of the calm sea surface (excluding waves and oscillations related to winds and atmospheric pressure variations) measured at hourly intervals over at least 18.6 years

Sea-floor spreading A process that occurs where tectonic plates move apart

Sediment budget The identification and quantification of the individual components of a sediment-transfer system

Sediment cell A section of the coastal zone where the sediment inputs, throughputs and outputs may be considered as part of a closed system

Sediment delivery ratio The rate of sediment yield at a specified point in a channel network, expressed as a fraction of the rate of erosion in the contributing catchment

Sediment load The load carried by a stream. It is broken into three types: dissolved load, suspended load, and bed load

Sediment rating curve A line averaging concentrations of fluvial sediment in transport, generally as measured from suspended sediment samples collected through the range of discharges typical of a stream. It shows mean variation in sediment concentration with variation in discharge for the period of data collection

Sediment routing The process through which fluvial sediment (including both suspended and bedload) is transported downstream following a specific path or route. This route may be the course of the natural channel, an artificial channel or canal, or a restored channel

Sediment wave A transient zone of sediment accumulation in a river channel that is created by sediment input and does not originate solely from variations in channel topography

Sediment yield The total sediment outflow from a watershed or a drainage area at a point of reference and in a specified time period

Sedimentation The settling of solids from suspension in a fluid, normally either wind or water. Deposition of sediment

Seepage erosion Erosion caused by the gradual seepage of groundwater from a valley head or cliff face

Segregated ice Ice formed by the migration of pore water to the freezing plane where it forms into discrete layers, seams or lenses

Seif A linear or longitudinal dune normally produced in areas with a bimodal wind regime

Seismic geomorphology The study of geomorphological phenomena created by earthquake activity

Sensitive clay The ratio of the undisturbed strength to the remoulded strength of a clay

Serac Pinnacles and cuboid masses of ice associated with an ice fall

Serir A desert terrain type with a surface mantled by sheets of pebbles

Serpulid reef a coastal reef produced by marine polychaetes which secrete hard, calcareous tubes

Shakehole A roughly circular depression in which water drains into an underground limestone cave system

Shearing Occurs when a material is subjected to a stress or confining pressure, acting in a particular direction, that exceeds the strength of the material

Shear stress The external force acting on an object or surface parallel to the slope or plane in which it lies; the stress tending to produce shear

Shear surface A surface within a rock or soil produced by shearing

Sheet erosion The process by which thin layers of surface material are removed more or less evenly from gently sloping land by water

Sheet flood, Sheet flow, Sheet wash A form of overland flow on gentle slopes, including pediments, in deserts where water is spread widely as a thin layer over the land surface

Sheeting the formation of joints in a massive rock such that the outer layers of the rock separate and exfoliate

Shields Large blocks of ancient rocks that have been worn down over extended periods

Shield volcano A volcanic cone formed from lava and characterised by gentle slopes and a large basal diameter

Shingle coast A coast formed of a mass of stones that have been rounded by attrition

Shingle ridge A coastal ridge formed of a mass of stones that have been rounded by attrition

Shoal An area of shallow water in a lake or sea

Shore The area of land immediately adjacent to a body of water

Shore platform A flat or gently sloping smooth or relatively smooth rock surface formed in the zone between high and low tide levels

Shrub-coppice dune A dune that accumulates around woody plants

Sichelwannen Bow-shaped hollows, with their arms generally pointing in the direction of flow of the glacier that formed them

Sieve deposit A well-sorted matrix-free conglomerate, which forms where the sediment transported and deposited comprises only pebble and gravel grades

Silcrete A highly siliceous indurated material formed at or near the land surface by the silicification of bedrock, weathering products and other superficial materials by low temperature physicochemical processes. A type of duricrust

Sill A tabular sheet of igneous rock injected along the bedding planes of sedimentary or volcanic formations

Siltation The settling out and accumulation of fine material in a body of water such as a lake or reservoir

Singing sands The generation of various types of noise by moving sand grains

Sinkhole A depression formed by solution and collapse in a limestone area

Sinter mound A mound composed of chemical precipitates from a spring

Sinuosity As applied to a stream channel, is a non-dimensional ratio of the length of the channel thalweg to the length of the stream valley, measured between the same points

Skerry A low, rugged rocky reef or scatter of reefs, generally intertidal but sometimes extending above high tide level, off a hard rock coast, particularly in Scandinavia and Scotland

Slab failure The failure of a mass of rock and its movement as a translational slide along discontinuities which dip outward from the face of a steep slope

Slab slide A translational failure in a slope composed of coherent, fine soils or coarser debris with a fine matrix. Weathered soils, especially those derived from clays, mudrocks and silty-clays, are commonly involved. The weathered material normally moves on a shear zone close to a surface of unweathered or lightly weathered bedrock, a pedogenic horizon or a structural surface

