

Part 629 – GLOSSARY OF LANDFORM AND GEOLOGIC TERMS

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Part 629 - GLOSSARY OF LANDFORM AND GEOLOGIC TERMS

629.00 *Definition and Purpose.*

This glossary provides the Soil Survey, soil scientists, and natural resource specialists with landform, geologic, and related terms and their definitions to:

- Improve soil landscape description with a standard, single source landform and geologic glossary;
- Enhance geomorphic content and clarity of soil map unit description by use of accurate, defined terms;
- Establish consistent geomorphic term usage in soil science, especially in the NCSS;
- Provide standard geomorphic definitions for data bases and soil survey technical publications; and
- Train soil scientists and related professionals in soils as landscape and geomorphic entities.

629.01 *Responsibilities.*

This glossary serves as the official National Cooperative Soil Survey (NCSS) reference for landform, geologic, and related terms. The National Soil Survey Center, Lincoln, NE, is responsible for maintaining and updating this glossary. MLRA office soil scientists and National Cooperative Soil Survey participants may, and are encouraged to, propose additions and changes for use in pedon or soil map unit descriptions and soil survey publications. The Glossary of Geology (AGI, 1997) serves as a major source for many glossary terms. Permission was granted (letters dated 9/11/85 and 9/22/93) to the USDA-Natural Resource Conservation Service (formerly the Soil Conservation Service) by the American Geological Institute (AGI), to use existing definitions. Modifications to original AGI definitions are explained below.

629.02 *Definitions.*

(a) Reference Codes.

Sources from which definitions were taken, whole or in part, are identified by a code (e.g. GG) following each definition. Underlined codes (e.g. GG) signify a definition modification from the original source. The reference codes are:

- BFM Boothroyd, J.C., Friedrich, N.E., and McGinn, S.R. 1985. Geology of microtidal coastal lagoons: Rhode Island. *Marine Geology* 63:35-76.
- BHM Buol, S.W., Hole, F.D., McCracken, R.J., and Southard, R.J. 1997. Soil genesis and classification, 4th Ed. Iowa State University Press, Ames, IA; 527p.
- CC Cowardin, L.M., Carter, V., Golet, F.C., and Laroe, E.T. 1979. Classification of wetlands and deepwater habitats of the United States. US Dept. Interior, US Fish and Wildlife Service, US Government Printing Office, Washington, DC.
- CF Clayton, L. and Freers, T.F. (eds.) 1967. Glacial geology of the Missouri Coteau and adjacent areas. Guidebook 18th annual field conference Midwest Friends of the Pleistocene. North Dakota Geological Survey Miscellaneous Series #30, 170 p.
- CV Cruden, D.M., and Varnes, D.J. 1996. Landslide types and processes. *In*: Turner, A.K., and Schuster, R.L., (eds). 1996. Landslides: investigations and mitigation. National Research Council,

- Transportation Research Board Special Report No. 247; National Academy Press, Washington, DC; 673 p.
- DV Varnes, D. 1978. Slope movement types and processes. *In*: Schuster, R.L., and R.J. Krizek. (eds). 1978. Landslides: analysis and control. National Academy Sciences, Transportation Research Board Special Report No. 176; 234 p.
- FC Freeze, A.L. and Cherry, J.A. 1979. Groundwater. Prentice-Hall, Inc., Englewood Cliffs, NJ, 604 p.
- FFP Peterson, F.F. 1981. Landforms of the Basin and Range Province defined for soil survey. Nevada Agricultural Experiment Station Technical Bulletin No. 28, Reno, NV. 52p.
- GG Jackson, J.A. (ed) 1997. Glossary of geology, 4th Ed. American Geological Institute, Alexandria, VA. 769p. ISBN 0-922152-34-9
- GG'87 Bates, R.L., and Jackson, J.A. (ed) 1987. Glossary of geology, 3rd Ed. American Geological Institute, Alexandria, VA. 788p.
- DA Davis, R.A. 1994. Barrier island systems - a geologic overview. P. 1-46. *In*: Davis, R.A. ed.) 1994. Geology of Holocene barrier island systems. Springer-Verlag, New York, NY.
- DR Ritter, D.F., Kochel, R.C., and Miller, J.R. 1995. Process geomorphology, 3rd ed. Wm. C. Brown, Publishers, Dubuque, IA.
- FS Fisher, J.J., and Simpson, E.J. 1979. Washover and tidal sedimentation rates as environmental factors in development of a transgressive barrier shoreline; pp.127-148. *In*: Leatherman, S.P. (ed.) 1979. Barrier islands from the Gulf of St Lawrence to the Gulf of Mexico. Academic Press, New York, NY.
- GD Demas, G.P. 1998. Subaqueous soil of Sinepuxent Bay, Maryland. PhD dissertation, Department of Natural Resources and Landscape Architecture, University of Maryland, College Park, MD.
- GHG Gile, L.H., Hawley, J.W., and Grossman, R.B. 1981. Soils and geomorphology in the Basin and Range area of southern New Mexico – Guidebook to the Desert Project. Memoir 39. New Mexico Bureau of Mines & Mineral Resources, Socorro, NM; 222 p.
- GM Goldthwaite, R.P. and Matsch, C.L. (eds.) 1988. Genetic classification of glaciogenic deposits: final report of the commission on genesis and lithology of glacial Quaternary deposits of the International Union for Quaternary Research (INQUA). A.A. Balkema, Rotterdam; 294 p.
- GS Green, J., and Short, N.M. 1971. Volcanic landforms and surface features: A photographic atlas and glossary. Springer – Verlag, New York, NY. 519 p.
- GSST Soil Science Society of America. 2001. Glossary of Soil Science terms. Soil Science Society of America, Madison, WI. 135p.
- HD Holdorf, H. and Donahue, J. 1990. Landforms for soil surveys in the Northern Rockies. Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Misc. Publ. No. 51. 26 p.
- HF Fisk, H.N. 1959. Padre Island and the Laguna Madre flats, coastal south Texas. Louisiana State University, 2nd Coastal Geography Conference; pp. 103-151.
- HP Hawley, J.W., and Parsons, R.B. 1980. Glossary of selected geomorphic and geologic terms. Mimeo. USDA Soil Conservation Service, West National Technical Center, Portland, OR. 30 p.

- KST Soil Survey Staff. 1994. Keys to Soil Taxonomy, 6th Ed. USDA - Natural Resources Conservation Service (p.54).
- MA MacDonald, G.A. and A.T. Abbott. 1970. Volcanoes in the sea, the geology of Hawaii. University of Hawaii Press, 441p.
- NL Lancaster, N. 1995. Geomorphology of desert dunes. Routledge, New York, NY. 209p.
- NRC National Research Council of Canada. 1988. Glossary of permafrost and related ground ice terms. Associate Committee Geotechnical Research, Technical Memorandum 142; 156 p
- RF Fairbridge, R. W. (ed.). Encyclopedia of geomorphology. 1968. Encyclopedia of Earth Sciences Series, vol. 3. Reinhold Book Corporation, New York, NY
- RD Daniels, Raymond B. (personal communication).
- RR Ruhe, Robert V. 1975. Geomorphology: Geomorphic processes and surficial geology. Houghton-Mifflin, Boston, MA, 246p.
- SJ Sugden, D.E. and John, B.S. 1976. Glaciers and landscape, a geomorphological approach. Halsted Press, John Wiley and Sons, Inc., New York, NY, 376 p.
- SM McGinn, S.R. 1982. Facies distribution of Ninigret Pond. Masters thesis, University of Rhode Island, Kingston, RI.
- SS Summer, M.E., and Stewart, B.A. (eds). 1992. Soil crusting in Australia. *In: Soil crusting: chemical and physical process. Advances in Soil Science*, Lewis Publishing, Boca Raton, FL.
- SSM Soil Survey Staff. 1993. Soil Survey Manual. USDA - Soil Conservation Service, Agricultural Handbook No. 18, U.S. Gov. Print. Office, Washington, DC.
- SSS Subaqueous Soils Subcommittee. 2005. Glossary of terms for subaqueous soils, landscapes, landforms, and parent materials of estuaries and lagoons. National Cooperative Soil Survey Conference, USDA-NRCS, National Soil Survey Center, Lincoln, NE.
- ST Soil Survey Staff. 1975. Soil Taxonomy. A basic system of soil classification for making and interpreting soil surveys. USDA - Soil Conservation Service Agricultural Handbook #436, U.S. Gov. Print. Office, Washington, DC, 754 p.
- SW Schoeneberger, P.J. and Wysocki, D.A. (personal communication), National Soil Survey Center, NRCS, Lincoln, NE.
- WA Way, D.S. 1973. Terrain analysis. Harvard University, Dowden, Hutchinson & Ross, Inc., Stroudsburg, PA. 392p.
- WCHP
Wells, D.V., Conkwright, R.D., Hill, J.M., and Park, M.J. 1994. The surficial sediments of Assawoman Bay and Isle of Wight Bay, Maryland: Physical and chemical characteristics. Coastal and Estuarine Geology File Report Number 94-2, Maryland Geological Survey, Baltimore, MD.
- WM Monroe, W.H. 1980. Some tropical landforms of Puerto Rico. US Geological Survey Professional Paper 1159, U.S. Govt. Print. Office, Washington, DC.
- WT Thornbury, W.D. 1969. Principles of geomorphology; 2nd Ed. John Wiley and Sons, Inc., New York, NY; 594 p.

WW White, W.B. 1988. Geomorphology and hydrology of karst terrains. Oxford Univ. Press, New York, NY; 478 p.

(b) Clarifying comments included with glossary definitions.

(not recommended) use – denotes an unacceptable term (obsolete, poorly-defined, or erroneous) that should not be used. The glossary provides an alternate term, if available.

(not preferred) refer to – denotes a technically acceptable, but poorly-defined or outdated term that should be avoided to prevent confusion and redundancy. Preferred alternatives are provided.

(colloquial:) – denotes a regionally-derived or applied term and identifies the region where it has been used. A colloquial term is either not widely accepted or unknown outside the geographic area where it originates. A colloquial term should be avoided if a more widely recognized alternative exists.

Compare – Follows a term definition and indicates additional glossary entries that are similar or related to that term.

(c) Glossary terms and definitions.

`a`a lava - A type of basaltic lava (material) having a rough, jagged, clinkery surface and a vesicular interior. Compare – block lava, pahoehoe lava, pillow lava. GG & MA

`a`a lava flow - A type of basaltic lava flow dominated by `a`a lava and a characteristically rough, jagged, clinkery surface. Compare - pahoehoe lava flow. Compare – block lava flow, pahoehoe lava flow, pillow lava flow. GG & MA

ablation till - A general term for loose, relatively permeable, earthy material deposited during the downwasting of nearly static glacial ice, either contained within or accumulated on the surface of the glacier. Compare - till, ground moraine. GG

accretion [sedimentology] - The gradual increase or extension of land by natural forces acting over a long period of time, as on a beach by the washing up of sand from the sea or on a flood plain by the accumulation of sediment deposited by a stream. Synonym: aggradation. GG

active layer - The top layer of ground subject to annual thawing and freezing in areas underlain by permafrost. NRC

active slope - (not recommended)

aeolian - (not recommended; obsolete) use eolian.

aggradation - The building-up of the Earth's surface by deposition; specifically, the accumulation of material by any process in order to establish or maintain uniformity of grade or slope; also called accretion. Compare - degradation. GG

alas - A type of thermokarst depression with steep sides and a flat, grass-covered floor, found in thermokarst terrain, produced by thawing of extensive areas of very thick and exceedingly ice-rich permafrost. Compare - thermokarst depression. NRC and GG

alluvial - Pertaining to material or processes associated with transportation and/or subaerial deposition by concentrated running water. Compare - colluvial. GSST

alluvial cone – A semi-conical type of alluvial fan with very steep slopes; it is higher, narrower, and steeper (e.g., > 40% slopes) than a fan, and composed of coarser, and thicker layers of material deposited by a combination of alluvial episodes and to a much lesser degree, landslides (e.g., debris flow). Coarsest materials tend to concentrate at the cone apex. Compare – alluvial fan, talus cone. SW

alluvial fan - A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes, shaped like an open fan or a segment of a cone, deposited by a stream (best expressed in semiarid regions) at the place where it issues from a narrow mountain or upland valley; or where a tributary stream is near or at its junction with the main stream. It is steepest near its apex which points upstream and slopes gently and convexly outward (downstream) with a gradual decrease in gradient. GG

alluvial flat - (a) (colloquial: western U.S.A.) A nearly level, graded, alluvial surface in bolsons and semi-bolsons that lacks distinct channels, terraces, or flood plain levels.

Compare – flood-plain step, terrace, valley flat. FFP, GG, & SW. (b) (not preferred) A general term for a small flood plain bordering a river, on which alluvium is deposited during floods. GG

alluvial plain - (a) A large assemblage of fluvial landforms (braided streams, terraces, etc.,) that form low gradient, regional ramps along the flanks of mountains and extend great distances from their sources (e.g., High Plains of North America. SW (b) (not recommended, use flood plain.) A general, informal term for a broad flood plain or a low-gradient delta. Compare - alluvial flat. FFP.

alluvial plain remnant - An erosional remnant of an alluvial plain which retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to a present-day stream or drainage network. Compare - alluvial plain, erosional remnant, paleoterrace. SW

alluvial terrace - (not preferred) refer to stream terrace.

alluvium - Unconsolidated, clastic material subaerially deposited by running water, including gravel, sand, silt, clay, and various mixtures of these. Compare - colluvium, slope alluvium. HP

alpine - (a) [geomorphology] - (adjective) Characteristic of, or resembling the European Alps, or any lofty mountain or mountain system, especially one so modified by intense glacial erosion as to contain cirques, horns, etc. (ex. alpine lake) GG; (b) (not recommended as a landform term). An ecological community term for high-elevation plant communities. SW & GG

alpine glacier - a) Any glacier in a mountain range except an ice cap or ice sheet. It usually originates in a cirque and may flow down into a valley previously carved by a stream. Compare - continental glacier. GG
b) (not preferred - refer to U-shaped valley): (relict) - landforms or sediments formed, modified or deposited by a glacier in or on mountains or high hills that has since melted away. Compare - glacial-valley floor, glacial-valley wall. SW

angle of repose - The maximum angle of slope (measured from a horizontal plane) at which loose, cohesionless material will come to rest. GG

annular drainage pattern - A drainage pattern in which subsequent streams follow a roughly circular or concentric path along a belt of weak rocks, resembling in plan view, a ring-like pattern where the bedrock joints or fracturing control the parallel tributaries. It is best displayed in streams draining a maturely dissected granitic or sedimentary structural dome or basin where erosion has exposed rimming sedimentary strata of greatly varying degrees of hardness, as in the Red Valley which nearly encircles the domal structure of the Black Hills, SD. SW & GG & WA

anthropogenic feature - An artificial feature on the earth's surface (including those in shallow water), having a characteristic shape and range in composition, composed of unconsolidated earthy, organic materials, artificial materials, or rock, that is the direct result of human manipulation or activities; can be either constructional (e.g., artificial levee) or destructional (quarry). SW

anticline - (a) [landform] A unit of folded strata that is convex upward and whose core contains the stratigraphically oldest rocks, and occurs at the earth's surface. In a single anticline, beds forming the opposing limbs of the fold dip away from its axial plane. Compare - monocline, syncline, fold. SW & HP
(b) [structural geology] A fold, at any depth, generally convex upward whose core contains the stratigraphically older rocks. GG

aquiclude - A layer of soil, sediment, or rock that may or may not be saturated, that is incapable of transmitting significant quantities of water under ordinary hydraulic gradients. Compare - aquitard. FC

aquifer - A saturated, permeable geologic unit of sediment or rock that can transmit significant quantities of water under hydraulic gradients. FC

aquitard - A body of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs but may serve as a storage unit for groundwater. GG

arete - A narrow, jagged mountain crest, often above the snowline, sculptured by alpine glaciers and formed by backward erosion of adjoining cirque walls. HP

arroyo - (colloquial: southwest U.S.A.) The channel of a flat-floored, ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material; sometimes called a wash. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed.

Where arroyos intersect zones of ground-water discharge, they are more properly classed as intermittent stream channels. HP

artificial collapsed depression – A collapse basin, commonly a closed depression, which is the direct result of surficial subsidence associated with subsurface mining (e.g., long-wall mining). SW.

artificial drainage pattern – Human-made networks of drainage structures (ditches, canals, etc.) built primarily to lower or control the local water table in low lying, flat topography such as glacial lakebeds, broad flood plains, low coastal plains, or marshes most commonly in humid climates. (Irrigation ditches found in arid and semiarid climates, which bring water into the fields, should not be confused with drainage structures). SW & WA

artificial levee - An artificial embankment constructed along the bank of a watercourse or an arm of the sea, to protect land from inundation or to confine streamflow to its channel. GG

ash [volcanic] - Unconsolidated, pyroclastic material less than 2 mm in all dimensions. Commonly called "volcanic ash" Compare - block [volcanic], cinders, lapilli, tephra. SW & KST

ash flow - (not preferred – see pyroclastic flow, pyroclastic surge) A highly heated mixture of volcanic gases and ash, traveling down the flank of a volcano or along the surface of the ground; produced by the explosive disintegration of viscous lava in a volcanic crater, or by the explosive emission of gas-charged ash from a fissure or group of fissures. The solid materials contained in a typical ash flow are generally unsorted and ordinarily include volcanic dust, pumice, scoria, and blocks in addition to ash. (Also called a *pyroclastic flow*.) Compare - nueé ardente, lahar, pyroclastic. GG

aspect - The direction toward which a slope faces with respect to the compass or to the rays of the Sun; also called *slope aspect*. GSST

atoll - A coral reef appearing in plan view as roughly circular, and surmounted by a chain of closely spaced, low coral islets that encircle or nearly encircle a shallow lagoon in which there is no land or islands of non-coral origin; the reef is surrounded by open sea. GG

avalanche - A large mass of snow, ice, soil, or rock, or mixtures of these materials, falling, sliding, or flowing very rapidly under the force of gravity. Velocities may sometimes exceed 500 km/hr. GG

avalanche chute - [preferred term] The central, channel-like corridor, scar, or depression along which an avalanche has moved. An eroded surface marked by pits, scratches, and grooves. GG

avalanche track - (not recommended as a landform term - use avalanche chute). The path formed by an avalanche. It may take the form of an open path in a forest, with bent and broken trees, or an eroded surface marked by pits, scratches, and grooves. Compare - avalanche chute GG

avulsion - A sudden cutting off or separation of land by a flood or by abrupt change in the course of a stream, as by a stream breaking through a meander or by a sudden change in current whereby the stream deserts its old channel for a new one. Compare - crevasse, flood-plain splay. GG

axial stream - (a) The main stream of an intermontane valley, flowing in the deepest part of the valley and parallel to its longest dimension. (b) A stream that follows the axis of a syncline or anticline. GG

back-barrier beach - A narrow, elongate, intertidal, sloping landform that is generally parallel with the shoreline located on the lagoon or estuary side of the barrier island, or spit. Compare – barrier island. SSS

back-barrier flat - A subaerial, gently sloping landform on the lagoon side of the barrier beach ridge composed predominantly of sand washed over or through the beach ridge during tidal surges; a portion of a barrier flat. Compare – washover-fan flat. SSS

backshore - The upper or inner, usually dry, zone of the shore or beach, lying between the high-water line of mean spring tides and the upper limit of shore-zone processes; it is acted upon by waves or covered by water only during exceptionally severe storms or unusually high tides. It is essentially horizontal or slopes gently landward, and is divided from the foreshore by the crest of the most seaward berm. Compare - washover fan. GG

backshore terrace - (not preferred) refer to berm.

backslope - The hillslope profile position that forms the steepest and generally linear, middle portion of the slope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below. They may or may not include cliff segments (i.e. free faces). Backslopes are commonly erosional forms produced by mass movement, colluvial action, and running water. Compare - summit, shoulder, footslope, toeslope. GSST & HP

backswamp - A flood-plain landform. Extensive, marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces. Compare - valley flat. HP

backswamp deposit - Laminated of silt and clay deposited in the flood basin between valley sides or terraces and the natural levees of a river. Compare - slackwater. GG

backwearing - Slope erosion that causes the parallel retreat of an escarpment or the slope of a hill or mountain or the sideways recession of a slope without changing its general slope; a process contributing to the development of a pediment. GG

badlands - A landscape which is intricately dissected and characterized by a very fine drainage

bar [Microfeature] – A small, sinuous or arcuate, ridge-like lineation on a flood plain and separated from others by small channels or troughs; caused by fluvial processes and common to flood plains and young alluvial terraces; a constituent part of *bar and channel topography*. Compare – meander scroll. SW

bar and channel topography – A local-scale topographic pattern of recurring, small, sinuous or arcuate ridges separated by shallow troughs irregularly spaced across low-relief flood plains (slopes generally 2–6 %); the effect is one of a subdued, sinuously undulating surface that is common on active, meandering flood plains. Micro-elevational differences between bars and channels generally range from <0.5 to 2 m and are largely controlled by the competency of the stream. The ridge-like bars often consist of somewhat coarser sediments compared to the finer textured sediments of the micro-low troughs. Compare – meander scroll, meander belt. SW

barchan dune - A crescent-shaped dune with tips extending leeward (downwind), making this side concave and the windward (upwind) side convex. Barchan dunes tend to be arranged in chains extending in the dominant wind direction. Compare - parabolic dune. HP

barrier bar - (not recommended) use longshore bar

barrier beach - (a) A narrow, elongate, coarse-textured, intertidal, sloping landform that is generally parallel with the beach ridge component of a barrier island or spit and adjacent to the ocean. Compare – barrier island. SSS (b) [relict] (colloquial: western U.S.A.) A wide, gently-sloping portion of a bolson floor comprising numerous, parallel, closely-spaced, relict longshore-bars and lagoons built by a receding pluvial lake. Synonym, offshore barrier, offshore beach, bar beach. Compare - bar [coast], barrier island. GG and FFP

barrier cove - A subaqueous area adjacent to a barrier island or submerged barrier beach that forms a minor embayment or cove within the larger basin. Compare – cove, mainland cove. SSS

barrier flat - A relatively flat, low-lying area, commonly including pools of water, separating the exposed or seaward edge of a barrier beach or barrier island from the lagoon behind it. An assemblage of both deflation flats left behind migrating dunes and /or storm washover sediments; may be either barren or vegetated. Compare – barrier beach, back-barrier flat. SSS

barrier island - A long, narrow, sandy island, that is above high tide and parallel to the shore that commonly has dunes, vegetated zones, and swampy **or marshy** terrains extending lagoonward from the beach. Compare – barrier beach. GG

barrow pit - (not preferred) refer to borrow pit

basal till - (a) (not preferred; obsolete) refer to subglacial till. Unconsolidated material of mixed composition deposited at the base (bottom) of a glacier [The term emphasizes only the relative position of deposition; e.g. subglacial till]. Types of basal till include lodgment, melt-out, and flow till. GG & SW (b) [obsolete- use lodgment till] - A firm, dense, clay-rich till containing many abraded stones (coarse fragments) dragged along beneath a moving glacier and deposited upon bedrock or other glacial deposits. GG

base level - The theoretical limit or lowest level toward which erosion of the Earth's surface constantly progresses but seldom, if ever, reaches; especially the level below which a stream cannot erode its bed. The general or ultimate base level for the land surface is sea level, but temporary base levels commonly exist locally. GG

base slope [geomorphology] - A geomorphic component of hills consisting of the concave to linear slope (perpendicular to the contour) which, regardless of the lateral shape is an area that forms an apron or wedge at the bottom of a hillside dominated by colluvial and slope wash processes and sediments (e.g., colluvium and slope alluvium). Distal base slope sediments commonly grade to, or interfinger with, alluvial fills, or gradually thin to form pedisegment over residuum. Compare - head slope, side slope, nose slope, interfluvium, free face. SW

basin - (a) Drainage basin; (b) A low area in the Earth's crust, of tectonic origin, in which sediments have accumulated. GG (c) (colloquial: western USA) A general term for the nearly level to gently sloping, bottom surface of an intermontane basin (bolson). Landforms include playas, broad alluvial flats containing ephemeral drainageways, and relict alluvial and lacustrine surfaces that rarely, if ever, are subject to flooding. Where through-drainage systems are well developed, flood plains are dominant and lake plains are absent or of limited extent. Basin floors grade mountainward to distal parts of piedmont slopes. FFP

basin floor - A general term for the nearly level, lower-most part of intermontane basins (i.e. bolsons, semi-bolsons). The floor includes all of the alluvial, eolian, and erosional landforms below the piedmont slope. Compare - basin, piedmont slope. FFP

basin-floor remnant - (colloquial: western U.S.A.) A relatively flat, erosional remnant of any former landform of a basin floor that has been dissected following the incision of an axial stream. FFP

batholith - A large, generally discordant plutonic rock body exposed at the land surface, with an aerial extent > 40 sq. mi. (100 km²) and no known bottom (e.g. Idaho batholith). Compare - stock. SW & GG

bay [coast] - a) A wide, curving open indentation, recess, or arm of a sea (e.g. Chesapeake Bay) or lake (e.g. Green Bay, WI) into the land or between two capes or headlands, larger than a cove [coast], and usually smaller than, but of the same general character as, a gulf. b) A large tract of water that penetrates into the land and around which the land forms a broad curve. By international agreement a bay is a water body having a baymouth that is less than 24 nautical miles wide and an area that is equal to or greater than the area of a semicircle whose diameter is equal to the width of the bay mouth. Compare - gulf. GG

bay [geom.] - (a) Any terrestrial formation resembling a bay of the sea, as a recess or extension of lowland along a river valley or within a curve in a range of hills, or an arm of a prairie extending into, or partly surrounded by, a forest. (b) A Carolina Bay. GG & GSST.

bay bottom - The nearly level or slightly undulating central portion of a submerged, low-energy, depositional estuarine embayment characterized by relatively deep water (1.0 to >2.5 m). Compare - lagoon bottom. SSS

bayou - A term applied to many local water features in the lower Mississippi River basin and in the Gulf Coast region of the U.S. Its general meaning is a creek or secondary watercourse that is tributary to another body of water; especially a sluggish and stagnant stream that follows a winding course through alluvial lowlands, coastal swamps or river deltas. Compare - oxbow, slough. GG

beach - (a) A gently sloping zone of unconsolidated material, typically with a slightly concave profile, extending landward from the low-water line to the place where there is a definite change in material or physiographic form (such as a cliff) or to the line of permanent vegetation (usually the effective limit of the highest storm waves); a shore of a body of water, formed and washed by waves or tides, usually covered by sand or gravel; (b) the relatively thick and temporary accumulation of loose water-borne material (usually well-sorted sand and pebbles) accompanied by mud, cobbles, boulders, and smoothed rock and shell fragments, that is in active transit along, or deposited on, the shore zone between the limits of low water and high water. GG

beach plain - A continuous and level or undulating area formed by closely spaced successive embankments of wave-deposited beach material added more or less uniformly to a prograding shoreline, such as to a growing compound spit or to a cusped foreland. Compare - wave-built terrace, chenier plain. GG

beach ridge - A low, essentially continuous mound of beach or beach-and-dune material heaped up by the action of waves and currents on the backshore of a beach, beyond the present limit of storm waves or the reach of ordinary tides, and occurring singly or as one of a series of approximately parallel deposits. The ridges are roughly parallel to the shoreline and represent successive positions of an advancing shoreline. GG

beach sands [soil survey] – Well sorted, sand-sized, clastic material transported and deposited primarily by wave action and deposited in a shore environment. Compare - eolian sands. SW

beach terrace - (a) A landform that consists of a wave-cut scarp and wave-built terrace of well-sorted sand and gravel of marine and lacustrine origin. (b) (colloquial: western U.S.A.) relict shorelines from pluvial lakes, generally restricted to valley sides. Compare - strandline, shoreline. FFP

beaded drainage pattern - (not recommended; use beaded stream pattern.)

beaded stream pattern - A characteristic pattern of small streams in areas underlain by ice wedges. The course of the stream channel is controlled by the pattern of the wedges, with beads (pools) occurring at the junctions of the wedges. NRC

bed [stratigraphy] - The layer of sediments or sedimentary rocks bounded above and below by more or less well-defined bedding surfaces. The smallest, formal lithostratigraphic unit of sedimentary rocks. The designation of a bed or a unit of beds as a formally named lithostratigraphic unit generally should be limited to certain distinctive beds whose recognition is particularly useful. Coal beds, oil sands, and other layers of economic importance commonly are named, but such units and their names usually are not a part of formal stratigraphic nomenclature. Compare - formation. GG

bedded - Formed, arranged, or deposited in layers or beds, or made up of or occurring in the form of beds; especially said of a layered sedimentary rock, deposit, or formation. GG

bedding plane – A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology) from the preceding or following layer; a plane of deposition. It often marks a change in the circumstances of deposition, and may show a parting, a color difference, a change in particle size, or various combinations. A term commonly applied to any bedding surface even when conspicuously bent or deformed by folding. SW & GG

bedrock - A general term for the solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface. Compare - regolith, residuum. GG

bench - (not preferred) refer to structural bench.

berm - [beach] A low, impermanent, nearly horizontal or landward-sloping shelf, ledge, or narrow terrace on the backshore of a beach, formed of material thrown up and deposited by storm waves; it is generally bounded on one side or the other by a beach ridge or beach scarp. Some beaches have no berms, others have one or several. GG

beveled base – The lower portion of a canyon wall or escarpment marked by a sharp reduction in slope gradient from the precipitous cliff above, and characteristically composed of thinly mantled colluvium (e.g. < 1 m) and / or capped with a thin surficial mantle of large rock fragments from above, which overly residuum of less resistant rock (e.g., shale) whose thin strata intermittently outcrop at the surface; a zone of erosion and transport common in the canyonlands of the semi-arid, southwestern USA. Compare – talus slope. SW

beveled cut – A bank or slope portion of a cut excavated into unconsolidated material (regolith) or bedrock as in a roadcut, whose slope gradient has been mechanically reduced to a subdued angle (e.g. to < 33 %) to increase slope stability, reduce erosion, or to facilitate revegetation. Compare – cut, cutbank, roadcut. SW

blind valley - A valley, commonly in karst, that ends abruptly downstream at the point at which its stream disappears underground. GG

block [volcanic] - A pyroclast that was ejected in a solid state; it has a diameter greater than 64 mm. Compare - bomb, cinder, lapilli, tephra. GG

block field - A thin accumulation of stone blocks, typically angular, with only coarse fragments in the upper part, over solid or weathered bedrock, colluvium, or alluvium, without a cliff or ledge above as an apparent source. Block fields occur on high mountain slopes above tree-line, or in polar or paleo-periglacial regions; they are most extensive along slopes parallel to the contour; and they generally occur on slopes of less than 5%. Synonym - felsenmeer. Compare - block stream, talus slope, scree slope. GG

block glide [mass movement] – The process, associated sediments (block glide deposit) or resultant landform characterized by a slow type of slide, in which largely intact units (blocks) of rock or soil slide downslope along a relatively planar surface, such as a bedding plane, without any significant distortion of the original mass; a type of translational rock slide. Compare – rotational landslide, debris slide, lateral spread, landslide. SW & DV

block lava - Lava having a surface of angular blocks; it is similar to `a`a lava but the fragments are larger and more regular in shape, somewhat smoother, and less vesicular. Compare – `a`a lava, pahoehoe lava, pillow lava. GG

block lava flow – A lava flow dominated by block lava. Compare – `a`a lava flow, pahoehoe lava flow, pillow lava flow. SW

block stream - An accumulation of boulders or angular blocks, with no fine sizes in the upper part, overlying solid or weathered bedrock, colluvium, or alluvium, and lying below a cliff or ledge from which coarse fragments originate. Block streams usually occur at the heads of ravines as narrow bodies that are more extensive downslope than along the slope. They may exist on any slope angle, but ordinarily not steeper than 90 percent slope (approx. 40 degrees). Compare - block field. GG

blowout – A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand, loose soil, or where protective vegetation is disturbed or destroyed; the adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Commonly small, some blowouts may be large (kilometers in diameter). Compare – deflation basin. GG

blue rock [volcanic] – (colloquial – Hawaii) The very dense (e.g. 2.75 g/cc), extremely hard and massive, nominally vesicular lava that commonly forms the inner core of an `a`a lava flow. SW

bluff - (a) A high bank or bold headland, with a broad, precipitous, sometimes rounded cliff face overlooking a plain or body of water, especially on the outside of a stream meander; ex. a river bluff. (b) (not preferred) use cliff. Any cliff with a steep, broad face. GG

bog - Waterlogged, spongy ground, consisting primarily of mosses, containing acidic, decaying vegetation such as sphagnum, sedges, and heaths that may develop into peat. Compare - fen, marsh, swamp. GG

bolson - (colloquial: western USA.) A term applied to an internally drained (closed) intermontane basin in arid regions where drainages from adjacent mountains converge toward a central depression. Bolsons are often tectonically formed depressions. According to Peterson, a bolson can include alluvial flat, alluvial plain, beach plain, barrier beach, lake plain, sand sheet, dune, and playa landforms. The piedmont slope above a bolson includes erosional (pediments) and older depositional surfaces (fans) that adjoin the mountain front. A semi-bolson is an externally drained (open) bolson. Synonym - intermontane basin. GG and FFP.

bomb [volcanic] - A pyroclast > 64 mm in at least one dimension that was ejected while still viscous and solidified into its rounded form in flight. Compare - block, cinder, lapilli, tephra. GG

borrow pit – An excavated area from which earthy material has been removed typically for construction purposes offsite; also called barrow pit. GG

bottomland - (not recommended) use flood plain. An obsolete, informal term loosely applied to varying portions of a flood plain. SW

boulder field - (not recommended) use block stream. Compare - block field.

bowl [gilgai] – A cup-or trough-shaped subsurface feature centered under and surrounding the micro-low of a gilgai, commonly 3–5 m across and 1.5–3 m thick, containing numerous slickensides (oblique slip / shear faces) within it and bounded at its base by master slickensides. A bowl contains turbated material produced in soils with substantial smectitic clay (e.g. Vertisols). Bowl morphology is distinct from that in adjacent micro-highs (chimney) and underlying horizons: Substratum morphology is not preserved within the bowl. Compare – chimney [gilgai], intermediate position [gilgai], gilgai. SW

box canyon a) A narrow gorge or canyon containing an intermittent stream following a zigzag course, characterized by high, steep rock walls and typically closed upstream by a similar wall, giving the impression, as viewed from its bottom, of being surrounded or “boxed in” by almost vertical walls. b) A steep-walled canyon heading against a cliff a dead-end canyon. GG

braided channel - (not recommended) use braided stream.

braided stream - A channel or stream with multiple channels that interweave as a result of repeated bifurcation and convergence of flow around inter-channel bars, resembling (in plan view) the strands of a complex braid. Braiding is generally confined to broad, shallow streams of low sinuosity, high **bed load**, non-cohesive bank material, and a steep gradient. At a given bank-full discharge, braided streams have steeper slopes and shallower, broader, and less stable channel cross sections than meandering streams. Compare - meandering channel, flood-plain landforms. HP

break - (slopes) An abrupt change or inflection in a slope or profile (as in “a break in slope”). Compare - knickpoint, shoulder, escarpment. (geomorphology) A marked variation of topography, or a tract of land distinct from adjacent land, or an irregular or rough piece of ground. Compare - breaks. GG

breaks - (colloquial: western USA) A landscape or large tract of steep, rough or broken land dissected by ravines and gullies and marks a sudden change in topography as from an elevated plain to lower hilly terrain, or a line of irregular cliffs at the edge of a mesa or a river (e.g., the Missouri River breaks). SW & GG

breccia - A coarse-grained, clastic rock composed of angular rock fragments (larger than 2 mm) commonly bonded by a mineral cement in a finer-grained matrix of varying composition and origin. The consolidated equivalent of rubble. Compare - conglomerate. GSST

broad interstream divide – (colloquial: southeastern USA) A type of very wide, low gradient (level to nearly level) interfluvium that lacks a well developed drainage network such that large portions of the local upland lack stream channels or other drainageways; extensive in lower coastal plains and some lake plains, till plains and alluvial plain remnants. Compare – interfluvium. SW & RD

brook [streams] – (not preferred, refer to ephemeral stream) Generally a very small, ephemeral stream, especially one that issues from a spring or seep and conducts less water volume and over shorter distances than a creek. Compare – intermittent stream. GG

burial mound – A small human-made hill, composed of debris accumulated during successive occupations of the site, or of earth heaped up to mark a burial site; also called mound. GG

buried - (adjective) Landforms, geomorphic surfaces, or paleosols covered by younger sediments (e.g. eolian, glacial, and alluvial). Compare - exhumed, relict. HP

buried soil - Soil covered by an alluvial, loessal, or other earthy mantle of more recent material, typically to depths exceeding 50 cm; recent surface deposits < 50 cm thick are generally considered as part of the ground soil. Compare - ground soil, exhumed, relict,. GSST & ST

butte - An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments, commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks. Compare - mesa, plateau, cuesta. HP & GG

caldera - A large, more or less circular depression, formed by explosion and/or collapse, which surrounds a volcanic vent or vents, and whose diameter is many times greater than that of the included vent, or vents. Compare - crater. GG

caliche - A general term for a prominent zone of secondary carbonate accumulation in surficial materials in warm, subhumid to arid areas. Caliche is formed by both geologic and pedologic processes. Finely crystalline calcium carbonate forms a nearly continuous surface-coating and void-filling medium in geologic (parent) materials. Cementation ranges from weak in non-indurated forms to very strong in types that are indurated. Other minerals (carbonates, silicate, sulfate) may be present as accessory cements. Most petrocalcic and some calcic horizons are caliche. HP

canyon - A long, deep, narrow, very steep-sided valley cut primarily in bedrock with high and precipitous walls in an area of high local relief (e.g., mountain or high plateau terrain), often with a perennial stream at the bottom; similar to but larger than a gorge. Compare – gorge, box canyon, slot canyon. SW, HP & GG

canyon bench – One of a series of relatively narrow, flat landforms occurring along a canyon wall and caused by differential erosion of alternating strong and weak horizontal strata; a type of structural bench. GG

canyonlands – A deeply and extensively dissected landscape composed predominantly of relatively narrow, steep-walled valleys with small flood plains or valley floors; commonly with considerable outcrops of hard bedrock on steep slopes, ledges, or cliffs, and with broader summits or interfluves than found in badlands. Side slopes exhibit extensive erosion, active back-wearing, and relatively sparse vegetation. SW

caprock – a) A hard rock layer, usually sandstone, lava or in arid environments, limestone, that lies above shale or other less resistant bedrock or sediments; specifically a rock layer that forms relatively level, resistant topmost strata that holds up hills, ridges, mesas, etc., and commonly forms cliffs or escarpments. Also spelled cap rock. SW & GG b) A hard rock layer, usually sandstone, over-lying the shale above a coal bed. Also spelled cap rock. GG

captured stream - A stream whose course has been diverted into the channel of another stream by natural processes. GG

Carolina Bay - Any of various shallow, often oval or elliptical, generally marshy, closed depressions in the Atlantic coastal plain (from southern New Jersey to northeastern Florida, especially developed in the Carolinas) which share an approximately parallel orientation of their long axes. They range from about 100 meters to many kilometers in length, are rich in humus, and under native conditions contain trees and shrubs different from those of the surrounding areas. Also called Grady ponds (colloquial: Georgia and Alabama) and Delmarva Bays (colloquial: Maryland). Compare - pocosin. GG

cat clay - (not recommended - obsolete) Wet, clay dominated soils containing ferrous sulfide which become highly acidic when drained. GSST

catena - [as used in USA] A sequence of soils across a landscape, of about the same age, derived from similar parent material, and occurring under similar climatic conditions, but have different characteristics due to variations in relief and in drainage. GSST

catsteps - (not preferred, refer to terracettes). A terracette; especially one produced by slumping of loess deposits as in western Iowa. GG

centripetal drainage pattern – A drainage pattern in which the streams converge inward toward a central depression; generally indicative of a structural basin, volcanic crater, caldera, breached dome, bolson, or the end of an eroded anticline or syncline. SW, GG, WA

channel - (a) [stream] The hollow bed where a natural body of surface water flows or may flow. The deepest or central part of the bed of a stream, containing the main current and occupied more or less continuously by water. (b) (colloquial: western U.S.A.) The bed of a single or braided watercourse that commonly is barren of vegetation and is formed of modern alluvium. Channels may be enclosed by banks or splayed across and slightly mounded above a fan surface and include bars and mounds of cobbles and stones. (c) [Microfeature] Small, trough-like, arcuate or sinuous channels separated by small bars or ridges, caused by fluvial processes; common to flood plains and young alluvial terraces; a constituent part of *bar and channel* topography. GG, FFP, & SW.

chenier - A long, narrow, vegetated marine beach ridge or sandy hummock, 1 to 6 m high, forming roughly parallel to a prograding shoreline seaward of marsh and mud-flat deposits, enclosed on the seaward side by fine-grained sediments, and resting on foreshore or mud-flat deposits. It is well drained, often supporting trees on higher areas. Widths range from 45 - 450 m and lengths may exceed several tens of kilometers. GG

chenier plain - A mud-rich strand plain, occupied by cheniers and intervening mud-flats with marsh and swamp vegetation. Compare - chenier, strand plain. GG

chert - A hard, extremely dense or compact, dull to semivitreous, cryptocrystalline sedimentary rock, consisting dominantly of interlocking crystals of quartz less than about 30 mm in diameter; it may contain amorphous silica (opal). It sometimes contains impurities such as calcite, iron oxide, or the remains of siliceous and other organisms. It has a tough, splintery to conchoidal fracture and may be white or variously colored gray, green, blue, pink, red, yellow, brown, and black. Chert occurs principally as nodular or concretionary segregations in limestones and dolomites. GG

chimney [gilgai] - A subsurface feature that forms a crude cone or wave-crest structure centered under a micro-high (e.g. a low mound or rim) and extending at least part-way under adjacent intermediate positions, composed of substratum material that appears to upwell and reaches close to the surface. A chimney is commonly bounded by master slickensides in the subsoil with maximum angles of dip reaching 60 - 75 degrees under the micro-high. Its morphology is distinct from the soil solum of the adjacent micro-lows (e.g. lighter colored and more alkaline and contain carbonate or gypsum concretions absent under micro-lows). Compare - puff [gilgai], bowl [gilgai], intermediate position [gilgai], gilgai. SW

chimney and bowl topography - (not recommended; use gilgai).

