

Applied Petrography Group Special Report : SR3 Part 1 (Draft for Comment, June 2010)

DISCLAIMER

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SR3 Part 1: Aggregate Terminology

(Note: Many definitions are based on those given in Aggregates (1993) 2nd Edition Geological Society SP 9, Eds. Smith M R and Collis L. Some definitions are based on National Standard Publications, ASTM and on the definitions in European Standards)

Accessory minerals – Minerals which are only minor constituents of a rock and are not essential to its broad classification, though they may be used to distinguish varieties of rock. (Smith and Collis 1993).

Added filler - filler aggregate of mineral origin, which has been produced separately (EN 13242)

Agglomerate – A volcanic breccias, i.e. a chaotic assemblage of mainly coarse angular to rounded pyroclastic materials.

Aggregate - Granular material used in construction. Aggregates may be, either processed from natural materials such as rock, gravel, sand, or recycled materials or manufactured materials such as slag. (BS 6100-6.3:1984). (Smith and Collis). See EN 12620 and EN 13242 for definitions

Aggregate abrasion value (AAV) – Resistance of an aggregate to abrasion as measured in the aggregate abrasion test. The smaller the value, the higher the resistance to abrasion. (BS 812–113: 1990) (Smith and Collis 1993).

Aggregate colour – The colour of an aggregate can be affected by its moisture content and the quantity of adhering fines. May be categorised using a Rock Colour Chart such as produced by the Geological Society of America (1991).

Aggregate (natural) – Sands and gravels formed by the geological erosion of rock and are composed of particles of rock and occasionally (particularly in the case of sand), discrete mineral grains. Sometimes, over-sized gravel material is crushed and then blended with the natural aggregate. (BS 7943:1999). Aggregate from mineral sources which has been subjected to nothing more than mechanical processing (EN 13242 and EN 12620)

Aggregate impact value (AIV) – Resistance of an aggregate to impact as measured in the aggregate impact test. The smaller the value, the more resistant to impact is the rock (Smith and Collis 1993). The aggregate impact value of aggregates is determined by measuring the reduction in particle size of material subjected to 10-15 blows from a testing machine (hammer or piston between 13.5-14.1kg), (BS 812-112: 1990).

Aggregate shrinkage – Some rocks exhibit the property of absorbing water with attendant change in dimension.

Aggregate drying shrinkage – The shrinkage that occurs as an aggregate is dried. (Smith and Collis 1993).

Aggregate sizes, for concrete – The European aggregate standard allows aggregate product sizes (mm) to be selected from the Basic Set plus Set 1 or Set 2. (Smith and Collis 1993). The European standard designation of aggregate size is given in terms of lower (*d*) and upper (*D*) sieve sizes expressed in terms as *d/D*. NOTE This particle size designation (qv) accepts the presence of some particles which are retained on the upper sieve (oversize) and some which pass the lower sieve (undersize) (EN 12620).

Aggregate types – An aggregate should be described as follows:

- i.) whether natural or artificial,
- ii.) if natural, whether crushed rock, gravel or sand,
- iii.) if a gravel or sand, whether uncrushed, partly crushed or crushed.
- iv.) If a gravel or sand, whether land won or marine.

(Smith and Collis 1993)

Aggregate shape – see Particle shape.

Aggregate/cement ratios – the ratio between the aggregate and cement in a concrete.

Alkali-silica reaction (ASR) - Expansive reaction that can take place in concrete when an alkaline solution reacts with a siliceous aggregate to form alkali-silica gel (Smith and Collis 1993).

All-in aggregate – Aggregate consisting of a mixture of coarse aggregate and sand. It may be produced without separating into coarse and fine fractions, or it may be produced by combining coarse aggregate and sand. (BS 882: 1992). The European definition is closely similar (EN 12620).

Alteration – Mineralogical changes imposed upon a rock or rock body by secondary geological activity. (BS 812: Part 104:1994).

Amygdale – Ellipsoidal to irregularly-shaped cavity in volcanic and some hypabyssal rocks formed during the evolution of gas. These cavities are generally infilled by minerals not present in the rock body, e.g. zeolites, calcite, different forms of silica, chlorite (Smith and Collis 1993).

Amygdaloidal – Amygdale-bearing (Smith and Collis 1993).

Anisotropy – Variation in physical or textural properties with direction (Smith and Collis 1993).

Arenaceous – Sandy; said of a sediment consisting wholly or partly of sand-size fragments (Smith and Collis 1993).

Argillite – A generic term for rocks formed from indurated (q.v.) silt and clay, e.g. mudstone, siltstone, shale. Often restricted to slightly metamorphosed argillaceous sediments (Smith and Collis 1993).

Argillaceous – Clayey or silty, term applied to sediments consisting wholly or partly of clay or silt-sized particles (Smith and Collis 1993).

Arkose – Sandstone with feldspar content in excess of 25% (Smith and Collis 1993).

Asphalt – A natural or artificial mixture in which bitumen is associated with a substantial proportion of mineral matter (Smith and Collis 1993).

Asphaltic cement – Bitumen, a mixture of lake asphalt and bitumen, or lake asphalt and flux oils or pitch or bitumen, having cementing qualities suitable for the manufacture of asphalt pavements (Smith and Collis 1993).

Basalt – A dark or medium-dark, commonly extrusive (lava), locally intrusive (as in a dyke or sill), glassy to fine-grained igneous rock; the extrusive equivalent of gabbro. SiO₂ content 45-62%. Rich in ferromagnesian minerals (>60% by volume) and labradorite feldspar (Smith and Collis 1993).

Base course – In a road pavement, the layer below the wearing course (q.v.) and above the road base; it serves to protect the less durable base materials from damage and provides a flat surface on which the wearing course is laid (Smith and Collis 1993).

Batch - A production quantity, a delivery quantity, a partial delivery quantity (railway wagon-load, lorry-load, ship's cargo) or a stockpile produced at one time under conditions that are presumed uniform. (BS EN 932-1:1997).
NOTE. With a continuous process the quantity produced during a specified period should be treated as a batch.

Bauxite – A natural mixture of hydrated aluminium oxides formed by the in situ breakdown by tropical weathering, usually of basic igneous rocks. The ore of aluminium. Used as calcined bauxite (q.v.) in friction courses on roads (Smith and Collis 1993).

Beneficiation – The processing of rocks and minerals to remove unwanted constituents (Smith and Collis 1993).

Binder – Any soil or aggregate cementing agent, e.g. water, clay, cement, lime, bitumen, synthetic resins (Smith and Collis 1993).

Biotite – A dark-coloured iron-bearing member of the mica group of rock forming minerals. Biotite occurs as an original constituent of many igneous and metamorphic rocks (Smith and Collis 1993).

Bitumen – A viscous liquid, or solid consisting essentially of hydrocarbons and their derivatives; it is substantially non-volatile and softens gradually when heated. It is black or brown in colour and possesses waterproofing and adhesive properties. It is obtained by refinery processes from petroleum, and is also found as a natural deposit or as a component of naturally occurring asphalt, in which it is associated with mineral matter (Smith and Collis 1993).

Bituminous – Containing coal tar, bitumen, pitch or mixtures thereof (Smith and Collis 1993).

Bleeding – The release of water from a concrete or mortar mix after placing (Smith and Collis 1993).

Blended aggregate - Blend of natural aggregates and/or manufactured aggregates. (BS 6100-6.3:1984).

Blended coarse aggregate – Coarse aggregate produced by blending gravel and crushed rock. (BS 6100-6.3:1984).

Blended Sand – Fine aggregate produced by the controlled mixing two or more size fractions in order to meet a specific grading requirement. (BS 882:1992).

Blinding – The obstruction of a screen surface which occurs when the apertures become blocked by an accumulation of very fine material. Also a layer of mortar or concrete used to protect or regulate a surface prior to construction (Smith and Collis 1993).

Boulder clay – A glacial deposit consisting of sub-angular pebbles and boulders of all sizes embedded in stiff or hard reworked clay or rock flour. The term ‘till’ is preferable because it covers the wide range of lithologies included here and does not imply the presence of either boulders or true clay .

Bound aggregate – Aggregates which are bound or coated with cementitious or bituminous binders, i.e. as in concrete or bituminous macadam (Smith and Collis 1993).

Breccia – A rubble-rock: a coarse-grained elastic (q.v.) rock composed of large, angular broken rock-fragments held together in a finer-grained matrix. Breccia is similar to conglomerate (q.v.) except that most of the fragments have sharp edges and unworn corners; it can be of any origin, mode of accumulation or composition. Hence brecciated: a rock converted into, characterized by or resembling a breccias (Smith and Collis 1993).

