

THE REGOLITH GLOSSARY

surficial geology, soils and landscapes

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Introduction a b d c e f g h i j k l m n o p q r s t u v w x y z

Regolith science evolved from several older disciplines, particularly geology, soil science, geography and geomorphology. Initially, the science drew on the terms from these sources, not always understanding them fully or using them accurately. This glossary has been written with several aims in mind:

- to compile a single reference for terms commonly used in regolith science;
- to bring consistency and uniformity to the terminology of regolith science;
- to clarify the meaning of words which, through the use in their primary definition of technical words, might be unclear to a non-specialist of that technical area; and,
- to explain the way words have been used in the regolith literature.

On this last point, there are words, such as ferricrete, which for many years have been used in a way rather different from that of their original definition. To define ferricrete as Lamplugh (1902) did: "A conglomerate of surficial sands and gravels cemented by Fe 'salts'", would not reveal the way the word has been used in many papers published since then, and such restriction would not inform the reader wanting to understand what might now be meant by the word. For many words we have therefore sought to explain the meaning, and in so doing we have redefined the terms as they are currently used.

We hope the glossary will be found useful by geologists, geographers, and mineral explorers, and those working in the environmental, soil, and agricultural sciences, as well as earth science teachers. As far as possible, words taken from glossaries of the

older sciences have been retained verbatim, or with some change in emphasis; we have not intentionally changed their meaning. Such sources are acknowledged in the right margin, with modified entries denoted by *, and all are given full attribution under the heading "Sources".

Some specialized areas of the 'parent' sciences deal with the regolith, and we had to decide on the level of detail this glossary could provide. For mineralogy, we have included those minerals more commonly formed in the regolith; for soil science we have tried to include the major field terms and classifications, but few of the terms specific to soil micromorphology and detailed classification. For geology, we have avoided restating the meanings of words that are fully defined in the American Geophysical Institute's "Glossary of Geology" except where these are indeed regolith geology terms.

There are a few entries which we consider to be confusing, or are terms that have been superseded, or which involve controversial and widely rejected concepts. These are printed in a smaller font size and we recommend against their usage.

Most scientific disciplines have classifications which make use of words in very specific ways. This glossary has included the more common of these, particularly words for landforms and soils. An example is the word 'hill', which is completely well understood by all English speakers, but which is defined for the purposes of land survey to be between 90 and 300 metres above its surrounds. In this glossary many such words are defined without reference to the essential classificatory terms. Users

should refer to the original source if a precise classification is sought. Such restricted definitions are generally recognizable from their attributed source, such as the Australian Soil and Land Survey Field Handbook (McDonald, 1990). An example is:

dune field An area dominated by dunes, generally *level to rolling landform pattern* of *very low to extremely low relief* without stream channels, built up or locally excavated, eroded or aggraded by wind.

In this definition, all the italicized words have specific definitions in McDonald, and to use this and other terms for land survey, one must know all their meanings. We have replaced this entry with: "An area dominated by dunes", and then referred to the McDonald Handbook.

Included in the Glossary are some 100 or so photographs and diagrams illustrating terms. These are largely bound in a colour section; their presence is flagged by a camera icon placed beneath the term.



To produce this glossary, Judy Papps typed, copied, scanned and copy edited the text and for her enthusiastic and sustained effort the Editorial Panel are most grateful. Original diagrams and photographs were contributed by members of the Editorial Panel, with drafting by Colin Steel and Angelo Vartesi. Critical comment by Paul Agnew, Rob Fitzpatrick, Bernie Joyce, Malcolm Sheard and Jonathan Clarke greatly improved early drafts. The work was supported by the Australian Government's Cooperative Research Centres Program.



Regolith and Landscape - Innamincka, S.A. (Photo S.M. Hill)

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source of the Snowy River, NSW. (Photo R.J. Arculus)

A b c d e f g h i j k l m

n o p q r s t u v w x y z

A horizon	See soil profile.
abrasion	The mechanical breaking of rocks or minerals by either friction against other rocks or by impact of other rock or mineral fragments. Friction abrasion is common at the base of glaciers, for example, whereas impact abrasion is more common in streams and in areas of wind transport. [RTMAP]
accretion	(i) The process by which an inorganic body increases in size by external addition, as by adhesion or precipitation. (ii) A concretion: specifically one that grows from the centre outward in a regular manner by successive additions of material. [AGI]
accretionary	Tending to increase by external additions or accumulations. [AGI]
accumulation zone	(weathering) That part of a weathering profile which is characterized by the accumulation of some elements (commonly Al, Fe, Mn, Ni).
Acid Peats	See Great Soil Group, No. 43 and Appendix 1 [Stace]
acid soil	Soil having a pH<7 throughout its profile.
acid sulfate soils	Soils characterized by low pH (<3.5) and the presence of bright yellow or straw coloured mottles of jarosite or natrojarosite (sulfuric horizon). Acid sulfate soils once contained pyrite (sulfidic material) and may still contain some, but have been exposed to the atmosphere by drainage or disturbance so that the pyrite has oxidized to form sulfuric acid.
aeolian	Pertaining to the wind; especially said of rocks, soils, and deposits (such as loess, parna, dune sand, and some volcanic tuffs) whose constituents were transported (blown) and laid down by the wind, or of sedimentary structures such as wind-formed ripple marks, or of erosion and deposition accomplished by the wind. [AGI*]
 aeolian sand	Wind blown sediment of sand size that may take the form of dunes with characteristic cross-bedding structures. [RTMAP*]
aeolian sediment	Sediment deposited from transport by wind. [RTMAP]

aeolianite (eolianite)



A consolidated sedimentary rock consisting of clastic material deposited by the wind; e.g., calcite cemented dune sand. [AGI]

aggradation

- (i) The building up of the Earth's surface by deposition; specifically the upbuilding performed by a stream in order to establish or maintain uniformity of grade or slope.
- (ii) A synonym of accretion, as in the development of a beach. [AGI]

alcove

Moderately inclined to very steep, short, open depression with concave cross-section, eroded by collapse, landslides, creep or surface erosion. [McDonald]

alcrete

Duricrust cemented mainly by aluminium compounds (compare with bauxite).

Alfisol

An order in the US soil taxonomy (Soil Survey Staff 1992).

allite

A weathering product with a high proportion of aluminium and iron oxyhydroxides.

allitic

Adjective, said of weathering which produces aluminium and iron oxide and oxyhydroxide minerals (generally gibbsite, boehmite, hematite, goethite), or of the product itself. The word 'ferrallitic' has the same meaning and may be preferred if the iron minerals dominate the assemblage. Allitic or ferrallitic regolith may also contain some quartz and kaolinite.

allitization

The chemical change of silicates to gibbsite (Pedro 1966); allitic alteration.

allocthonous

Said of regolith (or anything) formed or produced in a place different from where it now resides, such as parna.

allophane

Clay mineral, with composition in the range from $\text{Al}_2\text{O}_3 \cdot \text{SiO}_2 \cdot x\text{H}_2\text{O}$ to $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot x\text{H}_2\text{O}$ ($2 < x < 3$). Commonly as hollow ~5nm spheres in altered volcanic ash or soils derived therefrom.

alluvial

- (i) adj. Pertaining to or composed of alluvium.
- (ii) Said of a placer formed by the action of running water; also, said of the valuable mineral, e.g., gold or diamond, associated with an alluvial placer. [AGI]

alluvial fan

A fan deposited by a stream, for example at the place where it issues from a narrow mountain valley upon a plain or broad valley.

alluvial landform

A complex landform pattern on valley floors with active, inactive or relict erosion and aggradation by channelled and over-bank stream flow. [RTMAP]

alluvial plain

A level, or gently sloping, or slightly undulating land surface produced by extensive deposition of alluvium, generally adjacent to a river that periodically overflows its banks; it may be situated on a flood plain, a delta, or an alluvial fan. [AGI]

alluvial sediments

Materials deposited on the land surface from transport by flowing water confined to a channel or valley floor. (= alluvium) [RTMAP]

Alluvial Soils

See Great Soil Group, No 2 and Appendix 1. [Stace]

alluvial terrace

A terrace bordering a stream, covered by or built of alluvium, above the level of the present stream and its contemporary alluvial deposits. See also 'terraced land'.

alluvium

Sediment deposited from rivers, streams and creeks, etc.

Alpine Humus Soils

See Great Soil Group, No. 40 and Appendix 1. [Stace]

altération pistaché

A green coloured, lower horizon of the saprolite, particularly over mafic rock. Characterized by the presence of smectites, especially nontronite. [B&Z]

alterite

(French) Term, generally synonymous with saprolite. However, for some authors, 'alterite' refers less specifically to residual weathered material and 'isalterite' refers to saprolite. [B&Z]

alteroplasation

Incongruent alteration and formation of non-oriented plasma composed of secondary minerals within the primary minerals. [Tardy]

alunite

Mineral, $KAl_3(SO_4)_2(OH)_6$, found in acid argillic alteration, and in acid sulfate weathering in regolith of arid climates and in playa sediments.

alveole

The smallest of the interstices (<16 mm), generally equant to tri-axial in shape. The shape and distribution pattern of alveoli are highly variable, from a few openings to making > 50% of the rock surface or volume, in which case they determine the rock texture (alveolar, spongy); alveolar weathering = honeycomb weathering. [Aleva]

anabranch

A channel divergent from a main stream and either rejoining downstream or remaining separate and diminishing in size until becoming indistinct. Anabranches are common on alluvial plains. See also anastomosing and compare with braid.

anabranching drainage

A drainage pattern where the channels divide and then join further

down stream. This pattern is sometimes referred to as anastomosing or reticulated. It is similar in form to the arrangement of channels in a braided river channel but is at a much larger scale. [RTMAP]

anastomosing



A branching and reconnecting netlike pattern similar to the veins of a leaf. The term is commonly used to describe such a network of drainage channels (see also anabranch).

anastomotic plain

Flood plain on which the stream channels join and divide as do the veins on a leaf. (See McDonald for a more extensive definition.)

anatase

Mineral, TiO_2 , tetragonal. Most abundant polymorph of TiO_2 in the regolith. It commonly is found as very small ($0.1\mu m$) crystals, and is a common constituent of the fine-grained alteration assemblage known as leucoxene. Anatase has a cream-coloured appearance when it is concentrated, but mostly it is dispersed uniformly through silicate weathering products, where it results from the weathering of titanium-bearing minerals such as titanite, ilmenite, titanogite etc. It is a significant minor component of most silcretes and of QAZ cement.

ancestral river

According to Pels (1971), the alluvial Murrumbidgee riverine plain shows evidence for abandoned river channels roughly parallel to the existing courses, which were referred to as ancestral rivers. Evidence in the alluvium for older streams cross-cut by the ancestral rivers led to these streams being referred to as prior streams. Page and Nanson (1996) have queried this concept.

Andisols

An order in the US soil taxonomy (Soil Survey Staff 1992). Equivalent to Andosols.

ando soils

The same as Andosols. See Thorp and Smith 1949.

Andosols

Soils whose parent materials are wholly or mostly derived from volcanic ejecta (Matsuzuka 1977). Equivalent to Andisols. Only known in Australia from the Mt. Gambier region of South Australia.

anglesite

Mineral, $PbSO_4$, oxidation product of galena.

angulate drainage



Drainage pattern where channels follow a roughly rhomboid plan. This type of pattern occurs mainly where the underlying rock is weakened by intersecting joints. These joints control the location of drainage lines (compare with rectangular drainage). [RTMAP]

annular drainage



A drainage pattern where channels form parts of circles. Annular patterns are generally controlled by domal rock structures which are picked out by channels. They may be either circular or elliptical. [RTMAP]

<i>anomaly</i>	A deviation from common or normal experience. For numerical data, a value that differs significantly (in a statistical sense) from a previously established threshold or defined population.
<i>antecedent drainage</i>	An incised drainage which preserves a plan form not obviously related to the bedrock structure. It is thought to develop when uplift or warping raises an area of highlands across the path of a river, but the uplift is sufficiently slow to allow river downcutting to keep pace, and therefore maintain its course (compare with superimposed drainage).
<i>Anthroposols</i>	A soil order; soils which result from human activities. See Appendix 2: Australian Soil Classification. [Isbell]
<i>anti-dip slope</i>	Anti-dip slopes, also known as scarp slopes or scarps, are formed across the dip of bedded rocks. They are frequently irregular because of differential erosion of more and less resistant rocks that are interbedded. Drainage lines are often short and closely spaced. [RTMAP]
<i>antiformal landscape</i>	A landscape characterized by outward facing dip slopes and inward facing anti-dip slopes. They also may have divergent drainage patterns. In the case of domes, drainage may be radial, and annular. [RTMAP]
<i>Ap horizon</i>	That part of the A soil horizon (see soil profile) disturbed by tillage (ploughing).
<i>apedal</i>	Term applied to soils with no observable peds. [McDonald]
<i>aporic</i>	Soil fabric in which the voids observable in thin section show no relation to the packing of the physical fabric elements. The voids appear to be isolated (compare with poric). [B&S*]
<i>aquiclude</i>	A stratum or layer of rock that prevents water ingress. An aquiclude which is a boundary to an adjacent aquifer is called a confining bed.
<i>aquifer</i>	Permeable stratum carrying accessible water.
<i>aquitard</i>	A confining bed that retards but does not prevent the flow of water to or from an adjacent aquifer; a leaky confining bed. It does not readily yield water to wells or springs, but may serve as a storage unit for groundwater. [AGI]
<i>arene</i>	(French) Facies observed at the bottom of a weathering profile developed on granites or gneisses which still contain millimetric to centimetric grains of fresh primary minerals (feldspars and micas).

	The texture is coarse. An arene is equivalent to a coarse saprolite. See also grus. [Tardy]
arenization	Conversion to sand.
arenose	Sandy; composed largely of sand-sized particles (see also Wentworth size classes).
arenose horizon	(pedol) A sandy horizon, found above the pedoplasation front, which consists of a grain-supported (or nearly so) fabric. The loss of lithic fabric appears to be caused by solution of weatherable primary and secondary minerals and settling of resistant minerals, dominantly quartz (compare with plasmic horizon). [B&Z]
argiles bariolées	(French “variegated clay”) Refers to thick, soft, clay-rich saprolites consisting largely of sandy and pale clays, with fine violet and red spots and flecks derived from the weathering of ferromagnesian minerals.
argiles tachetées	(French, “mottled clay”) See mottled zone.
argillaceous	Containing significant clay; clay-rich.
argillan	A cutan composed dominantly of clay minerals; e.g., a clay skin. [B&S]
argillation	Syn. argillization.
argillic	Pertaining to clay.
argillization	Conversion to clay; said of the alteration of aluminosilicates to clay minerals.
argillized	Converted to clay
argilloferran	Cutan composed of clays, iron oxides and oxyhydroxides. [B&S]
Aridisol	An order in the US soil taxonomy (Soil Survey Staff 1992).
armour	See cuirasse, or desert armour.
armoured	Covered by a protective coat.
artesian	An adjective referring to confined groundwater under hydrostatic pressure. [AGI]
asepic fabric	Microscopic soil fabric that lacks patches and/or zones with a

striated or continuous pattern as viewed under crossed polars. [B&S]

ash plain

A plain aggraded by volcanic ash. (See McDonald for a more extensive definition.)

authigenesis

The process by which new minerals form in place within an enclosing regolith, sediment or sedimentary rock during or after deposition, as by replacement or recrystallization, or by secondary enlargement of quartz overgrowths. [AGI]

authigenic

Formed by authigenesis.

autochthonous

Formed in the place where found, such as in-situ regolith or saprolite.

avalanche

A large mass of snow, ice, soil, or rock, or mixtures of these materials, falling or sliding very rapidly under the force of gravity. Velocities may sometimes exceed 500 km/hr. Avalanches can be classified by their content, e.g., snow and ice avalanches, debris avalanches, soil or rock avalanches. [AGI]

azonal soils

Soils having no certain relationship with climatic zones e.g., lithosols.

azurite

Mineral, $\text{Cu}(\text{CO}_3)_2(\text{OH})_2$, bright blue weathering product of copper minerals such as chalcocopyrite.



antiformal landscape, California, (Photo R.A. Eggleton)

a **B** c d e f g h i j k l m
n o p q r s t u v w x y z

B horizon

See soil profile.

back slope



The slope at the back of a scarp; e.g., the gentler slope of a cuesta, fault block, or breakaway. It may reflect the dip of a duricrust, or of underlying strata, or of neither.

back swamp

A swampy or marshy depressed area developed on a flood plain, with poor drainage because it is limited by the levees of the river. [AGI*]

backwearing

Erosion that causes the parallel retreat of an escarpment or slope without changing its slope. Not recommended because of the presumptions involved in its application.

badlands



A landform of low relief (< 90 m) and steep to precipitous slopes, with closely spaced incised channels, typically undergoing almost continuous erosion by collapse, landslide, sheetflow, creep and channelled stream flow. Badlands develop where bedrock or regolith is poorly consolidated, and erodes faster than plants can colonize the slopes. (See McDonald for a more extensive definition.)

bajada

A broad, continuous alluvial slope or gently inclined detrital surface extending from the base of mountain ranges out into and around an inland basin, formed by the lateral coalescence of a series of separate but confluent alluvial fans and having an undulating character due to the convexities of the component fans. [AGI]

banded

Having layers that differ in colour, mineralogy or fabric. Also an outcrop feature developed in igneous and metamorphic rocks and in the weathering profile as a result of alternation of layers, stripes, flat lenses, or streaks differing conspicuously in mineral composition, fabric or colour. [Aleva*]

bar

Elongated, gently to moderately inclined low ridge built up by channelled stream flow; part of a stream bed. [McDonald]

bar plain

Flood plain having sub-parallel stream channels which both aggrade and erode so as to develop a generally corrugated surface with numerous bars. (See Isbell for a more extensive definition.)

barbed drainage

Barbed drainage patterns are those where tributaries join the main channel at angles greater than 90° . In this situation the tributaries flow in a direction opposite to that of the main channel. This may mean that the flow direction of the main channel has been reversed. [RTMAP]

barite

Mineral, BaSO_4 ; may form dense, white masses in regolith or occur dispersed.

base saturation

the extent to which the adsorption complex of a soil is saturated with exchangeable cations (Na, K, Ca and Mg) other than hydrogen and aluminium (Brady and Weil 1996).

bauxite

(i) Highly aluminous rock or regolith. Bauxite contains abundant aluminium hydroxides (gibbsite, less commonly boehmite, diaspore) and aluminium-substituted iron oxides or hydroxides, generally minor or negligible kaolin minerals, and may contain appreciable (20%) quartz. It is commonly a near surface or surface regolith, commonly but not essentially has a texture of pisoliths or nodules, loose or cemented. It is interpreted to have formed by the intense weathering of any parent rock, but most typically of basalts, syenites, granites, arkoses, marls and shales in freely drained, strongly leached environments. Transport and deposition may form colluvial or alluvial bauxite. Named for the type district, Le Baux, France.

(ii) Karst bauxite is a variant, formed in caves and hollows in limestones; the iron and aluminium are presumably derived from common erosion products, transported by flowing water as denudation products and trapped in the caves.

(iii) Economic term: the most common ore of aluminium.

bauxitic induration

Bauxitic induration occurs when cementing is largely by aluminous materials. [RTMAP]

bauxitization

Development of bauxite.

beach ridge

Very long, nearly straight low ridge, built up by waves and usually modified by wind. A beach ridge may be a relict feature remote from the beach. [McDonald*]

beach ridge plain

A plain made of linear wave-built ridges parallel to the shore. (See McDonald for a more extensive definition.)

beach sediments

Sediment mass deposited from transport by waves or tides at the shore of a sea or lake. [RTMAP]

bedload

The part of the total stream load that is moved along (on, near, or immediately above) the stream bed, such as the larger or heavier

	particles (boulders, pebbles, gravel) transported by traction or saltation along the bottom; the part of the load that is not continuously in suspension or solution. [AGI]
bedrock	Solid rock at the surface of the earth or at some depth beneath the regolith which has not been affected by weathering. [Aleva]
beidellite	Clay mineral of the smectite group, approximately $A_{0.3}Al_2[Si_{3.7}Al_{0.3}]O_{10}(OH)_2 \cdot 4H_2O$, where A is an exchangeable cation, K^+ , Na^+ , or $0.5Ca^{2+}$ etc. Beidellite is a common early weathering product of feldspars.
bentonite	Rock, largely composed of smectite clay minerals, produced by the alteration of volcanic tuff or ash in-situ. [GSS]
berm	(i) Short, very gently inclined to level minimal midslope in an embankment or cut face, eroded or aggraded by human activity; (ii) Flat, built up by waves above a beach. [McDonald]
bevelled	Said of a geologic structure or landform that is truncated or cut across by an erosion surface. [AGI]
billabong	Meandering stretch of river channel that has been abandoned on a floodplain. Similar to an oxbow lake, which is only one meander long. (Fairbridge 1968)
billy	Colloquial term for silcrete; also termed grey billy.
biotic weathering	A combination of chemical and physical weathering brought about by biological agents. [RTMAP]
bioturbated	That which has undergone bioturbation.
bioturbation	The churning and stirring of sediment and regolith by animals and plants.
birbirite	Erosion resistant weathering product of dunite made up largely of silica and iron oxides and oxyhydroxide. (Duparc et al. 1927)
biisillitization	The chemical change of primary silicates to 2:1 layer silicates such as illite, smectite. (Pedro 1966)
Black Earths	See Great Soil Group, No. 11 and Appendix 1. [Stace]
blocky	(i) rock or regolith: structure resulting from three or more sets of intersecting joint planes; the enclosed mass is in-situ, although the joints may leave a few millimetres space between the blocks; this



space may be open or filled with secondary minerals; size of block >64 mm.

(ii) soil: accommodated, equant, structural elements of soil with a number of plane faces; re-entrant angles between adjoining faces are virtually absent. [B&S]

blow-out

Usually small, open or closed depression excavated by the wind. [McDonald]

boathook bend

A sharp curvature of a tributary where it joins the main stream in an upstream direction in a barbed drainage pattern, resembling a boathook in plan. Also termed fish-hook bend. [AGI]

boehmite

Mineral, $\alpha\text{-AlO}(\text{OH})$. Common mineral of bauxite, formed under condition of low water activity or as an alteration product of gibbsite.

bog

A waterlogged area containing decaying organic material which may develop into peat. [CG]

bog iron

(i) A general term for a soft, spongy, and porous deposit of impure hydrous iron oxides formed in bogs, marshes, swamps, peat mosses, and shallow lakes by precipitation from iron-bearing waters. Bog iron is composed principally of limonite that is mostly impregnated with plant debris, clay, and clastic material and is found in tubular, pisolitic, nodular, concretionary, or thinly layered forms, or in irregular aggregates, and is especially abundant in the glaciated northern regions of North America and Europe. It may form a poor-quality iron ore.

(ii) A term commonly applied to a loose, porous, earthy form of limonite occurring in wet ground. [AGI *]

boinka



A landform complex of groundwater discharge, occupying shallow depressions in semi-arid regions of low relief. A boinka may include dunes, gypsum flats and salt lakes. e.g., the Raak Boinka of western Victoria. (Macumber, 1980).

bole



Ferruginous, clay-rich, weathering product of basalt.

borax

Mineral, $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$, evaporite found in playa sediments.

bornhardt



A residual peak having the characteristics of an inselberg; specifically a large granite or gneiss inselberg. [AGI *]

botryoidal

Groups of globular structures resembling clusters of grapes; the globular structure consists generally of acicular crystals in radiating clusters. [Aleva]

- boulder** Generally subrounded clast >256 mm in diameter. Also applied to in-situ weathering products with a similar structure. [Aleva]
- boxwork**
 A fabric of angular cells in a highly ferruginous and/or siliceous weathered rock. The cells are commonly formed by the dissolution of minerals and are defined by a network of intersecting blades or plates of iron oxides or silica that were deposited in cavities and original cleavages, grain boundaries and fracture planes of the dissolved mineral. Boxworks are typically associated with the weathering of sulphides and are found in some gossans and in caprocks over sulphide-bearing rocks, however, boxworks may form by the selective weathering of other minerals, e.g., carbonates and silicates such as olivine.
- braid** In a river channel, to branch and rejoin repeatedly to form an intricate pattern or network of small interlacing stream channels within the broader channel (compare with anabranch).
- breakaway**
 An escarpment, with a vertical fall and steep debris slope, generally a few metres high, but some rise to 40 m, capped by indurated and subindurated parts of the weathered mantle, forming a step between two tracts of more level land. Topographically similar to a jump up, 'breakaway' is most commonly used in Western Australia.
- brochantite** Mineral, $\text{Cu}_4\text{SO}_4(\text{OH})_6$. Bright emerald to dark green oxidation product of Cu-sulfides, particularly under low pH arid conditions.
- brousse tigre** (French, "tiger stripes") See grove-intergrove pattern.
- Brown Soils** A great soil group of the temperate to cool arid regions, composed of soils with a brown surface and a light-coloured transitional subsurface horizon over calcium carbonate accumulation. [GSS]
- Brown Earths** See Great Soil Group, No. 23 and Appendix 1. [Stace]
- Brown Podzolic Soils** See Great Soil Group, No. 34 and Appendix 1. [Stace]
- butte**
 A conspicuous, generally isolated, flat-topped hill or small mountain with relatively steep slopes or precipitous cliffs, which may be capped with a resistant layer of rock and bordered by talus. It represents an erosion remnant carved from flat-lying rocks. The summit is smaller in extent than that of a mesa, and many buttes in the western U.S. result from the wastage of mesas. [AGI]

a b **C** d e f g h i j k l m
n o p q r s t u v w x y z

C horizon	See soil profile.
calcan	See under cutan.
calcareous	Said of a substance that contains calcium carbonate. When applied to a rock name it implies that a considerable percentage (up to 50%) of the rock is calcium carbonate. [AGI]
calcareous induration	The in-situ cementation and/or replacement of regolith by carbonate. [RTMAP]
Calcareous Red Earth	See Great Soil Group, No. 24 and Appendix 1. [Stace]
Calcareous Sands	See Great Soil Group, No. 4 and Appendix 1. [Stace]
calcareous soil	Soil containing sufficient calcium carbonate or calcium-magnesium carbonate to effervesce visibly when treated with cold 0.1 M hydrochloric acid. [GSS]
Calcarosols	A soil order; soils which are calcareous throughout the profile. See Appendix 2: Australian Soil Classification. [Isbell]
calcic	(geochem) Said of minerals and igneous rocks containing a relatively high proportion of calcium; the proportion required to warrant the use of the term depends on circumstances. [AGI*]
calcite	Mineral, CaCO_3 , essential component of calcrete and common in regolith of more arid regions or over limestones.
calcrete	(i) A term suggested by Lamplugh (1902) for a conglomerate consisting of surficial sand and gravel cemented into a hard mass by calcium carbonate precipitated from solution and redeposited through the agency of infiltrating waters, or deposited by the escape of carbon dioxide from vadose water. (ii) Used broadly to refer to regolith carbonate accumulations, forming more- or less-well cemented aggregates composed largely of calcium carbonate, but not excluding dolomitic or magnesian material. Although some regolith carbonates clearly cement fragmental regolith to form duricrusts, others may be pisolitic,



nodular, pebbly, slabby or powdery. Calcrete is a convenient field term for all such carbonate accumulations responsive to the 0.1M HCl test, but more specific terms such as dolocrete or magcrete should be used if laboratory testing establishes such carbonate mineralogy.

calcrete, laminated



Hard, finely laminated sheet consisting of layers of authigenic calcite or dolomite. The laminar zone may display wavy bands. Rarely exceeds 1 m in thickness. [Anand2]

calcrete, powdery

Friable aggregates of fine (silt- and sand-sized) carbonate particles in regolith.

caldera

A large, basin-shaped volcanic depression, more or less circular in form, the diameter of which is many times greater than that of the included vent or vents, no matter what the steepness of the walls or form of the floor. [AGI*]

caliche

(i) Spanish-North American term used synonymously for calcrete.
(ii) A layer near the surface, more or less cemented by soluble minerals (calcite, dolomite, nitre, halite, etc.). It may occur as a soft thin soil horizon, as a hard thick bed just beneath the solum, or as a surface layer exposed by erosion.

canyon



A long, deep, relatively narrow, steep-sided valley confined between precipitous walls. [CG]

cap rock

A duricrust on top of a hill or upper slope, protecting it from erosion. Examples include silcretes derived from weathering of dunites and indurated ferruginous saprolite derived from weathering disseminated sulfides.

capillarity

The action by which a fluid, such as water, is drawn up (or depressed) in small interstices or tubes as a result of surface tension. [CG]

captured drainage

Drainage capture, or piracy, occurs when drainage from one catchment is diverted into another catchment. Sharp bends in river direction and barbed drainage patterns can indicate river capture. The stream from which drainage is captured is said to be beheaded. [RTMAP]