cinder cone - A conical hill formed by the accumulation of cinders and other pyroclastics, normally basaltic or andesitic composition. Slopes generally exceed 20 percent. GG

cinders - Uncemented vitric, vesicular, pyroclastic material, more than 2.0 mm in at least one dimension, with an apparent specific gravity (including vesicles) of more than 1.0 and less than 2.0. Compare - ash [volcanic], block [volcanic], lapilli, scoria, tephra. KST

circle - A form of patterned ground whose horizontal mesh is dominantly circular. Compare - Nonsorted circle, patterned ground. GG

circular gilgai - A type of gilgai dominated by circular closed depressions (micro-lows) separated by low mounds (micro-highs); the prevailing type of gilgai on relatively level terrain (slopes < 3 %). Distance from micro-high to the center of an adjacent micro-low is generally 4 - 8 m. Compare - elliptical gilgai, linear gilgai, gilgai. SW

cirque - A steep-walled, half bowl-like recess or hollow, crescent-shaped or semicircular in plan, commonly situated at the head of a glaciated mountain valley or high on the side of a mountain, and produced by the erosive activity of a mountain glacier. It often contains a small round lake (tarn). Compare - cirque floor, cirque platform, cirque wall. SW & GG.

cirque floor – The comparatively level bottom of a cirque, thinly mantled with till and consisting of glacially-scoured knolls and hillocks separated by depressions, flat areas and small lakes (tarn); commonly it is bounded by a slightly elevated rock lip at its exit. SW & HD

cirque headwall – The glacially-scoured, steep and arcuate side or wall of a cirque, dominated by rock-outcrops, rubble, and colluvium. Compare – headwall. SW & HD

cirque platform – A relatively level or bench-like surface formed by the coalescence of several cirques. GG & SW

cirque wall – (not preferred) refer to cirque headwall.

clast - An individual constituent, grain, or fragment of sediment or rock, produced by the mechanical weathering (disintegration) of a larger rock mass. HP

clastic - (adjective) Pertaining to rock or sediment composed mainly of fragments derived from preexisting rocks or minerals and moved from their place of origin. The term indicates sediment sources that are both within and outside the depositional basin. Compare - detritus, epiclastic, pyroclastic, volcanoclastic. GG

claypan - A dense, compact, slowly permeable layer in the subsoil, with a much higher clay content than overlying materials from which it is separated by a sharply defined boundary. Claypans are usually hard when dry, and plastic and sticky when wet. GSST

cliff - Any high, very steep to perpendicular or overhanging face of rock or earth; a precipice. Compare – bluff, beveled base. GG

climbing dune – A dune formed by the piling-up of sand by wind against a cliff or mountain slope; very common in arid regions with substantial local relief and strong, prevailing winds. Compare - sand ramp. GG & SW

closed depression – A generic name for any enclosed area that has no surface drainage outlet and from which water escapes only by evaporation or subsurface drainage; an area of lower ground indicated on a topographic map by a hachured contour line forming a closed loop. Compare – open basin. SW & GG

coalescent fan piedmont - (not preferred) refer to fan piedmont. HP

coastal plain - A low, generally broad plain that has as its margin an oceanic shore and its strata horizontal or gently sloping toward the water, and generally represents a strip of recently prograded or emerged sea floor; e.g. the coastal plain of the southeastern U.S. which extends for 3000 km from New Jersey to Texas. GG '87

coastal marl – An earthy, unconsolidated deposit of gray to buff-colored mud of low bulk density (dry) composed primarily of very fine, almost pure calcium carbonate formed in subaqueous settings that span freshwater lacustrine conditions (e.g. Florida Everglades) to saline intertidal settings (e.g. Florida Keys) formed by the chemical action of algal mats and organic detritus (periphyton); other marl varieties associated with different environments (e.g. freshwater marl, glauconitic marl) also occur. Coastal marl can be quite pure or it can be finely disseminated throughout living root mats (e.g. mangrove roots) and / or organic soil layers. Compare – marl, freshwater marl. SW

cockpit – A crudely star-shaped, closed depression (i.e. large sinkhole) in tropical karst having an inverted conical or slightly concave floor, with an irregular or serrate perimeter formed by subsidiary solution channels and corridors into adjacent hills, and surrounded by residual hills with steep, concave side slopes; the dominant type of closed depression in cockpit karst. Compare – sinkhole, kegel karst. SW, WW & GG

cockpit karst – A karst landscape dominated by subsurface drainage and serrate or star-shaped depressions (cockpits) that range widely in size and density but typically are considerably larger than sinkholes (dolines),

and are separated by intermediate residual hills with concave side slopes; a common type of tropical karst (e.g. Jamaica). Compare – kegel karst, karst. SW & WW

col - A high, narrow, sharp-edged pass or saddle through a divide or between two adjacent peaks in a mountain range; especially a deep pass formed by the headward erosion and intersection of two cirques. Compare - gap, pass, saddle. GG

collapsed ice-floored lakebed - A lakebed formed in a lake on glacial ice and subsequently "let down" or collapsed by the melting of underlying ice, resulting in contortion or folding of the lacustrine sediment and sedimentary structures. These modified or distorted lacustrine sediments cap present-day topographic highs and generally lie at elevations higher than the surrounding disintegration moraine. Compare - collapsed lake plain, collapsed ice-walled lakebed. SW & CF

collapsed ice-walled lakebed - A lakebed that formed in a lake bounded by stagnant ice, but floored by solid ground, usually till. Collapse features are limited to the lakebed margins. Presently, these materials and sedimentary structures generally occur as roughly circular-shaped hills of till capped by lacustrine sediments, generally at elevations higher than surrounding disintegration moraine. Compare - collapsed ice-floored lakebed, collapsed lake plain. SW & CF

collapsed lake plain - A lake plain formed on, and bounded by, glacial ice and subsequently "let down" or collapsed by the melting of underlying ice resulting in contortion or folding of the sediments and sedimentary structures. Lacustrine sediments cap present topography. Compare - lake plain. SW & CF

collapsed outwash plain - An outwash plain which forms on glacial ice (inside the glacial margin), and is subsequently let down or collapsed when the underlying ice melts, resulting in contortion or folding of the sediments and sedimentary structures to the extent that little of the original plain or its gradient remain. Outwash sediments commonly cap present-day topography. Compare - collapsed lake plain, pitted outwash plain. SW & CF

collapse sinkhole – A type of sinkhole that is formed by collapse of a cave within the underlying soluble bedrock (e.g., limestone, gypsum, salt). Compare – solution sinkhole. SW, WW, & GG

colluvial - (adjective) Pertaining to material or processes associated with transportation and/or deposition by mass movement (direct gravitational action) and local, unconcentrated runoff (overland flow) on side slopes and/or at the base of slopes. Compare – alluvial, fluvial. HP

colluvial apron - A landform with a concave to planar surface composed of a thick wedge-shaped deposit of colluvium and/or slope alluvium that forms the base (footslope) of a bluff, escarpment or steep slope. Compare – beveled base. SW

colluvium - Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g. direct gravitational action) and by local, unconcentrated runoff. Compare - alluvium, slope alluvium, scree, talus, mass movement. HP

competence - The ability of a current of water or wind to transport sediment, in terms of particle size rather than amount, measured as the diameter of the largest particle transported. It depends upon velocity: a small but swift current for example, may have greater competence than a larger but slower moving current. GG

complex landslide [mass movement] – A category of mass movement processes, associated sediments (complex landslide deposit) or resultant landforms characterized by a composite of several mass movement processes none of which dominates or leaves a prevailing landform. Numerous types of complex landslides can be specified by naming the constituent processes evident (e.g. a *complex earth spread* – *earth flow* landslide). Compare – fall, topple, slide, lateral spread, flow, landslide. SW & DV

compound sinkhole – (not preferred) refer to karst valley.

cone karst – A variety of kegel karst topography, common in the tropics (e.g. Puerto Rico, Pacific Basin Islands) characterized by steep-sided, cone-shaped residual hills and ridges separated by star-shaped depressions, broader valleys, or lagoons. These hills and ridges have steep, convex side slopes and rounded tops that are dissected into secondary karst surfaces with shafts and various forms of karren microfeatures. Compare – karst cone, cockpit karst, fluviokarst, sinkhole karst, tower karst. SW & GG, WW

conformity - The mutual and undisturbed relationship between adjacent sedimentary strata that have been deposited in orderly sequence with little or no evidence of time lapses; true stratigraphic continuity in the sequence of beds without evidence that the lower beds were folded, tilted, or eroded before the higher beds were deposited. Compare – unconformity. GG

conglifraction - (not preferred) refer to frost shattering.

congliturbate - (not recommended) use cryoturbate.

congliturbation - (not recommended) use cryoturbation.

conglomerate - A coarse-grained, clastic sedimentary rock composed of rounded to subangular rock fragments larger than 2 mm, commonly with a matrix of sand and finer material; cements include silica, calcium carbonate, and iron oxides. The consolidated equivalent of gravel. Compare - breccia. HP

conservation terrace – An earthen embankment constructed across a slope for conducting water from above at a regulated flow to prevent accelerated erosion and to conserve water. Compare – hillslope terrace. SW & GSST

constructional [geomorphology] - (adjective) Said of a landform that owes its origin, form, position, or general character to depositional (aggradational) processes, such as the accumulation of sediment (e.g., alluvial fan, volcanic cone). Compare - aggradation, destructional, erosional. GG

continuous permafrost - Permafrost occurring everywhere beneath the exposed land surface throughout a geographic region. Compare - discontinuous permafrost, sporadic permafrost. NRC

continental glacier – A glacier of considerable thickness completely covering a large part of a continent or an area of at least 50,000 square km, obscuring the underlying surface, such as the ice sheets covering Antarctica or Greenland. Continental glaciers occupied northern portions of the coterminous USA and Alaska in the past (e.g., Pleistocene) and usage commonly implies former continental glacier conditions. Compare – alpine glacier. SW & GG

coppice mound (also called coppice dune) - (not recommended: obsolete) use shrub-coppice dune.

coprogenous earth [Soil Taxonomy] - A type of limnic layer (sedimentary peat) composed predominantly of fecal material derived from aquatic animals. ST

coprogenic material [soil survey] - The remains of fish excreta and similar materials that occur in some organic soils. GSST

corda – Small, tightly bunched, parallel ridges or corrugations of lava, commonly < 1 m in amplitude (high) and < 3 m in period (wide) on the surface of corded pahoehoe lava (ropy lava). SW & GS

corrosion [geomorphology] - A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation. GG

coulee - (colloquial: northwest USA, and ND) A dry or intermittent stream valley or wash with an underfit stream, especially a long, steep-walled gorge representing a Pleistocene overflow channel that carried meltwater from an ice sheet; e.g. the Grand Coulee in Washington State. HP

country rock - A general term for the non-igneous rock surrounding an igneous intrusion. GG

cove [coast] – a) [water] A small, narrow sheltered bay, inlet, creek or recess in an estuary, often inside a larger embayment. Compare – lagoon bottom. SSS & GG b) A small, often circular, wave-cut indentation in a cliff; it usually has a restricted or narrow entrance. c) A fairly broad, looped embayment in a lake shoreline. d) A shallow tidal river, or the backwater near the mouth of a tidal river. Compare - estuary. GG

cove [geom.] – a) A walled and rounded or cirque-like opening at the head of a small steep valley. b) (colloquial - southern Appalachians, USA) A smooth-floored, somewhat oval-shaped "valley" sheltered by hills or mountains; e.g., Cades Cove in eastern Tennessee. GG

coral island – a) A relict coral reef that stands above sea level and surrounded by water (e.g. Florida Keys). Carbonate sands rich in coral and shell fragments generally mantle the underlying flat coral platform. b) An oceanic island formed from coral accumulations lying atop or fringing volcanic peaks or platforms. SW & GG

cradle and knoll topography – (not recommended) use tree-tip pit and mound topography.

crag and tail – An elongate hill or ridge of subglacially streamlined drift, having at the stoss end (up-ice) a steep, often precipitous face or knob of ice-smoothed, resistant bedrock (the “crag”) obstructing the movement of the glacier, and at the lee end (down-ice) a tapering, streamlined, gentle slope (the “tail”) of intact, weaker rock and / or drift protected by the crag; also called lee-side cone. Compare – drumlin, drumlinoid ridge, flute, stoss and lee. GG, SW, & GM

crater [volcanic] - A basin-like, rimmed structure, usually at the summit of a volcanic cone. It may be formed by collapse, by an explosive eruption or by the gradual accumulation of pyroclastic material into a surrounding rim. Compare - caldera. GG

craton - A part of the earth's crust that has attained stability, and has been minimally deformed for a prolonged period. The term is now restricted to continental areas of largely Precambrian rocks. GG

creek [streams] – (not preferred, refer to intermittent stream) A general term used throughout the USA (except New England), Canada, and Australia for a small, intermittent stream that is larger than a brook but smaller than a river. GG

creep [mass movement] - The process, surficial sediments, (creep deposit) and/or landform that results from very slow downslope mass wasting of unconsolidated earthy material driven primarily by gravity, but facilitated by water saturation and by and freeze-thaw. Sometimes redundantly called soil creep. Compare - mudflow, flow, landslide, solifluction. SW

crest - (a) The commonly linear, narrow top of a ridge, hill, or mountain. It is appropriately applied to elevated areas where retreating backslopes are converging such that these high areas are almost exclusively composed of convex shoulders; (b) (not preferred) Sometimes used as an alternative for the hillslope component *summit*. Compare - summit (*part b*), saddle. FFP & SW

crest [geomorphology] – A geomorphic component of hills consisting of the convex slopes (perpendicular to the contour) that form the narrow, roughly linear top area of a hill, ridge, or other upland where shoulders have converged to the extent that little or no summit remains; dominated by erosion, slope wash and mass movement processes and sediments (e.g., slope alluvium, creep). Commonly, soils on crests are more similar to those on side slopes than to soils on adjacent interfluves. Compare – interfluve, head slope, side slope, nose slope. SW

crevasse [geomorphology] - (a) A wide breach or crack in the bank of a river or canal; especially one in a natural levee or an artificial bank of the lower Mississippi River. Compare - flood-plain splay, avulsion. (b)

A wide, deep break or fissure in the Earth after an earthquake. [glaciology] A deep, nearly vertical fissure, crack, or rift in a glacier or other mass of land ice. GG

crevasse filling - A short, straight ridge of stratified sand and gravel believed to have been deposited in a crevasse of a wasting glacier and left standing after the ice melted; a variety of kame. May also occur as long, sinuous ridges and linear complexes of till or drift. GG

crevasse splay - (not recommended) use flood-plain splay. Compare - crevasse.

cross-bedding - (a) Cross-stratification in which the cross-beds are more than 1 cm in thickness. (b) A cross-bedded structure; a cross-bed. Compare - cross-lamination. GG

cross-lamination - (a) Cross-stratification characterized by cross-beds that are less than 1 cm in thickness. (b) A cross-laminated structure; a cross-lamina. Compare - cross-bedding. GG

cross-stratification - Arrangement of strata inclined at an angle to the main stratification. This is a general term having two subdivisions; cross-bedding, in which the cross-strata are thicker than 1 cm, and cross-lamination, in which they are thinner than 1 cm. A single group of related cross-strata is a set and a group of similar, related sets is a coset. GG

cryoplanation - The reduction and modification of a land surface by processes associated with intensive frost action, such as solifluction, supplemented by the erosive and transport actions of running water, moving ice, and other agents. GG

cryoturbate - A mass of soil or other unconsolidated earthy material moved or disturbed by frost action, and usually coarser than the underlying material; especially a rubbly deposit formed by solifluction. GG

cryoturbation - A collective term used to describe all soil movements due to frost action, characterized by folded, broken and dislocated beds and lenses of unconsolidated deposits. Compare - pedoturbation. NRC

cryptogamic crust - A type of microbial crust consisting of a thin, biotic layer at the ground surface composed predominantly of cryptogams (i.e. algae, lichen, mosses, lichens and liverworts); most commonly found in semiarid or arid environments. Compare - microbial crust. SW & SS

cuesta - An asymmetric ridge capped by resistant rock layers of slight to moderate dip, commonly less than 10° (approximately < 15 percent); a homocline type produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope), that roughly parallels the inclined beds, and on the opposite side has a relatively short, steep or cliff-like slope (scarp slope) that cuts the tilted rocks. Compare – hogback, homoclinal ridge, mesa, dipslope, scarp slope, cuesta valley. SW & HP

cuesta valley - An asymmetric depression adjacent to a cuesta that lies parallel to the strike of the underlying strata; a type of strike valley. It's formed by differential erosion of weaker strata interbedded with, or stratigraphically adjacent to more resistant rocks. It may or may not contain a local drainage network but commonly lies above and is unconnected to the regional drainage system. Compare - cuesta, strike valley. SW

cut [geology] – A passage, incision, or space from which material has been excavated, such as a road cut or a railroad cut. GG

cut and fill – A *process* of leveling, whereby material eroded from one place by waves, currents, streams, or winds is deposited nearby until the surfaces of erosion and deposition are continuous and uniformly graded; especially lateral erosion on the concave banks of a meandering stream accompanied by deposition within its loops. Compare – flood-plain step, stream terrace, terrace. GG

cutbank – a) A slope or wall portion of a cut excavated into unconsolidated material (regolith) or bedrock, as in a borrow pit. It may stand nearly vertical resulting from collapse as the base is undercut during excavation

or by erosion, or it may be reduced by subsequent erosion to a more subdued angle by slope wash. Compare – cut, beveled cut, roadcut. SW b) (not preferred – refer to escarpment, meander scar, bluff) [colloquial – western USA] – A steep, bare slope formed by lateral migration of a stream. GG

cutoff [streams] - The new and relatively short channel formed when a stream cuts through a narrow strip of land and thereby shortens the length of its channel. GG

cutter [karst] – A dissolution groove or trench formed along vertical bedrock fractures beneath soil and usually buried beneath regolith with little or no ground surface expression, commonly wider than a solution fissure (widths commonly range from 0.5 to 3 meters) and tapering down to a crack or a bedrock floored trench; also called grike (not preferred), or subsurface karren. Compare – karren, solution fissure, solution corridor. SW & WW

cyclothem - A series of beds deposited during a single sedimentary cycle of the type that prevailed during the Pennsylvanian Period. It is an informal, lithostratigraphic unit equivalent to "formation". Cyclothems are typically associated with unstable shelf or interior basin conditions in which alternate marine transgression and regressions occur. The term has also been applied to rocks of different ages and of different lithologies from the Pennsylvanian cyclothems. Compare - rhythmite. GG

dead-ice - (not recommended) use stagnant ice.

dead-ice moraine - (not recommended) use disintegration moraine.

debris - Any surficial accumulation of loose material detached from rock masses by chemical and mechanical means, as by decay and disintegration. It consists of rock clastic material of any size and sometimes organic matter. GG

debris avalanche [mass movement] – The process, associated sediments (debris avalanche deposit) or resultant landform characterized by a very rapid to extremely rapid type of *flow* dominated by the sudden downslope movement of incoherent, unsorted mixtures of soil and weathered bedrock which, although comparatively dry, behave much as a viscous fluid when moving. Compare – debris flow, rock fragment flow, debris avalanche, earthflow, landslide. SW &

debris fall [mass movement] – The process, associated sediments (debris fall deposit) or resultant landform characterized by a rapid type of *fall* involving the relatively free, downslope movement or collapse of detached, unconsolidated material which falls freely through the air (lacks an underlying slip face); sediments have substantial proportions of both fine earth and coarse fragments; common along undercut stream banks. Compare – rock fall, soil fall, landslide. SW

debris flow [mass movement] - The process, associated sediments (debris flow deposit) or resultant landform characterized by a very rapid type of *flow* dominated by a sudden downslope movement of a mass of rock, soil, and mud (more than 50% of the particles are > 2mm), and whether saturated or comparatively dry, behaves much as a viscous fluid when moving. Compare – lahar, mudflow, landslide. SW

debris slide [mass movement] - The process, associated sediments (debris slide deposit) or resultant landform characterized by a rapid type of *slide*, composed of comparatively dry and largely unconsolidated earthy material which slides or rolls downslope (does not exhibit backward rotation) and resulting in an irregular, hummocky deposit somewhat resembling a moraine. Compare – rotational landslide, block glide, lateral spread, landslide. SW & GG

debris spread [mass movement] – The process, associated sediments (debris spread deposit) or resultant landforms characterized by a very rapid type of *spread* dominated by lateral movement in a soil and rock mass resulting from liquefaction or plastic flow of underlying materials that may be extruded out between intact units; sediments have substantial proportions of both fine earth and coarse fragments. Compare – earth spread, rock spread, landslide. SW & DV

debris topple [mass movement] – The process, associated sediments (debris topple deposit) or resultant landform characterized by a localized, very rapid type of *topple* in which large blocks of soil and rock material literally fall over, rotating outward over a low pivot point; sediments have substantial proportions of both fine earth and coarse fragments. Portions of the original material may remain intact, although reoriented, within the resulting debris pile. Compare – earth topple, rock topple, landslide. SW

deflation - The sorting out, lifting and removal of loose, dry, fine-grained soil particles (clays, silts, and fine sands) by the turbulent eddy action of the wind; a form of wind erosion. GG & GSST

deflation basin - A topographic basin excavated and maintained by wind erosion which removes unconsolidated material and commonly leaves a rim of resistant material surrounding the depression. Unlike a blowout, a deflation basin does not include adjacent deposits derived from the basin. Compare - blowout. GG

deflation flat - (colloquial – US Gulf Coast) A series of low ridges and troughs on an essentially flat surface on barrier islands formed by dune field migration during alternating wet and dry periods; a type of interdune. Troughs are eroded down to the wet sand level during drought periods (dune slack), while the ridges are stabilized by vegetation that invades the edge of dune fields during wet periods. Compare – blowout, deflation basin. HF

degradation [geomorphology] - The wearing down or away, and the general lowering of the land surface by natural processes of weathering and erosion (e.g., the deepening by a stream of its channel) and may infer the process of transportation of sediment. Compare - destructional. GG

Delmarva Bay – see Carolina Bay

delta - A body of alluvium, nearly flat and fan-shaped, deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, usually a sea or lake. HP

delta plain - The level or nearly level surface composing the land-ward part of a large delta; strictly, a flood plain characterized by repeated channel bifurcation and divergence, multiple distributary channels, and interdistributary flood basins. GG

dendritic drainage pattern - A common drainage pattern in which the tributaries join the gently curving mainstream at acute angles, resembling in plan view the branching habit of an oak or chestnut tree; it is produced where a consequent stream receives several tributaries which in turn are fed by smaller tributaries. It indicates streams flowing across horizontal rock strata and homogenous soil typified by the landforms of soft sedimentary rocks, volcanic tuff, old dissected coastal plains, or complex crystalline rocks offering uniform resistance to erosion. SW, WA, GG

deposit - Either consolidated or unconsolidated material of any type that has accumulated by natural processes or by human activity. SW

deposition - The laying down of any material by any agent such as wind, water, ice or by other natural processes. HP

depression - Any relatively sunken part of the Earth's surface; especially a low-lying area surrounded by higher ground. A closed depression has no natural outlet for surface drainage (e.g. a sinkhole). An open depression has a natural outlet for surface drainage. Compare – closed depression, open depression. GG

deranged drainage pattern – A distinctively disordered drainage pattern of nonintegrated streams which indicates a complete lack of underlying structural and bedrock control, resulting from a relatively young landscape having a flat or undulating topographic surface and a high water table. It is characterized by relatively few, irregular streams with few, short tributaries, that flow into and out of depressions containing swamps, bogs, marshes, ponds, or lakes; interstream areas are swampy. Regional streams may meander through the area but do not influence its drainage. These drainage patterns commonly occur on young, thick till plains, end moraines, flood plains, and coastal plains. SW, WA

desert pavement - A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments, mantling a desert surface. It is formed where wind action and sheetwash have removed all smaller particles or where coarse fragments have migrated upward through sediments to the surface. It usually protects the underlying, finer-grained material from further deflation. Compare – erosion pavement, stone line. SW, GSST & GG

desert varnish - (not preferred) refer to rock varnish.

destructional [geomorphology] - (adjective) Said of a landform that owes its origin, form, position, or general character to the removal of material by erosion and weathering (degradation) processes resulting from the wearing-down or away of the land surface. Compare - constructional. GG

detritus [geology] - A collective term for rock and mineral coarse fragments occurring in sediments, that are detached or removed by mechanical means (e.g. disintegration, abrasion) and derived from pre-existing rocks and moved from their place of origin. Compare - clastic, epiclastic, pyroclastic. GG

diamict - (not preferred; refer to diamicton) A general term that includes both diamictite (coherent rock) and diamicton (unconsolidated sediments). GG

diamictite - A general term for any nonsorted or poorly sorted, noncalcareous, terrigenous sedimentary *rock* (e.g., pebbly mudstone) containing a wide range of particle sizes. Compare - diamicton. GG

diamicton - A generic term for any nonlithified, nonsorted or poorly sorted *sediment* that contains a wide range of particle sizes, such as coarse fragments contained within a fine earth matrix (e.g. till) and used when the genetic context of the sediment is uncertain. Compare - diamictite. SW & GG

diapir - A dome or anticlinal fold in which the overlying rocks or sediments have been ruptured by the squeezing-out of plastic core material. Diapirs in sedimentary strata usually contain cores of salt or shale; igneous intrusions may also show diapiric structure. GG

diatomaceous earth - A geologic deposit of fine, grayish, siliceous material composed chiefly or wholly of the remains of diatoms. It may occur as a powder or a rigid material. Also called diatomaceous materials. GSST

diatrema – A breccia-filled volcanic pipe that was formed by a gaseous explosion (e.g. hydrovolcanic eruption); commonly, but not exclusively associated with exposed throat or neck of maar, as in the Hopi Buttes area of Arizona. Compare – neck [volcanic]. SW & GG

dike [intrusive rocks] - A tabular igneous intrusion that cuts across the bedding or foliation of the country rock. Compare - sill. GG

dip – [soil survey] A geomorphic component (characteristic piece) of flat plains (e.g., lake plain, low coastal plain, low-relief till plain) consisting of a shallow and typically closed depression that tends to be an area of focused groundwater recharge but not a permanent water body and that lies slightly lower and is wetter than the adjacent talf, and favors the accumulation of fine sediments and organic materials. SW

dip - The maximum angle that a structural surface, (e.g. a bedding or fault plane) makes with the horizontal, measured perpendicular to the strike of the structure and in the vertical plane; used in combination with “dip” to describe the orientation of bedrock strata. SW & GG

dip slope - A slope of the land surface, roughly determined by and approximately conforming to the dip of underlying bedded rocks; (i.e. the long, gently inclined surface of a cuesta). Compare - scarp slope. HP

discontinuity - [stratigraphy] Any interruption in sedimentation, whatever its cause or length, usually a manifestation of nondeposition and accompanying erosion; an unconformity. GG

discontinuous permafrost - Permafrost occurring in some areas beneath the exposed land surface throughout a geographic region where other areas are free of permafrost. Compare - continuous permafrost, sporadic permafrost. NRC

disintegration moraine - A drift topography characterized by chaotic mounds and pits, generally randomly oriented, developed in supraglacial drift by collapse and flow as the underlying stagnant ice melted. Slopes may be steep and unstable and there will be used and unused stream courses and lake depressions interspersed with the morainic ridges. Characteristically, there are numerous abrupt, lateral and vertical changes between unconsolidated materials of differing lithology. SJ & SW

distal [sedimentology] - (adjective) Said of a sedimentary deposit consisting of fine clastics and deposited farthest from the source area. Compare - proximal. GG

distributary [streams] - (a) A divergent stream flowing away from the main stream and not returning to it, as in a delta or on a flood plain. It may be produced by stream deposition choking the original channel. (b) One of the channels of a braided stream; a channel carrying the water of a stream distributary. GG

ditch - An open and usually unpaved (unlined), channel or trench excavated to convey water for drainage (removal) or irrigation (addition) to or from a landscape; smaller than a canal; some ditches are modified natural waterways. GG

divide - A summit area or tract of high ground, which can vary from broad to narrow, or a line of separation that constitutes a watershed boundary between adjacent drainage basins; a divide separates surface waters that flow naturally in one direction from those that flow in a different or opposite direction. Compare – interfluvium. GG

doline – (not preferred; refer to synonym “sinkhole”)

doline karst – (not preferred) refer to sinkhole karst.

dolomite [mineral] - A common rock-forming rhombohedral carbonate mineral: $\text{CaMg}(\text{CO}_3)_2$. GG

dolomite [rock] -A carbonate sedimentary rock consisting chiefly (more than 50 percent by weight or by areal percentages under the microscope) of the mineral dolomite. GG

dolostone - (not recommended - use dolomite) An obsolete term proposed for the sedimentary rock called dolomite, in order to avoid confusion with the mineral of the same name. Compare - dolomite. GG

dome - (a) [structural geology] An uplift or anticlinal structure, either circular or elliptical in outline, in which the rocks dip gently away in all directions. A dome may be small (e.g. a salt dome) or many kilometers in diameter. (b) [geomorphology] A landform that is a smoothly rounded rock mass such as a rock-capped mountain summit that roughly resembles a building dome. (e.g., the rounded granite peaks of Yosemite, CA). GG

double-bedding mound – Raised, linear mounds with subdued, convex slope cross-sections constructed by mounding and shaping spoil material dredged from adjacent drainage ditches and placed over natural soil. The mounds serve as preferred, better-drained bedding areas for managed timber plantations; common in the lower coastal plains of the Atlantic and Gulf coasts, USA. SW

drainage basin - A general term for a region or area bounded by a drainage divide and occupied by a drainage system. GG

drainage network - (not preferred) refer to drainage pattern.

drainage pattern - The configuration or arrangement, in plan view, of stream courses in an area, including gullies or first-order channelized flow areas, higher order tributaries, and main streams. Drainage pattern is

related to local geologic materials and structure, geomorphologic features, and geomorphic history of an area; major drainage pattern types include dendritic, trellis, artificial, etc. Also called drainage network. SW, GG, WA

drainageway - (a) A general term for a course or channel along which water moves in draining an area. GG; (b) [soil survey] a term restricted to relatively small, roughly linear or arcuate depressions that move concentrated water at some time, and either lack a defined channel (e.g. head slope, swale) or have a small, defined channel (e.g. low order streams). SW

drainhead complex – An irregular series of low, broad depressions that form the uppermost reaches of surface drainage networks in low relief / low gradient terrain such as coastal plains, and separated by slightly higher and drier areas (e.g. flatwoods). They characteristically lack defined stream channels but contribute surface water to the drainage system further downstream through a network of subtle topographic lows. SW

draw - A small, natural watercourse cut in unconsolidated materials, generally more open with a broader floor and more gently sloping sides than an arroyo, ravine or gulch, and whose present stream channel may appear inadequate to have cut the drainageway that it occupies. SW

dredged channel - A roughly linear, deep water area formed by a dredging operation for navigation purposes (after Wells et al., 1994; dredged hole). Compare – dredge-deposit shoal. SSS

dredge-deposit shoal - A subaqueous area, substantially shallower than the surrounding area that resulted from the deposition of materials from dredging and dumping (modified from Demas 1998). Compare – dredged channel, shoal. SSS

dredge spoils – Unconsolidated, randomly mixed sediments composed of rock, soil, and/or shell materials extracted and deposited during dredging and dumping activities. Dredge spoils lie unconformably upon natural, undisturbed soil or regolith and can form anthropogenic landforms (e.g. dredge spoil bank). SW

dredge spoil bank - A subaerial mound or ridge that permanently stands above the water composed of dredge spoils; randomly mixed sediments deposited during dredging and dumping. Compare – dredged channel, dredge-deposit shoal, filled marshland. SW

drift [glacial geology] - A general term applied to all mineral material (clay, silt, sand, gravel, boulders) transported by a glacier and deposited directly by or from the ice, or by running water emanating from a glacier. Drift includes unstratified material (till) that forms moraines, and stratified deposits that form outwash plains, eskers, kames, varves, and glaciofluvial sediments. The term is generally applied to Pleistocene glacial deposits in areas that no longer contain glaciers. GG

dropstone - An oversized stone (compared to the matrix sediments) in laminated sediment that depresses the underlying laminae and can be covered by “draped laminae”. Most dropstones originate through ice-rafting; another source is floating tree roots. Compare - erratic, ice-rafting. GG

drumlin - A low, smooth, elongated oval hill, mound, or ridge of compact till that has a core of bedrock or drift. It usually has a blunt nose facing the direction from which the ice approached and a gentler slope tapering in the other direction. The longest axis is parallel to the general direction of glacier flow. Drumlins are products of streamline (laminar) flow of glaciers, which molded the subglacial floor through a combination of erosion and deposition. Compare – drumlinoid ridge. SW, HP, & GG

drumlin field - Groups or clusters of closely spaced drumlins or drumlinoid ridges, distributed more or less en echelon, and commonly separated by small, marshy tracts or depressions (interdrumlins). SW

drumlinoid ridge – A rock drumlin or drift deposit whose form approaches but does not fully attain that of a classic drumlin, even though it seemingly results from similar processes of moving ice. Compare – drumlin, interdrumlin. SW & GG

dry wash - (not preferred - refer to wash). A dry, ephemeral stream channel, especially in semiarid regions which only moves water in response to intense, infrequent precipitation. Compare - arroyo. SW

dump – An area of smooth or uneven accumulations or piles of waste rock, earthy material, or general refuse that without major reclamation are incapable of supporting plants. Compare – sanitary landfill, fill. GSST

dune - A low mound, ridge, bank or hill of loose, windblown, subaerially deposited granular material (generally sand), either barren and capable of movement from place to place, or covered and stabilized with vegetation, but retaining its characteristic shape. (See barchan dune, parabolic dune, parna dune, shrub-coppice dune, seif dune, transverse dune). SW & GG

dune field – An assemblage of moving and/or stabilized dunes, together with sand plains, interdune areas, and the ponds, lakes, or swamps produced by the blocking of waterways by migrating dunes. See dune lake. SW & SSS

dune lake – (a) A lake occupying a deflation basin as in a blowout on a dune. (b) A lake occupying a basin formed by the blocking of a stream by sand dunes migrating along a shore (e.g. Moses lake, WA). GG

dune slack – A damp depression or trough between dunes in a dune field or dune ridges on a shore, caused by intersecting the capillary fringe of the local water table; a moist type of interdune. Compare – interdune, dune lake. SW & GG

elevation [survey] - The height of a point on the earth's surface relative to mean sea level (msl). Compare - relief. SW

elevated lake plain - (not preferred) refer to collapsed lake plain, collapsed ice-floored lakebed.

elliptical gilgai – A type of gilgai dominated by elliptical, closed and semi-closed depressions (micro-lows) separated by low mounds or ridges (micro-highs); the prevailing type of gilgai on mildly sloping terrain (slopes 3 – 8 %); as slope increases, basins become more eccentric and the occurrence of interconnected micro-lows increases. Compare – circular gilgai, linear gilgai, gilgai. SW

end moraine - A ridge-like accumulation that is being or was produced at the outer margin of an actively flowing glacier at any given time; a moraine that has been deposited at the outer or lower end of a valley glacier. Compare - terminal moraine, recessional moraine, ground moraine. GG

Eocene - An epoch (from 35.4 to 56.5 million years ago) of the Tertiary Period of geologic time that follows the Paleocene and precedes the Oligocene epoch; also the corresponding (time-stratigraphic) “series” of earth materials. SW

eolian - Pertaining to material transported and deposited (eolian deposit) by the wind. Includes clastic materials such as dune sands, sand sheets, loess deposits, and clay (e.g. parna). HP

eolian deposit [soil survey] – Sand, silt or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess. Conventionally, primary volcanic deposits (e.g. tephra) are handled separately. Compare – loess, parna, beach sands. SW

eolian sands [soil survey] - Sand-sized, clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sand sheet. Compare - beach sands. SW

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erosional outlier - (not preferred) refer to erosion remnant.

erosional pavement – see erosion pavement.

erosion pavement – A surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further erosion. Compare – desert pavement, stone line. SW, GSST, GG

erosion remnant - A topographic feature that remains or is left standing above the general land surface after erosion has reduced the surrounding area; e.g., a monadnock, a butte, or a stack. GG

erosion surface - A land surface shaped by the action of erosion, especially by running water. GG

erratic - A rock fragment carried by glacial ice, or by floating ice (ice-rafting), and subsequently deposited at some distance from the outcrop from which it was derived, and generally, though not necessarily, resting on bedrock or sediments of different lithology. Coarse fragments range in size from a pebble to a house-size block. GG

escarpment - A relatively continuous and steep slope or cliff produced by erosion or faulting and that topographically interrupts or breaks the general continuity of more gently sloping land surfaces. The term is most commonly applied to cliffs produced by differential erosion. Synonym: "scarp." SW & HP

esker - A long, narrow, sinuous and steep-sided ridge composed of irregularly stratified sand and gravel deposited as the bed of a stream flowing in an ice tunnel within or below the ice (subglacial) or between ice walls on top of the ice of a wasting glacier, and left behind as high ground when the ice melted. Eskers range in length from less than a kilometer to more than 160 kilometers, and in height from 3 to 30 meters. Compare - kame, crevasse filling, glaciofluvial deposits, outwash. SW

estuarine deposit - Fine-grained sediments (very fine sand, silt and clay) of marine and fluvial origin commonly containing decomposed organic matter, laid down in the brackish waters of an estuary; characteristically finer sediments than deltaic deposits. Compare – fluviomarine deposit, lacustrine deposit, lagoonal deposit, marine deposit, overbank deposit. GG

estuarine subaqueous soils - Soils that form in sediment found in shallow-subtidal environments in protected estuarine coves, bays, inlets, and lagoons. Excluded from the definition of these soils are any areas “permanently covered by water too deep (typically greater than 2.5 m) for the growth of rooted plants”. SSS

estuary - (a) A seaward end or the widened funnel-shaped tidal mouth of a river valley where fresh water comes into contact with seawater and where tidal effects are evident; e.g., a tidal river, or a partially enclosed coastal body of water where the tide meets the current of a stream. (b) A portion of an ocean or an arm of the sea affected by fresh water. (c) A drowned river mouth formed by the subsidence of land near the coast or by the drowning of the lower portion of a non-glacial valley due to the rise of sea level. Compare – lagoon. GG

everglades – (colloquial – southern USA) A large expanse of marshy land, covered mostly by grasses, e.g. the Florida Everglades. GG

exfoliation - The process by which concentric scales, plates, or shells of rock, from less than a centimeter to several meters in thickness, are successively spalled or stripped from the bare surface of a large rock mass. It often results in a rounded rock mass or dome-shaped hill. GG

exhumed - (adjective) Formerly buried landforms, geomorphic surfaces, or paleosols that have been re-exposed by erosion of the covering mantle. Compare - relict, buried, ground soil. HP

extramorainic - (not preferred) refer to extramorainal

extramorainal - (adjective) Said of deposits and phenomena occurring outside the area occupied by a glacier and its lateral and end moraines. Compare - intramorainal. GG

extrusive - (adjective) Said of igneous rocks and sediments derived from deep-seated molten matter (magmas), deposited and cooled on the earth's surface (e.g. including lava flows and tephra deposits). Compare - intrusive, volcanic. HP

faceted spur - The inverted V-shaped end of a ridge that has been truncated or steeply beveled by steam erosion (e.g. meander scar or bluff), glacial truncation, or fault scarp displacement. Compare - spur. SW

facies [stratigraphy] - A distinctive group of characteristics that distinguish one group from another within a stratigraphic unit; the sum of all primary lithologic and paleontological characteristics of sediments or sedimentary rock that are used to infer its origin and environment; the general nature of appearance of sediments or sedimentary rock produced under a given set of conditions; e.g.: contrasting river-channel facies and overbank-flood-plain facies in alluvial valley fills. HP

fall [mass movement] - (a) A category of mass movement processes, associated sediments (fall deposit), or resultant landforms (e.g., rock fall, debris fall, soil fall) characterized by very rapid movement of a mass of rock or earth that travels mostly through the air by free fall, leaping, bounding, or rolling, with little or no interaction between one moving unit and another. Compare – topple, slide, lateral spread, flow, complex landslide, landslide. SW & DV; (b) The mass of material moved by a fall. GG

falling dune – An accumulation of sand that is formed as sand is blown off a mesa top or over a cliff face or steep slope, forming a solid wall, sloping at the angle of repose of dry sand, or a fan extending downward from a re-entrant in the mesa wall. Compare – climbing dune, sand ramp. GG

fall line - (not recommended; obsolete) An imaginary line or narrow zone connecting the water falls on several adjacent or near-parallel rivers, marking the points where these rivers make a sudden descent from an upland to a lowland, as at the edge of a plateau; specifically, the Fall Line marking the boundaries between the ancient, resistant crystalline rocks of the Piedmont Plateau and the younger, softer sediments of the Atlantic Coastal Plain of the Eastern United States. It also marks the limit of navigability of the rivers. Now considered an archaic term because Coastal Plain materials occur several miles west or inland of the Fall Line and current research is showing it to be a broad zone of high-angle reverse faults. GG

fan [geomorphology] - (a) A gently sloping, fan-shaped mass of detritus forming a section of a low-angle cone commonly at a place where there is a notable decrease in gradient; specifically an alluvial fan (not preferred – use alluvial fan). Compare – alluvial fan, alluvial cone. (b) A fan-shaped mass of congealed lava that formed on a steep slope by the continually changing direction of flow. GG

fan apron - A sheet-like mantle of relatively young alluvium and soils covering part of an older fan piedmont (and occasionally alluvial fan) surface, commonly thicker and further down slope (e.g., mid-fan or mid-fan piedmont) than a fan collar. It somewhere buries an older soil that can be traced to the edge of the fan apron where the older soil emerges as the land surface, or relict soil. No buried soils should occur within a fan-apron mantle itself. Compare – fan collar. FFP

fan collar – A landform comprised of a thin, short, relatively young mantle of alluvium along the very upper margin (near the proximal end or apex) of a major alluvial fan. The young mantle somewhere buries an older soil that can be traced to the edge of the collar where the older soil emerges at the land surface as a relict soil. Compare – fan apron. FFP

fanglomerate - A sedimentary rock consisting of waterworn, heterogeneous fragments of all sizes, deposited in an alluvial fan and later cemented into a firm rock. GG

fanhead trench - A linear depression formed by a drainageway that is incised considerably below the surface of an alluvial fan. GG

fan piedmont - The most extensive landform on piedmont slopes, formed by (a) the lateral, downslope, coalescence of mountain-front alluvial fans into one generally smooth slope with or without the transverse undulations of the semi-conical alluvial fans, and (b) accretions of fan aprons. FFP

fan remnant - A general term for landforms that are the remaining parts of older fan-landforms, such as alluvial fans, fan aprons, inset fans, and fan skirts, that either have been dissected (erosional fan-remnants) or partially buried (nonburied fan-remnants). An erosional fan remnant must have a relatively flat summit that is a relict fan-surface. A nonburied fan-remnant is a relict surface in its entirety. Compare – eroded fan remnant, ballena. FFP.

fan remnant sideslope – (not preferred) refer to eroded fan-remnant sideslope.

