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by

M.A. Condon



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# NOMENCLATURE OF SEDIMENTARY ROCKS - GLOSSARY.

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# NOMENCLATURE OF SEDIMENTARY ROCKS

## GLOSSARY.

This glossary gives brief descriptions of the more important sedimentary rocks. Composition percentages are tentative in nearly all cases. The terms listed are classified as follows:

ARKOSE - Capital letters, underlined - rock names proposed for Australian use.

ARENACEOUS - Capital letters, no underline - terms proposed for use.

mengwacke - Lower case letters - names and terms listed for information but not for Australian use (at least for the present).

"ARENITE" - Inverted commas - new terms or term not generally used in Australia; require definition.

(CHALK) - Brackets - poorly defined terms requiring definition.

((cement-stone)) - Double brackets - obsolete or obsolescent terms.

ARKOSE (a) - (a) after the name - names proposed for use in stratigraphic nomenclature.

"ARKOSE BRECCIA" (b) - (b) after name - names proposed for description of stratigraphic units.

ABYSSAL (c) - (c) after the term or name - genetic terms proposed for classification of stratigraphic units.

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ABYSSAL (c). In sediments, pertaining to, deposited in the deep sea - at a depth of more than 6,000 feet. Modern sediments include organic oozes and red mud. ( K & S)

AEOLIAN (c). Of, relating to, formed by or deposited from the wind. Aeolain deposits may be distinguished thus: sands are well-sorted, cross-laminated with steep fore-sets (up to perhaps 40°), and composed of rounded, minutely pitted and frosted grains, mainly of quartz (except beach dunes) and mainly less than 1 mm. in diam.; silts are commonly poorly sorted (en masse), not laminated, of very diverse mineralogy. (T., p.65-81).

ALGAL LIMESTONE (b). Massive or bedded organic limestone composed of the carbonate precipitated by algae. An important constituent of 'coral' reefs. See KLINTITE.

AGGLOMERATE (a). Pyroclastic rudite (q.v.) consisting of sub-rounded and sub-angular fragments, mainly greater than 4 mm. in diameter and usually including fragments of boulder size of volcanic rock in a tuff or ash matrix (W-W, modified).

AGGLOMERATING (b). See under COAL

ANHYDRITE (a). Crystalline evaporite (calcium sulphate). Commonly fine-grained, but may be fibrous or coarse-grained. Harder than gypsum but otherwise similar in

appearance and primary occurrence. (Fay). May also be developed by the metamorphism of gypsum.

ANTHRACITE (a). Hard, black, brilliant, opaque coal. It has a smooth fracture and is the heaviest of the coals (specific gravity 1.5 to 1.8). It ignites with difficulty but burns in a good draught with an intense heat. Its moisture content (up to 3%), volatiles (1 to 10%) and ash (up to 8%) are low; fixed carbon (84 to 94%) and heat value (13,550 to 14,500 B.T.U./lb.) are high. It is a 'non-weathering' and 'non-agglomerating' coal. (B & H, p.87; George, p. 266).

anthraxylon (U.S.). Coal maceral, cf. VITRINITE (q.v.)

ARENACEOUS (b). Consisting of or including a significant proportion of fragments between 0.06 and 4.0 mm.

"ARENITE" (b). Grain-size class name (Grabau, p.242) for fragmental sedimentary rocks having a grain-size between 0.06 and 4.0 mm. (D-K-S); (cf. PSAMMITE).

Sub-classes proposed are:

| | | |
|---|---|---|
| very coarse | : | 2.0 to 4.0 mm. |
| coarse | : | 1.0 to 2.0 mm. |
| medium | : | 1/4 to 1.0 mm. |
| fine | : | 1/8 to 1/4 mm. |
| very fine | : | 1/16 to 1/8 mm. |

ARGILLACEOUS (b). Consisting of or including a significant proportion of clay minerals.

ARGILLITE (a). Lutite hardened by recrystallization but not necessarily having slaty cleavage. (P. p.269).

ARKOSE (a). Arenite composed of felspar (20 to 60%), quartz, (20 to 78%), and heavy minerals of the granitic suite (2 to 4%) with up to 30% kaolinitic clay, 20% mica and/or 40% fragments of slate, quartzite, granitic rock and/or schist (Brongniart, quoted in Oriel, 1949).

"ARKOSE BRECCIA" (b). Breccia consisting of fragments of granitic rock, quartz and felspar in a matrix, generally sandy, of quartz, felspar and mica. May contain minor amounts of slate, quartzite, schist and/or kaolinitic clay.

"ARKOSE CONGLOMERATE" (b). Rudite similar to arkose breccia in composition but having the large fragments mainly rounded.

"ARKOSE SILTSTONE" (b). Siltstone consisting of (potash and soda) felspar (20 to 60%), quartz (20 to ?60%) and kaolinitic clay (20 to 50%) with up to 20% mica (muscovite and biotite) and up to 20% fragments of slate. (D-K-S).

ash. See COAL ASH, VOLCANIC ASH

BATHYAL (c). In sediments, pertaining to or deposited on the ocean bottom between depths of 600 and 6,000 feet. Modern bathyal sediments include very fine sand, silt clay, and calcareous glauconitic and siliceous sediments (K & S, 1951

BAT GUANO (b). See under GUANO.

BAUXITE (a). Aluminous rock consisting of aluminium hydroxides and 'impurities'. Two main types - lateritic and detrital (the original bauxite of Berthier, 1821). The detrital bauxite is fine-grained, earthy and light-coloured. Lateritic bauxite is pisolitic, oolitic, earthy or granular, usually light in colour but may be reddish or brown, of relatively low density and of a rather distinctive texture (like poorly-baked brick). Chemical analysis to determine at least the alumina, silica and iron is necessary for certain determination. The range of chemical composition of bauxite is as follows:

| | | |
|---|---|---|
| Alumina (available) | : | ?30 to 70% |
| (total) | : | 45 to 75% |
| Combined water | : | 15 to 35% |
| Ferric oxide | : | 1 to 12% |
| Combined silica | : | up to 10% |
| Titania | : | up to 10% |

The combined water is given off at 260° and 700°C.