Building sands – Sand with a grading suitable for use in mortars (Smith and Collis 1993).

Bulk sample – An aggregation of the sampling increments. (BS 812: part 102:1989, BS EN 932-1:1997).

Calcined bauxite – Bauxite (q.v.) which has been heated to produce corundum (Al_2O_3) as one of the main mineral phases, giving the material very good polish-resisting properties when used as a roadstone wearing course (Smith and Collis 1993).

Carbonate rocks – A generic term for rocks formed predominantly from the carbonates of calcium, magnesium, iron etc., occurring either singly or in combination. Limestone (calcium carbonate) is the most familiar example (Smith and Collis 1993).

Category - level of a property of an aggregate expressed as a range of values or a limiting value. *NOTE:* There is no relationship between the categories of different properties (EN 12620).

Cement – Natural or synthetic material which binds rock particles together. In sedimentary rocks this may be silica, calcium carbonate, clay or iron oxide etc.

Chalcedony – Cryptocrystalline (q.v.) variety of silica (Smith and Collis 1993).

Chert – Microcrystalline or cryptocrystalline siliceous rock comprising quartz and, sometimes, chalcedony (Smith and Collis 1993).

Chlorides, in concrete mixes – usually sodium chloride, occurs naturally in marine and some coastal sources of aggregates and also occur at significant levels in some inland sedimentary deposits. Chlorides have little significance on the properties of plain concrete but they introduce corrosion risks for the embedded steel in reinforced concrete. (Smith and Collis 1993)

Chlorite – Family of greenish platy clay minerals frequently occurring as alteration products of ferromagnesian minerals and as a prograde constituent in low grade metamorphic rocks. Hydrous silicates of aluminium, ferrous iron and magnesium (Smith and Collis 1993).

Classification – A classification groups together materials which show a characteristic or characteristics relevant to their use as aggregate.

Classifier – Particle sizing device based upon the relative motions of particles in a viscous fluid, air or water (Smith and Collis 1993).

Clast – A rock fragment; commonly applied to a fragment of pre-existing rock included in a younger sediment (Smith and Collis 1993).

Clastic – A term relating to a rock or sediment composed principally of broken fragments of pre-existing rocks or minerals that have been transported individually from their place of origin (Smith and Collis 1993).

Clay minerals – A complex group of finely crystalline to amorphous hydrous silicates essentially of aluminium, formed chiefly by alteration or weathering of primary silicate minerals such as the feldspars, micas, pyroxenes and amphiboles. The three most common clay minerals are kaolinite, illite and montmorillonite (smectite) (Smith and Collis 1993).

Cleavage – An ease-of-splitting direction/ planes of weakness in minerals and rocks. Mineral cleavage is controlled by the atomic lattice, Rock cleavage is most commonly seen in deformed rocks such as slates etc. It is an ease-of-splitting direction induced by the deformation (Smith and Collis 1993).

Coagulant – A simple soluble salt that causes particles dispersed in water to agglomerate and settle more rapidly (Smith and Collis 1993).

Coarse aggregate – Aggregate of which not less than 90% is retained on a 5mm test sieve. (BS 1047: 1983). European, EN 12620 (4mm), and the designation given to the larger aggregate sizes with D greater than or equal to 4 mm and d greater than or equal to 2 mm (EN 12620). USA, ASTM C 136 sizes larger than 4.75mm.

Coated chippings – Aggregate chippings which have been coated thinly with bituminous material for scattering over a wearing course or use in surface dressing (Smith and Collis 1993).

Coated macadam – A road material consisting of graded aggregate that has been coated with a tar or bitumen, or a mixture of the two, and in which the intimate interlocking of the aggregate particles is a major factor in the strength of the compacted roadbase or surfacing (Smith and Collis 1993).

Cold asphalt – A close-textured type of coated macadam wearing course material, consisting of aggregate wholly passing 6mm BS sieve for the fine grade, and wholly or substantially passing 10mm BS sieve for the coarse grade, coated with a binder solely or substantially of bitumen, the composition of the mixture being so adjusted that the material can be spread and compacted while cold or warm, and if required, after storage (Smith and Collis 1993).

Comminution – Reduction of particle size (Smith and Collis 1993).

Compaction – The process of causing soil or aggregate particles (bound or unbound) to pack more closely together, thereby causing an increase in the density (Smith and Collis 1993).

Cone crusher – A crushing machine consisting essentially of two upward pointing, concentric, conical crushing surfaces. The crushing action is produced by the eccentric rotation of the inner conical surface within the outer (Smith and Collis 1993).

Conglomerate – A coarse-grained, clastic sedimentary rock composed predominantly of rounded fragments (generally larger than 5mm in diameter) set in a fine-grained matrix of sand, silt or natural cementing material (Smith and Collis 1993).

Continuously-graded aggregate – Graded aggregate in which all particle sizes within a specified range are represented. (BS 6100-6.3:1984).

Cristobalite – A high temperature polymorph of the mineral quartz (SiO_2) i.e. possessing a different atomic structure but identical chemical composition (Smith and Collis 1993).

Crushed rock – Coarse aggregate produced by crushing rock. (BS 882:1992). (BS 6100-6.3:1984).

Crusher – A device for breaking rock in which the components contacting the rock follow a strictly controlled path (Smith and Collis 1993).

Crusher-run aggregate – Unsized material produced by a simple crushing procedure without screening (Smith and Collis 1993).

Cryptocrystalline – Very finely crystalline material in which the crystals are so small as to be indistinguishable except under powerful magnification (Smith and Collis 1993).

Cyclone – A classifying (q.v.) device which utilizes a vortex and gravity to effect a size separation (Smith and Collis 1993).

Deck – Screening surface (Smith and Collis 1993).

Decomposition – (In geology), the predominantly chemical changes in a rock, usually accompanied by physical deterioration, which result from weathering or hydrothermal alteration (q.v.) (Smith and Collis 1993).

Derived aggregate – Aggregate derived from the water or by-product of another process, especially slags, mining waste, power station ashes, incinerator ashes (Smith and Collis 1993).

Detrital – Relating to or formed from detritus, which is a collective term for loose rock and mineral fragmental material, such as sand, silt and clay, derived from older rocks by mechanical means, mainly abrasion and disintegration by erosion and weathering (Smith and Collis 1993).

Diabase – A basic crystalline (granular) rock of doleritic composition but altered to the extent that few of any of the original minerals survive (Smith and Collis 1993).

Diamict – An unsorted or poorly sorted terrigenous sediment containing a wide range of particle sizes, for example a glacial till or a pebbly mudstone (Smith and Collis 1993).

Diorite – A range of dark-coloured plutonic (q.v.) igneous rocks intermediate in composition (SiO_2 content 52-66%) and characterized by the common presence of the amphibole hornblende, plagioclase feldspar and sometimes a small amount of free quartz (Smith and Collis 1993).

Discontinuity – As used in this report, the term denotes any interruption in the mechanical integrity of the rock, such as by a joint, fissure or cavity (Smith and Collis 1993).

Disintegration – The breaking down of a rock into smaller particles by physical processes, without significant chemical alteration (Smith and Collis 1993).

Dolerite – A dark coloured, fine to medium grained igneous rock of basic composition (that is, without free quartz), found in intrusions of moderate size (especially dykes and sills), so allowing moderately rapid cooling of the magma (Smith and Collis 1993).

Dolomite – A double carbonate mineral of calcium and magnesium, $\text{CaMg}(\text{CO}_3)_2$; also a carbonate rock containing a significant proportion (usually over 50 per cent) of mineral dolomite (Smith and Collis 1993).

Dolostone – A carbonate rock consisting entirely of the mineral dolomite (q.v.) (Smith and Collis 1993).

Dry-bound macadam – Crushed aggregates laid in two separate sizes, coarse and fine, compacted dry by rolling and/or vibration to a dense layer (Smith and Collis 1993).

Dry-screened sand – Building sand which has been passed dry through an appropriate sieve to remove over-sized materials (Smith and Collis 1993).

Durability – The degree to which a material can withstand usage, weathering or aggressive agents over an extended period of time. (Groot, Ashall and Hughes).

Dust hazards – Respirable dust particles are less than 5µm and escape the filters of the human body and accumulate in the lungs. (Adapted from Smith and Collis 1993)

Effective size – The effective size is D_{10} . In other words, 10% of the particles are finer and 90% coarser than the effective size; often used in soil classifications (Smith and Collis 1993).

