Glossary of some engineering and geological terms

**Abrasion**: The mechanical wearing down or grinding away of rock surfaces by the friction of rock particles carried by the wind, running water, ice or waves. Abrasion polishes, smooths, scratches or pits exposed rock faces.

**Accretion**: (1) Gradual enlargement of a land area through the accumulation of settlement carried by a river or stream. (2) The increase in size of inorganic bodies by the addition of new material to the exterior.

**Acicular**: Needle shaped, as in certain crystals.

**Admixtures**: (Eng.) In concrete, plaster, etc., a substance other than aggregate, cement or water, added in small quantities to the concrete mix to alter its properties or those of the hardened concrete. The most usual admixtures for concrete for use in hot conditions include plasticizers and set retarders.

**Adobe**: Unfired earth bricks.

**Aeolian (Eolian)**: Processes or deposits formed by wind action; for example, loess, aeolian bedforms, aeolian sand, aeolian sediment.

**Aerobic**: In the presence of oxygen. Oxygenated environments.

**Aerosol**: A colloidal system in which liquid droplets or solid particles are dispersed in a gas, usually air.

**Agglomerate**: An indurated rock built of angular rock fragments embedded in an ashy matrix resulting from volcanic activity.

**Aggregate**: Crushed rock or natural fragmentary rock material, including sand and gravel, used for unbound compacted fills or sub-bases, or in the manufacture of bound materials such as concrete or tarmacadam.

**Albedo**: The fraction of solar energy (shortwave radiation) reflected from the Earth back into space. It is a measure of the reflectivity of the Earth’s surface.

**Alveoles**: Small angular cavities or pits, such as a honeycomb cell.

**Allogenic**: Derived minerals or particles in a sediment.

**Alluvial**: Description of conditions in which suspended detrital matter is transported and deposited by rivers and floods.

**Alluvium**: A general term for unconsolidated detrital material, such as clay, silt, sand and gravel, deposited by rivers and streams as sorted or semi-sorted sediment in the stream bed or on the flood plain.

**Alteration**: Changes to the chemistry and/or physical character of minerals due to Earth processes; for example, hydrothermal action, but not including weathering.

**Alveoles**: Small angular cavities or pits, such as a honeycomb cell.

**Alveoles**: Small angular cavities or pits, such as a honeycomb cell.

**Anaerobic**: In the absence of oxygen. Oxygen-deficient environments.

**Anastomosing**: Branching and recombining in a reticulated (criss-cross) pattern, as in a braided stream.

**Angle of friction**: One of the parameters used to express the shear strength of rock and soil, defined as the slope of the Mohr envelope. Geomaterials may display both friction and cohesion; in many cases friction increases with the applied normal stress, and cohesion is a constant equal to the value of shear stress for zero normal stress.

**Angle of repose**: Maximum angle at which unconsolidated material can stand. Various factors determine this angle, including particle size and angularity, the degree of interlocking between particles, and pore-water pressure. A typical angle of repose for coarse scree is 32°–36°.

**Anhydrite**: A mineral consisting of anhydrous calcium sulphate, CaSO₄.

**Anisotropic**: Term describing material for which the physical properties depend upon direction relative to some defined axes, such as foliation, bedding or cleavage.
Apparent angle of friction: The slope of a tangent to a curved Mohr envelope, where friction is not constant for different values of normal stress, as is frequently the case with rocks.

Apparent cohesion: Cohesion of grains due to surface tension in the surrounding pore water.

Apparent viscosity: A property displayed by certain fluids in which the viscosity increases if the material is left in a stationary condition.

Aquifer: A water-bearing stratum of soil or rock that is relatively permeable to water.

Aquitard: Stratum of soil or rock that is relatively impermeable to water. A confining bed that retards, but does not prevent, the flow of water to or from an adjacent aquifer.

Aragonite: An orthorhombic mineral, a form of calcium carbonate, polymorphous with calcite. Normally found as a low-temperature, near-surface deposit; for example, in caves as stalactites, near hot springs as sinter deposits and, occasionally, in vesicles in basaltic lava.

Arête: A sharp-crested, serrated or knife-edged ridge separating the heads of abutting valleys.

Ardisol: An order of soils found in arid environments. These soils have a very little organic matter in their surface horizons, but may contain calcium carbonate or gypsum and/or soluble salt accumulations.

Arising: Materials forming secondary, or waste, products of a process.

Armouring: A protective layer such as a heterogeneous river-bed material forming a thin layer of coarse grains one or two grains thick that inhibits transportation of the underlying finer material. Coastal protection armour units are revetments, such as rocks, and/or precast concrete blocks (see Dolos and Tetrapods) on a breakwater. An armoured bank is a flood defence of clay strengthened with facing material of stone, rock or cladding.

Arroyo: A steep-sided ephemeral stream channel found in deserts, in which several metres of poorly sorted sediment from occasional runoff may accumulate.

Auger: (augering) Device for sinking boreholes, primarily for soil sampling, that is turned in the ground and withdrawn with material clinging to it or contained within it or which forces cuttings to rise to the surface on spirals.

Authigenic: Minerals formed or developed in situ in sediments. (Authigenic transformation.)

Badlands: A landscape produced by the extensive incision and erosion of weakly cohesive rocks, consisting of deep gullies and ravines separated by steep ridges, small mesas and buttes. Usually devoid of vegetation, which has been stripped by erosion.

Bajada: A low-lying area of confluent pediment slopes and alluvial fans at the base of mountains around a desert.

Ballast: Crushed rock used for road beds or on railroad tracks.

Banksman: The trained operative working with an excavator or crane to guide the driver in blind spots, also acting as a watchman for the geologist (or other individual) working in a trial pit.

Barchan: An isolated crescent-shaped sand dune lying transverse to the direction of the prevailing wind, with a gently sloping convex side facing the wind, with wings or horns of the crescent pointing downwind, and a steep concave leeward slope inside the horns. Barchans can grow to heights of in excess of 30 m and to widths of up to 350 m from horn to horn.

Basalt: A fine-grained, volcanic, mafic (basic) igneous rock.

Basaltic plateaux: An extensive continental deposit/layer of basaltic volcanic rock (See Lava plateau.)

Basement: The surface beneath which sedimentary rocks are not found; the igneous, metamorphic, granitized or highly deformed rock underlying sedimentary rocks (basement rocks).

Batholith: A large intrusive mass of igneous rock (most commonly consisting of granitic rock).

Beach rock (ledge rock): Cemented beach sand deposit that develops within the intertidal zone by the precipitation of needle-like crystals of aragonite in the pores between grains. The cementation process is relatively rapid, taking as little as 10 years for lithified rock to develop. The precipitation of the cement is favoured by a warm climate and may be aided by algal or bacterial action.

Beach rock (stone): Beach deposits lithified by cementation by minerals (normally aragonite) that form as sea water evaporates.

Bed: A unit of deposition in a sedimentary rock, usually separated from units laid immediately beneath and above by bedding planes or bedding surfaces.

Bedding: The arrangement of sedimentary rock in beds or layers of varying thickness and character.

Bedform: The shape of the surface or a bed of granular sediment produced by a flow of water over the sediment.

Bedload: The coarser fraction of a river’s total sediment load, which is carried along the bed by sliding, rolling and saltation. It constitutes 5–10% of the total load.

Bedrock: The unweathered rock below any layers of soil and/or superficial deposits.

Belt press: Apparatus in which water is squeezed from wet spoil by being pressed between filter belts passing around sets of rollers.

Bentonite: A rock composed primarily of a mineral of the smectite group, such as montmorillonite. The term has no genetic connotations but is most often applied to deposits formed by the alteration of air-fall volcanic ash in a marine environment. Bentonites are mined as industrial raw materials, with many uses; for example, as a low-permeability clay in civil engineering, drilling and water retaining. They occur naturally in two main forms, sodium or calcium bentonite, depending on the exchangeable cation. Calcium bentonite may be converted to sodium bentonite artificially by cation exchange.
Berm: A relatively narrow, horizontal man-made shelf, ledge or bench built along an embankment, situated part way up and breaking the continuity of a slope.

Bingham fluid: A fluid whose shearing resistance increases linearly with shear rate, from an initial non-zero value (the yield strength) at zero shear rate.

Bingham solid: A solid that displays a yield stress which, once exceeded, will flow where the rate of shear is proportional to the shear stress.

Bioclastic rock: A biochemical sedimentary rock, consisting of fragmental or broken remains of organisms, such as a limestone composed of shell fragments.

Bioturbation: The mixing of sediment by the activities of organisms, such as feeding and burrowing.

Blastfurnace slag: Rock-like by-product of the iron-making process in a blast furnace, which may be crystalline when air-cooled or glassy when quenched rapidly. Crushed air-cooled slag is used extensively as an aggregate, whereas the glassy variety is often ground to a powder and used as a cement in combination with Portland cement. (See GGBS.)

Bleed: The separation of water from a slurry (or wet concrete or mortar), usually appearing on the surface as the solid material settles.

Blended cements: Hydraulic cements consisting essentially of an intimate and uniform blend of a number of different constituent materials. They are produced by intergrinding Portland cement clinker with the other materials or by blending Portland cement with the other materials or by a combination of intergrinding and blending.

Bluff: A steep promontory, bank or cliff, especially one formed by river erosion on the outside bend of a meander.

Bolson: (with playa lake) A bolson is the term for a closed basin in Mexico and SW USA associated with a centripetal endoreic drainage network. (The playa lake is fed by surface water flowing into the basin and is likely to dry out leaving a salt pan.)

Bored pile: Also cast in situ pile or bored cast in situ pile. A concrete pile that is cast within a bored hole in the ground. Usually, a cage of reinforcement is inserted into a bored hole and the hole filled with concrete. The hole may be bored within a casing, which may be permanent or removed immediately after concreting.