BENTONITE (a). A lutite consisting essentially of the clay minerals montmorillonite and/or beidellite. Two types - swelling and non-swelling ('sub-bentonite'). The swelling type is distinguished by its capacity for absorbing large volumes of water causing marked swelling. It has a waxy appearance, a soapy feel when wet and greenish-yellow to cream colour. When shaken with water and allowed to stand forms a gel. The non-swelling type is more difficult to distinguish in the field but can usually be distinguished from clay by poor plasticity and from fine-grained bauxite by insolubility in HCl. As in the case of bauxite confirmation is usually required by laboratory tests, including 'Sadler's Test' (Fisher, 1946) and chemical tests. Bentonite is probably derived from fine glassy material such as volcanic ash by chemical alteration. (Ross and Shannon, 1926; quoted in Twenhofel, 1932, p. 268).

BILLY (c). Hard to very hard quartzite or siliceous sandstone (Dunstan, 1900) developed as part of the lateritic profile or by contact metamorphism beneath lava flows. Grey, white, reddish or brown, of fine to very coarse sand grain-size, occurring as irregular sheet-like masses usually a few inches to several feet in thickness.

BIOHERM (c). Dome-like, mound-like, lenticular or otherwise circumscribed mass built exclusively or mainly by colonial organisms (Cumings & Shrock, 1928, quoted in P., p. 296).

biohermal limestone. cf. KLINTITE (q.v.)

BIOSTROME (c). A bed consisting mainly of tests of benthonic organisms.

biostromal limestone cf. COQUINITE (q.v.)

BITUMINOUS COAL (b). ((soft coal)). Black or dark grey, more or less laminated coal with a resinous, pitchy or earthy lustre. It is 'non-weathering' and 'agglomerating'. Its moisture content (2 to 10%) and ash (2 to 12%) are low, and its volatiles (20 to 40%), fixed carbon (50 to 75%) and heat value (11,000 to 14,500 B.T.U./lb. moist) are high. It burns readily with a long smoky flame. (B-H, p.72).

BOG-HEAD (c). Dull to satiny, black and brown, massive or thin-bedded coal with conchoidal fracture. The distinctive feature of bog-head coals is the presence of translucent yellow, algal colonies. The body of the coal consists of comminuted vegetable debris, fragments of cuticles, spore exines and resin. (Marshall, 1942, p. 394).

BOG IRON ORE (c). Yellow, red or brown, massive, earthy, pisolitic or nodular limonite, usually without lamination. It may be high in phosphate and generally contains some sand and clay. Formed probably by bacterial action in shallow water (Twenhofel, p.441).

BOULDER (b). A rounded fragment of large size - diameter greater than 256 mm. (Wentworth, 1922).

BOULDER BED (b). A bed of any rock type containing a proportion, which may be quite small, of boulders. Residual boulders at the outcrop of the bed may be much more concentrated than within the bed.

BOULDER CLAY (b). Clay, usually rock-flour, containing scattered boulders, cobbles and pebbles. (Holmes, 1920). Terrestrial boulder clay is generally unbedded but marine boulder clay may be bedded. One indication for a glacial environment.

BRECCIA (a). A rudite in which the fragments are dominantly angular to sub-angular (Fay, 1920). Breccia commonly has more than half its fragments with a roundness of 0.2 or less (Krumbein, 1941). Grain-size sub-classes are:

| | | |
|---|---|---|
| Very coarse breccia | : | larger than 256 mm. |
| Coarse breccia | : | 64 to 256 mm. |
| Medium breccia | : | 16 to 64 mm. |
| Fine breccia | : | 4 to 16 mm. |

**bright coal.** (U.S.) - cf. CLARAIN (q.v.)

BROWN COAL (a). Nearly opaque, brown, dark brown or black coal with dull, earthy or resinous lustre. Its moisture content ranges from 10 to 70%; it is low in fixed carbon (10 to 45%), heat value (less than 9500 B.T.U./lb. moist) and ash (generally less than 5%) and high in volatiles (20 to 53%). It is a 'weathering' and 'non-agglomerating' coal intermediate in rank between peat and sub-bituminous coal. (B&H, p.56).

"CALCARENITE" (b). Fragmental carbonate rock composed of fragments (between 0.06 and 4.0 mm.) of carbonate organic tests, crystalline limestone, dolomite or siderite, cleavage fragments of calcite, aragonite or other carbonate and/or calcareous ooliths. May contain up to 50% of fragmental silicate, especially quartz. Glauconite is a common accessory (Grabau, 1904).

OOLITIC CALCARENITE (b). Calcarenite composed dominantly of carbonate ooliths. Distinguished mainly by structures - cross-bedding, ripple-marking indicating reworking by wave or current action.

CALCAREOUS (b). 1. Adjective applied to fragmental rocks containing a cement of calcium carbonate - calcareous sandstone.

2. Adjective to describe chemical rocks composed dominantly of clacium carbonate, e.g. calcareous oolite.

"CALCILUTITE" (b). (Grabau, 1904). Fragmental limestone of particle size less than 0.06 mm. consisting dominantly of carbonate fragments. It may contain quartz, clay minerals and/or glauconite up to about 30% and up to about 10% of mica. Distinguished by dominance of carbonate fragments, resulting in solution of the bulk of the material in HCl, from chalk mainly by the fragmental nature of the carbonate and the size of the particles, from crystalline fine limestone in some cases by shadows of detrital grain outlines in the re-crystallized carbonate.

"CALICHE" (b). Deposits at or near the surface due to the evaporation of ground water. May consist of one or more salts such as sodium carbonate, calcium carbonate, calcium sulphate, sodium sulphate, potassium sulphate, calcium chloride, sodium chloride, sodium nitrate, potassium nitrate. May be powdery or hard, and may from a continuous layer or separate nodules. (Twenhofel, 1932, p.479). See also Kopai, Travertine.

CANNEL COAL (b). Dull to satiny or greasy, black, brown or grey massive or thin-bedded coal with conchoidal fracture. Consists of finely disintegrated vegetable debris, with fragments of cuticles, spore exines and resin bodies. (Marshall, 1942, p.394).

CEMENT (b). The precipitated material acting as a bonding agent in fragmental rocks. Silica (chalcedony, opal, quartz), calcite, iron oxides and hydroxides and dolomite are common cements. Where the cement comprises 20 to 50% of the rock it is indicated adjectivally in the name, e.g. calcareous sandstone - a (quartz) sandstone with a calcite cement (P. p. 480).

((cement-stone)). Argillaceous siliceous limestone - the rock from which Portland Cement is manufactured.

(CHALK) (a). White or light-coloured, friable, fine-grained, calcareous rock composed of very-fine-grained crystalline calcite with or without tests of microscopic organisms (mainly foraminifera). Distinguished by composition- almost pure $CaCO_3$ - friability and fine grain. The origin of the fine calcite is still in doubt. (Tarr, 1925; K & S, p.139).