Slack A depression in an area of sand dunes or of mud banks

Slackwater deposit A fine textured sediment that falls from suspension in a body of slack water owing to little or no stream velocity as in a side tributary during a flood

Slaking The disintegration of loosely consolidated material, such as shale, on the introduction of water or on exposure to the atmosphere

Slick slope Bare desert weathering-limited slopes developed on sandstone exposures especially on the backslopes of cuestas

Slickenside A polished or scratched rock surface that has been produced by friction generated during faulting

Slide A movement of material along a recognizable shear surface

Slip-face The leeward side of a sand dune down which sand avalanching may take place

Slope replacement A slope evolution model in which it is envisaged that as the slope develops, some parts of the slope replace other parts

Slope-over-wall profile A steep coast on which an upper, sloping facet descends to a steeper, often vertical, basal cliff. Such profiles are found on steep coasts where the rock formations dip seaward, on soft formations where a subaerial slope is recurrently undercut by marine erosion, and where a weak formation (such as glacial drift or head) forms a slope above a cliff in more resistant rock

Slopewash The water from rain, after it has fallen on the surface of the ground and before it has concentrated into definite streams

Slump A form of mass wasting event that occurs when loosely consolidated materials or rock layers move a short distance down a slope

Slushflow A water-saturated snow mass flowing principally along a first-order stream channel. Their formation is associated with an increase in the water content of a

snowpack through rainfall and/or through rapid snowmelt. At a critical point instability occurs and snow mass is released

Snout, glacial The terminus of a glacier

Snow patch erosion Nivation

Soft engineering The use of ecological principles and practices to reduce erosion and achieve the stabilization and safety of shorelines and the area surrounding rivers, while enhancing habitat, improving aesthetics, and saving money. Soft engineering is achieved by using vegetation and other materials to soften the land-water interface, thereby improving ecological features without compromising the engineered integrity of the shoreline or river edge

Soil conservation The protection of the soil against erosion

Soil creep The slow downslope movement of slope materials

Soil erosion The removal of soil by erosive processes such as deflation, gullying, rainwash, etc.

Soil spreading The collapse of a sensitive soil layer followed by either settlement of the overlying more resistant soil layers, or progressive failure throughout the whole sliding mass

Solifluction (solifluxion) The flowage of soil that has become saturated or super-saturated with water, often, but not always, under periglacial conditions

Soltafara A volcanic vent emitting sulphurous gases in a non-explosive manner

Solute rating curve A means of describing the relations between solute transport and water discharge. If the rating curve is stable, the water discharge can then be used to predict solute concentration and load. The characteristics of these plots, including slope, degree of scatter and intercept are frequently used to characterize the solute response of a drainage basin

Solution The removal of dissolved minerals

Sorted polygon A type of patterned ground having a sorted appearance due to a border of stones and characterized by a polygonal mesh

Sorting A measure of the standard deviation of the particle size distribution of a sediment sample

Source area The area of a drainage basin supplying water and sediment to a drainage network

Source bordering dune A sand dune that occurs close to the source of sediment (e.g. a river, pan or coast) from which material is deflated by aeolian processes

Space-time substitution The suggestion that sampling in space can be equivalent to sampling through time – the ergodic hypothesis

Spalling The peeling off of platy fragments from the surface of a rock

Speleothem A secondary mineral deposit formed in caves in limestone regions as dripstone or flowstone. Stalactites and stalagmites are types of speleothem

Spheroidal weathering The development of spheroidal boulders from original joint-bounded rock masses (as in granite) as a result of weathering processes

Spit A finger-like ridge or embankment of beach material built up above high tide level and diverging from the land at one end (proximal) to terminate (distal end) usually in one or more recurves or hooks curving landward

Spitzkarren Are peak-shaped features remaining from surface solution widespread over horizontal or gently sloping surfaces. Their sides are carved by rillenkarren. Their diameter is typically 50 cm and their height about 10cm

Splash erosion The erosion produced by the splashing of material downslope as a result of the impact of rain drops

Spring mound A mound of material precipitated from artesian springs and/or caused by sediment accumulation around moist, vegetated spring orifices

Spring sapping Headward erosion of a spring into the head of a channel

Stability The ability of a system to maintain or return to its original condition flowing a disturbance

Stack An isolated upstanding steep-sided rock pillar, column or pinnacle rising from the shore, a shore platform, or the sea floor close to a cliffed coast

Stage The water depth or the elevation of the water surface at a location on a river system; alternately, the factor of time in the operation of the cycle of erosion

Stagnant ice topography Landforms produced by the downwasting of stagnant ice *in situ*