Bore: (1) The internal diameter of a pipe. (2) A borehole or to drill a borehole. (3) A very rapid rise of the tide, in which the advancing floodwaters form a wave with an abrupt front. Bores occur in certain shallow estuaries and river mouths where there is a large tidal range and suitably funnelled-shaped regions.

Borrow: (Eng.) Earth material (sand, gravel, etc.) taken from one location to be used for fill at another location.

Borrow pit: An area where material has been excavated or ‘borrowed’ for use as fill at another location, usually for a specific construction project. Once formed, they may also be used for the disposal of (usually inert) unacceptable, waste or surplus earthworks materials.

Bottom dump bucket: Bucket for an excavator from which material is discharged from the rear or bottom; that is, from the opposite end from which it entered. This avoids having to rotate the bucket to empty it.

Braided stream (system): A stream that divides into numerous channel-ways that branch, separate and rejoin forming a tangle of channels, islands and sandbars resembling a complex braid. Braided streams occur under conditions of abundant bed load and highly variable discharge.

Breccia: A rock consisting of angular fragments embedded in a finer matrix, formed by erosion, volcanic activity, etc.

Brecciated: Fragmented condition of a rock, typically caused by tectonic or other movements.

Brickearth: Re-worked loess.

Brownfield site: Any land that has been previously developed, usually for an industrial purpose, or requires work done to it to bring it into use.

Brucite: An industrial mineral found in limestones and where magnesium silicates have been altered.

Bund: Small embankment or a fill area of soil or rock that has an environmental function; for example, reduction in noise and visual impact. Differs from an embankment as the engineering requirements may be less onerous as it does not carry any load other than its own self-weight.

Burial diagenesis (mesogenesis): The physical, chemical and biological processes acting on a sediment during burial as it is removed from the surface until the onset of metamorphism or structural inversion.

Buried valley: A depression in the ancient land surface or in bedrock, now covered by younger deposits; especially a preglacial valley, filled with glacial drift.

Butte: A small isolated hill capped by resistant rock, possibly representing the former land surface.

Calcarenite: A limestone consisting predominantly (more than 50%) of detrital calcite particles of sand size; a consolidated calcareous sand.

Calcareous: Containing readily detectable amounts of calcium-bearing minerals, such as calcite (calcium carbonate).

Calcic horizon: A mineral soil horizon with evidence of secondary calcium carbonate deposition that is more than 150 mm thick, with a calcium carbonate content of more than 15% by weight and with 5% more calcium carbonate than is in the parent material or horizons below it.

Calcified: Made hard and strong by the deposition of calcium salts.

Calcination: The process of subjecting a material to a high temperature, but without fusion, which results in the expulsion of volatiles, and changes the physical and chemical properties (e.g. heating limestone to create lime).

Calcite: The most common carbonate mineral the principal component of limestone.
**Calcium sulphate:** See Gypsum.

**Calcrete:** A variety of duricrust formed by precipitation of calcium carbonate.

**Caldera:** A large crater, usually formed as a result of the collapse of the top of a volcano following a major volcanic eruption.

**Caliche:** A layer, chiefly of calcium carbonate, at or near the ground surface in certain areas of scant rainfall. It is formed when groundwater containing dissolved calcium carbonate moves upward and evaporates, leaving a crust.

**California bearing ratio (CBR):** A standardized testing procedure, developed by the California State Highways Department in 1929, for comparing the strengths of base courses of roads or air strips. The resistance of a prepared sample to a standard plunger is measured. The ratio of this resistance to the corresponding resistance in crushed rock is then calculated. This ratio is the CBR.

**Capillary fringe (capillary zone):** The zone immediately above the water table into which water can be drawn (capillary rise) by capillary action, typically 0.1–3 m thick.

**Capping:** A relatively high-strength and high-stiffness layer placed and compacted on weaker fills to act as a foundation for construction layers (e.g. highway pavement or rail ballast) above, or a low-permeability layer placed on the top of a fill.

**Cap rock:** A hard covering atop the salt covering in a salt dome, consisting mainly of gypsum and anhydrite, some calcite and sulphur in varying amounts.

**Carbonate:** Mineral or minerals containing carbonate (CO₃) in their structure; for example, calcite, dolomite and siderite. Rocks comprising more than 50% carbonate minerals.

**Carbonation of concrete:** The ingress of carbon dioxide into the pore structure of concrete will reduce the alkalinity of the concrete matrix, thus reducing the protection afforded to reinforcement and leading to the possibility of reinforcement corrosion if oxygen and moisture are also present.

**Case hardening:** The induration of the surface of porous rocks, caused by the infilling of pore spaces by mineral cements precipitated from evaporating soil moisture or groundwater under tropical to subtropical conditions.

**Catena:** An association of soils that can be related in a regular fashion to changes in a set of soil-forming conditions, most often topography and hydrology.

**Cathodoluminescence:** Visible light emitted when an electron beam interacts with a solid (mineral) specimen.

**Cavernous:** An area or geological formation (for example, limestone) that contains large cavities, caverns or caves.

**Cavernous weathering features:** Chemical and mechanical weathering on a cliff face or surface in which grains and flakes of rock are loosened, so as to enlarge hollows and recesses on the surface. (See Tafoni.)

**Cement:** (Geol.) Minerals that form after the deposition of sediments and cause grains to be bound together. (Eng.) General term for binding material, but especially for the binder in concrete and mortar. See Portland cement.

**Cementation:** The process by which clastic sediments are converted into sedimentary rock by precipitation of mineral cement between the sediment grains, forming an integral part of the rock.

**Chert:** A rock that mainly consists of microcrystalline and/or cryptocrystalline silica, often forming in bands or layers within limestone. Flint is a form of chert found in Cretaceous Chalk.

**Cirque (corrie, cwm):** A horseshoe-shaped, sleep-walled valley head caused by glacial erosion.

**Clast:** Fragments (rock and/or mineral grains) in a rock or soil deposit that were derived from older rocks.

**Clastic:** A form of sediment or sedimentary rock composed of fragments of other rocks and minerals derived from weathering and erosion processes.

**Coefficient of variation (CV):** The standard deviation of a set of data divided by its arithmetic mean.

**Cohesion:** (General) A term often used to express a form of attraction between soil particles, thus giving them strength. However, such strength is normally due to pore-water suction in incompletely saturated soils, rather than significant attraction between particles. (Soil Mechanics). The value of the shear strength of a soil at zero normal stress.

**Cohesive soils:** Soils possessing strength mainly owing to the surface tension of capillary water; usually containing over about 35% of silt and clay-sized (<0.06 mm) material.

**Collapsible soils:** Soils that will undergo a large reduction in volume in response to small disturbances or changes in moisture content.

**Colloid:** Ultra-fine particles usually in the size range of less than 0.00024 mm, which when dispersed in an aqueous medium represent a state intermediate between a suspension and a true solution.

**Colluvium:** Unconsolidated material at the bottom of a cliff or slope, generally moved by gravity alone. It lacks stratification and is usually unsorted; its composition depends on its rock source, and its fragments range greatly in size. Such deposits include cliff debris and talus.

**Comminution:** The breakdown of a solid material into finer particles by mechanical means. In wet comminution, the solid material is broken down while suspended in liquid as a slurry.

**Compaction:** (Geology) This term is used to refer to the physical processes that form a dense coherent rock from loose unconsolidated sediment. (Soil Mechanics) The process of expelling air from a soil in a fill by the application of a dynamic loading (e.g. by rolling or vibration). The process involves particular construction plant, and an understanding of the grading and moisture content of the soil.

**Compressed blocks:** Earth blocks manufactured from dry earth without fibre compacted in a machine, using the same principle as rammed earth.
Compressed index: The reduction in void ratio for unit change in the logarithm of the increase in effective stress bringing about that change.

Compressive strength: A stress that tends to push together on opposite sides of a plane in the direction perpendicular to that plane. The maximum compressive stress that can be applied to a material under specified conditions before rupture or fracture occurs is the compressive strength of the material.

Concretion: A zone of enhanced cementation within a sedimentary rock, usually because of the precipitation of cementing material around a nucleus such as a fossil.

Cone penetration test (CPT): The testing of a soil by pressing a standard cone at the end of rod, guided by a steel tube into the ground under a known load, and measuring the penetration. The tube is then pushed down, carrying the cone with it. The resistance of the cone is a measure of bearing capacity and the difference between the resistance of the cone, and that of the cone and tube together is a measure of skin friction.

Connate water: Water trapped in the interstices of rock – never released or renewed.

Consolidation: (Geology) The process by which a sediment becomes a rock. (Soil Mechanics) The process by which a soil increases in density as a result of water being squeezed out by the imposition of a constant or increasing pressure.

Core: A cylindrical section of rock, usually 5–10 cm in diameter and up to several metres in length, taken as a sample of the material penetrated by a core bit, and brought to the surface for examination and or laboratory analysis.

Core barrel: Next to the cutting bit of a core drill is a length of pipe known as the core barrel, which contains the core. In very soft rock the barrel may be double, so that the inner lining does not rotate and damage the core.

Core bit: A hollow cylindrical drill bit for cutting a core of rock in a drill hole; the cutting end of a core drill.

Cover to reinforcement: The thickness of concrete between reinforcing steel and the nearest face of the concrete member.

Cratonic: Geologically very old and large, stable areas of the Earth’s continental crust. ‘Cratons’ are found in many continents, generally in the interiors.

Creep: A mode of deformation in materials brought about by the application of a constant stress. Down-slope movement of superficial materials on hill sides.

Critical state: State of soil after failure has occurred and the particles are undergoing turbulent flow. At the critical state, there are direct proportion relationships between shear stress and normal stress, and between the volume of the soil and the logarithm of the normal stress.