fan skirt - The zone of smooth, laterally-coalescing, small alluvial fans that issue from gullies cut into the fan piedmont of a basin or that are coalescing extensions of the inset fans of the fan piedmont, and that merge with the basin floor at their toeslopes. These are generally younger fans which onlap older fan surfaces. FFP

fan terrace - (not preferred) refer to fan remnant

fault - A discrete surface (fracture) or zone of discrete surfaces separating two rock masses across which one mass has slid past the other. GG

fault block - A displaced crustal unit, formed during block faulting, that is bounded by faults, either completely or in part, and behaves as a coherent unit during tectonic activity. SW & GG

fault-block mountains - Mountains that formed primarily by block faulting, and commonly exhibit asymmetrical rotation and vertical displacement from a horizontal plane by large, coherent fault-block units hinged along fault lines; common in , but not limited to, the Basin and Range region of the US.. The term is not applied to mountains formed by thrust-faulting. SW & GG

fault line - The trace of a fault plane on the ground surface or on a reference plane. Compare - fault-line scarp. GG

fault-line scarp - (a) A steep slope or cliff formed by differential erosion along a fault line, as by the more rapid erosion of soft rock on the side of a fault as compared to that of more resistant rock on the other side; e.g. the east face of the Sierra Nevada in California. (b) (not recommended) A fault scarp that has been modified by erosion. This usage is not recommended because the scarp is usually not located on the fault line. GG

fault zone – A fault that is expressed as a zone of numerous small fractures or of breccia or fault gouge. A fault zone may be as wide as hundreds of meters. Compare – fault, fault-scarp. GG

felsenmeer - refer to block field. GG

felsic rock - A general term for igneous rock containing abundant, light-colored minerals (granite, etc); also applied to those minerals (quartz, feldspars, feldspathoids, muscovite) as a group. Compare - mafic rock. GG

fen - Waterlogged, spongy ground containing alkaline decaying vegetation, characterized by reeds, that develops into peat. It sometimes occurs in sinkholes of karst regions. Compare - bog, marsh, swamp. GG

fenster – see window.

fill [eng. geol] – (a) Human-constructed deposits of natural earth materials (e.g., soil, gravel, rock) and waste materials (e.g., tailings or spoil from dredging) used to fill a depression, to extend shore land into a body of water, or in building dams. (b) Soil or loose rock used to raise the surface level of low-lying land, such as an embankment to fill a hollow or ravine in roads construction. GG

filled marshland - A subaerial soil area composed of fill materials (construction debris, dredged or pumped sandy or shell-rich sediments, etc.) deposited and smoothed to provide building sites and associated uses (e.g. lawns, driveways, parking lots). These fill materials are typically 0.5 to 3 m thick and have been deposited unconformably over natural soils. Compare – dredge spoil bank. SW

finger ridge – One in a group of small, tertiary spur ridges that form crudely palmate extensions of erosional remnants along the flanks or nose of larger ridges. Compare – ballena, rib. SW

first bottom - (not recommended; colloquial: Midwest USA) refer to flood-plain step. An obsolete, informal term loosely applied to the lowest flood-plain steps that experience regular flooding. However, the frequency of flooding is inconsistently specified. SW

fissure vent – An opening in earth's surface of a volcanic conduit in the form of a crack or fissure rather than a localized crater; a roughly linear crack or area along which lava, generally mafic and of low viscosity, wells up to the surface, usually without any explosive activity. The results can be an extensive lava plateau (e.g. Columbia River Plateau). Compare – crater [volcanic]. SW & GG

fjord - A long, narrow, winding, glacially eroded, U-shaped and steep-walled, generally deep inlet or arm of the sea between high rocky cliffs of slopes along a mountainous coast. Typically it has a shallow sill or threshold of solid rock or earth material submerged near its mouth and becomes deeper far inland. A fjord usually represents the seaward end of a deep, glacially excavated valley that is partially submerged by drowning after melting of the ice. GG

flat -[geomorphology] - (a) (adjective) Said of an area characterized by a continuous surface or stretch of land that is smooth, even, or horizontal, or nearly so, and that lacks any significant curvature, slope, elevations, or depressions. (b) (noun) An informal, generic term for a level or nearly level surface or small area of land marked by little or no local relief. Compare - mud flat. (c) (not recommended) A nearly level region that visibly displays less relief than its surroundings. GG.

flat - [lake] (a) (not preferred) refer to lakebed. The low-lying, exposed, flat land of a lake delta or of a lake bottom. Compare - lake plain. (b) (not preferred) The flat bottom of a desiccated lake in the arid parts of western USA. Compare - playa, pluvial lake. GG

flatwoods – (colloquial – southeastern US) Broad, low gradient (generally < 1 % slope but up to 2% near drainageways), low relief interstream areas and characterized by non-hydric, poorly drained soils (seasonal saturation or water table) at depths of 15 -45 cm (6 – 18”), and naturally forested by pines that dominate the Lower Coastal Plain of the southeastern US. Regional differences occur in dominant vegetation and soil material (e.g. in south Florida, soils are dominantly sandy Spodosols and the understory is dominantly saw palmetto). Hydopedologically and elevationally this landform occurs slightly above minor depressions (which have a seasonal water table at or above the surface), drainageways, and drainhead complexes, but lies below better drained and slightly higher small rises or knolls. Generally they are most extensive toward the interiors of low, broad interstream divides and away from drainageways. SW

flood plain - The nearly level plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the streams. HP

flood-plain landforms - A variety of constructional and erosional features produced by stream channel migration and flooding, e.g., backswamp, braided stream, flood-plain splay, meander, meander belt, meander scroll, oxbow lake, and natural levee. HP

flood-plain playa - A landform consisting of very low gradient, broad, barren, axial-stream channel segments in an intermontane basin. It floods broadly and shallowly and is veneered with barren fine-textured sediment that crusts. Commonly, a flood-plain playa is segmented by transverse, narrow bands of vegetation, and it may alternate with ordinary narrow or braided channel segments. FFP

flood-plain splay - A fan-shaped deposit or other outspread deposit formed where an overloaded stream breaks through a levee (natural or artificial) and deposits its material (often coarse-grained) on the flood plain. Compare - crevasse. GG

flood-plain step - An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by flood water from the present stream (e.g., below the 100 year flood level); any approximately horizontal surface still actively modified by fluvial scour and/or deposition (i.e., cut and fill and/or scour and fill processes). May occur individually or as a series of steps. Compare – stream terrace. SW & RR

flood-tidal delta - A largely subaqueous (sometimes intertidal), crudely fan-shaped deposit of sand-sized sediment formed on the landward side of a tidal inlet (modified from Boothroyd et al., 1985; Davis, 1994; Ritter et al., 1995). Flood tides transport sediment through the tidal inlet and into the lagoon over a flood ramp where currents slow and dissipate (Davis, 1994). Generally, flood-tidal deltas along microtidal coasts are multi-lobate and unaffected by ebbing currents (modified from Davis, 1994). Compare – flood-tidal delta slope. SSS

flood-tidal delta flat - The relatively flat, dominant component of the flood-tidal delta. At extreme low tide this landform may be exposed for a relatively short period (modified from Boothroyd et al., 1985). SSS

flood-tidal delta slope - An extension of the flood-tidal delta that slopes toward deeper water in a lagoon or estuary, composed of flood channels, inactive lobes (areas of the flood-tidal delta that are not actively accumulating sand as a result of flood tides), and parts of the terminal lobe of the flood-tidal delta (modified from Boothroyd et al., 1985). SSS

floodwall - (not recommended) use levee.

floodway – a) A large-capacity channel constructed to divert floodwaters or excess streamflow from populous, flood-prone areas, such as a bypass route bounded by levees. b) The part of the flood plain kept clear of encumbrances and reserved for emergency diversion of floodwaters. GG

floor [geomorphology] - (a) A general term for the nearly level, lower part of a basin or valley; (not preferred) refer to basin floor, valley floor, (b) The bed of any body of water; e.g., the nearly level surface beneath the water of a stream, lake, or ocean. GG

flow [mass movement] - A category of mass movement processes, associated sediments (flow deposit) and landforms characterized by slow to very rapid downslope movement of unconsolidated material which, whether saturated or comparatively dry, behaves much as a viscous fluid as it moves. Types of flows can be specified based on the dominant particle size of sediments (i.e. debris flow (e.g., lahar), earth flow (creep, mudflow), rock fragment flow (e.g., rockfall avalanche), debris avalanche]. Compare - fall, topple, slide, lateral spread, complex landslide, landslide. SW & DV

flowtill - A till, commonly supraglacial that is modified and transported by plastic mass flow; also spelled *flow till*. Compare - ablation till, basal till, lodgment till, mass-movement till, slump-till, supraglacial melt-out till. GG

flute [glacial] - A lineation or streamlined furrow or ridge parallel to the direction of ice movement, formed in newly deposited till or older drift. They range in height from a few centimeters to 25 m, and in length from a few meters to 20 km. Compare – glacial groove. GG

fluve - (refer to drainageway) A roughly linear or elongated depression (topographic low) of any size, along which water flows, at some time. Compare - interfluve. FFP & SW.

fluvial – (adjective) Of or pertaining to rivers or streams; produced by stream or river action. Compare – alluvial, colluvial. HP

fluviokarst – A karst landscape dominated by both 1) karst features (deranged and subsurface drainage, blind valleys, swallow holes, large springs, closed depressions, and caves), generally limited to low-lying interfluvial areas, and 2) surface drainage by large rivers, with associated fluvial features (adjacent stream terraces) and sediments (alluvium), that commonly maintain their surface courses and are fed by underground tributaries; the dominant karst in the eastern USA. Compare – sinkhole karst, pavement karst, glaciokarst, karst. SW, WW, & GG

fluviomarine bottom - The nearly level or slightly undulating, relatively low-energy, depositional environment with relatively deep water (1.0 to >2.5 m) directly adjacent to an incoming stream and composed of interfingering and mixed fluvial and marine sediments (fluviomarine deposits). SSS

fluviomarine deposit – Stratified materials (clay, silt, sand, or gravel) formed by both marine and fluvial processes, resulting from non-tidal sea level fluctuations, subsidence and/or stream migration (i.e. materials originally deposited in a nearshore environment and subsequently reworked by fluvial processes as sea level fell). Compare – estuarine deposit, lacustrine deposit, lagoonal deposit, marine deposit, overbank deposit. SW

fluviomarine terrace – A constructional coastal strip, sloping gently seaward and/or down valley, veneered or completely composed of fluviomarine deposits (typically silt, sand, fine gravel). Compare – terrace, stream terrace, marine terrace. SW

fly ash – All particulate matter that is carried in a gas stream, especially in stack gases at a coal-fired plant for the generation of electric power; also name given to sediments from the same source, stock piled in settling ponds or spoil piles. SW & GG

fold [structural geology] - A curve or bend of a planar structure such as rock strata, bedding planes, foliation, or cleavage. GG

foothills - A steeply sloping upland composed of hills with relief of 30 up to 300 meters and fringes a mountain range or high-plateau escarpment. Compare - hill, mountain, plateau. SW & HP

footslope - The hillslope profile position that forms the concave surface at the base of a hillslope. It is a transition zone between upslope sites of erosion and transport (shoulder, backslope) and downslope sites of deposition (toeslope). Compare - summit, shoulder, backslope, and toeslope. SW

foredune - A coastal dune or dune ridge oriented parallel to the shoreline, occurring at the landward margin of the beach, along the shoreward face of a beach ridge, or at the landward limit of the highest tide, and more or less stabilized by vegetation. GG

formation [stratigraphy] - The basic lithostratigraphic unit in the local classification of rocks. A body of rock (commonly a sedimentary stratum or strata, but also igneous and metamorphic rocks) generally characterized by some degree of internal lithologic homogeneity or distinctive lithologic features (such as chemical composition, structures, textures, or general kind of fossils), by a prevailing (but not necessarily tabular) shape, and is mappable at the earth's surface (at scales of the order of 1:25,000) or traceable in the subsurface. Formation may be combined into Groups or subdivided into members. Compare - bed. HP

fosse [glacial geology] - A long, narrow depression or trough-like hollow between the edge of a retreating glacier and the wall of its valley, or between the front of a moraine and its outwash plain. GG

free face - The part of a hillside or mountainside consisting of an outcrop of bare rock (scarp or cliff) that sheds colluvium to slopes below and commonly stands more steeply than the angle of repose of the colluvial slope (e.g. talus slope) immediately below. SW & GG

free face [geomorphology] – A geomorphic component of hills and mountains consisting of an outcrop of bare rock that sheds rock fragments and other sediments to, and commonly stands more steeply than the angle of repose of, the colluvial slope immediately below; most commonly found on shoulder and backslope

positions, and can comprise part or all of a nose slope or side slope. Compare – interfluve, crest, nose slope, side slope, head slope, base slope. SW

freshwater marl – A soft, grayish to white, earthy or powdery, usually impure calcium carbonate precipitated on the bottoms of present-day freshwater lakes and ponds largely through the chemical action of algal mats and organic detritus, or forming deposits that underlie marshes, swamps, and bogs that occupy the sites of former (glacial) lakes. The calcium carbonate may range from 90% to less than 30%. Freshwater marl is usually gray; it has been used as a fertilizer for acid soils deficient in lime. Syn.: *bog lime*. Compare – marl, coastal marl. SW

fringe-tidal marsh - Narrow salt marsh adjacent to a relatively higher energy environment. SSS

frost boil - A small mound of fresh soil material formed by frost action. A type of nonsorted circle commonly found in fine-grained sediment underlain by permafrost, or formed in areas affected by seasonal frost. Compare - patterned ground. NRC

frost bursting - (not recommended) use frost shattering.

frost churning - (not recommended) use cryoturbation.

frost polygons - (not recommended) use (periglacial) patterned ground.

frost riving - (not recommended) use frost shattering.

frost shattering - The mechanical disintegration, splitting, or breakup of a rock or soil caused by the pressure exerted by freezing water in cracks or pores, or along bedding planes. Sometimes referred to as congelifraction. GG

frost splitting - (not recommended) use frost shattering.

frost stirring - (not recommended) use cryoturbation.

frost weathering - (not recommended) use frost shattering.

frost wedging - (not recommended) use frost shattering.

furrow – A linear or arcuate opening left in the soil after a plow or disk has opened a shallow channel at the soil surface. A shallow channel cut in the soil surface, usually between planted rows for controlling surface water and soil loss, or for conveying irrigation water. GSST

gap - A sharp break or opening in a mountain ridge, or a short pass through a mountain range; e.g., a wind gap. GG

gelifraction - (not recommended) use frost shattering.

gelivation - (not recommended) use frost shattering.

geomorphic component - A fundamental, three dimensional piece or area of a geomorphic setting (i.e., hills, mountains, terraces, flat plains) that has unique and prevailing kinetic energy dynamics and sediment transport conditions which result in their characteristic form, patterns of sedimentation and soil development. SW

geomorphic component - flat plains: - A group of fundamental, three dimensional pieces or areas of flat plains. In descending elevational order, the geomorphic components of a simple, flat plain (e.g. lake plain, low coastal plain, etc.) are the *rise* [a broad, slightly elevated area with comparatively greater gradients (e.g., 1-3% slopes)], and the *talf* [a comparatively level (e.g., 0-1% slopes), laterally extensive, non-fluvial area], and

dip [a slight depression that is not a permanent water body nor part of an integrated drainage network].

Compare - geomorphic component - terraces. SW

geomorphic component - hills: - A set of fundamental, three-dimensional areas and positions that geomorphically define a hill or ridge. In descending topographic order, the geomorphic components are *interfluvium* (stable summit area); *crest* (unstable summit -converged shoulders); three geometric slope areas defined by plan shape and its influence on overland flow and throughflow: These are: *head slope* (convergent flow), *side slope* (parallel flow), and *nose slope* (divergent flow); *free face* (rock outcrop); and *base slope* (concave accretion area (colluvium / slope alluvium) at hill bottom). SW

geomorphic component - mountains: - A group of fundamental, three dimensional pieces or areas of mountains. In descending elevational order, the geomorphic components of a simple mountain are the *mountaintop* (roughly analogous to the crest or summit); *mountainflank* (the long slope along the sides of mountains which can be further subdivided into three portions based on the relative slope location: *upper third-*, *middle third-*, or *lower third mountainflank*); *free face* (rock outcrop); and the *mountainbase* (colluvium / slope alluvium apron at the bottom of the mountain). SW

geomorphic component – terraces, stepped landforms: - A group of fundamental, three dimensional pieces or areas of terraces, flood-plain steps, and other stepped landforms (e.g. stacked lava flow units). In descending elevational order, the geomorphic components are the *tread* (the level to gently sloping, laterally extensive top of a terrace, flood-plain step, or other stepped landform); and the *riser* (the comparatively short escarpment forming the more steeply sloping edge that descends to another level or a channel). SW

geomorphic surface - A mappable area of the earth's surface that has a common history; the area is of similar age and is formed by a set of processes during an episode of landscape evolution. A geomorphic surface can be erosional, constructional or both. The surface shape can be planar, concave, convex, or any combination of these. Compare constructional, erosional. RR

geomorphology - The science that treats the general configuration of the earth's surface; specifically the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures, and of the history of geologic changes as recorded by these surface features. The term is especially applied to the genetic interpretation of landforms. GG

geyser – A type of hot spring that intermittently erupts jets of hot water and steam, the result of ground water coming in contact with rock or steam hot enough to create steam under conditions preventing free circulation; a type of intermittent spring. Compare – mud pot, hot spring. GG

geyser basin – A valley that contains numerous springs, geysers, and steam fissures fed by the same ground-water flow. GG

geyser cone – A low hill or mound built up of siliceous sinter around the orifice of a geyser. GG

giant ripple - A ripple that is more than 30 m in length; e.g., the jokulhlaup derived giant ripples in Camas Prairie, MT.; it usually exhibits superimposed megaripples. Compare - ripple mark. GG

gilgai - A microfeature pattern of soils composed of a succession of microbasins and microknolls on level areas, or of microtroughs and microridges parallel to the slope on sloping areas, and produced by expansion / contraction and shear / thrust processes with changes in soil moisture. Found in soils containing large amounts of smectitic clay that swell and shrink considerably with wetting and drying. Various types of gilgai can be recognized based on the dominant shape of micro-highs and micro-lows: circular gilgai, elliptical gilgai, and linear gilgai. Also referred to, in part or in total, as crabhole, Bay of Biscay, or hushabye in older literature. SW & GSST

glacial - (adjective) (a) Of or relating to the presence and activities of ice and glaciers, as in glacial erosion. (b) Pertaining to distinctive features and materials produced by or derived from glaciers and ice sheets, as in glacial lakes. (c) Pertaining to an ice age or region of glaciation. GG

glacial drainage channel - A channel formed by an ice-marginal, englacial, or subglacial stream during glaciation. GG

glacial drift - (not recommended) use drift.

glacial groove – A deep, wide, usually straight furrow cut in bedrock by the abrasive action of a rock fragment embedded in the bottom of a moving glacier; it is larger and deeper than a glacial striation, ranging in size from a deep scratch to a small glacial valley. Compare – flute. GG

glacial lake - (a) A lake that derives much or all of its water from the melting of glacier ice, fed by meltwater, and lying outside the glacier margins (e.g. proglacial lake) or lying on a glacier (e.g. ice-walled lake, ice-floored lake) and due to differential melting. (b) A lake occupying a basin produced by glacial deposition, such as one held in by a morainal dam. (c) A lake occupying a basin produced in bedrock by glacial erosion (scouring, quarrying); e.g., cirque lake, fjord. (d) A lake occupying a basin produced by collapse of outwash material surrounding masses of stagnant ice. (e) [relict] An area formerly occupied by a glacial lake. GG

glacial-marine sedimentation - The accumulation of glacially eroded, terrestrially derived sediment in the marine environment. Sediment may be introduced by fluvial transport, by ice rafting, as an ice-contact deposit, or by eolian transport. Compare - glaciomarine deposits. GG

glacial outwash - (not recommended) use outwash.

glacial till - (not recommended; use till). Till should only be used for describing glacial sediments, therefore "glacial till" is redundant. GM

glacial-valley floor – The comparatively flat bottom of a mountain valley predominantly mantled by till but which can grade from glacial scour (scoured rock-outcrop) near it's head to a thick mantle of till, and ultimately merging with alluvium or colluvium further down valley. Some glacial-valley floors descend downstream in a series of scour-derived steps which may contain sequential tarn lakes (*pater noster lakes*); (not preferred: colloquial – western USA) sometimes called a trough bottom. SW

glacial-valley wall – The comparatively steep, glacially scoured, concave sides of a u-shaped, mountain valley mantled by colluvium with little or no till; (not preferred: colloquial – western USA) sometimes called a trough wall. SW

glaciation - The formation, movement and recession of glaciers or ice sheets. A collective term for the geologic processes of glacial activity, including erosion and deposition, and the resulting effects of such action on the earth's surface. GG

glacier - a) A large mass of ice formed, at least in part, on land by the compaction and recrystallization of snow, moving slowly by creep downslope or outward in all directions due to the stress of its own weight, and surviving from year to year. Included are small mountain glaciers as well as ice sheets continental in size, and ice shelves which float on the ocean but are fed in part by ice formed on land. b) A stream-like landform having the appearance of, or moving like a glacier; e.g. a rock glacier. Compare – snowfield, rock glacier. GG

glacier outburst flood – A sudden, often annual, release of meltwater from a glacier or glacier-dammed lake sometimes resulting in a catastrophic flood, formed by melting of a drainage channel or buoyant lifting of ice by water or by subglacial volcanic activity; also called jokuhlaup. Compare – scabland, giant ripple. GG

glaciofluvial deposit - Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and may occur in the form of outwash plains, valley trains, deltas, kames, eskers, and kame terraces. Compare - drift and outwash. HP

glaciokarst – Karst in glaciated terrain developed on bedrock susceptible to dissolution (e.g. limestone), thinly mantled (e.g. < 5 - 30 m) with glacial drift and characterized by surficial, closed depressions formed by post-

glacial, subsurface karstic collapse (e.g. sinkholes) rather than by glacial processes (e.g. ice-block melt-out); common in IN, MI. Compare – karst. SW & GG

glaciolacustrine deposit - Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes by water originating mainly from the melting of glacial ice. Many are bedded or laminated with varves or rhythmites. HP

glaciomarine deposit - Glacially eroded, terrestrially derived sediments (clay, silt, sand, and gravel) that accumulated on the ocean floor. Sediments may be accumulated as an ice-contact deposit, by fluvial transport, ice-rafting, or eolian transport. GG & GM

glade – (colloquial – Ozark uplands, USA) (a) A largely treeless, open, grassy area (e.g., oak savanna) on high, broad interfluves and hillsides, commonly with shallow soils. Compare – park. SW (b) (not preferred) refer to park: An ecological term for a grassy, open depression or small valley as in a high meadow; sometimes marshy and forming the headwaters of a stream, or a low, grassy marsh that is periodically inundated. GG & SW

glauconite pellets – Silt to sand-sized, nodular aggregates with a characteristic greenish color, dominantly composed of the clay mineral glauconite; formed in near-shore marine sediments and subsequently exposed by a drop in sea level or rise of a land mass, as on a coastal plain. Glauconite pellets have a high potassium content and higher CEC and moisture retention compared to other mineral sands. Compare – greensands. SW

gorge - (a) A narrow, deep valley with nearly vertical, rocky walls, smaller than a canyon, and more steep-sided than a ravine; especially a restricted, steep-walled part of a canyon. (b) A narrow defile or passage between hills or mountains. GG

graben - An elongate trough or basin bounded on both sides by high-angle, normal faults that dip towards the interior of the trough. It is a structural form that may or may not be geomorphically expressed as a rift valley. Compare – horst, half graben. GG

granitoid – a) In the (International Union of Geological Sciences) IUGS classification, a preliminary term (for field use) for a plutonic rock with Q (quartz) between 20 and 40 (%). b) A general term for all phaneritic igneous rocks (*mineral crystals visible unaided and all about the same size*) dominated by quartz and feldspars. SW & GG

Grady pond – see Carolina Bay

grassy organic materials - see organic materials

gravel pit – A depression, ditch or pit excavated to furnish gravel for roads or other construction purposes; a type of borrow pit. SW

greensands – a) An unconsolidated, near-shore marine sediment containing substantial amounts of dark greenish glauconite pellets, often mingled with clay or sand (quartz may form the dominant constituent); prominent in Cretaceous and Tertiary coastal plain strata of New Jersey, Delaware and Maryland; has been commercially mined for potassium fertilizer. The term is loosely applied to any glauconitic sediment. b) (Not Preferred – use glauconitic sandstone) A sandstone consisting of greensand that is commonly poorly cemented, and has a greenish color when unweathered but an orange or yellow color when weathered. Compare – glauconite pellets. SW

grike – (not preferred) refer to cutter.

groove – A small, natural, narrow drainageway on high angle slopes which separate tertiary spur ridges or mini-interfluves and is a constituent part of *rib and groove topography*; common in well dissected uplands. Compare – rib. SW

ground moraine - (a) Commonly an extensive, low relief area of till, having an uneven or undulating surface, and commonly bounded on the distal end by a recessional or end moraine; (b) A layer of poorly sorted rock and mineral debris (till) dragged along, in, on, or beneath a glacier and deposited by processes including basal lodgment and release from downwasting stagnant ice by ablation. Compare - end moraine, recessional, moraine, terminal moraine. SW

ground soil – Any soil at the present-day land surface and actively undergoing pedogenesis, regardless of its history (i.e., relict, exhumed). Compare – buried soil. SW & RR

grus - The fragmental products of in situ granular disintegration of granite and granitic rocks, dominated by inter-crystal disintegration. Compare - saprolite. SW & GG

gulch - (colloquial: western U.S.A.; not preferred – refer to ravine) A small stream channel, narrow and steep-sided in cross section, and larger than a gully, cut in unconsolidated materials. General synonym - ravine. Compare - arroyo, draw, gully, wash. HP

gulf [coast] – A relatively large part of an ocean or sea extending far into the land, partly enclosed by an extensive sweep of the coast, and opened to the sea through a strait (e.g. Gulf of Mexico); the largest of various forms of inlets of the sea. It is usually larger, more enclosed, and more deeply indented than a bay. Compare – bay. GG

gully - A small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water usually during and immediately following heavy rains or ice / snow melt. A gully generally is an obstacle to wheeled vehicles and too deep (e.g., > 0.5 m) to be obliterated by ordinary tillage; (a rill is of lesser depth and can be smoothed over by ordinary tillage). Compare - rill, ravine, arroyo, swale, draw. HP & GSST

gut - (a) (colloquial: U.S. Virgin Islands, Caribbean Basin) A gully, ravine, small valley, or narrow passage on land. (b) [stream] (not preferred – use tidal channel). A tidal stream connecting two larger waterways within a lagoon, estuary or bay. SW & GG

half graben – An elongate, structural trough or basin bounded on one side by a normal fault. It may or may not produce a topographic basin. Compare – graben. GG

hanging valley - A tributary valley whose floor at the lower end is notably higher than the floor of the main valley in the area of junction. GG

head [geomorphology] - (a) The source, beginning, or upper part of a stream. (b) The upper part or end of a slope or valley. GG

headland [coast] - (a) An irregularity of land, especially of considerable height with a steep cliff face, jutting out from the coast into a large body of water (usually the sea or a lake); a bold promontory or a high cape. (b) The high ground flanking a body of water, such as a cove. (c) The steep crag or cliff face of a promontory. GG

head-of-outwash – A sloping and sometimes high relief landform composed predominantly of glaciofluvial sediment that delimits a former ice-margin of a relatively static, rapidly wasting glacier. A steep *ice-contact slope* forms the ice-proximal face of the landform; a more gently sloping surface dips away on the distal slope, if not slumped. Compare – ice-margin complex. SW

head slope [geomorphology] - A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway, resulting in converging overland water flow (e.g. sheet wash); head slopes are dominated by colluvium and slope wash sediments (e.g., slope alluvium); contour lines form concave curves. Slope complexity (downslope shape) can range from simple to complex. Headslopes are comparatively moister portions of hillslopes and tend to accumulate sediments (e.g., cumelic profiles)

where they are not directly contributing materials to channel flow. Compare - side slope, nose slope, free face, interfluvium, crest, base slope. SW.

headwall - A steep slope at the head of a valley; e.g. the rock cliff at the back of a cirque. Compare – cirque headwall. GG

herbaceous organic materials - see organic materials.

herbaceous peat [Soil Taxonomy] - An accumulation of organic material, decomposed to some degree that is predominantly the remains of sedges, reeds, cattails and other herbaceous plants. Compare - moss peat, sedimentary peat, woody peat, peat, muck, and mucky peat. SSM

high-center polygon - A polygon whose center is raised relative to its boundary. Compare - low center polygon. NRC

high hill – A generic name for an elevated, generally rounded land surface with high local relief, rising between 90 meters (approx. 300 ft.) to as much as 300 m (approx. 1000 ft.) above surrounding lowlands. Compare – low hill, hill, hillock. SW

highmoor bog - A bog, often on the uplands, whose surface is covered by sphagnum mosses which, because of their high degree of water retention, make the bog more dependent upon precipitation than on the water table. The bog often occurs as a raised peat bog or blanket bog. Compare - lowmoor bog, raised bog. GG

hill - A generic term for an elevated area of the land surface, rising at least 30 m (100 ft.) to as much as 300 meters (approx. 1000 ft.) above surrounding lowlands, usually with a nominal summit area relative to bounding slopes, a well-defined, rounded outline and slopes that generally exceed 15 percent. A hill can occur as a single, isolated mass or in a group. A hill can be further specified based on the magnitude of local relief: *low hill* (30 – 90 m) or *high hill* (90 - 300 m). Informal distinctions between a hill and a mountain are often arbitrary and dependent on local convention. Compare - hillock, plateau, mountain, foothills, hills. SW & HP

hillock – A generic name for a small, low hill, generally between 3 – 30 m in height and slopes between 5 and 50% (e.g., bigger than a mound but smaller than a hill); commonly considered a microfeature. Compare – mound, hill. SW

hills – A landscape dominated by hills and associated valleys. SW

hillside - (not recommended) use hillslope.

hillslope - A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of the hill. Compare – mountain slope. HP

hillslope-profile position - Discrete slope segments found along a transect line that runs perpendicular to the contour, beginning at a divide and descending to a lower, bounding stream channel or valley floor; a discrete piece of a two-dimensional cross profile of a hill. Positions are commonly separated from one another by inflection points along the line. In descending elevational order, the hillslope-profile positions of a simple hillslope include summit, shoulder, backslope, footslope, and toeslope. Not all of these segments (positions) are necessarily present along a particular hillslope. Complex hillslopes include multiple sequences or partial sequences, or partial sequences. Compare - geomorphic components - hills. SW, HP, & RR

hillslope terrace – A raised, generally horizontal strip of earth and/or rock bounded by a down-slope berm or retaining wall, constructed along a contour on a hillslope to make land suitable for tillage and to prevent accelerated erosion; common in steep terrain, both archaic (e.g. Peru) and modern (e.g. Nepal). Compare – conservation terrace. SW & GSST

hill top (not recommended) use summit.

hogback - A sharp-crested, symmetric ridge formed by highly tilted resistant rock layers; a type of homocline produced by differential erosion of interlayered resistant and weak rocks with dips greater than about 25° (or approximately > 45 % slopes). Compare – homoclinal ridge, cuesta. SW & HP

Holocene - The epoch of the Quaternary Period of geologic time following the Pleistocene Epoch (from the present to about 10 to 12 thousand years ago); also corresponding (time-stratigraphic) “series” of earth materials. SW

homoclinal [structural geomorphology] - (adjective) Pertaining to strata that dip in one direction with a uniform angle. Compare - cuesta, hogback, homoclinal ridge. HP

homoclinal ridge – A homocline that forms an asymmetric ridge with a dip slope commonly between 10 to 25° (15 to 45 %). A homoclinal ridge has steeper dip than a cuesta, but lower dip than a hogback. Compare - cuesta, hogback. SW & RF

homocline - A general term for a series of rock strata that dip in one direction with a uniform angle; e.g. one limb of a fold, a tilted fault block, or an isocline. Compare - cuesta, homoclinal ridge, hogback. GG

hoodoo - A bizarrely shaped column, pinnacle, or pillar of rock produced by differential weathering or erosion in a region of sporadically heavy rainfall. Formation is facilitated by joints and layers of varying hardness. Compare - earth pillar. GG

horn [glacial geology] - A high, rocky, sharp pointed, steep-sided, mountain peak with prominent faces and ridges, bounded by the intersecting walls of three or more cirques that have been cut back into the mountain by headward erosion of glaciers. GG

horst - An elongate block that is bounded on both sides by normal faults that dip away from the interior of the horst. It is a structural form and may or may not be expressed geomorphically. GG

hot spring – A natural, geothermally heated spring whose temperature is above that of the human body. Compare – geyser, mud pot. GG

human transported material – Organic or mineral soil material (or any other material that can function as a soil material) that has been moved horizontally onto a pedon from a source area outside of that pedon by directed human activity, usually with the aid of machinery. There has been little or no subsequent reworking by wind, gravity, water, or ice. Human transported materials are most commonly associated with building sites, mining or dredging operations, land fills, or other similar activities that result in the formation of a constructional anthropogenic landform. ICOMANTH.

hummock - [geomorphology] (a) (not preferred – see hillock). An imprecise, general term for a rounded or conical mound or other small elevation. (b) (not preferred) A slight rise of ground above a level surface. GG.

hummock -[patterned ground] A small, irregular knob of earth (earth hummock) or turf (turf hummock). Neither type of hummock is diagnostic of permafrost, but both are most common in subpolar or alpine regions. Both require vegetative cover. GG

ice age - (not recommended) use Pleistocene.

ice-contact slope – A steep escarpment of predominantly glaciofluvial sediment that was deposited against a wall of glacier ice, marking the position of a relatively static ice-margin; an irregular scarp against which glacier ice once rested. Compare – head-of-outwash. SW & GG

ice-marginal stream – A stream drainage along the side or front of a glacier. Relict ice-marginal streams are used to trace the former position of a glacier; also called ice-marginal drainage. SW & GG

ice-margin complex – An assemblage of landforms constructed proximal to a relatively static, rapidly wasting continental glacial margin. Constituent landforms can include fosse, head-of-outwash, ice-contact slope, ice-contact delta, kame, kame moraine, kettle, outwash fan, small outwash plain, glacial sluiceway, and small proglacial lake. Moraines, if present, are of limited occurrence (except kame moraines which can be extensive). Glaciofluvial sediments dominate but glaciolacustrine sediments, till, and diamictons can be present in minor amounts. SW

ice-pushed ridge - An asymmetrical ridge of local, essentially non-glacial material (such as deformed bedrock, with some drift incorporated in it) that has been pressed up by the shearing action of an advancing glacier. It is typically 10 - 60 m high, about 150 - 300 m wide, and as much as 5 km long. Examples are common on the Great Plains where such ridges occur on the sides of escarpments formed of relatively incompetent rocks that face the direction from which the ice moved. GG

ice-rafting - The transportation of rock fragments of all sizes on or within icebergs, ice floes, or other forms of floating ice. Compare - dropstone, erratic. GG

ice segregation - The formation of ice by the migration of pore water to the frozen fringe where it forms into discrete layers or lenses. It commonly ranges in thickness from hairline to more than 10 m and often occurs in alternating layers of ice and soil. NRC

ice wedge - A massive, generally wedge-shaped body with its apex pointing downward, composed of foliated or vertically banded, commonly white, ice. NRC

ice wedge cast - A filling of sediment in the space formerly occupied by an ice wedge. NRC

ice wedge polygon - Patterned ground in areas of ice wedges. These polygons are commonly in poorly-drained areas and may be high-centered or low-centered. NRC

igneous rock - Rock formed by cooling and solidification from magma, and that has not been changed appreciably by weathering since its formation; major varieties include plutonic and volcanic rocks. Examples: andesite, basalt, granite. Compare - intrusive, extrusive, metamorphic rock. GSST & HP

inlet - A short, narrow waterway connecting a bay, lagoon, or similar body of water. Compare – tidal inlet. GG

impact crater – a) [anthropogenic] A generally circular or elliptical depression formed by hypervelocity impact of an experimental projectile or ordinance into earthy or rock material. Compare – caldera, crater, meteorite crater. SW; b) (not recommended – use meteorite crater) A generally circular crater formed by the impact of an interplanetary body (projectile) on a planetary surface. GG

inselberg - A prominent, isolated, residual knob, hill, or small mountain, usually smoothed and rounded, rising abruptly from an extensive lowland erosion surface in a hot dry region; generally bare and rocky although the lower slopes are commonly buried by colluvium. Compare - monadnock, nunatak. GG

inset fan - (colloquial; southwestern USA) The flood plain of an ephemeral stream that is confined between the fan remnants, ballenas, basin-floor remnants, or closely-opposed fan toeslopes of a basin. FF & SW.

integrated drainage - A general term for a drainage pattern in which stream systems have developed to the point where all parts of the landscape drain into some part of a stream system, the initial or original surfaces have essentially disappeared and the region drains to a common base level. Few or no closed drainage systems are present. SW

interbedded - Said of beds lying between or alternating with others of different character; especially said of rock material or sediments laid down in sequence between other beds, such as "interbedded" sands and gravels. GG

interdrumlin – The concave to relatively flat bottomed, roughly linear depressions ranging from small saddles or swales to small valleys that separate drumlins or drumlinoid ridges in drumlin fields. Streams, if present, have not had a dominant impact on the formation of the depression. Compare – drumlin, drumlinoid ridge. SW

interdrumlin swale – see interdrumlin

interdune - The relatively flat surface, whether sand-free or sand-covered, between dunes. GG

interdune valley – A broad interdune area consisting of a low-lying, relatively flat surface commonly found between very large dunes, and which lies in close proximity to the local groundwater table (if present). SW

interfluve - A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways. Compare - divide. GG & FFP

interfluve [geomorphology] - A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloped area of a hill; shoulders of backwearing hillslopes can narrow the upland (e.g., ridge) or merge (e.g., crest, saddle) resulting in a strongly convex shape. Compare – crest, side slope, head slope, nose slope, free face, base slope. SW

interior valley – A large, flat-floored closed depression in a karst area whose drainage is ultimately subsurface and its floor is commonly covered by alluvium. Some interior valleys may become ephemeral lakes during periods of heavy rainfall, when sinking streams that drain them cannot manage the runoff; also called polje (not preferred). Compare – karst valley, sinkhole. GG

intermediate position [gilgai] – A nearly level area, including the lower part (footslope) of a micro-high that is a transition zone between the slightly elevated micro-high (i.e. microknoll; *mound* in Russia) and the outer edge of an adjacent micro-low (i.e. microbasin, microtrough; *depression* in Russia) in gilgai or other patterned ground. Where present, it can make up a majority of the ground surface area in gilgai; called *slope* in Russia. Compare – gilgai. SW

intermittent stream - A stream, or reach of a stream, that does not flow year-round (commonly dry for 3 or more months out of 12) and whose channel is generally below the local water table; it flows only when it receives a) base flow (i.e. solely during wet periods), or b) ground-water discharge or protracted contributions from melting snow or other erratic surface and shallow subsurface sources. Compare - ephemeral stream. HP

intermontane basin - A generic term for wide structural depressions between mountain ranges that are partly filled with alluvium and called "valleys" in the vernacular. Intermontane basins may be drained internally (bolsons) or externally (semi-bolson). FFP

interstream divide - (a) (not preferred) A synonym for divide. (b) (colloquial - esp. southeastern USA). *Broad interstream divide* - A wide, relatively level area between incised drainageways; a broad, nearly level “summit” or interfluve. Compare - broad interstream divide, interfluve. SW

intertidal - (adjective) The coastal environment between mean low tide and mean high tide that alternates between subaerial and subaqueous depending on the tidal cycle. Compare – subtidal. SSS

intramorainal - said of deposits and phenomena occurring within a lobate curve of a moraine (e.g. within the area occupied by a glacier). Compare - extramorainal. GG

intrusive - Denoting igneous rocks derived from molten matter (magmas) that invaded pre-existing rocks and cooled below the surface of the earth. Compare - extrusive. HP

island - (a) An area of land completely surrounded by water. Compare – barrier island, coral island. (b) An elevated area of land surrounded by swamp, or marsh, or isolated at high water or during floods. Compare - barrier island. GG

joint [geology] - A surface of actual or potential fracture or parting in a rock, without displacement; the surface is usually planar and often occurs with parallel joints to form part of a joint set. HP

jokulhlaup - An Icelandic term for a glacial outburst flood, especially when an ice dam impounding a glacial lake breaks. Such breaks drained glacial Lake Missoula and created the Channeled Scablands in the Pacific Northwest. (Pronounced: yo-kool-loup, the last syllable as in "out".) Compare – glacier outburst flood, scabland, giant ripple. SW & GG

kame - A low mound, knob, hummock, or short irregular ridge, composed of stratified sand and gravel deposited by a subglacial stream as a fan or delta at the margin of a melting glacier; by a supraglacial stream in a low place or hole on the surface of the glacier; or as a ponded deposit on the surface or at the margin of stagnant ice. Compare - crevasse filling, kame moraine, kame terrace, esker, outwash. GG

kame moraine - (a) An end moraine that contains numerous kames. (b) A group of kames along the front of a stagnant glacier, commonly comprising the slumped or erosional remnants of a formerly continuous outwash plain built up over the foot of rapidly wasting or stagnant ice. GG

kame terrace - A terrace-like ridge consisting of stratified sand and gravel (a) deposited by a meltwater stream flowing between a melting glacier and a higher valley wall or lateral moraine, and (b) left standing after the disappearance of the ice. It is commonly pitted with "kettles" and has an irregular ice-contact slope. HP

karren – Repeating, surficial solution channels, grooves or other forms etched onto massive, bare limestone surfaces; types range in depth from a few millimeters to > 1 m and separated by ridges; the total complex (all varieties) of surficial solution forms found on compact, pure limestone. Many types can be specified. Compare – solution fissure. SW & GG

karst - A kind of topography formed in limestone, gypsum, or other soluble rocks by dissolution, and that is characterized by closed depressions, sinkholes, caves, and underground drainage. Various types of karst can be recognized depending upon the dominant surface features: karst dominated by closed depressions (*sinkhole karst* – temperate climates; *cockpit karst* – humid tropical climates), closed depressions and large rivers (*fluviokarst*), bare rock dominated by dissolution joints (*pavement karst*), tropical cone-, tower- or domed-hills (*kegel karst*), or karst thinly mantled with glacial drift (*glaciokarst*), etc. SW & WW

karst cone – A conically-shaped residual hill in karst with a rounded top and relatively steep, convex (e.g. parabolic) side slopes, commonly in tropical climates. Compare – karst tower, mogote. SW & WW

karst drainage pattern – A drainage pattern that lacks an integrated drainage system associated with soluble rocks with little or no surface drainage but a considerable underground, internal drainage system; characteristic of karst landscapes underlain by limestone, gypsum, or salt. SW

karstic – (adjective) Having the attributes of karst. SW & GG

karstic marine terrace – A relict, wave-cut terrace or solution platform formed across soluble bedrock (e.g. limestone), and subsequently subaerially weathered by solution resulting in prominent karst features (e.g. sinkholes, karst valleys, solution pipes, etc.); a type of marine terrace, extensive across the Florida peninsula. Dunefields and sand sheets of reworked coastal / fluviomarine sands are common capping materials. SW

karst lake – A large area of standing water in an extensive closed depression in soluble bedrock (e.g. limestone) and commonly is directly connected to and controlled by the subsurface karst drainage network. SW & GG

karstland – (not preferred) use karst. A landscape dominated by dissolution features (e.g., sinkhole, blind valley, closed depressions, underground drainage) formed in soluble rocks. SW & GG

karst tower – An isolated, separate hill or ridge in a karst region consisting of an erosional remnant of limestone or other sedimentary rocks with vertical or near-vertical, convex side slopes and commonly surrounded by an alluvial plain, lagoon, or deep rugged ravines. Compare – mogote, karst cone. SW

karst valley – A closed depression formed by the coalescence of multiple sinkholes; an elongate, solutional valley. Its drainage is subsurface, diameters range from several hundred meters to a few kilometers, and it usually has a scalloped margin inherited from the sinkholes. It may have nominal, local channel flow (small streams), sequential sinkhole inlets (springs) and outlets (swallow hole, etc.); also called compound sinkhole (not preferred), uvala (not preferred). Compare – sinkhole, interior valley. SW & GG

kegel karst – A general name used to describe several types of humid tropical karst landscapes characterized by numerous, closely spaced cone- (cone karst), hemispherical- (halbkugelkarst), or tower-shaped (tower karst) hills with vertical or near-vertical walls and having intervening closed depressions and narrow steep-walled karst valleys or passageways. Compare – cockpit karst. GG & SW

kettle - A steep-sided, bowl-shaped depression commonly without surface drainage (closed depression) in drift deposits, often containing a lake or swamp, and formed by the melting of a large, detached block of stagnant ice that had been wholly or partly buried in the drift. Kettles range in depth from 1 to tens of meters, and with diameters up to 13 km. Compare - pothole. GG

kipuka - A low "island" of land surrounded by a younger (more recent) lava flow. Compare - steptoe. MA

kluftkarren – (not preferred) refer to solution fissure.