Epidote – A group of minerals comprising the basic silicates of calcium, aluminium, iron and manganese. They commonly occur in regionally metamorphosed rocks (Smith and Collis 1993).

Epidotization – The process whereby epidote is formed as the product of hydrothermal alteration of plagioclase feldspar (Smith and Collis 1993).

Expanded aggregate - Lightweight aggregate produced from heat treated materials so that the final volume significantly exceeds the initial volume. (BS 6100-6.3:1984).

Fabric – The physical arrangement and orientation of particles or minerals in a rock which characterizes its texture and structure either on a visible or microscopic scale (Smith and Collis 1993).

Facies – The particular lithological and palaeontological characteristics of a sedimentary rock, from which its origin and conditions of formation may be deduced (Smith and Collis 1993). The term facies can also be applied to igneous and metamorphic rocks and implies a suite of rocks with related properties or origins.

Fault – A surface, or closely spaced surfaces, of rock fracture along which there has been displacement, which may range from a few millimetres to many kilometres. A fault plane is a fault surface, normally more or less planar (Smith and Collis 1993).

Feldspar, Felspar – The most important single group of rock-forming silicate minerals. They are aluminosilicates of potassium, sodium or calcium, depending for example on whether orthoclase (q.v.) or plagioclase (q.v.) feldspars are present (Smith and Collis 1993).

Felsite – A light-coloured, fine-grained extrusive or hypabyssal rock composed mainly of quartz and feldspar (Smith and Collis 1993).

Filler – In asphaltic technology, is inert material (e.g. cement, limestone dust or fly ash) finer than 75 µm. Its function is to fill in voids and modify the viscosity and the temperature-viscosity relationship of the bitumen binder. Also a possible aid to binder/aggregate adhesion.

Filler aggregate - Aggregate, most of which passes a 0,063 mm sieve, which can be added to construction materials to provide certain properties (EN 13242 and EN 12620)

Fine aggregate – The portion of an aggregate consisting of particles with diameters smaller than approximately 4.76 mm, for USA specification, ASTM C 33 (1986). The European (EN 12620) designation is for aggregate sizes with D less than or equal to 4 mm. Previous UK specification gives a 5mm limit BS 882 (1983). *NOTE:* Fine aggregate can be produced from natural disintegration of rock or gravel and/or by the crushing of rock or gravel or processing of manufactured aggregate.

Fine cold asphalt – A wearing course of bitumen and fine aggregate which is spread and compacted while cold or warm (Smith and Collis 1993).

Fines – Any solid material passing a 75µm BS 410 sieve. (BS 882:1992) The European definition is the particle size fraction of an aggregate which passes the 0.063 mm sieve. (EN 13242 and EN 12620)

Flint – Variety of chert occurring in Cretaceous chalk of northern Europe (Smith and Collis 1993).

Flint gravels – gravels formed by the erosion of flint.

Flocculant – A polymeric chemical used to promote the sedimentation of solids suspended in water (Smith and Collis 1993).

Flotation (froth) – A mineral separation process for fine particles suspended in water in which selected particles are attached to air bubbles and rise to form a froth (Smith and Collis 1993).

Flowsheet – A diagrammatic representation of the flow of material through a processing plant, showing the sequence of operations and their interrelationships.

Flow structure – The parallel alignment of particles (usually crystals) in the direction of movement of a fluid medium, such as lava (Smith and Collis 1993).

Fluvial – Relating to a river; a deposit produced by the action of a river. Geologists tend to use fluvatile for the product of river action for example, fluvatile sand (Smith and Collis 1993).

Fluvioglacial – May be applied to sediment transported and deposited by running water discharged from an ice mass.

Fly ash – The generic term for all finely divided residues collected or precipitated from the exhaust gases of any industrial furnace.

Foamed slag - Foamed slag is by-product of iron production and is formed by introducing water or steam into the molten material, either in foaming beds or by spraying.

Foliation: Any repetitively occurring or penetrative planar feature in a rock body and most usually applied to metamorphic rocks. More than one kind of foliation with more than one orientation may be present in a rock. Foliations may become curved or distorted. The surfaces to which they are parallel are called s-surfaces. More precise terms should be used wherever possible (Subcommission on the Systematics of Metamorphic Rocks of the IUGS).

Fossil weathering – Ancient weathered rock preserved below more recent material (Smith and Collis 1993).

Fracture cleavage – A type of cleavage developed in mechanically deformed but only slightly metamorphosed rocks by incipient shearing and slipping along individually recognizable, often closely-spaced, parallel fractures. (Smith and Collis 1993)

Fracture – A general term for any break in a rock, whether or not it causes displacement, due to mechanical failure by stress. Fracture includes cracks, joints and faults in rock masses.

Fragmentation – A term associated with hard rock quarrying to describe the degree of mechanical breakdown produced by blasting (Smith and Collis 1993).

Free Silica – In igneous rocks, silica (q.v.) which is present as quartz or one of its polymorphs, as opposed to silica present in the combined state as one of the many silicate minerals (Smith and Collis 1993).

Friction course – A uniformly graded asphalt material, with a high voids content and coarse texture, giving good drainage and skid resistance properties, used primarily on airfields (Smith and Collis 1993).

Gabbro – A coarse-grained basic plutonic rock containing plagioclase, a pyroxene and very commonly olivine. SiO₂ content 45-52%, dark minerals over 60% by volume (Smith and Collis 1993).

Gap-graded – Absence or near-absence in the proportions of particular size fractions in a grading; also known rarely as 'skip' or 'intermittent' grading (Smith and Collis 1993).

Gap graded aggregate - Graded aggregate in which one or more intermediate particle sizes is not represented. (BS 6100-6.3:1984).

Garnet – A group of complex silicates of aluminium, iron, manganese chromium, calcium and magnesium. Usually found in metamorphic rocks but also in some granites (q.v.) and pegmatites (q.v.)

Geomaterial – Processed or unprocessed soils, rocks or minerals used in construction, including man-made construction materials manufactured from soils, rocks or minerals (Smith and Collis 1993).

Geomorphology – The classification, description, nature, origin and development of landforms, their relation to underlying geological structure, and the history of geological changes recorded by these surface features.

Gibbsite – A hydrous aluminium oxide commonly occurring in deposits of bauxite (q.v.) and as an alteration product of aluminium silicates (Smith and Collis 1993).

Glacial deposits/debris/drift – Heterogeneous material transported by glaciers or icebergs and deposited on land or in the sea without sorting of the constituents (Smith and Collis 1993).

Glacial till – See till

Gneiss – A foliated rock formed by regional metamorphism in which bands or lenticles of granular minerals alternate with bands or lenticles in which minerals of flaky or elongate prismatic habit predominate (Smith and Collis 1993).
Grade, metamorphic – See metamorphic grade

Grade, graded – Size sorting category in which all the particles fall within specified size limits (see sorted). Also used in geology to denote degrees of alteration, e.g. by metamorphism or weathering, usually with reference to an agreed scale (Smith and Collis 1993).

Graded aggregate - Aggregate having a specified range of proportions by mass of a number of different particle sizes. (BS 6100-6.3:1984).

Graded bedding – Bedding in which successive layers show gradual, progressive change in particle size, usually from coarse at the base to fine at the top of a sequence (Smith and Collis 1993).

Grading – The proportions of different sizes present in an aggregate, established by sieve analysis; where the particle size distribution is expressed as the percentage by mass passing a specified set of sieves. (EN 13242 and 12620).

Grade, metamorphic – See metamorphic grade

Granite – Generally, any completely crystalline quartz-bearing plutonic rock with light-coloured feldspars and micas as essential constituents (over 60% by volume). There may be a speckling of dark minerals. SiO₂ content over 66% (Smith and Collis 1993).

Granodiorite – A coarse-grained plutonic (q.v.) rock intermediate in composition between granite (q.v.) and diorite (q.v.). Light-coloured minerals over 60% by volume, SiO₂ content over 66% (Smith and Collis 1993).

Granulite – A metamorphic rock characterized by granular texture. Originated under conditions of high grade regional metamorphism (Smith and Collis 1993).

Gravel – In the British Standard particle size classification (BS 1377: 1975 and BS 5930: 1981) the term denotes granular material in the size range 2mm to 60mm (Smith and Collis 1993).

Greywacke – A dark-coloured sandstone comprising mineral and rock fragments, poorly-sorted and bound together with clay cement (Smith and Collis 1993). Greywacke is also referred to as immature sandstones.