CHEMICAL ROCKS. The sedimentary rocks formed by precipitation from solution, with or without the intervention of organisms and separated arbitrarily from fragmental rocks on the basis of proportion of fragmental material. The chemical rocks are those that consist mainly of precipitated material. Two main classes - ORGANIC and INORGANIC (q.v.).

CHERT (a). Hard, dense, cryptocrystalline rock composed of chalcedony and opaline silica. It has a vitreous to waxy lustre, smooth, conchoidal or splintery fracture and a wide range of colours. It may be bedded, massive or nodular. May have clay minerals or fine carbonate in impure varieties. (Fay, 1920; Tarr, 1938).

CLARAIN (b). Well-laminated coal with a high proportion of translucent vitrinite bands and fragments, together with some resins spore exines, cuticles and a little fusinite. One of the main coal types as regards

composition (Marshall, 1942, p. 400). See also CANNEL, DURAIN and BOG-HEAD.

CLAY (a) Unconsolidated sediment of particle size less than 0.004 mm. Consists of various proportions of clay minerals (illite, montmorillonite, beidellite, kaolinite), quartz, sericite, iron oxides, felspar and calcite. Plastic when moist. Does not include materials composed primarily of bauxite or iron oxides (Grim, 1942).

"CLAYSTONE" (b). Massive lutite of grain-size less than 0.004 mm. Colour usually dark except where leached by weathering. Mineral composition not determinate by ordinary optical methods. (P., p.269).

CLAY-SHALE (b). Poorly indurated shale - slacks to clay on weathering or immersion in water. (Fay, 1920).

CLAY-SLATE (b). Slate which has been but little re-crystallized. Not very hard and the cleavage planes not lustrous. (Rice, 1940).

CLASTIC ROCK. Rocks composed mainly of fragments of older rocks. Also called FRAGMENTAL, DETRITAL, exogenetic or allogenic.

clastic limestone. Limestone composed of fragments of calcite. See CALCARENITE, CALCILUTITE, LIMESTONE CONGLOMERATE.

COAL (a). Brown to black, translucent to opaque, dull and earthy to brilliant and sub-metallic, combustible, non-crystalline solid formed by the partial decomposition of vegetable matter (B & H). Classified according to rank, i.e. the degree of diagenesis or metamorphism, or to physical constitution. Coal has a range in fixed carbon of 20 to 99%, volatiles 1 to 80% and ash 0 to 20%. The ranks of coal accepted for Australian use (Standards Assoc. Aust. 1929) are: (Peat), Brown Coal, Sub-bituminous, Bituminous, Semi-bituminous, Anthracite. The coal types (Marshall, 1942) are Clarain, Durain, Cannel and Bog-head, composed of various proportions of the following 'macerals' - Vitrinite, Fusinite, Cutinite, Sporinite, Micrinite and Algae.

'weathering' - If coal slacks (disintegrates) on exposure to the air it is described as "weathering".

'agglomerating' - If the carbonized residue from the heating of 1 gram of coal in the standard volatile matter test can be poured out of the crucible as a powder, or if it cannot support a 500-gram weight without being pulverized, the coal is classed as 'non-agglomerating'. If the residue will support a 500-gram weight or is a button showing swelling or coke structure, the coal is 'agglomerating'. (Rose, in Lowry, 1945, p.60).

COAL ASH (b). The mineral residue from the burning of coal. Occurs naturally where coal seams have burnt out. In this form it is fine-grained, friable, light-grey, wwhite or reddish. It is distinguished by its alkilinity, very fine grain and the presence of natural coke and/or collapse structures in the overlying strata. (B. & H, 122).

COBBLE (b). A fragment of rock with a diameter between 64 and 256 mm. and a roundness greater than 0.2 (Wentworth, 1922.

CONGLOMERATE (a) A consolidated fragmental rock composed mainly of fragments with a roundness greater than 0.2 and grain-size greater than 4.0 mm. (D-K-S). The name is usually qualified by the name of the dominant size and rock type, e.g. quartzite pebble conglomerate Grain-size sub-classes are:

| | | |
|---|---|---|
| boulder conglomerate | : | larger than 256 mm. |
| cobble conglomerate | ; | 64 to 256 mm. |
| pebble conglomerate | : | 16 to 64 mm. |
| fine conglomerate | : | 4 to 16 mm. |

See also ARKOSE CONGLOMERATE, GREYWACKE CONGLOMERATE, LIMESTONE CONGLOMERATE, QUARTZ CONGLOMERATE, VOLCANIC CONGLOMERATE.

COQUINA (b). Unconsolidated or loosely cemented and friable accumulation of entire and/or fragmental shells and other tests. Very porous and permeable. Very light in weight and usually light in colour. Matrix commonly absent. (Fay, 1920).

"COQUINITE" (b). A bedded organic rock consisting mainly of tests of benthonic organisms. The proportion of fossils may be relatively small but if they form the framework of the bed it may be considered a coquinite. The material between the tests may be any sedimentary material such as calcarenite, sandstone, siltstone, greywacke, etc. glauconite, calcite or dolomite. The dominant fossil is included in the name e.g. Inoceramus coquinite. Coquinite is distinguished from calcarenite by the absence of marked fragmentation of the tests, apart from the separation of valves or other hard parts held together by living tissue. It is distinguished from Klintite by being bedded instead of massive.

"COQUINITE" is a new word derived from 'coquina' and proposed as the name of the rock type comprising a biostrome (P., p.299).

"COQUINOID" (b) (P., p. 301). Adjective applied to rocks which contain a moderate but not dominant proportion of solitary benthonic fossils.

CUTINITE (b). One of the coal macerals, consisting of cuticular material.

DELTAIC (c). Of, pertaining to, deposited in river delta. Deltaic sediments are characterized by the presence of much vegetable debris, by beds of a wide range of grain-size, scour and fill structures, current bedding and ripples, with or without shallow marine characteristics.

DIATOMACEOUS EARTH (b). Unconsolidated siliceous organic rock consisting of the tests and fragments of diatoms with or without radiolaria, foraminifera, sponge spicules, sand, clay, organic residues. It is very light in weight and usually light in colour. It is very porous and moderately to very permeable, friable, fine-textured but not plastic when wet (Tolman, 1927).

DIATOMITE (a). Consolidated diatomaceous earth. Distinguished from lutites by its permeability and non-plasticity, from chalk by its permeability, abrasiveness and relative absence of calcite, from radiolarite only microscopically by the dominance of diatoms over radiolaria. (Murray and Renard, 1891, p.203).

