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sabbath. See hardpan, nari.

safe yield. The amount of water that can be safely withdrawn from an aquifer without causing undue effects such as aquifer depletion.

safe yield of stream. The lowest dry weather flow of a stream^[16].

safety line. A safety rope attached to a caver climbing on a ladder or negotiating a difficult situation and held by a man above^[25].

saline spring. See spring, saline.

saline water. Water that generally is considered unsuitable for human consumption or for irrigation because of its high content of dissolved solids. Generally expressed as milligrams per liter (mg/L) of dissolved solids, with 35,000 mg/L defined as sea water, slightly saline is 1,000-3,000 mg/L, moderately saline is 3,000-10,000 mg/L, very saline is 10,000-35,000 mg/L, and brine has more than 35,000 mg/L^[22].

salinity stratification. The stratification of water in estuaries due to salinity-density differences^[16].

salt dome. A dome-like intrusion of a mobile salt core into sedimentary rock^[16].

salt karst. Areas in which karst landforms are developed upon halite or halite-rich rock, which are generally small and limited to arid regions, are referred to as salt karst. Except in desert regions,

dissolution of rock salt occurs in buried, interstratal, situations, and the effects of such dissolution at the surface include subsidence pipes or wider subsidence areas, such as those represented by the meres and 'flashes' in the Cheshire Plain, England^[9].

salt lake. A lake containing high salt concentrations and usually not having any outflow^[16].

salt tolerance. The resistance of crops to salt concentration^[16].

salt weathering. Detachment of particles of various sizes from a rock surface by the growth of crystals from salt solutions. Forms substantial features in Nullarbor Plain caves^[25].

saltation. Solid matter transported by a stream by the action of leaping movement over the stream bed. See also saltation load.

saltation load. The solid matter transported by streams^[16].

saltwater intrusion. The movement of salt water into fresh water aquifers^[22].

sampling. The taking of small quantities of water or porous media for analysis^[16].

sand. Unconsolidated detrital rock material^[16].

sand pipe. See solution pipe.

sand stalagmite. A stalagmite formed on sand and made of calcite-cemented sandstone^[10].

sandstone caves. Most natural sandstone caves are surface river-cut notches at the foot of rock cliffs, or left part way up the cliff due to later downcutting. This origin accounts for most of the caves once inhabited by the Pueblo Indians in the sandstone cliffs of the western USA. True caves do occur in sandstone and some of these appear to be at least partially of dissolutional origin. Their existence probably reflects matrix leaching by ground water moving through zones of especially high primary porosity and permeability. Though sandstones with a calcite matrix cement are more prone to such development, even siliceous cement, which has a very low solubility in water, may be removed during a sufficiently long time span. The sandstone caves of the Sarisarinama Plateau, Venezuela may be a special case of this type of development. These include shafts 300m in diameter and 200m deep, and passages up to 500m long. They were probably cut in the quartz sandstone by underground streams, after early leaching of the cement by hydrothermal solutions, and the shafts have been modified by later collapse^[9].

saprophage. A scavenger feeding on decaying organic material^[25].

saturated. 1. Referring to rock with water-filled voids. 2. Referring to water which has dissolved as much limestone or other karst rock as it can under normal conditions^[25].

saturated flow. Single phase flow when all voids are filled^[16]. Not to be confused with chemical saturation.

saturated water. Water which is in chemical equilibrium with its enclosing media and is thus nonaggressive. Water, at about 25° C, in contact with calcite and the normal atmosphere, will contain approximately 30 to 50 ppm of Ca when saturated, variations being mainly due to differing pH. Determination of the saturation point of natural waters is complex^[20]. Synonyms: (French.) *eau saturée*; (German.) *gesättigtes Wasser*; (Greek.) *koressménon ýdor*; (Italian.) *acqua satura*; (Spanish.) *agua saturada*; (Turkish.) *doygun su*; (Yugoslavian.) *zasićena voda*.

saturated zone. See phreatic zone and zone of saturation.

saturation regime. A flow regime in completely saturated porous medium^[16].

saturation, zone of. See phreatic zone and zone of saturation.

scale. 1. A very thin and flat rock fragment^[16]. 2. The accumulation of precipitated solid material. 3. The ratio of prototype to model dimensions. 4. The ratio of the length between any two points on a map, plan or section to the actual distance between the same points on the ground or in a cave^[25].

scaling chip. A thin small rather irregular piece of limestone, commonly crumbly, which has fallen from the ceiling or wall of a cave. A form of cave breakdown^[10].

scaling factor. The ratio of characteristics of a model to those of the prototype^[16].

scaling plate. A small flat piece of rock of rectangular or polygonal shape, that has fallen to the floor of a cave. A form of cave breakdown in thin-bedded impure limestone cut by closely spaced joints^[10].

scaling poles. A lightweight metal alloy pole, in short sections for transport and fastened together where used, to raise a ladder to points inaccessible by climbing^[25].

scallop. 1. A spoon-shaped hollow carved in a cave wall, floor or ceiling due to erosion by eddies in flowing water. Scallops are commonly closely packed, leaving sharp ridges at the intersects. They range from 10mm to 1m in length and as a general rule the smaller they are then the faster flowing was the water that carved them. The scallops are generally asymmetrical, with their upstream end steeper than the downstream end — a useful indicator of paleo-flow direction in abandoned passages^[9]. 2. Oval hollow having an asymmetric cross section along its main axis. Scallops form patterns on the walls of caves and in streambeds and may be used to determine direction of flow of turbulent water, since they are steeper on the upstream side. Commonly called flutes in America^[10]. Synonyms: (French.) *cannelure, vague d'érosion*; (German.) *in Fließrichtung des Wassers ausgezogener Kolk*; (Greek.) *kilon o-oïthés*; (Spanish.) *huella de corriente*; (Turkish.) *değirmi, tarak*. See also flute.

scar. (Northern England.) Steep rock cliff in limestone country often indicating outcrop of relatively bare and massively bedded limestone^[20]. Synonyms: (French.) *cicatrice, griffure*; (German.)

Klippe; (Greek.) *oulí*; (Spanish.) *ceja* (in central Spain); (Turkish.) *kireçtaşı dik yarı*.

scats. Animal droppings, an important source of food in caves^[23].

scavenger. An animal that eats the dead remains and wastes of other animals and plants^[23]. See also *predator*.

Schichtfugenkarren. (German.) See bedding grike.

scholzite. A cave mineral — $\text{CaZn}_2(\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$ ^[11].

scour. The erosive action of running water in streams^[16].

screen, screen pipe. Slotted well casing that is positioned within the producing horizon to prevent the inflow of detrital particles into a well while allowing the inflow of water. See also well screen.

sea cave. 1. A cave cut in any rock type where a geological weakness is exploited by the highly selective erosion power of wave action. Fingal's Cave, cut in the basalt of Staffa, Scotland, is a famous example. True sea caves should not be confused with dissolutional caves that pre-dated the wave action but were then intersected and revealed as a cliff line was eroded back such as caves in the Chalk at Beachy Head in south-east England. In some young tropical islands, dissolutional voids have formed below sea-level in the mixing zone between fresh and saline ground water. Some have subsequently been tectonically uplifted into a shoreline position, to give the misleading

impression of having developed due to waver action. Caves of this type on the coast of Tongatapu, Tonga, have pools that connect with active dissolutional cavities below sea-level that might be related to the mixing zone^[9]. 2. A cave or cleft in a sea cliff or coastal karst outcrop eroded by waves or currents or dissolved by circulating ground water^[20].