Grinding – A process for breaking rock in which the motion of the machine components (media) that contact the rock is not strictly controlled and the components may touch (Smith and Collis 1993).

Gritstone – The BS 812:1975 trade group which includes all clastic rocks with sand-sized particles, such as arkose, greywacke and sandstone. The term grit (stone) is generally used in geology for a sand (stone) with coarse angular particles (Smith and Collis 1993).

Gypsum – Hydrous calcium sulphate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), associated with other evaporate minerals in extensive beds interstratified with limestone, shales and clays. Used, for example, as a soil additive, as a retarder in Portland cement and in making plaster-board (Smith and Collis 1993).

Gypsum plaster – A plaster consisting of calcium sulphate, either partially hydrated or anhydrous, made by the controlled heating of gypsum (Smith and Collis 1993).

Haematite or Hematite – A natural oxide of iron (Fe_2O_3) with a high specific gravity (4.9 to 5.3), sometimes used as an aggregate for special-purpose dense concretes (Smith and Collis 1993).

Heavy aggregate – Aggregate of very high unit weight, such as barium, boron, or iron ore, steel shot or punchings, which forms a high density mortar or concrete when bound together with hardened cement paste (IAEG). Aggregate that has a particle density greater than 3000 kg/m^3 . (BS 6100-6.3:1984). (According to the definition in EN 13242 of normal-weight aggregate, it can be inferred that the heavy-weight aggregate will have a particle density not less than 3000 kg/m^3).

Heavy-media separation – A mineral processing operation in which rock fragments can be separated on the basis of density differences by being allowed to float or sink in a heavy medium. The medium consists of finely divided particles of a high density solid, such as magnetite, dispersed in water (see medium separation).

High energy sedimentary environment – Turbulent action, such as that created by waves and currents, which prevents the settling and accumulation and abrasion of pebbles and sand grains (Smith and Collis 1993).

Hornblende – One of the most abundant rock-forming minerals of the amphibole (q.v.) family (Smith and Collis 1993).

Hornfels – A fine-grained rock made of a mosaic of mutually interfering silicate minerals without preferred orientation and typically formed by contact metamorphism. Commonly yields strong aggregate when homogeneous and uniformly granular (Smith and Collis 1993).

Hydrothermal alteration – Process of alteration to secondary minerals (q.v.) through the action of hot groundwater, i.e. late stage igneous activity (Smith and Collis 1993).

Hypabyssal – A term applied to intrusive igneous rocks, commonly dykes and sills, intermediate between plutonic (q.v.) and volcanic, generally medium grained (Smith and Collis 1993).

Igneous – Describes a rock or mineral that solidified from molten or partly molten material (Smith and Collis 1993).

Igneous rocks - rocks formed from molten rock (magma) either at or below the earth's surface.

Illite – A broad term for one of the commonest groups of clay minerals, formed by the alteration of micas, alkali feldspars etc. under alkaline conditions (Smith and Collis 1993).

Indurated – Rock or soil hardened and compacted by the action of pressure, heat and cementation after deposition. Induration is a progressive, natural process (Smith and Collis 1993).

In-pit – Description of a process conducted within the quarry itself (Smith and Collis 1993).

Intrusion – The process of emplacement of molten rock (magma) in pre-existing rock, also the igneous rock body so formed within the surrounding rock (the country rock). The term may also be applied to mobilized sediments, which may be injected along discontinuities or form plug-like masses under the influence of gravity (Smith and Collis 1993).

Iron pyrites – (see pyrite)

Ironstone – Imprecise term, but usually denoting an impure iron carbonate occurring as nodules in some clays, e.g. London Clay, or a ferruginous sandstone (Smith and Collis 1993).

Joint – A plane of discontinuity, fracture or parting in a rock, normally involving no displacement. Joints commonly occur as parallel sets, cutting the rock mass into joint blocks. (Smith and Collis 1993).

Kaolinite – A common white or greyish white clay mineral, formed by hydrothermal alteration (and to some extent, the chemical weathering) of feldspars and other aluminosilicate minerals through the process known as kaolinization. The process adversely affects the usefulness of rocks for concrete or road aggregate (Smith and Collis 1993).

Kaolinization – Replacement or alteration of minerals, especially feldspars and micas, to form kaolin as a result of weathering or hydrothermal alteration. (Bates and Jackson, 1980).

Laboratory sample - A reduced sample derived from a bulk sample for laboratory testing. (BS EN 932-1:1997).

Laterite – Highly weathered residual soil material rich in oxides of iron and aluminium, traditionally useful for brickmaking and exceptionally for low quality aggregate where hard iron-pan (ferricrete) layers have developed (Smith and Collis 1993).

Leaching – Selective removal of soluble constituents from a soil or rock mass by the action of percolating water (Smith and Collis 1993).

Lean mix concrete – Generally a concrete with a cement: aggregate ratio of 1:10 or greater, i.e. a low cement content which often incorporates an all-in aggregate (q.v.) (Smith and Collis 1993).

Lightweight aggregate - Aggregate having a bulk density not more than 1200 kg/m³ for fine aggregate or not more than 1000 kg/m³ for coarse aggregate. (BS 6100-6.3:1984). The European definition refers to aggregate of mineral origin having a particle density not exceeding 2 000 kg/m³ (2,00 Mg/m³) or a loose bulk density not exceeding

Lignite – A brownish-black coal in which the alteration of vegetable matter has proceeded further than in peat but not so far as in bituminous coal (Smith and Collis 1993).

Lime – Quick lime is calcium oxide made by heating limestone above 900°C. Slaked lime (calcium hydroxide) is the product of the reaction between quick lime and water (Smith and Collis 1993).

Limestone – A sedimentary rock composed mainly of calcium carbonate occurring as the mineral calcite or occasionally as aragonite in recent deposits (Smith and Collis 1993).

Lithified – Made into rock: lithification is the process of consolidating a loose sediment into a solid rock (Smith and Collis 1993).

Lithology – The description of the physical nature of a rock: including its grain size, mineralogical composition, structure, colour (Smith and Collis 1993).

Log-normal distribution – Graphical presentation of data as logarithm of parameter value versus frequency, which gives a normal distribution (Smith and Collis 1993).

Los Angeles abrasion value - Resistance of an aggregate to combination of impact and abrasion as measured in the Los Angeles abrasion test. The smaller the value, the more resistant the rock. (Smith and Collis 1993).

Low-grade metamorphism – see metamorphism, low grade.

Macadam – Crushed stone mechanically locked by rolling and cemented together by application of stone screenings and water. Bituminous macadam is crushed material in which the fragments are bound together by bituminous materials (Smith and Collis 1993).

Magma – Naturally occurring deep molten rock material from which igneous rocks are formed (Smith and Collis 1993).

Magnesium sulphate soundness value (MSSV) – Soundness of an aggregate as measured in the magnesium sulphate soundness test. In the British Standard method, the larger the value, the sounder the rock. In the ASTM method, the smaller the value, the sounder the rock. (Smith and Collis 1993).

Magnetite – An iron ore mineral, Fe₃O₄. It occurs as a primary constituent of most igneous rocks (Smith and Collis 1993).

Manufactured aggregate - Aggregate of mineral origin resulting from an industrial process involving thermal or other modification (EN 13242 and EN 12620) and (BS 6100-6.3:1984).

Marble - Metamorphic rock produced from limestone through recrystallization (Smith and Collis 1993).

Marine aggregates – Sand and gravel which is excavated by dredger from the sea bed and taken ashore for processing and distribution. (Smith and Collis 1993).

Marine-dredged sands – Sands dredged from the sea bed.

Massive – In geology, without stratification, cleavage or schistosity; particularly applied to igneous rock-bodies but can be used to describe thick or obscured bedding in stratified rocks (Smith and Collis 1993).

Mastic asphalt – A type of asphalt composed of suitably graded mineral matter and asphaltic cement in such proportions as to form a coherent, voidless, impermeable mass, solid or semi-solid under normal temperature conditions, but sufficiently fluid when brought to a suitable temperature to be spread by means of a float.

Mesh – The apertures in a screen surface, or the size of the apertures (Smith and Collis 1993).

Meta – Prefix implying instability or change, e.g. as in metamorphism (q.v.)

Metamorphic Rocks - rocks formed from pre-existing rocks by the action of heat and/or pressure in the earth's crust, which has caused mineralogical and structural transformations. Metamorphic rocks frequently have anisotropic texture. (BS EN 932-3: 1997).