DOLOMITE (a). Chemical (? metasomatic) rock consisting dominantly of the mineral dolomite (carbonate of calcium and magnesium - $CaMg(CO_3)2$). Very fine- to medium-grained crystalline, commonly idiomorphic. Transparent to translucent, commonly light coloured but may be dark. May be very compact or extremely porous or cavernous. Distinguished from limestone by being slightly harder to scratch, not effervescing in cold dilute HCl, not staining when treated with Lemberg's solution (Twenhofel, p.331). Dolomites are commonly poorly fossiliferous and fossils present are poorly preserved. (Twenhofel, p. 330).

DURAIN (b). Massive (non-laminated), dull, grey or black coal consisting mainly of micrinite and fusinite with or without megaspores and microspores, vitrinite, cutinite and resin bodies. Sporinite or cutinite may be concentrated locally. Durain is one of the main coal types as regards composition (Stopes, 1919; Marshall, 1942, p.394).

((encrinite)). Coquinite consisting of detached stem ossicles and plates of crinoids, blastoids and/or echinoids.

EPICONTINENTAL (c). Situated upon a continental platform.

EVAPORITE (c). Group name for crystalline sedimentary rocks formed by the evaporation of enclosed bodies of water. See ANHYDRITE, GYPSUM, ROCK SALT.

"FANGLOMERATE" (c). Conglomerate composed of a large range of sizes and rock types of sub-angular to sub-round fragments occurring in alluvial fans and piedmont aprons. A genetic term covering a wide range of types. (Lawson, 1913, cited in Twenhofel, p.802).

FERRUGINOUS (b). 1. Adjective applied to fragmental rocks containing a cement of iron oxides or hydroxides e.g. ferruginous sandstone.

2. Adjective to describe chemical rocks composed dominantly of iron minerals e.g. ferruginous oolite.

FLINT (c). 1. A nodule of chert in chalk

2. An artifact (? made of chert)

FLUVIAL (c). Pertaining to, deposited from, flowing water.

FLUVIO-GLACIAL (c). Produced by streams which have their source in glacial ice.

FRAGMENTAL ROCKS. (b). Sedimentary rocks composed mainly of fragments of pre-existing rocks, minerals and/or fossils. Also called 'Clastic', 'Detrital', 'Exogenetic' 'Allogenic'.

FULLERS EARTH (b). A fine-grained light-coloured earth composed essentially of the hydrated magnesium silicate attapulgite. Distinguished from clay by

its very low plasticity and from earthy bauxite mainly chemically by its low aluminium content. (Grim, 1942, p. 234).

FUSINITE (c). One of the coal macerals (Stopes, 1935) consisting of opaque "carbonized" cellular tissue. The cell cavities are empty or filled by mineral matter, not by coal substance. (Marshall, 1942, p.393).

GLACIAL (c). Of, pertaining to, deposited by, produced by glacier, sheet, mountain or floating ice.

GRADED BEDDING (b). Bedding in which there is a gradation in grain-size from coarser to finer upward from the base to the top of the bed (Bailey, 1936).

GRAIN-SIZE (b). The grain-size of a sedimentary fragment is to be taken as the aperture width of the largest standard sieve which will retain the fragment. In thin section, the grain size is to be taken as the mean diameter. The grain size of a fragmental sedimentary rock is the aperture-width of the standard sieve which in a sieve analysis would retain the largest fraction of the rock.

GRAVEL (b). Unconsolidated rock consisting of round to sub-angular fragments mainly larger than 4 mm. Terms indicating size and lithology of fragments and nature of matrix may be prefixed, e.g. sandy quartzite pebble gravel.

GREENSAND (a). A rock containing a large proportion of glauconite. May contain quartz (commonly very coarse), lutite or carbonate material. Foraminifera and other fossils, commonly infilled with glauconite or glauconitic mud, are common.

GREYWACKE (a). Arenite consisting of angular (and rounded) grains with a fine-grained micaceous and/or chloritic matrix constituting from 15 to 50% of the rock. The sand-size grains may be quartz (0 to 85%), felspar (0 to about 50%), rock fragments (0 to about 70%), ferromagnesian minerals (up to about 15%), heavy minerals (3 to about 5% in addition to the ferro-magnesian minerals). Distinguished from QUARTZ SANDSTONE by the presence of a fine-grained matrix, poorer sorting, poorer rounding of grains and commonly by the presence of fragments of rocks. Distinguished from ARKOSE mainly by the type of matrix (micaceous/chloritic rather than kaolinitic) by the type of felspar (mixed rather than orthoclase and acid plagioclase).

"QUARTZ GREYWACKE" (b). Name proposed for greywacke composed of more than 50% quartz, 10 to 30% fine grained matrix and 0 to 20% felspar.

"GREYWACKE BRECCIA" (b). An angular rudite consisting mainly of angular to subangular fragments larger than 4 mm. of quartz and/or sedimentary igneous and metamorphic rocks in a sandy and/or silty matrix.

"GREYWACKE CONGLOMERATE" (b). A rudite consisting of round to sub-angular fragments similar in size and type to those of greywacke breddia.

"GREYWACKE SILTSTONE" (b). (D-K-S). Siltstone consisting of quartz (40 to 85%), mica (5 to about 15%) and clay (15 to 50%) with or without felspar (up to about 15%) and fragments of chert and slate (up to about 20%).

(GRIT)(a). A poorly defined term preferably used only as a stratigraphic term for angular coarse to very coarse arenites.

GUANO (b). Friable, fine-grained, white, yellow or grey phosphatic rock formed from the excrement and parts of sea-birds, or bats (BAT GUANO). Changes into hard grey rock phosphate (q.v.) (Twenhofel, 1932, p.557).

leached guano - Porous, 'honeycombed' or brecciated hard rock phosphate, formed by the leaching of guano under hmmid conditions.

GUMBO (b). Fine-grained alkaline soil, usually devoid of sand, when saturated becomes waxy or soapy in appearance and sticky (Urquhart, 1950).

GYPSITE (b). White to light grey, incoherent, earthy gypsum. (Rice, 1940). Distinguished from chalk by absence of effervescence in acid, from diatomaceous earth by the greater density and by the presence of small selenite crystals, and from powdery rock salt by insolubility in water.

GYPSUM (b). Colourless to light grey or brown, medium to very coarse grained crystalline rock consisting mainly of the mineral gypsum (hydrated calcium sulphate). The bedded variety is formed by the evaporation of enclosed bodies of water. It may contain silt or clay and/or organic residues particularly carbon. Commonly interbedded with clay or shale. Distinguished by softness (scratched by finger nail) and crystallinity. SELENITE is the transparent, colourless, crystalline variety of the mineral, common in the weathered zone of shale.