Stalactite Calcite mass suspended from the roof of a limestone cavern and formed by the downward percolation of water containing dissolved calcium carbonate

Stalagmite An accumulation of calcite that has grown upwards from the floor of a cave or cavern as carbonate charged water has dripped down from above

Star dune A type of dune that has three or more radial arms extending in various directions from a central high point, and which has formed in response to multi-directional wind regimes

Stemflow The drainage of intercepted precipitation down the stems of plants

Step-pool system Alternating steps (composed of accumulations of cobbles, boulders and woody debris transverse to a channel) and pools in mountain streams with steep gradients

Steric effect In the case of sea water, steric effects are driven by changes in the temperature and/or salinity of the ocean, which cause the water to expand or contract, thereby causing a change in sea level rise

Stillstand A period during which the level of the sea or a lake in relation to the land remains unchanged

Stock A large, irregularly shaped intrusion of igneous rock

Stone forest Chinese pinnacle karst

Stone line An horizon of gravel-sized rock fragments with a weathering profile or soil

Stone pavement Also known as desert pavement, this is a surface type characterized by a surface armour or lag of coarse materials overlying a soil or sediment with a wider range of grain sizes

Stone polygon A type of patterned ground comprising borders of large, up-tilted rock fragments and a central core of finer material

Stone stripe A line of coarse debris flowing the line of maximum gradient of a slope, particularly in periglacial regions. Upslope they may merge with stone polygons

Storm surge A temporary abnormal rise of sea level on a coast, as when an exceptionally high tide (often with sea level raised by low atmospheric pressure) is accompanied by strong wave action generated by an onshore gale (cyclone, hurricane, typhoon)

Stoss slope A slope that faces the direction from which a particular type of movement is coming, e.g. the windward side of a dune or the upflow part of a glacier

Strandflat An extensive shallow submarine and low-lying emerged coastal platform (up to 65 km wide and typically with transverse gradients of up to 10° and many surmounting mounds and hillocks that were formerly stacks and islands), sharply contrasted with a high and rugged hinterland

Strandline A line of erosion running horizontally along a slope indicating the position of a former shoreline. Strandlines are used to reconstruct past lake levels

Strath terrace A rock-cut terrace produced as a river cuts down into bedrock

Stratified scree Alternating layers of angular stone and finer material occurring on hill slopes and thought to be the product of alternating frost action and solifluction under periglacial conditions

Stratovolcano Also known as a composite volcano, is a conical volcano built up by many layers (strata) of hardened lava, tephra, pumice, and volcanic ash. Stratovolcanoes are sometimes called composite volcanoes because of their composite layered structure built up from sequential outpourings of eruptive materials

Stream Length-Gradient Index (SL Index) This is represented as

$SL = (\Delta H/\Delta L)L$

Where ΔH is the change in elevation of a stream reach and ΔL is the length of the reach. L is the total channel length from the midpoint of the reach upstream to the highest point on the channel. The index is used to identify recent tectonic activity by identifying anomalously high index values on a particular lithology

Stream order The position that a stream-channel segment has within the hierarchy of channels of a drainage network

Stream power The ability of flowing water to accomplish work (e.g. sediment transport, erosion). It is the product of discharge and water-surface slope. Stream power, per unit length of channel, is usually expressed in watts per meter ($W\ m^{-1}$)

Striation A scratch or groove engraved into a hard rock surface by abrasive fragments frozen into moving ice or trapped between sliding ice and the valley floor

Strike-slip fault A fault in which surfaces on opposite sides of the fault plane have moved horizontally and parallel to the strike of the fault

String bog/mire An area of water-logged land that is characterized by ridges of peat separated by water-filled troughs

Stromatolite (stromatolith) Layered, early lithified, authigenic microbial structures – often domical or columnar in form that develop at the sediment water interface in freshwater, marine and evaporitic environments

Strombolian eruption A type of volcanic eruption in which molten lava and gases escape at frequent intervals but without violent explosions

Structural geomorphology The study of landforms whose appearance reflects and is adjusted to the geological structure and composition of underlying bedrock

Sturzstrom A very large rock avalanche that may travel large distances and at high velocities

Subaerial Processes and features produced at the land surface rather than in the marine environment

Suballuvial bench The lower portion of a rock pediment where it is overlain by alluvial sediments

Subcutaneous flow The lateral transfer of water in the subcutaneous (or epikarstic) zone. The subcutaneous zone is a highly weathered region in well-developed karst environments lying in the upper part of the percolation zone, between the soil and the relatively unweathered and permanently saturated phreatic zone below

Subduction zone The zone where oceanic lithosphere is consumed into the mantle at convergent plate margins