Metamorphism – Mineralogical and structural changes of rocks in their solid state in response to altered physical and chemical conditions (Smith and Collis 1993).

Metamorphism contact – The process of localized thermal metamorphism brought about by the intrusion (and to a lesser extent, extrusion) of magma into rocks; changes are effected at or near the contact by heat and materials emanating from the magma and by some deformation arising from the emplacement of the igneous mass (Smith and Collis 1993).

Metamorphism dynamic – Changes in rock structure and mineralogy brought about commonly on a regional scale by crushing and shearing in the Earth's crust; high temperatures may be involved, leading to extensive recrystallization of rocks (Smith and Collis 1993).

Metamorphic grade – Metamorphic grade is measured by the amount of change that the original (parent) rock has undergone. The conversion of shale to slate (q.v.) would indicate low grade metamorphism whilst its continued metamorphism to schist would be regarded as high-grade (Smith and Collis 1993).

Metamorphism, low grade – Metamorphic grade is measured by the amount of change that the original (parent) rock has undergone. The conversion of shale to slate (q.v.) would indicate low grade metamorphism whilst its continued metamorphism to schist would be regarded as high-grade (Smith and Collis 1993).

Metamorphism regional – Metamorphism affecting an extensive region usually brought about by deep burial of material in the earth's crust (Smith and Collis 1993).

Metamorphism thermal – Essentially the chemical reconstitution of rocks brought about by elevated temperature influenced, to some extent, by the confining pressure of deep burial in the earth's crust (though this is not essential).

Mica – A member of the layered-lattice silicate (including muscovite and biotite) group characterized by very strong cleavage (Smith and Collis 1993).

Micaceous – Mica-bearing (Smith and Collis 1993).

Microcline – A member of the feldspar group of minerals (KAlSi_3O_8) found generally in acid igneous rocks, pegmatites and metamorphic rocks (Smith and Collis 1993).

Microcrystalline – Composed of crystals so fine that they can be resolved only under a microscope. (BS 812: Part 104:1994)

Micro-Deval value – (MDS dry, MDE wet) Resistance of an aggregate to abrasion as measured (either dry or wet) in the Micro-Deval test. The smaller the value, the more resistant to abrasion is the rock. (Smith and Collis 1993).

Microdiorite – A range of hypabyssal igneous rocks of intermediate composition. Microdiorites are the hypabyssal equivalent of andesites and consist usually of intermediate plagioclase feldspar, hornblende or biotite (q.v.) and occasionally a small amount of quartz (Smith and Collis 1993).

Microfractures – Fractures in a material that are <0.01mm wide (Smith and Collis 1993).

Microgranite – A granite in which a majority of the crystalline matter requires microscopic examination to different individual crystals (Smith and Collis 1993).

Migmatite – A composite rock formed by solid-state reconstruction of igneous and/or metamorphic materials by injection of magma and/or in situ melting (Smith and Collis 1993).

Mineral – A naturally formed chemical element or compound and normally having a characteristic crystal form and a definite composition (Smith and Collis 1993).

Mineral reserve – That part of a mineral resource that has been defined by exploration within given levels of confidence.

Mineral resource – A mass of naturally occurring mineral material (such as metallic ores and aggregate minerals) which is judged, against arbitrary physical, chemical and economic criteria, to have foreseeable use (Smith and Collis 1993).

Mineralogy – The science concerned with the study of minerals, including their occurrence, composition, forms, properties and structure (Smith and Collis 1993).

Mohs' scale of hardness – A scale of scratch resistance graduated in terms of the relative hardness of ten common minerals which, in order to increasing hardness, are: 1, talc; 2, gypsum; 3, calcite; 4, fluorite; 5, apatite; 6, orthoclase; 7, quartz; 8, topaz; 9, corundum; 10, diamond (Smith and Collis 1993).

Monomictic – Aggregates essentially comprising particles of one rock or mineral type. (BS 812:Part 104:1994).

Monominerallic – Rock composed essentially of one mineral species (Smith and Collis 1993).

Montmorillonite – Member of smectite clay mineral group characterized by marked swelling properties when contacted with water (Smith and Collis 1993).

Mortar - A mixture consisting essentially of cement, sand and water, and the hardened product of such a mixture (Smith and Collis 1993).

Mudstone – An indurated mud (or mud-rock), commonly massive, blocky, non-fissile and comprising about equal proportions of clay and silt (Smith and Collis 1993).

Mundic – A Cornish word for iron pyrites which is commonly found in mineralized zones in the Cornish granites and the surrounding rocks of Devonian geological age. (Smith and Collis 1993).

Muscovite – A light coloured member of the mica (q.v.) group of rock forming minerals (Smith and Collis 1993).

Natural graded 0/8 mm aggregate - Designation given to natural aggregate of glacial and/or fluvial origin with *D* less than or equal to 8 mm. *NOTE*: This aggregate can also be produced by blending processed aggregate.

Nearsizes – Particles of a size between 1 and 1.5 times the aperture size of a screen (Smith and Collis 1993).

Normal frequency distribution – Bell-shaped frequency distribution curve symmetrical with respect to the mean value (Smith and Collis 1993).

Normal weight aggregate - Aggregate of mineral origin having a particle density not less than 2,00 Mg/m³ (2000 kg/m³) but less than 3,00 Mg/m³ (3000 kg/m³) (NE 13242).

Olivine – Common rock-forming mineral in basic, ultrabasic and low-silica igneous rocks; typically dark olive-green to brown magnesium iron silicate: (Mg,Fe)₂SiO₄. Alters to serpentine (Smith and Collis 1993).

Oolite – A sedimentary rock commonly a limestone (hence oolitic limestone), made chiefly of ooliths cemented together. Ooliths are spherical or ovoid accretionary bodies resembling the egg-roe of a fish, made of concentric layers typically deposited around a nucleus (such as a shell fragment or sand grain) in shallow moving water. Ooliths range in size from 0.25 to 2.00mm, but are typically between 0.5mm and 1.0mm in diameter (Smith and Collis 1993).

Opal – Amorphous and hydrous variety of silica (Smith and Collis 1993).

Open-area – Proportion (%) of total screen area represent by the apertures (Smith and Collis 1993).

Ophiolite – An assemblage of ultrabasic to basic rocks, frequently layered, with an upward succession from plutonic to hypabyssal and volcanic (q.v.). These represent sections of oceanic crust and the upper part of the underlying mantle incorporated into a sedimentary sequence during strong disturbances caused by plate underthrusting (Smith and Collis 1993).

Organic content – Organic matter is usually considered to represent a potentially deleterious impurity in aggregates intended for use in concrete. Some types of organic material including humus, fuel oil and sugars, can retard or even prevent the hydration of cement and the consequent hardening of concrete, even when present in only trace concentrations. (Smith and Collis 1993).

Orthoclase – A potassium feldspar (q.v.) KAlSi₃O₈ occurring as an essential constituent of the more acid igneous rocks and also found in some metamorphic rocks (Smith and Collis 1993).

Orthoquartzite – A very hard sandstone in which the constituent quartz grains have been cemented by secondary silica so that the rock breaks across individual grains rather than around them. Often loosely termed ‘quartzite’ (q.v.) (Smith and Collis 1993).

Outcrop – The total area over which a particular rock unit or structure occurs at the ground surface or immediately below the superficial deposits (q.v.), whether visibly exposed or not (Smith and Collis 1993).

Partially crushed gravel – Mixture of crushed gravel and uncrushed gravel. (BS 6100-6.3:1984).

Particle density – The particle density of dense aggregates is a property of particular value in concrete mix design, concrete yield checks, and in the assessment of compaction and void content of hardened concrete. (Smith and Collis 1993).

Particle shape – The shape of a particle can be classed into the following groups; rounded, irregular, angular, flaky, elongated and flaky and elongated. (Adapted from Smith and Collis 1993).

Particle size classifications – Methods used for the separation of particles into selected size gradings (qv). In industrial particle classifiers the particles are fed into a moving, or cyclonically rotating fluid (usually water). Their terminal velocity is proportional to the sizes of the particles thus allowing size fractions to be separated by adjusting fluid flow rates or classifier dimensions.