HARDPAN (c). A layer within the soil profile formed by the cementation of the soil, by iron hydroxides or oxides, carbonates, sulphates or silica. May be one of the zones of a lateritic profile or formed by evaporation of ground water (Leggett, "Geology in Engineering", Appendix A).

"IGNIMBRITE" (b). See under TUFF

INORGANIC ROCKS (c). The class of (sedimentary) rocks formed by precipitation from solution without the intervention of organisms. Distinguished from fragmental rocks by the dominance of crystalline material precipitated in situ and from organic material by the absence of structures formed by organisms. Includes EVAPORITES, METASOMATIC ROCKS, PRECIPITATED ROCKS.

IRONSTONE (a). Crystalline to earthy inorganic rock consisting of iron oxides (hematite, magnetite, goethite, limonite), iron carbonate, chamoisite, and/or iron sulphide totalling from about 30 to 100%. Sedimentary ironstone usually has some silica and may be interbedded or interlaminated with chert. Clay, manganese minerals and/or ilmenite may be present. (P., p.333-347).

CLAY IRONSTONE (b). Concretionary or bedded argillaceous iron carbonate.

OOLITIC IRONSTONE (b). Ironstone composed mainly of

ooides of siderite, limonite, hematite, etc. The rock may be called 'siderite oolite', etc.

PISOLITIC IRONSTONE (b). Ironstone in which the iron mineral is mainly in the form of pisolities. Common as the ferruginous zone of laterite.

"KLINTITE" (b). (Biohermal limestone). Massive organic limestone composed of the carbonate tests of colonial organisms - algae, corals, stromatoporoids, bryozoa, worms - with or without solitary organisms - foraminifera, brachiopods, molluscs, etc. - calcarenite and quartz sand. Distinguished from coquinite and calcarenite by the absence of bedding and by the framework of colonial organisms. May be dolomitized. The essential component of reefs but not necessarily part of a reef. (P., p.296).

"KOPAI" (c). Local name for CALICHE (q.v.).

"KUNKAR" (c). Concretionary nodules or masses of carbonate of lime, deposited in the soil from ground water. (Reed, 1949, p. 468).

LACUSTRINE (c). Of, pertaining to, deposited in lake(s). Lake deposits are variable as to type and extent, depending on freshness or salinity of the water and the climatic and topographic environment. Difficult to differentiate from marine deposits except on the evidence of terrestrial fossils. (Twenhofel, 1932, p.819).

LAMINA (b). A (sedimentary rock) stratum less than 10 mm. thick, composed of sediment of a single type and grain-size.

LAMINATE(D). Consisting of laminae.

INTERLAMINATE(D). Laminae of two or more types in more or less repetitive sequence, e.g. interlaminated sandstone and siltstone; interlaminated chert and hematite.

LATERITE (c). 1. Dark red-brown, pisolitic, vermicular or concretionary ironstone formed as part of the mature soil profile by weathering under humid tropical conditions.

2. Soft, sectile clay, which hardens on exposure (Buchanan, quoted in Fox, 1932, p.2).

3. Used also for the complete lateritic profile which includes: Surface soil
Ferruginous zone - see 1. above
Mottled zone - mottled red, purple, yellow, brown and white earthy decomposed rock - includes 2. above.
Pallid zone - light-coloured weathered rock with structure of parent rock, grading down into the parent rock.

LIGNITE (a). Brown or dark brown, dull and earthy variety of brown coal (q.v.) with residual wood structure.

LIMESTONE. 1.(a). Any rock consisting dominantly of calcium carbonate.

2.(b). In a restricted sense, applied to the dense

very fine-grained to coarse-grained crystalline calcium carbonate sedimentary rocks which may contain clay, sand, fossils, iron oxide and/or dolomite. Distinguished by strong effervescence in cold acid and relative softness (scratched by bronze coin).

((lithographic limestone)). Very homogeneous and fine-grained calcilutite (q.v.)

OOLITIC LIMESTONE (b). Limestone including a significant proportion of calcium carbonate ooides. See also OOLITE.

LIMESTONE CONGLOMERATE (b). Conglomerate consisting of rounded fragments of limestone with or without fragments of other rock and/or quartz in a matrix of calcarenite, quartz sand (stone) or lutite.

"LUTITE" (c). (Grabau, 1904). Grain-size class name for fragmental rocks of grain-size smaller than 0.06 mm.

"MACERAL" (b). (Stopes, 1935). Individual constituents of coal. Main types are: Vitrinite, Fusinite, Cutinite, Sporinite, Micrinite.

(MARL). Lutite consisting of nearly equal proportions of clastic silicates (clay minerals, quartz, felspar, etc.) and carbonate. Distinguished by relatively pale colour, effervescence in acid, argillaceous smell, composition. Commonly, but not necessarily, fossiliferous (P., p.286).

MASSIVE (b). Applied to strata of uniform type and grain-size with a thickness of more than 100 mm. (P. p. 122).

MATRIX (b). In fragmental rocks consisting of fragments of different orders of magnitude, where the larger fragments are dominant the material made up of the smaller fragments is called the 'matrix'. (Krynine, 1948, p.138). Compare CEMENT.

mengwacke (Ger.). (Fischer, 1933). Fischer's term for poorly sorted arenite having from 33 to 90% unstable minerals.

MICRINITE (b). (Stopes, 1935, modified by Heerlen Comm., 1936) Coal maceral consisting of finely-divided, opaque, carbonized tissues.

(MUDSTONE ) (a). May be used as an inclusive term for massive siltstone and/or claystone.

NERITIC (c). Of, pertaining to, deposited on sea floor at depths up to 600 feet. Characterized by benthonic faunas, arenites and siltstones, current bedding, ripple marking, trails of marine animals.

OILSAND (a). Any rock containing petroleum recoverable by drainage.

ooide. Oolith or oolite (q.v.).

OOLITE (a). (i) Rock consisting mainly of ooliths (see below). In the restricted sense the name is applied to calcareous oolite (i.e. oolite consisting of calcite ooides). Other types are indicated by a compositional

adjective, e.g. siderite oolite. If the mineral composition is in doubt more general terms such as 'ferruginous oolite' may be given.
(ii) Used for the particle (oolith - q.v.)