knickpoint - (a) A point of abrupt inflection in the longitudinal profile of a stream or of its valley (e.g. a waterfall); it marks the maximum headward erosion of a new erosion cycle that grades to a new, lower base level; (b) Any interruption or break in slope. SW

knob - (a) A rounded eminence, a small hill or mountain; especially a prominent or isolated hill with steep sides, commonly found in the Southern United States. (b) A peak or other projection from the top of a hill or mountain. Also, a boulder or group of boulders or an area of resistant rocks protruding from the side of a hill or mountain. Compare – stack [geom]. GG

knoll - A small, low, rounded hill rising above adjacent landforms. HP

lacustrine deposit - Clastic sediments and chemical precipitates deposited in lakes. HP

lagoon - [coast] A shallow stretch of salt or brackish water, partly or completely separated from a sea or lake by an offshore reef, barrier island, sandbank or spit. GG'87. [relict landform] A nearly level, filled trough or depression behind the longshore bar on a barrier beach and built by a receding pluvial or glacial lake. Compare - sewage lagoon. FFP

lagoonal deposit – Sand, silt or clay-sized sediments transported and deposited by wind, currents, and storm washover in the relatively low-energy, brackish to saline, shallow waters of a lagoon. Compare – estuarine deposit, fluviomarine deposit, marine deposit. SSS

lagoon bottom - The nearly level or slightly undulating central portion of a submerged, low-energy, depositional estuarine basin (McGinn, 1982) characterized by relatively deep water (1.0 to >2.5 m). Compare – bay bottom. SSS

lagoon channel - A subaqueous, sinuous area within a lagoon that likely represents a relict channel (paleochannel) (Wells et al., 1994) that is maintained by strong currents during tidal cycles (Short, 1975). SSS

lahar - The process, associated sediments or resultant landform characterized by a mudflow composed chiefly of volcanoclastic materials on or near the flank of a volcano. The debris carried in the flow includes pyroclastic material, blocks from primary lava flows, and epiclastic material. Thick flows can exhibit a crude (poorly sorted) upward-fining sediment sequence. Compare - mudflow. SW & GG

lake [water] - An inland body of permanently standing water fresh or saline, occupying a depression on the Earth's surface, generally of appreciable size (larger than a pond) and too deep to permit vegetation (excluding subaqueous vegetation) to take root completely across the expanse of water. GG

lakebed - (a) [relict] The flat to gently undulating ground underlain or composed of fine-grained sediments deposited in a former lake. (b) The bottom of a lake; a lake basin. GG

lake plain - A nearly level surface marking the floor of an extinct lake filled by well-sorted, generally fine-textured, stratified deposits, commonly containing varves. GG

lakeshore - The narrow strip of land in contact with or bordering a lake; especially the beach of a lake. GG

lake terrace - A narrow shelf, partly cut and partly built, produced along a lake shore in front of a scarp line of low cliffs and later exposed when the water level falls. GG

lamella - (a) [soil] A thin (< 7.5 cm thick), discontinuous or continuous, generally horizontal layer of fine material (especially clay and iron oxides) that has been pedogenically concentrated (illuviated) within a coarser (e.g. sandy), eluviated layer (several centimeters to several decimeters thick). Compare - lamina. SW & ST (b) [mineralogy] A thin scale, leaf, lamina, or layer, e.g. one of the units of a polysynthetically twinned mineral, such as plagioclase. GG

lamina - (noun) The thinnest recognizable layer (commonly < 1 cm thick) of original deposition in a sediment or sedimentary rock, differing from other layers in color, composition, or particle size. Several laminae constitute a bed. Compare - lamella. GG

lamination - (not recommended) see lamina.

landfill - (see sanitary landfill). Compare - dump.

landform - Any physical, recognizable form or feature on the earth's surface, having a characteristic shape, internal composition, and produced by natural causes; a distinct individual produced by a set of processes. Landforms can span a large size (e.g., *dune* encompasses a number of feature including *parabolic dune*, which is tens-of-meters across and *seif dune*, which can be up to a 100 kilometers across. Landforms provide an empirical description of the earth's surface features. SW & GG

landscape [soils] A broad or unique land area comprised of an assemblage or collection of landforms that define a general geomorphic form or setting (e.g., mountain range, lake plain, lava plateau, or loess hill) Landforms within a landscape are spatially associated, but may vary in formation processes and age. SW & GSST

landslide [mass movement] – A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials, caused by gravitational forces and which may or may not involve saturated materials. Names of landslide types generally reflect the dominant process and/or the resultant landform. The main operational categories of mass movement are *fall* (rockfall, debris fall, soil fall), *topple* (rock topple, debris topple, soil topple), *slide* (rotational landslide, block glide, debris slide, lateral spread), *flow* [rock fragment flow (especially rockfall avalanche), debris avalanche, debris flow (e.g., lahar), earthflow, (creep, mudflow)], and *complex landslides*. Compare – solifluction. SW & DV

land-surface form - The description of a given terrain unit based on empirical analysis of the land surface rather than interpretation of genetic factors. Surface form may be expressed quantitatively in terms of vertical and planimetric slope-class distribution, local and absolute relief, and patterns of terrain features such as interfluvial crests, drainage lines, or escarpments. HP

lapilli - Non or slightly vesicular pyroclastics, 2.0 to 76 mm in at least one dimension, with an apparent specific gravity of 2.0 or more. Compare - ash [volcanic], block [volcanic], cinders, tephra. KST

lateral moraine - A ridge-like moraine carried on and deposited at the side margin of a valley glacier. It is composed chiefly of rock fragments derived from valley walls by glacial abrasion and plucking, or colluvial accumulation from adjacent slopes. GG

lateral spread [mass movement] - A category of mass movement processes, associated sediments (lateral spread deposit) or resultant landforms characterized by a very rapid *spread* dominated by lateral movement in a soil or fractured rock mass resulting from liquefaction or plastic flow of underlying materials; also called spread. Types of lateral spreads can be specified based on the dominant particle size of sediments (i.e. debris spread, earth spread, rock spread. Compare - fall, topple, slide, flow, complex landslide, landslide. SW, DV & GG

lava - A general term for a molten extrusive, also the rock solidified from it. GG

lava channel - see lava trench.

lava field - An area covered primarily by lava flows whose terrain can be rough and broken or relatively smooth; it can include vent structures (e.g., small cinder cones, spatter cones, etc.), surface flow structures (e.g., pressure ridges, tumuli, etc.) and small, intermittent areas covered with pyroclastics. Compare - lava plain, volcanic field. SW

lava flow - A solidified body of rock formed from the lateral, surficial outpouring of molten lava from a vent or fissure, often lobate in form. Compare - *ʼaʼa* lava flow, lava flow unit, pahoehoe lava flow. GG

lava flow unit - A separate, distinct lobe of lava that issues from the main body of a lava flow; a specific outpouring of lava, a few centimeters to several meters thick and of variable lateral extent that forms a subdivision within a single flow. A series of overlapping lava flow-units together comprise a single lava flow. Also called flow unit. Compare - lava flow. GS & GG

lava plain - A broad area of nearly level land, that can be localized but is commonly hundreds of square kilometers in extent, covered by a relatively thin succession of primarily basaltic lava flows resulting from fissure eruptions. Compare - lava plateau, lava field, volcanic field. SW & GG

lava plateau - A broad elevated tableland or flat-topped highland that may be localized but commonly is many hundreds or thousands of square kilometers in extent, underlain by a thick succession of basaltic lava flows resulting from fissure eruptions (e.g. Columbia River Plateau). Compare - lava plain, lava field. GG

lava trench - A natural surface channel in a lava flow that never had a roof, formed by the surficial draining of molten lava rather than by erosion from running water; also called lava channel. Compare - mawae, lava tube. SW

lava tube - A natural, hollow tunnel beneath the surface of a solidified lava flow through which the lava flow was fed; the tunnel was left empty when the molten lava drained out. MA & GG

ledge - (a) A narrow shelf or projection of rock, much longer than wide, formed on a rock wall or cliff face, as along a coast by differential wave action on softer rocks; erosion is by combined biological and chemical weathering. (b) A rocky outcrop; solid rock. (c) A shelf-like quarry exposure or natural rock outcrop. Compare - structural bench. GG

lee – (adj.) Said of a side or slope that faces away from an advancing glacier or ice sheet, and facing the downstream (“down-ice”) side of a glacier and relatively protected from its abrasive action. Compare – stoss, stoss and lee, crag and tail. GG

levee [streams] - An artificial or natural embankment built along the margin of a watercourse or an arm of the sea, to protect land from inundation or to confine streamflow to its channel. Compare artificial levee, natural levee. GG

leveled land – A land area, usually a field, that has been mechanically flattened or smoothed to facilitate management practices such as flood irrigation; as a result the natural soil has been partially or completely modified (e.g., truncated or buried). SW

limestone - A sedimentary rock consisting chiefly (more than 50 percent) of calcium carbonate, primarily in the form of calcite. Limestones are usually formed by a combination of organic and inorganic processes and include chemical and clastic (soluble and insoluble) constituents; many contain fossils. HP

limestone pavement – (not preferred) refer to pavement karst.

linear gilgai – A type of gilgai dominated by parallel micro-low troughs separated by low ridges (micro-highs) and oriented perpendicular to the topographic contour (i.e., up and down slopes); the prevailing type of gilgai on sloping terrain (slopes > 8 %). Compare – circular gilgai, elliptical gilgai, gilgai. SW

lithification - The conversion of unconsolidated sediment into a coherent and solid rock, involving processes such as cementation, compaction, desiccation, crystallization, recrystallization, and compression. It may occur concurrently with, shortly after, or long after deposition. HP

lithologic - (adjective) Pertaining to the physical character of a rock. HP

local relief - A general term referring to the prevailing difference in elevation between the lowest and highest parts of the landscape at a given locale (e.g. the average difference in elevation between a representative portion of a valley floor and the tops of the bounding valley walls). SW

lodgment till - A basal till commonly characterized by compact, fissile ("platy") structure and containing coarse fragments oriented with their long axes generally parallel to the direction of ice movement. Compare - till, flow-till, melt-out till. GG

local relief – A generic term referring to the collective, relative differences in elevation of a land surface on a broad scale; also called “relief”. SSM

loess - Material transported and deposited by wind and consisting predomin

longitudinal dune – A long, narrow sand dune, usually symmetrical in cross profile, oriented parallel to the prevailing wind direction ; it is wider and steeper on the windward side but tapers to a point on the lee side. It commonly forms behind an obstacle in an area where sand is abundant and the wind is strong and constant. Such dunes can be a few meters high and up to 100 km long. Compare – seif dune, transverse dune. GG

long run-out landslide – (not recommended; see rockfall avalanche).

longshore bar [relict] - A narrow, elongate, coarse-textured ridge that once rose near to, or barely above, a pluvial or glacial lake and extended generally parallel to the shore but was separated from it by an intervening trough or lagoon; both the bar and lagoon are now relict features. GG

louderback - A hill or ridge composed of a lava flow remnant that caps or is exposed in a tilted fault block and bounded by a dip slope. Used as evidence of block faulting in Basin-and-Range terrain (western USA). Compare – hogback. GG

low-center polygon - A polygon whose center is depressed relative to its boundary. Compare - high-center polygon. NRC

low hill – A generic name for an elevated, generally rounded land surface with low local relief, rising between 30 meters (100 ft.) to as much as 90 m (approx. 300 ft.) above surrounding lowlands. Compare – high hill, hill, hillock. SW

lowland - (a) An informal, generic, imprecise term for low-lying land or an extensive region of low-lying land, especially near a coast and including the extended plains or country lying not far above tide level. (b) (not preferred) A generic, imprecise term for a landscape of low, comparatively level ground of a region or local area, in contrast with the adjacent higher country. (c) (not recommended – use valley, bolson, etc.) A generic term for a large valley. Compare - upland. SW

low marsh - (refer to mud flat). The flat, usually bare ground situated seaward of a salt marsh and regularly covered and uncovered by the tide; e.g., a mud flat. GG

lowmoor bog - A bog that is at or only slightly above the water table, on which it depends for accumulation and preservation of peat (chiefly the remains of sedges, reeds, shrubs, and various mosses). Compare - highmoor bog, raised bog. GG

maar – A low relief, broad volcanic crater formed by multiple, shallow explosive eruptions. It is surrounded by a crater ring in the form of low ramparts of gently dipping (i.e. < 25 degrees), well-bedded ejecta; may be partially or completely filled by water (*maar lake*). SW & GG

mafic rock - A general term for igneous rock composed chiefly of one or more ferromagnesian, dark-colored minerals; also said of those minerals. Compare - felsic rock. GG

mainland cove - A subaqueous area adjacent to the mainland or a submerged mainland beach that forms a minor recess or embayment within the larger basin. Compare – cove, barrier cove. SSS

main scarp - The steep surface on undisturbed ground at the upper edge of a landslide, caused by movement of displaced material away from the undisturbed ground; it is visible a part of the surface of rupture (slip surface). Compare – minor scarp, toe. CV & SW

mangrove swamp - A tropical or subtropical marine swamp formed in a silty, organic, or occasionally a coralline substratum and characterized by abundant mangrove trees along the seashore in a low area of salty or brackish water affected by daily tidal fluctuation but protected from violent wave action by reefs or land; dominated by saturated soils, commonly sulfaquents. SW & GG

marine deposit - Sediments (predominantly sands, silts and clays) of marine origin; laid down in the waters of an ocean. Compare - estuarine deposit, lagoonal deposit. SW

marine lake [water] - An inland body of permanently standing brackish or saline water, occupying a depression on the Earth's surface whose water level is commonly influenced by ocean tides through subterranean cavities connecting to nearby lagoons; generally of appreciable size (larger than a pond) and too deep to permit emergent vegetation to take root completely across the expanse of water. Such water bodies can have unique biota (e.g. sting-less jellyfish of Palau). SW

marine terrace - A constructional coastal strip, sloping gently seaward, veneered by marine deposits (typically silt, sand, fine gravel). Compare - terrace, wave-built terrace. GG

marl - A generic term loosely applied to a variety of materials, most of which occur as an earthy, unconsolidated deposit consisting chiefly of an intimate mixture of clay and calcium carbonate formed commonly by the chemical action of algae mats and organic detritus (periphyton); specifically an earthy substance containing 35 - 65 % clay and 65-35% calcium carbonate mud; formed primarily under freshwater lacustrine conditions, but varieties associated with more saline environments and higher carbonate contents also occur. Compare - coastal marl, freshwater marl, SW & HP

marsh - Periodically wet or continually flooded areas with the surface not deeply submerged. Covered dominantly with sedges, cattails, rushes, or other hydrophytic plants. Compare - salt marsh, swamp, bog, fen. GSST

mass movement - A generic term for any process or sediments (mass movement deposit) resulting from the dislodgment and downslope transport of soil and rock material as a unit under direct gravitational stress. The process includes slow displacements such as creep and solifluction, and rapid movements such as landslides, rock slides, and falls, earthflows, debris flows, and avalanches. Agents of fluid transport (water, ice, air) may play an important, if subordinate role in the process. HP

mass-movement till - (not preferred) refer to "till"

mass wasting - (not preferred) refer to mass movement.

mawae - (colloquial: Hawaii) A natural surface channel commonly found near the middle of an a'a lava flow, formed by the surficial draining of molten lava rather than by erosion from running water; a type of lava trench. Compare - lava tube. MA

meander [streams] - One of a series of regular freely developing sinuous curves, bends, loops, turns, or windings in the course of a stream. GG.

meander belt - The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops. Landform components of the meander-belt surface are produced by a combination of gradual (lateral and down-valley) migration of meander loops and avulsive channel shifts causing abrupt cut-offs of loop segments. Landforms flanking the sinuous stream channel include: point bars, abandoned meanders, meander scrolls, oxbow lakes, natural levees, and flood-plain splays. Meander belts may not exhibit prominent natural levee or splay forms. Flood plains of broad valleys may contain one or more abandoned meander belts in addition to the zone flanking the active stream channel. HP

meandering channel - The term "meandering" should be restricted to loops with channel length more than 1.5 to 2 times the meander wave length. Meandering stream channels commonly have cross sections with low width-to-depth ratios, cohesive (fine-grained) bank materials, and low gradient. At a given bank-full discharge, meandering streams have gentler slopes, a

recommended – refer to oxbow) An abandoned meander, commonly filled in by deposition and vegetation, but still discernable. GG

meander scroll - (a) One of a series of long, parallel, close fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank. Compare - meander belt, point bar. (b) (not recommended; refer to oxbow lake) - A small, elongate lake on a flood plain in a well-defined part of an abandoned stream channel. GG

medial moraine - (a) An elongate moraine carried in or upon the middle of a glacier and parallel to its sides, usually formed by the merging of adjacent and inner lateral moraines below the junction of two coalescing valley glaciers. (b) A moraine formed by glacial abrasion of a rocky protuberance near the middle of a glacier and whose debris appears at the glacier surface in the ablation area. (c) The irregular ridge left behind in the middle of a glacial valley, when the glacier on which it was formed has disappeared. GG

melt-out till - Till derived from slow melting of debris-rich stagnant ice buried beneath sufficient overburden to inhibit deformation under gravity, thus preserving structures derived from the parent ice. Compare - flow-till, lodgment till. GG

mesa - A broad, nearly flat-topped, and usually isolated landmass bounded by steep slopes or precipitous cliff and capped by layers of resistant, nearly horizontal, rocky summit width greater than the height of bounding escarpments. (Colloquial: western USA; not preferred) Also used to designate broad structural benches and alluvial terraces that occupy intermediate levels in stepped sequences of platforms bordering canyons and valleys. Compare - butte, plateau, cuesta. HP & GG

metamorphic rock - Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement at depth in the earth's crust. Nearly all such rocks are crystalline. Examples: schist, gneiss, quartzite, slate, marble. HP

metasediment - A sediment or sedimentary rock that shows evidence of having been subjected to metamorphism. GG

meta-stable slope - (not recommended)

meteorite crater – An impact crater formed by the falling of a large meteorite onto the earth's surface; e.g., Barringer Crater (AZ). Compare – crater, impact crater. SW & GG

microbiotic crust - A thin, surface layer (crust) of soil particles bound together primarily by living organisms and their organic byproducts; thickness can range up from < 1 cm up to 10 cm; aerial coverage of the ground surface can range from 10 - 100%. Crusts stabilize loose earthy material. Other types of surface crusts include chemical crusts (e.g., salt crusts) and physical crusts (e.g., raindrop-impact crust). SW & SS

micro-depression - (not preferred) refer to microlow.

microfeature [soil survey] - Small, local, natural forms (features) on the land surface that are too small to delineate on a topographic or soils map at commonly used map scales (e.g. 1:24,000 to 1:10,000). Examples include earth pillar, patterned ground, frost boil. Compare - microrelief. SW

microhigh - A generic microrelief term applied to slightly elevated areas relative to the adjacent ground surface; changes in relief range from several centimeters to several meters; cross-sectional profiles can be simple or complex and generally consist of gently rounded, convex tops with gently sloping sides; also spelled *micro-high*. SW.

micro-knoll - (not preferred) refer to microhigh.

microlow - A generic microrelief term applied to slightly lower areas relative to the adjacent ground surface (e.g. shallow depression); changes in relief range from several centimeters to several meters; cross-sectional

profiles can be simple or complex and generally consist of subdued, concave, open or closed depressions with gently sloping sides; also spelled *micro-low*. SW.

microrelief - (a) [soil survey] Slight variations in the height of a land surface that are too small or intricate to delineate on a topographic or soils map at commonly used map scales (e.g. 1:24,000 through 1:10,000). Examples include microhigh, microlow. Compare - microfeature. SW (b) (not preferred - refer to microfeature) Generically refers to local, slight irregularities in form and height of a land surface that are superimposed upon a larger landform, including such features as low mounds, swales, and shallow pits. GG

midden - A mound or stratum of refuse (broken pots, ashes, food remains, etc.) normally found on the site of an ancient settlement. GG

mima mound - A term used for one of numerous low circular or oval domes composed of loose, unstratified, gravelly, silty, or sandy material. The basal diameter varies from 3 meters to more than 30 meters, and the height from 30 centimeters to about 2 meters. Compare - pimple mound, patterned ground, shrub-coppice dune. GG

mine spoil, coal extraction – Randomly mixed, earthy materials artificially deposited as a result of either surficial or underground coal mining activities; a type of mine spoil. SW

mine spoil, metal-ore extraction – Randomly mixed, earthy materials artificially deposited as a result of either surficial or underground metal-ore mining activities; a type of mine spoil. SW

mine spoil or earthy fill [soil survey] - An accumulation of displaced earthy material, rock, or other waste material removed during mining or excavation. SW & GSST

minor scarp – A steep surface on the displaced material of a landslide, produced by differential movements within the sliding mass. Compare – main scarp, toe. CV

Miocene - An epoch of the Tertiary Period of geologic time (approximately 5.2 to 23 million years ago) that immediately follows the Oligocene and precedes the Pliocene Epoch; also the corresponding (time-stratigraphic) "series" of earth materials. HP

mogote – (colloquial: Caribbean Basin) An isolated, steep-sided, commonly asymmetrical hill or ridge composed of limestone, generally steeper on its leeward side (prevailing downwind side) and surrounded by nearly level to sloping coastal plain composed of marine and alluvial sediments; a type of karst tower. They range in height from a few feet (< 1 m) to over 150 ft (50 m). Most are isolated and cover small areas but some form clusters of hills or ridges rising out of the surrounding blanket deposits. Mogotes are extensive in northern Puerto Rico. SW, Monroe (1976, 1980), & WW.

monadnock - An isolated hill or mountain of resistant rock rising conspicuously above the general level of a lower erosion surface in a temperate climate representing an isolated remnant of a former erosion cycle in an area that has largely been beveled to its base level. Compare - inselberg, nunatak. GG

monocline - (a) [landform] A unit of folded strata that dips from the horizontal in one direction only, is not part of an anticline or syncline, and occurs at the earth's surface. This structure is typically present in plateau areas where nearly flat strata locally assume steep dips caused by differential vertical movements without faulting. Compare - anticline, syncline, fold. SW & HP (b) [structural geology]- A local steepening in an otherwise uniform gentle dip. GG

moraine [glacial geology] - (a) [material] A mound, ridge, or other topographically distinct accumulation of unsorted, unstratified glacial drift, predominantly till, deposited primarily by the direct action of glacier ice, in a variety of landforms. (b) [landform] A general term for a landform composed mainly of till that has been deposited by a glacier; a kame moraine is a type of moraine similar in exterior form to other types of moraines but composed mainly of stratified outwash materials. Types of moraine include: disintegration, end, ground, kame, lateral, recessional, and terminal. SW

mossy organic materials - see organic materials

moss peat [Soil Taxonomy] - An accumulation of organic material that is predominantly the remains of mosses (e.g. sphagnum moss). Compare - Herbaceous peat, sedimentary peat, woody peat, peat, muck, and mucky peat. SSM

mound - (a) A low, rounded natural hill of unspecified origin, generally < 3 m high and, composed of earthy material; (b) A small, human-made hill, composed either of debris accumulated during successive occupations of the site (e.g. tell) or of earth heaped up to mark a burial site (e.g. burial mound). (c) A structure built by colonial organisms (e.g. termite mound). GG

mountain - A generic term for an elevated area of the land surface, rising more than 300 meters above surrounding lowlands, usually with a nominal summit area relative to bounding slopes and generally with steep sides (greater than 25 percent slope) with or without considerable bare-rock exposed. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are primarily formed by tectonic activity and/or volcanic action and secondarily by differential erosion. Compare - hill, hillock, plateau, foothills, mountains. SW & HP

mountainbase - A geomorphic component of mountains consisting of the lowermost area, consisting of the strongly to slightly concave colluvial apron or wedge at the bottom of mountain slopes; composed of long-transport colluvium and slope alluvium sediment. It can extend out onto more level valley areas where it ultimately interfingers with, is buried by alluvium or is replaced by re-emergent residuum. Compare - mountaintop, mountainflank, free face, geomorphic component. SW

mountainflank - A geomorphic component of mountains consisting of the side area of mountains, characterized by very long, complex backslopes with comparatively high slope gradients and composed of highly-diverse, colluvial sediment mantles, complex near-surface hydrology, mass movement processes and features (e.g., creep, landslides); rock outcrops or structural benches may be present. The mountainflank can be subdivided by the general location along the mountainside (i.e., upper third, middle third, or lower third mountainflank). Compare - mountaintop, mountainbase, free face, geomorphic component. SW

mountain range - A single, large mass consisting of a succession of mountains or narrowly spaced mountain ridges, with or without peaks, closely related in position, direction, orientation, formation, and age; a component part of a mountain system. Compare - mountain system, mountains. GG

mountains - A region or landscape characterized by mountains and their intervening valleys; a generic name for any group, cluster, or sequence of mountains or narrowly spaced mountain ridges, with or without peaks, closely related in position, orientation, direction, formation, or age, and whose summits commonly exceed 300 m (approx. 1000 ft). Compare - foothills, hills, mountain range, mountain system. SW.

mountainside - (not recommended) use mountain slope.

mountain slope - A part of a mountain between the summit and the foot. Compare - mountainflank, hillslope. GG

mountain system - A group of mountain ranges exhibiting certain unifying features, such as similarity in form, structure and alignment, and presumably originating from the same general causes; especially a series of mountain ranges belonging to an orogenic belt. Compare - mountain range, mountains. GG

mountaintop - A geomorphic component of mountains consisting of the uppermost, comparatively level or gently sloped area of mountains, characterized by relatively short, simple slopes composed of bare rock, residuum, or short-transport colluvial sediments. In humid environments, mountaintop soils can be quite thick and well developed. Compare - mountainflank, mountainbase, free face, geomorphic component. SW

mountain valley - (a) Any small, externally drained V-shaped depression (in cross-section) cut or deepened by a stream and floored with alluvium, or a broader, U-shaped depression modified by an alpine glacier and floored with either till or alluvium, that occurs on a mountain or within mountains. Several types of mountain valleys can be recognized based on their form and valley floor sediments (i.e., *V-shaped valley*, *U-shaped valley*). Compare – valley. SW (b) (colloquial: Basin and Range, USA) A relatively small, structural depression within a mountain range that is partly filled with alluvium and commonly drains externally to an intermontane basin, bolson, or semi-bolson. Compare - valley flat. SW & FFP

muck - Unconsolidated soil material consisting primarily of highly decomposed organic material in which the original plant parts are not recognizable (i.e. "sapric" in Soil Taxonomy). It generally contains more mineral matter and is usually darker in color, than peat. Compare - peat, mucky peat, herbaceous peat. GSST

mucky peat - Unconsolidated soil material consisting primarily of organic matter that is in an intermediate stage of decomposition such that a significant part of the original material can be recognized and a significant part of the material can not be recognized (i.e. "hemic" in Soil Taxonomy). Compare - peat, muck, herbaceous peat. SSM

mud flat – (not preferred – use tidal flat) A relatively level area of fine grained material (e.g. silt) along a shore (as in a sheltered estuary) or around an island, alternately covered and uncovered by the tide or covered by shallow water, and barren of vegetation. Compare – low marsh, tidal flat, tidal marsh. GG

mudflow [mass movement] – The process, associated sediments (mudflow deposit) or resultant landform characterized by a very rapid type of *earthflow* dominated by a sudden, downslope movement of a saturated mass of rock, soil, and mud (more than 50 % of the particles are < 2 mm), that behaves as much as a viscous fluid when moving. Compare – debris flow, flow, landslide. SW & DV

mud pot – A type of hot spring containing boiling mud, usually sulfurous and often multicolored, as in a paint pot. Mud pots are commonly associated with geysers and other hot springs in volcanic areas, especially in Yellowstone Natl. Park, WY. Compare – geyser, hot spring. GG

mudstone - (a) A blocky or massive, fine-grained sedimentary rock in which the proportions of clay and silt are approximately equal; (b) A general term that includes clay, silt, claystone, siltstone, shale, and argillite, and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified. GG

muskeg - A bog, usually a sphagnum bog, frequently with grassy tussocks (hummocks), growing in wet, poorly drained boreal regions, with deep accumulations of organic material, often in areas of permafrost; a moss-covered muck or peat bog of boreal regions. GG and HP

natural levee - A long, broad low ridge or embankment of sand and coarse silt, built by a stream on its flood plain and along both sides of its channel, especially in time of flood when water overflowing the normal banks is forced to deposit the coarsest part of its load. It has a gentle slope away from the river and toward the surrounding floodplain, and its highest elevation is closest to the river bank. Compare - levee, artificial levee, meander belt. GG

neck [volcanic] – A vertical, pipe-like tower of solidified lava or consolidated fragmental igneous rock that represents a former volcanic vent whose surrounding material (e.g. tuff and tephra) has been largely removed by erosion. Compare – plug [volcanic], diatreme. SW, GG, & GS

net (nonsorted) - (not preferred) refer to patterned ground.

net (sorted) - (not preferred) refer to patterned ground.

nivation - The process of excavation of a shallow depression or nivation hollow on a mountain side by removal of fine material around the edge of a shrinking snow patch or snow bank, chiefly through sheetwash, rivulet flow, and solution in melt water. Freeze-thaw action is apparently insignificant. GG

nivation hollow – A shallow, non-cliffed depression or hollow on a mountain side permanently or intermittently occupied by a snow bank or snow patch and produced by nivation. If the snow completely melts each summer the hollow is deepened; otherwise not; may be a cirque precursor if further enlarged and deepened by alpine glaciation. GG

nonsorted circle - A type of patterned ground whose mesh (shape) is dominantly circular and has a nonsorted appearance due to the absence of a border of coarse fragments. Vegetation characteristically outlines the pattern by forming a bordering ridge. Diameters commonly range from 0.5 to 3 m. Nonsorted circles include mud boils, earth hummocks, turf hummocks, and frost boils. Nonsorted circles have various origins. Some, such as mud and earth hummocks and frost boils, involve cryoturbation activity and differential heave of frost-susceptible materials. Others, such as mud boils, involve hydraulic pressures and diapir-like displacement of water-saturated sediments. Compare - sorted circle, frost boil, patterned ground. NRC and GG

nonsorted polygon - (not preferred) refer to patterned ground.

nose slope [geomorphology] - A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside, resulting in predominantly divergent overland water flow (e.g., sheet wash); contour lines generally form convex curves. Nose slopes are dominated by colluvium and slope wash sediments (e.g., slope alluvium). Slope complexity (downslope shape) can range from simple to complex. Nose slopes are comparatively drier portions of hillslopes and tend to have thinner colluvial sediments and profiles. Compare - head slope, side slope, free face, interfluvium, crest, base slope. SW

notch - (a) (colloquial - northeast USA) A narrow passageway, or short defile between mountains; a deep, close pass. Compare - gap. (b) A breached opening in the rim of a volcanic crater. GG

novaculite - A dense, even-textured, extremely finely grained, siliceous, sedimentary rock recrystallized from chert with microcrystalline quartz dominant over chalcedony (cryptocrystalline quartz). It is hard, white to grayish-black in color, translucent on thin edges, has a dull to waxy luster, and displays smooth conchoidal fracture when broken. Novaculite occurs in the Ouachita Mountains of AR and OK and the Marathon Uplift of TX where it forms erosion resistant ridges. At the Ouachita Mountain type occurrence, novaculite formed by low-grade, thermal metamorphism of bedded chert. This rock serves widely as a whetstone or oilstone. Compare - chert. SW & GG

nuée ardente - A swiftly flowing, turbulent gaseous cloud, sometimes incandescent, erupted from a volcano and containing ash and other pyroclastics in its lower part; a density current of pyroclastic flow. Compare - lahar. GG

nunatak - An isolated hill, knob, ridge, or peak of bedrock that projects prominently above the surface of a glacier and is completely surrounded by glacier ice. Compare - inselberg, monadnock. GG

ocean – The continuous salt-water body that surrounds the continents and fills the Earth's great depressions; also, one of its major geographic divisions. Compare – sea. GG

offshore bar - (not recommended) use barrier beach.

Oligocene - The epoch (from 23.3 to 35.4 million years ago) of the Tertiary Period of geologic time, which follows the Eocene and precedes the Miocene Epoch; also the corresponding (time-stratigraphic) "series" of earthy materials. SW

open depression – A generic name for any enclosed or low area that has a surface drainage outlet whereby surface water can leave the enclosure; an area of lower ground indicated on a topographic map by contour lines forming an incomplete loop or basin indicating at least one surface exit. Compare – closed basin. SW

openpit mine – A relatively large depression resulting from the excavation of material and redistribution of overburden associated with surficial mining operations. Compare – quarry, surface mine. SW & GG

organic materials - [soil survey] Unconsolidated sediments or deposits in which carbon is an essential, substantial component. Several types of organic materials (deposits) can be identified based on the composition of the dominant fibers (grassy organic materials, herbaceous organic materials, mossy organic materials, woody organic materials). Compare - herbaceous peat, moss peat, sedimentary peat, woody peat. SW

outcrop - (a) That part of a geologic formation or structure that appears at the surface of the earth. (b) [soil survey] An actual exposure of bedrock at or above the ground surface. Compare - cliff. SW & GG

outwash [glacial geology] - Stratified and sorted sediments (chiefly sand and gravel) removed or "washed out" from a glacier by melt-water streams and deposited in front of or beyond the end moraine or the margin of a glacier. The coarser material is deposited nearer to the ice. Compare - pitted outwash, drift, esker, kame, till. SW & GG

outwash delta - A relict (inactive) delta composed of glaciofluvial sediments formed where a sediment laden outwash river emptied into an open lake, commonly a proglacial lake. Sediment attributes include very gently dipping topset beds (coarser textures) and steeply dipping foreset beds (finer textures). SW & GM

outwash fan - A fan-shaped accumulation of outwash deposited by meltwater streams in front of the end or recessional moraine of a glacier. Coalescing outwash fans form an outwash plain. GG

outwash plain - An extensive lowland area of coarse textured, glaciofluvial material. An outwash plain is commonly smooth; where pitted, due to melt-out of incorporated ice masses (pitted outwash plain), it is generally low in relief and largely retains its original gradient. Compare - outwash, pitted outwash plain, collapsed outwash plain, kettles; also called sandur. SW & HP

outwash terrace - A flat-topped bank of outwash with an abrupt outer face (scarp or riser) extending along a valley downstream from an outwash plain or terminal moraine; a valley train deposit. Compare - kame terrace, valley train. SW

overbank deposit - Fine-grained sediments (silt and clay) deposited from suspension on a flood plain by floodwaters that cannot be contained within the stream channel. GG

overburden - (a) The upper part of a sedimentary deposit, compressing and consolidating the materials below. (b) The loose soil or other unconsolidated material overlying bedrock, either transported or formed in place (synonym for regolith). GG

overflow stream channel - A watercourse that is generally dry but conducts flood waters that have overflowed the banks of a river, commonly from large storms, annual meltwater, or glacial meltwaters. SW

overprinting - The process of superimposing a new set of features over a preexisting set due to a shift in environmental conditions such as a change in climate or local hydrology. The resulting composite morphology retains features that would not form under present conditions. Compare - overprinted soil. SW

overprinted soil - A soil in which new soil morphology has developed and is superimposed upon that of a pre-existing soil due to a shift in pedogenic conditions such as a change in climate or hydrology; the composite morphology retains some relict features that would not form under present day conditions. (not preferred) Sometimes called welded soil. SW.

overthrust - A low angle thrust fault of large scale, with displacement generally measured in kilometers. GG

oxbow - A closely looping stream meander having an extreme curvature such that only a neck of land is left between the two parts of the stream. (colloquial: northeastern U.S.A.) the land enclosed, or partly enclosed, within an oxbow. Compare - meander belt, oxbow lake, bayou. GG

oxbow lake - The crescent-shaped, often ephemeral body of standing water situated by the side of a stream in the abandoned channel (oxbow) of a meander after the stream formed a neck cutoff and the ends of the original bend were silted up. Compare - meander belt, oxbow. GG

paha - (colloquial: Midwestern USA) Commonly a low, elongated, rounded ridge or hill cored by an erosional remnant of drift, rock, or windblown sand, silt, or clay and capped with a thick cover (e.g. up to 10 m) of loess; found especially in northeast Iowa. Height varies between 10 and 30 m. SW & GG

pahoehoe lava - A type of basaltic lava (material) with a characteristically smooth, billowy or rope-like surface and vesicular interior. Compare - `a`a lava, block lava, pillow lava. GG & MA

pahoehoe lava flow - A type of basaltic lava flow with a characteristically smooth, billowy or rope-like surface. Compare - `a`a lava flow, block lava flow, pillow lava flow. GG & MA

Paleocene - The earliest epoch (from 56.5 to 65.0 million years ago) of the Tertiary Period of geologic time that follows the Cretaceous Period and precedes the Eocene Epoch; also the corresponding (time-stratigraphic) "series" of earthy materials. SW

paleosol - A soil that formed on a landscape in the past with distinctive morphological features resulting from a soil-forming environment that no longer exists at the site. The former pedogenic process was either altered because of external environmental change or interrupted by burial. A paleosol (or component horizon) may be classed as relict if it has persisted in a land-surface position without major alteration of morphology by processes of the prevailing pedogenic environment. An exhumed paleosol is one that formerly was buried and has been re-exposed by erosion of the covering mantle. Most paleosols have been affected by some subsequent modification of diagnostic horizon morphologies and profile truncation. HP

paleoterrace - An erosional remnant of a terrace which retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to a present-day stream or drainage network. Compare - alluvial plain remnant. SW

palsa - An elliptical dome-like permafrost mound containing alternating layers of ice lenses and peat or mineral soil, commonly 3-10 m high and 2-25 m long, occurring in subarctic bogs of the tundra and often surrounded by water; pl. palsen. NRC

parabolic dune - A sand dune with a long, scoop-shaped form, convex in the downwind direction so that its horns point upwind, whose ground plan, when perfectly developed, approximates the form of a parabola. GG

parallel drainage pattern - A drainage pattern in which the streams and their tributaries are regularly spaced and flow parallel or subparallel to one another and tributaries characteristically join the mainstream at approximately the same angle, over a considerable area. It is indicative of a region having a pronounced, uniform slope and a homogeneous lithology and rock structure, such as young coastal plains and large basalt flows. SW, GG, WA

parent material - The unconsolidated and more or less chemically weathered mineral or organic matter from which a soil's solum is developed by pedogenic processes. GSST

park - (colloquial - Rocky Mountains, USA; not preferred - refer to valley, intermontane basin) (a) An ecological term for a grassy or shrubby, wide, open valley lying at high elevation and confined between forested mountain slopes, as in a high meadow; sometimes marshy. Compare - glade. (b) (refer to intermontane basin) A level valley between mountain ranges. GG & SW

parna - A term used, especially in southeast Australia and southwestern USA, for silt and sand-sized aggregates of eolian clay occurring as sheets or dunes. Compare - parna dune. SW & GG

parna dune - A dune largely composed of silt and sand-sized aggregates of clay; sometimes called a clay dune or lunette. Compare - parna. HP

partial ballena - (not preferred) refer to ballena

patina - A general term for a colored film or thin outer layer produced on the surface of a rock or other material by weathering after long exposure. Compare - rock varnish. GG

patterned ground - A general term for any ground surface exhibiting a discernibly ordered, more-or-less symmetrical, morphological pattern of ground and, where present, vegetation. Patterned ground is characteristic of, but not confined to, permafrost regions or areas subjected to intense frost action; it also occurs in tropical, subtropical, and temperate areas. Patterned ground is classified by type of pattern and presence or absence of sorting and includes nonsorted and sorted circles, net, polygons, steps and stripes, garlands, and solifluction features. In permafrost regions, the most common macroform is the ice-wedge polygon and a common microform is the nonsorted circle. Stone polygons generally form on slopes of less than 8 percent, while garlands and stripes occur on slopes of 8 to 15 percent and more than 15 percent, respectively. NRC and HP

pavement karst – Areas of bare limestone, usually sculpted by solution erosion into karren of various types and where soils have been stripped off, commonly by glaciation in alpine areas (e.g. Rocky Mountains – USA) and high latitudes, and by water erosion in arid karst areas. Compare – fluviokarst, glaciokarst, sinkhole karst, karst. SW & WW

peak - Sharp or rugged upward extension of a ridge chain, usually at the junction of two or more ridges; the prominent highest point of a summit area. HP

peat - Unconsolidated soil material consisting largely of undecomposed, or slightly decomposed, organic matter (i.e. "fibric" in Soil Taxonomy) accumulated under conditions of excessive moisture. Compare - muck, mucky peat, herbaceous peat. GSST

peat plateau - A generally flat-topped expanse of peat, elevated above the general surface of a peatland, and containing segregated ice that may or may not extend downward into the underlying mineral soil. Controversy exists as to whether peat plateaus and palsen are morphological variations of the same feature. NRC

pediment - A gently sloping erosional surface developed at the foot of a receding hill or mountain slope, commonly with a slightly concave-upward profile, that cross-cuts rock or sediment strata that extend beneath adjacent uplands. The erosion surface may be essentially bare bedrock (i.e. *rock pediment*), or it may be thinly mantled (e.g. 1 to 3 m) with debris (i.e. *pediment*) such as colluvium, pedisediment, or alluvium that is ultimately in transit from an upland front to basin or valley lowland. In hill-footslope terrain the debris mantle (over an erosional contact) is designated "pedisediment." The term has been used in several geomorphic contexts: Pediments may be classed with respect to (a) landscape positions (e.g. intermontane-basin piedmont = *apron pediment*, or valley-border footslope surfaces (= *terrace pediment*); Cooke and Warren, 1973); (b) type of material eroded (e.g. bedrock = *rock pediment*, or regolith = *pediment*); or (c) combinations of the above. Compare – rock pediment, Piedmont slope, structural bench. SW, HP, RR

pedisediment - A sediment layer, eroded from the shoulder and backslope of an erosional slope that lies on and is, or was, being transported across a pediment. FFP

pedoturbation - The mixing of soil materials by natural processes. Compare - cryoturbation. BHM

peneplain - (not recommended; obsolete) A low nearly featureless, gently undulating land surface of considerable area, which presumably has been produced by the processes of long-continued subaerial erosion. GG

peninsula – (a) An elongated body or stretch of land nearly surrounded by water (e.g., on three sides) and connected with a larger tract of land area, usually by a neck or an isthmus. (b) A relatively large tract of land jutting out into the water, with or without a well-defined isthmus; e.g., the Italian peninsula. GG

perennial stream - A stream or reach of a stream that flows continuously throughout the year and whose surface is generally lower than the water table adjacent to the region adjoining the stream. Compare - Ephemeral stream, Intermittent stream. GG

periglacial - (adjective) Pertaining to processes, conditions, areas, climates, and topographic features occurring at the immediate margins of glaciers and ice sheets, and influenced by cold temperature of the ice. The term was originally introduced to designate the climate and related geologic features peripheral to ice sheets of the Pleistocene. HP

permafrost - Ground, soil, or rock that remains at or below 0^o C for at least two years. It is defined on the basis of temperature and is not necessarily frozen. Compare - continuous permafrost, discontinuous permafrost, sporadic permafrost, thaw-stable permafrost, thaw sensitive permafrost. NRC