Subglacial A glacial sub-system directly beneath an ice mass that includes cavities and channels that are not influenced by subaerial processes. Subglacial geomorphology considers all aspect of topographic change beneath ice masses as a result of erosional and depositional processes

Subjacent karst Karst landscape in non-carbonate rocks due to presence of karstified rocks beneath the surface formation

Sublimation till Similar to meltout till, except the ice is lost through sublimation rather than melt. Often occurs only in extremely cold and arid conditions, mainly in Antarctica

Sublittoral zone The area of the seas between the intertidal zone and the edge f the continental shelf. It can also refer to the deeper parts of a lake in which pats cannot root

Submarine canyon A deeply incised, steep-sided trench that crosses the continental shelf, and which may continue the line of a major river. Turbidity currents may play a role in their development

Submerged forest The remains of a forest that has been submerged as a result of sea-level rise and has been preserved by more recent deposits

Subsequent stream A stream that develops as a tributary of a consequent stream, mainly by the process of headward erosion along a line of geological weakness

Subsidence The gradual lowering or sinking of a land area, with little or no horizontal component, as a result of such processes as solution of carbonate rocks, melting of permafrost, and as a response to removal of water or hydrocarbons

Suffosion The digging or undermining of soil or rock by throughflow

Sulphation The reaction between materials containing calcium carbonate and sulphur dioxide in humid atmospheres, as in cities where polluted air may react with limestone walls

Suncups A bowl-like depression melted into a snow or ice surface, separated by a network of connected ridges. Individual suncups may be more than a meter deep and three m in diameter. They form during warm, sunny conditions

Superimposed drainage The pattern of a drainage network which developed on a landscape or bedrock which has since been removed by erosion, the network being preserved on the new land surface

Superimposed ice Ice formed when water comes into contact with a cold glacier surface and freezes

Supraglacial Lying on or above the surface of a glacier or ice sheet

Surface detention That part of precipitation which remains in temporary storage during or immediately after a storm before it moves downslope by overland flow

Surging glacier A glacier which flows at a velocity an order of magnitude higher than normal

Suspect terrane theory A theory that sea floor spreading causes blocks of terranes to move across the ocean floor into a plate boundary where subduction is occurring. At this location, the terrane is then scraped off the submerging ocean floor and in turn joined into the continental crust by the submerging interaction of the two plates

Suspended sediment Fine sediment particles carried along in the body of a stream and supported by the water itself, or material carried in the wind above the ground, as in a dust storm

Swale An elongated hollow or low-lying area between dune ridges, usually running parallel to the coastline

Swallow hole and swallet A funnel-shaped or vertical shaft down which water flows into limestone

Swamp A type of wetland, dominated by woody plants

Swash The rapid flow (uprush) of a breaking wave up the beach face

Swash bar A nearshore bar built parallel to the shore by wave swash, with a steeper landward slope advancing into a shallow lagoon

Syngenetic karst Karst that has developed concurrently with the diagenesis and consolidation of the host karst rock

Synrift A rock sequence deposited during a phase of active rifting

Tafoni (singular tafone). Cavernous weathering hollows produced in vertical or near-vertical rock faces

Takyr A clay rich desert soil with a bare, parquet-like surface, broken up by a network of splits into numerous polygonal aggregates and associated with areas of shallow seasonal flooding

Talik A layer of unfrozen ground below the seasonally frozen surface layer and above or within permafrost

Taluvium A slope deposit composed of rock fragments in a fine matrix, thereby bridging the gap between talus (composed of rock fragments) and colluvium (fine material only)

Talus Rock fragments derived from, or lying at, the base of a cliff or steep rocky slope.

Talus creep The slow movement of material on the upper parts of scree slopes caused by rock falls, freezing activity, bioturbation, etc.

Tarn A small mountain lake

Tectonic geomorphology The study of landforms produced by movements in the Earth's crust, such as uplift, depression, lateral sliding, warping, folding and faulting

Tepee An overthrust sheet of limestone which appears in section to be an inverted V and is formed by desiccation and contraction processes in saline tidal areas and around salt lakes

Terlough A limestone depression with a sinkhole which fills with water when the water table rises, as in a tidal area

Terminal moraine A moraine at the terminus of a glacier

Termitaria Mounds produced by termites

Terrace, river A valley-contained surface that typically consists of a long, narrow and gently inclined landform bounded along the lower edge by a steeper descending slope or tread, and along the higher edge by a steeper ascending slope. Terraces can be depositional or in the case of a strath terrace can be erosional

Terracette A small terrace that forms a step on a hillside. They often occur in near parallel series running approximately along the contours of a hillslope