**carapace
(and carapace nodulaire)**

French term referring to the lower, poorly indurated horizon of the ferruginous zone of a laterite profile. Consists of ferruginous nodules and pisoliths in a weakly cemented matrix of kaolinite and iron oxides and oxyhydroxides. [B&Z]

carnotite

Mineral, $K_2(UO_2)_2(VO_4)_2 \cdot 3H_2O$, occurs in some groundwater

- calcretes where it may reach economic amounts, and in weathered U-deposits.
- carpedolith** See stone-line.
- catchment** A region, surrounded by a divide, from which all its surface rainfall runoff is collected by its drainage. A drainage basin.
- catena** A sequence of soils from hill top to valley floor. Initially described as a mapping unit, (Milne, 1935) the catena concept has evolved to mean a sequence of soils derived from the same or similar parent material but displaying variability that can be related to differences in the topography and drainage of their landscape position.
- cation exchange** See ion exchange.
- cation exchange capacity** See ion exchange capacity.
- cave** An interstice varying in size between a cavity and a cavern, i.e., varying between 256 mm to several metres in diameter. [Aleva]
- cavern** An interstice larger than a cave, exceeding a few metres in size. [Aleva]
- cavernous weathering**  Chemical and mechanical weathering on a cliff face, in which grains and flakes or rock are loosened so as to enlarge hollows and recesses "opened through a chemically hardened shell" on the surface of the cliff face (Cotton, 1958, p.15). It produces the tafoni in seaside cliffs. See also honeycomb weathering and tafoni. [AGI]
- cavity** An interstice in size between an alveole and a cave, i.e., varying between 16 and 256 mm in size. [Aleva]
- CEC** Cation exchange capacity.
- cellular** Said of the texture of a rock (e.g., a cellular duricrust) characterized by moderately small to large openings or cavities which may or may not be connected. Although there are no specific size limitations, the term is usually applied to cavities larger than pore size and smaller than caverns. The synonym vesicular is preferred when describing igneous rocks. [AGI *]
- cellular duricrust** See duricrust, cellular.
- cementation front** A transformation front resulting in cementation by components such as oxides and oxyhydroxides of Al, Fe and Mn, silica and Ca or Mg carbonates. [Aleva]

<i>cemented</i>	Indurated; having a hard, brittle consistency because the constituent particles are held together by cementing substances such as humus, calcium carbonate, or the oxides of silicon, iron, and aluminum. The hardness and brittleness persist even when wet. [GSS]
<i>centrifugal</i>	(In the context of regolith development) The migration of a transformation front or a transfer of material is centrifugal when it proceeds outwards from a void, a mottle, a nodule or a glaeble. The migration of the front can be centrifugal while the associated transfer of material is centripetal. [Tardy]
<i>centripetal</i>	(In the context of regolith development) The migration of a transformation front or a transfer of material is centripetal when it proceeds inwards toward a void, a mottle, a nodule or a glaeble. The migration of the front can be centripetal while the associated transfer of material is centrifugal. [Tardy]
<i>centripetal drainage</i> 	A drainage pattern where channels flow in towards a central point or area from a surrounding area encompassing at least 180°. In many cases this central area is a closed depression, such as a caldera, in which case the incoming channels drain a surrounding area encompassing 360°. [RTMAP]
<i>cerussite</i>	Mineral, PbCO_3 , weathering product of galena.
<i>chalcidony</i>	Mineral SiO_2 , cryptocrystalline variety of quartz.
<i>channel deposit</i>	Alluvium which is deposited in an alluvial channel. It is commonly coarser than surrounding deposits, and is found in both active and relict channels. It includes deposits in cut-off meanders, and point bar deposits. [RTMAP]
<i>channelway</i>	An opening or passage in a rock through which mineral-bearing solutions or gases may move. [AGI]
<i>chelate (noun)</i>	A molecule capable of binding an ion by multidentate ligands. An ion so held becomes unavailable for inorganic reactions, thus the chemical activity of that ion is reduced.
<i>chelation</i>	Chelation, or complexing, is the holding of an ion, commonly a metal, by multidentate ligands. It is an important process in the aqueous chemistry of regolith involving both mineral and organic materials.
<i>cheluviation</i>	Eluviation under the influence of chelates.
<i>chemical weathering</i>	The process of weathering by which chemical reactions (such as

hydrolysis, hydration, oxidation, carbonation, ion exchange, and solution) between minerals, air, water, and its dissolved chemicals transform rocks and minerals into new chemical combinations more stable under conditions prevailing at or near the Earth's surface; e.g., the alteration of orthoclase to kaolinite, or the solution of the calcium carbonate in limestone by carbonic acid derived from rainwater containing carbon dioxide. [AG]

- chenier plain** Level to gently undulating landform pattern of extremely low relief on which stream channels are very rare. The pattern consists of relict, parallel linear ridges built by waves, separated by and built over flats aggraded by tides or over-bank stream flow. [RTMAP]
- Chernozems** See Great Soil Group, No. 13 and Appendix 1. [Stace]
- Chocolate Soils** See Great Soil Group, No. 22 and Appendix 1. [Stace]
- Chromosols** A soil order; soils with a strong texture contrast between A and B horizons and in which the B horizon is neither sodic nor strongly acid. See Appendix 2: Australian Soil Classification. [Isbell]
- chronosequence** A sequence of soils developed under similar soil-forming conditions, but at different times.
- circumvolcanic drainage** In many areas with volcanic landforms, drainage lines flow in semicircular courses around volcanoes. These drainage lines are called circumvolcanic. Generally they indicate that former drainage lines have been diverted into a circular course by the eruption and growth of the volcano. [RTMAP]
-  **cirque** Precipitous to gently inclined, typically closed depression of concave contour and profile excavated by ice. The closed part of the depression may be shallow, the larger part being an open depression like an alcove.
-  **clast** An individual constituent, grain, or fragment of a sediment, rock, or hardened regolith material produced by the mechanical weathering (disintegration) of a larger rock mass. [AGI*]
- clay** A naturally occurring material composed primarily of fine-grained minerals, which is generally plastic at appropriate water contents and will harden when dried or fired. (Guggenheim and Martin 1995). See also clay size.
- clay induration** Induration of regolith by clay. [RTMAP]
- clay mineral** Phyllosilicate (layer silicate) mineral or other mineral which imparts

plasticity to clay and which hardens upon drying or firing.
(Guggenheim and Martin 1995)

clay size

Defined by most modern authorities as having an equivalent spherical diameter less than 0.002 mm (2 μm), though by Wentworth (1922) as $<4 \mu\text{m}$. (See also Wentworth size classes).

clay zone

See plasmic zone, also laterite profile.

claypan



A term used in Australia for a shallow depression filled with clayey and silty sediment, and having a hard, sun-baked surface; a playa formed by deflation of alluvial topsoils in a desert, and in which water collects after rain. [AGI]

clod

A compact and coherent soil aggregate produced artificially, generally by ploughing or digging. [C&M*]

closed depression

A hollow below the general land surface that has no surface drainage outlet. [CG]

coastal dunes

Level to rolling landform pattern of very low to extremely low relief without stream channels, built up or locally excavated, eroded or aggraded by wind. This landform pattern is restricted to coastal locations. [RTMAP]

coastal lands

Level to gently undulating landform pattern of extremely low relief eroded or aggraded by waves, tides, over-bank or channel flow, or wind. The landform pattern may be either active or relict. [RTMAP]

coastal progradation

Accumulation of sediment along a coast causing the coast to advance seawards. [RTMAP]

coating

A deposit on the walls of open cracks and voids, covering all primary textures of that wall. Three varieties may be distinguished:
(i) paint or scale coating, composed of dense matter, generally with colour banding in cross-section, and following the void wall as a coat of paint or plaster; the surface of the coating is generally smooth but may be knobby or wavy; the thickness may vary between the thickness of a coat of paint to almost closing the void;
(ii) dust coating, a dull, earthy coating, generally whitish or reddish and strongly adhering to the walls of the void;
(iii) (Soil micromorphology) pedofeatures that coat the surfaces of voids, grains and aggregates; coated grains and aggregates can be embedded in the groundmass. See also cutan, desert varnish. [Aleva]

cobbles

Fragments with a high sphericity, ranging in diameter from 64 to 256 mm. (See also Wentworth size classes).

<i>collapsed saprolite</i>	Residual regolith consisting of fragments having some of the lithic fabric of the underlying saprolite and bedrock. Individual fragments may have lost their original orientation, but megascopic features such as quartz veins and lithological contacts remain discernible. Collapsed saprolite results from selective volume loss (e.g., by leaching, eluviation) of saprolite and the settling of resistant portions.
<i>colloform</i>	A fabric composed of rounded, finely banded kidney-shaped mineral matter; also said of the rounded globular texture of a colloidal mineral deposit.
<i>collophane</i>	Mineral, apatite in cryptocrystalline form.
<i>colluvial</i>	Pertaining to colluvium.
<i>colluvial fan</i>	A fan built by the deposition of colluvium.
<i>colluviation</i>	The formation of colluvium. [AGI]
<i>colluvium</i>	Heterogeneous materials of any particle size, generally composed of soil and/or rock fragments, accumulated on the lower parts of slopes, transported there by gravity, soil creep, sheet flow, rainwash, mudflows or solifluction.
<i>columnar</i> 	(geol) A structure composed of solid prisms or cylindrical elements that are close together in parallel position, most commonly with the long axes arranged vertically; the spaces between the columns may be void or filled with mineral matter. e.g., columnar jointing in basalt flows. (soil) Prismatic soil peds with rounded tops. (For drawing, see ped) [Aleva]
<i>comminution</i>	(i) The diminution of a substance to a fine powder or dust by crushing, grinding, or rubbing, specifically the reduction of a rock to progressively smaller particles by weathering, erosion, or tectonic movements. (ii) The breaking, crushing, or grinding by mechanical means of stone, coal, or ore, as for sample preparation, road metal, aggregate, or ballast. [AGI*]
<i>conakryte</i>	Iron accumulation with goethite, hematite, sometimes with gibbsite, without kaolinite, with a scoriaceous or massive structure, with neither nodules nor pisoliths. Similar to a plinthite. [Tardy]
<i>concretion</i>	A hard, compact, rounded, normally subspherical (but may be any shape) mass or aggregate of mineral matter generally formed by precipitation from aqueous solution (commonly about a nucleus or centre, such as a leaf, shell, bone, or fossil) within a rock or regolith

and generally of a composition widely different from that of the rock in which it is found and from which it is rather sharply separated. It represents a concentration of some minor constituent (of the enclosing rock) or a cementing material such as silica (chert), calcite, dolomite, iron oxide, pyrite, or gypsum, and it varies in size from a small pellet-like object to a spheroidal body as much as 3 m in diameter. See also accretion. [AGI*]

concretionary

Characterized by, consisting of, or producing concretions. [AGI]

confining bed

Essentially impermeable stratum confining an aquifer.

congelifluction

See gelifluction.

congelifraction

See frost weathering.

conglomerate



The consolidated and or cemented equivalent of gravel, both in size range and in the essential roundness of its framework components. May or may not have a clastic matrix.

congruent dissolution

Dissolution of a mineral without the formation of a different mineral; as the dissolution of halite or quartz. (Compare with incongruent dissolution).

consolidated

Said of regolith that has such firmness and coherence that a tool is needed to take a sample from outcrop or that remains coherent after extraction from a coring device.

consolidation

Any process whereby loosely aggregated, soft, or liquid earth materials become firm and coherent rock; e.g., the lithification of loose sediments to form a sedimentary rock. [AGI]

convergent drainage



A drainage pattern where channels converge towards a point or area from a surrounding area encompassing less than 180°. Such patterns can be found, for example, on synclines. [RTMAP]

copi

See kopi.

core-stone



A rounded, ellipsoidal or broadly rectangular block, composed of virtually fresh parent rock in saprock or saprolite; the residual relatively unweathered remnant of a joint block, originating from any massive type of parent rock, e.g., granite, gabbro, dolerite, basalt etc., but separated from it. [Aleva]

corrasion

The wearing away of loose particles by abrasion during movement. Mostly used in the context of glacial erosion.

cortex 	The outer, concentric shell or envelope of a particle, such as on a nodule or pisolith. A cortex may vary in thickness. (Compare with coating, cutan, see also nucleus).
covered plain	Flood plain with a number of alluvial channels which are widely-spaced (i.e., a little under a km), migrating, more or less parallel, and deep (i.e., width-depth ratio <20:1). Aggradation by over-bank stream flow occurs at least once every 50 years, providing further alluvial cover. (See McDonald for a more extensive definition.)
crackled	A fabric of small to minute cracks in a discrete body such as a nodule; the cracks may be open or filled with other material. Such a fabric is generally developed by shrinkage during crystallization or ageing of colloidal matter or gels (syneresis or septarian cracks).
crandallite	Mineral, $\text{CaAl}_3(\text{PO}_4)_2(\text{OH})_5 \cdot \text{H}_2\text{O}$. Also a mineral group including florencite (having Ce and other rare earth elements in place of Ca) plumbogummite (Pb); gorceixite (Ba). These minerals are members of an isostructural series of regolith phosphates, ultimately derived from the weathering of apatite and monazite. They form small (<5 μm) crystals in regolith.
creep	Slow movement of rock and/or soil particles down slope influenced by wetting and drying, shrinking and swelling, and freezing and thawing. [RTMAP]
creep deposit	A thin layer of saprolite or earthy colluvium which moves very slowly down slope. In some circumstances it may be recognized by, for example, the bending and fragmentation of rock strata, dykes or quartz veins down slope, but in other cases creep can only be inferred.
crest	The highest point or line of a landform, from which the surface slopes downward in opposite directions; especially the highest point of a mountain or hill, or the highest line or culminating ridge of a range of mountains or hills. [AGI*]
crevasse	A fissure formed in the brittle upper part of a glacier or ice sheet. [CG]
route calcaire	French term for calcrete.
crown scarp	The scarp left above a landslide.
cryptocrystalline	Composed of crystals below the resolution of optical microscopy.
cryptomelane	Mineral, $\text{K}_2\text{Mn}_8\text{O}_{16}$, isostructural with hollandite, coronadite, found

particularly in weathered manganese-rich rocks, e.g., at Broken Hill, NSW, Australia. (See also Manganese oxides, wad, psilomelane)

cuesta



A hill or ridge with a gentle slope on one side and a steep slope on the other; specifically an asymmetric ridge (as in the SW U.S.A.) with one face (dip slope) long and gentle and conforming with the dip of the resistant bed or beds that form it, and the opposite face (scarp slope) steep or even cliff-like and formed by the outcrop of the resistant rocks, the formation of the ridge being controlled by the differential erosion of the gently inclined strata. Originally, the term applied to the steep slope or scarp that terminates a gently sloping plain at its upper end; the term has also been used to denote the sloping plain itself, such as the top of a mesa. [AGI]

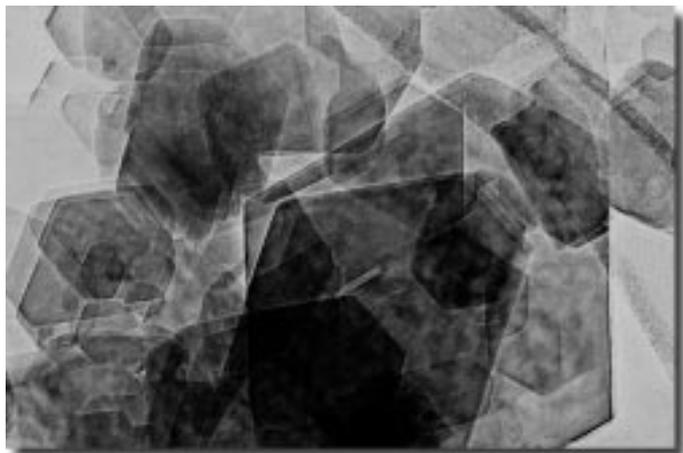
cuirasse

(French -armour, commonly translated in the context of a lateritic profile as 'iron-crust') The highly indurated upper facies or horizon of the ferruginous zone of a lateritic regolith, with a massive pisolitic, nodular or vesicular fabric (syn. lateritic duricrust).

cutan



A skin, generally thin, on the natural surfaces in soil, that is, on the walls of the voids, the surfaces of skeleton grains and aggregates (e.g., pisoliths) or associated structures (e.g., glaeboles), or the boundaries of other associated structures. Cutans have a composition and/or fabric different from the objects they coat. Cutans may be, e.g., argillans (clay), ferrans (iron oxide hydroxide), mangans (manganese oxide/hydroxide), calcans (or calcitans) (calcite).



clay-sized kaolinite crystals. Field of view is 3 μ m wide. (Photo R.A. Eggleton)

a b c **D** e f g h i j k l m
n o p q r s t u v w x y z

D horizon

A soil horizon below the C horizon but unrelated to the C, B and A horizons above. An example would be where soil-forming processes have affected alluvium over granite and also affected the granite. The granite would show a D horizon; the A, B and C horizons being in the alluvium.

debris flow

A fluid, mobile mass of earth material, dominantly coarser than sand-size.

deep lead

A valley fill generally investigated for potential placer deposits.

deep weathering

See weathering, deep.

deflation

Wind erosion.

degradation

(i) The wearing down or away, and the general lowering or reduction, of the Earth's surface by the natural processes of weathering and erosion; e.g., the deepening by a stream of its channel. The term is sometimes used to include the process of transportation, and sometimes it is used synonymously with denudation, or used to signify the results of denudation.
(ii) Less broadly, the vertical erosion or downcutting performed by a stream in order to establish or maintain uniformity of grade or slope.
(iii) Change in a soil (decrease in exchangeable bases and destruction of layer-silicate clay) due to leaching. [AGI]

delta

The low, nearly flat, alluvial tract of land at or near the mouth of a river, commonly forming a triangular or fan-shaped plain of considerable area, crossed by many distributaries of the main river. It may extend beyond the general trend of the coast as a result of the accumulation of sediment supplied by the river in such quantities that is not removed by tides, waves, and currents. Most deltas are partly subaerial and partly below water. The term was introduced by Herodotus in the 5th century B.C. for the tract of land, at the mouth of the Nile River, whose outline broadly resembled the Greek capital letter "delta", Δ, with the apex pointing upstream.

DEM

Digital Elevation Model. A gridded representation of elevation. DEM is relative, DTM absolute.

<i>dendritic drainage</i> 	Integrated drainage pattern where small branch channels join, usually at acute angles, to feed a trunk channel. Dendritic drainage shows no preferred orientation, and is typical of areas where the underlying rock is more or less homogeneous. [RTMAP]
<i>denudation</i>	The consequence of weathering and erosion; the wearing down of the landscape.
<i>depositional plain</i>	Level landform pattern with extremely low relief formed by unspecified depositional processes. [RTMAP]
<i>depositional regime</i>	A grouping of regolith mapping units in regolith-dominated terrain characterized by surficial deposits. These deposits may overlie lateritic residuum, saprolite or bedrock. See also RED Scheme.
<i>Dermosols</i>	A soil order; soils with structured B2 horizons and lacking strong contrast between A and B horizons. See Appendix 2: Australian Soil Classification. [Isbell]
<i>desert armour</i> 	A desert pavement whose surface of stony fragments protects the underlying finer-grained material from further wind erosion. [AGI]
<i>Desert Loams</i>	See Great Soil Group, No. 8 and Appendix 1. [Stace]
<i>desert pavement</i>	The layer of gravel or stones left on the land surface in desert regions after the removal of the finer material by erosion. More commonly termed lag. [GSS]
<i>desert varnish</i>	A glossy sheen or coating on outcrop, stones and gravel in arid regions. The coating is commonly ferruginous, but may also contain manganese and silica.
<i>desilication</i>	Syn. desilicification.
<i>desilicification</i>	Removal of silica by chemical means.
<i>detrital</i>	Pertaining to or formed from detritus; said especially of rocks, minerals, and sediments. The term is generally used to indicate a source from outside a depositional basin, as compared to clastic. A detrital rock. [AGI]
<i>detritus</i>	A collective term for loose rock and regolith material that is worn off or removed by mechanical means, as by disintegration or abrasion; especially fragmental material, such as gravel, sand, silt and clay, derived from older rocks or regolith and moved from their place of origin. [AGI]

- dhubite** Manganese-rich regolith equivalent to iron-rich gossan (Nicholson 1992). The component manganese minerals may incorporate any of Ag, Ba, Ce, Co, Cr, Cu, La, Mo, Ni, Pb, Sb, Sr, V, Y, Zn. (See also Manganese oxides, wad, psilomelane)
- diamicton** Massive to poorly-sorted sediment with a wide range of particle size. e.g., a mixture of glacially deposited gravel, sand and clay.
- diastrophism** Diastrophic movements are those which result directly or indirectly in relative or absolute changes of position, level or attitude of rocks forming the earth's crust. This includes uplift and faulting. [AGI]
- dip slope**
 Landform of a long, more or less planar, slope, parallel to the bedding of strata, generally dominated by an erosion resistant stratum, giving rise to a ramp. Such structural ramps commonly have parallel drainage.
- dispersion** (geochem): Relocation of geochemical components by transport, either as particles or in solution.
 (soil): A phenomenon that may accompany slaking. Dispersion occurs when the soil microaggregates break down into individual clay particles which drift out of the aggregates and cause the aggregate to have a halo of cloudiness. The more exchange sodium in the clay, the more likely it is that dispersion will occur.
- distributary drainage**
 A drainage pattern where a single channel breaks or diverges into a number of smaller channels. This pattern is typical of deltas, but can occur in any area where a single channel flows out of a confining valley. In some parts of Australia these areas are called "floodouts". [RTMAP]
- divergent drainage**
 A drainage pattern where multiple channels diverge from a small area to a surrounding area. Such patterns can be found, for example, on the ends of anticlines, and are typical of fans. [RTMAP]
- diverted drainage** Drainage may be diverted when uplift or warping raises an area of land across the path of a river. If the river cannot cut down its bed as fast as the rate of uplift, the river will be diverted to flow in another direction.
- divide** (Geomorphology) A ridge-line, however prominent or subdued, separating drainage flowing from either side of that line.
- doline**
 A general term for a closed depression in an area of karst topography that may communicate with a subterranean passage. It is formed either by solution of the surficial limestone or by collapse of underlying caves. Its dimensions are measured in metres, and its form

	is generally basin-like or funnel-shaped. Also called a sinkhole. [AGI]
dolocrete	As for calcrete, but with the carbonate mineral dominated by dolomite.
dolomite	Mineral, $\text{CaMg}(\text{CO}_3)_2$, found in many calcretes, essential component of dolocrete, commonly associated with the weathering of mafic rocks.
downwarp	The tectonic subsidence, predominantly by tilting or folding, of a region of the Earth's crust.
downwasting	See mass wasting.
downwearing	Erosion that causes the flattening out of a hill or mountain and the decline of its slope; a process contributing to the development of a peneplain. [AGI]
drainage	A collective term for the creeks, streams and rivers of a region.
drainage depression	Level to gently inclined, long, narrow, shallow, open depression with smoothly concave cross-section, rising to moderately inclined side slopes, eroded or aggraded by sheet wash. [McDonald] When mapping regolith landforms, the term is used for a single depression or valley in a plateau or other surface where the scale of mapping does not allow the depression to be subdivided into its component parts (e.g., rises, flood plain).
drainage floors	Flat alluvial tracts having little, if any, stream incision.
drainage pattern	The plan shape of drainage channels on the land surface. It should not be confused with channel pattern, which refers to the plan shape of river reaches. Drainage patterns may reflect underlying rock structures or the nature of the original surface on which they were developed. [RTMAP*]
drainageway	A channel or course along which water moves in draining an area. [AGI]
drawdown	(i) The difference between the height of the water table and that of the water in a well. (ii) Reduction of the pressure head as a result of the withdrawal of free water. [AGI]
drift (regolith)	Any unconsolidated rock material, such as boulders, till, gravel, sand, loess or clay, transported from one place and deposited in another. There are several more specialized meanings of the word, most commonly that of glacial geology where it is used for deposits by or

from the ice, or by or in water derived from the melting of the ice. In this context the term is generally used for Pleistocene glacial deposits.

drumlin

A streamlined hill or ridge of till or other drift, with a long axis that parallels the direction of flow of a former glacier; generally the upstream end is widest and highest, and the drumlin tapers in the downflow direction. Drumlins commonly occur in swarms in previously glaciated areas of low relief.

dry drainage

Channels in which water flows rarely. In Australia, this drainage character is confined largely to the arid areas of the centre. [RTMAP]

dryland salinity

The development of salt in the regolith at places removed from the effects of evaporation of bodies of standing or running water.

DTM

Digital Terrain Model. A gridded representation of terrain height above sea-level. DTM is absolute, DEM is relative.

dune

A low mound, ridge, bank, or hill of loose, windblown granular material (generally sand, in some places volcanic ash), either bare or covered with vegetation, capable of being moved from place to place by wind but always retaining its own characteristic shape. [AGI]

dune field



An area dominated by dunes. (See McDonald for a more extensive definition.)

Duplex soil



Soil profiles dominated by the mineral fraction with a texture contrast of one and a half texture groups or greater between the A and the B horizons. Horizon boundaries are clear to sharp. The distance from the bottom of the A2 horizon to the top of the main B horizon occurs over a vertical interval of 10 cm or less, except for those profiles in which sesquioxidic layers (laterite) occur between the A and B horizons when the vertical interval between them may be as great as the thickness of the sesquioxidic layer. [Northcote]

duricrust

Regolith material indurated by a cement, or the cement only, occurring at or near the surface, or as a layer in the upper part of the regolith. The cement may be, e.g., siliceous (silcrete), ferruginous (ferricrete, lateritic duricrust), aluminous (alcrete), gypseous (gypcrete), manganiferous (manganocrete), calcareous (calcrete), dolomitic (dolocrete), salty (salcrete) or a combination of these.

duricrust, cellular

Duricrust characterized by irregular to rounded bladder, cell, or bubble-shaped voids. May contain pisoliths and or nodules, and show development of a mottled fabric. [Anand2]

duricrust, fragmental

A duricrust that has a fragmental or blocky fabric in outcrop and/or

hand specimen. The interstices between fragments are commonly occupied by a clayey, ferruginous, or sandy matrix. The fabric of the parent bedrock may be preserved within the fragments. [Anand2]

duricrust, massive

A duricrust having an homogeneous fabric at the hand-specimen scale. Rarely completely massive, usually contains minor amounts of vesicles and tubules which may be filled or partly filled with clay and/or other sediment. May either be uniformly coloured or be multicoloured due to segregation of secondary minerals or to selective ferruginization. Commonly underlies nodular duricrust. [Anand2]

duricrust, moderately cemented

Duricrust where the material is 70-90% cemented. It often has a grainy texture and may be mottled. [RTMAP]

duricrust, packed pisolitic

Consists of pisoliths which are cemented as a framework-supported mass. The interstices between pisoliths commonly are cavities or are partly filled with clay or sandy clay. The degree of cementation is variable. [Anand2]

duricrust, partially cemented

Duricrust with less than 70% cemented material, generally with an open texture; also termed hardpan.

dust

Solid particles of varying character and size that are carried in suspension in the atmosphere.

dust deposition

Accumulation of dust on the land surface following wind transport.



duricrust forming a breakaway on the Yilgarn, W.A. (Photo R.A. Eggleton)

a b c d **E** f g h i j k l m
n o p q r s t u v w x y z

earth

- (i) Colloquial term for soil.
- (ii) Used to refer to soils which are rather uniform or which have relatively little texture variation down profile, such as Red Earths (See Great Soil Group # 25).
- (iii) A soil fabric with ca 80% clay.

earthflow

A mass-movement landform and process characterized by downslope translation of solid and weathered rock over a discrete basal shear surface (landslide) within well defined lateral boundaries. The basal shear surface is more or less parallel with the ground surface in the downslope portion of the flow, which terminates in lobelike forms. Overall, little or no rotation of the slide mass occurs during displacement, although, in the vicinity of the crown scarp, minor initial rotation is usually observed in a series of slump blocks. Earthflows grade into mudflows through a continuous range of morphology associated with increasing fluidity. [AGI]

earthy

(soil) Soil material that is coherent and characterized by the presence of pores, few if any peds, and a general floc condition throughout. Ultimate soil particles (sand grains, for example) are coated with oxides and/or clays and are arranged (clumped) around the pores. [Northcote]
(mineralogy) Having the very dull lustre of a lump of earth.