Synonyms: (French.) *grotte marine*; (German.) *Küstenhöhle*, *Meereshöhle*; (Greek.) *thalassion spelon - paraktion speleon*; (Italian.) *grotta marina*; (Russian.) *morskaja pescera*; (Spanish.) *cueva marina*; (Turkish.) *deniz mağarası*; (Yugoslavian.) *morska pećina (spilja)*. See cave. Compare nip. See also littoral zone.

sea estavelle. Submarine or sea-shore opening in karst formations which at one season or period discharges ground water (fresh or brackish) from the aquifer into the sea-bed and at another season or period draws seawater into the aquifer by a vacuum^[20]. Synonyms: (French.) *estavelle marine*; (German.) *submarine Estavelle*; (Greek.) *estavelle thalassia (estavella)*; (Italian.) *Estavella sottomarina, sorgente sottomarina a flusso alterno*; (Spanish.) *estavela marina*; (Turkish.) *sahil batar çıkarı*.

sea level. The average height of the surface of the sea used as a datum for elevations^[16].

sea-mill. A mill whose motive power is derived from the flow of water into (or possibly out of) a sea estavelle; the classical example is on the Vinaria Peninsulas, at Argostolion, Kephallinia^[20]. Synonyms: (French.) *moulin de la mer, moulin d'Argostoli*;

(German.) *Meermühle*; (Greek.) *thalassomylos*; (Spanish.) *molino de mar*; (Turkish.) *deniz suyu değirmeni*; (Yugoslavian.) *morska vodenica*. See sea estavelle.

sea ponor. A submarine opening in karst formations where seawater flows or is drawn by a vacuum into the aquifer^[20]. Synonyms: (French.) *perte sous-marine*; (German.) *submariner Ponor*; (Greek.) *ypothalassia katavothra*; (Italian.) *inghiottitoio sottomarino*; (Spanish.) *sumidero marino*; (Turkish.) *denizalte suyutarı*; (Yugoslavian.) *morska vodenica, morski ponor*. See ponor.

sea water intrusion. See saltwater intrusion.

sealing-grout, grout. Cement grout injected between a well casing and the borehole wall (annular space) to seal off an aquifer from external contamination.

secondary interstices. Voids formed in a rock after the rock had been formed^[16].

secondary porosity. Porosity created after rock formation due to fracturing, leaching, etc.

section. A plot of the shape and details of a cave in a particular intersecting plane, called the section plane, which is usually vertical^[25].

sediment. Material recently deposited by water, ice or wind, or precipitated from water^[25].

sedimentation. The deposition of solid disintegrated rock material by water, wind, or gravity transport^[16].

sediment transport. The transport of eroded rock material by moving water or wind^[16].

seep. 1. An area, generally small, where water or oil percolates slowly to the land surface. See seepage and spring^[22]. 2. To move slowly through small openings of a porous material^[22].

seepage. 1. The infiltration or percolation of water through rock or soil to or from the surface and usually restricted to the very slow movement of ground water. 2. The fluid discharged at a seep^[22]. 3. The amount of fluid discharged at a seep^[22]. 4. The slow flow of water through a porous medium. 5. The movement of water in unsaturated soil^[16].

seepage water. See percolation.

seepage face. A boundary between the saturated flow field and the atmosphere along which ground water discharges, either by evaporation or movement 'downhill' along the land surface or in a well as a thin film in response to the force of gravity^[22].

seepage force. The frictional drag of water flowing through voids or interstices in rock causing an increase in the intergranular pressure (i.e. the hydraulic force per unit volume of rock or soil which results from the flow of water and which acts in the direction of flow).

seepage line. 1. The uppermost level at which flowing water emerges along a seepage face^[22]. 2. The upper free water surface of the zone of seepage.

Synonymous with line of seepage, phreatic line^[22].

seepage path. The trajectory of fluid particles in seepage flow^[16].

seepage rate. The rate of seepage flow^[16].

seepage spring; filtration spring. See spring, seepage.

seepage surface. The outflow surface between water level and the intersection of the phreatic surface in a well^[16].

seepage velocity. See specific discharge.

selenite. Blade-like crystals of gypsum^[9].

self-cleaning capacity. The capacity of a river to clean its water of pollutants over a given length of water course^[16].

selenite needles. A sulfate speleothem having the shape of a needle that grows from gypsiferous cave soils^[13]. See also speleothem.

semiconfined aquifer. See leaky aquifer.

sepiolite. A cave mineral —
 $\text{Mg}_4\text{Si}_6\text{O}_{15}(\text{OH})_2 \cdot 6\text{H}_2\text{O}$ ^[11].

series. A subdivision of rock according to age at which they were laid down in a geologic epoch^[16].

setting of cement. The process of hardening of cement^[16].

settling basin. A basin used for the settling out of solids from suspension^[16].

settling velocity. The terminal velocity at which a particle will fall through a fluid^[16].

sewage. Domestic and municipal wastes^[16].

shaft. 1. Vertical, or steeply inclined, sections of a cave passage, of enormously varied size. The world's deepest known shaft is the entrance shaft of Brezno pod Velbom on the Kanin plateau, Slovenia; it is 501m deep, with no ledges. Much debate surrounds statistics on the depths of fully underground shafts, which may be broken by ledges, but among the deepest is a shaft about 430m deep in Italy's Abisso di Monte Novegno^[9]. 2. A cylindrical tube generally steep sided, that forms by solution and (or) collapse^[10]. 3. A vertical passage in a cave^[10]. 4. A vertical and usually large diameter hole penetrating geologic formations for access of subsurface points^[16]. See jama, karst shaft. See also pit; pothole (definition 2.).

shake; shakehole. (England; sometimes spelled shackhole.) 1. Term used mainly by cavers to indicate a doline, especially one formed by subsidence. 2. Hole formed by solution, subsidence, and compaction in loose drift or alluvium overlying beds of limestone^[10]. 3. Small subsidence or suffosion doline formed in the glacial till overlying limestones in the northern Pennines. See jama.

shall sand. Sand containing considerable amounts of clay and shale^[16].

shawl. Simple triangular-shaped curtain^[10].

shear plane. A plane along which failure of material occurs by shearing.

shear stress. See stress, shear.

sheet. A thin coating of calcium carbonate formed on walls, shelves, benches, and terraces by trickling water^[10].

sheet erosion. Erosion occurring over widespread tabular sedimentary or effusive rock^[16].

sheet jointing. Fracturing of tensile character, mostly in granitoid rocks, parallel to the land surface. Sheet jointing is developed either by load release or temperature differences.

shield; cave shield. 1. A thin circular disc of calcite projecting from a cave wall at any upward inclination, commonly a meter or more in diameter and with the underside draped with stalactites and curtains. The shield is actually a double disc with a thin central crack that acts as the continuation of a wallrock fracture. It grows by water moving up the crack under pressure and depositing calcite on both sides of its outer rim. Shields are rare, but Lehman Cave, Nevada, has more than a hundred of them^[9]. 2. A disk-shaped speleothem standing edgewise at a high angle^[10]. 3. A geologically stable and undisturbed continental block^[16].

shilin. A type of pinnacle karst formed on low plateau of gently dipping limestone; it is distinguished by densely packed pinnacles up to 25m high, fluted by sharp

- Rillenkarrren.** Known only in southern China, shilin (pronounced sherlin) translates as stone forest^[9].
- shore.** The zone of separation between land and moving water^[16].
- show cave.** A cave that has been made accessible to the public for guided visits^[25].
- sieve analysis.** The determination of the particle-size distribution of a soil, sediment, or rock by measuring the percentage of the particles that will pass through standard sieves of various sizes^[6].
- sieve opening.** The opening between the mesh wires of a sieve^[16].
- sieve retention.** The material retained on a sieve^[16].
- silicate rock.** Rock containing silica in predominant proportions^[16].
- silicic acid.** H_4SiO_4 monomeric acid^[16].
- silicon dioxide.** Silica (SiO_2 .) See also quartz.
- Silikatkarren.** (German.) Granites and related rocks that possess small outcrop sculpturing such as rounded runnels. They are best developed in the humid tropics such as Malaysia^[8].
- silt.** A grain particle with a diameter that ranges between 0.005 to 0.05 mm^[16].
- silting.** The deposition of silt in wells, caves, or reservoirs^[16].
- simá.** (Spanish.) Natural well that has vertical sides^[10].
- similarity criteria.** The conditions indicating under what circumstances a model and prototype are similar^[16].
- simple hydrograph.** A single peaked hydrograph^[16].
- single outlet.** A stream cutting through a divide (tributary basin) or outflow to the sea (major basin)^[16].
- single rope technique.** The practice of climbing up and down ropes with the help of ascenders and descenders. Abbreviation: SRT.
- sink; sinkhole.** (American.) 1. A point where a stream or river disappears underground. The sinking water may filter through a choke that excludes cavers, or may flow into an open horizontal cave or vertical shaft, and while active all of these may be termed sinkholes. The flow of water may be very small, but in full flood many sinkholes swallow flows of tens of cubic meters per second. The character of sink water (or swallet water, as it is commonly termed by hydrologists), flowing directly and rapidly into an open cave, distinguishes it from percolation water^[9]. 2. General terms for closed depressions. They may be basin, funnel, or cylindrical shaped^[10]. See also closed depression; doline; ponor; stream sink; sumidero; swallet; swallow hole.
- sinkhole plain.** (American.) Plain on which most of the local relief is due to closed

depressions and nearly all drainage is subterranean^[10].