Terrain evaluation In its narrowest definition terrain evaluation is regarded as synonymous with mapping of land systems, a procedure for classifying the landscape by dividing it into landform assemblages with similarities in terrain, soils, vegetation and geology). In a slightly broader definition, it can be regarded as a method for summarizing the physical aspects of a landscape initially through classification and then including an assessment of ground conditions in terms of engineering requirements

Terrane A structural entity which has a stratigraphic sequence and history quite distinct from those of adjacent units

Thalassostatic Relating to fluctuations in sea level

Thalweg The line extending down a channel that follows the lowest elevation of the bed

Thermal fatigue weathering A type of physical weathering whereby rapid and frequent changes of temperature cause rock to fracture

Thaw lake A lake created by the melting of frozen ground. They are a product of thermokarstic processes

Thermal shock Occurs when a thermal gradient causes different parts of an object to expand by different amounts. The stress created can exceed the strength of the material, causing a crack to form

Thermal subsidence A mechanism of subsidence in which conductive cooling of the Earth's mantle thickens the lithosphere and causes it to decrease in elevation

Thermoclasty the breakdown of rocks as a result of temperature changes. More or less synonymous with insolation weathering and thermal fatigue weathering

Thermokarst The formation in periglacial areas of an irregular ground surface with many depressions as a result of the thawing of ground ice

Threshold, geomorphological A threshold of landform stability that is exceeded either by intrinsic change of the landform itself, or by a progressive change of an external variable (an extrinsic threshold)

Throughflow The movement of water through the soil by percolation either through interconnecting pore spaces or along discrete pipes

Thufur A soil hummock formed under periglacial conditions

Tidal creek An inlet in a shoreline, a channel in a marsh, or another narrow, sheltered waterway. Creeks occur extensively on mud flats and muddy coasts, on mangrove swamps and on saltmarsh surfaces

Tidal delta A large sand body formed within, or in the vicinity of, tidal inlets. The latter may be associated with barrier island chains and the entrances to coastal lagoons or estuaries. Flood-tidal deltas form landward of the inlet mouth, under the influence of flood-tidal currents. Ebb-tidal deltas occur seaward of the inlet, predominantly under the influence of ebb-tidal currents and wave action

Tidal flat An intertidal, non-vegetated, soft sediment habitat, found between mean high-water and mean low-water spring tide levels and generally located in estuaries and other low energy coastal environments

Tidal prism The volume of water in an estuary or inlet between mean high tide and mean low tide, or the volume of water leaving an estuary at ebb tide

Tidal wave (see Tsunami)

Tiger bush (see Brousse tigrée)

Till Unconsolidated debris deposited by glacier ice. It is typically unsorted and non-stratified in contrast with debris deposited by glacial meltwater

Tillage erosion Erosion resulting from ploughing on a slope. The turning over of soil produces a downhill movement

Tombolo A ridge or barrier of sand or shingle built above high tide level so as to link a former island to the mainland, or unite two islands. Sometimes this Italian term is taken to include the island as well as the depositional linking feature. Where the connecting deposit is submerged at high tide the terms tie-bar or tombolino are used

Topographic dune An obstacle dune that accumulates where a sand-carrying wind encounters a hill or other obstacle that causes the sand carrying capacity to be reduced and for sand to accumulate

Toposequence Adjacent soils that show differing profile characteristics reflecting the influence of local topography

Toppling failure A topple consists of a forward rotation of a mass of rock, debris or soil about a pivot or hinge on a hillslope. The toppling may culminate in an abrupt falling or sliding, but the form of movement is tilting without collapse

Tor A rock outcrop on a hill summit or its sides that has been exposed by erosion

Toreva block A large mass of relatively unfractured rock that has slipped down a cliff or mountain side rotating backwards in doing so

Total load The total amount of material that is transported by a stream (i.e. the combined fluxes of suspended sediment and bedload)

Tower karst A type of karst, comprising steep hills (mogotes) rising up above near level plains. It is found in, but is not restricted to, tropical environments

Trafficability The quality of a terrain that permits passage (as of vehicles and troops)

Transfluence The breaching of a glacial watershed in which ice builds up in a valley whose exit is blocked, for example, by a lager glacier, and escapes at the head of the valley across a major watershed

Transform fault or ***transform boundary*** A type of fault whose relative motion is predominantly horizontal in either a sinistral or dextral direction. They end abruptly and are connected at both ends to other faults, ridges, or subduction zones. Transform faults are commonly found linking segments of mid-oceanic ridges or spreading centres

Transgression The movement of sea level in an upward direction. The opposite of regression

Translational slide A non-circular slope failure which involves translational motion on a near planar slip surface. The movement is largely controlled by surfaces of weakness within the structure of the slope forming material

Transmission loss The reduction in flow in an ephemeral or intermittent stream channel as discharge migrates downstream. It results from infiltration of streamflow into the dry channel bed and banks