Earthy Sands

See Great Soil Group, No. 6 and Appendix 1. [Stace]

elaterite

A variety of bitumen which is elastic, but which, on exposure to the atmosphere, becomes hard and brittle. (The etymology is from Latin *elater*-one who drives, as in a spring driving a mechanism, not *later*-a brick).

eluviation

The generally downward movement of material in the regolith, largely from the soil A horizon to the B horizon, by water. The term refers especially but not exclusively to the movement of colloids and clays, whereas the term leaching refers to the removal of soluble materials.

eluvium

Regolith deposit originating in the place where found. The preferred term is in-situ regolith.

encrustation	A crust or coating of minerals on a rock surface. Syn. incrustation. [AGI]
Entisol	An order in the US soil taxonomy (Soil Survey Staff 1992).
eolian	See aeolian.
eolianite	See aeolianite.
ephemeral drainage	Drainage in which surface water ceases to flow from time to time, generally seasonally. Compare with dry drainage.
erosion 	The general process or the group of processes whereby the earthy and rocky materials of the Earth's crust are loosened and moved from one place to another, by natural agencies that include weathering, solution, corrasion, and transportation, but usually exclude mass-wasting; specifically the mechanical destruction of the land and the removal of material (such as soil) by running water (including rainfall), waves and currents, moving ice, or wind. The term is sometimes restricted by excluding transportation (in which case "denudation" is the more general term) or weathering (thus making erosion a dynamic or active process only). [AGI *]
erosional	Pertaining to or produced by the action of erosion. [AGI *]
erosional landform	Any landform pattern formed by erosion.
erosional plain	Level to undulating or, rarely, rolling landform pattern of extremely low relief (<9 m) eroded by continuous or sporadic geomorphic processes. [RTMAP]
erosional regime	A grouping of regolith mapping units in partly eroded regolith-dominated terrain characterized by outcrop and subcrop of saprolite and/or bedrock. See also RED Scheme.
escarpment 	Steep to precipitous landform pattern forming a linearly extensive, straight or sinuous inclined surface that separates terrains at different altitudes, that above the escarpment commonly being a plateau, mesa, cuesta or a gently sloping surface (see backslope). The upper margin of an escarpment is commonly marked by an included cliff and commonly marks the outcrop of a resistant layer. The term is commonly used synonymously with scarp, although "escarpment" is more often applied to a cliff formed by differential erosion.
esker	A long winding ridge of sand and gravel formed within or beneath a stagnant or retreating glacier.

- estuary** Stream channel close to its junction with a sea or lake, where the action of channelled stream flow is modified by tides and waves. The width typically increases downstream. [McDonald]
- etchplain** Level to undulating or, uncommonly, rolling landform pattern of extremely low relief formed by deep weathering and then erosion of the resulting weathered regolith. Removal of the weathered material may be either partial or complete (see also Ollier 1984).
- Euchrozems** See Great Soil Group, No. 28 and Appendix 1. [Stace]
- evaporite** A precipitation of solutes on or near the land surface, typically as lacustrine sediments, or within the regolith e.g., halite, gypsum.
- exfoliation** The shedding of thin sheets or shells from a weathering boulder or rock face.

- exolaterite** A rock, having a composition comparable to the iron-rich part of a laterite profile, made up of material transported from elsewhere (allocthonous). Not recommended.



estuary of the Pascoe River, Qld. (Photo C.F Pain.)

a b c d e **F** g h i j k l m
n o p q r s t u v w x y z

fabric

The physical nature of a regolith unit or component or rock according to the spatial arrangement, orientation (or lack of it), and mutual relationships of the discrete elements, such as particles, crystals, cements, and voids of which it is composed. [Anand]

facet

(i) An homogeneous element of a landscape, defined in terms of the slope, material and drainage conditions in which it is developed. The facet is the smallest unit of an ad hoc hierarchical system of landsurface classification, in which combinations of facets are termed landforms and combinations of landforms are termed land systems. e.g., a flat or a slope.
(ii) A small, nearly planar surface produced on a rock fragment by abrasion, as by wind or by the grinding action of a glacier.
(iii) Any planar surface produced by erosion or faulting, and intersecting a general slope of the land; e.g., a triangular facet. [B&Z,AGI *]

fan



A gently sloping, fan-shaped mass of detritus forming a section of a very low cone, commonly at a place where there is a notable decrease in gradient.

fanglomerate

A sedimentary rock consisting of slightly water-worn, heterogeneous fragments of all sizes, originally deposited in an alluvial fan and subsequently cemented into a firm rock, and characterized by a considerable persistence parallel to the depositional strike but by a rapid down-dip thinning. The term was proposed by Lawson (1913, p.329) for the coarser, consolidated rock material occurring in the upper part of an alluvial fan. [AGI]

fault line scarp

A scarp formed by erosion of a fault scarp. This may be simple modification of a scarp formed by faulting, or more complex differential erosion where softer rocks on one side of a fault are removed leaving harder rocks on the other side of the fault upstanding.

fault scarp



A scarp formed by faulting, where the footwall surface is exposed; i.e., the scarp face marks the fault plane, and the feature is very fresh.

fenestra

Gaps in a rock framework larger than a grain-supported void; in a regolith context: a small interstice in an aphanitic to finely crystalline and otherwise homogeneous duricrust or sediment.

ferral(l)ite

A humid tropical soil, or in-situ weathering product, formed by the leaching of silica and bases, and characterized by a large content of iron or aluminium oxides, or both. Sometimes used synonymously for laterite, latosol, oxisol. Not recommended. [Aleva]

ferrallitic

See allitic.

Ferralsol

Humid tropical soil characterized by a high iron oxide content, formed by the leaching of silica and bases. Commonly used synonymously for laterite, latosol, oxisol. [B&Z]

ferran

See under cutan.

ferrargillan

A cutan of clay and iron oxide or oxyhydroxide minerals.

ferricrete

An indurated material formed by the in-situ cementation of regolith by iron oxyhydroxides, mainly goethite and/or hematite. The fabric, mineralogy and composition of the cemented materials may reflect those of the parent (regolith) material. Some authors restrict the term to the ferruginous horizon of lateritic regolith (and therefore synonymous with cuirasse, lateritic duricrust) but the more general definition is preferred. [Anand1]

Original definition: A conglomerate of surficial sands and gravels cemented by Fe "salts". (Lamplugh 1902).

ferrihydrite

Mineral, approximate composition $5\text{Fe}_2\text{O}_3 \cdot 9\text{H}_2\text{O}$. Ferrihydrite is the brown rusty scum visible at springs, where water seeps from cracks in rocks, or as an "oil slick" on some swamp water. Ferrihydrite crystals range from about 2-8 nm in diameter. The degree of organization of these particles is low, and the X-ray pattern is very simple and weak and the lines are broad. The surface area of ferrihydrite crystals ranges from 200-800 m^2/g and they are strong adsorbers of phosphate, silica, organic molecules, and heavy metals. Ferrihydrite transforms to a more stable oxyhydroxide (goethite, usually) over a period of a few years. Most ferrihydrite is associated with bacteria (*Gallionella* and *Lepthotrix*) which gain their energy from the oxidation reaction $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}^-$.

ferrite

(i) An older and confusing term for a lateritic rock in which the iron minerals represent $\geq 80\%$ of the lateritic weathering minerals; should be replaced on composition diagrams by "sum of Fe minerals". [Aleva]
 (ii) A term used by Tiejie (1921, p.656) for cemented iron-rich sediment whose particles do not interlock. [AGI]

(iii) A term applied to that class of oxides which contain trivalent iron ions, and which have the cubic crystal structure of the mineral spinel. (Brailsford 1960).

(iv) Iron with a small amount of carbon dissolved in it. It is also known as alpha phase in steel.

Recommendation. Do not use the term for any regolith feature.

ferrolithic

Adjective applied to a lag derived from an original iron-rich lithology. (Alipour et al., 1995)

ferrolysis

Originally used by Brinkman (1970) to refer to the gradual destruction of clays in a soil through repeated cycles of replacement of exchange ions by Fe^{2+} during reducing conditions, followed by oxidation of the iron, consequent drop in pH, partial dissolution of the clays and the introduction of alumina in the exchange sites. More recently it has been used to refer only to the decrease in pH caused by hydromorphic oxidation of iron, according to the equation: $\text{Fe}^{2+} + 3\text{H}_2\text{O} = \text{Fe}(\text{OH})_3 + 3\text{H}^+ + \text{e}^-$.

Ferrosols

A soil order; soils with a B2 horizon high in free ferric oxide and which lack strong texture contrast between A and B horizons. See Appendix 2: Australian Soil Classification. [Isbell]

ferruginized rock fragments

Lithic fragments enriched in iron oxyhydroxides. Relict fabric may be visible. [Anand2]

ferruginous

Pertaining to or containing iron. Commonly used for regolith having obvious ferric oxides and oxyhydroxides.

ferruginous zone

Highly weathered, upper part of a regolith profile composed principally of secondary oxides and oxyhydroxides of iron (goethite, hematite, maghemite) and hydroxides of aluminium (e.g., gibbsite). These minerals may incorporate clays and other secondary minerals and resistant primary minerals. The term may be used to encompass any or all of lateritic residuum, cuirasse, lateritic gravels, lateritic duricrust, carapace, plinthite, ferricrete, etc.

fill

(sed.) Any sediment deposited by any agent so as to fill or partly fill a valley, sink, or other depression [AGI]

(eng.) Artificial sediment mass formed by earth moving works. Fill is sometimes compacted to the status of a very weak rock but typically remains an earth mass. [McDonald]

flat

A level plot of ground. [CG]

floc



Aggregate of clay-sized particles in a clay-water system. The product of flocculation.

- flood plain** Alluvial plain characterized by frequently active aggradation by over-bank stream flow (i.e. by flooding more often than every 50 years) and erosion by channelled stream flow. [McDonald*]
- flour gypsum** See kopi.
- fluvial** Of or pertaining to a river or rivers. [AGI]
- fluviatile** A synonym of fluvial. Geologists tend to use the term for the results of river action (e.g., fluviatile dam, or fluviatile sands) and for river life. [AGI]
- fluvioglacial** A synonym of glaciofluvial. The term "glaciofluvial" is preferred in U.S. "since logically the glac- precedes the fluv-". [AGI]
- foot slope** A general term for the lower, generally concave, part of a hill slope.
- fragipan** An earthy pan, which is generally loamy. A dry fragipan slakes in water, a wet fragipan does not slake in water but has moderate or weak brittleness. Fragipans are more stable on exposure than overlying or underlying horizons. [McDonald]
- fragmental duricrust** See duricrust, fragmental.
- frost weathering** Breaking and separation of rock fragments by the force exerted when water freezes to ice. Freeze-thaw cycles are very important in the breakdown and mixing of rock and soil material (congelifraction). [RTMAP]



flood plain. (Photo R.A. Eggleton)

a b c d e f **G** h i j k l m
 n o p q r s t u v w x y z

<i>garnierite</i>	Mineral, green nickel-bearing mixture of clay minerals, occurring in weathered nickel-rich ultramafic rocks.
<i>gastrolith</i>	A rounded stone in or from the gut of an animal.
<i>gelifluction</i>	The progressive and lateral flow of earth material under periglacial conditions; solifluction in a region underlain by frozen ground (syn. congelifluction). [AGI]
<i>Gelisol</i>	An order in the US soil taxonomy (Soil Survey Staff 1992).
<i>geode</i>	A hollow or partly hollow globular or sub-spherical body, generally over 20 mm in diameter and with a relatively smooth outer surface. The void is lined with crystals, commonly quartz or calcite, but also various sulfides, barite, etc. or gibbsite as rods, threads or irregularly shaped plates in geodes in bauxite. The central part of bauxitic geodes may be filled with soft kaolinitic clay or clayey gibbsite. A geode is separable (by weathering) from the rock in which it occurred as a discrete nodule or concretion.
<i>geomorphic</i>	(i) Pertaining to the form of the Earth or of its surface features; e.g., a geomorphic province. (ii) Pertaining to geomorphology. [AGI]
<i>geomorphic processes</i>	Geomorphic processes are those which form or modify landforms. They can refer to either present or past activity. [RTMAP]
<i>geomorphologic</i>	Syn. geomorphic.
<i>geomorphological</i>	Syn. geomorphic.
<i>geomorphology</i>	The science concerned with the form of the land surface and the processes that created it (Stewart, 2000).
<i>gibber</i> 	An Australian term for a pebble or boulder, especially one of the wind-polished or wind-sculpted stones that compose the desert pavement, or the lag gravels of an arid region (AGI). See also reg.
<i>gibber plain</i>	A desert plain strewn with gibbers.

<i>gibbsite</i>	Mineral, $\text{Al}(\text{OH})_3$, white. Major mineral of bauxite, formed by the weathering of kaolinite or of primary aluminous minerals. Occurs in pisoliths and as earthy deposits.
<i>gilgai</i>	Surface micro-relief (up to a few metres) consisting of mounds and depressions of varying sizes and spatial distribution, some separated by a subplanar or slightly undulating surface. Gilgai is associated with soils containing shrink-swell clays. [McDonald*]
<i>GIS</i>	Geographical Information System. A data-handling and analysis system based on sets of spatial attributes. The data sets are map oriented when they consist of qualitative attributes of an area recorded as lines, points and areas (in vector format), or image oriented, when the data are quantitative attributes referring to cells in a rectangular grid (usually in raster format). (Harrison and Jupp 1989).
<i>glacial deposition</i>	Deposition of material from melting ice. The deposits are referred to by the general term moraine. [RTMAP]
<i>glacial erosion</i>	Erosion and transport of material by glacial ice, giving rise to distinctive landforms such as U-shaped valleys and cirques. [RTMAP]
<i>glacial sediment</i>	Sediment deposited from transport by moving ice. It is neither bedded nor sorted. It has a matrix of clay or silt enclosing larger particles of unweathered rock ranging up to large boulders. [RTMAP]
<i>glacier</i>	A body of ice formed by the compaction and recrystallization of snow, that has definite lateral limits, and motion in a definite direction. [CG]
<i>glaciofluvial</i>	Pertaining to the meltwater streams flowing from glaciers.
<i>glaebole</i>	A three-dimensional compound unit within the matrix of a soil material, or occurring as a discrete physical fabric element, generally approximately equant or prolate in shape, and with a sharp boundary. [B&S]
<i>gley</i>	Greyish, bluish or greenish coloured soil commonly produced under poor drainage; indicative of chemically reducing conditions.
<i>Gleyed Podzolic Soils</i>	See Great Soil Group, No. 36 and Appendix 1. [Stace]
<i>goethite</i>	Mineral, $\alpha\text{-FeO}(\text{OH})$, with common substituents Al, Mn, Ni; polymorphous with lepidocrocite. The most common iron oxide mineral in the regolith. Structure: hexagonal close-packed oxygens,

double chains of Fe-O octahedra linked laterally. Yellow-brown, forming as compact aggregates of sub-micron-sized crystals or as dispersed micro-crystals; common as cutans on ferruginous nodules. Very high surface area, up to 200 m²/g, resulting in high sorptive capacity for cations (eg Cu, Pb, Zn) and anions, especially phosphate. Substitution of Al for Fe reaches 30 mole % in goethites formed in hydromorphic regolith. Goethite can be useful as a geochemical sampling medium in mineral exploration.

gorceixite

See under crandallite.

gossan

The weathered expression of rocks that contained substantial sulfide mineralization. Gossans derived from iron-bearing sulfide assemblages typically consist largely of iron oxides and oxyhydroxides and are a form of ironstone, whereas gossans formed from the weathering of iron-poor sulfides (e.g., carbonate-hosted Pb-Zn deposits) give iron-poor gossans; such gossans may be siliceous or have a high manganese content. Gossans commonly exhibit a boxwork fabric derived from that of their sulfide precursors. The term gossan has no economic connotation. (Nickel 1998)

gossan, direct

Formed in-situ (syn. indigenous gossan). [B&Z]

gossan, false

A discrete ferruginous outcrop (ironstone) with a fabric and/or composition suggestive of a gossan, but not developed over sulphides (syn. pseudo-gossan). [B&Z]

gossan, fossil

Formed during an earlier weathering episode; particularly applies to gossans buried by later sedimentary or volcanic events. [B&Z]

***gossan,
solution-deposited***

An accumulation of hydromorphically transported iron oxides derived from a sulphide source. It may occur within a gossan profile or some distance away (syn. leakage gossan). [B&Z]

gossan, translocated

Gossan that has been mechanically moved. It may subsequently have been recemented. [B&Z]

gossan: pseudo-

See gossan, false. [B&Z]

gradational

(i) Said of gradual spatial change in the appearance of material such that no exact boundary is determinable between regions which are clearly dissimilar when viewed some distance apart.
(ii) Activities which tend to reduce the land to a common elevation (= degradational).

Gradational soils

Soils with a profile dominated by the mineral fraction and showing increasingly finer (more clayey) texture grades on passing down the

solum of such an order that the texture of each successive horizon passes gradually from the one above into the one below (boundaries between horizons are usually gradual or diffuse but may, less commonly, be clear); and the texture difference between consecutive horizons is less than one and a half texture groups, while the range of texture throughout the entire solum exceeds the equivalent of the span covered by one texture group. [Northcote]

grain

Discrete particle of any shape, generally smaller than a few millimetres.

grain-supported

Unconsolidated or consolidated rock in which the composing grains or pebbles touch each other and form the framework of the rock, which would not collapse through removal of the finer grained matrix - if such were possible. [Aleva]

granular

Said of the texture of a rock, regolith or soil that consists of grains of approximately equal size, generally granule sized.

granule

A term proposed by Wentworth (1922) for a rock fragment larger than a very coarse sand grain and smaller than a pebble, having a diameter in the range of 2-4 mm, being somewhat rounded or otherwise modified by abrasion in the course of transport.

gravel

An unconsolidated natural accumulation of rock fragments, themselves resulting from erosion, consisting predominantly of particles larger than sand (>2 mm diameter) such as boulders, cobbles, pebbles, granules, or any combination of these fragments. [AGI*]

gravity slope

The slope at the surface of debris eroded from a cliff or rock outcrop where the debris has fallen and tumbled to its resting place. The slope of the surface is influenced by the sizes of the particles; steeper slopes are associated with coarser debris.

Great Soil Group

A soil classification category in which soils are classified according to their mode of formation as reflected in major morphological characteristics and profile form. See Appendix 1. [Stace]

A

No profile differentiation

1. Solonchaks
Saline soils with little profile development in the top 30 cm and generally having characteristics of the parent material.
2. Alluvial Soils
Soils developed in alluvium with some development of the A horizon. Sedimentary character of the alluvium is preserved.
3. Lithosols
Thin stony soils on a range of bedrocks with some development of the A horizon.
4. Calcareous Sands
Slight organic accumulation at surface. Soils formed on calcareous coastal sands, with no profile development beyond some organic matter in the surface horizon.
5. Siliceous Sands
Generally quartzose with or without a poorly developed A1 horizon.
6. Earthy Sands
Composed of coherent sands, clayey sands, or light sandy loams. Usually red or yellow, thick or thin, has an "earthy" appearance because of clay and iron oxide bridges between grains.

B

Minimal profile development

7. Grey-Brown and Red Calcareous Soils
Soft, powdery, weakly structured loams and light clays with fine-grained carbonates throughout.
8. Desert Loams
Thin, loamy A horizon over a structured, clayey B of red to brown colour. Carbonates and gypsum may occur throughout.
9. Red and Brown Hardpan Soils
Red to brown loamy soils over a silica-and clay-indurated hardpan
10. Grey, Brown & Red Clays
Uniformly coloured soils of high clay content throughout; self-mulching surface, carbonates common at depth; crack deeply on drying.

C

Dark Soils

11. Black Earths Uniformly very dark brown to black colour, high clay content throughout; self-mulching surface, carbonates common at depth; crack deeply on drying.
12. Rendzinas Shallow, dark brown to black clay loams to light clays; strong small peds; carbonate nodules may occur with the limestone parent rock at depth.
13. Chernozems Uniformly very dark brown to black colour; usually a clay loam surface grading to a clay at depth; minor carbonates may occur at depth.
14. Prairie Soils Slightly acid soils with dark A horizons with moderate crumb structure over clayey B horizons; carbonates usually absent.

D

Mildly leached soils

15. Wiesenboden Dark clay to clay loam soils of uniform to gradational profile. Varying gley features in the subsoil. Usually deep soils with acid upper profiles becoming alkaline with depth. May contain Mn-oxide and CaCO_3 segregations.
16. Solonetz Soils with prominent texture contrast between A and B horizons; B horizons are sodic and alkaline and have a coarse prismatic structure.
17. Solodized Solonetz/
Solodic Soil Soils with very prominent texture contrast between A and B horizons; A horizon usually bleached; B horizon sodic and alkaline with coarse columnar structure.
18. Soloths Similar to solodized solonetz but profiles are slightly acid to neutral with less prominent structure in the B horizon.
19. Solonized Brown Soils Also termed malleisols and formerly known as mallee soils. Characterized by carbonate, both fine- and coarse-grained soft to hard segregations. Carbonate is

- at a maximum in the subsoil. Mn-oxide segregations may occur in the subsoil.
20. Red-Brown Earths Brownish, loamy A horizons (usually with A2) abruptly overlying reddish clayey B horizons of blocky to prismatic structure; carbonates are common at depth.
21. Non-Calcic - Brown Soils Brownish, loamy A horizons (no A2) abruptly overlying reddish clayey B horizons with blocky to prismatic structure; no carbonates at depth.
22. Chocolate Soils Acid, friable clay loam and clay soils with weak to moderate horizon differentiation and moderately deep sola.
23. Brown Earths Dark A horizon over yellowish, brownish or reddish B horizon with little texture change at depth; profile acid throughout.

E Soils dominated by sesquioxides

24. Calcareous Red Earth Red, massive sandy to loamy soils of earthy fabric. Carbonates occur in the lower part of the profile. Have a gradual increase with depth of clay and pH (acid to alkaline). Generally very deep soils.
25. Red Earths Gradational, apedal or weakly structured soils with dark, sandy to loamy A horizon changing gradually to a reddish, more clayey B; typically porous; sesquioxide nodules common in the B.
26. Yellow Earths Gradational profiles similar to red earths except for a yellow coloured B.
27. Terra Rossa Soils Reddish soils over limestone or other highly calcareous rocks; brown loamy A horizon with gradational change to reddish clayey B horizon.
28. Euchrozems Reddish clayey soils with prominent, strong, peds, generally blocky or polyhedral; similar to krasnozems except for their neutral reaction; on basalt or other basic rocks.

29. Xanthozems Yellowish clayey soils with prominent, strong, peds, generally blocky or polyhedral; similar to krasnozems except for their yellow B horizon colour; acid profiles on basaltic rocks.
30. Krasnozems Soils with prominent, strong, peds, generally blocky or polyhedral, with dark A horizon grading into clayey red B horizon; acid reaction; formed on basaltic rocks.

F

Mildly to strongly leached soils

31. Grey-Brown Podzolic Soils Have moderately differentiated profile with an abrupt A/B horizon boundary. The thick A horizon is yellow – brown with a 20-40 cm thick yellow brown blocky B horizon of much higher clay content (than the A). May or may not have a bleached A2 horizon. The B horizon is moderately base-saturated and not sodic, pH is neutral to alkaline in the C horizon.
32. Red Podzolic Soils Soils with a loamy A horizon abruptly overlying a red clayey B horizon; a distinct A2 is present and the profile is acid throughout and not sodic.
33. Yellow Podzolics Soils As for red podzolic soils except in having a yellowish B horizon.
34. Brown Podzolic Soils Lack an A2 horizon and have an acid non-sodic profile. Moderately deep medium textured soils with an equal or increasing clay content in the B horizon.
35. Lateritic Podzolic Soils Soils with a thick sandy A horizon abruptly overlying a mottled red/yellow brown B horizon with a nodular, pisolitic or massive ironstone in the base of the A2. The B horizon grades downward into white kaolinized parent rock.
36. Gleyed Podzolic Soils Poorly drained soils with a grey sandy to loam A horizon and a distinct A2 overlying a yellow-grey mottled clay B horizon.

37. Podzols Sandy texture throughout but strong differentiation into a greyish to pale A horizon over a dark brown to black organic and iron-enriched B.

G Organic soils

38. Humus Podzols A dark A1 horizon with a light-coloured A2 over a dark grey to black humic B above a weakly mottled mineral subsoil.

39. Peaty Podzols Some depth of acid fibrous peat or peaty sand overlying a sandy mineral soil with most features of a podzol but lacking an A2.

40. Alpine Humus Soils Well defined humic organic matter with some mineral matter forming a thick surface horizon. Strongly acid throughout.

41. Humic Gleys Acid to neutral predominantly mineral soils with significant but varying organic content. A thick organic A horizon over a gleyed subsoil.

42. Neutral to Alkaline Peats Highly granular dark brown to black fibrous soils. May contain shell or carbonate segregations irregularly with depth.

43. Acid Peats Little profile development, acid, black, sticky, decomposed organic matter.

Grey, Brown and Red Calcareous Soils	See Great Soil Group, No. 7 and Appendix 1. [Stace]
Grey, Brown and Red Clays	See Great Soil Group, No. 10 and Appendix 1. [Stace]
Grey-Brown Podzolic Soils	See Great Soil Group, No. 31 and Appendix 1. [Stace]
greybilly, grey billy	Colloquial term for silcrete.
groundmass	A common fabric term used in several of the earth sciences, generally with the meaning of a finer grained material occupying the spaces between coarser fabric elements. Comparable terms are matrix, plasma, mesostasis, micromass.
groundwater	Loosely, all subsurface water. Formally, subsurface water in the saturated zone, i.e., below the water table. See also vadose, phreatic.
groundwater ferricrete	Iron-oxide-and oxyhydroxide accumulation and induration developed at the surface of the groundwater. There may be a relation between its thickness and fluctuation in the level of the watertable. A term based on poorly understood genetic processes and therefore not recommended for field description.
groundwater laterite	Groundwater ferricrete.
grouting structures	Structures formed by a natural process similar to the grouting techniques used in mining, formed as a result of injecting a watery cement slurry into fissures, joints and pores of a rock thereby reducing its porosity. [Aleva]
groutite	Mineral; α -MnO(OH).
grove-intergrove pattern	A striking vegetation pattern of alternating lines of woodland about 4 m high and strips of bare or sparsely vegetated ground, found in semi-arid rangeland areas in W. Africa, N. America and Australia (where it occurs in mulga woodlands). In W. Africa it occurs on shallow gravelly soils of very low slopes (<1%) on plateau lands formed by a thick lateritic curaisse of Tertiary age. (Mabbutt and Fanning, 1987). Also termed brousse tigrée.
	
grus	Fragmented disintegration product of largely unweathered coarse-grained igneous rocks, especially granite. Commonly applied to surface products, but also to a porous horizon ranging from a few centimetres to 10 m or more thick at the base of saprolite. In the
	

French literature, *grus* or “*arene*” is used to designate such horizons over any lithology. *Grus* is saprolite, distinctive in that it is friable, gravelly or sandy, rather than compact.

gully



A channel resulting from erosion and caused by the concentrated but intermittent flow of water usually during and immediately following heavy rains. A gully is more than 0.3 m deep, a rill is less than 0.3 m deep. [GSS]

gutter drainage



Gutter drainage, like circumvolcanic drainage, is associated with volcanoes. It occurs, for example, where two volcanoes overlap, and the drainage lines flow along the low line of intersection. [RTMAP]

gypcrete

Duricrust cemented mainly by gypsum. [RTMAP]

gypseous

Gypsiferous.

gypsiferous

Containing gypsum.

gypsum

Mineral, $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$, white, bladed, fibrous or powdery. Very common evaporite mineral, found across arid Australia in saline lakes and soils. Important as an industrial mineral and soil modifier.



gully, Bredbo, NSW. (Photo R.S.B. Greene)

a b c d e f g **H** i j k l m
n o p q r s t u v w x y z

- halite** Mineral, NaCl, common salt. Very common evaporite mineral, found across arid Australia in saline lakes, playas and regolith.
- halloysite** Clay mineral, $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4 \cdot 0.0\text{-}2\text{H}_2\text{O}$, similar to kaolinite in chemistry, properties and occurrence, but hydrated (or presumed to have been formerly hydrated), with cylindrical, spherical or rarely platy morphology.
- hanging valley** A tributary valley whose floor is higher than that of the trunk valley in the vicinity of their junction; most commonly applied to glacial landscapes. [CG]
- hardened mottles** A mottle in regolith, the mottle being more indurated than its surrounds and so potentially more erosion resistant. Fragments of hardened iron-rich mottles, released from their surrounds, may form a lag of irregularly shaped hematitic/goethitic fragments, commonly of pebble-size (4-64 mm).
- hardpan**  A relatively hard, impervious layer in the regolith lying at or near the surface. It offers great resistance to digging or drilling, and hampers root penetration and downward movement of water. Its hardness does not change appreciably with changes in moisture content, and it does not slake or become plastic when mixed with water; it can be shattered mechanically or by explosives. It is produced as a result of cementation of soil particles by precipitation of relatively insoluble materials, most commonly silica, with some iron oxide, calcium carbonate, and organic matter. Red-brown hardpans, such as the Wiluna Hardpan (WA), consist of a variety of transported or residual host materials, including soil, colluvium, pisolitic horizons and brecciated saprolite, set in a porous, red-brown, earthy matrix, cemented by silica (generally hyalite), clay, and iron oxyhydroxides. This material has a coarsely laminated appearance and commonly has Mn oxides on partings.
- hematite** Mineral, $\alpha\text{-Fe}_2\text{O}_3$, hexagonal close-packed structure, very common in regolith of warm or arid regions. Colour black or blue-black where massive, red where fine-grained and dispersed. Its intense colour may mask the presence of goethite.

hematized	Impregnated with or replaced by hematite.
heterogranular	Said of a granular rock with a grain-size distribution with two or more widely separated modes. [Aleva*]
hill	Prominence between 90 and 300 m. Compare with mountain. (See McDonald for a more extensive definition.)
hill (low)	A prominence lower than 90 m. (See McDonald for a more extensive definition.)
hillwash	See sheet erosion.
hisingerite	Clay mineral, brown, vitreous, almost amorphous Fe ³⁺ member of the kaolin group: Fe ₂ Si ₂ O ₅ (OH) ₄ . Low temperature alteration product of pyrite, olivine, and other iron-rich minerals.
Histosol	An order in the US soil taxonomy (Soil Survey Staff 1992).
honeycomb weathering	A type of chemical weathering in which innumerable pits are produced on a rock exposure. The pitted surface resembles an enlarged honeycomb and is characteristic of finely granular rocks, such as tuffs and sandstones, in an arid region. See also cavernous weathering and tafone. [AGI]
	
horizon	(i) (geol) An interface indicative of a particular position in a stratigraphic sequence. [AGI] (ii) (soils) A layer of soil approximately parallel to the land surface, with morphological properties different from layers below and/or above it. [McDonald] (iii) (regolith) A layer within the regolith, approximately parallel to the landsurface, with field observable properties different from layers below and/or above it.
horizon, soil	See horizon and soil horizon.
Humic Gleys	See Great Soil Group, No. 41 and Appendix 1. [Stace]
Humus Podzols	See Great Soil Group, No. 38 and Appendix 1. [Stace]
humus	The decomposed organic material in soil. Humus gives surface soil horizons their dark colours. [CG]
hyalite	Mineral, glassy form of opaline silica.
hydrolysis	Chemical reaction between a solid and water. Hydrolysis changes both the solid and the water; for example the hydrolysis of anorthite

may yield kaolinite and release lime.



hydromorphic

Formed under conditions of water saturation.