sinkhole pond. (American.) Small lake in closed depression in limestone, due to an impervious clay floor or to intersection of depression with the water table^[10]. See doline lake.

sinking river, sinking stream. A small stream that disappears underground^[10]. See also lost river; doline; ponor; sink; sinkhole; stream sink; sumidero; swallet; swallow hole.

sinter. 1. A rock or deposit formed by precipitation from natural water, often from a hot or cold spring. Calcareous sinter is calcium carbonate and is also known as tufa, travertine, and onyx marble. Siliceous sinter is silica and is also known as geyserite and fiorite^[20]. 2. A mineral precipitate deposited by a mineral spring, either hot or cold. Siliceous sinter, consisting of silica, may be called geyserite and fluorite; calcareous sinter, consisting of calcium carbonate, may be called tufa, travertine, and onyx marble^[10]. Synonyms: (French.) *concrétion*; (German.) *Sinter, Kalktuff, Travertin*; (Greek.) *asvestolithikos toffos*; (Italian.) *concrezione*; (Russian.) *otlozenija istocnikov*; (Spanish.) *concreción*; (Turkish.) *kaynak tüfü*; (Yugoslavian.) *travertin, sedra, bigar, lehnjak*. Related to travertine.

siphon. 1. Synonym for a sump, or a section of flooded cave passage, in common parlance. True siphons, where water flows first up and then down are rare in caves, as the fractures in limestone tend to disrupt the required hydraulics. They are, however, the origin of such

intermittent springs as the Fontestorbes spring in France, and the Ebbing and Flowing Well at Giggleswick Yorkshire. Both flow in regular pulses when the siphon is full and working, only to cease when the siphon input is broken by air, as the upstream reservoir level drops. Their operation depends on critical flows and both operate only in favorable weather conditions^[9]. 2. Gallery in form of an inverted 'U' with water moving only under pressure when the siphon has completely filled up; the water head at the input end being higher than at the drainage point^[20]. 3. In speleology, a cave passage in which the ceiling dips below a water surface^[10]. Synonyms: (French.) *siphon*; (German.) *Siphon*; (Greek.) *siphon*; (Italian.) *sifone*; (Russian.) *sifon*; (Spanish.) *sifon*; (Turkish.) *sifon*; (Yugoslavian.) *sifon, smrk*. See also water trap.

site characterization. Means the program of exploration and research, both in the laboratory and in the field, undertaken to establish the geologic conditions and the ranges of those parameters relevant to a particular site. Site characterization includes borings, surface excavations, excavation of exploratory shafts, limited subsurface lateral excavations and borings, and in situ testing at depth needed to determine the suitability of the site for a geologic repository, but does not include preliminary borings and geophysical testing needed to decide whether site characterization should be undertaken^[22].

skin effect. The effect of the zone of reduced permeability immediately around

the borehole on transient flow phenomena in pumping tests^[16].

skrytyj karst, zakrytyj karst. (Russian.)
See closed karst.

skylight. A hole in the roof of a cave passage through to the ground surface. It may be an inlet shaft, a section of collapse or a breach due to surface lowering^[9].

slickenside. 1. A polished, commonly striated rock surface within a fault plane, produced due to friction during fault movement. The striae give an indication of the fault movement direction^[9]. 2. A polished fault plane with grooves due to relative motion of fault blocks^[16].

sliding. 1. The relative displacement of two bodies along a surface, without loss of contact between the bodies. 2. The downslope movement of rock and earth material^[16].

sling. A joined loop of rope or tape^[25].

slocker. Local term used in the eastern Mendip Hills, England for a swallet or stream sink^[9].

slope. The inclination of a surface^[16].

slump pit. A hollow in the clay fill of a cave floor caused by erosion beneath the fill^[10].

smithsonite. A cave mineral — ZnCO_3 ^[11].

snow. Solid crystalline form of water^[16].

snow cover; snowpack. The accumulated height of snow covering a given area^[16].

snow line. A line connecting elevations above which snowpack remains throughout the year^[16].

snow sampler. A tube used for the taking of cylindrical snow samples through a snow profile^[16].

snowdrift. Snow accumulation due to wind transport^[16].

sod. Root system in a soil^[16].

soda straw. 1. Proto-stalactite in which water flow down through the center of the straw. Upon entering a vadose cave passage, the change in the partial pressure of carbon dioxide cause CO_2 degassing and the slow precipitation of CaCO_3 . The straw grows downwards as a result; water also flows down the outside of the straw causing the stalactite to grow outwards around the straw. 2. American name for straw stalactite^[9].

soddy karst. See subsoil karst.

sodium. A naturally occurring element (Na).

soil aggregate. Loosely cemented cluster of soil particles^[16].

soil air. The air that fills soil and rock interstices above the zone of saturation^[10].

soil bulk density. The mass of dry soil per unit bulk soil^[22].

soil-covered karst. See subsoil karst.

soil mechanics. The science of dealing with the mechanical properties of soils^[16].

soil moisture. Subsurface liquid water in the unsaturated zone expressed as a fraction of the total porous medium volume occupied by water. It is less than or equal to the porosity^[22].

soil-moisture meter. A device used to record soil moisture in situ^[16].

soil-moisture suction. The negative pore pressure exerted by capillary forces^[16].

soil profile. A vertical section of the soil mantle usually with distinguishable soil horizons^[16].

soil sample. A sample of soil on which soil properties are to be determined^[16].

soil swelling. The volume increase of soil due to swelling of unsaturated clay particles when in contact with water^[16].

soil water. See soil moisture.

soil-water pressure. The pressure (positive or negative), in relation to the external gas pressure on the soil water, to which a solution identical in composition with the soil water must be subjected in order to be in equilibrium through a porous permeable wall with the soil water^[22].

soilcover. A layer of soil material covering bedrock^[16].

soilwater zone. The upper portion of the zone of aeration containing soil water^[16].

solid matrix. An assembly of interconnected solid mineral grains surrounded by voids^[16].

solid volume. The volume of solid particles in a porous sample^[16].

solifluction. The slow flowage of mud streams in arctic regions.

solubility. The total amount of solute species that will remain indefinitely in a solution maintained at constant temperature and pressure in contact with the solid crystals from which the solutes were derived^[22].

solum. The top layers of a soil profile^[16].

solute. The substance present in a solution in the smaller amount. For convenience, water is generally considered the solvent even in 'concentrated' solutions with water molecules in the minority^[22].

solute transport. The net flux of solute through a hydrogeologic unit controlled by the flow of subsurface water and transport mechanisms^[22].

solution. 1. Synonym for dissolution, except that the product of the solution (or dissolution) process, is also termed a solution, this being a combination of liquid and non-liquid (solid or gaseous) components that exists as a liquid^[9]. 2. A homogeneous mixture of two or more components. In ideal solutions, the movement of molecules in charged species are independent of each other; in aqueous solutions charged species interact even at very low concentrations, decreasing the activity of the solutes^[22].

4. The change of matter from a solid or gaseous state to a liquid state by combination with a liquid^[10]. 5. The result of such change; a liquid combination of a liquid and a nonliquid substance^[10]. See corrosion.

solution breccia. A mass of rock composed of angular to rounded fragments of rock that have accumulated by solution of surrounding or underlying carbonate. See also collapse breccia.

solution flutes. See rillenkarren.

solution lake. A lake whose origin is attributed largely to solution of underlying rock.

solution notch. These form wherever humic soil borders on a very steep or vertical limestone surface. The rock becomes undercut by water rich in biogenic CO₂. In the cone karst of the humid tropics, foot caves occur which are over-sized enlargements of solution notches^[3].

solution pan. Shallow solution basin or closed depression formed on bare limestone, generally characterized by flat bottom and overhanging sides^[10]. The initial form is a closed hollow created by a humus patch. It may have over-hanging side walls and a flat floor covered by algae and small pieces or broken rock. Diameters are rarely greater than 15 cm^[3]. Synonyms: (German.) *Kamenitza* or *Kamenica*, *opferkeßel*; (British.) *panhole*; (Spanish.) *tinajita*. See *Kamenica*.

solution pipe. A vertical cylindrical hole attributable to solution, often without

surface expression, filled with debris, such as sand, clay, rock chips, and bones^[10]. Synonym: sand pipe. See also geologic organ.

solution runnel. See Rinnenkarren.

solution scarp. Escarpment formed by more active solution of lower area or by corrosional undercutting of the base of the escarpment^[10].