Crouˆte de nappe: True gypsum occurring in two forms: either as lightly cemented gypsum crystals, up to 1 mm in length commonly developed beneath non-gypsum sediment; or as desert rose crust, consisting of interlocking lenticular gypsum crystals, ranging in size from a few millimetres to 20 cm.

Crushing plant: Plant for the production of aggregate from rock. This includes operations such as screening and washing, as well as crushing. The crushing process itself involves a number of different stages for which different crushing methods are appropriate, such as between jaws (using jaw crushers – a primary crusher) for breaking down the largest rocks, and between rollers (a roll mill – secondary crusher) for producing fine aggregate.

Daya: A small, silt-filled, solutional depression on a limestone surface in arid areas of the Middle East and North Africa.

Deflation: The process by which particles are removed from the ground surface by wind action.

Deflation hollow: Enclosed depression produced by wind erosion. It may be found both in hot deserts, where wind may scour a hollow in relatively unconsolidated material, and in more temperate regions, where a protective cover of vegetation has been removed from a sand dune.

Denudation: The exposure of deeper rock structures by the erosion of the land surface. Denudation and erosion are often use synonymously, but an eroded landscape is not necessarily a denuded one.

Desalination: A series of processes whereby salt water is rendered potable.

Desert pavement: A thin covering of gravel and stones found in many desert areas, left after erosion by wind and water has removed the finer soil materials.

Desert varnish: Thin, dark surface veneer of iron and manganese oxides, which coats exposed rocks, especially in hot deserts. It results from the surface precipitation of minerals, released from the rock by chemical weathering.

Desertification: The spread of desert-like conditions, particularly in arid or semi-arid areas, due to the influence of human activity and climate change.

Detrital: Description of rock and/or mineral grains, transported as detritus and deposited as sediments, that were derived from pre-existing rocks either within or outside the area of deposition. Any particle derived from pre-existing rocks by processes of weathering and/or erosion.

Diagenesis: All the chemical, physical, and biological changes undergone by sediment and any of its components after its initial deposition, and during and after initial transformation into rock, excluding weathering and metamorphism.

Diaphragm wall: A concrete wall constructed underground in a trench to form foundations, a retaining wall or a cut-off wall.

Diapir: A volume of rock rising upwards buoyantly because of its low density, relative to its surrounding, and causing deformation of overlying strata. Rocks forming diapirs include evaporites. The rise of salt domes to the surface is diapiric.

Dilatancy: An increase in the bulk volume during deformation, caused by a change from close-packed structure to an open-packed structure, accompanied by an increase in the pore volume.

Dimension stone: A building stone dressed into regularly shaped blocks.
**Directional drilling:** Subhorizontal drilling using steerable bits to provide inclined and horizontal bores.

**Disaggregation:** Separation or reduction of an aggregate into its component parts.

**Discontinuity:** A break in the continuum of a soil or rock, arising from depositional changes, structural dislocations and weathering effects, but generally considered to be a mechanical break; includes bedding planes, joints, fissures and faults.

**Dispersive soil:** A soil, which on immersion in static water will go into suspension.

**Dispersive:** A property of a soil where, owing to the presence of water, the soil particles are prone to disaggregate.

**Displacement:** The relative movement on either side of a fault plane; it may be in any direction parallel to the plane. The finite displacement on a fault plane is defined by a straight line connecting the positions of the initial and final points.

**Disseminated:** Said of mineral deposit in which the desired minerals occur as scattered particles in the rock, but in sufficient quantity to make the deposit viable as an ore.

**Distal:** The sedimentary deposits formed furthest from the source of the sediment.

**Dolerite:** A fine- to medium-grained mafic igneous rock, mineralogically and chemically equivalent to basalt, commonly forming minor intrusions.

**Doline (sinkhole):** A circular to oval, simple closed depression found in karst terrain, formed by solution, cave collapse, piping or subsidence.

**Dolomite:** A carbonate mineral found in magnesium limestone formed by dolomitization.

**Dolomitization:** The formation of dolomite or a dolostone by the replacement of the calcium of a calcium carbonate precursor by magnesium.

**Dolos (plural dolosse):** A concrete block in a complex geologic shape weighing up to 20 tons, used in great numbers to protect harbour walls from the erosive force of ocean waves.

**Draa:** Large aeolian dunes structures that may be up to 400 m in height and have wavelengths of over 650 m. They may form longitudinally or transverse to the prevailing wind direction and sometimes develop star-shaped forms known as rhouords.

**Drawdown:** Reduction in water level or pressure, usually as a result of pumping or lowering the level of water in a reservoir.

**Dreikanter:** See Ventifact.

**Drift deposits:** Sedimentary materials, usually of glacial origin, overlying the older bedrock formations.

**Drilling fluid (drilling mud):** During rotary drilling, the fluid mud that is circulated to cool the drill bit, convey rock chippings to the surface, and to seal permeable layers and fractures. The drilling mud is usually maintained under pressure to prevent the drill stem being blown out if it penetrates a pocket of pressurized gas. The mud may be oil- or water-based, and is frequently thixotropic bentonite, lime or barite.

**Driven piles:** A pile of steel, wood or reinforced concrete that is forced into the ground by blows from a pile hammer.

**Drying shrinkage:** Loss of volume during drying.

**Dune:** (1) An accumulation of unconsolidated material, sand, clay, gypsum or carbonate, shaped by the wind into a distinguishable landform. (2) A bedform resulting from transport and deposition in a current under a particular range of flow conditions.

**Duricrust:** Hardened ground surface horizons formed in soil profiles or in unconsolidated sediments by precipitation of various compounds from moisture evaporation, which may subsequently become buried by sedimentary processes. Common duricrust examples are ‘ferricrete’ formed by the precipitation of iron oxide, ‘calcrete’ by calcium carbonate and ‘silcrete’ by silica. Duricrusts developed within the soil profile are sometimes referred to as ‘floating’.

**Dyke:** A sheet-like, near-vertical minor igneous intrusion that cuts across horizontal to gently dipping planar structures in the country rock.

**Eh:** Redox (reduction–oxidation) potential measured relative to a standard hydrogen half cell in which oxidation is defined as a loss of electrons from an atom, with a positive redox potential, and reduction, the addition of electrons to an atom, with a negative redox potential.

**Elasticity:** Deformation in which the strain is proportional to the stress (Hooke’s law) and in which there is complete recovery of strain on removal of the stress.

**Eluviation:** (out-washing). The process of leaching in a soil, which mainly removes iron and calcium.

**Endogenic, endogenetic or endogenous:** Of processes originating below the Earth’s surface.

**Endolithic:** (1) An ooid that has been invested by boring microorganisms; for example, fungi or cyanobacteria. (2) A breccia formed by forces acting within the Earth’s crust, as by tectonic movements, by swelling or hydration, or by foundering.

**Endoreic (endorheic):** Said of the basin, or region, characterized by internal drainage.

**Endoreic drainage (endorheism):** (1) Internal drainage. (2) The condition of a region in which little or no surface drainage reaches the ocean.

**Entisols:** An order of embryonic mineral soils that have no distinct horizons. Representing only the initiation of soil profile development. Entisols are common on recent floodplains, steep eroding slopes, stabilized sand dunes and recent deep ash or wind deposits.

**Eolian:** See Aeolian.

**Epeirogenic (epeirogenesis):** The large-scale, upward or downward movements of continental or ocean areas. Epeirogenic movements should not be confused with the more dynamic mountain-building episodes of an orogeny.
Ephemeral stream: A stream, which flows only after rain or snow melt and has no base flow component. A desert wadi may form an ephemeral stream.

Epizone: The highest zone or grade of low-grade metamorphism, transitional between the lower-grade anchizone and the higher-grade greenschist facies of classic regional metamorphism. The boundaries of the epizone can be defined in terms of illite.

Erg (koum, sand sea): An undulating plain region occupied by complex sand dunes produced by wind deposition.

Erodibility: The resistance of a soil to the entrainment and transport of its particles by an agent of erosion, controlled by its mechanical and chemical properties.

Erosion: The process by which particles are detached from rock or soil and transported away, the principal agents being ice, wind and water.

Erosion surface: A flat plain resulting from erosion and representing the final phase of a cycle of erosion.

Erosivity: A measure of the potential ability of an eroding agent, such as rainfall or wind, to cause erosion, based on its kinetic energy.

Escarplot (scarp): A high, more or less continuous, cliff or inclined surface (sheet flood) or down a normally dry stream channel (stream flood). Usually, it is caused by heavy convectional rainfall of short duration, and is typical of semi-arid and desert environments.

Ethalion: A landform with steep triangular cliff facets resulting from the presence of rock resistant to erosion that protects the underlying more readily eroded rocks.

Flight auger: An auger that is shaped like a corkscrew. The auger is screwed into the ground then lifted out. Soil is retained on the blades of the auger and kept for testing. The soil sampled this way is considered disturbed.

Fluting: A type of differential erosion in which the surface of a coarse-grained rock is made ridged or corrugated. (A pebble with three distinct facets on its upper surface is known as a Dreikanter.)

Fluvial: Pertaining to a river or stream.

Fly ash: Fine ash material derived from the flues of power stations burning pulverized coal. Pulverized-fuel ash (PFA) is a fly ash.

Foggara: A term used in the Sahara Desert region for a gently inclined, underground conduit or tunnel designed to intercept groundwater near the foot of mountains, and to conduct it by gravity to a neighbouring lowland for irrigation; a horizontal well. (See also Qanat.)

Foliation: The planar arrangement of textural or structural features in any type of rock; for example, 'schistosity' in meta-morphic rocks (See Schist.)

Fracture: A general name for a structural discontinuity in rocks and rock masses, such as a joint or bedding plane.

Fresh: Description of rock in an unweathered condition, so that material shows no evidence of the action of weathering processes.