Hydrosols

A soil order; soils which are seasonally or permanently wet.
See Appendix 2: Australian Soil Classification. [Isbell]

hydrothermal alteration

Alteration produced by chemical changes in rock materials caused by hot water and steam rising through country rock. This is not weathering, but produces very similar effects. The best field distinction between clay bodies formed by weathering and hydrothermal alteration is that weathering decreases with depth, and hydrothermal alteration increases with depth. [RTMAP]



hill (low), Broken Hill, N.S.W. (Photo S.M. Hill)

the dominant indurating material as : bauxitic, calcareous, clay, ferruginous, gypsiferous, siliceous, humic. See also duricrust. [RTMAP]

induration

The hardening of a rock, rock material or regolith by the action of heat, pressure, or the introduction of some cementing material not commonly contained in the original mass: especially the process by which relatively consolidated rock is made harder or more compact. e.g., the development of a hardpan or duricrust. [AGI*]

inlier

An area or group of rocks surrounded by rocks of younger age. [AGI]

inselberg



Range, ridge, or isolated hill that stands abruptly from the surrounding plains, like an island from the sea, characterized by steep slopes which meet the adjacent plain in a sharp, almost angular, junction. e.g., Uluru (Ayers Rock), Kata Tjuta (The Olgas). (Twidale 1982).

insolation



Sunshine (incoming solar radiation).

insolation weathering



Insolation weathering occurs when varying insolation induces temperature changes which cause expansion and contraction of rocks. Repeated temperature changes or rapid change causes rocks to fracture. Insolation weathering is recognized where rocks at the surface consist of interlocking angular fragments. [RTMAP*]

integrated drainage

Drainage having all channels connected, so one can traverse the entire drainage without ever leaving a stream channel. By contrast, interrupted drainage has channels stopping, for example by their entry to a sink-hole, then continuing after a stretch of drainage-free terrain.

interfluve

The area between rivers; especially the relatively undissected upland or ridge between two adjacent drainage basins. [AGI]

intermittent drainage

Channels which flow on a seasonal or irregular basis, containing water during wet parts of the year, and drying up during periods of no rain. [RTMAP]

interrupted drainage



Drainage where the channel segments are short and unconnected. Typically this occurs in karst landforms, and in areas where the drainage pattern has not been fully integrated. Some parts of the arid centre of Australia show this pattern, because of the lack of sufficient precipitation, and disruption of drainage lines by wind blown materials. [RTMAP]

<i>interstice</i>	A void in rock or regolith with walls composed of rock or soil. The shape and size of interstices may vary widely and are not directly related to the grain size of the rock forming the walls. See also alveole, cavity, cave, cavern. [Aleva]
<i>intertextic</i>	A soil fabric where the skeleton grains are linked by intergranular braces or are embedded in a porous matrix. [AGI]
<i>intrazonal soils</i>	Soils with more or less well-developed characteristics which reflect the influence of some local factor other than climate, such as parent material, hydrology and relief. [Aleva]
<i>ion exchange</i>	The replacement of a weakly bonded ion of any solid (commonly a surface or interlayer cation of a clay or the alkaline cation of a zeolite) by an ion from solution.
<i>ion exchange capacity</i>	The total amount of particular material's exchangeable ions. It is expressed in centimoles of positive charge per kilogram (cmole(+)/kg), formerly in milli-equivalents per kg, and commonly determined for soil or clay.
<i>iron crust</i>	A substantial, hard, surficial (or buried) layer or armour of iron oxides and oxyhydroxides. See also cuirasse.
<i>iron segregations</i>	Dark nonmagnetic and goethite-rich iron enrichments within ferruginous saprolite or the upper saprolite, occurring as pods, lenses, and large slabs. They lack cutans and range in size from 0.1 m to 25 m.
<i>ironstone</i>	Highly ferruginous weathered material consisting mainly of iron oxides and oxyhydroxides, with variable amounts of aluminium hydroxides, silica and phyllosilicates. Examples are: (i) a part of a laterite profile, essentially conformable with the land surface, i.e., lateritic ironstone or duricrust; (ii) essentially linear outcrop following an underlying geological unit or structure (See ironstone (stratigraphic)); (iii) ferruginous gravels composed of a majority of ferruginous grains, which may include hematitic and or goethitic pisoliths or nodules of irregular shape such as are released by erosion of the ferruginous and mottled zones of a weathering profile; (iv) gossans.
<i>ironstone gravel soils</i>	Soils containing abundant pisolitic and/or nodular iron-rich (or ironstone) gravel, and commonly showing an acid reaction. [Anand2]

ironstone (stratigraphic) In-situ weathering products of iron-rich strata.



ironstone, lateritic See cuirasse, duricrust.

ironstone, leakage Ironstone that forms where dissolved iron precipitates. The iron, originally derived from the weathering of iron-bearing minerals, is precipitated at depth along joints, lithological contacts and faults, and at the surface in seepage areas and in drainages.

isalterite French term, synonymous with saprolite. See also alterite. [B&Z]



ironstone formed in a WWII dump, Darwin, N.T. (Photo R.A. Eggleton)

a b d c e f g h i **J** k l m
n o p q r s t u v w x y z

jarosite-natrojarosite

Mineral, $\text{KFe}_3(\text{SO}_4)_2(\text{OH})_6\text{-NaFe}_3(\text{SO}_4)_2(\text{OH})_6$. A member of the alunite group. Formed in a reaction between sulfuric acid formed by pyrite oxidation and surrounding silicates. These minerals are common in regolith where pyrite is weathering, and are particularly so in acid-sulfate soils and mine dumps.

joint



A fracture in a rock, generally planar. Jointing patterns are generally expressed in the landscape as a result of weathering and geomorphic processes etching the weaknesses provided by the joints. Drainage patterns may reflect such joint control. [RTMAP]

jump up



A short steep slope between two tracts of more level land. Very similar to a breakaway, but without necessarily culminating in an escarpment. 'Jump up' is used more commonly in New South Wales, Queensland and the Northern Territory, 'breakaway' in Western Australia.



Joints in Cretaceous shales, Darwin, N.T. (Photo R.A. Eggleton)

a b d c e f g h i j **K** l m
n o p q r s t u v w x y z

kame	A conical hill or short irregular ridge of stratified gravel or sand deposited in contact with glacier ice.
kandite	Mineral group term for the varieties of $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$, comprising kaolinite, dickite, nacrite and halloysite. The word has not been widely used in the mineralogical literature.
Kandosols	A soil order; soils which lack strong texture contrast, have massive, or only weakly structured B horizons, and are not calcareous throughout. See Appendix 2: Australian Soil Classification. [Isbell]
kankar (kunkar)	Term for calcrete.
kaolin	An unconsolidated rock in which the kaolinite group (see kandite) represents $\geq 80\%$ of the minerals. It is generally a soft, fine, white, earthy, non-plastic material.
kaolinized	Altered to kaolin.
kaolinite	Clay mineral, $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$. Major component of regolith, particularly in the plasmic zone of weathering profiles. Formed by the weathering of aluminosilicate minerals, primarily plagioclase and muscovite. Typically forms micron-sized hexagonal platy crystals; cation exchange capacity 20-100 meq/kg. Important as an industrial mineral. See also halloysite.
karst	Terrain with distinctive characteristics of relief and drainage arising primarily from a higher degree of rock solubility in natural waters than is found elsewhere (Jennings, 1971). Typically, karst is marked by intermittent stream flow, or by many closed depressions without stream channels, and by subterranean drainage. Karst is most common in limestone terrain, but may develop wherever erosion occurs by solution and collapse, the products being removed through underground channels. e.g., Limestone towers at Riversleigh, Qld., sinkholes and depressions in lateritized sediments, Sturt Plateau, NT.
karst bauxite	Bauxite occurring in limestone karst.
karstification	The formation of the features of a karst topography by the solutional,

and sometimes mechanical, action of water in a region of limestone, dolomite, or gypsum bedrock. [AGI]

kettle

A depression in glacial drift, ranging in diameter from a few metres to several kilometres or so.

knickpoint



Any interruption or break of slope in the longitudinal profile of a stream or of its valley, especially a point of abrupt change or inflection, resulting from rejuvenation, glacial erosion, or the outcropping of a resistant bed. [AGI]

kopi (copi)

Microcrystalline powdery gypsum, found as an alteration product at the surface of more massive gypsum. Also known as flour gypsum. (Jack 1921).

koppie (kopje)



A small but prominent hill occurring on the veld of Southern Africa, some reaching 30 m above the surrounding land; especially an isolated, elongate, scrub-covered hillock or knob representing an erosion remnant, such as a small inselberg. [AGI*]

Krasnozems

See Great Soil Group, No. 30 and Appendix 1. [Stace]

kunkar (kankar)

Term for calcrete.

Kurosols

A soil order; soils with a strong texture contrast between A horizons and strongly acid B horizons. See Appendix 2: Australian Soil Classification. [Isbell]



karstic weathering of Cretaceous clay-stone, Tiger Brennan Drive, Dawin, N.T. (Photo R.A. Eggleton)

a b d c e f g h i j k **L** m

n o p q r s t u v w x y z _____

- lacustrine** Pertaining to, produced by, or formed in a lake or lakes. [AGI]
- lacustrine (lake) sediments** Sediments deposited from transport by waves and from solution and suspension in still water in a closed depression on land. [RTMAP]
- lacustrine plain** Level landform pattern with extremely low relief formerly occupied by a lake or lakes but now partly or completely dry. (See McDonald for a more extensive definition.)
- lag**  A general term for a surface accumulation of materials of diverse origin, such as regolith, rock, and mineral particles, most being in the granule to cobble range (2 to 256 mm); resulting from removal of finer material by pluvial and aeolian processes, or by matrix removal as a result of differential weathering. The type of lag present in an area is partly a function of the local regolith, landform and bedrock.
- lagoon** Closed depression filled with water that is typically salt or brackish, bounded at least in part by dunes or reefs. [McDonald]
- laminated calcrete** See calcrete, laminated.
- land system** A repeated association or pattern of landforms characteristic of a terrain. [B&Z]
- landform** Any physical, recognizable aspect or feature of the earth's surface, having a characteristic shape, and produced by natural processes.
- landform element** Area in the landscape of the order of 40 m or more across, such as a footslope, river flat, or cliff face. See landform pattern. [McDonald]
- landform pattern** Area in the landscape more than 600 m across made up of landform elements. [McDonald]
- landscape** All the natural features of land or territory encompassed in a single view such as fields, hills, forests, water, etc., which distinguish one part of the earth's surface from another part. [GSS]
- landslide**  A general term covering a wide variety of mass-movement landforms and processes involving the downslope transport, under gravitational influence, of soil and rock material en masse. [AGI *]

landslide deposit

Colluvium which has been rapidly displaced down slope by failure of a mass of earth or rock. If the mass was not already part of the regolith the landslide incorporates it into the regolith. Original rock structures are fragmented and tilted by the action of the landslide. [RTMAP]

lateral moraine

A moraine deposited along or near the lateral margins of a valley glacier.

laterite

Generally, regolith exhibiting the characters of all, or at least the upper part, of a laterite profile. Laterite, or lateritic regolith, commonly has a hard, more or less prominent, ferruginous surface expression, with some degree of chemical and mineralogical differentiation below, characterized by varying colour reflecting varying iron and silicate distribution. Laterite is the product of weathering.

COMMENT

Laterite is the word that created most discussion in the preparation of this glossary. The word was coined by Buchanan (1807) during travels in India:

“It is diffused in great masses, without any appearance of stratification, and is placed over the granite that forms the basis of Malayala. It is full of cavities and pores, and contains a very large quantity of iron in the form of red and yellow ochres. In the mass, while excluded from air, it is so soft that any iron instrument readily cuts it, and it is cut into square masses with a pick axe and immediately cut into the shape wanted with a trowel or large knife. It soon becomes as hard as brick, and resists the air and water much better than any bricks.”

Some who have more recently visited this locality would describe Buchanan’s laterite as ‘mottled saprolite’ or ‘vermiform mottled clay’.

After Buchanan, the use of the word ‘laterite’ changed. Walther visited many regions where ferruginous surface materials were common, including India and Australia, and wrote (1915):

“The geological mappers of east India over the past 50 years have laid the emphasis on the surficial iron crust, and describe only this as laterite; later observers have repeatedly followed this interpretation ”

Walther disagreed with this usage, and concluded:

“Considering the facts that white, yellow, violet-red mottled, red and brown-red plastic clays lie one upon another without sharp boundary in the laterite profiles I have investigated, it appears to me expedient to designate the whole phenomenon as laterization.”

Aleva (1994) following Schellmann (1983), proposed:

“They (laterites) consist predominantly of mineral assemblages of goethite, hematite, aluminium

hydroxides, kaolinite minerals and quartz. The $\text{SiO}_2 : (\text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3)$ ratio of a laterite must be lower than that of the kaolinized parent rock in which all the alumina of the parent rock is present in the form of kaolinite, all the iron in the form of iron oxides, and which contains no more silica than is fixed in the kaolinite plus the primary quartz.”

The literature thus allows at least four different views of laterite: Red mottled saprolite, hard iron crust, a weathering profile or a mineral assemblage of limited chemistry. Because of these differences, and because some recent authors suggest abandoning the word (Bourman, 1993, Pain and Ollier, 1992), this glossary recommends:

- Buchanan’s use of ‘laterite’ has not been followed for almost two centuries. We do not recommend such restricted usage of the word;
- ‘Laterite’ should not be used to describe a rock. Rather, use an appropriate descriptive expression for the material in hand, such as ‘ferricrete’, ‘ferruginous duricrust’, ‘bauxite’ etc., as these have none of the historical baggage of ‘laterite’;
- ‘Laterite profile’ should be used to describe a weathering profile showing most or all of: (from the bottom) bedrock, saprolite, plasmic zone, mottled zone, ferruginous or aluminous duricrust and/or gravels, soil; and,
- ‘Laterite’ should always be used informally or broadly, never as a defining word.

laterite derivative facies Generally, an allochthonous lithofacies composed of detritus derived from a laterite profile, parts of which may still be in existence.
[Aleva*]

laterite, false Used by some authors to refer to a rock that on superficial inspection looks lateritic, but is not the product of intense in-situ weathering. Recommend use of a term to describe what it is, not what it is not.
[Aleva]

laterite profile  A vertical sequence of regolith facies showing (or reasonably interpreted to have if hidden) some or all of the following, from the bottom up: bedrock, saprock, saprolite, plasmic zone, mottled zone or ferruginous saprolite, lateritic residuum (lateritic duricrust, lateritic gravel).



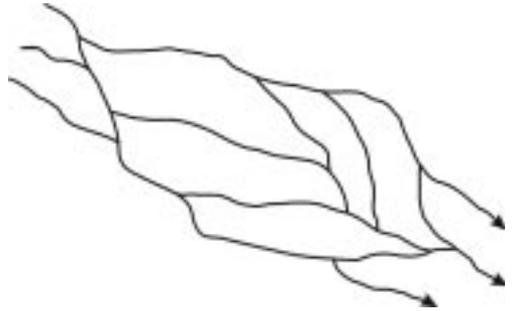
aeolian material in an approaching dust storm; Hay Plains, New South Wales (Photo S.M. Hill)



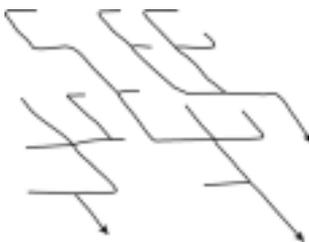
aeolianite exposed in coastal cliffs, Mornington Peninsula, Victoria (Photo S.M. Hill)



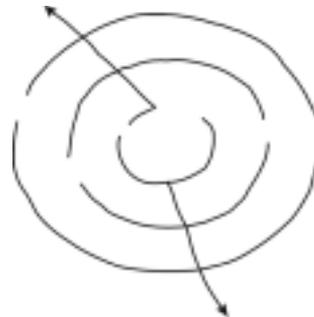
alluvial plain, Whakatane River, Bay of Plenty, North Island, New Zealand (Photo C.F. Pain)



anastomosing drainage



angulate drainage



annular drainage



back slope on Cretaceous sediments, Olive Downs, New South Wales (Photo R.A. Eggleton)



badlands, South Dakota, USA (Photo R.A. Eggleton)



barbed drainage



bauxite mine, Le Baux, France (Photo R.A. Eggleton)



blocky fabric in a soil profile, Queensland (Photo G.G. Murtha)



boinka, Raak, Victoria (Photo J. Magee)



bole between two basalt flows, Barrington Tops, New South Wales (Photo C.F. Pain)



bornhardt, Mt Isa, Queensland (Photo G. Taylor)



boxwork of ferruginous joint-fill in Ordovician shales, Mystery Bay, New South Wales (Photo R.A. Eggleton)



breakaway on the Yilgarn of Western Australia (Photo R.A. Eggleton)



buttes west of Chillagoe, Queensland (Photo C.F. Pain)



calcrete at Limestone Station, Broken Hill, New South Wales (Photo S.M. Hill)



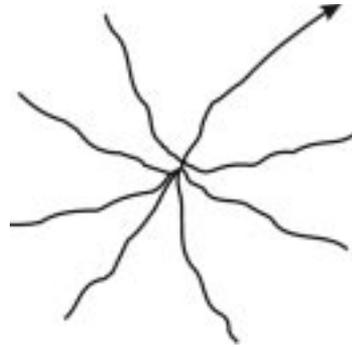
calcrete, laminated, from Nine Mile, Broken Hill, New South Wales (Photo S.M. Hill)



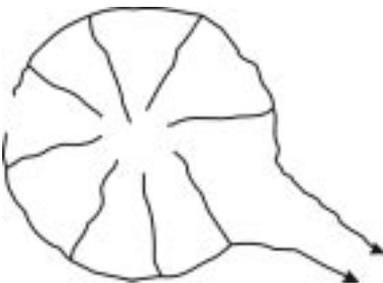
canyon, Porcupine Gorge, Queensland (Photo C.F. Pain)



cavernous weathering, Cleft Island, Victoria (Photo S.M. Hill)



centripetal drainage



circum-volcanic drainage



cirque at Blue Lake, Snowy Mountains, New South Wales (Photo B. Pillans)



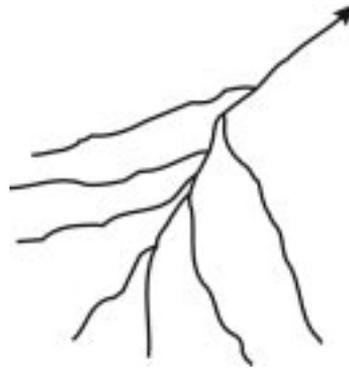
claypan developed in clay-rich soil of river terrace;
Glen Helen, Northern Territory (Photo I.D.M. Robertson)



columnar silcrete developed on Mesozoic sediments,
Grey Ghost, Mt Isa Region, Queensland (Photo R.R. Anand)



conglomerate, weathered Brewer Conglomerate;
Tylers Pass, Northern Territory (Photo I.D.M. Robertson)



convergent drainage



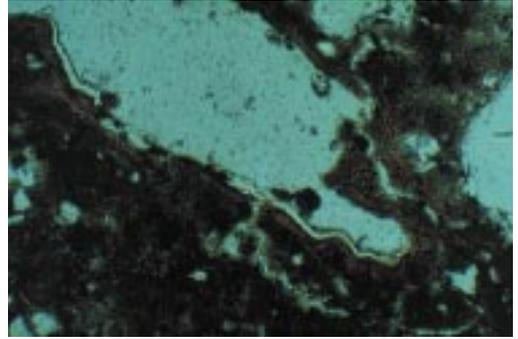
corestone of granite in granitic saprolite, Island Bend,
New South Wales (Photo G. Taylor)



cortex surrounding a quartz-kaolinite nodule, Weipa,
Queensland (Photo D.B. Tilley)



cuesta formed on Heavitree Quartzite, Tanami Road; Narwietooma, Northern Territory (Photo I.D.M. Robertson)



cutan of clay lining a void (Photo G. Taylor)



delta, north branch of Cooper Creek, South Australia (Photo G. Taylor)



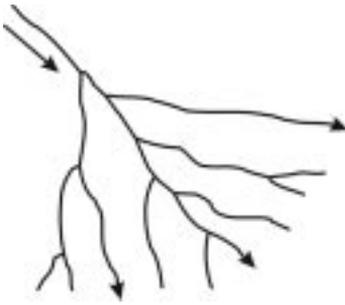
dendritic drainage



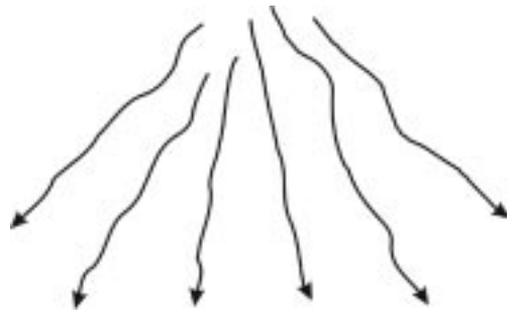
desert armour, near Tibooburra, New South Wales (Photo R.A. Eggleton)



dip slope formed on Eocene sediments, Huesca, Spain (Photo G. Taylor)



distributary drainage



divergent drainage



dolines at Coolemon Plain, New South Wales
(Photo C.F. Pain)



dune field on the southern Australian coast
(Photo R.A. Eggleton)



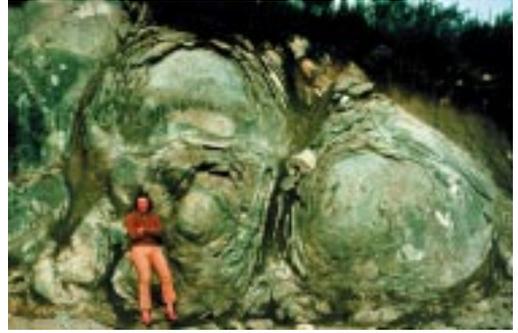
duplex soil profile with a dark A1, bleached A2 and clayey B horizons, near Wagga Wagga, New South Wales
(Photo X.Y. Chen)



erosion gully, Bredbo, New South Wales
(Photo G. Taylor)



escarpment, west Arnhem Land, Northern Territory
(Photo G. Taylor)



exfoliation shells of granite, Monaro, New South Wales
(Photo G. Taylor)



fan of alluvium, near Gisborne, New Zealand
(Photo C.F. Pain)



fault scarp, Meckering, Western Australia
(Photo R.A. Eggleton)



ferricrete, goethite-rich and slabby, on plateau margin,
Python prospect, Queensland (Photo R.R. Anand)



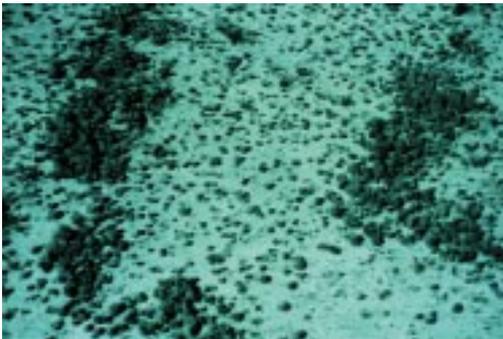
ferrihydrite precipitating at a spring (Photo R.W. Fitzpatrick)



flocs formed by clay entering saline mine water, Kunwarara, Queensland (Photo R.A. Eggleton)



gibber overlying desert loam, Sturt Stony Desert, Innamincka, South Australia (Photo G. Taylor)



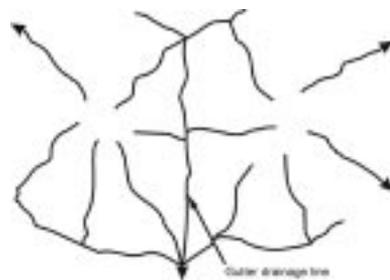
grove-intergrove pattern in mulga and sheetwash, Wiluna-Meekatharra, Western Australia (Photo J.A. Mabbutt)



grus, near Wyndham, New South Wales (Photo G. Taylor)



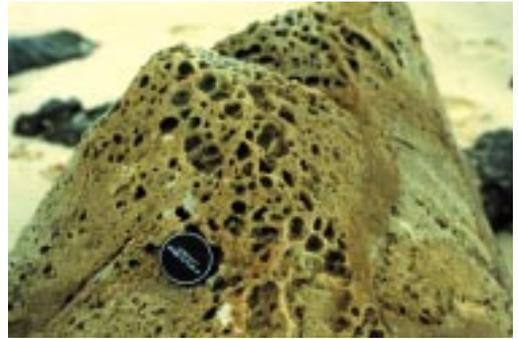
gully in Tertiary sediments, Murray River, Victoria (Photo R.A. Eggleton)



gutter drainage



hardpan (siliceous) within a soil profile over granite, near Wagga Wagga, New South Wales (Photo X.Y. Chen)



honeycomb weathering in Ordovician shales, Mystery Bay, New South Wales (Photo R.A. Eggleton)



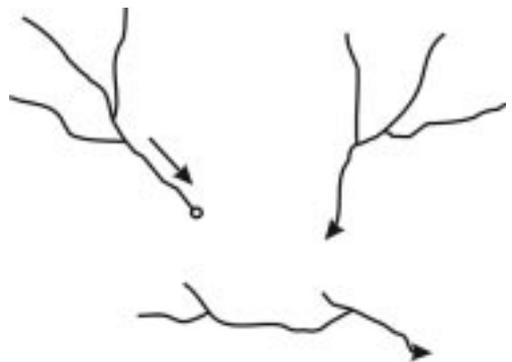
inselberg, Kata Tjuta (Olgas), Northern Territory (Photo G. Taylor)



insolation commencing, near Wilcannia, New South Wales (Photo R.A. Eggleton)



insolation weathering; split quartzite boulders in lag on Brewer Conglomerate; Ross River Syncline, Northern Territory (Photo I.D.M. Robertson)



interrupted drainage



ironstone, stratigraphic, cropping out as blocky and massive ironstone around the mines at Selwyn, Queensland (Photo R.R. Anand)



jointed granite, Phillip Island, Victoria (Photo S.M. Hill)



jump up, Olive Downs, New South Wales (Photo R.A. Eggleton)



knick point on the Jardine River, Queensland (Photo C.F. Pain)



koppie developed on Arunta granitoid, The Garden, Northern Territory (Photo I.D.M. Robertson)



lag of fragments of ferruginised bedrock, silcrete, vein quartz, quartzite and rounded quartz pebbles, Noonthorangee Range, New South Wales (Photo D. Gibson)



landslide on the Barrington Tops, New South Wales
(Photo C.F. Pain)



laterite bricks awaiting use, Angadipuram, Kerala, India.
The material is vesicular mottled saprolite
(Photo R.R. Anand)



laterite profile on Cretaceous shales, Dawin, N.T.
(Photo R. A. Eggleton)



liesegang rings in sandstone, Victoria Hill open pit, Bendigo,
Victoria (Photo K.G. McQueen)



lunettes near Menzies, Western Australia (Photo G. Taylor)



magnesite in colluvium, Marlborough region, Queensland
(Photo L.D. Foster)



meander plain of the Murray River, Australia
(Photo G. Taylor)



megamottles in saprolite, Lake Brown, Western Australia
(Photo R.R. Anand)



melon hole, Cape York, Queensland (Photo C.F. Pain)



mesa, Olive Downs, New South Wales (Photo S.M. Hill)