Particle size distribution – The particle size distribution is found in a crusher and determines the yield of saleable products that can be obtained by sizing alone without re-crushing. (adapted from Smith and Collis 1993). The same particle size distribution expressed as the percentage by mass passing a specified set of sieves (EN 13242)

Particle size fraction d_i/D_i – The fraction of an aggregate passing the larger (D_i) of two sieves and retained on the smaller (d_i) (EN 933-4)

Particle sizes –The general dimensions (such as average diameter or volume) of the particles in a sediment or rock, or of the grains of a particular mineral that make up a sediment or rock (Bates and Jackson, 1980).

Particle sizing – A laboratory method used to analyze particle size. This is carried out by many methods including sieving, and classification. Sieving of dry material is possible at sizes as fine as 0.05mm and classification would not be applied to sizes greater than 0.1mm. (adapted from Smith and Collis 1993).

Particle texture – The main influence of particle surface texture is the effect on the bond between the aggregate and the cement paste in hardened concrete. Surface texture is generally only considered in relation to concrete flexural strengths, which are frequently found to reduce with increasing particle smoothness. (Smith and Collis 1993).

Pavement – The whole constructed thickness of a road or similar slab whether of concrete, asphalt, macadam, stabilized soil, etc. (Smith and Collis 1993).

Pavement wearing surfaces - The surface layer of a road on which the traffic runs. Sometimes known as the wearing course, or surfacing. It is laid directly above the base course layer of the road

Pegmatite – A very coarse grained igneous rock, conventionally refers to a rock of granite (q.v.) composition. Also used for other plutonic rocks whose names are used as a prefix, e.g.gabbro-pegmatite (Smith and Collis 1993).

Pelite – A sediment (or sedimentary rock) composed of the finest (i.e. clay or mud sized) detrital particles (Smith and Collis 1993). Commonly used to refer to clay rich metamorphosed sedimentary rocks

Pelletized expanded blastfurnace slag aggregate - Expanded blast furnace slag aggregate produced in pelletized form. (BS 6100-6.3:1984).

Petrography – The branch of geology dealing with the description and systematic classification of rocks especially by the microscopic study of thin sections (Smith and Collis 1993).

Phenocryst – A relatively large, conspicuous crystal set in a finer-grained or glassy ground-mass and occurring in igneous rocks (Smith and Collis 1993). The equivalent in a metamorphic rock is a porphyroblast

Phyllite – A cleaved metamorphic rock, coarser grained and less perfectly cleaved than slate (q.v.), but finer grained and better cleaved than schist. Formed by low temperature regional metamorphism (q.v.) (Smith and Collis 1993).

Pillow-lava – A lava displaying pillow-structure and considered to have been formed under water, usually from a basaltic or andesitic magma (Smith and Collis 1993).

Pitch – The residue, liquid when hot and almost solid when cold, obtained from the distillation of tars, etc. When no source of specified, it is implied that it is obtained from coal tar (Smith and Collis 1993).

Pitch-bitumen binder – Penetration grade binder (q.v.) containing pitch and predominance of bitumen suitable for use in rolled asphalt or dense bitumen macadam. (Smith and Collis 1993).

Plagioclase – The group of Na – Ca feldspars (q.v.). They are one of the most common rock forming mineral groups, having a continuous gradation in chemical composition between albite $\text{NaAlSi}_3\text{O}_8$ and anorthite $\text{CaAl}_2\text{Si}_2\text{O}_8$ (Smith and Collis 1993).

Plastic fines – Plastic fines in sandy soils usually create sufficient adhesion between the sand grains to limit the ability of larger particles to move into a denser arrangement.

Plasticizer – An additive to mortar or concrete which has the ability to entrain air in the mix and improve its working qualities (Smith and Collis 1993).

Plasticity index – The numerical difference between the liquid and plastic limits, representing the range of moisture content at which the soil is plastic. Together with the liquid limit it gives an indication of the sensitivity of the soil to changes in moisture condition (Smith and Collis 1993).

Plutonic – Applies to igneous rocks formed at great depth, which are characteristically medium or coarse-grained and of granite-like texture (Smith and Collis 1993).

Point Counting – (Modal analysis) A statistically rigorous and systematic method of determining the volume proportions of components in thin-sections, grain mounts or cut surfaces by traversing the surface using a microscope to identify components at points at regular intervals on a traverse or grid pattern, eg. ASTM C295.

Point load strength – Rock material strength determined by loading a rock specimen to failure between two conical points. The result is expressed as a point-load index (I_p) which is the force at failure divided by the square of the length of the loaded axis (Smith and Collis 1993).

Polished stone value (PSV) – Resistance of an aggregate to polishing as measured in the accelerated polishing test. The larger the value, the more resistant to polishing is the rock (Smith and Collis 1993).

Polymictic – A detrital rock consisting of fragments of many different materials.

Poorly graded – In engineering terms this implies the absence or a low proportion of essential particle sizes. In geological terms it implies the presence of a wide range of particle sizes (Smith and Collis 1993).

Porphyry – An igneous rock that contains conspicuous large crystals (phenocrysts) in a fine-grained groundmass. Hence porphyritic, the texture of a porphyry (Smith and Collis 1993).

Pozzolana – Naturally occurring deposits which, when finely ground, combine chemically with hydrated limes at normal temperatures and so can be used in mortars (Smith and Collis 1993). ASTM C618 defines pozzolana as a siliceous and aluminous material which, in itself, possesses little or no cementitious value, but which will, in finely divided form and in the presence of moisture, react chemically with calcium hydroxide (lime) at ordinary temperature to form compounds possessing cementitious properties.

Psammite – Metamorphic rock derived from an impure sandstone (Smith and Collis 1993).

Pulp – A suspension of mineral particles in water, i.e. a slurry (Smith and Collis 1993).

Pulverized fuel ash - A type of fly ash resulting from the burning of pulverised higher ranking coals in power station furnaces. (See fly ash).

Pumice – A light-coloured highly vesicular glassy volcanic rock commonly of rhyolitic composition (Smith and Collis 1993).

Pyrite – Iron sulphide mineral, (FeS_2), the most abundant of the sulphide minerals; it occurs most commonly as cubes and nodules in sedimentary rocks and as veins associated with other minerals such as copper with which it may be mined. Undesirable in aggregates because it decomposes giving rise to iron-oxide in mass concrete, and may oxidize to ferrous sulphate, which causes sulphate attack (Smith and Collis 1993).

Pyroclastic – Descriptive of broken rock material formed by volcanic explosion or by being ejected from a volcanic vent. A pyroclastic rock may be made of rock fragments of a wide size range and largely unsorted (Smith and Collis 1993).

Pyroxene – A group of rock-forming silicates, somewhat similar in general composition to amphibole (q.v.) but without hydroxyl (OH). Augite is the best-known example (Smith and Collis 1993).

QA – Quality assurance (Smith and Collis 1993).

Qualitative examination – An examination in which some or all of the constituents of a sample are identified and described, but the proportions of those constituents are not established. (BS 812:Part 104:1994)

Quantitative examination – An examination in which the amounts and proportions of one or more constituents of a sample are determined. (BS 812:Part 104:1994)

Quartering – Reduction of a sample to a desired volume by dividing a cone of material into four quarters and combining alternate quadrants. This is repeated until the desired sample quantity is obtained (Smith and Collis 1993).

Quartz – Crystalline silica, SiO_2 ; an important durable rock-forming mineral (see also silica) (Smith and Collis 1993).

Quartzite – Metamorphic rock consisting mainly of quartz and formed by recrystallization of sandstone or chert by thermal or regional metamorphism. Also loosely used synonymously with ‘orthoquartzite’. (Smith and Collis 1993).

Quartzo-feldspathic minerals – Minerals of the quartz and feldspar groups, generally imparting a light colour and relatively low specific gravity to the rock (Smith and Collis 1993).

Recycled aggregate – Material collected and separated from waste, especially that created by the demolition of existing structures, including concrete, masonry or road plantings, and subsequently processed to form aggregate for new use (Smith and Collis 1993). The European definition is an aggregate resulting from the processing of inorganic or mineral material previously used in construction (EN 13242 and EN 12620).

Reef limestone – A limestone consisting of the fossilized remains of reef-building organisms, such as corals, bryozoa, algae and sponges (Smith and Collis 1993).

Representative sample - A bulk sample created by taking sampling increments according to a sampling plan, which makes it likely that the quality of this sample corresponds to that of the batch. (BS EN 932-1:1997).

Reused aggregate – Material reclaimed for use as aggregate without processing to change its physical or chemical characteristics; an example is the recovery of aggregate for reuse from the washing of unwanted fresh concrete (Smith and Collis 1993).