Fusion-bonded epoxy-coating: Commonly referred to as FBE coating, it is an epoxy-based powder coating that is used to protect steel pipelines, reinforcing bars in concrete, etc., from corrosion. FBE coatings are thermoset polymer coatings. The name 'fusion-bond epoxy' is due to resin cross-linking and the application method. The resin and hardener components in the dry powder FBE stock remain unreacted at normal storage conditions. At typical coating application temperatures, usually in the range of 180–250 °C, the contents of the powder melt and transform to a liquid form. The liquid FBE film wets and flows onto the steel surface.
on which it is applied, and soon becomes a solid coating by chemical cross-linking, assisted by heat. This process is known as ‘fusion bonding’. The chemical cross-linking reaction taking place in this case is irreversible. Once curing takes place, the coating cannot be returned to its original form by any means. Application of further heating will not ‘melt’ the coating and thus it is known as a ‘thermoset’ coating.

**Galvanized steel reinforcement:** The use of galvanized steel reinforcement can be used to add some protection against corrosion to the steel in concrete. The galvanized surface has some resistance to the effects of carbonation and/or chloride ingress.

**Gap grading:** An aggregate or sediment particle-size distribution in which one particular size is absent from the range. For example, some tills are gap graded in that they consist of clay-, silt- and gravel-sized material, but not sand.

**Gara:** A mushroom-shaped rock occurring in arid or desert regions, resulting from the undercutting of soft rock by wind-driven sand, especially if the soft rock is overlain by more resistant strata.

**Gel:** A substance with properties intermediate between the liquid and solid states.

**Gelifluction:** See Solifluction.

**Geomaterials:** Natural geological materials or materials manufactured there from, usually used for construction purposes.

**Geomembrane:** A solid sheet of polymer material for use as an impermeable barrier in geotechnical construction.

**Geomorphology:** The study of the form of the ground surface and the processes that shape it.

**Geophysical surveying:** The study of the variations in the natural or induced physical properties of the Earth’s crust with the object of gaining knowledge about the subsurface, such as the location and structure of a mineral deposit.

**Geosynthetic:** A general name for a Geotextile or Geomembrane.

**Geotextile:** A woven or non-woven (heat-bonded or needle-punched) sheet material made from polymer or sometimes natural fibres for use in geotechnical construction.

**GGBS:** Ground Granulated Blastfurnace Slag: GGBS is obtained by quenching molten iron slag (a by-product of iron and steel making) from a blast furnace in water or steam, to produce a glassy, granular product that is then dried and ground into a fine powder. GGBS is a cementitious material used in combination with ordinary Portland cement and/or other pozzolanic materials. Concrete made using GGBS sets more slowly than concrete made with ordinary Portland cement, depending on the amount of GGBS in the cementitious material, but continues to gain strength over a longer period. This results in lower heat of hydration and lower temperature rises, and makes avoiding cold joints easier, but may also affect construction schedules where quick setting is required.

**Gibbsite:** The most common aluminium hydroxide mineral, often found in highly weathered tropical soils.

**Gnammas:** A term for a hole in rock, particularly one which is full of water. Gnammas are not formed by weathering in small puddles, which speed up the process of erosion in what is initially a slight depression.

**Gneiss:** A banded high-grade metamorphic rock.

**Grading:** The particle-size distribution of an aggregate or sediment, which may be well graded (a spread of sizes), uniformly graded (a predominance of one size) or gap graded (a spread of sizes but with an absence of one size). See also Sorting.

**Granite:** A coarse-grained igneous rock composed of more than 20% quartz and feldspar, of which plagioclase and alkali feldspar are present in approximately equal amounts.

**Granodiorite:** A coarse-grained igneous rock composed of more than 20% quartz and feldspar, of which plagioclase makes up more than 67% of the total feldspar.

**Graphite:** A soft, grey-black, low-pressure form of carbon.

**Gravel:** Deposit or aggregate comprising particles between 2 and 60 mm in size.

**Grizzly screen:** A screen to separate out oversized material as part of rock and aggregate processing. The screen may consist of a series of parallel bars at appropriate spacing or a suitably sized grid. The grizzly surface is sloped to assist the movement of material over and through the screen, and is often fitted with a vibration system to further assist this process.

**Groundmass:** The finer-grained material constituting the main body of a rock, in which is set relatively larger crystals or particles. See also Porphyritic.

**Grout:** (Geotechnical) Fluid material that is injected into the ground to fill voids or fractures, and then solidifies to increase the strength or reduce the permeability of the ground.

**Gully erosion (gullying):** The erosion of steep-sided channels and small ravines in poorly consolidated superficial material or bedrock by ephemeral streams, often prompted by the reduction or removal of vegetation cover.

**Gypcrete:** A duricrust composed of gysum.

**Gypsum:** Hydrated calcium sulphate, CaSO_4 \cdot 2H_2O, a common, widely distributed mineral.

**Gyratory breaker (crusher):** A primary crusher in which rock is crushed between the surfaces of an erect solid cone gyrating on an eccentric bearing within an erect fixed hollow cone.

**Habit:** General shape of mineral crystals and crystalline aggregates that reflect their crystal structure and the conditions of formation.

**Haematite (hematite):** (Fe_2O_3) A major ore mineral of iron, also found as an accessory mineral in many rocks.

**Halite:** Common salt or rock salt an isometric mineral, sodium chloride, that occurs most commonly in bedded deposits. It
is the most abundant of the evaporites, following gypsum and anhydrite in the sequence of precipitation of salts from sea water.

**Haloclasty:** A process of rock weathering, due largely to periodic wetting, leading to the crystallization of salt and the creation of stresses in the rock owing to swelling. It is one of the major weathering processes in hot deserts.

**Haloturbation:** The disturbance of ground surfaces by the effects of haloclasty (salt heave/disruption).

**Hamada (hammada):** A flat to gently dipping, bare rock surface in a desert, sometimes with a thin cover of gravel or a boulder lag, formed from weathering of surface rock.

**Hard pan:** Strongly cemented material in unconsolidated sediments, often just below the ground surface; usually formed by precipitation of mineral cements from groundwater. In North America, the term is used for cemented glacial deposits.

**Harmattan wind:** A dry, dusty, northeasterly or easterly wind, which occurs in West Africa, north of the Equator. Its effect extends from just north of the Equator in January, almost to the northern tropic in July. In West Africa it is known as 'the doctor', because of its invigorating dryness compared with humid tropical air.

**Head:** Superficial granular deposits on valley sides and floors formed by a flow of soil and rock fragments from higher ground, usually under conditions of high water content.

**Honeycombs:** See Alveoles.

**Horizon:** (1) An informal term used in stratigraphy to denote a plane within a body of strata. This may be at a boundary of lithological change or, commonly, the term may refer to a thin, distinctive bed within a lithological unit. (2) An interface separating two media with different geophysical properties. (3) In soil, a horizontal layer that can be distinguished from the layers below and (except for the surface layer) above it.

**Horizonation:** The organization of a soil profile into distinctive soil horizons.

**Hortonian equation:** An empirical equation, which describes the infiltration process.

**Hydraulic conductivity:** A measure of the ease with which fluids may pass through a material.

**Hydraulic fill:** Material that has been excavated, transported and flushed into place by moving water.

**Hydraulic trap (containment):** A method of reducing or preventing leachate flow out of a landfill facility by inducing inward flow of water from the surrounding ground.

**Hypersaline:** Salinity substantially greater than sea water.

**Igneous rock:** A type of crystalline rock that forms from the crystallization of a hot melt or magma. Igneous rocks may be intrusive (only seen on the surface after the overlying rocks have eroded away) or extrusive (brought to the surface by volcanic activity).

**Illuviation:** The accumulation of material in the lower soil zone by the leaching and eluviation of fine-grained material and water-soluble minerals from the upper soil zone and their downward transport.

**Induration:** Natural process of hardening of sediments into rock by pressure, heat or cementation.

**Infiltration:** The movement of a fluid into a solid substance through pores or cracks, in particular the movement of water into soil or porous rock.

**Inliers:** An area of older rocks surrounded by younger rocks.

**Inselberg:** A large, steep-sided outcrop rising abruptly from a flat landscape, formed as a residual produced by the parallel retreat of bedrock slopes or as a remnant on the land surface affected by deep weathering.

**Insolation:** The heat received from the sun.

**Insolation weathering (thermoclasty or thermal stress fatigue):** The shattering or disintegration of surface rock by the rapid expansion and contraction resulting from large temperature fluctuations.

**Intake:** See Recharge.

**Interfluve:** The comparatively undissected upland between adjacent streams flowing in the same direction.

**Intermontane:** Lying or located between mountains.

**Interparticle bonds**

**Intrusives:** Bodies of igneous rock that have intruded themselves into pre-existing rocks, often with a gravel surface.

**Invert:** The lowest part of the inner surface of a tunnel.

**Illuviation:** The accumulation of material in the lower soil zone by the leaching and eluviation of fine-grained material and water-soluble minerals from the upper soil zone and their downward transport.

**Iron pyrites:** See Pyrite.

**Isohypothesis:** A line connecting points of equal precipitation.

**Isomorph:** Solid phases with different chemical compositions but the same crystal structure.

**Isopachyte (isopach):** A line drawn on a map through points of equal true thickness of a designated stratigraphical unit or group of stratigraphical units.

**Isopachyte map:** A map that shows the thickness of the unit, such as a bed or sill, throughout a geographical region by means of isopachytes, which are contour lines representing equal thickness.

**Isostasy:** The study of the response of the Earth to the removal and imposition of large loads.

**Isotropic:** Having the same properties in all directions.

**Joint:** (1) A fracture or discontinuity in a rock mass along which there has not been relative displacement in the plane of the structure. (2) A place where elements or parts of a structure meet that may or may not be connected.
Kamenitza: A solution pan or basin formed on a limestone surface by the dissolution of calcium carbonate.