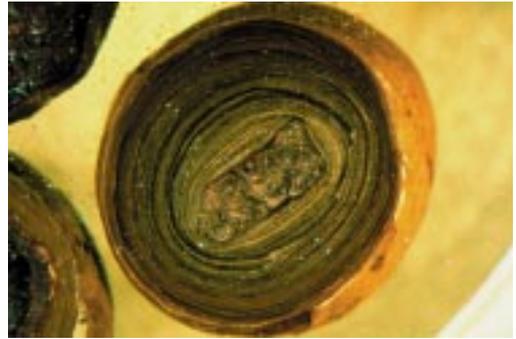
mottled regolith near Pentland Qld. (Photo R.A. Eggleton)



mottled zone at the QED deposit, Kanowna, Western Australia
(Photo I.D.M. Robertson)



nodules in silcrete, Tibooburra region, New South Wales (Photo R.A. Eggleton)



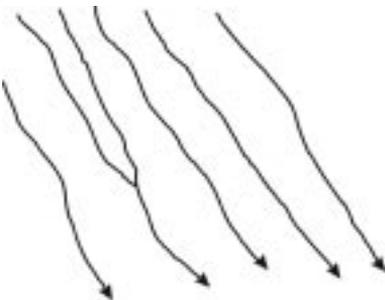
nucleus of a pisolith, Paddington, Western Australia (Pisolith diameter = 5 mm) (Photo R.R. Anand)



ochre pit, Apt Basin, France. (Photo R.A. Eggleton)



pallid zone with bauxite above, Hay Point, Weipa, Queensland (Photo G. Taylor)



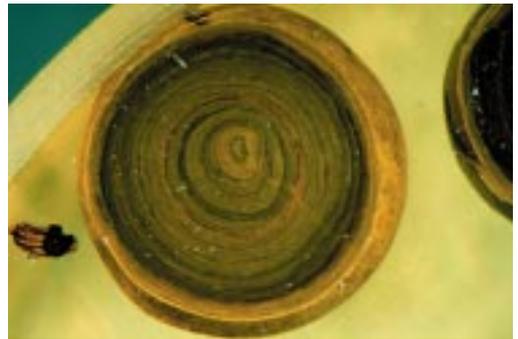
parallel drainage



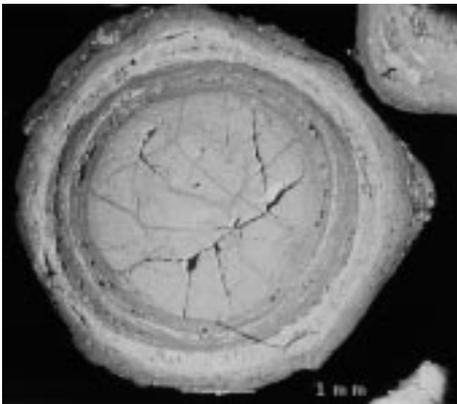
parna overlying granite saprolite, McMahoans Reef Road, Harden, New South Wales (Photo B. Pillans)



pipes in silcrete (Photo G. Taylor)



pisolith showing multiple concentric layers, Paddington, Western Australia (Pisolith diameter 5 mm, photo R.R. Anand)



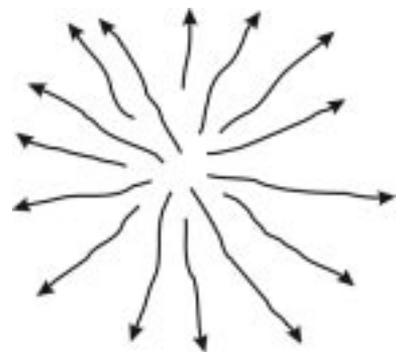
pisolith, 10 mm in diameter, viewed by back-scattered scanning electron microscopy (Photo D.B. Tilley)



plain, Karumba region, Queensland. (Photo C.F. Pain)



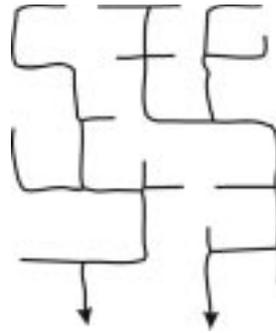
polygons of dried mud, Broken Hill New South Wales (Photo R.A. Eggleton)



radial drainage



reach of the River Murray (Photo G. Taylor)



rectangular drainage



Red Earth near Pentland, Queensland (Photo R.A. Eggleton)



rhizoconcretions near Port Fairy, Victoria (Photo S.M. Hill)



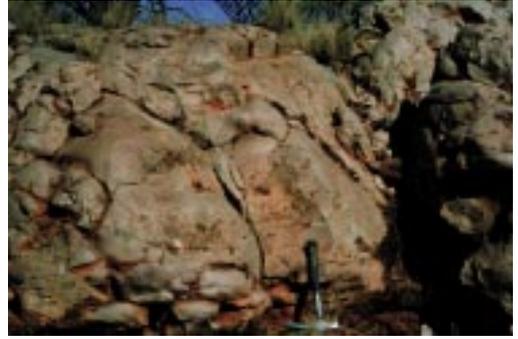
rills in a lunette, Lake Mungo, New South Wales (Photo S.M. Hill)



scree of basalt, Devil's Kitchen, Victoria (Photo S.M. Hill)



sheet-flood fan, Mundi Mundi Plain, New South Wales
(Photo S.M. Hill)



silcrete developed in fluvial sediments; Ross River Syncline,
Northern Territory (Photo I.D.M. Robertson)



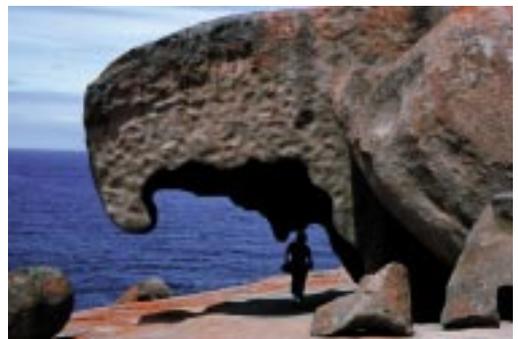
soil profile overlying metasedimentary rock, near Wagga
Wagga, New South Wales, showing a dark A1, pale A2
and red clay B horizons underlain by C horizon and
bedrock (Photo X.Y. Chen)



solifluxion terraces Snowy Mountains, New South Wales
(Photo C.F. Pain)



stone line profile showing red soil over quartz-rich stone line,
Airforce-Mumba area, Zambia (Photo R. R. Anand)



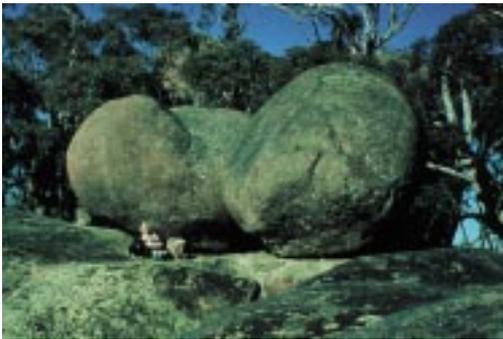
tafone, Remarkable rocks, Kangaroo Is. South Australia
(Photo M.J. Lintern)



termitaria, Hamersley region, Western Australia
(Photo R.A. Eggleton)



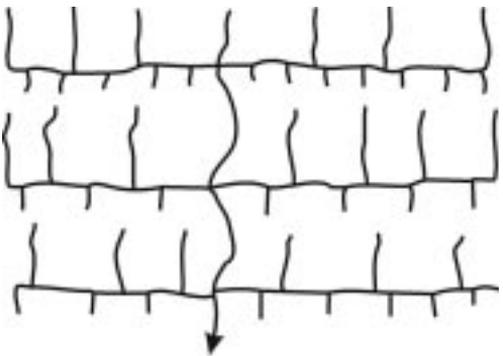
terraced land along the Whakatane River, New Zealand
(Photo C.F. Pain)



tors of the Bega Batholith, New South Wales
(Photo S. Beams)



tree throw, Krawaree West, New South Wales
(Photo S.M. Hill)

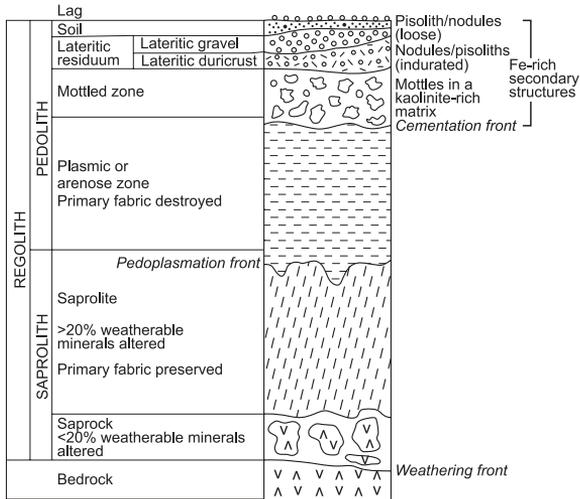


trellis drainage

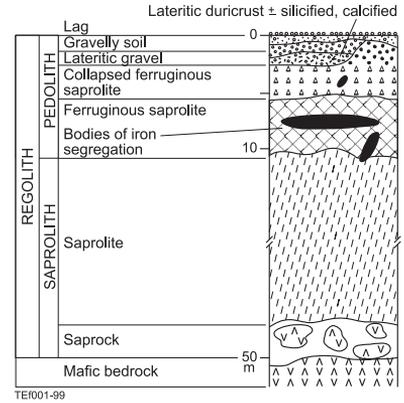


vermiform silcrete (Photo G. Taylor)

A. GENERALIZED REGOLITH TERMINOLOGY



B. MAFIC ROCKS, NORTH YILGARN CRATON (SEMI-ARID CLIMATE)



Preferred	Aleva 1994	Tardy 1993	Walther 1915	Ollier and Rajaguru 1989
soil	soil and lag	termites		soil
lateritic gravel	lateritic gravel	gravels		spaced pisoliths
lateritic duricrust	laterite: cuirasse laterite: main zone	ferruginous cuirasse carapace	iron crust	packed/cemented pisoliths
mottled (clay) zone	mottled zone	mottled horizon (horizon tacheté)	mottled zone	vesicular laterite (mottled zone)
plasmic/arenose zone	plasmic zone	lithomarge or fine saprolite	pallid zone	pallid zone
saprolite	saprolite	arène or coarse saprolite		
saprock	saprock			
bedrock	bedrock	bedrock	bedrock	

laterite sensu lato	Used by some authors as a term with the general connotation of an iron-rich weathering product, generally with emphasis on tropical weathering conditions. [Aleva]
lateritic	Of or pertaining to laterite. NOT "similar to a laterite".
lateritic duricrust	The cemented part of the lateritic residuum. [Anand2]
lateritic gravel	The gravel-sized unconsolidated part of the lateritic residuum. [Anand2]
Lateritic Podzolic Soils	See Great Soil Group, No. 35 and Appendix 1. [Stace]
lateritic residuum	A collective term for the ferruginous part of a laterite profile, composed dominantly of oxides and oxyhydroxides of iron or aluminium (goethite, hematite, maghemite, gibbsite, boehmite) with or without quartz. The term includes both fragments and duricrust developed essentially by residual processes and, therefore, has a broad genetic and/or compositional relationship with the substrate. Where a duricrust is present, the fragments commonly overlie the duricrust. NB. These materials have formed by both vertical and some minor (of the order of 5-50 metres) lateral movement of clasts and are therefore better regarded as residual rather than in-situ.
lateritic soil	A suborder of zonal soils formed in warm, temperate, and tropical regions and including the following great soil groups: Yellow Podzolic, Red Podzolic, Yellowish-Brown Lateritic, and Lateritic. [GSS]
lateritite	An alternative for detrital lateritic material: rocks formed by the accumulation of detritus from a laterite profile, either alone or mixed with extraneous materials. [Aleva]
lateritization	The process of transformation of a (near) surface layer (rock or soil) into lateritic regolith. [Aleva]
lateritoid	(i) Certain lateritic rocks that have been formed by the metasomatic replacement at the outcrops of a variety of rocks, and which cannot be regarded as residual products of decomposition of the underlying rocks, have been designated lateritoid. (Fermor 1911) (ii) An exolaterite formed through precipitation of lateritic matter from solutions. [Aleva]
laterization	Lateritization.
latosol	A zonal soil characterized by deep weathering and abundant hydrous oxide material, developed under forested humid tropical conditions. [Aleva]

leakage gossan	See gossan, solution-deposited.
leakage ironstone	See ironstone, leakage.
lepidocrocite	Mineral, γ -FeO(OH), polymorph with the oxygens in approximate cubic close packing (compare with goethite). Recognizable by its orange colour, lepidocrocite is a relatively uncommon mineral, forming in preference to goethite as a direct oxidation product of ferrous iron and in preference to ferrihydrite if oxidation is slow. It also seems to be precipitated rather than goethite in the presence of Cl ⁻ .
lessivage	(French = leaching) Mechanism of subtraction of material from a given volume or structure. The movement of all materials both in solution and in suspension.
leucoxene	Petrographic term for cream-coloured, high brightness alteration product of titanium-bearing mafic minerals such as ilmenite. Leucoxene is a mixture of minerals, including rutile, pseudorutile (Fe ₂ Ti ₃ O ₉), anatase, iron oxyhydroxides and clay minerals.
levee	Very long, very low, nearly level sinuous ridge immediately adjacent to a stream channel, built up by over-bank flow. Levees are built, usually in pairs bounding the two sides of a stream channel, at the level reached by frequent floods. [McDonald]
liesegang rings 	(weathering) Nested rings or bands of yellow/brown/red colour in weathered rocks, generally caused by the precipitation of iron oxides and oxyhydroxides from solution.
limonite	Mineral aggregate, earthy, ochreous, largely composed of goethite with variable amounts of lepidocrocite, hematite, clay silicates and other fine-grained minerals.
lithic	Of rock, as: 'lithic fragments' are fragments of rock, 'lithic fabric' is the fabric of rock.
lithomarge	(French) Compact, massive, generally kaolinitic clay. It has been applied in the French and Indian literature to clay-rich zones of the regolith, particularly in the upper saprolite. [B&Z]
lithorelic	A weathered fragment of rock.
lithorelict	An unweathered fragment of rock in an assemblage of secondary minerals. [B&Z]
Lithosols	See Great Soil Group, No. 3 and Appendix 1. [Stace]

- litter*** Freshly fallen plant (or animal) matter on the ground surface. [B&Z]
- littoral*** Pertaining to the shore of a water body. [CG]
- lixiviation*** Mechanism of subtraction of material by congruent dissolution. [Tardy]
- loam*** Soil texture term. See Texture triangle.
- loess*** Material transported and deposited by wind and consisting of predominantly silt-sized particles. (See also parna). [GSS]
- low hill*** See hill, low.
- lunette*** Elongated, gently curved, low ridge built up by wind on the margin of a playa, typically with a moderate, wave-modified slope towards the playa and a gentle outer slope. [McDonald]



lagoon, Gunn Point, N.T. (Photo R.A. Eggleton)

a b d c e f g h i J k l **M**
 n o p q r s t u v w x y z _____

- maar** Level floored, commonly water-filled closed depression with a nearly circular steep rim, excavated by volcanism. [McDonald]
- made land** An area of artificial or engineered fill consisting of earth materials more or less mixed with waste, refuse, and debris, such as on the marshy borders of a lake shore or on a shallow lake bottom bordering the shoreline. Also spelled madeland. [AGI*]
- mafic** Rock or mineral of high magnesium-iron content, such a gabbro or olivine.
- maghemite** Mineral, $\gamma\text{-Fe}_2\text{O}_3$, spinel. Maghemite can form by the oxidation of magnetite, and by the dehydration of goethite or lepidocrocite during fires. Lepidocrocite can transform easily to maghemite, as both have cubic close-packed structures. Maghemite is strongly magnetic.
- magnesite** Mineral, MgCO_3 , found particularly in veins, sheets, nodules or bodies up to the size of a cauliflower in regolith over ultramafic rocks, e.g., Kunwarara, Qld.

- magnetite** Mineral of the spinel family, Fe_3O_4 . Magnetite is strongly ferromagnetic, crystallizing as black octahedra that are quite resistant to weathering and consequently are common as resistates or placers in the regolith. Magnetite slowly weathers to maghemite or to hematite. Pseudomorphs of hematite after magnetite are known as martite.
- malachite** Mineral, $\text{Cu}_2\text{CO}_3(\text{OH})_2$, bright green weathering product of copper minerals such as chalcopyrite.
- mallee soil** See Great Soil Group No. 19, Solonized brown soils.
- mallisol** See Great Soil Group No. 19, Solonized brown soils.
- mangan** (i) Prefix denoting manganese.
 (ii) A cutan consisting of manganese oxides or hydroxides. (Brewer & Sleeman, 1988).
- manganese oxides** Minerals common in regolith, particularly in weathering profiles of ultramafic rocks, or manganese-bearing rocks and base metal

deposits, e.g., Broken Hill, NSW, Grootte Eylandt, N.T. etc. Typically a variety of species occur together in black, very fine-grained aggregates referred to as wad if soft, or psilomelane if hard. Minerals include:

asbolane	(Co-Ni-Mn oxyhydroxide)
birnessite	$((\text{Na},\text{K})_4\text{Mn}_{14}\text{O}_{27}\cdot 9\text{H}_2\text{O})$,
the cryptomelane-coronadite-hollandite group	$(\text{K}, \text{Pb}, \text{Ba})_{2-1}\text{Mn}_8\text{O}_{16}$
chalcophanite	$(\text{ZnMn}_3\text{O}_7\cdot 3\text{H}_2\text{O})$
lithiophorite	$((\text{Al},\text{Li})\text{MnO}_2(\text{OH})_2)$
manganite	$(\text{MnO}(\text{OH}))$
nsutite	$(\text{Mn}^{4+}_{1-x}\text{Mn}^{2+x}\text{O}_{2.2x}(\text{OH})_{2x}[\text{x small}])$
pyrolusite	(MnO_2)
romanchèite	$(\text{Ba},\text{H}_2\text{O})_2(\text{Mn}^{4+},\text{Mn}^{3+})_5\text{O}_{10}$
todorokite	$((\text{Na},\text{Ca},\text{K})_{0.3-0.7}(\text{Mn},\text{Mg})_6\text{O}_{12}\cdot n\text{H}_2\text{O})$
vernadite	$(\delta\text{-MnO}_2)$.

(see, e.g., Anthony et al 1997)

manganite

Mineral, $\gamma\text{-MnO}(\text{OH})$.

manganocrete

Duricrust cemented mainly by manganese oxides.

mangcrete

Manganocrete

marine plain

Plain eroded or aggraded by waves, tides, or submarine currents, and aggraded by deposition of material from suspension and solution in sea water, elevated above sea level by earth movements or eustacy, and little modified by subaerial agents such as stream flow or wind. [McDonald]

marine sediments

Sediments deposited from the sea. Marine sediments may occur in the regolith in coastal areas.

marl

A loose, earthy material consisting chiefly of an intimate mixture of clay and calcium carbonate, commonly formed in freshwater lakes. Specifically, a mixture of 35-65% clay and 65-35% calcium carbonate. [AGI*]

mass wasting

A general term for the dislodgment and downslope transport of soil and rock material due to gravity. Mass wasting includes slow displacements, such as creep and solifluction, and rapid movements such as rockfalls, rockslides, and debris flows. Also termed downwasting. [AGI*]

massflow

Movement of part of the regolith or sediment by processes of creep, slip or landslide.

massive	Homogeneous, without visible internal fabric.
massive duricrust	See duricrust, massive.
matrix	The finer-grained material enclosing, or filling the interstices between the larger grains or particles of a rock or regolith. The term refers to the relative size and disposition of the particles, and no particular particle size is implied. Also called groundmass (igneous rocks). [Aleva]
matrix-supported	Texture of a heterogranular rock or regolith in which the larger particles are loosely distributed, generally without touching each other, in an abundant matrix; removal of the matrix would result in a loose pile of the larger particles. [Aleva*]
meander 	[streams] One of a series of somewhat regular, sharp, freely developing and sinuous curves, bends, loops, turns or windings in the course of a stream. It is produced by a stream swinging from side to side as it flows across its flood plain or shifts its course laterally toward the convex side of an original curve. The process of meandering leads to a fining-upwards sequence of sedimentary deposits typical of meandering fluvial facies. [AGI*]
meander plain	Flood plain aggraded and eroded by meandering streams. (See McDonald for a more extensive definition.)
megamottles 	Mottles greater than 200 mm in mean diameter.
melacic	A near surface soil horizon which is black throughout and has a pH (in soil:water mix 1:5) <5.5. (Isbell 1994).
melanic	A near surface soil horizon which is black throughout and has a pH (in soil:water mix 1:5) >5.5. (Isbell 1994).
melon hole 	Local term for a shallow oval depression with no surface outlet generally less than 100 m in diameter.
mesa 	An isolated, nearly level landmass standing distinctly above the surrounding country, bounded by abrupt or steeply sloping erosion scarps on all sides, and capped by layers of resistant, nearly horizontal rock or regolith (e.g., lava or duricrust). Less strictly, a very broad, flat-topped, usually isolated hill or mountain of moderate height bounded on at least one side by a steep cliff or slope and representing an erosion remnant. A mesa is similar to, but has a more extensive summit area than, a butte. [AGI*]
microaggregation	The aggregation of soil particles into units <250 μm diameter (Oades 1984).

microaggregation (front)	A transformation (front) associated with a change to a microaggregated fabric in friable soil.
microrelief	Small-scale, local differences in topography, including mounds, swales, or pits that are only a metre or so across with elevation differences of up to 2 metres. [GSS]
microtubular	A void consisting of sinuous tubes with a diameter of <0.5 mm, occurring in otherwise more or less massive and fine-grained rock or soil. [Aleva]
minimottle	Mottle <10 mm in mean diameter.
mobile zone	The material above saprolite that is not in situ but has somehow been mobilized. It may have been simply expanded, collapsed, displaced, reworked by bioturbation, or may be transported material such as alluvium or colluvium.
moderately cemented duricrust	See duricrust, moderately cemented.
Mollisol	An order in the US soil taxonomy (Soil Survey Staff 1992).
monadnock	An upstanding rock, hill or mountain of circumdenudation rising conspicuously above the general level of a plain. Differs from an inselberg in rising less abruptly from the plain.
monosiallitization	The chemical change of silicates to 1:1 layer silicates such as kaolinite, halloysite (Pedro 1966).
montmorillonite	Clay mineral of the smectite group, approximately $A_{0.3}(Al_{1.7}Mg_{0.3})[Si_4]O_{10}(OH)_2 \cdot 4H_2O$, where A is an exchangeable cation, K^+ , Na^+ , or $0.5Ca^{+2}$ etc. Montmorillonite is less common than the other aluminous smectite beidellite. (Formerly used also for the smectite group.)
moraine	Drift, deposited chiefly by direct glacial action, and having constructional topography independent of control by the surface on which the drift lies. The term is used both for the till deposited by a glacier and for the consequent landform. See also terminal moraine, lateral moraine and recessional moraine. [AGI*]
morphotectonics	The tectonic interpretation of the morphological, or present topographic features, of the Earth's surface; it deals thus with their tectonic or structural relations and origins, rather than with their more obvious origins by surficial processes of erosion and sedimentation. [AGI]

mottle	Segregation of subdominant colour different from the surrounding region's colour. In regolith, mottles may have sharp, distinct, or diffuse boundaries. They typically range in size from 10-100 mm, but may reach several metres in size. Larger mottles (>200 mm) have been termed megamottles, and those <10 mm minimottles.
mottled 	Bearing mottles.
mottled zone 	Part of a weathering profile showing mottles. Where present in a laterite profile, it underlies the lateritic residuum and is commonly above the plasmic zone.
mountain	Any part of the Earth's crust higher than a hill, sufficiently elevated above the surrounding land surface of which it forms a part to be considered worthy of a distinctive name, characterized by a restricted summit area (as distinguished from a plateau), and generally having comparatively steep sides and considerable bare-rock surface; it can occur as a single, isolated eminence, or in a group forming a long chain or range, and it may form by earth movements, erosion, or volcanic action. Generally, a mountain is considered to project at least 300 m (1000 ft) above the surrounding land. [AG]
mud	<ul style="list-style-type: none"> i) Soft, wet, sticky or slippery mixture of water and predominantly fine-textured sediments, ii) A textural term used to refer to a mixture of water, silt and clay. [CG]
mudflow	A fluid, mobile mass of fine-grained (dominantly less than sand-sized) earth material.
mulch	Loose material on the soil surface, generally decaying plant material or small pieces of soil. See also self-mulching.
Munsell colour system	A colour designation system specifying the relative degrees of the three simple variables of colour: hue, value, and chroma. [CG]

a b d c e f g h i J k l m
N o p q r s t u v w x y z

- neoformed** Newly formed; authigenic.
- neotectonics** The study of the structures and structural history of the Earth's crust, after the Miocene and during the later Tertiary and the Quaternary. Although some deformational and even orogenic structures were formed during this time, most neotectonic features are epeirogenic and were produced by vertical movements. [AGI*]
- nepouite** Mineral, nickel equivalent of the serpentine mineral lizardite.
- Neutral to Alkaline Peats** See Great Soil Group, No. 42 and Appendix 1. [Stace]
- nickpoint** See knickpoint.
- nitre** Mineral, KNO₃, evaporite, found in very arid climates.
- nodular**
 - (i) Composed of nodules; consisting of scattered to loosely packed nodules in a matrix of like or unlike character, characterized by lumps, flocculated material, roundish aggregations, or large coated grains, often composed of the same material that encloses them. e.g., "nodular ferricrete".
 - (ii) Having the shape of a nodule, or occurring in the form of nodules; e.g., "nodular ore" such as a colloform mineral aggregate with a bulbed surface. [AGI *]
- nodule**
 - (regolith) A lump of regolith, generally pebble-sized, not rock, different from its immediate surrounds. Nodules are distinguished from other similar-sized bodies by having the following characters: they may have an irregular but commonly smooth shape, and generally, although not necessarily, have a contrasting cortex, but are more uniform inside, except they may have either a nucleus or a central cavity. Of the smaller nodules in a weathering profile, as sphericity increases, the terms nodule and pisolith merge.
-  **Non-Calcic Brown Soils** See Great Soil Group, No. 21 and Appendix 1. Stace
- nontronite** Clay mineral of the smectite group, approx. A_{0.3}(Fe³⁺²)[Si_{3.7}Al_{0.3}]O₁₀(OH)₂.4H₂O, where A is an exchangeable cation, K⁺, Na⁺, or 0.5Ca⁺² etc. Nontronite is a common weathering

product of iron-bearing silicates, and is the main colouring mineral in altération pistaché.

nucleus



A central part; for example the central part of a pisolith or nodule; it may be of similar or contrasting shape, chemistry and mineralogical composition to the cortex.

nulasepic

Soil fabric term in which the smallest birefringent units of clay sized minerals visible in a light microscope are unoriented with regard to each other and have unoriented clay-sized material between. [B&S]



nodules of bauxite, Weipa, Qld. (Coin is 20mm, photo D.B. Tilley)

a b d c e f g h i j k l m

n **O**

p q r s t u v w x y z

ochre

A strongly coloured, generally earthy, regolith material, typically red, yellow, orange or brown, composed of clays and iron oxide and oxyhydroxide minerals.

ochreous

Bearing ochre.

oid

(i) An individual spherite of an oolitic rock; an oolith. The term has been used in preference to "oolith" to avoid confusion with "oolite".
(ii) A general, nongeneric term for a particle that resembles an oolith in outer appearance and size. [AGI]

oolite

Rock composed of ooliths.

oolith

A small (0.25 to 2 mm), round (ovate, spherical, or oblate ellipsoidal) body in the regolith or in a sedimentary rock, in aggregation resembling the roe of fish. Regolith ooliths may be composed of gibbsite, hematite, goethite, or combinations of these minerals. Sedimentary ooliths are generally formed of calcium carbonate (but may be of dolomite, silica, iron oxide, pyrite, or other minerals). An oolith typically has successive concentric layers commonly around a nucleus (such as a shell fragment, an algal pellet, or a quartz-sand grain). [AGI]

oolitic

Bearing ooliths.

opal

Silica mineral, amorphous to poorly crystalline, composition $\text{SiO}_2 \cdot n\text{H}_2\text{O}$. Electron microscopy shows a microstructure of packed silica spheres. Precious opal displays an iridescent play of colour; common opal is varicoloured, vitreous, glassy (hyalite) or translucent. Commonly formed from solution and reprecipitation of silica in regolith; in Australia, notably within late Cretaceous and Cainozoic deeply weathered profiles which developed in the Eromanga Basin sequence of S.A., Queensland and N.S.W., in red-brown hardpans. Also found as late stage deuteric alteration within volcanic rocks.