OOLITH (b). Spherical or ovoid inorganic particles smaller than 2 mm. with concentric, laminated structure (Twenhofel, 1932, p.757). Mostly have a nucleus which may be a particle of quartz, felspar, calcite, etc., or a gas bubble. The material of the oolith may be calcite, dolomite, iron oxides, phosphate, silica, bauxite, glauconite, pyrite, chamoisite, siderite, etc. 'Ooide' and 'oolite' are synonyms.

ORGANIC ROCK (c). Sedimentary rock consisting mainly of the remains of organisms. (Fay, 1920).

PALUDAL (c). Of, pertaining to, deposited in swamps. Paludal deposits are characterized by peat, carbonaceous siltstone, iron oxide and carbonate, and marl.

PEAT (a). Brown to black, unconsolidated, moist, combustible (when air-dried), non-crystalline material formed by the partial decomposition of swamp vegetation. It is very porous and has high moisture content (50 to 90%). The fibrous material, dried to a moisture content of 10 to 20% for use has high volatiles content and low heat value, fixed carbon and ash.

PEBBLE (b). Round to sub-round fragment of rock or mineral of grain-size between 16 to 64 mm.

PELITE (c). Grain-size class name for fragmental rocks of the grain-size of clay.

PELITIC (b). Pertaining to, characteristic of, composed of pelite.

PETROLEUM (b). A typically oily, combustible, fluid mixture of numerous hydrocarbons, mainly filling voids in sedimentary rocks (Rice, 1940).

PHOSPHORITE (b). Amorphous, grey, brown or black, thin-bedded, dense, powdery, oolitic, or nodular calcium phosphate with phosphatized shelly fossils and with or without calcite, quartz and/or clay minerals. Distinguished by hardness, solubility without effervescence in acid (Holmes, 1920).

PISOLITE (b). Similar to oolith in structure and composition but larger - between 2 and about 10 mm. (Twenhofel, 1932, p.757).

PISOLITIC (b). Consisting mainly of pisolites.

PLUVIAL (c). Caused by rain (in contrast to ARID), rainy. e.g. Pluvial climate, pluvial environment.

PRECIPITATE (c). Chemical rocks formed by precipitation from solution but excluding those due mainly to evaporation of the solution.

PSAMMITE (c). Grain-size class name for fragmental rocks composed mainly of fragments of sand size (Rice, 1940).

PSAMMITIC (b). Of, pertaining to, consisting of or including material of sand size. (c.f. ARENACEOUS).

PSEPHITE (c). Grain-size class name for fragmental rocks composed mainly of fragments larger than sand. (c.f. RUDITE).

PSEPHITIC (b). Of, pertaining to, consisting of or including material of size larger than sand.

QUARTZ CONGLOMERATE (b). Conglomerate consisting mainly of rounded fragments of quartz usually in a matrix of quartz sand.

QUARTZ BRECCIA (b). Breccia consisting mainly of angular fragments of quartz.

"QUARTZ GREYWACKE" (b). (See under GREYWACKE).

quartz-mengwacke (from German). Greywacke including from 10 to 33% of unstable fragments (Fischer, 1933).

QUARTZ SANDSTONE (b). Arenite composed predominantly of quartz (more than 85%) with minor amounts of felspar (less than 10%), mica, chert, carbonate and/or glauconite and a small amount (less than 3%) of a small stable suite of heavy minerals. Distinguished from QUARTZ GREYWACKE by the absence of matrix, rounding of grains, and from ARKOSE by the small amount of felspar. May have calcite, silica, iron oxide cement and often has iron-stained grains. Equivalent to Pettijohn's 'orthoquartzite' (P.p.237).

QUARTZ SILTSTONE (b). Siltstone consisting mainly of quartz with minor amounts of clay minerals, mica, felspar and/or glauconite. Distinguished from other siltstones by the proportion of quartz, relatively good sorting (very little sand), relatively high permeability and friability (except where cemented).

QUARTZITE (b). QUARTZ SANDSTONE with siliceous cement. The cement may be quartz, chalcedony or opal. Distinguished (from siliceous sandstone) by breaking evenly through grains and cement and by relative absence of voids and optically by the optical continuity of grains and cement and/or by the sutured intergrowth of crystal boundaries in the cement.

QUARTZITIC (b). Having the texture of quartzite, with a siliceous cement. e.g. quartzitic quartz pebble conglomerate.

quartz-wacke (from German). Greywacke including up to 10% of unstable minerals (Fischer, 1933). Compare "QUARTZ GREYWACKE".

RADIOLARITE (a). Siliceous organic rock consisting mainly of the tests and fragments of radiolaria with or without diatoms, foraminifera, sponge spicules, other pelagic fossils clay, sand and organic residues. It is light in colour and low in density, very porous, moderately permeable, fine-textured, friable but not plastic when wet. Distinguished from lutites by its permeability (sticks to the tongue) and non-plasticity when wet; from chalk by its abrasiveness, and non-effervescence in acid; from diatomite only microscopically by the dominance of radiolaria. May be converted to CHERT by lateritization, diagenesis, contemporaneous deposition of silica or by metamorphism.

RANK. Degree of diagenesis of coal, used as one basis of classification (see COAL).

ROCK PHOSPHATE (b). PHOSPHORITE (q.v.)

ROCK SALT (b). Crystalline evaporite consisting mainly of halite (sodium chloride) with or without other evaporite minerals (halides, sulphates, carbonates, nitrates and/or borates). Generally very coarse to medium-grained crystals. Commonly interbedded with gypsum and clay. Distinguished by solubility in water and particularly by taste. (Twenhofel, 1932, p.460).

ROUNDNESS (b). Degree of elimination of corners and edges. Compare SPHERICITY. Defined numerically as the ratio of the average radius of curvature of the several corners and edges to the radius of the maximum contained sphere. Determined on sections or projections when the roundness is taken as the ratio of the average radius of curvature of the several corners to the radius of the maximum inscribed circle. Roundness grades are as follows (P., p.51):

ANGULAR: (Roundness of 0 to 0.15) - showing little or no evidence of wear.
SUB-ANGULAR: (0.15 to 0.25) - showing definite effects of wear. The fragments still have their original form but corners and edges have been rounded to some extent.
SUB-ROUNDED: (0.25 to 0.40) - showing considerable wear. Corners and edges rounded to smooth curves but original shape quite distinct.
ROUNDED: (0.40 to 0.60) - original faces almost completely gone but some faces may be present. Corners and edges smoothed to broad curves, not quite co-tangential.
WELL-ROUNDED (0.60 to 1.0) - no original faces, edges or corners left. Entire surface consists of co-tangential broad curves. Original shape suggested only by dimensions of grain.