Physiographic Division - A large portion of a continent of which all parts are similar in geologic structure and climate at a small scale (e.g. 1:5,000,000) and which has consequently had a unified geomorphic history and whose pattern of relief or landforms differ significantly from that of adjacent areas. Examples: the Laurentian Upland, Rocky Mountain System, and Interior Highlands of the U.S.A. western U.S.A. [*The highest level in the Physiographic Location part of the Geomorphic Description System*]. SW & NASIS Data Dictionary

Physiographic Province - A region of which all parts are similar in geologic structure and climate and which has consequently had a unified geomorphic history; a region whose pattern of relief or landforms differ significantly from that of adjacent regions; **i.e. a subset within a Physiographic Division**. Examples: the Valley and Ridge, Blue Ridge, and Piedmont provinces in the eastern U.S.A., and the Basin and Range, Rocky Mountains, and Great Plains provinces in the western U.S.A. [*The second highest level in the Physiographic Location part of the Geomorphic Description System*]. SW & GG

Physiographic Section - An area which all parts are similar in geologic structure and climate at a relatively small scale and which has consequently had a unified geomorphic history, and whose pattern of relief or landforms differ significantly from that of adjacent areas (= Fenneman's (1957) "Section"); i.e. a subset within a Physiographic Province). Examples: the Mohawk, Green Mountain, and Floridian Sections in the eastern U.S.A. and the Sacramento Section, Puget Trough, and Klamath Mountains in the western U.S.A. [*The third highest level in the Physiographic Location part of the Geomorphic Description System*]. SW, NASIS Data Dictionary

piedmont - (adjective) Lying or formed at the base of a mountain or mountain range; e.g., a piedmont terrace or a piedmont pediment. (noun) An area, plain, slope, glacier, or other feature at the base of a mountain; e.g., a foothill or a bajada. In the United States, the Piedmont (noun) is a low plateau extending from New Jersey to Alabama and lying east of the Appalachian Mountains. GG

piedmont slope – (colloquial – western USA) The dominant gentle slope at the foot of a mountain; generally used in terms of intermontane-basin terrain in arid to subhumid regions. Main components include: (a) An erosional surface on bedrock adjacent to the receding mountain front (pediment, rock pediment); (b) A constructional surface comprising individual alluvial fans and interfan valleys, also near the mountain front; and (c) A distal complex of coalescent fans (bajada), and alluvial slopes without fan form. Piedmont slopes grade to basin-floor depressions with alluvial and temporary lake plains or to surfaces associated with through drainage (e.g., axial streams). Compare – bolson, fan piedmont. HP

pillow lava – A general term for lava displaying pillow structure (discontinuous, close-fitting, bun-shaped or ellipsoidal masses, generally < 1 m in diameter); considered to have formed in a subaqueous environment; such lava is usually basaltic or andesitic. Compare – `a`a lava, block lava, pahoehoe lava. SW, GG, & GS

pillow lava flow – A lava flow or body displaying pillow structure and considered to have formed in a subaqueous environment (underwater); usually basaltic or andesitic in composition. Compare – `a`a lava flow, block lava flow, pahoehoe lava flow. SW & GS

pimple mound - (colloquial: Gulf Coast U.S.A.) Low, flattened, approximately circular or elliptical features composed of sandy loam that is coarser than, and distinct from, the surrounding soil; the basal diameter ranges from 3 m to more than 30 m, and the height from 30 cm to more than 2 m. Compare - mima mound, patterned ground, shrub-coppice dune. GG

pingo - A large frost mound; especially a relatively large conical mound of soil-covered ice (commonly 30 to 50 meters high and up to 400 meters in diameter) raised in part by hydrostatic pressure within and below the permafrost of Arctic regions, and of more than 1 year's duration. GG

pinnacle [geomorphology] - A tall, slender, tapering tower or spire-shaped pillar of rock, either isolated, as on steep slopes or cliffs formed in karst or other massive rocks, or at the summit of a hill or mountain. Compare - erosional remnant, hoodoo. SW, GG, & WW

pinnate drainage pattern - A variation of the dendritic drainage pattern in which the main stream receives many closely spaced, subparallel tributaries that join it at slightly acute angles upstream, resembling in plan a feather. They typically form on steep slopes with soils that have a high silt content; such as loess landscapes or fine-textured flood plains. SW, GG, WA

pit and mound topography - (not recommended) use tree-tip pit and mound topography.

pitted outwash - Outwash deposits with surficial pits or kettles, produced by the partial or complete burial of glacial ice by outwash and the subsequent thaw of the ice and collapse of the surficial materials. Compare - pitted outwash plain. GG

pitted outwash plain - An outwash plain marked by many irregular depressions such as kettles, shallow pits, and potholes which formed by melting of incorporated ice masses; much of the gradient and internal structures of the original plain remain intact; many are found in WI, MN, MI, and IN. Compare - collapsed outwash plain, outwash, pitted outwash. GG

pitted outwash terrace - A relict glaciofluvial terrace that retains its original attitude, composed of undistorted outwash sediments and depositional structures and whose surface is pock-marked with numerous potholes or kettle depressions. Compare - collapsed outwash plain. SW

plain - A general term referring to any flat, lowland area, large or small, at a low elevation. Specifically, any extensive region of comparatively smooth and level gently undulating land. A plain has few or no prominent hills or valleys but sometimes has considerable slope, and usually occurs at low elevation relative to surrounding areas. Where dissected, remnants of a plain can form the local uplands. A plain may be forested or bare of trees and may be formed by deposition or erosion. Compare - lowland, plateau. GG

plateau - [geomorphology] A comparatively flat area of great extent and elevation; specifically an extensive land region considerably elevated (more than 100 meters) above adjacent lower-lying terrain, and is commonly limited on at least one side by an abrupt descent, has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level. Compare - hill, foothill, mountain, mesa, plain. GG

playa - The usually dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those occurring on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation-runoff events. Playa deposits are fine grained and may or may not have high water table and saline conditions. HP

playa dune - (colloquial - Southern High Plains) A linear or curvilinear ridge of windblown, granular material (generally sand or parna) removed from the adjacent basin by wind erosion (deflation), and deposited on the leeward (prevailing downwind) margin of a playa, playa basin, or salina basin. The dune may be barren or vegetated. Compare - dune. SW

playa floor – (colloquial – Southern High Plains) The lowest extensive, flat to slightly concave surface within a playa basin, consisting of a dry lake bed or lake plain underlain by stratified clay, silt or sand, and commonly by soluble salts. Compare – playa step. SW

playa lake - A shallow, intermittent lake in a arid or semi-arid region, covering or occupying a playa in the wet season but drying up in summer; an ephemeral lake that upon evaporation leaves or forms a playa. GG

playa rim – (colloquial – Southern High Plains) The convex, upper margin (shoulder) of a playa basin where the playa slope intersects the surrounding terrain. Compare – playa slope. SW

playa slope – (colloquial – Southern High Plains) The generally concave to slightly convex area within a playa basin that lies between the relatively level playa floor below (or playa step, if present) and the convex playa rim above. Overland flow is typically parallel down slope. Compare – playa step, playa rim. SW

playa step – (colloquial – Southern High Plains) The relatively level or gently inclined “terrace-like” bench or toeslope within a large playa basin flanking and topographically higher than the playa floor and below the playa slope; a bench or step-like surface within a playa basin that breaks the continuity of the playa slope and modified by erosion and/or deposition. Temporary ponding may occur in response to precipitation / runoff events. Compare – playa slope. SW

playette – A very small, playa-like, shallow, closed depression typically with a salt-encrusted surface, little or no vegetation in semi-arid to arid climates and infrequently subject to ponding from precipitation events; commonly lacks the component parts of a playa except for a small *playa floor*. Compare – playa. SW & GHG

Pleistocene - The epoch of the Quaternary Period of geologic time (from about 10 to 12 thousand to 1.6 million years ago), following the Pliocene Epoch and preceding the Holocene also the corresponding (time-stratigraphic) "series" of earth materials. SW & HP

Pliocene - The last epoch (from 1.6 to 5.2 million years ago) of the Tertiary Period of geologic time that follows the Miocene and precedes the Pleistocene Epoch; also, the corresponding (time-stratigraphic) "series" of earth materials. HP

plug [volcanic] – A consolidated crater-filling of lava, the surrounding material of which has been largely removed by erosion leaving an isolated hill or knob. Compare – neck [volcanic]. SW & GG

plug dome - A volcanic dome characterized by an upheaved, consolidated conduit filling. GG

pluton - A deep-seated igneous intrusion. GG

plutonic - Pertaining to igneous rocks formed at great depth, but also including associated metamorphic rocks. GG

pluvial lake - A lake formed in a period of exceptionally heavy rainfall; a lake formed in the Pleistocene Epoch during a time of glacial advance, and now either extinct (relict) or existing as a remnant (lake); e.g., Lake Bonneville. Compare - glacial lake, proglacial lake. GG

pocosin - (colloquial: southeastern U.S.A.) A large wet area on broad, commonly a swamp, which occurs on nearly level interflaves in the Atlantic coastal plain with distinctive, native vegetation relative to adjacent areas. Soils may be either mineral or organic. A Native American term for "swamp on a hill." Compare - raised bog. RD

point bar - One of a series of low, arcuate ridges of sand and gravel developed on the inside of a growing meander by the slow addition of individual accretions accompanying migration of the channel toward the outer bank. Compare - meander scroll. GG

point bar [coastal] - Low, arcuate, subaerial ridges of sand developed adjacent to an inlet and formed by the lateral accretion or movement of the channel. Compare – sit. SSS

polje – (not preferred) refer to interior valley.

polygon - A type of patterned ground consisting of a closed, roughly equidimensional figure bounded by more or less straight sides; some sides may be irregular. Refer to patterned ground. Compare - High center polygon, low center polygon, ice wedge polygon, nonsorted polygon. NRC

pond - (a) A natural body of standing fresh water occupying a small surface depression, usually smaller than a lake and larger than a pool. (b) A small artificial body of water, used as a source of water. Compare - salt pond. GG

pool - A small, natural body of standing water, usually fresh; e.g. a stagnant body of water in a marsh, or a transient puddle in a depression following a rain. GG

porcellanite - A dense, siliceous rock formed as a indurated or baked clay or shale with a dull, light-colored, cherty appearance, often found in the roof or floor of a burned-out coal seam. GG

postglacial - (not preferred) refer to Holocene.

pothole - [geomorphology] (not preferred) A generic, imprecise term for any pot-shaped pit or hole. GG

pothole -[glacial geology] A type of small pit or closed depression (1 to 15 meters deep), generally circular or elliptical, occurring in an outwash plain, a recessional moraine, or a till plain. GG

pothole -[lake] - A shallow depression, generally less than 10 hectares in area, occurring on disintegration moraines and commonly containing an intermittent or seasonal pond or marsh. GG

pressure ridge [ice] – A rugged, irregular wall of broken floating ice buckled upward by the lateral pressure of wind or current forcing or squeezing one floe against another, or against a shore; it may extend for kilometers in length and up to 30 m in height. Along shores they are lower (< 10 m tall) and contribute to the temporary or permanent formation of a beach berm or a rim of boulders and stones. SW & GG

pressure ridge [volcanic] - An elongate uplift of the congealing crust of a lava flow, probably due to the pressure of the underlying, still-flowing lava; commonly < 5 m in height (but range up to 15 m) and < 100 m length (but can exceed 500 m). Compare – tumulus. SW, GG, & GS

proglacial lake - A type of glacial lake which formed just beyond the margin of an advancing or retreating glacier; generally in direct contact with the ice. Compare - glacial lake, pluvial lake. GG

proglacial lake [relict] - Remnant features of a glacial lake that is now extinct which formed just beyond the margin of an advancing or retreating glacier; generally in direct contact with the ice. Compare - proglacial lake, pluvial lake. SW

proximal [sedimentology] - (adjective) Said of a sedimentary deposit consisting of coarse clastics and deposited nearest the source area. Compare - distal. GG

puff [gilgai] – A surface drape or exposure of up-welled substratum material forced to the surface and outcropping on a low mound or rim; the surface exposure of a chimney [gilgai]; a type of diapir composed of earthy material. Compare – chimney, intermediate position [gilgai], gilgai. SW

pumice - (a) [soils] Rock fragments > 2 mm in diameter (i.e., retained upon a 2 mm sieve), or coherent rock layers (pumice flow), made of light-colored, vesicular, glassy rock commonly having the composition of rhyolite. The material commonly has a specific gravity of < 1.0 and is thereby sufficiently buoyant to float on

water. SW; pumice-like fragments < 2 mm in size are called pumiceous ash. ST; Compare - scoria, tephra; (b) [geology] same as (a) but does not include any size restrictions. SW.

pyroclastic – (adj.) Pertaining to clastic rock particles produced by explosive, aerial ejection from a volcanic vent. Such materials may accumulate on land or under water. Compare - epiclastic, volcanoclastic, clastic. G. Smith & HP

pyroclastic flow – A fast density current of pyroclastic material, usually very hot, composed of a mixture of gasses and a variety of pyroclastic particles (ash, pumice, scoria, lava fragments, etc.); produced by the explosive disintegration of viscous lava in a volcanic crater or by the explosive emission of gas-charged ash from a fissure and which tends to follow topographic lows (e.g. valleys) as it moves; used in a more general sense than *ash flow*. Compare –pyroclastic surge, ash flow, nueé ardente, lahar. SW, SN, GG

pyroclastic surge – A low density, dilute, turbulent *pyroclastic flow*, usually very hot, composed of a generally unsorted mixture of gases, ash, pumice and dense rock fragments that travels across the ground at high speed and less constrained by topography than a pyroclastic flow; several types of pyroclastic surges can be specified (e.g. base surge, ash-cloud-surge). Compare - pyroclastic flow. SW, SN, GG

quarry – Excavation areas, open to the sky, usually for the extraction of stone. GG

Quaternary - The period of the Cenozoic Era of geologic time, extending from the end of the Tertiary Period (about 1.6 million years ago) to the present and comprising two epochs, the Pleistocene (Ice Age) and Holocene (Recent); also, the corresponding (time-stratigraphic) "series" of earth materials. GG

radial drainage pattern - A drainage pattern in which consequent streams radiate or diverge outward, like the spokes of a wheel from a high central area.; a major collector stream is usually found in a curvilinear alignment around the bottom of the elevated topographic feature. It is best developed on the slopes of a young domal structure, a volcanic cone, or isolated hills (erosional remnant). SW, GG, WA

railroad bed – The trace or track of a railroad route, commonly constructed slightly above the adjacent land, and composed mostly of earthy materials (gravel, rock fragments, etc.). Abandoned or reclaimed beds may no longer be topographically or visually distinct, but the materials used to construct them may still be a significant portion of the soil zone. SW

raised beach - An ancient (relict) beach occurring above the present shoreline and separated from the present beach, having been elevated above the high-water mark either by local crustal movements (uplift) or by lowering of sea or lake level, and which may be bounded by inland cliffs. GG

raised bog - An area of acid, peaty soil especially that developed from moss, in which the center is higher than the margins. Compare - pocosin, Carolina Bay, moss peat. [Note: raised peat bog (not preferred) - refer to highmoor bog]. SW & GG 87

ravine - A small stream channel; narrow, steep-sided, commonly V-shaped in cross section and larger than a gully, cut in unconsolidated materials. General synonym (not preferred) - gulch. Compare – arroyo, draw, gully. HP

recessional moraine - An end or lateral moraine, built during a temporary but significant halt in the final retreat of a glacier. Also, a moraine built during a minor readvance of the ice front during a period of general recession. Compare - end moraine, ground moraine, terminal moraine. GG

reclaimed land – a) A land area composed of earthy fill material that has been placed and shaped to approximate natural contours, commonly part of land-reclamation efforts after mining operations; b) A land area, commonly submerged in its native state, that has been protected by artificial structures (e.g. dikes) and drained for agricultural or other purposes (e.g. polder). SW

rectangular drainage pattern – A drainage pattern in which the tributaries join the main streams at right-angles, and exhibit sections of approximately the same length which form rectangular shapes; it is indicative

of streams following prominent bedrock fault, joint, or foliation systems that break the rocks into rectangular blocks. It is more irregular than the trellis drainage pattern, as the side streams are not perfectly parallel and not necessarily as conspicuously elongated, and secondary tributaries need not be present. The stronger or more harsh the pattern, the thinner the soil cover. These patterns commonly form in slate, schist, and gneiss, in resistive sandstone in arid climates, or in sandstone in humid climates if little soil has developed. SW, GG, WA

reef - (a) A ridge-like or mound-like structure, layered or massive, built by sedentary calcareous organisms, especially corals, and consisting mostly of their remains; it is wave-resistant and stands above the surrounding contemporaneously deposited sediment. Reefs can also include a mass or ridge of rocks, especially coral and sometimes sand, gravel, or shells, rising above the surrounding estuary, sea or lake bottom to or nearly to the surface. SSS, SW & GG

regolith - All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits. Soil scientists regard as soil only that part of the regolith that is modified by organisms and soil-forming processes. Most engineers describe the whole regolith, even to a great depth, as "soil." Compare - residuum, bedrock. HP

relict - (adjective) Pertaining to surface landscape features e.g., landforms, geomorphic surfaces, and paleosols that have never been buried and yet are predominantly products of past environments. Compare - exhumed, buried, ground soil. HP

relict-tidal inlet - A channel remnant of a former tidal inlet. The channel was cutoff or abandoned by infilling from migrating shore sediments. Compare - inlet, tidal inlet. SSS

relief - The relative difference in elevation between the upland summits and the lowlands or valleys of a given region. Compare - local relief. GG

remnant - (not preferred) refer to erosion remnant.

residuum - (residual soil material) Unconsolidated, weathered, or partly weathered mineral material that accumulates by disintegration of bedrock in place. Compare - colluvium, regolith, saprolite. HP

reworked lake plain - The bottom of a shallow, extinct glacial lake composed of thin (e.g., < 2 m thick), fine-textured, reworked lacustrine sediments that overlie outwash or till; original lacustrine sediments have been subsequently redistributed primarily by wave action (eroded and / or moved a short distance). A distinctive lake plain topography is not always present. It may include subdued, till-capped topographic highs, ringed by shores or strandlines that were once emergent islands. Common to MI, OH. Compare - till-floored lake plain. SW

rhythmite - An individual unit of a succession of beds developed by rhythmic sedimentation; e.g. a cyclothem. The term implies no limit as to bedding thickness or complexity and denotes no time or seasonal connotation. Compare - varves, cyclothem. GG

rib - A small, high angle, tertiary spur ridge or mini-interfluvium that is a constituent part of rib & groove topography; (slopes generally 20 - 90 %,); common on the mid and lower hillslopes of well dissected uplands. Compare - finger ridge, groove, rib and groove topography. SW

rib and groove topography - A local scale topography composed of repeating, small, high-angle (slopes generally 20 - 90 %), tertiary spur ridges or mini-interfluviums (ribs) separated by small, natural, narrow drainageways (grooves); the overall effect is a corrugated transverse surface, common on the mid and lower slopes of well dissected uplands in semi-arid to humid environments (e.g. Basin and Range, Ozarks, etc.). Micro-elevational differences generally range from < 3 to < 15 m. SW

ribbed fen - A nutrient-rich wetland with a surface pattern of ridges and depressions.

rice paddy - An anthropogenic, nearly level impoundment that is inundated for long periods typically for wetland rice production. It is applied to areas that have been used in this fashion for a long enough period of time to significantly change the original soil morphology (especially redoximorphic features). SW

ridge - A long, narrow elevation of the land surface, usually sharp crested with steep sides and forming an extended upland between valleys. The term is used in areas of both hill and mountain relief. HP

rift valley - A valley that has developed along a long, narrow continental trough that has down-dropped and is bounded by normal faults; a graben of regional size. It marks part of a zone along which the entire thickness of the lithosphere has ruptured under crustal extension. SW & GG

rill - A very small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water, usually during and immediately following moderate rains or after ice / snow melt. Generally, a rill is not an obstacle to wheeled vehicles and is shallow enough (e.g., < 0.5 m) to be obliterated by ordinary tillage. Compare - gully. SW & GSST

rim - The border, margin, edge, or face of a landform, such as the curved brim surrounding the top part of a crater or caldera; specifically the rimrock of a plateau or canyon. GG

ripple mark - An undulating surface of alternating, subparallel, small-scale ridges and depressions, commonly composed of loose sand. It is produced on land by wind and under water by the agitation of water by currents or wave action, and generally tends at right angles or obliquely to the direction of flow of the moving fluid. Compare - giant ripple mark. GG

rise - (refer to lake plain) (a) A imprecise term for a slight increase in slope and elevation of the land surface, usually with a broad summit and gently sloping sides. GG (b) [soil survey] same as (a) but the term is restricted to microfeatures in areas of very low relief such as lake plains or coastal plains. SW

rise [geomorphology] - A geomorphic component of flat plains (e.g., lake plain, low coastal plain, low-gradient till plain) consisting of a slightly elevated but low, broad area with low slope gradients (e.g. 1-3 % slopes); typically a microfeature but can be fairly extensive. Commonly soils on a rise are better drained than those on the surrounding talf. Compare - talf. SW

riser [geomorphology] - A geomorphic component of terraces, flood-plain steps, and other stepped landforms consisting of the vertical or steep side slope (e.g. escarpment) typically of minimal aerial extent. Commonly a recurring part of a series of natural, step-like landforms such as successive stream terraces. Its characteristic shape and alluvial sediment composition are derived from the cut and fill processes of a fluvial system. Compare - tread. SW

river [streams] - (a) A general term for a natural, freshwater surface stream of considerable volume and generally with a permanent base flow, moving in a defined channel toward a larger river, lake, or sea. (b) (not recommended: colloquial - New England, USA) A small watercourse which elsewhere in the USA is known as a *creek*. Compare - stream. GG

river valley - an elongate depression of the Earth's surface carved by a river during the course of its development. Compare - valley side, valley floor. GG

road bed - The trace or track of a wheeled vehicle route that may or may not be raised slightly above the adjacent land, and composed of earthy fill material (gravel, rock fragments, etc.) or local soil material. Traffic can alter various soil properties primarily by compaction. Abandoned or reclaimed beds may no longer be topographically or visually distinct. However, materials used to construct beds or changes in soil properties may continue to have a significant impact on soil management or plant growth. SW

road cut - A common anthropogenic feature, typically a microfeature, consisting of the sloping, cut surface flanking a road bed on one or both sides, that remains after local topography is minimized by cutting an elongated depression through higher ground during road construction; a type of cutbank. Compare - cut, cutbank. SW

roche moutonnée - A small elongate protruding knob or hillock of bedrock, so sculptured by a large glacier as to have its long axis oriented in the direction of ice movement, an upstream (stoss or scour) side that is gently inclined, smoothly rounded, and striated, and a downstream (lee or pluck) side that is steep and rough. It is usually a few meters in height, length, and breadth. GG

rockfall [mass movement] – The process, associated sediments (rockfall deposit) or resultant landform characterized by a very rapid type of *fall* dominated by downslope movement of detached rock bodies which fall freely through the air or by leaps and bounds (lacks an underlying slip face); also spelled *rock fall*. Compare – debris fall, soil fall, landslide. SW

rockfall avalanche [mass movement] - The process, associated sediments (rockfall avalanche deposit) or resultant landform characterized by an extremely rapid, large type of *rock-fragment flow* (a type of landslide) that starts as a rockfall but turns into a flow and characteristically deposits rock-dominated debris long distances from the failure face (such as 10 – 20 times the fall height); occurs only when huge rockfalls and rockslides involving millions of metric tons of material attain extremely rapid speeds; most common in a rugged mountainous area; ex. the 1903 Franks, Alberta, Canada avalanche. Sometimes loosely referred to as a long run-out landslide. Compare – rock fragment flow, flow, landslide. SW

rock glacier - A mass of poorly sorted angular boulders and fine material, with interstitial ice a meter or so below the surface (ice-cemented) or containing a buried ice glacier (ice-cored). It occurs in a permafrost area, and is derived from a cirque wall or other steep cliff. Rock glaciers have the general appearance and slow movement of small valley glaciers, ranging from a few hundred meters to several kilometers in length, and having a distal area marked by a series of transverse, arcuate ridges. GG

rock pediment – An erosion surface of low relief, cut directly into and across bedrock and composed of either bare rock or thinly veneered pediment or residuum (e.g. < 1.5 m) over bedrock; it occurs along the flanks of mountain fronts, or at the base of mountains or high hills. Its surface grades to the backwearing mountain slopes or hillslopes above, and generally grades down to and merges with a lower-lying alluvial plain, piedmont slope or valley floor below. SW & FFP

rock spread [mass movement] – The process, associated sediments (rock spread deposit) or resultant landforms characterized by a very rapid type of *spread* dominated by lateral movement in a rock mass resulting from liquefaction or plastic flow of underlying materials that may be extruded out between intact units; rock bodies predominate. Compare – debris spread, earth spread, landslide. SW & DV

rock topple [mass movement] – The process, associated sediments (rock topple deposit) or resultant landform characterized by a localized, very rapid type of fall in which large blocks of rock material literally fall over, rotating outward over a low pivot point; rock bodies predominate (little fine earth). Portions of the original material may remain intact, although reoriented, within the resulting deposit. Compare – earth topple, debris topple, landslide. SW

rock varnish - A thin, dark, shiny film or coating, composed of iron oxide accompanied by traces of manganese oxide and silica, formed on the surfaces of pebbles, boulders, and other rock fragments, commonly on rock outcrops in arid regions. It is believed to be caused by exudation of mineralized solutions from within and deposition by evaporation on the surface. GG

rotational debris slide – [mass movement] – The process, associated sediments (rotational debris slide deposit) or resultant landform characterized by an extremely slow to moderately rapid type of slide, composed of comparatively dry and largely unconsolidated earthy material, portions of which remain largely intact and in which movement occurs along a well-defined, concave shear surface and resulting in a backward rotation of the displaced mass; sediments have substantial proportions of both fine earth and coarse fragments. The landform may be single, successive (repeated up and down slope), or multiple (as the number of slide components increase). Compare – rotational earth slide, rotational rock slide, translational slide, lateral spread, landslide. SW & DV

rotational earth slide – [mass movement] – The process, associated sediments (rotational earth slide deposit) or resultant landform characterized by an extremely slow to moderately rapid type of slide, composed of comparatively dry and largely unconsolidated earthy material, portions of which remain largely intact and in which movement occurs along a well-defined, concave shear surface and resulting in a backward rotation of the displaced mass; sediments predominantly fine earth (< 2 mm). The landform may be single, successive (repeated up and down slope), or multiple (as the number of slide components increase). Compare – rotational debris slide, rotational rock slide, translational slide, lateral spread, landslide. SW & DV

rotational landslide – (not preferred) use rotational slide.

rotational rock slide – [mass movement] – The process, associated sediments (rotational rock slide deposit) or resultant landform characterized by an extremely slow to moderately rapid type of slide, composed of comparatively dry and largely consolidated rock bodies, portions of which remain largely intact but reoriented, and in which movement occurs along a well-defined, concave shear surface and resulting in a backward rotation of the displaced mass. The landform may be single, successive (repeated up and down slope), or multiple (as the number of slide components increase). Compare – rotational debris slide, rotational earth slide, translational slide, lateral spread, landslide. SW & DV

rotational slide [mass movement] – The process, associated sediments (rotational landslide deposit) or resultant landforms characterized by an extremely slow to moderately rapid type of slide, composed of comparatively dry and largely soil-rock materials, portions of which remain largely intact and in which movement occurs along a well-defined, concave shear surface and resulting in a backward rotation of the displaced mass. The landform may be single, successive (repeated up and down slope), or multiple (as the number of slide components increase). Compare – rotational debris slide, rotational earth slide, rotational rock slide, translational slide, lateral spread, landslide. SW & DV

rotational slump - (not recommended) use rotational slide.

rubble - An accumulation of loose angular rock fragments, commonly overlying outcropping rock; the unconsolidated equivalent of a breccia. Compare - scree, talus. GG

saddle - A low point on a ridge or interfluvium, generally a divide (pass, col) between the heads of streams flowing in opposite directions. Compare - summit, crest. HP

sag – A small, partially or completely closed depression formed by movement along a strike-slip fault, or by mass movement (i.e., landslide) that may or may not temporarily pond water from impounded drainage or surface runoff. For example, a closed depression formed between a scarp or headwall and an adjacent rotated slump block of a landslide. SW

sag pond - A small, permanent body of water in a semi-closed or closed depression formed by movement along a strike-slip fault or by mass movement (i.e., landslide) that ponds water from impounded drainage or surface runoff. Also spelled sagpond. SW & GG

salt marsh - Flat, poorly drained area that is subject to periodic or occasional overflow by salt water, containing water that is brackish to strongly saline, and usually covered with a thick mat of grassy halophytic plants; e.g., a coastal marsh periodically flooded by the sea, or an inland marsh, (or salina) in an arid region and subject to intermittent overflow by salty water. Compare - tidal marsh, mud flat. GG

salt pond - A large or small body of salt water in a marsh or swamp along the seacoast. GG

sand boil - An accumulation of sand commonly in the form of a low mound, produced by the expulsion of liquefied sand to the ground surface; sometimes called sand volcanoes (not preferred). Examples are found on top of some landslide deposits (i.e. spreads) or on the upper surface of highly contorted layers of laminated sediments. SW & GG

sand dune - see dune

sandur – (not preferred – use *outwash plain*).

sand flow [mass movement] – a) A flow of wet sand, as along banks of noncohesive clean sand that is subject to scour and to repeated fluctuations in pore-water pressure due to rise and fall of the tide. b) A flow of loose, dry sand, as along the slip face of a sand dune; typically a microfeature. SW, CV & GG

sandhills - A region of semi-stabilized sand dunes or sandy hills, either covered with vegetation or bare, as in north-central Nebraska and the midlands of the Carolinas. GG

sand pit – A depression, ditch or pit excavated to furnish sand for roads or other construction purposes off-site; a type of borrow pit. SW

sand plain – (a) [geomorphology] A sand-covered plain, which may originate by deflation of sand dunes, and whose lower limit of erosion is governed by the water table. Also spelled *sandplain*. GG (b) [glacial geology] (not preferred – refer to *sandy outwash plain*) A small outwash plain composed chiefly of sand deposited by meltwater streams flowing from a glacier. GG

sand ramp – A sand sheet blown up onto the lower slopes of a bedrock hill or mountain and forming an inclined plane, sometimes filling small mountain-side valleys and even crossing low passes. Compare – climbing dune, sand sheet. FFP & SW

sand ridge - (a) (not preferred) An imprecise, generic name for any low ridge of sand, formed at some distance from shore, e.g. submerged (longshore bar) or emergent (barrier beach). (b) One of a series of long, wide, extremely low, parallel ridges believed to represent the eroded stumps of former longitudinal sand dunes, as in western Zimbabwe. GG

sand sheet - A large, irregularly shaped, commonly thin, surficial mantle of eolian sand, lacking the discernible slip faces that are common on dunes. GG

sand volcano – (not preferred) use sand boil.

sand wedge - (not preferred) refer to ice wedge cast.

sandstone - Sedimentary rock containing dominantly sand-size clastic particles. HP

sanitary landfill – A land area where municipal solid waste is buried in a manner engineered to minimize environmental degradation. Commonly the waste is compacted and ultimately covered with soil or other earthy material. Compare – dump. GG

saprolite - Soft, friable, isovolumetrically weathered bedrock that retains the fabric and structure of the parent rock (Colman and Dethier, 1986) and exhibiting extensive inter-crystal and intra-crystal weathering. In pedology, saprolite was formerly applied to any unconsolidated residual material underlying the soil and grading to hard bedrock below. Compare - grus, residuum. SW & HP

scabland - An elevated, flat-lying, basalt-floored area, with little if any soil cover, sparse vegetation, and usually deep, dry channels scoured into the surface, especially by glacial meltwaters such as the Channeled Scablands of eastern Washington. Compare - coulee. GG

scalped area – a) A modified slope, feature, or land area where much or all of the natural soil has been mechanically removed (e.g. scraped off) due to construction or other management practices. Compare – truncated soil. b) A forest soil area where the ground vegetation and root mat has been removed to expose mineral soil in preparation for planting or seeding. Compare – truncated soil. SW

scarp - An escarpment, cliff, or steep slope of some extent along the margin of a plateau, mesa, terrace, or structural bench. A scarp may be of any height. Compare - escarpment. GG

scarp slope - The relatively steeper face of a cuesta, facing in a direction opposite to the dip of the strata. Compare - dip slope. GG

scoria - (a) [soils] Vesicular, rock fragments > 2 mm in at least one dimension and a specific gravity > 2.0, or a cindery crust of such material on the surface of andesitic or basaltic lava; the vesicular nature is due to the escape of volcanic gases before solidification; it is usually heavier, darker, and more crystalline than pumice. Compare - cinder, pumice, tephra; (b) [geology] The same as (a) except no size restrictions are applied. SW

scour [geomorphology] - (a) The powerful and concentrated clearing and digging action of flowing air, water, or ice, especially the downward erosion by stream water in sweeping away mud and silt on the outside curve of a bend, or during the time of a flood; a process. (b) A place in a stream bed swept (scoured) by running water, generally leaving a gravel bottom. GG

scour and fill [geomorphology] - A *process* of alternate excavation and refilling of a channel, as by a stream or the tides; especially such a process occurring in time of flood, when the discharge and velocity of an aggrading stream are suddenly increased, causing the digging of new channels that become filled with sediment when the flood subsides. Compare - cut and fill. GG

scree - A collective term for an accumulation of coarse rock debris or a sheet of coarse debris mantling a slope. Scree is not a synonym of talus, as scree includes loose, coarse fragment material on slopes without cliffs. Compare - talus, colluvium, mass movement. HP

scree slope - A portion of a hillside or mountainslope mantled by scree and lacking an up-slope rockfall source (i.e. cliff). Compare - talus slope, scree, talus. SW

scroll - (not preferred) refer to meander scroll.

sea - a) A large inland body of salt water (e.g. the Sultan Sea, CA). b) A geographic subdivision of an ocean (e.g. the South China Sea). Compare - gulf, ocean, salt pond. GG

sea cliff [coastal] - A cliff or slope produced by wave erosion, situated at the seaward edge of the coast or the landward side of the wave-cut platform. It may vary from an inconspicuous slope to a high, steep escarpment. GG

sediment - Material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by water, wind, ice or mass-wasting and has come to rest on the earth's surface either above or below sea level. Sediment in a broad sense also includes materials precipitated from solution or emplaced by explosive volcanism, as well as organic remains; e.g., peat that has not been subject to appreciable transport. HP

sedimentary peat [Soil Taxonomy] - An accumulation of organic material that is predominantly the remains of floating aquatic plants (e.g. algae) and the remains and fecal material of aquatic animals, including coprogenous earth. Compare - herbaceous peat, moss peat, woody peat, peat, muck, and mucky peat. SSM

sedimentary rock - A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under "normal" low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, marine deposits; e.g., sandstone, siltstone, mudstone, clay-stone, shale, conglomerate, limestone, dolomite, coal, etc. Compare - sediment. HP

seep - (noun) An area, generally small, where water outflows slowly at the land surface. Flow rates for seeps are too small to be considered as springs, but reflow and / or lateral subsurface flow keeps the surface or near soil saturated during dry periods. SW & GG

seif dune - A large, sharp-crested, elongated, longitudinal (linear) dune or chain of sand dunes, oriented parallel, rather than transverse (perpendicular), to the prevailing wind. If unmodified, the crest, in profile, commonly consists of a succession of curved slip faces produced by strong, but infrequent cross winds. A

seif dune may be as much as 200 m high and from 400 m to more than 100 km long. Compare – longitudinal dune. GG and HP

semi-bolson - (colloquial: western USA) A wide desert basin or valley that is drained by an intermittent stream, an externally drained (open) intermontane basin. Compare - bolson GG

semi-open depression – A topographically enclosed basin that generally functions as a closed depression and lacks a defined exit channel. Surface water loss may occur via overland flow through a topographic low area or gap in response to large storm events. Semi-open depressions commonly contain small lakes, ponds, or wet meadows dominated by hydric soils (e.g. in karst valleys, or in low areas on marine terraces with < 1 % slopes). SW

sewage lagoon – Any artificial pond or other water-filled excavation for the natural oxidation of sewage or disposal of animal manure. GG

shale - Sedimentary rock formed by induration of a clay, silty clay, or silty clay loam deposit and having the tendency to split into thin layers, i.e., fissility. HP

sheep tracks - (not recommended) use terracettes.

shield volcano - A volcano having the shape of a very broad, gently sloping dome, built by flows of very fluid basaltic lava or rhyolitic ash flows. Compare - stratovolcano. GG & MA

shoal - (noun) (a) A relatively shallow place in a stream, lake, sea, or other body of water; a shallows. (b) A natural, subaqueous ridge, bank, or bar consisting of, or covered by, sand or other unconsolidated material, rising from the bed of a body of water (e.g. estuarine floor) to near the surface. It may be exposed at low water. Compare - reef. SSS & GG

shoal (relict) - A surficial ridge, bank, or bar consisting of sand or other subaqueous deposit that has become permanently exposed by the retreat or lowering of a proglacial lake or other body of water. Compare - longshore bar [relict]. GG

shore – The narrow strip of land immediately bordering any body of water, esp. the sea or a large lake; specifically the zone over which the ground is alternately exposed and covered by tides or waves, or the zone between high water and low water. GG

shore complex – Generally a narrow, elongate area that parallels a coastline, commonly cutting across diverse inland landforms, and dominated by landforms derived from active coastal processes which give rise to beach ridges, washover fans, beaches, dunes, wave-cut platforms, barrier islands, cliffs, etc. SW

shoreline - The intersection of a specified plane of water with the beach; it migrates with changes of the tide or of the water level. Compare - shore complex, beach, swash zone. GG

shoulder - The hillslope profile position that forms the convex, erosional surface near the top of a hillslope. If present, it comprises the transition zone from summit to backslope. Compare - summit, crest, backslope, footslope, and toeslope. SW & HP

shrub-coppice dune - A small, streamlined dune that forms around brush and clump vegetation. GG

side slope [geomorphology] - A geomorphic component of hills consisting of a laterally planar area of a hillside, resulting in predominantly parallel overland water flow (e.g., sheet wash); contour lines generally form straight lines. Side slopes are dominated by colluvium and slope wash sediments. Slope complexity (downslope shape) can range from simple to complex. Compare - head slope, nose slope, free face, interfluvium, crest, base slope. SW; The slope bounding a drainageway and lying between the drainageway and the adjacent interfluvium. It is generally linear along the slope width. RR

sidewall – (not preferred) refer to glacial-valley wall.

sill [intrusive rocks] - A tabular, igneous intrusion that parallels the bedding or foliation of the surrounding sedimentary or metamorphic rock. Compare - dike. GG

siltite - A compact, weakly metamorphosed rock formed by alteration of siltstone, mudstone or silty shale. Siltite is more indurated than mudstone or shale and lacks either shale fissility or slate-like cleavage. Siltite differs from argillite in that silt-size grains (0.002 to 0.062 mm) dominate the matrix rather than clay-size particles (<0.002 mm). Siltite differs from siltstone, mudstone, or shale in that it exhibits very low to low grade metamorphic or diagenetic layer silicate and feldspar alteration to sericite, chlorite, and albite (subgreenschist to greenschist metamorphic facies) (Maxwell, 1973; Kidder, 1987). SW

siltstone - An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt predominates over clay. GG.