Organic soil

Soil with a profile dominated by plant remains – the organic fraction – such that the surface 30 cm contains 20% or more organic matter if the clay content of the fine earth is 15% or lower, or 30% or more organic matter if the clay content of the fine earth is higher than

15%. The organic matter should equal, or exceed the stated amounts at all depths down to, and including, the 30 cm. [Northcote]

Organosols

A soil order; soils dominated by organic material. See Appendix 2: Australian Soil Classification. [Isbell]

outlier

An area or group of rocks surrounded by outcrops of older age, e.g., an eroded geosynclinal trough, or a remnant on the downthrown side of a fault. [AGI]

outwash

Glaciofluvial sediments deposited by glacial meltwater downstream from a glacier. [CG]

outwash plain

A flat or very gently sloping surface underlain by glaciofluvial sediments. [CG]

over-bank deposit

Alluvium which is deposited outside an alluvial channel from flowing water which has overflowed from the channel. It includes levees and back swamp deposits. [RTMAP]

overburden

(econ geol) Barren rock material, generally unconsolidated, overlying a mineral deposit which must be removed prior to mining.
(sed) (i) The upper part of a sedimentary deposit, compressing and consolidating the material below.
(ii) The loose soil, silt, sand, gravel, or other unconsolidated material overlying bedrock, either transported or formed in place. [AGI]

oxbow

See billabong.

oxisol

A structured (i.e., pedal) sesquioxidic soil. Close synonyms in other classifications include: Krasnozem, Euchrozem and Xanthozem (Stace et al .1968), Ferrosol or Dermasol. (Australian Soil Classification Orders , Isbell 1996). Also Oxisol - an order in the US soil taxonomy (Soil Survey Staff 1992).

oxyhydroxide

Minerals in which the anions are both O and (OH): most commonly goethite, lepidocrocite (FeO(OH)), boehmite, diaspore (AlO(OH)), and groutite (MnO(OH)).

a b c d e f g h i j k l m

n o **P** q r s t u v w x y z

- packed pisolitic duricrust** See duricrust, packed pisolitic.
- packstone** A term used by Dunham (1962) for a sedimentary carbonate rock whose granular material is arranged in a self-supporting framework, yet also contains some matrix of calcareous mud. [AGI]
- palaeosol** Soil formed under environmental conditions different from those of the present. May be buried.
- pallid** In the context of a weathering profile: very pale to white, lacking pigmentation.
- pallid zone** A zone or portion of a weathering profile that lacks colour. Its position in the profile and its mineralogy may vary, but the zone is generally dominated by kaolin ± quartz. In a laterite profile the pale-coloured region below the mottled zone, incorporating parts of the plasmic zone and or saprolite has been referred to as the pallid zone (Walther 1916).

- palygorskite** Fibrous mineral approximately $(Mg,Al)_5Si_8O_{20}(OH)_2 \cdot 4H_2O$, generally found in arid, evaporitic environments.
- palynoflora** The whole suite of palynomorphs from a given rock unit. The term microflora is sometimes used as a synonym but should be avoided as it better applies to assemblages of extant microscopic algae and fungi. [AGI]
- pan** An indurated or cemented soil horizon. See also hardpan. [McDonald]
- panplain** A broad plain, shared by all the streams of a region, formed by the coalescence of floodplains by their own growth (Crickmay, 1933).
- papule** A prolate to equant, somewhat rounded glæbule composed dominantly of clay minerals with a continuous and/or lamellar fabric and having sharp external boundaries; e.g., a clay gall in soil material. [AGI]
- parallel drainage** A drainage pattern where the channels are parallel to each other.


This type of drainage is commonly initiated on a planar sloping surface, and the presence of a parallel drainage pattern or its remnants may suggest the former presence of such a surface. [RTMAP]

parent material

The material, whether fresh rock, unconsolidated sediment or prior regolith, whether mineral or organic, from which the regolith or soil develops.

parent rock

See parent material.

parna



Silt- and sand-sized aggregates of mixtures of silts and clays. The aggregates commonly occur in dune-like deposits or in sheets that drape the landscape. The aggregates may be bonded internally by clays, iron oxides, carbonates, gypsum, or other salts. If by clays they may have one of the sepic fabrics. Their properties and position on the landscape suggest that they are aeolian materials. See also loess.

partially cemented duricrust

See duricrust, partially cemented.

particle fall

Free fall of small particles of rock and/or soil from or near vertical faces. [RTMAP]

patterned ground

Land surface with distinctive arrangement of stones, vegetation or micro topography. Patterned ground can be due to the effects of ground freezing and seasonal frost characteristic of periglacial environments, or it can be associated with gilgai and desert landscapes. Patterned ground includes stone stripes, sorted circles and tundra polygons, as well as grove-intergrove and other vegetation patterns. [CG*]

peat

Black or brown, partly decomposed, fibrous vegetative matter that has accumulated in a waterlogged environment such as a bog. [CG]

Peaty Podzols

See Great Soil Group, No. 39 and Appendix 1. [Stace]

ped

Naturally formed soil aggregate separated from adjacent peds by irregular spaces. Peds range in size from about 10 mm to several hundred millimetres. Qualifying terms are granular, lenticular, platy, blocky, polyhedral, columnar and prismatic (see figure page 98)

pedalfer

Soil in which calcium carbonate does not accumulate in any part of the profile. [Stace]

pediment

Gently inclined to level landform pattern of extremely low relief, commonly with a thin veneer of detritus underlain by bedrock,

characteristically lying down-slope from adjacent hills with markedly steeper slopes. (See McDonald for a more extensive definition.)

<i>pediplain</i>	Level to very gently inclined plain with extremely low relief formed by the coalescence of pediments. (See McDonald for a more extensive definition.)
<i>pedo</i>	Prefix: relating to soil.
<i>pedocals</i>	Soils in which calcium carbonate has accumulated in the profile during soil formation. [Stace]
<i>pedoenvironment</i>	The environment of the soil.
<i>pedofeature</i>	Discrete fabric units present in soil materials; recognisable from adjacent material by a difference in concentration in one or more components, e.g., a granulometric fraction, organic matter, crystals, chemical components or an internal fabric. [Aleva]
<i>pedogenesis</i>	Soil formation. Adjective: pedogenetic, pedogenic. [Aleva]
<i>pedogenic</i>	Pertaining to soil formation. [AGI]
<i>pedolith</i>	Upper part of the regolith, above the pedoplasation front, that has been subjected to soil forming processes resulting in the loss of the fabric of the parent material and the development of new fabrics. [B&Z]
<i>pedology</i>	The study of soil morphology, genesis and classification. [AGI]
<i>pedoplasma</i>	A plasma developed and organized during pedogenesis or soil formation.
<i>pedoplasation front</i>	Transformation front at which the lithic fabric is destroyed, although commonly with little chemical reworking (pedoplasation, Flach et al., 1968). It forms the boundary between the saprolith and pedolith in deeply weathered profiles. [B&Z]
<i>pedoturbation</i>	Mixing of soil components by biological activity and by shrink-swell processes in, e.g., vertisols. [B&Z]
<i>pelitomorph</i>	Pertaining to or composed of clay-sized particles. [Aleva]
<i>penplain</i>	Level to gently undulating landform pattern with extremely low relief, formed from slope decline by the processes of long-continued sub-aerial erosion. (Davis 1889)
<i>percoline</i>	See under subsurface solution.

perennial drainage	Drainage with water flow all year round.
periglacial	An environment in which frost action is an important factor or a term used to describe processes that are induced by conditions found in an area where frost action is important. [CG]
permafrost	The state of natural materials that exist at below freezing temperatures for a relatively long period of time (2 or more years) [CG]
petroferric phase	A continuous layer of indurated material in which iron is an important cement. Preferred term is ferricrete. [Aleva]
petroplinthite	See plinthite.
phreatic	Of subsurface water, that which is below the watertable. Formally equivalent to groundwater. (Compare with vadose)
physical weathering	Weathering without chemical change. The break-up of rocks, rock fragments and minerals by physical force, such as gravity, heating and cooling, crystal growth, biological activity (compare with chemical weathering).
pipelite	Informal name for a nickel-rich talc-related mineral, soft, green, variable composition. Found as a weathering product of ultramafic rocks See willemsite.
pipe 	A tubular cavity, from several centimetres to a few metres in depth, often filled with sand and gravel; e.g., a vertical joint or sinkhole in limestone, enlarged by solution of the carbonate and filled with clastic material. [AGI*]
piping	Subterranean erosion by percolating water forming tubular underground conduits through which solutions and solid particles are removed. This may lead to collapse and initiate gully erosion. [Aleva*]
pisoid	Syn. pisolith.
pisoidal	Texture of a rock composed of pisoliths. [Aleva]
pisolite	A sedimentary rock made up chiefly of pisoliths cemented together. [Aleva]
pisolith 	A spherical or ellipsoidal body resembling a pea in shape and limited in size to between 2 mm and about 64 mm in diameter. It may have a concentric internal structure but concentric lamination is not diagnostic; however, most pisoliths have an outer cortex or skin. Syn. pisoid. [B&Z]

<i>pisolitic</i>	Pertaining to pisolite, or to the texture of a rock made up of pisoliths or pea-like grains; e.g., “ <i>pisolitic bauxite</i> ” or “ <i>pisolitic duricrust</i> ”. [AGI*]
<i>placer</i>	A mineral deposit formed by the accumulation of weathering resistant minerals, commonly in alluvium or on a shore. Most placer deposits are of dense, durable minerals such as diamond or cassiterite (SnO ₂).
<i>plain</i>	A flat area, large or small; specifically, an extensive region of comparatively flat, smooth, and level or gently undulating land, having few or no hills or valleys.
<i>planation</i> 	(i) The process or processes of erosion whereby the surface of the Earth or any part of it is reduced to a flat, or level surface; The term also includes erosion by waves and currents, and abrasion by glaciers or wind, in producing a flat surface. The term was originated by Gilbert (1877) who considered alluviation of the flattened surface as part of the planation process; however, this condition is not necessary. (ii) A broad term for the general lowering and flattening of the land. [AGI*]
<i>plasma</i>	All the material of regolith, inorganic and organic, crystalline and amorphous, of clay size (<2µm). Adjective plasmic.
<i>plasmic horizon</i>	Plasmic zone with essentially horizontal boundaries.
<i>plasmic zone</i>	Mesoscopically homogeneous part of a weathering profile, having clay (plasma) as a significant component, which has neither the lithic fabric of the saprolite (or saprock) nor the significant development of secondary entities such as nodules or pisoliths. Major structural features, such as quartz veins and lithological contacts, may be preserved, possibly with change in orientation (dip). See also laterite profile.
<i>plateau</i>	Level to rolling elevated tract of land, generally standing above an abrupt descent, cliff, or escarpment that extends along at least part of its perimeter. (See McDonald for a more extensive definition).
<i>playa</i>	Vegetation-free, flat area at the lowest part of an undrained desert basin, underlain by stratified clay, silt, or sand, and commonly by soluble salts, dry most of the time. [AGI*]
<i>playa plain</i>	Level landform with extremely low relief, typically without stream channels, aggraded by rarely active sheet flow and modified by wind, waves, and pedogenesis. Playa plains are depositional areas and are the lowest parts of the landscape.

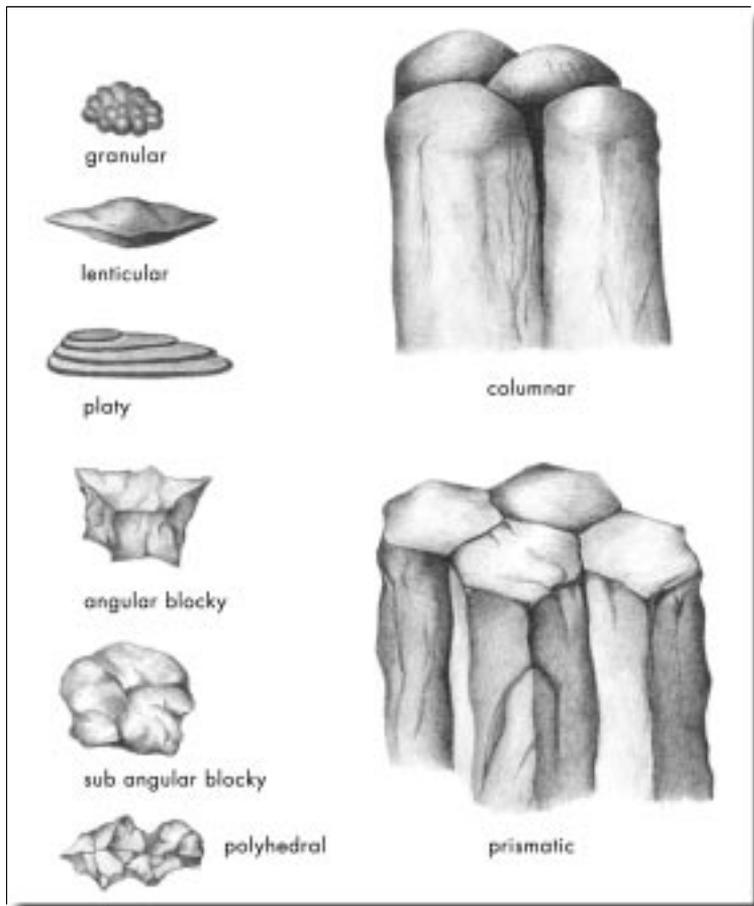
plinthite	Iron-rich, humus-poor mixture of clay and quartz, commonly occurring as mottles, firm but uncemented when moist but hardening irreversibly into an ironstone hardpan or irregular aggregates on repeated wetting and drying. Used synonymously for lateritic duricrust or cuirasse by some authors. [B&Z*]
plumbogummite	See under crandallite.
pluvial	Pertaining to rain or other precipitation.
Podosols	A soil order; soils with B horizons dominated by the accumulation of compounds of organic matter, aluminium and/or iron. See Appendix 2: Australian Soil Classification. [Isbell]
podsol	Podzols.
podzolic	Group of acid soils with a strongly differentiated profile with a bleached sub-surface horizon overlying an horizon which is rich in sesquioxides relative to those lying above and below it. [Stace]
podzolization	Process leading to the formation of a podzol.
Podzols	See Great Soil Group, No. 37 and Appendix 1. [Stace]
point bar	A low, arcuate ridge of sand and gravel developed on the inside of a growing meander. [AGI*]
polygon	i) A plane figure, or a landscape feature enclosed by straight sides. ii) In regolith mapping, it is the term used for an area on a map bounded by a line. [CG]
porcellanite 	A hard, dense, siliceous rock having the texture, dull lustre, hardness, fracture, or general appearance of unglazed porcelain; it is less hard, dense, and vitreous than chert. The term has been used for various kinds of rocks, such as an impure chert, in part argillaceous and in part calcareous, or more rarely, sideritic; an indurated or baked clay or shale with a dull, light-coloured, cherty appearance, often found in the roof or floor of a burned-out coal seam; a fine-grained, acidic tuff compacted by secondary silica, or a silica-replaced silt- or clay-stone. In Australia the term is commonly applied to silicified clay- or mud-stone. [AGI*]
pore	A small to minute opening or passageway in a rock or soil; an interstice. [AGI]
poric	Soil fabric in which the voids observable in thin section are due entirely to the packing of the physical fabric elements. The voids are

	interconnected. Compare with aporic. [B&S*]
porosity	The amount of pore space present, expressed as a percentage of the total volume of the material. [CG]
pothole	A word widely used to refer to any small, rounded pit or depression. Specific applications include bowl-shaped depressions in stream beds and karst-associated pits or shafts.
powdery calcrete	See calcrete, powdery.
powdery carbonate	See calcrete, powdery.
prairie	A tract of level to rolling, temperate grasslands. [CG]
Prairie Soils	See Great Soil Group, No. 14 and Appendix 1. [Stace]
prior river	A river channel in a system that is older than the present system and not used by the present system. The Murrumbidgee riverine plain has prior rivers marked by tree lines and shallow channels. Contrast ancestral river.
prior stream	See under ancestral river.
prismatic	(soil) A type of ped having soil particles arranged around a vertical axis and bounded by well defined, relatively flat faces with much accommodation to the faces of surrounding peds. (For drawing, see ped) [McDonald]
profile	A vertical section.
proto-saprolite	Intermediate stage of rock weathering between fresh rock and saprolite. In the literature the term 'rotten rock' is frequently - but erroneously - used (syn. saprock). [Aleva]
protolith	General term for parent material from which the regolith has formed. [B&Z]
protore	The rock below the sulphide zone of supergene enrichment; the primary, sub-economic material; in a more general meaning: the rock that became an ore through subsequent enrichment by ore minerals, independent of the processes involved. [Aleva]
pseudo-gossan	See gossan, false.
pseudomorph	A mineral or mineral aggregate that has the outward shape of a former mineral species or aggregate that has been replaced through

alteration, e.g., goethite with the shape of pyrite. Hence 'pseudomorphic' - the state of showing pseudomorphosis. A pseudomorph is described as being "after" the mineral whose outward form it has, e.g., goethite after pyrite. [Aleva]

psilomelane

Field term for hard aggregates of manganese oxides. Formerly applied to the mineral now known as romanchèite. See also manganese oxides and wad.



ped types. (Drawing C.M. Eggleton after N. Schoknecht; Moore 1998)

a b d c e f g h i j k l m

n o p **Q** r s t u v w x y z

QAZ cement

Acronym for quartz-anatase-zircon cement, the cement of silcretes on some granites and quartzites.

quartz

Mineral SiO_2 . Commonly milky white, but may be grey or glassy. Much quartz in the regolith is coloured red from iron staining (see wustenquartz) . Quartz has a hardness of 7, a vitreous lustre and conchoidal fracture. It is a major component of most regolith, whether in situ or transported, because of its high abundance in crustal rocks and resistance to physical and chemical weathering, and its common occurrence as an authigenic mineral.



quartz lag, Broken Hill, N.S.W. (Photo S.M.Hill)

a b d c e f g h i j k l m

n o p q **R** s t u v w x y z

R horizon

See soil profile.

radial drainage



A drainage pattern where the channels radiate from a point or small area. Commonly this occurs on volcanoes or domal structures. [RTMAP]

rainwash

The washing away of loose surface material by rainwater after it has reached the ground but before it has been concentrated into definite streams; specifically sheet erosion. Also, the movement downslope (under the action of gravity) of material loosened by rainwater. [AGI*]

rainwash deposit

The material that originates by the process of rainwash; material transported and accumulated, or washed away, by rainwater. [AGI*]

rattle rock

A volume of rock with one or more voids containing a freely moving grain or piece of rock; the voids vary in size from a small alveole containing a single quartz grain with a solution-textured surface, to cavities with a smaller free-moving stone inside. [Aleva]

reach



A straight section of a waterway as can be seen in a view.

recessional moraine

A moraine developed by build up of till during a pause in the recession of a glacier

rectangular drainage



A drainage pattern in which the channels follow a roughly rectangular plan with channels joining at about 90°. This type of pattern occurs where the underlying rock is broken by rectangular jointing or, less frequently, bedding and orthogonal jointing, where bedding controls stream direction one way and joints the other. [RTMAP]

RED Scheme

Acronym for Relict, Erosional and Depositional. A means of interpreting factual regolith maps of deeply weathered terrain, initially developed for application to geochemical exploration on the Yilgarn Craton, Australia (Anand 1). It is based on the concept of a landscape that was characterized by an extensive blanket of lateritic residuum and that has been modified by erosion and deposition. This concept is somewhat of an oversimplification, because the lateritic

residuum probably did not form a widespread, continuous unit on a peneplained surface, but a discontinuous cover on a broadly undulating plateau. Nonetheless the scheme provides a practical guide for geochemical sampling and interpretation and has application in equivalent terrains elsewhere.

Red and Brown Hardpan Soils

See Great Soil Group, No. 9 and Appendix 1. [Stace]

Red Earths



Red Podzolic Soils

See Great Soil Group, No. 25 and Appendix 1. [Stace]

See Great Soil Group, No. 32 and Appendix 1. [Stace]

Red-Brown Earths

See Great Soil Group, No. 20 and Appendix 1. [Stace]

redox

Abbreviation for reduction-oxidation. The term is also used to refer to the oxidation state (Eh or pe) of material, as in 'the mineral assemblage allows the redox conditions to be estimated' or to describe a reduction-oxidation interface i.e., 'redox boundary'.

reductomorphic

Formed under chemically reducing conditions, such as generally exist below the water table or in gleyed soils.

reg

Desert pavement consisting of angular gravel- to cobble-sized rock debris, commonly with coatings of desert varnish. [B&Z]

regolith

(i) The term was introduced by Merrill (1897) who wrote of the incoherent mass of varying thickness covering the underlying rocks: "In places this covering is made up of material originating through rock weathering in-situ. In other instances it is of fragmental and more or less decomposed material drifted by wind, water or ice from other sources. This entire mantle of unconsolidated material, whatever its nature or origin, it is proposed to call the regolith, from the Greek words ρεγος (rhegos), meaning a blanket, and λιθος (lithos), a stone."

(ii) The entire unconsolidated or secondarily recemented cover that overlies more coherent bedrock, that has been formed by weathering, erosion, transport and/or deposition of the older material. The regolith thus includes fractured and weathered basement rocks, saprolites, soils, organic accumulations, volcanic material, glacial deposits, colluvium, alluvium, evaporitic sediments, aeolian deposits and ground water.

iii) Everything from fresh rock to fresh air.

regolith facies

The aspect, appearance and characteristics of a regolith unit.

regolith-landform regimes	Broad genetic groupings of some landforms and their associated regolith. They may form the basis of regolith-landform models, particularly for weathered terrain. In these models, the development of an extensive deeply-weathered mantle is proposed as the first stage, and this is subsequently modified by erosion and deposition. In broad terms, three major regimes are perceived as being widely applicable in lateritic terrain, namely, relict, erosional, and depositional. See also RED. [Anand1]
regolith landform unit	A land area characterized by similar landform and regolith attributes; it refers to an area of land of any size that can be isolated at the scale of mapping. (RLU) [RTMAP.]
regolith stratigraphy	The science of regolith strata (tabular or sheet-like layers of sediment). Where general reference is made to a zoned, layered or variable regolith, expressions such as regolith geology, profile, structure, units or facies are preferred.
regolith terrain unit	Old name for regolith landform unit. (RTU)
regolith unit	A subdivision of the regolith, generally mappable, and having visibly distinguishable boundaries, unless defined outside the visible spectrum using remotely sensed data. The term may be used for zones or horizons of weathering profiles such as soil, duricrust, gravel, mottled regolith, saprolite, etc., or mappable entities with boundaries associated with a change in landform.
regosol	Any soil of the azonal order without definite genetic horizons and developing from or on deep, unconsolidated, deposits such as sands, loess, or glacial drift. [GSS*]
rejuvenated	Said of a stream which has had its erosive power increased.
relic	A memorial. Commonly applied to original fabrics or textures that remain visible after the replacement of pre-existing minerals. [Aleva, B&Z]
relict	A survivor. A species (plant, animal, mineral) in a changed environment; e.g., a primary mineral, especially a weatherable one, present within a predominantly secondary mineral assemblage. [B&Z]
relict regime	A grouping of regolith mapping units in regolith-dominated terrain which are characterized by the occurrence of lateritic residuum at or close to the surface. (The term 'relict' implies that these units represent an ancient weathered surface, but the grouping is based only on factual observation). Is also called residual regime, but relict is preferred. See RED Scheme.

- relief** The difference between the elevation of two points. More loosely, the general variation in height of the land surface. [CG]
- Rendzinas** See Great Soil Group, No. 12 and Appendix 1. [Stace]
- residual** (i) Left in its original place. Residual regolith results from the weathering of rock without significant lateral movement of the solid weathered products.
(ii) Said of a topographic or geologic feature (such as a rock, hill, mountain, or plateau) that is a part of a formerly greater mass or area, and that remains above the surrounding surface. [AGI*]
- residual clay** Clay that remains behind after weathering has removed part of the original rock. A common example is the clay found on limestone after solution has removed the calcareous part of the rock. [RTMAP]
- residual regime** See relict regime.
- residual sand** A deposit of sand sized-material, commonly composed largely of quartz covering the land surface and left after the removal of finer material either in solution or suspension in subsurface water. It includes the sandy top of some soil types. [RTMAP]
- residue** See residuum.
- residuum** Specifically, that which is left after weathering. See, e.g., lateritic residuum.
- resistate** Mineral more resistant to weathering than most, e.g., cassiterite, ilmenite, spinel, zircon, chromite.
- reversed drainage** The reversal of flow in a river channel; can occur as a result of tectonic tilting, causing lowering of the headwaters of a river system. [RTMAP]
- reworked** Geological materials that have been displaced from their place of origin and incorporated in a still recognizable form in a younger formation. [CG]
- rhizoconcretion** A root-shaped, solid or hollow concretion, cylindrical or conical in shape, generally branching. (Syn. rhizomorph). [Aleva]
-  **rhizomorph** See rhizoconcretion.
- rhizosphere** The soil in the immediate vicinity of the plant roots in which the abundance or composition of the microbial population is affected by the presence of roots. [AGI]

rill



rises

A channel <0.3 m deep resulting from erosion. See also gully.

Landform pattern of very low relief (9-30 m) and very gentle to steep slopes. [McDonald]

RLU

Regolith Landform Unit.

roche moutonnée

A knob of rock with the shape of a recumbent sheep. It is a landform of glaciated terrain, having its long axis oriented parallel to former ice flow, and having a smooth, glacially-abraded up-flow slope and a much steeper and rougher, glacially-plucked down-flow slope. [CG]

root channel

A tubular void of up to a few centimetres diameter and up to several metres long, generally more or less vertical and fairly straight; remnants of the original root may still be present, or the cavity may be filled with regolith matter as grains, small pisoliths or clay. [Aleva*]

rotten rock

An imprecise term used to indicate the transition between fresh rock and its more weathered state, saprolite; saprock is the preferred term. [Aleva]

RTU

Regolith Terrain Unit.

rubble

i) Angular rock fragments.
ii) Angular particles between 2 and 256 mm; may include interstitial sand. [CG]

Rudosols

A soil order; soils having negligible pedological organization. See Appendix 2: Australian Soil Classification. [Isbell]



regolith, Yilgorn region, W.A. (Photo R.A. Eggleton)

a b d c e f g h i j k l m

n o p q r **S** t u v w x y z

- salcrete** Duricrust cemented mainly by halite.
- salinity** (regolith): Accumulation of salts at the surface or within the near-surface soil. This can arise from a number of causes ranging from a rise in water table levels in irrigated areas to emergence of subsurface water in lower footslope areas. Also called dryland salinity. [RTMAP]
- salinization** The increase in concentration of salts in soil and/or water by naturally occurring physical and chemical processes (primary) or by human activities (secondary).
- salt weathering** The granular disintegration or fragmentation of rock by saline solutions or by salt-crystal growth. [AGI]
- sand** (i) A rock fragment or detrital particle smaller than a granule and larger than a coarse silt grain, having a diameter in the range of 1/16 to 2 mm (62-2000 μm). See also Wentworth size classes.
(ii) A loose aggregate of mineral or rock particles of sand size; an unconsolidated or moderately consolidated sedimentary deposit consisting essentially of medium-grained clastics. The material is most commonly composed of quartz resulting from rock disintegration, and when the term "sand" is used without qualification, a siliceous composition is implied, but the particles may be of any mineral composition or mixture of rock or mineral fragments, such as "coral sand" consisting of calcareous skeletal fragments. [AGI*]
- sand plain** Sand-covered plain. (See McDonald for a more extensive definition.)
- sand size** Having an equivalent spherical diameter above that of silt (normally $\geq 20 \mu\text{m}$, but see silt-size) and $< 2 \text{ mm}$.
- saponite** Mineral of the smectite group; $\text{A}_{0.3}\text{Mg}_3[\text{Si}_{3.7}\text{Al}_{0.3}]\text{O}_{10}(\text{OH})_2 \cdot 4\text{H}_2\text{O}$, where A is an exchangeable cation, K^+ , Na^+ , or 0.5Ca^{2+} etc. Alteration product of magnesium silicates.
- saprock** Compact, slightly weathered rock with low porosity; defined as having less than 20% of weatherable minerals altered but generally requiring a hammer blow to break. Weathering effects are present

mainly at the micro-sites of contacts between minerals and intra-mineral fissures, along shears and fractures through the rock as a whole, or affecting only a few individual mineral grains or mineral species.

The first signs of weathering are generally oxidation of sulphides and iron-bearing silicates or breakdown of feldspars to clays. The gradational boundaries of the saprock may be difficult to locate at the hand specimen scale as it is difficult to determine the proportion of weatherable minerals in the fresh rock without a detailed petrographic study.

saprolite

From Greek σαπρος (*sapros*), putrid and λιθος (*lithos*), stone. (Becker 1895). Weathered bedrock in which the fabric of the parent rock, originally expressed by the arrangement of the primary mineral constituents of the rock (e.g., crystal, grains), is retained. Compared to saprock, saprolite has more than 20% of weatherable minerals altered, and generally collapses under a light blow. Saprolite may be extended to include weathered rocks in which only larger structures such as bedding, schistosity, veining or lithological contacts are preserved. The presence of saprolite implies that weathering has been essentially isovolumetric.