Rock - Rock is a natural material that forms the crust of the earth. There are three broad categories of rock distinguished according to their origins; Igneous, sedimentary and metamorphic rocks. (Smith and Collis 1993).

Rhyolite – A fine-grained to glassy acid volcanic rock, mineralogically similar to granite. The more glassy members of the group are termed obsidian (Smith and Collis 1993).

Riffling – Sample reduction using riffle box. This is a box comprising a number of internal chutes directing alternately towards the two receiving trays. By this means each sample pass is halved and the material of one tray is rejected (Smith and Collis 1993).

Rippability – The facility with which a rock can be excavated by ripping (Smith and Collis 1993).

Ripper – A tractor or bulldozer with a hooked tine or array of tines which can be forced into the ground hydraulically to break it up as the tractor moves forward (Smith and Collis 1993).

Ripping – The process of excavating rock with a ripper.

Riprap – A material used to protect slopes against the action of water, consisting of broken stone placed on the slope surface (Smith and Collis 1993).

Rock-forming minerals – Those minerals which are widespread in nature and which contribute significantly to the common rock groups, serving to define and classify the common rocks (Smith and Collis 1993).

Sand – In the British Standard particle size classification (BS 1377:1975 5930:1981) sand is a granular material in the size range 0.06mm to 2mm. For aggregates within Europe, ‘sand’ is the preferred term for fine aggregates with a top size of 4mm (Smith and Collis 1993).

Sandstone – A sedimentary rock made of abundant fragments of sand size set in a fine-grained matrix or cementing material. The sand particles are usually of quartz. The term sand-stone may be used to describe any clastic (q.v.) rock containing individual grains visible to the unaided eye (Smith and Collis 1993).

Sand waves – Large, linear, subaqueous sand dunes or sand ripples formed by currents on the bed of the sea or in a river; the smallest sand waves in sedimentary rocks are ripple marks, larger ones are megaripples. May be applied to wind-blown ripples – that is sand dunes (Smith and Collis 1993).

Sampler - An individual, a number of individuals working as a team, or an organization, taking samples on a routine basis. (BS EN 932-1:1997).

Sampling increment – A quantity of material taken at one time from a larger body of material. (BS 812:part 102:1989).

Scalping – Removal of finer fraction of feed to process plant with the objective of rejecting deleterious material (Smith and Collis 1993).

Schist – Metamorphic rock characterized by a parallel arrangement of the bulk of the constituent minerals. The common minerals which give rise to the layered structure are the micas (q.v.) (Smith and Collis 1993).

Schmidt rebound number – Value obtained from test with the Schmidt concrete test hammer. The value obtained may be empirically correlated with rock strength (Smith and Collis 1993).

Screen – A particle sizing device like a sieve, consisting of a surface (usually flat) which is perforated by apertures of characteristic size and shape. Screening is a sizing operation effected by means of a screen (Smith and Collis 1993).

Scrubber/scrubbing – A mineral processing machine/operation in which adherent fine fragments or clay coatings are washed from the surface of larger particles (Smith and Collis 1993).

Secondary aggregates – Secondary aggregates include artificial aggregates, industrial by-products and waste materials. There is a considerable pressure to use secondary aggregates because of both the scarcity of primary aggregates and environmental benefits. (Smith and Collis 1993).

Secondary minerals – Minerals formed by alteration or replacement of the original rock minerals, e.g. serpentine after olivine (q.v.) (Smith and Collis 1993).

Sedimentary rocks - rocks formed at the earth's surface by the accumulation, or precipitation, of the products of weathering and erosion of existing rocks. They can also be formed by the accumulation of organic debris. Such accumulated material can remain unconsolidated or it can be lithified into rock. Sedimentary rocks are usually layered. (BS EN 932-3: 1997).

Sericite – A secondary mica usually resulting from the alteration of other rock-forming minerals. Chemically similar to muscovite, and may be considered as a microcrystalline muscovite (q.v.) (Smith and Collis 1993).

Shale – Fine-grained sedimentary rock composed of clay minerals and other finely divided material. These rocks are characterized by a well-marked bedding-plane fissility (Smith and Collis 1993).

Shape sorting – Shape sorting is employed to reject flaky particles that are detrimental to many uses of aggregates such as roadstone and concrete. (Smith and Collis 1993).

Shelling-out – Particles or fragments breaking off rock as a result of frost action or other physical or chemical changes (Smith and Collis 1993).

Silica – The chemically and physically resistant dioxide of silicon, SiO₂, which occurs naturally as quartz, flint, chert, opal or chalcedony and combines in silicates as an essential constituent of many rock-forming minerals (Smith and Collis 1993).

Sill – A tabular or sheet-like minor igneous intrusion that conforms with the bedding or other layered structure of the host (or country) rock (Smith and Collis 1993).

Silt – A deposit which has the average grain size between that of sand and clay (q.v.) (Smith and Collis 1993).

Siltstone – An indurated fine grained rock in which the amount of silt grade material exceeds that of clay; it tends to be flaggy, hard and durable (Smith and Collis 1993).

Single sized aggregate - Aggregate containing a major proportion of particles of one size. (BS 6100-6.3:1984).

Sintered aggregate - Lightweight aggregate produced by heating small particles of a material causing them to cohere. (BS 6100-6.3:1984).

Slate – A low grade regionally metamorphosed argillaceous (q.v.) rock which has developed a well marked cleavage (q.v.) but has undergone little recrystallization, so that the rock is still very fine grained (Smith and Collis 1993).

Slime – Very fine material, often clay particles, in suspension which usually presents a processing and dewatering problem. ‘Desliming’ is an operation which involves removing very fine material from a pulp or slurry (Smith and Collis 1993).

Slurry – A suspension of mineral particles in water (Smith and Collis 1993).

Slurry seal – A mixture of binder, fine aggregate and mineral filler with water added to produce a material of slurry consistency used as a barrier to groundwater movement in construction (Smith and Collis 1993).

Smectites – A group of clay minerals including montmorillonite. They are ‘swelling’ clay minerals and can take up water or organic liquids between their layers, and they show cation exchange properties (Smith and Collis 1993).

Soil – In engineering geology: all unlithified material overlying the bedrock. In Britain it comprises most materials of Tertiary and Quaternary age. In soil science: the natural medium for the growth of land plants and classifiable into soil types and soil horizons on characteristic physical properties such as structure, texture, colour and chemical composition including organic content, acidity, alkalinity etc. (Smith and Collis 1993).

Sorted – Referring to the size distribution of unconsolidated sediments, e.g. sands, gravels etc., size separation having taken place naturally (Smith and Collis 1993).

Sorted, well – Having a relatively narrow size distribution free of coarse particles and fine clays (Smith and Collis 1993).

Sorted, poorly – having a relatively wide size distribution (Smith and Collis 1993).

Sorting – there are two types of sorting, hand sorting and mechanical sorting. Mechanized optical sorting based upon colour or reflectivity has been applied in some cases. (Smith and Collis 1993).

Spheroidal weathering – The progressive splitting away, from a central core, of usually fine-grained rock of concentric or spherical shells (‘onion-skins’) of chemically weathered material. Also brought about by mechanical weathering through the freezing of water which has penetrated progressively into blocks, boulders or pebbles, or by differential expansion and contraction by alternating heating and cooling usually on a daily cycle in response to insolation (i.e. heating by the sun) (Smith and Collis 1993).

Spilite – A chemically altered basalt characterized by presence of secondary minerals giving a greenish colour (‘greenstone’) (Smith and Collis 1993).

Stratified – Sedimentary material laid down in layers on beds; bedded (Smith and Collis 1993).

Stratum – A distinct layer or bed of sedimentary material. Commonly used in the plural form: strata (Smith and Collis 1993).

Stucco work – Plaster used for coating walls (Smith and Collis 1993).

Sub-base – In a road pavement, a layer of usually granular material below the road base. Its functions include insulating the pavement from the subgrade (q.v.) increasing the pavement thickness to protect against frost and to provide an adequate surface for construction plant (Smith and Collis 1993).

Subgrade – Rock or soil horizon immediately beneath a pavement (q.v.)

Subsample - A sample obtained from sampling increments or a bulk sample by means of a sample reduction procedure. (BS EN 932-1:1997).

Subsoil – The Weathered soil or rock immediately below the topsoil (Smith and Collis 1993).

Sulphate content – The percentage of sulphate in the aggregate composition.