sinkhole - A closed, circular or elliptical depression, commonly funnel-shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock (e.g., limestone, gypsum, salt) (*solution sinkhole*) or by collapse of underlying caves within bedrock (*collapse sinkhole*); diameters range from a few meters to as much as 1000 m. Complexes of sinkholes in carbonate-rock terrain are the main components of karst topography. Synonym (not preferred) - doline. Compare – karst valley, interior valley, cockpit. SW & WW

sinkhole karst – A landscape dominated by subsurface drainage and sinkholes (dolines) that range widely in sizes and density; the most common type of karst in **upland areas of** temperate regions (e.g. Highland Rim of TN, northern FL, southwestern MO, etc.); also called doline karst (not preferred). Compare – fluviokarst, pavement karst, glaciokarst, karst. SW, WW, & GG

skid trail – Irregularly spaced, roughly linear to radial depressions or small mounds associated with shallow to deep soil disturbance caused by dragging logs across a slope from where they were cut down to a central processing area such as a log landing during timber harvest operations. SW

slick rock - (colloquial: southwestern U.S.A.) A barren, highly smoothed and subrounded bedrock pavement with considerable, irregular topography sculpted primarily by wind in an arid climate; a type of rock outcrop common on the top of massive sandstone bedrock (e.g. Navajo, Windgate, or Kayenta Formations), especially on summits of ridges and near the leading edge of plateaus, mesas and cuestas. Compare – pavement karst. SW

slackwater - A quiet part of, or a still body of water in a stream. Compare - backswamp. GG

slickensides [pedogenic] - Shrink-swell produced slip faces on pedo-structure faces (e.g. wedges, bowls); grooves, striations, glossy sheen. Most evident in (**but not limited to**) Vertisols. Compare – slickensides [geogenic]. SW

slickensides [geogenic] - Vertical or oblique, roughly planar slip face produced by external forces such as tectonics (e.g. fault), or mass movement (e.g. large slump blocks; grooves, striations on slip face). Compare – slickensides [pedogenic]. SW

slide [mass movement] - (a) - A category of mass movement processes, associated sediments (slide deposit) or resultant landforms (e.g., rotational slide, translational slide, and snowslide) characterized by a failure of earth, snow, or rock under shear stress along one or several surfaces that are either visible or may reasonably be inferred. The moving mass may or may not be greatly deformed, and movement may be rotational (rotational slide) or planar (translational slide). A slide can result from lateral erosion, lateral pressure, weight of overlying material, accumulation of moisture, earthquakes, expansion owing to freeze-thaw of water in cracks, regional tilting, undermining, fire, and human agencies. Compare - fall, topple, lateral spread, flow, complex landslide. SW & DV (b) The track of bare rock or furrowed earth left by a slide. (c) The mass of material moved in or deposited by a slide. Compare - fall, flow, complex landslide, landslide. SW & GG

slip face - The steeply sloping surface on the lee side of a dune, standing at or near the angle of repose of loose sand, and advancing downwind by a succession of slides wherever that angle is exceeded. GG

slip surface – A landslide displacement surface, often slickensided and striated, or brecciated, and subplanar. It is best exhibited in argillaceous materials and in those materials which are highly susceptible to clay alteration when granulated; also called shear surface (not preferred). Compare – main scarp, landslide, escarpment. GG

slope - (also called slope gradient or gradient) The inclination of the land surface from the horizontal. Percent slope is the vertical distance divided by the horizontal distance, then multiplied by 100. SW

slope alluvium - Sediment gradually transported down mountain or hill slopes primarily by non-channel alluvial processes (i.e., slope wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of coarse fragments and may be separated by stone lines. Sorting of rounded or subrounded pebbles or cobbles and burnished peds distinguish these materials from unsorted colluvial deposits. Compare – colluvium, slope wash. SW & HP

slope wash – A collective term for non-fluvial, incipient alluvial *processes* (e.g. overland flow, minor rills) that detach, transport, and deposit sediments down hill and mountain slopes. Related sediments (*slope alluvium*) exhibit nominal sorting or rounding of particles, peds, etc., and lateral sorting downslope on long slopes; stratification is crude and intermittent and readily destroyed by pedoturbation and frost action. Also called *slope wash processes*. Compare – slope alluvium, colluvium, valley-side alluvium. SW

slot canyon – A long, narrow, deep and tortuous channel or drainageway with sheer rock walls eroded into sandstone or other sedimentary rocks, especially in the semi-arid western USA (e.g. Colorado Plateau); subject to flash flood events; depth to width ratios exceed 10:1 over most of its length and can approach 100:1; commonly containing unique ecological communities distinct from the adjacent, drier uplands. SW

slough - (a) A small marsh, especially a marshy area lying in a local, shallow, closed depression on a piece of dry land, as on the prairie of the Midwestern U.S.A. (b) A term used, especially in the Mississippi Valley, for a creek or sluggish body of water in a tidal flat, flood plain, or coastal marshland. Compare - bayou, oxbow. (c) A sluggish channel of water, such as a side channel of a river, in which water flows slowly through low, swampy ground, as along the Columbia River, or a section of an abandoned river channel which may contain stagnant water and occurs in a flood plain or delta. (d) (not preferred) An area of soft, miry, muddy or waterlogged ground, a place of deep mud. GG

sloughed till - (not recommended) use flow till.

slump [mass movement] - (a) (not preferred- refer to rotational slide) A generic, obsolete term for various types of landslides, especially rotational landslide; the process, associated sediments, or resultant landform characterized by a slide involving a shearing and rotary movement of a generally independent mass of rock or earth along a curved slip surface (concave upward) and about an axis parallel to the slope from which it descends, and by backward tilting of the mass with respect to that slope so that the slump surface often exhibits a reversed slope facing uphill. Compare - rotational slide, slide, landslide. SW, GG, & DV. (b) (not recommended) refer to rotational slide. An informal term for the landform or mass of material slipped down during, or produced by a landslide. GG & DV

slump block - A mass of material torn away as a coherent unit during a landslide; a largely intact but displaced and commonly reoriented body of rock or soil. SW & GG

slump till - not recommended; see "flowtill"

snowfield – a) A broad expanse of terrain covered with snow, relatively smooth and uniform in appearance, occurring usually at high latitudes or in mountainous regions above the snowline and persisting throughout

year. b) A region of permanent snow cover, as at the head of a glacier; the accumulation area of a glacier. Compare - glacier. GG

soil creep - (not preferred) refer to creep.

soil fall [mass movement] – The process, associated sediments (soil fall deposit) or resultant landform characterized by a rapid type of *fall* involving the relatively free, downslope movement or collapse of detached, unconsolidated soil material which falls freely through the air (lacks an underlying slip face); sediments predominantly fine earth (< 2 mm); common along undercut stream banks. Also called earth fall, and (not recommended) debris fall. Compare – rock fall, debris fall, topple, landslide. SW

soil ripples - (not recommended) use terracettes.

solifluction - Slow, viscous downslope flow of water-saturated regolith. Rates of flow vary widely. The presence of frozen substrate or even freezing and thawing is not implied in the original definition. However, one component of solifluction can be creep of frozen ground. The term is commonly applied to processes operating in both seasonal frost and permafrost areas. Compare - creep. NRC

solifluction deposit – A deposit of non-sorted, water-saturated, earthy material locally derived that is moving or has moved down slope en masse, caused by the melting of seasonal frost or permafrost. SW

solifluction lobe - An isolated tongue-shaped feature up to 25 m wide and 150 m or more long, formed by rapid solifluction on certain sections of a slope showing variations in gradient. This feature commonly has a steep (e.g. 15° - 60°) front and a relatively smooth upper surface. NRC

solifluction sheet - A broad deposit of nonsorted, water-saturated, locally derived material that is moving or has moved downslope, en masse. Stripes are commonly associated with solifluction sheets. Compare – stripe. NRC

solifluction terrace - A low step with a straight or lobate front, the latter reflecting local differences in rate of flow. A solifluction terrace may have bare mineral soil on the upslope part and 'folded under' organic matter in both the seasonally thawed and the frozen soil. NRC

solution chimney – Small diameter (e.g. 1-5 m), irregular, hollow, vertical shaft 5-10+ m deep on karst landscapes, typically covered with a thin layer of soil or plant debris that can collapse and expose the shaft to the surface; represents a significant safety hazard. Locally called “stove-pipe sinkholes in Florida (not recommended). Compare – solution pipe. SW

solution corridor – A straight, open trench about 3 to 10 m wide in a karst area, formed by vertical and lateral solution zones developed along bedrock fractures; also called (not preferred) bogaz, zanjon (Puerto Rico). Compare – cutter, solution fissure, karst valley. SW & GG

solution fissure – One of a series of vertical open cracks commonly < 0.5 m wide dissolved along joints or fractures, separating limestone pavement (pavement karst) into blocks (clints); also called kluftkarren (not preferred). Compare – cutter, solution corridor, karren. SW, GG, & WW

solution pipe – A subsurface, vertical, cylindrical or cone-shaped hole, formed by dissolution in soluble bedrock (e.g. limestone) and often without surface expression, that is filled with detrital material (e.g. soil) and which serves as a bypass route for internal water flow. SW & GG

solution platform – A broad, nearly horizontal intertidal surface (modern or relict) formed across carbonate rocks, produced primarily by solution with contributions by intertidal weathering and biological erosion and deposition, not by abrasion. Compare – wave-cut platform. SW & GG

solution sinkhole – The most common type of sinkhole, caused by dissolution that forms fissures or a chimney and a depression in the bedrock surface which grows when closely spaced fissures underneath it enlarge and coalesce. Compare – collapse sinkhole. SW, WW, & GG

solution valley – (not preferred) use karst valley.

sorted circle - A type of patterned ground whose mesh (shape) is largely circular and has a sorted appearance commonly due to a border of coarse fragments surrounding finer material, occurring either singly or in groups. Diameters range from a few centimeters to more than 10 meters. The coarse fragment border may be 35 cm high and 8 to 12 cm wide. Compare - patterned ground. GG and NRC

sorted polygon - refer to patterned ground.

sound [coast] - a) A relatively long, narrow waterway connecting two larger bodies of water (as a sea or lake with the ocean or another sea) or two parts of the same water body, or an arm of the sea forming a channel between the mainland and an island (e.g. Puget Sound, WA); it is generally wider and more extensive than a strait [coast]. b) A long, large, rather broad inlet of the ocean, generally extending parallel to the coast (e.g. Long Island Sound, NY). c) A lagoon along the southeast coast of the US (e.g. Pamlico Sound, NC). d) A long bay or arm of a lake; a stretch of water between the mainland and a long island in a lake. Compare – sound, lagoon, gulf, ocean. GG

spatter cone - A small, steep-sided cone (e.g., 3 – 15 m high, or more) built up on a lava flow, usually pahoehoe, composed of clots of lava ejected with escaping gases from a vent or fissure which spatters and congeals as it hits the ground to form a small cone; rougher lava clots than a spiracle. Compare – spiracle. SW

specific gravity - The ratio of a material's density to that of water [material weight in air ÷ (weight in air - weight in water)]. Used to differentiate different kinds of volcanoclastics and other materials. SW

spiracle [volcanic] – A small tubular opening or chimney formed by fluid lava congealing and mounding around a fumarolic vent in a basaltic lava flow, usually about 1 m in diameter and up to 5 m high, although in the northwestern USA where spiracles are common they generally are 10 m in diameter and 12 m high or more; formed by a gaseous explosion in lava that is still fluid, probably due to steam generated from underlying wet material; smoother lava clots and drapes than a spatter cone. Compare – spatter cone. SW, GS, & GG

spit - (a) A small point or low tongue or narrow embankment of land, commonly consisting of sand or gravel deposited by longshore transport and having one end attached to the mainland and the other terminating in open water, usually the sea; a finger-like extension of the beach. (b) A relatively long, narrow shoal or reef extending from the shore into a body of water. GG

splay - (not preferred) refer to flood-plain splay.

spoil bank - A bank, mound, or other artificial accumulation of rock debris and earthy dump deposits removed from ditches, strip mines, or other excavations. Compare – dredge spoil bank. SW

spoil pile – (a) A bank, mound, or other artificial accumulation composed of spoil; e.g., an embankment of earthy material removed from a ditch and deposited alongside it. Compare – dredge spoil bank. (b) A pile of refuse material from an excavation or mining operation; e.g., a pile of dirt removed from, and stacked at the surface of a mine in a conical heap or in layers. SW & GG

sporadic permafrost - The area near the southern boundary of discontinuous permafrost where permafrost occurs in isolated patches or islands. Compare - continuous permafrost, discontinuous permafrost. NRC

spread – see lateral spread

spur [geomorphology] - A subordinate ridge or lesser elevation that projects sharply from the crest or side of a hill, mountain, or other prominent range of hills or mountains. GG

spur ridge - (not recommended) use spur.

stack [coast] – An isolated pillar-like rocky island or mass near a cliffy shore, detached from a headland by wave erosion assisted by weathering; especially one showing columnar structure with horizontal stratification. Examples occur along the Oregon coast and the Lake Superior shore. SW & GG

stack [geom] – A steep-sided mass of rock rising above its surroundings on all sides from a slope or hill. Compare – knob. GG

stagnant ice - (a) Glacial ice that is not flowing forward and is not receiving material from an accumulation area; (b) Detached blocks of ice left behind by a retreating glacier, usually buried in a moraine and melting very slowly. GG

star dune – A large, isolated sand dune whose base, in plan view, resembles a star, with sharp-crested ridges converging from basal points to a central peak that may be as high as 100 m above the surrounding plain. It tends to remain fixed for centuries in an area where the wind blows from all directions. Compare – dune. GG

State Physiographic Area - An area of relatively local extent and whose parts are similar in geologic structure and climate and which has consequently had a unified geomorphic history, and whose pattern of relief or landforms differ significantly from that of adjacent areas; i.e. a subset within a Physiographic Section. [*The fourth highest level in the Physiographic Location part of the Geomorphic Description System*]. SW & NASIS Data Dictionary

steptoe - An island-like area of older rock surrounded by a lava flow. Compare - kipuka. HP

stock – A relatively small, concordant and / or discordant plutonic rock body exposed at the land surface, with an aerial extent < 40 sq. mi. (100 km²) and no known bottom. Compare – batholith. GG

stone line - In vertical cross-section, a line formed by scattered fragments or a discrete layer of angular and subangular rock fragments, commonly a gravel- or cobble-sized lag concentration that drape across a former topographic surface and later buried by additional sediments. A stone line generally caps material that was subject to weathering, soil formation, and erosion before burial. Many stone lines seem to be buried erosion pavements, originally formed by sheet and rill erosion across the land surface. It can best be observed as outcrops in natural and artificial cuts. Also called a carpedolith. Compare - erosional pavement, desert pavement. SW & RR

stone net - (not preferred) refer to patterned ground. Synonym - sorted polygon, stone polygon.

storm surge - An abnormal, sudden rise of sea level along an open coast during a storm, caused primarily by onshore-wind stresses, or less frequently by atmospheric pressure reduction, resulting in water piled up against the coast. It is most severe when accompanied by a high tide. GG

strait [coast] – A relatively narrow waterway connecting two larger bodies of water, as the Straits of Mackinac linking Lake Michigan and Lake Huron; a large channel. Compare – sound. GG

strandline - (a) The shoreline, especially a former (relict) shoreline now elevated above the present water level, that commonly appears as a bench or line wrapping around the landscape at a common elevation. SW (b) A beach, especially one raised above the present sea or lake level. GG

strand plain - A prograded shore built seaward by waves and currents, and continuous for some distance along the coast. It is characterized by subparallel beach ridges and swales, in places with associated dunes. GG

strath terrace - A type of stream terrace, formed as an erosional surface cut on bedrock and thinly mantled (e.g. < 3 m) with stream deposits (alluvium), commonly with a gravel lag deposit immediately above the bedrock. SW & GG

stratified - (adjective) Formed, arranged, or laid down in layers. The term refers to geologic deposits. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata. HP

stratigraphy - The branch of geology that deals with the definition and interpretation of layered earth materials; the conditions of their formation; their character, arrangement, sequence, age, and distribution; and especially their correlation by the use of fossils and other means. The term is applied both to the sum of the characteristics listed and a study of these characteristics. HP

stratovolcano - A volcano that is constructed of alternating layers of lava and pyroclastic deposits, along with abundant dikes and sills. Viscous, acidic lava may flow from fissures radiating from a central vent, from which pyroclastics are ejected. Compare - shield volcano. GG

stream - (a) Any body of running water that moves under gravity to progressively lower levels, in a relatively narrow but clearly defined channel on the ground surface, in a subterranean cavern, or beneath or in a glacier. It is a mixture of water and dissolved, suspended, or entrained matter. (b) A term used in quantitative geomorphology interchangeably with channel. Compare - river. GG

stream channel - (not preferred) refer to channel.

stream order - An integer system applied to tributaries (stream segments) that documents their relative position within a drainage basin network as determined by the pattern of its confluences. The order of the drainage basin is determined by the highest integer. Several systems exist. In the Strahler system, the smallest unbranched tributaries are designated order 1; the confluence of two first-order streams produces a stream segment of order 2; the junction of two second-order streams produces a stream segment of order 3, etc. GG

stream terrace - One, or a series of flat-topped landforms in a stream valley that flank and are parallel to the stream channel, originally formed by a previous stream level, and representing remnants of an abandoned flood plain, stream bed, or valley floor produced during a past state of fluvial erosion or deposition (i.e., currently very rarely or never flooded; inactive cut and fill and/or scour and fill processes). Erosional surfaces cut into bedrock and thinly mantled with stream deposits (alluvium) are called "strath terraces." Remnants of constructional valley floors thickly mantled with alluvium are called alluvial terraces. Compare - alluvial terrace, flood-plain step, strath terrace, terrace. HP & SW

strike [structural geol.] – The compass direction or trend taken by a structural surface (e.g. a bed or fault plane) as it intersects the horizontal; used in combination with “dip” to describe the orientation of bedrock strata. SW & GG

strike valley – A subsequent valley eroded in, and developed parallel to the strike of, underlying weak strata, such as a cuesta; a valley that commonly, but not necessarily contains a stream valley. SW & GG

string bog - A peatland with roughly parallel, narrow ridges of peat dominated by peat vegetation interspersed with slight depressions, many of which contain shallow pools. The ridges are at right angles to low (< 2^o) slopes. They are typically 1 to 3 m wide, up to 1 m high and may be over 1 km long. The ridges are slightly elevated and are better drained allowing shrubs and trees to grow. They are best developed in areas of discontinuous permafrost. NRC

stripe - A type of patterned ground; one of the alternating bands of fine and coarse surface material, or of rock or soil and vegetation-covered ground, commonly found on steeper slopes. It is usually straight, but may be sinuous or branching. Compare - patterned ground. GG

stoss – (adj.) Said of the side of the hill or knob that faces the direction from which an advancing glacier or ice-sheet moved; facing the upstream (“up-ice”) side of a glacier, and most exposed to its abrasive action. Compare – lee, stoss and lee, crag and tail. GG

stoss and lee – An arrangement of small hills or prominent rocks, in a strongly glaciated area, having gentle slopes on the stoss (“up-ice”) side and somewhat steeper, plucked slopes on the lee (“down-ice”) side. This arrangement is the opposite of crag and tail. Compare – crag and tail, drumlin, drumlinoid ridge, flute. GG

structural back slope - (not recommended) use dip slope.

structural bench - A platform-like, nearly level to gently inclined erosional surface developed on resistant strata in areas where valleys are cut in alternating strong and weak layers with an essentially horizontal attitude. Structural benches are bedrock controlled, and in contrast to stream terraces, have no geomorphic implication of former, partial erosion cycles and base-level controls, nor do they represent a stage of flood-plain development following an episode of valley trenching. Compare - pediment, ledge; see scarp. HP

subaerial - (adjective) Said of conditions and processes, such as erosion, that exist or operate in the open air on or immediately adjacent to the land surface; or of features and materials, such as eolian deposits, that are formed or situated on the land surface. Compare – subaqueous. GG

subaqueous – (adjective) Said of conditions and processes, features or deposits, that exist or operate in or under water. Compare – subaerial. SSS & GG

subaqueous landscapes - Permanently submerged areas that are fundamentally the same as subaerial (terrestrial) systems in that they have a discernable topography composed of mappable, subaqueous landforms. SSS

subaqueous soils - Soils that form in sediment found in shallow, permanently flooded environments. Excluded from the definition of these soils are any areas “permanently covered by water too deep (typically greater than 2.5 m) for the growth of rooted plants”. SSS

subglacial - (a) Formed or accumulated in or by the bottom parts of a glacier or ice sheet; said of meltwater streams, till, moraine, etc. (b) Pertaining to the area immediately beneath a glacier, as subglacial eruption or subglacial drainage. GG

subglacial melt-out till - (not preferred) refer to till.

subglacial till – Till deposited in or by the bottom parts of a glacier or ice sheet; types include lodgment till, subglacial flow till; synonym (not preferred; obsolete): basal till. SW & GM

submerged-upland tidal marsh – An extensive nearly level, intertidal landform composed of unconsolidated sediments (clays, silts, and/or sand and organic materials), a resistant root mat, vegetated dominantly by hydrophytic (water loving) plants. The mineral sediments largely retain pedogenic horizonation and morphology (e.g. argillic horizons) developed under subaerial conditions prior to submergence due to sea level rise; a type of tidal marsh. Compare – tidal marsh. SW

submerged back-barrier beach - A permanently submerged extension of the back-barrier beach that generally parallels the boundary between estuary and the barrier island. Compare – submerged mainland beach, barrier beach. SSS

submerged mainland beach - A permanently submerged extension of the mainland beach that generally parallels the boundary between an estuary or lagoon and the mainland. Compare – submerged back-barrier beach, barrier beach. SSS

submerged point bar [coastal] - The submerged extension of an exposed (subaerial) point bar. SSS

submerged wave-built terrace - A subaqueous, relict depositional landform originally constructed by river or longshore sediment deposits along the outer edge of a wave-cut platform and later submerged by rising sea level or subsiding land surface. Compare wave – built terrace, wave-cut platform. GG

submerged wave-cut platform - A subaqueous, relict erosional landform that originally formed as a wave-cut bench and abrasion platform from coastal wave erosion and later submerged by rising sea level or subsiding land surface. Compare – wave-built terrace, wave-cut platform. GG

subtidal - (adjective) – Continuous submergence of substrate in an estuarine or marine ecosystem; these areas are below the mean low tide. Compare – intertidal. SSS & CC

subtidal wetlands - Permanently inundated areas within estuaries dominated by subaqueous soils and submerged aquatic vegetation. SSS

summit - (a) The topographically highest position of a hillslope profile with a nearly level (planar or only slightly convex) surface. Compare - shoulder, backslope, footslope, and toeslope, crest. (b) A general term for the top, or highest area of a landform such as a hill, mountain, or tableland. It usually refers to a high interfluvial area of relatively gentle slope that is flanked by steeper slopes, e.g., mountain fronts or tableland escarpments. HP

superglacial - (not recommended) refer to supraglacial.

supraglacial - Carried upon, deposited from, or pertaining to the top surface of a glacier or ice sheet; said of meltwater streams, till, drift, etc. GG

supraglacial debris-flow sediment - (not preferred) refer to "till"

supraglacial melt-out till - (not preferred) refer to "till"

supraglacial till - (not preferred) refer to ablation till.

surface mine - A depression, open to the sky, resulting from the surface extraction of earthy material (e.g. soil / fill) or bedrock material (e.g. coal). Compare – borrow pit, openpit mine, quarry. SW

swale - (a) A shallow, open depression in unconsolidated materials which lacks a defined channel but can funnel overland or subsurface flow into a drainage way. Soils in swales tend to be moister and thicker (cumulic) compared to surrounding soils. SW (b) A small, shallow, typically closed depression in an undulating ground moraine formed by uneven glacial deposition; Compare - swell-and-swale topography. (c) (not preferred; refer to interdune) A long, narrow, generally shallow, trough-like depression between two beach ridges, and aligned roughly parallel to the coastline. GG

swallow hole - A closed depression or doline into which all or part of a stream disappears underground. GG

swamp - An area of low, saturated ground, intermittently or permanently covered with water, and predominantly vegetated by shrubs and trees, with or without the accumulation of peat. Compare - marsh, bog, fen. GG

swash zone - The sloping part of the beach that is alternately covered and uncovered by the uprush of waves, and where longshore movement of water occurs in a zigzag (upslope-downslope) manner. Compare – shoreline. GG

swell - (not recommended) refer to swell-and-swale topography.

swell and swale topography – A local scale topography composed of small, well-rounded hillocks and shallow, closed depressions irregularly spaced across low-relief ground moraine (slopes generally 2 – 6%); the effect is a subdued, irregularly undulating surface that is common on ground moraines. Micro-elevational differences generally range from < 1 to < 5 m. SW

syncline - (a) [landform] A unit of folded strata that is concave upward whose core contains the stratigraphically younger rocks, and occurs at the earth's surface. In a single syncline, beds forming the opposing limbs of the fold dip toward its axial plane. Compare - monocline, syncline, fold. SW & HP (b) [structural geology] A fold, at any depth, generally concave upward whose core contains the stratigraphically younger rocks. GG

tableland - A general term for a broad upland mass with nearly level or undulating summit area of large extent and steep side slopes descending to surrounding lowlands (e.g. a large plateau). Compare - plateau, mesa, cuesta. HP

talf [geomorphology] - A geomorphic component of flat plains (e.g., lake plain, low coastal plain, low-gradient till plain) consisting of an essentially flat (e.g. 0-1 % slopes) and broad area dominated by closed depressions and a non-integrated or poorly integrated drainage system. Precipitation tends to pond locally and lateral transport is slow both above and below ground, which favors the accumulation of soil organic matter and a retention of fine earth sediments; better drained soils are commonly adjacent to drainageways. Compare - rise. SW

talus - Rock fragments of any size or shape (usually coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose broken rock formed chiefly by falling, rolling, or sliding. Compare - talus slope, colluvium, mass movement, scree. GG

talus cone - A steep (e.g. 30 - 40°), cone-shaped landform at the base of a cliff or escarpment that heads in a relatively small declivity or ravine, and composed of poorly sorted rock and soil debris that has accumulated primarily by episodic rockfall or, to a lesser degree, by slope wash. Finest material tends to be concentrated at the apex of the cone. Not to be confused with an *alluvial cone*; a similar feature but of fluvial origin, composed of better stratified and more sorted material, and that tapers up into a more extensive drainageway. Compare - alluvial cone, beveled base, talus slope. SW

talus slope - a portion of a hillslope or mountainslope mantled by talus and lying below a rockfall source (e.g. cliff). Compare - scree slope, scree, talus. Compare - beveled base. SW

tank - (colloquial: southwestern USA) A natural depression or cavity in impervious rocks in which water collects and remains for the greater part of the year. GG

tarn - A relatively deep, steep-banked lake or pool occupying an ice-gouged rock basin amid glaciated mountains. A cirque lake. GG

tephra - A collective, general term for any and all clastic materials, regardless of size or composition, ejected from a vent during a volcanic eruption and transported through the air; including ash [volcanic; < 2 mm], blocks [volcanic; > 64 mm], cinders [volcanic; 2 - 64 mm], lapilli [2 - 76 mm & specific gravity > 2.0], pumice [> 2 mm & specific gravity < 1.0], and scoria [> 2 mm & specific gravity < 2.0]. Tephra, unlike many volcanoclastic terms, does not denote properties of composition, vesicularity, or grain size. SW

terminal moraine - An end moraine that marks the farthest advance of a glacier and usually has the form of a massive arcuate or concentric ridge, or complex of ridges, underlain by till and other drift types. Compare - end moraine, recessional moraine, ground moraine. HP and GG

terrace [geomorphology] - A step-like surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, or lake or sea shore. The term is usually applied to both the relatively flat summit surface (tread), cut or built by stream or wave action, and the steeper descending slope (scarp, riser), graded to a lower base level of erosion. Compare - stream terrace, flood-plain step. HP. [soil survey] Practically, terraces are considered to be generally flat alluvial areas above the 100 yr. flood stage. SW

terrace slope - not recommended, use riser

terraces - Small, irregular step-like forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock such as sheep or cattle. Synonyms (not preferred) - catstep, sheep or cattle track. HP

terrain - A generic name for a tract or region of the Earth's surface considered as a physical feature, an ecological environment, or a site of some planned human activity. GG

Tertiary - A period of the Cenozoic Era of geologic time (from 65 to 1.6 million years ago). The Tertiary epoch/series subdivisions comprise, by increasing age, the Pliocene, Miocene, Oligocene, Eocene, and Paleocene. HP

thalweg [geomorphology] - The line of continuous, maximum descent from any point on a land surface; e.g., the line connecting the lowest points along the bed of a stream, or the line crossing all contour lines at right angles. GG

thaw-sensitive permafrost - Perennially frozen ground which, upon thawing, will experience significant thaw settlement and suffer loss of strength to a value significantly lower than that for similar material in an unfrozen condition. Compare - thaw-stable permafrost. NRC

thaw-stable permafrost - Perennially frozen ground which, upon thawing, will not experience either significant thaw settlement or loss of strength. Compare - thaw-sensitive permafrost. NRC

thermokarst - Karst-like topographic features produced in a permafrost region by local melting of ground ice and subsequent settling of the ground. GG

thermokarst depression - A hollow in the ground resulting from subsidence following the local melting of ground ice in a permafrost region. GG

thermokarst drainage pattern - Drainage patterns that form polygonal and hexagonal shapes with streams that may connect rounded depressions, exhibiting a beaded appearance; developed in poorly drained, fine-grained sediments and in organic materials in regions of permafrost. Freezing causes many cracks to develop; thawing causes slumping, settlement, and depressions. This type of drainage pattern with its associated hexagons and beaded ponds indicates the existence or previous presence of permafrost conditions. SW, WA

thermokarst lake - Lake or pond produced in a permafrost region by melting of ground ice. HP

tidal flat - An extensive, nearly horizontal, barren or sparsely vegetated tract of land that is alternately covered and uncovered by the tide, and consists of unconsolidated sediment (mostly clays, silts and/or sands and organic materials). Compare - tidal marsh, wind-tidal flat. GG

tidal inlet - Any inlet through which water alternately floods landward with the rising tide and ebbs seaward with the falling tide. Compare - inlet, relict tidal inlet. GG

tidal marsh - An extensive, nearly level marsh bordering a coast (as in a shallow lagoon, sheltered bay or estuary) and regularly inundated by high tides; formed mostly of unconsolidated sediments (e.g. clays, silts, and/or sands and organic materials), and the resistant root mat of salt tolerant plants; a marshy tidal flat. Compare - tidal flat. SW & GG

till [glacial] - Dominantly unsorted and unstratified drift, generally unconsolidated and deposited directly by a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders; rock fragments of various lithologies are imbedded within a finer matrix that can range from clay to sandy loam. Compare - ablation till, basal till, flowtill, lodgment till, drift, moraine. SW & GG

till-floored lake plain - [soil survey] The floor of an extinct glacial lake where a thin (e.g. < 2 m), often discontinuous veneer of lacustrine sediments overlies till. Commonly its topography reflects the underlying,

irregular or undulating till surface rather than a distinctive, flat, lake plain surface. It may include subdued, till-capped topographic highs, ringed by shore deposits or strandlines, which were once emergent islands. Compare – reworked lake plain. SW

till plain – An extensive, flat to gently undulating area underlain predominantly by till and bounded on the distal end by subordinate recessional or end moraines. Compare – till, ground moraine. SW

tilted fault block - A fault block that has become tilted, perhaps by rotation on a hinge line (fault). Compare - fault-line scarp. GG

toe [mass movement] – The lowest, usually curved margin of displaced material of a landslide, most distant from the main scarp. Commonly it has an irregular surface that has ripples and may be breached by radial cracks or gaps. Compare – main scarp, minor scarp. CV & SW

toeslope - The hillslope position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear, and are constructional surfaces forming the lower part of a hill-slope continuum that grades to valley or closed-depression floors. Compare - summit, shoulder, backslope, footslope, valley floor. HP

tombolo - A sand or gravel bar or barrier that connects an island with the mainland or with another island. GG

topography - The relative position and elevations of the natural or manmade features of an area that describe the configuration of its surface. HP

topple [mass movement] – A category of processes, associated sediments (topple deposit) or resultant landforms characterized by a localized, very rapid type of fall in which large blocks of soil or rock literally fall over, rotating outward over a low pivot point. Portions of the original material may remain intact, although reoriented, within the resulting debris pile. Types of topples can be specified based on the dominant particle size of sediments (i.e. debris topple, soil topple, rock topple. Compare – fall, flow, slide, spread, complex landslide, landslide. SW & DV

tor - A high, isolated pinnacle, or rocky peak; or a pile of rocks, much-jointed and usually granitic, exposed to intense weathering, and often assuming peculiar or fantastic shapes. GG

Toreva block – A slump block consisting of a single large mass of unjostled material which, during descent, has undergone a backward rotation toward the parent cliff along a horizontal axis that roughly parallels it; a type of rotational landslide. The unit forms a crude, elongated rectangular block rather than a bowl shape or chaotic mass; typically associated with horizontal to gently dipping, interbedded bedrock (e.g. Black Mesa area, NM). SW, GG, & RF

tower karst – (a) A type of tropical karst topography characterized by isolated, steep-sided, residual limestone hills or ridges with vertical or near-vertical walls, and may be relatively flat-topped; commonly surrounded by a flat alluvial plain or lagoons. (Also called *fenglin*). (b) A cluster of peaks or ridges with vertical or near-vertical walls, and convex upper side slopes where towers rise from a common base and are separated by deep, rugged ravines or large sinkholes. (Also called *fengcong*, *turmkarst*). Compare – karst tower, cockpit karst, cone karst, fluviokarst, kegel karst, sinkhole karst. SW & GG

translational debris slide [mass movement] – The process, associated sediments (translational debris slide deposit) or resultant landform characterized by an extremely slow to moderately rapid type of slide, composed of comparatively dry and largely unconsolidated earthy material, portions or blocks of which remain largely intact and in which movement occurs along a well-defined, planar slip face roughly parallel to the ground surface and resulting in lateral displacement but no rotation of the displaced mass; sediments have substantial proportions of both fine earth and coarse fragments. The landform may be single, successive (repeated up and

down slope), or multiple (as the number of slide components increase). Compare – translational earth slide, translational rock slide, rotational slide lateral spread, landslide. SW & DV

translational earth slide [mass movement] – The process, associated sediments (translational earth slide deposit) or resultant landform characterized by an extremely slow to moderately rapid type of slide, composed of comparatively dry and largely unconsolidated earthy material, portions or blocks of which remain largely intact and in which movement occurs along a well-defined, planar slip face roughly parallel to the ground surface and resulting in lateral displacement but no rotation of the displaced mass; sediments predominantly fine earth (< 2 mm). The landform may be single, successive (repeated up and down slope), or multiple (as the number of slide components increase). Compare translational debris slide, translational rock slide, rotational slide, lateral spread, landslide. SW & DV

translational rock slide [mass movement] – The process, associated sediments (translational rock slide deposit) or resultant landform characterized by an extremely slow to moderately rapid type of slide, composed of comparatively dry and largely consolidated rock bodies, portions or blocks of which remain largely intact and in which movement occurs along a well-defined, planar slip face roughly parallel to the ground surface and resulting in lateral displacement but no rotation of the displaced mass; sediments predominantly fine earth (< 2 mm). The landform may be single, successive (repeated up and down slope), or multiple (as the number of slide components increase). Compare translational debris slide, translational earth slide, rotational slide, lateral spread, landslide. SW & DV

translational slide - A category of mass movement processes, associated sediments (translational slide deposit) or resultant landforms characterized by the extremely slow to moderately rapid downslope displacement of comparatively dry soil-rock material on a surface (slip face) that is roughly parallel to the general ground surface, in contrast to falls, topples, and rotational slides. The term includes such diverse *slide* types as translational debris slides, translational earth slide, translational rock slide, block glides, and slab or flake slides. . Compare - rotational slide, slide, landslide. SW, DV, GG

transverse dune - A very asymmetric sand dune elongated perpendicular to the prevailing wind direction, having a gentle windward slope and a steep leeward slope standing at or near the angle of repose of sand; it generally forms in areas of sparse vegetation. Compare – longitudinal dune. GG

tread [geomorphology] - A geomorphic component of terraces, flood-plain steps, and other stepped landforms consisting of the flat to gently sloping, topmost and laterally extensive slope. Commonly a recurring part of a series of natural, step-like landforms such as successive stream terraces. It's characteristic shape and alluvial sediment composition is derived from the cut and fill processes of a fluvial system. Compare - riser. SW

tree-throw – (not preferred) see tree-tip, tree-tip mound, tree-tip pit.

tree-tip – The process of uprooting and tipping over of trees by strong winds, commonly resulting in a small depression from which the root-ball is displaced and an adjacent mound from the sediments subsequently sloughed from the root ball. Most prevalent in shallow forested soils over a restrictive layer (e.g. bedrock); also called tree-throw, windthrow. Compare – tree-tip mound, tree-tip pit. SW

tree-tip mound - The small mound of debris sloughed from the root plate (root ball) of a tipped-over tree. Sometimes called a cradle knoll (not recommended). Local soil horizons are commonly obliterated and result in heterogeneous strata. Compare - tree-tip pit. SW & BHM.

tree-tip pit - The small pit or depression resulting from an area vacated by the root plate (ball) resulting from tree-tip ("tree-throw"). Such pits are commonly adjacent to small mounds composed of the displaced material. Subsequent infilling commonly results in a heterogeneous soil matrix that may or may not include a stone line that lines the depression. Compare - tree-tip mound. SW & BHM.

tree-tip pit and mound topography – A local-scale topography composed of irregularly spaced, small, closed depressions and adjacent mounds caused by the displacement of root balls from trees knocked down by wind (i.e., tree-tip; also called tree-throw). The result is a subdued, irregularly pock-marked or undulating

surface; most common in forested areas overlying shallow rooting conditions (e.g., lithic contact, water table, etc). Micro-elevational differences generally range from 0.5 to < 2 m. Sometimes also referred to as (not preferred:) *cradle and knoll*, or *pit and mound* topography. Compare – tree-tip mound, tree-tip pit. SW

trellis drainage pattern – A drainage pattern characterized by parallel main streams intersected at, or nearly at, right angles by their tributaries, which in turn are fed by elongated secondary tributaries and short gullies parallel to the main streams, resembling, in plan view, the stems of a vine on a trellis. This pattern indicates marked bedrock structural control rather than a type of bedrock and usually indicates in which the main parallel channels follow the strike of the beds. It is commonly developed where the beveled edges of alternating hard and soft rocks outcrop in parallel belts, as in tilted, interbedded sedimentary rocks in a rejuvenated folded-mountain region or in a maturely dissected belted coastal plain of tilted strata. SW, GG, WA

tripoli – A light-colored, porous, friable, siliceous (largely chalcedonic) sedimentary rock, which occurs in powdery or earthy masses that result from the weathering of siliceous limestone. It has a harsh, rough feel and is used to polish metals and stones. GG

trough [geomorphology] - (a) Any long, narrow depression in the earth's surface, such as one between hills or with no surface outlet for drainage. (b) (not preferred – see U-shaped valley, mountain valley) A broad, elongate U-shaped valley, such as a glacial trough. Compare - U-shaped valley. GG

trough bottom – (not preferred) refer to glacial-valley floor.

trough end - (not recommended - refer to cirque, cove). The steep, semicircular rock wall forming the abrupt head or end of a U-shaped valley. Compare - headwall. GG

trough valley - (not preferred) refer to U-shaped valley.

trough wall - (not preferred) refer to glacial-valley wall.

truncated soil – Soil that has had part or all of the upper soil horizon(s) removed by erosion, excavation, etc. Compare – scalped area. SW & GSST

tuff - A generic term for any consolidated or cemented deposit that is ≥ 50 percent volcanic ash (< 2 mm); various types of tuff can be recognized based on composition: acidic tuff is predominantly composed of acidic particles; basic tuff is predominantly composed of basic particles. SW

tumulus (pl. tumuli) – A small dome or mound on the surface of a lava flow formed by the buckling of the congealing crust near the edge of a flow caused by differences in flow rates of the cooler crust above and the hotter, more fluid lava below. Dimensions commonly range from < 1 m to 5 m in height, 3 to 10 m in width and 30 to 40 m in length. Some tumuli are hollow. Compare – pressure ridge [volcanic]. SW, GG, and GS

tunnel valley - A relatively shallow trench or depression cut into drift and other loose material, or in bedrock, by a subglacial stream not loaded with coarse sediment that may or may not be part of the present day drainage pattern. GG

tunnel-valley lake – A glacial lake occupying a portion of a tunnel valley. GG

turf hummock - A hummock consisting of vegetation and organic matter with or without a core of mineral soil or stones. Compare - earth hummock, non-sorted circle, patterned ground. NRC

unconformity - A substantial break or gap in the geologic record where a unit is overlain by another that is not in stratigraphic succession. Compare – conformity, discontinuity. GG

underfit stream - A stream that appears to be too small to have eroded the valley in which it flows; a stream whose volume is greatly reduced or whose meanders show a pronounced shrinkage in radius. It is a common result of drainage changes effected by capture, glaciers, or climatic variations. GG

upland [geomorphology] - An informal, general term for (a) the higher ground of a region, in contrast with a low-lying, adjacent land such as a valley or plain. (b) Land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hillslope continuum. Compare - lowland. HP & GG

uplift [tectonic] - A structurally high area in the earth's crust, produced by positive movements that raise or upthrust the rocks, as in a dome or arch. GG

upthrust - (a) An upheaval of rock; said preferably of a violent upheaval. (b) A high angle gravity or thrust fault in which the relatively upthrown side was the active (moving) element. HP

U-shaped valley - A valley having a pronounced parabolic cross profile suggesting the form of a broad letter "U", with steep walls and a broad, nearly flat floor; specifically a valley carved by glacial erosion. Compare - V-shaped valley. GG

uvala – (not preferred) refer to karst valley.

valley - An elongate, relatively large, externally drained depression of the Earth's surface that is primarily developed by stream erosion or glacial activity. Compare - basin. HP

valley-border surfaces - A general grouping of valley-side geomorphic surfaces of relatively large extent that occur in a stepped sequence graded to successively lower stream base levels, produced by episodic valley entrenchment; for example, multiple stream terrace levels, each with assemblages of constituent landforms (e.g. interfluves, hillslopes, fans, etc.) that dominate the margins of large river valleys. SW & HP

valley fill - The unconsolidated sediment deposited by any agent (water, wind, ice, mass wasting) so as to fill or partly fill a valley. HP

valley flat – A generic term for the low or relatively level ground lying between valley walls and bordering a stream channel; especially the small plain at the bottom of a narrow, steep-sided valley. The term can be generally applied noncommittally to a flat surface that cannot be identified with certainty as a floodplain or terrace. Compare – backswamp, meander belt. GG

valley floor - A general term for the nearly level to gently sloping, lowest surface of a valley. Landforms include axial stream channels, the flood plain, flood-plain steps, and, in some areas, low terrace surfaces. Compare - flood-plain landforms, meander, braided channel, valley side. HP

valley floor remnant - Hills that are now erosion remnants of a former valley or basin floor, composed mostly of unconsolidated valley / basin fill sediments (e.g. alluvium) and typically lie well above the modern valley floor and flood plain. Former basin floor surfaces have become dissected and irregular and consist of hillslope positions (shoulder, backslope, etc.) and hill components (interfluve, headslope, etc.); common in large valleys of the western US. SW

valley side - The sloping to very steep surfaces between the valley floor and summits of adjacent uplands. Well-defined, steep valley sides have been termed valley walls (not recommended). Note: Scale, relief, and perspective may require use of closely related terms such as hill slope or mountain slope. HP

valley-side alluvium - A concave "slope wash" deposit at the base of a hill slope, mountain slope, terrace escarpment, etc., that may or may not include the alluvial toe slope. Compare – base slope, slope alluvium. HP

valley train - A long narrow body of outwash confined within a valley beyond a glacier; it may, or may not, emerge from the valley and join an outwash plain. GG

valley wall - (not recommended) use valley side.