solution subsidence. 1. Any subsidence due to solution of underlying rock but particularly the subsidence of parts of a formation into hollows or pockets of an immediately underlying soluble formation^[10]. 2. A crater-like doline in rock other than karst limestone, formed by surface subsidence above solutionally enlarged fissures in a sub-surface karst limestone stratum^[19]. Synonyms: (French.) *affaissement par dissolution*; (German.) *Lösungstaschen*, *Lösungstrichter*; (Greek.) *katakáthisma thiá thialíseos*; (Italian.) *subsidenza per dissoluzione*, *subsidenza per suberosione*; (Russian.) *prosedanie vsledstvie rastvorenija*; (Spanish.) *subsidencia por disolucion*; (Turkish.) *erime alçalımı*; (Yugoslavian.) *korozivno urušavanje*.

sonar. A system for detecting obstacles by emitting sound and intercepting and interpreting echoes that bounce back. It is used by bats and also by oilbirds and some swiftlets when they fly in the darkness of caves^[23].

sorption. 1. A general term used to encompass the process of absorption and adsorption^[22]. 2. All processes which remove solutes from the fluid phase and

concentrate then on the solid phase of the medium^[22].

sótano. (Spanish for cellar or basement.) Term used in Mexico for deep vertical shafts in limestone, which may or may not lead to a cave^[10].

spangolite. A cave mineral — $\text{Cu}_6\text{Al}(\text{SO}_4)(\text{OH})_{12}\cdot 3\text{H}_2\text{O}$ ^[11].

species (singular or plural). A group of plants or animals whose members breed naturally only with each other and resemble each other more closely than they resemble members of any similar group^[23].

specific capacity. The rate of discharge of water from a well per unit of drawdown. It is commonly expressed as gpm/ft or $\text{m}^3/\text{day}/\text{m}$ and varies with pumping test duration^[6].

specific conductance. A measure of the ability of water to conduct an electrical current expressed in micromhos per centimeter at 25°C ^[22].

specific discharge. The rate of discharge of ground water per unit area of a porous medium measured at right angle to the direction of flow. Synonyms: Darcy velocity; seepage velocity.

specific drawdown. The amount of drawdown per unit discharge in a well^[16].

specific gravity. The weight of a particular volume of water that a given body of rock or soil will hold against the pull of gravity to the volume of the body itself. It is usually expressed as a percentage^[6].

specific retention, water retaining capacity. The ratio of the volume of water that a given body of rock or soil will hold against the pull of gravity to the volume of the body itself. It is usually expressed as a percentage^[6].

specific storage. The volume of water released from or taken into storage per unit volume of the porous medium per unit change in head^[6].

specific surface. The ratio of grain particle surface to the volume of grain particles^[16].

specific yield. The ratio of the volume of water that a given mass of saturated rock or soil will yield by gravity to the volume of that mass. This ratio is stated as a percentage^[6].

spelean. Of, pertaining to, or related to caves^[10].

speleogen. A secondary cave structure formed by dissolving, such as a dome pit or a scallop^[10].

speleogenesis. Although the term literally means the birth, origin or mode of formation of caves, the full extent of speleogenesis includes all the changes that take place between the inception and the eventual destruction of an underground drainage system. It includes development phases during which the active drainage voids are too small to be considered caves as normally defined, as well as phases when the cave no longer functions as a drain, is enlarging only by collapse and, eventually, is being totally removed^[9].

speleogenetics. The totality of all processes which effect the creation and development of natural underground cavities. These comprise corrosion, erosion, and incision, but are also influenced by lithology, tectonics, and climate.

speleologist. 1. A scientist engaged in the study and exploration of caves, their environment, and their biota^[10]. 2. Explorer of caves, caverns, and other underground openings especially in karst. Caver and potholer are slang terms^[20]. Synonyms: (French.) *spéléologue*; (German.) *Höhlenforscher*, *Speläologe*; (Greek.) *speleologos*; (Italian.) *speleologo*; (Russian.) *speleolog*; (Spanish.) *espeleólogo*; (Turkish.) *speleolo*, *mağarabilimci*; (Yugoslavian.) *speleolog*, *spiljar*, *jamar*.

speleology. 1. Scientific study of caves, including aspects of sciences, such as geomorphology, geology, hydrology, chemistry and biology, and also the many techniques of cave exploration^[9]. 2. The scientific study, exploration, and description of caves, cave organisms, and related features^[10]. 3. The branch of knowledge dealing with the study and exploration of underground caves^[20]. 4. Study, exploration, and description of caves, caverns, and other underground cavities in karst and rarely in lavas or ice^[20]. Synonyms: (French.) *spéléologie*; (German.) *Höhlenforschung*, *Höhlenkunde*; (Greek.) *speleologia*; (Italian.) *speleologia*; (Russian.) *speleologija*; (Spanish.) *espeleología*; (Turkish.) *speleoloji*, *mağarabilim*; (Yugoslavian.) *speleologija*, *pećinarstvo*, *jamarstvo*.

speleothem. 1. General term for all cave mineral deposits, embracing all stalactites, flowstone, flowers, etc. Most are formed of calcite whose precipitation processes, related mainly to carbon dioxide levels in the water, are the direct reverse of the dissolution of limestone. Climatic influences on dissolution processes ensure that speleothems are generally larger and more abundant in the caves of the wet tropics, which are typified by thick stalactites and massive stalagmites, in contrast to the straws and flowstones of alpine caves^[9]. 2. General term for stalactites, stalagmites, moonmilk, helictites, and other secondary mineral deposits in caves and caverns^[20]. 3. A secondary mineral deposit formed in caves, such as stalactite or stalagmite^[10]. Synonyms: (French.) *concrétions cavernicoles*; (German.) *Höhlenformation*; (Greek.) *speleolithoma*; (Italian.) *concrezione*; (Russian.) *natecniia obrazovanija*; (Spanish.) *concreción (estalagmítica o estalactítica)*; (Turkish.) *magara oluşturu*; (Yugoslavian.) *sige*. See also cave formation.

spelunker. See caver.

spelunking. See caving.

spencerite. A cave mineral — $Zn_4(PO_4)_2(OH)_2 \cdot 3H_2O$ ^[11].

sphalerite. A cave mineral — ZnS ^[11].

spillway. A device that allows for the escape of excess water^[16].

Spitzkarren. (German.) These are isolated projections that may be of a beehive form

or may be sharply pointed and tend to lie between grikes and the strike ribs of bedding grikes^[8]. See also grike; bedding grike; clint.

Spitzkegelkarst. (German.) Tropical karst topography containing sharply pointed residual limestone hills^[10].

splash cup. The shallow concavity in the top of a stalagmite^[10].

spongework. 1. Randomly shaped cavities created by undirected phreatic dissolution in a massive, essentially homogeneous limestone. Fine examples occur in Carlsbad Caverns, New Mexico^[9]. 2. An arrangement of partitioned depressions found in cave ceilings and walls, and attributed to the differential solution of submerged karst limestones. Larger and more isolated hollows are known as 'pockets'^[19].

spongework cave pattern. A complex maze cave pattern consisting of irregular interconnecting cavities with intricate perforation of the rock. The cavities may be large or small. All spongework patterns are non-branching in development and contain profuse travertine. In map view, these caves often appear as an irregular ink blot.

spontaneous potential. See self-potential.

spore tracer. Dyes spores of the fern, *Lycopodium clavatum*, used to label ground water in karstic terranes. Synonyms: (French.) *traceur marqueur*; (German.) *Sporenmarkierung*; (Greek.) *lycopodium ichnithetis*; (Italian.) *tracciante vegetale*; (Spanish.) *trazador*

de esporas; (Turkish.) *spor izleyici*. See isotope tracer, *Lycopodium* spores.

spring. 1. Point where underground water emerges on to the surface, not exclusive to limestone, but generally larger in cavernous rocks. The image of a trickle of water springing from a hillside hardly matches that of a vast cave pouring forth a river, but both are called springs. Among the world's largest is the Dumanli spring, Turkey, with a mean flow of over 50 cubic meters per second. Springs may be exurgences or resurgences, depending upon the source of their water, and also may be vaclusian in character^[9]. 2. A natural outflow of water (or other liquid or gas) at the surface of the land or into surface water. In some usages, 'spring' is restricted to the water which outflows, in other usages the word can refer to the water, the outlet, or to the locality of the outflow^[20]. 3. Any natural discharge of water from rock or soil onto the surface of the land or into a body of surface water^[10]. 4. A discrete place where ground water flows naturally from a rock or the soil onto the land surface or into a body of surface water^[22]. Synonyms: (French.) *source*; (German.) *Quelle*; (Greek.) *pighi*; (Italian.) *sorgente*; (Russian.) *istocnik*; (Spanish.) *fuenta*; (Turkish.) *kynak*. See also seep.