Karst: Features including rock mass cavities, and also the topography created in limestone terrain by the solution effects of percolating water and subterranean streams. Named after the Karst region of former Yugoslavia.

Katabatic wind: Generic term for the wind that occurs when cold, dense air, chilled by radiation cooling, usually at night, moves downslope gravitationally beneath warm, less dense air.

Kubler index: An empirical but formal measure of illite crystallinity.

Lacustrine: Description of deposits formed in a lake.

Lag deposit: A coarse-grained residue left behind after finer particles have been transported away due to the inability of the transporting medium to move the coarser particles.

Lagoonal: Description of deposits formed in a lagoon.

Laminated: Exhibiting thin (typically less than about 10 mm) distinct layers of sediment, often of differing grain size or colour.

Landsat: Unmanned NASA satellites that orbit the Earth and transmit, to receiving stations on earth, spectral images in the 0.4–1.0 μm range. They are usually used in the determination of vegetation cover.

Lapiés (karren): Minor solutional features developed on carbonate rocks, formed mostly by dissolution.

Laser altimeter: An instrument that measures the distance from an orbiting satellite to a point on the Earth’s surface by measuring the time of travel of a reflected laser beam. Accuracy is within a few metres. Since the position of the satellite is known, elevations on the surface can be obtained.

Lateral planation: The reduction of the land in an interstream area to a plain or a nearly flat surface by the lateral erosion of a meandering stream; the creation and development by a stream of its flood plain.

Laterite: A residual deposit of iron and aluminium hydroxides formed by the weathering of rocks in humid, tropical conditions.

Lateritic: Description of rock and soil materials in the process of becoming laterite.

Latocrete: Red hardened crust that sometimes forms on the dried surface of laterite.

Lava plateau: A broad, elevated tableland or flat-topped highland, usually many hundreds or thousands of square kilometres in extent, underlain by a thick succession of lava flows.

Leachate: A solution obtained by leaching; for example, water that has percolated through the soil containing soluble substances and that contains certain amounts of these substances in solution.

Leaching (illuviation): A process of a pedogenesis in which soluble minerals are removed from the soil.

Ledge rock: See Beach rock.

Lenticular: A lens-like geological layer of limited lateral extent.

Leucocratic: Of light-coloured igneous rocks that are rich in felsic minerals.

Lineament: A major, linear, topographical feature of regional extent of structural or volcanic origin, most easily appreciated from remote-sensing data; for example, a fault system.

Liquid limit: A term for the minimum amount of water required to be mixed with sediment so that it will flow under standard conditions.

Lithification: The process of changing unconsolidated sediments into rock. This involves cementation of the grains, but not necessarily burial alteration or compaction.

Lithogenetic: Relating to the processes of formation of geological materials/sedimentary rocks.

Lithology: The description of the characteristics of rocks, as seen in hand specimen and outcrops, on the basis of colour, grain size, texture and composition.

Loess: Sediment formed of predominately silt-sized material deposited by the action of wind.

Lunette: A dune shaped or bent like a bow, about 20 m in height, formed on the leeside of a deflated lagoon, lake basin or river bed in semi-arid areas.

Mafic (ferromagnesian minerals): Minerals rich in magnesium and iron minerals.

Map cracking: Cracking on the surface of concrete that has the appearance of contours or zones on a map. Usually only on the surface and of limited depth and caused by rapid loss of moisture from the wet surface immediately after the concrete has been placed or to limited early thermal effects.

Matrix: Finer material between framework grains; for example, clay matrix between sand-sized framework grains in a sediment. In concrete, the fine material (sand and hydrated cement) surrounding the coarser stone aggregate.

Mesa: A steep-sided, flat-topped plateau or promontory surrounded by a flat erosional plain, forming as a result of parallel retreat or protection from erosion by a hard capping.

Microtunnelling: Pipe jacking using a tunnelling machine remotely controlled from the surface; in the UK this refers only to tunnels of diameter less than 1.0 m.

Migrating dune (wandering dune): A sand dune, such as the barchan, that is slowly shifted more or less as a unit in the leeward direction of the prevailing winds, and that is characterized by insufficient vegetation to anchor it.

Miliolite: A building stone almost entirely made up of many-chambered microscopic shells.

Mirabilite (or Glauber’s salt): A yellow monocrystalline mineral, Na₂SO₄ · 10 H₂O, that occurs as a residue from playas and saline lakes; it is a source of sodium sulphate.

Modulus: The ratio of the stress imposed on a body to the amount of deformation thus caused.

Mohr’s circle: A two-dimensional graphical construction that relates the principal stresses acting in a body to the shear
and normal stresses thus induced, where the shear and normal stresses are plotted at the same scales on the vertical and horizontal axes of the graph. If the Mohr’s circles represent the conditions for failure, then the common tangent drawn for a series of circles defines the failure condition for the material, where the slope of the line is the value of angle of friction and the intercept on the vertical axis is the value of cohesion. For many soils, the Mohr envelope is a straight line, whereas for rocks it is liable to be curved.

Moisture content: In most applications, the mass of water in a material expressed as a percentage of the mass of the dry solids (dried at 105 °C to constant mass), or, in some applications, as the mass of wet soil.

Monominalic: Composed of a single mineral.

Montmorillonite: A clay mineral; the principal component of bentonite clays.

Muscovite: A common variety of mica; white mica.

Nallah (nullah): (1) A term used in the desert regions of for a sandy river bed or channel, or a small ravine or gully, that is normally dry, except after heavy rain. (2) The small intermediate, generally torrential stream that shows flows through a nallah.

Nebkha: An aeolian bedform of wind-blown sand collected within and behind, and stabilized by, vegetation.

Nodules: Spherical or ovoid concretions in rocks composed of minerals that precipitated out after deposition.

Octahedral co-ordination: An atomic arrangement in which an ion is surrounded by six ions of opposite sign, whose centres form the corners of an octahedron. An example is the structure of sodium chloride.

Oedometer: Laboratory apparatus in which the one-dimensional consolidation characteristics of a small soil specimen can be obtained over a range of applied static (loading) pressures.

Onion-skin weathering: See Spheroidal weathering.

Ooidal: Description of a sediment consisting of sand-sized spherical accretionary particles (ooloids) cemented together. See also Oolitic.

Ooid (oolith): Spherical or subspherical sand-sized grains consisting of concentric lamellae around a nucleus; usually composed of carbonates.

Oolitic: Texture of sediment or sedimentary rock comprising ooids or ooliths, hence ‘oolitic limestone’ (or sometimes ‘oolite’).

Optimum moisture content: The moisture content measured in a standard engineering soil compaction test that provides the maximum dry density.


Orogenesis (orogeny): The process of creation of a mountain belt by tectonic activity, generally by the collision of continental plates or microplates, characterized by regional metamorphism, igneous activity and vertical movements.

Overburden: In a general geological sense, the unconsolidated sediments that overlie the solid rock (or ‘bedrock’). In mineral extraction or quarrying, the material that has to be removed to provide access to the mineral.

Overburden pressure: Pressure or vertical stress at a particular point in the ground resulting from the mass of the material above that point.

Overcut: The excavation of the ground to a diameter slightly greater than the pipes in pipe jacking or microtunneling, to allow the pipes to be pushed easily through the ground.

Oxisols: A highly weathered group of soils found mostly in the tropics and noted for their high content of oxides.

Palaeo- (paleo-): From the Greek palaios meaning ancient, a prefix meaning very old or ancient.

Palaeosol: A fossil soil that is no longer actively forming, usually buried below the present ground surface. Such a soil may be of recent origin or be very ancient.

Pan: A closed depressions, often one of a great number, in arid to semi-arid areas, caused mainly by deflation, but also by solution and animal activity.

Particle-size distribution: The ranges of sizes of particles in a disaggregated material, such as sediment, soil or aggregate, usually expressed as a histogram or a frequency diagram.

Pavement: (1). Geology; a bare rock surface, resembling a road; for example, a limestone pavement. (2). Road construction; any material spread on the subgrade to distribute load and protect against erosion and traffic wear.

Pediment: A gently sloping, 0.5°–7°, concave-up erosion surface on the flank of a steep-sided hill or mountain, and common at the base of mesas or inselbergs. Possibly the product of sheet-flood erosion or back-wearing by parallel retreat.

Pediplain: Any degradational piedmont surface produced in arid climates and either exposed or covered with a thin blanket of contemporary alluvium.

Pedogenesis (Pedogenic): Soil-forming process.

Pelagic: A term applied to sediments accumulated in the deep sea and oceans.

Penelplain: A low-angle ground surface developing at a late stage in the cycle of erosion.

Penetrometer: Instrument for assessing the in situ strength of soil by measuring the resistance to the controlled penetration by a probe, usually cone-shaped. A laboratory type of penetrometer is also used for the standard determination of liquid limit.

Perimarine: Adjacent or marginal to a marine environment.

Permeability: A measure of the ease with which a fluid (or gas) is able to pass through a material.

Permeameter: Laboratory apparatus for measuring the permeability of soils.

Petrofabrics: Description of rocks/soils by their textures and granular or crystal inter-relationships.
**Petrography:** Systematic description and classification of rocks from hand specimens and thin sections.

**Petrological microscope:** Microscope principally used for the analysis of thin sections of rock mounted on glass slides and examined in transmitted plane-polarized or crossed-polarized light.

**Petrology:** General term for the overall study of rocks through their mineralogy, geochemistry, textures, field relationships and, especially, their formation.

**pH:** Measurement of acidity/alkalinity on a scale of 1–14, with 7 being neutral (as in pure water), values <7 being acid and those >7 being alkaline.

**Phenocryst:** Large and often well-formed crystals set in a finer groundmass or matrix. Rocks containing phenocrysts are said to be porphyritic.