Transport limited A condition where the rate of material transport is lower than regolith formation (supply-unlimited). Weathering and soil formation rates are faster than rates of removal

Transverse aeolian ridge Ripple-like aeolian bedforms on Mars. It is unknown whether they formed as large ripples or small dunes

Transverse bars alternating Coastal bars that are welded to the shoreline and are separated by channels occupied by rip currents

Transverse dune A sand dune that forms transverse or perpendicular to the formative winds

Travertine A terrestrial freshwater accumulation of calcium carbonate, whose formation often involves a degree of organic involvement. The names tufa and travertine can be used synonymously, but often tufa is taken to refer to a softer, more friable deposit whilst travertine refers to a harder, more resistant material frequently used as a building material. Tufas and travertines form in freshwater environments where thermodynamic and kinetic characteristics favour the precipitation of calcium carbonate from carbonate-rich waters

Trellis drainage A drainage pattern often associated with scarp and vale topography and characterized by right-angled stream junctions

Trench, submarine (see Ocean trench)

Trimline The maximum level to which glaciers or ice sheets have eroded or trimmed bedrock or debris in a valley hillside

Triple junction The point where the boundaries of three tectonic plates meet. At the triple junction each of the three boundaries will be one of 3 types - a ridge, trench, or

transform fault. In plate tectonics theory during the breakup of a continent, three divergent boundaries form, radiating out from a central point (the triple junction). One of these divergent plate boundaries fails (an aulacogen) and the other two continue spreading to form an ocean

Trittkarren Step or heel-print-like karren features, about 10 to 30 cm in scale, essentially features of very gentle slopes. Their headwall is arc-shaped, they are flat floored and they open downslope

Trombe's curve A graph portraying the relationship between the calcium content of saturated solutions at different temperatures and the pH

Trottoir A constructional bench formed by the growth of algae at about mid-tide level on cliffed coasts (notably made of limestones)

Truncated spur A spur, formerly projecting into a preglacial river valley, that has been eroded away in its lower part by an erosive valley glacier

Tsunami Long seismic sea wave, generated by a major disturbance within an ocean basin (mainly due to earthquakes, but sometimes explosive volcanic eruptions or submarine landslides). They are of subdued form in deep water, but on entering shallow nearshore areas their height increases greatly, and can exceed 30 m when they break over the coastline

Tufa (***also see Travertine***) A freshwater carbonate deposit formed in springs, waterfalls or lakes in limestone regions

Tuff ring A vent landform from the explosive interaction of magma and ground or surface water. They have a low profile apron of tephra surrounding a wide crater that is generally lower than the surrounding topography. The tephra is often unaltered and thinly bedded, and is generally considered to be an ignimbrite, or the product of a pyroclastic density current

Tundra polygon A type of periglacial patterned ground

Tunnel erosion and tunnelling A form of land degradation that is initiated in subsoil and/or substrata and remains inconspicuous until considerable damage has occurred. This type of water erosion is found in earthworks as well as hillslopes and in the latter case refers to the hydraulic removal of subsurface material causing the formation of underground channels in the natural landscape. Tunnelling takes place primarily when the shear stress applied by flowing water enlarges an existing macro-pore or passageway

Tunnel valley A valley formed by subglacial stream action

Turbidity current A density current. A sinking mass of sediment laden air or water. Submarine turbidity currents may play a role in submarine canyon formation

Turbulent flow Water movement in which the lines of flow are erratic and mixed and in which flow direction at all sites changes frequently and nearly instantaneously

Undercliff An area of slumped material at the foot of a sea cliff that is affected by mass movements

Underfit stream A stream which is much smaller than expected from the size of its valley

Underflow The down-valley movement of water in a near-surface alluvial aquifer that lies beneath a stream channel particularly in a dryland

Undrained loading If a soil is loaded very quickly it can result in there being no time for the drainage of pore water. There may be no consequential change in volume, but pore water pressures change and result in differential shear and normal stress at every point in the loaded material. This rapidly reduces resistance and sometimes initiates shear movement, or accelerates movement downslope

Unequal slopes, law of States that slopes will behave differently depending on their declivities. As rain falls on a slope, the amount of work it can do is proportional to the declivity of the slope. The steeper slope is always degraded faster, and will carry the divide towards the gentler slope. Thus, unless there are equal slope declivities, with homogenous material and identical rainfall, unequal slope activity will proceed

Uniclinal shifting The process whereby a stream or river flowing in an asymmetric valley in an area of gently dipping rocks migrates down the dip slope of the valley, cutting back the steeper scarp slope

Uniformitarianism The concept that present-day processes have been operating in a similar manner through geological time. In this sense, present-day processes can be used as analogues for understanding past processes that have shaped the environment