spring, artesian. Water flowing under artesian pressure with the potentiometric surface above the land surface^[16].

spring, barrier. A subsurface barrier forcing water to rise to ground surface and discharge as a spring^[16].

spring, boiling. 1. An uncommon type of vauculian spring, where the flow is large enough in a constricted site to form turbulence on the surface of the resurgence pool^[9]. 2. (Jamaican.) A. variable-discharge artesian spring in which hydrostatic pressure is great enough to cause a turbulent or even fountain-like discharge^[19]. See also blue hole.

spring, boundary. A spring located at the boundary between a permeable formation overlying an impermeable substratum^[16].

spring, cave. A spring rising in a cave^[10].

spring, contact. A spring formed at the intersection of the land surface and a permeable water-bearing formation overlying a less permeable formation^[16].

spring, depression. A spring originating at the intersection of the land surface with the water table^[16].

spring, drowned. A spring which continues to function as a spring after it has become submerged by rising sea or lake levels or by subsidence of the ground^[20].
Synonyms: (French.) *source sous-aquatique, source noyé*; (German.) *submarine Quelle, sublacustre Quelle*; (Greek.) *vetthithesa pigí*; (Italian.) *sorgente sommersa*; (Russian.) *subakvaljnij istočnik*; (Spanish.) *fuelle subacuática*; (Turkish.) *batık kaynak*; (Yugoslavian.) *potopljen izvor, potopljeno vrelo, potopljen izvir (vrec)*. Related to spring, sublacustrine, spring, submarine.

spring, ebb-and-flow; ebbing-and-flowing well. A spring (flowing well or borehole) exhibiting periodic variation in volume of flow; this variation, which may be regular or irregular, is often attributed in karst regions to siphonic action. Ebb-and-flow springs differ from intermittent springs because the latter can be related to seasonal variations in rainfall^[20].
Synonyms: (French.) *source intermittente*; (German.) *intermittierende Quelle*; (Greek.) *pighí ambótidos kai palírrrias*; (Italian.) *sorgente carsica intermittente*; (Russian.) *sifonnij istocnik*; (Spanish.) *manatial intermittente, fuente intermittente*; (Turkish.) *soğultkan kaynak*; (Yugoslavian.) *periodicni ixvor, periodicni izvir*. See also spring, periodic. Related to intermittent spring.

spring, drowned. A spring which continues to function as a spring after it has been submerged by rising sea or lake levels or by subsidence of the ground^[20].
Synonyms: (French.) *source sous-aquatique, source noyé*; (German.) *submarine Quelle, sublacustre Quelle*; (Greek.) *vetthithesa pigí*; (Italian.) *sorgente sommersa*; (Russian.) *subakvaljnij istočnik*; (Spanish.) *fuelle subacuática*; (Turkish.) *batık kaynak*; (Yugoslavian.) *potopljen izvor, potopljeno vrelo, potopljen izvir (vrec)*. Related to sublacustrine spring, submarine spring.

spring, fracture. A spring with its outflow openings consisting of fractures^[16].

spring, fullflow. A spring that is the sole drain of an area.

spring, gravity. A spring flowing as a result of gravity^[16].

spring head alcove. The arcuate cliff surrounding many risings, formed by progressive headward sapping and cavern collapse. The rapidity of their formation is increased by the cliff-line which frequently exists already at the lower margin of the karst area^[19].

spring, intermittent. 1. A karst spring with a pulsating flow, caused by the presence within the rock of cavities and siphons fed by a subterranean watercourse. When the cavity is full, the siphon is complete and causes a pulse of water to issue from the spring. This diminishes or empties the water supply in the cavity and no further water is discharged from the spring until the system is reactivated. The discharge is said to be a *reciprocating* spring when a reduced level of flow is maintained between pulses^[19]. 2. A spring flowing at irregular intervals^[16]. Synonyms: (French.) *source temporaire, source intermittente*; (German.) *intermittierende Quelle, periodische Quelle*; (Greek.) *thialepousa pege*; (Italian.) *sorgente temporanea, sorgente intermittente*; (Russian.) *peremezajuscij sja istočnik*; (Spanish.) *fuelle intermitente, fuente temporal*; (Turkish.) *kesintili kaynak*; (Yugoslavian.) *periodicko vrelo, potajnica, obdovni izvir*. Related to spring, ebb-and-flow; spring, periodic.

spring, karst. A spring emerging from karstified limestone^[10]. See also emergence; exurgence; resurgence; rise.

spring, medicinal. A spring with healing properties^[16].

spring, mineral. A spring having a high mineral content.

spring, overflow. A spring that is part of a distributary but which drains only at the level above base flow.

spring, perched karst. The emergence of underground water some where above the basement of a calcareous massif caused by the interbedding of an impermeable or intermittent *perched water table* by restricting the vertical movement of water, which instead issues from the contact^[19].

spring, perennial. Stream flowing above land surface throughout the year^[16].

spring, periodic. A spring that shows variation in flow that is either regular or irregular. It may be due to siphonic action^[20]. Synonyms: (French.) *source périodique*; (German.) *Periodische Quelle, intermittierende Quelle*; (Greek.) *periodhiki piyi*; (Italian.) *sorgente periodica*; (Spanish.) *fuelle periódica*; (Turkish.) *periyodik kaynak*; (Yugoslavian.) *periodičini izvir (izvir)*. See ebb-and-flow spring. Related to intermittent spring.

spring, saline. Spring water having a high salt content^[16].

spring, seepage. A spring where surface discharge occurs from numerous small openings^[16]. Synonym: filtration spring.

spring, subaqueous. A spring that discharges below the surface of a water body (e.g. ocean, lake, river, or stream)^[16].

spring, sublacustrine. A spring emerging in the bed of a lake predominantly in karst areas^[20]. Synonyms: (French.) *source*

sous lacustre; (German.)
Unterwasserquelle, sublacustre Quelle;
(Greek.) *ypovrichios pighi*; (Italian.)
sorgente sublacustre; (Russian.) *istocnik*
na dne ozera; (Spanish.) *fuenta*
sublacustre; (Turkish.) *gölalti kaynağı*.
See spring, drowned.

spring, submarine. 1. A spring emerging in a sea or lagoon predominantly in karst terranes. This is a descriptive term generally corresponding to the genetic term 'drowned spring'^[20]. 2. Large offshore emergence, generally from cavernous limestone, but in some areas from beds of lava^[10]. Synonyms: (French.) *source sous marine*; (German.) *Untermeeresquelle, Grundquelle, submarine Quelle*; (Greek.) *ypothalassia pighi*; (Italian.) *sorgente sottomarina*; (Russian.) *submarinnij istocnik*; (Spanish.) *fuenta submarina*; (Turkish.) *denizalti kaynağı*; (Yugoslavian.) *vrulja*. See spring, drowned.

spring, thermal. A spring with temperature of the spring water above the average temperature of superficial rock^[16].

spring, tubular. A spring issuing from a round channel such as a tubular passage^[16].

spring, unconformity. A spring issuing at the contact of an aquifer with an unconformity.

spring, underflow. A spring that is part of a distributary but which is at lower elevation and preferentially drains base flow. Between it and an overflow spring there may be several underflow-overflow springs.

spring, valley. Springs occurring at valley sides where the water table intersects the land surface.

spring, vauclosian; rising, vauclosian. 1. A type of rising or spring where direct drainage from the phreas flows up a flooded cave passage under pressure to emerge in daylight. The term is best applied where water rises from a vertical or very steep bedrock passage. Such risings are named after the Fontaine de Vaucluse in southern France. The River Sorgue rises from the Fontaine with a mean flow of 26 cubic meters per second. Its upper part is steeply inclined, but at a depth it is vertical. A diver has reached a depth of -200m, and a robot reached -243m, below which the flooded shaft continues^[9]. 2. Large karst spring (name by Fournet, after la Sorgue en Vaucluse, France) characterized by a stream surging up as from a siphon. Also applied to karst springs with artesian characteristics^[20]. 3. A large spring or exsurgence of an underground river, generally from limestone, that varies greatly in output and is impenetrable except with diving apparatus^[10]. Synonym: (American.) *gushing spring*; (French.) *source vauclosienne, bouillidou (South of France)*; (German.) *Vauclusequelle, (Riesenquelle)*; (Greek.) *kephalari/vauclusiana pighi*; (Italian.) *sorgente valchiusana*; (Russian.) *vokljuz*; (Spanish.) *fuenta vauclosiana, ojo, heryidero*; (Turkish.) *basınçlı kaynak*; (Yugoslavian.) *voklisko vrelo, obrh*. See also gushing spring.