**Photogeology:** The geological interpretation of aerial and satellite photographs.

**Photogrammetry:** The process of making measurements from photographs, especially aerial photographs.

**Phreatic zone (zone of permanent saturation):** The zone beneath the water table in which intergranular pours and fissures are completely filled with water at hydrostatic pressures in excess of atmospheric.

**Phylllosilicate:** A silicate mineral, such as mica, the tetrahedral silicate groups of which are linked in sheets.

**Piezometer:** An instrument for measuring water or gas pressure or level in the ground.

**Pile:** A column-like structural member of concrete, steel or timber that is driven, jacked or cast into the ground. A pile cast in the ground in a borehole is a bored pile. Piles are constructed singly or in a pile group to support a superstructure above. Piles are usually vertical but may be inclined, raking piles. A pile may resist downward loads (e.g. a bearing pile), upward loads (e.g. a friction pile) or lateral loads (e.g. a sheet pile retaining wall).

**Pipe jacking:** A trenchless process of constructing a tunnel or pipeline in which the tunnel is excavated by jacking forward lengths of pipe from a launch pit or drive shaft. It differs from conventional tunnelling in soft ground where tunnels or ‘pipes’ through which soluble or granular soil material is removed.

**Pisé (pisé de terre):** Rammed earth.

**Pisolite:** Sedimentary rock, usually a limestone, made chiefly of pisoliths cemented together; a coarse-grained oolite.

**Pisolith:** One of the small, round ellipsoidal accretionary bodies in a sedimentary rock, resembling a pea in size and shape, and constituting one of the grains that make up a pisolite.

**Planation:** The process or processes of erosion, whereby the surface of the Earth or any part of it is reduced to a fundamentally even, flat or level surface; specifically, lateral planation by a meandering stream.

**Plastic limit:** A term for the minimum amount of water mixed with a sediment necessary for it to deform plastically under standard conditions.

**Plasticity index:** The water content range of a soil at which it is plastic, defined numerically as the liquid limit minus the plastic limit.

**Plasticizer:** (1) A substance which when added to another makes it easier to mould into shape. (2) An admixture that is added to concrete or mortar during mixing to improve workability.

**Plateau:** Any large, relatively flat area at high altitude.

**Plate-bearing test:** A load is applied to a standard (circular) plate to measure settlement under load on soils, fill and sub-base to determine the ground’s bearing capacity.

**Playa:** A flat dry barren plain at the bottom of a desert basin, underlain by silt, clay and evaporites. It is often the bed of an ephemeral lake and may be covered with white salts.

**Playa lake:** A shallow recurring lake that covers a playa after rains but disappears during a dry period.

**Plinthite:** A thick, well-cemented horizon that forms by the illuvial accretion of ferricrete or other hard soil crusts, often lateritic and protecting underlying materials from erosion.

**Plutonic:** Adjective to describe large igneous intrusions (‘plutons’) that have cooled at great depth in the Earth’s crust.

**Pneumatic-tyred roller:** A roller that compacts soil using the kneading action of the tyres passing over the surface of the ground. The rollers may be towed by a tractor unit or self-propelled and they can be ballasted; for example, with sand or water.

**Point counting:** Microscopic analysis of thin sections of rocks involving the systematic counting of identified grains/crystals that intersect the microscope cross-hairs as the microscope stage is moved in fixed lateral steps. Quantitative analysis of thin sections usually requires the counting of hundreds (or even thousands) of grains/crystals.

**Poisson’s ratio:** The ratio of the strain in the direction of an applied stress to the strain at right angles to this.

**Polje:** A large, commonly flat-floored, closed depression in a karst area of equivocal origin.

**Polydisperse:** System of colloidal dispersion with particles of varying size.

**Polymictic:** Description of detrital rock or sediment consisting of fragments or grains of many different rock and/or mineral materials.

**Pore pressure:** The pressure of the air or, more usually, the water occupying the pore space in a soil or rock.

**Porosity:** (Hydrogeology) The pore space within a rock that may be occupied by a fluid. (Soil Mechanics) The ratio between the volume of voids in a soil to its total volume.
**Porphyritic**: An igneous rock texture, comprising relatively large well-developed crystals (phenocrysts) set in a finer-grained groundmass.

**Portland cement**: Hydraulic cement invented in England in 1824 and named for its supposed resemblance, when set, to Portland stone. Now the most commonly used manufactured cement worldwide. It is manufactured by fusing limestone and clay or shale, which is then ground to a powder with a small proportion of gypsum. Unhydrated Portland cement principally consists of a mixture of tricalcium silicate (50–70%), dicalcium silicate (15–30%), tetracalcium aluminoferrite (5–15%) and tricalcium aluminate (5–10%). On hydration, complex calcium–silicate–hydrates are formed, together with calcium hydroxide (portlandite) and other minor phases.

**Pozzolanas**: Natural or artificial forms of silica, silicates or aluminosilicates that have the ability to react with calcium hydroxide and water, at ambient temperatures, to give calcium–silicate cementitious products.

**Precipitation**: (Chemical Reactions) The formation of an insoluble solid, such as a mineral, by a reaction that occurs in solution. (Meteorology) The amount of rain (or snow or hail) falling on an area per unit time.

**Preconsolidation pressure**: The maximum value of consolidation pressure borne by a sediment since its deposition.

**Principal stress**: Any system of shear and normal stresses acting on a body can be represented by three orthogonal principal (normal) stresses. These are, respectively, the major, intermediate and minor principal stresses in terms of magnitude.

**Proctor compaction test**: A way of compacting soils in the laboratory, standardized to give results that can be compared. By weighing different compacted samples of the same soil at various moisture contents, the optimum moisture content corresponding to the maximum density can be determined. This test is used on soils in earth structures such as earth dams, soil-stabilized roads, etc.

**Pseudo-karst**: A topography that resembles karst, but was not formed by the dissolution of rock. Pseudo-karst has been applied to covered karst and to karst produced by the dissolution of rocks that are relatively insoluble, such as quartzite and granite, but more general usage regards these as varieties of true karst.

**Pulverized-fuel ash (PFA)**: See Fly ash.

**Punned**: Description of soil, hard-core and similar material that has been compacted (or rammed) by repeated blows from a heavy-ended tool (a punner) to densify the material in order to create a stronger, denser layer of low permeability.

**Pyrite**: A mineral comprising iron sulphide, FeS₂; formerly known as ‘iron pyrites’ and popularly known as ‘fool’s gold’.

**Pyroclastic**: Description of fragmental material, such as volcanic ash, that has been blown into the atmosphere from a volcano by explosive activity.

**Pyroclastic flow (ash flow)**: A concentrated dispersion of hot, juvenile, volcanic fragments (ash, pumice, scoria), in a gas that moves in response to gravity. This forms deposits, ranging in volume from 0.01 km³ to more than 1000 km³.

**Pyrophyllite**: An aluminous phyllosilicate found in some metamorphic or hydrothermally altered rocks.

**Qanat (falaj)**: Term(s) used for an ancient, gently inclined, underground channel or conduit to conduct groundwater by gravity from alluvial gravels and the foot of hills to an arid lowland; a horizontal well.

**Quartz**: The most common silica (SiO₂) mineral, widely distributed in a great variety of rock types.

**Quartzite**: (1) A metamorphic rock consisting primarily of quartz grains, formed by the recrystallization of sandstone by thermal or regional metamorphism. (2) A sandstone composed of quartz grains cemented by silica.

**Quartz Porphyry**: A medium-grained, porphyritic, acid igneous rock containing phenocrysts of quartz and feldspar. The term ‘microgranite’ is preferred for modern usage.

**Rain-splash/rain-wash**: General terms for the transfer of material across the surface and down a hill slope as a result of rainfall. Normally, it consists of two components: rain-splash, which is the detachment and subsequent downslope transfer of small particles by raindrop impact; and rain-wash, which causes the down-slope movement of material by surface water flow.

**Reaction interval**: The temperature band within which a reaction, change of state or the formation of new minerals occurs.

**Recharge**: The precipitation reaching the water table and replenishing groundwater supply.

**Reconstituted soil**: Soil material that has been removed from its original position in the ground and then recompacted in the laboratory, usually prior to testing.

**Refractory**: The property of being resistant to high temperature and changes in temperature.

**Regolith**: The surface layer of fragmented or unconsolidated soil or rocky materials.

**Reinforcement**: Adding strength. Steel is used in reinforced concrete to resist tension. Steel reinforcing bars, usually round, come in different diameters and in different grades of steel, mild steel and high-tensile steel. They may be plain or deformed to provide better bond with the concrete.

**Relict**: (1) A mountain, lake, glacier, etc., that is a remnant of a pre-existing formation after a destructive process has occurred. (2) A mineral that remains unaltered after the metamorphism of the rock in which it occurs.

**Rendering**: Coating a wall or similar with render, which may be mortar, plaster or another material, to protect or decorate it.

**Residual Soil**: Surface soil formed in situ by the degradation of parent material by weathering processes.

**Retarder**: An admixture to a concrete mix to slow down the rate at which it hardens, usually by inhibiting hydration.

**Rhouords**: See Draa.
Rift valley: A long narrow valley resulting from the subsidence of land between two parallel or subparallel faults.

Rill: A small channel, measured in centimetres, that changes direction with each runoff event.

Rip-rap (Riprap): Also known as rubble, shot rock or rock armour: rock or other material used to armour (protect) shorelines, streambeds, bridge abutments, pilings and other shoreline structures against scour, water or ice erosion.

River terrace: Part of a former valley floor that now stands well above the level of the present flood plain. It is caused by stream incision, which may be due to uplift of the land, to a fall in sea level or to a change in climate.

Road base: The main structural element/layer in a road pavement. See also Sub-base.

Rock anchor (rock bolt): A long anchor bolt, for stabilizing rock excavations, which may be tunnels or rock cuts. It transfers load from the unstable exterior, to the confined (and much stronger) interior of the rock mass. The ends of metal bolts are secured into solid rock with face plates and nuts at the external ends.