Saprolite is commonly the material referred to as the C horizon in pedology.

saprolite, coarse

Saprolite containing blocks or remnants of unweathered rock.

saprolite, fine

Saprolite without blocks or remnants of unweathered rock.

saprolith

The saprolith is the (generally lower) part of the regolith that has retained the fabric of the parent rock. That is, saprock plus saprolite. The definition may include weathered rocks in which only larger structures including bedding, schistosity, veining or lithological contacts are preserved. The presence of these fabric elements implies that weathering has been essentially isovolumetric, pseudomorphic and in-situ. [Anand1]

scald

Flat, bare of vegetation, from which soil has been eroded or excavated by surface wash or wind. [McDonald]

scarp

See escarpment.

scree



(i) A loose equivalent of talus: broken rock fragments; a heap of such fragments; and the steep slope consisting of such fragments. Some authorities regard "scree" as the material (broken rock debris) that makes up the sloping land feature known as "talus"; others consider "scree" as a sheet of any loose, fragmental material lying on or mantling a mountain slope or hillside, and "talus" as that material

accumulating specifically at the base of, and obviously derived from, a cliff or other projecting mass.

(ii) A deposit of loose angular material greater than 10 cm in diameter.

(iii) A loose stone or pebble, as on a hillside. [AGI]

scroll

Long, curved very low ridge built up by channelled stream flow and left relict by channel migration. Part of a meander plain landform pattern. McDonald

self-mulching

The condition of well-aggregated soil in which the surface layer forms a shallow mulch of soil aggregates when dry. Aggregation is maintained largely as a response of the clay minerals to the natural processes of wetting and drying. Such soils typically have moderate to high clay contents and marked shrink-swell potential. Any tendency to crust and seal under the impact of rain is counteracted by shrinkage and cracking, thus producing a mulch effect as the soil dries out. Tillage when wet may appear to destroy the surface mulch but it will re-form upon drying. Black earths are commonly self-mulching.

sepic

A soil fabric visible in a petrographic microscope characterized by the presence of patches and/or zones with a striated interference pattern. [B&S]

sepiolite

Fibrous mineral approximately $Mg_8Si_{12}O_{30}(OH)_4 \cdot 4H_2O$ generally found in arid, evaporitic environments. See also palygorskite.

sesquioxide

Al_2O_3 or Fe_2O_3 or Mn_2O_3 , etc.

sheet erosion

Erosion of material by sheet flow. It commonly removes fine material, leaving coarser material behind as a lag deposit. Also called hillwash, sheetwash, surface wash, slope wash, rain wash.

sheet flood

Large scale sheet flow.



sheet-flood fan

Level to very gently inclined fan of extremely low relief, aggraded by sheet flow and channelled stream flow, with subordinate wind erosion. (See McDonald for a more extensive definition.)

sheet flow

An overland flow or downslope movement of water taking the form of a thin, continuous film over relatively smooth soil or rock surfaces and not concentrated into channels larger than rills. [AGI]

sheet-flow deposit

Sediment deposited from transport by sheet erosion. Sheet flow deposits are normally very thin except at the foot of a slope and beneath sheet flood fans. [McDonald*]

sheeting	The division of rock into sheets by joint-like fractures that are generally parallel to the ground surface. It is caused by pressure release and expansion of rock masses following erosion. Topographic jointing is another name for this process. [RTMAP]
sheetwash	Sheet erosion.
siallitic	An old term used to describe weathered rock material consisting mainly of aluminosilicate clay minerals and highly leached of alkalis and alkaline earths. [AGI]
silcrete 	<p>(i) Strongly silicified, indurated regolith, generally of low permeability, commonly having a conchoidal fracture with a vitreous lustre. Silcrete appears to represent the complete or near-complete silicification of precursor regolith by the infilling of available voids, including fractures. Most are dense and massive, but some may be cellular, with boxwork fabrics. The fabric, mineralogy and composition of silcretes may reflect those of the parent (regolith) material and hence, if residual, the underlying lithology. Thus, silcretes over granites and sandstones have a floating or terrazzo fabric and tend to be enriched in Ti and Zr (see also QAZ cement); silcretes with lithic fabrics (e.g., on dunites) are silicified saprolites with initial constituents diluted or replaced by silica.</p> <p>(ii) A term originally suggested by Lamplugh (1902) for a conglomerate consisting of surficial sand and gravel cemented into a hard mass by silica. [B&Z]</p>
silica	<p>SiO₂. In the mineral processing context two varieties are commonly recognized:</p> <p>(i) reactive silica, which is the silica present in the clay minerals, in particular kaolinite and halloysite, or in a very fine-grained state, which is soluble in hot sodium hydroxide solutions;</p> <p>(ii) free silica = quartz. [Aleva]</p>
siliceous	(petrology) Said of a rock containing abundant silica, especially free silica rather than as silicates.
siliceous induration	Induration leading to either the absolute or relative accumulation of silica as a cementing agent. [RTMAP]
Siliceous Sands	See Great Soil Group, No. 5 and Appendix 1. [Stace]
siliclastic	Pertaining to clastic noncarbonate rocks which are almost exclusively silica-bearing, either as forms of quartz or as silicates. [AGI*]
silicification	(i) A process of fossilization whereby the original organic components of an organism are replaced by silica, either as quartz,

chalcedony, or opal.

(ii) The introduction of, or replacement by, silica, generally resulting in the formation of fine-grained quartz, chalcedony, or opal, which may both fill pores and replace existing minerals. [AGI]

silicified

Adj. of silicification. [AGI]

sillite

An accumulation of silica as quartz. [Tardy]

silt size

Having an equivalent spherical diameter above clay size ($\geq 2 \mu\text{m}$) and less than $20 \mu\text{m}$ (Northcote, MacDonald, Isbell, International Soil Science Society), or less than $50 \mu\text{m}$ (Soil Science Society of America), or less than $60 \mu\text{m}$ (Wentworth 1922).

sinkhole

See doline.

skeletal soil

A thin stony soil with some development of the A horizon over weathered material. For a fuller description see Lithosols (Great Soil Group #3, Appendix 1), Rudosols and Tenosols, (Australian Soil Classification, Appendix 2).

slaking

The breakdown of soil aggregates upon immersion in water. Slaking is caused by the release of entrapped air and/or the swelling of expandable clay minerals.

slickensides

(soil) Natural shiny surfaces found on soil aggregates formed by the parallel orientation of clay particles during swelling and shrinking cycles. They only occur in clay rich materials with high swelling clay content.

slopewash

Sheet erosion.

slough

A small marsh; especially a marshy tract lying in a swale or other local, shallow, and undrained depression. [CG]

smectite

A group name for layer silicates formerly known as montmorillonite. Smectites readily take water between their structural layers in the form of molecules bound to exchangeable Ca, K, Mg or Na. The "shrink-swell" character of smectites gives soils much of their mobility and cracking character. Smectites typically form the finest particles in a soil. They may be no more than two or three layers thick (3-4.5 nm) and $0.1 \mu\text{m}$ across. They have very high cation exchange capacity (800-1200 meq/kg), largely derived from exchange sites in the interlayer. Their small size also gives them a high edge exchange capacity. A small amount of smectite in a soil therefore has a considerable effect on the soil's properties. See also beidellite, montmorillonite, nontronite, saponite.

smithsonite	Mineral, $ZnCO_3$, weathering product of sphalerite.
sodic	(i) Having sodium; (ii) (soils) Having more than 6% of the exchangeable ions attributable to sodium.
Sodosols	A soil order; soils with a strong texture contrast between A horizons and sodic B horizons which are not strongly acid. See Appendix 2: Australian Soil Classification. [Isbell]
soil	The unconsolidated mineral matter on or near the surface of the earth that has been subjected to and influenced by genetic and environmental factors such as climate (including moisture and temperature effects), macro- and micro-organisms and topography, all acting to produce a product - soil - that differs from the material from which it is derived in many physical, chemical, biological and morphological properties, and characteristics. [GSS]
soil horizon	See under horizon (ii).
soil profile 	A vertical section of a soil, from the soil surface through all its horizons to parent material (McDonald) A soil profile may have a number of horizons, with alpha- or alpha-numeric labels (such as the A2 horizon) broadly defined (after McDonald) as:

O	O1	The surface layer of undecomposed plant materials.
	O2	The layer beneath the O1 which is partly decomposed.
A	A1	The surface soil which is generally referred to as topsoil. Relative to other horizons it has a high content of organic matter, a dark colour and maximum biological activity. This is the most useful part of the soil for revegetation and plant growth. It is typically from 5 to 30 cm thick.
	A2 or E	A layer of soil of similar texture to the A1 horizon, but is paler in colour, poorer in structure and less fertile. A white or grey colouration, known as bleaching, is often caused by impeded soil drainage and/or eluviation. The A2 horizon is typically from 5 to 70 cm thick, but does not always occur.
B	B1	A transitional horizon dominated by properties characteristic of the underlying B2 horizon.
	B2	A horizon of maximum development due to concentration of silicate clay and/or iron, and/or aluminium and/or translocated organic material. Structure and/or consistence are unlike that of the A and C horizons and colour is typically stronger.
C		Layers below the B horizon which may be weathered, consolidated or unconsolidated parent material little affected by biological soil-forming processes. The C horizon is recognized by its lack of pedological development, and by the presence of remnants of geologic organisation. Its thickness is very variable.
D		Layers below the solum which are not C horizon, and are not related to the solum in character or pedologic organisation.
R		Hard rock that is continuous.

soil salinity	Soil salinity refers to the amount of dissolved salts in the soil solution, commonly estimated by measuring the electrical conductivity of a soil: water extract or suspension.
soil texture	The physical nature of soil according to the proportions of different size fractions (e.g., sand, silt, clay). Soil texture can be estimated from the behaviour of a small handful of soil when moistened and kneaded into a ball and then pressed out between thumb and forefinger. See also texture triangle.
soils, differentiated	Soils showing development of pedogenic horizons, such as A and B horizons (see soil profile).
soils, undifferentiated	Soils showing little or no development of A and B horizons (see soil profile).
sola	Plural of solum.
solifluxion 	The slow flow of water-logged soil down slope associated with alternating freezing and thawing.
Solodized Solonetz and Solodic Soils	See Great Soil Group, No. 17 and Appendix 1. [Stace]
Solonchaks	See Great Soil Group, No. 1 and Appendix 1. [Stace]
Solonetz	See Great Soil Group, No. 16 and Appendix 1. [Stace]
solonized	Said of a soil profile in which the pH varies from slightly acid in the upper horizon to slightly alkaline in the lower. Carbonate nodules may occur in the deeper parts of the profile. (Stace et al, 1968).
Solonized Brown Soils	See Great Soil Group, No. 19 and Appendix 1. [Stace]
Soloths	See Great Soil Group, No. 18 and Appendix 1. [Stace]
solum	The upper part of the regolith profile; the A and B soil horizons (see soil profile).
spalling	Splitting or splintering, particularly of stone.
speleothem	A secondary mineral deposit that is formed in a cave by the action of water. [AGI]
spheroidal weathering	Rounding of a pebble, boulder, joint block or tor by preferential weathering of protruberances and corners, and by exfoliation of concentric shells.

Spodosol	An order in the US soil taxonomy (Soil Survey Staff 1992).
spongilite	Sediment composed largely of sponge spicules.
spongy	Said of a rock with numerous, more or less evenly distributed voids, interconnected or not, generally ranging in size from 2-16 mm. [Aleva]
spring	A place where groundwater issues from the ground. [CG]
stagnant alluvial plain	Alluvial plain on which both erosion and aggradation are essentially inactive. (See McDonald for a more extensive definition.)
stone line 	Layer in the regolith composed of gravel-size angular to subrounded fragments of weathering-resistant rock, commonly quartz, and normally occurring at a depth between 0.3 and several metres below a gently sloping ground surface. Stone-lines have been variously interpreted as marking an unconformity, as the base of bioturbation, or as the boundary between in-situ weathered parent rock (saprolite) below an originally residual soil layer gradually moving downslope (syn. carpedolith).
stony	A general term indicating that a material includes a high percentage of coarse clasts (generally >15 cm) [CG]
storm surge	Unusually high sea level resulting from storms that force sea water on to the land through a combination of strong onshore winds and high tides. [RTMAP*]
stratabound	Said of a mineral deposit confined to a single stratigraphic unit. The term can refer to a stratiform deposit or to a randomly oriented orebody contained within a single stratigraphic unit. [AGI]
stream channel spacing	Stream channel spacing is a measure of drainage density, the total length of channel per unit area (Speight 1990). At a very broad level it is affected by precipitation; higher rainfall areas generally having closer stream channel spacing. At more local levels, where climate is more uniform, stream channel spacing can reflect underlying lithology, with softer rocks generally having a closer stream channel spacing than harder rocks. Values for stream channel spacing can be obtained by counting the number of channels that cross a line equivalent to 2 or 3 km. Several such measurements will give a representative value for each landform unit. [McDonald]

Absent or very rare		>2500 m
Sparse	1500 -	2500 m
Very widely spaced	1000 -	1500 m
Widely spaced	625 -	1000 m
Moderately spaced	400 -	625 m
Closely spaced	250 -	400 m
Very closely spaced	150 -	250 m
Numerous		<150 m

strike aligned

Said of landforms such as ridges and rivers that are aligned along the strike of the bedrock. This may lead to the exposure of a series of cuestas, or in some cases anticlines and synclines. [RTMAP]

stripped slopes

Erosional slopes flanking hills. Stripped slopes can have much rock exposed and/or a shallow mantle of stony colluvium. [Anand1]

structure

(Geol.) The three dimensional arrangement and geometry of geological contacts, discontinuities and deformation features, such as bedding, stratification, joints, faults, shear zones, dikes, plutons, folds, foliation and lineation. [CG]

structured saprolite

See saprock.

subrosion

Removal of regolith material in solution or as solids by flow of groundwater along subsurface channels and pipes. Such removal may cause collapse and settling of overlying regolith.

subrosion channels

Subsurface piping, up to 50 cm diameter, following roots, burrows, horizon planes and fractures, that permit drainage from closed depressions.

**subsurface solution/
piping**

The movement of materials by subsurface water flow, both in solution and in suspension, to result in changes to the shape of the land surface. Such removal can lead to both circular and linear depressions; the latter are percolines. Subsurface removal of weathered materials can lead to the development of tunnels, or pipes, which may collapse to form shafts. Such processes can occur in most regolith materials and rocks, and the phenomenon reaches its best development in limestone karst areas. [RTMAP]

supergene

Said of a mineral deposit or enrichment formed near the surface, commonly by descending solutions; also, said of those solutions and of that environment. [AGI]

superimposed drainage Drainage is interpreted to be superimposed when a stream's course is unrelated to the geologic structures and underlying rocks over which it flows. Such an interpretation presumes that the drainage developed on a prior land surface at a higher level, and that differential erosion has subsequently emphasized the geologic structures.

surface wash Sheet erosion.

surficial At the surface, especially the surface of the Earth.

swale (i) Linear, level-floored open depression excavated by wind, or left relict between ridges built up by wind or waves, or built up to a lesser height than them;
(ii) Long, curved open or closed depression left relict between scrolls built up by channelled stream flow. [McDonald]

swamp Almost level, closed or almost closed depression with a seasonal or permanent water table at or above the surface, commonly aggraded by over-bank stream flow and sometimes biological (peat) accumulation. [McDonald]

syneresis The spontaneous separation or throwing off of a liquid from or by a gel or flocculated colloidal suspension during aging, resulting in shrinkage and in the formation of cracks, pits, mounds, cones, or craters. [AGI]



sapolite in granite overlain by soil. (Lens cap is 50 mm, photo R. A. Eggleton)

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tafone (plural tafoni)

Weathered cavern chiefly found in igneous rocks, commonly in coastal or arid environments. The hole or recess may reach a diameter of a metre or more. See also honeycomb weathering and cavernous weathering.

talc

Mineral, $Mg_3Si_4O_{10}(OH)_2$. A common secondary mineral derived by hydration of non-aluminous magnesium silicates (olivine, enstatite, tremolite) in mafic and ultramafic igneous rocks.

talus

Fragments of rock and soil material accumulated by gravity at the foot of cliffs or steep slopes. See also scree. [GSS]

tenic

Said of a soil B horizon which is weakly developed in terms of its contrast with the horizons above and below in terms of texture and/or colour, and/or structure and/or presence of segregations of pedogenic origin. [Isbell]

Tenosols

A soil order; soils with weak pedological organization apart from the A horizon. See Appendix 2: Australian Soil Classification. [Isbell]

terminal moraine

A moraine formed at the farthest advance of a glacier.

termitaria

The nests of a termite colony.

Terra Rossa Soils

See Great Soil Group, No. 27 and Appendix 1. [Stace]

terrace

A level, generally narrow, plain bordering a river, lake, or the sea. Some rivers are bordered by terraces at different levels. [GSS]

terraced land

Landform pattern including one or more terraces and commonly a flood plain. Relief is low or very low (9-90 m). [McDonald*]

terracette

A very small terrace or step (less than 1 m high). Terracettes usually occur in groups on grass covered steep slopes, indicative of mass movement.

texture

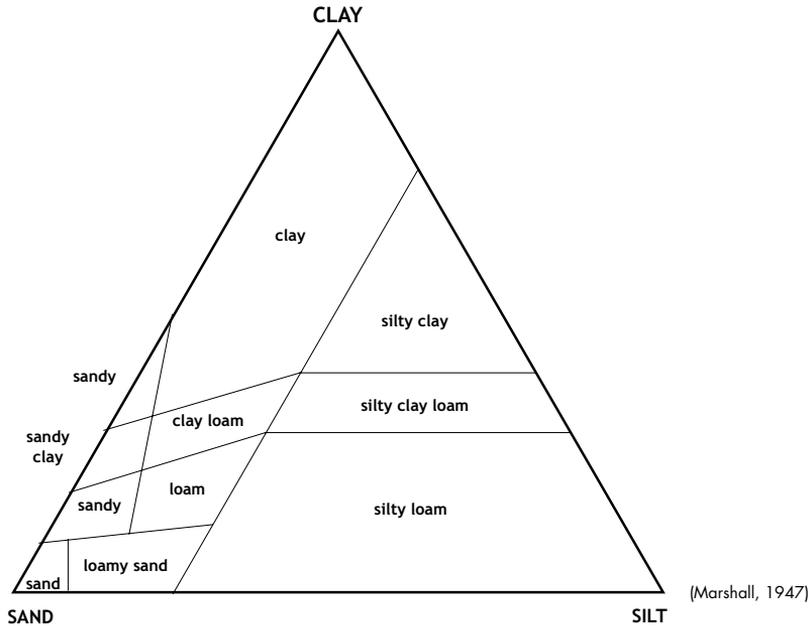
(regolith) The physical nature of a regolith unit or component according to the proportions of different size fractions (e.g., sand, silt, clay). For physical characteristics related to the spatial

arrangement of the constituents at the microscopic and mesoscopic scale, the term "fabric" is preferred. [B&Z]

texture group

A grouping of soils based on the proportion of their clay:silt:sand in the <2 mm fraction.

texture triangle



thalweg

(geomorph) The line of continuous maximum descent from any point on a land surface; e.g., the line of greatest slope along a valley floor, or the line crossing all contour lines at right angles, or the line connecting the lowest points along the bed of a stream. [AGI]

thermokarst

- (i) Karst-like topographic features produced in a permafrost region by the local melting of ground ice and the subsequent settling of the ground.
- (ii) A region marked by thermokarst topography. [AGI]

tidal flat

Almost horizontal landform pattern with extremely low relief alternately covered and uncovered by the tide. Slowly migrating, deep alluvial stream channels form dendritic tributary patterns.

till

Unsorted, unstratified sediment carried and deposited by a glacier or ice sheet without subsequent reworking by any other agent of transportation. [CG]

titania	TiO ₂ .
toeslope	The lower, gentle slope of a hillside, lying at the foot of an escarpment or steep rock face and generally covered by an accumulation of talus; it is less steep than the slope element above and commonly consists of alluvial fans or pediments. [AGI]
toposequence	A sequence of soils whose variation is related to their topographic position.
tor 	A rounded boulder, generally of a coarse-grained igneous rock, free-standing on the land surface. Also a high, isolated pinnacle or rocky crag, commonly of granite.
transformation front	The boundary of a change (or transformation) in the composition or other property of the regolith. [B&Z]
transported overburden	A term referring to material of exotic or redistributed origin such as alluvium, colluvium and aeolian material that blankets fresh or weathered bedrock. It may be friable or partially or wholly consolidated, or cemented. [Anand1]
tree throw 	Disturbance of the regolith caused by the uprooting of a tree.
treeline	The elevation or latitudinal limit at which tree growth stops. [CG]
trellis drainage 	A drainage pattern where secondary channels flow at right angles to the main channel. The secondary channels are joined at right angles by small tributaries flowing parallel to the main channel. This pattern is common in well bedded rocks with scarp and dip slopes. Small tributaries on the scarp slopes are short and steep, whereas those on the dip slopes are longer and more gently sloping. [RTMAP]
tube	Generally cylindrical interstice whose long axis may be straight, curved, crooked or winding; the long axis can have any attitude in space. The ratio of the two shorter axes may vary along the length of the long axes; the diameter ranges up from 2 mm. See also tubule. [Aleva*]
tubular	Said of rock or regolith composed of one or more tubes. The individual tubes may contain fill-in structures or linings of a secondary nature. [Aleva*]
tubule	Tube with diameter <2 mm. See also tube. [Aleva]
tumulus	Hillock heaved up by volcanism. Also a hillock built by human activity at a burial site. [McDonald*]

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Ultisol	An order in the US soil taxonomy (Soil Survey Staff 1992).
ultra-desiccation	Extreme drying such as to cause the collapse of the soil microfabric.
unconsolidated	Primary property of looseness of the constituents, that allow it to be crumbled or deformed with the fingers. [Aleva]
underground drainage	Drainage occurring below the surface. Found most commonly in karst areas. Surface drainage may move underground where it enters a limestone area, to emerge many kilometres away. [RTMAP*]
Uniform Soils	Soils having a profile dominated by the mineral fraction with small, if any, texture differences throughout – such that no clearly defined texture boundaries are to be found in the solum except possibly for surface crusts 2.5 cm or less in thickness, and the range of texture throughout the solum is not more than equivalent to that which can be included within the span of one texture group. [Northcote]
upwarp	The upwards warping (tect) or uplift of a regional area of the Earth's crust, generally as the result of the release of isostatic pressure, e.g., melting of an ice sheet, but also epeirogenic. [AGI*]
UTM	Universal Transverse Mercator grid; present on most topographic maps and used for quantitative description of locations. In this system the world is divided into a series of zones, and points are located according to grid co-ordinates (eastings and northings) in each zone. [CG]

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- vadose** Of subsurface water, that which is above the water table. Water below the water table is formally defined as groundwater. (compare with phreatic).
- vadose zone** Region of the regolith unsaturated by water; above the water table.
- valley** An elongate, relatively large, gently sloping depression of the earth's surface often containing a stream and commonly formed by stream erosion. [CG]
- ventifact** Stone faceted or polished by wind action.
- vermicular** See vermiform
- vermiculite** Mineral structurally mid-way between biotite and chlorite. It has a trioctahedral 2:1 layer, and a hydrous interlayer bearing Mg or Al. Vermiculite has a high layer charge and a high cation exchange capacity (1000-1500 meq/kg). It is the first weathering product of biotite, found in the saprolite over granite. Vermiculite also forms from pyroxene or amphibole during weathering of mafic rocks.
- vermiform** Having the form of a worm. In the regolith, a fabric consisting of tubes, pipes or worm-shaped voids which may be filled or partly filled with, e.g., clays, sandy sediments, or iron oxides (syn. vermicular).

- vertic** Said of soil with a clayey field texture or 35% or more clay, which cracks strongly when dry and which has slickensides and/or lenticular peds (Isbell)
- vertical collapse** Collapse of large fragments of rock and/or soil, commonly from cliff faces. The collapsed materials accumulate where they fall, and may be acted on by other processes.. [RTMAP]
- Vertisol** An order in the US soil taxonomy, equivalent to Black Earth (Soil Survey Staff 1992).
- Vertosols** A soil order; soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular

structural aggregates. See Appendix 2: Australian Soil Classification. [Isbell]

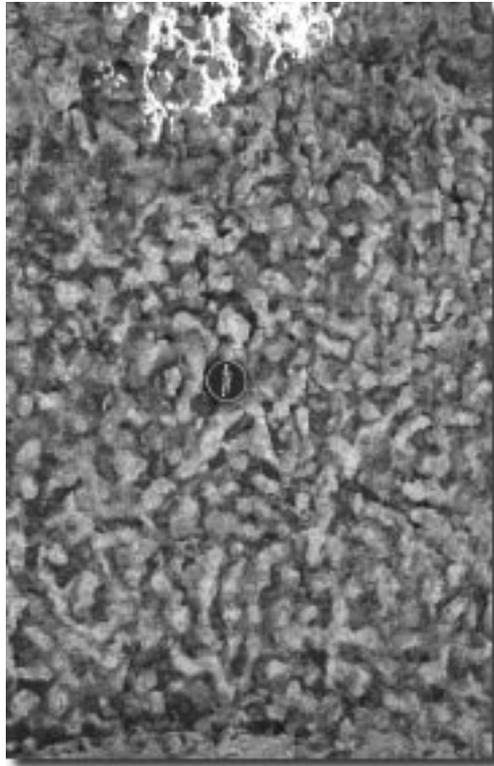
vesicle A small cell- or bubble-shaped void (adjective: vesicular). [B&Z]

vesicular See vesicle.

vesicular pod Podiform or sheetlike mass having small, irregular, lenticular cavities or vesicles.

void Volume of vacant space enclosed in solid matter; interstice. [Aleva]

vugh (vug) Irregularly shaped void ≥ 4 mm which may be lined with mineral matter, differing in composition from the rock in which it occurs.



vermiform mottles. (Photo R.A. Eggleton)

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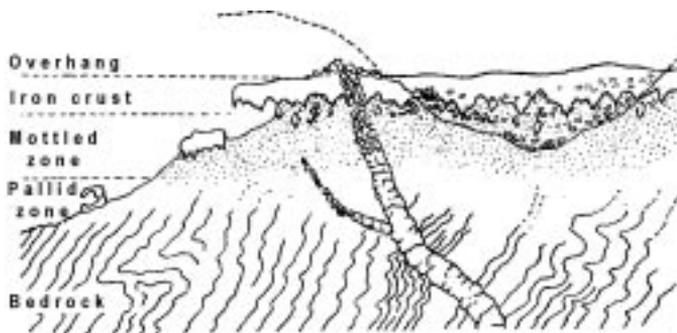
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wad

Mineral aggregate; hand specimen term for soft, black, earthy manganese oxides and oxyhydroxides, typically including pyrolusite (MnO₂), romanchèite, manganite, nsutite, todorokite. Largely equivalent to psilomelane. Occurs with other manganese oxides in the weathering profiles of ultramafic rocks, or manganese-bearing rocks and base metal deposits, e.g., Broken Hill, NSW. See also manganese oxides.

Walther profile

Term introduced by Ollier and Galloway (1990) for a laterite profile, in order to stem the confusion that had arisen over varied use of that term. This glossary recommends retention of 'laterite profile' as discussed in that entry.



Walther's laterite profile from Western Australia (1916)

watertable

The surface to which water rises in an open well or piezometer.

weathered

Having experienced weathering. The word may properly only be applied to a rock or mineral where there remain recognizable aspects of the parent material such as fabric or mineral pseudomorphs. Applied to an outcrop or profile, the term may refer to the extent to which it has undergone chemical and mineralogical change by weathering. Recommended terms are:

	Field criteria	Alteration assemblage/composition
unweathered	Having no visible signs of weathering.	None.
slightly weathered	Core-stones, if present, are interlocked, few microfractures, is easily broken with a hammer. Sediments have traces of weathering on the surfaces of sedimentary particles. Some clay or iron oxides may be present, filling voids between coarse particles.	Weak iron staining; slight weathering of feldspars. Primary minerals very prominent; some smectite and minor goethite may be present. Ca, Mg, Na appreciably depleted; K, Si show slight depletion.
moderately weathered	Marked iron staining common; up to 50% secondary minerals; core-stones rectangular and interlocked. Larger particles have thick weathering skins. Can be broken by a kick (with boots on), but not by hand.	Most feldspars in larger particles are weathered. Most alkalis and alkaline earths have been lost. Primary minerals still dominant, with smectite, kaolin ± iron oxides and oxyhydroxides present.
highly weathered	Strong iron staining, and more than 50% secondary minerals; core-stones are free and rounded, and there are numerous microfractures. The material can be broken apart in the hands with difficulty.	Nearly all feldspars are weathered. Appreciable silica has been lost; mineralogy includes kaolin ± goethite ± hematite with significant amounts of primary minerals
very highly weathered	Retains structures from the original rock; may be pale coloured, and is composed completely of secondary minerals and resistates from the parent material. Core-stones, if present, are rare and rounded. It can easily be broken by hand.	All feldspars are weathered, mineralogy is dominated by kaolin ± goethite ± hematite with or without residual quartz. Other primary minerals in low abundance or absent.
intensely weathered	Only major parent rock features discernable, such as lithological changes or resistant veins; resistate minerals may remain in a matrix of secondary minerals.	Mineralogy is essentially ± goethite/hematite/maghemite ± quartz ± kaolinite ± gibbsite. High levels (>50%) of sesquioxides; negligible alkalis and alkaline earths; significant titania.