squeeze. A narrow passage or opening just passable with effort. Differs from flattener in that there is little spare space in any direction^[10].

staff gage. A fixed graduated scale^[16].

stage. Water surface elevation at a point along a stream, river, lake, etc., above an arbitrary datum^[16].

stage-discharge relation. See rating curve.

stage hydrograph. The elevation of stage plotted against time^[16].

stage record. Stage discharge relations presented in tabulated form^[16].

stagnalite. A general term including stalactite and stalagmite. Superseded by dripstone^[10].

stagnation point. The foremost point on a streamline dividing an area of pumping depression from a zone of influence in a tilted aquifer being pumped by a well^[16].

stalactite. 1. Speleothem, generally of calcite, formed by dripping water and hanging from a cave roof. Stalactites embrace an enormous variety of sizes and shapes. They form where percolation water seeps from a cave ceiling and becomes saturated with respect to calcite due to loss of carbon dioxide into the cave air. Calcite is precipitated round the rim of the water droplet and continued deposition creates a hollow tubular straw stalactite (soda straw). Additional deposition of calcite on the outside of the initial cylinder creates an ordinary tapering stalactite. Almost infinite variation in shape may be influenced by changes in water flow, cave air chemistry, evaporation, temperature or dissolved impurities, and by crystal growth blocking flow paths. They are the most

common speleothem. Though the single 7m long stalactite in Ireland's Poll an Ionain is not the world's longest, it is uniquely spectacular against the dark chamber walls^[9]. 2. Conical deposit of calcite or aragonite often with a hollow center hanging from the roof of a cave or cavern formed by precipitation of carbonate due to escape of CO₂ from hanging water beads and to evaporation of part of the water^[20]. 3. A cylindrical or conical deposit of minerals, generally calcite, formed by dripping water, hanging from the roof of a cave, generally having a hollow tube at its center. From Greek word meaning exude drops^[10]. Synonyms: (French.) *stalactite*; (German.) *Tropfstein*, *Stalaktit*; (Greek.) *stalaktitis*; (Italian.) *stalattite*; (Russian.) *stalaktit*; (Spanish.) *estalactita*; (Turkish.) *sarkıt* (Yugoslavian.) *mosur*, *viseci kapnik*, *stalaktit*.

stalagmite. 1. Speleothem, normally of calcite, formed by upward growth from a cave floor, and therefore the complement of a stalactite. Stalagmites form when dripwater that is still saturated falls from a cave roof or stalactite and, when or after it lands, loses more carbon dioxide to the cave air, causing precipitation of calcite. They vary in size and shape, from tall thin towers to wide domes that grade into flowstone, the main controls being drip rate and height, and saturation levels of the water. The stalagmites of Aven Armand, France, are of the multiple splash-cup variety while being notably slender and up to 30m tall. Spectacularly massive stalagmites occur in the Carlsbad and Cottonwood Caves of New Mexico^[9]. 2. Columnar or partly irregular deposit of calcite or aragonite on the floor of a cave or cavern formed by the precipitation of

carbonates due to escape of CO₂ from water dripping from the roof^[20]. 3. A deposit of calcium carbonate rising from the floor of a limestone cave, formed by precipitation from a bicarbonate solution through loss of CO₂. The water drops on the stalagmite from above. From Greek word meaning drip^[10]. Synonyms: (French.) *stalagmite*; (German.) *Bodenzapfen*, *Stalagmit*; (Greek.) *stalagmitis*; (Italian.) *stalagmite*; (Russian.) *stalagmit*; (Spanish.) *estalagmita*; (Turkish.) *dikit*; (Yugoslavian.) *óulak*, *stojeći kapnik*, *stalagmit*. See also dripstone.

stalagmite, capillary. See capillary stalagmite.

standard deviation. A measure of variability of the square of individual deviations from their mean^[16].

standing line. A rope of approximately 0.4375 inches or 11 mm in diameter that is tied to a solid anchor and is used for descending and ascending^[13]. See also ascender; knot; mechanical ascender; prusik knot; prusiking.

state of solution. The degree to which a mineral or rock has gone into solution^[16].

static head. See head, static.

static water level. The level of water in a well that is not being affected by withdrawal of ground water^[6].

station. A survey point in a chain of such points in a survey^[25].

steady flow. Flow where the velocity at a point remains constant with respect to time^[16].

steam hole. An opening from a cavity through which a current of air charged with vapor blows upwards and condenses at the orifice to appear as steam. Such openings are an occasional feature in karst terranes^[20]. Synonyms: (French.) *puits à vapeur*, *puits fumant*; (German.) *Dampfschlot*; (Greek.) *atmotrypa*; (Spanish.) *cavidad fumante*; (Turkish.) *buhar deliği*.

steep. The property of inclination with a very steep gradient^[16].

steephead. A deeply cut valley, generally short, terminating at its upslope end in an amphitheater, at the foot of which a stream may emerge^[10].

stegamite. A speleothem projecting upwards from a cave floor in the form of a calcite ridge. A medial crack appears along the top of the ridge where water is thought to be forced from the speleothem under capillary action^[25].

stemflow. Rain water flowing down the stem of plants^[16].

stereo aerial photographs. Aerial photographs shot in sequence over a landscape so that when adjoining photos are viewed at the proper interpupillary spacing, features may be seen in three-dimensions.

stereogram. A block diagram or three-dimensional diagram^[16].

stilling well. A well connected to a flowing stream or spring through a bottom conduit permitting elevation measures to be taken in quiescent water^[16].

stomatal transpiration. The transpiration by escape of water through pores (stomata) of leaves^[16].

stone forest. See shilin.

stopping. The upward migration of the ceiling in a passage or room by the action of slabs falling^[13].

storage capacity. 1. The ability of an aquifer to store water^[16]. 2. The capacity of rivers to store water in their own channel^[16].

storage coefficient. 1. The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head^[22]. In a confined aquifer, the water is derived from storage with decline in head resulting from an expansion of the water and compression of the aquifer. Similarly, water added to storage with a rise in head is accommodated partly by compression of the water and partly by expansion of the aquifer. In an unconfined aquifer, the amount of water so released or accepted is generally negligible compared to the amount involved in gravity drainage or filling of pores, hence, in an unconfined aquifer, the storage coefficient is virtually equal to the specific yield. 2. The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head (virtually equal to the specific yield in an unconfined aquifer.) 3. The volume of

water a confined hydrogeologic unit releases from or takes into storage per unit subsurface area of the hydrogeologic unit per unit change in head.

storage gage. A precipitation gage for collecting and storing the total amount of inflowing water to be read at long intervals^[16].

storage in depressions. Water retention in surface depressions^[16].

storativity. See storage coefficient.

storm. 1. A disturbance of average meteorological conditions and usually connected with precipitation^[16]. 2. A period of precipitation over a specific drainage basin^[16].

strath terrace. An erosional remnant of an elevated broad river valley^[16].

stratification. 1. A depositional structure of sedimentary rocks in beds and layers^[16]. 2. The separation into non-discrete layers of water as a result of chemical, saline, or temperature differences which in turn create density differences in the water.

stratigraphic column. A graphic means of representing the various rock types of an area in a geologic report^[13].

stratigraphic sequence. The sequence of rock types in an area^[13].

stratum. A sedimentary bed or layer^[16].

straw stalactite; straw. 1. The simplest form of stalactite — a fragile, thin walled tube, normally of calcite, which is the

diameter of the drops of water that hang from its end and continue its growth. Though only about 5mm in diameter, straw stalactites (or straws) may grow to great length in clusters of spectacularly dense profusion, more commonly in caves of cooler climates. The length record may be held by a 6m straw in Easter Cave, Western Australia. Also known as straw stalactite or soda straw^[9]. 2. Thin tubular stalactite, generally less than a centimeter in diameter and of very great length (examples as long as 4 meters); also called soda straw^[10]. See also soda straw; stalactite.

stream. A body of flowing water^[16].

stream bed. The bottom of a stream covered by water^[16].

stream development. The ratio of actual tortuous stream length between two points on a straight line connecting these points^[16].

stream flow. The total runoff confined in a stream and its' channel^[16].

stream frequency. Channel frequency; the number of stream segments per unit area^[16].

stream order. The hierarchic order of stream segments according to tributaries^[16].

stream profile. The elevation of the main stream bed as a function of distance from outflow.

stream sink, streamsink. Point at which a surface stream sinks into the ground^[10].