Rock cycle: The cycle of rock change in which rocks are uplifted, eroded, transported, deposited, possibly metamorphosed and intruded, and then uplifted to start a new cycle.

Rock varnish: A dark coating found on exposed rock surfaces in arid environments. Rock varnish forms only on physically strong rock masses and not on talus. The varnish is primarily composed of particles of clay along with iron and manganese oxides. There is also a host of trace elements and almost always some organic matter. The colour of the varnish varies from shades of brown to black.

Rotary drilling: Cutting into the ground by the rotating cutting edge of a drill bit or auger, used in both rock and soft ground.

Rotary percussive drilling: A method of rock drilling in which the rock is broken out to form a hole by means of both a percussive and rotary action, as distinct from simple rotary drilling.

Sabkha: A supratidal environment of sedimentation, formed under arid to semi-arid conditions on restricted coastal plains just above normal high tide level. It is gradational between the land surface and the intertidal environment. Sabkhas are characterized by evaporite salt, tidal flow and aeolian deposits.

Salina: (1) A place where crystalline salt deposits are formed or found, such as a salt flat or pan, a salada, or a salt lick; especially a salt-encrusted playa or a wet playa. (2) A body of saline water such as a salt pond, lake, well or spring, or a playa lake with a high concentration of salts.

Salt dome: A salt diapir with a dome-like shape.

Salt heave: A source of damage to structures, arising from the presence of soluble salts that increase in volume on hydration. See also Haloturbation.

Saltation: A process of bedload transport comprising a series of ballistic jumps in which grains ascend sleepily (\( > 45^\circ \)) from the bed and return at a low angle (\(< 10^\circ \)). Height and impact effects are dependent on the fluid characteristics, being greater in air than in water.

Sand: Mineral or rock grains with particles of grain size between 0.06 and 2 mm (various other size definitions are in use).

Saturation: The degree to which all the pore space in a material is occupied by water.

Scar: A steep, rocky cliff in massively bedded limestone.

Scarp: See Escarpment.

Schist: A type of metamorphic rock characterized by a distinct metamorphic particle alignment (schistosity). See also Foliation.

Screen (screening process): A wire mesh or punched plates acting as a sieve; for example, for screening aggregate by separating and grading it into required sizes as used in a crushing plant. Vibrating screens shake aggregate through an appropriate sized mesh or in a revolving drum screen, through appropriate sized holes. ‘Screened’ material is that which has passed through a screen. ‘Screenings’ are the undersized or oversized rejected material from screening.

Secant pile wall: A continuous wall formed underground by overlapping circular section piles.

Sediment: Solid material, organic or inorganic in origin that has been transported and deposited by wind, water or ice. It may consist of fragmented rock material, products derived from chemical action or from the secretions of organisms. Loose sediment, such as gravel, sand or mud, may become consolidated and/or cemented to form coherent sedimentary rock.

Sedimentary rock: A rock formed from the consolidation of detrital sediment that has accumulated in layers (including sandstones and shales), or a chemical rock formed by precipitation (including some limestones and evaporites), or an organic rock consisting largely of the remains of plants and animals (including some limestones and coal).

Sedimentation: The processes by which sediment accumulates to form a deposit.

Seep: An area, generally small, where water or oil percolates slowly to the land surface. For water, it may be considered as a synonym of seepage spring, but it is used by some for flows too small to be considered as springs.

Seepage: (1) The act or process involving the slow movement of water or other fluid through a porous material. (2) The amount of fluid that has been involved in seepage.

Sensitivity: The ratio of the undrained strength of undisturbed soil to the strength of reconstituted soil at the same moisture content.
Glossary of Some Engineering and Geological Terms

Sericite: White fine-grained potassium mica, close to muscovite in composition, occurring as an alteration product of various aluminosilicate minerals. The term ‘sericite’ tends to be used imprecisely for any fine-grained micaceous alteration or weathering products.

Serpentine: A group of common rock-forming minerals often showing variegated shades of light and dark green, with a waxy lustre when massive and silky when fibrous. The group includes three common polymorphs: antigorite, lizardite and chrysotile. Serpentine is widely distributed, usually as a product of the alteration of magnesium silicates, in particular olivine, a pyroxene and amphibole. It is often associated with magnesite, chrome and magnesite. Chrysotile is the principal asbestos mineral and as such is known as white asbestos.

Sesquioxides: A general term for the hydrated oxides and hydroxides of iron and aluminium.

Shale: A fine-grained (grain size <0.06 mm) sedimentary rock that exhibits fissility (i.e. tendency to split into thin sheets). Certain mudstones develop into shales as a consequence of weathering action.

Shear strain: A measure of the distortion a body suffers as a result of the imposition of stress.


Shear surface: A surface along which differential movement has taken place parallel to the surface.

Sheet piles: A pile (of reinforced concrete, timber, steel) that is designed to resist lateral loading. Sheet piles are driven to form a set of interlocking piles in a panel. Steel sheet piles are widely used to support ground or water loads in both temporary works (e.g. excavation support) and permanent works (e.g. retaining walls, quay and river walls).

Sheet silicate: See Phyllosilicates.

Sheet flood: A broad sheet-like area of moving water. It is a characteristic of desert fans in which loose silt and sand become water-loaded so quickly that the water is unable to scour into the surface.

Sheetflow (sheetwash): Overland flow over a smooth soil surface.

Shield: The continental shelf, the region of shallow seas surrounding continents that is distinguished from the deeper ocean basins.

Shield: See Cratonic.

Shrinkage limit: The moisture content below which there is no further decrease in volume of a soil with decreasing moisture content.

Silcrete: A variety of duricrust formed by the precipitation of silica.

Silica: Silicon dioxide, which occurs in a great variety of crystalline and cryptocrystalline forms depending on physical and chemical conditions.

Silica fume (microsilica): A fine-grained, thin and very high surface area silica. Silica fume is a by-product of a very fine pozzolanic material, composed of mostly amorphous silica, produced by electric arc furnaces during the production of elemental silicon or ferro silicon alloys. Originally regarded as a waste product, it is now used in some Portland cement-based concretes to improve strength and reduce porosity.

Silt: (1) A detrital particle, finer than very fine sand and coarser than clay, in the range of 0.002–0.06 mm (various other size definitions are in use). (2) An un cemented clastic sediment of silt-sized rock or mineral particles. (3) Fine earth material in suspension in water.

Sinkhole: An approximately circular depression in limestone terrain into which water drains and collects.

Sinter (sintering): The bonding of powdered materials by solid-state reactions at temperatures lower than those required for the formation of a liquid phase.

Slake durability: A measure of the resistance of material to degradation by slaking.

Slaking: A degradation process in geomaterials caused by alternating cycles of wetting and drying.

Slip-face: The face on the lee slope of a dune where sand accumulates at its angle of repose (30°–34°).

Slope stability: The resistance of a slope, natural or artificial, to land sliding.

Slurry wall: Concrete wall constructed in situ using mud, usually a bentonite slurry to support the sides during excavation. On the completion of excavation, concrete may be introduced at the base of the excavation and the slurry is displaced upwards to form a subsurface concrete wall. In some cases, a low-permeability boundary is formed by backfilling the trench with bentonite.

Soffit: Underside of any deck, beam, arch or similar structural unit.

Soil modification: General term for improving the properties of soil. With lime, the ‘modification’ is usually the immediate improvement in workability, placeability, compactability of the soil. With Portland cement-based concretes to improve strength and durability of the soil. With lime, the ‘modification’ is usually the immediate improvement in workability, placeability, compactability of the soil. With lime, the ‘modification’ is usually the immediate improvement in workability, placeability, compactability of the soil.

Soil profile: A sequence of layers or horizons that reflect the development from the parent material and composition of a soil.

Soil stabilization: See Soil modification.

Solifluction: The process of slow flow of soil from high to low ground, whilst oversaturated with water.

Solifluction shear: Shear surfaces resulting from the slow down-slope movement of unconsolidated materials or debris containing some fines as a result of alternate freeze and thaw of the water in these materials. May also include shear planes from episodes of more rapid downslope failure or flow.

Solution: A process of chemical weathering by which mineral and rock material passes into solution.
Sorting: The geological processes by which fragmented materials are separated into fractions of different sizes: well-sorted materials contain fragments of a similar size; unsorted materials consist of fragments of a wide range of sizes; and poorly sorted materials contain a range of sizes but with an absence or predominance of one particular size.

Spalling: (1) The chipping, fracturing or fragmentation, and the upward and outward heaving, of rock caused by the interaction of a shock (compressional) wave at a free surface. (2) Exfoliation. (3) Disintegration or exfoliation of the surface layer of hardened concrete due to chemical or physical attack.

Spheroidal weathering: The process of mechanical spalling and surficial chemical weathering of a boulder. Often associated with the deep weathering of basalt, dolerite and granite, in which water promotes chemical weathering within cooling joints.

Spoil: Material (e.g. soil or rock) taken from excavations. Also rubbish and waste material (e.g. from dredging).

Standard penetration test (SPT): A penetration test of the in situ shear strength of a non-cohesive soil. The result is expressed as a number of blows to drive a standard size tube a given distance into the soil.

Star dunes: A pyramidal dune, with three arms radiating from a high central dome.

Stereoscope: An optically simple device holding lenses and, sometimes, mirrors for the inspection of pairs of aerial photographs or images; the image viewed in stereo allows the viewer to gain an appreciation of the relief of the land.

Stiffness: The ability of a material to resist deformation.

Stone pavement: A flat desert area, covered with the surface layer of rounded pebbles or gravel, often a lag deposit caused by the removal of fine particles by wind and wash erosion.

Stoss slope: The slope/side of a dune facing into the direction of the prevailing wind. More usually, and similarly, used for the side of a hill that faced the direction from which an advancing glacier or ice sheet moved.