Universal soil loss equation A method for estimating annual soil erosion on the basis of soil loss from a field or hillslope. The metric version of the equation is:

$$E = R.K.L.S.C.P$$

where E is mean annual soil loss (t ha^{-1}), R is annual rainfall erosivity (10^7 J ha^{-1}), K is soil erodibility (relative to a control soil without vegetation cover), L is slope length (relative to a standard slope length of 22.6 m), S is slope gradient (relative to a standard 9 per cent slope), C is crop management (relative to a cultivated bare field), and P is a conservation practices factor (relative to a bare surface without conservation measures)

Unloading The stripping or removal of rock or ice from a landscape and the resulting effects the release of pressure has on the exhumed landscape

Unstable channel River or tidal channel that is shifting through erosion and deposition

Urstromtäler Pattern of anastomosing long subglacial meltwater channels as found in northern Germany

Uvala A depression or large hollow in limestone areas produced when several sinkholes or dolines coalesce

Vadose passage A passage formed in the vadose zone (also termed the unsaturated zone), i.e. the part of Earth between the land surface and the top of the phreatic zone. Cave passages formed in the vadose zone tend to be canyon-like in shape, as the water dissolves or abrades bedrock on the floor of the passage. Passages created in

completely water-filled conditions are called phreatic passages and tend to be circular in cross-section

Valley bulge Strata that have been bulged up in the base of a valley as a result of erosive processes cutting down and permitting susceptible clays to become plastic under the weight of more competent beds above them and to be extruded into the valley floor

Valley meander A meander which is usually cut in bedrock and which usually has a greater wavelength than that of the contemporary river pattern

Valley, drowned A ria

Valley meander A meander which is usually cut in bedrock and usually has a greater wavelength than that of the contemporary river pattern

Valloni The drowned river valleys of a Dalmatian-type coastline

Variable source area The concept that within a drainage basin the amounts of water and sediment entering the drainage network from sub-basins (or source areas) may vary depending on local characteristics such as climate, geology, slope, land cover, etc.

Vasques Wide, shallow pools which form a network consisting of a tiered terrace-like series of steps on intertidal limestone coastal platforms

Ventifact A stone that has been abraded, polished and shaped by wind abrasion

Vermetid reef An intertidal coastal reef formed primarily of vermetids (a family of gastropods)

Vesuvian eruption A type of volcanic activity marked by very explosive eruptions which occur after long periods of dormancy, during which gas pressures in the underlying magma have built up sufficiently to eject the plug of solid lava from the vent. Escaping gases, exsolved in the magma, produce a mobile, frothy lava (pumice) and clouds of ash and gases are released into the air

Viscous deformation Time-dependent deformation in which the deformation velocity is constant at constant differential stress (i.e. the difference between the maximum and minimum shearing stress within the rock, resulting from the application of an external force). This deformation is also not recovered by the rock as the applied stress is relieved

Visor Corrosional notches at the cliff foot sometimes have protruding visors above them and plinths below them. The visor consists of a band of hardened, indurated rock, which may form when fresh rain water deposits calcium carbonate where it comes into contact with rock that is saturated with sea water

Volcano, active A volcano known to have erupted in recent times, or which is likely to erupt. Examples include Mt. St Helens, USA, and Etna, Sicily

Volcano, dormant A volcano which, though not currently or perhaps even recently active, is not extinct since it is likely to erupt in the future

Vulcanian eruption A volcanic eruption in which the lava surface rapidly solidifies because of its high viscosity

Wadi An ephemeral stream channel in a dryland

Waning slope A depositional hillslope unit formed at the base of a talus slope as weathering and rain wash fine-grained particles from the talus and deposit them as a concave unit which may become progressively flatter

Warm-based glacier A glacier characterised throughout its depth by temperatures very close to $0^{o}C$ and the pressure melting point

Wash load Part of the total sediment load of a stream that is usually supplied from bank erosion or from upland sources by overland flow

Wash slope The gentle slope on a hillside occurring below the gravity slope and lying at the foot of an escarpment or steep rock face; usually covered by an accumulation of talus

Washboard moraine Also known as corrugated moraine, this is a geomorphic feature caused by glaciers. The name refers to the fact that, from the air, it resembles a washboard

Waterfall A vertical or near-vertical fall of water that occurs when a river slope is interrupted by a marked break of gradient

Water gap A valley through a cuesta or ridge eroded by a river

Water-layer weathering The accelerated geochemical weathering that occurs on shore platforms immediately above the platform water level. This is a result of a number of interrelated processes that require an unsaturated or alternately wet and dry environment in which to operate. These processes include the combined actions of wetting and drying including thermal expansion, the chemical action of salt spray, salt crystallisation and the removal of solutions through rock capillaries