RUBBLE (b). Unconsolidated angular rock and mineral fragments mainly larger than 4 mm.

"RUDACEOUS" (b). Consisting of or containing a significant proportion of fragments larger than 4 mm.

"RUDITE" (c). Grain-size class name (Grabau, 1904) for fragmental rocks of grain-size larger than 4 mm. (D-K-S). Includes conglomerate, breccia, agglomerate, fanglomerate, some tillite. cf. PSEPHITE.

SAND (a). Unconsolidated rock, mineral and/or organic fragments of grain-size mainly between 0.06 and 4.0 mm.

SANDY (b). Containing a significant proportion (10 to about 30%) of (quartz) sand. If the sand is other than quartz the nature of the sand should be indicated, e.g. felspar-sandy siltstone.

SANDSTONE 1. (a). In the restricted sense, QUARTZ SANDSTONE (q.v.)

2. (b). Any monomineralic arenite, i.e. consisting predominantly of one mineral, e.g. felspar sandstone, zircon sandstone.

3. In a loose sense any arenite (except tuff).

SEMI-BITUMINOUS COAL (b). Coal intermediate in rank between bituminous coal and anthracite (Standards Assoc. Aust., 1929, p. 13). It is black, laminated or massive, pitchy or dull in lustre, sub-conchoidal in fracture, and burns well in a good draught with a short smokeless flame. It is non-weathering and non-agglomerating. Moisture content (less than 5%), ash (5 to 8%) and volatiles content (12 to 25%) are low; fixed carbon (70 to 80%) and heat value (13,500 to 14,500 B.T.U./lb.) are high. It is the best "steam coal".

SHALE (a). Laminated lutite of fine grain (grain-size less than 0.004 mm.). Usually dark in colour, weathering light-coloured. Porosity very high to low depending on compaction and diagenesis, permeability very low. The less indurated varieties are plastic when wet and disintegrate on exposure. Typically but not necessarily fissile. The mineralogy of the grains is not determinate by ordinary optical methods. Distinguished from CLAYSTONE by lamination, from SILTSTONE by grainsize (in hand specimen by smoothness as compared with the fine granularity of siltstone), from radiolarite and diatomite by impermeability, grain-size, from chert by fracture, chemical composition. Several varieties are recognized (Krumbein, 1947):

ARGILLACEOUS SHALE (b). Composed dominantly of illite. Distinguished by extreme smoothness and fissility.

BITUMINOUS SHALE (b). Black or very dark blue-grey, finely laminated. Consists of illite, kaolinite, carbon, pyrite and/or marcasite, hydrocarbons. Yields on destructive distillation between 10 and about 20% hydrocarbons. The hydrocarbons are not extractable with the ordinary solvents for petroleum (such as ether, benzol, carbon tetrachloride, carbon bisulphide, alcohol).

CALCAREOUS SHALE (b). Light-coloured, laminae typically 1 to 5 mm. thick, non-fissile, may be very fossiliferous - both benthonic and pelagic forms. Distinguished by colour, softness (non-abrasive) and stong effervescence in acid. Probably the fine-grained equivalent of calcilutite or marl. Consists dominantly of calcite and dolomite with illite, kaolinite and quartz.

CARBONACEOUS SHALE (b). Black or very dark brown, finely laminated. Consists of illite, kaolinite, carbon, humic hydrocarbons, and pyrite and/or marcasite. Allied to and often associated with coal. In terms of proximate analysis of coal, carbonaceous shale has variable fixed carbon (20 to 80%), volatiles (up to 60%) and ash (20 to 80%). (These percentages in terms of dry weight.) The main difference between the carbonaceous shale and the bituminous and oil shales is in the fixed carbon content which is always less than 20% in the bituminous and oil shales (Day, 1922, p.833).

chloritic shale. The existence of this type is doubtful, the name having been used probably for chloritic siltstone.

FELSPATHIC SHALE (b). Consists dominantly of kaolinite with minor amounts of illite, felspar, quartz. Distinguished by light colour, medium-thick laminae (1 to 2 mm.), non-effervescence in acid.

FERRUGINOUS SHALE (b). 'red shale'. Mainly argillaceous shale with moderate amount (10 to 30%) of very fine-grained hematite. Distinguished by red colour, hardness (abrasive), and fissility.

GLAUCONITIC SHALE (b). 'green shale'. Contains a significant amount (10 to perhaps 50%) of very fine-grained glauconite in argillaceous shale.

OIL SHALE (b). Mainly argillaceous shale containing sapropelic hydrocarbons. Black or dark brown, finely laminated, may be silty. Consists of illite, kaolinite, carbon, sapropelic hydrocarbons with or without quartz, calcite, pyrite, marcasite. The proximate analysis shows low fixed carbon (2 to 20%), and variable volatiles (20 to 80%) and ash (20 to 80%). It is distinguished from bituminous shale by a higher volatiles content and from carbonaceous shale by a lower fixed carbon content and from cannel coal by a higher ash content (Day, 1922, p.832).

SILICEOUS SHALE (b). Composed dominantly of very fine-grained quartz, often with a chalcedonic or opaline cement. Besides quartz, contains illite, felspar, calcite. Fairly dark in colour, with laminae typically 1 to 5 mm. thick. Distinguished from chert sometimes with difficulty by argillaceous appearance and weathering, from other shales by hardness and chemical composition.

(SHALY)(b). A rather ambiguous term, preferably replaced by 'laminated', 'clayey', 'argillaceous' or 'slaty' as required.

SIDERITE (b). Grey to brown iron carbonate occurring as fine to coarse-grained crystalline masses, in concretions in shale which are fibrous within, and compact and earthy. The concretions in shale are called 'clay ironstone'. Black, earthy siderite interbedded with coal is called 'black band ore'. Also occurs in large masses as a metasomatic alteration product of limestone and as SIDERITE OOLITE (p., p.334).

SILICEOUS (b). 1. Adjective applied to fragmental rocks containing a cement of silica e.g. siliceous siltstone.
2. Adjective for chemical rocks containing significant amounts of silica, e.g. siliceous limestone, siliceous oolite.

SILT (b). Unconsolidated sediment of grain-size between 0.06 and 0.004 mm.

SILTSTONE (a). Consolidated lutite of grain-size between 0.004 and 0.06 mm. consisting mainly of fragmental silicate material - ashstone and calcilutite are not included in the term. The several varieties - QUARTZ SILTSTONE, GREYWACKE SILTSTONE, and ARKOSE SILTSTONE - are generally recognizable in the field but can only be determined adequately by optical means. SILTSTONE in general is distinguished from SHALE and CLAYSTONE by its fine but obvious granularity, from fine-grained arenites by the finer grain-size, from RADIOLARITE

and DIATOMITE by its relatively low permeability.