See also doline; ponor; sink; sinkhole; sumidero; swallet; swallow hole.

stream tube. 1. A cave passage completely filled, now or in the past, with fast-moving water and whose ceiling and walls normally show scallops^[10]. 2. The imaginary space formed between two adjacent streamlines in which flow is constant (assuming steady flow conditions). Synonyms: (French.) *conduite forcée*; (German.) *Druckflußrohr*; (Greek.) *ypóghios síranx*; (Italian.) *condotta forzata*; (Spanish.) *tubo (o conducto) fréatico*; (Turkish.) *akarsu mecrası*. See conduit, pressure flow tube.

streamline. A curve that is everywhere tangent to the specific discharge vector and indicates the direction of flow at every point in a flow domain.

streamtube. A cave passage completely filled, or formerly filled, with fast-moving water and whose ceiling and walls normally possess scallops^[10].

strength. The maximum stress which a material can resist without failing for any given type of loading.

stress. The force acting across a given surface element divided by the area of the element.

stress, applied. The downward stress imposed at an aquifer boundary. It differs from effective stress in that it defines only the external stress tending to compact a deposit rather than the grain-to-grain stress at any depth within a compacting deposit^[21].

stress, effective. Stress (pressure) that is borne by and transmitted through the grain-to-grain contacts of a deposit, and thus affects its porosity or void ratio and other physical properties. In one-dimensional compression, effective stress is the average grain-to-grain load per unit area in a plane normal to the applied stress. At any given depth, the effective stress is the weight (per unit area) of sediments and moisture above the water table, plus the submerged weight (per unit area) of sediments between the water table and the specified depth, plus or minus the seepage stress (hydrodynamic drag) produced by downward or upward components, respectively, of water movement through the saturated sediments above the specified depth. Thus, effective stress may be regarded as the algebraic sum of the two body stresses, gravitational stress, and seepage stress. Effective stress may also be regarded as the difference between geostatic and neutral stress^[21].

stress, geostatic. The total load per unit area of sediments and water above some plane of reference. It is the sum of (1) the effective stress, and (2) the neutral stress^[21].

stress, neutral. Fluid pressure exerted equally in all directions at a point in a saturated deposit by the head of water. Neutral pressure is transmitted to the base of the deposit through the pore water, and does not have a measurable influence on the void ratio or on any other mechanical property of the deposits^[21].

stress, preconsolidation. The maximum antecedent effective stress to which a

deposit has been subjected, and which it can withstand without undergoing additional permanent deformation. Stress changes in the range less than the preconsolidation stress produce elastic deformations of small magnitude. In fine-grained materials, stress increases beyond the preconsolidation stress produce much larger deformations that are principally inelastic (nonrecoverable)^[21].

stress, seepage. When water flows through a porous medium, force is transferred from the water to the medium by viscous friction. The force transferred to the medium is equal to the loss of hydraulic head. This force, called seepage force, is exerted in the direction of flow^[21].

stress, shear. Stress directed parallel (tangential) to the surface element across which it acts.

strike. The direction or azimuth of a horizontal line in the plane of an inclined stratum, joint, cleavage plane or other planar feature within a rock mass.

strike valley. A valley following the strike of underlying strata^[16].

structure. One of the larger features of a rock mass (*e.g.*, bedding, foliation, jointing, cleavage, brecciation, etc.). Also the sum total of such features as contrasted with texture. In a broader sense, it refers to the structural features of an area such as anticlines or synclines.

structural factor. Features modifying or interrupting the continuity of rock types^[16].

structural geology. That part of geology dealing with structures formed in rocks^[16].

struga. (Slavic.) A corridor formed along a bedding plane in karst country^[10].

styglobite. An aquatic troglobite^[23].

stygophile. An aquatic troglophile^[23].

stygoxene. An aquatic troglaxene^[23].

stylolite. An irregular suture-like boundary developed along some bedding planes in limestones, probably caused by dissolution under pressure and possibly related in some cases to subsequent inception of speleogenesis^[9].

subaqueous spring. See spring, subaqueous.

subaqueous karst. A karst terrane that is covered by a discrete body of water^[17]. See also drowned karst; subfluvial karst; submarine karst.

subartesian well. An artesian well with insufficient head to raise water above the land surface^[16].

sub-conduit. Any void, whether of tectonic or dissolutional origin, that is smaller than the accepted defined size of a conduit. Sub-conduits originate under inception conditions and enlarge during gestation, but many fail to achieve larger dimensions when drainage later becomes concentrated along preferred routes. In most cases, however, they will continue to function as part of the micro-fissure, or percolation, system within the rock mass.

Sub-conduits are an essential part of a continuum of void sizes that extends between microscopic discontinuities and the largest tube passages^[9].

subcutaneous drain. Discrete percolation drains contained within the epikarst zone and leading to the transition zone. See also epikarst zone; subcutaneous flow; subcutaneous zone; transition zone.

subcutaneous flow. Lateral and vertical flow that occurs within the epikarst zone under saturated conditions. Lateral flow distances can exceed hundreds of meters and several meters per day while vertical within discrete percolation drains (subcutaneous drains) may allow flow rates in excess of several hundred meters per hour. See also epikarst zone; subcutaneous drain; subcutaneous zone; transition zone.

subcutaneous zone. Synonym for epikarst zone. See epikarstic zone.

subfluvial karst. Karst topography developed beneath a river. See also subaqueous karst.

subjacent karst. Karst landscape in non-carbonate rocks due to presence of karstified rocks beneath the surface formation^[10]. Synonyms: (French.) *karst sous-jacent*; (German.) *unterirdisches Karstphänomen*; (Greek.) *ypokímenon karst*; (Russian.) *pokritij karst*; (Spanish.) *karst subyacente*; (Turkish.) *gizli karst*; (Yugoslavian.) *pokriven kŕs(kras)*. See also interstratal karst.

subkutan karst. See subsoil karst.

sublacustrine spring. See spring, sublacustrine.

sublimation. The direct conversion of water from its solid state to the vapor phase^[16].

submarine karst. Karst topography developed below the tidal zone. See also subaqueous karst.

submarine spring. See spring, submarine.

subpermafrost karst. Underground karst in areas of permafrost. Karstification is due to the solvent action of subpermafrost (or intrapermafrost) water^[20]. Synonyms: (French.) *karst sous-permafrost*; (German.) *Pseudokarst*; (Greek.) *karst ypomonímou paghetoú*; (Italian.) *carsismo di subpermafrost*; (Russian.) *podmerzlonij karst, mezmerzlotnij karst*; (Spanish.) *karst de subpermafrost, karst de intrapermafrost*; (Turkish.) *don alanı yeraltı karstı*. See permafrost karst. See also intrapermafrost karst.

subpermafrost water. Ground water below the permafrost^[16].

subsequent river. 1. A river flowing along the strike of a weak formation^[16]. 2. A tributary to a consequent river^[16].

subsidence. Lowering of the surface of the ground because of removal of support. Caused in karst areas by subterranean solution or collapse of caves^[10].

subsidence doline. A closed karst depression formed due to local subsidence of the surface rocks and/or soil into cavities formed by widespread

dissolution or local collapse of caves. The type of subsidence doline formed by downwashing of the soil cover is better described as a suffosion doline^[9]. Also known as sinkhole.

subsidence/head-decline ratio. The ratio between land subsidence and hydraulic head decline in the coarse-grained beds of the compacting aquifer system^[21].

subsoil karst. Karst covered by soil, usually residual soil^[17]. Synonyms: (British.) *soddy karst*; (French.) *karst vert, karst subcutané*; (German.) *bedeckter Karst, bodenbedeckter Karst, grükarst, subkutan karst*; (Greek.) *ypethaphikon karst*; (Russian.) *zadernovannyĭ karst*; (Spanish.) *karst subcutáneo*; (Turkish.) *toprakaltı karstı*; (Yugoslavian.) *pokriveni kŕs(kras)*. See also covered karst.

subsurface divide. See underground divide.

subsurface flow. See subsurface runoff.

subsurface runoff, storm seepage, subsurface flow, subsurface storm flow. Runoff due to infiltrated precipitation moving laterally under the surface.

subsurface water. All water that occurs below the land surface^[22].

subterranean. Beneath the land surface^[16].

subterranean cut-off. The diversion underground of a surface watercourse beneath a surface meander neck, marked by a swallow hole on the upstream side

and a spring on the downstream side^[19].
See also stream piracy.

subterranean river, subterranean stream.