Watershed Either a drainage divide between drainage basins or a drainage basin or catchment itself

Wave diffraction Increased curvature in the pattern of waves moving through a natural or artificial entrance to a bay or lagoon because of frictional retardation by bordering headlands or breakwaters

Wave reflection A phenomenon that occurs when a wave breaks against a vertical structure and its energy is reflected off the face of the cliff, seawall or other structure

Wave refraction The process by which waves undergo a change in direction as they approach headlands and beaches

Wave-cut (shore) platform A low angle surface eroded in solid rock by wave action at the base of a retreating sea cliff

Waxing slope A hillslope unit that forms a crest of a convex profile at the intersection of the cliff and the hilltop or plateau surface

Weathering The chemical, chemical and biological breakdown/decomposition of rocks on exposure to the atmosphere, hydrosphere and biosphere

Weathering front The boundary between unaltered or fresh bedrock and saprolite

Weathering index A quantitative or semi-quantitative indicator of the degree of weathering

Weathering intensity The degree of decomposition of a rock or mineral, it is a measure of the amount of alteration that has occurred. Numerous indices of weathering intensity have been developed and include both descriptive measures which are based on changes in the visual appearance of regolith as it becomes more altered, as well as quantitative measures of the amount of chemical and /or mineralogical change that has occurred to the primary mineral or unaltered rock

Weathering limited A system is one in which the supply of material determines the flux of mass, while in a transport-limited system, sufficient material is available at any given time for mass movement to occur

Weathering pit A small closed depression, also called gnamma, Opferkessel or pia, that iscommon on horizontal and gently inclined rock surfaces and on a range of silicate rock types, most frequently granites and sandstones. They may be similar in their broad morphology to solutional pits developed in carbonate rocks, to which the term ‘kamenitza’ is often applied

Weathering rind An oxidation phenomenon in which the parent rock is stained when exposed at the surface

Wedge failure The removal of blocks of rock where two or three factures, often joints, intersect at a high angle in a cliff and then dip down towards the valley

Wetted perimeter The length of a transverse channel section in which water is in contact with the channel bed and banks

Wetting and drying weathering Rock breakdown involving the development of internal rock stresses as a result of the progressive formation of ordered water layers which exert forces against confining walls or void boundaries. As the positively charged ends of water molecules are attracted to the negatively charged surfaces of clay minerals and colloids they form a layer of oriented water particles. With each wetting event a new layer of ordered water is added to clay particles, which remain during the drying phase. Failure appears to be most pronounced during the drying phase when negative pore water pressure is greatest and tensile failure occurs

Whaleback Either a glacially smoothed rock exposure or a very large longitudinal dune

Wilson cycle The hypothesis that oceans are born as rifts, grow by sea-floor spreading, and finally close again. Six stages are identified: (1) uplift and extension forming rift valleys (2) early seafloor spreading, (3) mature ocean with a broad ocean bounded by continental shelves and a spreading centre at the mid-ocean ridge, (4) shrinking of the ocean, bounded by island arcs, (5) further shrinking, compression, metamorphism and uplift of accretionary wedges to form mountains (6) all oceanic crust is subducted, and the continents converge on a collision-zone suture. The united plate breaks along a new rift, re-starting the cycle

Wind gap A valley or col in a ridge through which no stream passes

Windstreak A stringer of sand without a slipface that forms a thin sheet on a desert surface and is the result of wind action. Also known as a sandstreak

Window, karst An area over a subterranean stream that is open to the surface and appears as a depression at whose bottom the stream is visible. Also known as a karst fenster

Yardang Streamlined wind-erosion forms with their long axes parallel to the wind

Yazoo A tributary stream that is prevented from joining the main river because of the levees which flank the latter

Zetaform beach An asymmetrical beach between headlands, where the outline is shaped by waves arriving obliquely, and refracted round the headlands. Also known as a log-spiral or half-heart beach, and sometimes as a headland bay beach (but this term does not indicate that the beach outline is asymmetrical)

Zeuge A tabular mass of rock resulting from selective wind erosion in a desert

Zibar A low dome-shaped sand dune that is usually formed of coarse sand and has no slip face

Zoogeomorphology The study of the geomorphic effects of animals, ranging in size from small invertebrates (e.g. worms, termites, ants) to terrestrial and aquatic vertebrates, including fish, amphibians, reptiles, birds and mammals (both wild and domesticated). Animals dig, burrow, turn over stones to seek food, create nests, build mounds, wallow, and, in the case of beavers, build dams. In addition their trampling and over-grazing may change soil infiltration capacities and vegetation characteristics, which may influence surface runoff and erosion