Strain: A measure of the linear, volumetric or shear deformation that results from the application of a stress.

Strath (strath terrace): An extensive undissected terrace-like remnant of a broad, flat valley floor that has undergone dissection following uplift; for example, a continuous river terrace along a valley wall interrupted in its development during the mature stage of a former erosion cycle.

Stress relief: Reduction in overburden stress due to the erosion or removal of overlying materials.

Sub-base: A layer of material laid under a road base on the natural ground to strengthen it, to improve the drainage or for some other purpose.

Subgrade: The natural ground below a road.

Sulphate attack: Sulphate attack is a chemical reaction affecting ordinary Portland cement concrete. Sulphates present in, or entering, the concrete matrix together with a source of moisture reacts with the cement in the concrete causing it to expand and crack.

Sulphate reduction: The chemical and biochemical processes by which sulphate is reduced to sulphide.

Supratidal: Descriptive of the part of the tidal-flat environment above the normal level of the mean high water of spring tides.

Synoptic: Pertaining to simultaneously existing meteorological conditions that together give a description of the weather; also said of a weather map or chart that shows such conditions.

Tafoni: Pits and hollows on rock surfaces, particularly granites in desert environments. Possibly formed when salt weathering and wind scour small depressions on the surfaces of exposed rock, which enlarge when moisture accumulates in them. Some may form when a case-hardened surface is breached exposing the softer rocks beneath to erosion.

Talluvium: Coarse hill-slope deposit comprising talus (scree) and finer materials.

Talus: See Scree.

Tanking: A layer of waterproofing material (e.g. asphalt) applied to the outside of walls, basements or foundations. Tanking also provides protection against the ingress of deleterious materials.

Tell (tel): An archaeological mound created by human occupation and the abandonment of a geographical site over many centuries. A classic tell looks like a low truncated cone with a flat top and sloping sides.

Tensile strength: Maximum tensile stress that can be borne by a material before fracturing or a large increase in the rate of strain occurs. May be determined directly by applying a tensile force to a specimen, or indirectly by loading a prismatic sample that is supported at two points or by splitting a cylindrical sample by the application of a diametral compressive load.

Tephra: Air-fall debris from a volcano.

Terrigenous: Derived from land.

Tetrapod: Precast concrete tetraods are large four-legged precast concrete elements that are placed to break up and reduce wave action, and so protect shorelines.

Thalweg (talweg): A line joining the lowest points of successive cross-sections, either along a river channel or, more generally, along the valley that it occupies.

Thaumasite: A naturally occurring material, containing calcium and silicon. It is a sulphate formed by sulphate attack of concrete and mortar, a process referred to as the thaumasitic form of sulphate attack. The cement expands, causing serious deterioration of concrete and mortar. The formation of thaumasite requires a source of sulphates or sulphides in the ground, mobile groundwater and low temperature. It is most active below 15 °C. It is not usually found in hot desert environments, except possibly in very localized cold and damp locations.
Thematic map: In remote sensing, an image that has a classification overlaid on to it.

Thenardite: An evaporite mineral (Na₂SO₄), whose hydration to mirabilite is accompanied by a significant increase in volume that assists in the weathering of a rock.

Thermal cracking: May occur within mass concrete as it cools after hydration.

Thermal expansion: Reversible or permanent change in the dimensions of a body as a result of temperature increase.

Till: Term used for the deposits left by glaciers; generally synonymous with the looser terms Boulder clay and Glacial drift.

Tip: An accumulation or deposit of mineral or waste materials. In quarries, this can be in a solid or liquid state, and may include overburden dumps, spoil heaps, stockpiles and lagoons. Elsewhere, tips are generally temporary or permanent disposal areas for unsuitable, surplus or waste materials.

Titrometric: Quantitative chemical analysis method involving the reaction of a measured volume of one liquid added to a fixed volume of another liquid to determine the volume of the added liquid required to complete the reaction.

Topsoil: The uppermost part of a soil layer that by its humus content supports vegetation. In the UK, the topsoil is typically approximately the uppermost 150 mm of soil, but in wet tropical climates it may be a metre or more in thickness.

Trafficability: Ability of vehicles (e.g. construction plant) to traverse the ground.

Trailing dredge: Usually, a dredge from which a suction cutter or suction pump is lowered into the water and dragged along as the dredge moves, sucking up water and sediment.

Transect: A transect is a path along which one records and counts occurrences of the phenomena of study.

Transverse dune: A dune, whose long axis is normal to the main sand-moving wind direction.

Travertine: Calcareous material, formed by precipitation from flowing fresh water at a hot spring or waterfall after its passage through calcareous rock or sediment, aided by biochemical activity.

Tremie (pipe): A pipe used to deliver concrete or grout to the base of a trench or pile bore to prevent segregation of the concrete or contamination by slurry. See Diaphragm wall and Slurry wall.

Triaxial test: A strength test for soil or rock in which an axial load is applied to a specimen that is also subjected to a lateral pressure or confining pressure at right angles to the axial load.

Tropical weathering: Weathering by the combined effects of heat and moisture under tropical climate conditions.

Tufa: A chemical sedimentary rock of calcium carbonate precipitated by evaporation; it commonly occurs as incrustations around the mouth of a spring or along a stream. The compacted dense variety is travertine.

Ultrabasic (ultramafic): A group of igneous rocks relatively low in silica and extremely rich in ferromagnesian minerals such as olivine and pyroxene.

Unconfined compressive strength (uniaxial compressive strength): The strength of a rock or soil sample when crushed in one direction (uniaxial) without lateral restraint.

Unconfined tensile strength (uniaxial tensile strength): The maximum tensile stress that can be borne by a material before it fractures or undergoes a rapid increase in strain rate, where the stress is applied in one direction only.

Undisturbed sample: A sample taken in such a way that the chemical and physical condition of the sample is not changed.

Undrained shear strength: The maximum stress that can be borne by a material before it fractures or undergoes a rapid increase in strain rate where the test takes place under undrained or total stress conditions; that is, pore pressure changes due to the application of stress that is not allowed to dissipate during the test.

Uvala: An irregularly shaped hollow in a karst terrain. It is generally 500–1000 m in diameter and may be 100–200 m deep. It is the result of the coalescence of a number of dolines.

Vadose zone: A shallow subsurface zone of infiltration and percolation of rainfall, runoff or meltwater between the surface and the water table.

Veins: Fractures or fissures in rock or soil materials that are infilled with minerals.

Ventifact: A stone or pebble shaped, worn, faceted, cut or polished by the abrasive or sand blast action of wind-blown sand, generally under desert conditions.

Vertisol: A type of soil with a high content of smectite that imparts shrink–swell characteristics to the soil, leading, for example, to the development of deep vertical cracks during dry periods.

Void ratio: In a soil or rock, the volume of voids divided by the volume of dry solids in the sample.

Volcanic: Description of igneous rocks and pyroclastic deposits that are formed by extrusion from a volcano.

Volcanic ash: See pyroclastic.

Wadi: A steep side watercourse with sporadic flow in an arid region.

Wash boring: The lowering of a casing or drive pipe by loosening and washing out the soil with a jet of water. Used for moving loose ground before drilling solid rock.

Water absorption: A measure of the amount (by mass) of water that a body or substance will absorb or assimilate, under standard conditions; expressed as a percentage of the dry weight of the body or substance.

Water potential: A measure of the free energy of water in a solution, as in a soil sample, and hence of its tendency to move by diffusion, osmosis or as a vapour.
**Water table:** The level of free-standing water within intergranular pores or fissures at the top of the phreatic zone, below which the pores of the host are saturated with water.

**Weathering:** The physical and chemical processes by which rocks are broken down and decomposed by external agencies such as water, wind, ice, temperature changes, and the actions of plants and bacteria.

**Wind-blown silt:** See Loess.

**Workability:** The combination of properties that contribute to the ease, with which plastic materials can be mixed, handled, transported and placed.

**Workability (of concrete):** The ease of placing or pumping concrete, especially through congested reinforcement.

**X-ray diffraction (XRD):** Method for the analysis of crystalline solids involving the diffraction of a monochromatic X-ray beam in which the regular array of atoms in the crystal structure act as planes of a diffraction grating to the incident X-rays.

**X-ray fluorescence (XRF):** A technique of chemical analysis in which a sample is irradiated with X-rays. This produces secondary fluorescent X-rays that are characteristic of the elements present. Analysis of the fluorescent spectrum enables quantitative identification of certain of the chemical elements present in the sample.

**X-ray powder diffractometer:** (Position sensitive) In a position sensitive X-ray diffractometer the powdered sample is mounted in the path of the fixed incident beam of monochromatic X-rays and rotated in a horizontal plane. The diffracted X-rays are detected by a fixed array of detectors arranged in an arc. (Scanning) In a scanning diffractometer the powdered sample is mounted in the path of the incident monochromatic X-rays and is rotated in a plane about a horizontal axis to change the angle of incidence of the fixed X-ray beam whilst the X-ray detector rotates at twice the rate of the sample.

**X-rays:** Electromagnetic radiation of wavelengths in the range of 0.01 – 20 nm (analytical X-rays in the range 0.02 – 2 nm) generated when an atom is bombarded by electrons – each element produces a characteristic X-ray spectrum.

**Yardang:** An elongate landform resembling the hull of an inverted boat, sculptured by wind erosion from weakly consolidated rocks.

**Yield:** The point that defines the end of elastic deformation, such that the stress–strain relationship is no longer linear.

**Young’s modulus:** A modulus of elasticity in tension or compression, involving a change in length.

**Zeuge:** A tabular rock mass perched on a pinnacle of softer rock as a result of differential erosion of the underlying rock.
Appendix A  Desert model

The desert model from Fookes et al. (2007), is based on Fookes & Krill (1969).

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