Underground stream of flowing water in caves and caverns, but not necessarily large^[10]. See also underground stream.

suction. See moisture tension.

suffosion. Undermining through removal of sediment by mechanical and corrosional action of underground water^[20].

Synonyms: (French.) *soutirage karstique*; (German.) *Anzapfung*; (Greek.) *ypoghion thiavrosis*; (Russian.) *suffozija*; (Spanish.) *sufosión*; (Turkish.) *karstik yeraltısuyu kazıması*; (Yugoslavian.) *sufozija*.

suffosion doline. More accurate synonym for a type of subsidence doline, indicating formation by the suffosion, or downwashing, of the soil into an underlying fissure^[9]. Also known as shakehole.

sulfate. A mineral compound characterized by the sulfate radical SO_4^{2-} . Anhydrous sulfates, such as barite, BaSO_4 , have divalent cations linked to the sulfate radical; hydrous and basic sulfates, such as gypsum, $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$, contain water molecules^[11].

sulfate minerals. Minerals containing the SO_4^{2-} radical, formed by precipitation from water. The most common are the anhydrous and hydrated calcium sulfates, anhydrite (CaSO_4) and gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$). Sulfates are deposited as a generally minor component of most carbonate successions, but due to their

high solubility they may not survive subsequent dissolution by ground water. Even if they survive subsequent dissolution by ground water. Even if they survive at depth, they tend to dissolve as they are raised nearer to the surface following uplift and erosion of overburden. Removal of sulfates by dissolution may contribute to the early establishment of secondary permeability in limestone sequences. Sulfate solutions have a limited corrosional effect upon calcium carbonate, but may also be oxidized to produce sulphuric acid, which is highly corrosive of limestone.

sulfate-reduction karst. Karst topography developed in the subsurface where solution of bedrock is chiefly a result of sulfate reduction by petroleum hydrocarbons aided by bacterial processes that oxidize hydrocarbons to yield carbon dioxide. Little, if any of the water that dissolves the rock is meteoric^[17].

sulfide. A mineral compound characterized by the linkage of sulfur with a metal or semimetal, such as galena, PbS , or pyrite, FeS_2 ^[11]. See also gypsum and pyrite.

sulfide minerals. Minerals that are composed of one or more metals combined with sulphur. The most common is pyrite. They are believed to be produced by the metabolic action of micro-organisms, and are found in many sedimentary rocks, usually in trace amounts.

sumidero. (Spanish.) 1. A swallow hole. 2. In Latin America, any closed depression caused by solution^[10].

summation curve. A curve of cumulated values^[16].

summit. The highest point of a physiographic feature^[16].

sump. 1. In caves a sump is a section of flooded passage. This may be a perched sump, probably quite short, within a vadose cave and created by a local reverse passage gradient. Alternatively it may be a major feature, where a cave passage descends below the regional water table into the phreas, as is common at the lower end of many cave systems. Some short sumps can be dived without the use of breathing apparatus, but most are restricted to exploration by cave divers. Logistics are a barrier to endless sump penetrations, but some have now been explored for many kilometers in length, notable in Cocklebidy Cave, Australia, the Nohoch Nah Chich and other great flooded systems in Mexico's Yucatan, and behind Keld Head in Yorkshire^[9]. 2. A pool of underground water or point on an underground stream that has a submerged extension, the nature of which has not been determined^[10]. 3. A place where the ceiling of a passage drops to and below water level in a cave, leaving no air space with the cave passage continuing underwater^[13]. 4. A water trap.

sulfuric acid. An acid (H₂SO₄).

sunken pan. An evaporation pan buried in the ground for equal elevation of the water surface with the ground surface^[16].

superimposed valley. A valley established on the land surface with a pattern that is independent of the underlying rock structure.

supersaturated. Referring to water that has more limestone or other karst rock in solution than the maximum corresponding to normal conditions^[25].

supersaturation. A liquid that is over saturated with respect to whatever particles may be contained in the fluid.

suprapermafrost karst. Surface karst in areas or permafrost. Karstification is due to the solvent action of suprapermafrost water^[20]. Synonyms: (French.) *karst suprapermafrost*; (German.) *Pseudokarst*; (Greek.) *karst epi monimou paghetoú*; (Italian.) *carsismo superficiale di permafrost*; (Russian.) *nadmerzlotnij karst*; (Spanish.) *karst de suprapermafrost*; (Turkish.) *don alanı yüzey karstı*. See also permafrost karst.

suprapermafrost water. Ground water above permafrost^[16].

surf karren. Surf karren form along marine limestone and dolomite coasts where the surf sprays water onto abrasion surfaces that lie slightly above normal sea level. They are a result of corrosion caused by the mixing of sea- and rainwater, but do not exist under the sea surface as seawater is not limestone-corrosive. Beyond the splashwater zone the karren are much less sharp^[3].

surfactant. A substance capable of reducing the surface tension of a liquid in which it is dissolved. Used in air-based

drilling fluids to produce foam, and during well development to disaggregate clays^[6]. Surfactants are now being considered for the purpose of aquifer remediation by helping disperse immiscible contaminants.

surface detention. Sheet flow of water in overland flow before a channel is reached^[16].

surface entry. An opening immediately at the land surface that permits infiltration to take place^[16].

surface film. A monomolecular film of organic compounds forming on water or grain surfaces^[16].

surface mapping. The topographic and geodetic mapping of an area^[16].

surface mine. Strip mine^[16].

surface retention. Water held on land surface^[16].

surface runoff. That part of runoff traveling over the ground surface and through channels^[16].

surface seepage. Surface discharge of ground water not important enough to form a rivulet^[16].

surface spreading. A method of artificial recharge of water to an aquifer by spreading on a surface^[16].

surface tension. The free specific surface energy occurring at the interface between a liquid and its own vapor phase^[16].

surface water. Water obtained from surface supplies^[16].

survey. In caving, the measurement of directions and distances between survey points and of cave details from them, and the plotting of cave plans and sections from these measurements either graphically or after computation of coordinates^[25].

sušica. Yugoslavian term for intermittent stream or river in a karst terrane in which the water diverts and soaks gradually into the karst ground-water system^[20]. See also intermittent river.

suspended load. Detrital matter being transported in suspension by a moving stream^[16].

suspended matter. Solid matter small enough to be held in suspension by moving or stagnant water^[16].

suspended water. See vadose water.

sustained yield. The rate at which water can be withdrawn from an aquifer without depleting the supply^[16].

suunto clinometer[®]. A small, handheld pendulum clinometer commonly used in cave survey^[25].

suunto compass[®]. A small, handheld sighting compass commonly used in cave survey^[25].

swale. A marshy depression or depression in a ground moraine^[16].

swallet, swallow hole. (British.) A place where water disappears underground in a limestone region. A swallow hole generally implies water loss in a closed depression or blind valley, whereas a swallet may refer to water loss into alluvium at a streambed, even though there is no depression^[10]. See also doline; ponor; sink; sinkhole; stream sink; sumidero.

swelling. The volume increase due to intake and absorption of water, especially clays^[16].

swelling rate. The time rate of volume increase^[16].

swirlhole. A hole in rock in a streambed eroded by eddy water, with or without sand or pebble tools^[25].

synclinal valley. A valley following the axis of a syncline^[16].

syncline. Downfolded stratum^[16].

syngenetic karst. 1. Karst developed contemporaneously with the lithification of the formation, as in eolian calcarenite where lithification and karstification of dune sands may proceed simultaneously^[10]. 2. Karst landforms that developed upon young, porous carbonate rocks, such as aeolianites, as they underwent lithification^[9].
Synonyms: (French.) *karst syngénétique*; (German.) *Syngenetischer Karst*; (Greek.) *synegeticon karst*; (Italian.) *carsismo singenetico*; (Spanish.) *karst singenético*; (Turkish.) *eştürümlü karst*; (Yugoslavian.) *singenetski kŕs(kras)*.

syngenite. A cave mineral —
 $\text{K}_2\text{Ca}(\text{SO}_4)_2 \cdot \text{H}_2\text{O}$ ^[11].

synoptic network. A network of first order stations permitting the regular observation of weather for all points at the same time^[16].

synthetic unit hydrograph. A unit hydrograph constructed by assuming the reaction of a drainage basin will be based on its physical characteristics^[16].

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