- weathered bedrock** Rock that has been chemically altered but which is still coherent, has some original structural elements preserved and is essentially in-situ, with no lateral physical movement having taken place (compare with saprolite, saprock). [B&Z]
- weathering** Weathering refers to any process which, through the influence of gravity, the atmosphere, hydrosphere and/or biosphere at ambient temperature and atmospheric pressure, modifies rocks, either physically, or chemically.
- weathering, deep** Term properly applied to the depth of weathering (as measured in metres), not to the degree of weathering. Deep weathering is a relative term, applicable to a profile weathered to a greater depth than the average for the region.
- weathering front** The boundary between unweathered and weathered rock. The rock/saprock interface.
- weathering profile** A weathering profile is a one-dimensional section of weathered regolith from its surface through all its zones to parent material.
- weathering, unknown degree of** A classification category used during reconnaissance mapping when a regolith landform unit has been recognized on imagery or maps, but has not been visited in the field. [RTMAP]
- Wentworth size classes** The recommended scale for sedimentary particle sizes. Note, however, that soil science uses different upper boundaries for clay and silt, viz 2 μm and 20 μm respectively, and a lower boundary of 20 μm for sand. See also silt size.
- | | | |
|---------|---------------|---------|
| <4 | μm | clay |
| 4-62 | μm | silt |
| 62-2000 | μm | sand |
| 2-4 | mm | granule |
| 4-64 | mm | pebble |
| 64-256 | mm | cobble |
| >256 | mm | boulder |
- (Wentworth, 1922)
- Wiesenboden** See Great Soil Group, No. 15 and Appendix 1. [Stace]
- willemsite** Ni analogue of talc, $(\text{Ni},\text{Mg})_3\text{Si}_4\text{O}_{10}(\text{OH})_2$.
- wind erosion (deflation)** Erosion of material by wind action. This typically involves entrainment

of sand and dust particles, and their movement to other locations.
[RTMAP]

wustenquartz

Quartz with a reddish, iron-oxide stained surface.



weathering front in a drill core marked by a change to darker colour. Keremenge, Papua New Guinea. (Photo I.D.M. Robertson)

a b d c e f g h i j k l m

n o p q r s t u v w **XYZ*****Xanthozems***

See Great Soil Group, No. 29 and Appendix 1. [Stace]

Yellow Earths

See Great Soil Group, No. 26 and Appendix 1. [Stace]

Yellow Podzolic Soils

See Great Soil Group, No. 33 and Appendix 1. [Stace]

zonal soils

Soils whose characteristics are allegedly dominated by climate. See also intrazonal soils and Great Soil Groups.

zone

In the regolith context, a part of the regolith having a distinctive character, differing from parts adjacent, as in "mottled zone".



zoned regolith. (Photo R.A. Eggleton)

Appendix 1 a b d c e f g h i j k l m n o p q r s t u v w x y z

Stace, H. C. T., Hubble, G. D., Brewer, R., Northcote, K. H., Sleeman, J. R., Mulcahy, M. J., and Hallsworth, E. G. (1968). *A Handbook of Australian Soils*. Rellim Technical Publications, Glenside, SA.

GREAT SOIL GROUP

1. Solonchaks
Highly saline soils in which pedological development is largely confined to the top 30 cm or so of the profile. Below this their characteristics are essentially those of their parent materials which range from sands to clays and may be somewhat layered owing to sedimentary origin. Very salty soils with well-defined features of other soils groups are classified as saline forms of them.

2. Alluvial Soils
Soils which are restricted to alluvium so juvenile that soil-forming processes, other than organic matter accumulation, have not had time to leave their marks. Although these soils may show considerable variations in the profile with depth, especially in textural character, these are inherited from the parent material and the soils have no true pedologic horizons other than the A1. The sedimentary layers within these soils can vary greatly in a number of characteristics including texture, stoniness, depth, colour, and carbonate content; but generally they are fairly clearly defined at their contact with each other and quite frequently sedimentary laminae and current bedding are evident. In general the differences between pedologic horizons and sedimentary layers are not difficult to detect. Often layers in the profile show evidence in their content of organic matter of having been former surface soils buried under later deposits. Sometimes the buried or fossil soils show evidence of pedologic horizons.

3. Lithosols
Essentially stony or gravelly soils lacking horizon development other than an A1 due to organic matter accumulation and structure development in the surface. Normally they are shallow sands, loams, and clay loams and usually contain a large proportion of coarse-textured material in the form of fragmented rock, which may show some degree of weathering. Stoniness and lack of pedological differentiation are the essential features.

4. Calcareous Sands
No profile development is shown beyond some accumulation of organic matter in the surface horizon when they have been fixed by vegetation for sufficient time. The surface soil is characteristically grey-brown to brownish grey and 15 to 30 cm thick, but under dry vine scrub in some areas along the north-eastern coast it is dominantly brown and may extend to a depth of 60 cm. The sands are usually weakly coherent when moist but tend to be loose when dry. Where

they are still unvegetated there is no darker A1 horizon. Generally the sands are deep, medium to coarse, and range from pale yellow to pale brown in colour.

5. Siliceous Sands
A broad group of sands varying considerably in colour but characterized by their dominantly quartzose nature, uniform sand to clayey sand texture, deep profiles, and the general absence of horizon differentiation except for a darker A1 resulting from some accumulation of organic matter. This horizon is absent where the sands are not fixed by vegetation and hence are frequently moved by wind as on the crests of desert sandhills. Otherwise it ranges from dark brownish grey to reddish brown, its degree of differentiation increasing with annual rainfall.
6. Earthy Sands
Sands characterized by uniform profiles of coherent, clayey sands, or light sandy loams, dominantly red in colour but in some areas yellow, and ranging from relatively shallow to very deep. The soil has an "earthy" appearance apparently due to the coating and bridging of sand grains by clayey materials including iron oxides. These coatings obscure the nature of the sands which are siliceous, and the appearance of the soil mass often suggests much finer (loam) texture than, in fact, it has. The earthy sands are the coarser and uniform-textured equivalents of the red earths.
7. Grey, Brown and Red Calcareous Soils
Shallow, soft, powdery or weakly structured loams to clays containing finely divided carbonates throughout the solum and showing little pedological differentiation. They are essentially sedentary soils formed from highly calcareous rocks which underlie them at depths varying from a few to about 40 cm. Fragments of limestone are commonly present in the solum and may be strewn on the surface along with silicified limestone gravel. Many are little more than calcareous lithosols.
8. Desert Loams
Essential features are moderate texture contrast with thin loamy A horizons clearly separated from structural clay B horizons, brown to red colour, and alkaline reaction - commonly strongly so in the deeper subsoil. The surface soil ranges from strongly alkaline to neutral.
9. Red and Brown Hardpan Soils
Simple, shallow to moderately deep profiles of red earthy and massive soil sharply overlying an indurated pan resulting from silica cementation and clay deposition.
10. Grey, Brown and Red Clays
A very broad group of soils whose common properties are determined by their high clay contents. Typically, they are moderately deep to very deep soils with uniform colour and texture profiles, weak horizonation mostly related to structure differentiation, and some carbonates and/or gypsum in their subsoils. They crack deeply on drying.

11. Black Earths
- Weakly differentiated heavy clay soils with uniform texture profiles but are dark grey, very dark brown or almost black and typically alkaline although the upper 25 to 50 cm of some profiles may be near neutral. The clay contents usually range from 50% to 80% with slightly lower values in the medium clay surface soils of some types. When dry they develop closely-spaced wide deep cracks and hard consistence: when moist or wet they are very plastic or extremely sticky. The surface soil is strongly granular and self-mulching.
12. Rendzinas
- Shallow to very shallow soils formed from limestones and marls: typically they are black, very dark brown, or dark grey clay loams or light clays of strong very fine crumb to granular structure and loose soft consistence which usually continues throughout their thin sola. There is normally no significant horizon differentiation, but in the slightly deeper members the clay content may increase by about one texture class through the solum. Structure may grade to strong fine blocky or polyhedral in the subsoil but consistence remains much softer than for other soils of similar clay content. A few carbonate nodules and odd fragments of limestone or patches of soft carbonates often occur in the lower part of the solum. Soil reaction is neutral to alkaline.
13. Chernozems
- Generally morphologically similar to the black earths but differing from them mainly in having much lower clay contents, finer and more porous structural units, and characteristically friable consistence when dry and very friable when moist. The profile shows weak horizon differentiation with gradual boundaries and usually a gradual increase in clay content with depth. The reaction profile grades from mildly acid in the surface soil to moderately alkaline and calcareous subsoils.
14. Prairie Soils
- Not widely recognised in Australia. Those so classified include soils that differ significantly from the prairie soils of North America in having higher clay contents and sometimes with a pronounced texture contrast, coarser structure of denser peds, and generally harder consistence.
15. Wiesenboden
- Dark clay to clay loam soils with uniform to gradational texture profiles and varying development of gley features in the deeper subsoil due to intermittent partial saturation associated with seasonal seepage and perched water. Most are essentially somewhat hydromorphic black earths but the range includes some soils of lower clay content lacking free carbonates in the solum and therefore more closely related to prairie soils. Generally they are deep soils, slightly acid to slightly alkaline in the surface and becoming alkaline with small amounts of calcium carbonate in the deep subsoil. Some black manganiferous segregations or nodules are often present in the upper profile.

horizons, weakly structured to massive, an abrupt to clear boundary between A and B horizons, and brighter brown to red clay B horizons with well-developed medium prismatic to blocky structure. The surface soil is usually moderately thick and mildly acid to neutral, and the B horizons are alkaline usually with some segregations of carbonates in the lower parts. Calcium and magnesium are the dominant exchangeable cations throughout the solum. There is often a weakly developed A2 horizon. Soils with darker surface horizons and duller subsoils previously separated as brown earths are here considered as members of this group.

21. Non-Calcic Brown Soils Morphologically very similar to the red-brown earths, the essential differences being that they have no A2 horizon, the solum is carbonate-free, and the lower B horizon is neutral to slightly alkaline with lower base saturation. They are also generally thinner soils, varying from about 0.5 to 1 m deep.
22. Chocolate Soils Acid, friable clay loam and clay soils with weak to moderate horizon differentiation and moderately deep sola. Three subgroups are distinguished; reddish, normal, and grey chocolate soils.
23. Brown Earths Braunerde or brown forest soils as they have been variously named, show little profile differentiation. The profile is a uniform yellowish, reddish or dark brown, sometimes becoming either more yellowish or more reddish with depth. In texture they range from light loams to clays. The acidity varies from moderately acid to neutral in the surface. In the acid soils both pH and base saturation generally increase with depth, particularly if the parent material is limestone, calcareous shale or basic rock, but may fall to minimum values in the deeper horizons of forest soils in base-deficient parent materials. The fine earth is completely leached of carbonates, although calcareous stones and gravel may occur, particularly as the underlying rock is approached. The subsurface horizons have a crumb or fine subangular blocky structure. Where the drainage is impeded, varicoloured mottlings appear leading to gley, and iron and manganese concretions may be found.
24. Calcareous Red Earth Essentially red, massive, sandy to loamy soils, porous and "earthy" in fabric, with some free carbonates in the lower part of the profile. Horizon differentiation is weak and boundaries are gradual or diffuse except at the base of the surface horizon. Usually there is a gradual increase in clay content with depth and parallel change in soil reaction from acid to alkaline in the calcareous deep subsoil. The soils are deep to very deep.
25. Red Earths Vary greatly in some properties. However, their distinguishing characteristics are massive, predominantly sandy textures, porous and

earthy soil materials, red-brown to red colour, weak profile differentiation with gradual or diffuse horizon boundaries except for the darker A1 horizon, and acid to mildly alkaline reaction. In most profiles there is a gradual increase in clay content with depth, equivalent to more than one texture class. Often the textural range within a profile is three classes or more, e.g. loamy sand to sandy clay loam, or sandy clay loam to medium clay. However, more or less uniform, medium-textured soils are included. The characteristic earthy fabric is evident as a dull matt or 'dusty' appearance on the face of freshly-broken soil in contrast to the rather shiny 'glazed' appearance common in clay soils. Most red earths are acid, but many are nearly neutral at the surface becoming a little more acid with depth while others are mildly alkaline. Typically they have deep to extremely deep profiles but the range is from less than a metre to more than 6 m of red soil. Three main forms are recognised: normal, lateritic, and 'podzolic' red earths. Any of them may contain some ferromanganiferous nodules irregularly distributed throughout the profile.

26. Yellow Earths

Very similar to the red earths but predominantly yellow in colour and some have a more pronounced increasing texture gradient down the profile. They are essentially massive, highly porous, earthy soils with weak profile differentiation, gradual horizon boundaries, acid to neutral reaction, and yellow to yellow-brown colour. Typically they are deep and gradually increase in clay content with depth, but some of the medium-textured members have almost uniform texture profiles.

27. Terra Rossa Soils

In Australia the name terra rossa has been restricted to dominantly red soils formed on limestone or highly calcareous parent materials. Actually, surface soils range in colour from greyish brown to red-brown and subsoils from red-brown to red. Their textures also range from sands to clays, but medium to fine textured forms are more common. Generally they are porous and well drained shallow soils varying from a few to about 60 cm deep. Where they overlie hard limestone, outcrops are common and fragments of rock often occur in the lower part of the solum. In some profiles small amounts of ferruginous concretions occur in the B horizon but these are not a consistent feature of terra rossa.

28. Euchrozems

Red, strongly structured, clay soils with a somewhat lower clay content near the surface, weak horizon differentiation apart from the dark A1 horizon, and essentially neutral reaction. They differ from the closely related Krasnozems mainly in their lower acidity, only mild base unsaturation, and rather compact, firm to friable subsoil consistence. They have sometimes been called neutral Krasnozems. Soil reaction increases gradually from pH values of about 6.5 at the surface to 7.5 in the deep subsoil: occasionally the pH may rise as high as 8 at the

base of the solum and a little carbonate may occur. Generally they range from 1 to 2 m deep. Some small black ferromanganiferous segregations and nodules are usually present in the subsoil.

29. Xanthozems

A group of predominantly yellow, friable, strongly-structured clay soils with moderate horizon differentiation and gradational texture profiles. They are yellow clayey latosols – essentially the yellow counterparts of the krasnozems – and were previously included with the yellow earths. Like the krasnozems they are acid, deep soils, but with more prominent horizon differentiation in the lower part of the profile although horizon boundaries are gradual or diffuse. Soil reaction is mildly to moderately acid in the surface horizon usually becoming more acid with increasing depth. There are, however, variants with mildly alkaline deep B-C horizons which may have a few carbonate segregations. The clay content also increases gradually from moderate in the A1 horizon to high contents in the B horizons. Varying amounts of reddish to black ferromanganiferous nodules are commonly present in the B horizons, less so in the surface soil, and in extreme instances are cemented to form large pisolitic masses.

30. Krasnozems

Like the euchrozems, they are red, strongly-structured, clay soils with clay content gradually increasing with depth in the upper part of the profile and weak horizon differentiation beyond the accumulation of organic matter to form a dark A1 horizon. They are very deep soils ranging up to more than 6 m. They are distinguished from the euchrozems by their very friable consistence, acid reaction profiles, and greater unsaturation with metal ions. The level of base saturation is usually less than 50% throughout. They are also similar to the xanthozems, differing mainly in colour. With these two groups they form a set of structured clay soils parallel to the calcareous red earth, yellow earth, red earth set of massive soils and sandier materials.

31. Grey-Brown
Podzolic Soils

Typically have moderately differentiated profiles with a clear to abrupt boundary between grey to brown medium-textured A horizons and brown to yellow-brown blocky B horizons of much higher clay content; a distinct but not bleached A2 horizon; and acid reaction usually decreasing with depth. However, some soils with a weak texture contrast have been included, along with others that have a bleached A2 horizon, strong texture contrast, and neutral to alkaline reaction in the C horizon. The lower B horizon may be only mildly unsaturated with bases, but soils with more than about 6% of exchangeable sodium are excluded. Base-saturation in the B horizons ranges from about 50% to 80%. Sola commonly range from 50cm to 1m. deep but may be much deeper, and the A horizons are moderately thick.

32. Red Podzolic Soils

The essential features are a pronounced texture contrast with pale, medium to coarse-textured, A horizons overlying a predominantly red

B horizon of much higher clay content; a distinct pale A2 horizon; and acid reaction throughout the solum. The boundary between the A and B horizons is characteristically clear to gradual rather than abrupt, and the B horizons have firm to friable rather than tough moist consistence. These two features along with the finer B horizon structure, less bleached A2 horizon, and low exchangeable sodium percentage in the B horizons, generally distinguish these soils from red soloths or solods which often occur in the same regions. The reaction is usually mildly to moderately acid at the surface and with depth either remains fairly uniform or becomes more acid: the level of base-saturation in the B horizons is usually moderate but varies greatly from moderately high to low. The soils are typically moderately deep but vary from shallow to deep. Under virgin conditions there is often a thin discontinuous A00 horizon of leaves, twigs, and bark but an A0 horizon rarely occurs.

33. Yellow Podzolic Soils

Distinguished by strongly differentiated profiles with light to medium-textured A horizons clearly separated from predominantly yellow-brown, friable, more clayey B horizons; a distinct pale A2 horizon; and acid reaction throughout the solum. They are the yellowish equivalents of the red podzolic soils: in some areas intermediate forms with strongly mottled yellow-brown and red clay subsoils are more common than either group, and most yellow podzolics have some red mottles in the lower part of the B horizon. Some ferromanganiferous nodules are commonly present in the lower part of the A2 horizon and upper B horizon. Soil reaction is mildly to strongly acid in the A1 horizon, either staying more or less the same or becoming more acid with increasing depth. The degree of base-saturation varies greatly but is usually moderate in the B horizons and may be very low in high rainfall areas. Hydrogen and magnesium are the dominant exchangeable cations in the subsoil. Under natural forest vegetation there is normally a sparse cover of dry litter but typically no A0 horizon; however some soils associated with wet temperate forests in southern Australia and Tasmania do have a varying weak to moderate A0 horizon of decomposed litter. Soils vary from shallow to very deep but moderately deep soils are most common.

34. Brown Podzolic Soils

Acid, predominantly brownish to yellowish soils, lacking or with a weak A2 horizon, and generally having weakly to moderately differentiated profiles with merging horizons. They are considered to be iron podzols in which the normal whitish A2 horizon is masked by organic matter extending downward from the A1 horizon. Most are moderately deep, medium-textured soils, either more or less uniform or gradually increasing in clay content in the B horizons. The A horizons are relatively thin ranging from 10 to 25 cm thick. The reaction profile is typically

moderately to strongly acid but some mildly acid to neutral soils have been included.

35. Lateritic Podzolic Soils The essential features are strong texture contrast with thick sandy A horizons overlying mottled yellow-brown and red clay B horizons, an horizon of nodular pisolitic, or massive ironstone in the base of the A2 and in the upper part of the B horizon, a thick zone of coarsely mottled white, red, and yellow clay below the B horizon grading into dominantly white clay above the kaolinized parent rock, and acid reaction throughout the profile. In some areas the lower part of the profile includes a patchy accumulation of silica to form isolated patches of a light grey rock (silcrete). Rarely it may form a discontinuous horizon, sometimes in the upper part of the underlying rock.
36. Gleyed Podzolic Soils Poorly drained acid soils with strongly differentiated profiles consisting of brownish grey sandy to loamy A horizons with a distinct paler A2, overlying grey and yellow-grey clay B horizons with coarse ochreous and some reddish mottles. The texture contrast between the A and B horizons is usually clear to abrupt. Varying gley features may occur in any part of the profile but rusty ochreous root tracings and spotting are usually concentrated in the A horizons. They are mainly associated with old root channels, voids, and the surfaces of structural units. The poor drainage is due to either perching of water, and seepage on the clay subsoil, or deeper seated seepage intermittently affecting most of the profile. Typically the soils are moderately acid and deep with rather thick A horizons ranging up to 60 cm. Some ferromanganiferous nodules, usually in small amounts, are often present in the lower A and upper B horizons. They range from reddish to yellowish brown, mainly ferruginous types to predominantly black manganiferous forms.
37. Podzols Acid sandy soils with strongly differentiated profiles distinguished by a grey A1 horizon with much organic accumulation, a thick whitish sand A2 horizon and a B horizon of accumulation of organic matter and/or sesquioxides, slightly clayey in texture, and varying from reddish to yellowish brown to black in colour. The Australian podzols differ from North American or European podzols in that only rarely is there a continuous layer of decomposing litter (the A0 horizon) across the soil surface.
38. Humus Podzols The essential features are a dark A1 horizon or organic accumulation, a light grey or whitish A2 horizon, and a dark grey to black, dominantly humic B horizon overlying water-saturated and weakly mottled mineral soil. They are mostly sands in texture and acid to very strongly acid throughout, but soil reaction varies greatly with regional rainfall and moisture conditions. Commonly the solum is

moderately deep, although its depth is controlled by the water-table which is an essential feature and directly underlies the B horizon. Under natural conditions there is some fibrous or woody litter on the soil surface but rarely an A0 horizon as surface conditions are generally too dry and the litter is frequently burnt. Most of the organic matter in the A1 and B horizons has probably come from decomposition of the dense mat of fibrous roots in the former.

39. Peaty podzols Consist essentially of some depth of acid fibrous peat or sandy peat overlying sandy mineral soil that has most of the features of humus podzols but generally lacks a distinct A2 horizon. The peat is in effect an organic A0 horizon and varies in thickness from a few cm. to a metre or so. It is extremely acid, with pH values from about 4.5 to less than 4.
40. Alpine Humus Soils Characterized by a marked accumulation of well-humified organic matter that is intimately incorporated in the mineral soil to form thick surface horizons of profiles otherwise showing little horizon development. Changes with depth are gradual and the soil is strongly acid throughout.
41. Humic Gleys Acid to neutral, predominantly mineral soils with significant but widely varying organic matter contents intimately incorporated in the dark A horizons. These grade into subsoils marked by rusty and ochreous streaks and mottles on a pale grey matrix. Below this mottled horizon the soil is typically grey to bluish grey and permanently waterlogged, but the water-table fluctuates, periodically rising almost to the surface. Occasionally the soils are flooded for short periods.
42. Neutral To Alkaline Peats May be black and highly granular, dark brown and fibrous, or of some intermediate character and range in depth from 25 cm to several metres. Lenses of shells and patches of soft carbonates sometimes occur irregularly within the peat and occasionally on the surface.
43. Acid Peats Show little horizon development, their main feature being the accumulation of a surface horizon of almost black, strongly acid, peaty organic matter which is maintained near saturation with water. The peat is generally well decomposed and sticky, but significant amounts of fibrous roots and partly decomposed plant remains occur near the surface and the lower part is commonly clayey or gravelly grading into the underlying mineral material.

Appendix 2 a b d c e f g h i j k l m n o p q r s t u v w x y z

The Australian Soil Classification (Isbell 1996)

This classification arranges soils hierarchically by Order, Suborder, Great Group, Subgroup, and Family. Here we list only the definition of each Order as given in that classification. For the complete classification, and to explain words that have special meaning in the classification see the whole work.

Anthrosols	Soils resulting from human activities which have led to a profound modification, truncation or burial of the original soil horizons, or the creation of new soil parent materials by a variety of mechanical means. Where burial of a pre-existing soil is involved, the anthropic materials must be 0.3 m or more thick. Pedogenic features may be the result of in-situ processes (usually the minimal development of an A1 horizon, sometimes the stronger development of typical soil horizons) or the result of pedogenic processes prior to modification or placement (i.e. the presence of identifiable pre-existing soil material).
Calcarosols	Soils that are calcareous throughout the solum – or at least directly below the A1 or Ap horizon, or a depth of 0.2 m if the A1 horizon is only weakly developed. Carbonate accumulations must be judged to be pedogenic (either current or relict), and the soils do not have clear or abrupt textural B horizons. Hydrosols, Organosols and Vertosols are excluded.
Chromosols	Soils other than Hydrosols with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is not sodic and not strongly acid. Soils with strongly subplastic upper B2 horizons are also included even if they are sodic.
Dermosols	Soils other than Vertosols, Hydrosols, Calcarosols and Ferrosols which: (i) Have B2 horizons with structure more developed than weak throughout the major part of the horizon: and (ii) Do not have clear or abrupt textural B horizons.
Ferrosols	Soils other than Vertosols, Hydrosols, and Calcarosols that: (i) Have B2 horizons in which the major part has a free iron oxide content greater than 5% Fe in the fine earth fraction (<2 mm); and (ii) Do not have clear or abrupt textural B horizons or a B2 horizon in which at least 0.3 m has vertic properties.

Hydosols	Soils other than Organosols, Podosols and Vertosols in which the greater part of the profile is saturated for at least 2-3 months in most years.
Kandosols	Soils other than Hydosols which have all of the following: <ul style="list-style-type: none"> (i) B2 horizons in which the major part is massive or has only a weak grade of structure; (ii) A maximum clay content in some part of the B2 horizon which exceeds 15% (i.e. heavy sandy loam, SL₊); (iii) Do not have a tenic B horizon; (iv) Do not have clear or abrupt textural B horizons; (v) Are not calcareous throughout the solum, or below the A1 or Ap horizon or a depth of 0.2 m if the A1 horizon is only weakly developed.
Kurosols	Soils other than Hydosols with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is strongly acid.
Organosols	Soils that are not regularly inundated by saline tidal waters and either: <ul style="list-style-type: none"> (i) Have more than 0.4 m of organic materials within the upper 0.8 m. The required thickness may either extend down from the surface or be taken cumulatively within the upper 0.8 m; or (ii) Have organic materials extending from the surface to a minimum depth of 0.1 m; these either directly overlie rock or other hard layers, partially weathered or decomposed rock or saprolite, or overlie fragmental material such as gravel, cobbles or stones in which the interstices are filled or partially filled with organic material. In some soils there may be layers of humose and/or melacic horizon material underlying the organic materials and overlying the substrate.
Podosols	Soils which possess either a Bs horizon (visible dominance of iron compounds), a Bhs horizon (organic-aluminium and iron compounds), or a Bh horizon (organic-aluminium compounds). These horizons may occur singly in a profile or in combination.
Rudosols	Soils with negligible (rudimentary) pedologic organisation apart from <ul style="list-style-type: none"> (i) minimal development of an A1 horizon which does not meet the requirement for a Leptic Tenosol (see under Tenosol), or (ii) the presence of less than 10% of B horizon material (including pedogenic carbonate) in fissures in the parent rock or saprolite. There is little or no texture or colour change with depth unless stratified, or buried soils are present. The soils are

apedal or only weakly structured in the A1 horizon and show no pedological colour changes apart from the darkening of an A1 horizon. Hydrosols are excluded on the basis that these will normally show some pedological development, e.g. mottling.

Sodosols

Soils with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is sodic and not strongly acid. Hydrosols and soils with strongly subplastic upper B2 horizons are excluded.

Tenosols

Soils other than Organosols, Hydrosols and Calcarosols with one or more of the following:

- (i) A peaty horizon;
- (ii) A humose, melacic or melanic horizon which overlies hard unweathered rock, partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials;
- (iii) A horizons which meet all the conditions for a peaty, humose, melacic or melanic horizon except the depth requirement, and which overlie hard unweathered rock, partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials;
- (iv) A1 horizons which have more than a weak development of structure and which directly overlie hard unweathered rock, partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials;
- (v) An A2 horizon which directly overlies hard unweathered rock or other hard materials, or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials;
- (vi) Either a tenic B horizon, or a B2 horizon with 15% clay (SL-) or less, or a transitional horizon (C/B) occurring in fissures in the parent rock or saprolite which contains between 10 and 50% of B horizon material (including pedogenic carbonate).

Vertosols

Soils with the following:

- (i) A clay field texture or 35% or more clay throughout the solum except for thin, surface crusty horizons 0.03 m or less thick; and
- (ii) When dry, open cracks occur at some time in most years. These are at least 5 mm wide and extend upward to the surface or to the base of any plough layer, self-mulching horizon, or thin, surface crusty horizon; and
- (iii) Slickensides and/or lenticular peds occur at some depth in the solum.

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a b c d e f g h i j k l m n o p q r s t u v w x y z

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