varve - A sedimentary layer, lamina, or sequence of laminae, deposited in a body of still water within 1 year; specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier. Compare - rhythmite. GG

ventifact - A stone or pebble that has been shaped, worn, faceted, cut, or polished by the abrasive action of windblown sand, usually under arid conditions. When the pebble is at the ground surface, as in a desert pavement, the upper part is polished while the lower or below ground part is angular or subangular. GG & HP

vernal pool – A natural, seasonal pond in a small closed depression (micro-low) which supports a semi-aquatic or aquatic ecosystem adapted to annual cycles of standing water in the springtime followed by drying in the summer / autumn; commonly recognized in CA. SW

vitric - Pyroclastic material that is more than 75% glass. GG

volcanic - (adjective) Pertaining to (a) the deep seated (igneous) processes by which magma and associated gases rise through the crust and are extruded onto the earth's surface and into the atmosphere, and (b) The structures, rocks, and landforms produced. Compare - extrusive, volcanoclastic. HP

volcanic breccia – A volcanoclastic rock composed mostly of angular rock fragments greater than 2 mm in size. The name volcanic breccia is not synonymous with pyroclastic breccia (volcanic breccia forms in different ways). GG

volcanic cone - A conical hill of lava and/or pyroclastics that is built up around a volcanic vent. GG

volcanic dome - A steep-sided, rounded extrusion of highly viscous lava squeezed out from a volcano, and forming a dome-shaped or bulbous mass of congealed lava above and around the volcanic vent. GG

volcanic field – A more or less well defined area that is covered with volcanic rocks of much more diverse lithology and distribution than a lava field, or that is so modified by age and erosion that it's original topographic configuration, composition and extent is uncertain. Compare – lava field, lava plain. SW

volcanoclastic - Pertaining to the entire spectrum of fragmental materials with a preponderance of clasts of volcanic origin. The term includes not only pyroclastic materials but also epiclastic deposits derived from volcanic source areas by normal processes of mass movement and stream erosion. Examples: welded tuff, volcanic breccia. HP

volcanic plug - (not recommended) use plug.

volcano - (a) A vent in the surface of the Earth through which magma and associated gases and ash erupt; also, the form or structure, usually conical, that is produced by the ejected material. (b) Any eruption of material, e.g. mud, sand, etc. that resembles a magmatic volcano. GG

V-shaped valley - A valley having a pronounced cross profile suggesting the form of the letter "V", characterized by steep sides and short tributaries; specifically a narrow valley resulting from downcutting by a stream. The "V" becomes broader as the downcutting progresses. Compare - U-shaped valley. GG

wash (dry wash) - (colloquial: western U.S.A.) The broad, flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in alluvium. Note: When channels reach intersect zones of ground-water discharge they are more properly classed as "intermittent stream" channels. Synonym - arroyo. Compare - gully. HP

washover fan - A fan-like deposit of sand washed over a barrier island or spit during a storm and deposited on the landward side. Washover fans can be small to medium sized and completely subaerial, or they can be

quite large and include subaqueous margins extending into adjacent lagoons or estuaries. Large fans can be subdivided into sequential parts: ephemeral washover channel (microfeature) cut through dunes or beach ridges, back-barrier flats, (subaqueous) washover-fan flat, (subaqueous) washover-fan slope. Subaerial portions can range from barren to completely vegetated.. SSS

washover-fan apron – (not preferred) use washover-fan flat.

washover-fan flat - A gently sloping, fan-like, subaqueous landform created by overwash from storm surges that transports sediment from the seaward side to the landward side of a barrier island (GG). Sediment is carried through temporary overwash channels that cut through the dune complex on the barrier spit (Fisher and Simpson, 1979; Boothroyd et al., 1985; Davis, 1994) and spill out onto the lagoon-side platform where they coalesce to form a broad belt. Also called storm-surge platform flat (Boothroyd et al., 1985) and washover fan apron (GG). Compare – washover fan slope. SSS

washover-fan slope - A subaqueous extension of a washover-fan flat that slopes toward deeper water of a lagoon or estuary and away from the washover-fan flat. Compare – washover-fan flat. SSS

water [soil survey] - A generic map unit for any permanent, open body of water (pond, lake, reservoir, etc.) that does not support rooted plants. SW

waterway - (a) A general term for a way or channel, either natural (as a river) or artificial (as a canal), for conducting the flow of water. (b) A navigable body or stretch of water available for passage; a watercourse. Compare - drainageway. GG

wave-built terrace - A gently sloping coastal feature at the seaward or lakeward edge of a wave-cut platform, constructed by sediment brought by rivers or drifted along the shore or across the platform and deposited in the deeper water beyond. Compare – submerged wave-built terrace, beach plain, strand plain. GG

wave-cut platform - A gently sloping surface produced by wave erosion, extending into the sea or lake from the base of the wave-cut cliff. This feature represents both the wave-cut bench and the abrasion platform. Compare – submerged wave-cut platform. GG

wave-cut terrace - (not recommended) use wave-built terrace.

weathering - All physical disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth's surface by atmospheric or biologic agents or circulating surface waters with essentially no transport of the altered material. These changes result in disintegration and decomposition of the material. Compare - regolith, residuum, saprolite. HP

welded soil – (not preferred – use overprinted soil).

welded tuff - A glass-rich, pyroclastic rock composed of volcanic ash indurated at the time of deposition by the welding together of its glass shards under the combined action of the heat retained by particles, the weight of overlying material, and hot gasses. It is generally composed of silica pyroclasts and appears banded or streaked. GG

welding - (a) Consolidation of sediments (especially of clays) by pressure resulting from the weight of superincumbent material or from earth movement, characterized by cohering particles brought within the limits of mutual molecular attraction as water is squeezed out of the sediments. (b) the diagenetic process whereby discrete crystals and/or grains become attached to each other during compaction, often involving pressure solution and pressure transfer. GG

wind gap - A former water gap now abandoned by the stream that formed it, suggesting stream piracy or stream diversion. HP

window [tectonic] - An eroded area of a thrust sheet, commonly a basin or valley floor, that exposes the incongruous bedrock stratigraphy beneath the thrust-sheet; a particular structural or stratigraphic relationship is implied, rather than a particular topographic form. Common in the Appalachian and Rocky Mountain margins. Synonym: *fenster*. GG, WT, SW

windthrow – (not preferred) see tree-tip.

wind-tidal flat – A broad, low-lying, nearly-level sand flat that is alternately inundated by ponded rainwater or by wind-driven bay or estuarine water from storm surges or seiche. Frequent salinity fluctuations and prolonged periods of subaerial exposure preclude establishment of most types of vegetation except for mats of filamentous blue-green algae. Compare – tidal flat. SSS & HF

woody organic materials - see organic materials

woody peat [Soil Taxonomy] - An accumulation of organic material that is predominantly composed of trees, shrubs, and other woody plants. Compare herbaceous peat, moss peat, sedimentary peat, peat, muck, and mucky peat. SSM

yardang - (a) A microfeature in the form of a long, irregular, sharp-crested, undercut ridge between two round-bottomed troughs, carved on a plateau or unsheltered plain in a desert region by wind erosion, and cut into soft but coherent deposits (such as clayey sand); it lies in the direction of the dominant wind, and may be up to 6 m high and 40 m wide. (b) A landform produced in a region of limestone or sandstone by infrequent rains combined with wind action, and characterized by “a surface bristling with a fine lacework of sharp ridges pitted by corrosion”. Compare – pavement karst. GG

yardang trough - A long, shallow, round-bottomed groove, furrow, trough, or corridor excavated in the desert floor by wind abrasion, and separating two yardangs. Compare – yardang. GG

zibar – A small, low-relief sand dune that lacks discernible slip faces and commonly occurs on sand sheets, in interdune areas, or in corridors between larger dunes. Zibar spacing can range from 50 – 400 m with local relief < 10 m. Unlike coppice dunes, zibars are not related to deposition around vegetation. Generally dominated by coarser sands. Compare – dune, coppice dune. SW, GG, NL, CW.

629.03 References.*(a) Current references.*

- Birkeland, P.W. 1999. Soils and geomorphology, 3rd Ed. Oxford University Press; 430 p.
- Bloom, Arthur L. 1997. Geomorphology: a systematic analysis of late Cenozoic landforms, 3rd Ed. Prentice Hall;
- Boothroyd, J.C., Friedrich, N.E., and McGinn, S.R. 1985. Geology of microtidal coastal lagoons: Rhode Island. *Marine Geology* 63:35-76.
- Buol, S.W., Southard, R.J., Graham, R.C., and McDaniel, P.A. 2003. Soil classification and genesis, 5th ed. Iowa State Press Ames, IA. ISBN:0-8138-2873-2
- Cherry, J.A.. 1999. Groundwater. Prentice-Hall, Inc., Englewood Cliffs, NJ.
- Colman, S.M. and Ethier, D.P. (ed.) 1986. Rates of chemical weathering of rocks and minerals. Academic Press, Inc., Orlando, FL. 603 p.
- Compton, R.R. 1985. Geology in the field. John Wiley & Sons, Inc., New York, NY; 398 p.
- Cooke, R.U. and Warren, A.. 1973. Geomorphology in deserts. University of California Press, Berkeley, CA; 374 p.
- Cowardin, L.M., Carter, V., Golet, F.C., and Laroe, E.T. 1979. Classification of wetlands and deepwater habitats of the United States. US Dept. Interior, US Fish and Wildlife Service, US Government Printing Office, Washington, DC.
- Cruden, D.M. and Varnes, D.J. 1996. Landslide types and processes. *In: Turner, A.K., and Schuster, R.L. , (eds). 1996. Landslides: investigations and mitigation. National Research Council, Transportation Research Board Special Report No. 247; National Academy Press, Washington, DC; 673 p.*
- Curran, H.A., Justus, P.S., Young, D.M., and Garver, J.B. 1984. Atlas of landforms, 3rd Ed. US Military Academy, West Point, NY, Dept Geography and Computer Science; 155 p.
- Daniels, Dr. Raymond B. 1992. (Personal communication). Head (retired), Soil Survey Investigations, USDA - Soil Conservation Service, Washington, D.C.
- Daniels, R.B., and Hammer, D.. 1992. Soil geomorphology. John Wiley & Sons, Inc., New York, NY;
- Davis, R.A. 1994. Barrier island systems - a geologic overview. P. 1-46. *In: Davis, R.A. ed.) 1994. Geology of Holocene barrier island systems. Springer-Verlag, New York, NY.*
- Demas, G.P. 1998. Subaqueous soil of Sinepuxent Bay, Maryland. PhD dissertation, Department of Natural Resources and Landscape Architecture, University of Maryland, College Park, MD.
- Dixon, J.B., and Weed, S.B.. (eds). 1989. Minerals in the soil environment, 2nd Ed. Soil Science Society of America, Madison, WI, Book Series, No. 1; 1244 p.
- Dutro, J.T., Dietrich, R.V., Foose, R.M.. 1989. AGI field data sheets: for geology in the field, laboratory and office, 3rd Ed. American Geological Institute, Alexandria, VA.;

- Fisher, J.J., and Simpson, E.J. 1979. Washover and tidal sedimentation rates as environmental factors in development of a transgressive barrier shoreline; pp.127-148. *In*: Leatherman, S.P. (ed.) 1979. Barrier islands from the Gulf of St Lawrence to the Gulf of Mexico. Academic Press, New York, NY.
- Fisk, H.N. 1959. Padre Island and the Laguna Madre flats, coastal south Texas. Louisiana State University, 2nd Coastal Geography Conference; pp. 103-151.
- Gile, L.H., Hawley, J.W., and Grossman, R.B. 1981. Soils and geomorphology in the Basin and Range area of southern New Mexico- guidebook to the Desert Project. Memoir 39. New Mexico Bureau of Mines & Mineral Resources, Socorro, NM; 222 p.
- Gile, L.H., and Ahrens, R.J, (eds). 1994. Supplement to the desert project soil monograph: Soils and landscapes of a desert region astride the Rio Grande Valley near Las Cruces, New Mexico. USDA - Soil Conservation Service, Soil Survey Investigations Report No. 44, vol. 1: Soil water and soils at the soil water sites, Jornada experiment range. National Soil Survey Center, Lincoln, NE; 592 p.
- Goldthwaite, R.P. and Matsch, C.L, (eds.) 1988. Genetic classification of glacial deposits: final report of the commission on genesis and lithology of glacial Quaternary deposits of the International Union for Quaternary Research (INQUA). A.A. Balkema, Rotterdam; 294 p.
- Graf, W.L. (ed.) 1987. Geomorphic systems of North America. Geological Society America, Decade of North American Geology, Centennial Special Volume, No. 2.; 643 p.
- Hamblin, W.K. and Howard, J.D.. 1995. Exercises in physical geology, 8th Ed. Burgess Publ. Co., Minneapolis, MN; 192p.
- Harland, W.B., Armstrong, R.L., Craig, L.E., Smith, A.G., and Smith, D.G. 1990. A geologic time scale. Press Syndicate of University of Cambridge, Cambridge, UK; 1 sheet.
- Holdorf, H. and Donahue, J. 1990. Landforms for soil surveys in the Northern Rockies. Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Misc. Publ. No. 51; 26 p.
- Hunt, C.B. 1986. Surficial deposits of the United States. Van Nos Reinhold Co., Inc., New York, NY; 208p.
- Jackson, J.A.. (ed.). 1997. Glossary of geology, 4th Ed. American Geological Institute, Alexandria, VA; 769p. ISBN 0-922152-34-9
- Kidder, David L. 1987. Stratigraphy, micropaleontology, petrography, carbonate geochemistry, and depositional history of the Proterozoic Libby Formation, Belt Supergroup, northwestern Montana and northeastern Idaho. USGS Open File Report 87-635. US Dept of Interior.
- Lancaster, N. 1995. Geomorphology of desert dunes. Routledge, New York, NY. 209 p.
- Mausbach, M.J., and Wilding, L.P. (eds). 1991. Spatial variabilities of soils and landforms. Soil Science Society of America, Madison, WI, Special Publication No.28; 270 p.
- Maxwell, D.T. 1973. Layer silicate mineralogy of the Precambrian Belt Series in Belt Symposium sponsored by the Dept of Geology, Univ. of Idaho and the Idaho Bur. of Mines and Geology, Sept 17-22, 1973. vol II, pp. 114-138.
- McGinn, S.R. 1982. Facies distribution of Ninigret Pond. Masters thesis, University of Rhode Island, Kingston, RI.

- Monroe, W.H. 1976. The karst landforms of Puerto Rico. US Geological Survey Professional Paper 899, U.S. Govt. Print. Office, Washington, DC.
- Monroe, W.H. 1980. Some tropical landforms of Puerto Rico. US Geological Survey Professional Paper 1159, U.S. Govt. Print. Office, Washington, DC.
- Morrison, R.B. (ed.). 1991. Quaternary nonglacial geology: conterminous United States. Geological Society of America, Decade of North American Geology, Geology of North America, Vol. K-2; 672p.
- National Research Council of Canada. 1988. Glossary of permafrost and related ground ice terms. Associate Committee Geotechnical Research, Technical Memorandum 142; 156p.
- Neuendorf, K.K.E., Mehl, J.P., Jr., Jackson, J. 2005. Glossary of geology, 5th Ed. American Geological Institute, Alexandria, VA. ISBN 0-922152-76-4
- Nordt, J.S., Sowers, J.M., and Lettis, W.R. 2000. Quaternary geochronology. AGU Reference Shelf 4, American Geophysical Union, Washington, DC; (ISBN 0-87590-950-7); 582 p.
- Peterson, F.F. 1981. Landforms of the Basin and Range Province defined for soil survey. Nevada Agricultural Experiment Station, Technical Bulletin No. 28, Reno, NV; 52 p.
- Peterson, F.F. 1990. A manual for describing NSSL soil sampling sites: Terms and concepts for identifying physiographic position and other sampling site descriptors; Draft ver. 1.0; USDA-NRCS National Soil Survey Laboratory, Lincoln, NE; 61p. [unpublished]
- Porter, S.C. (ed) 1983. Late-quaternary environments of the United States, Vol. 1: the late Pleistocene. University of Minnesota Press, Minneapolis, MN. 277 p.
- Ritter, D.F., Kochel, R.C., Miller, J.R. 1995. Process geomorphology, 3rd Ed. Wm C. Brown Publ.; Dubuque, IA; 539 p.
- Royse, C.F. and Barsch, D.. 1971. Terraces and pediment terraces in the southwest: an interpretation. Geological Society of America Bulletin, 82:3177-3182.
- Schoeneberger, P.J. and Wysocki, D.A. 2002. Geomorphology. In: Schoeneberger, P.J., Wysocki, D.A., Benham, E.C., and Broderson, W.D. 2002. Field Book for describing and sampling soils, version 2.0. National Soil Survey Center, Natural Resources Conservation Service, USDA, Lincoln, NE.
- Schoeneberger, P.J. and Wysocki, D.A. 2000. (personal communication). National Soil Survey Center, USDA - NRCS, Lincoln, NE.
- Schoeneberger, P.J., Wysocki, D.A., Benham, E.C., and Broderson, W.D. 2002. Field Book for describing and sampling soils, version 2.0. National Soil Survey Center, Natural Resources Conservation Service, USDA, Lincoln, NE.
- Schumm, S.A. 1977. The fluvial system. John Wiley & Sons., Inc., New York, NY; 338 p.
- Schumm, S.A. 1987. Experimental fluvial geomorphology. John Wiley & Sons, Inc., New York, NY; 413p.
- Schumm, S.A. 1991. To interpret the earth: 10 ways to be wrong. Cambridge Univ. Press; 180 p.

- Schumm, S.A., Harvey, M.D., and Watson, C.C.. 1984. Incised channels: morphology, dynamics, and control. Water Resources Publications, Littleton, CO; 200 p.
- Schuster, R.L., and Krizek, R.J., (eds). 1978. Landslides: analysis and control. National Academy Sciences, Transportation Research Board Special Report No. 176; 234 p.
- Selby, M.J. 1993. Hillslope materials and processes, 2nd Ed. Oxford University Press Inc., New York; 451p.
- Sibrava, V., Bowen, D.Q., and Richmond, D.Q., (eds). 1986. Quaternary glaciations in the Northern Hemisphere: final report of the International Geological Correlation Programme, Project 24. Quaternary Science Reviews, Vol. 5, Pergamon Press, Oxford; 514 p.
- Smith, G.D. 1978. The Andisol proposal. *In*: Leamy, M.L., Kinlock, D.I., and Parfitt, R.L. International Committee on Andisols – Final Report. Soil Management Support Services Technical Monograph #20 (p. 5). USDA – Soil Conservation Service, Washington, D.C.
- Soil Science Society of America. 2001. Glossary of soil science terms. Soil Science Society of America, Madison, WI; 135 p.
- Soil Survey Staff. 1993. Soil Survey Manual. USDA - Soil Conservation Service, Agricultural Handbook No. 18, U.S. Government Printing Office, Washington, DC; 437 p.
- Soil Survey Staff. 1994. Keys to Soil Taxonomy, 6th Ed. USDA - Natural Resources Conservation Service.
- Soil Survey Staff. 1998. Keys to Soil Taxonomy, 8th Ed. USDA - Natural Resources Conservation Service.
- Soil Survey Staff. 1999. Soil Taxonomy, 2nd Ed. A basic system of soil classification for making and interpreting soil surveys. USDA - Soil Conservation Service, Agricultural Handbook #436, U.S. Government Printing Office, Washington, DC, 869p.
- Sposito, G. 1989. The chemistry of soils. Oxford Univ. Press, Oxford; 277 p.
- Strahler, A.N. and Strahler, A.H. 1989. Elements of physical geography, 4th Ed. John Wiley & Sons, Inc., New York, NY;
- Subaqueous Soils Subcommittee. 2005. Glossary of terms for subaqueous soils, landscapes, landforms, and parent materials of estuaries and lagoons. National Cooperative Soil Survey Conference, USDA-NRCS, National Soil Survey Center, Lincoln, NE.
- Sugden, D.E. and John, B.S.. 1976. Glaciers and landscape, a geomorphological approach. Halsted Press, John Wiley and Sons, Inc., New York, NY; 376 p.
- Summer, M.E., and Stewart, B.A. (eds). 1992. Soil crusting in Australia. *In*: Soil crusting: chemical and physical process. Advances in Soil Science, Lewis Publishing, Boca Raton, FL.
- Trewartha, G.T., Robinson, A.H., Hammond, E.H., and Horn, A.T.. 1976. Fundamentals of physical geography, 3rd Ed. Magraw-Hill, New York, NY.; 384 p.
- Turner, A.K., and Schuster, R.L., (eds). 1996. Landslides: investigations and mitigation. National Research Council, Transportation Research Board Special Report No. 247; National Academy Press, Washington, DC; 673 p.

- U.S. Geological Survey. 1970. The national atlas of the United States. (sheets 61-63: Classes of Land-Surface from E.H. Hammond). U.S. Geological Survey, Washington, DC; 417 p.
- Wahrhaftig, C. 1965. Physiographic divisions of Alaska. US Geological Survey, USGS Professional Paper # 482; 52p.
- Washburn, A.L. 1973. Periglacial processes and environments. St. Martin's Press, New York, NY; 320 p.
- Washburn, A.L. 1980. Geocryology. John Wiley and Sons, New York, NY.; 406 p.
- Wells, D.V., Conkwright, R.D., Hill, J.M., and Park, M.J. 1994. The surficial sediments of Assawoman Bay and Isle of Wight Bay, Maryland: Physical and chemical characteristics. Coastal and Estuarine Geology File Report Number 94-2, Maryland Geological Survey, Baltimore, MD.
- White, W.B. 1988. Geomorphology and hydrology of karst terrains. Oxford Univ. Press, New York, NY; 478 p.
- Wright, H.E. (ed) 1983. Late-Quaternary environments of the United States, Vol. 2: the Holocene. University of Minnesota Press, Minneapolis, MN. 277 p.
- Wysocki, D.A., Schoeneberger, P.J., and LaGarry, H.E. Geomorphology of soil landscapes. 2000. In: Sumner, M.E., editor. 2000. Handbook of Soil Science. CRC Press LLC, Boca Raton, FL. ISBN: 0-8493-3136-6

(b) Classic references.

[Significant references that are Out of Print (no longer commercially available).]

- Balster, C.A. and Parsons, R.B.. 1968. Geomorphology and soils, Willamette Valley, Oregon. Oregon State Univ., Oregon Agricultural Experiment Station Special Report 265, Corvallis, OR; 31 p.
- Buol, S.W., Hole, F.D., and McCracken, R.J. 1973 (1st ed), 1980 (2nd ed.), 1989 (3rd ed.). Soil genesis and classification. Iowa State University Press, Ames, IA.
(now *Buol, Southard, Graham, and McDaniel 2003*)
- Birkeland, P.W. 1974. Pedology, weathering and geomorphic research. Oxford University Press, New York, NY ; 285 p. *(see Birkeland, 1999)*
- Birkeland, P.W. 1984. Soils and geomorphology, 2nd Ed. Oxford University Press; 386 p.
(see Birkeland, 1999)
- Bryan, K. 1946. Cryopedology: The study of frozen ground and intensive frost-action, with suggestions on nomenclature. American Journal of Science, V. 244; 642 p.
- Clayton, L. and Freers, T.F. (eds.) 1967. Glacial geology of the Missouri Coteau and adjacent areas. Guidebook 18th annual field conference Midwest Friends of the Pleistocene. North Dakota Geological Survey Miscellaneous Series #30, 170p.
- Compton, R.R. 1962. Manual of field geology. John Wiley and Sons, Inc., New York, NY; 378 p. (use Compton, 1985, Geology in the Field).
- Compton, R.R. 1977. Interpreting the earth. Harcourt-Brace-Jovanovich, New York, NY; 554 p.

- Daniels, R.B., and Jordan, R.H.. 1966. Physiographic history and the soils, entrenched stream systems, and gullies, Harrison County, Iowa. USDA - Soil Conservation Service, Technical Bulletin 1348; 133 p.
- Fairbridge, R.W. (ed). 1968. The encyclopedia of geomorphology. Encyclopedia of Earth Sciences Series, Vol. 3. McGraw-Hill Company, Inc., New York, NY; 1295 p.
- Fenneman, N.M. 1931. Physiography of the western United States. Magraw-Hill Co., New York, NY; 534p.
- Fenneman, N.M. 1938. Physiography of the eastern United States. Magraw-Hill Co., New York, NY.; 714p.
- Fenneman, N.M. 1946. (reprinted 1957). Physical divisions of the United States. US Geological Survey, US Government Printing Office, Washington, DC; 1 sheet; 1: 7,000,000.
- Flint, R.F. 1971. Glacial and Quaternary geology. John Wiley and Sons, Inc., New York, NY; 892 p.
- Freeze, A.L. and Cherry, J.A. 1979. Groundwater. Prentice-Hall, Inc., Englewood Cliffs, NJ.; 604 p.
- Gary, M., McAfee, R., Jr., Wolf, C.L.(eds). 1974. Glossary of geology. American Geological Institute, Falls Church, VA; 805 p. (use Bates & Jackson, 1987).
- Green, J., and Short, N.M. 1971. Volcanic landforms and surface features: A photographic atlas and glossary. Springer-Verlag, New York, NY. 519p.
- Hawley, J.W. and Parsons, R.B. 1980. Glossary of selected geomorphic and geologic terms. Mimeo. U.S. Dept. Agric., Soil Cons. Serv., West Technical Center, Portland, OR; 30p. (replaced by National Soil Survey Handbook (NSSH), part 629, 1995).
- Hunt, C.B. 1967. Physiography of the United States. W.H. Freeman & Co., London; 480 p.
- Monkhouse, F. 1978. Dictionary of geography. Aldine Publ. Co., Chicago, IL.; 344 p.
- Monkhouse, F. and Small, J. 1978. Dictionary of the natural environment. John Wiley & Sons, Inc., New York, NY; 320 p.
- Peterson, F.F. 1981. Landforms of the Basin and Range Province defined for soil survey. Nevada Agricultural Experiment Station, Technical Bulletin No. 28, Reno, NV; 52 p.
- Ruhe, R.V. 1969. Quaternary landscapes in Iowa. Iowa State University Press, Ames, IA; 255 p.
- Ruhe, R.V. 1975. Geomorphology: geomorphic processes and surficial geology. Houghton-Mifflin Co., Boston, MA; 246p.
- Ruhe, R.V., Daniels, R.B., and Cady, J.G. 1967. Landscape evolution and soil formation in southeastern Iowa. USDA - Soil Conservation Service Technical Bulletin 1349; 242 p.
- Russel, R.J. (ed.). 1968. Glossary of terms used in fluvial, deltaic, and coastal morphology. Louisiana State Univ., New Orleans, LA.; Coastal Studies Institute Technical Report No. 63; 97 p.
- Soil Survey Staff. 1975. Soil Taxonomy. A basic system of soil classification for making and interpreting soil surveys. USDA - Soil Conservation Service, Agricultural Handbook #436, U.S. Government Printing Office, Washington, DC, 754p.

- Strahler, A.N. 1946 Geomorphic terminology and classification of land masses. *Journal of Geology* 54:35-42.
- Thornbury, W.D. 1969. Principles of geomorphology; 2nd Ed. John Wiley and Sons, Inc., New York, NY; 594 p.
- Thornbury, W.D. 1965. Regional geomorphology of the United States. John Wiley and Sons, Inc., New York, NY; 609 p.
- Varnes, D. 1978. Slope movement types and processes. *In*: Schuster, R.L., and R.J. Krizek. (eds). 1978. Landslides: analysis and control. National Academy Sciences, Transportation Research Board Special Report No. 176; 234 p.

Exhibit 629-1 Lists of Landscape, Landform, Microfeature, and Anthropogenic Feature Terms defined in the Glossary

(comprehensive alphabetical and subset lists arranged by Geomorphic Process or Setting). Geomorphic Process is a framework for the *Geomorphic Description System* (Schoeneberger and Wysocki, 2002).

[Note: Codes follow some entries: **NR** - indicates terms that are NOT RECOMMENDED (should not be used); **NP** - indicates terms that are NOT PREFERRED (have been used, but better alternatives exist). Also following terms are italicized letters for the corresponding shorthand code (e.g., *BA*); a dash (--) indicates that no shorthand code has been assigned.]

D) ALPHABETICAL LISTS (Landscapes, Landforms, Microfeatures, Anthropogenic Features).

A) LANDSCAPES (broad or unique groups or clusters of natural, spatially associated features).

alluvial plain	--	lake plain (also Landform)	--
alluvial plain remnant	--	lava field (also Landform)	--
badlands	<i>BA</i>	lava plain (also Landform)	--
bajada (also Landform)	<i>BJ</i>	lava plateau (also Landform)	<i>LL</i>
basin	<i>BS</i>	lowland	--
basin floor (also Landform)	--	marine terrace (also Landform)	--
batholith	--	meander belt	<i>MB</i>
bay [coast] (water body; also Landform)	--	mountain range	--
bolson	<i>BO</i>	mountains (singular = Landform)	<i>MO</i>
barrier island (also Landform)	--	mountain system	--
breaks	<i>BK</i>	ocean (water body)	--
canyonlands	--	outwash plain (also Landform)	--
coastal plain (also Landform)	<i>CP</i>	peninsula	--
cockpit karst	--	piedmont	<i>PI</i>
cone karst	--	piedmont slope	--
continental glacier	--	plains (also Landform)	<i>PL</i>
delta plain (also Landform)	--	plateau (also Landform)	<i>PT</i>
drumlin field	--	rift valley	--
dune field	--	river valley (also Landform)	<i>RV</i>
estuary (water body; also Landform)	--	sandhills	<i>SH</i>
everglades	--	sand plain	--
fan piedmont (also Landform)	<i>FP</i>	scabland	<i>SC</i>
fault-block mountains	--	sea (water body; also Landform)	--
fluviokarst	--	semi-bolson	<i>SB</i>
fluviomarine terrace (also Landform)	--	shore complex	--
foothills	<i>FH</i>	sinkhole karst	--
glaciokarst	--	sound (water body; also Landform)	--
gulf [coast] (water body; also Landform)	--	strait (water body; also Landform)	--
hills (singular = Landform)	<i>HI</i>	tableland	<i>TB</i>
ice-margin complex	--	thermokarst	<i>TK</i>
intermontane basin (also Landform)	<i>IB</i>	till plain (also Landform)	<i>TP</i>
island (also Landform)	--	tower karst	--
karst	<i>KP</i>	upland	<i>UP</i>
kegel karst	--	valley (also Landform)	<i>VA</i>
lagoon [coast] (water body; also Landform)	--	volcanic field (also Landform)	--

B) LANDFORMS (natural, individual, earth-surface features mappable at common survey scales)

`a`a lava flow	--	canyon bench	--
alas	AA	Carolina Bay	CB
alluvial cone	--	channel (also Microfeature)	CC
alluvial fan	AF	chenier	CG
alluvial flat	AP	chenier plain	CH
alpine glacier	--	cinder cone	CI
anticline	AN	cirque	CQ
arete	AR	cirque floor	--
arroyo	AY	cirque headwall	--
ash flow	AS	cirque platform	--
atoll	AT	cliff	CJ
avalanche chute	AL	climbing dune	--
axial stream	--	closed depression (also Microfeature)	--
back-barrier beach	--	coastal plain (also Landscape)	CP
back-barrier flat	--	cockpit	--
backshore	AZ	col	CL
backswamp	BS	collapsed ice-floored lakebed	CK
bajada (also Landscape)	BJ	collapsed ice-walled lakebed	CN
ballena	BL	collapsed lake plain	CS
ballon	BV	collapsed outwash plain	CT
bar	BR	collapse sinkhole	--
barchan dune	BQ	colluvial apron	--
barrier beach	BB	complex landslide	--
barrier cove	--	coral island	--
barrier flat	BP	coulee	CE
barrier island (also Landscape)	BI	cove [coast] (water body)	--
basin floor (also Landscape)	BC	cove [geom]	CO
basin-floor remnant	BD	crag and tail	--
bay [coast] (water body; also Landscape)	WB	crater [volcanic]	CR
bay [geom.]	--	creep	--
bay bottom	--	crevasse filling	CF
bayou (water body)	WC	cuesta	CU
beach	BE	cuesta valley	--
beach plain	BP	cutoff	CV
beach ridge	BG	debris avalanche	DA
beach terrace	BT	debris fall	--
berm	BM	debris flow	DF
beveled base	--	debris slide	--
blind valley	VB	debris spread	--
block field	BW	debris topple	--
block glide	--	deflation basin	DB
block lava flow	--	deflation flat	--
block stream	BX	delta	DE
blowout	BY	delta plain (also Landscape)	DC
bluff	BN	depression	DP
bog	BO	diapir	DD
box canyon	--	diatreame	--
braided stream	BZ	dike	DK
broad interstream divide	--	dipslope	DL
butte	BU	disintegration moraine	DM
caldera	CD	divide	DN
canyon	CA	dome	DO

drainageway	<i>DQ</i>	Mountains)	<i>FW</i>
drainhead complex	--	fringe-tidal marsh	--
draw	<i>DW</i>	gap	<i>GA</i>
drumlin	<i>DR</i>	geyser	--
drumlinoid ridge	--	geyser basin	--
dune	<i>DU</i>	geyser cone	--
dune field (also Landscape)	--	giant ripple	<i>GC</i>
dune lake (water body)	--	glacial drainage channel	<i>GD</i>
dune slack (also Microfeature)	--	glacial lake (water body)	<i>WE</i>
earth flow	<i>EF</i>	glacial lake [relict]	<i>GL</i>
earth spread	--	glacial-valley floor	--
earth topple	--	glacial-valley wall	--
end moraine	<i>EM</i>	glacier	--
ephemeral stream (also Microfeature)	--	gorge	<i>GO</i>
eroded fan remnant	--	graben	<i>GR</i>
eroded fan-remnant sideslope	--	ground moraine	<i>GM</i>
erosion remnant	<i>ER</i>	gulch	<i>GT</i>
escarpment	<i>ES</i>	gulf [coast] (water body; also Landscape)	--
esker	<i>EK</i>	gut [stream]; (water body)	<i>WH</i>
estuary (water body; also Landscape)	<i>WD</i>	gut (valley)	<i>GV</i>
faceted spur	<i>FS</i>	half graben	--
fall	<i>FB</i>	hanging valley	<i>HV</i>
falling dune	--	headland	<i>HE</i>
fan	<i>FC</i>	head-of-outwash	--
fan apron	<i>FA</i>	headwall	<i>HW</i>
fan collar	--	high hill	--
fanhead trench	<i>FF</i>	highmoor bog	<i>HB</i>
fan piedmont (also Landscape)	<i>FG</i>	hill	<i>HI</i>
fan remnant	<i>FH</i>	hillslope	--
fan skirt	<i>FI</i>	hogback	<i>HO</i>
fault-block	--	homoclinal ridge	--
fault-line scarp	<i>FK</i>	horn	<i>HR</i>
fault zone	--	horst	<i>HT</i>
fen	<i>FN</i>	hot spring	--
fissure vent	--	ice-contact slope	--
fjord (water body)	<i>FJ</i>	ice-marginal steam	--
flat	<i>FL</i>	ice-pushed ridge	--
flatwoods	--	inlet	--
flood plain	<i>FP</i>	inselberg	<i>IN</i>
flood-plain playa	<i>FY</i>	inset fan	<i>IF</i>
flood-plain splay	<i>FM</i>	interdrumlin	--
flood-plain step	<i>FO</i>	interdune (also Microfeature)	<i>ID</i>
flood-tidal delta	--	interfluve (also Geom. Component - Hills)	<i>IV</i>
flood-tidal delta flat	--	interior valley	--
flood-tidal delta slope	--	intermittent stream (also Microfeature)	--
flow	--	intermontane basin (also Landscape)	<i>IB</i>
flute (also Microfeature)	<i>FU</i>	island (also Landscape)	--
fluviomarine bottom	--	kame	<i>KA</i>
fluviomarine terrace (also Landscape)	--	kame moraine	<i>KM</i>
fold	<i>FQ</i>	kame terrace	<i>KT</i>
foredune	<i>FD</i>	karst cone	--
fosse	<i>FV</i>	karst tower	--
free face (also Geom. Comp. – Hills,		karst valley	--

kettle	<i>KE</i>	mountain valley	<i>MV</i>
kipuka	--	mud flat	<i>MF</i>
knob	<i>KN</i>	mudflow	<i>MW</i>
knoll	<i>KL</i>	mud pot	--
lagoon [coast] (water body; also Landscape)	<i>WI</i>	muskeg	<i>MX</i>
lagoon bottom	--	natural levee	<i>NL</i>
lagoon channel	--	neck [volcanic]	--
lahar	<i>LA</i>	notch	<i>NO</i>
lake (water body)	<i>WJ</i>	nunatak	<i>NU</i>
lakebed [relict]	<i>LB</i>	open depression (also Microfeature)	--
lake plain (also Landscape)	<i>LP</i>	outwash delta	--
lakeshore	<i>LF</i>	outwash fan	<i>OF</i>
lake terrace	<i>LT</i>	outwash plain (also Landscape)	<i>OP</i>
landslide	<i>LK</i>	outwash terrace	<i>OT</i>
lateral moraine	<i>LM</i>	overflow stream channel	--
lateral spread	--	oxbow	<i>OX</i>
lava field (also Landscape)	--	oxbow lake (water body)	<i>WK</i>
lava flow	<i>LC</i>	oxbow lake (ephemeral)	<i>OL</i>
lava flow unit (also Microfeature)	--	paha	<i>PA</i>
lava plain (also Landscape)	<i>LN</i>	pahoehoe lava flow	--
lava plateau (also Landscape)	<i>LL</i>	paleoterrace	--
lava trench (also Microfeature)	--	parabolic dune	<i>PB</i>
lava tube	--	parna dune	<i>PD</i>
ledge	<i>LE</i>	partial ballena	<i>PF</i>
levee [stream]	<i>LV</i>	patterned ground	<i>PG</i>
loess bluff	<i>LO</i>	pavement karst	--
loess hill	<i>LQ</i>	peak	<i>PK</i>
longitudinal dune	--	peat plateau	<i>PJ</i>
longshore bar [relict]	<i>LR</i>	pediment	<i>PE</i>
louderback	<i>LU</i>	perennial stream (water body)	--
low hill	--	pillow lava flow	--
lowmoor bog	<i>LX</i>	pingo	<i>PI</i>
maar	--	pinnacle	--
mainland cove	--	pitted outwash plain	<i>PM</i>
main scarp (also Microfeature)	--	pitted outwash terrace	--
mangrove swamp	--	plain (also Landscape)	<i>PN</i>
marine lake (water body)	--	plateau (also Landscape)	<i>PT</i>
marine terrace (also Landscape)	<i>MT</i>	playa	<i>PL</i>
marsh	<i>MA</i>	playa dune (also Microfeature)	--
mawae	--	playa floor (also Microfeature)	--
meander	<i>MB</i>	playa lake (water body)	<i>WL</i>
meandering channel	<i>MC</i>	playa rim (also Microfeature)	--
meander scar	<i>MS</i>	playa slope (also Microfeature)	--
meander scroll	<i>MG</i>	playa step (also Microfeature)	--
medial moraine	<i>MH</i>	plug [volcanic]	--
mesa	<i>ME</i>	plug dome	<i>PP</i>
meteorite crater	--	pluvial lake (water body)	<i>WM</i>
mogote	--	pluvial lake (relict)	<i>PQ</i>
monadnock	<i>MD</i>	pocosin	<i>PO</i>
monocline	<i>MJ</i>	point bar	<i>PR</i>
moraine	<i>MU</i>	point bar [coastal]	--
mountain (plural = Landscape)	<i>MM</i>	pothole (also Microfeature)	<i>PH</i>
mountain slope	<i>MN</i>	pothole lake (water body)	<i>WN</i>

pressure ridge [ice]	--	slough (ephemeral water)	<i>SL</i>
pressure ridge [volcanic]; also Micro.)	<i>PU</i>	slough (permanent water)	<i>WU</i>
proglacial lake (water body)	<i>WO</i>	slump	<i>SK</i>
proglacial lake [relict]	--	slump block	<i>SN</i>
pyroclastic flow	--	snowfield	--
pyroclastic surge	--	soil fall	--
raised beach	<i>RA</i>	solution platform	--
raised bog	<i>RB</i>	solution sinkhole	--
ravine	<i>RV</i>	sound (water body; also Landscape)	--
recessional moraine	<i>RM</i>	spit	<i>SP</i>
reef	<i>RF</i>	spur	<i>SQ</i>
relict-tidal inlet (water body)	--	stack [coast]	--
reworked lake plain	--	stack [geom]	<i>SR</i>
ribbed fen	<i>RG</i>	star dune	--
ridge	<i>RI</i>	steptoe	<i>ST</i>
rim	<i>RJ</i>	stock	--
river (water body)	--	stoss and lee	--
river valley (also Landscape)	--	strait (water body; also Landscape)	--
roche moutonnée (also Microfeature)	<i>RN</i>	strand plain	<i>SS</i>
rock fall (also Microfeature)	--	strath terrace	<i>SU</i>
rock avalanche	--	stratovolcano	<i>SV</i>
rock glacier	<i>RO</i>	stream (water body)	--
rock pediment	--	stream terrace	<i>SX</i>
rock spread	--	strike valley	--
rock topple	--	string bog	<i>SY</i>
rotational debris slide	--	structural bench	<i>SB</i>
rotational earth slide	--	submerged back-barrier beach	--
rotational rock slide	--	submerged mainland beach	--
rotational slide	<i>RP</i>	submerged point bar [coastal]	--
saddle	<i>SA</i>	submerged-upland tidal marsh	--
sag (also Microfeature)--		submerged wave-built terrace	--
sag pond (water body, also Microfeature)	--	submerged wave-cut platform	--
salt marsh	<i>SM</i>	swale (also Microfeature)	<i>SC</i>
salt pond (water body also Microfeature)	<i>WQ</i>	swallow hole	<i>TB</i>
sand flow	<i>RW</i>	swamp	<i>SW</i>
sand ramp	--	syncline	<i>SZ</i>
sand sheet	<i>RX</i>	talus cone	--
scarp	<i>RY</i>	talus slope	--
scarp slope	<i>RS</i>	tarn (water body; also Microfeature)	--
scree slope	--	terminal moraine	<i>TA</i>
sea (water body; also Landscape)	--	terrace	<i>TE</i>
sea cliff	<i>RZ</i>	thermocarst depression	<i>TK</i>
seif dune	<i>SD</i>	thermocarst lake (water body)	<i>WV</i>
semi-open depression	--	tidal flat	<i>TF</i>
shield volcano	--	tidal inlet	--
shoal (water body)	<i>WR</i>	tidal marsh	--
shoal (relict)	<i>SE</i>	till-floored lake plain	--
shore	--	till plain (also Landscape)	<i>TP</i>
sill	<i>RT</i>	toe (also Microfeature)	--
sinkhole	<i>SH</i>	tombolo	<i>TO</i>
slackwater (water body)	<i>WS</i>	topple	--
slick rock (also Microfeature)	--	tor	<i>TQ</i>
slide	<i>SJ</i>	Toreva block	--
slot canyon	--	translational debris slide	--

translational earth slide	--	volcanic dome	VD
translational rock slide	--	volcanic field (also Landscape)	--
translational slide	TS	volcano	VO
transverse dune	TD	V-shaped valley	VV
trough	TR	wash	WA
tunnel valley	TV	washover fan	WF
tunnel-valley lake (water body)	--	washover-fan flat	--
U-shaped valley	UV	washover-fan slope	--
valley	VA	wave-built terrace	WT
valley-border surfaces	--	wave-cut platform	WP
valley flat	VF	wind gap	WG
valley floor	VL	window	--
valley floor remnant	--	wind-tidal flat	--
valley side	VS	yardang (also Microfeature)	--
valley train	VT	yardang trough (also Microfeature)	--
volcanic cone	VC		

C) MICROFEATURES (discrete, natural, earth-surface features too small to delineate at survey scales).

bar	--	gully	--
channel (also Landform)	--	hillock	--
closed depression (also Landform)	--	hoodoo	--
corda	--	interdune (also Landform)	--
cutter	--	intermittent stream (water body; also Landform)	--
dune slack (also Landform)	--	karren	--
dune traces	--	lava flow unit (also Landform)	--
earth pillar	--	lava trench (also Landform)	--
ephemeral stream (also Landform)	--	main scarp (also Landform)	--
finger ridge	--	minor scarp	--
flute (also Landform)	--	mound	M
frost boil	--	nivation hollow	--
glacial groove	--	open depression (also Landform)	--
groove	--	patterned ground (<i>see below</i>)	PG

Patterned ground microfeatures (used in association with the landform “patterned ground” or *PG*):

(a) **Periglacial** patterned ground microfeatures:

circle	--	palsa, palsen	--
earth hummocks	--	(= peat hummocks)	--
high-center polygons	--	polygons	--
ice wedge polygons	--	sorted circles	--
low-center polygons	--	stripes	--
non-sorted circles	--	turf hummocks	--

(b) **Other** patterned ground microfeatures:

bar and channel	--	linear gilgai	--
circular gilgai	--	gilgai	G
elliptical gilgai	--	hummocks	--

intermediate position [gilgai] --	pimple mounds	--
mima mounds --		
perennial stream (water body; also Landform) --	slip face	--
pinnacle --	solifluction lobe	--
playa dune (also Landform) --	solifluction sheet	--
playa floor (also Landform) --	solifluction terrace	--
playa rim (also Landform) --	solution chimney	--
playa slope (also Landform) --	solution corridor	--
playa step (also Landform) --	solution fissure	--
playette --	solution pipe	--
pond (water body) --	spatter cone	--
pool (water body) --	spiracle	--
pothole (also Landform) --	strandline	--
pressure ridge [volcanic] --	swale (also Landform) --	
rib --	swash zone	--
rill --	tank (water body) --	
ripple mark --	tarn (water body; also Landform) --	
roche moutonnée (also Landform) --	terraces <i>T</i>	
rockfall (also Landform) --	toe [mass move.] (also Landform) --	
sag (also Landform) --	tree-tip mound	--
sag pond (water body; also Landform) --	tree-tip pit	--
sand boil --	tumulus (tumuli = plural) --	
scour (mark) --	vernal pool (seasonal water body) --	
shoreline --	yardang (also Landform) --	
shrub-coppice dune --	yardang trough (also Landform) --	
slick rock (also Landform) --	zibar	--

D) ANTHROPOGENIC FEATURES [discrete, human-made or modified, earth-surface features].

artificial collapsed depression	<i>G</i>	log landing	--
artificial levee	<i>A</i>	midden	<i>H</i>
beveled cut	--	openpit mine	--
borrow pit	--	pond (<i>human-made</i>)	--
burial mound	<i>B</i>	quarry	--
cut (<i>road, railroad</i>)	--	railroad bed	<i>D</i>
cutbank	--	reclaimed land	--
ditch	--	rice paddy	<i>E</i>
dredged channel	--	road bed	<i>I</i>
dredge-deposit shoal	--	road cut	--
dredge spoil bank	--	sand pit	--
dump	--	sanitary landfill	--
fill	--	scalped area	--
filled marshland--	--	sewage lagoon	--
floodway	--	skid trail	--
gravel pit	--	spoil bank	--
impact crater	--	spoil pile	--
landfill (<i>see sanitary landfill</i>)	--	surface mine	--
leveled land	--	tillage features (<i>below</i>)	<i>F</i>

Tillage / Management features (common types) :

conservation terrace (<i>modern</i>)	--	furrow	--
double-bedding mound--	--	hillslope terrace (<i>e.g., archeological features</i>)	--
drainage ditch	--	inter-furrow	--
truncated soil	--		
urban land	--		

II) GEOMORPHIC ENVIRONMENTS AND OTHER GROUPINGS (Landscape, Landform, and Microfeature terms grouped by geomorphic process (e.g. Fluvial) or setting e.g. Water Bodies). These lists are not mutually exclusive; some features occur in more than one environment or setting.)