Surface coating, filters – Some aggregates have a coating that may, or may not, be easily removed during initial processing. Coatings are commonly composed of clay, silt, calcium carbonate, iron oxides, silica or gypsum, but other coatings can occur. Such coatings may vary in thickness and hardness and are, on the whole, undesirable in filter aggregates. (Smith and Collis 1993).

Surface dressing – One or two coats of single-sized aggregate rolled into the wearing-course to provide a non-skid, abrasion-resistant surface. (Smith and Collis 1993).

Surface texture – Surface texture can be classed in the following groups; glassy, smooth, granular, rough, crystalline, honeycombed. (Smith and Collis 1993).

Syenite – A coarse-grained plutonic igneous rock, characteristically with pink feldspar and dark minerals (especially hornblende) but little quartz (Smith and Collis 1993).

Tar – A viscous liquid, black in colour, having adhesive properties, obtained by the destructive distillation of coal, wood, shale etc. Where no specific source is stated it is implied that the tar is obtained from coal (Smith and Collis 1993).

Tar emulsion – An emulsion in which, with the aid of suitable emulsifying agents, tar is dispersed in water, or in an aqueous solution (Smith and Collis 1993).

Tarmacadam – A road material consisting of stone coated in tar or a tar bitumen mixture. It has very little fine aggregate and a high proportion of voids (Smith and Collis 1993).

Ten per cent fines value (TFV) – Resistance of an aggregate to crushing as measured by the force in kN applied in the ten per cent fines test. The larger the value, the more resistant to crushing is the rock. (Smith and Collis 1993).

Tension jointing – Fractures in a rock resulting from tensile stresses (Smith and Collis 1993).

Teschenite – An alkali-rich variety of gabbro generally containing soda rich amphiboles or pyroxenes (q.v.) calcic plagioclase and analcite (Smith and Collis 1993).

Test portion – The material used as a whole in testing or inspection. (BS 812: Part 102:1989). A sample used as a whole in a single test (EN 933-4)

Texture depth – A measure of the macrotexture of a paving surface; it determines the rate at which the skidding resistance of the surface changes with change in vehicle speed (Smith and Collis 1993).

Thermal metamorphism – See metamorphism, thermal.

Tremolite – An amphibole, $\text{Ca}_2\text{Mg}_5\text{Si}_8\text{O}_{22}(\text{OH})_2$, the end member of the tremolite – actinolite series.

Tridymite – High temperature polymorph of quartz (Smith and Collis 1993).

Tuff – A compacted, commonly stratified, pyroclastic deposit having up to half of its bulk composed of clay to sand-sized particles (Smith and Collis 1993).

Unbound aggregate – Aggregate which is not bound or coated with cementitious or bituminous binders (i.e. various forms of wet or dry mix macadam as used in bases and sub-bases for road pavements) (Smith and Collis 1993).

Unconformity – An interruption in a geological sequence representing an interval of geological time during which no sediments or other rocks were formed. The underlying older rocks may have been deeply eroded, tilted, folded or even metamorphosed (q.v.) before sedimentation was resumed, resulting in non-parallelism of the structure above and below the unconformity (Smith and Collis 1993).

Unconsolidated – A broad term describing sediments which have not been hardened by deep burial and/or cementation and correspond to the engineering meaning of ‘soil’, i.e. clays, silts, sands and gravels (Smith and Collis 1993).

Uncrushed gravel – Coarse aggregate processed from gravel without crushing. (BS 6100-6.3:1984).

Uniformity coefficient – The ratio between the D_{60} size on a grading curve and the D_{10} size, the D_{60} size being that at which 60% of the material is finer, the D_{10} size being that with 10% of finer material. The ratio D_{60}/D_{10} gives a measure of the soil grading, with a well graded (q.v.) soil having a coefficient of five or more (Smith and Collis 1993).

Unsoundness – The inadequate resistance of a material to chemical attack or to repeated physical changes such as temperature, moisture content, stress etc. (Smith and Collis 1993).

Vein quartz – A coarsely crystalline variety of quartz characteristic of hydrothermal (q.v.) veins (Smith and Collis 1993).

Vermiculite – A layered silicate mineral of the chlorite (q.v.) family which on heating expands greatly to give a light cellular material much used for thermal insulation (Smith and Collis 1993).

Vesicular, vesiculate – Describes the texture of a rock, especially a lava, containing abundant bubbles or vesicles formed by expanding gases when the lava was fluid; the vesicles may subsequently become filled with secondary minerals (such as calcite or quartz) to form amygdales (Smith and Collis 1993).

Water absorption – Percentage of water by mass that can be absorbed by an aggregate when in a saturated surface-dried condition (Smith and Collis 1993) (BS 812- 107, 1990).

Water-bound aggregate, or water-bound macadam – Usually a road base or sub-base in which a layer of aggregate has sand watered in to fill the voids (Smith and Collis 1993).

Wearing course – In a road pavement, the uppermost layer. It contains the highest quality materials in the pavement and its function is to provide the desired riding and non-skid properties to the road (Smith and Collis 1993).

Weathering – The process by which rocks are broken down and decomposed by the actions of external agencies such as wind, rain, temperature changes, plants and bacteria. (BS 812:Part 104:1994)

Weathering grade – The degree of weathering experienced by the aggregate classed into the following groups; fresh, faintly, slightly, moderately, highly, completely and residual soil. (Adapted from Smith and Collis 1993).

Weathering resistance – Resistance to weathering is not an engineering property in itself but a measure of the reaction to weathering agencies which result in greater or less change in the engineering properties of strength, resistance to abrasion, polishing and adhesion described above. (Smith and Collis 1993).

Well-graded – In civil engineering, natural or artificial aggregate with a wide range of particle sizes distributed in a continuous sequence. In geology, in contrast, it denotes a single sized grading, e.g. Aeolian dune sand (Smith and Collis 1993).

Whinstone – A colloquial term which includes any dark fine-grained igneous rock, e.g. andesite, basalt, dolerite. Derived from Whin Sill in northern England (Smith and Collis 1993).

Winning – Extraction of minerals by stripping of overburden and open excavation of underlying mineral matter (Smith and Collis 1993).

Workability – For practical purposes, the ease with which a concrete or mortar mix can be handled and placed in its final form (Smith and Collis 1993).

Xenolith – An inclusion in an igneous rock of an unrelated rock-type, derived from the country-rock (q.v.) or carried up from depth (Smith and Collis 1993).

Zeolite – A group of hydrated silicates of calcium and aluminium, sometimes with sodium and potassium. They are secondary minerals resulting, in general, from the alteration of feldspars and other aluminous minerals in igneous rocks (Smith and Collis 1993).

Zircon – Zirconium silicate, $ZrSiO_4$. The mineral occurs as a primary constituent of igneous rock, especially the more acid, e.g. granite (Smith and Collis 1993).

REFERENCES

Bates, R. L. and Jackson, J. A. 1980. Glossary of Geology, 2nd Edition ISBN 0-913312-15-0

BS 7943:1999 Guide to the interpretation of petrographical examinations for alkali-silica reactivity

BS 812: Part 102: 1989, Testing Aggregates, Methods for Sampling, British Standards Institution, London, UK.

BS 812: Part 104: 1994. Testing aggregates. Method for qualitative and quantitative petrographic examination of aggregates.

BS 882:1992. Aggregates from natural sources for concrete.

BS EN 932-1:1997, Tests for General Properties of Aggregates, Part 1, Methods for Sampling, British Standards Institution, London, UK.

BS EN 932-3: 1997, Tests for General Properties of Aggregates, Part 3, Procedure and Terminology for Simplified Petrographic Description, British Standards Institution, London, UK.
(not finished)

Characterisation of old mortars with respect to their repair: 2004, 5. Glossary. Edited by C.Groot, G.Ashall and J. Hughes. RILEM TC 167 – COM Chapter 5, State of the art report, November 2004.

BS 6100-6.3:1984 glossary of Building and Civil Engineering Terms – Section 6.3 Aggregates.

EN 933-4, Tests for geometrical properties of aggregates — Part 4: Determination of particle shape — Shape index, 2007.

EN 12620:2002+A1, Aggregates for concrete, 2008.

EN 13055-1, Lightweight aggregates - Part 1: Lightweight aggregates for concrete, mortar and grout, 2002.

EN 13242:2002+A1, Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction, 2007.

Smith, M. R. (Ed), Collins, L. (Ed), 1993, Aggregates Sand, gravel and crushed rock aggregate for construction purposes, Geological Society, 2nd Edition.

Whitten D. G. A. and Brooks, J. R. V. 1972. The penguin Dictionary of Geology, Penguin Books.

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