SINTER (b). Light-coloured, porous material deposited by hot or cold springs.

CALCAREOUS SINTER or TUFA (b). Light-coloured and low-density usually porous and spongy limestone deposited around springs, or from surface water generally. (Twenhofel, 1932, p. 323).

SILICEOUS SINTER (b). Light-coloured and low-density siliceous material deposited around springs. Distinguished from TUFA by hardness (abrasiveness) and non-effervescence in acid.

SLATE (a). Lutite hardened by diagenesis and/or dynamic metamorphism and fissile along closely spaced (cleavage) planes independent of the original bedding. (Rice, 1940).

SLATY (b). Having the characteristic cleavage of slate, e.g. slaty limestone.

spergenite. Calcarenite with less than 10% quartz and consisting of fossil detritus and ooides. Unnecessary term. (P., p.301.

SPHERICITY (b). The degree of approach to the spherical shape. Defined numerically as the ratio of the nominal diameter (diameter of a sphere of equal volume) to the diameter of the circumscribing sphere (generally the long axis of the fragment). (Krumbein, 1941, p.64). Shape classes are defined numerically by the ratios of long (a-) axis and short (c-) axis to intermediate (b-) axis where c is normal to the plane but not necessarily at the intersection of a and b. Shape classes are:

OBLATE (DISC) - a/b 1.5, c/b 2/3
EQUANT (SPHERE, CUBE) - a/b 1.5, c/b 2/3
ELONGATE (BLADE) - a/b 1.5, c/b 2/3
(ROD) - a/b 1.5, c/b 2/3

SPORINITE (b). (Stopes, 1935). Coal maceral derived from exines of megaspores and microspores.

SUB-BITUMINOUS COAL (b). Coal intermediate in rank between brown coal and bituminous coal (Standards Assoc. Aust., 1929, p.13). It is black, dull to moderately bright in lustre, usually laminated. It is weathering and non-agglomerating. It burns with a long flame. It has high moisture content (10 to 30%) and volatiles (30 to 50%) and moderate fixed carbon (35 to 50%) and heat value (9,000 to 11,000 B.T.U./lb.).

SULPHUR (a). Typically friable, yellow, combustible material occurring as a deposit around volcanic springs, or fumaroles, as beds interstratified with gypsum and shale, or as disseminated particles in shale. Distinguished by colour, softness (scratches by finger nail), low melting point (105°C.) burning readily with a blue flame and giving off pungent white fumes.

TILL (c). Unconsolidated and generally unbedded rock-flour clay and/or sand with scattered pebbles, cobbles and boulders deposited by sheet, glacier, mountain or floating ice. Distinguished by the wide range of size and type in the fragments, the presense of striated and facetted pebbles and the freshness of unstable minerals (feldspar, biotite, etc.) (Rice, 1940).

TILLITE (c). Consolidated and more or less indurated till.

TILLITIC (b). Having the characteristics of till.

TORBANITE (b). 'Kerosene shale'. Brownish black to greenish black, sapropelic material, intermediate between rich oil shale and bog-head coal. Streak yellow-brown to greyish; fracture concoidal to hackly; specific gravity 1.008 to 1.3; lustre dull to satiny; laminated to thin-bedded. Distinguished by the dominance of a single kind of plant, generally an alga, very well preserved. The algal colonies are up to 0.1 mm. in diameter, lemon yellow to orange, sponge like bodies in a very fine-grained, dark brown or black, opaque micrinite. Proximate analysis shows less than 1% moisture, fixed carbon between 5 and 30%, volatiles between 45 and 90% and ash up to about 50% (Morrison, 1928). The range of proximate composition overlaps both the bog-head coal and the oil shale, the distinction being the dominant amount of algal remains. Yields on destructive distillation from 70 to 120 gallons of hydrocarbon distillate per ton of rock.

TRAVERTINE (c). Dense, fine- to medium-grained crystalline calcium carbonate deposited from solution in ground and/or surface waters (Fay, 1920). Includes the following varieties: TUFA, KUNKAR. Commonly has appreciable proportion of sand or clay.

TUFA (c). Calcareous sinter (q.v.)

TUFF (a). Pyroclastic arenite (grainsize between 0.06 to 4.0 mm.) more or less indurated, consisting of volcanic ejecta-menta with or without other sedimentary materials. Distinguished by the presence of volcanic glass, unstable volcanic minerals in crystalline or angular form, occasional volcanic bombs, rough graded bedding, association with other pyroclastics and volcanic rocks. Named according to the volcanic rock type from which it derived, e.g. rhyolite tuff. Varieties are 'crystal tuff' - mainly crystals of volcanic minerals, 'vitric tuff' - mainly volcanic glass fragments, and 'lithic tuff' - mainly fragments of volcanic rock (W-W).

IGNIMBRITE (b). "Welded" acid tuff formed from a nuee ardente Katmaieene (Marshall, 1933, p.360). It has uniform and fine texture, prismatic jointing, flow structure and no bedding. It is coherent, but may be very porous.

PALAGONITE TUFF (c). Consists mainly of palagonite - formed by the alteration by hydration of basic volcanic glass (Murray and Renard, 1891, p.209).

VARVE (c). Sediment deposited during one year. Distinguished by graded bedding related to seasonal deposition (sand

to silt or silt to clay) and regular repetition with minor fluctuations in thickness. May be from 1 to 2,000 mm. thick but generally thin. Mainly but not necessarily fluvio-glacial. (Rice, 1940).

VOLCANIC ASH (b). Unconsolidated pyroclastic material of grainsize less than 0.06 mm. Where consolidated forms ASHSTONE.

VOLCANIC BRECCIA (b). PYROCLASTIC rudite in which the fragments are mainly angular. May consist of fragments of volcanic rock, volcanic minerals, with or without other rocks and minerals in a finer matrix of tuff or ash. A rare type as ejectamenta is usually somewhat rounded during explosion (W-W).

VOLCANIC CONGLOMERATE (b). Pyroclastic rudite composed of mainly rounded fragments of rock ejected from volcanoes. The rounding may be due to abrasion during the passage through the vent, during transport in a mud-flow or river, or by wave action on a beach. (W-W). Distinguished from VOLCANIC AGGLOMERATE by the larger proportion of rounded fragments.

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