1. COASTAL MARINE and ESTUARINE (wave or tidal control or near-shore / shallow marine).

Landscapes:

bay [coast] (water body; also Landform) --	ocean (water body; also Landform) --
coastal plain (also Landform) <i>CP</i>	peninsula --
barrier island (also Landform) --	sea (water body; also Landform) --
estuary (water body; also Landform) --	shore complex --
fluviomarine terrace (also Landform) --	sound (water body; also Landform) --
gulf [coast] (water body; also Landform) --	strait (water body; also Landform) --
island (also Landform) --	
lagoon [coast] (water body; also Landform) --	
lowland --	

marine terrace (also Landform) --

Landforms:

atoll <i>AT</i>	island (also Landscape) --
back-barrier beach --	lagoon [relict] <i>WI</i>
back-barrier flat --	lagoon (water body) --
backshore <i>AZ</i>	longshore bar [relict] <i>LR</i>
bar <i>BR</i>	mangrove swamp --
barrier beach <i>BB</i>	marine lake (water body)--
barrier cove --	marine terrace (also Landscape) <i>MT</i>
barrier flat <i>BF</i>	mud flat <i>MF</i>
barrier island (also Landscape) <i>BI</i>	point bar [coastal] --
bay [coast] (water body; also Landscape) <i>WB</i>	raised beach <i>RA</i>
bay bottom --	reef <i>RF</i>
beach <i>BE</i>	salt marsh <i>SM</i>
beach plain <i>BP</i>	sea (water body; also Landscape) --
beach ridge <i>BG</i>	sea cliff <i>RZ</i>
beach terrace <i>BT</i>	semi-open depression --
berm <i>BM</i>	shoal (relict) <i>SE</i>
bluff <i>BN</i>	shore --
chenier <i>CG</i>	sound (water body; also Landscape) --
chenier plain <i>CH</i>	spit <i>SP</i>
coastal plain <i>CP</i>	stack [coast] --
coral island --	strait (water body; also Landscape) --
delta <i>DE</i>	strand plain <i>SS</i>
delta plain (also Landscape) <i>DC</i>	tidal flat <i>TF</i>
drainhead complex -	tidal marsh --
flat <i>FL</i>	tombolo <i>TO</i>
flatwoods --	washover fan <i>WF</i>
fluviomarine terrace (also Landscape) --	wave-built terrace <i>WT</i>
foredune <i>FD</i>	wave-cut platform <i>WP</i>
fringe-tidal marsh --	wind-tidal flat --
gulf [coast] (water body; also Landscape) --	
headland <i>HE</i>	

Microfeatures:

ripple mark	--	swash zone	--
shoreline	--		

2. LACUSTRINE (related to inland water bodies).**Landscapes:**

island (also Landform)	--	peninsula	--
lake plain (also Landform)	--	shore complex	--

Landforms:

backshore	AZ	lake terrace	LT
bar	BR	longshore bar [relict]	LR
barrier beach	BB	mud flat	MF
barrier flat	BF	oxbow lake (ephemeral)	OL
barrier island	BI	playa	PL
beach	BE	playa floor (also Microfeature)	--
beach plain	BP	playa rim (also Microfeature)	--
beach ridge	BG	playa slope (also Microfeature)	--
beach terrace	BT	playa step (also Microfeature)	--
berm	BM	pluvial lake (relict)	PQ
bluff	BN	raised beach	RA
delta	DE	reworked lake plain	--
delta plain (also Landscape)	DC	salt marsh	SM
flat	FL	shoal (relict)	SE
flood-plain playa	FY	shore	--
foredune	FD	spit	SP
headland	HE	stack [coast]	--
island (also Landscape)	--	strand plain	SS
lagoon [relict]	WI	till-floored lake plain	--
lakebed [relict]	LB	tombolo	TO
lakebed (water body)	LB	wave-built terrace	WT
lake plain (also Landscape)	LP	wave-cut platform	WP

Microfeatures:

bar	--	ripple mark	--
playa floor (also Landform)	--	shoreline	--
playa rim (also Landform)	--	strandline	--
playa slope (also Landform)	--	swash zone	--
playa step (also Landform)	--	vernal pool	--
playette	--		

3. **FLUVIAL** (dominantly related to concentrated water flow (channel flow); includes erosional and depositional features, but excluding glaciofluvial landforms (see Glacial), and permanent water features (see Water Bodies).

Landscapes:

alluvial plain	--	delta plain	--
alluvial plain remnant	--	fan piedmont	<i>FP</i>
badlands	<i>BA</i>	meander belt	<i>MB</i>
bajada	<i>BJ</i>	river valley	--
breaks	<i>BK</i>	scabland	<i>SC</i>
canyonlands	--		

4. SOLUTION (dominated by dissolution, and commonly, subsurface drainage).***Landscapes:***

cockpit karst	--	kegel karst	--
cone karst	--	sinkhole karst	--
fluviokarst	--	thermokarst	<i>TK</i>
glaciokarst	--	tower karst	--
karst	<i>KP</i>		

Landforms:

blind valley	<i>VB</i>	sinkhole	<i>SH</i>
cockpit	--	solution platform	--
collapse sinkhole	--	solution sinkhole	--
interior valley	--	swallow hole	<i>TB</i>
karst cone	--	thermokarst depression (also Microfeature)	<i>TK</i>
karst tower	--	yardang (also Microfeature)	--
karst valley	--	yardang trough (also Microfeature)	<i>TK</i>
mogote	--		
pavement karst	--		
pinnacle	--		

Microfeatures:

cutter	--	thermokarst depression (also Landform)	--
karren	--	yardang (also Landform)	--
solution chimney	--	yardang trough (also Landform)	--
solution corridor	--		
solution fissure	--		
solution pipe	--		

5. EOLIAN (dominantly wind related, erosional or depositional).***Landscapes:***

dune field	--	sand plain	--
sandhills	<i>SH</i>		

Landforms:

barchan dune	<i>BQ</i>	longitudinal dune	--
blowout	<i>BY</i>	paha	<i>PA</i>
climbing dune	--	parabolic dune	<i>PB</i>
deflation basin	<i>DB</i>	parna dune	<i>PD</i>
dune	<i>DU</i>	playa dune (also Microfeature)	--
dune field (also Landscape)	--	sand ramp	--
dune lake (water body)--	--	sand sheet	<i>RX</i>
dune slack (also Microfeature)	--	seif dune	<i>SD</i>
falling dune	--	slick rock (also Microfeature)	--
foredune	<i>FD</i>	star dune	--
interdune	<i>ID</i>	transverse dune	<i>TD</i>
loess bluff	<i>LO</i>	yardang (also Microfeature)	--
loess hill	<i>LQ</i>	yardang trough (also Microfeature)	--

Microfeatures:

dune slack (also Landform) --	slick rock (also Landform) --
dune traces --	slip face --
interdune (also Landform) --	yardang (also Landform) --
playa dune (also Landform)--	yardang trough (also Landform) --
playette --	zibar --
shrub-coppice dune --	

6. GLACIAL (includes ice contact, glaciofluvial, glaciolacustrine, glaciomarine, and outwash features).**Landscapes:**

continental glacier --	ice-margin complex --
drumlin field --	outwash plain (also Landform) --
glaciokarst --	till plain (also Landform) TP
hills HI	

Landforms:

alpine glacier --	ice-contact slope --
arete AR	ice-marginal stream --
cirque CQ	ice-pushed ridge --
cirque floor --	interdrumlin --
cirque headwall --	kame KA
cirque platform --	kame moraine KM
col CL	kame terrace KT
collapsed ice-floored lakebed CK	kettle KE
collapsed ice-walled lakebed CN	lateral moraine LM
collapsed lake plain CS	medial moraine MH
collapsed outwash plain CT	moraine MU
crag and tail --	nunatak NU
crevasse filling CF	outwash delta --
disintegration moraine DM	outwash fan OF
drumlin DR	outwash plain (also Landscape) OP
drumlinoid ridge --	outwash terrace OT
end moraine EM	paha PA
esker EK	pitted outwash plain PM
fjord (water body) FJ	pitted outwash terrace --
flute (also Microfeature) FU	pothole (also Microfeature) PH
fosse FV	pressure ridge [ice] --
giant ripple GC	proglacial lake [relict] --
glacial drainage channel GD	proglacial lake (water body) --
glacial lake [relict] GL	recessional moraine RM
glacial lake (water body) --	reworked lake plain --
glacial-valley floor --	roche moutonnée (also Microfeature) RN
glacial-valley wall --	rock glacier RO
glacier --	snowfield --
ground moraine GM	stoss and lee --
hanging valley HV	tarn (water body; also Microfeature) --
head-of-outwash --	terminal moraine TA

till-floored lake plain	--	underfit stream	--
till plain (also Landscape)	TP	valley train	VT
tunnel valley	TV	U - shaped valley	UV
tunnel-valley lake (water body)	--		

Microfeatures:

flute (also Landform)	--	pothole [glacial]	--
glacial groove	--	roche moutonnée (also Landform)	--
ice wedge	--	swale (also Landform)	--
ice wedge cast	--	tarn (water body; also "Landform")	--
nivation hollow	--		

7. PERIGLACIAL [related to non-glacial, cold climate (modern or relict), including periglacial forms of patterned ground. Note: consider "patterned ground" as a Landform, but treat specific types of patterned ground, singular or plural, as Microfeatures.]

Landscapes:

coastal plain (e.g. North Slope, AK)	CP	plains	PL
hills	H	thermokarst	TK
I			

Landforms:

alas	AA	pingo	PI
block field	BW	rock glacier	RO
muskeg	MX	string bog	SY
patterned ground (see Microfeatures for types)	PG	thermokarst depression	TK
peat plateau	PJ	thermokarst lake (water body)	--

Microfeatures:

circle	--	polygon	--
earth hummocks	--	solifluction lobe	--
frost boil	--	solifluction sheet	--
high-center polygons	--	solifluction terrace	--
ice wedge polygons	--	sorted circles	--
low-center polygons	--	stripes	--
nivation hollow	--	turf hummocks	--
non-sorted circles	--		
palsa (palsen = plural; = peat hummocks)	--		

8. MASS MOVEMENT (MASS WASTING) (dominated by gravity, including creep forms).

Landscapes: (these generic Landscapes are not Mass Movement features per se, but are commonly modified by, and include localized areas of, Mass Movement).

foothills	<i>FH</i>	mountain range	--
hills	<i>HI</i>	mountains	<i>MO</i>

Landforms:

ash flow	<i>AS</i>	rockfall avalanche	--
avalanche chute	<i>AL</i>	rock spread	--
block glide	--	rock topple	--
block stream	<i>BX</i>	rotational debris slide	--
colluvial apron	--	rotational earth slide	--
complex landslide	--	rotational rock slide	--
creep	--	rotational slide	<i>RP</i>
debris avalanche	--	sag (also Microfeature)--	
debris fall	--	sag pond (water body; also Micro.)	--
debris flow	<i>DF</i>	sand flow	<i>RW</i>
debris slide	--	scree slope	--
debris spread	--	slide	<i>SJ</i>
debris topple	--	slump	<i>SK</i>
earth flow	<i>EF</i>	slump block	<i>SN</i>
earth spread	--	soil fall	--
earth topple	--	talus cone	--
fall	<i>FB</i>	talus slope	--
flow	--	toe [mass move.] (also Micro.)	--
lahar	<i>LA</i>	topple	--
landslide	<i>LK</i>	Toreva block	--
lateral spread	--	translational debris slide	--
main scarp (also Microfeature)	--	translational earth slide	--
mudflow	<i>MW</i>	translational rock slide	--
rock fall (also Microfeature)	--	translational slide	<i>TS</i>

Microfeatures:

main scarp (also Landform)	--	solifluction lobe	--
minor scarp	--	solifluction sheet	--
rockfall (also Landform)	--	solifluction terrace	--
sag (also Landform)	--	terraces	<i>T</i>
sag pond (also Landform)	--	toe [mass move.] (also Landform)	--
sand boil	--		

9. VOLCANIC and HYDROTHERMAL***Landscapes:***

foothills	<i>FH</i>	lava plateau (also Landform)	--
hills	<i>HI</i>	mountains	<i>MO</i>
lava field (also Landform)	--	volcanic field (also Landform)	--
lava plain (also Landform)	--		

Landforms:

lava flow	--	lava tube	--
ash flow	<i>AS</i>	louderback	<i>LU</i>
block lava flow	--	maar	--
caldera	<i>CD</i>	mawae	--
cinder cone	<i>CI</i>	mud pot	--
crater [volcanic]	<i>CR</i>	neck [volcanic]	--
diatreme	--	pahoehoe lava flow	--
fissure vent	--	pillow lava flow	--
geyser	--	plug [volcanic]	--
geyser basin	--	plug dome	<i>PP</i>
geyser cone	--	pressure ridge [volcanic] (also Micro.)	<i>PU</i>
hot spring	--	pyroclastic flow	--
kipuka	--	pyroclastic surge	--
lahar	<i>LA</i>	shield volcano	--
lava field (also Landscape)	--	steptoe	<i>ST</i>
lava flow-unit (also Microfeature)	--	stratovolcano	<i>SV</i>
lava flow	<i>LC</i>	volcanic cone	<i>VC</i>
lava plain (also Landscape)	<i>LN</i>	volcanic dome	<i>VD</i>
lava plateau (also Landscape)	<i>LL</i>	volcanic field (also Landscape)	--
lava trench (also Microfeature)	--		

Microfeatures:

corda	--		
lava flow unit (also Landform)	--	spatter cone	--
lava trench (also Landform)	--	spiracle	--
pressure ridge [volc.] (also Landform)	--		
tumulus (tumuli = plural)	--		

10. TECTONIC and STRUCTURAL (related to regional or local bedrock structures, or crustal movement. In Soil Survey, tectonic and structural features are only recognized if they have some expression at or near the land surface).

Landscapes:

batholith	--	mountain system	--
bolson	<i>BO</i>	plateau	<i>PT</i>
fault-block mountains	--	rift valley	--
foothills	<i>FH</i>	semi-bolson	<i>SB</i>
hills	<i>HI</i>	tableland	<i>TB</i>
intermontane basin	<i>IB</i>	valley	<i>VA</i>
mountain range	--		
mountains	<i>MO</i>		

Landforms:

anticline	<i>AN</i>	cuesta	<i>CU</i>
canyon bench	--	fold	<i>FQ</i>
cuesta valley	--	graben	<i>GR</i>
diapir	<i>DD</i>	half graben	--
dike	<i>DK</i>		
dipslope	<i>DL</i>	hogback	<i>HO</i>
dome	<i>DO</i>	homoclinal ridge	--
fault-line scarp	<i>FK</i>	horst	<i>HT</i>
fault-block	--	louderback	
fault zone	--	strike valley	--
	<i>LU</i>	structural bench	<i>SB</i>
meteorite crater	--	syncline	<i>SZ</i>
monocline	<i>MJ</i>	window	--
scarp slope	<i>RS</i>		
sill	<i>RT</i>		
stock	--		

Microfeatures:

sand boil	--
-----------	----

- 11. SLOPE** - generic terms or those that describe slope form, geometry, or arrangement of land features, rather than any particular genesis or process.

Landscapes:

badlands	<i>BA</i>	mountain system	--
breaks	<i>BK</i>	piedmont	<i>PI</i>
canyonlands	--	piedmont slope	--
foothills	<i>FH</i>	plateau (also Landscape)	<i>PT</i>
hills	<i>HI</i>	tableland	<i>TB</i>
mountain range	--	upland	<i>UP</i>
mountains	<i>MO</i>		

Landforms:

beveled base	--	mesa	<i>ME</i>
block stream	<i>BX</i>	mountain (plural = Landscape)	<i>MM</i>
bluff	<i>BN</i>	mountain slope	<i>MN</i>
broad interstream divide	--	mountain valley	<i>MV</i>
butte	<i>BU</i>	notch	<i>NO</i>
canyon bench	--	paha	<i>PA</i>
cliff	<i>CJ</i>	peak	<i>PK</i>
colluvial apron	--	pediment	<i>PE</i>
cuesta	<i>CU</i>	plain (plural = Landscape)	<i>PN</i>
dome	<i>DO</i>	plateau (also Landscape)	<i>PT</i>
escarpment	<i>ES</i>	ridge	<i>RI</i>
faceted spur	<i>FS</i>	rim	<i>RJ</i>
fault-line scarp	<i>FK</i>	rock pediment	--
free face (also Geom Component – Hills, Mountains.)	<i>FW</i>	scarp	<i>RY</i>
gap	<i>GA</i>	scarp slope	--
headwall	<i>HW</i>	scree slope	--
high hill	--	slick rock (also Microfeature)	--
hill (plural = Landscape)	<i>HI</i>	spur	<i>SQ</i>
hillslope	--	stack [geom]	<i>SR</i>
hogback	<i>HO</i>	talus cone	--
interfluve (also Geom. Component - Hills)	<i>IV</i>	talus slope	--
knob	<i>KN</i>	tor	<i>TQ</i>
knoll	<i>KL</i>	valley	<i>VA</i>
ledge	<i>LE</i>	valley floor remnant	--
low hill	--	wind gap	<i>WG</i>

Microfeatures:

finger ridge	--	slick rock (also Landform)	--
mound	<i>M</i>		
rib	--		
rill	--		

12. EROSIONAL – related dominantly to water erosion but excluding perennial, channel flow (i.e. fluvial, glaciofluvial), or eolian erosion.

Landscapes:

badlands	<i>BA</i>	mountains	<i>MO</i>
breaks	<i>BK</i>	piedmont	<i>PI</i>
canyonlands	--	piedmont slope	--
foothills	<i>FH</i>	plateau (also Landscape)	<i>PT</i>
hills	<i>HI</i>	tableland	<i>TB</i>
mountain range	--		

Landforms:

ballena	<i>BL</i>	notch	<i>NO</i>
ballon	<i>BV</i>	paha	<i>PA</i>
basin floor remnant	<i>BD</i>	partial ballena	<i>PF</i>
beveled base	--	peak	<i>PK</i>
canyon bench	--	pediment	<i>PE</i>
col	<i>CL</i>	plateau (also Landscape)	<i>PT</i>
colluvial apron	--	rock pediment	--
cuesta	<i>CU</i>	saddle	<i>SA</i>
cuesta valley	--	scarp slope	<i>RS</i>
eroded fan remnant	--	slick rock (also Microfeature)	--
eroded fan-remnant sideslope	--	stack [geom]	<i>SR</i>
erosion remnant	<i>ER</i>	strike valley	--
free face (also Geom. Comp. – Hills, Mountains)	<i>FW</i>	structural bench	<i>SB</i>
gap	<i>GA</i>	tor	<i>TQ</i>
hogback	<i>HO</i>	valley border surfaces	--
inselberg	<i>IN</i>	valley floor remnant	--
monadnock	<i>MD</i>	wind gap	<i>WG</i>
		window	--

Microfeatures:

earth pillar	--	rib	--
finger ridge	--	rill	--
groove	--	slick rock (also Landform)	--
gully	--	swale	--
hoodoo	--		

3c 0.031 1 Tf0 -

pinnacle --

14. WETLANDS - [Related to vegetated and / or shallow wet areas, and wet soils. Provisional list: conventional, geologic definitions; not legalistic or regulatory usage].

Landscapes:

estuary (also Landform)--
 everglades --

[generally, there is no appropriate Landscape term for wetlands; by default, choose the most appropriate Landscape term from another Process Environment or Other Grouping]

Landforms:

alas AA
 backswamp BS
 bog BO
 Carolina Bay CB
 dune slack (also Microfeature) --
 ephemeral stream (also Microfeature) --
 estuary (also Landscape) WD
 fen FN
 flood-plain playa FY
 fringe tidal marsh --
 highmoor bog HB
 intermittent stream (also Microfeature) --
 lowmoor bog LX
 mangrove swamp --
 marsh MA

mud flat MF
 muskeg MX
 oxbow lake (ephemeral water) OL
 peat plateau PJ
 playa (intermittent water) PL
 pocosin PO
 pothole (intermittent water; also Micro.) PH
 raised bog RB
 ribbed fen RG
 salt marsh SM
 slough (intermittent water) SL
 string bog SY
 swamp SW
 tidal flat TF
 tidal marsh --

Microfeatures:

dune slack (also Landform) --
 ephemeral stream (also Landform) --
 intermittent stream (also Landform) --

playette --
 pothole (intermittent water; also Landform)--
 vernal pool (seasonal water) --

15. WATER BODIES - Discrete “surface water” features, primarily permanent open water, which in Soil Survey Reports are commonly treated as the generic map unit “water” (e.g. lake), or as a spot / line symbol (e.g., perennial stream).

Landscapes:

bay [coast] (water body; also Landform) --
 estuary (water body; also Landform) --

lagoon [coast] (water body; also Landform) --

Landforms:

629-115	2	9	-	1	1
629-115619-115					

16. SUBAQUEOUS FEATURES [Discrete, relatively shallow underwater features that commonly can support rooted plants, and adjacent features, ordinarily found below permanent open water. Historically, in Soil Survey Reports these underwater features have been included in the generic map unit "water"]. Subaqueous "Landscape" terms are obviously not terrestrial, but are Earth surface features.

Landscapes:

bay [coast] (water body; also Landform) --	<i>sea</i> (water body) --
<i>gulf</i> [coast] (water body) --	<i>sound</i> (water body) --
estuary (water body; also Landform) --	<i>strait</i> (water body) --
lagoon [coast] (water body; also Landform) --	
<i>ocean</i> (water body) --	

Landforms:

barrier cove --	? lake	WJ
bay [coast] (water body; also Landscape)		
--		
bay bottom --	mainland cove	--
cove [coast] --	marine lake	--
dredged channel (<i>Anthropogenic Feature</i>)--	reef	RF
dredge-deposit shoal (<i>Anthro. Feature</i>)	relict-tidal inlet	--
--	shoal	--
estuary (water body; also Landscape)WD	submerged back-barrier beach	--
flood-tidal delta --	submerged mainland beach	--
flood-tidal delta flat --	submerged point bar [coastal]	--
flood-tidal delta slope --	submerged wave-built terrace	--
fluviomarine bottom --	submerged wave-cut platform	--
inlet --	tidal inlet	--
lagoon [coast] (water body; also Landscape) WI	washover-fan flat	--
lagoon bottom --	washover-fan slope	--
lagoon channel --		

Microfeatures:

channel (permanent water) --	
------------------------------	--

Exhibit 629-2 List of Materials or Material-Related, Structure, or Morphological-Feature Terms Contained in the Glossary.

(NR - terms that are NOT RECOMMENDED; NP - terms that are NOT PREFERRED)

`a`a lava	debris
ablation till	debris avalanche deposit
alluvium	debris flow deposit
anticline	debris slide deposit
aquiclude	deposit
aquifer	desert pavement
aquitard	desert varnish - NP
ash	detritus (geology)
ash flow	diamictite
backswamp deposit	diamicton
basal till	diatomaceous earth
beach sands	dike
bed	dip
bedded	discontinuity
bedding plane	discontinuous permafrost
bedrock	dropstone
block	dolomite (mineral)
block lava	dolomite (rock)
block field	dolostone - NR
block glide deposit	dome
block stream	dredge spoils
blue rock [volcanic]	drift (glacial geology)
bombs [volcanic]	earthflow deposit
boulder field - NR	eolian deposit
bowl	epiclastic
breccia	erosional pavement
buried soil	erratic
caliche	estuarine deposit
caprock	facies (stratigraphy)
chert	fanglomerate
chimney	felsenmeer - NP
cinders	felsic rock
clast	fill
clastic	fly ash
coastal marl	flowtill
colluvium	fluviomarine deposit
complex landslide deposit	fold
conglomerate	formation (stratigraphy)
continuous permafrost	freshwater marl
coprogenous earth	glacial drift - NR
coprogenous material	glacial outwash - NR
country rock	glacial till - NR
craton	glaciofluvial deposits
creep deposit	glaciolacustrine deposits
cross-bedding	glaciomarine deposits
cross-lamination	glaucinite pellets
cross-stratification	graben
cryptogamic crust	greensands
cryoturbate	ground soil
cyclothem	grus
dead-ice - NR	herbaceous peat

horst	pyroclastic
ice-pushed ridge	regolith
ice wedge	relict soil
ice wedge cast	residuum
igneous rock	rhythmite
interbedded	rockfall deposit
intrusive	rockfall avalanche deposit
lacustrine deposit	rockfall landslide deposit
lagoonal deposit	rock varnish
lahar	rotational landslide deposit
lamella	rubble
lamina	sand sheet
lamination - NR	sandstone
lapilli	saprolite
lateral spread deposit	scoria
lava flow	scree
limestone	sediment
lithologic	sedimentary peat
lodgment till	sedimentary rock
loess	shale
louderback	siltstone
mafic rock	sill
marine deposit	siltite
marl	slide
melt-out till	slip face
metamorphic rock	slip surface
metasediment	slope alluvium
microbiotic crust	sloughed till - NR
mine spoil, coal extraction	slump - NR
mine spoil, metal-ore extraction	slump block
mine spoil or earthy fill	slump till
moraine	soil fall deposit
moss peat	solifluction sheet
muck	spoil bank
mucky peat	spoil pile
mudstone	sporadic permafrost
mudflow deposit	stagnant ice
novaculite	stone line
nueé ardente	strandline
outcrop	subglacial till
outwash	subglacial melt-out till
overbank deposit	supraglacial till
overburden	supraglacial debris-flow sediment - NP
overthrust	supraglacial melt-out till - NP
paleosol	supraglacial till - NP
pahoehoe lava	syncline
parna	talus
peat	tephra
pedisediment	thaw-sensitive permafrost
permafrost	thaw-stable permafrost
pillow lava	till (glacial)
pitted outwash	tombolo
pluton	topple deposit
plutonic	tor
porcellanite	tuff
puff [gilgai]	valley fill
pumice	valley side alluvium

varve
ventifact
vitric
volcanic breccia

volcaniclastic
welded soil
welded tuff
woody peat

Exhibit 629-3 Genesis - Process Terms and Geologic Time Terms Contained in the Glossary.

(**NR** - terms that are NOT RECOMMENDED; **NP** - terms that are NOT PREFERRED).

aeolian - NR	frost riving - NR
accretion	frost shattering
active layer	frost splitting - NR
active slope - NR	frost stirring - NR
aggradation	frost weathering - NR
alluvial	frost wedging - NR
angle of repose	geomorphology
avalanche	gelifraction - NR
avulsion	gelivation - NR
backwearing	glacial
block glide	glacial epoch
buried	glacial marine sedimentation
bypassed	glacial outburst flood (see <i>jokulhlaup</i>)
cat clay - NR	glaciation
colluvial	Holocene
competence	ice age - NR
complex landslide	ice-rafting
conformity	ice segregation
conglifraction - NP	intramorainal
congliturbation - NR	joint
constructional (geomorphology)	knickpoint
corrosion	landslide
creep	lateral spread
cryoplanation	lithification
cryoturbation	mass movement
cut and fill	mass wasting – NP
debris avalanche	metastable slope - NR
debris flow (mudflow)	Miocene
debris slide	mudflow
deflation	nivation
degradation	Oligocene
deposition	Paleocene
destructional (geomorphology)	pedoturbation
dip [structural geol.]	periglacial
discontinuity	Pleistocene
distal	Pliocene
earthflow	postglacial - NP
Eocene	proximal
eolian	Quaternary
erosion	recent
erosional (geomorphology)	relict
exfoliation	rockfall
exhumed	rockfall avalanche
extramorainic - NP	rotational landslide
extramorainal	sand flow
extrusive	scour
fall	scour and fill
flow	slide
fluvial	slope wash
frost bursting - NR	slump - NP
frost churning - NR	soil creep - NP

soil fall
solifluction
strike [structural geol.]
subaerial
subaqueous
storm surge
stratified
stratigraphy
stream order

subaerial
subglacial
superglacial - NP
Tertiary
topple
translation slide
volcanic
weathering
welding

Exhibit 629-4 North American Glacial Episodes and General Geologic Time Scale.

(Schoeneberger, et al, 2002; After Morrison; In: Sibrava, et al., 1986; and Harland, et al., 1990)

Geologic Period	Geologic Epoch	Sub-Division	O Isotope Stage ²	Years (BP)	
QUATERNARY	Holocene		(1)	0 to 10-12 ka*	
	<i>Late Pleistocene</i>	Late Wisconsin	(2)	10-12 to 28 ka	
		Middle Wisconsin	(3, 4)	28 to 71 ka	
		Early Wisconsin	(5a - 5d)	71 to 115 ka	
		<i>Late Sangamon</i>			
		<i>Sangamon</i>	(5e)	115 to 128 ka	
	Pleistocene	<i>Middle Pleistocene</i>	Late – Mid Pleistocene (<i>Illinoian</i>)	(6 - 8)	128 to 300 ka
			Middle – Mid Pleistocene	(9 - 15)	300 to 620 ka
			Early – Mid Pleistocene	(16 - 19)	620 to 770 ka
			Mid Pleistocene		770 ka to 1.64 Ma**
TERTIARY	Pliocene			1.64 to 5.2 Ma	
	Miocene			5.2 to 23.3 Ma	
	Oligocene			23.3 to 35.4 Ma	
	Eocene			35.4 to 56.5 Ma	
	Paleocene			56.5 to 65.0 Ma	
CRETACEOUS	<i>Late Cretaceous</i>			65.0 to 97.0 Ma	
	<i>Early Cretaceous</i>			97.0 to 145.6 Ma	
JURASSIC				145.6 to 208.8 Ma	
TRIASSIC				208.8 to ≈ 243.0 Ma	
PERMIAN				≈ 243.0 to 290.0 Ma	
PENNSYLVANIAN				290.0 Ma to 322.8 Ma	
MISSISSIPPIAN				322.8 to 362.5 Ma	
DEVONIAN				362.5 to 408.5 Ma	
SILURIAN				408.5 to 439.0 Ma	
ORDOVICIAN				439.0 to 510.0 Ma	
CAMBRIAN				510.0 to ≈ 570.0 Ma	
PRECAMBRIAN				> ≈ 570.0 Ma	

* ka = x 1,000; ** Ma = x 1,000,000

≈ = “approximately”

¹ Modified from Morrison, 1991; Sibrava, et al., 1986; and Harland, et al., 1990.² Oxygen isotope.**REFERENCES**

Harland, W.B., R.L. Armstrong, L.E. Craig, A.G. Smith, and D.G. Smith. 1990. A geologic time scale. Press Syndicate of University of Cambridge, Cambridge, UK. 1 sheet.

Morrison, R.B. (ed.). 1991. Quaternary nonglacial geology: conterminous United States. Geological Society of America, Decade of North American Geology, Geology of North America, Vol. K-2. 672 p.

Schoeneberger, P.J., Wysocki, D.A., Benham, E.C., and Broderson, W.D. 2002. Field book for describing and sampling soils, version 2.0. Natural Resource Conservation Service, USDA, National Soil Survey Center, Lincoln, NE.

Sibrava, V., D.Q. Bowen, and D.Q. Richmond (eds.). 1986. Quaternary glaciations in the Northern Hemisphere: final report of the International Geological Correlation Programme, Project 24. Quaternary Science Reviews, Vol. 5, Pergamon Press, Oxford. 514 p.

Exhibit 629-5 Till Terms.**TILL TERMS**

Genetic classification and relationships of till terms commonly used in soil survey. (Schoeneberger, et al., 2002; adapted from Goldthwaite and Matsch, 1988.)

Location (Facies of tills grouped by position at deposition)	Till Types	
	Terrestrial	Waterlaid
Proglacial Till (at the front of, or in front of a glacier)	proglacial flowtill	waterlaid flowtill
Supraglacial Till (on top of, or within upper part of a glacier)	supraglacial flowtill ^{1,3} supraglacial melt-out till ¹ (ablation till - NP) ¹ (lowered till - NP) ² (sublimation till - NP) ²	-----
Subglacial Till (within the lower part of, or beneath a glacier)	lodgment till ¹ subglacial melt-out till subglacial flowtill (= "squeeze till" ^{2,3}) (basal till - NP) ¹ (deformation till - NP) ² (gravity flowtill - NP) ²	waterlaid melt-out till waterlaid flowtill iceberg till (= "ice-rafted")

¹ *Ablation till* and *basal till*, generic terms that only describe "relative position" of deposition, have been widely replaced by multiple, more specific terms that convey both relative position and process. *Ablation till* (any comparatively permeable, non-sorted debris deposited within or above stagnant ice) is replaced by *supraglacial melt-out till*, *supraglacial flowtill*, etc. *Basal till* (any dense, non-sorted, subglacial till) is replaced by *lodgement till*, *subglacial melt-out till*, *subglacial flowtill*, etc.

² Additional (proposed) till terms that have not gained wide acceptance, and are therefore considered to be *Not Preferred*, and should not be used (shown for completeness).

³ Also called *gravity flowtill* (Not Preferred).

REFERENCES

Goldthwaite, R.P. and Matsch, C.L. (eds.). 1988. Genetic classification of glacial deposits: final report of the commission on genesis and lithology of glacial quaternary deposits of the International Union for Quaternary Research (INQUA). A.A. Balkema, Rotterdam. 294 p.

Jackson, J.A. (ed.). 1997. Glossary of geology, 4th Ed. American Geological Institute, Alexandria, VA. 769 p.

Schoeneberger, P.J., Wysocki, D.A., Benham, E.C., and Broderson, W.D. 2002. Field book for describing and sampling soils, ver. 2.0. Natural Resource Conservation Service, USDA, National Soil Survey Center, Lincoln, NE.

Exhibit 629-6 Pyroclastic Terms.

PYROCLASTIC TERMS: Size and compositional relationships of pyroclastic terms commonly used in soil survey. (Schoeneberger, et al., 2002; adapted from Fisher, 1989.)

Pyroclasts and Pyroclastic Deposits (Unconsolidated)			
Size Scale: 0.062 mm ¹ 2 mm 64 mm ¹			
←———— tephra —————→ (all ejecta)			
←———— ash —————→		←— cinders ² —→ (specific gravity > 1.0 & < 2.0)	←— bombs ² —→ (fluid-shaped coarse fragments)
←————→ fine ash	←————→ coarse ash		
		←— lapilli ² —→ (specific gravity > 2.0)	←— blocks ² —→ (angular-shaped coarse fragments)
		←———— scoria ² —————→ (slightly to moderately vesicular; specific gravity > 2.0)	
	←————→ pumiceous ash ³	←———— pumice ² —————→ (highly vesicular; specific gravity < 1.0)	
Associated Lithified (Consolidated) Rock Types			
←————→ fine tuff ₁	←————→ coarse tuff ¹	< lapillistone ¹ > (sp. gr. > 2.0)	< — pyroclastic breccia — >
←— welded tuff —→		←———— agglomerate —————→ (rounded, volcanic coarse fragments)	
←— ignimbrite —→ (ash-dominated flows and nuee ardentes)		←———— volcanic breccia —————→ (angular, volcanic coarse fragments)	

¹ These size breaks are taken from geologic literature (Fisher, 1989) and based on the modified Wentworth scale. The 0.062 mm break is very close to the USDA's 0.05 mm break between *coarse silt* and *very fine sand* (Soil Survey Staff, 1993). The 64 mm "geologic" break is relatively close to the USDA's 76 mm break between *coarse gravel* and *cobbles*. (See the chart "Comparison of Particle Size Classes in Different Systems" in the "Profile / Pedon Description Section" under "Soil Texture" in the Field Book for Describing and Sampling Soils (Schoeneberger, et al., 2002).

² A minimum size limit of 2 mm is required in Soil Taxonomy (Soil Survey Staff, 1994; p. 54), but is not required in geologic usage (Fisher, 1989).

³ The descriptor for pumice smaller than 2 mm, as used in Soil Taxonomy (Soil Survey Staff, 1999). Geologic usage is based solely upon composition and does not include any size restrictions;

REFERENCES

Fisher, R.V. 1989. Pyroclastic sediments and rocks. AGI Data Sheet 25.2. In: Dutro, J.T., Dietrich, R.V., and Foose, R.M. 1989. AGI data sheets for geology in the field, laboratory, and office, 3rd edition. American Geological Institute, Washington, D.C.

Jackson, J.A. (ed.). 1997. Glossary of geology, 4th Ed. American Geological Institute, Alexandria, VA. 769 p.

Schoeneberger, P.J., Wysocki, D.A., Benham, E.C., and Broderson, W.D. 2002. Field book for describing and sampling soils, ver. 2.0. Natural Resource Conservation Service, USDA, National Soil Survey Center, Lincoln, NE.

Soil Survey Staff. 1994. Keys to Soil Taxonomy, 6th Ed. USDA - Natural Resources Conservation Service.

Soil Survey Staff. 1998. Keys to Soil Taxonomy, 8th Ed. USDA - Natural Resources Conservation Service, Pocahontas Press, Inc., Blacksburg, VA. 524 pp.

Soil Survey Staff. 1999. Soil Taxonomy, 2nd Ed. A basic system of soil classification for making and interpreting soil surveys. USDA - Soil Conservation Service, Agricultural Handbook #436, U.S. Government Printing Office, Washington, DC, 869p.